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ABOUT US

INDUS

Since our inauguration in 1987 Power Electronics' strategy of continuous innovation in product development has realized an extensive range of AC variable speed drives and soft starters in low and medium voltage and utility scale solar inverters.

The expertise and know-how gained over more than 25 years in the business is demonstrated in the unique features and patented designs of our products, coupled with the shortest lead-times and unbeatable 24/7 Power On Support has consolidated Power Electronics position as a global market leader in the AC drive and soft starter business.

SOLAR

SOLAR INVERTERS SOLAR POWER STATIONS



VARIABLE SPEED DRIVES

he most complete range of AC drives and soft starters

0.4kW - 6000kW

0.23kV - 11kV

+25 years

of product excellence and diversification

Financial stability and strength

SUSTAINABLE GROWTH



+1200 Employees worldwide



Product and Factory independent Reports and Certifications + Engineered for reliability

3 year warranty: Industrial products



Medium voltage experts

MV 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.







Vertical integration for customer satisfaction

Flexibility and specialization play a key role in standard product manufacturing but even more in customised products. Vertical integration gives us the flexibility to be able to adapt to customer requirements and still provide very short lead times.

RELIABLE ENGINEERING HIGH QUALITY COMPONENTS VALUE CHAIN SUPERVISION FACTORY TESTED

DESIGN FLEXIBILITY IMMEDIATE DELIVERY







Power on Support customer oriented strategy

Power on Support is the concept of a customer oriented strategy implemented by Power Electronics since its origins more than 25 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.

ENGINEERING SUPPORT 24/7 CUSTOMER SUPPORT 24/7 ONSITE ASSISTANCE COMMISSIONING SUPPORT TRAINING SEMINARS 3 YEAR WARRANTY





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SAVING ENERGY FOR THINGS THAT MATTER

In Power Electronics we know that the modern world is moving faster and becoming more complicated daily and that often priorities in life change. When we design and create our products, we not only think about numbers and graphs, we also think about our clients, their companies and the surrounding environment.

Power Electronics understands that there are more things in life than work. We don't want our clients to worry about our products; we want to save their energy so that they can invest it in the things that really matter, their families, their friends, their hobbies... We will take care of the rest: we will set up technical seminars and courses so that our clients and their technicians can get to know the products as well as we do, we will assist with the commissioning because we believe in work well done, we will offer a 24h phone help line so that you can always ask what you want to know no matter the time of day or night and we will never let our clients down if they have a problem. We will take care of all these things so that you can save your energy for things that really matter...

"WORKING PASSIONATELY TODAY WILL CREATE A BETTER FUTURE FOR THINGS THAT REALLY MATTER"





DISCOVER THE POWER ELECTRONICS PRODUCT RANGE







THE MOST RELIABLE MEDIUM VOLTAGE TECHNOLOGY IN ELECTRONIC SOFT STARTERS AND VARIABLE SPEED DRIVES

MATE









XMV660 OUTDOOR

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.

EXTREME INNOVATION FOR EXTREME ENVIRONMENTS

- RUGGED DESIGN: NEMA3R | IP55-OUTDOOR RATED STAINLESS STEEL ENCLOSURE WITH MINERAL ISOLATION AND C5M EXTERIOR COATING
- 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 SMART AND RELIABLE CYCLONE AIR FILTERING THAT WITHSTANDS EXTREME DESERT CONDITIONS
- LOW DV/DT NO MOTOR DERATING OR MOTOR CABLE LENGTH RESTRICTION
- OUTPUT VOLTAGE BOOST TRANSFORMER TAP ADJUSTMENT
- REDUNDANCY





XMV660 OUTDOOR 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?

BECAUSE OUR OUTDOOR SOLUTION GIVES YOU GREAT SAVINGS:

- 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







XMV660 OUTDOOR COOLING SYSTEM

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.





2













RUGGED DESIGN FOR OUTDOOR CONDITIONS

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:

- Totally Sealed electronics protected from dust and moisture.
- \cdot Conformal coating on electronic board shields PCBs from aggressive atmospheres.
- Rugged outdoor enclosure with double gasketed doors.
- 50mm mineral isolation panel that dissipates heat from direct sunlight.
- · Corrosion impervious polymeric coating (C5-M).
- Temperature and humidity control prevents harmful internal water condensation.



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.









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).







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.









SAFETY AND PROTECTION

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.
- Reduces the short circuit power and therefore the fault current in case of an unlikely internal isolation defect.
- 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.
- 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.





MAXIMUM RELIABILITY 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.



REGENERATIVE MODULE

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.









MAINTENANCE FRIENDLY

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.

Low voltage tests allow for a safe fully functional performance before commissioning.

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.

A redundant design of the power conversion stage and cooling system increases availability rates with a reduced stock of spare parts.

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.







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 customised programs, the combinations are virtually unlimited.



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.





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 customised configurations defined by the user.

- TFT-LCD screen of 2.8".
- Customised visualization by the user.
- Fault Register (Logs).
- Language selection.
- Removable display unit for remote installation.



COMMUNICATIONS

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 (%, I/s, m³/s ,I/m, m³/m, I/h, m³/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 customise 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 & mixers, accumulators, calendar functions, and much more... The user establishes the limits for the XMV660.



