

Active harmonic filters

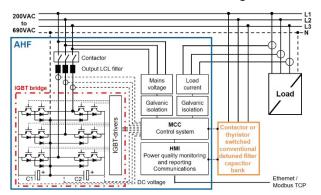
Active harmonic filters (AHF) are the ultimate answer to power quality problems caused by waveform distortions, low power factor, voltage variations, voltage fluctuations and load unbalance for a wide range of segments and applications. They are a high performance, compact, flexible, modular and cost-effective 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.



AHF module rated 400V 50/60Hz 100A

AHFs eliminate waveform distortions from the loads like harmonics, interharmonics and notching, and harmonic voltages caused by harmonic currents, by injecting in real-time the distorted current of same magnitude but opposite in phase in the electric power system. In addition, AHFs can take care of several other power quality problems by combining 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 AHF

Highlights

- Full range: Specifications from 50A to 200A (200V-690V) in 3- and 4-wire systems can be covered by a single module. Unlimited amount of AHF modules can be connected in parallel.
- 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.
- Global or selective compensation of harmonic currents up to the 50th order (odd and even).
- Instantaneous, precise & stepless power factor correction of inductive and capacitive loads.
- · Load balancing and unloading of neutral wires.
- Capability of switching contactors or thyristor switches of detuned filter capacitor bank steps.
- Compact and modular design optimized for installation, commissioning and maintenance.

Typical segments

AHFs 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 extraction & processing	Mining	
	Oil & gas	
	Minerals & cement	
	Steel & metals	
Manufacturing	Conventional manufacturing	
&	Critical process industries	
infrastructure	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

AHFs 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.

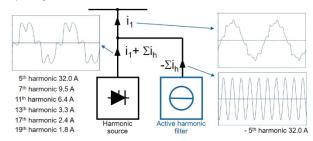




Operating principle

An AHF is a power electronics-based device connected in parallel with the load that requires harmonics mitigation. The AHF works as a controlled current source providing any kind of current waveform in real time.

AHFs monitor the currents of the load and compensate any produced harmonic currents by generating a compensation current for each selected harmonic order in phase opposition to the harmonic current. Result is a reduction on the levels of harmonics of the installation to the limit requested by the customer ensuring compliance with power quality standards and recommendations.



AHF operating principle

Benefits

Main benefits of AHFs can be summarized as:

- Protection of loads and equipment from waveform distortions, voltage variations and fluctuations, low power factor and unbalance.
- Energy efficiency and savings: Lower energy losses and a higher efficiency of the system.
- Reduced production or installation downtime.

- Increased lifetime of the electrical equipment.
- Better use of transformers and generators.
- 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.



AHF rated 415V 50/60Hz 400A

Comparison with conventional solutions

	Passive harmania filtara	A stive harmania filtara
	Passive harmonic filters	Active harmonic filters
Response	 Contactor-based solutions take at least 30s to 40s to mitigate 	
time	the problem and thyristor-based solutions 20ms to 30ms	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	• Grid voltage fluctuation has no influence on the output
	Steps inject extra capacitive reactive power in the system	No injection of extra capacitive reactive power
Harmonic	•One filter needed for eliminating each single harmonic order	•2nd to the 50th order simultaneously (odd and even)
filtering	• Characteristics affected by network impedance and unbalance	 Unaffected by network impedance or unbalance
Power factor	•Capacitor banks needed for inductive loads and reactor banks	•Corrects simultaneously from -1 to +1 power factor of
correction	for capacitive loads. Problems in systems with mixed loads	lagging (inductive) and leading (capacitive) loads
	•Not possible to guarantee unity power factor as they have steps,	• Guaranteed unity power factor at all times without any
	system will be having continuous over and undercompensation	over or undercompensation (stepless output)
Unbalance	Do not correct load unbalance	•Can correct by selecting the amount of load balancing
Design &	•Extensive harmonic studies needed to size the proper solution	Not required extensive studies as it is adjustable
sizing	•Usually oversized to better adjust to changing load demands	 Mitigation capacity can be exactly what load demands
	 Need to be designed taking into account system harmonics 	 Unaffected by harmonic distortion in the system
	Custom-built for specific load and network conditions	 Can adapt to load and network conditions & changes
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 &	•Medium to large footprint, especially if several harmonic orders	•Small footprint and simple installation as modules are
installation	•Not simple installation, especially if loads upgraded frequently	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



