



GED 16/0719

SHORT CATALOG

- ACTIVE SHUNT COMPENSATOR
POWER QUALITY MANAGEMENT
- POWER FACTOR CORRECTION
- ENERGY MANAGEMENT IoT PLATFORM
- METERING AND PANEL ACCESSORIES
- SWITCHES AND FUSES
- SYSTEM FOR TIME AND LIGHT
- KNX SYSTEM
- CABLE MANAGEMENT SYSTEM
- FACTORY SOLUTION
- BUSDUCT
- LIGHTNING PROTECTION
- SURGE PROTECTION DEVICE
- POWER CIRCUITE BREAKER AND CONTROL



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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 high performance, compact, flexible, modular and cost-effective active shunt compensators (ASHC) 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's can eliminate waveform distortions from the load like harmonics, inter harmonics 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, AHF's can take care of several other power quality problems by combining different functions in a single device:

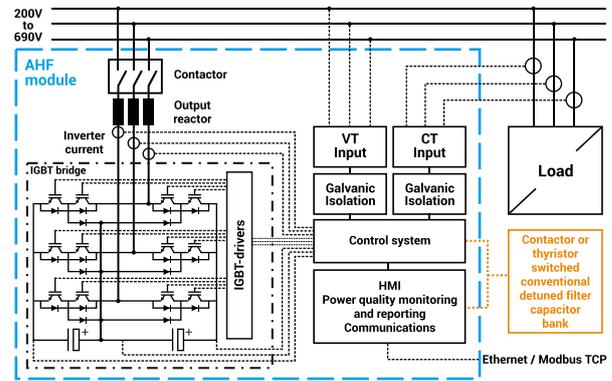
- Elimination of harmonic currents and voltages.
- Power factor correction (lagging or leading).
- Voltage variations (sags & swells) reduction.
- Voltage fluctuations (flicker) mitigation.
- Load balancing in three-phase systems.
- Controlled & selectable harmonic generation.



AHF module
rated 400V 50Hz 100A

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.
- Response time of less than 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 design of an AHF

Typical applications

AHF's have many low and high voltage potential applications where their use offer plenty of 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 devices: Transformers, reactors, generators, motors and induction heaters.

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. AHF's 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 IEEE519, G5/4, EN 50160 or any other international power quality standards and recommendations.

Typical segments

AHF's 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 & Infrastructure	Convention manufacturing	
	Critical process industries	
	Transport	
Green building & smart cities	Water & wastewater	
	Healthcare facilities	
	Critical process facilities	
	Industrial & office facilities	
	Retail & leisure facilities	

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

ACTIVE HARMONIC FILTERS

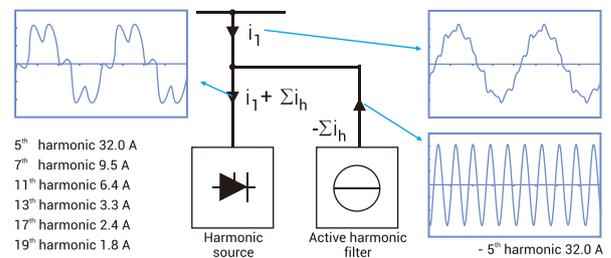


AHF rated 415V 50Hz 400A

Benefits

Main benefits of AHFs can be summarized as:

- Protection of loads and equipment from wave form distortions, low power factor, voltage variations and fluctuations, 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.