	Input voltage (kV) [1]	2 3kV to 13 8kV (+10%)
INPUT	Frequency	50/60Hz (±10%)
	Power factor	> 0.95 (over 20% load)
	THDi (%) current [2]	< 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)
	Output voltage boosting	Transformer Tap Adjustment
ENVIRONMENTAL RATINGS	Degree of protection	(IEC60529) IP55, NEMA3R
	Operation temperature ^[3]	-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 mode	Local control (Display and push-buttons)
		V/Hz
	Control method	VECTOR CONTROL
		Open Loop: PWM speed / torque control, AVC: speed / torque control Close Loop (Encoder): PWM speed / torque control, AVC: speed / torque control
CONTROL	Carrier frequency	1kHz
	Control power supply	Redundant 2x230Vac II P+N (1kVA). UPS integrated
	Other characteristics	Voltage/Power ride through, quick setting and commisioning, 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.
USER INTERCONNECTION [7]	Digital inputs	5 programmable, Active high (24Vdc), Isolated power supply 5 pre-configurated (Start/Stop ; Reset, control mode, reference) 1 PTC input
	Analogue inputs	3 programmable differential inputs. 0–20mA, 4–20mA, 0–10Vdc and \pm 10Vdc. (Optically isolated)
	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 y vector control). Input signal from 5 to 24Vdc
COMMUNICATIONS	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

NOTES [1] Other configurations, consult Power Electronics.

[2] Harmonics are below the limits defined in IEEE519 for all $\rm I_{sc}/\rm I_{L}$
XMV660 OUTDOOR - CONFIGURATION TABLE

X66	1000		A	Α		66		5		3		н	
XMV66O Series	Acti	ve Power	Cells Max. Ai	s mps	Outp	out voltage	Overload		Degree of protection		Gr	id voltage	
X66	0150	150kW	А	120	23	2.3kV	2	120%	1	UL NEMA1	х	Low voltage	
			В	200	30	3kV	5	150%	3	UL NEMA3R	Α	2.3kV	
	1000	1000kW	С	300	33	3.3kV	в	Starting Model	4	IEC IP41	в	3kV	
	1100	1100kW	D	450	38	3.8kV		Under request	5	IEC IP54	С	3.3kV	
	1200	1200kW	E	630	41	4.1kV				Under request	D	3.8kV	
			F	900	60	6kV					Е	4.1kV	
	9000	9000kW	G	1250	63	6.3kV					F	6kV	
	10M0	10000kW	Н	1500	66	6.6kV					G	6.3kV	
	12M5	12500kW	Regener	ative	69	6.9kV					н	6.6kV	
	24M5	24500kW	R	120	10	10kV					Ι	6.9kV	
		Under request	S	200	11	11kV					J	10kV	
			Т	300	13	13.8kV					К	11kV	
			U	450		Under request					L	13.8kV	
			V	630							М	15kV	
			W	900								Under request	
			Х	1250]								
			Y	1500									
				Under request		NOTES	Che circı	ck the rated cu uit current to g	urrent uaran	of the motor na tee the compatib	mepl pility	ate and indi with the sele	

icate the short circuit current to guarantee the compatibility with the selected drive.

Consult configuration availabilities with Power Electronics.

XMV660 OUTDOOR - STANDARD RATINGS

	XMV660 4.16kV						
CODE	NOMINAL	MOTOR POWER					
CODE	CURRENT (A)	(kW)	(HP) ^[1]				
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 reque	st					

XMV660 6.6kV						
0005	NOMINAL	MOTOR POWER				
CODE	CURRENT (A)	(kW) ^[2]	(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						

NOTES [1] HP standard motor rated power (cos $\varphi \cdot \text{Eff} = 0.8, 4.16\text{kV})$ [2] kW standard motor rated power (cos $\varphi \cdot \text{Eff} = 0.8, 6.6\text{kV})$

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







XMV660 INDOOR

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.

MAXIMUM MOTOR CARE, OPERATOR SAFETY AND RELIABILITY WITHOUT COMPROMISE

- 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
- REDUNDANCY
- RUGGED AND MAINTENANCE FRIENDLY DESIGN



XMV660 - TOPOLOGY

The XMV660 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.







TRANSFORMER CABINET



		2 3kV/ to 13 8kV/ (+10%)					
	Frequency	50/60Hz (±10%)					
	Prequency Dower factor	S0/00H2 (110%)					
	THDi (%) surrent [2]	> 0.95 (over 20% load)					
INPUT	Rower transformer	N 370 Dhasa-shift transformer dry type (From 18 to 54)					
		Exceeds IEC/EN 61000-4-34					
	Drive bypass	Optional bypass cabinet					
		Multi-level, pulse-width modulation, low voltage power modules connected in series					
	Output voltage (KV)	2.3KV, 3KV, 5.3KV, 4.16KV, 5KV, 5.5KV, 6KV, 6.6KV, 10KV, 11KV, 15.8KV					
	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)					
OUTPUT	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)					
	Tripless operation	Redundant Power System (RPS)					
	Output voltage boosting	Transformer Tap Adjustment					
	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					
ENVIRONMENTAL	Storage temperature	-25°C a +55°C					
RATINGS	Humidity	< 95%, non condensing					
	Altitude	<1000m; >1000m power derating 1%/100m. Max. 3000m					
	Cooling	Forced air cooling Optional redundant					
	Control mode	Local control (Graphic display 2.8" and push-button)					
	Control mode	Kemole control I/O					
	Control method	V/nz VECTOR CONTROL					
CONTROL	Control method	Open Loop: PWM speed / torque control, AVC: speed / torque control Close Loop (Encoder): PWM speed / torque control, AVC: speed / torque control					
CONTROL	Carrier frequency	1kHz					
	Control power supply	Redundant 2x230Vac II P+N (3kVA), UPS integrated					
	Other characteristics	Voltage/Power ride through, quick setting and commisioning, 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.					
	Display	Graphic displayTFT-LCF 2.8"					
	Connection	RJ45, 3m (5m Optional)					
		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.					
	Features	Ethernet switch with double connection RJ45 Self powered by RJ45, optional 5Vdc external power supply or batteries Comprenhensive screens with built-in help system Coded access to parameters with pasword					
	Leds	Led ON: Control board is energized Led RUN: Motor receiving power supply Led FAULT: Flashing displays that a fault has occurred					
LOCAL CONTROL PANEL	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					
		Control mode selector: local/stop/remote					
	Push buttons	Emergency stop Green: Local start push button Red: Local Stop push button White: Fault Reset					