Technical specifications – 200-480VAC devices

LOOSE MODULES	A2-50	A2-60	A2-75	A2-100	A2-120	A2-150	A2-200	
	72 00	72 00	72.10	Electrical ratings	72 120	72 100	PE 200	
Rated voltage		200-480VAC +/-10°	% (auto sensing). Cor	nnection to higher voltage	es through suitable:	step-up transformer.		
Rated frequency				50/60Hz (auto sensing)				
Phase RMS current output	50A	60A	75A	100A	120A	150A	200A	
Neutral RMS current output	150A	180A	225A	300A Electrical features	360A	450A	600A	
Reaction / response time	Reaction	time <50 microseco	ands / Overall respons		nds (1 network cycle	if working in selectable	a mode)	
Electrical system compatibility	reaction	Reaction time <50 microseconds / Overall response time <100 microseconds (1 network cycle if working in selectable mode). 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.							
Harmonic filtering	1st to 50th harmonic order (odd and even harmonics). Fully selectable and programmable per harmonic order.							
Operation modes				nics but not fundamenta				
Power factor correction				ole power factor correcti		, , , , , , , , , , , , , , , , , , , ,		
Voltage support	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). Load balancing degree can be set from 0% to 100% of the output current of the module.						ver lactor).	
Harmonic generation function	Controlled & se			r validating the performa			power system.	
Protection functions				ervoltage, overtemperat				
Stand-by & AutoStart	Stand-by stop	s the IGBTs if required	d compensation curre	ent is below a certain lim	it. AutoStart allows a	automatic start after a r	etwork failure.	
Remote discrete control				Remote run/stop.				
	_ ::			nk steps control (HPQ		1.69		
Operation	Dedicate			hyristor switch modules			nk steps.	
Number of steps and size		b capacitor bank ste	eps per module. One	digital output can switch Connections	a step rated between	en 10kvar to 200kvar.		
Digital inputs	3 nc	ntential free inputs 15-	48VDC or up to 277V	AC. Any input can be pro	ogrammed as trigge	r for stand-by trip or al	arm.	
Digital outputs				rammed for trip, alarm,				
Current transformers (CT)	- p - t - t - t - t - t - t - t - t - t			secondary (5A preferre				
CT location	Open loor			d closed loop (current tr			possible.	
CT polarity		_		is possible to change t				
Number of CTs required	Open loop co	nnection: 3 CTs. Clos	sed loop connection of	f 1 module: 3 CTs. Clos	ed loop connection o	of several modules in p	arallel: 6 CTs.	
Connection of parallel modules	Unlimi	ted scalability. Paralle	el operation of any ration	ng combinations up to 7	modules per one HI	VII. Unlimited amount o	HMIs.	
				Interfaces				
HMI / display				aphical HMI (new langua	-			
Monitoring and reporting		On-site and re		abilities. Reports data of		s up to 30 days.		
Communication capability Software update				thernet and Modbus TC				
Software update	Via Ethernet or USB drive. Mechanical features							
Mounting arrangement			Loose modul	e ready for cubicle or wa	all installation.			
Enclosure features	Compact IP20 galvanized steel enclosure in black colour.							
Cooling method	Fo	orced air by easy to se	ervice automatically c	ontrolled DC cooling far	ns adjusted by modu	le temperature via PW	VI.	
Losses				<2.3%				
Noise level (ISO 3746)	60dB	60dB	64dB	64dB	65dB	67dB	68dB	
Dimensions WxHxD Weight	225x850x500mm 70kg	225x850x500mm 70kg	225x850x500mm 70kg	225x850x500mm 70kg	225x850x500mm 70kg	225x1150x500mm 110kg	225x1150x500mn	
TTOIGHT	7 0 kg	rong		stallation and operation		Trong	TTONG	
Temperature (without derating)		+5°C tr	o +40°C.		+5°C to +30°C.	+5°C to	+40°C.	
Humidity			Maxim	um 85% RH, non-conde	ensing.	•		
Attitude (without derating)				Up to 1000m.				
Needed airflow for the module	350 m³/h	350 m³/h	400 m³/h	450 m³/h	500 m³/h	750 m³/h	1000 m ³ /h	
Ventilation requirements				•			1000 111 711	
	AULION 1 / O 00A			and above the module				
Main circuit fuses	NH00 gL/gG 63A	NH00 gL/gG 80A	MH00 gL/gG 100A	NH00 gL/gG 125A	required for air ventil NH00 gL/gG 160A	ation. NH00 gL/gG 200A		
Main circuit fuses Cable entry	NH00 gL/gG 63A		NH00 gL/gG 100A	NH00 gL/gG 125A Top or bottom.	NH00 gL/gG 160A			
Cable entry	NH00 gL/gG 63A		NH00 gL/gG 100A	NH00 gL/gG 125A Top or bottom. Indards and certification	NH00 gL/gG 160A			
