

# DATASHEET

# Hybrid var compensators

Hybrid var compensators (HVC) are the ultimate answer to power quality problems caused by waveform distortions, low power factor, voltage variations, voltage fluctuations and load unbalance for a wide range of segments and applications. They are a high performance, compact, flexible, modular and cost-effective type of active power filters (APF) that provide an instantaneous and effective response to power quality problems in low or high voltage electric power systems. They enable longer equipment lifetime, higher process reliability, improved power system capacity and stability, and reduced energy losses, complying with most demanding power quality standards and grid codes.



HVC rated 400V 50/60Hz -144kvar to +984kvar

HVCs combine the technical advantages of active harmonic filters (AHF) or static var generators (SVG) with the cost-effectiveness of conventional contactor or thyristor switched detuned filter capacitor banks to form an economical stepless real-time compensator with a single controller. They combine different functions in a single device:

- Elimination of harmonic currents and voltages.
- Power factor correction (lagging or leading).
- Voltage variations (sags & swells) reduction.
- Voltage fluctuations (flicker) mitigation.
- Load balancing in three-phase systems.
- Controlled & selectable harmonic generation.



Typical design of an HVC

### Highlights

- Full range: Specifications from -144kvar to +984kvar (200V-690V) in 3- & 4-wire systems can be covered by a single AHF or SVG module (unlimited amount can be paralleled).
- Simple connection to high voltage systems.
- 3-level NPC inverter topology reduces losses, noise, size and extends module's lifetime.
- Overall response time <100 microseconds.
- Instantaneous, precise & stepless power factor correction of inductive and capacitive loads.
- Global or selective compensation of harmonic currents up to the 50th order (odd and even).
- Load balancing and unloading of neutral wires.
- Not possible to over or under compensate the system and no risk of harmonic resonance.
- Compact and modular design optimized for installation, commissioning and maintenance.

#### Typical segments

HVCs can be applied to small, medium or large applications in a wide range of segments.

Markets	Segments	Applications
Smart grid	Renewable generation	
	Non-renewable generation	
	Transmission & distribution	
	Microgrids	
Raw material	Mining	
extraction &	Oil & gas	
processing	Minerals & cement	
	Steel & metals	
Manufacturing & infrastructure	Conventional manufacturing	
	Critical process industries	
	Transport	
	Water & wastewater	
Green	Healthcare facilities	
buildings &	Critical process facilities	
smart cities	Industrial & office facilities	
	Retail & leisure facilities	

Applications: Green -primary, yellow - secondary, red - none.

## **Typical applications**

HVCs have many low and high voltage potential applications where their use offers many benefits.

- Equipment using variable speed drives (VSD).
- Arcing devices: Electric arc furnaces (EAF), discharge-type lighting (fluorescent, sodium vapor and mercury vapor) and arc welders.
- Switch mode power supplies: Computers, TVs, battery chargers, LED lighting, PLCs, etc.
- UPS systems.
- Solar inverters and wind turbine generators.
- Modulated phase controllers, cycloconverters and thyristor-controlled AC voltage regulators.
- Saturable/rotating devices: Induction heaters, transformers, generators, reactors and motors.



#### ELCO POWER (MALAYSIA) SDN BHD

11 Jln SS13/3A, Subang Jaya Industrial Estate, 47500 Subang Jaya, Selangor Darul Ehsan, Malaysia. Tel: +6 (03) 5637 7302 Fax: +6 (03) 5634 3961 Email: sales@elcopower.com.my Website: www.elcopower.com.my



- Installations with fast changing reactive power demand or highly dynamic loads like ball mills.
- Correction of leading power factor like in data centers allowing back-up generators operation
- Railway electrification systems: Trains & trams
- Loads with low power factor: Motors, cables, lightly loaded transformers, lighting, etc.

### **Operating principle**

An HVC is a power electronics-based device connected in parallel with the load that creates power quality problems. The HVC works as a controlled current source providing any kind of current waveform in real time.

HVCs use the capacitor bank steps to fulfil the most of the capacitive reactive power needs of the system while the AHF or SVG will take care of the extra continuous compensation needed (capacitive or inductive). At the same time, they can filter out the harmonics of the system, reduce voltage variations, mitigate flicker and balance the loads.