USER INTERCONNECTION TO Analogue inputs 3 programmable differential inputs. 0 - 20mA, 4 - 20mA, 0 - 10Vdc and ±10Vdc. (Optically isolated) 0 Digital outputs 2 programmable changeover relays (250Vac, 8A or 30Vdc, 8A) 3 pre-configured contacts (Star/Stop, Warning, Fallure) 3 Analogue outputs 0 - 20mA, 4 - 20mA, 1 - 20mA, 2 - 20mA		Digital inputs	9 programmable, Active high (24Vdc), Isolated power supply 5 pre-configurated (Start/Stop ; Reset, control mode, reference) 1 PTC input				
USER INTERCONNECTION ID Digital outputs 2 programmable changeover relays (250Vac, 8A or 30Vdc, 8A) 3 programmables NO contacts (250Vac, 8A or 30Vdc, 8A) 3 programmables NO contacts (250Vac, 8A or 30Vdc, 8A) 3 pre-configured contacts (Start/Stop, Warning, Failure) Analogue outputs 0 - 20mA, 4 - 20mA, 0 - 10Vdc and ±10Vdc Encoder (optional) 1 put signal from 5 to 24Vdc Digital outputs 0 - 20mA, 4 - 20mA, 0 - 10Vdc and ±10Vdc COMMUNICATIONS Standard hardware USB, R3232, R5485 Optional hardware USB, R3232, R5485 Optional protocol Profibus-DP, DeviceNet, Ethernet, 9 Pin D-SUB, CAN Standard protocol Modobus-RTU Optional protocol Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open Motor protections Drive protections Drive protections Drive protections Power modules protections Overcurrent (Imit, Motor overload, (Ithernal mode), Output base loage (Ference) elso), communication loss (Ithere-out), Power supply fault, Emergency stop VSD design and construction IEC/EN 61800-3 IEEC/EN 61800-4 General requirements IEC/EN 61800-5 IEC/EN 61800-51 Safety IEC/EN 60146-13 IEC/EN 60146-13 IEC/EN 60146-13 IEC/EN 600146-13		Analogue inputs	3 programmable differential inputs. 0 – 20mA, 4 – 20mA, 0 – 10Vdc and ±10Vdc. (Optically isolated)				
Analogue outputs 3 isolated programmable outputs: 0 - 20mA, 4 - 20mA, 0 - 10Vdc and ±10Vdc Encoder (optional) 2 differential encoders input (process y vector control). Input signal from 5 to 24Vdc COMMUNICATIONS Standard hardware USB, R5322, R5485 Optional hardware Fiber optics, Ethernet, 9 Pin D-SUB, CAN Standard protocol Modbus-RTU Optional protocol Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open Motor protections Rotor locked, torque limit, Phase voltage 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 requercy, drive overlead, thereue cover-temperature, Analogue voltage instability, low input voltage, Ether net (Modbus Voltage, Imput signal loss (Speed reference loss), communication loss rotime-out), Power supply fault.Emergency stop Power modules protections Overcurrent (fuses), high DC bus voltage, Low DC bus voltage, instability, low input voltage, fiber optics or outnication lost, gate drive fault, power module voetamperature. VSD design and construction IEC/EN 61800-3 IEC/EN 61800-5-1 Safety 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) IEC/EN 60146-1-3		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)				
Encoder (optional) 2 differential encoders input (process y vector control). Input signal from 5 to 24Vdc COMMUNICATIONS Standard hardware USB, RS232, R5485 Optional hardware Fiber optics, Ethernet, 9 Pin D-SUB, CAN Standard protocol Modous-RTU Optional protocol Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open Rotor protections Rotor locked, torque limit, Motor overload (thermal model), Output current, Phase voltage imbalance, Motor over-temperature (PTC), Speed limit, excessive starting and stopping time. PROTECTIONS Drive protections Prover modules protections Input phase loss, Low input voltage, High input voltage, maximum number of faulty moditage, Low input voltage, Mator over-temperature, Analogue input signal loss (speed instability, low input voltage, maximum number of faulty moditage, Low DC bus voltage, over-temperature, Analogue input signal loss (speed instability, low input voltage, fiber optics communication lost, communication loss), communication loss (time-out), control voltage lost, gate drive fault, power module overlemperature. Power modules protections Electromagnetic compatibility VSD design and construction IEC/EN 61800-3 IEEC/EN 61800-3 IEEC/EN 61800-4 General requirements IEC/EN 60146-1-1 Semiconductor converters UL 347A MV drives (4.16kV models only) UL 508C power conversion equipments (4.16kV models only) IEC/EN 60146-1-3 IEC/EN 60146-1-		Analogue outputs	3 isolated programmable outputs: 0 - 20mA, 4 - 20mA, 0 - 10Vdc and ±10Vdc				
Standard hardware USB, RS232, RS485 Optional hardware Fiber optics, Ethernet, 9 Pin D-SUB, CAN Standard protocol Modbus-RTU Optional protocol Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open Rector 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 voltage, maximum number of faulty modules, High input voltage, tow retemperature, 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 out), control voltage lost, gate drive fault, power module overtemperature. Power modules protections Electromagnetic compatibility VSD design and construction IEC/EN 61800-4 General requirements IEC/EN 61800-5-1 Safety IEC/EN 60076-1, -11 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3		Encoder (optional)	2 differential encoders input (process y vector control). Input signal from 5 to 24Vdc				
Optional hardware Fiber optics, Ethernet, 9 Pin D-SUB, CAN Standard protocol Modbus-RTU Optional protocol Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open Record location Motor protections PROTECTIONS Motor protections Drive protections Input phase loss, Low input voltage, High input voltage, maximum number of faulty modules, High input voltage, maximum number of faulty modules, High input voltage, maximum number of faulty modules, High input voltage, Malo voltage, Edu Tererence, Low DC bus voltage, Communication loss (time-out), Power supply fault, Emergency stop Power modules protections Overcurrent (fuses), high DC bus voltage, High input voltage, fiber optics communication loss (time-out), Power supply fault, Emergency stop Power modules protections Overcurrent (fuses), high DC bus voltage, Low DC bus voltage, Communication lost, communication time overpassed (time-out), control voltage lost, gate drive fault, power module voltage fister optics VSD design and construction IEC/EN 61800-3 IEC/EN 61800-5-1 Safety IEC/EN 61800-5-1 Safety IEC/EN 60146-1-1 Semiconductor converters UL 347A MV drives (4.16kV models only) UL 15082 (power conversion equipments (4.16kV models only) IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3		Standard hardware	USB, RS232, RS485				