Cable entry	NH00 gL/gG 63A		NH00 gL/gG 100A	NH00 gL/gG 125A Top or bottom.	NH00 gL/gG 160A			
Cable entry Electrical safety	NH00 gL/gG 63A		NH00 gL/gG 100A	NH00 gL/gG 125A Top or bottom. Indards and certification EN 50178	NH00 gL/gG 160A			
Cable entry Electrical safety Electromagnetic compatibility Third party approvals	NH00 gL/gG 63A		NH00 gL/gG 100A Sta Emissions: EN/IEC	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity: CE, UL.	NH00 gL/gG 160A ons EN/IEC 61000-6-2.			
Cable entry Electrical safety Electromagnetic compatibility Third party approvals	NH00 gL/gG 63A		NH00 gL/gG 100A Sta Emissions: EN/IEC	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity: CE, UL.	NH00 gL/gG 160A ons EN/IEC 61000-6-2.			
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Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage	NH00 gL/gG 63A	NH00 gL/gG 80A	NH00 gL/gG 100A Sta Emissions: EN/IEC Mod % (auto sensing). Cort is possible. Unlimited	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity: CE, UL. Industrial of in cubi Electrical ratings In parallel operation of an	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles ges through suitable and a combination	NH00 gL/gG 200A		
Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage RMS current output	NH00 gL/gG 63A	NH00 gL/gG 80A	NH00 gL/gG 100A Sta Emissions: EN/IEC Mod % (auto sensing). Cort is possible. Unlimited	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity: CE, UL. Idules installed in cubi Electrical ratings nection to higher voltag I parallel operation of an	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles ges through suitable and a combination	NH00 gL/gG 200A		
Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage RMS current output Power frequency voltage test	NH00 gL/gG 63A	NH00 gL/gG 80A	NH00 gL/gG 100A Sta Emissions: EN/IEC Mod % (auto sensing). Cort is possible. Unlimited	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity: CE, UL. Industrial of in cubi Electrical ratings In parallel operation of an	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles ges through suitable and a combination	NH00 gL/gG 200A		
Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage RMS current output Power frequency voltage test Impulse withstand voltage	NH00 gL/gG 63A	NH00 gL/gG 80A	NH00 gL/gG 100A Sta Emissions: EN/IEC Moc % (auto sensing). Cor is possible. Unlimited Ele	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity: CE, UL. dules installed in cubi Electrical ratings nection to higher voltag I parallel operation of an cotrical features (cubic 2.5kV/1min	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles les through suitable sy rating combination cle)	NH00 gL/gG 200A		
Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage RMS current output Power frequency voltage test Impulse withstand voltage Short-circuit current		NH00 gL/gG 80A 200-480VAC +/-10 ⁴ Any output	NH00 gL/gG 100A Sta Emissions: EN/IEC Moo % (auto sensing). Cor is possible. Unlimited Ele 65kA r	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity: CE, UL. Idules installed in cubi Electrical ratings Inection to higher voltage parallel operation of an ictrical features (cubic 2.5kV/1min	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles ges through suitable gyrating combination cle)	NH00 gL/gG 200A step-up transformer. of modules.	NH00 gL/gG 250A	
Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage RMS current output Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection		NH00 gL/gG 80A 200-480VAC +/-10 st Any output CB or fuse-switch. Ge	NH00 gL/gG 100A Sta Emissions: EN/IEC Moc % (auto sensing). Cor is possible. Unlimited Ele 65kA r eneral design rule is to g to local regulations,	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity: CE, UL. dules installed in cubi Electrical ratings Inection to higher voltage I parallel operation of an actrical features (cubic 2.5kV/1min 6kV Imms (3 seconds) / 143k/ p select the protection le 16mm² Cu conductor is	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles use through suitable syrating combination cle) A peak. evel 1.3 times the nois the minimum recor	NH00 gL/gG 200A step-up transformer. of modules.	NH00 gL/gG 250/	
Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage RMS current output Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing		NH00 gL/gG 80A 200-480VAC +/-10 st Any output CB or fuse-switch. Ge	NH00 gL/gG 100A Sta Emissions: EN/IEC Moc % (auto sensing). Cor is possible. Unlimited Ele 65kA r eneral design rule is to g to local regulations,	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity. CE, UL. dules installed in cubi Electrical ratings mection to higher voltage parallel operation of an actrical features (cubic 2.5kV/1min 6kV ms (3 seconds) / 143k/c 5 select the protection le 16mm² Cu conductor is chanical features (cubic	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles use through suitable syrating combination cle) A peak. evel 1.3 times the nois the minimum recor	NH00 gL/gG 200A step-up transformer. of modules.	NH00 gL/gG 250/	
Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage RMS current output Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement		NH00 gL/gG 80A 200-480VAC +/-10 st Any output CB or fuse-switch. Ge	NH00 gL/gG 100A Sta Emissions: EN/IEC Moo % (auto sensing). Con is possible. Unlimited Ele 65kA r eneral design rule is to g to local regulations, Mec	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity: CE, UL. Idules installed in cubi Electrical ratings Inection to higher voltage I parallel operation of an Ictrical features (cubic 2.5kW/min 6kV Imms (3 seconds) / 143k/ o select the protection le 16mm² Cu conductor is Ishanical features (cubic Ishanical features (cubic	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles ges through suitable and a suitable	step-up transformer. of modules. minal current of the demmended.	NH00 gL/gG 250/	
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Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage RMS current output Power frequency voltage test Impulse withstand voltage Short-circuit current Power circuit protection Earthing Mounting arrangement Enclosure material and colour Panel thickness and treatment Cooling method		NH00 gL/gG 80A 200-480VAC +/-10 ⁴ Any output CB or fuse-switch. Ge Accordin	MH00 gL/gG 100A Sta Emissions: EN/IEC Moo % (auto sensing). Cor is possible. Unlimited Ele 65kAr eneral design rule is to g to local regulations, Meo for indoor installation anized steel, light grey, 2m	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity. CE, UL. Idules installed in cubi Electrical ratings Inection to higher voltage parallel operation of an ictrical features (cubic 2.5kW/1min 6kV Imms (3 seconds) / 143k/ o select the protection le 16mm² Cu conductor is ishanical features (cubic ree-standing cubicle. (other classes or outdor y RAL7035 (other mater Imm. Epoxy powder coatir ced air or heat exchang	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles les through suitable: y rating combination cle) A peak. evel 1.3 times the nois the minimum recor icle) or installation cubicle lials or colours on record.	step-up transformer. of modules. minal current of the denmended. s on request).	NH00 gL/gG 250A	
Cable entry Electrical safety Electromagnetic compatibility Third party approvals ASSEMBLED MODULES Rated voltage RMS current output 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		NH00 gL/gG 80A 200-480VAC +/-10 ⁴ Any output CB or fuse-switch. Ge Accordin	Moo gL/gG 100A Sta Emissions: EN/IEC Moo % (auto sensing). Cor is possible. Unlimited Ele 65kA r eneral design rule is to g to local regulations, Meo for indoor installation anized steel, light grey Fo	NH00 gL/gG 125A Top or bottom. Indards and certificati EN 50178 C 61000-6-4. Immunity. CE, UL. dules installed in cubi Electrical ratings nection to higher voltage parallel operation of an actrical features (cubic 2.5kV/1min 6kV select the protection le 16mm² Cu conductor is chanical features (cubic chanical features (cubic chanical features (cubic chanical features) (cubic cubic chanical features) (cubic cubic chanical features) (cubic cubic cu	NH00 gL/gG 160A ons EN/IEC 61000-6-2. cles ges through suitable gy rating combination cle) A peak. evel 1.3 times the note the minimum recordicte or installation cubicle ials or colours on recong. ger.	step-up transformer. of modules. minal current of the demmended. s on request).	NH00 gL/gG 250A	