HVC operating principle

# Comparison with conventional solutions

#### **Benefits**

Main benefits of HVCs can be summarized as:

- Protection of loads and equipment from waveform distortions, voltage variations and fluctuations, low power factor and unbalance.
- Capability to deliver instantaneous capacitive and inductive reactive power compensation.
- Optimized for applications where conventional capacitor banks, reactor banks or passive harmonic filters are unable to perform.
- No risk of harmonic amplification or resonance
- Unaffected by network voltage drop. Even at reduced network voltage levels, full reactive current can be provided to meet demand.
- Flexibility: Take care of individual disturbance patterns and automatically adapt to changing load conditions and network topologies.
- Simple dimensioning and installation.
- Compliance with the strictest power quality standards and grid codes including G5/4, IEEE519, IEC61000 3-2/3-4 and EN50160.



HVC connection

	Capacitor banks, reactor banks or passive harmonic filters	Hybrid var compensators
Response time	•Contactor-based solutions take at least 30s to 40s to mitigate the problem and thyristor-based solutions 20ms to 30ms	•Real-time mitigation of power quality problems as the overall response time is less than 100µs
Output	•Depends on step sizes, cannot match load demand in real time •Depends on grid voltage as capacitor units & reactors are used •Steps inject extra capacitive reactive power in the system	<ul> <li>Instantaneous, continuous, stepless and seamless</li> <li>Grid voltage fluctuation has no influence on the output</li> <li>No injection of extra capacitive reactive power</li> </ul>
Harmonic filtering	<ul> <li>One filter needed for eliminating each single harmonic order</li> <li>Characteristics affected by network impedance and unbalance</li> </ul>	<ul> <li>2nd to the 50th order simultaneously (odd and even)</li> <li>Unaffected by network impedance or unbalance</li> </ul>
Power factor correction	<ul> <li>Capacitor banks needed for inductive loads and reactor banks for capacitive loads. Problems in systems with mixed loads</li> <li>Not possible to guarantee unity power factor as they have steps, system will be having continuous over and undercompensation</li> </ul>	<ul> <li>Corrects simultaneously from -1 to +1 power factor of lagging (inductive) and leading (capacitive) loads</li> <li>Guaranteed unity power factor at all times without any over or undercompensation (stepless output)</li> </ul>
Unbalance	Do not correct load unbalance	•Can correct by selecting the amount of load balancing
Design & sizing	<ul> <li>Extensive harmonic studies needed to size the proper solution</li> <li>Usually oversized to better adjust to changing load demands</li> <li>Need to be designed taking into account system harmonics</li> <li>Custom-built for specific load and network conditions</li> </ul>	<ul> <li>Not required extensive studies as it is adjustable</li> <li>Mitigation capacity can be exactly what load demands</li> <li>Unaffected by harmonic distortion in the system</li> <li>Can adapt to load and network conditions &amp; changes</li> </ul>
Resonance	Parallel or series resonance can amplify currents in the system	•No risk of harmonic resonance with the network
Transients	•Caused by the switching of capacitor units or shunt reactors	•Not created (no switching of passive components)
Overloading	Possible due to slow response and/or variation of loads	•Not possible as current limited to max. RMS current
Footprint & installation	<ul> <li>Medium to large footprint, especially if several harmonic orders</li> <li>Not simple installation, especially if loads upgraded frequently</li> </ul>	• Small footprint and simple installation as modules are compact in size. Existing switchgear can be used
Expansion	•Limited and depends on load conditions and network topology	•Simple (and not dependant) by adding modules
Maintenance & lifetime	•Using components that need extensive maintenance like fuses, circuit breakers, contactors, reactors and capacitor units •Switching, transients and resonance reduce lifetime	•Simple maintenance and service life up to 15 years as there is no electro-mechanical switching and no risk of transients or resonance



11 Jln SS13/3A, Subang Jaya Industrial Estate, 47500 Subang Jaya, Selangor Darul Ehsan, Malaysia. Tel: +6 (03) 5637 7302 Fax: +6 (03) 5634 3961 Email: sales@elcopower.com.my Website: www.elcopower.com.my