AHF operating principle

Comparison with conventional solutions

	Passive harmonic filters	AHF
Response time	• Contactor-based solutions take at least 30s to 40s to mitigate the problem and thyristor-based solutions 20ms to 30ms	• Real-time power quality problem mitigation as the overall response time is less than 100 ps
Output	• Depends on step sizes, cannot match load demand in real time • Depends on grid voltage as capacitor units & reactors are used	• Instantaneous, continuous, stepless and seamless • Grid voltage has no influence on the output rating
Harmonic filtering	• One filter is designed only for one harmonic order	• 2nd to the 50 th harmonic order (odd and even) • Corrects simultaneously from -1 to +1 power factor of lagging (inductive) and leading (capacitive) loads
Power factor correction	• Capacitor banks needed for inductive loads and reactor banks for capacitive loads. Problems if mixed reactive power demand • Not possible to guarantee unity power factor as they have steps, system will be having continuous over and under compensation	• Guaranteed unity power factor at all times without any over or under compensation (stepless output) • Can correct by selecting the amount of load balancing
Unbalance	• Do not correct load unbalance	• Mitigation capacity can be exactly what load demands
Design & sizing	• Usually oversized to better adjust to changing load demands • Need to be designed taking into account system harmonics	• Unaffected by harmonic distortion in the system • No risk of harmonic resonance with the network
Resonance	• Resonant amplification may easily occur and cause incidents	• Not created (no switching of passive components)
Transients	• Caused by the switching of capacitor units or shunt reactors	• Small footprint and simple installation as modules are compact in size. Existing switchgear can be used
Footprint & installation	• Medium to large footprint, especially if several harmonic orders • Not simple installation, especially if loads upgraded frequently	• Simple (and not dependant) by adding modules
Expansion	• Limited and depends on load conditions and network topology	• Simple maintenance and service life up to 15 years as there is no electro-mechanical switching and no risk of harmonics, transients or resonance
Maintenance & lifetime	• Using components that need extensive maintenance like fuses, contactors, thyristor switches, reactors and capacitor units • Switching, harmonics, transients and resonance reduce lifetime	

STATIC VAR GENERATORS

Static var generators (SVG), also known as active power factor compensators (APFC) or instantaneous stepless reactive power compensators are the ultimate answer to power quality problems caused by low power factor and reactive power demand for a wide range of segments and applications.

They are high performance, compact, flexible, modular and cost-effective active shunt compensators (ASHC) 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.

Low power factor increases the active energy losses of installations and affects their stability. It is typically caused by inductive or capacitive loads that demand extra reactive power to perform properly. Other contributors to low power factor are harmonic currents produced by nonlinear loads and the change of load in the electric power system. SVGs deliver real-time inductive or capacitive reactive power compensation. Rapid response time provides stable and accurate power factor correction without the drawbacks of conventional solutions like capacitor banks and reactor banks.



AVG/APFC module
rated 400V 50Hz -69 kvar to +69 kvar

Highlights

- Full range: Specifications from +/-17kvar to +/- 152kvar (200V-690V) in 3- and 4-wire systems can be covered by a single module. Unlimited amount of modules can be paralleled.
- Simple connection to high voltage systems.
- 3-level NFC inverter topology reduces losses, noise, size and extends module's lifetime.
- Response time of less than 100 microseconds,
- Instantaneous, precise & stepless power factor correction of inductive and capacitive loads.
- Not possible to over or under compensate the system and no risk of harmonic resonance.
- Suitable for networks with harmonic distortion.
- Capability of switching contactors or thyristor switches of detuned filter capacitor bank steps.
- Compact and modular design optimized for installation, commissioning and maintenance.

Typical applications

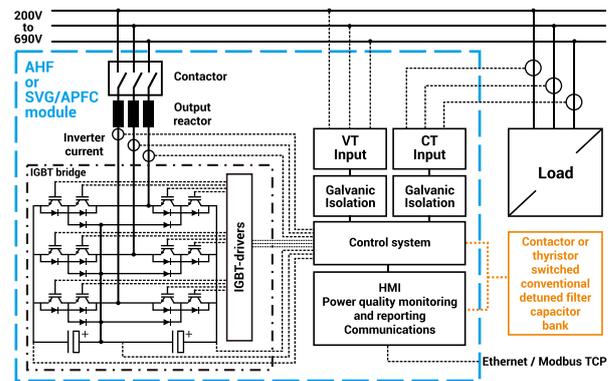
SVGs have many low and high voltage potential applications where their use offer plenty of benefits.

- Installations with fast changing reactive power demand like electric arc furnaces and ball mills
- Highly dynamic loads where the power factor fluctuates rapidly or in big steps like cranes, sawmill machinery, welding machines, etc.
- Correction of leading power factor like in data centers allowing back-up generators operation
- UPS systems.
- Solar inverters and wind turbine generators.
- Reactive power support like for traction loads.
- Loads with low power factor: Motors, cables, lightly loaded transformers, lighting, etc.