Standard protocol Modbus-RTU Optional protocol Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open Retor locked, torque limit, Motor overload (thermal model), Output current limit, Pase 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 requency, Low input frequency, drive over-temperature, Analogue input signal loss (speed reference loss), communication loss (time-out), Power supply fault, Emergency stop Power modules protections Drive protections Electromagnetic compatibility (PC Loss voltage instability, low input voltage, fiber optics communication lost, communication lost, (communication lost, communication lost, communication lost, communication lost, (communication lost, communication lost, (communication lost, communication lost, (communication lost, communication inter-cut), Power fault, power module overtemperature. REGULATION EMECTOMAGNA IEC/EN 61800-3 IEC/EN 61800-51 Safety IEC/EN 61800-51 Safety IEC/EN 60146-11 Semiconductor converters UL 347A MV drives (4.16kV models only) WV transformer IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3		Optional hardware	Fiber optics, Ethernet, 9 Pin D-SUB, CAN				
Optional protocol Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open 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. PROTECTIONS Drive protections Input phase loss, Low input voltage, High input voltage, maximum number of faulty modules, High input frequency, Low input frequency, drive over-temperature, Analogue (time-out), Power supply fault, Emergency stop Overcurrent (fuses), high DC bus voltage, Low DC bus voltage, DC bus voltage instability, Iow input voltage, fiber optics communication lost, communication time overpassed (time- out), control voltage lost, gate drive fault, power module overtemperature. REGULATION Electromagnetic compatibility VSD design and construction EMC 2004/108/EC IEC/EN 61800-4 General requirements IEC/EN 61800-4 General requirements IEC/EN 61800-51 Safety IEC/EN 61800-61 Safety WV transformer IEC/EN 60076 - 1, -11 IEC/EN 60076 - 1, -11 IEC/EN 60076 - 1, -11 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3	COMMUNICATIONS	Standard protocol	Modbus-RTU				
PROTECTIONS Motor protections Rotor locked, torque limit, Motor overlead (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 ringut 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, power modules protections Electromagnetic compatibility Electromagnetic compatibility IEC/EN 61800-3 IEEC/EN 61800-3 IEC/EN 61800-5-1 Safety IEC/EN 61800-5-1 Safety IEC/EN 61800-5-1 Safety IEC/EN 61800-5-1 Safety IEC/EN 61800-5-1 Safety IEC/EN 61800-61, -11 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3		Optional protocol	Profibus-DP, DeviceNet, Ethernet (Modbus TCP), Ethernet IP, CAN Open				
PROTECTIONS Drive protections Input phase loss, Low input voltage, High input voltage, maximum number of faulty modules, High input frequency, Low input frequency, Cow 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, commented list, Poweret module		Motor protections	Rotor locked, torque limit, Motor overload (thermal model) Output current limit, Phase current imbalance, Ground faul current, Phase voltage imbalance, Motor over-temperature (PTC), Speed limit, excessive starting and stopping time.				
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 lest, communication lost, communication lost, communication lest, communicatin lest,	PROTECTIONS	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				
REGULATION Electromagnetic compatibility EMC 2004/108/EC IEC/EN 61800-3 IEEE 519-1992 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) IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 61378-1 UL 1562 (4.16kV models only)		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.				
Electromagnetic compatibility IEC/EN 61800-3 IEEE 519-1992 IEC/EN 61800-4 General requirements IEC/EN 61800-5-1 Safety IEC/EN 61800-5-1 Safety VSD design and construction IEC/EN 60146-1-1 Semiconductor converters UL 347A MV drives (4.16kV models only) UL 508C power conversion equipments (4.16kV models only) WV transformer IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 UL 1562 (4.16kV models only) UL 1562 (4.16kV models only)			EMC 2004/108/EC				
REGULATION IEEE 519-1992 VSD design and construction IEC/EN 61800-4 General requirements IEC/EN 61800-5-1 Safety IEC/EN 61800-5-1 Safety UL 347A MV drives (4.16kV models only) UL 347A MV drives (4.16kV models only) UL 508C power conversion equipments (4.16kV models only) IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 61378-1 UL 1562 (4.16kV models only)		Electromagnetic compatibility	IEC/EN 61800-3				
REGULATION IEC/EN 61800-4 General requirements IEC/EN 61800-5-1 Safety IEC/EN 61800-5-1 Safety UL 347A MV drives (4.16kV models only) UL 347A MV drives (4.16kV models only) UL 508C power conversion equipments (4.16kV models only) IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 61378-1 UL 1562 (4.16kV models only)			IEEE 519-1992				
REGULATION VSD design and construction 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) IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 60146-1-3 IEC/EN 61378-1 UL 1562 (4.16kV models only)			IEC/EN 61800-4 General requirements				
REGULATION VSD design and construction IEC/EN 60146-1-1 Semiconductor converters UL 347A MV drives (4.16kV models only) UL 508C power conversion equipments (4.16kV models only) IEC/EN 60076 -1, -11 IEC/EN 60076 -1, -11 IEC/EN 60146-1-3 IEC/EN 61378-1 UL 1562 (4.16kV models only) IEC/EN 60146-1-3			IEC/EN 61800-5-1 Safety				
REGULATION UL 347A MV drives (4.16kV models only) UL 508C power conversion equipments (4.16kV models only) UL 508C power conversion equipments (4.16kV models only) IEC/EN 60076 -1, -11 IEC/EN 60146-1-3 IEC/EN 61378-1 UL 1562 (4.16kV models only)		VSD design and construction	IEC/EN 60146-1-1 Semiconductor converters				
UL 508C power conversion equipments (4.16kV models only) IEC/EN 60076 -1, -11 IEC/EN 60146-1-3 IEC/EN 61378-1 UL 1562 (4.16kV models only)	REGULATION		UL 347A MV drives (4.16kV models only)				
MV transformer IEC/EN 60076 -1, -11 IEC/EN 60146-1-3 IEC/EN 61378-1 UL 1562 (4.16kV models only)			UL 508C power conversion equipments (4.16kV models only)				
MV transformer IEC/EN 60146-1-3 IEC/EN 61378-1 UL 1562 (4.16kV models only)			IEC/EN 60076 -1, -11				
IEC/EN 61378-1 UL 1562 (4.16kV models only)			IEC/EN 60146-1-3				
UL 1562 (4.16kV models only)		MV transformer	IEC/EN 61378-1				
			UL 1562 (4.16kV models only)				

