

Medium Voltage Frequency Inverter

MVW3000

Generation 4 (G4)

User Manual



User Manual

MVW3000

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SUMMARY OF THE REVISIONS

The information below describes the revisions made to this manual.

Version	Revision	Description
-	R00	First edition
-	R01	General revision

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1 SAFETY NOTICES

This manual contains the necessary information for the correct use of the MVW3000 inverter.

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

This manual describes all the functions and part of the parameters of the MVW3000, but it is not intended to present all possible applications of the MVW3000. WEG is not liable for applications not described in this manual.

This product is not intended for applications whose function is to ensure the physical integrity and/or the life of people, or any other application where failure of the MVW3000 can create a risk to the physical integrity and/or life of people. The designer who applies the MVW3000 must provide ways to ensure the safety of the installation even in the event of a drive failure.

1.1 SAFETY NOTICES IN THE MANUAL

The following symbols are attached to the product, serving as safety notices:

**DANGER!**

Failure to observe the procedures recommended in this warning may lead to death, serious injuries and/or considerable material damages.

**ATTENTION!**

Failure to observe the procedures recommended in this warning may lead to material damages.

**NOTE!**

The text intends to supply important information for the correct understanding and good operation of the product.

1.2 SAFETY NOTICES ON THE PRODUCT

The following symbols are attached to the product, serving as safety notices:



High voltages are present.



Components sensitive to electrostatic discharge. Do not touch them.



Mandatory connection to the protective earth (PE).



Connection of the shield to the ground.



Hot surface.

1.3 PRELIMINARY RECOMMENDATIONS

**DANGER!**

Only qualified personnel familiar with the MVW3000 frequency inverter and associated equipment should plan or implement the installation, start-up and subsequent maintenance of this equipment. Such personnel must follow the safety instructions described in this manual and/or defined by local standards.

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

**NOTE!**

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

1. Install, ground, energize and operate the MVW3000 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 input power before touching any electrical component associated to the inverter.

Many components can remain charged with high voltages or remain in movement (fans) even after that AC power is disconnected or switched off.

Wait at least 10 minutes to assure a total discharge of the capacitors.

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

**ATTENTION!**

A preliminary shutdown is indicated by the neon lamps mounted on the HVM2 (High Voltage Monitoring) board. In addition, the board indicates residual voltages on the panel.

For detailed instructions on de-energizing, see [Section 6.6 SAFE DE-ENERGIZATION INSTRUCTIONS](#) on page 6-28.

**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 execute any withstand voltage test on the inverter!
If it is necessary consult WEG.

**NOTE!**

Frequency inverter may interfere with other electronic equipment. In order to reduce these effects, take the precautions recommended.

**NOTE!**

Read the full user manual before installing or operating the inverter.

**DANGER!**

This product was not designed to be used as a safety device. Additional measures must be taken so as to avoid material damages and personal injuries.

The product was manufactured under strict quality control; however, if installed in systems in which a failure may cause risks of material damages or personal injuries, additional external safety devices must be installed to ensure the safety in case of a product failure, preventing accidents.

**ATTENTION!**

When in operation, electric energy systems - such as transformers, converters, motors and cables - generate electromagnetic fields (EMF). Therefore, there is risk for people with pacemakers or implants that stay close to such systems.

Thus, such people must stay at least 2 meters away from such machines.

2 GENERAL INFORMATION

This chapter provides information about the contents of this manual, describes the main features of the MVW3000 and explains how to identify its components. In addition, information on receipt, storage and preventive maintenance of the product is provided.

2.1 ABOUT THIS MANUAL

This manual has 10 chapters in a logical sequence for the user to install and operate the MVW3000:

Chapter 1 SAFETY NOTICES on page 1-1.

Chapter 2 GENERAL INFORMATION on page 2-1.

Chapter 3 PRODUCT CHARACTERISTICS on page 3-1.

Chapter 4 TECHNICAL DATA on page 4-1.

Chapter 5 SUPPORTED MOTORS on page 5-1.

Chapter 6 INSTALLATION, CONNECTION, ENERGIZATION AND PREVENTIVE MAINTENANCE on page 6-1.

Chapter 7 OPTIONAL ACCESSORIES AND BOARDS on page 7-1.

Chapter 8 SPECIAL FUNCTIONS on page 8-1.

Chapter 9 PERFORMANCE on page 9-1.

The user manual provides information about the MVW3000 medium voltage inverter. This document is arranged in dedicated and specific chapters to explain the proper handling, installation, care, troubleshooting, adaption to applications and functionalities of the equipment.

The characteristics and recommendations contained in this manual were based on models of the standard MVW3000. However, it is possible to develop and provide customized solutions according to your customers' needs and specific applications.

The MVW3000 product can be customized (engineered) to meet the needs and technical specifications of our customers. Sizes, technical recommendations, performance data and the need to add optional components may vary in relation to the information contained in this document.

The customer will receive the user manual, the programming manual (both available for download at **www.weg.net**), and a detailed project package to the product supplied. This design contains all the electrical, mechanical and interface/installation information with other equipment of the MVW3000.

The MVW3000, as well as other WEG products, is in constant evolution in relation to both its internal parts (hardware) and its programming (software/firmware). Any question about the equipment and its documentation can be answered by means of WEG communication channels.

WEG is not liable for the improper use of the information contained in this manual.

2.2 MVW3000 IDENTIFICATION LABEL

The identification label of the MVW3000 is located inside the product control panel. This label describes important information about the inverter.

An example of an identification label for the MVW3000 is shown in [Figure 2.1 on page 2-2](#).

WEG UNIDADE AUTOMAÇÃO MEDIUM VOLTAGE FREQUENCY INVERTER	
Type: MVW3000	Input:
Year of Manufacture:	3~, 4.16 kV, 60 Hz, 200 A
Document:	
Series No.:	
Material:	Output:
IP: 42	0-4.16 kV, 3~, 0-120 Hz, 200 A
Ur: 7.2 kV	Rating Power: 1440 KVA
Up: 60 kV	Overload: 115 %
Ud : 12 kV	Auxiliary supply:
Ik: 31.50 kA	120 V, 1~, 60 Hz
Ip: 5.57 kA	UPS Power Supply:
	120 V 60 Hz
	Control Voltage: 120 Vac
WEG, CP420 - 89256-900 Jaraguá do Sul - Brazil	

Figure 2.1: MVW3000 identification label (example)

2.3 RECEIVING AND STORAGE

The MVW3000 is supplied with the power cells mounted on the panel. Spare power cells are supplied in separate package. The package is composed of an OSB (wood by-product) frame and injected foam shims. An identification label is affixed to the outside of the package, identical to the label affixed to the side of the inverter. Confront the content of this label with the purchase order.

To open the cell packaging, see the procedure described in [Item 6.1.5 Opening the Package on page 6-7](#). Spare power cells must be stored in a clean and dry location (temperature between -25 °C (-13 °F) and 50 °C (122 °F) and humidity below 80 %), protected with a cover to prevent dust accumulation or water splashes. It is recommended to replace the silica gel every three months.

The MVW3000 panel has a dehumidifier module, which must remain turned on in case of storage for over thirty days.

The MVW3000 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 6 INSTALLATION, CONNECTION, ENERGIZATION AND PREVENTIVE MAINTENANCE on page 6-1](#).

2.4 HOW TO SPECIFY THE MVW3000 MODEL

Table 2.1: Coding ⁽¹⁾

1 MVW3000	2 G4	3 A0140	4 V138	5 T6A	6 138	7 D72	8 AC
9 S	10 I	11 42	12 ST	13 SN	14 F0	15 CE	

1 - Product Line / 2 - Generation / 3 - Rated Output Current ⁽²⁾ , as per the table below				7 - Rectifier type and number of pulses			
40 A	A0040	400 A	A0400	18-pulse diode	D18	72-pulse diode	D72
50 A	A0050	450 A	A0450	24-pulse diode	D24	90-pulse diode	D90
60 A	A0060	500 A	A0500	30-pulse diode	D30	108-pulse diode	D108
70 A	A0070	550 A	A0550	36-pulse diode	D36	126-pulse diode	D126
80 A	A0080	600 A	A0600	42-pulse diode	D42	144-pulse diode	D144
90 A	A0090	650 A	A0650	48-pulse diode	D48	162-pulse diode	D162
100 A	A0100	700 A	A0700	54-pulse diode	D54	180-pulse diode	D180
110 A	A0110	750 A	A0750	60-pulse diode	D60	198-pulse diode	D198
125 A	A0125	800 A	A0800	66-pulse diode	D66	216-pulse diode	D216
140 A	A0140	855 A	A0855	8 - Cooling			
160 A	A0160	950 A	A0950	Air	AC		
180 A	A0180	1045 A	A1045	9 - Cell Type			
200 A	A0200	1140 A	A1140	Default	S		
225 A	A0225	1235 A	A1235	Bypass	B		
265 A	A0265	1330 A	A1330	Redundant	R		
310 A	A0310	1425 A	A1425	10 - Installation Type			
340 A	A0340	1520 A	A1520	Indoor	I		
4 - Rated Output Voltage				11 - Protection Rating			
1150 V	V011	7200 V	V072	IP42	42		
2300 V	V023	8000 V	V080	12 - Arc Flash Protection			
3300 V	V033	9000 V	V090	Standard (without)	ST		
4160 V	V041	10000 V	V100	13 - Input Protection			
5500 V	V055	11000 V	V110	Not included	SN		
6000 V	V060	12000 V	V120	Included	SI		
6300 V	V063	13200 V	V132	14 - Output Filter Type			
6600 V	V066	13800 V	V138	No	F0		
6900 V	V069			Type 1	F1		
5 - Input transformer				Type 2	F2		
AI 50 Hz		T5A		Type 3	F3		
AI 60 Hz		T6A		15 - Certification			
Cu 50 Hz		T5C		CE			
Cu 60 Hz		T6C		UL			
6 - Rated Input Voltage							
1150 V	011	6900 V	069				
2300 V	023	7200 V	072				
3000 V	030	8000 V	080				
3300 V	033	8400 V	084				
4160 V	041	10000 V	100				
4800 V	048	11000 V	110				
5500 V	055	12000 V	120				
6000 V	060	12400 V	124				
6300 V	063	13200 V	132				
6600 V	066	13800 V	138				

Notes:

- (1) Other configurations available on request.
(2) Overload capacity: ND = Normal Duty: 115 % for 60 seconds, every 10 minutes.
(3) Table containing standard references assembled in MVW3000 G4 section – standardized versions.
(4) Interfaces incorporated into the control unit and optional modules are listed in the technical data table.

Table 2.2: Technical specifications

Power Supply	Input and output voltages	1150 to 13800 V (±10 %, -20 % with output power derating)	
	Frequency	50 or 60 Hz ±3 % (other values available on request)	
	Voltage imbalance between phases	< 3 %	
	Cos φ	> 0.95	
	Overvoltage category	Category III	
	Dry-type phase shifting transformer standard built-in	With surge arresters on primary high-voltage side	
		Impedance matched for the secondary windings to minimize line side harmonics & reduce losses	
		Transformer winding temperature monitoring (Pt-100 in windings) available via optional 8 channel temperature monitor	
	Efficiency	97.5 % for aluminum winding transformers and 98 % for copper winding transformers (higher efficiencies on request)	
	Input switchgear (optional)	Disconnect switch with fuses and vacuum contactor up to 6.9 kV AC	
Metal clad switchboard up to 36 kV (MTW lines)			
Mechanical interlocking to prevent access to HV section when switch is in ON position			
Bottom or top cable entry			
Auxiliary supply	Voltages	Three-phase: 220, 380, 400, 415, 440, 460 or 480 V (optional up to 690 V)	
	Frequency	50 or 60 Hz (±3 %)	
	Voltage imbalance between phases	< 3 %	
Enclosure	Degree of protection	IP42	
	Color	RAL 7035	
	Painting plan	80 μm epoxy powder coating, equivalent to C3H according to ISO 12944-6:2018 and IEEE C37.23 standards	
	Cable entry and exit options	Bottom or top cable entry	
Environmental conditions operating	Temperature	0 to 40 °C (32 to 104 °F) (with derating up to 50 °C (122 °F), reducing output current by 2.5 % / °C (1.39 % / °F))	
	Humidity	5 to 90 % without condensation	
	Altitude	0 to 1000 m (3.300 ft) (with derating up to 4000 m (13.200 ft), reducing by 10 % / 1000 m (3.300 ft)) (above this altitude, upon request)	
	Pollution degree	2	
Power output	Motor voltage	1150 to 13800 V	
	Topology	Cascaded H-Bridge (CHB)	
	Frequency range	0...120 Hz (above on request)	
	Overload capacity	ND Duty: 115% for 60 seconds, every 10 minutes (1.15 x ND rated current)	
HD Duty: 150% for 60 seconds, every 10 minutes (1.5 x HD rated current)			
Control	Microprocessor	32 bits	
	Control method	Sinusoidal PWM	
	Control types	Scalar (V/f), vector	
	IGBT switching frequency	500 Hz	
	Switching frequency per cell	1000 Hz	
	Inverter switching frequency	1000 Hz x cell quantity per phase	

Performance	Efficiency (typical values)	> 96.0 % (transformer with aluminium windings)	
		> 96.5 % (transformer with copper windings)	
	Speed control	V/f induction motor	■ Regulation: 1 % of rated speed (with slip compensation) ■ Resolution: 1 rpm (reference via HMI)
		VVW PM motor	
		VVW synchronous machine, with sensor-assisted starting (with optional RSSI board)	
		With sensor	Setting: ■ With optional ACCE-ENC1 for incremental encoder: ± 0.01 % of rated speed with digital reference (keyboard, serial, Fieldbus, electronic potentiometer, multispeed) ■ With optional RSSI for absolute encoder: ± 0.1 % of rated speed with 10-bit analog input
		Sensorless	Regulation: 0.5 % of rated speed
			Speed variation range: 1:100
I/O, storage, and communication interfaces	Inputs	Analog (standard interface)	2 differential analog inputs
			Isolated from the power circuits
			Levels: -10/0 to 10 V (11 bits + signal), 0/4 to 20 mA (10 bits)
			Maximum voltage: 30 V
			Maximum current: 25 mA
			Impedance: 400 k Ω (voltage mode), 250 Ω (current mode)
			Maximum common-mode voltage: 10 V
		Digital (standard interface)	6 digital inputs (total), as follows:
			■ DI1 to DI4: 4 isolated digital inputs - Low level: Vdc -3 V to 5 V, I<1.5 mA - High level: Vdc > 11 V, I>2 mA - Current: 8 mA @ 24 V (typical) - Maximum voltage: 30 Vdc - Maximum current: 11 mA @ 30 Vdc
			■ DI5 and DI6: 2 isolated digital inputs - Low level: Vdc -3 V to 5 V, I<0.5 mA - High level: Vdc > 15 V, I>2 mA - Current: 10 mA @ 24 V (typical) - Maximum voltage: 30 Vdc - Maximum current: 13 mA @ 30 Vdc - Maximum frequency: 32 kHz - Frequency speed reference

GENERAL INFORMATION

I/O, storage, and communication interfaces	Outputs	Analog (standard interface)	2 analog outputs
			Isolated from the power circuits
			Levels: 0 to 10 V (12 bits), 0/4 to 20 mA (12 bits)
			Load: RL 1 kΩ (voltage mode), RL 600 Ω (current mode)
		Digital (standard interface)	2 transistor digital outputs (NPN)
			Isolated from the power circuits
			Maximum current: 40 mA
			Protected against short circuit to GND
			Maximum voltage: 24 Vdc
			With freewheeling diode for 24 Vdc power supply
			Maximum frequency: 32 kHz
		Relay (standard interface with CFW900-REL-01 module)	3 relay outputs (total), as follows: - 2 relay outputs with normally NO contact - 1 relay output with NO/NC contact
			Maximum voltage: 30 Vdc, 250 Vac, OVC III
			Maximum current: 2 A
			Minimum current: 10 mA @ 5 Vdc
			400 V TVS across contacts
	MicroSD card slot ⁽¹⁾	Characteristics	Card requirements: Maximum size 32 GB
			Industrial temperature (-40 °C to 85 °C) (-40 °F to 185 °F)
			FAT32 file system
	Communication	RS485 (standard interface)	Isolated RS485 interface
			Modbus-RTU protocol
		Dual-port Ethernet network (RJ45) (standard interface)	Two RJ45 Ethernet connectors
			10/100 Mbps data rate with built-in dual-port switch
			Available protocols: MQTT, Modbus-TCP, EtherNet/IP
		Fieldbus (optional)	CANopen; DeviceNet; EtherCAT; Profibus-DP; PROFINET-IRT
Optional interfaces ⁽²⁾	Optional modules	Optional accessories for slot installation (backplane with 6 slots available for modules)	
		CFW900-CCAN-W	CAN interface module (CANopen/DeviceNet)
		CFW900-IOAI-01	Module with 3 analog inputs and 2 isolated analog outputs
		CFW900-IOD-01	Module with 8 isolated digital inputs and 8 isolated digital outputs
		CFW900-REL-01	Module with 3 relay outputs (1 unit provided as standard)
		CFW900-TEMP-01	Module with 6 isolated inputs for PTC/Pt-100/Pt-1000 sensors
		CFW900-CECAT-N	EtherCAT2) interface module
		CFW900-CPN-IRT-N	PROFINET-IRT2) interface module
		CFW900-CPDP-N	Profibus-DP2) interface module
	Optional boards	Optional accessories that do not occupy slots	
		ACCE-ENC	Incremental encoder module (installed on the CCE board)
		RSSI	Absolute encoder module
		Temperature protection and monitoring relays	Motor and transformer thermal protection and monitoring
		MicroSD slot	
		CFW900-SDC	8 GB industrial temperature microSD card

Software	Local configuration, programming, and monitoring software	WEG Programming Suite (WPS) download at www.weg.net	
	Asset management platform	Compatible with WEG Motion Fleet Management (WMFM)	
		Embedded limited-time license. Check availability and activate the product	
		IoT Ready product with MQTT protocol	
Safety	Protections (memories of the last 100 faults/alarms with date and time stamp)	DC Link overvoltage	Output short circuit
		DC Link undervoltage	Output ground fault
		Frequency inverter and motor overtemperature	External fault
		Output overcurrent	Self-diagnostics for faults and programming errors
		Motor overload ($I \times t$)	Serial communication fault
		Dynamic braking resistor overload	Supply phase loss
		CPU/EPROM error (Watchdog)	
HMI	Commands	Start/stop, programming of general functions	
		Increase/decrease speed	
		JOG, H/AH and local/remote	
	Monitoring (record of the last 10 faults and 10 alarms, both with date and time stamp)	Speed reference (rpm)	Output current (A)
		Motor speed (rpm)	Output voltage (V)
		Scaled speed value (e.g., ft/min)	Drive status
		Output frequency (HZ)	Digital input status
		DC Link voltage (V)	Digital output status
		Motor torque (%)	Relay output status
		Output power (kW)	Value of the analog inputs
		Motor operating hours (h)	Fault/alarm messages
		VSD operating hours (h)	
	Characteristics	10-inch TFT LCD color touchscreen HMI	
		Password to protect the drive programming	
		LCD display language selection: English, Spanish, French, German, and Portuguese	

Control characteristics	Default	Fault self-diagnostics and auto-reset
		Parameter reset to factory defaults or user defaults
		Slip compensation (V/Hz mode)
		Manual torque boost - I x R (V/Hz mode)
		Adjustable V/Hz curve (V/Hz mode)
		Minimum and maximum adjustment points for speed, current, and DC Link voltage
		Adjustable motor overload protection
		Adjustable digital gain and offset for analog inputs
		Adjustable digital gain for analog outputs
		JOG +/-JOG- function (momentary speed increase/decrease)
		Copy-paste/backup function (drive ↔ HMI)
		Comparison functions for digital outputs: N1) > Nx; N > Nx; N < Nx; N = 0; N = N1); Is > Ix; Is < Ix; T > Tx and T < Tx3)
		Linear, S-curve and dual ramps
		Independent acceleration and deceleration ramps
		Multispeed function (up to 8 preset speeds)
		Special indicators (hour meter and wattmeter)
		Superimposed PID controller (for automatic level, flow, pressure, and weight control)
		Rotation direction selection (CW/CCW)
		Local/remote operation selection
		Flying start function (restarting into a spinning load)
Certifications	Electromagnetic compatibility according to IEC 61800	2014/30/EU – EMC Directive
		EN 61800-3 standard (EMC - emission and immunity)
		Adjustable Speed Electrical Power Drive System
		Part 4 - General Requirements
		Part 5 - Safety Requirements
	RoHS	2011/65/EU
		2015/863/EU
Certifications	CE / EAC / UKCA / UL	

Notes:

(1) microSD card not included.

(2) Occupy 3 backplane slots (if installed in the last position, occupies 1 slot). The remaining modules occupy a single slot. For additional features, refer to the accessory manual available on the WEG website.

(3) N = Motor speed; N1) = Speed reference; Is = Output current, and T = Motor torque.

2.4.1 Available Models

The MVW3000 line of medium voltage inverters offers different models, classified according to their voltage levels and rated current of the power cells. Different MVW3000 models may have different frames, which are presented [Table 2.3 on page 2-9](#) to [Table 2.17 on page 2-23](#) together with their respective codes. For construction details of the available frames, refer to [Chapter 4 TECHNICAL DATA on page 4-1](#), [Figure 4.3 on page 4-3](#), and [Table 4.2 on page 4-4](#) through [Table 4.13 on page 4-6](#).

Table 2.3: 1150 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V011	1150	40	90	70	2.77	2.43	4000 CFM 6800 m³/h	A1
MVW3000 A0050 V011		50	110	80	3.47	3.03		
MVW3000 A0060 V011		60	130	100	4.16	3.64		
MVW3000 A0070 V011		70	160	120	4.85	4.25		
MVW3000 A0080 V011		80	180	130	5.55	4.85		
MVW3000 A0090 V011		90	200	150	6.24	5.46		B1
MVW3000 A0100 V011		100	220	170	6.93	6.07		
MVW3000 A0110 V011		110	250	180	7.62	6.67		
MVW3000 A0125 V011		125	280	210	8.66	7.58		
MVW3000 A0140 V011		140	310	230	9.70	8.49		
MVW3000 A0160 V011		160	360	270	11.09	9.70		C1
MVW3000 A0180 V011		180	400	300	12.48	10.92		
MVW3000 A0200 V011		200	450	330	13.86	12.13		
MVW3000 A0225 V011		225	500	370	15.60	13.65	4200 CFM 7140 m³/h	D1
MVW3000 A0265 V011		265	590	440	18.37	16.07		
MVW3000 A0310 V011		310	690	520	21.49	18.80		E1
MVW3000 A0340 V011		340	760	570	23.57	20.62		
MVW3000 A0400 V011		400	890	670	27.73	24.26	5400 CFM 9174 m³/h	F1
MVW3000 A0450 V011		450	1000	750	31.19	27.29		
MVW3000 A0500 V011		500	1120	830	34.66	30.33		G1
MVW3000 A0550 V011		550	1230	910	38.12	33.36		
MVW3000 A0600 V011		600	1340	1000	41.59	36.39	7600 CFM 12920 m³/h	H1
MVW3000 A0650 V011		650	1450	1080	45.06	39.42		
MVW3000 A0700 V011		700	1560	1160	48.52	42.46		I1
MVW3000 A0750 V011		750	1670	1250	51.99	45.49		
MVW3000 A0800 V011		800	1790	1330	55.45	48.52	Upon request	2xF1
MVW3000 A0855 V011		855	1910	1420	59.27	51.86		2xG1
MVW3000 A0950 V011		950	2120	1580	65.85	57.62		
MVW3000 A1045 V011		1045	2330	1740	72.44	63.38		
MVW3000 A1140 V011		1140	2550	1900	79.02	69.14	Upon request	2xH1
MVW3000 A1235 V011		1235	2760	2050	85.61	74.91		
MVW3000 A1330 V011		1330	2970	2210	92.19	80.67		2xI1
MVW3000 A1425 V011		1425	3180	2370	98.78	86.43		
MVW3000 A1520 V011		1520	3390	2530	105.36	92.19		

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Table 2.4: 2300 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V023	2300	40	180	130	5.55	4.85	4000 CFM 6800 m³/h	A2
MVW3000 A0050 V023		50	220	170	6.93	6.07		
MVW3000 A0060 V023		60	270	200	8.32	7.28		
MVW3000 A0070 V023		70	310	230	9.70	8.49		
MVW3000 A0080 V023		80	360	270	11.09	9.70		
MVW3000 A0090 V023		90	400	300	12.48	10.92		B2
MVW3000 A0100 V023		100	450	330	13.86	12.13		
MVW3000 A0110 V023		110	490	370	15.25	13.34		
MVW3000 A0125 V023		125	560	420	17.33	15.16		
MVW3000 A0140 V023		140	630	470	19.41	16.98		
MVW3000 A0160 V023		160	710	530	22.18	19.41	8000 CFM 13595 m³/h	C2
MVW3000 A0180 V023		180	800	600	24.95	21.83		
MVW3000 A0200 V023		200	890	670	27.73	24.26		
MVW3000 A0225 V023		225	1000	750	31.19	27.29	8400 CFM 14275 m³/h	D2
MVW3000 A0265 V023		265	1180	880	36.74	32.15		E2
MVW3000 A0310 V023		310	1380	1030	42.98	37.60		
MVW3000 A0340 V023		340	1520	1130	47.14	41.24		
MVW3000 A0400 V023		400	1790	1330	55.45	48.52	10920 CFM 18553 m³/h	F2
MVW3000 A0450 V023		450	2010	1500	62.39	54.59		G2
MVW3000 A0500 V023		500	2230	1660	69.32	60.65		
MVW3000 A0550 V023		550	2460	1830	76.25	66.72		
MVW3000 A0600 V023		600	2680	2000	83.18	72.78	14100 CFM 23955 m³/h	H2
MVW3000 A0650 V023		650	2900	2160	90.11	78.85		I2
MVW3000 A0700 V023		700	3130	2330	97.04	84.91		
MVW3000 A0750 V023		750	3350	2500	103.98	90.98		
MVW3000 A0800 V023		800	3570	2660	110.91	97.04	Upon request	2xF2
MVW3000 A0855 V023		855	3820	2840	118.53	103.72		2xG2
MVW3000 A0950 V023		950	4240	3160	131.70	115.24		
MVW3000 A1045 V023		1045	4670	3480	144.87	126.76	Upon request	2xH2
MVW3000 A1140 V023		1140	5090	3790	158.04	138.29		2xI2
MVW3000 A1235 V023		1235	5520	4110	171.21	149.81		
MVW3000 A1330 V023		1330	5940	4430	184.38	161.33		
MVW3000 A1425 V023		1425	6360	4740	197.55	172.86		
MVW3000 A1520 V023		1520	6790	5060	210.72	184.38		

Table 2.5: 3300 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V033	3300	40	260	190	7.96	6.96	8000 CFM 13595 m³/h	A3
MVW3000 A0050 V033		50	320	240	9.95	8.70		
MVW3000 A0060 V033		60	380	290	11.93	10.44		
MVW3000 A0070 V033		70	450	330	13.92	12.18		
MVW3000 A0080 V033		80	510	380	15.91	13.92		
MVW3000 A0090 V033		90	580	430	17.90	15.66		B3
MVW3000 A0100 V033		100	640	480	19.89	17.40		
MVW3000 A0110 V033		110	700	530	21.88	19.14		
MVW3000 A0125 V033		125	800	600	24.86	21.76		
MVW3000 A0140 V033		140	900	670	27.85	24.37		
MVW3000 A0160 V033		160	1030	760	31.83	27.85		C3
MVW3000 A0180 V033		180	1150	860	35.80	31.33		
MVW3000 A0200 V033		200	1280	950	39.78	34.81		
MVW3000 A0225 V033		225	1440	1070	44.75	39.16	8400 CFM 14275 m³/h	D3
MVW3000 A0265 V033		265	1700	1270	52.71	46.12		
MVW3000 A0310 V033		310	1990	1480	61.66	53.95		E3
MVW3000 A0340 V033		340	2180	1620	67.63	59.18		
MVW3000 A0400 V033		400	2560	1910	79.56	69.62	11400 CFM 19375 m³/h	F3
MVW3000 A0450 V033		450	2880	2150	89.51	78.32		
MVW3000 A0500 V033		500	3200	2390	99.45	87.02		G3
MVW3000 A0550 V033		550	3520	2630	109.40	95.72		
MVW3000 A0600 V033		600	3840	2860	119.35	104.43	22800 CFM 38750 m³/h	H3
MVW3000 A0650 V033		650	4160	3100	129.29	113.13		
MVW3000 A0700V033		700	4490	3340	139.24	121.83		I3
MVW3000 A0750 V033		750	4810	3580	149.18	130.53		
MVW3000 A0800 V033		800	5130	3820	159.13	139.24	Upon request	2xF3
MVW3000 A0855 V033		855	5480	4080	170.07	148.81		2xG3
MVW3000 A0950 V033		950	6090	4530	188.96	165.34		
MVW3000 A1045 V033		1045	6700	4990	207.86	181.88		
MVW3000 A1140 V033		1140	7300	5440	226.76	198.41	Upon request	2xH3
MVW3000 A1235 V033		1235	7910	5900	245.65	214.95		
MVW3000 A1330 V033		1330	8520	6350	264.55	231.48		2xI3
MVW3000 A1425 V033		1425	9130	6800	283.44	248.01		
MVW3000 A1520 V033		1520	9740	7260	302.34	264.55		

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Table 2.6: 4160 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V041	4160	40	320	240	10.03	8.78	8000 CFM 13595 m³/h	A4
MVW3000 A0050 V041		50	400	300	12.54	10.97		
MVW3000 A0060 V041		60	480	360	15.04	13.16		
MVW3000 A0070 V041		70	570	420	17.55	15.36		
MVW3000 A0080 V041		80	650	480	20.06	17.55		
MVW3000 A0090 V041		90	730	540	22.57	19.75		
MVW3000 A0100 V041		100	810	600	25.07	21.94		
MVW3000 A0110 V041		110	890	660	27.58	24.13		
MVW3000 A0125 V041		125	1010	750	31.34	27.43		
MVW3000 A0140 V041		140	1130	840	35.10	30.72		
MVW3000 A0160 V041		160	1290	960	40.12	35.10	12000 CFM 20395 m³/h	B4
MVW3000 A0180 V041		180	1450	1080	45.13	39.49		
MVW3000 A0200 V041		200	1620	1200	50.15	43.88		
MVW3000 A0225 V041		225	1820	1350	56.42	49.37	12600 CFM 21415 m³/h	C4
MVW3000 A0265 V041		265	2140	1590	66.45	58.14		
MVW3000 A0310 V041		310	2500	1870	77.73	68.01		D4
MVW3000 A0340 V041		340	2750	2050	85.25	74.60		
MVW3000 A0400 V041		400	3230	2410	100.30	87.76	15200 CFM 25830 m³/h	E4
MVW3000 A0450 V041		450	3630	2710	112.84	98.73		
MVW3000 A0500 V041		500	4040	3010	125.37	109.70		
MVW3000 A0550 V041		550	4440	3310	137.91	120.67	28300 CFM 48080 m³/h	F4
MVW3000 A0600 V041		600	4850	3610	150.45	131.64		
MVW3000 A0650 V041		650	5250	3910	162.98	142.61		
MVW3000 A0700 V041		700	5650	4210	175.52	153.58		
MVW3000 A0750 V041		750	6060	4510	188.06	164.55	28300 CFM 48080 m³/h	I4
MVW3000 A0800 V041		800	6460	4810	200.60	175.52		
MVW3000 A0855 V041		855	6910	5150	214.39	187.59		
MVW3000 A0950 V041		950	7670	5720	238.21	208.43	Upon request	2xF4
MVW3000 A1045 V041		1045	8440	6290	262.03	229.28		
MVW3000 A1140 V041		1140	9210	6860	285.85	250.12		
MVW3000 A1235 V041		1235	9980	7430	309.67	270.96	Upon request	2xG4
MVW3000 A1330 V041		1330	10740	8000	333.49	291.81		
MVW3000 A1425 V041		1425	11510	8580	357.31	312.65		
MVW3000 A1520 V041		1520	12280	9150	381.13	333.49		

Table 2.7: 5500 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V055	5500	40	430	320	13.26	11.60	12000 CFM 20395 m³/h	A5
MVW3000 A0050 V055		50	530	400	16.58	14.50		
MVW3000 A0060 V055		60	640	480	19.89	17.40		
MVW3000 A0070 V055		70	750	560	23.21	20.31		
MVW3000 A0080 V055		80	850	640	26.52	23.21		
MVW3000 A0090 V055		90	960	720	29.84	26.11		B5
MVW3000 A0100 V055		100	1070	800	33.15	29.01		
MVW3000 A0110 V055		110	1170	880	36.47	31.91		
MVW3000 A0125 V055		125	1330	990	41.44	36.26		
MVW3000 A0140 V055		140	1500	1110	46.41	40.61		
MVW3000 A0160 V055		160	1710	1270	53.04	46.41	15000 CFM 25490 m³/h	C5
MVW3000 A0180 V055		180	1920	1430	59.67	52.21		
MVW3000 A0200 V055		200	2140	1590	66.30	58.02		
MVW3000 A0225 V055		225	2400	1790	74.59	65.27	16000 CFM 27180 m³/h	D5
MVW3000 A0265 V055		265	2830	2110	87.85	76.87		E5
MVW3000 A0310 V055		310	3310	2470	102.77	89.92		
MVW3000 A0340 V055		340	3630	2710	112.71	98.63		19000 CFM 32290 m³/h
MVW3000 A0400 V055		400	4270	3180	132.61	116.03	G5	
MVW3000 A0450 V055		450	4810	3580	149.18	130.53		
MVW3000 A0500 V055		500	5340	3980	165.76	145.04	38000 CFM 64580 m³/h	H5
MVW3000 A0550 V055		550	5870	4380	182.33	159.54		
MVW3000 A0600 V055		600	6410	4770	198.91	174.05		I5
MVW3000 A0650 V055		650	6940	5170	215.48	188.55		
MVW3000 A0700 V055		700	7480	5570	232.06	203.05	Upon request	2xF5
MVW3000 A0750 V055		750	8010	5970	248.64	217.56		
MVW3000 A0800 V055		800	8540	6360	265.21	232.06	Upon request	2xG5
MVW3000 A0855 V055		855	9130	6800	283.44	248.01		
MVW3000 A0950 V055		950	10150	7560	314.94	275.57		
MVW3000 A1045 V055		1045	11160	8310	346.43	303.13	Upon request	2xH5
MVW3000 A1140 V055		1140	12170	9070	377.93	330.69		
MVW3000 A1235 V055		1235	13190	9830	409.42	358.24		2xI5
MVW3000 A1330 V055		1330	14200	10580	440.91	385.80		
MVW3000 A1425 V055		1425	15220	11340	472.41	413.36		
MVW3000 A1520 V055		1520	16230	12090	503.90	440.91		

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Table 2.8: 6300 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V063	6300	40	490	360	15.19	13.29	12000 CFM 20395 m³/h	A6
MVW3000 A0050 V063		50	610	460	18.99	16.61		
MVW3000 A0060 V063		60	730	550	22.78	19.94		
MVW3000 A0070 V063		70	860	640	26.58	23.26		
MVW3000 A0080 V063		80	980	730	30.38	26.58		
MVW3000 A0090 V063		90	1100	820	34.18	29.90		B6
MVW3000 A0100 V063		100	1220	910	37.97	33.23		
MVW3000 A0110 V063		110	1350	1000	41.77	36.55		
MVW3000 A0125 V063		125	1530	1140	47.47	41.53		
MVW3000 A0140 V063		140	1710	1280	53.16	46.52		
MVW3000 A0160 V063		160	1960	1460	60.76	53.16	16000 CFM 27190 m³/h	C6
MVW3000 A0180 V063		180	2200	1640	68.35	59.81		
MVW3000 A0200 V063		200	2450	1820	75.95	66.45		
MVW3000 A0225 V063		225	2750	2050	85.44	74.76	16800 CFM 28550 m³/h	D6
MVW3000 A0265 V063		265	3240	2420	100.63	88.05		E6
MVW3000 A0310 V063		310	3790	2830	117.72	103.00		
MVW3000 A0340 V063		340	4160	3100	129.11	112.97	22800 CFM 38745 m³/h	F6
MVW3000 A0400 V063		400	4890	3650	151.89	132.91		
MVW3000 A0450 V063		450	5500	4100	170.88	149.52		
MVW3000 A0500 V063		500	6120	4560	189.87	166.13		G6
MVW3000 A0550 V063		550	6730	5010	208.85	182.75		
MVW3000 A0600 V063		600	7340	5470	227.84	199.36		
MVW3000 A0650 V063		650	7950	5920	246.83	215.97	42400 CFM 72038 m³/h	H6
MVW3000 A0700 V063		700	8560	6380	265.81	232.59		
MVW3000 A0750 V063		750	9170	6840	284.80	249.20		I6
MVW3000 A0800 V063		800	9790	7290	303.79	265.81		
MVW3000 A0855 V063		855	10460	7790	324.67	284.09	Upon request	2xF6
MVW3000 A0950 V063		950	11620	8660	360.75	315.65		2xG6
MVW3000 A1045 V063		1045	12780	9520	396.82	347.22		
MVW3000 A1140 V063		1140	13950	10390	432.90	378.79		Upon request
MVW3000 A1235 V063		1235	15110	11260	468.97	410.35		
MVW3000 A1330 V063		1330	16270	12120	505.05	441.92	2xI6	
MVW3000 A1425 V063		1425	17430	12990	541.12	473.48		
MVW3000 A1520 V063		1520	18590	13850	577.20	505.05		

Table 2.9: 6900 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V069	6900	40	540	400	16.64	14.56	12000 CFM 20395 m³/h	A6
MVW3000 A0050 V069		50	670	500	20.80	18.20		
MVW3000 A0060 V069		60	800	600	24.95	21.83		
MVW3000 A0070 V069		70	940	700	29.11	25.47		
MVW3000 A0080 V069		80	1070	800	33.27	29.11		
MVW3000 A0090 V069		90	1210	900	37.43	32.75		B6
MVW3000 A0100 V069		100	1340	1000	41.59	36.39		
MVW3000 A0110 V069		110	1470	1100	45.75	40.03		
MVW3000 A0125 V069		125	1670	1250	51.99	45.49		
MVW3000 A0140 V069		140	1880	1400	58.23	50.95		
MVW3000 A0160 V069		160	2140	1600	66.54	58.23	16000 CFM 27190 m³/h	C6
MVW3000 A0180 V069		180	2410	1800	74.86	65.50		
MVW3000 A0200 V069		200	2680	2000	83.18	72.78		
MVW3000 A0225 V069		225	3010	2250	93.58	81.88	16800 CFM 28550 m³/h	D6
MVW3000 A0265 V069		265	3550	2650	110.21	96.44		E6
MVW3000 A0310 V069		310	4150	3090	128.93	112.81		
MVW3000 A0340 V069		340	4560	3390	141.41	123.73		
MVW3000 A0400 V069		400	5360	3990	166.36	145.57	22800 CFM 38745 m³/h	F6
MVW3000 A0450 V069		450	6030	4490	187.16	163.76		G6
MVW3000 A0500 V069		500	6700	4990	207.95	181.96		
MVW3000 A0550 V069		550	7370	5490	228.75	200.15		
MVW3000 A0600 V069		600	8040	5990	249.54	218.35		
MVW3000 A0650 V069		650	8710	6490	270.34	236.54	42400 CFM 72038 m³/h	H6
MVW3000 A0700 V069		700	9380	6990	291.13	254.74		I6
MVW3000 A0750 V069		750	10050	7490	311.93	272.93		
MVW3000 A0800 V069		800	10720	7990	332.72	291.13		
MVW3000 A0855 V069		855	11460	8530	355.59	311.15	Upon request	2xF6
MVW3000 A0950 V069		950	12730	9480	395.11	345.72		2xG6
MVW3000 A1045 V069		1045	14000	10430	434.62	380.29		
MVW3000 A1140 V069		1140	15270	11380	474.13	414.86		2xH6
MVW3000 A1235 V069		1235	16550	12330	513.64	449.43	Upon request	
MVW3000 A1330 V069		1330	17820	13280	553.15	484.00		
MVW3000 A1425 V069		1425	19090	14220	592.66	518.58		
MVW3000 A1520 V069		1520	20360	15170	632.17	553.15		

