

**EASY TO DRIVE**

# **MEDIUM VOLTAGE**

**VARIABLE SPEED DRIVES  
ELECTRONIC SOFT STARTER**



**EASY TO DRIVE**







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**Since 1987** Power Electronics has been producing high power variable speed drives and soft starters for low and medium voltage AC motor applications, as well as solar inverters for photovoltaic energy generation. This experience has allowed Power Electronics to position itself as the leading manufacturer of power electronics thanks to our unique product features, patented designs, fastest global delivery times and unbeatable 24/7 Power on Support.



**30 YEARS OF PRODUCT EXCELLENCE**



**24/7 POWER ON SUPPORT**



**INTERNATIONAL PRESENCE**



**FINANCIAL STABILITY AND STRENGTH**



**INDEPENDENT REPORTS AND CERTIFICATIONS**



**SUSTAINABLE GROWTH**

## ENGINEERING & CONSULTING

**Energy projects** often require customer specific solutions, for this reason our clients also have our Engineering and Consulting department at their disposal, which comprise a wide number of highly skilled and experienced engineers that are available to modify our standard product to suit customer demands and ensure our clients get the product they need.

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TECHNICAL ADVICE  
ENGINEERING  
CUSTOMIZED SOLUTIONS  
PROJECT MANAGEMENT  
COMMISSIONING  
24/7 SERVICE

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## VERTICAL INTEGRATION

**Flexibility and specialization** play a key role in the manufacture of standard products, but even more so in personalized products. We design and manufacture integrally the mechanics of our equipment. Vertical integration gives us the flexibility to adapt to customer requirements and still provide very short delivery times.

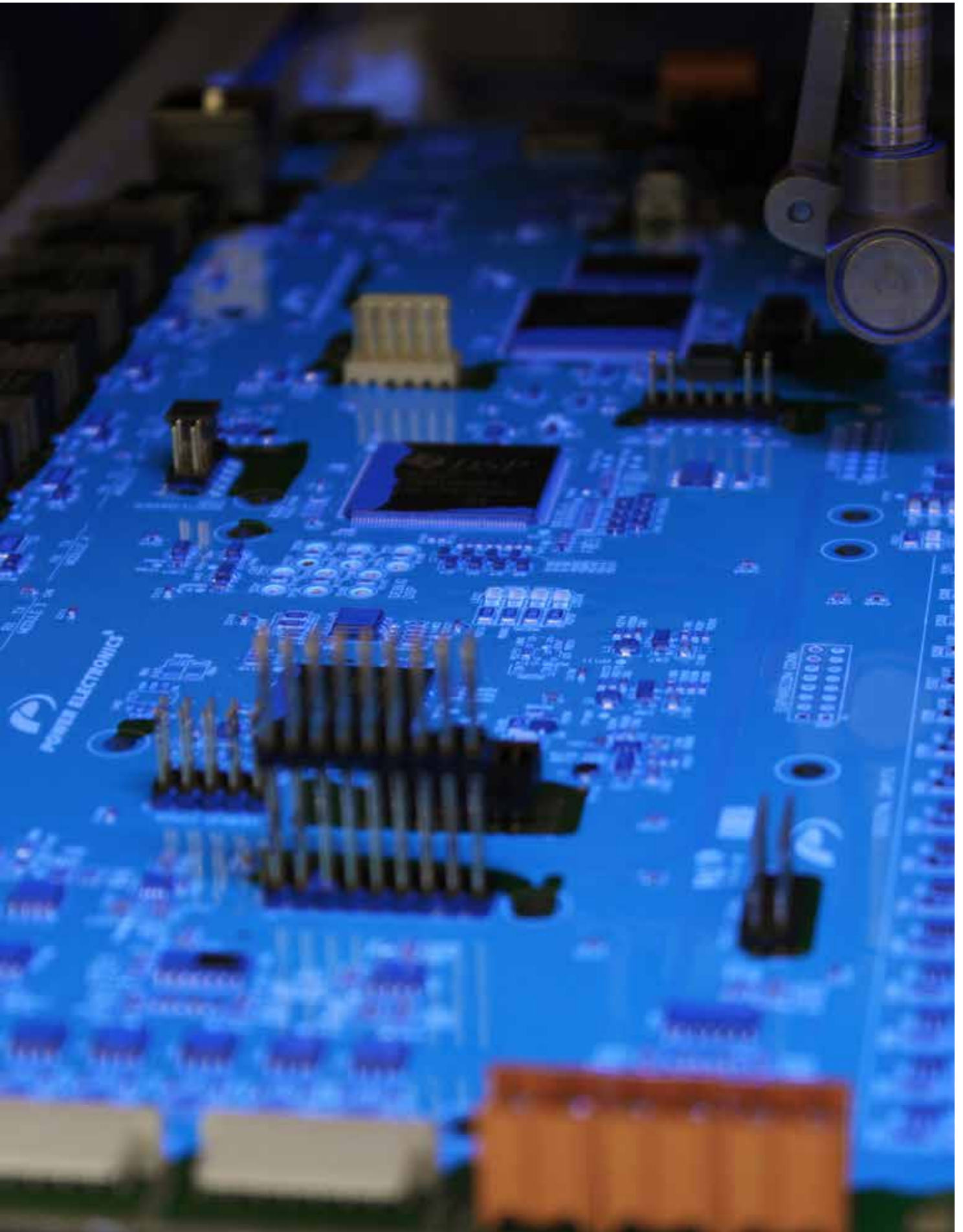
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INNOVATION & DESIGN FLEXIBILITY  
HIGH QUALITY COMPONENTS  
RELIABLE ENGINEERING  
FACTORY TESTED  
VALUE CHAIN SUPERVISION  
IMMEDIATE DELIVERY

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*"We design, manufacture and test  
the electronic boards of all our products"*







**AVAILABILITY****COMMISSIONING****CUSTOMER SUPPORT****ONSITE ASSISTANCE****SPARE PARTS WARRANTY****TRAINING SEMINARS****WARRANTY**

## POWER ON SUPPORT

**Power on Support is the concept** of a customer oriented strategy implemented by Power Electronics since its origins more than 30 years ago with 24/7 after sales service available for all our customers and end users without the need of signing an O&M contract.

*Customer Oriented Strategy.*

## WORLDWIDE PRESENCE

From the beginning, customer service and internationalization have been key elements for the development of the company. Thanks to the global expansion in the five continents, today we have presence and provide technical service throughout the world.



HEADQUARTERS

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**+20**

DELEGATIONS

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**+100**

SALES COUNTRIES

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**+1.000.000**

UNITS INSTALLED

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**+12GW**

ANNUAL CAPACITY PRODUCTION

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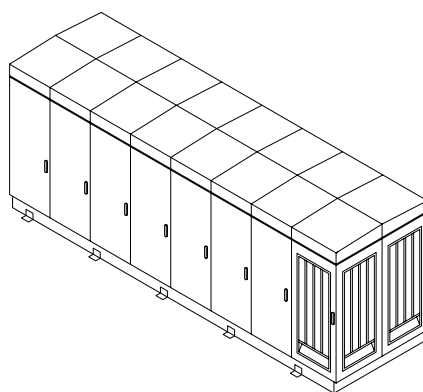


# PRODUCT RANGE

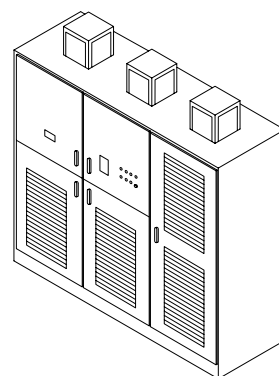


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**MEDIUM VOLTAGE VARIABLE SPEED DRIVES**



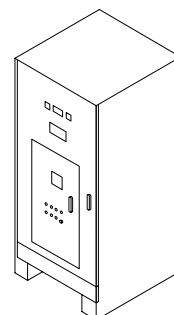
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**MEDIUM VOLTAGE SOFT STARTER**



VS65  
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# XMV660 OUTDOOR

MEDIUM VOLTAGE VARIABLE SPEED DRIVE



**ROBUST DESIGN**



**MULTI-LEVEL, PULSE-WIDTH MODULATION  
WITH PHASE SHIFT TRANSFORMER**



**HIGH EFFICIENCY AND POWER FACTOR  
AT PARTIAL LOADS**



**LOW HARMONICS - IEEE 519 COMPLIANCE**



**50°C OPERATION**



**NON-STOP INNOVATIVE COOLING**



**LOW DV/DT - NO MOTOR DERATING OR  
MOTOR CABLE LENGTH RESTRICTION**



**CONFORMALLY COATED ELECTRONICS**



**OUTPUT VOLTAGE BOOST  
TRANSFORMER TAP ADJUSTMENT**



**REDUNDANCY**



**CUSTOMIZED SOLUTIONS**



**FUNCTIONAL AND ELECTRICAL SAFETY**



**MAXIMUM MOTOR CARE**



**PRECISE AND FLEXIBLE CONTROL**

## EXTREME INNOVATION FOR EXTREME ENVIRONMENTS

The XMV660 NEMA3R is the most innovative, rugged and reliable outdoor medium voltage drive ready for 24/7 operation under the most demanding environments. The XMV660 MV drive goes one step further in achieving high performance by implementing proven low voltage technology within a rugged, modular, multi-level configuration. The multistep quasi-sinusoidal output voltage produced by the cascaded H-bridge power modules is low in  $dV/dt$  and supplies sinusoidal current to the motor. The multi-pulse phase shift transformer at the input minimises harmonic current drawn from the grid ensuring compliance to international THD standards. Designed under the strictest safety regulations, the XMV660 OUTDOOR complies with the most demanding industrial requirements. The XMV660 is available in a wide voltage and power range and offers the best power quality, uncompromising safety and proven reliability across the full range.

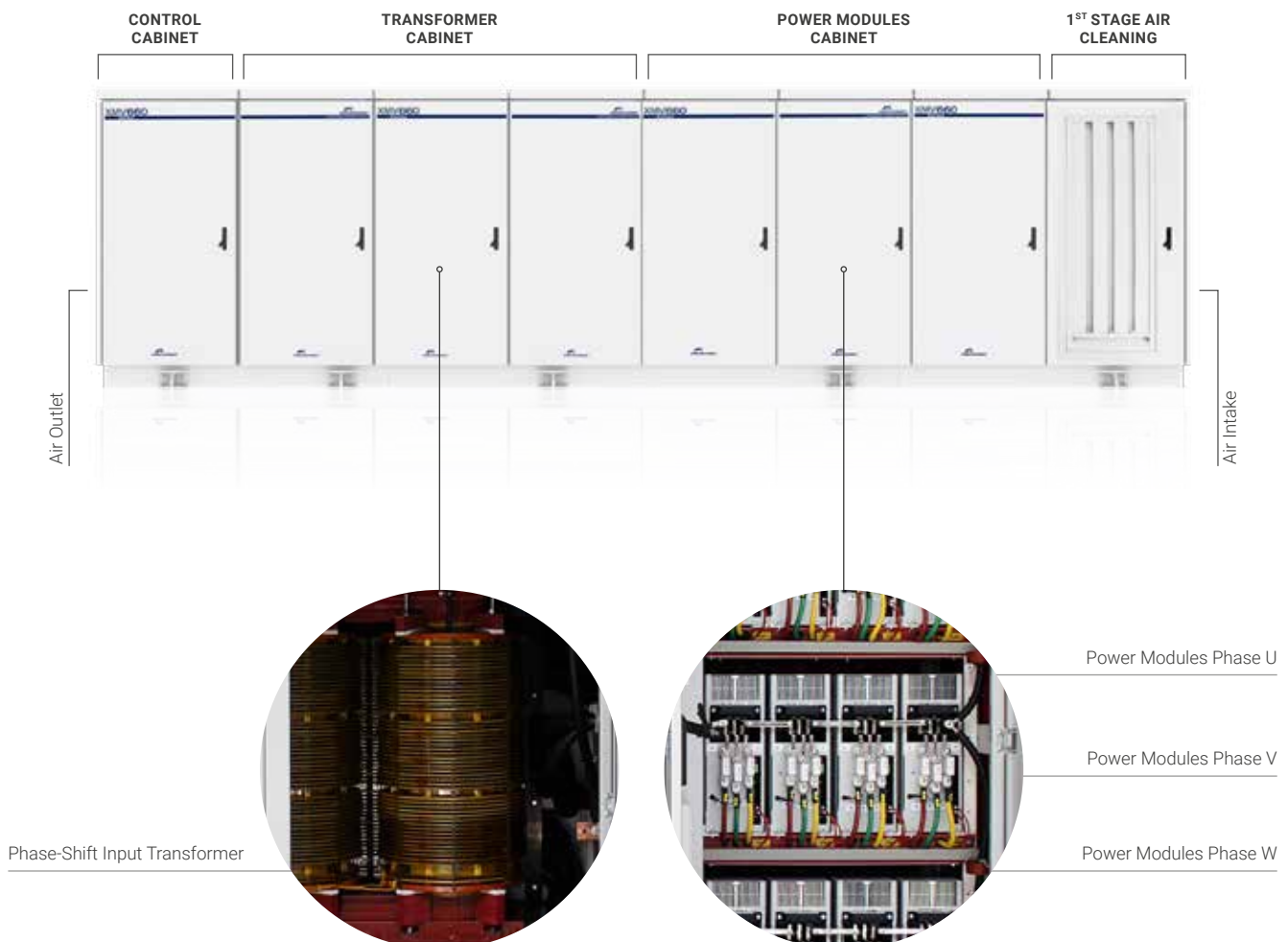
## TOPOLOGY

The XMV660 OUTDOOR uses multi-step pulse width modulation (PWM) to control the series connected LV power modules, producing a quasi-sinusoidal output voltage waveform with low  $dV/dt$  and sinusoidal current low in THDi, without the need for bulky external filters. This topology eliminates problematic peak voltages at the motor terminals, and other side effects

such as excessive motor heating and stray currents through to motor bearings. The input of each power module is connected to individual secondary windings of the multipulse phase shift transformer, minimising harmonic current drawn from the grid, and provides high electric protection and improved power factor and efficiency, even at light loads.

## WHY THE XMV660 OUTDOOR IS UNIQUE?

- NO NEED FOR AN ELECTRICAL ROOM
- NO CIVIL WORKS ASSOCIATED
- NO NEED FOR A COOLING SYSTEM
- NO COOLING SYSTEM CONSUMING ENERGY
- REDUCED O&M – FILTERLESS SYSTEM
- NO AMBIENT NOISE INSIDE FACILITY



## ROBUST DESIGN

**The XMV660 OUTDOOR delivers high performance under extreme conditions owing to its rugged sandstorm resistant design.**

The leading medium voltage technology has been integrated in a truly outdoor enclosure. A system born to run under the most extreme conditions that are commonplace in Oil & Gas, Power Generation and Water applications.

Outdoor equipment is a challenge that has been overcome by Power Electronics' Solar Division, and the best engineering practices have been migrated to the XMV660 OUTDOOR by featuring the unit with:

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Totally sealed electronics protected from dust and moisture.

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Conformal coating on electronic board shields PCBs from aggressive atmospheres.

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Rugged outdoor enclosure with double gasketed doors.

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50mm mineral isolation panel that dissipates heat from direct sunlight.

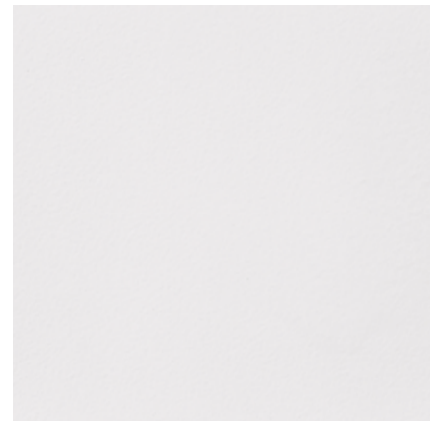
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Corrosion impervious polymeric coating (C5-M).

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Temperature and humidity control prevents harmful internal water condensation.

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**Polymeric Painting**



**Mineral Panel**



**Stainless Steel**



## COOLING SYSTEM

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The innovative filter-less “cyclone drive” cooling system delivers a constant stream of clean air to the XMV660.