NOTES [1] Other configurations, consult Power Electronics. [2] Harmonics are below the limits defined in IEEE519 for all I_{sc}/I_{L} .





CUSTOMISED 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.

POWER ELECTRONICS / MEDIUM VOLTAGE

Control, user terminal strip and pushbuttons:

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

 Power PLC dedicated applications

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.



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, withdraw-able contactor, on-load disconnector with or without fuses, Earthing switch, Motor protection relay.

- Commutation cells.
- Cell with Soft-load system.

Documentation:

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



CONFIGURATION TABLE - XMV660

X66	1000		Α			66		5		4		н
XMV66O Series	Active Power		Cell Max. A	s mps	Out	out voltage	ut voltage		Degree of protection		Grid voltage	
X66	0150	150kW	А	120	23	2.3kV	2	120%	1	UL NEMA1	х	Low voltage
			В	200	30	3kV	5	150%	3	UL NEMA3R	A	2.3kV
	1000	1000kW	С	300	33	3.3kV	В	Starting Model	4	IEC IP41	В	3kV
	1100	1100kW	D	450	38	3.8kV		Under request	5	IEC IP54	С	3.3kV
	1200	1200kW	Е	630	41	4.1kV				Under request	D	3.8kV
			F	900	60	6kV					E	4.1kV
	9000	9000kW	G	1250	63	6.3kV					F	6kV
	10M0	10000kW	Н	1500	66	6.6kV					G	6.3kV
	12M5	12500kW	Regener	ative	69	6.9kV					н	6.6kV
	24M5	24500kW	R	120	10	10kV					Т	6.9kV
		Under request	S	200	11	11kV					J	10kV
			Т	300	13	13.8kV					к	11kV
			U	450		Under request					L	13.8kV
			V	630							м	15kV
			W	900								Under request
			Х	1250								
			Y	1500		NOTEC	Char			of the mechanism		ata anal indi
				Under request		NULES	circu	it current to g	uaran	tee the compatib	niepi ility v	with the sele

Consult configuration availabilities with Power Electronics.

DIMENSIONS - XMV660



Rated Current		Current	Width	Depth	Height	Height	Height RC ^[1]	Weight
	50°C Heavy duty	40°C Normal duty	W (mm)	D (mm)	h (mm)	H (mm)	H (mm)	(kg) ^[2]
	< 120A	<140A	2700	1200	2320	2650	2800	4900
416107	121A - 200A	141A-240A	4020	1425	2320	2650	2800	6900
4.16KV	201A - 300A	241A-360A	4390	1425	2370	2790	2930	10600
	> 300A	>360			Under re	equest		
	< 120A	<140A	3420	1200	2320	2650	2800	5500
C CIN/	121A - 200A	141A-240A	4580	1425	2320	2650	2800	7400
6.6KV	201A - 300A 241A-360A		5685	1425	2370	2790	2900	11000
	> 300A	>360	Under request					

NOTES [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.