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Table 2.10: 7200 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V072	7200	40	560	420	17.36	15.19	14000 CFM 23790 m³/h	A7
MVW3000 A0050 V072		50	700	520	21.70	18.99		
MVW3000 A0060 V072		60	840	620	26.04	22.78		
MVW3000 A0070 V072		70	980	730	30.38	26.58		
MVW3000 A0080 V072		80	1120	830	34.72	30.38		B7
MVW3000 A0090 V072		90	1260	940	39.06	34.18		
MVW3000 A0100 V072		100	1400	1040	43.40	37.97		
MVW3000 A0110 V072		110	1540	1150	47.74	41.77		
MVW3000 A0125 V072		125	1750	1300	54.25	47.47		
MVW3000 A0140 V072		140	1960	1460	60.76	53.16		
MVW3000 A0160 V072		160	2240	1670	69.44	60.76	20000 CFM 33985 m³/h	C7
MVW3000 A0180 V072		180	2520	1870	78.12	68.35		
MVW3000 A0200 V072		200	2800	2080	86.80	75.95	21000 CFM 35685 m³/h	D7
MVW3000 A0225 V072		225	3150	2340	97.65	85.44		
MVW3000 A0265 V072		265	3700	2760	115.01	100.63		E7
MVW3000 A0310 V072		310	4330	3230	134.53	117.72		
MVW3000 A0340 V072		340	4750	3540	147.55	129.11	24700 CFM 41975 m³/h	F7
MVW3000 A0400 V072		400	5590	4170	173.59	151.89		
MVW3000 A0450 V072		450	6290	4690	195.29	170.88	26600 CFM 45200 m³/h	G7
MVW3000 A0500 V072		500	6990	5210	216.99	189.87		
MVW3000 A0550 V072		550	7690	5730	238.69	208.85		
MVW3000 A0600 V072		600	8390	6250	260.39	227.84	49400 CFM 83950 m³/h	H7
MVW3000 A0650 V072		650	9090	6770	282.09	246.83		
MVW3000 A0700 V072		700	9790	7290	303.79	265.81	53200 CFM 90400 m³/h	I7
MVW3000 A0750 V072		750	10490	7810	325.49	284.80		
MVW3000 A0800 V072		800	11180	8330	347.19	303.79		

Table 2.11: 8000 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V080	8000	40	620	460	19.29	16.88	14000 CFM 23790 m³/h	A7
MVW3000 A0050 V080		50	780	580	24.11	21.10		
MVW3000 A0060 V080		60	930	690	28.93	25.32		
MVW3000 A0070 V080		70	1090	810	33.75	29.53		
MVW3000 A0080 V080		80	1240	930	38.58	33.75		B7
MVW3000 A0090 V080		90	1400	1040	43.40	37.97		
MVW3000 A0100 V080		100	1550	1160	48.22	42.19		
MVW3000 A0110 V080		110	1710	1270	53.04	46.41		
MVW3000 A0125 V080		125	1940	1450	60.28	52.74		
MVW3000 A0140 V080		140	2170	1620	67.51	59.07		
MVW3000 A0160 V080		160	2490	1850	77.15	67.51	20000 CFM 33985 m³/h	C7
MVW3000 A0180 V080		180	2800	2080	86.80	75.95		
MVW3000 A0200 V080		200	3110	2310	96.44	84.39	21000 CFM 35685 m³/h	D7
MVW3000 A0225 V080		225	3500	2600	108.50	94.93		
MVW3000 A0265 V080		265	4120	3070	127.78	111.81		E7
MVW3000 A0310 V080		310	4820	3590	149.48	130.80		
MVW3000 A0340 V080		340	5280	3930	163.95	143.46	24700 CFM 41975 m³/h	F7
MVW3000 A0400 V080		400	6210	4630	192.88	168.77		
MVW3000 A0450 V080		450	6990	5210	216.99	189.87	26600 CFM 45200 m³/h	G7
MVW3000 A0500 V080		500	7770	5790	241.10	210.96		
MVW3000 A0550 V080		550	8540	6360	265.21	232.06		
MVW3000 A0600 V080		600	9320	6940	289.32	253.16	49400 CFM 83950 m³/h	H7
MVW3000 A0650 V080		650	10100	7520	313.43	274.25		
MVW3000 A0700 V080		700	10870	8100	337.54	295.35	53200 CFM 90400 m³/h	I7
MVW3000 A0750 V080		750	11650	8680	361.65	316.45		
MVW3000 A0800 V080		800	12430	9260	385.76	337.54		

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Table 2.12: 9000 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V090	9000	40	700	520	21.70	18.99	16000 CFM 27190 m³/h	A8
MVW3000 A0050 V090		50	870	650	27.12	23.73		
MVW3000 A0060 V090		60	1050	780	32.55	28.48		
MVW3000 A0070 V090		70	1220	910	37.97	33.23		
MVW3000 A0080 V090		80	1400	1040	43.40	37.97		B8
MVW3000 A0090 V090		90	1570	1170	48.82	42.72		
MVW3000 A0100 V090		100	1750	1300	54.25	47.47		
MVW3000 A0110 V090		110	1920	1430	59.67	52.21		
MVW3000 A0125 V090		125	2180	1630	67.81	59.33		
MVW3000 A0140 V090		140	2450	1820	75.95	66.45		
MVW3000 A0160 V090		160	2800	2080	86.80	75.95	22000 CFM 37385 m³/h	C8
MVW3000 A0180 V090		180	3150	2340	97.65	85.44		
MVW3000 A0200 V090		200	3500	2600	108.50	94.93	23100 CFM 39255 m³/h	D8
MVW3000 A0225 V090		225	3930	2930	122.06	106.80		
MVW3000 A0265 V090		265	4630	3450	143.76	125.79		E8
MVW3000 A0310 V090		310	5420	4040	168.17	147.15		
MVW3000 A0340 V090		340	5940	4430	184.44	161.39	30400 CFM 51660 m³/h	F8
MVW3000 A0400 V090		400	6990	5210	216.99	189.87		
MVW3000 A0450 V090		450	7860	5860	244.12	213.60		G8
MVW3000 A0500 V090		500	8740	6510	271.24	237.33		
MVW3000 A0550 V090		550	9610	7160	298.36	261.07		
MVW3000 A0600 V090		600	10490	7810	325.49	284.80	60800 CFM 103320 m³/h	H8
MVW3000 A0650 V090		650	11360	8460	352.61	308.53		
MVW3000 A0700 V090		700	12230	9110	379.73	332.27		I8
MVW3000 A0750 V090		750	13110	9760	406.86	356.00		
MVW3000 A0800 V090		800	13980	10420	433.98	379.73		

Table 2.13: 10000 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V100	10000	40	780	580	24.11	21.10	18000 CFM 30590 m³/h	A9
MVW3000 A0050 V100		50	970	720	30.14	26.37		B9
MVW3000 A0060 V100		60	1170	870	36.17	31.64		
MVW3000 A0070 V100		70	1360	1010	42.19	36.92		
MVW3000 A0080 V100		80	1550	1160	48.22	42.19		
MVW3000 A0090 V100		90	1750	1300	54.25	47.47		
MVW3000 A0100 V100		100	1940	1450	60.28	52.74		
MVW3000 A0110 V100		110	2140	1590	66.30	58.02		
MVW3000 A0125 V100		125	2430	1810	75.34	65.93		
MVW3000 A0140 V100		140	2720	2030	84.39	73.84		
MVW3000 A0160 V100		160	3110	2310	96.44	84.39	22000 CFM 37385 m³/h	C9
MVW3000 A0180 V100		180	3500	2600	108.50	94.93		
MVW3000 A0200 V100		200	3880	2890	120.55	105.48	25200 CFM 42825 m³/h	D9
MVW3000 A0225 V100		225	4370	3250	135.62	118.67		
MVW3000 A0265 V100		265	5150	3830	159.73	139.76		E9
MVW3000 A0310 V100		310	6020	4480	186.85	163.50		
MVW3000 A0340 V100		340	6600	4920	204.94	179.32	34200 CFM 58115 m³/h	F9
MVW3000 A0400 V100		400	7770	5790	241.10	210.96		
MVW3000 A0450 V100		450	8740	6510	271.24	237.33		G9
MVW3000 A0500 V100		500	9710	7230	301.38	263.70		
MVW3000 A0550 V100		550	10680	7960	331.51	290.08	70600 CFM 119950 m³/h	H9
MVW3000 A0600 V100		600	11650	8680	361.65	316.45		
MVW3000 A0650 V100		650	12620	9400	391.79	342.82		I9
MVW3000 A0700 V100		700	13590	10130	421.93	369.19		
MVW3000 A0750 V100		750	14560	10850	452.07	395.56		
MVW3000 A0800 V100		800	15530	11570	482.20	421.93		

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Table 2.14: 11000 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V110	11000	40	850	640	26.52	23.21	18000 CFM 30590 m³/h	A10
MVW3000 A0050 V110		50	1070	800	33.15	29.01		
MVW3000 A0060 V110		60	1280	950	39.78	34.81		
MVW3000 A0070 V110		70	1500	1110	46.41	40.61		
MVW3000 A0080 V110		80	1710	1270	53.04	46.41		B10
MVW3000 A0090 V110		90	1920	1430	59.67	52.21		
MVW3000 A0100 V110		100	2140	1590	66.30	58.02		
MVW3000 A0110 V110		110	2350	1750	72.93	63.82		
MVW3000 A0125 V110		125	2670	1990	82.88	72.52		
MVW3000 A0140 V110		140	2990	2230	92.82	81.22		
MVW3000 A0160 V110		160	3420	2550	106.08	92.82	26000 CFM 44185 m³/h	C10
MVW3000 A0180 V110		180	3840	2860	119.35	104.43		
MVW3000 A0200 V110		200	4270	3180	132.61	116.03	29400 CFM 49960 m³/h	D10
MVW3000 A0225 V110		225	4810	3580	149.18	130.53		
MVW3000 A0265 V110		265	5660	4220	175.70	153.74		E10
MVW3000 A0310 V110		310	6620	4930	205.54	179.85		
MVW3000 A0340 V110		340	7260	5410	225.43	197.25	38000 CFM 64575 m³/h	F10
MVW3000 A0400 V110		400	8540	6360	265.21	232.06		
MVW3000 A0450 V110		450	9610	7160	298.36	261.07		G10
MVW3000 A0500 V110		500	10680	7960	331.51	290.08		
MVW3000 A0550 V110		550	11750	8750	364.67	319.08		
MVW3000 A0600 V110		600	12820	9550	397.82	348.09	70600 CFM 119950 m³/h	H10
MVW3000 A0650 V110		650	13880	10340	430.97	377.10		
MVW3000 A0700 V110		700	14950	11140	464.12	406.11		I10
MVW3000 A0750 V110		750	16020	11930	497.27	435.11		
MVW3000 A0800 V110		800	17090	12730	530.42	464.12		

Table 2.15: 12000 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V120	12000	40	930	690	28.93	25.32	20000 CFM 33985 m³/h	A11
MVW3000 A0050 V120		50	1170	870	36.17	31.64		B11
MVW3000 A0060 V120		60	1400	1040	43.40	37.97		
MVW3000 A0070 V120		70	1630	1220	50.63	44.30		
MVW3000 A0080 V120		80	1860	1390	57.86	50.63		
MVW3000 A0090 V120		90	2100	1560	65.10	56.96		
MVW3000 A0100 V120		100	2330	1740	72.33	63.29		
MVW3000 A0110 V120		110	2560	1910	79.56	69.62		
MVW3000 A0125 V120		125	2910	2170	90.41	79.11		
MVW3000 A0140 V120		140	3260	2430	101.26	88.60		
MVW3000 A0160 V120		160	3730	2780	115.73	101.26	28000 CFM 47580 m³/h	C11
MVW3000 A0180 V120		180	4190	3120	130.19	113.92		
MVW3000 A0200 V120		200	4660	3470	144.66	126.58	33600 CFM 57095 m³/h	D11
MVW3000 A0225 V120		225	5240	3910	162.74	142.40		
MVW3000 A0265 V120		265	6170	4600	191.68	167.72		E11
MVW3000 A0310 V120		310	7220	5380	224.22	196.20		
MVW3000 A0340 V120		340	7920	5900	245.92	215.18	41800 CFM 71030 m³/h	F11
MVW3000 A0400 V120		400	9320	6940	289.32	253.16		
MVW3000 A0450 V120		450	10490	7810	325.49	284.80		G11
MVW3000 A0500 V120		500	11650	8680	361.65	316.45		
MVW3000 A0550 V120		550	12820	9550	397.82	348.09	83600 CFM 142060 m³/h	H11
MVW3000 A0600 V120		600	13980	10420	433.98	379.73		
MVW3000 A0650 V120		650	15150	11280	470.15	411.38		I11
MVW3000 A0700 V120		700	16310	12150	506.31	443.02		
MVW3000 A0750 V120		750	17480	13020	542.48	474.67		
MVW3000 A0800 V120		800	18640	13890	578.64	506.31		

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Table 2.16: 13200 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V132	13200	40	1030	760	31.83	27.85	22000 CFM 37385 m³/h	A12
MVW3000 A0050 V132		50	1280	950	39.78	34.81		B12
MVW3000 A0060 V132		60	1540	1150	47.74	41.77		
MVW3000 A0070 V132		70	1790	1340	55.69	48.73		
MVW3000 A0080 V132		80	2050	1530	63.65	55.69		
MVW3000 A0090 V132		90	2310	1720	71.61	62.66		
MVW3000 A0100 V132		100	2560	1910	79.56	69.62		
MVW3000 A0110 V132		110	2820	2100	87.52	76.58		
MVW3000 A0125 V132		125	3200	2390	99.45	87.02		
MVW3000 A0140 V132		140	3590	2670	111.39	97.47		
MVW3000 A0160 V132		160	4100	3060	127.30	111.39	28000 CFM 47580 m³/h	C12
MVW3000 A0180 V132		180	4610	3440	143.21	125.31		
MVW3000 A0200 V132		200	5130	3820	159.13	139.24	33600 CFM 57095 m³/h	D12
MVW3000 A0225 V132		225	5770	4300	179.02	156.64		
MVW3000 A0265 V132		265	6790	5060	210.84	184.49		E12
MVW3000 A0310 V132		310	7950	5920	246.65	215.82		
MVW3000 A0340 V132		340	8710	6490	270.52	236.70	45600 CFM 77490 m³/h	F12
MVW3000 A0400 V132		400	10250	7640	318.25	278.47		
MVW3000 A0450 V132		450	11530	8590	358.04	313.28		G12
MVW3000 A0500 V132		500	12820	9550	397.82	348.09		
MVW3000 A0550 V132		550	14100	10500	437.60	382.90	84800 CFM 144076 m³/h	H12
MVW3000 A0600 V132		600	15380	11460	477.38	417.71		
MVW3000 A0650 V132		650	16660	12410	517.16	452.52		I12
MVW3000 A0700 V132		700	17940	13370	556.94	487.33		
MVW3000 A0750 V132		750	19220	14320	596.73	522.14		I12
MVW3000 A0800 V132		800	20500	15280	636.51	556.94		

Table 2.17: 13800 V models

Models	Nominal Voltage [V]	Rated Current ND ⁽⁵⁾ [A]	Motor Rated Power ⁽¹⁾		Dissipated Power ⁽²⁾ [kW]	Dissipated Power ⁽³⁾ [kW]	Flow ⁽⁴⁾	Frame Size
			HP	kW				
MVW3000 A0040 V138	13800	40	1070	800	33.27	29.11	22000 CFM 37385 m³/h	A12
MVW3000 A0050 V138		50	1340	1000	41.59	36.39		B12
MVW3000 A0060 V138		60	1610	1200	49.91	43.67		
MVW3000 A0070 V138		70	1880	1400	58.23	50.95		
MVW3000 A0080 V138		80	2140	1600	66.54	58.23		
MVW3000 A0090 V138		90	2410	1800	74.86	65.50		
MVW3000 A0100 V138		100	2680	2000	83.18	72.78		
MVW3000 A0110 V138		110	2950	2200	91.50	80.06		
MVW3000 A0125 V138		125	3350	2500	103.98	90.98		
MVW3000 A0140 V138		140	3750	2790	116.45	101.90		
MVW3000 A0160 V138		160	4290	3190	133.09	116.45	28000 CFM 47580 m³/h	C12
MVW3000 A0180 V138		180	4820	3590	149.72	131.01		
MVW3000 A0200 V138		200	5360	3990	166.36	145.57	33600 CFM 57095 m³/h	D12
MVW3000 A0225 V138		225	6030	4490	187.16	163.76		
MVW3000 A0265 V138		265	7100	5290	220.43	192.87		E12
MVW3000 A0310 V138		310	8310	6190	257.86	225.63		
MVW3000 A0340 V138		340	9110	6790	282.81	247.46	45600 CFM 77490 m³/h	F12
MVW3000 A0400 V138		400	10720	7990	332.72	291.13		
MVW3000 A0450 V138		450	12060	8980	374.31	327.52		G12
MVW3000 A0500 V138		500	13400	9980	415.90	363.91		
MVW3000 A0550 V138		550	14740	10980	457.49	400.30	84800 CFM 144076 m³/h	H12
MVW3000 A0600 V138		600	16080	11980	499.08	436.70		
MVW3000 A0650 V138		650	17420	12980	540.67	473.09		I12
MVW3000 A0700 V138		700	18760	13970	582.26	509.48		
MVW3000 A0750 V138		750	20100	14970	623.85	545.87		
MVW3000 A0800 V138		800	21440	15970	665.44	582.26		

(1) Motor power ratings are provided for reference only, and proper inverter sizing must be based on the rated current of the motor to be used, as well as overload conditions related to the application.

Derating factors may apply due to operation at altitude (above 1000 m), extreme temperatures (above 40 °C (104 °F)), or low output frequencies (below 20 Hz).

The motor rated output takes into account the operation with 0.87 power factor and 97 % efficiency at full load.

(2) Power dissipation considering a transformer with aluminum windings and operation under the conditions described in note (1).

The dissipated power with the filter is obtained with the multiplication by 1.002597.

(3) Power dissipation considering a transformer with copper windings and operation under the conditions described in note (1).

The dissipated power with the filter is obtained with the multiplication by 1.002597.

(4) Reference values. Actual values depend on the final project design.

(5) The rated current for Heavy Duty (HD) (I_{rat_hd}) is equivalent to 0.77 times the rated current for Normal Duty (ND) (I_{rat_nd}) of the inverter.



NOTES!

1 hp = 746 kW.

1 kW = 3412.14 BTU/hour for dissipated power.

1 m³/h = 5885 CFM.



Figure 2.2: MVW3000 panel general view (Frame B10)

3 PRODUCT CHARACTERISTICS

A brief theoretical explanation about the operation of the MVW3000 and a simplified electrical diagram of the power cells and their connections are shown below. At the end, the basic operation of the control system is described.

The MVW3000 is a frequency inverter designed to control medium voltage motors at rated values of 1.15 kV to 13.8 kV and for a power range from 85 HP to 16215 HP (for other models, see www.weg.net). Based on a topology where low voltage cells (< 1000 V) are connected in series to form each inverter phase, its modular assembly allows different configurations if it is necessary to drive high power motors.



NOTE!

The characteristics described in this manual are based on standard MVW3000 models to be applied on 6.6 kV motors. Therefore, the MVW3000 used in the general illustrations will contain 18 low voltage power cells (six in series per phase). Notice that the MVW3000 can be engineered to meet the needs and technical specifications of our customers. Contact our technical team for more details.

3.1 INPUT TRANSFORMER

The MVW3000 inverter has an input transformer, because the cascade cell topology demands the feeding of each cell to be insulated from each other. This transformer is built so as to meet the different functions for the MVW3000, such as the necessary insulation for the power cells, cancellation of the harmonic current coming from the cell input rectifiers, and it also has an auxiliary winding responsible for the system pre-charge.

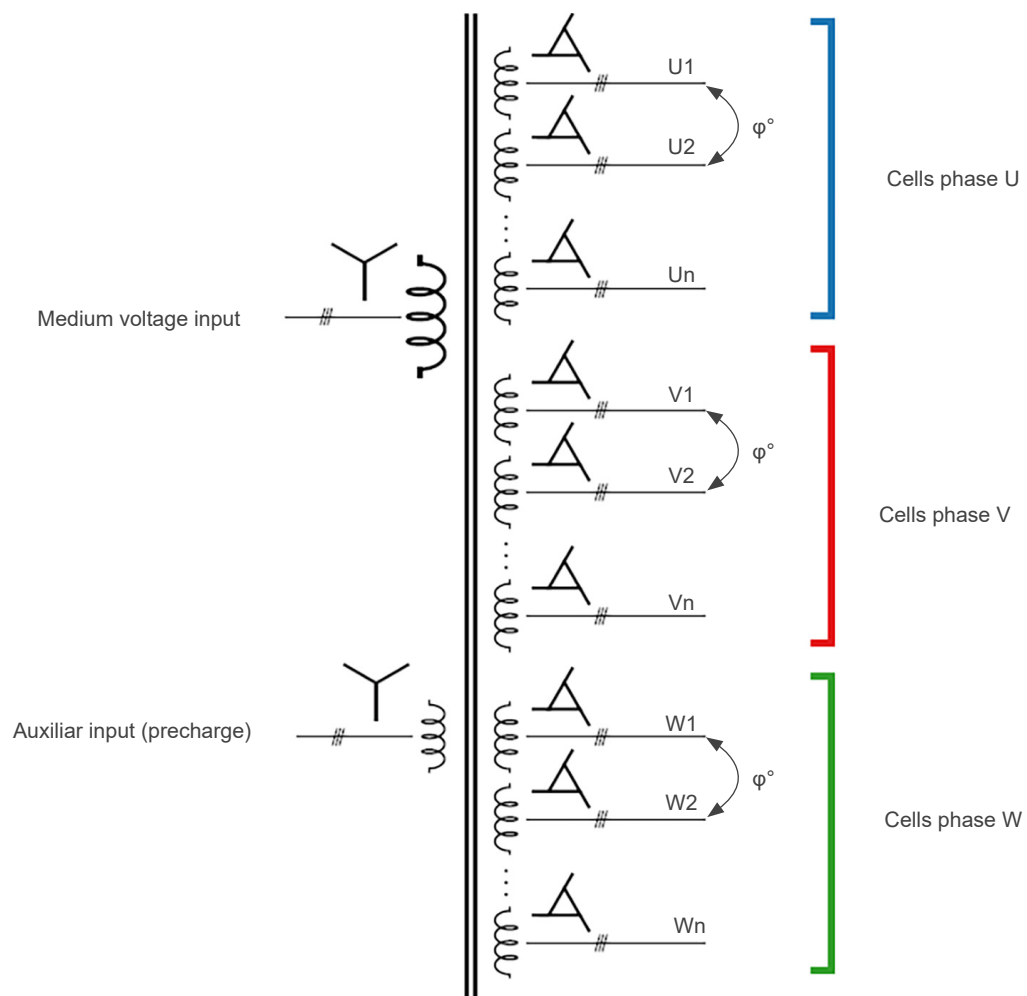


Figure 3.1: Input phase-shifting transformer diagram

PRODUCT CHARACTERISTICS

The transformer configuration is extended star – delta, with phase-shifting angles φ° between the secondary windings of the same phase. The main primary windings (star connection) and the auxiliary input windings (also star) do not present phase shifting between each other.

The transformer is designed according to the number of cells used in the inverter. There are $3 \times 3 \times n$ windings (number of motor phases $\times$ number of cell input phases $\times$ number of cells per phase), forming n isolated secondaries, each processing $1/(3n)$ of the rated inverter power, totaling one secondary winding per cell.

The number of secondary windings depends on the number of cells. [Table 3.1 on page 3-2](#) presents the number of main transformer secondary windings required to supply the cells.

Table 3.1: Number of isolated secondary windings per voltage level

Output Voltage [kV]	1.15	2.3	3.3	4.16	5.5-6	6.3-6.9	7.2-8	9	10	11	12	13.2-13.8
Secondaries Quantity	3	6	9	12	15	18	21	24	27	30	33	36

The transformer secondary windings have phase-shifting designed according to the number of cells and the specified harmonic level, and it may be engineered upon the customer's request. The phase-shifting helps cancel the harmonic components coming from the non-controlled semiconductor devices. As each cell has a 6-pulse diode rectifier at the input, and the secondary windings have a phase-shifting between each other, the transformer primary winding perceives multiples of six in its windings.

The bigger the number of pulses, the smaller the phase-shifting angle between the secondary windings, and the smaller the harmonic distortion rate observed by the transformer primary winding. Smaller phase-shifting angles imply more complex manufacture and parameter control of the transformer. Thus, a good complexity-performance ratio is sought.

For the 18-cell MVW3000, the 36-pulse transformer is used, offering good cost effectiveness with great performance regarding harmonic component cancellation and lower cost in comparison to transformers with more pulses.

[Table 3.2 on page 3-2](#) presents the possible input transformer configurations for different numbers of cells installed in the MVW3000 panel.

Table 3.2: Number of pulses that can be obtained in relation to the number of cells

Motor Voltage	Cells per Phase	Total Cells	Default Number of Pulses	Number of Redundant Pulses N+1
1150 V	1	3	18 ⁽¹⁾	36 ⁽¹⁾ , 18
2300 V	2	6	36 ⁽¹⁾ , 18	54, 18 ⁽¹⁾
3300 V	3	9	54, 18 ⁽¹⁾	72, 36, 24 ⁽¹⁾
4160 V	4	12	72, 36, 24 ⁽¹⁾	90, 30 ⁽¹⁾
5500-6000 V	5	15	90, 30 ⁽¹⁾	108, 54, 36 ⁽¹⁾
6300-6900 V	6	18	108, 54, 36 ⁽¹⁾	126, 42 ⁽¹⁾
7200-8000 V	7	21	126, 42 ⁽¹⁾	144, 72, 48 ⁽¹⁾
9000 V	8	24	144, 72, 48 ⁽¹⁾	162, 54 ⁽¹⁾
10000 V	9	27	162, 54 ⁽¹⁾	180, 90, 60 ⁽¹⁾
11000 V	10	30	180, 90, 60 ⁽¹⁾ , 30 ⁽³⁾	180, 90, 60 ⁽¹⁾
12000 V	11	33	198, 66 ⁽¹⁾	216, 108, 72 ⁽¹⁾
13200-13800 V ⁽²⁾	12	36	216, 108, 72 ⁽¹⁾ , 36 ⁽³⁾	216, 108, 72 ⁽¹⁾

(1) Standard option.

(2) Cell redundancy (N + 1) only for the 13200 V model; the 13800 V model is supplied without redundancy.

(3) Option valid only for solutions with a single phase-shifting transformer.

[Figure 3.2 on page 3-3](#) indicates the connection points for the power cell inputs, namely phases R, S, and T. The windings, with a rated voltage of 690 or 710 Vrms, process 1/18 of the rated inverter power in the case of the 18-cell MVW3000.

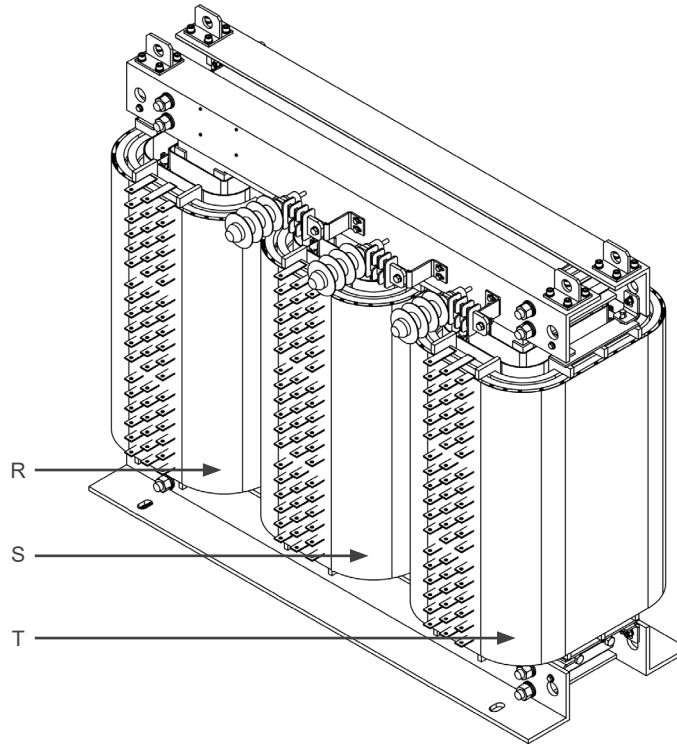


Figure 3.2: Input transformer of the 18-cell MVW3000 (frame B6)

The cells forming phases U, V, and W are physically connected to the main transformer, as shown in [Figure 3.3 on page 3-3](#). Depending on the model, these connections may vary. For further information, refer to the specific project documentation.

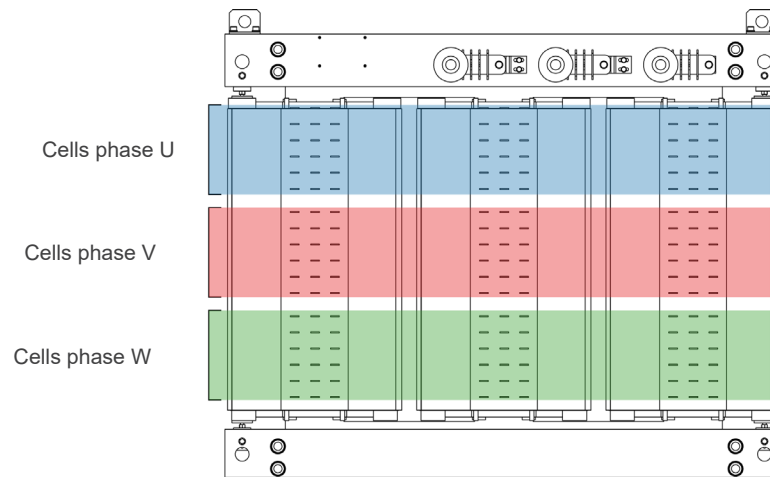


Figure 3.3: Cell connection area of each phase

The transformer has its own panel, being fully integrated to the MVW3000. For further details regarding the panels, refer to [Chapter 4 TECHNICAL DATA on page 4-1](#), [Figure 4.3 on page 4-3](#), and [Table 4.2 on page 4-4](#) through [Table 4.13 on page 4-6](#).

3.2 POWER CELLS

The power cells used in the arms of the MVW3000, are single-phase low voltage inverters (output voltage 690 or 710 Vrms), in a topology known as H bridge or full bridge. A basic diagram of the power cell circuit is shown in [Figure 3.4 on page 3-4](#). Each cell has its own main transformer secondary winding (three-phase) power supply, which ensures the medium voltage isolation of the inverter.

PRODUCT CHARACTERISTICS

The input three-phase voltages of the modules are then rectified by a Graetz bridge using non-controlled semiconductor devices (diodes), forming an own DC Link (direct current) with the addition of the capacitors to the cell (represented by symbol C1).

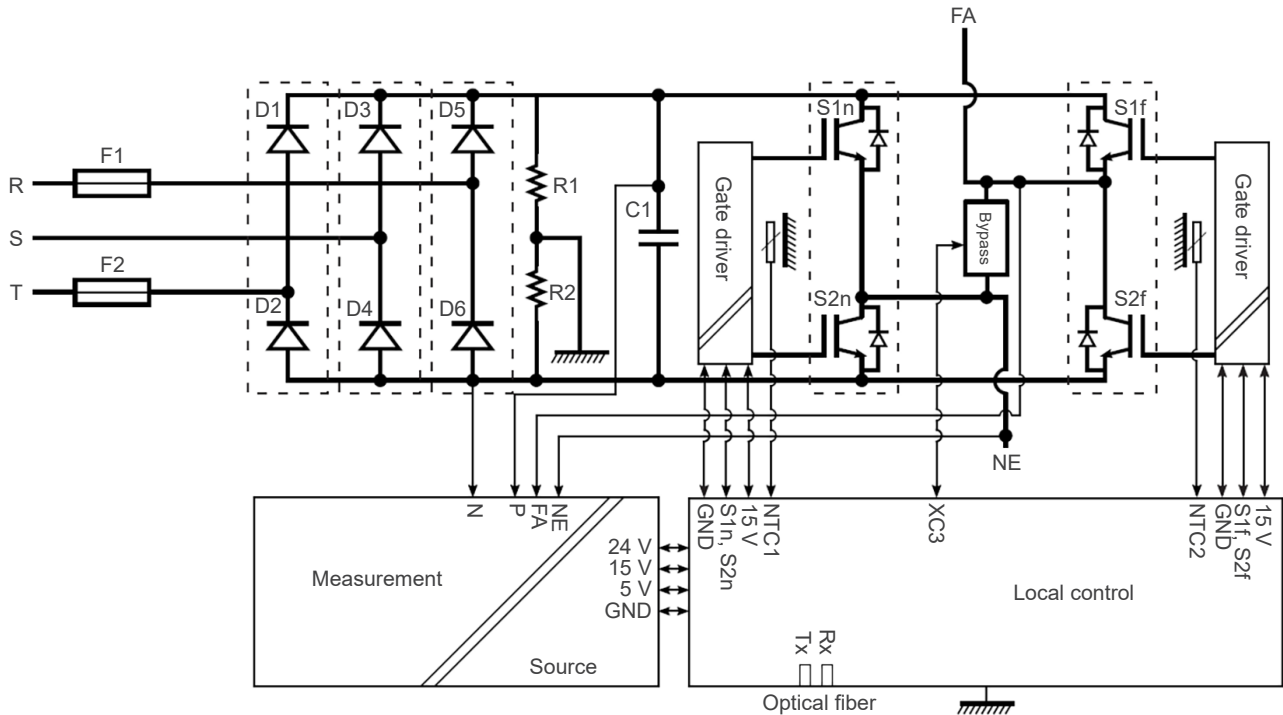


Figure 3.4: Basic diagram of a power cell

IGBT (Insulated Bipolar Gate Transistor) controlled semiconductor devices are used to implement the inverter H bridge; thus, each power cell has four IGBTs in the configuration shown above. During operation, the voltage between FA and NE output terminals has three possible voltage levels. Considering that the DC Link voltage of each cell is V_{dc} and that only two IGBTs can be operating simultaneously (due to short circuit protection, the two IGBTs of each arm cannot be conducting simultaneously), when S1f and S2n are operating, the voltage between FA and NE will be $+V_{dc}$, whereas if S1n and S2f start operating, the voltage between FA and NE will be $-V_{dc}$. If S1n and S1f or S2n and S2f are turned on, the voltage, in both cases, will be equal to zero.

To protect the modules, two or three fuses (depending on the cell model) are connected to the input phases R, S, and T. Figure 3.4 on page 3-4 shows an example of a cell with two fuses, F1 and F2. In case a module presents some fault, the bypass system, when available, will be responsible for circumventing the fault, removing it from the series and allowing the operation to continue.

When that occurs, control strategies will be applied so that the load remains operating. For further information, refer to Chapter 8 SPECIAL FUNCTIONS on page 8-1.

Each power cell has one local control module. This module communicates with the main control module by means of an fiber optic interface, necessary to obtain – in addition to the insulation degree required for the communication – noise immunity, greater robustness and reliability, which are necessary characteristics for the application. The local control makes acquisitions and monitors relevant magnitudes for the cell operation.

Some of the monitored magnitudes are the income temperature of the diode modules and IGBTs, voltage of the DC Link capacitors, voltage of the cell power supplies, among others.

The local control is also responsible for local drives, such as the switching of the IGBTs and the triggering of the bypass system. In case the cell presents readings out of the expected operation standards, for example, temperatures close to damaging the semiconductors, overvoltage on the DC Link, or other faults monitored by the control, the bypass system may be activated for protection against a possible cell failure or for the removal of a damaged cell from operation.

3.3 CELL CONNECTION

To form a three-phase output, a number "n" of power cells, operating at 690 or 710 "Vrms, are grouped in series per phase. The cell assemblies representing phases U, V, and W are connected in a star configuration, with a common floating neutral shared by the phases, as indicated in Figure 3.5 on page 3-5.

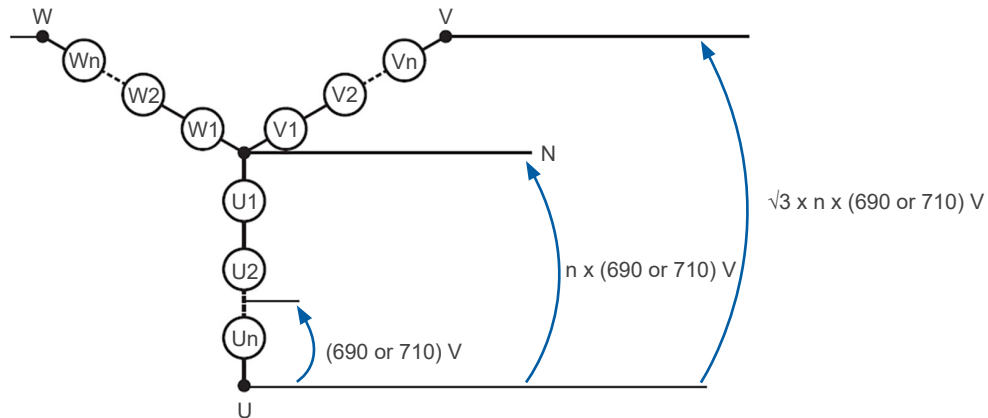


Figure 3.5: Cell-to-phase connection diagram

Figure 3.6 on page 3-5 shows the transformer, the input cubicle, and the secondary windings connected to each power cell. This association in series of the power cells allows obtaining more voltage levels at the inverter output. Locally, each cell produces three voltage levels; however, at the inverter three-phase output, it is possible to obtain $2n+1$ levels on the phase voltage and $4n+1$ levels on the line voltage.

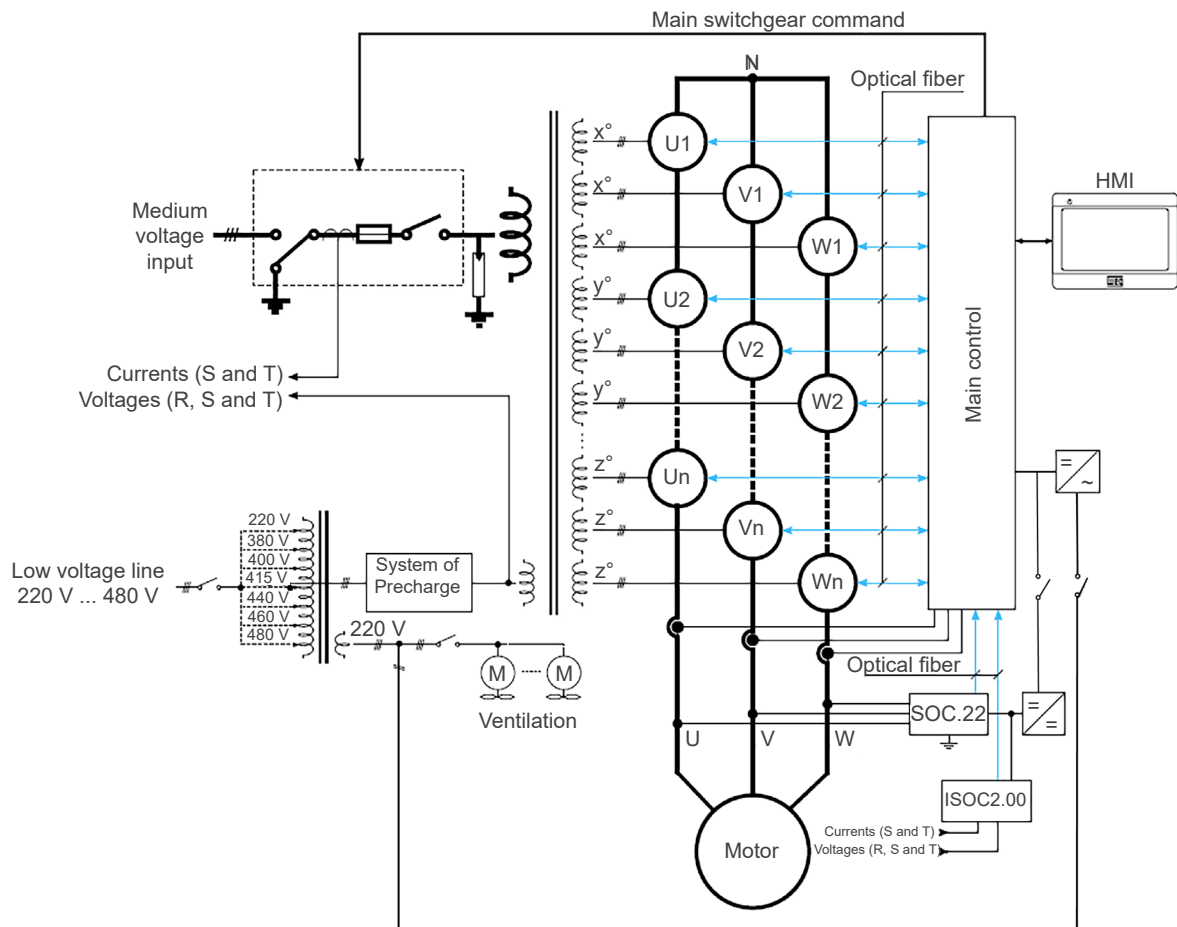


Figure 3.6: MVW3000 simplified diagram for n power cells

This effect occurs, because the voltage of each phase is instantaneously given by the addition of the voltages at terminals FA and NE of each cell pertaining to the analyzed phase. Figure 3.7 on page 3-6 illustrates the sum of the voltage of each cell to form the phase voltage in a 9-cell MVW3000 (3 cells per phase).

Therefore, increasing the number of cells per phase, in addition to allowing driving motors with higher voltages and powers, provides a better sinusoidal shaped wave. Thus, the converter provides a smaller THD (total harmonic distortion) rate and lower noise and vibration levels on the motor, operating with high efficiency.

Figure 3.6 on page 3-5 also shows the medium-voltage input cubicle, the low-voltage auxiliary winding used for precharging the cell capacitors, as well as the fiber-optic interface between the main control and the local control of the power cells.