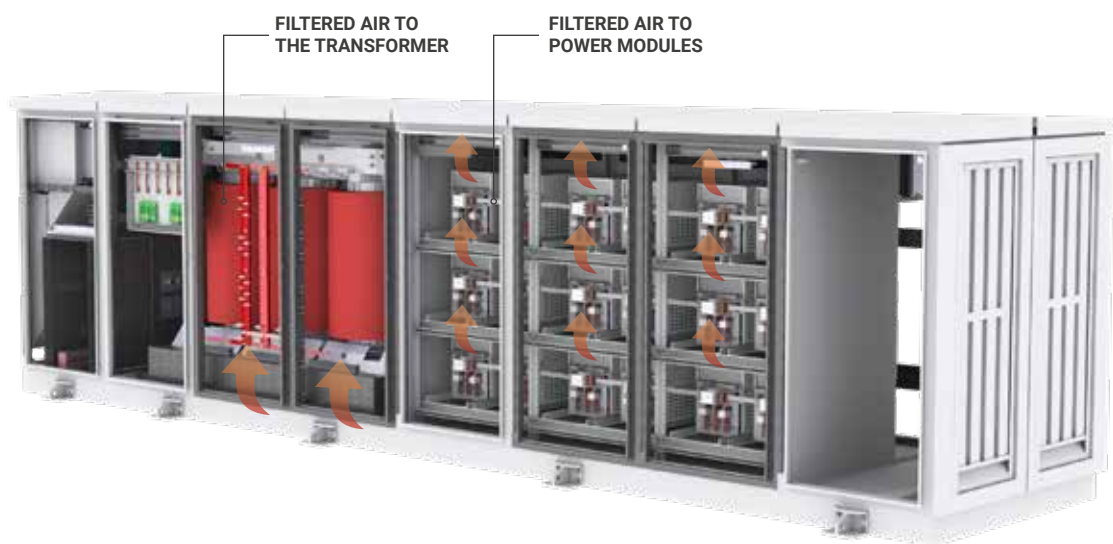
At the air intake, the labyrinth sifts the larger dust particles from the air stream, enabling the cyclone drive to eject the remaining contaminants, ensuring a constant flow of clean air into the electronics chamber and transformer cubicle without the need to maintain cumbersome dust filters.

### AIR CLEANING 1<sup>ST</sup> STAGE



### AIR CLEANING 2<sup>ND</sup> STAGE





## CAPEX AND OPEX

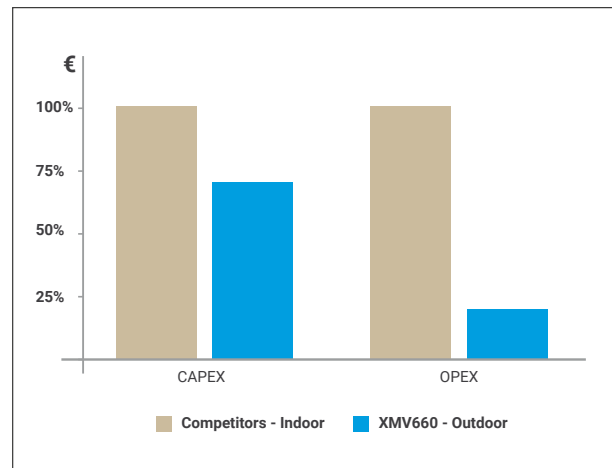
A highly globalized market demands reliable, safe and efficient solutions to reduce the OPEX and CAPEX in new projects, and XMV660 OUTDOOR MV drive links these concepts by providing substantial savings on:

### CAPEX (Construction and Civil Works)

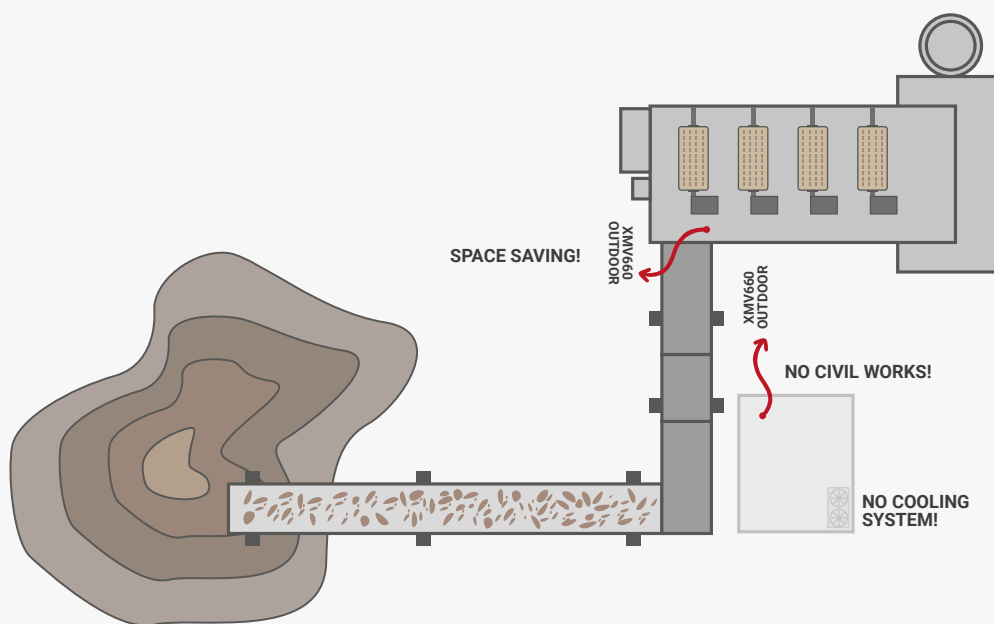
Multi-MW AC drives have a large foot print that force designers and constructors to build impressive technical rooms. The civil works in remote locations represent an important investment that the outdoor XMV660 helps to minimize.

### OPEX (HVAC)

The AC drives dissipates in heat between 2% to 4% of the power converted, this means that the HVAC systems for e-houses represents a high percentage of the electrical operating cost of the facility. The XMV660 OUTDOOR is ready to directly exchange heat into the surrounding environment at up to 50°C, being the smarter and the most cost-effective solution.



NO NEED OF  
TECHNICAL ROOM  
AND HVAC SYSTEM





## MAXIMUM MOTOR CARE

Power modules of 700V are connected in series to generate a quasi sinusoidal voltage low in  $dV/dt$ , supplying sinusoidal current to the motor with negligible THDi. Additional output filters are not needed.

Series connected H-bridge power modules generate a quasi-sinusoidal output voltage waveform low in  $dV/dt$ , harmonic voltage factor and negligible THDi, providing sinusoidal current to the motor.

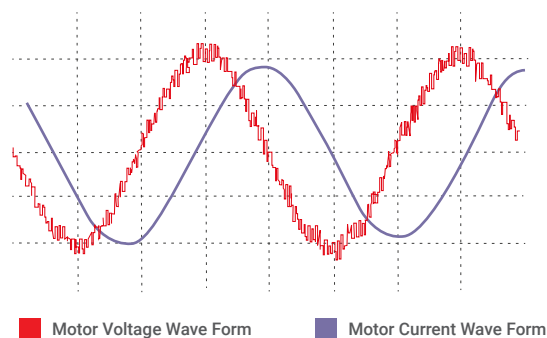
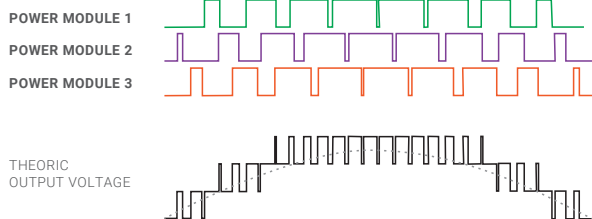
The multi-step topology offers low common mode voltage (CMV), coupled with the low  $dV/dt$ , eliminates voltage peaks

at the motor terminals. Therefore the XMV660 can be installed with new and existing motors employing standard insulation, without the need for additional motor derating or further motor protection, or to compensate for long motor cables.

Eliminating potential common mode currents (CMC) from circulating through the motor bearings allows the use of standard bearings and lubrication techniques.

Noise induced vibrations and torque pulses on the motor shaft are non-existent owing to the multi-step pulse width modulation (PWM) with H-bridge cascaded power modules topology.

### 3 MODULES MULTILEVEL - PULSE WIDTH MODULATED



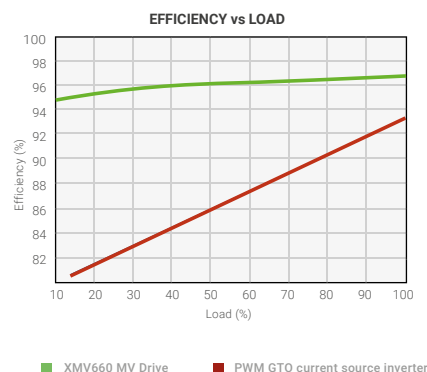
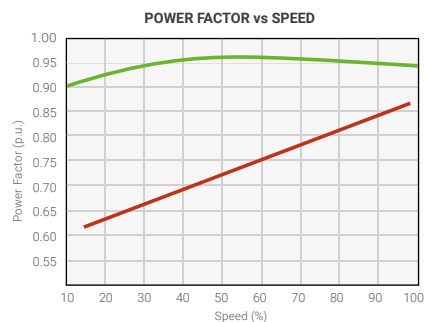
## POWER QUALITY AND EFFICIENCY

XMV660 topology meets the most stringent regulations regarding power quality (IEEE519) and electromagnetic compatibility (EMC 2004/108/EC).

An input phase shift transformer of 18 to 54 pulses minimises the THDi level, eliminating the need for harmonics filters

Outstanding Power Factor  $PF > 0.95$  above 20% load, therefore no capacitor banks or active filters are needed.

High efficiency  $\eta > 96\%$  above 40% load (Including transformer).





Downhill conveyor for high altitude mining.



Mini-hydraulic (<10MW) generation and elevation.

## MAXIMUM REABILITY AND AVAILABILITY

The XMV660 is delivered fully factory tested to ensure the best performance under any load condition.

Transformer's and power module's temperature are permanently monitored to detect fan clogging or failure.

Additionally the drive is available with a redundant cooling system that maximises the availability rate.

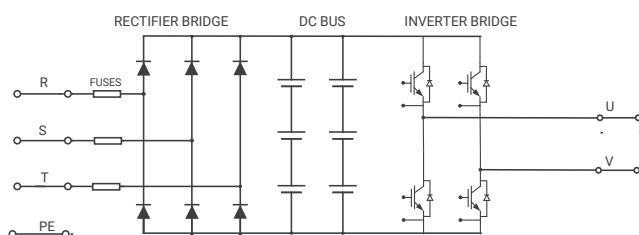
The Redundant Power System (RPS) permits the drive to keep running at reduced capacity in the unlikely event of a power module failure.

Multi-step topology using proven low voltage power modules ensures long service life and maximum availability.

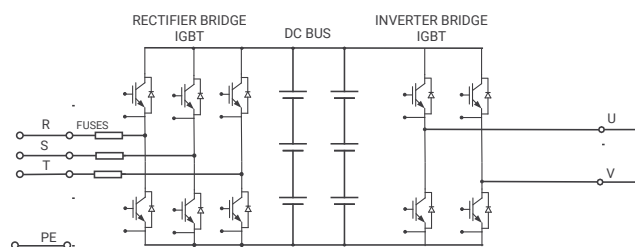
## POWER MODULE TOPOLOGIES

The XMV660 is available with different module topologies that improve built-in standard features (regenerative, reduced size...), for further information consult Power Electronics.

### STANDARD MODULE



### REGENERATIVE MODULE



## REGENERATIVE CAPACITY

The Power Electronics XMV660 regenerative drive is a high-performance device. It is applicable for "downhill" conveyor belts, lifting systems, winches and it is especially used to reverse the direction on high power fans or stopping large loads in highly reduced times such as in the case of centrifugal machines.

The XMV660 Active Front End is built to operate indefinitely at full capacity as an electric power generator, for example, connected to mini-hydraulic turbine generators (<10MW), or even be capable of connecting to two medium voltage networks of different frequencies and voltages, transferring energy in a bidirectional and controlled way between the two non-synchronized networks.

The regenerative XMV660 can be used to raise water and store electrical energy as potential energy, the same equipment

is able to return power to the electricity grid when necessary. Thanks to the versatility of the motor control, low maintenance asynchronous induction motors can be used. Furthermore, the turbines are not required to rotate at a fixed speed, the XMV660 is able to optimize the system's efficiency, both elevation and generation.

The regenerative cell topology allows the XMV660 to maintain fault tolerance in both power and ventilation elements, as well as all the benefits of our systems and control algorithms such as Master-Slaves using fiber optics, tolerance for voltage gaps, unnecessary auto tuning, start on the fly ....

In the unlikely event of a power module failure, the equipment can continue to operate until the process allows the replacement of the damaged module.

## SAFETY AND PROTECTION

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**The XMV660 integrates built-in hardware and software protections that reduce the associated risk of medium voltage installations. An input phase-shift transformer offers a wide variety of benefits to your installation:**

- Protects power rectifier bridge semiconductors and withstands grid transient fluctuations.
- Boosts output voltage by compensating for grid and drive voltage drops by using an onsite tap adjustment of the transformer. The motor will work at the rated voltage avoiding undesired motor oversizing and overheating.
- Reduces the short circuit power and therefore the fault current in case of an unlikely internal isolation defect.
- A custom made input transformer allows the user to order a different input and output voltage. Thus, there is no need to install further transformers or switchgear, and allows the user to work with different rated voltage equipment within the same facilities.

The drive monitors the input, the output and each individual power module offering multiple software and hardware protections that will protect your costly rotating assets (pump, fan, conveyor, compressors...).

Each power module is protected by fuses that provide overcurrent protection to the rectifier bridge.

The XMV660 can be delivered with a pre-charge system that magnetises the transformer and charges each power module DC bus. This system limits the inrush current at the drive's connection.

The XMV660 can be delivered with input protection modules that avoid the need for medium voltage protection switchgear.

Safety system, mechanical interlocks, restricted settings access with password and a warning buzzer will warn you of undesirable settings.

## MAINTENANCE FRIENDLY

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**The XMV660 is delivered with full frontal access to all compartments: power modules cabinet and power transformer cabinet with the control cabinet integrated.**

- All of the cabinets are designed to provide an easy front access that simplifies maintenance and supervision. The transformer cabinet can be installed out of the plant room in order to reduce indoor heat loads.
- A redundant design of the power conversion stage and cooling system increases availability rates with a reduced stock of spare parts.
- Low voltage tests allow for a safe fully functional performance before commissioning.
- Filters and gratings are easily removable from the front without opening the cabinet or disturbing the normal operation of the application. Hence providing maximum safety to routine maintenance tasks.
- An accessible front connection together with a guide frame permits power modules to be manually changed by an operator with the aid of a trolley.





## QUICK AND POWERFUL RESPONSE

**PMC and AVC allow its application in high starting torque, dynamic or precise applications.**

**The XMV660 is suitable for all existing applications.**

### NO AUTO TUNING NEED

PMC factory settings and motor nameplate parameters ensure perfect performance without enabling the auto tuning function during commissioning. We have invested in new control methods to simplify settings. A fast and reliable commissioning saves time and money.

### START AND STOP MAXIMUM CONTROL

Owing to the MBC (Mechanical Brake Control), the Pre-Magnetisation and Delay off IGBT, preloaded processes can be started and stopped smoothly.

### MULTIPLE DRIVE'S SYNCHRONIZATION

PMC-OLTC is the unique master-slave motor control that allows the synchronisation of multiple drives and motors without encoder. The result is a smooth, powerful and fast response with the least maintenance and supervision. Every motor will provide the same torque under any circumstance, therefore ageing all the motors homogeneously. Moreover, its reduced starting inrush current peaks allow the reduction of the drive and motor oversizing in demanding conveyors and mills.