CONFIGURATION TABLE - PROTECTION CELL XMV660

X66R	30	00		3		4		IA	F		0	
XMV660 Protection module	Rated c	urrent 미	Rat	ted voltage		Degree of Configuration		Configuration Earth swi		rth switch and Fuses		Cables access
X66R	045	45A	1	3.6kV	1	NEMA1	CL	Fixed line contactor	0	-	0	Bottom
	050	50A	2	4,76kV	3	NEMA3R	сх	Withdrawable line contactor	F	Fuses	т	Top input bottom output
	055	55A	3	7.2kV	4	IEC IP44	xx	Line contactor and withdrawable bypass	E	Earth	U	Top both
			4	8.25 kV	5	IEC IP54	IX	Withdrawable VCB	G	F+E	S	Side
	120	120A	5	12kV		Under request	SI	On/Off/Earth input & output	I	On/Off/Earth input & output	В	Bus bars
	200	200A	6	15kV			IA	Automatic circuit breaker	м	On/Off/Earth input & output		Under request
	300	300A	7	17.5kV	1		SE	Disconnector and Earth		Under request		
	450	450A		Under request			BP	Line contactor and bypass				
	630	630A			-			Under request]			
	900	900A							-			

 K00
 1000A

 K25
 1250A

 K50
 1500A

 2K0
 2000A

 Under
 0

request

NOTES [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 - PROTECTION CELL XMV660



	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				

NOTES [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.

STANDARD RATINGS - XMV660

XMV660 2.3kV							
CODE	NOMINAL	MOTOR	POWER				
CODE	CURRENT (A)	(kW)	(HP) ^[1]				
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				

XMV660 3kV						
CODE	NOMINAL	MOTOR POWER				
CODE	CURRENT (A)	(kW) ^[2]	(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			

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

	XMV660 3.3kV						
CODE	NOMINAL	MOTOR POWER					
CODE	CURRENT (A)	(kW) ^[3]	(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				

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

XMV660 4.16kV								
CODE	NOMINAL	MOTOR POWER						
CODE	CURRENT (A)	(kW)	(HP) ^[4]					
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)

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

NOTE Request your quote by filling the Ordering info template; please consult Power Electronics with your additional demands. Variable speeds drives over 400A and 7.2kV will be engineered under request, consult availability.

	XMV660 6	kV			
CODE	NOMINAL	MOTOR POWER			
CODE	CURRENT (A)	(kW) ^[5]	(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		

XMV660 6.6kV								
CODE	NOMINAL	MOTOR POWER						
CODE	CURRENT (A)	(kW) ^[6]	(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					

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

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

XMV660 11kV								
CODE	NOMINAL	MOTOR	POWER					
CODE	CURRENT (A)	(kW) ^[8]	(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					

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

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









VS65

Power Electronics' VS65 medium voltage soft starter is the most reliable and safest solution, fully flexible with a customised 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 customised 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.

> THE MOST RELIABLE AND SAFE CUSTOMER ORIENTED SOLUTION

- HIGHEST OPERATOR SAFETY AND BUILT-IN MOTOR PROTECTION FUNCTIONALITIES
- HIGH RELIABILITY AND AVAILABILITY, EASY OPERATION AND INTUITIVE CONTROL
- HIGHEST BREAK AWAY TORQUE
- FULLY CUSTOMISABLE TO THE MOST DEMANDING REQUIREMENTS



VS65 - TOPOLOGY

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 thyrisitors from the mains at rated speed, hence the VS65 offers 100% efficiency with maximum reliability and protection.

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.







Maximum safety

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

• 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 creapage 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 SAFETY AND OUTSTANDING FEATURES DESIGNED FOR THE MOST DEMANDING INDUSTRY



Maximum motor care and soft starter protection

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.

POWER ELECTRONICS / MEDIUM VOLTAGE

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 disconnector 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)

- STATOR WINDING 1
- STATOR WINDING 2STATOR WINDING 3
- STATOR WINDING 4
- STATOR WINDING 5STATOR WINDING 6
- MOTOR BEARING 1
- (8) MOTOR BEARING 2
- application bearing 1
 application bearing 2
 case
 ambient

CONTINUOUS CURRENT AND VOLTAGE MONITORING



-0 111-0

Reliability

0

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.





• 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.

 \bullet Copper busbars that can withstand from 40kA to 80kA short circuit currents.

Rated voltage	SCR pairs in series	SCRs Inverse Peak Voltage
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

TOTALLY SEALED AND CONFORMALLY COATED ELECTRONICS



Multiple features

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



POWER ELECTRONICS MEDIUM VOLTAGE

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:



GET THE MOST OF YOUR APPLICATION WITH THE DUAL SETTING FUNCTION 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, i²t overload curve, n^o start per hour, minimum speed and water hammer control algorithm.



Intuitive control

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

VS65

POWER ELECTI: ONICS / MEDIUM VOLTAGE



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.



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

NOTES [1] Other configurations consult with Power Electronics.



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



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CUSTOMISED 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.



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

Customised control and pushbuttons:

- Selectors and pushbuttons • Digital and analogue I/O
- pre-configuration
- Customised 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.

Documentation:

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

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".