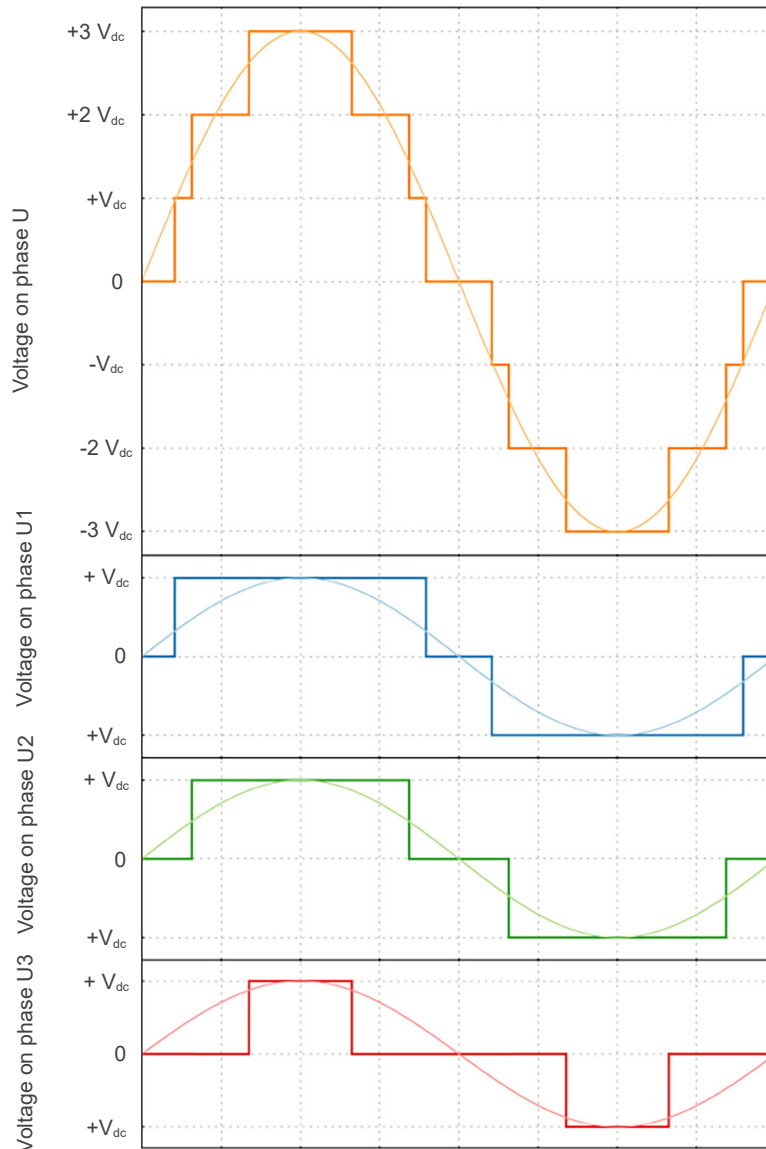


Figure 3.7: Wave form of the phase voltage for a CHB of 3 cells per phase

3.4 CONTROL

The MVW3000 has protections against overload, short circuit, current limitation, under and overvoltage, overtemperature, ground fault and monitoring of the individual faults of each power cell. The control type can be selected by the user between: scalar control (constant V/f ratio) or vector control (sensorless or with feedback by speed sensor).

The MVW3000 inverter uses the PWM modulation technique (Pulse Width Modulation); from the direct voltage of each independent DC Links, it synthesizes an alternate voltage with variable frequency and amplitude at the output terminals. The medium voltage level is obtained at the inverter output terminals with the association of "n" low voltage cells in series.

For further information about the central control, refer to [Section 4.3 CONTROL RACK on page 4-9](#).

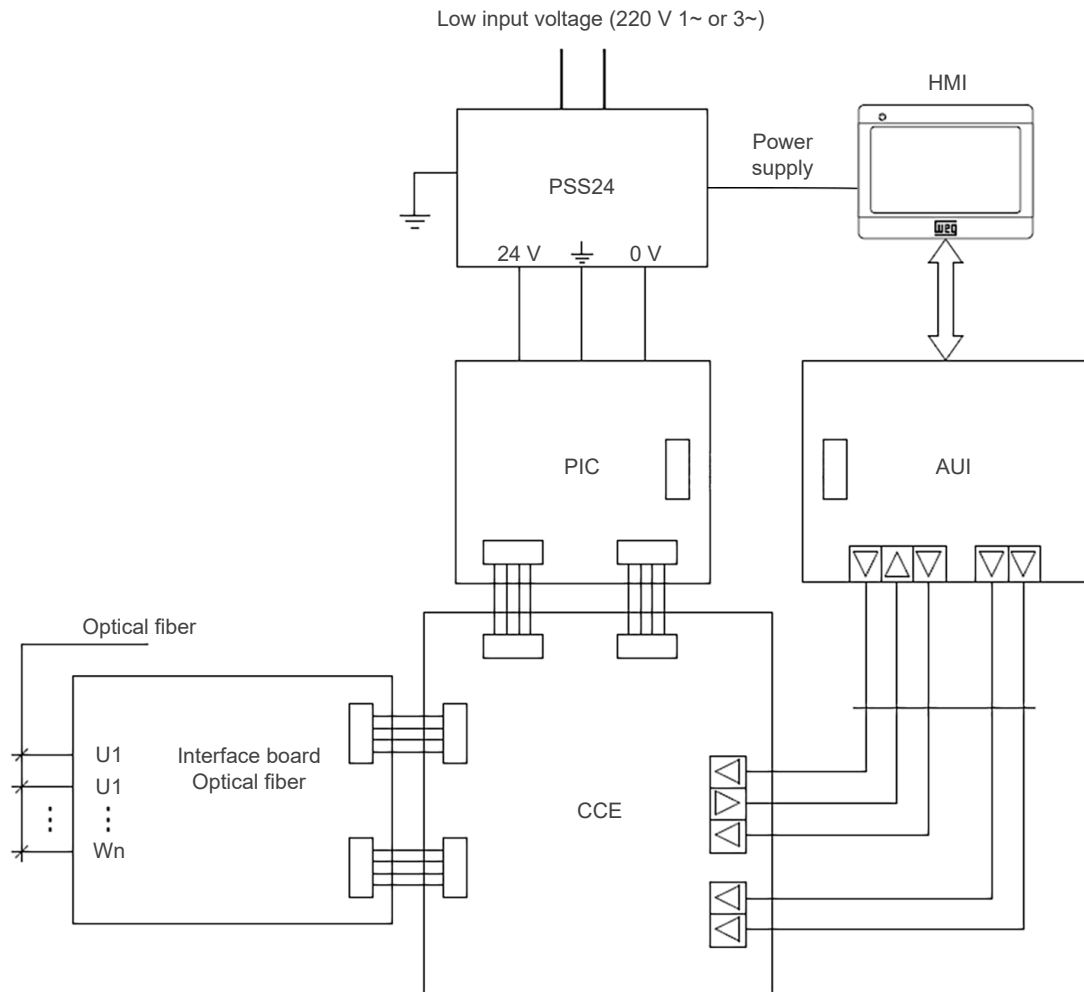


Figure 3.8: Central control simplified diagram

The output currents of the three phases (motor currents) are measured using the Hall-effect CTs (current transformers). Those current signals are sent to the central control board. The measurement is done to be displayed on the HMI and to implement the inverter control and protection functions.

The pre-charge is carried out by means of a current limiting system and an auxiliary winding of the input transformer, which is activated at the start of the MVW3000. In order to prevent high starting current levels on the inverter, activation of protection systems or even damages to its own components, the cell capacitors must be pre-charged through an auxiliary winding of the input transformer. The auxiliary power supply also feeds the control circuit and the panel cooling fans.

4 TECHNICAL DATA

This chapter contains technical information on the MVW3000, details on the panel, input transformer, power and control cells. In addition, further information is provided about the output filters available for the MVW3000.

The MVW3000 complies with the international standards, such as harmonic limits, contained in IEEE-519 and G5/4-1 standards, and also electromagnetic emission limits (EMC), contained in IEC61800-3 standard.

4.1 MVW3000 PANEL

The MVW3000 is assembled as coupled panels forming separate compartments. These compartments consist of one or more columns for power cells, one or more columns for transformers and, optionally, for the input safety devices, such as fuses and the input circuit breaker/contactors. There are also models in which a transformer is placed together with the power cells. The panel column contains the control boards and user interface. An example of the MVW3000 is illustrated in [Figure 4.1 on page 4-1](#) with the doors closed, and in [Figure 4.2 on page 4-2](#) with the doors open, showing an MVW3000 with frame B10.



Figure 4.1: Closed panel of the 30-cell MVW3000 (Frame B10)

The medium voltage cables that feed the inverter cells come from the secondaries of the input transformer. The number of cables and conductor diameter varies according to the number and current of the cells installed on the MVW3000.

Each cell receives the input supply from an independent secondary winding insulated from the main transformer. The control compartment is in the upper compartment of the right panel, housing the main control, user interface, HMI, command and signaling, which are exclusively powered by low voltage circuits.

The inverter three-phase medium voltage output is located in the compartment below the control. This compartment may also be used to install optional output filters.

The standard panels of the models equipped with input protection and drive systems feature medium voltage fuses to protect the system against short circuit. The fuses must match the rated voltage of the input medium voltage circuit.

[Table 4.1 on page 4-2](#) presents the recommended fuse models for standard inverters in which the input and output voltages are equal. For applications with different input and output voltage values, the fuse model will be provided upon request.

Table 4.1: Recommended fuses

Inverter Rated Current (A)	Fuse
40 - 60	3R
70 - 100	5R
110 - 160	12R
180 - 310	18R
340	24R
450	38R
600	48X
> 600	On request (*)

(*) For currents above 600 A, the use of an input cubicle with protection relay is recommended.

The standard panels supplied for the MVW3000 are suitable to be connected to medium voltage circuits capable of providing a maximum short-circuit current to meet the installation requirements and informed in the specific design and on the product nameplate.

For requirements above such short circuit capacity, the product will be supplied in a special panel according to the application. For further details, consult WEG.

4.1.1 Panel Constructive Aspects

The panel is made with steel sheets painted and processed (cut, drilled, bent, chemically treated, painted and finished) by WEG or accredited manufacturers, ensuring quality in every step of the manufacturing process. The inverter parts that are not painted are zinc plated or have another suitable treatment in order to assure their resistance against corrosion.



Figure 4.2: Panel of the 30-cell MVW3000 (frame B10)

The MVW3000 panel can be supplied with different protection ratings, such as IP42 or others, according to the installation environment requirements, specification requirements, and customer needs.

The panel is cooled by forced convection. Air enters through the louvers positioned on the front doors of the panel, passes through the windings of the transformer and also through the power sinks located in each of the power cells. The hot air is exhausted from the top of the panel, where the fans are installed, enabling maintenance without opening the inverter doors.

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 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.

The standard product is supplied with bolted closures on the transformer columns and power cells. As an option, the equipment can be supplied with doors and Kirk interlocking. Under this condition, only the grounding switch can be opened and the input disconnect switch can be closed. For inverter models that do not have integrated input switchgear, it is recommended that the customer implement an interlocking system between the switchgear and the master switch provided by the inverter.

Figure 4.3 on page 4-3 illustrates an example of the MVW3000 construction features with dimensions listed in Table 4.2 on page 4-4 through Table 4.13 on page 4-6.

In case the doors are unlocked, the inverter will prevent the operation and turn off the input circuit breaker. The control panel is powered by an auxiliary three-phase supply (220 V – 480 V) that can be locked to prevent its activation.

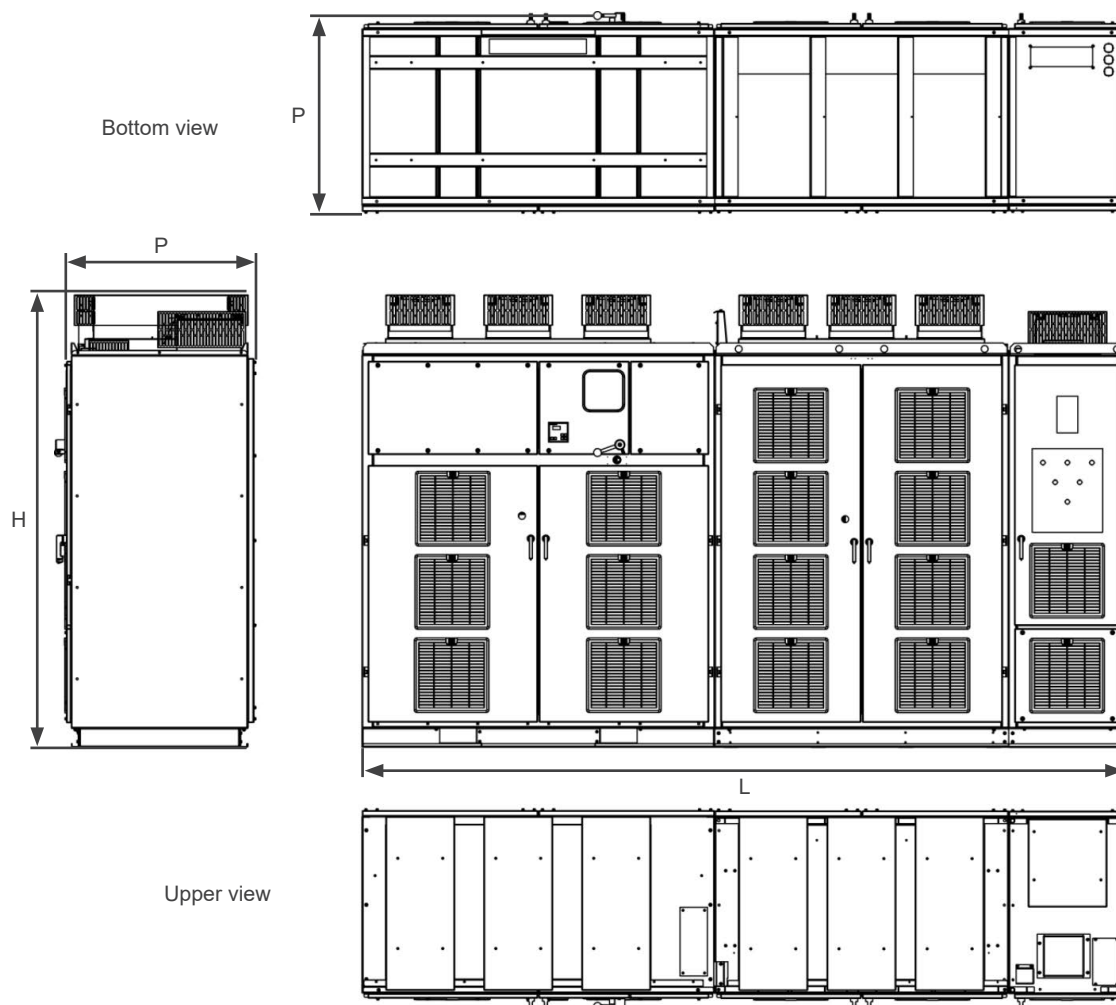


Figure 4.3: Panel constructive aspects

Table 4.2 on page 4-4 through Table 4.13 on page 4-6 list the physical size and weight of the panels for the maximum supported current of each respective frame.

For values related to frame A, reduce the weight by 10 %. It is worth mentioning that the dimensions may vary according to the input voltage and output voltage. For the N+1 redundant configuration, request dimensions.

TECHNICAL DATA

Table 4.2: Available frame sizes for the MVW3000 of 1150 V and respective panel values

Frame Size	L (") [mm]	H (") [mm]	P (") [mm]	Weight (") [kg]
A1	1500	2405	1220	1500
B1	2400			1800
C1				2100
D1				2450
E1				2800
F1	3900	2700	1620	3400
G1			1820	4050
H1				4725
I1				5400

Table 4.3: Available frame sizes for the MVW3000 of 2300 V and respective panel values

Frame Size	L (") [mm]	H (") [mm]	P (") [mm]	Weight (") [kg]
A2	1500	2405	1220	1900
B2	2400			2500
C2				3150
D2				3800
E2				4500
F2	3900	2700	1620	6450
G2	4100		1820	7750
H2				9040
I2				10330

Table 4.4: Available frame sizes for the MVW3000 of 3300 V and respective panel values

Frame Size	L (") [mm]	H (") [mm]	P (") [mm]	Weight (") [kg]
A3	1500	2405	1220	2850
B3	3400			3800
C3				4650
D3	3600	2640	1320	5800
E3				6850
F3	4650	2700	1620	8500
G3	4950			10450
H3			1820	12190
I3				13930

Table 4.5: Available frame sizes for the MVW3000 of 4160 V and respective panel values

Frame Size	L (") [mm]	H (") [mm]	P (") [mm]	Weight (") [kg]
A4	1500	2405	1220	3150
B4	3400			4350
C4				5450
D4	3600	2640	1320	6800
E4				8150
F4	5250	2700	1620	10250
G4	5550			12750
H4			1820	14870
I4				17000

Table 4.6: Available frames for the 6000 V MVW3000 and values for the respective panels

Frame Size	L ^(*) [mm]	H ^(*) [mm]	P ^(*) [mm]	Weight ^(*) [kg]
A5	3400	2405	1220	3650
B5	3900			5200
C5		2500		6600
D5	4400	2640	1320	8400
E5				10050
F5	5900	2700	1620	12850
G5	6500			16200
H5	7000		1820	18900
I5				21600

Table 4.7: Available frame sizes for the MVW3000 of 6900 V and respective panel values

Frame Size	L (") [mm]	H (") [mm]	P (") [mm]	Weight (") [kg]
A6	3400	2405	1220	4050
B6	3900			6050
C6				7800
D6	4400	2640	1320	10000
E6	4800			12100
F6	6850	2700	1620	15650
G6	7350			19700
H6		2900	1820	23000
I6				26270

Table 4.8: Available frame sizes for the MVW3000 of 8000 V and respective panel values

Frame Size	L (") [mm]	H (") [mm]	P (") [mm]	Weight (") [kg]
A7	3950	2405	1220	5450
B7	4400			7500
C7	4600	2500		9350
D7	5400	2640	1320	11750
E7	5700			14000
F7	6500		1620	17750
G7	9000			22050
H7			1820	25720
I7				29400

Table 4.9: Available frame sizes for the MVW3000 of 9000 V and respective panel values

Frame Size	L (°) [mm]	H (°) [mm]	P (°) [mm]	Weight (°) [kg]
A8	3950	2405	1220	5700
B8	4400			7950
C8	4600	2500		10000
D8	5400	2640	1320	12600
E8	9600			15100
F8			1620	19100
G8				23950
H8			1820	27940
I8				31930

Table 4.10: Available frame sizes for the MVW3000 of 10000 V and respective panel values

Frame Size	L (*) [mm]	H (*) [mm]	P (*) [mm]	Weight (*) [kg]
A9	4350	2500	1220	6350
B9	5100			9200
C9	5300			11850
D9	6300	2640	1320	15050
E9				18050
F9	11450	2700	1620	23200
G9				29200
H9			1820	34060
I9				38930

Table 4.11: Available frame sizes for the MVW3000 of 11000 V and respective panel values

Frame Size	L (*) [mm]	H (*) [mm]	P (*) [mm]	Weight (*) [kg]
A10	4350	2500	1220	6750
B10	5600			9800
C10	5800			12700
D10	6900	2640	1320	16250
E10			1500	19550
F10	11800	2700	1620	25150
G10				31750
H10			1820	37040
I10				42330

Table 4.12: Available frame sizes for the MVW3000 of 12000 V and respective panel values

Frame Size	L (") [mm]	H (") [mm]	P (") [mm]	Weight (") [kg]
A11	5000	2500	1320	7050
B11	6000			10500
C11	6300			13650
D11	8400	2640		17400
E11	8800			21050
F11	12150	2700	1620	27250
G11	13150	3115		34400
H11	14350	2900	1820	40130
I11	14350			45860

Table 4.13: Available frame sizes for the MVW3000 of 13800 V and respective panel values

Frame Size	L (") [mm]	H (") [mm]	P (") [mm]	Weight (") [kg]
A12	5000	2640	1220	7450
B12	6600	2500	1320	11250
C12	6900			14700
D12	9400			18750
E12	9400	2640		22850
F12	13500	2700	1620	29600
G12	13500	3115		37500
H12	14700	2900	1820	43750
I12	14700			50000

(*) Standard values for frames with input voltage class equal to output voltage class. For further information, see the WEG.



NOTE!

The values presented in [Table 4.2 on page 4-4](#) through [Table 4.13 on page 4-6](#) are standard values; however, they may change due to special product characteristics such as:

- Input switchgear.
- Output filter.
- Transformer characteristics.
- 2 input protection fuses.
- Special grounding and safety systems.

4.2 POWER CELLS

4.2.1 Constructive Aspects

The power cells of the same MVW3000 have seven frame models available. Information regarding power cell models and dimensions can be found in [Table 4.14 on page 4-7](#), as well as an example illustration of frame B in [Figure 4.4 on page 4-7](#).

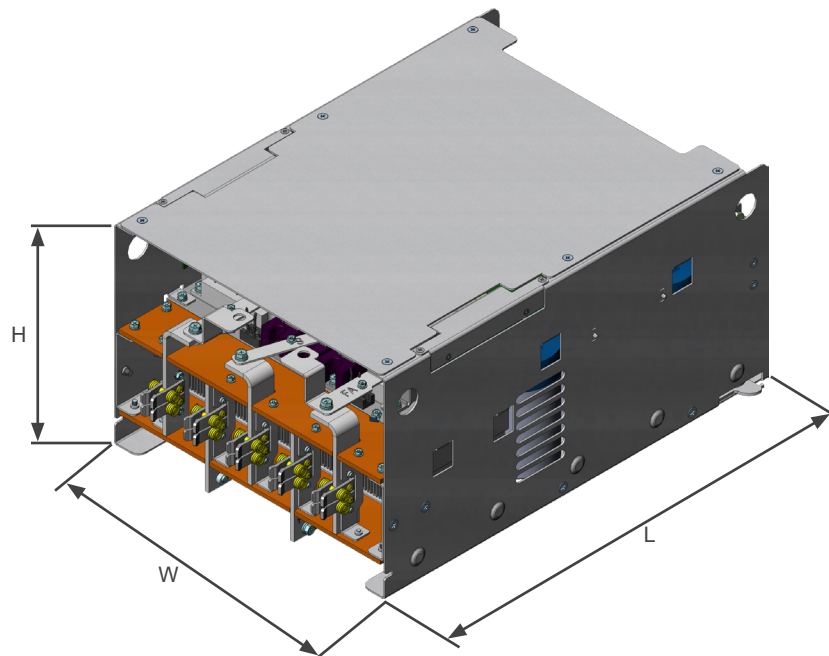


Figure 4.4: MVW3000 power cell dimensions

Table 4.14: Dimensions of the different frames available

Frame Size	Current [A]	H = Height [mm]	W = Width [mm]	L = Length [mm]	Mass [kg]
A	70	218	190	597	26
B	140	255	356	595	30
C	200	255	356	595	40
D	265	255	406	682	53
E	340	255	406	682	58
F	450	505	297	870	87
G	600	505	297	870	92
H	800	505	297	1040	113

The power cells may also contain a bypass system, at the costumer's discretion, which provides greater safety and robustness for the applications. Thus, a power cell of the standard MVW3000 contains:

- 1, 5, 7, 9, 12, 13, 15, 16, 17 or 22 capacitors (according to the model).
- 6 diodes with blocking voltage of 1.6 kV.

- 4 IGBTs with blocking voltage of 1.7 kV (frames F, G and H models have parallel modules).
- 1 heatsink for heat exchange.
- 2 gate driver electronic boards.
- 1 switched-mode power supply electronic board.
- 1 local control electronic board with fiber optic interface.
- 2 or 3 input protection fuses.
- 2 temperature sensors.

The listed items can be identified in [Figure 4.5 on page 4-8](#) and [Figure 4.6 on page 4-9](#).

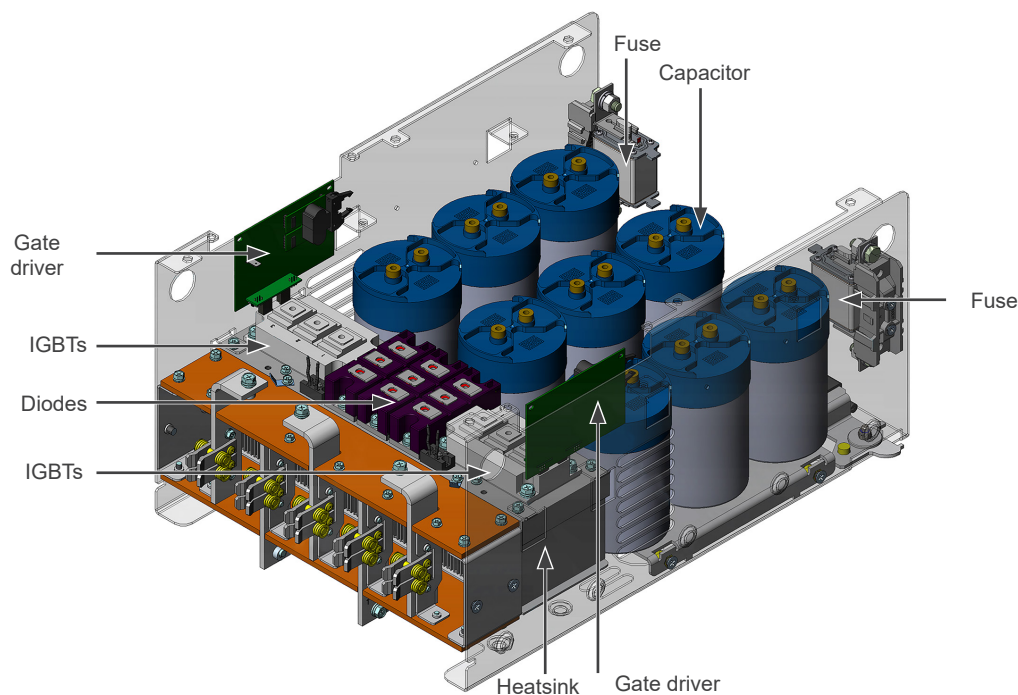


Figure 4.5: Position of the components of the MVW3000 140 A power cell

The mechanical structure of each cell is basically formed by galvanized steel plates, and it is easy to install due to the connection clamp system and the insertion and extraction mechanism present in the the set.

As the connection and mounting of the cell to the MVW3000 requires only one tool (shipped with the product), a cell can be changed in few minutes, reducing downtime. Additional information regarding cell installation and replacement can be found in [Chapter 6 INSTALLATION, CONNECTION, ENERGIZATION AND PREVENTIVE MAINTENANCE on page 6-1](#).

4.2.2 Power Cell Boards and Connections

The electrical connection inside the cell is done by means of laminated busbars, insulated between each other by means of insulating material compatible with the applied voltage level.

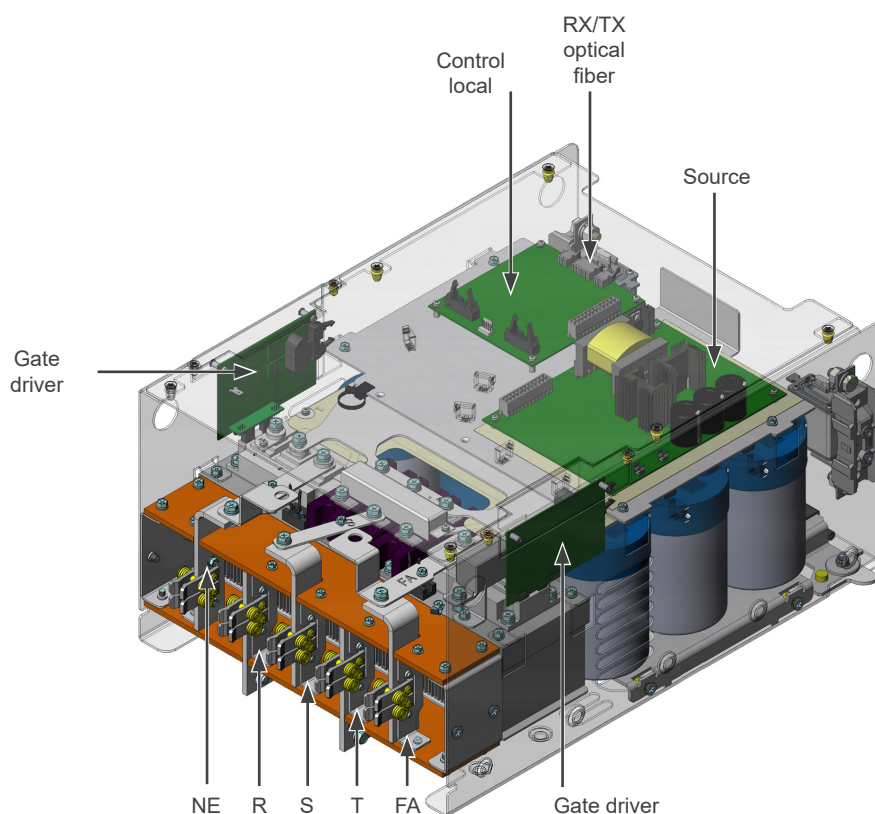


Figure 4.6: Standard power cell boards and connections of the MVW3000 (frame B)

The local control and power supply electronic boards are in the upper part of the cell, above the laminated busbars, insulated and fastened to a metal base. The serial communication between the cell and the main control module occurs by means of the local control board via the fiber optic interface.

The modulation signals leave the local control and go to the gate driver boards via multiway flat cables. The power supply provides the voltages of: 5 V, 15 V, -15 V, 24 V that feed all the cell control part (local control, gate drivers and bypass system).

The cell is connected to the DC Link through clamps located at the rear of the cell. There are a total of 5 connections per cell, connecting it to the transformer three-phase secondary (terminals R, S, and T) and to the applied phase series circuit through terminals FA and NE (phase and neutral).



ATTENTION!

The electronic boards have components sensitive to electrostatic discharges. Do not touch directly on components or connectors. If necessary, touch a grounded metal surface beforehand or use an appropriate grounding strap.

4.3 CONTROL RACK

For the control power supply, the auxiliary voltage (220 - 480 Vac) should be available and connected to the specific terminal strip, located in the control panel. The provided transformer has taps for different voltages in the primary winding and supplies 220 Vac in the secondary winding to feed all the low voltage circuits and exhaust fans present in the product.

The MVW3000 control rack has four electronic boards, grouped in a mechanical assembly that improves the view and access to the analog, digital and fiber optic interfaces. For this assembly, [Figure 4.7 on page 4-10](#) presents the CCE, AUI, PIC3, and CIB boards.

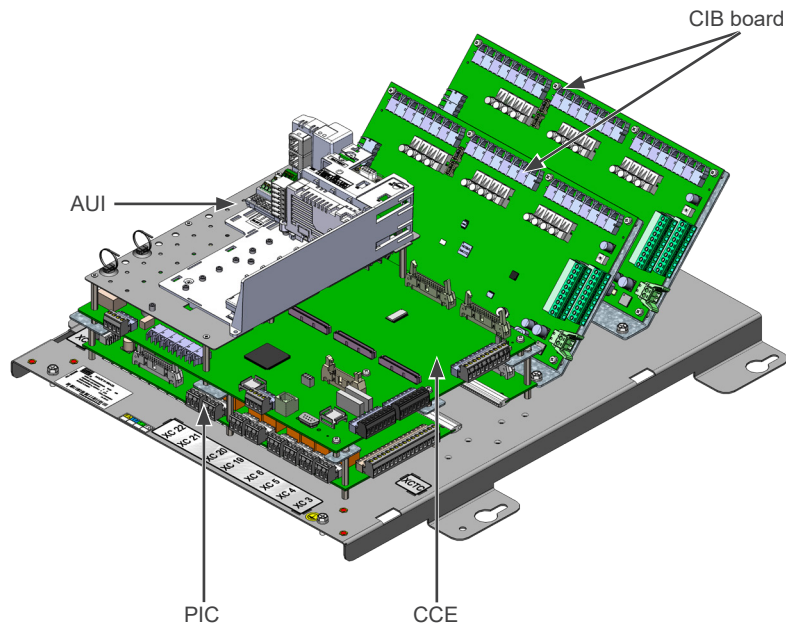


Figure 4.7: MVW3000 standard control rack

The control rack is supplied with 24 Vdc by the PSS24 power supply. The PSS24 power supply supports 85 - 264 Vac or 125 - 370 Vdc supply. The control rack consists of the power supply and interface board (PIC3), a control board (CCE), a user functions board (AUI), and one/two fiber-optic interface boards (CIB). The CCE board is responsible for motor and inverter control, while the AUI board performs user interface functions. Both boards are powered by isolated low voltages supplied by the PIC3 board, which also contains opto-isolated digital inputs and relay outputs (220 Vac) for internal MVW3000 use.

Optional Fieldbus communication boards may be connected to the AUI control board. Signal connections between the CCE board and the power cells are made through fiber-optic cables via the interface board (CIB).



ATTENTION!

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

4.4 OUTPUT FILTERS

Depending on the installation conditions, it may be necessary to add an output filter. For drives with cables between 200 and 1000 m, it is recommended to use type 1 output filter on the motor phases. For drives with long cables (above 1000 m) or for motors not able to operate with PWM modulation (retrofitting applications), it is recommended to use type 2 or 3 filter (contact WEG). [Figure 4.8 on page 4-11](#), items (a) and (b), illustrates Type I and Type II filters, respectively.

The available filter models follow the voltage and current values specified in [Table 2.3 on page 2-9](#) through [Table 2.17 on page 2-23](#).

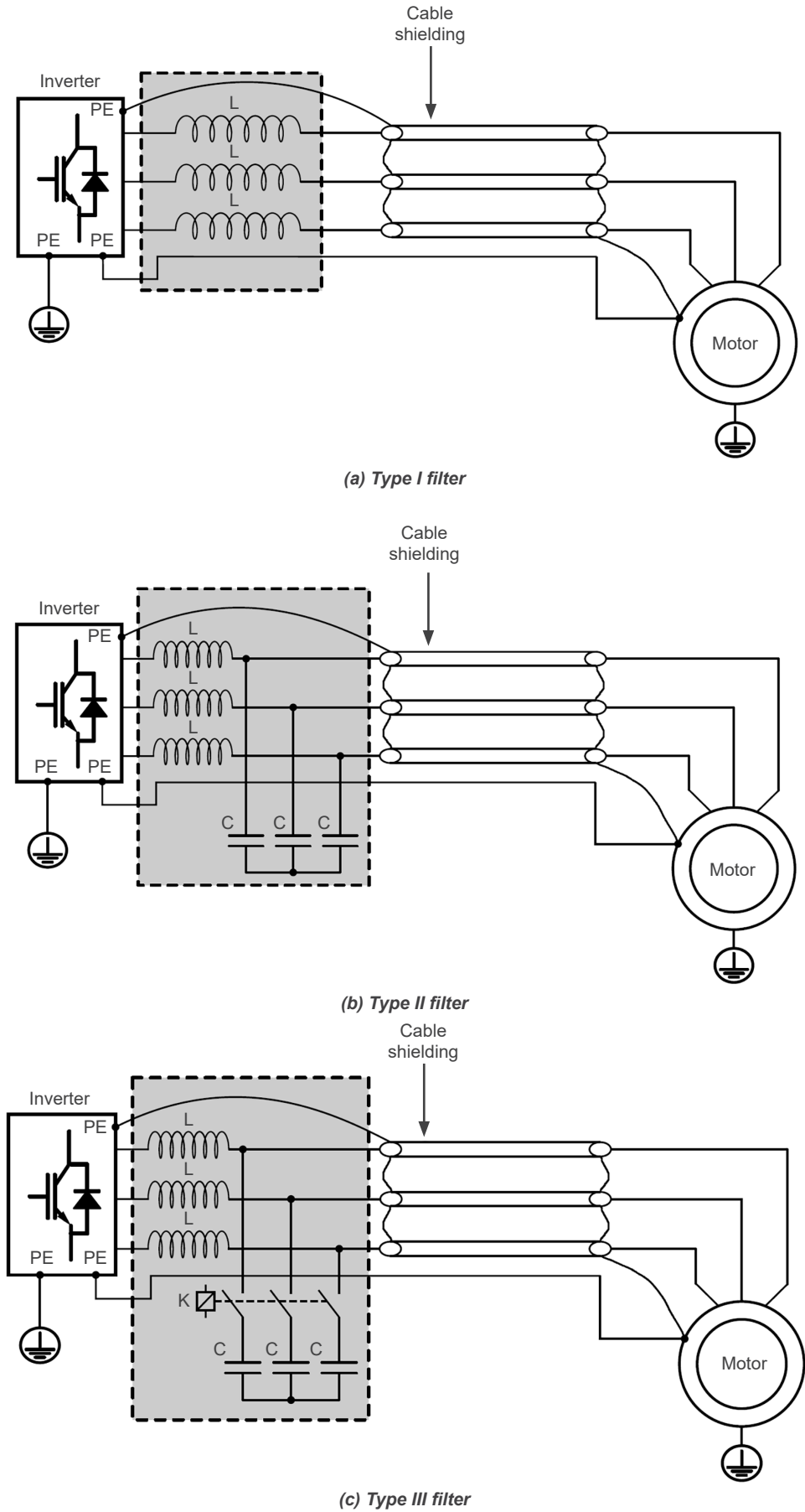


Figure 4.8: (a) to (c) Output filters for the MVW3000

Table 4.15 on page 4-12 presents a summary of filter types according to voltage and cable length between the inverter and motor.

Table 4.15: Recommended filter type

Motor Use with Inverter			
Motor voltage	Output cable length		
	d ≤ 200 m	200 m < d ≤ 1000 m	d > 1000 m
≤3.3 kV ⁽¹⁾	None	Type 1	Type 3
4.16 kV ... 6.9 kV	None	Type 1	Type 2
> 6.9 kV	None	None	Type 2
Motor not Prepared/Retrofitted			
Motor voltage	Output cable length		
	d ≤ 200 m	200 m < d ≤ 1000 m	d > 1000 m
≤3.3 kV ⁽¹⁾	Type 3	Type 3	Type 3
4.16 kV...6.9 kV	Type 2	Type 2	Type 2
>6.9 kV	Type 1	Type 1	Type 2
New WEG motors ⁽²⁾	None	Type 1	Type 2

(1) No option for type 2 or type 3 filter use for the 1.15 kV and 2.3 kV models (if equipped with a cell with bypass).

(2) Except for 4.16 kV.

5 SUPPORTED MOTORS

This chapter presents the types of motors compatible with the MVW3000 and the respective control strategies.

5.1 INDUCTION MOTOR

The MVW3000 is a high performance product designed for speed and torque control of three-phase induction motors. Motors of this type can be controlled by the following control strategies:

- Scalar control (V/f).
- Vector control (for further details, refer to [Section 7.8 ACCE-ENC INCREMENTAL ENCODER INPUT BOARD on page 7-19](#).
- Vector control without encoder ('sensorless').

For more detailed information regarding the control modes presented, refer to the programming manual available at www.weg.net.

5.2 SYNCHRONOUS MOTOR

In order to allow driving synchronous motors, the MVW3000 introduces a number of software functions and new hardware elements for commanding and controlling these motors.

[Figure 5.1 on page 5-1](#) presents the general synchronous motor drive diagram using the MVW3000. For more details on the excitation control system and the direct connection of the motor to the line, refer to the electrical project of the inverter.