### REDUNDANT POWER SYSTEM (RPS)

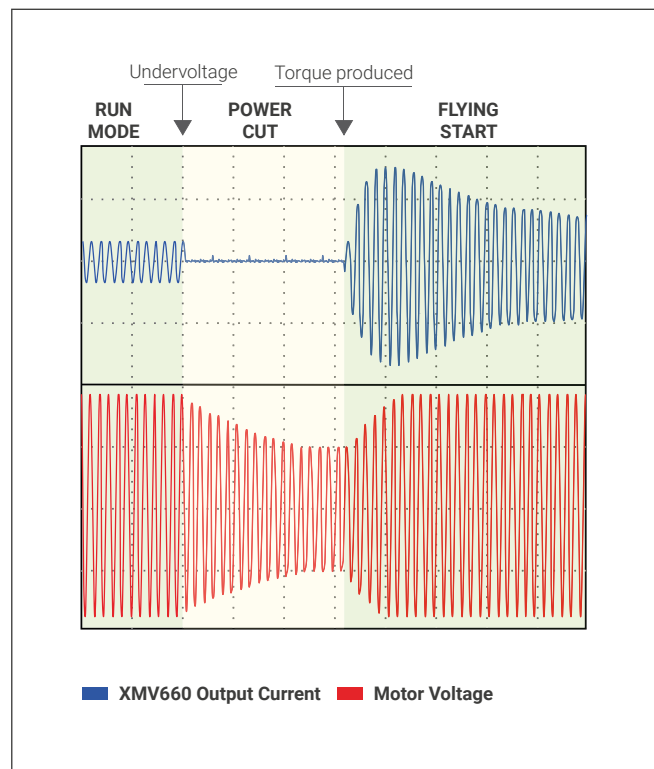
In the unlikely case of a power module failure the RPS permits the drive to keep running by overriding the failed module and the corresponding modules in the other two phases, ensuring the output voltage remains balanced at reduced power.

### POWER LOSS RIDE THROUGH

The on board UPS enables continued motor control during grid transient undervoltage conditions, until the drive is able to reconnect the motor when the grid voltage returns to normal.

### ADDITIONAL FUNCTIONALITIES

Thermal motor protection, motor overload prediction, motor stall, fly start, automatic restart, etc... complete the wide control features.



## ACCURATE, POWERFUL AND FLEXIBLE MOTOR CONTROL

Power Electronics' success is measured by our customer's satisfaction so the motor control systems developed by Power Electronics have been designed to meet the most demanding requirements. Integrating V/f control and two vector controls: the Power Motor Control (PMC) and the Advanced Vector Control (AVC) as standard.

### SECOND GENERATION PLATFORM

In order to take advantage of the latest in control technology microprocessors, the XMV660 incorporates new control hardware. This technology includes Backward Compatibility and retrofit features for easy transition and coexistence of both the latest models and also the previous versions, where a long life cycle is mandatory.

New hardware lets us increase the motor control precision, there are additional control algorithms, also new and improved functions such as ventilation speed control, integrated control for external bypass, more capacity for several PowerPLC customized programs, the combinations are virtually unlimited.

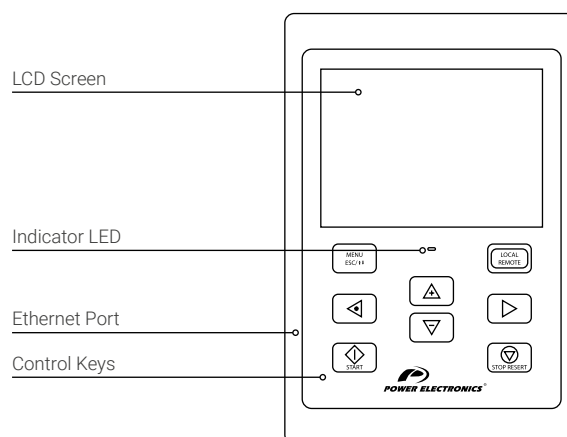
## EASY TO DRIVE

The user interface of the XMV660 is intuitive and user friendly. Coupled with the wide range of Fieldbus protocols available, the XMV660 can meet any connection requirement.

### GRAPHIC DISPLAY

The graphic display provides a much more intuitive data presentation, an easy navigation through the control parameters and allows saving thousands of customized configurations defined by the user.

- **TFT-LCD SCREEN OF 2.8".**
- **CUSTOMIZED VISUALIZATION BY THE USER.**
- **FAULT REGISTER (LOGS).**
- **LANGUAGE SELECTION.**
- **REMOVABLE DISPLAY UNIT FOR REMOTE INSTALLATION.**



## COMMUNICATIONS

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**The XMV660 integrates as standard Modbus RTU protocol over RS232, RS485 and USB hardware. Optionally fibre optic and the communication protocols Profibus -DP, DeviceNet, CAN Open, Ethernet Modbus TCP and Ethernet IP are available.**

## I/O SIGNALS

**DI:** There are 9 programmable and 5 preassigned digital inputs optically isolated and 1 motor PTC input built-in. 3 digital inputs can be programmed to select up to 7 different speed or torque references or they can be programmed individually to set remote commands such as start, stop, reverse, set acceleration and deceleration ramps, speed limit, alternative control, pulse flow meter, ...

**DO:** 2 programmable and 3 pre-assigned changeover relays and 3 programmable contacts built-in as standard. The XMV660 is capable of configuring the output relays by using the 3 built-in comparators to set remote alarms (current, speed, torque, power, flow, low and high input voltage, reference, acceleration and deceleration ramps, etc), control external mechanical brakes, control external cooling, action pipe filling pump,...

**AI/AO:** There are 3 inputs and 3 programmable analogue outputs. They are optically and galvanically isolated. External sensors or potentiometers are easily programmable as a voltage or current analogue signal in engineering units (% , l/s, m<sup>3</sup>/s ,l/m, m<sup>3</sup>/m, l/h, m<sup>3</sup>/h, m/s, m/m, m/h, Bar, kPa, Psi, m, °C, °F, °K, Hz, rpm). Additionally if the sensor is damaged or with noise coupling problems, the drive is able to filter, detect the failure and stop the application.

Many more options available. Consult Power Electronics with your requirements.

## POWERCOMMS

**The PowerCOMMS tool offers real performance information about motor and drive status.**

**The XMV660 integrates an accurate power grid analyser and drive's diagnosis function.**

This tool operates from a PC, and communicates with the drives through Ethernet or RS485/ RS232, registers, plots and exports all the drive visualisation parameters: energy consumption, regenerated energy, motor voltage, PTC signal, IGBT temperature, motor overload, Power Modules status,

etc. Not only can you monitor both drive and motor, you can also remotely control and commission multiple drives. Use the tool to copy and save the XMV660 parameters remotely to speed up the commissioning or configuration, saving time and money.

## POWERPLC

**PowerPLC is the tool that allows our Applications Engineers to customize and enhance the XMV660 performance for the customer's application, implementing multiple functions without additional hardware.**

Multiple motor control, automatic pump and crusher unclogging, compressor regulation, cranes control, petrol pump softstart, paper and cable rolling control, biogas digesters and mixers, accumulators, calendar functions, and much more.

The user establishes the limits for the XMV660.



## TECHNICAL CHARACTERISTICS

INPUT	Input voltage (kV) <sup>[1]</sup>	2.3kV to 13.8kV (±10%)
	Frequency	50/60Hz (±10%)
	Power factor	> 0.95 (over 20% load)
	THDi (%) current <sup>[2]</sup>	< 5%
	Power transformer	Phase-shift transformer, dry type (Copper or aluminum)
	Voltage dip	Exceeds IEC/EN 61000-4-34
	Overvoltage protection	Surge Arresters
OUTPUT	Technology	Multi-level, pulse-width modulation, low voltage power modules connected in series
	Pulses / power modules in series	18p/3, 24p/4, 30p/5, 36p/6, 54p/9
	Power modules (A) / (V)	120A, 200A, 300A - (400A, 630A Optional) / 600V-700V
	Current harmonic distortion (THDi)	< 5%
	Harmonic voltage factor (HVF)	< 0.019 ( No motor derating required)
	Efficiency	≥96% (including transformer) @Pn
	Tripless operation	Redundant Power System (RPS)
ENVIRONMENTAL RATINGS	Output voltage boosting	Transformer Tap Adjustment
	Degree of protection	(IEC60529) IP55, NEMA3R
	Operation temperature	-20°C to +50°C
	Storage temperature	-25°C to +55°C
	Humidity	< 95%, non condensing
	Altitude	<1000m; >1000m power derating 1%/100m. Max. 3000m Optional reinforced isolation for up to 4500m.
	Cooling	Forced air cooling, Self cleaning filters
CONTROL	Control mode	Local control (Display and push-buttons) Remote control (I/O and communications), Web display (wifi)
	Control method	V/Hz VECTOR CONTROL Open Loop: PWM speed / torque control, AVC: speed / torque control Close Loop (Encoder): PWM speed / torque control, AVC: speed / torque control
	Carrier frequency	1kHz
	Control power supply	Redundant 2x230Vac II P+N (1kVA), UPS integrated
	Other characteristics	Voltage/Power ride through, quick setting and commissioning, master-slave synchronization, skip critical frequencies, delay-off IGBT, motor pre-magnetization, flux reduction at low load (energy saver), electric DC brake, multi-reference and speed ramp, Power PLC programming, Other consult Power Electronics.
	Digital inputs	5 programmable, Active high (24Vdc), Isolated power supply 5 pre-configured (Start/Stop ; Reset, control mode, reference) 1 PTC input
	Analogue inputs	3 programmable differential inputs. 0–20mA, 4–20mA, 0–10Vdc and ±10Vdc. (Optically isolated)
USER INTERCONNECTION <sup>[1]</sup>	Digital outputs	2 programmable changeover relays (250Vac, 8A or 30Vdc, 8A) 3 programmables NO contacts (250Vac, 8A or 30Vdc, 8A) 3 pre-configured contacts (Start/Stop, Warning, Failure)
	Analogue outputs	3 isolated programmable outputs: 0–20mA, 4–20mA, 0–10Vdc and ±10Vdc
	Encoder (optional)	2 differential encoders input (process and vector control). Input signal from 5 to 24Vdc
	Standard Hardware	USB, RS232, RS485, Ethernet
	Optional Hardware	Fiber optics, 9 Pin D-SUB, CAN
	Standard Protocol	Modbus-RTU, Modbus TCP, Ethernet IP
	Optional Protocol	Profibus-DP, Devicenet, CAN Open
PROTECTIONS	Motor protections	Rotor locked, torque limit, Motor overload (thermal model), Output current limit, Phase current imbalance, Ground fault current, Phase voltage imbalance, Motor over-temperature (PTC), Speed limit, excessive starting and stopping time.
	Drive protections	Input phase loss, Low input voltage, High input voltage, maximum number of faulty modules, High input frequency, Low input frequency, drive overload, drive over-temperature, Analogue input signal loss (speed reference loss), communication loss (time-out), Power supply fault, Emergency stop
	Power modules protections	Overcurrent (fuses), high DC bus voltage, Low DC bus voltage, DC bus voltage instability, low input voltage, fiber optics communication lost, communication time overpassed (time-out), control voltage lost, gate drive fault, power module overtemperature.
REGULATION	Electromagnetic compatibility	Directive EMC 2004/108/EC, IEC/EN 61800-3, IEEE 519-1992
	VSD design and construction	IEC/EN 61800-4 General requirements, IEC/EN 61800-5-1 Safety, IEC/EN 60146-1-1 Semiconductor converters
	MV transformer	IEC/EN 60076 -1, -11, IEC/EN 60146-1-3, IEC/EN 61378-1

[1] Other configurations, consult Power Electronics.

[2] Harmonics are below the limits defined in IEEE519 for all  $I_{sc}/I_L$ .

# CONFIGURATION TABLE

X66	1000		A		66		5		3		H				
XMV660 Series	Active Power (kW)		Cells Max. Amps		Output voltage (kV)		Overload		Degree of protection		Grid voltage (kV)				
X66	0150	150	A	120	23	2.3	2	120%	1	UL NEMA1	X	Low voltage			
	...	...	B	200	30	3	5	150%	3	UL NEMA3R	A	2.3			
	1000	1000	C	300	33	3.3	B	Starting Model	4	IEC IP41	B	3			
	1100	1100	D	450	38	3.8	...	Under request	5	IEC IP54	C	3.3			
	1200	1200	E	630	41	4.1				D	3.8				
	...	...	F	900	60	6				E	4.1				
	9000	9000	G	1250	63	6.3				F	6				
	10M0	10000	H	1500	66	6.6				G	6.3				
	12M5	12500	Regenerative		69	6.9				H	6.6				
	24M5	24500	R	120	10	10				I	6.9				
	...	Under request	S	200	11	11				J	10				
			T	300	13	13.8				K	11				
			U	450	...	Under request				L	13.8				
			V	630							M	15			
			W	900							...	Under request			
			X	1250											
			Y	1500											
			...	Under request											
	Check the rated current of the motor nameplate and indicate the short circuit														

Check the rated current of the motor nameplate and indicate the short circuit current to guarantee the compatibility with the selected drive.

Consult configuration availabilities with Power Electronics.

# STANDARD RATINGS

XMV660 4.16kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW)	(HP) <sup>[1]</sup>
X660298A 41	50	298	400
X660336A 41	60	336	450
X660373A 41	70	373	500
X660447A 41	80	447	600
X660522A 41	90	522	700
X660597A 41	100	597	800
X660671A 41	120	671	900
X660746B 41	130	746	1000
X660932B 41	160	932	1250
X661119B 41	200	1119	1500
X661305C 41	230	1305	1750
X661491C 41	260	1491	2000
X661752C 41	300	1752	2350
X661864D 41	320	1864	2500
X662051D 41	360	2051	2750
X662237D 41	390	2237	3000
X662610D 41	450	2610	3500
X662983E 41	520	2983	4000
X663356E 41	580	3356	4500
Under request			

XMV660 6.6kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[2]</sup>	(HP)
X660400A 66	45	400	536
X660450A 66	50	450	603
X660500A 66	55	500	671
X660560A 66	60	560	751
X660630A 66	70	630	845
X660710A 66	80	710	952
X660800A 66	90	800	1073
X660900A 66	100	900	1207
X661000A 66	110	1000	1341
X661250B 66	140	1250	1676
X661400B 66	150	1400	1877
X661600B 66	180	1600	2146
X661800B 66	200	1800	2414
X662000C 66	220	2000	2682
X662500C 66	270	2500	3353
X662800C 66	300	2800	3755
X663150D 66	350	3150	4224
X663550D 66	390	3550	4761
X664000D 66	440	4000	5364
X664500E 66	500	4500	6035
X665000E 66	550	5000	6705
Under request			

[1] HP standard motor rated power (cos φ • Eff = 0.8, 4.16kV)

[2] kW standard motor rated power (cos φ • Eff = 0.8, 6.6kV)

2.3kV, 3kV, 3.3kV, 6kV, 10kV, 11kV, and 13.8kV Standard Ratings available under request.



# XMV660

MEDIUM VOLTAGE VARIABLE SPEED DRIVE



**50°C OPERATION**



**MULTI-LEVEL, PULSE-WIDTH MODULATION  
WITH PHASE SHIFT TRANSFORMER**



**HIGH EFFICIENCY AND POWER FACTOR  
AT PARTIAL LOADS**



**LOW HARMONICS - IEEE 519 COMPLIANCE**



**SUITABLE FOR RETRO FITTING TO EXISTING MOTORS**



**LOW DV/DT - NO MOTOR DERATING OR  
MOTOR CABLE LENGTH RESTRICTION**



**OUTPUT VOLTAGE BOOST  
TRANSFORMER TAP ADJUSTMENT**



**CONFORMALLY COATED ELECTRONICS**



**RUGGED AND MAINTENANCE FRIENDLY**



**REDUNDANCY**



**CUSTOMIZED SOLUTIONS**



**FUNCTIONAL AND ELECTRICAL SAFETY**



**MAXIMUM MOTOR CARE**



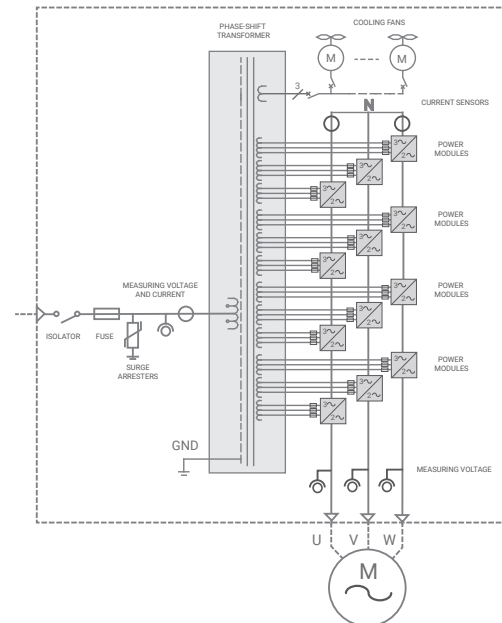
**PRECISE AND FLEXIBLE CONTROL**

## MAXIMUM MOTOR CARE, OPERATOR SAFETY AND RELIABILITY WITHOUT COMPROMISE

The XMV660 MV drive goes one step further in achieving high performance by implementing proven low voltage technology within a rugged, modular, multi-level configuration. The multistep quasi-sinusoidal output voltage produced by the cascaded H-bridge power modules is low in  $dV/dt$  and supplies sinusoidal current to the motor. The multi-pulse phase shift transformer at the input minimises harmonic current drawn from the grid, ensuring compliance to international THD standards. Designed under the strictest safety regulations, the XMV660 complies with the most demanding industrial requirements. Available in a wide voltage and power range, the XMV660 offers the best power quality, maximum motor care, uncompromising safety and proven reliability across the whole range.