# Technical specifications – 200-480VAC devices

HVC WITH 1 MODULE	A2-50	A2-60	A2-75	A2-100	A2-120	A2-150	A2-200				
Bata da a Kara		000 400 40 + 400		Electrical ratings	and the second second second						
Rated voltage Rated frequency		200-480VAC +/-10%	(auto sensing). Con	inection to higher volta 50/60Hz (auto sensing	ges through suitable s	step-up transformer.					
Reactive power output at 415V	-36 to +246kvar	-43 to +283kvar	-54 to +354kvar	-72 to +492kvar	-86 to +566kvar	-108 to +708kvar	-144 to +984kvar				
using SVG module	05 to 1475 been	00.4- + 0404	07.5 40 000.5 4000	50 to 10501a and	00.1	75 10 1 505 10 100	400 to 1700				
Reactive power output at 415V using AHF module at 50%	-25 to +175kvar	-30 to +210kvar	-37.5 to +262.5kvar	-50 to +350kvar	-60 to +420kvar	-75 to +525kvar	-100 to +700kvar				
Phase RMS current output at 415V using AHF module at 50%	35A	42A	53A	70A	85A	106A	141A				
Neutral RMS current output at 415V using AHF module at 50%	150A	180A	225A	300A	360A	450A	600A				
Reactive power output at high	-36 to +246kvar	-43 to +283kvar	-54 to +354kvar	-72 to +492kvar	-86 to +566kvar	-108 to +708kvar	-144 to +984kvar				
voltage (>1kV) with SVG and transformer (415V secondary)											
Prostion / response time	Electrical features Reaction time <50 microseconds / Overall response time <100 microseconds (1 network cycle if working in selectable mode).										
Electrical system compatibility	3-phase 3-wire and 3-phase 4-wire.										
Inverter features	3-level NPC inverter topology (IGBT). Switching frequency 20kHz.										
Controller / redundancy	Each module has an independent controller. In parallel operation of several modules, if any module fails, the rest will continue in operation.										
Operation modes	All harmonics / All harmonics but not fundamental / Selectable harmonics.										
Power factor correction	Optimized, stepless and continuously adjustable power factor correction, leading (capacitive) and lagging (inductive).										
Voltage support	Reduction of voltage variations (sags and swells) and mitigation of voltage fluctuations (flicker) via reactive power injection.										
	rvegauve sequence current injected to balance tundamental current on the system (inherently corrects displacement power factor). Load balancing degree can be set from 0% to 100% of the output current of the module.										
Harmonic generation function	Controlled & selectable harmonic injection can be used for validating the performance of different components of the electric power system.										
Stand-by & AutoStart	Overcurrent, overvoltage, undervoltage, overtemperature and ripple circuit overload. Stand-by stops the IGBTs if required compensation current is below a certain limit. AutoStart allows automatic start after a petwork failure										
Remote discrete control			,	Remote run/stop.							
Number of stope and size		6 appositor bask ato		Capacitor bank step	S	an 10kers to 200kers					
Protection		6 capacitor bank ste	Fuses or mou	Ided case circuit brea	kers (MCCBs).	eri tukvar lo zuukvar.					
Switching devices			Contacto	ors or thyristor switch	modules.						
Reactors Capacitor units	Singlo	phase capacitor units	Iron-core o	detuned reactors 6%, 7	7% or 14%.	atod intornally in star o	or dolta				
	Sirigie	phase capacitor units	Connected in star or	Connections	capacitor units connec	sted internally in star o					
Digital inputs	3 po	tential free inputs 15-4	18VDC or up to 277VA	AC. Any input can be p	rogrammed as trigger	for stand-by, trip or al	larm.				
Digital outputs	6 potential free of	utputs DC or up to 27	7VAC. 4 can be progr	ammed for trip, alarm,	running & force, or a	I can be used for capa	acitor bank steps.				
CT location	Open loop	(current transformer	s in the load side) and	closed loop (current f	ransformers in the su	pply side) connections	s possible.				
CT polarity	If one or more (	CTs are connected wi	th inversed polarity, it	is possible to change	the load current polar	ity from normal to inve	rsed in the HMI.				
Number of CTs required	Open loop cor	nection: 3 C I s. Close ed scalability Parallel	ed loop connection of loperation of any ratir	1 module: 3 C I s. Clo	sed loop connection o	Open loop connection: 3 CTs. Closed loop connection of 1 module: 3 CTs. Closed loop connection of several modules in parallel: 6 CTs.					
	Unlimited scalability. Parallel operation of any rating combinations up to 7 modules per one HMI. Unlimited amount of HMIs.										
				Interfaces	r modules per one m	All. Unlimited amount o	of HMIs.				
HMI / display		7" touch s	creen multilingual gra	Interfaces	ages can be added or	n request).	of HMIS.				
HMI / display Monitoring and reporting Communication capability		7" touch s On-site and re	creen multilingual gra mote monitoring capa Et	Interfaces aphical HMI (new langu abilities. Reports data of hernet and Modbus TO	ages can be added or of power quality events	vil. Unlimited amount o n request). s up to 30 days.	of HMIs.				