Operating principle

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

When the load generates inductive or capacitive current, it makes load current lagging or leading the voltage. An SVG detects the phase angle difference and injects in real time leading or lagging current into the electric power system, making the phase angle of the current almost the same as that of the voltage, bringing fundamental power factor to unity.



Typical design of an SVG/APFC

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 & Infrastructure	Convention manufacturing	
	Critical process industries	
	Transport	
Green building & smart cities	Water & wastewater	
	Healthcare facilities	
	Critical process facilities	
	Industrial & office facilities	
	Retail & leisure facilities	

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

STATIC VAR GENERATORS

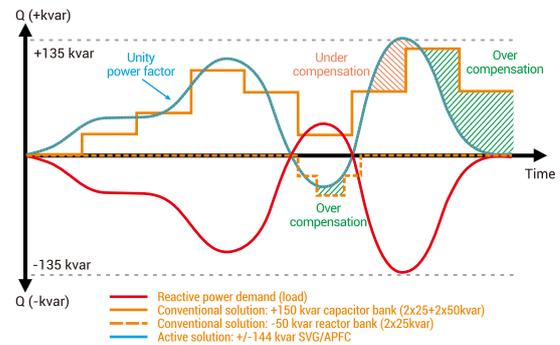


AHF rated 415V 50Hz -288kvar to +288kvar

Benefits

Main benefits of AHFs can be summarized as:

- Capability to deliver simultaneously capacitive and inductive reactive power compensation.
- Optimized for highly dynamic applications where conventional Capacitor banks or reactor banks are unable to track the loads.
- Allow compensation of loads fed by generators without risk of over compensation.
- Only inject in the system the reactive power that is required by the load at each instant.
- No need forever dimensioning: Compensation capacity equals the installed capacity.
- Unaffected by network voltage drop. Even under reduced network voltage levels, full reactive current can be provided to meet required demand.
- Simple dimensioning and installation.
- Compliance with the strictest power quality standards and grid codes.



SVG/APFC operating principle

Comparison with conventional solutions

	Capacitor Bank of reactor bank	SVG / APFC
Response time	• Contactor-based solutions take at least 30s to 40s to mitigate the problem and thyristor-based solutions 20ms to 30ms	• Real-time power quality problem mitigation as the the overall response time is less than 100 us
Output	• Depends on step sizes, cannot match load demand in real time • Depends on grid voltage as capacitor units & reactors are used	• Instantaneous, continuous, stepless and seamless • Grid voltage has no influence on the output rating
Power factor correction	• Capacitor banks needed for inductive loads and reactor banks for capacitive loads. Problems if mixed reactive power demand • Not possible to guarantee unity power factor as they have steps, system will be having continuous over and under compensation	• Corrects simultaneously from -1 to +1 power factor of lagging (inductive) and leading (capacitive) loads • Guaranteed unity power factor at all times without any over or under compensation (stepless output) • Can correct by selecting the amount of load balancing
Unbalance	• Do not correct load unbalance	• Mitigation capacity can be exactly what load demands
Design & sizing	• Usually oversized to better adjust to changing load demands • Need to be designed taking into account system harmonics	• Unaffected by harmonic distortion in the system • No risk of harmonic resonance with the network
Resonance	• Resonant amplification may easily occur and cause incidents	• Not created (no switching of passive components)
Transients	• Caused by the switching of capacitor units or shunt reactors	• Small footprint and simple installation as modules compact in size. Existing switchgear can be used
Footprint & installation	• Medium to large footprint, especially if large number of steps • Not simple installation, especially if loads upgraded frequently	• Simple (and not dependant) by adding modules
Expansion	• Limited and depends on load conditions and network topology	• Simple maintenance and service life up to 15 years as there is no electro-mechanical switching and no risk of harmonics, transients or resonance
Maintenance & lifetime	• Using components that need extensive maintenance like fuses, contactors, thyristor switches, reactors and capacitor units • Switching, harmonics, transients and resonance reduce lifetime	

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 high performance, compact, flexible, modular and cost-effective active shunt compensators (ASHC) 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.

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 can take care of several power quality problems:

- 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.