## TOPOLOGY

The XMV600 is based on a multi-step pulse width modulation (PWM). Low voltage power modules are connected in series producing a quasi-sinusoidal voltage and current motor waveform. This topology offers low  $dV/dt$ , THDi and HVF without output  $dV/dt$  or sinusoidal filters. This leads to reduced peak voltages at the motor terminals, motor vibrations and overheating. Power modules are connected to dedicated output terminals of the phase-shift transformer that can be configured from 18 to 54 pulses. This transformer offers a low THDi, high electric protection, and high power factor at low loads. The control panel, which can be mounted over the transformer cabinet or in an adjoining cabinet, monitors the transformer status and communicates with power modules through fiber optics. At the same time, interacts with the user and DCS (Distributed Control system) through the local display, serial communication ports, and I/O signals.





## CUSTOMIZED SOLUTIONS

High value medium voltage projects often require customer specific solutions. Our team of highly experienced engineers are available to modify our standard products to suit your specific demands to ensure you get the product you need.

### Control, user terminal strip and pushbuttons

- Pushbuttons, selectors and pilots.
- Digital and analogue I/O pre-configuration.
- Customized user terminal strip.
- PTC and PT100 relays.
- Process and motor encoder boards.
- Optional communication protocols (Profibus-DP, Devicenet, Ethernet Modbus TCP, Can Open...).
- PowerPLC dedicated applications.

### Documentation

- Electrical and dimensional drawings.
- ITP reports.
- Witness Factory Acceptance Test (FAT).
- ....

### Input and output protection cells

- Synchronous or Asynchronous bypass cell with fully controlled contactors, VCBs and earthing switches.
- Input protection cell featured with Automatic circuit breaker, fuses, withdrawable contactor, on-load disconnecter with or without fuses, Earthing switch, Motor protection relay.
- Commutation cells.
- Cell with Soft-load system.

### Cabinet Features

- Stainless steel enclosure, specific RAL, tailor made labelling.
- Incoming MV cable or busbar connection from top, right or backside.
- Aligned VSD with common main input busbar and protection.



## TECHNICAL CHARACTERISTICS

INPUT	Input voltage (kV) <sup>[1]</sup>	2.3kV to 13.8kV (±10%)
	Frequency	50/60Hz (±10%)
	Power factor	> 0.95 (over 20% load)
	THDi (%) current <sup>[2]</sup>	< 5%
	Power transformer	Phase-shift transformer, dry type (From 18 to 54)
	Overvoltage protection	Surge Arresters
	Voltage dip	Exceeds IEC/EN 61000-4-34
	Drive bypass	Optional bypass cabinet
OUTPUT	Technology	Multi-level, pulse-width modulation, low voltage power modules connected in series
	Output voltage (kV)	2.3kV, 3kV, 3.3kV, 4.16kV, 5kV, 5.5kV, 6kV, 6.6kV, 10kV, 11kV, 13.8kV
	Pulses / power modules in series	18p/3, 24p/4, 30p/5, 36p/6, 54p/9
	Power modules (A) / (V)	120A, 200A, 300A - (400A, 630A Optional) / 600V-700V
	Overload capacity	150% (60s/10min)
	Current harmonic distortion (THDi)	< 5%
	dV/dt value	< 1000V/μs (Multi-level topology reduce peak voltages)
	Harmonic voltage factor (HVF)	< 0.019 ( No motor derating required)
	Frequency	0.5 to 120Hz. (0.01Hz accuracy)
	Efficiency	≥96% (including transformer)
	Triplex operation	Redundant Power System (RPS)
	Output voltage boosting	Transformer Tap Adjustment
ENVIRONMENTAL RATINGS	Operation conditions	Indoor, No caustic and volatile air, no dust
	Degree of protection	IP41 (IEC60529)
	Operation temperature	-20°C to +50°C; >50°C power derating 1%/°C Pn
	Storage temperature	-25°C a +55°C
	Humidity	< 95%, non condensing
	Altitude	<1000m; >1000m power derating 1%/100m. Max. 3000m Optional reinforced isolation for up to 4500m
	Cooling	Forced air cooling. Optional redundant
CONTROL	Control mode	Local control (Graphic display 2.8" and push-button) Remote control I/O
	Control method	V/hz VECTOR CONTROL Open Loop: PWM speed / torque control, AVC: speed / torque control Close Loop (Encoder): PWM speed / torque control, AVC: speed / torque control
	Carrier frequency	1kHz
	Control power supply	Redundant 2x230Vac II P+N (3kVA), UPS integrated
	Other characteristics	Voltage/Power ride through, quick setting and commissioning, master-slave synchronization, skip critical frequencies, delay-off IGBT, motor pre-magnetization, flux reduction at low load (energy saver), electric DC brake, multi-reference and speed ramp, Power PLC programming Other consult Power Electronics.
LOCAL CONTROL PANEL	Display	Graphic displayTFT-LCF 2.8"
	Connection	RJ45, 3m (5m Optional)
	Features	4Gb microSD card - Faults and events log and notification, save and copy the parameters. Quad Band GSM modem integrated to remote start, stop and notification by SMS. Ethernet switch with double connection RJ45 Self powered by RJ45, optional 5Vdc external power supply or batteries Comprehensive screens with built-in help system Coded access to parameters with password
	Leds	Led ON: Control board is energized Led RUN: Motor receiving power supply Led FAULT: Flashing displays that a fault has occurred
	Display information	Average current and 3-phase motor current, Average voltage and 3-phase motor voltage, Average input voltage and 3-phase input voltage, 3-phase input and output frequency, Drive Status, Speed, Torque, Power, Power factor of motor, Individual Modules status, Register of total and partial drive running time with reset function. (hours), Register of total and partial drive energy consumption with reset function (kWh), Relay status, Digital inputs / PTC status, Output comparator status, Analogue inputs and sensor values, Analogue output value, Motor overload and equipment status, Drive and rectifier temperature, Fault history (last 6 faults).
	Visualization leds	RED: Running; GREEN: Stopped; AMBER:Warning; RED: Fault
	Push buttons	Control mode selector: local/stop/remote Emergency Stop Green: Local start push button Red: Local Stop push button White: Fault Reset

[1] Other configurations, consult Power Electronics.

[2] Harmonics are below the limits defined in IEEE519 for all  $I_{SC}/I_L$ .

<b>USER INTERCONNECTION</b> <sup>[1]</sup>	<b>Digital inputs</b>	9 programmable, Active high (24Vdc), Isolated power supply 5 pre-configured (Start/Stop ; Reset, control mode, reference) 1 PTC input
	<b>Analogue inputs</b>	3 programmable differential inputs. 0 – 20mA, 4 – 20mA, 0 – 10Vdc and ±10Vdc. (Optically isolated)
	<b>Digital outputs</b>	2 programmable changeover relays (250Vac, 8A or 30Vdc, 8A) 3 programmables NO contacts (250Vac, 8A or 30Vdc, 8A) 3 pre-configured contacts (Start/Stop, Warning, Failure)
	<b>Analogue outputs</b>	3 isolated programmable outputs: 0 – 20mA, 4 – 20mA, 0 – 10Vdc and ±10Vdc
	<b>Encoder (optional)</b>	2 differential encoders input (process y vector control). Input signal from 5 to 24Vdc
<b>COMMUNICATIONS</b>	<b>Standard hardware</b>	USB, RS232, RS485
	<b>Optional hardware</b>	Fiber optics, Ethernet, 9 Pin D-SUB, CAN
	<b>Standard protocol</b>	Modbus-RTU
	<b>Optional protocol</b>	Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open
<b>PROTECTIONS</b>	<b>Motor protections</b>	Rotor locked, torque limit, Motor overload (thermal model), Output current limit, Phase current imbalance, Ground fault current, Phase voltage imbalance, Motor over-temperature (PTC), Speed limit, excessive starting and stopping time.
	<b>Drive protections</b>	Input phase loss, Low input voltage, High input voltage, maximum number of faulty modules, High input frequency, Low input frequency, drive overload, drive over-temperature, Analogue input signal loss (speed reference loss), communication loss (time-out), Power supply fault, Emergency stop
	<b>Power modules protections</b>	Overcurrent (fuses), high DC bus voltage, Low DC bus voltage, DC bus voltage instability, low input voltage, fiber optics communication lost, communication time overpassed (time-out), control voltage lost, gate drive fault, power module overtemperature.
<b>REGULATION</b>	<b>Electromagnetic compatibility</b>	EMC 2004/108/EC
		IEC/EN 61800-3
		IEEE 519-1992
	<b>VSD design and construction</b>	IEC/EN 61800-4 General requirements
		IEC/EN 61800-5-1 Safety
		IEC/EN 60146-1-1 Semiconductor converters
		UL 347A MV drives (4.16kV models only)
		UL 508C power conversion equipments (4.16kV models only)
	<b>MV transformer</b>	IEC/EN 60076 -1, -11
		IEC/EN 60146-1-3
		IEC/EN 61378-1
		UL 1562 (4.16kV models only)

[1] Other configurations, consult Power Electronics.

[2] Harmonics are below the limits defined in IEEE519 for all  $I_{SC}/I_L$ .

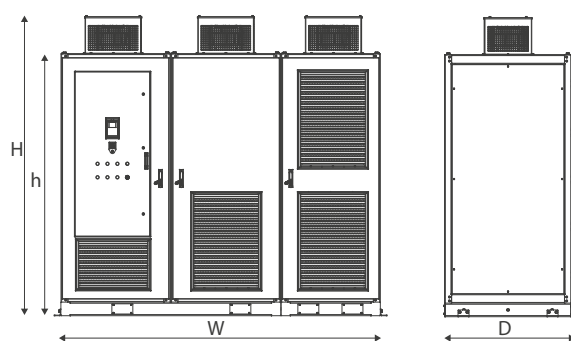
## TECHNICAL CHARACTERISTICS

**XMV660 - CONFIGURATION TABLE**

X66	1000		A		66		5		4		H		
XMV660 Series	Active Power (kW)		Cells Max. Amps		Output voltage (kV)		Overload		Degree of protection		Grid voltage (kV)		
X66	0150	150	A	120	23	2.3	2	120%	1	UL NEMA1	X	Low voltage	
	...	...	B	200	30	3	5	150%	3	UL NEMA3R	A	2.3	
	1000	1000	C	300	33	3.3	B	Starting Model	4	IEC IP41	B	3	
	1100	1100	D	450	38	3.8	...	Under request	5	IEC IP54	C	3.3	
	1200	1200	E	630	41	4.1			...	Under request	D	3.8	
	...	...	F	900	60	6	E		4.1				
	9000	9000	G	1250	63	6.3	F		6				
	10M0	10000	H	1500	66	6.6	G		6.3				
	12M5	12500	Regenerative		69	6.9	H		6.6				
	24M5	24500	R	120	10	10	I		6.9				
	...	Under request	S	200	11	11	J		10				
			T	300	13	13.8	K		11				
			U	450	...	Under request	L		13.8				
			V	630							M	15	
			W	900							...	Under request	
			X	1250									
			Y	1500									
			...	Under request									

Check the rated current of the motor nameplate and indicate the short circuit current to guarantee the compatibility with the selected drive.  
Consult configuration availabilities with Power Electronics.

## DIMENSIONS



Voltage	Rated Current		Width W (mm)	Depth D (mm)	Height h (mm)	Height H (mm)	Height RC <sup>[1]</sup> H (mm)	Weight <sup>[2]</sup> (kg)
	50°C Heavy duty	40°C Normal duty						
4.16kV	< 120A	<140A	2700	1200	2320	2650	2800	4900
	121A – 200A	141A-240A	4020	1425	2320	2650	2800	6900
	201A – 300A	241A-360A	4390	1425	2370	2790	2930	10600
	> 300A	>360	Under request					
6.6kV	< 120A	<140A	3420	1200	2320	2650	2800	5500
	121A – 200A	141A-240A	4580	1425	2320	2650	2800	7400
	201A – 300A	241A-360A	5685	1425	2370	2790	2900	11000
	> 300A	>360	Under request					

[1] Total height with redundant cooling option (RC). Dimensions valid for aluminum transformer, A power module type and 120% overload.

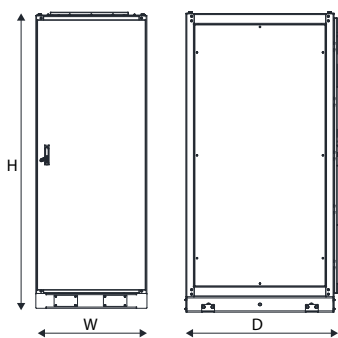
[2] Final weight will depend about the options, power and transformer material.

# PROTECTION CELL XMV660 - CONFIGURATION TABLE

X66R	300		3		4		IA		F		O	
XMV660 Protection module	Rated current <sup>[1]</sup> (A)		Rated voltage (kV)		Degree of protection		Configuration		Earth switch and Fuses		Cables access	
X66R	045	45	1	3.6	1	NEMA1	CL	Fixed line contactor	O	-	O	Bottom
	050	50	2	4,76	3	NEMA3R	CX	Withdrawable line contactor	F	Fuses	T	Top input bottom output
	055	55	3	7.2	4	IEC IP44	XX	Line contactor and withdrawable bypass	E	Earth	U	Top both
	--	---	4	8.25	5	IEC IP54	IX	Withdrawable VCB	G	F+E	S	Side
	120	120	5	12	...	Under request	SI	On/Off/Earth input & output	I	On/Off/Earth input & output	B	Bus bars
	200	200	6	15			IA	Automatic circuit breaker	M	On/Off/Earth input & output	...	Under request
	300	300	7	17.5			SE	Disconnecter and Earth	...	Under request		
	450	450	...	Under request			BP	Line contactor and bypass				
	630	630					...	Under request				
	900	900										
	K00	1000										
	K25	1250										
	K50	1500										
	2K0	2000										
...	Under request											

[1] Check the rated current of the motor nameplate and indicate the short circuit current to guarantee the compatibility with the selected protection module. Consult availability with Power Electronics. Please consult Power Electronics with your additional demands.

## DIMENSIONS



Configuration	Width W (mm)	Depth D (mm)	Height H (mm)
Frame 1	715	1200/1425	2320/2370
Frame 2	900	1200/1425	2320/2370
Frame 3	995	1200/1425	2320/2370

[1] Check the rated current of the motor nameplate and indicate the short circuit current to guarantee the compatibility with the selected drive.

[2] Consult availability with Power Electronics. Please consult Power Electronics with your demands.