HMI / display Monitoring and reporting Communication capability Software update		7" touch s On-site and re	creen multilingual gra mote monitoring capa Et Vi	Interfaces Interfaces Iphical HMI (new langu Ibilities. Reports data of hernet and Modbus TO ia Ethernet or USB driv	ages can be added or of power quality events CP. ve.	n request). s up to 30 days.	of HMIs.				
HMI / display Monitoring and reporting Communication capability Software update Enclosure features		7" touch s On-site and re	creen multilingual gra mote monitoring capa Et Mec Compact IP20 ga	Interfaces phical HMI (new langu bilities. Reports data of hernet and Modbus T( ia Ethernet or USB dri- hanical features (mo Wanized steel enclos)	ages can be added or of power quality events CP. ve. dule) re in black colour.	n request). s up to 30 days.	of HMIs.				
HMI / display Monitoring and reporting Communication capability Software update Enclosure features Cooling method	Fc	7" touch s On-site and re	icreen multilingual gra mote monitoring capa Et Vi Mec Compact IP20 ga ervice automatically co	Interfaces uphical HMI (new langu bilities. Reports data of hernet and Modbus TC ia Ethernet or USB driv hanical features (mo livanized steel encloss) pontrolled DC cooling fa	ages can be added or of power quality events CP. ve. dule) ire in black colour. ins adjusted by modul	ML Unlimited amount o n request). s up to 30 days. e temperature via PW	M.				
HMI / display Monitoring and reporting Communication capability Software update Enclosure features Cooling method Losses	Fc	7" touch s On-site and re rced air by easy to se	creen multilingual gra mote monitoring capa Et Vi Mec Compact IP20 ga ervice automatically co	Interfaces Interfaces Iphical HMI (new langu- Ibilities. Reports data of hernet and Modbus TC ia Ethernet or USB dri- hanical features (mo Ivanized steel enclosus pontrolled DC cooling fa <2.3%	ages can be added or of power quality events pp. ve. dule) rre in black colour. Ins adjusted by modul	ML Unlimited amount on request). Is up to 30 days. In the temperature via PW	M.				
HMI / display Monitoring and reporting Communication capability Software update Enclosure features Cooling method Losses Noise level (ISO 3746) Dimensions WxHXD	60dB 225x850x500mm	7" touch s On-site and re rced air by easy to se 60dB 225x850x500mm	icreen multilingual gra mote monitoring capa Et Vit Mec Compact IP20 ga ervice automatically co 64dB 225x850x500mm	Interfaces Interfaces Iphical HMI (new langu Ibilities. Reports data of hernet and Modbus TC ia Ethernet or USB driv hanical features (mo Ivanized steel enclose ontrolled DC cooling fa <2.3% 64dB 225x850x500mm	ages can be added ou of power quality events PP. ve. dule) ure in black colour. uns adjusted by modul 65dB 225x850x500mm	II. Unlimited amount o      request).     s up to 30 days.      e temperature via PW     67dB     225x1150x500mm	M. 68dB 225x1150x500mm				
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HMI / display Monitoring and reporting Communication capability Software update Enclosure features Cooling method Losses Noise level (ISO 3745) Dimensions WxHxD Weight Temperature (without derating) Humidity Altitude (without derating) Needed airflow for the module Ventilation requirements Main circuit fuses Cable entry Electromagnetic compatibility Third party approvals Short-circuit current Power frequency voltage test Impulse withstand voltage Short-circuit current Power frequency soltage Short-circuit current Power frequency soltage Short-circuit current Power frequency soltage Enclosure IP class Enclosure IP class Enclosure material and colour Panel thickness and treatment Cooling method Cable entry Door locking system	Fc 60dB 225x850x500mm 70kg 350 m³/h NH00 gL/gG 63A MCC	7" touch s On-site and re rced air by easy to se 60dB 225x850x500mm 70kg +5°C to 350 m³/h 300r NH00 gL/gG 80A CB or fuse-switch. Ge According IP20 to IP42 f Galva	creen multilingual gra mote monitoring capa mote monitoring capa mote monitoring capa mote monitoring capa Mec Compact IP20 ga ervice automatically co 64dB 225x850x500mm 70kg 140°C. Maximu 400 m³/h nm free space below NH00 gL/gG 100A Star Emissions: EN/IEC Ele 65kA m mereal design rule is to g to local regulations, Mec for indoor installation ( inized steel, light grey 2m For andle without lock, lock	Interfaces phical HMI (new langu- bilities. Reports data of hernet and Modbus TG ia Ethernet or USB drin hanical features (mo ivanized steel enclosu- ontrolled DC cooling fa <2.3% 64dB 225x850x500mm 70kg stallation and operat with 8% RH, non-conc Up to 1000m. 450 m³/h and above the module NH00 gL/gG 125A Top or bottom. ndards and certificat EN 50178 c 61000-6-4. Immunity: CE, UL. ctrical features (cub 2.5kV/1min 6kV ms (3 seconds) / 143k s elect the protection 1 free-standing cubicle other classes or outdor RAL7035 (other mate m. Epoxy powder coa ced air or heat exchar Top or bottom.	ages can be added or of power quality events CP. ve. dule) re in black colour. ins adjusted by modul 65dB 225x850x500mm 70kg ion +5°C to +30°C. fensing. 500 m³/h e required for air ventik NH00 gL/gG 160A ions EN/IEC 61000-6-2. icle) icle is the minimum recor is	e temperature via PW 67dB 225x1150x500mm 110kg +5°C to 750 m³/h ation. NH00 gL/gG 200A minal current of the den mended. s on request). iuest).	M. 68dB 225x1150x500mm 110kg +40°C. 1000 m³/h NH00 gL/gG 250A vice.				