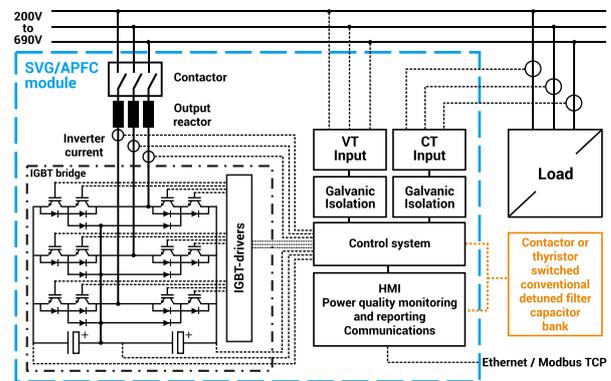
Highlights

- 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.
- Response time of less than 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 applications

HVCs have many low and high voltage potential applications where their use offer plenty of 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.
- Modulated phase controllers, cyclo converters and thyristor Controlled AC voltage regulators.
- Solar inverters and wind turbine generators.
- Saturable devices: Transformers, reactors, generators, motors and induction heaters.
- Installations with fast changing reactive power demand like electric arc furnaces and ball mills.
- Highly dynamic loads where the power factor fluctuates rapidly Or in big steps like cranes, sawmill machinery, welding machines, etc.
- Correction of leading power factor like in datacenters allowing back-up generators operation
- Reactive power support like for traction loads.
- Loads with low power factor: Motors, cables, lightly loaded transformers, lighting, etc.



Typical design of an HVC

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.

Typical segments

AHF's 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	
Manufacturing & Infrastructure	Steel & metals	
	Convention manufacturing	
	Critical process industries	
Green building & smart cities	Transport	
	Water & wastewater	
	Healthcare facilities	
	Critical process facilities	
	Industrial & office facilities	
	Retail & leisure facilities	

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

HYBRID VAR COMPENSATORS

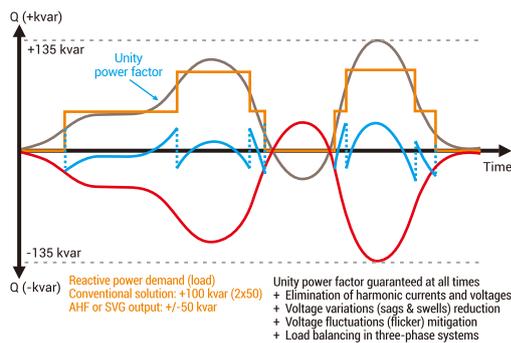


AHF rated 400V 50Hz -144kvar to +984kvar

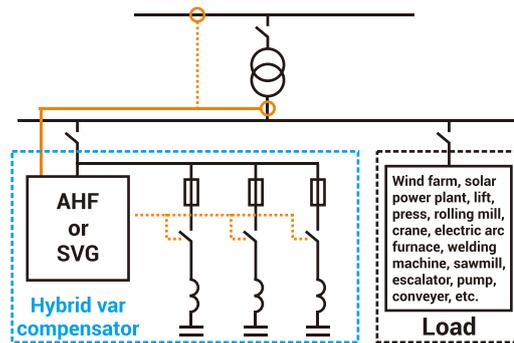
Benefits

Main benefits of AHFs can be summarized as:

- Protection of loads and equipment from wave form distortions, low power factor, voltage variations and fluctuations, and unbalance.
- Capability to deliver simultaneously capacitive and inductive reactive power compensation.
- Optimized for applications where conventional capacitor banks, reactor banks or passive harmonic filters are unable to perform.
- No need for over dimensioning: Compensation capacity equals the installed capacity.
- Unaffected by network voltage drop. Even under reduced network voltage levels, full reactive current can be provided to meet required 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.