TECHNICAL CHARACTERISTICS

STANDARD RATINGS - XMV660

XMV660 2.3kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW)	(HP) <sup>[1]</sup>
X660149A 23	50	149	200
X660186A 23	60	186	250
X660224A 23	70	224	300
X660261A 23	80	261	350
X660298A 23	90	298	400
X660336A 23	100	336	450
X660373A 23	120	373	500
X660447B 23	140	447	600
X660522B 23	170	522	700
X660597B 23	190	597	800
X660671C 23	210	671	900
X660746C 23	230	746	1000
X660932C 23	300	932	1250
X661119D 23	350	1119	1500
X661305D 23	410	1305	1750
X661491E 23	470	1491	2000
X661678E 23	530	1678	2250
X661864E 23	590	1864	2500

[1] HP standard motor rated power (cos φ • Eff = 0.8, 2.3kV)

XMV660 3kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[2]</sup>	(HP)
X660200A 30	50	200	268
X660250A 30	60	250	335
X660315A 30	75	315	422
X660355A 30	85	355	476
X660400A 30	100	400	536
X660450A 30	110	450	603
X660500A 30	120	500	671
X660560B 30	135	560	751
X660630B 30	150	630	845
X660710B 30	170	710	952
X660800B 30	200	800	1073
X660900C 30	220	900	1207
X661000C 30	240	1000	1341
X661250C 30	300	1250	1676
X661400D 30	340	1400	1877
X661600D 30	390	1600	2146
X661800D 30	430	1800	2414
X662000E 30	480	2000	2682
X662240E 30	540	2240	3004
X662500E 30	600	2500	3353

[2] kW standard motor rated power (cos φ • Eff = 0.8, 3kV)

XMV660 3.3kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[3]</sup>	(HP)
X660200A 33	45	200	268
X660250A 33	55	250	335
X660315A 33	70	315	422
X660355A 33	80	355	476
X660400A 33	90	400	536
X660450A 33	100	450	603
X660500A 33	110	500	671
X660560A 33	120	560	751
X660630B 33	140	630	845
X660710B 33	150	710	952
X660800B 33	175	800	1073
X660900B 33	200	900	1207
X661000C 33	220	1000	1341
X661250C 33	270	1250	1676
X661400C 33	310	1400	1877
X661600D 33	350	1600	2146
X661800D 33	400	1800	2414
X662000D 33	440	2000	2682
X662240E 33	490	2240	3004
X662500E 33	550	2500	3353

[3] kW standard motor rated power (cos φ • Eff = 0.8, 3.3kV)

XMV660 4.16kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW)	(HP) <sup>[4]</sup>
X660298A 41	50	298	400
X660336A 41	60	336	450
X660373A 41	70	373	500
X660447A 41	80	447	600
X660522A 41	90	522	700
X660597A 41	100	597	800
X660671A 41	120	671	900
X660746B 41	130	746	1000
X660932B 41	160	932	1250
X661119B 41	200	1119	1500
X661305C 41	230	1305	1750
X661491C 41	260	1491	2000
X661730C 41	300	1730	2320
X661864D 41	320	1864	2500
X662051D 41	360	2051	2750
X662237D 41	390	2237	3000
X662610D 41	450	2610	3500
X662983E 41	520	2983	4000
X663356E 41	580	3356	4500

[4] HP standard motor rated power (cos φ • Eff = 0.8, 4.16kV)

XMV660 6kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[5]</sup>	(HP)
X660400A 60	50	400	536
X660450A 60	55	450	603
X660500A 60	60	500	671
X660560A 60	70	560	751
X660630A 60	80	630	845
X660710A 60	85	710	952
X660800A 60	100	800	1073
X660900A 60	110	900	1207
X661000A 60	120	1000	1341
X661250B 60	150	1250	1676
X661400B 60	170	1400	1877
X661600B 60	190	1600	2146
X661800C 60	220	1800	2414
X662000C 60	240	2000	2682
X662240C 60	270	2240	3004
X662500C 60	300	2500	3353
X662800D 60	340	2800	3755
X663150D 60	380	3150	4224
X663550D 60	430	3550	4761
X664000E 60	480	4000	5364
X664500E 60	540	4500	6035
X665000E 60	600	5000	6705

[5] kW standard motor rated power (cos φ • Eff = 0.8, 6kV)

XMV660 6.6kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[6]</sup>	(HP)
X660400A 66	45	400	536
X660450A 66	50	450	603
X660500A 66	55	500	671
X660560A 66	60	560	751
X660630A 66	70	630	845
X660710A 66	80	710	952
X660800A 66	90	800	1073
X660900A 66	100	900	1207
X661000A 66	110	1000	1341
X661250B 66	140	1250	1676
X661400B 66	150	1400	1877
X661600B 66	180	1600	2146
X661800B 66	200	1800	2414
X662000C 66	220	2000	2682
X662240C 66	250	2240	3004
X662500C 66	270	2500	3353
X662800C 66	300	2800	3755
X663150D 66	350	3150	4224
X663550D 66	390	3550	4761
X664000D 66	440	4000	5364
X664500E 66	500	4500	6035
X665000E 66	550	5000	6705

[6] kW standard motor rated power (cos φ • Eff = 0.8, 6.6kV)

XMV660 10kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[7]</sup>	(HP)
<b>X660315A 10</b>	<b>20</b>	<b>315</b>	<b>422</b>
X660355A 10	25	355	476
X660400A 10	30	400	536
X660500A 10	35	500	671
X660560A 10	40	560	751
X660630A 10	45	630	845
X660710A 10	50	710	952
X660800A 10	60	800	1073
X660900A 10	65	900	1207
X661000A 10	70	1000	1341
X661250A 10	90	1250	1676
X661400A 10	100	1400	1877
X661600A 10	115	1600	2146
X661800B 10	130	1800	2414
X662000B 10	145	2000	2682
X662240B 10	160	2240	3004
X662500B 10	180	2500	3353
X662800B 10	200	2800	3755
X663150C 10	230	3150	4224
X663550C 10	260	3550	4761
X664000C 10	290	4000	5364
X664500D 10	325	4500	6035
X665000D 10	360	5000	6705
X665600D 10	400	5600	7510

[7] kW standard motor rated power (cos φ • Eff = 0.8, 10kV)

XMV660 11kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[8]</sup>	(HP)
X660315A 11	20	315	422
X660355A 11	23	355	476
X660400A 11	25	400	536
X660500A 11	30	500	671
X660560A 11	35	560	751
X660630A 11	40	630	845
X660710A 11	45	710	952
X660800A 11	50	800	1073
X660900A 11	60	900	1207
X661000A 11	65	1000	1341
X661250A 11	80	1250	1676
X661400A 11	90	1400	1877
X661600A 11	100	1600	2146
X661800A 11	120	1800	2414
X662000B 11	130	2000	2682
X662240B 11	150	2240	3004
X662500B 11	165	2500	3353
X662800B 11	185	2800	3755
X663150C 11	210	3150	4224
X663550C 11	230	3550	4761
X664000C 11	260	4000	5364
X664500C 11	300	4500	6035
X665000D 11	330	5000	6705
X665600D 11	370	5600	7510

[8] kW standard motor rated power (cos φ • Eff = 0.8, 11kV)



# VS65

MEDIUM VOLTAGE ELECTRONIC SOFT STARTER

## THE MOST RELIABLE AND SAFE CUSTOMER ORIENTED SOLUTION

Power Electronics' VS65 medium voltage soft starter is the most reliable and safest solution, fully flexible with a customized arrangement of MV cells. Applications range from 2.3kV to 13.8kV and the VS65 combines outstanding design and hardware under the most stringent IEC regulations, using advanced technology motor control and safety, allowing for smooth starts and stops under any circumstances.

The VS65 series have been designed and tested under the most demanding environments, together with an easy to use robust interface unit which allows the user to configure the ultimate motor control and safety protection, taking care of your valuable rotating assets. The VS65 is compartmentalised in 4 independent arc-resistant sections that cleverly isolate the medium voltage parts from the low voltage control sections. Fiber optic communications between the control board and the power stage offering the maximum safety and immunity levels.

Our vertical integration production strategy and a dedicated project department allow us to offer customized equipment such as input MV protection cells, user terminal strips, communications protocols, ... the VS65 by Power Electronics is your fully integrated tailor made solution, manufactured and factory tested, together with the most reliable warranty and unique on-site technical service.

# TOPOLOGY

Highest operation safety with internal arc approved.

## SCR POWER STAGE

The power stage consists of high voltage anti-parallel pairs of SCR, which are connected in series depending on the rated voltage. Available from 2,3kV to 13.8kV. Our heavy duty design has a maximum overload capacity of 500% In.

The VS65 takes care of its thyristors at any load and temperature condition by means of its built-in SCR snubber circuit and hardware protections. The Snubber circuit balances and protects the SCR stacks to enable a safe start and stop under any circumstance.

Located above the power stage is the trigger circuit. This board communicated through fibre optic to the main control board that precisely sends the triggering pulses to perform a soft start. A fibre optic communication offers maximum safety, total immunity to noise and fast communication rates.

## MV CONNECTION AND VACUUM CONTACTORS

The input and output bus bars are tailor made to be ready to plug in to your mains. Top and bottom and either cable or copper bus bar connection options are available.

The VS65 integrates built-in as standard two MV vacuum contactors (line and bypass). The START command initialises the starting sequence by enabling the line contactor, and then the pre-configured soft start is performed. Once the motor reaches the designated point, the bypass contactor is enabled and the line contactor is opened.

This topology isolates the thyristors from the mains at rated speed, hence the VS65 offers 100% efficiency with maximum reliability and protection.

## LV USER INTERCONNECTION AND INTERFACE

The user has easy frontal and safe access to the terminal strip (I/O signals) where the centralised control signals will be connected.

The front panel integrates built-in as standard: 3 push buttons (start, stop, E-stop), 1 start mode selector (LOC, REM, STOP), 5 status pilots lamps (running, stop, ready, power supply, warning). Additionally the user can easily configure the soft starter due to its intuitive backlit display and comprehensive documentation.

TRIGGER CIRCUIT

SCR STACKS

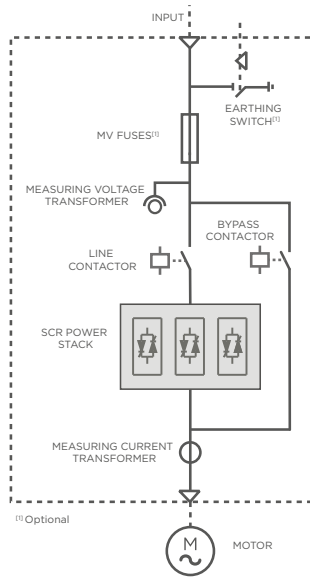
MV TRANSFORMER FOR AUXILIARY POWER SUPPLY



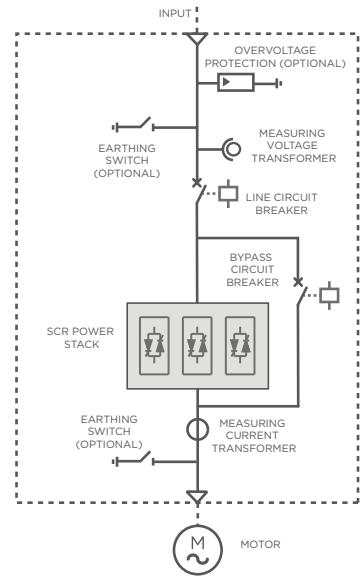


OPERATIONAL DIAGRAM

2.3kV to 11kV



13.8kV



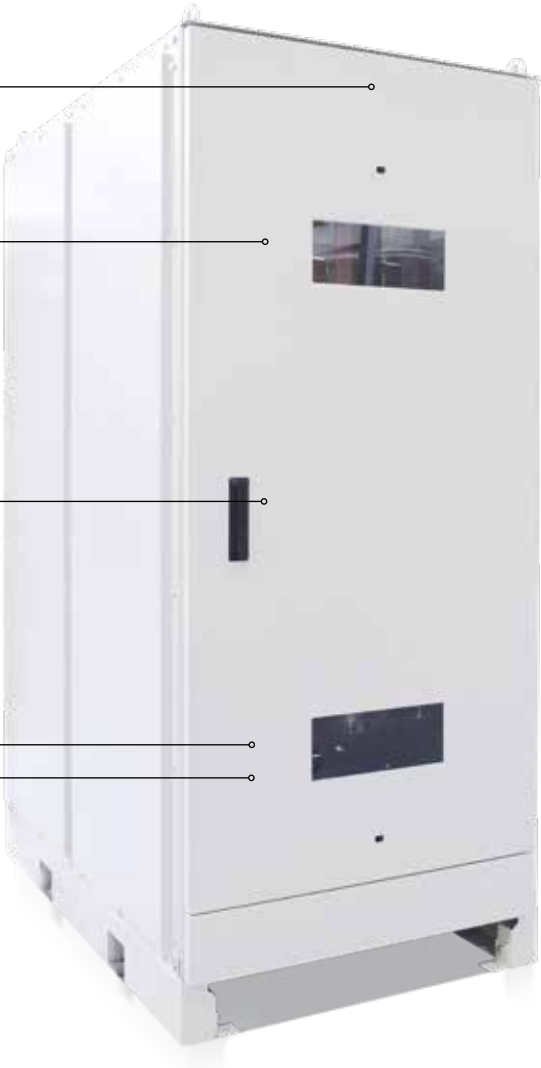
EXPLOSION RELEASE DUCTS

LINE VACUUM CONTACTOR

BYPASS VACUUM CONTACTOR

OUTPUT BUSBAR

INPUT BUSBAR



## MAXIMUM SAFETY

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**The VS65 has been designed under the stringent IEC and EN standards and regulations, hence minimising the inherent risk of medium voltage equipment.**

**Maximum safety and outstanding features designed for the most demanding industry**

- Independent sections isolate terminal strip and interface, from medium voltage equipment.
- Mechanic interlock or by procedure that avoid unexpected door opening that give access to live parts of the equipment.
- Optional input grounding switch that connects to ground each phase avoiding unexpected reconnections during maintenance.
- Pre start low voltage test by using a LV motor allows a safely fully functional performance test including: plant control integration, enabling bypass and line contactors, I/O settings and thyristor firing.
- Explosion proof cabinet resistant to internal shortcircuit. The energy generated is released through a dedicated duct on the top, therefore avoiding any personal injury.
- BIL rating up to 50kV for safety and reliability. Clearance and creepage distances oversizing offers maximum safety.
- Factory tested at full current and optionally specific witness testing available.
- Power Electronics personnel is present in every commissioning to get the most to your application.

## MAXIMUM MOTOR CARE AND SOFT STARTER PROTECTION

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**The VS65 soft starter includes built-in as standard the ultimate motor and soft starter protections, features that allow it to act as a motor protection relay.**

### STANDARD MOTOR AND SOFT STARTER PROTECTIONS

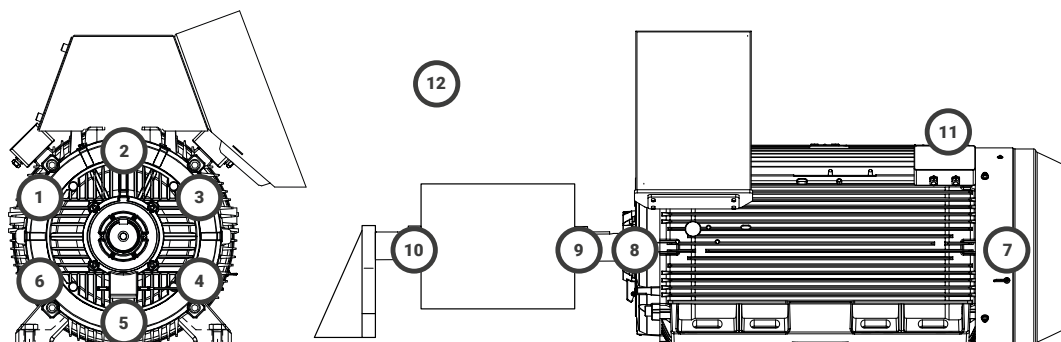
- Motor start delay
- Door open sensor
- Accelerating and decelerating control
- Starting to running transition
- SCRs over temperature
- Low input voltage
- Under-load protection
- Local and remote control selector
- Current imbalance
- Phase rotation
- Locked rotor / incomplete sequence
- i2t Electronic motor over load
- Instantaneous electronic over current trip / Shearpin
- Motor overcurrent
- Over voltage protection
- Input phase loss
- Controlled stopping ramp
- Starts per hour - Notching and jogging
- Communication loss
- Local emergency stop
- Line contactor
- Remote emergency stop
- Excessive start time (max. 120s)

### OPTIONAL

- Input automatic circuit breaker, fuses, on-load disconnect or contactor
- Grounding switch
- Instantaneous ground fault detection
- Stator and bearing RTD protection
- Power factor protection
- Automatic circuit breaker, fuses and contactor status indicator
- Over and under frequency protection

### REMOTE RTD SENSORS (OPTIONAL). Continuous current and voltage monitoring

- |                     |                     |                           |
|---------------------|---------------------|---------------------------|
| 1. Stator Winding 1 | 5. Stator Winding 5 | 9. Application Bearing 1  |
| 2. Stator Winding 2 | 6. Stator Winding 6 | 10. Application Bearing 2 |
| 3. Stator Winding 3 | 7. Motor Bearing 1  | 11. Case                  |
| 4. Stator Winding 4 | 8. Motor Bearing 2  | 12. Ambient               |





## RELIABILITY

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**Our record in industrial technical service has set the boundaries to all of our designs in terms of reliability. Hence, we offer the most comprehensive and extended warranties of the market.**

#### **Totally sealed and conformally coated electronics.**

- Electronics conformally coated with military and aerospace technology (IEC61086-1:2004, -3-1) and totally sealed, allow to be installed in harsh environments.
- Heavy duty SCR design (125% continuous, 500% 5s and 50°C) and high inverse peak voltage without reactors (chokes).
- IP44 and optional IP54 degree of protection. No dust filters that is suitable for humid and polluted environments.
- EMC cabinet design to offer maximum immunity and minimum emissions.
- Line and bypass vacuum contactors isolate the power stage in running mode against mains disturbances.
- Copper busbars that can withstand from 40kA to 80kA short circuit currents.