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HMI / display Monitoring and reporting Communication capability Software update Enclosure features Cooling method Losses Noise level (ISO 3746) Dimensions WXHXD Weight Temperature (without derating) Humidity Attitude (without derating) Needed airflow for the module Ventilation requirements Gable entry Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit protection Earthing Mounting arrangement Enclosure IP class Enclosure material and colour Panel thickness and treatment Cooling method Cable entry Door locking system	Fc 60dB 225x850x500mm 70kg 350 m³/h NH00 gL/gG 63A MCC	7" touch s On-site and re rced air by easy to se 60dB 225x850x500mm 70kg +5°C to 350 m³/h 300r NH00 gL/gG 80A CB or fuse-switch. Ge According IP20 to IP42 f Galva	creen multilingual gra mote monitoring capa mote monitoring capa mote monitoring capa mote monitoring capa mote monitoring capa Mec Compact IP20 ga crvice automatically co 64dB 225x850x500mm 70kg Ind 225x850x500mm 70kg Ind 225x850x500mm 70kg Ind 24d0 m³/h nm free space below NH00 gL/gG 100A Star Emissions: EN/IEC Ele 65kA rr ineral design rule is to g to local regulations, Mec for indoor installation ( inized steel, light grey 2m For andle without lock, lock	Interfaces phical HMI (new langu biblities. Reports data of hernet and Modbus TG la Ethernet or USB drin hanical features (mo livanized steel enclosu ontrolled DC cooling fa <2.3% 64dB 225x850x500mm 70kg stallation and operat um 85% RH, non-conc Up to 1000m. 450 m²/h and above the module NH00 gL/gG 125A Top or bottom. ndards and certificat EN 50178 c 81000-6-4. Immunity: CE, UL. ctrical features (cub 2.5kV/1min 6kV ms (3 seconds) / 143k select the protection 16mm² Cu conductor hanical features (cub creasses or outdo RAL7035 (other mate m. Epoxy powder coa ced air or heat exchara Top or bottom. k with key, electrical fo Electrical ratings	ages can be added or of power quality events CP. ve. dule) re in black colour. ins adjusted by modul 65dB 225x850x500mm 70kg ion +5°C to +30°C. fensing. 500 m³/h required for air ventil. NH00 gL/gG 160A ions EN/IEC 61000-6-2. icle) cA peak. evel 1.3 times the nor is the minimum recor picle) cor installation cubicle rials or colours on rec ting. ger.	In Unlimited amount of a request).     sup to 30 days.     e temperature via PW         67dB         225x1150x500mm         110kg         +5°C to         750 m³/h         ation.         NH00 gL/gG 200A         minal current of the denomended.     s on request).     uest).     uest).	M. 68dB 225x1150x500mm 110kg +40°C. 1000 m³/h NH00 gL/gG 250A vice.				
HMI / display Monitoring and reporting Communication capability Software update Enclosure features Cooling method Losses Noise level (ISO 3746) Dimensions WXHXD Weight Temperature (without derating) Humidity Attitude (without derating) Needed airflow for the module Ventilation requirements Main circuit fuses Cable entry Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit protection Earthing Mounting arrangement Enclosure IP Class Enclosure material and colour Panel thickness and treatment Cooling method Cable entry Door locking system	Fc 60dB 225x850x500mm 70kg 350 m³/h NH00 gL/gG 63A MCC	7" touch s On-site and re rced air by easy to se 60dB 225x850x500mm 70kg +5°C to 350 m³/h 300r NH00 gL/gG 80A 0 NH00 gL/gG 80	creen multilingual gra mote monitoring capa mote monitoring capameter capa mote monitoring capameter capam	Interfaces phical HMI (new langu biblities. Reports data of hernet and Modbus TG ia Ethernet or USB drin hanical features (mo livanized steel encloss ontrolled DC cooling fa <2.3% 64dB 225x850x500mm 70kg stallation and operat um 85% RH, non-conc Up to 1000m. 450 m²/h and above the module NH00 gL/gG 125A Top or bottom. ndards and certificat EN 50178 c 61000-6-4. Immunity: CE, UL. ctrical features (cub 2.5kV/1min 6kV ms (3 seconds) / 143k select the protection 16mm² Cu conductor hanical features (cub 2.5kV/1min 6kV ms (3 seconds) / 143k select the protection 16mm² Cu conductor hanical features (cub catal features (cub ca	ages can be added or of power quality events CP. ve. dule) re in black colour. Ins adjusted by modul 65dB 225x850x500mm 70kg ion +5°C to +30°C. Jensing. 500 m³/h required for air ventil. NH00 gL/gG 160A ions EN/IEC 61000-6-2. icle) CA peak. evel 1.3 times the nor is the minimum recor bicle cor installation cubicle rials or colours on rec ting. ger. ck or special safety lo	e temperature via PW 67dB 225x1150x500mm 110kg +5°C to 750 m³/h ation. NH00 gL/gG 200A ninal current of the den mended. s on request). uest). ck.	M. 68dB 225x1150x500mm 110kg +40°C. 1000 m³/h NH00 gL/gG 250A vice.				