Technical specifications – 500-690VAC devices

LOOSE MODULES	A2-50-E	A2-60-E	A2-75-E	A2-100-E	A2-120-E	
			Electrical ratings			
Rated voltage	500-69	0VAC +/-10% (auto sensing).	Connection to higher voltages t	hrough suitable step-up transf	former.	
Rated frequency	504	20.4	50/60Hz (auto sensing).	4004	1004	
Phase RMS current output Neutral RMS current output	50A 150A	60A 180A	75A 225A	100A 300A	120A 360A	
Neutral RMS current output	150A	TOUA	Electrical features	300A	300A	
Reaction / response time	Reaction time <50) microseconds / Overall resp	onse time <100 microseconds	(1 network cycle if working in	selectable mode).	
Electrical system compatibility			AC modules) and 3-phase 4-wi			
Inverter features		3-level NPC inve	rter topology (IGBT). Switching	requency 20kHz.		
Controller / redundancy			el operation of several modules,			
Harmonic filtering	1st to 50th		en harmonics). Fully selectable		onic order.	
Operation modes Power factor correction	Ontimized s		rmonics but not fundamental / S stable power factor correction,		na (inductive)	
Voltage support						
Load balancing	Reduction of voltage variations (sags and swells) and mitigation of voltage fluctuations (flicker) via reactive power injection. Negative sequence current injected to balance fundamental 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 h		d for validating the performance		e electric power system.	
Protection functions			undervoltage, overtemperature			
Stand-by & AutoStart Remote discrete control	Stand-by stops the IGB	Is if required compensation of	current is below a certain limit. A Remote run/stop.	utoStart allows automatic star	t after a network failure.	
Remote discrete control		Canacitor	bank steps control (HPQ fun	ctionality)		
Operation	Dedicated digital of		or thyristor switch modules of		acitor bank steps	
Number of steps and size			One digital output can switch a s			
			Connections			
Digital inputs			77VAC. Any input can be progra			
Digital outputs	5 potential free outputs DC		programmed for trip, alarm, runr		d for capacitor bank steps.	
CT leastion	Open lean /a		r 5A secondary (5A preferred).		nnoations noosible	
CT location CT polarity) and closed loop (current transity, it is possible to change the lo			
Number of CTs required			on of 1 module: 3 CTs. Closed le			
Connection of parallel modules			rating combinations up to 7 mo			
			Interfaces			
HMI / display			al graphical HMI (new languages			
Monitoring and reporting	Oı	n-site and remote monitoring	capabilities. Reports data of pov	ver quality events up to 30 day	/S.	
Communication capability Software update			Ethernet and Modbus TCP. Via Ethernet or USB drive.			
Software update			Mechanical features			
Mounting arrangement		Loose mo	odule ready for cubicle or wall in	stallation.		
Enclosure features		Compact IP2	20 galvanized steel enclosure in	black colour.		
Cooling method	Forced air h	by easy to service automatica	lly controlled DC cooling fans a	djusted by module temperatur	e via PWM.	
Losses	07-10	07-ID	<2.8%	07-ID	00 dD	
Noise level (ISO 3746) Dimensions WxHxD	67dB 225x1150x500mm	67dB 225x1150x500mm	67dB 225x1150x500mm	67dB 225x1150x500mm	68dB 225x1150x500mm	
Weight	120kg	120kg	120kg	120kg	120kg	
			Installation and operation		,	
Temperature (without derating)			+5°C to +40°C.			
Humidity		Ma	aximum 85% RH, non-condensi	ng.		
Altitude (without derating)	Up to 1000m.					
Needed airflow for the module Ventilation requirements	350 m³/h 350 m³/h 400 m³/h 450 m³/h 500 m³/h 500 m³/h 300mm free space below and above the module required for air ventilation.					
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		J J	Top or bottom.	3 3 3	, , , , , , , , , , , , , , , , , , , ,	
			Standards and certifications			
Electrical safety			EN 50178	F0.04000.0.0		
Electromagnetic compatibility		Emissions: EN	VIEC 61000-6-4. Immunity: EN/	EU 61000-6-2.		
Third party approvals			CE, UL.			
ASSEMBLED MODULES			Modules installed in cubicles			
			Electrical ratings			
Rated voltage			Connection to higher voltages t		former.	
RMS current output	Any	output is possible. Unlimited	parallel operation of any rating c	ombination of modules.		
Power frequency voltage test			Electrical features (cubicle) 2.5kV/1min			
Impulse withstand voltage			2.5KV/1min 6kV			
Short-circuit current	65kA rms (3 seconds) / 143kA peak.					
Power circuit protection	MCCB or fus		is to select the protection level		of the device.	
Earthing		According to local regulation	ons, 16mm² Cu conductor is the	minimum recommended.		
	Mechanical features (cubicle)					
Mounting arrangement	.	D20 to ID42 for indeed in	Free-standing cubicle.	etelletien eubiel "		
Enclosure IP class Enclosure material and colour	I		tion (other classes or outdoor in			
Panel thickness and treatment	Galvanized steel, light grey RAL7035 (other materials or colours on request).					
Cooling method	2mm. Epoxy powder coating. Forced air or heat exchanger.					
Cable entry	Top or bottom.					
	Handle without lock, lock with key, electrical lock or special safety lock.					
Door locking system		Handle without lock	, lock with key, electrical lock or	special safety lock.		