<b>Rated voltage</b>	<b>SCR pairs in series</b>	<b>SCRs Inverse Peak Voltage</b>
2.3kV	1	6.500V
3.3kV/4.16kV	2	13.000V
5kV/5.5kV/6kV/6.6kV	3	18.000V
10kV	4	26.000V
11kV	5	32.500V
13.8kV	6	39.000V

## MULTIPLE FEATURES

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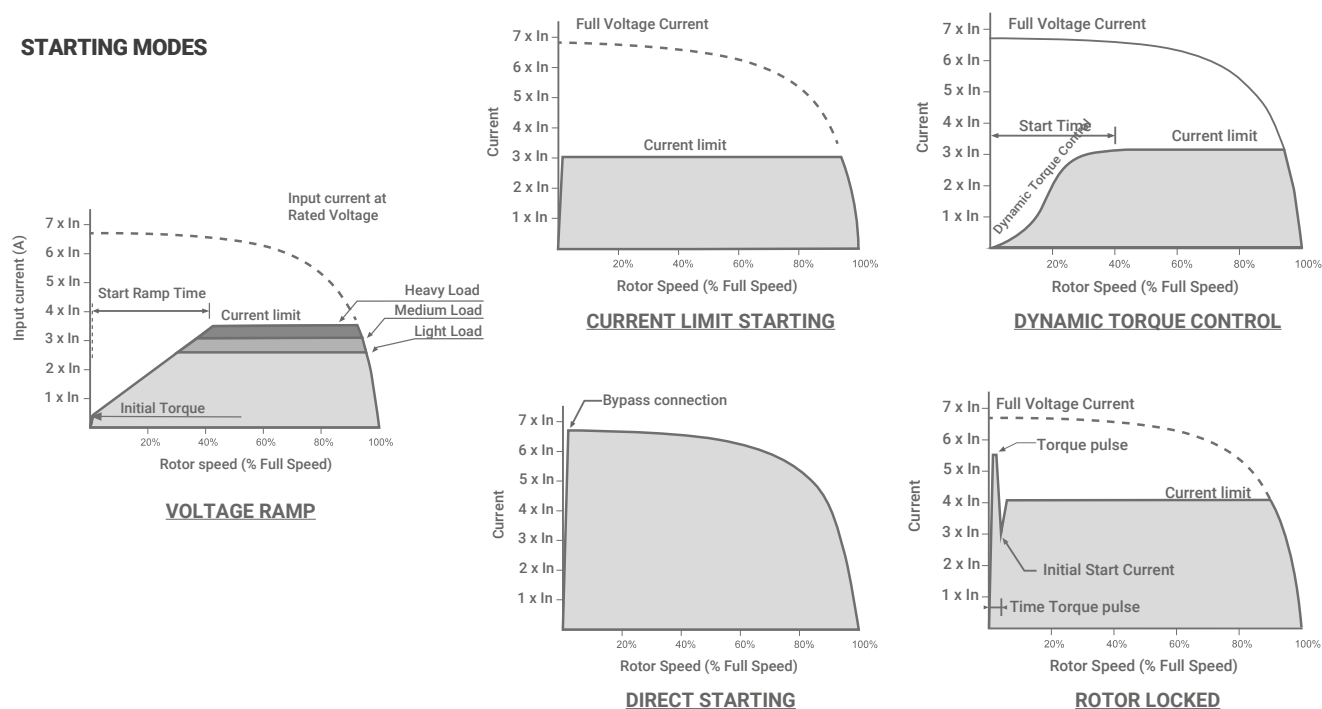




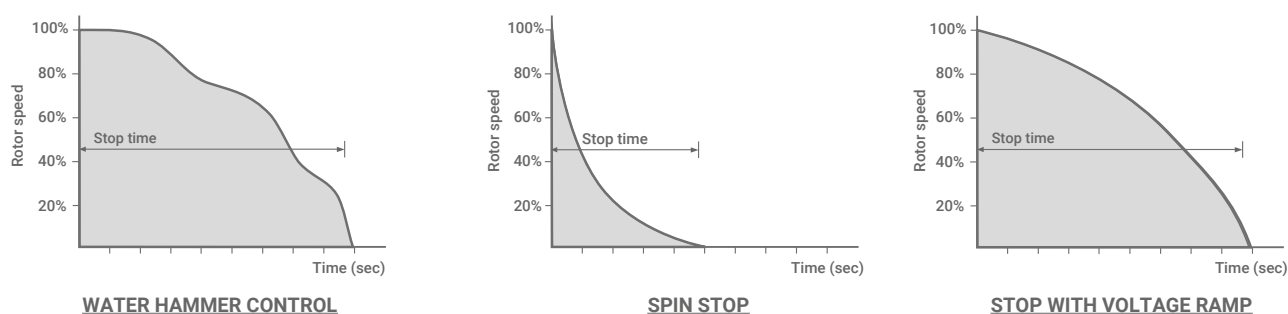
**A high investment in the development of control software has lead to them most accurate, powerful and flexible performance.**

The VS65 soft starter gets the most from your facilities, by implementing the unique dynamic torque control algorithm (CDP) that offers an ultimate break away torque and starts the most demanding applications. Some of the starting and stopping extended settings are:

### STARTING MODES



### STOP MODES



The VS65 soft starter offers a double independent setting of the start and stop parameters, which permits the soft starter to shift performance according to the conditions: loaded or unloaded, raw material conditions, static pressure, temperature variations, blocked shaft, etc... the VS65 control allows the advanced users to adjust: torque pulse duration, break away torque and time, current limit, stop time, level and time of the overload and underload protections,  $i^2t$  overload curve, n° start per hour, minimum speed and water hammer control algorithm.

**Get the most of your application with the dual setting function.**

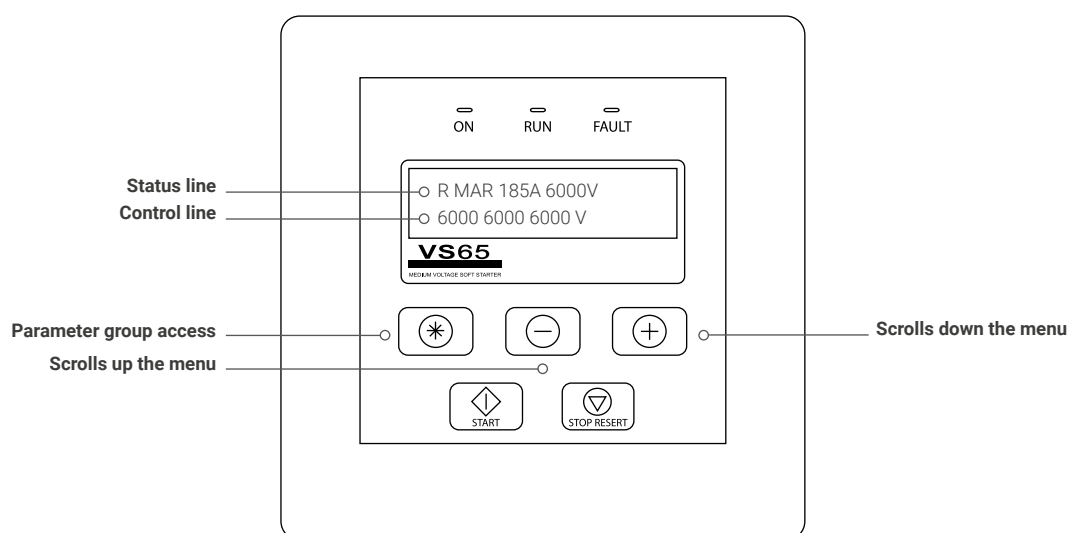
EASY TO DRIVE



The VS65 integrates an intuitive and dust resistant interface that includes backlit alphanumeric display with membrane keypad, status lights and pushbuttons that allow the user an easy operation and visualisation under the most demanding conditions.

## EASY TO USE

Local operation through display or pushbuttons, and remote operation through serial communication or I/O signals, can both be easy selected using the door mounted selector.



## COMMUNICATIONS

Modbus-RTU over serial communication (RS232/RS485) built-in as standard, optionally communications gateways are available: Ethernet TCP/IP, Profibus- DP and DeviceNet.

**PROFIPOWER:** Modbus RTU (RS485) to Profibus-DP (9 Pin D-SUB/F). Communication speed máx. 12MB, Profibus cable recommended.

**DEVICENET:** Modbus RTU (RS485) to Devicenet (CAN) gateway. 31 nodes maximum. Asynchronous communication control mode. Half Duplex communication system, Transmission type: Bus method, Multi drop Link system. Communication speed: 125kbps, 250kbps, 500kbps, 1000 kbps. Transmission distance max. 500m. (125kbps Devicenet cable).

**ETHERNET:** Modbus RTU (RS485) to Modbus TCP (Ethernet). Communication system: Half Duplex, Full Duplex. CSMA/CD communication method. Communication speed: 10Mbps, 100Mbps.





## TECHNICAL CHARACTERISTICS

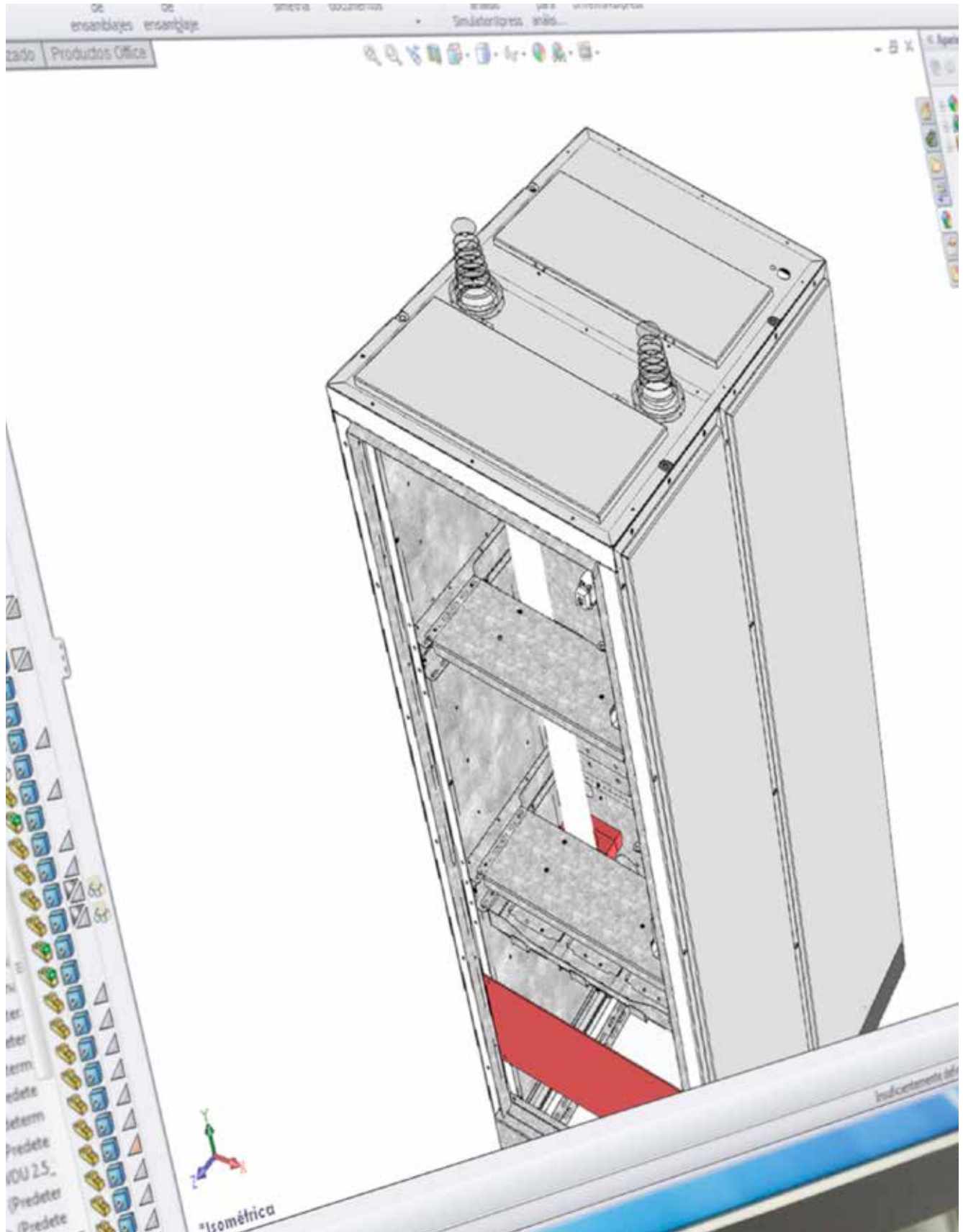
INPUT	Input voltage <sup>[1]</sup>	2,3kVca, 3kVca-3.3kVca, 4.16kVca, 5kVac-5.5kVac, 6kVca-6.6kVac, 10kVca-11kVca, 13.8kVca <sup>[1]</sup>
	Input frequency	47 ~ 62Hz
	Control voltage <sup>[1]</sup>	230Vac ±10%, 50Hz / 110Vac ±10%, 50Hz
	Phase sequence	Compatible with any phase sequence
	Transitory over voltage protection	Snubber network / Optional Surge arresters
OUTPUT	Efficiency (full load)	> 99.6%, 100% Bypass activated
	Overload	125% of the continuous rated value 100% to 500% (during 1 ~ 60s configurable)
	Bypass contactor	Capacity to start the motor in direct start mode
ENVIRONMENTAL CONDITIONS	Protection degree	IP44, IP54 (optional)
	Cooling system	Natural
	Work temperature	0°C to +50°C
	Storage temperature	-25°C to +55°C
	Humidity	5% - 95%, non condensing
	Altitude <sup>[1]</sup>	1000m, (reinforced isolation optional for 4500masl)
INTERCONNECTION	Painting <sup>[1]</sup>	RAL 7035, C4 corrosion (ISO 12944-2)
	Digital inputs	5 configurable input
	Analogue inputs	2 analogue inputs of 0-20mA or 4-20mA, 0-10V
	Output relays	3 switched relays (non-inductive 10A 250Vac)
OPERATION MODES	Analogue outputs	1 configurable output 0-20mA or 4-20mA
	Starting modes	Current limit starting
		Current ramp and current limit starting
		Dynamic torque control
		Initial torque pulse starting
		Direct starting
	Stop modes	Spin stop
		Stop by voltage ramp
		Stop by water hammer control
KEYPAD AND CONTROL PUSH BUTTONS	Display	Backlit, alphanumeric 2x16 characters
		5 keys: start, stop, access and scroll menu
		Status leds: ON: Green. Turned on indicates there is voltage in the control boards. RUN: Orange. Flashing shows when the motor accelerates or decelerates. When turned on indicates the motor is working. FAULT: Red. Indicates fault.
	Door mounted indicators and buttons (soft starter)	3 push buttons: Start, Stop and emergency stop
		1 starting mode selector
		7 status pilots (running, stopped, ready, power supply, alarm, line contactor and bypass contactor)
	Door mounted indicators and buttons (Optional Input module )	7 status pilots (Power supply L1/L2/L3, MV switches status on/off/loaded control voltage supply)
		3 push buttons: switch status, connection and disconnection
		1 selector of MV locking
	Display information	Current of the three phases
		Line average voltage
		Digital inputs and relays status
		Analogue inputs and outputs status
		Power supply and motor frequency
		Power factor
		Motor torque and power
		Fault history (5 last faults)
		Total and partial starts number
		Total and partial operation hours
		Partial motor consumption (kWh)

[1] Other configurations consult with Power Electronics.