ELCO POWER (MALAYSIA) SDN BHD
 11 Jln SS13/3A, Subang Jaya Industrial Estate, 47500 Subang Jaya, Selangor Darul Ehsan, Malaysia.
 Tel: +6 (03) 5637 7302 Fax: +6 (03) 5634 3961 Email: sales@elcopower.com.my Website: www.elcopower.com.my



# Technical specifications – 500-690VAC devices

HVC WITH 1 MODULE	A2-50-E	A2-60-E	A2-75-E	A2-100-E	A2-120-E		
Datadualtare	Electrical ratings						
Rated voltage	500-08	UVAC +/- 10% (auto sensing).	50/60Hz (auto sensing).	iniough suitable step-up transi	onner.		
Reactive power output at 690V	-60 to +420kvar	-72 to +492kvar	-90 to +630kvar	-120 to +840kvar	-143 to +983kvar		
using SVG module	40 to + 290kupr	E0 to + 2E0layor	60 to 1 420 layor	90 to + E60kror	100 to + 700kvor		
using AHF module at 50%	-40 to +280kvar	-50 t0 +350kVar	-00 to +420kvar	-80 10 +360kvar	- 100 to +700kvar		
Phase RMS current output at	35A	42A	53A	70A	85A		
690V using AHF module at 50%	1504	1004	2254	200.4	2004		
690V using AHF module at 50%	AUGI	160A	220A	300A	300A		
Reactive power output at high	-60 to +420kvar	-72 to +492kvar	-90 to +630kvar	-120 to +840kvar	-143 to +983kvar		
voltage (>1kV) with SVG and							
transformer (690V secondary)			Electrical features				
Reaction / response time	Reaction time <5	) microseconds / Overall resp	onse time <100 microseconds	(1 network cycle if working in s	selectable mode).		
Electrical system compatibility	3-phase 3-wire (500-690VAC modules) and 3-phase 4-wire (500-525VAC modules). 3-level NPC inverter topology (IGBT). Switching frequency 20kHz.						
Controller / redundancy	Each module has an independent controller. In parallel operation of several modules, if any module fails, the rest will continue in operation.						
Harmonic filtering	1st to 50th harmonic order (odd and even harmonics). Fully selectable and programmable per harmonic order.						
Operation modes	All harmonics / All harmonics but not fundamental / Selectable harmonics.						
Voltage support	Optimized, stepless and continuously adjustable power factor correction, leading (capacitive) and lagging (inductive). Reduction of voltage variations (sags and swells) and mitigation of voltage fluctuations (flicker) via reactive power injection						
Load balancing	Negative sequence current injected to balance fundamental current on the system (inherently corrects displacement power factor).						
Harmonic constation function	Controlled & colociable	Load balancing degree can be	be set from 0% to 100% of the	output current of the module.	electric power system		
Protection functions		Overcurrent, overvoltage.	undervoltage, overtemperature	and ripple circuit overload.	e electric power system.		
Stand-by & AutoStart	Stand-by stops the IGB	Ts if required compensation c	urrent is below a certain limit. A	AutoStart allows automatic star	t after a network failure.		
Remote discrete control			Remote run/stop.				
Number of steps and size	5 capa	citor bank steps per module. C	ne digital output can switch a	step rated between 10kvar to 2	00kvar.		
Protection		Fuses or	moulded case circuit breakers	(MCCBs).			
Switching devices		Con	tactors or thyristor switch mod	ules.			
Capacitor units	Single-phase c	apacitor units connected in sta	r or delta, or three-phase capa	r 14%. citor units connected internally	in star or delta.		
	- <b>.</b>	F	Connections	,			
Digital inputs	3 potential fre	e inputs 15-48VDC or up to 27	7VAC. Any input can be progra	ammed as trigger for stand-by,	trip or alarm.		
Current transformers (CT)	5 potential free outputs D	Any primary ratio with 1A or	5A secondary (5A preferred).	Class 1 accuracy or better.	for capacitor bank steps.		
CT location	Open loop (current	transformers in the load side)	and closed loop (current trans	formers in the supply side) cor	nnections possible.		
CT polarity	If one or more CTs are o	connected with inversed polari	y, it is possible to change the I	oad current polarity from norma	al to inversed in the HMI.		
Connection of parallel modules	Unlimited scala	bility. Parallel operation of any	rating combinations up to 7 m	odules per one HMI. Unlimited a	amount of HMIs.		
		<u> </u>	Interfaces	•			
HMI / display Monitoring and reporting	0	7" touch screen multilingua	graphical HMI (new languages	s can be added on request).	<u> </u>		
Communication capability	0	n-site and remote monitoring t	Ethernet and Modbus TCP.	wer quality events up to 50 day	3.		