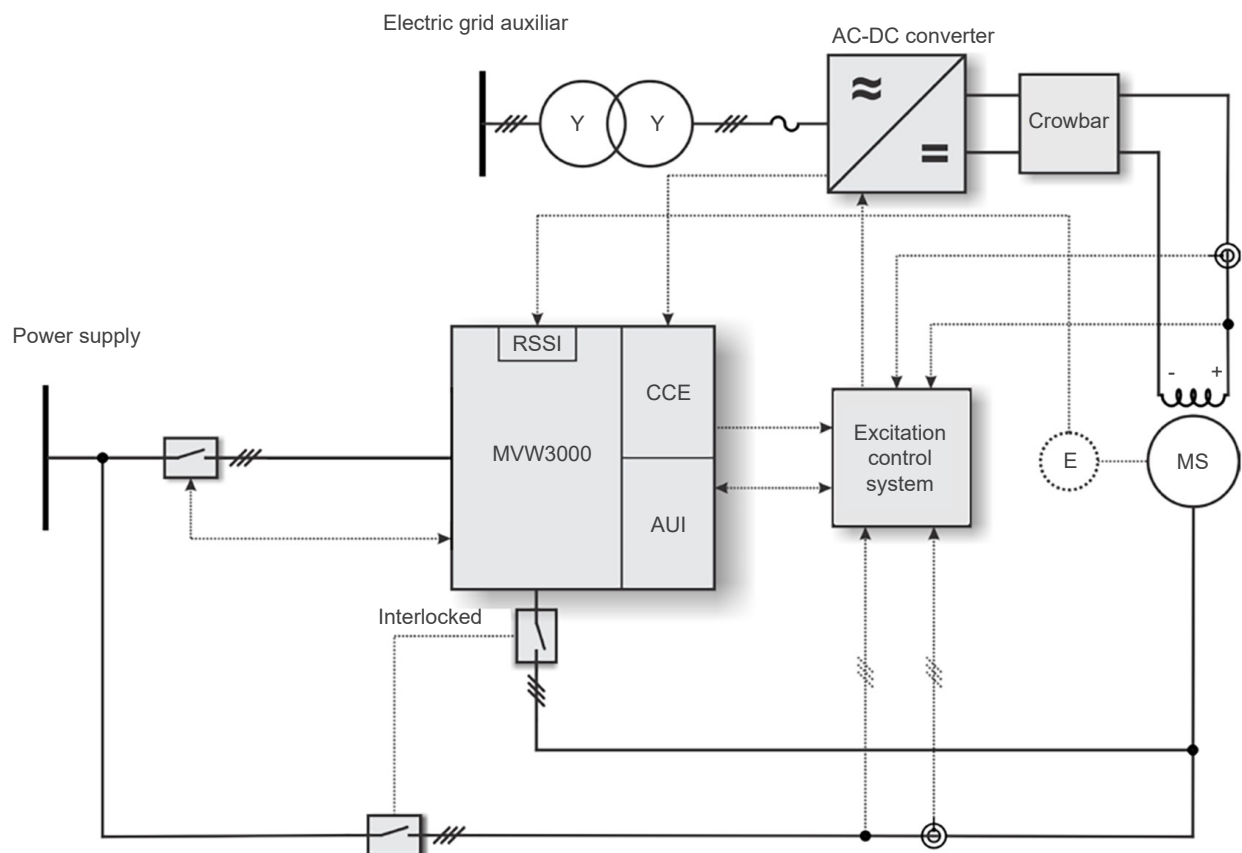


Figure 5.1: General diagram of the inverter for synchronous motor

5.2.1 Absolute Encoder with RSSI Board

In synchronous machine drive applications, it is necessary to use an absolute encoder so as to obtain the exact rotor position in relation to the stator, since the incremental encoder is not able to provide such information.

5.2.1.1 Absolute Encoder

Synchronous motor control requires the use of an absolute encoder (available for the models presented in [Table 5.1 on page 5-2](#) with 13 and 14 bits), which must comply with the following specifications:

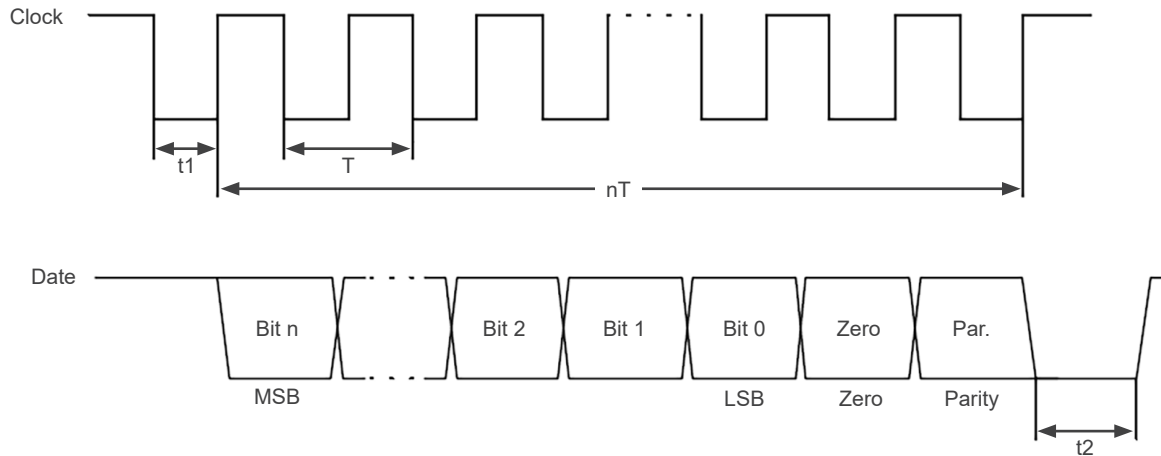


Figure 5.2: Example of clock specification and data transfer to the absolute encoder

Table 5.1: Encoder examples for use in the MVW3000

Manufacturer	Encoder Model	Quantity of Bits	Zero Bit	Parity Bit
Leine Linde	ISA647100150	13	Yes	No
Baumer	MHAP 400 B5 XXXXSB14EZ D	14	Yes	Yes

When mounting the encoder next to the motor, it is recommended:

- Coupling the encoder directly to the motor shaft (using a flexible coupling, however without torsional flexibility).
- Both the encoder metallic housing and shaft must be electrically isolated from the motor (minimum spacing 3 mm).
- For more details on installing the encoder, refer to the manufacturer's installation manual.

Use good quality flexible couplings that avoid mechanical oscillations or backlash.

5.2.1.2 RSSI Board

The use of absolute encoder implies the need for an SSI data interface (Synchronous Serial Interface) between the encoder and the inverter. The RSSI board was developed for the encoder specification previously described. This board needs to be powered with 24 V in direct current, consumes up to 700 mA and has the following characteristics:

- RS485 communication channel for data transmission and clock according to SSI standard with absolute encoder.

For electric connection, use shielded cables, keeping a minimum distance of 25 cm from other wiring (power, control, etc.). Preferably inside a metallic conduit, as shown in [Figure 5.3 on page 5-3](#).

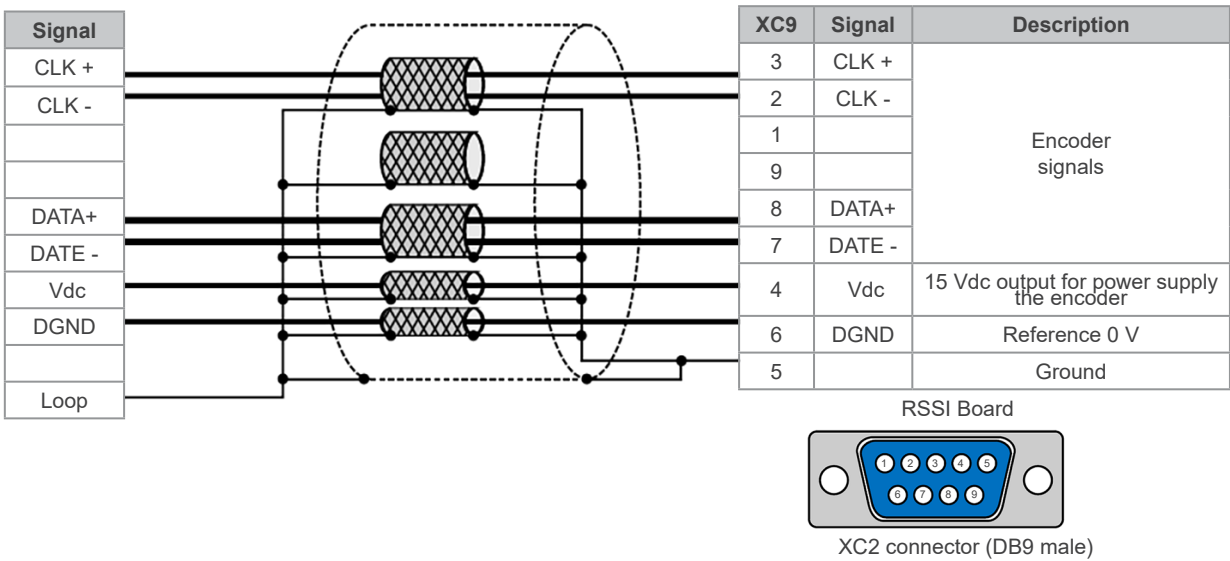


Figure 5.3: RSSI - Encoder connection cable

Connections to the encoder, the CCE and fiber-optic interface boards, as well as the RSSI board components, are shown in [Figure 5.4 on page 5-3](#) and [Figure 5.5 on page 5-4](#), respectively.

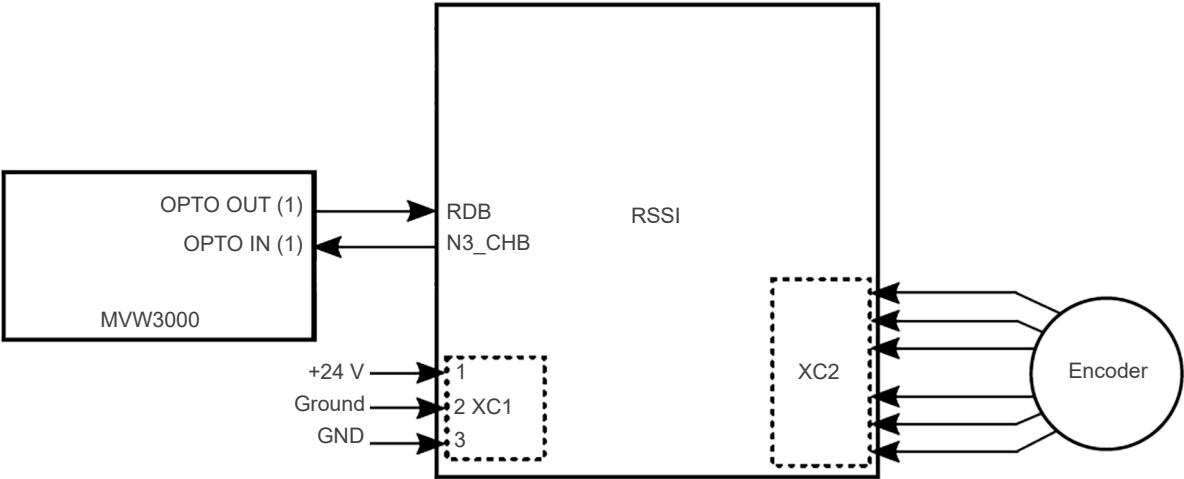


Figure 5.4: Wiring diagram

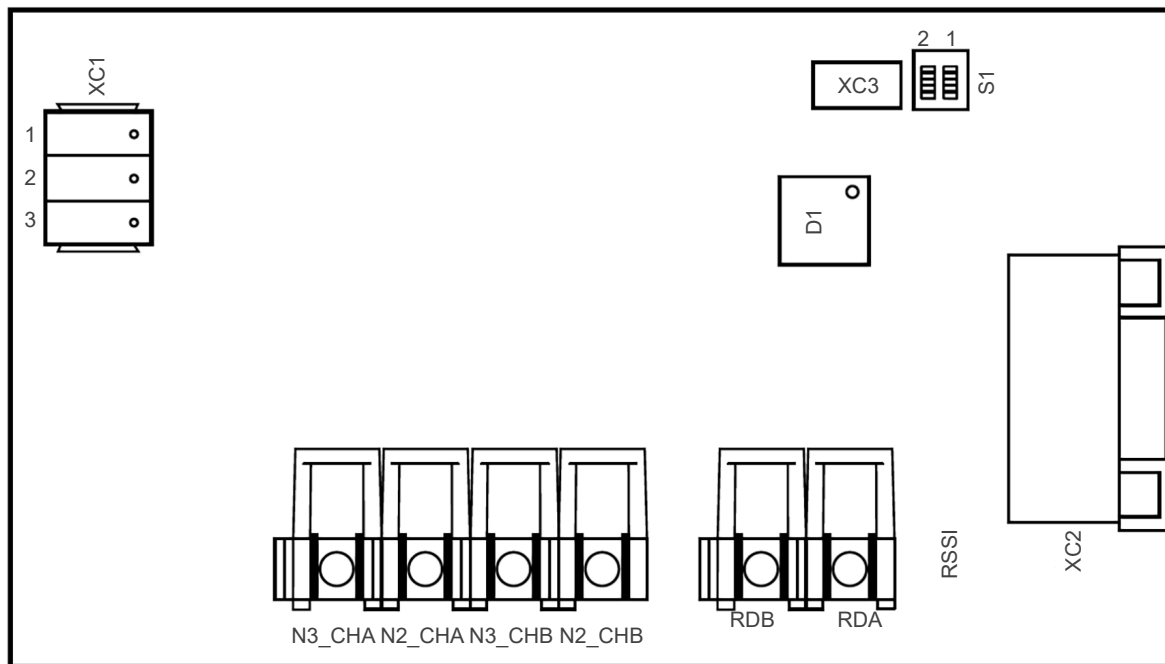


Figure 5.5: RSSI Board

5.2.2 Field Set (DC with Brushes)

The field excitation of the synchronous motor can be done through an AC-DC converter that presents the possibility of being controlled by a control loop, and that has an input for current reference and presents an analogue output with the information of its output current (feedback for the MVW3000).

Specifications:

AC-DC current reference input: 0 to 10 V (AC-DC 5 V = 1 PU; see P00594 (C3.2.2.2 of the programming manual)).

Output current feedback to the MVW3000: 0 to 10 V (MVW3000 5 V = 1 PU; see P00594 (C3.2.2.2 of the programming manual) and P00581 or P00584 (AI1 and AI2 analog input function, C5.11.1 of the programming manual)).



NOTE!

The CCE board supports voltage signals only. For current operation, an external current transducer must be used.



NOTE!

The information described in [Chapter 5 SUPPORTED MOTORS on page 5-1](#) of this manual refers to the operation of synchronous machines with DC excitation and brushes. In order to drive synchronous machines with other types of excitation, consult WEG.

5.3 PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)

The MVW3000 is a high-performance product designed also for controlling smooth-pole permanent magnet (PMSM) synchronous motors.

Application of smooth pole permanent magnet motors (PMSM) becomes attractive due to performance, high rotation, power density, and efficiency, is widely used in deep-sea oil extraction applications and motor applications at high speed.

The control method used by the MVW3000 is voltage vector control without a position or speed sensor (sensorless). This robust control enables operation with a unity power factor and maximum utilization of the drive and motor. This control allows operation in Maximum Torque Per Ampere (MTPA) mode.

6 INSTALLATION, CONNECTION, ENERGIZATION AND PREVENTIVE MAINTENANCE

This chapter describes the preventive maintenance and electrical and mechanical installation procedures for the MVW3000. The presented guidance and suggestions must be followed in order to assure the proper inverter operation.



ATTENTION!

Handling and mechanical/electrical installation of the MVW3000 must be performed by personnel trained and qualified by WEG.

Storage of the MVW3000 panel and power cells:

- After receiving the equipment, remove the plastic film in order to prevent moisture condensation.
- Do not store exposed to sunshine and to temperatures above 40 °C (104 °F).
- Store in a clean, protected location with relative humidity not exceeding 80 %.
- During all the storage period the conditions mentioned earlier must be satisfied, but when components are stored for more than one year, measures must be taken to dehumidify the storage location.
- When using equipment after a long storage period, verify whether the equipment is free of scratches, dirt, rust and other damages.
- The inverter performance and reliability can be impaired if the inverter or the power arms were stored in an environment out of the conditions listed previously.



DANGER!

- The procedures recommended in this warning have the purpose of protecting the user from death, severe personal injury and considerable property damage.
- Power supply isolating switches: equipment for isolating the inverter power and auxiliary supplies must be planned. They must cut off the inverter supplies (e.g., during installation maintenance tasks).
- This equipment cannot be used as emergency stop mechanism.
- Make sure that the power supply is disconnected before starting the wiring.
- The following information is intended to be a example for a proper installation. Comply with applicable local regulations for electrical installations.

6.1 MECHANICAL INSTALLATION

6.1.1 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 °C to 40 °C (32 °F to 104 °F) - nominal conditions.
- From 40 °C to 50 °C (104 °F to 122 °F) current reduction of 2.5 % for each Celsius degree above 40 °C (104 °F).
- Relative humidity: from 5 % to 90 % non-condensing.
- Maximum altitude: up to 1000 m (3.300 ft) - rated conditions.
- From 1000 m to 4000 m (3.300 ft to 13.200 ft), 1 % current derating for each 100 m (330 ft) above 1000 m (3.300 ft).
- Pollution degree: 2 (according to IEC/UL standards). Non-conductive pollution only.
- Condensation must not cause conductivity in the pollution.

The MVW3000 medium-voltage inverter is supplied in panel form, and its dimensions are presented in [Table 4.2 on page 4-4](#) through [Table 4.13 on page 4-6](#). According to the components assembled in each panel division and their function, this whole panel results in the inseparable union of four functions: switching and protection circuit, phaseshifting transformer, power cells and main control.

The inverter power arms are supplied inserted in their respective compartments.

6.1.2 Recommended handling procedures

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.

6.1.3 Hoisting

Ensure that the equipment used to lift the inverter panel and cells is suitable for their geometry and weight (valid for the maximum current of each respective frame), as shown in [Table 6.1 on page 6-2](#). For the cell values of each frame, refer to [Table 4.14 on page 4-7](#).

Table 6.1: Panel mass (approximate; values may vary depending on the current supported)

Frame Size	Inverter Panel Mass + Cells [kg]	Panel Mass + Transformer [kg]	Control Panel [kg]	Total Mass [kg]
A1	100	950	450	1500
B1	100	1250	450	1800
C1	150	1500	450	2100
D1	200	1800	450	2450
E1	200	2150	450	2800
F1	300	2650	450	3400
G1	300	3300	450	4050
A2	200	1250	450	1900
B2	200	1850	450	2500
C2	250	2450	450	3150
D2	350	3000	450	3800
E2	350	3700	450	4500
F2	1300	4700	450	6450
G2	1300	6000	450	7750
A3	900	1500	450	2850

INSTALLATION, CONNECTION, ENERGIZATION AND PREVENTIVE MAINTENANCE

Frame Size	Inverter Panel Mass + Cells [kg]	Panel Mass + Transformer [kg]	Control Panel [kg]	Total Mass [kg]
B3	900	2450	450	3800
C3	1000	3200	450	4650
D3	1250	4050	500	5800
E3	1300	5050	500	6850
F3	1550	6450	500	8500
G3	1600	8350	500	10450
A4	950	1750	450	3150
B4	1000	2900	450	4350
C4	1100	3900	450	5450
D4	1400	4900	450	6800
E4	1450	6200	450	8150
F4	1800	7950	450	10250
G4	1850	10400	450	12750
A5	1050	2150	450	3650
B5	1100	3650	450	5200
C5	1250	4900	450	6600
D5	1550	6350	500	8400
E5	1600	7950	500	10050
F5	2050	10300	500	12850
G6	2150	13500	500	16200
A6 ⁽¹⁾	1100	2350	450	3900
B6 ⁽¹⁾	1200	4050	450	5700
C6 ⁽¹⁾	1350	5550	450	7350
D6 ⁽¹⁾	1700	7150	500	9350
E6 ⁽¹⁾	1800	9000	500	11300
F6 ⁽¹⁾	2350	11700	500	14550
G6 ⁽¹⁾	2400	15450	500	18350
A6 ⁽²⁾	1100	2500	450	4050
B6 ⁽²⁾	1200	4400	450	6050
C6 ⁽²⁾	1350	6000	450	7800
D6 ⁽²⁾	1700	7800	500	10000
E6 ⁽²⁾	1800	9800	500	12100
F6 ⁽²⁾	2350	12800	500	15650
G6 ⁽²⁾	2400	16800	500	19700
A7 ⁽³⁾	1800	3200	450	5450
B7 ⁽³⁾	1900	5150	450	7500
C7 ⁽³⁾	2100	6800	450	9350
D7 ⁽³⁾	2600	8650	500	11750
E7 ⁽³⁾	2700	10800	500	14000
F7 ⁽¹⁾	3350	13900	500	17750
G7 ⁽¹⁾	3450	18100	500	22050
A7 ⁽⁴⁾	1800	3450	450	5700
B7 ⁽⁴⁾	1900	5600	450	7950
C7 ⁽⁴⁾	2100	7450	450	10000
D7 ⁽⁴⁾	2600	9500	500	12600
E7 ⁽⁴⁾	2700	11900	500	15100
F7 ⁽⁴⁾	3350	15250	500	19100
G7 ⁽⁴⁾	3450	20000	500	23950

INSTALLATION, CONNECTION, ENERGIZATION AND PREVENTIVE MAINTENANCE

Frame Size	Inverter Panel Mass + Cells [kg]	Panel Mass + Transformer [kg]	Control Panel [kg]	Total Mass [kg]
A8	2000	3650	450	6450
B8	2000	6150	450	8600
C8	2200	8250	450	10900
D8	2800	10550	500	13850
E8	2850	13200	500	16550
F8	3600	17050	500	21150
G8	3700	22350	500	26550
A9	1950	3950	450	6350
B9	2050	6700	450	9200
C9	2350	9050	450	11850
D9	2950	11600	500	15050
E9	3050	14500	500	18050
F9	3850	18850	500	23200
G9	4000	24700	500	29200
A10	2050	4250	450	6750
B10	2150	7200	450	9800
C10	2450	9800	450	12700
D10	3100	12650	500	16250
E10	3200	15850	500	19550
F10	4100	20550	500	25150
G10	4250	27000	500	31750
A11	2100	4500	450	7050
B11	2250	7800	450	10500
C11	2600	10600	450	13650
D11	3250	13650	450	17400
E11	3400	17150	450	21050
F11	4400	22350	450	27250
G11	4550	29350	450	34400
A12 ⁽⁵⁾	2200	4800	450	7450
B12 ⁽⁵⁾	2350	8450	450	11250
C12 ⁽⁵⁾	2700	11550	450	14700
D12 ⁽⁵⁾	3400	14850	500	18750
E12 ⁽⁵⁾	3550	18800	500	22850
F12 ⁽⁵⁾	4650	24450	500	29600
G12 ⁽⁵⁾	4800	32200	500	37500
A12 ⁽⁶⁾	2200	5000	450	7650
B12 ⁽⁶⁾	2350	8750	450	11550
C12 ⁽⁶⁾	2700	12000	450	17250
D12 ⁽⁶⁾	3400	15500	500	19400
E12 ⁽⁶⁾	3550	19600	500	23650
F12 ⁽⁶⁾	4650	25500	500	30650
G12 ⁽⁶⁾	4800	33600	500	38900

(1) For models with voltage from 6000 V to 6300 V.

(2) For models with voltage from 6600 V to 6900 V.

(3) For models with voltage of 7200 V.

(4) For models with voltage of 8000 V.

(5) For models with voltage of 13200 V.

(6) For models with voltage of 13800 V.

Observe the center of gravity and ensure that the lifting supports are suitable and safe. Use the configuration indicated in [Table 6.1 on page 6-2](#).

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 deformation or damage to the panel structure is identified, stop the lifting operation and reposition the cables or chains, as shown in [Figure 6.1 on page 6-5](#).

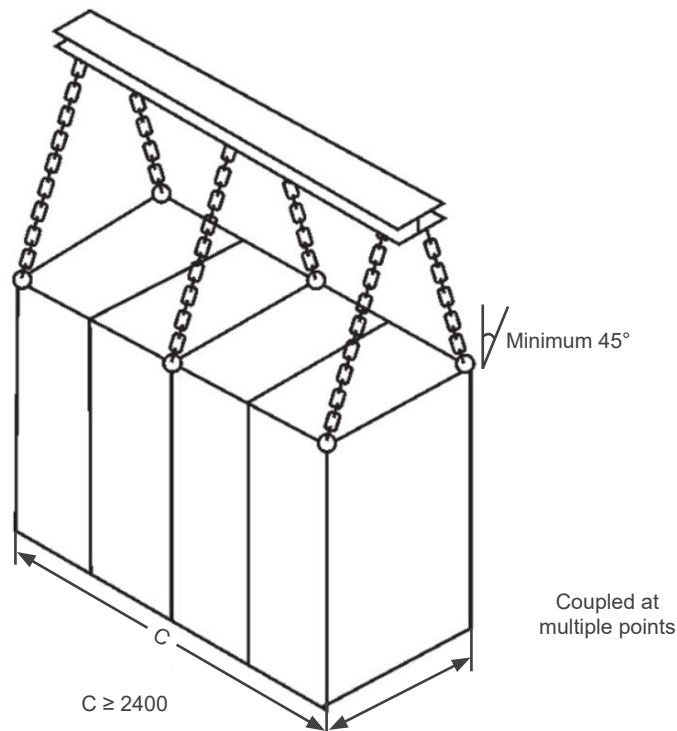


Figure 6.1: Recommended hoisting mechanism for the panel movement



ATTENTION!

During lifting, connect chains or cables to all available hoisting points on the panel.

6.1.4 Moving

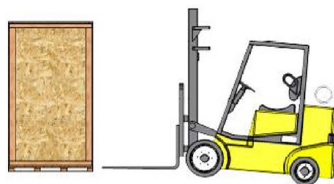
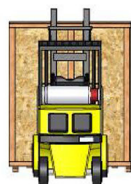
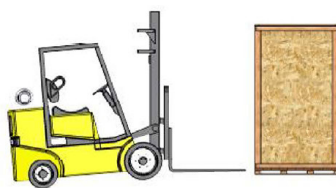
When cranes or pulleys are used, make sure that the movements are slow and smooth, so that the panel and the arms do not suffer excessive swings and vibration.

When using hydraulic carts, forklifts, rollers or other handling equipment, distribute the mechanical support points of such equipment from one end of the panel to the other, avoiding applying pressure on fragile areas. Make sure that all the panel doors are closed and locked, and that the door handles are in protected position.

The use of forklifts and cranes with chains is illustrated in [Figure 6.2 on page 6-6](#). The transformer panel door must be handled with forklift only. For information about the transformer weight, see [Table 6.1 on page 6-2](#).

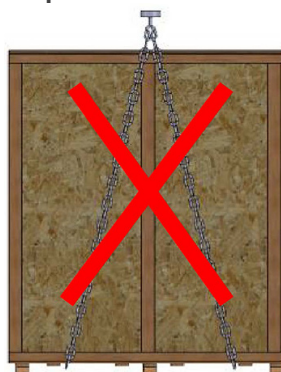


- Forklift.
- Hoist with spreader beam.

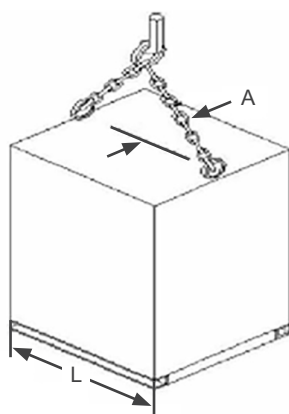


(a)

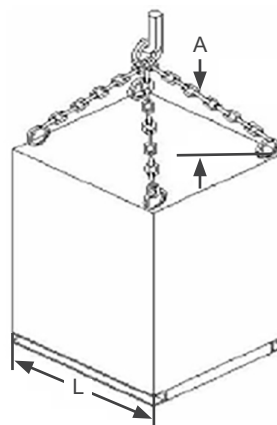
Hoisting and movements below the box is prohibited.



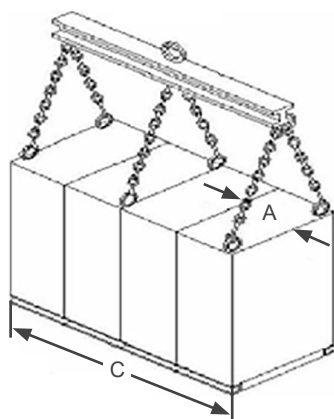
(b)



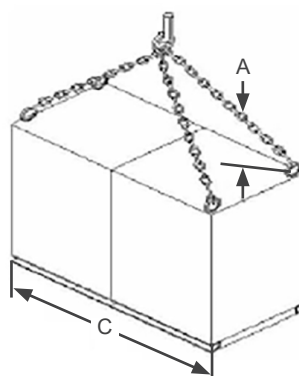
- Individual two (2) points



- Individual four (4) points



- Multiple-point couplings



- Four (4) point couplings

A - Min. 45° C > 2400 mm L < 2400 mm

(c)

Figure 6.2: (a) to (c) MVW3000 handling procedure

**NOTE!**

Lift the transformer panel only by forklift.



6.1.5 Opening the Package

Use proper tools to unpack the MVW3000 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 packaging from the spare cells, because they 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, check if there are damages to the product. Do not to install the cells in case you suspect 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 opening the package immediately.
- Contact the carrier and formally fill in a complaint with the problem found.
- Take pictures of the damaged parts.

The standard power cell packaging for transportation of up to three cells is shown in [Figure 6.3 on page 6-7](#).

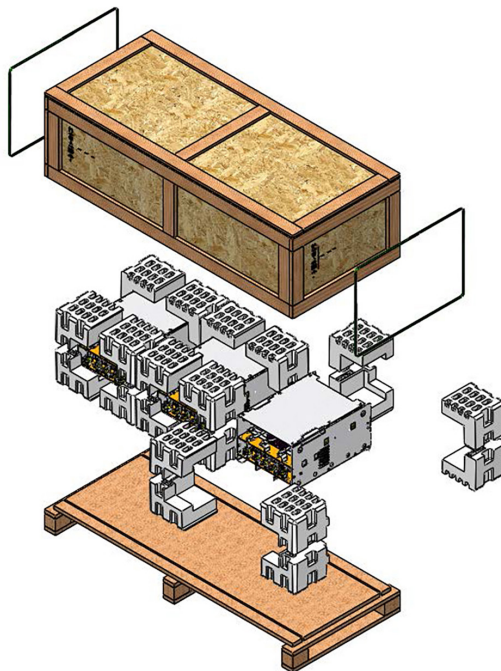


Figure 6.3: Standard power cell with package

For air transport, extra reinforcements have been installed, which need to be removed when unpacking the product according to the following procedure:

1. Remove the two upper louvers from the cell panel to gain access to the upper support bolts: [Figure 6.4 on page 6-8](#) - image 1.
2. Remove the bolts securing the upper supports: [Figure 6.4 on page 6-8](#) - image 2.
3. After removing the upper transport supports, install the lifting supports using the same bolts: [Figure 6.4 on page 6-8](#) - image 3.
4. On the transformer panel, remove the rear transport support: [Figure 6.4 on page 6-8](#) - image 4.
5. Also remove the two front supports from the transformer panel: [Figure 6.4 on page 6-8](#) - image 5.
6. Reinstall the front covers and louvers: [Figure 6.4 on page 6-8](#) - image 6.
7. Reinstall the rear covers: [Figure 6.4 on page 6-8](#) - image 7.



Figure 6.4: Procedure to remove the air transport reinforcements from the MVW3000

6.1.6 Panel Coupling

The coupling of the MVW3000 must follow the described procedure:

1. Position the columns side by side so that they are aligned in depth direction, according to [Figure 6.5 on page 6-9](#) - image 1.
2. Use the bolts, washers, and nuts supplied with the product in the loose items box in the eight available coupling holes shown in [Figure 6.5 on page 6-9](#) - image 2.
3. Install the bolts according to the sequence shown in [Figure 6.5 on page 6-9](#) - image 3 and apply a torque of 19 Nm:
 - a) M8x20 bolt.
 - b) Washer.
 - c) M8 nut.
4. Bolt, nut, and washer assembled as illustrated in [Figure 6.5 on page 6-9](#) - image 4.

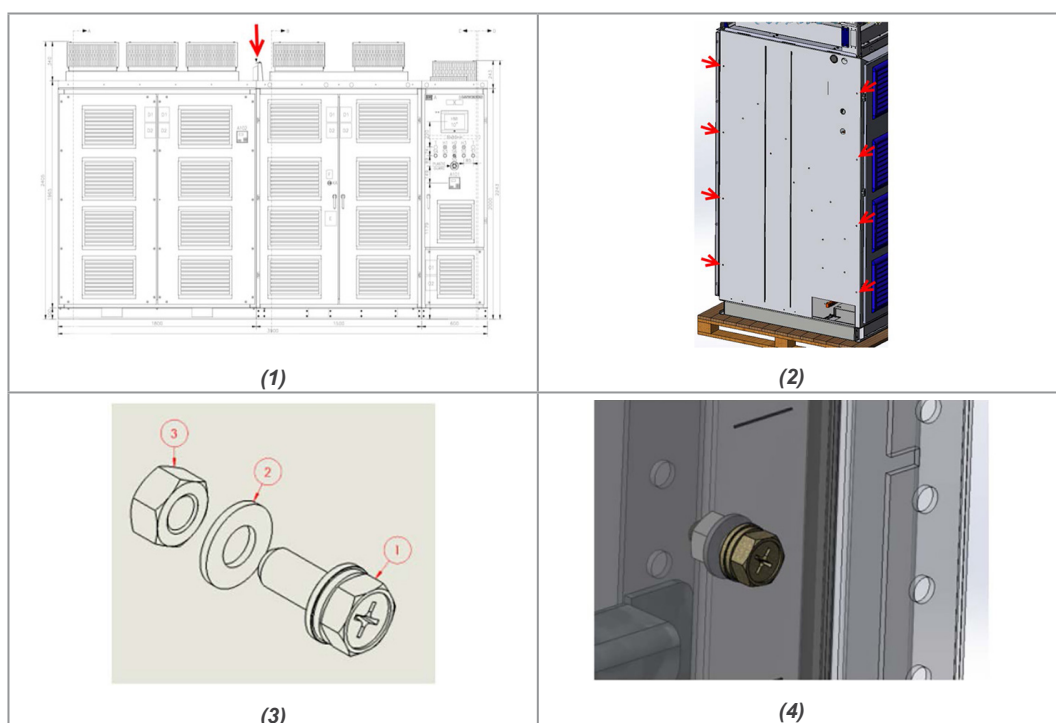


Figure 6.5: Procedure for coupling the MVW3000

6.1.7 Positioning/Mounting

The panel of the MVW3000 must be positioned on a smooth and level surface, thus avoiding mechanical instability, door misalignment, among other problems.



ATTENTION!

Some models of the MVW3000 are shipped with some parts disassembled. All disassembled parts must be properly assembled during the commissioning.

The permanent operation position must allow heat radiation from all the surfaces and the necessary ventilation for its operation. The front area of the panel must not be blocked in order to allow the full opening of the panel doors, the insertion and withdrawal of the inverter cells and the installation and/or handling of the power and control cables.

[Figure 6.6 on page 6-10](#) shows the panel fastening to the floor. For guidance, refer to the customer's specific project.

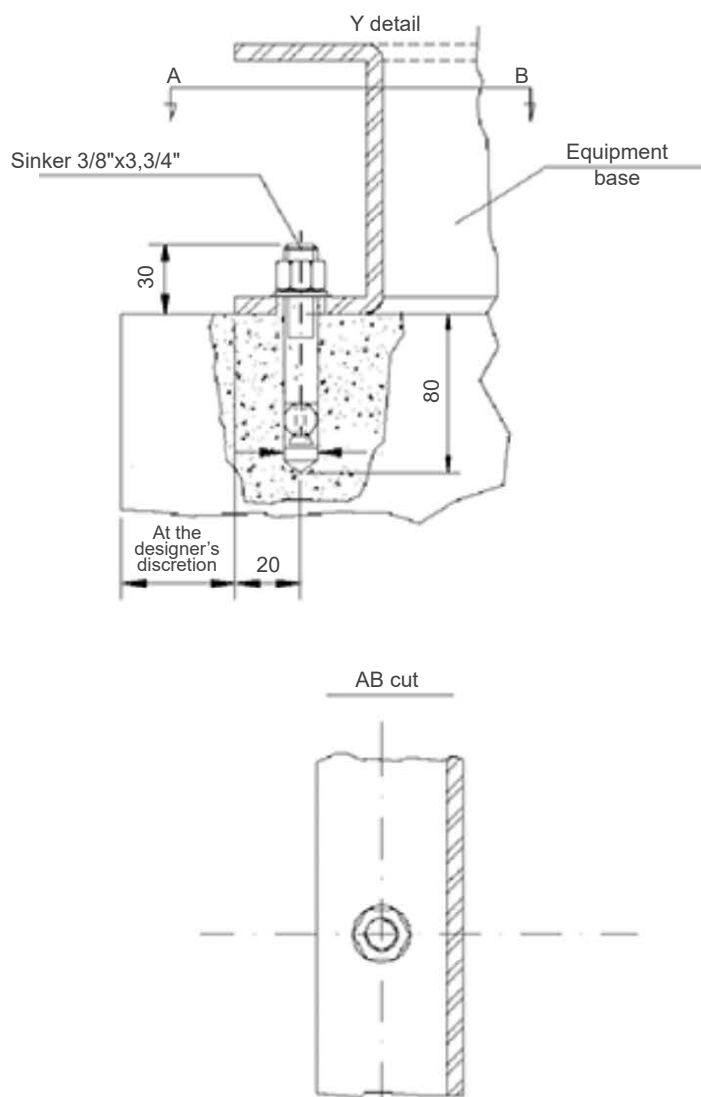
Table 4.2 on page 4-4 through Table 4.13 on page 4-6 present the dimensions of the available panels.



ATTENTION!

Make sure there is access for the electric connections:

- Input cables for the MVW3000 panel and output to the motor.
- Protection of the transformer and motor.
- Digital and analog inputs and outputs.
- Commands and states of the input switchgear when it is supplied separately from the MVW3000 panel. It is necessary to allow space behind the panel for back access to the internal components during the product installation.



Comments:

- (1) Guideline instructions; refer to the customer-specific project.
- (2) Panel fixing points on the base.
- (3) All dimensions are in millimeters (mm), unless otherwise specified.

Figure 6.6: Anchoring the MVW3000 panel to the floor



NOTE!

Recommendations for anchoring the panel may vary for the several MVW3000 models. For more information refer to the specific project documentation.

6.1.8 Insertion of the Power Cells

Insertion of the power cells must be performed using the transport cart, as shown in [Figure 6.7 on page 6-11](#) and according to the following procedure.

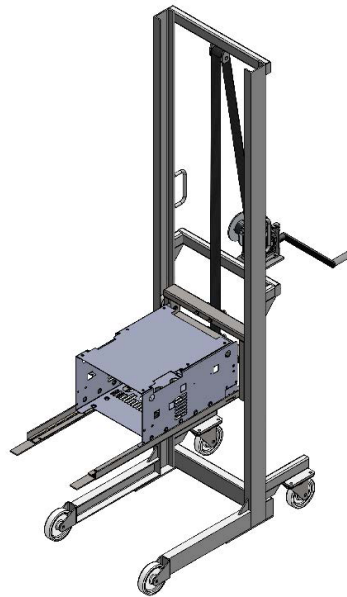


Figure 6.7: Cart for inserting / withdrawing / moving the power cells

[Figure 6.8 on page 6-12](#) shows the steps for inserting a cell into the inverter according to the following sequence:

1. Rotate the crank handle until the trolley reaches the floor level. Position the cell on the cart tray - image 1.
2. Bring the cart close to the panel, lift the cell to the required height - image 2.
3. Attach the cart tray to the panel support - image 3.
4. Check that the tray has fitted correctly and lock the cart wheels - image 4.
5. Push the cell while observing the alignment with the panel support until the cell reaches the end of travel - image 5.
6. Fit the two insertion handles on the cell pins in the position indicated - image 6.
7. Position the lever so that its smaller hole is concentric with the cell insertion pin of the cell - image 7.
8. Turn both handles simultaneously until they become parallel to each other and the cell reaches the fastening position with the panel support - image 8.
9. Remove the two levers and fasten the cell to the panel support with the two locking screws. Torque: 8 Nm - image 9.
10. Lift the cart tray until it uncouples from the cell support and move the cart away from the panel.

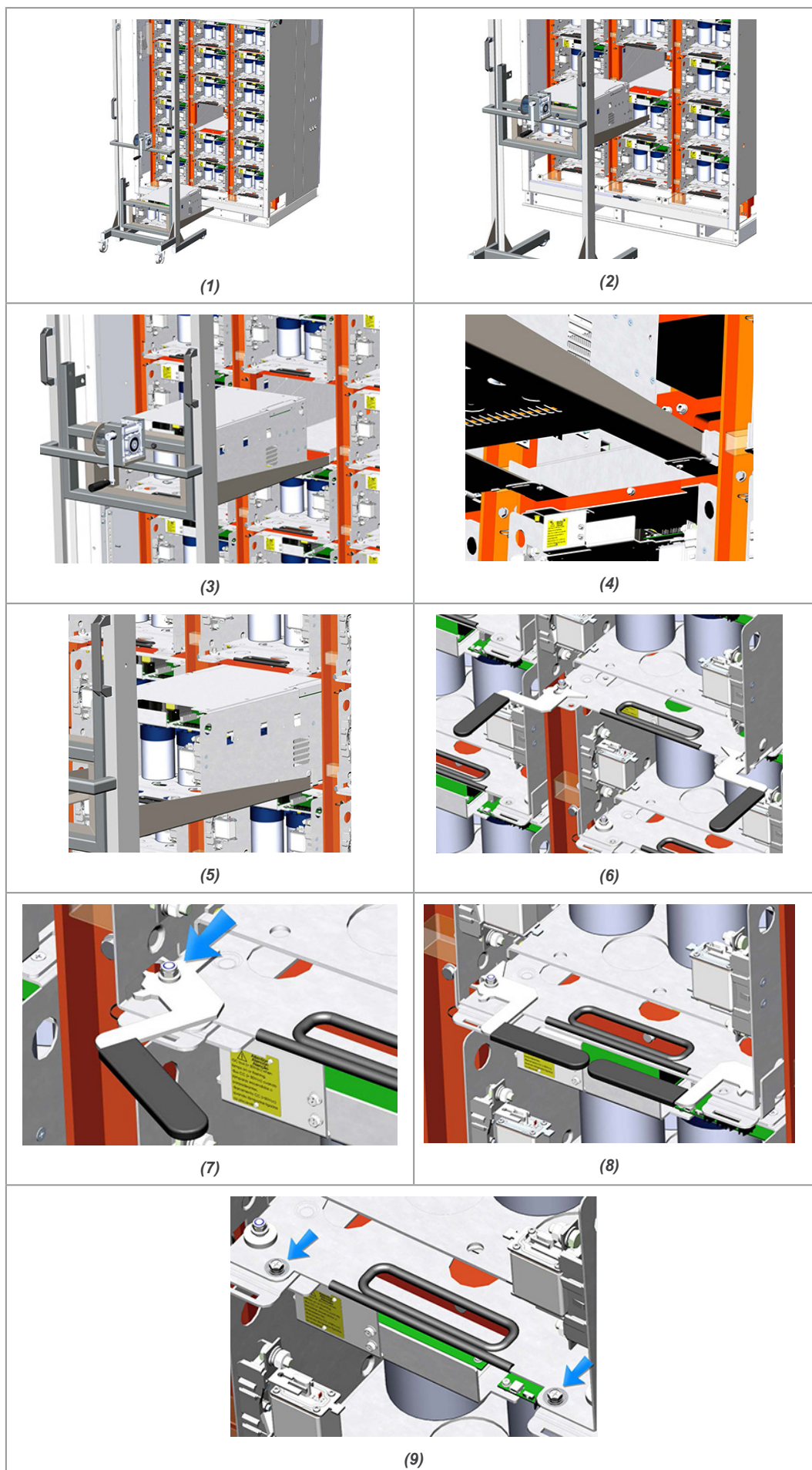


Figure 6.8: Details of the cell insertion step



ATTENTION!