COMMUNICATIONS	Standard Hardware	RS232 / RS485
	Optional Hardware	Ethernet / 9-Pin D-SUB/F
	Standard Protocol	Modbus-RTU
	Optional Protocol	Profibus DP, Devicenet, Ethernet, IEC 61850
	Control modes	Local: from keyboard and pushbuttons Remote: from the digital and analogic inputs. PLC: start / stop
STANDARD MOTOR PROTECTIONS <sup>[1]</sup>	Input phases sequence	
	High voltage	
	Input low voltage	
	Start current limit	
	Rotor locked	
	Motor overload (thermal model)	
	Under load	
	Unbalanced phases	
	Shearpin current	
	Maximum number of starts/hour	
	Other, consult Power Electronics	
SOFT STARTER PROTECTIONS	SCR overheat	
	Excessive start time (max 120s)	
	Input phase loss	
SOFT STARTER SETTINGS	Torque pulse	
	Initial torque	
	Initial torque time	
	Acceleration time	
	Current limit: 1 to 5·In	
	Overload: 0.8 to 1.2·In, Overload curve: 0 to 10	
	Deceleration time / Spin stop	
	Slow Speed(1/7 fundamental frequency)	
	Dual setting	
	Number of Starts/hour allowed	
REGULATIONS	Torque control	
	Water hammer control	
	Certification	CE
	Designed as	EMC Directive (2004/108/CE) EN61000-6-2, -4
	Design and construction	EN62271-1,-200 EN60071-1,-2

## CUSTOMIZED SOLUTIONS

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**High value medium voltage projects often require customer specific solutions. Our team of highly experienced engineers are available to modify our standard products to suit your specific demands to ensure you get the product you need.**

#### Reactive power compensation module

- Medium voltage line fuses
- Withdrawable vacuum contactors
- Current limit inductances
- Medium Voltage capacitor banks

#### Input protection module

- Automatic Circuit Breaker (VCB)
- Medium Voltage Line Fuses
- Withdrawable vacuum contactors
- Earthing switch
- Commutation MV cabin
- Surge arresters
- Line switch with earthing

#### Cabinet features

- Special RAL, special labelling and warning labels
  - Incoming MV cable or busbar connection from top, right or backside
  - Lined up soft starters with common main input busbar and protection
- "Run busbar"

#### Documentation

- Electrical and dimensional drawings
- ITP reports
- Witness factory Acceptance test (FAT)
- ....

#### Customized control and pushbuttons

- Selectors and pushbuttons
- Digital and analogue I/O pre-configuration
- Customized user terminal strip
- PTC and PT100 relays
- Instantaneous ground fault protection relay
- Specific external Power Supply (UPS, 110Vac,...)
- Optional communication protocols (Profibus-DP, Devicenet, Modbus TCP,...)
- Soft starter's and motor's heating resistor control

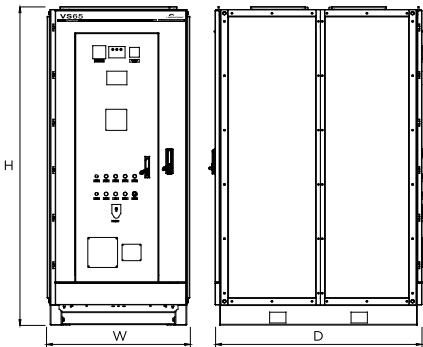


TECHNICAL CHARACTERISTICS

CONFIGURATION TABLE - VS65 SOFT STARTER MODULE

V65	200		4		4		CL		F		3		0					
VS65 Series	Rated output current <sup>(1)</sup> (A)		Rated input voltage (kV)		Degree of protection		Configuration		Earth switch + Fuses		Isolation (kV)		Power cable access					
V65	045	45	2	2.3	1	NEMA1	CL	Fixed - Line contactor	O	O	1	3.6	O	Bottom				
	050	50	3	3/3.3	3	NEMA3R	CX	Withdrawable - Line contactor/ Fixed bypass	F	Fuses	2	4,76	T	Top input bottom output				
	055	50	4	4.1	4	IEC IP41	XX	Line contactor and withdrawable bypass	S	On/Off/ Earth	3	7.2	U	Top both				
	...	...	5	5/5.5	5	IEC IP54	IA	Fixed - Line circuit breaker	E	Earth	4	8.25	S	Side				
	120	120	6	6/6.3/6.6	...	Under request	IX	Withdrawable - Line circuit breaker	G	F+E	5	12	B	Bus bars				
	200	200	8	10/11			...	Under request	H	F+S	6	15	...	Under request				
	300	300	9	13.2/13.8			...	Under request	7	17.5								
	450	450	...	Under request			...	Under request										
	630	630																
	900	900																
	K00	1000																
	K25	1250																
	...	Under request																
Check the rated current of the motor nameplate and indicate the short circuit current to guarantee the compatibility with the selected soft starter. Consult configuration availabilities with Power Electronics.																		

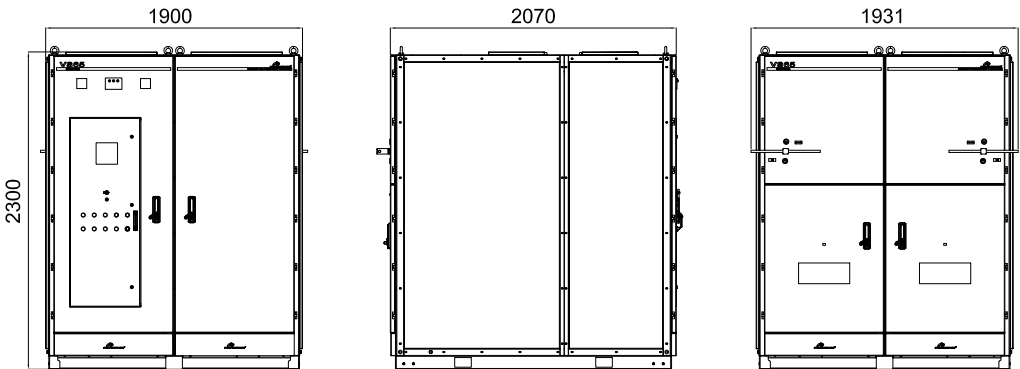
DIMENSIONS - VS65 SOFT STARTER MODULE - UP TO 6.6kV



VOLTAGE	CONFIGURATION	WIDTH W (mm)	DEPTH D (mm)	HEIGHT H (mm)
<4.16kV	CL, CL_F, CL_E	1050	1550	2300
	CL_S, CL_FS, CL_FE	1050	1820	2300
5kV-6.6kV	CL, CL_F	1050	1550	2300
	CL_E, CL_S	1050	1820	2300

NOTE Units In<300A. Other voltages and configurations consult Power Electronics.

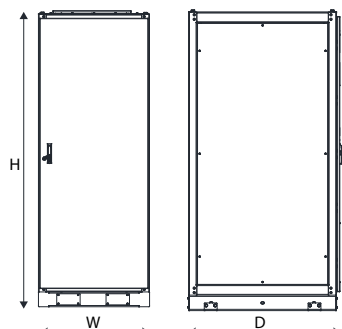
DIMENSIONS - VS65 SOFT STARTER MODULE - UP TO 13.8kV



**CONFIGURATION TABLE - PROTECTION CELL VS65R**

V65R	300		3		4		IA		F		O	
VS65 Protection module	Rated current <sup>[1]</sup> (A)		Rated voltage (kV)		Degree of protection		Configuration		Earth switch and Fuses		Cables access	
V65R	045	45	1	3.6	4	IEC IP44	CL	Fixed line contactor	O	-	O	Bottom
	050	50	2	4,76	5	IEC IP54	CX	Withdrawable line contactor	F	Fuses	T	Top input bottom output
	055	55	3	7.2	...	Under request	XX	Line contactor and withdrawable bypass	E	Earth	U	Top both
	--	---	4	8.25			IX	Withdrawable VCB	G	F+E	S	Side
	120	120	5	12			SI	On/Off/Earth input & output	I	On/Off/Earth input & output	B	Bus bars
	200	200	6	15			IA	Automatic circuit breaker	M	On/Off/Earth input & output	...	Under request
	300	300	7	17.5			SE	Disconnecter and Earth	...	Under request		
	450	450	...	Under request			PF	Reactive power capacitors + Fuses + Contactor + Choke				
	630	630					BP	Line contactor and bypass				
	900	900					...	Under request				
	K00	1000										
	K25	1250										
	K50	1500										
	2K0	2000										
	...	Under request										

Check the rated current of the motor nameplate and indicate the short circuit current to guarantee the compatibility with the selected soft starter.  
Consult configuration availabilities with Power Electronics.

**DIMENSIONS - PROTECTION CELL VS65R**

CONFIGURATION	WIDTH W (mm)	DEPTH D (mm)	HEIGHT H (mm)
<7.2kV	900	1550/1820	2320
>7.2kV	1050	1550/1820	2300



TECHNICAL CHARACTERISTICS

STANDARD RATINGS - VS65

VS65 2.3kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW)	(HP) <sup>[1]</sup>
V65040 2	40	149	200
V65050 2	50	186	250
V65060 2	60	224	300
V65070 2	70	261	350
V65090 2	90	298	400
V65100 2	100	336	450
V65110 2	110	373	500
V65130 2	130	447	600
V65150 2	150	522	700
V65170 2	170	597	800
V65190 2	190	671	900
V65210 2	210	746	1000
V65270 2	270	932	1250
V65320 2	320	1119	1500
V65370 2	370	1305	1750
V65420 2	420	1491	2000
V65480 2	480	1678	2250
V65530 2	530	1864	2500
V65590 2	590	2051	2750

[1] HP standard motor rated power (cos φ = 0.88, 2.3kV)

VS65 3kV–3.3kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[2]</sup>	(HP)
V65040 3	40	200	268
V65050 3	50	250	335
V65060 3	60	315	422
V65070 3	70	355	476
V65080 3	80	400	536
V65090 3	90	450	603
V65100 3	100	500	670
V65110 3	110	560	751
V65120 3	120	630	845
V65140 3	140	710	952
V65160 3	160	800	1073
V65180 3	180	900	1207
V65200 3	200	1000	1341
V65250 3	250	1250	1676
V65280 3	280	1400	1877
V65320 3	320	1600	2145
V65360 3	360	1800	2413
V65400 3	400	2000	2681
V65450 3	450	2240	3003
V65500 3	500	2500	3352
V65560 3	560	2800	3754

[2] kW standard motor rated power (cos φ = 0.88, 3.3kV)

VS65 4.16kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW)	(HP) <sup>[3]</sup>
V65050 4	50	298	400
V65055 4	55	336	450
V65060 4	60	373	500
V65070 4	70	447	600
V65080 4	80	522	700
V65095 4	95	597	800
V65110 4	110	671	900
V65120 4	120	746	1000
V65150 4	150	932	1250
V65180 4	180	1119	1500
V65210 4	210	1305	1750
V65240 4	240	1491	2000
V65270 4	270	1678	2250
V65300 4	300	1864	2500
V65320 4	320	2051	2750
V65350 4	350	2237	3000
V65410 4	410	2610	3500
V65470 4	470	2983	4000
V65530 4	530	3356	4500
V65590 4	590	3728	5000

[3] HP standard motor rated power (cos φ = 0.88, 4.16kV)

VS65 5-5.5kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[4]</sup>	(HP)
V65050 5	50	400	536
V65055 5	55	450	603
V65060 5	60	500	671
V65065 5	65	560	751
V65075 5	75	630	845
V65085 5	85	710	952
V65095 5	95	800	1073
V65110 5	110	900	1207
V65120 5	120	1000	1341
V65150 5	150	1250	1676
V65170 5	170	1400	1877
V65190 5	190	1600	2146
V65220 5	220	1800	2414
V65240 5	240	2000	2682
V65270 5	270	2240	3004
V65300 5	300	2500	3353
V65330 5	330	2800	3755
V65380 5	380	3150	4224
V65420 5	420	3550	4761
V65480 5	480	4000	5364
V65540 5	540	4500	6035
V65600 5	600	5000	6705

[4] kW standard motor rated power (cos φ = 0.88, 5.5kV)

VS65 6kV – 6.6kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[5]</sup>	(HP)
V65040 6	40	400	536
V65045 6	45	450	603
V65050 6	50	500	671
V65055 6	55	560	751
V65060 6	60	630	845
V65070 6	70	710	952
V65080 6	80	800	1073
V65090 6	90	900	1207
V65100 6	100	1000	1341
V65125 6	125	1250	1676
V65140 6	140	1400	1877
V65160 6	160	1600	2146
V65180 6	180	1800	2414
V65200 6	200	2000	2682
V65220 6	220	2240	3004
V65250 6	250	2500	3353
V65280 6	280	2800	3755
V65300 6	300	3150	4224
V65350 6	350	3550	4761
V65400 6	400	4000	5364
V65450 6	450	4500	6035
V65500 6	500	5000	6705
V65560 6	560	5600	7510

[5] kW standard motor rated power (cos φ = 0.88, 6.6kV)

VS65 10kV – 11kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[6]</sup>	(HP)
V65020 8	20	355	476
V65025 8	25	400	536
V65030 8	30	500	671
V65035 8	35	630	845
V65040 8	40	710	952
V65050 8	50	800	1073
V65055 8	55	900	1207
V65060 8	60	1000	1341
V65075 8	75	1250	1676
V65085 8	85	1400	1877
V65095 8	95	1600	2146
V65110 8	110	1800	2414
V65120 8	120	2000	2682
V65135 8	135	2240	3004
V65150 8	150	2500	3353
V65170 8	170	2800	3755
V65190 8	190	3150	4224
V65210 8	210	3550	4761
V65240 8	240	4000	5364
V65270 8	270	4500	6035
V65300 8	300	5000	6705
V65340 8	340	5600	7510
V65380 8	380	6300	8449

[6] kW standard motor rated power (cos φ = 0.88, 11kV)

VS65 13.8kV - NEMA			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) <sup>[7]</sup>	(HP)
V65040 138	40	746	1000
V65050 138	50	932	1250
V65060 138	60	1119	1500
V65070 138	70	1305	1750
V65080 138	80	1491	2000
V65090 138	90	1678	2250
V65100 138	100	1864	2500
V65120 138	120	2237	3000
V65140 138	140	2610	3500
V65160 138	160	2983	4000
V65180 138	180	3356	4500
V65200 138	200	3728	5000
V65220 138	220	4101	5500
V65240 138	240	4474	6000
V65270 138	270 <sup>[8]</sup>	5220	7000
V65310 138	310 <sup>[8]</sup>	5966	8000

[7] kW standard motor rated power (cos φ = 0.8, 13.8kV).

[8] Overload capacity limited.

Request your quote by filling the Ordering info template; please consult Power Electronics with your additional demands.

Soft starters over 400A and 7.2kV will be equipped with automatic circuit breaker instead of vacuum contactors and engineered under request, consult availability.

# INDUSTRIES



OIL & GAS

WATER

MINING AND CEMENT

POWER GENERATION

METALS







When security is paramount, the medium voltage VS65 soft starters and XMV660 variable speed drives provide a high level of integrity of software and hardware, which enables their integration into critical industries such as chemical plants, refineries, exploration and extraction, processing and packaging plants, LNG treatment and storage... XMV660m drives also offer custom solutions to operate with ATEX motors. The multi-level topology of the XMV660 generates a quasi-sine waveform, coupled with reduced  $dV/dt$  and lower THDi, minimises electrical stress on the motor mitigating the possibility of partial discharge. VS65 soft starter cabinets are designed in 4 independent arc-resistant sections for maximising safety.

## OIL & GAS

The design and the construction of the **XMV660** variable speed drive make it the ideal product for Oil & Gas pipelines, Gas Processing, LNG transportation, Refining and Petrochemical applications. Pumps, Compressors, Blowers and Cooling Fans are safely controlled by the XMV660 up to 15kV mains voltage with an input THD value lower than the 5% limit of IEEE-519 regulation. Fast installation allows quick start up. Safety systems, mechanical interlocks, password restricted settings access will protect your investment and personnel. Built-in web server easily connects the drive to the SCADA System.

For isolated sites, the XMV660 is available in the exclusive outdoor version. Customization capability within the cubicle arrangement allows the XMV660 to comply with your specific requirements and facilitate ease of integration into the plant lay-out.

The **VS65** soft starter ensures frequent trouble free motor startup eliminating inrush current and damaging torque surges. Applications like seawater injection pumps, gas compressors, hot oil and emergency fire pumps take advantage of the unique features of the VS65, including standard IP44 cabinet, easy programming and debugging, full accessibility to components for quick maintenance increasing efficiency and reducing system's downtimes.

Maximum safety and reliability is offered through an explosion proof cabinet, resistant to internal short-circuit, and oversized internal clearance distances.



Plant: CAB Poza Rica  
Location: Nuevo Teapa - Veracruz, Mexico  
Capacity: 2M barrels/day  
Oil pumps



Plant: Energy dock  
Location: Port of Barcelona  
Capacity: 544.3 GWh/day  
Liquified gas pumps



Plant: Ayatsil-B drilling platform  
Location: Bay of Campeche, Mexico  
Capacity: 150k barrels/day  
Air compressors



Plant: Sagunto regasification plant  
Location: Port of Sagunto  
Capacity: 267.000 m³ max. ship operation  
Liquified gas pumps





VS65 and XMV660 provide reliability and outstanding features aiming to optimise and increase safety in water applications. Well proven features in low voltage applications offer a wide number of possibilities in those high power applications that are driving the water life cycle.