HVC operating principle



HVC connection

Comparison with conventional solutions

	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 power quality problem mitigation as the overall response time is less than 100 ps
Output	• Depends on step sizes, cannot match load demand in real time • Depends on grid voltage as capacitor units & reactors are used	• Instantaneous, continuous, stepless and seamless • Grid voltage has no influence on the output rating
Harmonic filtering	• One filter is designed only for one harmonic order • Capacitor banks needed for inductive loads and reactor banks	• Corrects simultaneously from -1 to +1 power factor of lagging (inductive) and leading (capacitive) loads • Guaranteed unity power factor at all times without any over or under compensation (stepless output) • Can correct by selecting the amount of load balancing
Power factor correction	• for capacitive loads. Problems if mixed reactive power demand • Not possible to guarantee unity power factor as they have steps. System will be having continuous over and under compensation • Do not correct load unbalance	• Mitigation capacity can be exactly what load demands • Unaffected by harmonic distortion in the system
Unbalance	• Usually oversized to better adjust to changing load demands	• No risk of harmonic resonance with the network
Design & sizing	• Need to be designed taking into account system harmonics • Resonant amplification may easily occur and cause incidents	• Not created (no switching of passive components)
Resonance	• Caused by the switching of capacitor units or shunt reactors	• Small footprint and simple installation as modules are compact in size. Existing switchgear can be used
Transients	• Medium to large footprint, especially if several harmonic orders	• Simple (and not dependant) by adding modules
Footprint & installation	• Not simple installation, especially if loads upgraded frequently • Limited and depends on load conditions and network topology	• Simple maintenance and service life up to 15 years as there is no electro-mechanical switching and no risk of harmonics, transients or resonance
Expansion	• Using components that need extensive maintenance like fuses, contactors, thyristor switches, reactors and capacitor units	
Maintenance & lifetime	• Switching, harmonics, transients and resonance reduce lifetime	

Technical specifications - 200-480VAC devices

MODEL	A2-50	A2-60	A2-75	A2-100	A2-120	A2-150	A2-200
Electrical ratings							
Rated voltage	200-480VAC +/-10% (autosensing).						
Higher voltages connection	With suitable step-up transformer.						
Rated frequency	50/60Hz +/-2% (autosensing).						
Reactive power output at 415V using SVG module	-36kvar to +246kvar	-43kvar to +283kvar	-54kvar to +354kvar	-72kvar to +492kvar	-86kvar to +566kvar	-108kvar to +708kvar	-144kvar to +984kvar
Reactive power output at 415V using AHF module at 50%	-18kvar to +108kvar	-21kvar to +141kvar	-27kvar to +177kvar	-36kvar to +216kvar	-43kvar to +283kvar	-54kvar to +354kvar	-72kvar to +492kvar
Phase RMS current output at 415V using AHF module at 50%	25A	30A	37.5A	50A	60A	75A	100A
Neutral RMS current output at 415V using AHF module at 50%	75A	90A	112.5A	150A	180A	225A	220A
Reactive power output at 3.3/6.6/11/33kV with SVG and step-up transformer with 415V secondary	-36kvar to +24kvar	-43kvar to +283kvar	-54kvar to +354kvar	-72kvar to +492kvar	-86kvar to +566kvar	-108kvar to +708kvar	-108kvar to +708kvar
Electrical features							
Response time	< 100 microseconds (1 network cycle if working in selectable).						
Electrical system compatibility	3-phase 3-wire and 3-phase 4-wire.						
Inverter topology	three level NPC inverter topology (IGBT).						
Switching frequency	20kHz.						
Controller	Real-time digital control with FFT.						
Harmonic filtering	2nd to 50th harmonic order. Fully selectable and programmable per harmonic order.						
Operation modes	All harmonics (odd and even) / All harmonics but not fundamental (odd and even) / Selectable harmonics (only odd).						
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. Maintains defined set point voltage by injecting leading reactive power to raise voltage and lagging reactive power to lower voltage.						
Load balancing	Negative sequence current injected to balance fundamental current on the electric power 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 and selectable harmonic injection can be used for validating the performance of different component of the electric power system.						
Protection functions	Overcurrent, overvoltage, undervoltage, overtemperature and ripple circuit overload.						
Stand-by mode	Programmable via HMI.						
Remote discrete control	Remote run/stop.						
AutoStart	Device starts automatically if enabled.						
Capacitor bank steps control (HPQ functionality)							
Operation	Dedicated digital outputs can take care of switching the contactors or thyristor switch modules of conventional detuned filter capacitor bank steps.						
Number of step and size	6 capacitor bank steps per module. One digital output can switch a step rated between 10kvar to 200kvar.						
Connections							
Digital inputs	4 potential free inputs 15-48VDC or up to 277VAC. 3 preprogrammed (stand-by, trip, alarm) and 1 not (not in use).						
Digital outputs	11 potential free outputs DC or up to 277VAC. 4 preprogrammed (trip, alarm, running, force), 1 not (not in use) and 6 capacitor bank steps control.						
Current transformers (CT)	Any primary ratio with 1A or 5A secondary (5A preferred). Class 1 accuracy or better.						
CT location	Open loop (current transformers in the load side) and closed loop (current transformers in the supply side) connection possible.						
CT polarity	If one or more of the CTs are connected with inversed polarity, it is possible to change the load current polarity from normal to inversed in the HMI.						
Number of CTs required	Open loop connection: 3 CTs. Closed loop connection of 1 module: 3 CTs. Closed loop connection of several modules in parallel: 6 CTs.						
Connection of parallel modules	Unlimited scalability, Parallel operation of any rating combinations up to 7 modules per one HMI. Unlimited amount of HMIs.						