Transportation of the power cell must be performed with the cell kept close to the floor, as shown in [Figure 6.8 on page 6-12](#) - image 1.

6.1.9 Electrical and Fiber Optic Connections in the Power Cells

After the power cells are inserted (phases U, V and W), connect them to the fiber optic cables, according to the labels located on the cells and cables. Refer to [Figure 6.9 on page 6-13](#) for more details.

Cable identifications are presented in [Table 6.2 on page 6-14](#).

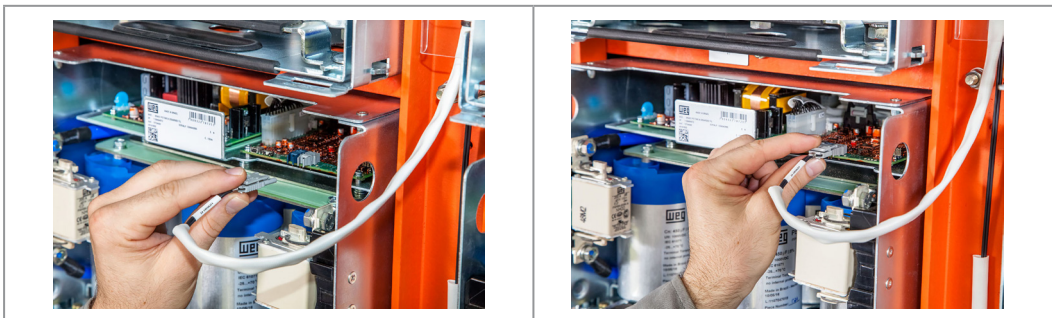


Figure 6.9: Detail of the steps to install the fiber optic cable in the power cell



ATTENTION!

The fiber optic cables must be handled with caution, in order not to fold, bend, squeeze or cut them. In order to insert or remove the cables, pull or push the connectors only – never the fiber.



NOTE!

To remove the power cells, follow the procedures described in the previous sections in reverse order. Remove the fiber optic cable before removing the cell.

Table 6.2: Identification of fiber optic cables - inverters with 15, 18, 21, 24, 27, 30, 33 and 36 cells

Power Cell Connection	Connection to Main Control	Function
U1	CIB 1: NR1	RX
	CIB 1: NT1	TX
U2	CIB 1: NR2	RX
	CIB 1: NT2	TX
U3	CIB 1: NR3	RX
	CIB 1: NT3	TX
U4	CIB 1: NR4	RX
	CIB 1: NT4	TX
U5	CIB 1: NR13	RX
	CIB 1: NT13	TX
U6	CIB 1: NR14	RX
	CIB 1: NT14	TX
V1	CIB 1: NR5	RX
	CIB 1: NT5	TX
V2	CIB 1: NR6	RX
	CIB 1: NT6	TX
V3	CIB 1: NR7	RX
	CIB 1: NT7	TX
V4	CIB 1: NR8	RX
	CIB 1: NT8	TX
V5	CIB 1: NR15	RX
	CIB 1: NT15	TX
V6	CIB 1: NR16	RX
	CIB 1: NT16	TX
W1	CIB 1: NR9	RX
	CIB 1: NT9	TX
W2	CIB 1: NR10	RX
	CIB 1: NT10	TX
W3	CIB 1: NR11	RX
	CIB 1: NT11	TX
W4	CIB 1: NR12	RX
	CIB 1: NT12	TX
W5	CIB 1: NR17	RX
	CIB 1: NT17	TX
W6	CIB 1: NR18	RX
	CIB 1: NT18	TX
U7	CIB 2: NR1	RX
	CIB 2: NT1	TX
U8	CIB 2: NR2	RX
	CIB 2: NT2	TX
U9	CIB 2: NR3	RX
	CIB 2: NT3	TX
U10	CIB 2: NR4	RX
	CIB 2: NT4	TX
U11	CIB 2: NR13	RX
	CIB 2: NT13	TX
U12	CIB 2: NR14	RX
	CIB 2: NT14	TX

Power Cell Connection	Connection to Main Control	Function
V7	CIB 2: NR5	RX
	CIB 2: NT5	TX
V8	CIB 2: NR6	RX
	CIB 2: NT6	TX
V9	CIB 2: NR7	RX
	CIB 2: NT7	TX
V10	CIB 2: NR8	RX
	CIB 2: NT8	TX
V11	CIB 2: NR15	RX
	CIB 2: NT15	TX
V12	CIB 2: NR16	RX
	CIB 2: NT16	TX
W7	CIB 2: NR9	RX
	CIB 2: NT9	TX
W8	CIB 2: NR10	RX
	CIB 2: NT10	TX
W9	CIB 2: NR11	RX
	CIB 2: NT11	TX
W10	CIB 2: NR12	RX
	CIB 2: NT12	TX
W11	CIB 2: NR17	RX
	CIB 2: NT17	TX
W12	CIB 2: NR18	RX
	CIB 2: NT18	TX

6.2 ELECTRICAL INSTALLATION

6.2.1 Power Section

The power cables connecting the line supply to the MVW3000 and those connecting the inverter panel to the medium-voltage motor ([Figure 6.13 on page 6-21](#)) must be suitable for medium-voltage applications and sized according to the rated currents.

Table 6.3: Recommended power cables cross section (copper) [mm²]

	Power Cables [mm ²]: R, S, T, U, V, W	Maximum Current [A]
Single cable	10	71
	16	96
	25	126
	35	157
	50	189
	70	241
	95	292
	120	337
	150	384
	185	438
	240	514
Two cables	2x50 (*)	302
	2x70 (*)	386
	2x95 (*)	467
	2x120 (*)	539
	2x150 (*)	614
	2x185 (*)	701
	2x240 (*)	822
Three cables	3x95 (*)	613
	3x120 (*)	708
	3x150 (*)	806
	3x185 (*)	920
	3x240 (*)	1079
Four cables	4x120 (*)	876
	4x150 (*)	998
	4x185 (*)	1139
	4x240 (*)	1336
Five cables	5x185 (*)	1314
	5x240 (*)	1542

(*) It is recommended that parallel cable connections be made through auxiliary busbars.



NOTE!

For proper sizing of the power cables indicated in [Table 6.3 on page 6-16](#), cable length and ambient temperature must be considered, according to applicable local electrical installation standards and regulations.

Table 6.4: Recommended gauges for power and grounding cables (copper)

Power Wiring Gauge (Cross-section S) [mm ²]	Minimum Grounding Wiring Gauge (Cross-section S) (PE) [mm ²]
$S \leq 16$	S
$16 < S \leq 35$	16
$35 < S$	$S / 2$



NOTE!

The gauge values presented in [Table 6.3 on page 6-16](#) and [Table 6.4 on page 6-16](#) are for reference only. Proper cable sizing must take into account installation conditions, applicable standards, and the maximum allowable voltage drop.

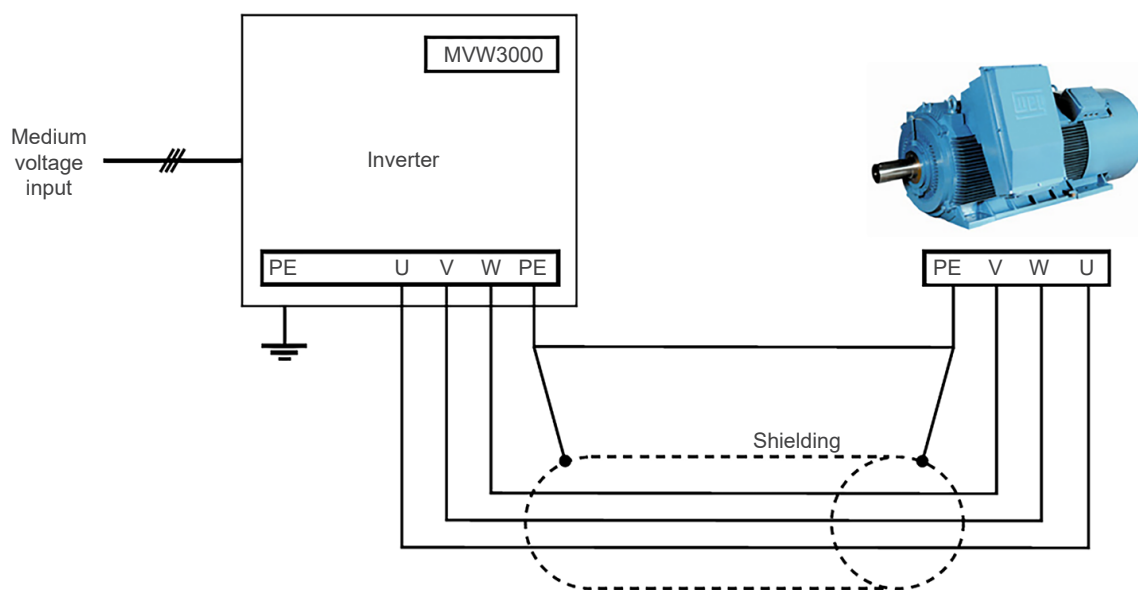


Figure 6.10: Power and ground connections

The MVW3000 connection cables must withstand the phase-to-ground and phase-to-phase peak voltages indicated in [Table 6.5 on page 6-17](#) for standard and special operating conditions (valid for models with and without redundancy).

The cables were chosen so as not to exceed more than 20 % of the rated value.



ATTENTION!

It is recommended to use shielded power cables for the connection between the inverter and the motor.

Local medium voltage cable insulation norms and standards must be observed.

Table 6.5: Minimum insulation voltage of the power cables

Rated Output Voltage [kV]	Minimum Insulation Voltage				
	Standard Operation			Special Operation ⁽²⁾	
	Phase-Ground Peak Voltage [V]	Phase-Phase Peak Voltage [V]	Recommended Cable Insulation [kV] ⁽¹⁾	Phase-Ground and Phase-Phase Peak Voltage [V]	Recommended Cable Insulation [kV] ⁽¹⁾
1.15	1553	1863	1.8/3	1863	1.8/3
2.3	2484	3726	1.8/3	3726	3.6/6
3.3	3416	5589	3.6/6	5589	3.6/6
4.16	4347	7452	3.6/6	7452	6/10
5.5	5279	9315	3.6/6	9315	6/10
6.3	6210	11178	6/10	11178	8.7/15
6.9	6210	11178	6/10	11178	8.7/15
7.2	7142	13041	6/10	13041	8.7/15
8	7142	13041	6/10	13041	8.7/15
9	8073	14904	6/10	14904	12/20
10	9005	16767	6/10	16767	12/20
11	9936	18630	8.7/15	18630	12/20
12	10868	20493	8.7/15	20493	12/20
13.2	11799	22356	8.7/15	22356	15/25
13.8	11799	22356	8.7/15	22356	15/25

(1) According to ABNT NBR 7286 standard. Effective values (rms).

(2) Possibility of continuous operation with a short circuit between one phase and ground.

Use proper connectors for the power connections and the shield connections to the grounding bar.

Tighten the connections with the proper torque, as shown in [Table 6.6 on page 6-18](#).

Table 6.6: Power connections cable lugs and tightening torque

Cable Lug	Torque [Nm] $\pm 20\%$
M8	22
M10	43
M12	75



DANGER!

The inverters must be properly connected to protective earth (PE). The grounding connection must follow the local regulations. Use at least the cable gauge indicated in [Table 6.4 on page 6-16](#). Connect to a dedicated grounding rod or to the main grounding point (resistance ≤ 10 ohms).

6.2.2 Input Switchgear

The input switchgear, which may be a circuit breaker or contactor, can only be driven by the MVW3000. The circuit breaker circuits are powered by the MVW3000. The following signals, provided by the circuit breaker, are necessary for its operation:

READY (Contact closed = ready): System ready to be operated.

ON (Closed contact = on): Contactor/circuit breaker status ON.

OFF (Closed contact = off): Contactor/circuit breaker OFF state.

TRIP (Open contact = fault): It indicates a defect in the driving system or actuation of the protection circuit.



NOTE!

These signals must be dry contacts (potential free).
Emergency circuits must be associated with the **READY** signal and never with the **TRIP** signal.



NOTE!

When the switching circuit is supplied by third parties, it is strongly recommended that the MVW3000 door lock key be blocked together with the circuit breaker/contactactor when it is in the non-grounded position.



NOTE!

The terminal blocks shown in [Figure 6.11 on page 6-19](#) and [Figure 6.12 on page 6-20](#) (X10 and X12) may vary according to the project. Always refer to the project documentation supplied with the product.



ATTENTION!

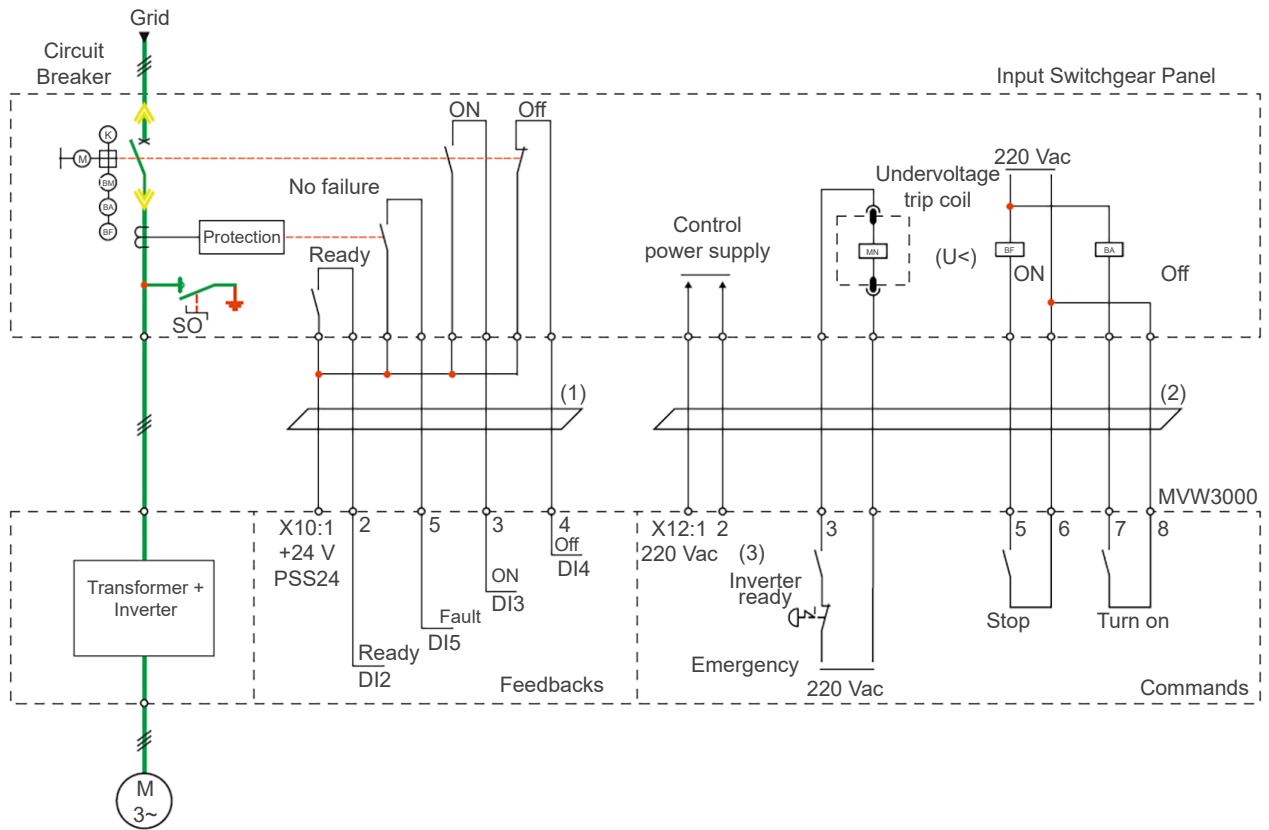
The input cubicle must be closed only by the inverter; otherwise, the transformer and the inverter may be damaged.
It is highly recommended that the grounding switch of the input switchgear be connected to the "ready" signal. Operating the inverter pre-charge system with the switchgear grounded may damage the inverter.



DANGER!

Although the inverter commands the opening of the circuit breaker, there is no guarantee of its opening.

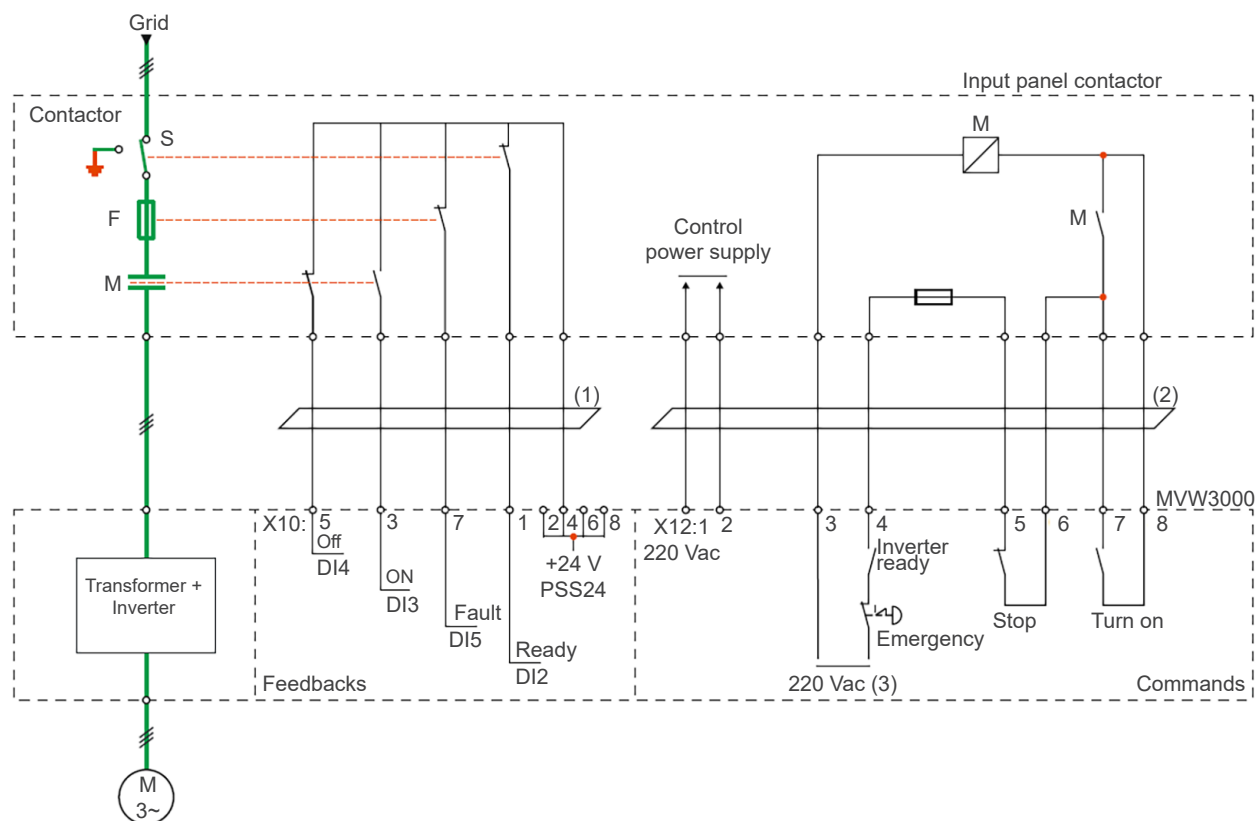
For opening medium-voltage panels or performing maintenance, follow all safe de-energization procedures (refer to [Section 6.6 SAFE DE-ENERGIZATION INSTRUCTIONS](#) on page 6-28).



Note:

- (1) 24 Vdc wiring: Use shielded cables and keep them separated from power and control wiring.
- (2) 220 Vac wiring: Keep away from power wiring.
- (3) Example for 220 Vac. Consult the project.

Figure 6.11: Connections of the inverter input circuit breaker for situations in which it is supplied separately



Note:

- (1) 24 Vdc wiring: Use shielded cables and keep them separated from power and control wiring.
- (2) 220 Vac wiring: Keep away from power wiring.
- (3) Example for 220 Vac. Consult the project.

Figure 6.12: Connections of the inverter input contactor for situations in which it is supplied separately

6.2.3 Low Voltage Auxiliary Supply

Control column power supply nominal voltage selection

An auxiliary voltage supply (220 - 480 Vac) should be available in the installation. This voltage must be wired to the terminal strip present in the control column. The command transformer taps must be selected according to the available auxiliary voltage. For more details, refer to the MVW3000 electrical project.

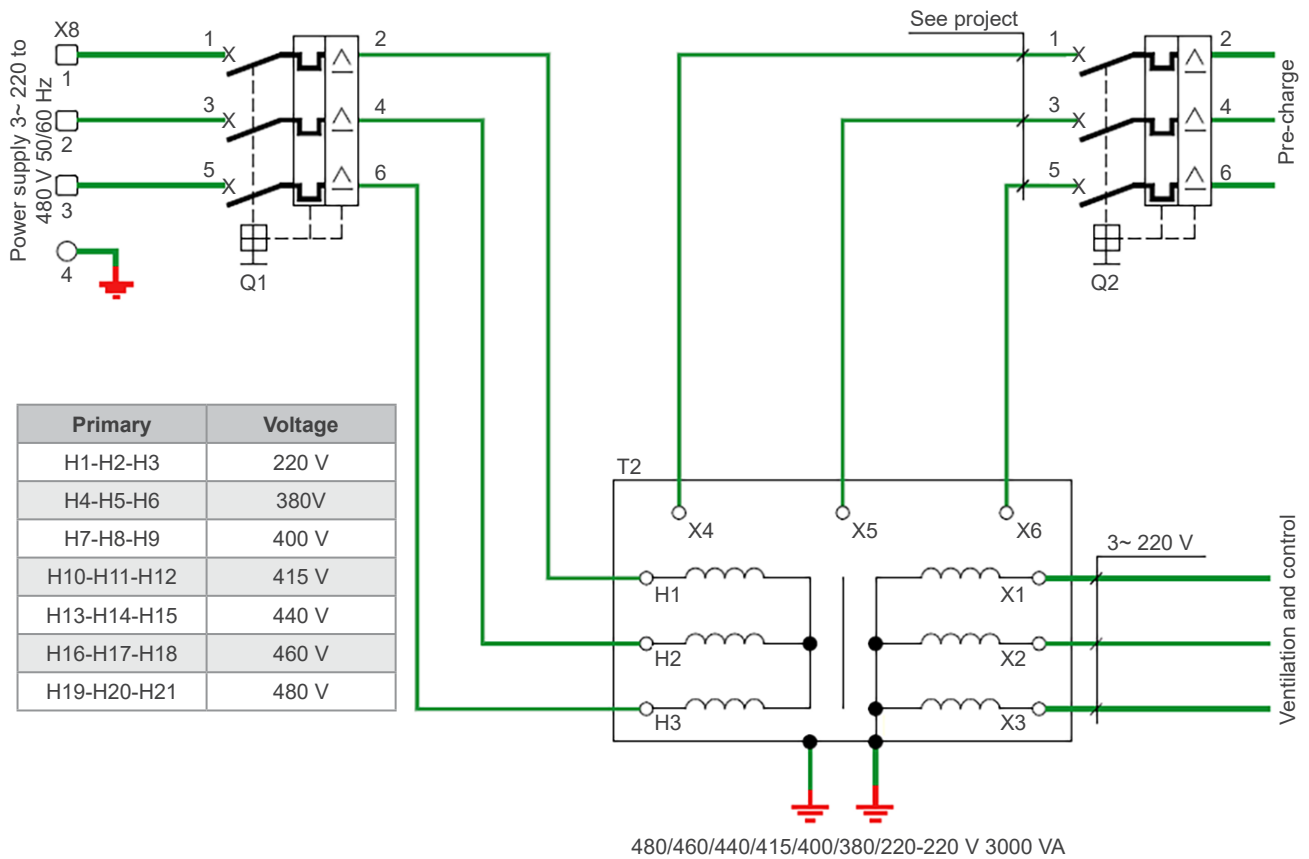


Figure 6.13: Auxiliary power supply example (3000 VA transformer)



NOTE!

The values presented in [Figure 6.13 on page 6-21](#) are standard values. For other values, consult WEG.

6.3 POWER-UP IN OPERATION

This chapter contains the following information:

- How to check and prepare the inverter before power-up.
- How to perform the power-up and check its success.
- How to operate the inverter when installed according to the typical drives (refer to [Section 6.2 ELECTRICAL INSTALLATION on page 6-15](#) and to the specific documentation (project) supplied with the product).
- How to de-energize the inverter safely.



DANGER!

Residual voltages are indicated by the neon lamps on the HVM2 (High Voltage Monitoring) board. It is essential to observe those lamps during energization/de-energization!

6.3.1 Preparation for Power-up

The inverter must already have been installed according to [Chapter 6 INSTALLATION, CONNECTION, ENERGIZATION AND PREVENTIVE MAINTENANCE on page 6-1](#). If the drive project is different from the typical drives suggested, the steps below still apply.



DANGER!

- Always disconnect all the power supplies before making any connections.
- Although the inverter commands the opening of the input cubicle, 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 that all the power, grounding and control connections are correct and firm.
2. Check the inside of the panel and remove all material residues left in the MVW3000 panel.
3. Check the motor connections and whether the voltage and current are according to the inverter.
4. If possible, mechanically disconnect the motor from the load; otherwise, make sure that spin in any direction (forward/reverse) will not cause damage to the machine or personal hazards.
5. Close and lock the panel doors.

6.3.2 Initial Energization (Minimum Required Parameter Adjustment)

After preparation for energization, the inverter can be energized according to the following steps:

Make sure:

1. The auxiliary power supply voltage and the medium voltage supply line voltage are available in the input switchgear. Check whether the low-voltage auxiliary supply feeding the control panel is within the permitted range (rated voltage +10 % / -15 %).
2. The control panel circuit breakers are installed according to the electrical project. Then close the door of the control panel.
3. The emergency button is not activated.
4. The control panel has been energized, the auxiliary supply disconnect switch of the control panel is closed, and verify the initialization of the main control through the HMI.
5. The first energization was successfully completed, the initialization process has finished, and the HMI status indicates inverter undervoltage.

6.3.3 Start-up

This section describes the inverter start-up with HMI 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 MVW3000 inverter. The inverter must already have been installed and programmed according to [Chapter 6 INSTALLATION, CONNECTION, ENERGIZATION AND PREVENTIVE MAINTENANCE](#) on page 6-1.

6.3.3.1 Commissioning - HMI Operation - Control Type: V/f 60 Hz

1. Apply power to the panel close the disconnect switch at the control column power supply input.

2. Once the control panel is energized, the main control board enters the initialization process, displaying the message "booting" on the HMI.

After the control has completed initialization (approximately 10 s), the message "inverter undervoltage" is displayed on the HMI.

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

3. Ready to initiate the pre-charge and power section energization.

On the MVW3000, the command to start the DC Link pre-charge must be performed manually:

- With the ready to energize indicating light turned on, press the ON button.
- Wait until the pre-charge is finished (approximately 15 seconds). During the pre-charge the pilot light must remain on.
- Once the pre-charge is successfully completed, the pre-charge indicating light (PRECHARGE) will turn off and the Energized light will turn on, indicating the input switchgear was successfully closed.
- The message "inverter disabled" is displayed on the HMI.



ATTENTION!

If during the pre-charge any problem occurs, the inverter indicates an error related to it. Possible faults are:

- F0020: Pre-charge fault.
- F0092: Precharge power supply.
- F0027: Improper opening of the input cubicle.
- F0026: Input cubicle not ready fault.

Refer to the description of these faults/alarms in the programming manual available for download at: www.weg.net.



NOTE!

The last speed reference value adjusted through the ▲ and ▼ keys is stored in memory (P0120 = 1).

If you want to change its value before enabling the inverter, change it using parameter P0121 - Switch Reference.



NOTES!

1. If the motor rotation direction is reversed, de-energize the inverter, follow the instructions in [Section 6.6 SAFE DE-ENERGIZATION INSTRUCTIONS on page 6-28](#), and interchange any two motor output cables.
The HMI must indicate the same direction seen looking against the motor shaft end.
2. If the current is too high during the acceleration, especially at low speeds, it is necessary to reduce the acceleration ramp time (P0100 or P0102) or change P0136 - Torque boost setting.
Gradually increase and decrease the P0136 content until reaching an operation with approximately constant current throughout the entire speed range. In the case above, refer to the parameter descriptions in the programming manual available for download at: www.weg.net.
3. In case some DC Link overvoltage fault occurs during the deceleration, it will be necessary to increase the deceleration time through P0101/P0103 and check P0151.



ATTENTION!

If the inverter receives an "Enable General" or "Run/Stop" command before the precharge procedure has been completed (the inverter is still in undervoltage state), the command will be ignored.

6.4 CONTACT THE AUTHORIZED SERVICE CENTER



NOTE!

For technical support or servicing, it is important to have the following information at hand:

- Inverter model.
- Serial number, manufacturing date, and hardware revision indicated on the product nameplate (refer to [Section 2.2 MVW3000 IDENTIFICATION LABEL on page 2-1](#)).

For explanations, training or services, please contact a WEG Authorized Service Center.

6.5 PREVENTIVE MAINTENANCE



DANGER!

- Only personnel properly qualified and familiar with the MVW3000 and related equipment should perform the maintenance of this equipment. All the safety instructions contained in this manual or defined by local standards must be followed.
- Always disconnect the power supply lines (power and auxiliary) before touching any electrical component related to the inverter.
- High voltages and rotating parts (fans) may be present even after the supply voltage is disconnected. To open or access the medium voltage panels, follow all safe de-energization instructions.
- **NOT FOLLOWING THE SAFETY INSTRUCTIONS MAY RESULT IN DEATH OR DAMAGE TO THE EQUIPMENT.**



ELECTROSTATIC DISCHARGES – ESD

Electronic boards have components sensitive to electrostatic discharges.

Precautions against ESD are required when handling those boards. When the electronic boards are installed or removed, it is recommended to:

- Wear a wrist-type anti-static strap grounded on the inverter frame.
- Attach the anti-static strap before removing the new board from the anti-static package.
- After removing a board from the drive, insert it immediately into an anti-static package.



ATTENTION!

- The distinction between preventive maintenance in operation and the one with transformer de-energization does not exclude the possibility to make a single process encompassing all the tasks described in those two items.
- It is recommended to keep a detailed record of the preventive maintenances done. Those records serve as proof that it was done and may help identifying the causes of possible faults and alarms.

Preventive maintenance helps identify possible future failures in advance, extending equipment service life and increasing mean time between failures, while also reducing downtime.

It also helps identify whether the equipment is being used within its mechanical, electrical and environmental limits.

Periodic cleaning performed during preventive maintenance ensures proper operation when the inverter is operated under rated conditions.

In order to obtain the best benefits, the preventive maintenance must be performed regularly at fixed intervals by a qualified technician.

The interval depends on factors like duty cycle (operating conditions) and environmental conditions (ambient temperature, ventilation, presence of dust etc.).

It is recommended to start preventive maintenance at shorter intervals and gradually extend the time between maintenance procedures as the observed results indicate that the frequency can be reduced.

A detailed record of the preventive maintenance is also recommended.

These records serve as proof the maintenance was executed and help identify the cause of possible faults and alarms.

Two types of preventive maintenance are described below:

With the inverter in operation and with its complete stop/de-energization.

6.5.1 Preventive Maintenance in Operation

This type of maintenance is performed with the inverter energized and in operation. Access is required only to the control panel, where low-voltage supplies (≤ 690 V) are present, but still with potential risk of accidents.



DANGER!

- This equipment has high voltages that may cause electric shocks. Only people properly qualified and familiar with the MVW3000 inverter and associated equipment must plan or service this equipment. In order to avoid the risk of electric shock, follow all the safety procedures required for servicing energized equipment.
- Do not touch any electrical circuit before ensuring it is de-energized.

Procedures:

1. Operation of the fans/exhausters:

Check the correct operation of the exhausters on top of the inverter panel: the fans must be spinning in the same direction and their panel air exhausting action must be checked. Check the correct operation of the fan on the control panel door: it must be spinning and blowing air into the panel.

2. Cleaning of the ventilation air inlet filters:

Remove the protection grids from the air inlets on 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 define the correct interval between preventing maintenances. Reinstall the filters and bolt the protection grids again.

3. Open the control panel door and visually inspect the components inside, checking the following points to detect faults or the need for preventive maintenance with complete stop/de-energization for cleaning or replacement:

Components	Abnormality
Electronic boards	Excess accumulation of dust, oil, humidity, etc. Discolored or blackened spots due to overheating
Capacitors on electronic boards	Discoloration, smell, electrolyte leakage, case deformation
Resistors in general	Discoloration or smell

Table 6.7 on page 6-26 presents the periodic preventive maintenance procedures under operating conditions.

Table 6.7: Intervals and procedure of the preventive maintenance in operation

Interval	Items	Procedure
1 month after start-up	Monitoring parameters	Check whether the inverter is operating within the project specifications: input transformer secondary voltages ($V_{SEC} = V_{LINK} / 1.35$ in each power cell) and output current (P0003). Change the main transformer tap positions if necessary
Every 6 months	Cleaning (or replacement) of the air of the air filters ⁽¹⁾	- Remove all filters from the panel and clean them with an air blower or with compressed air, or wash them with neutral detergent and dry them well, before installing them back into the panel - Replace all filters if cleaning is not efficient. Filter specification: Scotch-Brite P-210 (3M) ⁽²⁾
Every 6 months	Visual inspection of the ventilation	- Check the rotation direction of the exhausters - Check the rotation direction of the control panel fan
Every 6 months	Upload of the Log of Faults and Alarms	- Perform a backup of the complete inverter parameter settings. Follow the WPS® software instructions - Upload the Log of Faults and Alarms (P0067). Follow the WPS® software instructions
Every 6 months	Date and time setting	Adjust the current date and time, if necessary. Use the parameters P0080 (Date) and P0081 (Hour) by the Graph HMI V2 or the menu Settings by the Graph HMI G3 (touchscreen)
Every 6 months	Visual inspection of the control panel	Electronic boards: - Check for excessive dust accumulation or any buildup of conductive particles or moisture - Check for hot spots (discoloration or blackening of components) - Check for leakage or deformation (swelling) of electrolytic capacitor housings Precharge resistors ⁽³⁾: check for hot spots (discoloration or blackening) Ribbon cables and internal wiring: check for hot spots (deformation, discoloration, or blackening). Internal and signaling lamps: check operation Anti-condensation heater: Check operation. If a thermostat is installed, adjust its temperature setting to switch off between 5 and 10 °C (41 and 50 °F) above the average electrical room ambient temperature
Every 6 months	Basic measurements on the control panel	Auxiliary power supplies: - Measure auxiliary supply voltages L1, L2, and L3 and verify that they are within the +10/-15 % tolerance - Measure the single-phase auxiliary voltage for anti-condensation heaters, outlets, and lamps (if separate) and verify that it is within the +10/-15 % tolerance 24 V power supply: - Measure the 220 Vac input voltages and verify that they are within the +10/-15 % tolerance - Measure the 24 Vdc output voltage and verify that it is within the ±0.2 V tolerance - Measure the aluminum base temperature and verify that it is below $T_{amb} + 20$ °C (68 °F) 15 V power supply: - Measure the 12 to 24 Vdc input voltage and verify that it is within the ±0.2 V tolerance - Measure the 15 Vdc output voltage and verify that it is within the ±0.2 V tolerance

(1) The interval may be extended, depending on the cleanliness of the electrical room, from 3 to 6 or 12 months.

(2) Synthetic fiber filter media with intertwined fibers bonded by waterproof and resistant resin for air filtration where precision retention of microscopic particles is not required.

(3) In newer panels, precharge is performed using a frequency inverter and therefore there are no precharge resistors.

6.5.2 Preventive Maintenance with Stop and De-Energization of the Transformer



DANGER!

- This equipment has high voltages that may cause electric shocks. Only people properly qualified and familiar with the MVW3000 inverter and associated equipment must plan or service this equipment. In order to avoid the risk of shock, follow all the safety procedures required for servicing energized equipment.
- Do not touch any electrical circuit before ensuring that it is de-energized.

This type of maintenance is intended to clean and visually inspect the high voltage panels; therefore, it requires the complete de-energization of the inverter.

To place the inverter in a de-energized state and perform cleaning of the medium-voltage panels, it is mandatory to follow the instructions presented in [Section 6.6 SAFE DE-ENERGIZATION INSTRUCTIONS on page 6-28](#).

Its frequency can be lower than the preventive maintenance in operation.

Procedures:

1. Perform procedures 1 and 3 described in [Item 6.5.1 Preventive Maintenance in Operation](#) on page 6-25.
2. Follow the instructions in [Section 6.6 SAFE DE-ENERGIZATION INSTRUCTIONS](#) on page 6-28.

[Table 6.8 on page 6-27](#) presents the periodic preventive maintenance procedures under shutdown and de-energized conditions.

Table 6.8: Intervals and procedure of the preventive maintenance with stop and de-energization

Interval	Items	Procedure
Whenever necessary	Internal panel cleanliness	■ Main transformer: use a vacuum cleaner, duster, or cloth (dry or moistened with isopropyl alcohol), depending on the type of impurity present. The ventilation ducts can be cleaned with compressed air from the bottom up. Use a dry cloth to finish cleaning ■ Power cells ⁽²⁾: remove the power cells for cleaning only if necessary. Refer to the following items ■ Electronic boards: use only an antistatic brush. ■ Insulating materials, busbars, and air ducts: use compressed air and a cloth moistened with isopropyl alcohol. Avoid using compressed air, as it could contaminate the panels with oil or humidity ■ Power cables: use a dry cloth ■ Heat sink fins: Use compressed air. ■ Exhaust fans and fan: Use compressed air and a cloth moistened with isopropyl alcohol.
Every 12 months	Input circuit breaker maintenance ⁽¹⁾ ⁽³⁾	■ Indicators ON/OFF ■ Operations counter ■ Abnormal smell and noise
Every 12 months	Visual inspection of the power panels ⁽¹⁾	■ Electronic boards: - Check for excessive dust accumulation or any buildup of conductive particles or moisture - Check for hot spots (component discoloration or darkening) - Check for leakage or deformation (swelling) of electrolytic capacitor housings ■ Optical fibers and internal wiring: - Ensure that the optical fibers are properly inserted and that they are not bent with a radius smaller than 4 cm (1.6 in) - Check for hot spots (deformation, discoloration, or blackening) ■ Heater cable: check operation. If a thermostat is installed, adjust its temperature setting to switch off between 5 and 10 °C (41 and 50 °F) above the average electrical room temperature.
Every 12 months	Power and control connections	■ Check the tightening of all connections (control and power) ■ Use the torques recommended by the user's guide
Every 5 years	Calibrations	■ Check the status of the offset calibrations. VMPGND must be 0.0 % and within the ±1.0 % tolerance
Every 2 years	Protection relay testing ⁽⁴⁾	■ Test of the selectivity adjustments ■ Trip test of the overcurrent output
Every 3 years	Input circuit breaker or contactor maintenance ⁽³⁾	■ Insulation resistance ■ Lubrication ■ Cleanliness ■ Heating points etc
Every 40000 h of operation ⁽⁵⁾	Replacement of the exhausters	■ Replace the exhausters of the power columns and the fan of the control column
Every 5 years	Power cells clamps	■ Clean the contacts and clamps with a dry cloth and apply new conductive grease ⁽⁶⁾ to all clamps.
Every 5000 energizations	Input circuit breaker or contactor maintenance ⁽³⁾	■ Insulation resistance ■ Lubrication ■ Cleanliness ■ Heating points etc
Every 10 years	Electrolytic capacitors	■ Replace the DC Link electrolytic capacitors present in the PSC1, PS24 or PSS24 power supply ■ Precharge system with CFW500: replace the inverter DC Link electrolytic capacitors
Every 15 years	Plastic film capacitors	■ Replace the plastic film capacitors present in the power cells ■ Precharge system with CFW501: replace the inverter DC Link film capacitors

- (1) The interval may be extended, depending on the cleanliness of the electrical room, from 3 to 6 or 12 months.
- (2) Remove the cells only in case of heavy dirt accumulation. Use an air blower and antistatic brush. Never use compressed air, as it could contaminate the cell with oil or humidity.
- (3) Recommendation from most medium-voltage circuit breaker and contactor manufacturers. Refer to the manufacturer's documentation.
- (4) Recommendation from most protection relay manufacturers. Refer to the manufacturer's documentation.
- (5) If the inverter operates 24/7, 40000 h corresponds to approximately 4 years and 7 months.
- (6) Conductive grease type PENETROX A, manufacturer BURNDY.