## WATER

**XMV660** variable speed drive provides ideal features for the water, pump and irrigation sector.

- Accurate direct and reverse action of the PID control regulation of pressure, flow, level.
- Water hammer control to prevent catastrophic pipes or valves breakdowns.
- Power module and cooling redundancy increase plant's availability.
- Conformal coating on PCBs with military and aerospace technology.
- Multi-step topology by using 700V power modules that leads into a very low dV/dt, THDi and HVF. No motor cable length limitation, no dV/dt filters and no power derating on medium voltage motors.

- Direct programming in engineering units (l/s, m<sup>3</sup>/s, %, °C, ...).

Compatible with pulse measurement of the flow. Visualisation of working time per pump and number of starts.

- Operation in manual or automatic mode is up to you. Several Pump duty cycling modes for homogeneous ageing.

Redundant master-slave systems.

- Under-pressure and Over-pressure compensation, pipe filling function, sleep and wake functionality for extra energy saving depending on pressure and flow, out of service motor monitoring, head or pressure compensation depending on flow rate.

- Pump safety protections: clogging detection, cavitation with reset activation time, minimum pressure detection, over-pressure control, zero-flow detection...

**VS65** soft starter provides ideal features for water supply protecting your installation.

- Water Hammer control to prevent catastrophic pipes or valves breakdowns.
- Pipe filling function.
- Pump clogging detection due to the under and overpressure protections.
- Forward and reverse operation and torque pulse function.
- Double setting to adjust different pump performance depending on static pressure.
- Multi master-slave system working together in parallel.
- Visualisation of working time per pump and number of starts.
- Slow speed function for clearing blockages.



Facility: El Realito reservoir- water supply San Luis de Potosí and Guanajuato – CONAGUA  
Location: San Luis de la Paz (Mexico)  
Capacity: 86.400 m<sup>3</sup>/day



Facility: Irrigation community Canal Segarra Garrigues  
Location: Lleida (Spain)  
Capacity: 70.150 ha



Facility: Desalination plant Bajo Almanzora  
Location: Almeria (Spain)  
Capacity: 20 hm<sup>3</sup>/year



Facility: Tuaspring desalination plant  
Location: Singapore  
Capacity: 318,500m<sup>3</sup> a day



Facility: Water system Mexico DF  
Location: Mexico



Facility: EDAR Galindo Waste water treatment  
Location: Sestao, Spain  
Capacity: 350.000m<sup>3</sup>/day





Copper, gold, aluminium, iron, uranium and coal, leading mining companies already trust the VS65 and the XMV660 by Power Electronics due to the product reliability, performance and quality. Our unique mechanical and hardware design works perfectly in adverse situations and demanding applications. Altitude, dust, pollution, moisture or hazardous environments are easy challenges for the VS65 and the XMV660 series.

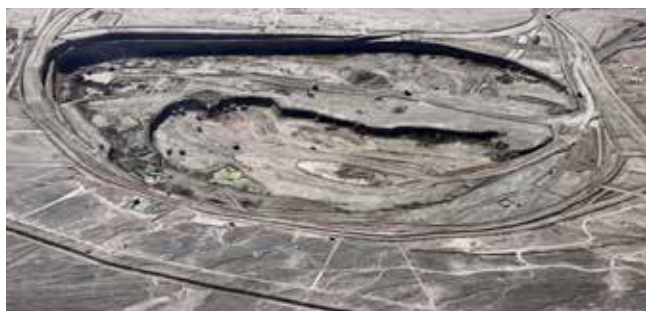
## MINING & CEMENT

**XMV660** variable speed drive offer the perfect solution for the requirements of the cement, mining and minerals industries.

- PMC-OLTQ (Power Motor Control-Open Loop Torque Control) over fiber optics communications provides unique master-slave performance in the most demanding applications, and guaranties a perfect torque distribution.
- Automatic jaw crusher or mill unclogging and conveyor unblocking.
- Precise and high starting torque features dedicated to heavy loaded lifting systems.
- Fast commissioning and rapid control response due to motor or belt parameter variation.
- High power factor and low THDi due to the in-line phase shift transformer from 18 to 54 pulses.
- Multi-step topology by using 700V power modules that leads to low dV/dt, THDi and HVF. No motor cable length limitation, no dV/dt filters or motor derating required.

**VS65** soft starter extensive experience and innovation helps mining and cement companies around the world to improve plant performance and production.

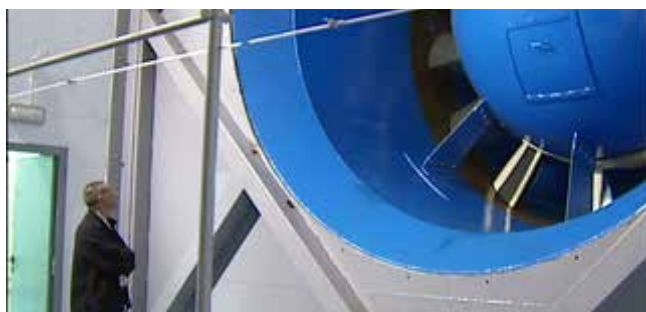
- Motor shaft unlocking by using either the torque pulse function or the direct on-line start.
- Accurate start and stop due to the dynamic torque control and the current limit functions, that reduce motor wear.
- Continuous thermal and electronic protection assures the integrity of your costly rotating assets.
- Constantly monitoring the motor and the application's duty cycle will help you follow performance trends and take remedial action before potential failures occur.
- Maximum efficiency and SCR protection due to the activation of the bypass vacuum contactor.
- Natural convection cooling without dust filters, 50°C operation without the need for fan replacement.
- Rugged and user friendly operator interface designed for the most demanding environments.



Plant: Ministro Hales Codelco North Division  
Location: Calama, II - Antofagasta, Chile  
Capacity: 200 kton fine copper



Plant: Zapolitic Cemex  
Location: Jalisco, Mexico  
Capacity: 30M tons/year

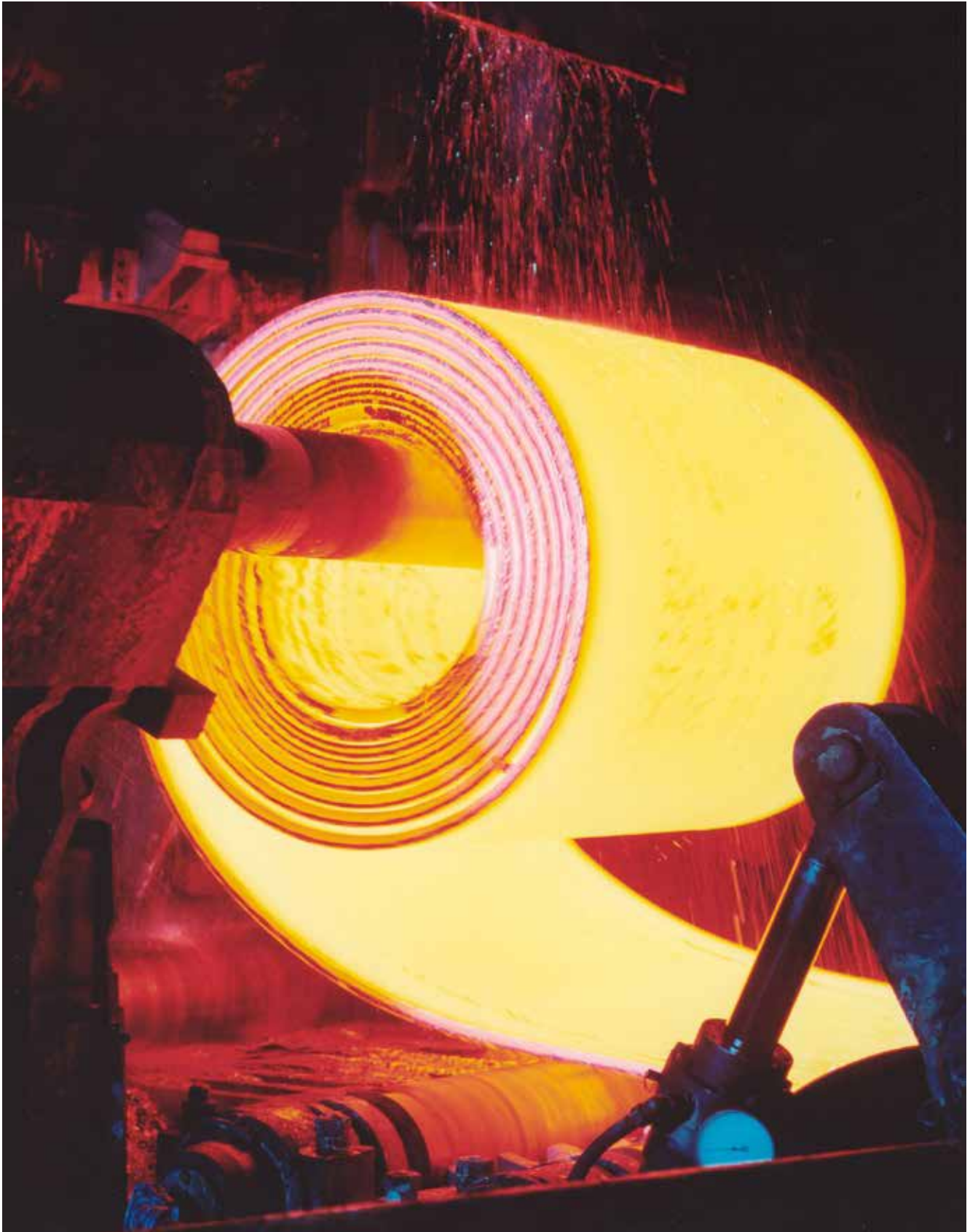


Plant: Underground mine  
Location: Siberia, Russia  
Fans



Plant: Yarwun - Refining of aluminium  
Location: Australia  
Capacity: 3.4M tons/year  
Bauxite slurry pumps





The Medium Voltage VS65 Soft Starters and XMV660 drives are designed for high reliability, the modular arrangement increases system availability, reduces spare parts inventory, and results in less downtime. The precise and rapid responses of the motor controllers are necessary features for demanding applications such as multiple motors controlled by electronic line shafting. Additionally, high torque at low speed, high overload capacity and torque distribution control make them suitable for the most demanding applications.

## METALS

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**The Steel & Metallurgy industries have a wide range of applications such as materials handling, material processing, many types of pumps, fans & compressors, where the VS65 and XMV660 provides time and energy saving, precision and accuracy of process control and full motor protection.**

- In metallurgy applications pumps and fans are essential for the process, such as descaling pumps, induced draft and forced draft fans. Moreover, regulation of the rolling mills requires another magnitude of precision in the control of torque and speed in the high voltage, high power motors.
- The XMV660 variable speed drive Power Motor Control (PMC) and the Advanced Vector Control (AVC) algorithms provides high performance process control, multiple drives synchronization and 4-quadrant operations.
- On applications such as a hammer mill the VS65 soft starter generates the right amount of torque to give linear acceleration with minimal starting current, even to this type of heavy load that has high breakaway torque. Choice of Spin or Ramp stop enables the VS65 to match the motor stop function to the application's needs.
- The VS65 soft starter can be customized to include additional controls and pushbuttons, additional protection modules and special RAL colours, cables in/out, etc. in order to fit the requirement of harsh working environment.



Plant: Chhattisgarh, Jindal Steel and Power Limited  
Location: Raigarh, India  
Capacity: 10M tons/year



Plant: Hyundai Steel  
Location: Korea  
Capacity: 24M tons/year





The severe requirements of industry, together with our experiences in the solar sector where competitiveness, high availability and harsh environmental conditions are the norm, have compelled us to develop the most robust and cost effective drives and soft starters for the power generation market. Power Electronics supply drives into hydroelectric and thermal generation plants (geothermal, gas, coal and biomass) controlling many critical machines within the process. Power Electronics is a world leader in providing drives into gigawatt range solar thermal power plants.

## POWER GENERATION

**The XMV660 variable speed drive is the perfect solution for new installations and renovation of existing systems. It does not require special motors and works seamlessly with existing motors.**

- In older systems in coal power plants, the boiler fans were typically controlled by inefficient dampers where the fan motor is run continuously at fixed speed, regardless of boiler load demand. Combustion rates were controlled by an air damper system located at each boiler to control airflow.

- The XMV660 medium voltage drive allows the motors and boiler fans to run as needed, to directly match the required airflow rate, thus optimizing the boiler control and coal combustion, and reducing energy costs. Replacement of the air damper system directly with a variable speed drive also provides smooth system starting and stopping eliminating inrush current and spikes, while protecting the integrity of the electric motors.

- The VS65 soft starter provides high resolution control during the starting phase of large medium voltage motors in order to minimize high inrush currents and high starting torque shocks.

- Controlling the starting characteristics of a pumps in many hydroelectric and thermal plants (geothermal, gas, coal and biomass) enables customers to save money by reducing the peak DOL start-up current and reduce the shock loading on the system.

- The VS65 medium soft starter offers 5 different starting methods for optimal motor control and a specific function to reduce the effect of “hammering” often associated with DOL starting of large pumps. This makes the whole system more reliable and reduces production downtimes due to mechanical problems to pump system components.



Plant: Kaxu Solar One thermosolar plant  
Location: South Africa  
Capacity: 100MW



Plant: Shagaya - on construction  
Location: Kuwait  
Capacity: 50MW



Plant: Coal-fired power plant  
Location: Opole, Poland  
Capacity: 1800MW



Plant: Ouarzazate thermosolar plant  
Location: Morocco  
Capacity: 160MW

## WARRANTY

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Power Electronics (the Seller) warrants that their INDUSTRIAL Products are free of faults and defects for a period of 3 years, valid from the date of delivery to the Buyer. It shall be understood that a product is free of faults and defects when its condition and performance is in compliance with its specification.

The warranty shall not extend to any Products whose defects are due to (i) careless or improper use, (ii) failure to observe the Seller's instructions regarding the transport, installation, functioning, maintenance and the storage of the Products, (iii) repairs or modifications made by the Buyer or third party without prior written authorization of the Seller, (iv) negligence during the implementation of authorized repairs or modifications, (v) if serial numbers are modified or illegible, (vi) anomalies caused by, or connected to, the elements coupled directly by the Buyer or by the final customer, (vii) accidents or events that place the Product outside its storage and operational specification, (viii) continued use of the Products after identification of a fault or defect.

The warranty excludes components that must be replaced periodically such as fuses, lamps & air filters or consumable materials subject to normal wear and tear.

The warranty excludes external parts that are not manufactured by the Seller under the brand of Power Electronics.

The Seller undertakes to replace or to repair, himself, at their discretion, any Product or its part that demonstrates a fault or defect, which is in conformance with the aforementioned terms of the warranty. Reasonable costs associated with the disassembly/assembly, transport

and customs of equipment will also be undertaken by the Seller except in cases of approved intervention by the Buyer and/or their representative where cost allocation has been previously agreed.

In case of fault or defect, the Buyer shall notify the Seller in writing by using the following contact email: [quality@power-electronics.com](mailto:quality@power-electronics.com), of the presence of any fault or defect within 15 days of the fault or defect event. The serial number of the defective product plus a brief description of the fault must be included in the email. Failure to notify the Seller of fault or defect within this time period may result in the warranty becoming invalid.

In the event of replacement of defective Product or part thereof, the property of the Product or part shall be transferred to the Seller.

The Seller shall bear no liability for damages to property or third persons, even as manufacturer of the Products, other than that expressly provided by virtue of applicable mandatory law provisions. In any case, the Seller shall not be liable for indirect or consequential damages of whatsoever nature as, by way of example, production losses or unearned profits.

The Seller shall, at their discretion, forfeit all warranty rights of the Buyer if the total sum of the contract and payment has not been reached in accordance with the agreed conditions of the contract.

No other warranties, express or implied, are made with respect to the Products including, but not limited to, any implied warranty of merchantability or fitness for a particular purpose. In any case, the Buyer's right to damages shall be limited to a maximum amount equal to no more than the price obtained by the Seller of the faulty or defective Products.

These conditions shall apply to any repaired or replacement products. Notwithstanding the above, the replacement of a Product does not imply an extension of the term of warranty outside that of the original term.

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