CONFIGURATION TABLE - VS65 SOFT STARTER MODULE

V65	2	200		4		4		CL		F		3		0
VS65 Series	Rate cu	d output rrent 🖽	Ra	ted input voltage		Degree of protection		Configuration		Earth switch + Fuses		solation	Power cable access	
V65	045	45A	2	2.3kV	1	NEMA1	CL	Fixed - Line contactor	0	0	1	3.6kV	0	Bottom
	050	50A	3	3kV 3.3kV	3	NEMA3R	сх	Withdrawable - Line contactor/ Fixed bypass		Fuses	2	4,76kV	Т	Top input bottom output
	055	50A	4	4.1kV	4	IEC IP41	XX	X Line contactor and withdrawable bypass A Fixed - Line circuit breaker X Withdrawable - Line circuit breaker		On/Off/ Earth	3	7.2kV	U	Top both
			5	5kV 5.5KV	5	IEC IP54	IA			Earth	4	8.25 kV	S	Side
	120	120A	6	6kV 6.3kV 6.6kV		Under request	IX			F+E	5	12kV	В	Bus bars
	200	200A	8	10kV 11kV				Under request	н	F+S	6	15kV		Under request
	300	300A	9	13.2kV 13.8kV						Under request	7	17.5kV		
	450	450A		Under request								Under request		
	630	630A												
	900	900A												
	коо	1000A					NOTES Check the rated current o						eplate and	indicate the sh
	K25	1250A						circuit o	curre	nt to guaran	tee	the compati	bility with	the selected s
		Under request						Consult	conf	iguration ava	ilabili	ties with Po	ver Electro	nics

Consult configuration availabilities with Power Electronics.

DIMENSIONS - VS65 SOFT STARTER MODULE - UP TO 6.6kV



VS65									
		DIMENSIONS							
VOLTAGE	CONFIGURATION	WIDTH W (mm)	DEPTH D (mm)	HEIGHT H (mm)					
< 4.1614)/	CL, CL_F, CL_E	1050	1550	2300					
<4.10KV	CL_S, CL_FS, CL_FE	1050	1820	2300					
	CL, CL_F	1050	1550	2300					
5KV-6.6KV	CL_E, CL_S	1050	1820	2300					

NOTE Units $\rm I_n{<}300A.$ Other voltages and configurations consult Power Electronics.

DIMENSIONS - VS65 SOFT STARTER MODULE - 13.8kV







CONFIGURATION TABLE - PROTECTION MODULE VS65R

V65R	30	300 3		3 4		IA	F			0		
VS65 Protection module	Rated c	urrent 미	Rat	ed voltage	Degree of protection		Configuration		Earth switch and Fuses		Cables access	
V65R	045	45A	1	3.6kV	4	IEC IP44	CL	Fixed line contactor	0	-	0	Bottom
	050 50A 2 4,76kV 5 IEC IP54		IEC IP54	СХ	Withdrawable line contactor	F	Fuses	Т	Top input bottom output			
	055	55A	3	7.2kV		Under request	xx	Line contactor and withdrawable bypass	Е	Earth	U	Top both
			4	8.25 kV			IX	Withdrawable VCB	G	F+E	S	Side
	120	120A	5	12kV			SI	On/Off/Earth input & output	I	On/Off/Earth input & output	В	Bus bars
	200	200A	6	15kV				Automatic circuit breaker	М	On/Off/Earth input & output		Under request
	300	300A	7	17.5kV]		SE	Disconnector and Earth		Under request		
	450	450A		Under request			PF	Reactive power capacitors + Fuses + Contactor + Choke				
	630	630A					BP	Line contactor and bypass				
	900	900A]					Under request				
	K00	10004]									

NOTES [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 - PROTECTION MODULE VS65R

1250A

1500A 2000A

Under request

K25

K50

2K0



	VS65R						
	DIMENSIONS						
CONFIGURATION	WIDTH W (mm)	DEPTH D (mm)	HEIGHT H (mm)				
<7.2kV	900	1550/1820	2300				
>7.2kV	1050	1550/1820	2300				

STANDARD RATINGS - VS65 SOFT STARTER MODULE

	VS65 2.3I	kV	
CODE	NOMINAL	MOTOR	POWER
CODE	CURRENT (A)	(kW)	(HP) ^[1]
VS65040 2	40	149	200
VS65050 2	50	186	250
VS65060 2	60	224	300
VS65070 2	70	261	350
VS65090 2	90	298	400
VS65100 2	100	336	450
VS65110 2	110	373	500
VS65130 2	130	447	600
VS65150 2	150	522	700
VS65170 2	170	597	800
VS65190 2	190	671	900
VS65210 2	210	746	1000
VS65270 2	270	932	1250
VS65320 2	320	1119	1500
VS65370 2	370	1305	1750
VS65420 2	420	1491	2000
VS65480 2	480	1678	2250
VS65530 2	530	1864	2500
VS65590 2	590	2051	2750

VS65 3kV-3.3kV					
CODE	NOMINAL	MOTOR	POWER		
CODE	CURRENT (A)	(kW) ^[2]	(HP)		
VS65040 3	40	200	268		
VS65050 3	50	250	335		
VS65060 3	60	315	422		
VS65070 3	70	355	476		
VS65080 3	80	400	536		
VS65090 3	90	450	603		
VS65100 3	100	500	670		
VS65110 3	110	560	751		
VS65120 3	120	630	845		
VS65140 3	140	710	952		
VS65160 3	160	800	1073		
VS65180 3	180	900	1207		
VS65200 3	200	1000	1341		
VS65250 3	250	1250	1676		
VS65280 3	280	1400	1877		
VS65320 3	320	1600	2145		
VS65360 3	360	1800	2413		
VS65400 3	400	2000	2681		
VS65450 3	450	2240	3003		
VS65500 3	500	2500	3352		
VS65560 3	560	2800	3754		