Software update			Via Ethernet or USB drive.				
Enclosure features		Compact IP2	Aechanical features (module 0 galvanized steel enclosure in	) black colour			
Cooling method	Forced air	by easy to service automatical	ly controlled DC cooling fans a	djusted by module temperature	e via PWM.		
Losses			<2.8%		00.15		
Noise level (ISO 3746) Dimensions WxHxD	67dB 225x1150x500mm	6/dB 225x1150x500mm	67dB 225x1150x500mm	67dB 225x1150x500mm	680B 225x1150x500mm		
Weight	120kg	120kg	120kg	120kg	120kg		
To more ture (without denoting)			Installation and operation				
Humidity		Ma	ximum 85% RH, non-condens	ing.			
Altitude (without derating)			Up to 1000m.	-			
Needed airflow for the module	350 m³/h	350 m³/h 300mm free space be	400 m <sup>3</sup> /h low and above the module reg	450 m³/h	500 m³/h		
Main circuit fuses	NH00 gL/gG 63A	NH00 gL/gG 80A	NH00 gL/gG 100A	NH00 gL/gG 125A	NH00 gL/gG 160A		
Cable entry			Tan as bettern				
			TOP OF DOLLOFFI.				
Electrical safety			Standards and certifications EN 50178	i de la companya de l			
Electrical safety Electromagnetic compatibility		Emissions: EN	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN	IEC 61000-6-2.			
Electrical safety Electromagnetic compatibility Third party approvals		Emissions: EN	Standards and certifications EN 50178 //EC 61000-6-4. Immunity: EN CE, UL.	IEC 61000-6-2.			
Electrical safety Electromagnetic compatibility Third party approvals Power freq <u>uency voltage test</u>		Emissions: EN	ICP of obtion. Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN/ CE, UL. Electrical features (cubicle) 2.5kV/1min	iec 61000-6-2.			
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage		Emissions: EN	International Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN/ CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV	IEC 61000-6-2.			
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit current	MCD or for	Emissions: EN	International and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV c4 rms (3 seconds) / 143kA pe	IEC 61000-6-2.	of the device		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatic	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4A rms (3 seconds) / 143kA pe is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th	IEC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatic	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4A rms (3 seconds) / 143kA pe is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th Aechanical features (cubicle	EC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatio	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4A rms (3 seconds) / 143kA pe is to select the protection level is to select the protection level is , 16mm <sup>2</sup> Cu conductor is th Acchanical features (cubicle Free-standing cubicle.	IEC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement Enclosure IP class Enclosure material and colour	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatic P20 to IP42 for indoor installat Galvanized steel. linh t	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4A rms (3 seconds) / 143kA pe is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th Aechanical features (cubicle Free-standing cubicle. on (other classes or outdoor in rever NAL7035 (other materials	EC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement Enclosure IP class Enclosure material and colour Panel thickness and treatment	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatic I P20 to IP42 for indoor installat Galvanized steel, light	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4A rms (3 seconds) / 143kA pe is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th Aechanical features (cubicle Free-standing cubicle. on (other classes or outdoor in rgey RAL7035 (other materials 2mm. Epoxy powder coating.	IEC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement Enclosure IP class Enclosure material and colour Panel thickness and treatment Cooling method	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatic l P20 to IP42 for indoor installat Galvanized steel, light	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4A rms (3 seconds) / 143kA pe is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th Aechanical features (cubicle Free-standing cubicle. on (other classes or outdoor ir rgey RAL7035 (other materials 2mm. Epoxy powder coating. Forced air or heat exchanger.	