6.6 SAFE DE-ENERGIZATION INSTRUCTIONS



DANGER!

- Although the inverter commands the opening of the input cubicle, 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. View the voltage values of the installed power cell busbars through HMI parameters P02250 to P02285.
3. Press the "POWER OFF" pushbutton.

The input transformer switchgear should open at this moment, which is indicated by the "INPUT ON" pilot light going off.



ATTENTION!

If the input transformer switchgear does not open with the "POWER OFF" command, then open it manually.

4. Observe the DC Link voltage decrease through the respective parameters on the HMI.

Even with the zero volt indication, you must wait for ten minutes to ensure the full discharge of the DC Link capacitors.

Monitor the DC bus voltage decay through HMI parameters P02250 to P02285, as well as through the neon lamps installed on the HVM2 board.

When the DC Link voltage remains < 50 V, the neon lamps remain off, and for voltage > 50 V, they start blinking or remain on.

5. Press the emergency pushbutton located on the control panel door and remove the key.
6. For switchgear with switch-disconnectors, fuses and vacuum contactors, it is mandatory to open the switch-disconnector and ground the inverter circuit. It is necessary to confirm visually the opening of the switch-disconnector through the inspection window.

For switchgear with circuit breaker and protection relay, it is mandatory to withdraw the circuit breaker and ground the inverter circuit before any intervention on the MVW3000 control panel.

In both cases, it is necessary to lock the panel and/or add a warning tag indicating "System in maintenance".

7. Turn off circuit breaker Q2 located in the control panel and lock it in the open position with a padlock or warning tag indicating "System under maintenance".
8. Switch off the Q1 circuit breaker in the control column. De-energize the auxiliary power supply.
Only after the sequence of procedures described above are performed, the doors of the high voltage compartment can be opened.

**DANGER!**

Even after the DC Link voltage indication parameters display 0 V on the HMI, 250 V may still be present on the DC Links of the power cells. Wait for ten minutes, and the panel doors may be opened. In cases where it is not possible to monitor the discharge of the DC Link capacitors through the HMI and the neon lamps mounted on the HVM2 board due to a malfunction or a preliminary shutdown, follow instructions 5 to 8 above and wait for 10 minutes.

9. Perform procedures 2 and 3 described in [Item 6.5.1 Preventive Maintenance in Operation on page 6-25](#).
10. Clean the dust accumulated inside the control and high voltage panels as described next:
 - Ventilation system (fans/sinks of the inverter arms): remove the dust accumulated on their fins using compressed air.
 - Electronic boards: remove the dust accumulated on the boards using an anti-static brush and/or low-pressure ion compressed air gun. If necessary, remove the boards from the inverter.

**ATTENTION!**

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

- Panel interior and other components: remove the accumulated dust using a vacuum cleaner with a nonmetallic nozzle. Perform this cleaning especially on the insulating materials that hold energized parts to avoid leakage currents during operation.
11. Tightening of the connections: inspect all the electrical and mechanical connections and tighten them if necessary.
 12. Reinstall all removed components or connections in their respective positions and follow the commissioning procedures described in [Section 6.3 POWER-UP IN OPERATION on page 6-21](#).

7 OPTIONAL ACCESSORIES AND BOARDS

7.1 ACCESSORY LIST

Accessories are hardware features that can be added to the inverter to expand the possible product application. Thus, all models in the MVW3000 G4 line can be equipped with the accessories listed in [Table 7.1 on page 7-1](#).

The MVW3000 G4 includes built-in Ethernet and RS485 communication interfaces. Other communication interfaces are available through accessories.

For further information regarding the installation and use of accessories, refer to the guides for each accessory available on the WEG website - www.weg.net.

Table 7.1: Available accessories

WEG Item	Name	Description	Occupied slots
Control accessories for installation in slots A to G ⁽¹⁾			
15691379	CFW900-CCAN-W ⁽²⁾	CAN interface module (CANopen/DeviceNet)	1
17825657	ACCE-ENC	Module for incremental encoder connection with a signal up to 310 kHz	0 ⁽⁴⁾
15691117	CFW900-IOAI-01	Module with 3 analog inputs and 2 isolated analog outputs	1
15691249	CFW900-IOD-01	Module with 8 isolated digital inputs and 8 isolated digital outputs	1
15691251	CFW900-REL-01	Module with 3 relay outputs (1 unit provided as standard)	1
15691253	CFW900-TEMP-01	Module with 6 isolated inputs for PTC/PT100/PT1000-type sensors	1
17143201	CFW900-CECAT-N ⁽³⁾	EtherCAT interface module	3
17143199	CFW900-CPNT-IRT-N ⁽³⁾	Profinet interface module	3
17143198	CFW900-CPDP-N ⁽³⁾	Profibus interface module	3

(1) Control accessories can be installed in any available slot. Except for explicitly listed exceptions, up to 7 accessories of the same type can be used.

(2) Only one CFW900-CCAN-W communication module can be used per inverter.

(3) Only one Anybus accessory can be used per inverter, regardless of the communication network type.

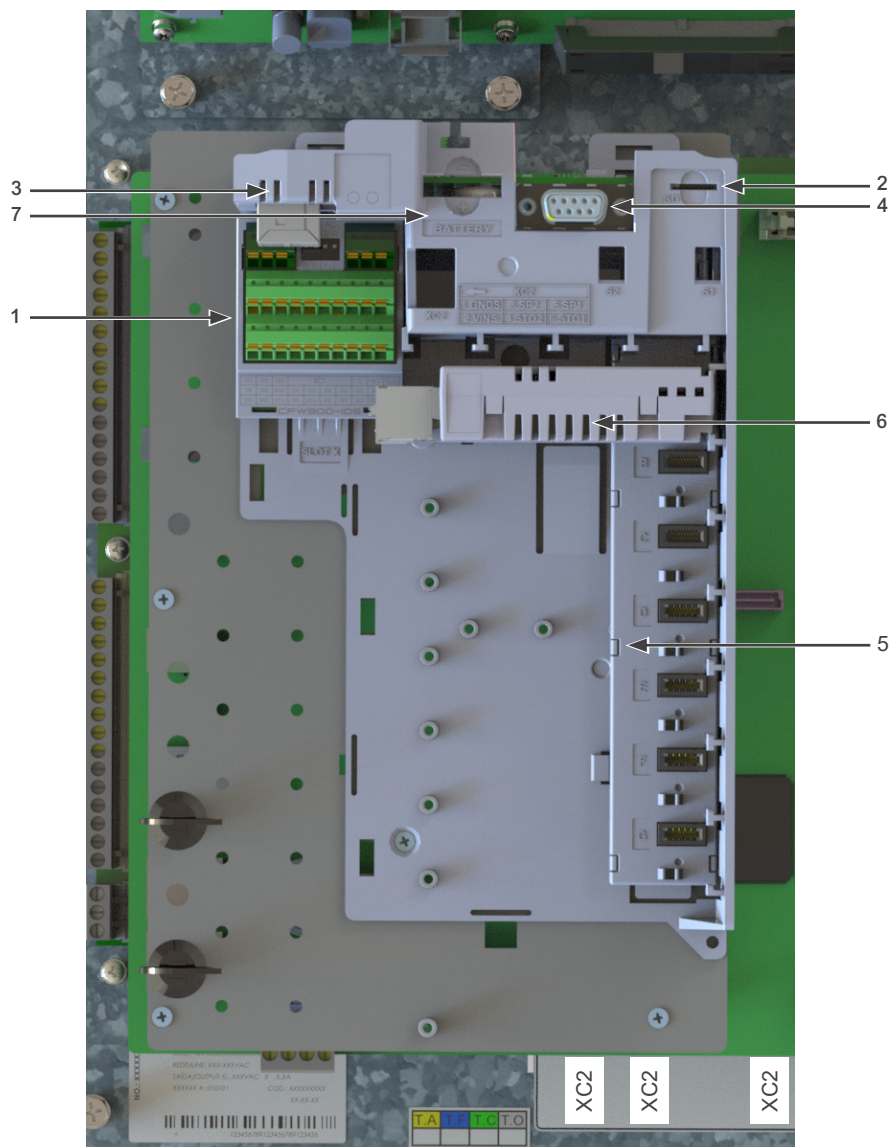
(4) Encoder accessory connected to the CCE control board.

Table 7.2: Accessory consumption

Model	Consumption ($I_{ACC,n}$) ⁽¹⁾
CFW900-CCAN-W	0.00 A
CFW900-IOAI-01	0.10 A
CFW900-IOD-01	0.00 A
CFW900-REL-01	0.05 A
CFW900-TEMP-01	0.05 A
CFW900-CECAT-N	0.05 A
CFW900-CPNT-IRT-N	0.05 A
CFW900-CPDP-N	0.05 A

(1) "n" indicates the slot into which the accessory will be connected.

7.2 SIGNAL CONNECTIONS OF THE USER INTERFACE BOARDS



Item	Description
1	Connector XC1 (CFW900-IOS): digital and analog inputs and outputs, external power supply input, and RS485 communication
2	Connector XC3 (microSD card slot): allows parameter copy and SoftPLC program storage (refer to the programming manual)
3	Connectors XC4A and XC4B: dual-port Ethernet connection (RJ45) (refer to the Ethernet communication manual)
4	XC6 connector: DB9 connector for HMI/remote HMI connection
5	CFW900-7SLOTS expansion board for connection of up to seven accessories
6	XC30 (CFW900-REL-01): Relay outputs
7	CR2032 battery for the real-time clock. Use non-conductive pliers or tweezers to remove/replace the battery

Figure 7.1: AUI - Customer connectors

The AUI board controls the accessories involved in user interaction and communication. Thus, the items shown in the figure above, used for communication with the user, are modular. Therefore, if any component becomes damaged, only the affected component needs to be replaced, without requiring replacement of all involved boards.

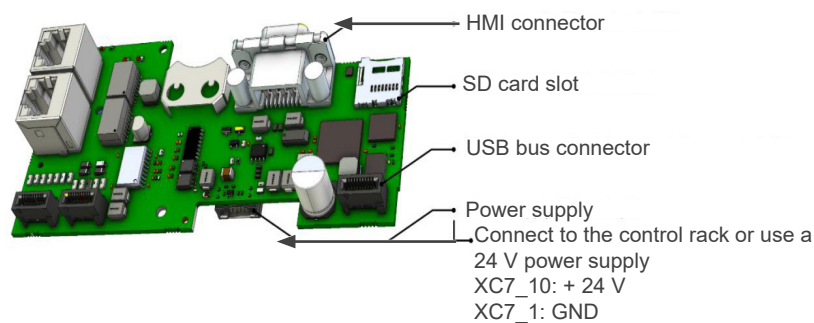


Figure 7.2: AUI - Customer connectors

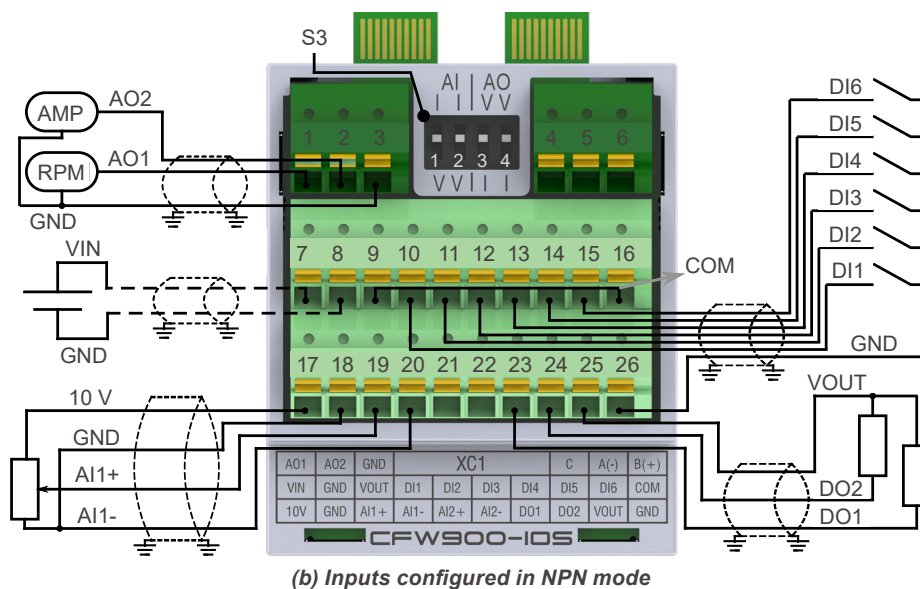
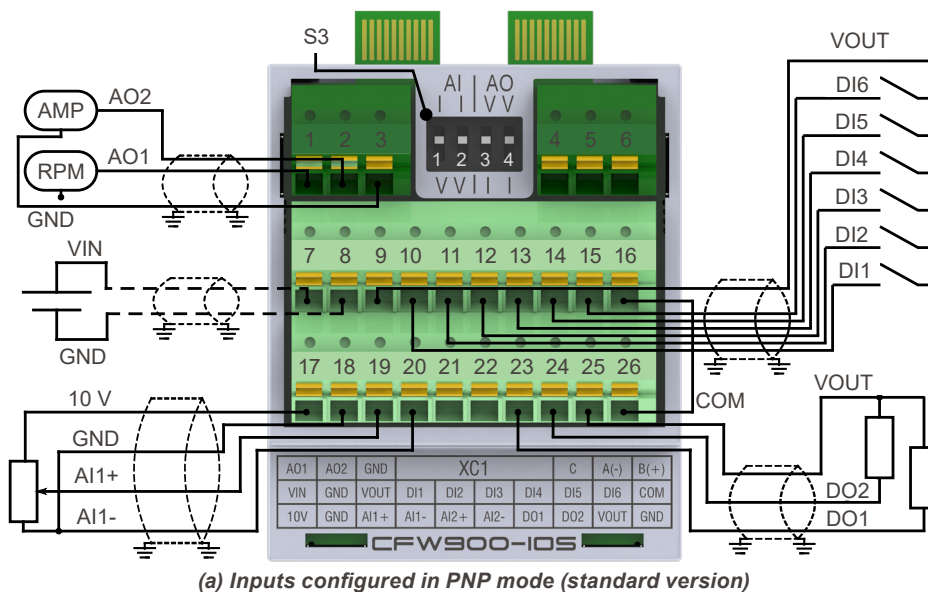


Figure 7.3: (a) and (b) Connection examples on XC1 (CFW900-IOS)

OPTIONAL ACCESSORIES AND BOARDS

Table 7.3: XC1 connector (CFW900-IOS)

Connector	Signal	Specification	Function
1	AO1	Analog output 1	Applies to the output a value proportional to the current motor speed used by the control module (P07187)
2	AO2	Analog output 2	Applies to the output a value proportional to the RMS value of the fundamental component of the inverter output current (P07188)
3	GND	Control circuit reference	
4	C	RS-485 interface reference	Speed reference (P00683)
5	A (-)	RS-485 interface negative	
6	B (+)	RS-485 interface positive	
7	VIN	+24 Vdc external power supply input	
8	GND	Control circuit reference	
9	VOOUT	+24 Vdc power supply output	
10	DI1	Digital input 1	Not used
11	DI2	Digital input 2	Not used
12	DI3	Digital input 3	Not used
13	DI4	Digital input 4	Not used
14	DI5	Digital input 5	Configurable digital input (P07289)
15	DI6	Digital input 6	Configurable digital input P07290
16	COM	Digital input common	
17	10 V	10 V power supply for potentiometer	
19	AI1+	Differential analog input 1	
20	AI1-		
21	AI2+	Differential analog input 2	
22	AI2-		
23	DO1	Digital output 1	Configurable digital output (P07155. Default 22)
24	DO2	Digital output 2	Configurable digital output (P07156. Default 19)
25	VOOUT	+24 Vdc power supply output	
26	GND	Control circuit reference	



NOTE!

The digital outputs of the CFW900-IOS include freewheeling diodes for the 24 Vdc supply of the inverter control (internal inverter power supply or external power supply connected to VIN). If a separate external 24 Vdc power supply is used to power the digital output loads, the output states will remain undefined while the 24 V control supply of the inverter is not energized. If this characteristic is undesirable, the outputs of the CFW900-REL-01 or CFW900-IOD-01 should be used.

Table 7.4: DIP switch configuration for selecting the signal type on the analog inputs/outputs of the CFW900-IOS board

Input/Output	DIP Switch	DIP Position	Factory Default
AI1	S3.1	V: -10 to 10 V; I: 4 to 20 mA / 0 to 20 mA	V
AI2	S3.2	V: -10 to 10 V; I: 4 to 20 mA / 0 to 20 mA	V
AO1	S3.3	V: -10 to 10 V; I: 4 to 20 mA / 0 to 20 mA	V
AO2	S3.4	V: -10 to 10 V; I: 4 to 20 mA / 0 to 20 mA	V

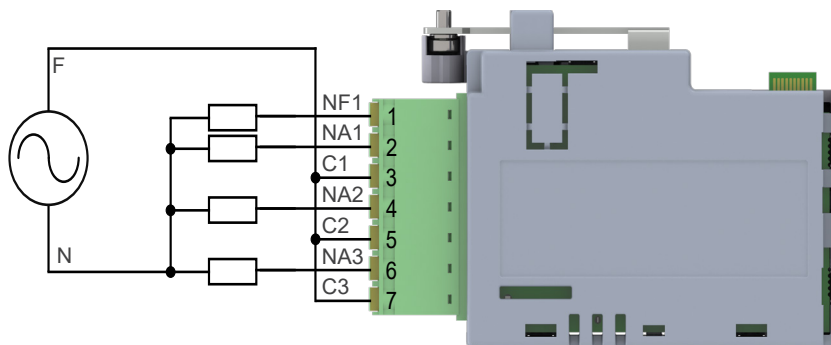


Figure 7.4: Pin assignment of connector XC30 of the CFW900-REL-01 with AC load connection example.

Table 7.5: XC30 connector (CFW900-REL-01 Accessory)

XC30 Connector		Description: Standard Function (if any) ⁽¹⁾
Pin	Name	
1	NF1	Relay digital output 1 A: no fault ⁽²⁾ NA: normally open, C: common, NC: normally closed
2	NA1	
3	C1	
4	NA2	Relay digital output 2 A: ⁽²⁾ N>Nx (S2.1.1 > C5.9.4)
5	C2	
6	NA3	Relay digital output 3 A: ⁽²⁾ N*>Nx (S2.1.3 > C5.9.4)
7	C3	

(1) For further information, refer to the detailed specification in the accessory manual.

(2) The CFW900-REL-01 supplied with the inverter will be connected to slot E, and the corresponding outputs will be 1E, 2E, and 3E, with the standard functions indicated. If the accessory is reconnected to another slot, the output identification will change to 1n, 2n, and 3n, where "n" is the slot into which the accessory was connected.



ATTENTION!

For protection against electric shock, the CFW900-REL-01 provides reinforced insulation between the relay output contacts and the remaining control circuits. The insulation between outputs is of the basic type according to IEC 61800-5-1 and UL 61800-5-1, with voltage limits of 60 Vdc / 25 Vac. To comply with IEC and UL standards, user-accessible circuits and circuits with voltages above 60 Vdc/25 Vac must not be switched on the same CFW900-REL-01.

In the installation of signal and control wiring, the following care must be taken:

1. Cable gauges 0.5 mm² to 1.5 mm².
2. Maximum torque: 0.50 N.m (4.50 lbf.in).
3. Connections to XC1A, XC1B and XC1C must be made with shielded cable and separated from the other connections (power, control at 110/220 V, etc.). If those cables have to cross, such cross must be perpendicular, keeping a minimum separation distance of at least 5 cm at the crossing point.

Screws located on the board and on the support plate of the AUI board; connect the shield as shown in [Figure 7.5 on page 7-6](#):

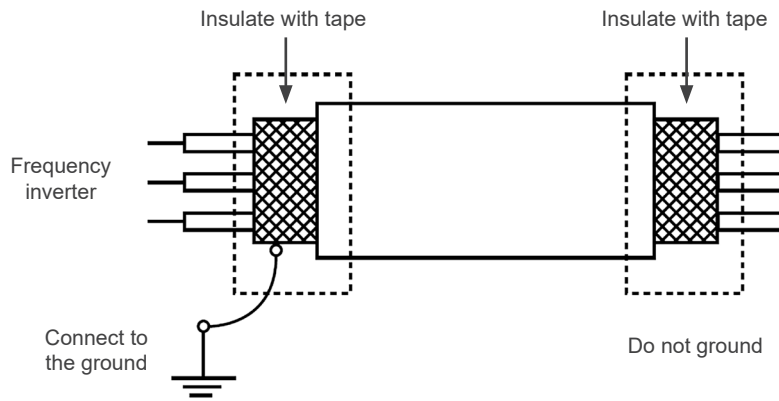


Figure 7.5: Shield connection

7.2.1 Current Capacity of the Internal 24 Vdc Power Supply

Inverters of the MVW3000 line feature an internal 24 Vdc/0.8 A power supply used to power the accessories connected to slots A through G. The current capacity not used by the accessories can be used to power external circuits, such as sensors, digital inputs, loads on the digital outputs, etc., through the VOUT output of XC1. In applications using multiple accessories, it may be necessary to use an external 24 Vdc power supply.

Follow the steps below to evaluate the consumption of the internal power supply and calculate the current available at VOUT:

1. Check the consumption of the accessories to be installed in each backplane slot through [Table 7.2 on page 7-1](#).
2. Sum the consumption of each accessory to be connected to slots A through G using the equation:

$$I_{ACC} = I_{ACC,A} + I_{ACC,B} + I_{ACC,C} + I_{ACC,D} + I_{ACC,E} + I_{ACC,F} + I_{ACC,G}$$
to obtain the total consumption of the accessories.
3. Check the total current consumed by the accessories:
 - If the current consumed by the accessories is greater than 0.8 A (i.e., $I_{ACC} > 0.8$ A), it will be necessary to use an external power supply. Refer to [Item 7.2.2 Use of External 24 Vdc Power Supply on page 7-7](#).
 - If the accessory consumption is less than or equal to 0.8 A (i.e., $I_{ACC} \leq 0.8$ A), the remaining current may be consumed through the VOUT outputs. Continue to item 4 to verify the current available at VOUT.
4. Calculate the maximum current at VOUT: $I_{OUT} = 0.8 \text{ A} - I_{ACC}$.
5. Verify that the circuits to be connected to the VOUT output do not exceed the calculated maximum I_{OUT} current.

Table 7.6: Examples for verifying internal power supply consumption and current available at VOUT

Ex.	Accessory ⁽²⁾	SLOT A	SLOT B	SLOT C	SLOT D	SLOT E	SLOT F	SLOT G	I_{ACC}	I_{OUT}
1	Model	REL-01							0.05 A	0.75 A
	Consumption	0.05 A								
2	Model	REL-01	TEMP-01	CCAN-W	ENC-01				0.30 A	0.50 A
	Consumption	0.05 A	0.05 A	0.00 A	0.20 A					
3	Model	REL-01	TEMP-01	CCAN-W	ENC-01	IOAI-01	IOD-01	IOD-01	0.40 A	0.40 A
	Consumption	0.05 A	0.05 A	0.00 A	0.20 A	0.10 A	0.00 A	0.00 A		
4	Model	REL-01	TEMP-01	ENC-01	ENC-01	IOAI-01	IOAI-01	IOAI-01	0.80 A	0.00 A
	Consumption	0.05 A	0.05 A	0.20 A	0.20 A	0.10 A	0.10 A	0.10 A		
5 ⁽¹⁾	Model	ENC-01	ENC-01	IOAI-01	IOAI-01	IOAI-01	IOAI-01	IOAI-01	0.90 A	-0.10 A ⁽¹⁾
	Consumption	0.20 A	0.20 A	0.10 A	0.10 A	0.10 A	0.10 A	0.10 A		

(1) In this example, the internal power supply capacity was exceeded, making it necessary to use an external power supply according to [Item 7.2.2 Use of External 24 Vdc Power Supply on page 7-7](#).

(2) The prefix "CFW900" has been omitted.



NOTE!

If it is necessary to use an external power supply because the consumption of the accessories and loads connected to VOUT is greater than 0.8 A, ensure that the external power supply is energized before or at the same time as the inverter, and that the inverter is de-energized before or together with the external power supply.

7.2.2 Use of External 24 Vdc Power Supply

The external power supply operates redundantly with the inverter internal power supply and allows the control, communication, and accessory circuits to remain active (powered and responding to commands) even when the power circuit is de-energized.

The inverter indicates the “Poff” status when the control power supply is active and there is no voltage on the inverter DC Link. The use of an external power supply also becomes necessary if the total current consumed by the accessories exceeds the capacity of the inverter internal power supply, as explained in [Item 7.2.1 Current Capacity of the Internal 24 Vdc Power Supply on page 7-6](#).

When the external power supply is energized, the inverter control circuits, accessories, and loads connected to the XC1 VOUT output consume current from the external power supply. Thus, the loads on VOUT will also have redundant power supply.

Follow the steps below to size the external power supply:

1. Check the consumption of the accessories to be installed in each backplane slot through [Table 7.2 on page 7-1](#).
2. Sum the consumption of each accessory to be connected to slots A through G using the equation:

$$I_{ACC} = I_{ACC,A} + I_{ACC,B} + I_{ACC,C} + I_{ACC,D} + I_{ACC,E} + I_{ACC,F} + I_{ACC,G}$$
to obtain the total consumption of the accessories.
3. Calculate I_{OUT} , which is the total consumption of the circuits to be connected to VOUT. Even with an external power supply, a maximum of 0.8 A may be consumed from VOUT without triggering the internal overcurrent protection.
4. Size the minimum current capacity of the external power supply using the equation: $I_{FE} = 0.5 \text{ A} + I_{ACC} + I_{OUT}$
5. Use an external 24 Vdc $\pm 10\%$ power supply with a current capacity of at least I_{FE} . The external power supply must be connected to the VIN and GND terminals of XC1.
6. Verify that the internal power supply is also capable of supplying the current required by the accessories and loads connected to VOUT, i.e., $I_{OUT} + I_{ACC} \leq 0.8 \text{ A}$. Otherwise, ensure that the external supply is energized before or simultaneously with the inverter energization, and that the inverter is de-energized before the external power supply.

Table 7.7: Examples for verifying the external power supply consumption and current available at VOUT

Ex.	Accessory ⁽²⁾	SLOT A	SLOT B	SLOT C	SLOT D	SLOT E	SLOT F	SLOT G	I_{ACC}	I_{OUT}	I_{FE}
1	Model	REL-01							0.05 A	0.1 A	0.65 A
	Consumption	0.05 A									
2 ⁽¹⁾	Model	REL-01	TEMP-01	CCAN-W	ENC-01				0.30 A	0.80 A	1.60 A
	Consumption	0.05 A	0.05 A	0.00 A	0.20 A						
3	Model	REL-01	TEMP-01	CCAN-W	ENC-01	IOAI-01	IOD-01	IOD-01	0.40 A	0.40 A	1.30 A
	Consumption	0.05 A	0.05 A	0.00 A	0.20 A	0.10 A	0.00 A	0.00 A			
4 ⁽¹⁾	Model	REL-01	TEMP-01	ENC-01	ENC-01	IOAI-01	IOAI-01	IOAI-01	0.80 A	0.10 A	1.40 A
	Consumption	0.05 A	0.05 A	0.20 A	0.20 A	0.10 A	0.10 A	0.10 A			
5 ⁽¹⁾	Model	ENC-01	ENC-01	IOAI-01	IOAI-01	IOAI-01	IOAI-01	IOAI-01	0.90 A	0.50 A	1.90 A
	Consumption	0.20 A	0.20 A	0.10 A	0.10 A	0.10 A	0.10 A	0.10 A			

(1) In this example, the internal power supply capacity was exceeded, making it necessary to use an external power supply according to [Item 7.2.2 Use of External 24 Vdc Power Supply on page 7-7](#).

(2) The prefix "CFW900" has been omitted.

7.3 CCEMVW CONTROL BOARD CONNECTIONS – MAIN CONTROL BOARD

This board generates the PWM signals for the cells and controls the digital outputs of the PIC board. It receives current, voltage, temperature, and arc detection feedback signals, as well as the information sent by the cells.

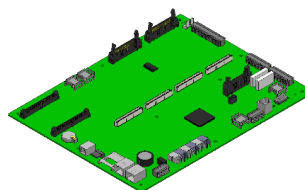


Table 7.8: CCEMVW – Main control board

Switch	Function	On	Off
S1:1	Signal at analog input AI1	4 to 20 mA / 0 to 20 mA	0 to ± 10 V (factory default)
S1:2	Signal at analog input AI2		
S4:1	Function	ON	Off
S5:1	CAN termination resistor	Resistor enabled	Resistor disabled

Note: switches S4:2 and S5:2 have no function.

S3 (key for WEG exclusive use)FPGA reset.

FO1 (OPTO OUT (1)): optical transmitter connector for TX_FO_1 signal.

FO2 (OPTO IN (1)): optical receiver connector for RX_FO_1 signal (arc sensor C).

FO3 (OPTO IN (2)): optical receiver connector for RX_FO_2 signal (arc sensor B).

FO4 (OPTO IN (3)): optical receiver connector for RX_FO_3 signal (arc sensor A).

FO5 (OPTO OUT (2)): optical transmitter connector for TX_FO_2 signal.

FO6 (OPTO OUT (3)): optical transmitter connector for TX_FO_3 signal.

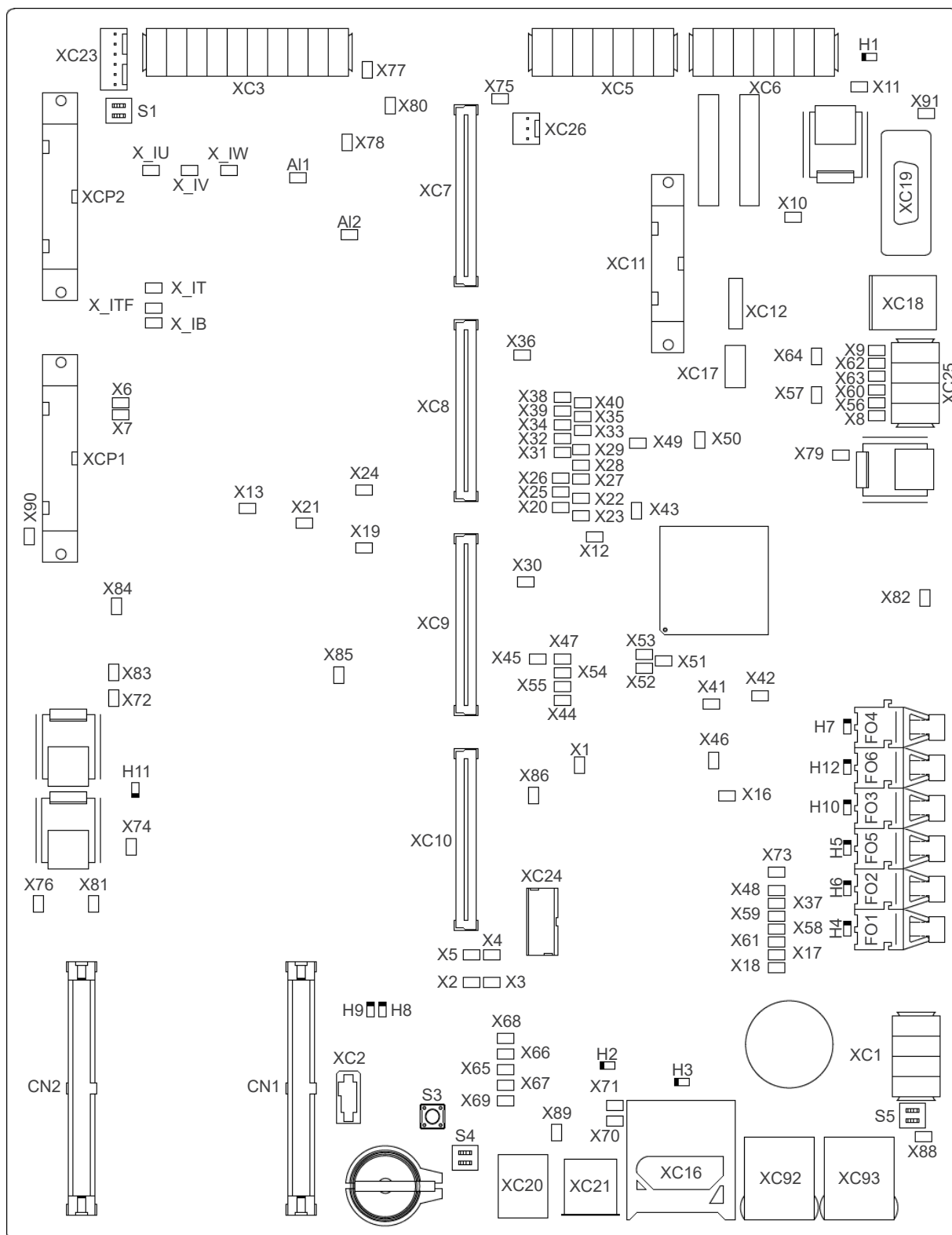


Figure 7.6: CCEMVW board connections

CN1, CN2: IGBT command and supervision signals. Connected to the CIB board.

OPTIONAL ACCESSORIES AND BOARDS

Table 7.9: Description of CCEMVW board connections

XC1: CAN interface connection			
Pin	Input/Output	Description	Signal
1	Input	CAN communication reference	GND_CAN
2	Input/Output	Communication signal	CAN_L
3	----	Shielding	Shield
4	Input/Output	Communication signal	CAN_H
XC2: connection to the AUI90 board			
1, 2, 7, 8	Output	Reference for the signals	DGND
9, 10	Output	Source	+24 V*
Note: The remaining pins are responsible for serial communication between the boards.			
XC3: analog inputs and outputs			
1	Output	+10 V reference for potentiometer	AN_REF+
2	Input	Analog input 1	AI1+
3	Input		AI1-
4	Output	-10 V reference for potentiometer	AN_REF-
5	Input	Analog input 2	AI2+
6	Input		AI2-
7	Output	Analog output 1	AO1
8, 10	Output	Reference for analog outputs	DGND
9	Output	Analog output 2	AO2
XC5: digital inputs			
1	Output	24 Vdc isolated power supply	24V* (23.5 V to 29.5 V)
2	Input	Common point of the digital inputs	COM
3	Output	Reference for the 24 Vdc isolated power supply	DGND*
4	Input	Digital input 1	DI1
5	Input	Digital input 2	DI2
6	Input	Digital input 3	DI3
7	Input	Digital input 4	DI4
XC6: relay digital outputs			
1	Output	NC contact of relay 1	NC1
2	Output	Common point of relay 1	C1
3	Output	NO contact of relay 1	NO1
4	Output	NC contact of relay 2	NC2
5	Output	Common point of relay 2	C2
6	Output	NO contact of relay 2	NO2
Note: Pin 7 is not connected.			
XC7, XC8, XC9, XC10: expansion connectors			
XC11: firmware programming (for WEG exclusive use)			
XC12: connector for JTAG trace (for WEG exclusive use)			
XC16: SD card connector			
XC17: RS232 communication signals			
5, 6	Output	5 V power supply	5 V
7, 8	Output	Reference for the signals	DGND
Note: the remaining pins carry communication signals and are not used for testing purposes.			
XC18: RS232 serial communication			
XC19: RS485 serial communication with the service HMI and temperature relays			
XC20, XC21: USB connectors			

XC23: output current reading signals			
1	Output	Phase U output current	I_U+
2	Output		I_U-
3	Output	Phase V output current	I_V+
4	Output		I_V-
5	Output	Phase W output current	I_W+
6	Output		I_W-
XC24: firmware programming (for WEG exclusive use)			
XC25: analog outputs			
1	Output	Analog output 3	AO3
2.4	Output	Reference for the signals	DGND
3	Output	Analog output 4	AO4
X26: power supply for digital inputs			
1	Input	24 Vdc isolated power supply	24V* (23.5 V to 29.5 V)
3	Input	Reference for the 24 Vdc isolated power supply	DGND*
Note: Pin 2 is not connected.			

XC92, XC93: Ethernet communication connectors.

XCP1: internal digital inputs and power supplies. See the description of the PIC3 board.

XCP2: internal digital outputs, output current measurement signals, and power supplies. See the description of the PIC3 board.



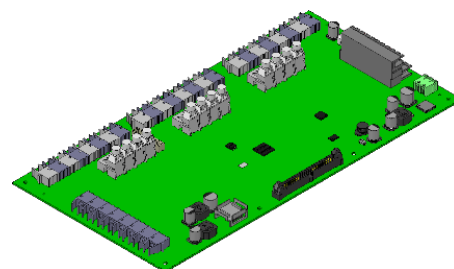
ATTENTION!

The I/Os described above are not isolated. Their utilization must be with galvanic isolators.

7.4 CIB2 – FIBER OPTIC INTERFACE BOARD

The fiber optic interface board converts the electrical signals from the main control board into optical signals transferred through serial communication to the cells in the inverter panel, and also converts the optical signals from the power circuits into electrical signals to be sent to the main control board. The signals from the power circuits connected to the CIB2 board vary according to the project.

Communication with the CCEMVW control board is performed through a 50-way ribbon cable connected to CN.



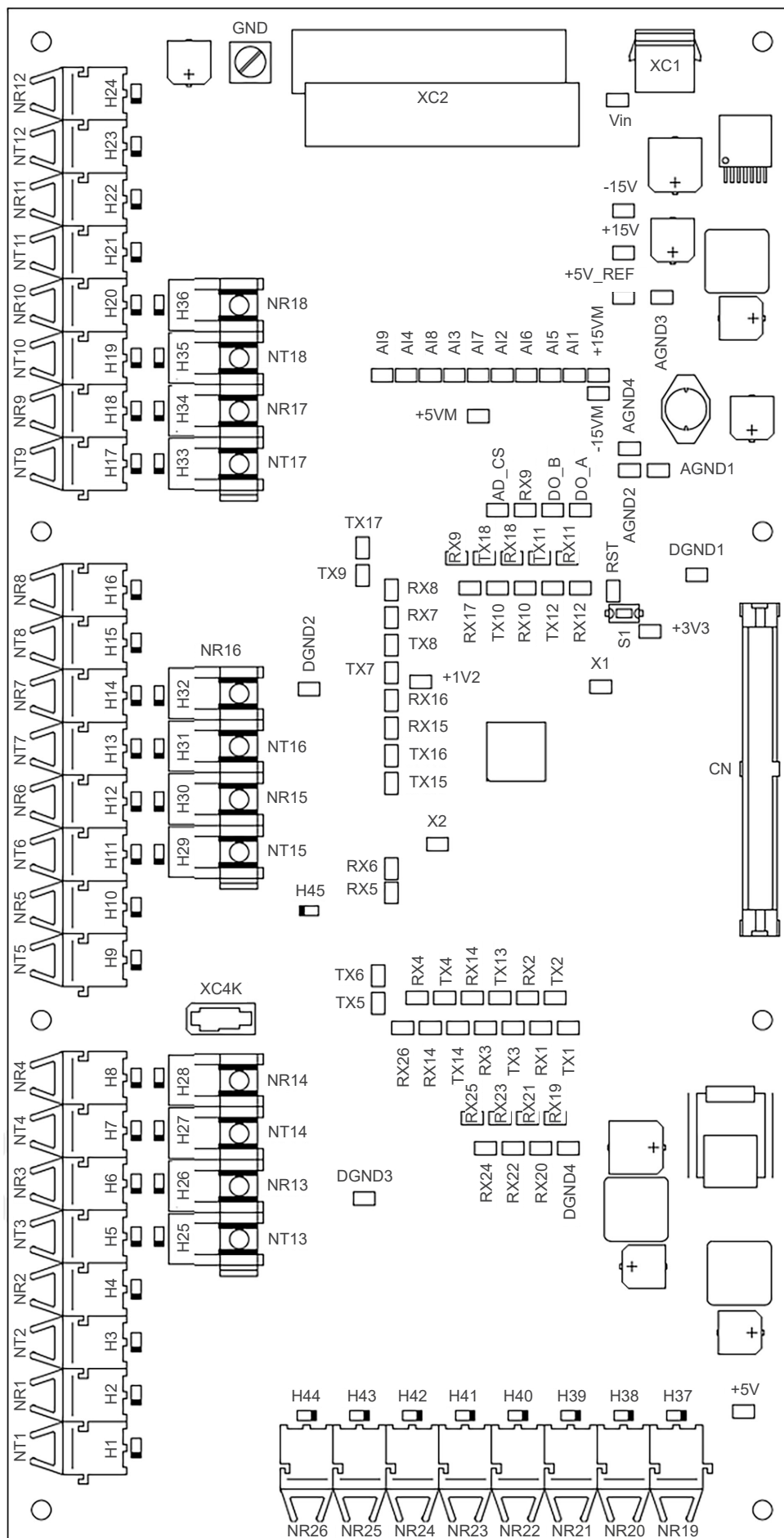


Figure 7.7: CIB2 board connections

Table 7.10: Description of the CIB2 board optical connections

Optical Connector	LED	Test Point	Description
NT1	H1	TX1	Serial communication with the cells (phase U)
NR1	H2	RX1	
NT2	H3	TX2	
NR2	H4	RX2	
NT3	H5	TX3	
NR3	H6	RX3	
NT4	H7	TX4	
NR4	H8	RX4	
NT5	H9	TX5	Serial communication with the cells (phase V)
NR5	H10	RX5	
NT6	H11	TX6	
NR6	H12	RX6	
NT7	H13	TX7	
NR7	H14	RX7	
NT8	H15	TX8	
NR8	H16	RX8	
NT9	H17	TX9	Serial communication with the cells (phase W)
NR9	H18	RX9	
NT10	H19	TX10	
NR10	H20	RX10	
NT11	H21	TX11	
NR11	H22	RX11	
NT12	H23	TX12	
NR12	H24	RX12	
NT13	H25	TX13	Serial communication with the cells (phase U)
NR13	H26	RX13	
NT14	H27	TX14	
NR14	H28	RX14	
NT15	H29	TX15	Serial communication with the cells (phase V)
NR15	H30	RX15	
NT16	H31	TX16	
NR16	H32	RX16	
NT17	H33	TX17	Serial communication with the cells (phase W)
NR17	H34	RX17	
NT18	H35	TX18	
NR18	H36	RX18	
NR19	H37	RX19	Input current T
NR20	H38	RX20	Input current S
NR21	H39	RX21	Input voltage VBC
NR22	H40	RX22	Input voltage VAB
NR23	H41	RX23	Output voltage VUV or arc sensor 5
NR24	H42	RX24	Voltage N_GND or arc sensor 4
NR25	H43	RX25	Output voltage VVW or arc sensor 3
NR26	H44	RX26	Arc sensor 1 or arc sensor 2

CN: IGBT command and supervision signals. Connected to the CCEMVW board.