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

VS65 4.16kV				
CODE	NOMINAL	MOTOR POWER		
CODE	CURRENT (A)	(kW)	(HP) ^[3]	
VS65050 4	50	298	400	
VS65055 4	55	336	450	
VS65060 4	60	373	500	
VS65070 4	70	447	600	
VS65080 4	80	522	700	
VS65095 4	95	597	800	
VS65110 4	110	671	900	
VS65120 4	120	746	1000	
VS65150 4	150	932	1250	
VS65180 4	180	1119	1500	
VS65210 4	210	1305	1750	
VS65240 4	240	1491	2000	
VS65270 4	270	1678	2250	
VS65300 4	300	1864	2500	
VS65320 4	320	2051	2750	
VS65350 4	350	2237	3000	
VS65410 4	410	2610	3500	
VS65470 4	470	2983	4000	
VS65530 4	530	3356	4500	
VS65590 4	590	3728	5000	

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

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

VS65 5-5.5kV				
CODE	NOMINAL	MOTOR POWER		
CODE	CURRENT (A)	(kW) ^[4]	(HP)	
VS65050 5	50	400	536	
VS65055 5	55	450	603	
VS65060 5	60	500	671	
VS65065 5	65	560	751	
VS65075 5	75	630	845	
VS65085 5	85	710	952	
VS65095 5	95	800	1073	
VS65110 5	110	900	1207	
VS65120 5	120	1000	1341	
VS65150 5	150	1250	1676	
VS65170 5	170	1400	1877	
VS65190 5	190	1600	2146	
VS65220 5	220	1800	2414	
VS65240 5	240	2000	2682	
VS65270 5	270	2240	3004	
VS65300 5	300	2500	3353	
VS65330 5	330	2800	3755	
VS65380 5	380	3150	4224	
VS65420 5	420	3550	4761	
VS65480 5	480	4000	5364	
VS65540 5	540	4500	6035	
VS65600 5	600	5000	6705	

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



VS65 6kV – 6.6kV				
CODE	NOMINAL	MOTOR POWER		
CODE	CURRENT (A)	(kW) ^[5]	(HP)	
VS65040 6	40	400	536	
VS65045 6	45	450	603	
VS65050 6	50	500	671	
VS65055 6	55	560	751	
VS65060 6	60	630	845	
VS65070 6	70	710	952	
VS65080 6	80	800	1073	
VS65090 6	90	900	1207	
VS65100 6	100	1000	1341	
VS65125 6	125	1250	1676	
VS65140 6	140	1400	1877	
VS65160 6	160	1600	2146	
VS65180 6	180	1800	2414	
VS65200 6	200	2000	2682	
VS65220 6	220	2240	3004	
VS65250 6	250	2500	3353	
VS65280 6	280	2800	3755	
VS65300 6	300	3150	4224	
VS65350 6	350	3550	4761	
VS65400 6	400	4000	5364	
VS65450 6	450	4500	6035	
VS65500 6	500	5000	6705	
VS65560 6	560	5600	7510	

[5]	kW	standard	motor	rated	power	(cos	φ=	0.88,	6.6k ^v	V)

VS65 13.8kV - NEMA				
CODE	NOMINAL	MOTOR POWER		
CODE	CURRENT (A)	(kW) ^[7]	(HP)	
VS65040 138	40	746	1000	
VS65050 138	50	932	1250	
VS65060 138	60	1119	1500	
VS65070 138	70	1305	1750	
VS65080 138	80	1491	2000	
VS65090 138	90	1678	2250	
VS65100 138	100	1864	2500	
VS65120 138	120	2237	3000	
VS65140 138	140	2610	3500	
VS65160 138	160	2983	4000	
VS65180 138	180	3356	4500	
VS65200 138	200	3728	5000	
VS65220 138	220	4101	5500	
VS65240 138	240	4474	6000	
VS65270 138	270 [8]	5220	7000	
VS65310 138	310 [8]	5966	8000	

[7] kW standard motor rated power (cos φ = 0.8, 13.8kV). [8] Overload capacity limited.

VS65 10kV – 11kV				
CODE	NOMINAL MO		FOR POWER	
CODL	CURRENT (A)	(kW) ^[6]	(HP)	
VS65020 8	20	355	476	
VS65025 8	25	400	536	
VS65030 8	30	500	671	
VS65035 8	35	630	845	
VS65040 8	40	710	952	
VS65050 8	50	800	1073	
VS65055 8	55	900	1207	
VS65060 8	60	1000	1341	
VS65075 8	75	1250	1676	
VS65085 8	85	1400	1877	
VS65095 8	95	1600	2146	
VS65110 8	110	1800	2414	
VS65120 8	120	2000	2682	
VS65135 8	135	2240	3004	
VS65150 8	150	2500	3353	
VS65170 8	170	2800	3755	
VS65190 8	190	3150	4224	
VS65210 8	210	3550	4761	
VS65240 8	240	4000	5364	
VS65270 8	270	4500	6035	
VS65300 8	300	5000	6705	
VS65340 8	340	5600	7510	
VS65380 8	380	6300	8449	

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

NOTES 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.



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FOR ALL MEDIUM VOLTAGE INDUSTRIAL APPLICATIONS

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OIL & GAS

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... XMV660 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.

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. Customisation 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

POWER ELECTRONICS / INDUSTRIES





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.

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 (I/s, m³/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 mater-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 m³/day



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



Facility: Desalination plant Bajo Almanzora Location: Almeria (Spain) Capacity: 20 hm³/year



Facility: Tuaspring desalination plant Location: Singapore Capacity: 318,500m³ a day



Facility: Water system Mexico DF Location: Mexico



Facility: EDAR Galindo Waste water treatment Location: Sestao, Spain Capacity: 350.000m³/day



MINING & CEMENT

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.

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: Zapoltitic 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



METALS

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. 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 customised 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



POWER GENERATION

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.

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



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



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

Warranty

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, 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. Not withstanding 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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