EC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement Enclosure IP class Enclosure material and colour Panel thickness and treatment Cooling method Cable entry Door locking system	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatic P20 to IP42 for indoor installat Galvanized steel, light Handle without lock	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4A rms (3 seconds) / 143kA pe is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th Aechanical features (cubicle Free-standing cubicle. on (other classes or outdoor ir rgey RAL7035 (other materials 2mm. Epoxy powder coating. Forced air or heat exchanger. Top or bottom. lock with key, electrical lock of	IEC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement Enclosure IP class Enclosure material and colour Panel thickness and treatment Cooling method Cable entry Door locking system	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatic P20 to IP42 for indoor installat Galvanized steel, light Handle without lock	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4A rms (3 seconds) / 143kA pe is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th Aechanical features (cubicle Free-standing cubicle. on (other classes or outdoor in rgey RAL7035 (other materials 2mm. Epoxy powder coating. Forced air or heat exchanger. Top or bottom. lock with key, electrical lock o	IEC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement Enclosure IP class Enclosure material and colour Panel thickness and treatment Cooling method Cable entry Door locking system HVC WITH FEW MODULES	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatio P20 to IP42 for indoor installat Galvanized steel, light Handle without lock	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4Arms (3 seconds) / 143kApg is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th Aechanical features (cubicle Free-standing cubicle. on (other classes or outdoor in grey RAL7035 (other materials 2mm. Epoxy powder coating. Forced air or heat exchanger. Top or bottom. lock with key, electrical lock of	IEC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement Enclosure IP class Enclosure material and colour Panel thickness and treatment Cooling method Cable entry Door locking system HVC WITH FEW MODULES Rated voltage	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatio P20 to IP42 for indoor installat Galvanized steel, light Handle without lock	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4Arms (3 seconds) / 143kApe is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th Aechanical features (cubicle Free-standing cubicle. on (other classes or outdoor ir grey RAL7035 (other materials 2mm. Epoxy powder coating. Forced air or heat exchanger. Top or bottom. lock with key, electrical lock of Electrical ratings Connection to higher voltages	IEC 61000-6-2.	of the device.		
Electrical safety Electromagnetic compatibility Third party approvals Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement Enclosure IP class Enclosure material and colour Panel thickness and treatment Cooling method Cable entry Door locking system HVC WITH FEW MODULES Rated voltage RMS current output	MCCB or fus	Emissions: EN 65 e-switch. General design rule According to local regulatio P20 to IP42 for indoor installat Galvanized steel, light Handle without lock UVAC +/-10% (auto sensing). output is possible. Unlimited p	Standards and certifications EN 50178 /IEC 61000-6-4. Immunity: EN CE, UL. Electrical features (cubicle) 2.5kV/1min 6kV 4Arms (3 seconds) / 143kApp is to select the protection level ns, 16mm <sup>2</sup> Cu conductor is th Aechanical features (cubicle Free-standing cubicle. on (other classes or outdoor in rgey RAL7035 (other materials 2mm. Epoxy powder coating. Forced air or heat exchanger. Top or bottom. lock with key, electrical lock of Electrical ratings Connection to higher voltages arallel operation of any rating of	IEC 61000-6-2.	of the device.		



ELCO POWER (MALAYSIA) SDN BHD
 11 Jln SS13/3A, Subang Jaya Industrial Estate, 47500 Subang Jaya, Selangor Darul Ehsan, Malaysia.
 Tel: +6 (03) 5637 7302 Fax: +6 (03) 5634 3961 Email: sales@elcopower.com.my Website: www.elcopower.com.my