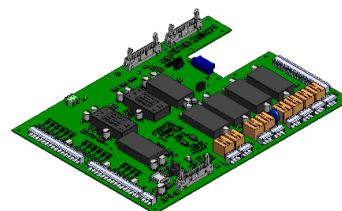
XC1: board power supply. Connected to XC10 of the PIC3 board.

Table 7.11: Description of the CIB2 board connections

XC1: board power supply. Connected to XC10 of the PIC3 board			
Pin	Input/Output	Description	Signal
1	Input	+24 V power supply from the PS24 board	+Vdc (15 V to 24 V)
2	Input	Reference for the power supply	AGND
XC2: differential inputs			
1	Output	+15V power supply	+15 V
2,3	Input	Differential analog input 1	DIF1
4	Output	-15V power supply	-15 V
5,6	Input	Differential analog input 2	DIF2
7, 8	Input	Differential analog input 3	DIF3
9, 10	Input	Differential analog input 4	DIF4
21, 22	Input	Differential analog input 5	DIF5
23, 24	Input	Differential analog input 6	DIF6
25, 26	Input	Differential analog input 7	DIF7
27, 28	Input	Differential analog input 8	DIF8
29, 30	Input	Differential analog input 9	DIF9

7.5 PIC3 – INTERNAL SIGNAL AND POWER SUPPLY BOARD

The PIC3 board (Power Interface Card) adapts the internal inputs and outputs of the inverter assembly + input cubicle + transformer and, from the 24 Vdc supplied by the PSS24 power supply, generates and distributes the power supplies to the control boards and to the HCTU, HCTV, and HCTW current sensors.



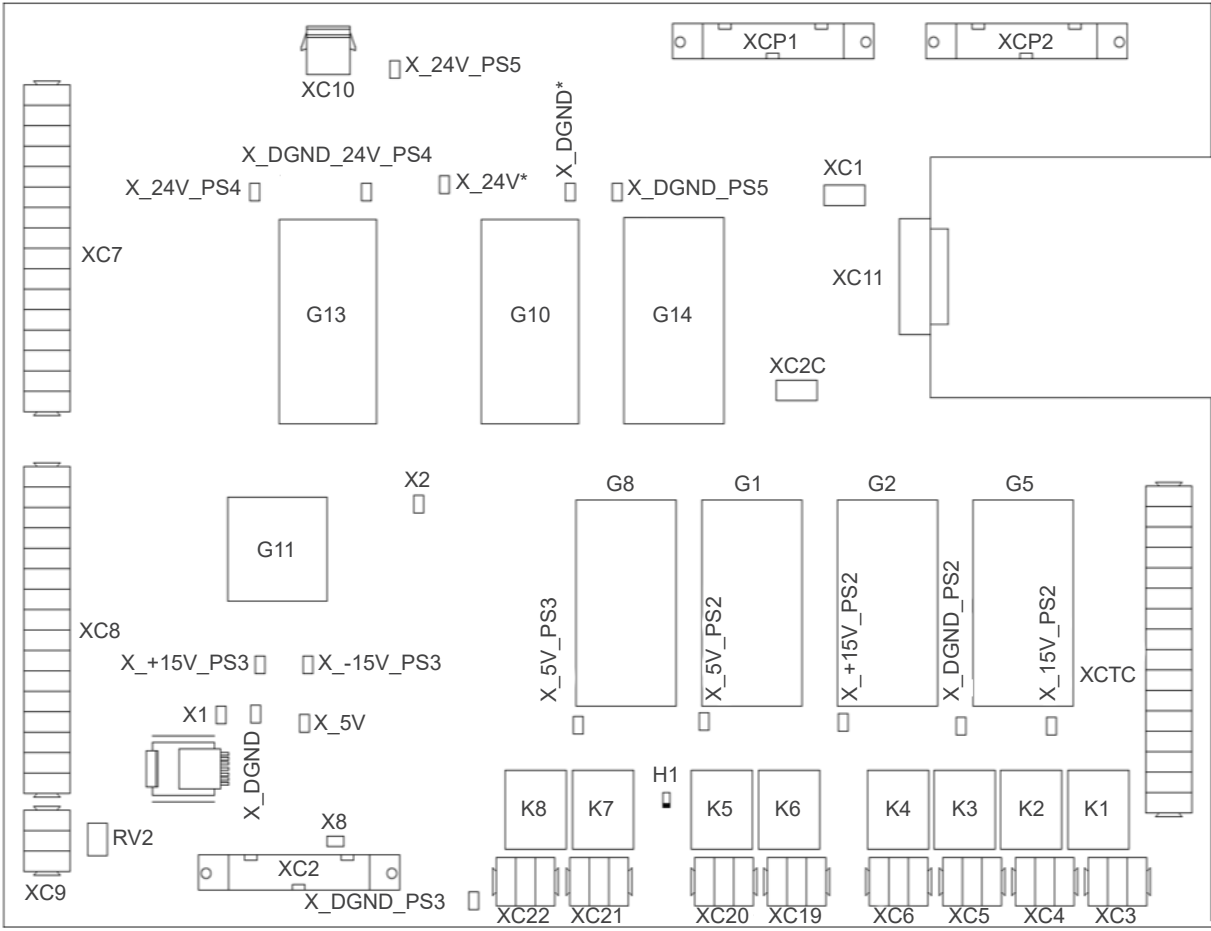


Figure 7.8: PIC3 board connections

Table 7.12: Description of the PIC3 board connections

XC1: current feedback (via PCS board)			
Pin	Input/Output	Description	Signal
1, 4, 8	Output	Reference for the signals	DGND_PS2
2, 5, 6	Output	+15 V PS2 power supply (G2 converter output)	+15 V_PS2
3	Input	Phase U current	I _u
7	Input	Phase V current	I _v
XC2C: current feedback (via PCS board)			
3	Input	Phase W current	I _w
4	Output	Reference for the signals	DGND_PS2
5, 6, 7	Output	-15 V PS2 power supply (G5 converter output)	-15 V_PS2
XC3: relay output RL1, active to indicate inverter ready (READY)			
XC4: relay output RL2, active to command the first precharge stage			
XC5: relay output RL3, active to command medium-voltage circuit breaker closing (CB ON)			
XC6: relay output RL4, active to command medium-voltage circuit breaker opening (CB OFF)			
XC7: internal digital inputs			
1	Input	Isolated digital input for Power ON signal	DI1
2	Input	Isolated digital input for CB READY signal	DI2
3	Input	Isolated digital input for CB ON signal	DI3
4	Input	Isolated digital input for CB OFF signal	DI4
5	Input	Isolated digital input for CB NO TRIP signal	DI5
6	Input	Isolated digital input with no function	DI6
7, 8	Output	+24 V PS4 power supply (G13 converter output)	24 V_PS4
9	Input	Common point for inputs DI1 to DI6	COM_DI1_DI6

OPTIONAL ACCESSORIES AND BOARDS

10, 11	Output	Reference for PS4 power supply	DGND_PS4
12	Input	Isolated digital input for power supply signal (precharge)	DI7
13	Input	Isolated digital input with no function	DI8
14	Input	Isolated digital input with no function	DI9
15	Input	Isolated digital input for no fault in the inverter panel ventilation signal (through auxiliary contacts of the fan circuit breakers)	DI10
16	Input	Isolated digital input for transformer alarm signal	DI11
XC8: internal digital inputs			
1	Input	Isolated digital input for transformer fault signal	DI12
2, 3, 11, 12	Output	+24 V PS4 power supply (G13 converter output)	24 V_PS4
4	Input	Common point for inputs DI7 to DI12	COM_DI7_DI12
5, 6, 14, 15	Output	Reference for PS4 power supply	DGND_PS4
8	Input	Isolated digital input for no alarm in the inverter panel ventilation signal (through pressure sensors)	DI14
9	Input	Isolated digital input with no function	DI15
10	Input	Isolated digital input for doors closed signal	DI16
13	Input	Common point for inputs DI13 to DI16	COM_DI13_DI16
Note: Pin 16 is not connected.			
XC9: PIC3 board power supply (coming from the PSS24 power supply)			
XC10: power supply for the CIB2 boards			
1	Output	+24 V PS5 power supply (G14 converter output)	24 V_PS5
2	Output	Reference for PS5 power supply	DGND_PS5
XC11: PSH board connection			
3, 5, 7	Output	Reference for PS3 power supply	DGND_PS3
8	Output	5 V PS3 power supply (G8 converter output)	5 V_PS3
12, 17, 18, 23, 24, 29	Output	Reference for current reading signals	DGND_PS2
14, 15	Input	Phase W current	I _w
20, 21	Input	Phase V current	I _v
26, 27	Input	Phase U current	I _u
Note: Pins 1, 9, 10, 11, 13, 16, 19, 22, 25, 28, and 30 are not connected. Pins 2, 4, and 6 are not used for testing purposes.			
XC19: relay output RL6, active to indicate that the medium-voltage circuit breaker is ON (CB ON)			
XC20: relay output RL5, active to command the second precharge stage			
XC21: relay output RL7, active to command the ventilation activation			
XC22: relay output RL8, active to lock the panel doors (not used)			
1	Output	Relay digital output for internal inverter function	NO contact
2	Input		Common contact
3	Output		NC contact
XCP1: internal digital inputs and power supplies. Connected to the CCEMVW board			
1, 11 21 25	Output	Reference for PS2 power supplies	DGND_PS2
2, 12	Output	+5 V PS2 power supply (U1 converter output)	+5 V_PS2
3	Output	Power on. Active at high level (5 V)	DI_1
4	Output	CB READY. Active at high level (5 V)	DI_2
5	Output	CB ON. Active at high level (5 V)	DI_3
6	Output	CB OFF. Active at high level (5 V)	DI_4
7	Output	CB TRIP. Active at low level	DI_5
8	Output	No function, 0 to 5 V	DI_6
9	Output	Power supply (precharge) Active at low level	DI_7
10	Output	Power supply (PS1 power supply) Active at low level	DI_8
13	Output	No alarm in the rectifier panel ventilation. Active at low level	DI_9
14	Output	No alarm in the inverter panel ventilation (through auxiliary contacts of the fan circuit breakers). Active at low level	DI_10

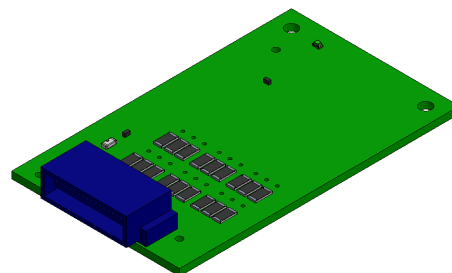
15	Output	Transformer alarm. Active at high level (5 V)	DI_11
16	Output	Transformer fault. Active at high level (5 V)	DI_12
17	Output	General enable. Active at high level (5 V)	DI_13
18	Output	No alarm in the inverter panel ventilation (via pressure sensors) Active at low level	DI_14
19	Output	No function, 0 to 5 V	DI_15
20	Output	Doors closed. Active at high level (5 V)	DI_16
22	Output	24 V PS5 power supply (G14 converter output)	24 V_PS5
23	Output	+5 V: power supplies with no fault (reference: DGND_PS2)	POWER_OK
24	Output	24 V isolated power supply (G10 connector output)	24 V*
26	Output	Reference for the 24 V isolated power supply	DGND*
XCP2: internal digital outputs, output current measurement signals, and power supplies. Connected to the CCEMVW board			
1, 11 15 16 25 26	Output	Reference for PS2 power supplies	DGND_PS2
2, 12	Output	+5 V power supply (G1 converter output)	+5 V_PS2
3	Input	High level (+5 V) activates relay K1 (XC3)	DO_1
4	Input	High level (+5 V) activates relay K2 (XC4)	DO_2
5	Input	High level (+5 V) activates relay K3 (XC5)	DO_3
6	Input	High level (+5 V) activates relay K4 (XC6)	DO_4
7	Input	High level (+5 V) activates relay K5 (XC20)	DO_5
8	Input	High level (+5 V) activates relay K6 (XC19)	DO_6
9	Input	High level (+5 V) activates relay K7 (XC21)	DO_7
10	Input	High level (+5 V) activates relay K8 (XC22)	DO_8
13, 14	Output	+15 V power supply (G2 converter output)	+15 V_PS2
17, 18	Output	-15 V power supply (G5 converter output)	-15 V_PS2
19	Output	Phase U current feedback. I_U- connected to DGND_PS2	I_U+
20	Output		I_U-
21	Output	Phase V current feedback. I_V- connected to DGND_PS2	I_V+
22	Output		I_V-
23	Output	Phase W current feedback. I_W- connected to DGND_PS2	I_W+
24	Output		I_W-
XCTC: current feedback			
1, 5, 9	Output	+15 V power supply for the CT	+15 V_PS2
2	Input	Phase U current	I _u
3, 7, 11	Output	-15 V power supply for the CT	-15 V_PS2
4, 8, 12	Output	Current measurement cable shield	GROUND
6	Input	Phase V current	I _v
10	Input	Phase W current	I _w
13...16	Output	Reference for the signals	DGND_PS2

7.6 PSH – CURRENT FEEDBACK BOARD

The PSH board is used to adjust the current gains and, therefore, each model has a different board version. This board is connected to the PIC3 board, but it is not supplied with the control rack.

H1: LED active when the 5 V_PS3 power supply is present.

XC11: connection to the PIC3 board for current reading. See the description of the PIC3 board.



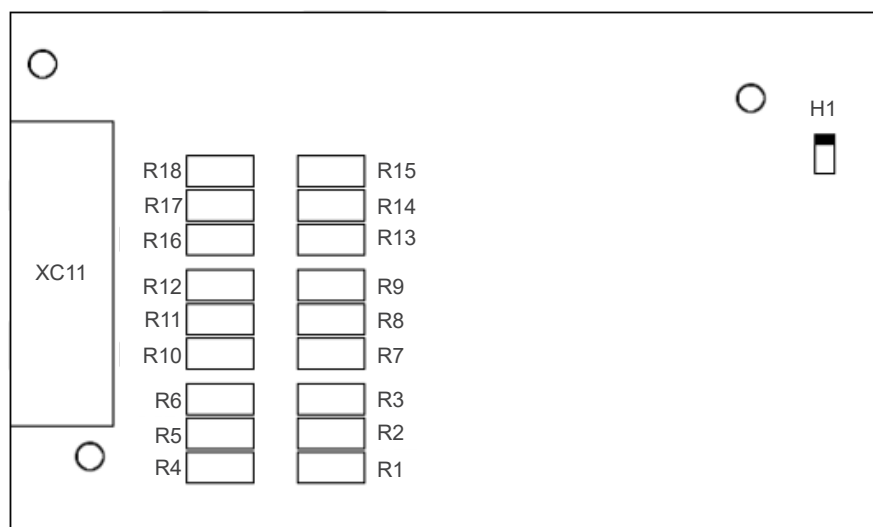


Figure 7.9: PSH board connections

7.7 RSSI – ABSOLUTE ENCODER INPUT BOARD

The absolute encoder input board is an accessory that enables the use of an absolute encoder for synchronous motor drives.

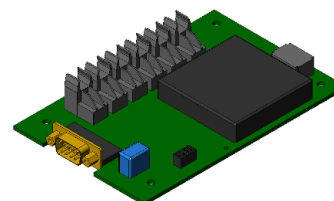


Table 7.13: RSSI – Absolute encoder input board configuration

Switch S1:1	Switch S1:2	Function
0	0	500 kHz (RSSI communication frequency)
0	1	250 kHz (RSSI communication frequency)
1	0	100 kHz (RSSI communication frequency)
1	1	Bypass (the RSSI board operates as an optical/electrical signal transducer, and RSSI communication occurs directly between the CCE board and the absolute encoder)

Note: for the MVW3000 G4, option S1:1 must be set to 1 and S1:2 must be set to 1, and the communication frequency must be parameterized directly through the HMI.

Table 7.14: Description of the RSSI board connections

XC1: power supply for the board			
Pin	Input/Output	Description	Signal
1	Input	+24 Vdc power supply	+24 V
2	Input	Grounding point	GROUND
3	Input	Reference for the power supply	GND_24V
XC2: encoder connection			
2,3	Output	Clock signal for the encoder	CLK
4	Output	+15 V power supply for the encoder	+15 V
5	Input	Grounding point	Ground
6	Output	Reference for the power supply	DGND
7, 8	Input	Encoder position signal	DATE
Note: Pins 1 and 9 are not connected.			
XC3: firmware programming (for WEG exclusive use)			

Configuration of the SSI interface of the absolute encoder.

Table 7.15: Compatible configurations for the absolute encoder

Configuration	Description
Accepted clock frequency values	100 kHz
	150 kHz
	200 kHz
	250 kHz
	500 kHz
Number of supported data bits	8 bits
	9 bits
	10 bits
	11 bits
	12 bits
	13 bits
	14 bits
	15 bits
	16 bits
	17 bits
	18 bits
	19 bits
	20 bits
Available parity settings	None
	Par
	Odd
Available coding settings	Binary
	Gray
Direction of rotation	Reverse: Sensor installed at the rear of the load
	Forward: Sensor installed at the rear of the motor

7.8 ACCE-ENC INCREMENTAL ENCODER INPUT BOARD

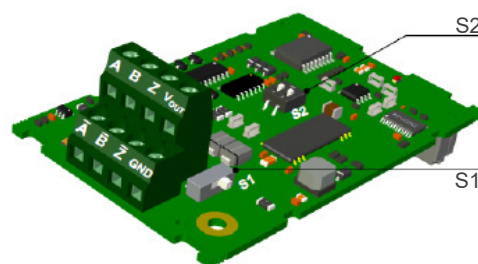
Encoder accessory for the control board expansion slot. For vector control with encoder, this accessory must be used.

Switch S1 selects the output voltage for the encoder power supply: 5 or 15 V.

Switch S2 allows quadrant faults to be disabled

1 = ON: Disable only the Z fault

2 = ON: Disables all faults (A, B, and Z)



The range of pulse-per-revolution values accepted by the incremental encoder is from 1 to 65535 ppr.

The ACCE-ENC board is mounted on the CCE control board.

7.9 ISOC2 – INPUT CURRENT AND VOLTAGE FEEDBACK BOARD

The ISOC2 board is a signal feedback board intended for measuring the input currents of the transformer primary and the voltages of the precharge winding, and for sending this information, by means of optical frequency signals, to the inverter control for processing.

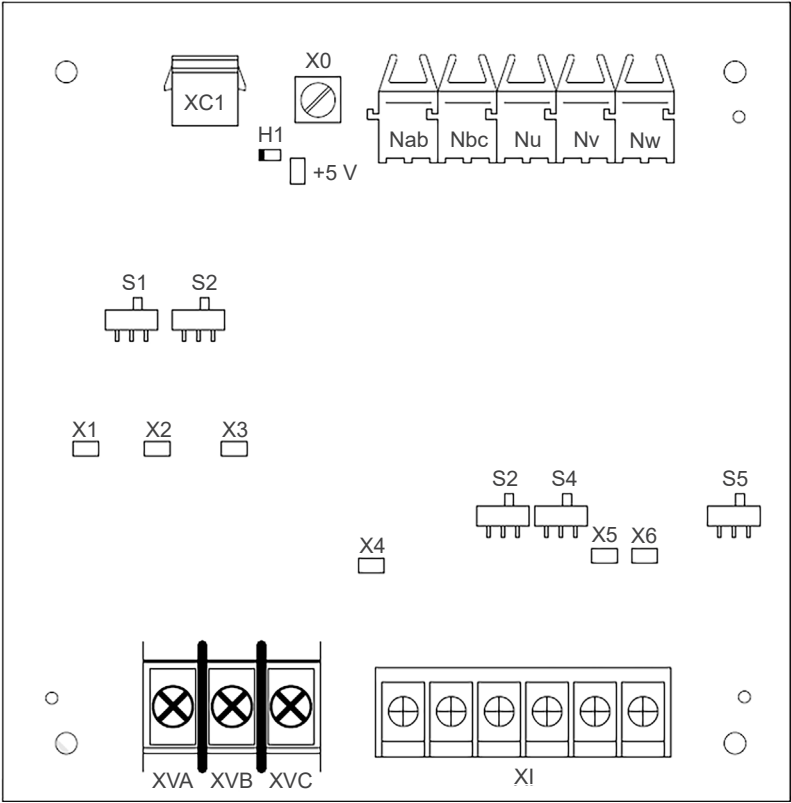
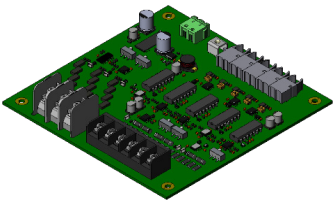


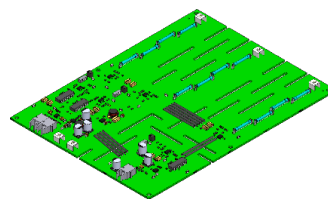
Figure 7.10: ISOC2 board connections

Table 7.16: Description of the ISOC2 board connections

X0: connection of the +15 Vdc power supply reference			
XVA: phase A connection			
XVB: phase B connection			
XVC: phase C connection			
XC1: +15V power supply connection			
Pin	Input/Output	Description	Signal
1	Input	+15 V power supply	+15 V
2	Input	Reference for the signals	GND
XI: CT connections			
1	Input	Phase R CT connection	IA
2, 4, 6	Input	Reference for the signals	GND
3	Input	Phase S CT connection	I _B
5	Input	Phase T CT connection	I _C

7.10 ISOC.22 – OUTPUT VOLTAGE FEEDBACK BOARD

The ISOC board is a signal feedback board intended for measuring output voltages and sending this information, by means of optical frequency signals, to the inverter control for processing.



N4: optical transmitter for the voltage between phases U and V. Connected to the CIB2 board.

N5: optical transmitter for the voltage between the neutral point and GND. Connected to the CIB2 board.

N6: optical transmitter for the voltage between phases V and W. Connected to the CIB2 board.

X0: connection of the +15 Vdc power supply reference.

X7: phase V connection.

X8: phase U connection.

X13: phase W connection.

X15: +15 Vdc power supply connection.

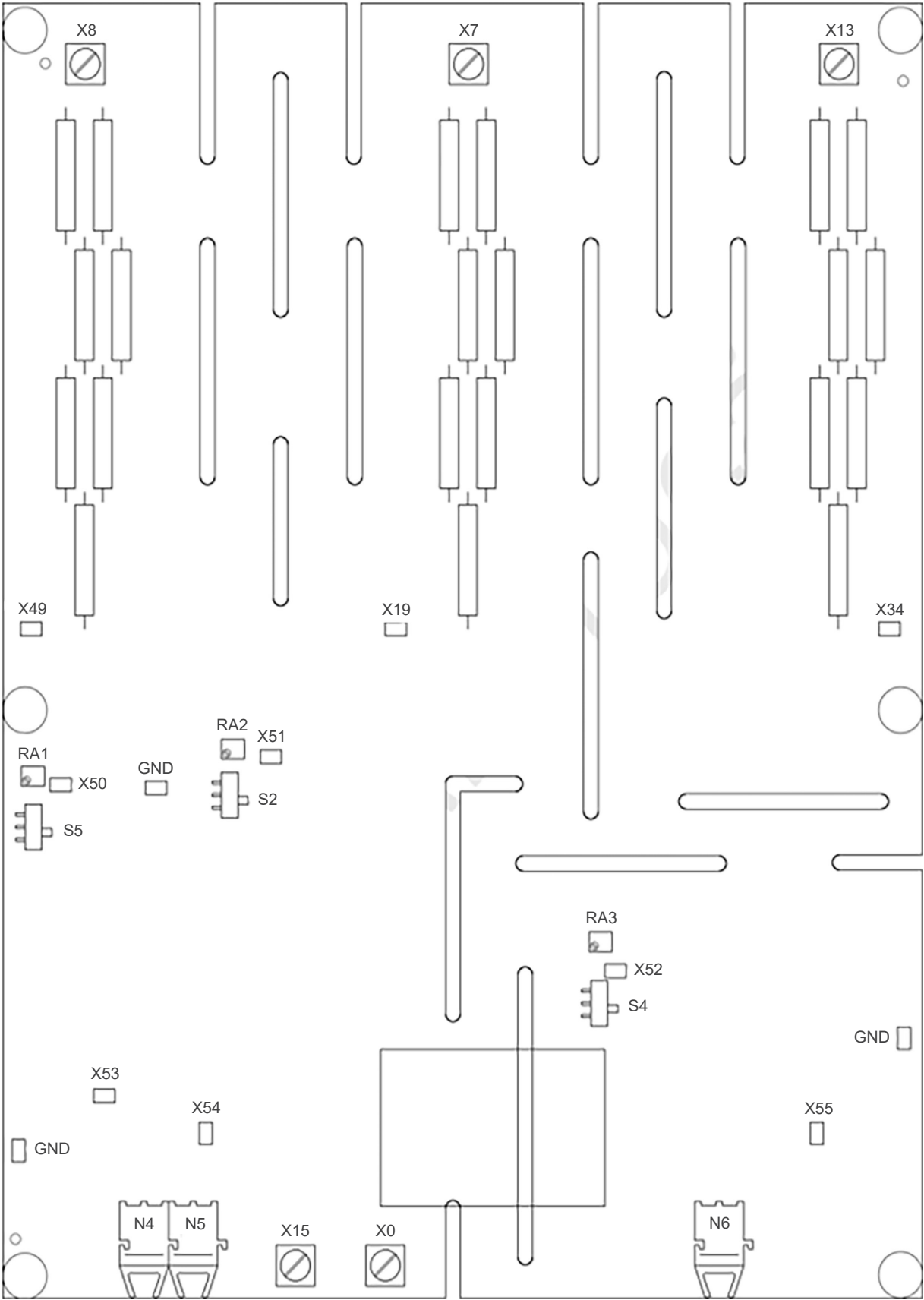


Figure 7.11: ISOC board connections

7.11 CSMAT – VOLTAGE ATTENUATION BOARD

This board is connected between the output terminal and the corresponding connector on the ISOC.22 board to increase the signal attenuation capability in inverters with output voltage higher than 6.9 kV.

X11: connection to the ISOC board.

X12: connection to the motor output.

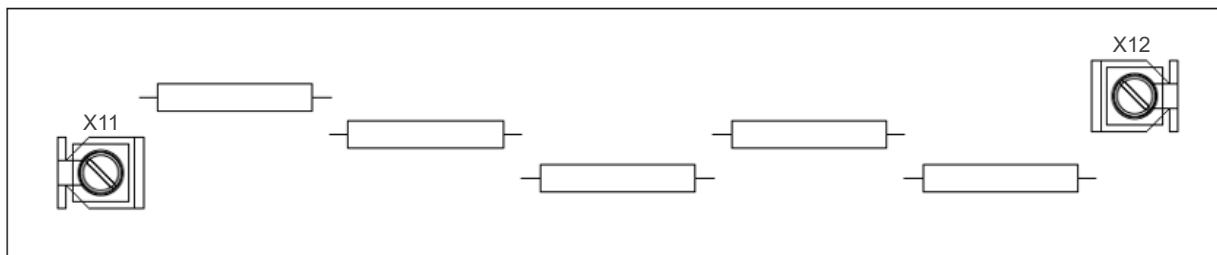
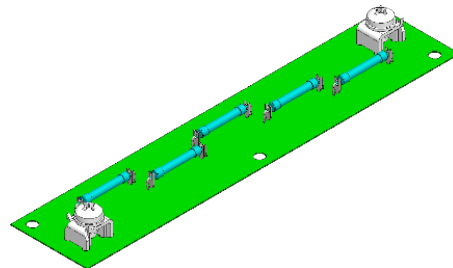


Figure 7.12: CSMAT board connections

7.12 PSS24 – 24 VDC POWER SUPPLY

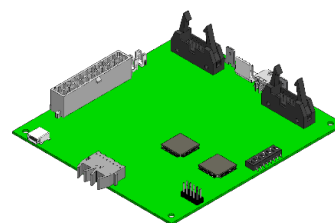
The PSS24 power supply is powered by 220 Vac from the auxiliary power supply transformer. The PSS24 power supply generates the 24 Vdc for powering the PIC3 board.

Table 7.17: PSS24 connection description

X1: input power supply			
Pin	Input/Output	Description	Signal
1	Input	100-240 Vac (85 - 264 Vac or 125 - 370 Vdc); 50/60 Hz (47 - 63 Hz); universal input	L
2	Input		N
3	Input	Grounding point	Ground
X2: connection to the PICx board			
1, 2	Output	+24 Vdc power supply	+24 V
3,4	Output	Reference for the power supply	0 V

7.13 MCC1 – CELL CONTROL BOARD

The cell control board provides the interface between the control and the power cell circuits.



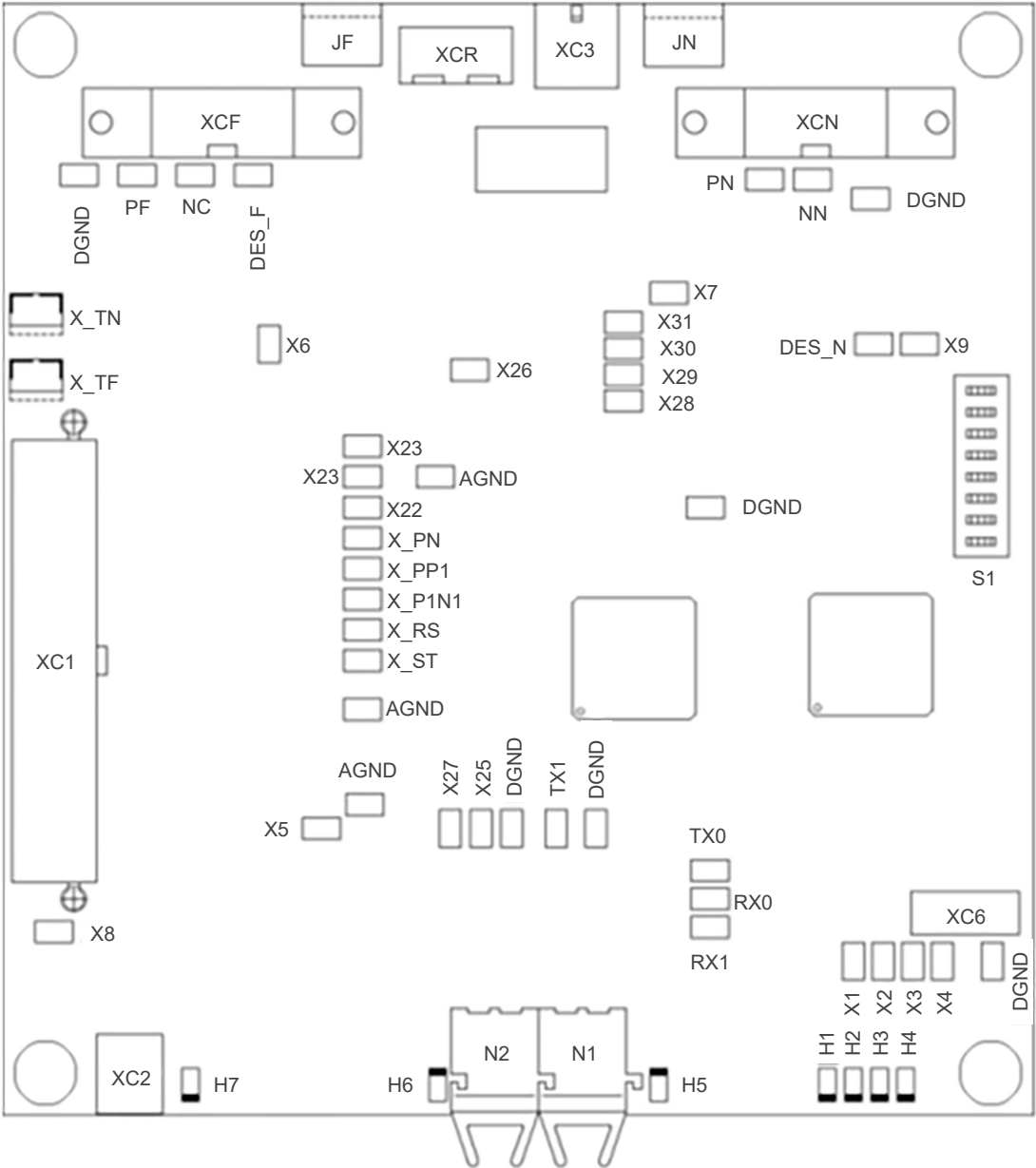


Figure 7.13: MCC1 board connections

S1:1, S1:2, S1:3, S1:4: cell rated current settings.

Table 7.18: DIP settings for cell model

Cell Rated Current	S1:1	S1:2	S1:3	S1:4
70 A (compact)				
70 A				ON
140 A			ON	
200 A			ON	ON
265 A		ON		
340 A		ON		ON
450 A		ON	ON	
600 A		ON	ON	ON
200 A (modified)	ON			
800 A	ON			ON

Table 7.19: DIP settings for cell configuration

Switch	Function	On	Off
S1:5	Indicates that the cell is configured and can operate	Switches configured	Switches not configured
S1:6	Bypass option selection	With bypass relay	Without bypass relay
S1:7	Rectifier type selection	Thyristor rectifier	Diode rectifier
S1:8	Link capacitor type selection	Plastic film capacitors	Electrolytic capacitors

Table 7.20: Description of the MCC1 board connections

X_TF (phase), X_TN (neutral): connection of the IGBT temperature sensors			
Pin	Input/Output	Description	Signal
1	Output	+5 V power supply for the NTCs	+5 V(REF)
2	Input	Temperature signal	TEMP
XC1: connection to the PSC1 power supply board			
1, 2	Input	+5 V power supply	+5 V
3, 4	Input	+15 V power supply	+15 V
5	Input	Phase pulse feedback	PF_F(5 V)
6	Input	Neutral pulse feedback	PF_N(5 V)
7	Input	AC input voltage between phases S and T	PHASE_S_T_DIF(15 V)
8	Input	AC input voltage between phases R and S	PHASE_R_S_DIF(15 V)
10	Input	Voltage between +UD and the cell frame	LINK_P_P1_DIF(15 V)
11	Input	Cell link voltage	LINK_P_N_DIF(15 V)
12, 19, 20, 21, 22, 23, 24	Input	Reference for the signals	AGND
13	Input	Isolated +15 V power supply	+15VI
14	Input	Reference for the +15 VI power supply	GND_15VI
15, 16	Input	+24 V power supply	+24 V
17	Input	-15 V power supply	-15 V
18	Input	-24 V power supply	-24 V
Note: pin 9 is not used.			
XC2: mini USB connector for firmware programming.			
XC3: bypass relay connection			
1	Output	+24 V power supply	+24 V
2	Output	Reference for the signals	DGND
3	Output	Bypass activation signal	BYPASS
4	Input	Bypass activation feedback	FEED_BYP
XC6 firmware programming (WEG internal use)			
XCF (phase), XCN (neutral): connection to the GDC1Bx or GDC1F board.			
1, 2, 10	Output	+15 V power supply	+15 V
3, 5, 7, 9	Output	Reference for the signals	DGND
4	Output	Positive IGBT firing signal	GATE_P_(F/N)
6	Output	Negative IGBT firing signal	GATE_N_(F/N)
8	Input	IGBT desaturation signal	DESAT_(F/N)
XCR: connection to the rectifier bridge			
1	Output	+24 V power supply	+24 V
2	Output	Firing signal for phase T thyristor	TIR_T
3	Output	Firing signal for phase S thyristor	TIR_S
4	Output	Firing signal for phase R thyristor	TIR_R
5	Output	Reference for the signals	DGND

7.14 PSC1 – POWER SUPPLY BOARD

This board attenuates the input and link voltage signals and generates the power supplies for the cell circuits.

XP: connection to the cell +UD link.

XN: connection to the cell -UD link.

XNE: neutral output point connection.

XFA: phase output point connection.

XC1: connection to the cell MCC1 control board.

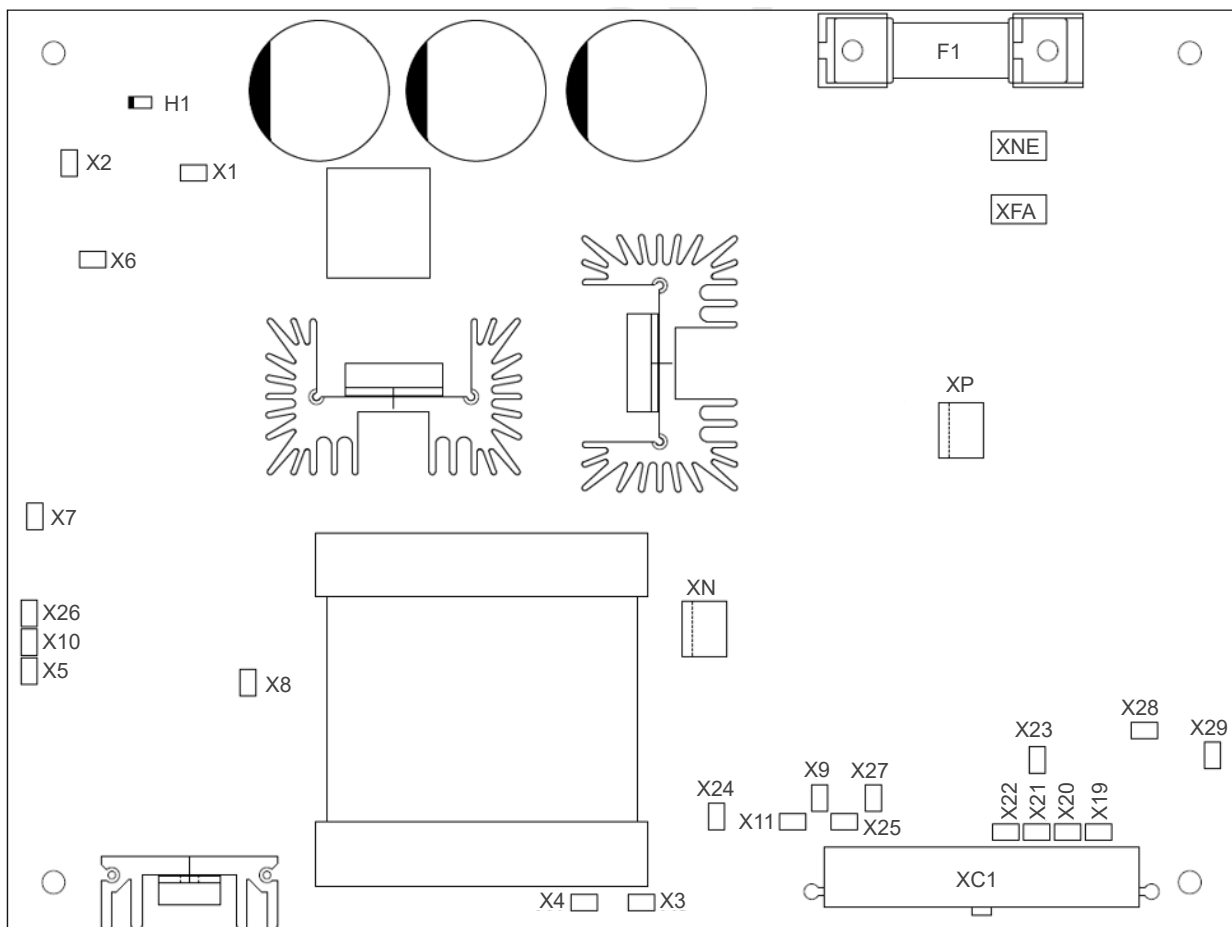
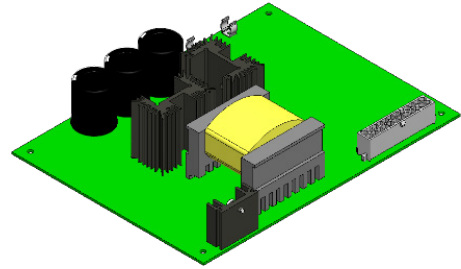


Figure 7.14: PSC1 board connections

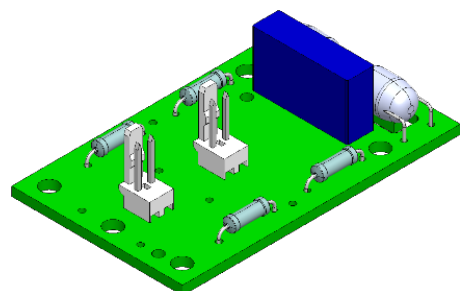
7.15 HVM2 – VOLTAGE INDICATION BOARD

This board indicates the presence of voltage greater than 50 Vdc on the cell link.

H1, H2: lamps indicating link voltage.

XC1: connection to the cell +UD.

XC2: connection to the cell -UD.



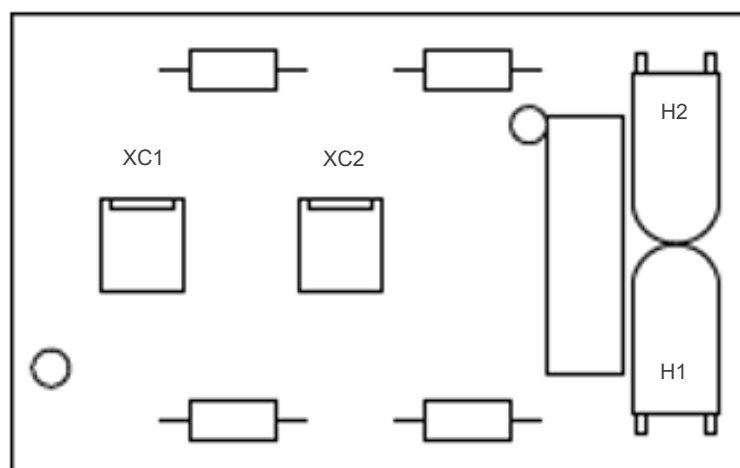


Figure 7.15: HVM2 board connections

7.16 SHORT UPS MODULE

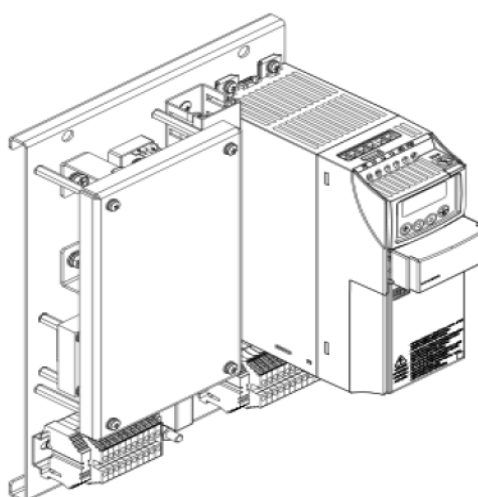


Figure 7.16: Parameterization of the CFW300 inverter

The Short UPS module is an accessory that provides autonomy of approximately 500 ms in case of failure of the MVW3000 inverter auxiliary power supply. After the occurrence of the auxiliary power supply failure, the inverter remains operational, without faults, during 500 ms.

The module is based on a low voltage frequency inverter, CFW300 and an external capacitor bank, which ensure the energy supply to the power supplies during the specified period. A filter is added to the inverter output, necessary because of the characteristic of the fed loads.

The Short UPS feeds the following loads:

- PSS24 power supply: responsible for feeding the control.
- General command: input circuit breaker supply and its undervoltage release.

CFW300 Inverter Parameterization

For the correct operation of the Short UPS module, the CFW300 inverter must be parameterized as shown below:

- P100 = 1.0 s (acceleration time).
- P101 = 0.5 s (deceleration time).
- P121 = 60 Hz (output frequency).

OPTIONAL ACCESSORIES AND BOARDS

- P149 = 2 (DC Link Comp. Mode).
- P206 = 3 (auto-reset time).
- P222 = 0 (remote speed reference).
- P263 = 0 (DI1 digital input).
- P264 = 0 (DI2 digital input).
- P265 = 1 (DI3 digital input).
- P266 = 9 (DI4 digital input).
- P275 = 26 (digital output “with Fault”).
- P297 = 10 kHz (switching frequency).
- P340 = 10 s (auto-reset time).

8 SPECIAL FUNCTIONS

8.1 FUNCTION LOAD SHARING "MAIN/ASSISTANT"

Conveyors belts and overhead cranes are classic examples of applications where the torque or position control is used to maintain the conveyor belt voltage within the limits during the operation, start and stop procedures or even in the transportation of materials in a rising slope.

For motors connected to the same load, it is necessary to ensure a reliable load sharing. Such characteristic is best achieved with the use of multiple inverters operating in speed reference mode (Main) and torque limitation mode (Assistant(s)).

Implementation Modes

Three modes to implement the load sharing function will be presented. For the first two modes, it is mandatory that the inverters involved in the process are to be set to vector operating mode. For most applications, the vector operating mode with speed or position sensor is recommended.

In order to implement the load sharing, the inverter assigned as main controls the load speed using all the other inverters of the process as actuators.

In the vector mode, there are two ways to implement the load sharing function: in the first one, the main inverter sends the assistants the torque reference signal; in the second one, it sends the torque reference limitation signal. The mode to be used must be analyzed for each application.

For operation in scalar mode with load sharing, all inverters must receive the same speed reference signal. This type of load sharing is called "droop" or negative slip.

The three implementation methods and the main parameters used in each method are shown below.

Torque reference - Vector mode operation

One of the possible ways to implement the load sharing function is by parameterizing the assistant inverter(s) to follow an external torque reference, which will be sent by the main inverter. [Figure 8.1 on page 8-1](#) presents the control strategy scheme using torque reference.

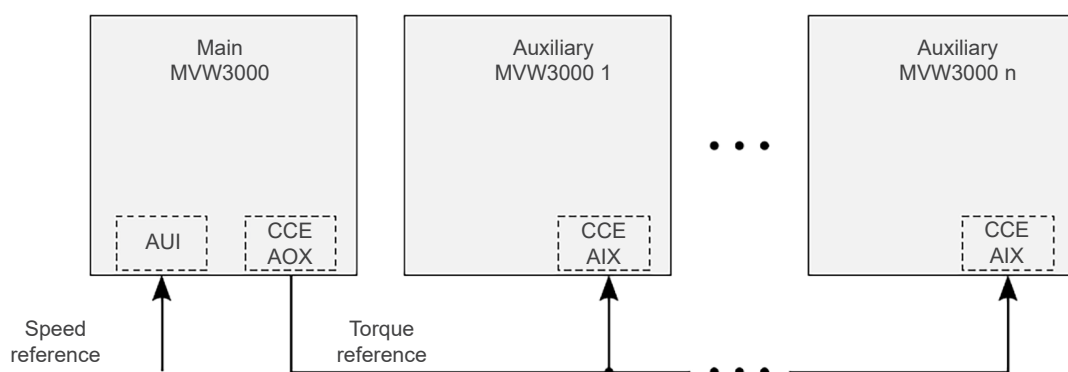


Figure 8.1: General operating diagram of the torque reference function

In order to do so, the inverters must be parameterized as follows:

Main:

Parameterize one of the analog outputs of the CCE control board to send the torque reference to the auxiliary inverter(s). In the example below, the analog output AO1 is parameterized.

P0652 (Analog Output 1 Function) = 188 (Inverter torque reference).

Assistant(s):

On the auxiliary inverter(s), it is necessary to parameterize one analog input of the CCE board to receive the torque reference sent by the main inverter.

P0740 (Analog Input 1 Function) = 1 (Torque reference).



NOTE!

Observe the polarity of the analog ones at the moment of the connection between the inverters.

Torque current limitation - Vector mode operation

As in the previous mode, the main inverter operates in speed control mode, while the assistant inverter operates in torque current regulation mode. Besides the limit value of the torque current, the assistants inverter(s) receives the speed reference signal; therefore, in a potential situation of sudden load reduction, the speed reference is saturated, thereby avoiding a possible sudden acceleration of the motor.

The speed reference signal sent to the assistants inverter(s) must be set to a value slightly above the main inverter reference. It is recommended to apply an offset to the analog inputs of the assistant(s) greater than 5 % added to the reference sent by the main inverter; the ideal value may vary according to the application. The general scheme of this control strategy is presented in [Figure 8.2 on page 8-2](#).

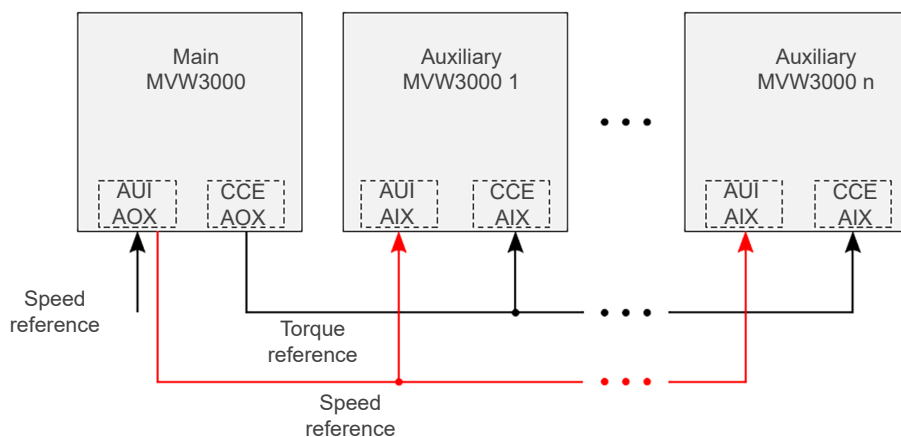


Figure 8.2: General operating diagram of the torque current limitation function

In order to do so, the inverters must be parameterized as follows:

Main:

Parameterize one of the analog outputs of the CCE board to send the torque current limitation to the auxiliary inverter(s). The example below shows the parameterization of analog output AO1. For sending the speed reference, analog output AO1 of the AUI board is used.

P0652 (Analog Output 1 Function - CCE) = 188 (Inverter torque reference).

P0251 (Analog Output 1 Function - AUI) = 0 (Speed reference).

Assistant(s):

On the auxiliary inverter(s), it is necessary to parameterize one analog input of the CCE board to receive the torque current limit sent by the main inverter. For the speed reference, use analog input AI1 of the AUI board, whose default function is the speed reference signal.

P0740 (Analog Input 1 Function - CCE) = 2 (Torque Current Limitation).

P0221/P0222 (Speed Reference Selection Local/Remote Situation) = 1 (AI1 - AUI).

P0236 (Input AI1 Offset) = 5.0 %.

P0133 (Minimum Speed Reference) = set according to the application.

P0134 (Maximum Speed Reference) = set according to the application; it must be 5 % above the maximum limit of the main inverter.

Negative slip - Scalar mode operation

This method to implement the load sharing function is limited to applications of induction motor drive. It is based on the decrease of the frequency according to the increase of load on the motor; thus there is a natural distribution of the loads.

Regardless of the chosen speed reference source, it must be sent to all inverters. Due to the low accuracy of analog inputs, its use as speed reference source is not recommended.

This method to implement the load sharing must not be used for applications that require dynamic performance, which can only be used when the inverters drive motors with the same characteristic slip. [Figure 8.3 on page 8-3](#) presents the general scheme of the negative slip control strategy.

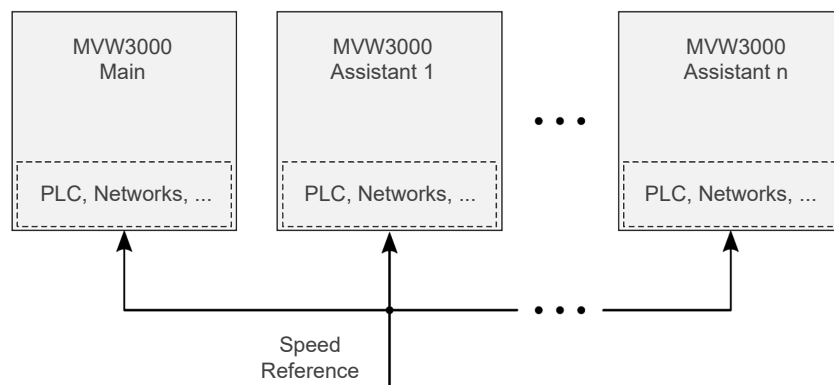


Figure 8.3: General operating diagram of the negative slip function

Besides the presented parameter settings, the implementation of the load sharing function requires that all inverters involved in the process be enabled simultaneously; thus, the "General Enable" and "Run/Stop" signal must be sent to all inverters at the same time. There are several ways to meet such requirement and the most appropriate method will depend on each application.

The description given of the ways to implement the load sharing function intends neither to approach all possibilities of implementation, nor to detail all the aspects involved. The definition of the best implementation mode for a certain application, as well as the optimal adjustment of each mode must be defined by WEG engineering and application teams.

8.2 SYNCHRONOUS TRANSFER FUNCTION

For applications where speed variation is not required during operation, the synchronous transfer function enables the motor to be accelerated through the inverter up to the rated operating frequency, and then the transfer to the supply line occurs. Thus, it is possible to eliminate the effects of the starting current related to a direct on-line start, and the inverter is sized only for the motor starting condition.

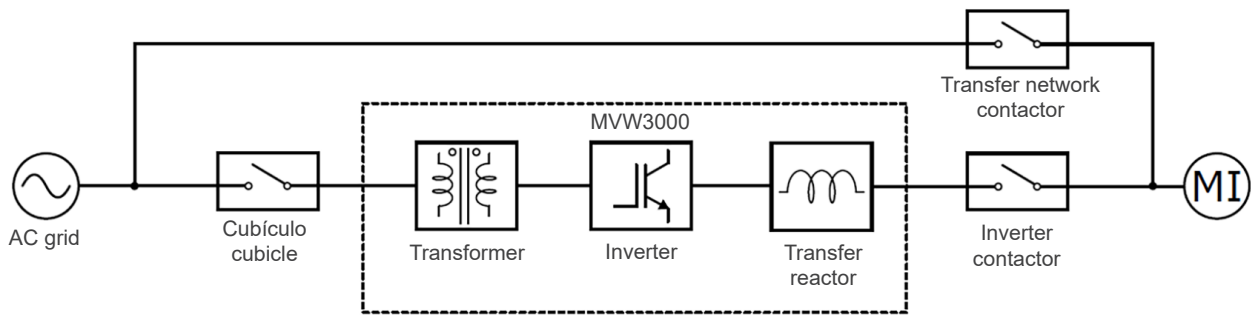


Figure 8.4: General scheme of synchronous transfer

Basic Settings

The synchronous transfer process involves accelerating the motor up to the rated speed, synchronizing the voltage imposed to the motor with the line voltage, and making the transfer to the line. For the transfer to occur properly and with minimal impact on the motor and on the inverter, a series of parameters must be carefully adjusted so as to ensure the phase synchronization, the minimum difference of the RMS value between the inverter and the line voltages and the timely occurrence of each step of the process.

Even with the correct setting of parameters related to the synchronous transfer process, it is necessary to use a reactor between the inverter and the motor in order to absorb differences between the inverter and the line voltage, thus protecting the inverter during the closing of the line contactor.

For parameterization guidelines, refer to section “C3.11 Synchronous transfer” of the programming manual.

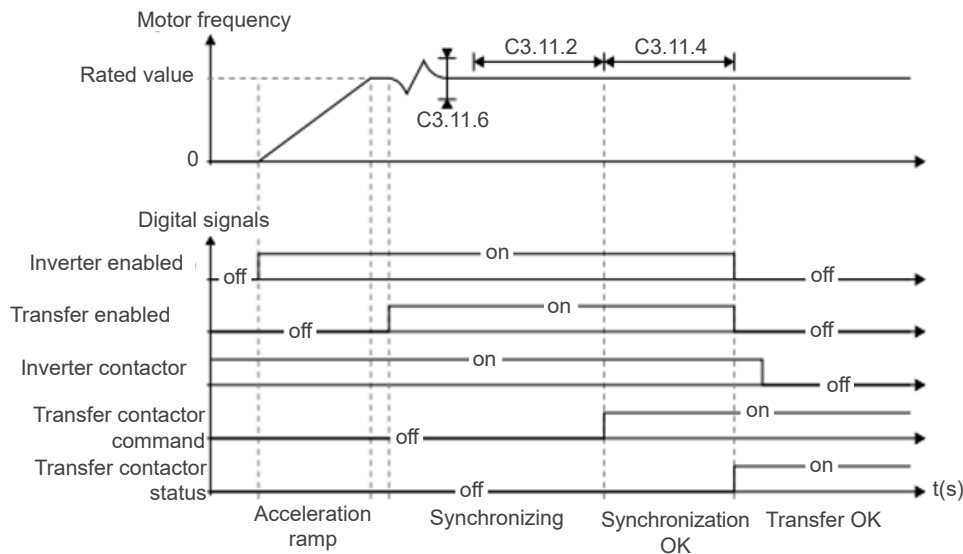


Figure 8.5: Operating diagram of the synchronous transfer function

8.3 CELL BYPASS

The MVW3000 has the cell bypass system as optional function. For this function to be available, the MVW3000 power cells must have the bypass system integrated. The bypass system goes into operation if some fault is detected inside a cell. If a fault occurs, the main control requests the local control to activate the bypass system, the main control inhibits the IGBT command pulses of the cell and starts ignoring the fault signals of this cell, informing that the cell number "X" of phase "Y" went into bypass mode.

It is important to point out that during this process, the inverter continues operating normally with a small reduction in the output voltage. Control techniques will be used for the application to continue operating normally. For applications that cannot operate with reduced voltage, it is recommended to use an MVW3000 with voltage above the motor rated voltage so as to withstand the load at full voltage even with a higher number of cells out of operation simultaneously.

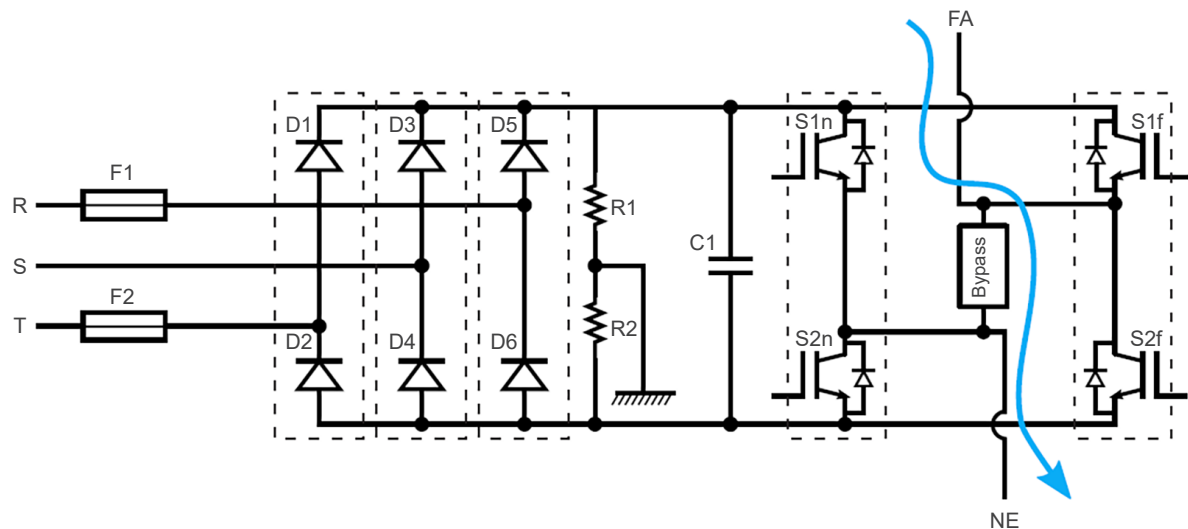


Figure 8.6: Power cell with bypass system active

Figure 8.6 on page 8-5 represents the operation of the power cell with the bypass system active. The current of the respective phase passes through the bypass system so as not to reduce the inverter current capacity. That is a consequence of the connection in series of the power cells.

8.4 AMPLITUDE ADJUSTMENT

During MVW3000 operation in bypass mode, the current capability of the inverter is preserved; however, due to the series connection of the power modules, the maximum available voltage at the output terminals decreases. In addition to the smaller voltage available for the load, the inverter output also becomes unbalanced, jeopardizing the motor operation. Those problems can be circumvented by using the technique of amplitude adjustment between the converter phases.

This technique consists of changing the modulation indices of the cells to compensate for phase differences and maintain the balance between the line voltages. Thus it is possible to balance the line voltages, keep the three amplitudes equal and have a smaller impact of the cell bypass on the output voltage applied to the motor. In order to exemplify how the technique works, it is possible to represent an 18-cell MVW3000 with 9 cells (3 per phase), by 9 voltage sources (3 in series per phase, connected in Y). In normal inverter operation, with all cells operating, the phase voltages are shifted by 120° relative to each other and the line voltages have the same amplitude, as shown in Figure 8.7 on page 8-6.

In bypass operation, without the amplitude readjustment technique, the line voltages become unbalanced because the amplitude of the phase whose cell has undergone bypass is reduced, as shown in Figure 8.7 on page 8-6. In practice, this case is not compatible with the operation of the application; therefore, as soon as the cell is bypassed, the inverter applies the amplitude adjustment method to balance the line voltages.

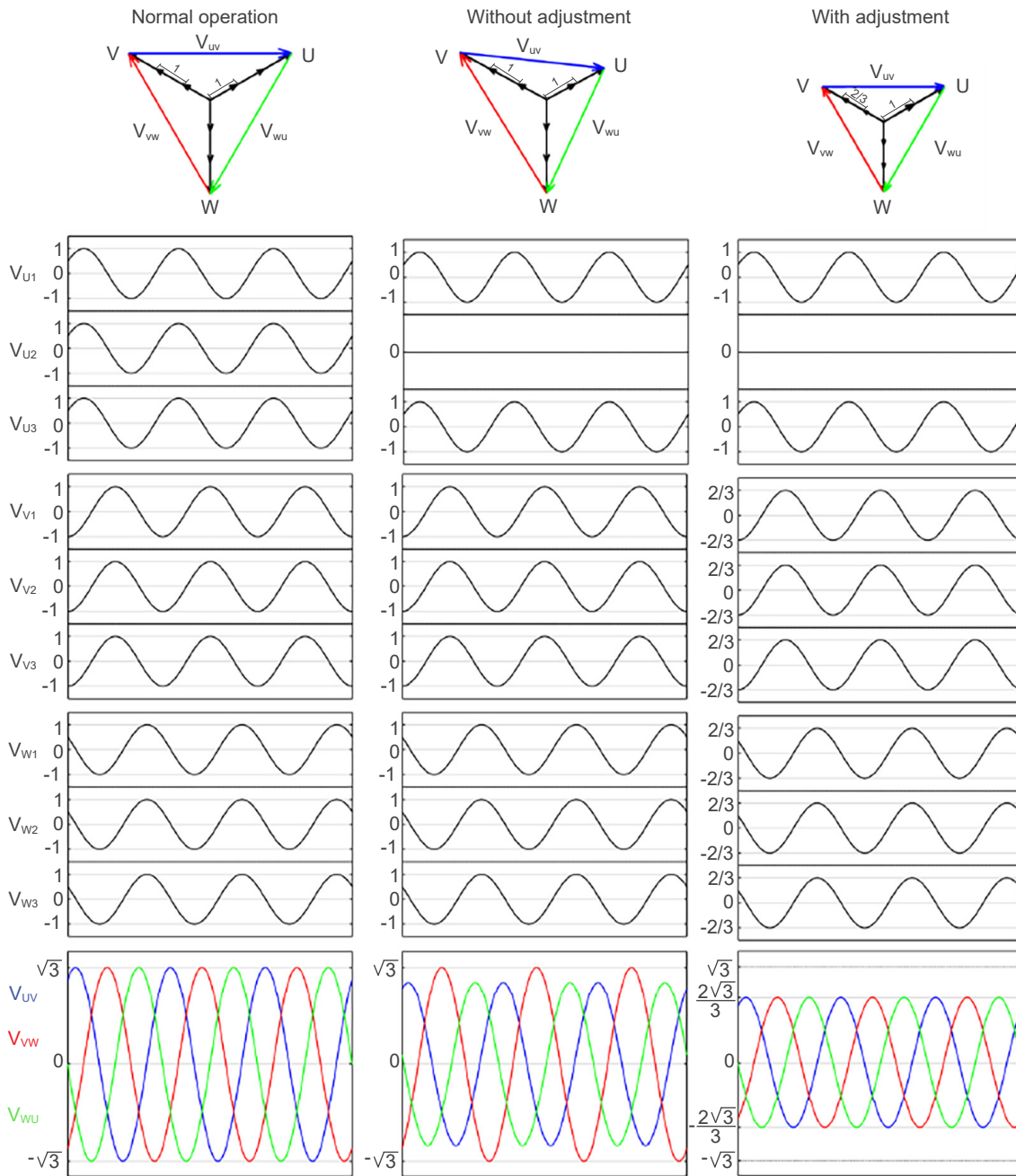


Figure 8.7: Phase (center) and line (below) voltage diagrams during a bypass

With the amplitude readjustment shown in [Figure 8.7 on page 8-6](#), it is possible to verify that the line voltages remain balanced. The phase voltage amplitudes are controlled to ensure the balance among the line voltages. The voltage available at the motor terminals for such condition is 67 % (0.667 p.u.) of the inverter rated voltage.

The graph in [Figure 8.8 on page 8-7](#) presents the obtained line voltage (in p.u.) after bypass of one cell, in inverters with 2 to 12 cells per phase (possible value range for the MVW3000)

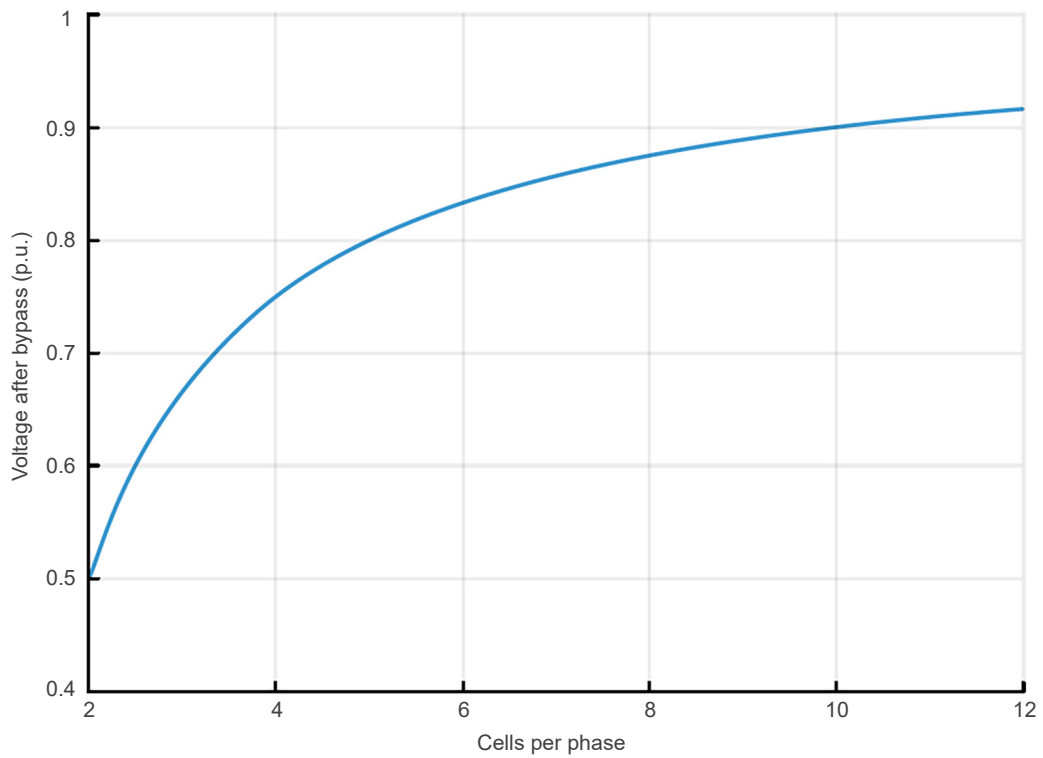


Figure 8.8: Voltage after bypass of one cell



NOTE!

For other possible configurations in bypass, contact WEG technical assistance.

9 PERFORMANCE



NOTE!

The values presented in [Table 9.1 on page 9-1](#) through [Table 9.16 on page 9-10](#) are typical values; however, they may change due to special product characteristics:

- Acoustic noise from the MVW3000 may vary according to the number of fans used.
- Final dimensions of MVW3000.
- Final mass of MVW3000.
- Voltage and current THD values may vary according to the electrical installations of the source and motor used.

Table 9.1: General information about the models MVW3000

Technical Specification		Unit
Power Supply		
Input voltage tolerance	Table 2.2 on page 2-4	%
Rated frequency		Hz
Cos ϕ (typical values for operation at rated condition)	> 0.95	-
Basic impulse level (BIL)	According to the supply voltage level of the MVW3000	kV
Short-circuit capacity	According to design	kA
Rated voltage	Table 9.2 on page 9-3 to Table 9.16 on page 9-10	
Total harmonic current distortion - THDi		
Voltage class		
Low voltage power supply	Table 2.2 on page 2-4	
Environment Conditions		
Operating temperature	0 ~ 40 °C (32 ~ 104 °F) (max. 50 °C (122 °F), with 2.5 % current derating for each 1 °C (1.8 °F) above 40 °C (104 °F))	°C
Storage temperature	-20 ~ +50	°C
Humidity	5 ~ 90 non-condensing	%
Altitude	0 ~ 1000 m (3.300 ft) (max. 4000 m (13.200 ft), with 1 % current derating for each 100 m (330 ft) above 1000 m (3.300 ft))	m
Installation	Indoor	-
Rating	Non-hazardous	-
Pollution degree	2 - non-conductive	-
Electrical Details		
Converter type	Voltage Source Inverter (VSI)	-
Topology	Cascaded H-Bridge (CHB)	-
Motor Type	Induction motor Brushed synchronous motor Brushless synchronous motor Permanent magnets synchronous motor	-
Rectifier section	Low voltage diodes	-
Number of pulses: standard - redundant N+1	Table 3.2 on page 3-2	-
Control method	Sinusoidal PWM	-
Control mode	Speed control	-
Control types	V/f (scalar) Vector with/without speed sensor	-
Output frequency range	0 ~ 120	Hz
Low voltage IGBT switching frequency	500	Hz
Power cell switching frequency (full bridge)	1000	Hz

PERFORMANCE

Technical Specification		Unit
Output voltage range	0 ~ rated	kV
Overload capacity (normal operation)	115 % for 60 s every 10 minutes	-
Efficiency (typical values for operation at rated condition)	> 96.00 (transformer al) > 95.75 (al transformer) + filter > 96.50 (cu transformer) > 96.25 (cu transformer) + filter	%
Output filter	Table 4.15 on page 4-12	-
dV/dt without output filter	< 2000	V/μs
dV/dt with type 1 output filter	< 200	V/μs
Control voltage	Check: 'Auxiliary power supply' in Table 2.2 on page 2-4	Vac
Motor temperature controller	8x Pt100	-
Communication	Modbus RTU PROFIBUS DP DeviceNet EtherNet Modbus TCP PROFINET	-
Operation quadrants	2Q	-
Electronic board coating	Default (ISO 60721-3-3:2002)	-
Number of starts per hour	6	starts/hour
Total losses for Al transformers	Table 2.3 on page 2-9 to Table 2.17 on page 2-23	
Total losses for Al transformers + output filter		
Total losses for Cu transformers		
Total losses for Cu transformers + output filter		
Voltage peak (phase-ground)	Table 9.2 on page 9-3 to Table 9.16 on page 9-10	
Voltage peak (phase-phase)		
Number of pulses (default)		
Number of transformers shifted per input phase		
Number of power cells per phase		
Output switching frequency (applied to the motor)		
Drive Details		
MTTR (Mean Time To Repair)	30	minutes
Speed regulation	1 (V/f) 0.5 (vector without sensor) 0.01 (vector with encoder)	%
Maximum sag during ride-through	30	%
Maximum ride-through time	Depends on the load inertia	-
Mechanical Details		
Protection Degree	NEMA 1, IP42	-
Line cable entry	Top / bottom	-
Motor cable entry	Bottom Other options on request	-
Cooling method	Forced air	-
Mechanical interlock between low and medium voltage	yes	-
Redundant fans	Yes (optional)	-
Mechanical dimensions	Table 9.2 on page 9-3 to Table 9.16 on page 9-10	
Mass	Table 6.1 on page 6-2	

Technical Specification		Unit
Material Thickness		
Frame Size	1.984	mm
Doors/Covers	1.984	mm
Base	3.038	mm
Mounting plates	1.984	mm

Table 9.2: 1150 V and 40-600 A model

Technical Specifications: 1150 V model		Unit
Rated voltage	1150	V
Output rated voltage	3.6	kV
Number of phase-shifting transformers	1	-
Number of power cells per phase: default - redundant (N+1)	1 - 2	-
Default output switching frequency - redundant N+1	1000 - 2000	Hz
Voltage peak (phase-ground)	1553	V
Voltage peak (phase-phase)	1863	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Without type 2 or type 3 filter option	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.3: 2300 V and 40-600 A model

Technical Specifications: 2300 V model		Unit
Rated voltage	2300	V
Output rated voltage	3.6	kV
Number of phase-shifting transformers	1	-
Number of power cells per phase: default - redundant (N+1)	2 - 3	-
Default output switching frequency - redundant N+1	2000 - 3000	Hz
Voltage peak (phase-ground)	2484	V
Voltage peak (phase-phase)	3726	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Without type 2 or type 3 filter option when using cell with Bypass	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.4: 3300 V and 40-600 A model

Technical Specifications: 3300 V model		Unit
Rated voltage	3300	V
Output rated voltage	7.2	kV
Number of phase-shifting transformers	1	-
Number of power cells per phase: default - redundant (N+1)	3 - 4	-
Output switching frequency: default - redundant N+1	3000 - 4000	Hz
Voltage peak (phase-ground)	3416	V
Voltage peak (phase-phase)	5589	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.5: 4160 V and 40-600 A model

Technical Specifications: 4160 V model		Unit
Rated voltage	4160	V
Output rated voltage	7.2	kV
Number of phase-shifting transformers	1	-
Number of power cells per phase: default - redundant (N+1)	4 - 5	-
Output switching frequency: default - redundant N+1	4000 - 5000	Hz
Voltage peak (phase-ground)	4347	V
Voltage peak (phase-phase)	7452	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) (for THDv of the power grid voltage THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.6: 5500 V and 40-600 A model

Technical Specifications: 5500 V model		Unit
Rated voltage	5500	V
Output rated voltage	7.2	kV
Number of phase-shifting transformers	1	-
Number of power cells per phase: default - redundant (N+1)	5 - 6	-
Output switching frequency: default - redundant N+1	5000 - 6000	Hz
Voltage peak (phase-ground)	5279	V
Voltage peak (phase-phase)	9315	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.7: 6000-6300 V and 40-600 A model

Technical Specifications: 6300 V model		Unit
Rated voltage	6300	V
Output rated voltage	7.2	kV
Number of phase-shifting transformers	1	-
Number of power cells per phase: default - redundant (N+1)	6 - 7	-
Output switching frequency: default - redundant N+1	6000 - 7000	Hz
Voltage peak (phase-ground)	6210	V
Voltage peak (phase-phase)	11178	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.8: 6600-6900 V and 40-600 A model

Technical Specifications: 6900 V model		Unit
Rated voltage	6900	V
Output rated voltage	7.2	kV
Number of phase-shifting transformers	1	-
Number of power cells per phase: default - redundant (N+1)	6 - 7	-
Output switching frequency: default - redundant N+1	6000 - 7000	Hz
Voltage peak (phase-ground)	6210	V
Voltage peak (phase-phase)	11178	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.9: 7200 V and 40-600 A model

Technical Specifications: 7200 V model		Unit
Rated voltage	7200	V
Output rated voltage	12	kV
Number of phase-shifting transformers	< 500 A: 1 ≥ 500 A: 2	-
Number of power cells per phase: default - redundant (N+1)	7 - 8	-
Output switching frequency: default - redundant N+1	7000 - 8000	Hz
Voltage peak (phase-ground)	7142	V
Voltage peak (phase-phase)	13041	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.10: 8000 V and 40-600 A model

Technical Specifications: 8000 V model		Unit
Rated voltage	8000	V
Output rated voltage	12	kV
Number of phase-shifting transformers	< 500 A: 1 ≥ 500 A: 2	-
Number of power cells per phase: default - redundant (N+1)	7 - 8	-
Output switching frequency: default - redundant N+1	7000 - 8000	Hz
Voltage peak (phase-ground)	7142	V
Voltage peak (phase-phase)	13041	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.11: 9000 V and 40-600 A model

Technical Specifications: 9000 V model		Unit
Rated voltage	9000	V
Output rated voltage	12	kV
Number of phase-shifting transformers	< 400 A: 1 ≥ 400 A: 2	-
Number of power cells per phase: default - redundant (N+1)	8 - 9	-
Output switching frequency: default - redundant N+1	8000 - 9000	Hz
Voltage peak (phase-ground)	8073	V
Voltage peak (phase-phase)	14904	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.12: Model 10000 V and 40-800 A

Technical Specifications: 10000 V model		Unit
Rated voltage	10000	V
Output rated voltage	12	kV
Number of phase-shifting transformers	< 340 A: 1 ≥ 340 A: 2	-
Number of power cells per phase: standard - redundant (N+1)	9 - 10	-
Output switching frequency: default - redundant N+1	9000 - 10000	Hz
Voltage peak (phase-ground)	9005	V
Voltage peak (phase-phase)	16767	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.13: Model 11000 V and 40-800 A

Technical Specifications: 11000 V model		Unit
Rated voltage	11000	V
Output rated voltage	12	kV
Number of phase-shifting transformers	< 340 A: 1 ≥ 340 A: 2	-
Number of power cells per phase: default - redundant (N+1)	10 - 10	-
Output switching frequency: standard - redundant N+1	10000 - 10000	Hz
Peak voltage (phase-ground): default - redundant	9936 - 9265	V
Peak voltage (phase-phase): default - redundant	18630 - 17253	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.14: Model 12000 V and 40-800 A

Technical Specifications: 12000 V model		Unit
Rated voltage	12000	V
Output rated voltage	17.5	kV
Number of phase-shifting transformers	< 225 A: 1 ≥ 225 A: 2	-
Number of power cells per phase: default - redundant (N+1)	11 - 12	-
Output switching frequency: standard - redundant N+1	11000 - 12000	Hz
Voltage peak (phase-ground)	10868	V
Voltage peak (phase-phase)	20493	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame E. (Optional for frame size F, G, H and I)	-

Table 9.15: Model 13200 V and 40-800 A

Technical Specifications: 13200 V model		Unit
Rated voltage	13200	V
Output rated voltage	17.5	kV
Number of phase-shifting transformers	< 225 A: 1 ≥ 225 A: 2	-
Number of power cells per phase: default - redundant (N+1)	12 - 12	-
Output switching frequency: standard - redundant N+1	12000 - 12000	Hz
Peak voltage (phase-ground): default - redundant	11799 - 11183	V
Peak voltage (phase-phase): default - redundant	22356 - 21087	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) ≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Filter type 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame size E (Optional for frame sizes F, G, H and I)	-

Table 9.16: Model 13800 V and 40-800 A

Technical Specifications: 13800 V model		Unit
Rated voltage	13800	V
Output rated voltage	17.5	kV
Number of phase-shifting transformers	< 225 A: 1 ≥ 225 A: 2	-
Default number of power cells per phase	12	-
Output switching frequency: standard - redundant N+1	12000 - 12000	Hz
Voltage peak (phase-ground)	11799	V
Voltage peak (phase-phase)	22356	V
Total harmonic distortion of the input current - THDi	≤ 5 (according to IEEE 519 or better) (for mains voltage with THDv ≤ 2)	%
Total harmonic distortion of the output current - THDi	According to the motor characteristics	%
Total harmonic distortion of the input voltage - THDv	≤ 5 (according to IEEE 519 or better)	%
Total harmonic distortion of the output voltage - THDv	Without filter & type 1 filter: Upon request Type 2 filter 2: ≤ 5	%
Acoustic noise	Upon request	dB
Redundant fans	Standard up to frame size E (Optional for frame sizes F, G, H and I)	-



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