Technical specifications - 200-480VAC devices

MODEL	A2-50	A2-60	A2-75	A2-100	A2-120	A2-150	A2-200
Interfaces							
HMI / Display	7 " touch screen graphical HMI.						
Languages	Multilingual, New languages can be added on request.						
Monitoring and reporting	On-site and remote monitoring capabilities, Reports data of power quality events up to 30 days.						
Communication capability	Ethernet and Modbus TCP.						
Software update	Via Ethernet						
Mechanical features							
Mounting arrangement	Loose module ready for cubicle or wall installation						
Enclosure IP class	IP20						
Enclosure material and colour	Galvanized steel. Black.						
Cooling method	Forced air by easy to service automatically controlled DC cooling fans adjusted by module temperature via PWM.						
Losses	<2.3%						
Noise level (ISO 3746)	60dB	60dB	60dB	60dB	60dB	60dB	60dB
Dimension WxHxD (mm)	225 x 850 x 500 mm	225 x 850 x 500 mm	225 x 850 x 500 mm	225 x 850 x 500 mm	225 x 850 x 500 mm	225 x 1150 x 500 mm	225 x 1150 x 500 mm
Weight (kgs.)	70kg	70kg	70kg	70kg	70kg	110kg	110kg
Installation and operation							
Temperature (without derating)	+5°C to +40°C					+5°C to +30°C	+5°C to +40°C
Humidity	Maximum 85% RH, non condensing.						
Altitude (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 m³/h
Ventilation requirements	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	NH00 gL/ gG 200A	NH00 gL/ gG 250A
Cable entry	Top or bottom.						
Standards and certifications							
Electrical safety	EN 50178						
Electromagnetic compatibility	Emissions: EN/IEC 61000-6-4. Immunity: EN/IEC 61000-6-2.						
Third party approvals	CE, UL (pending)						
Electrical features (cubicle)							
Insulation level	2.5kV/1min						
Impulse withstand voltage	6kV						
Short-circuit current	65kA rms (3 seconds) / 143kA peak.						
Power circuite protection	MCCB or fuse-switch, General design rule is to select the protection level 1.3 times the nominal current of the device.						
Earthing	16mm² Cu conductor is the minimum recommended.						
Mechanical features (cubicle)							
Mounting arrangement	Free-standing cubicle.						
Enclosure IP class	IP30 to IP42 for indoor installation (other classes or outdoor installation cubicles on request).						
Enclosure material and colour	Galvanized steel. Light grey RAL7035 (other colours on request).						
Enclosure panel thickness	2mm						
Treatment and paint	Epoxy powder coating.						
Cooling method	Forced air or heat exchanger.						
Cable entry	Top or bottom.						
Door locking system	Handle without lock, lock with key, electrical lock or special safety lock.						
Anticondensation protection	Thermostat controlled heater.						

AUTOMATIC POWER FACTOR CORRECTION

Automatic Power Factor Correction, typical for large electrical systems with fluctuating load where it is common to connect a number of capacitors to a main power distribution station or substation. The capacitors are controlled by a microprocessor based relay which continuously monitors the reactive power demand on the supply.

The installation of detuned (reactor-reconnected) capacitors is designed to force the resonant frequency of the network below the frequency of the lowest harmonic present, there by ensuring no resonant circuit end, by implication, no amplification of harmonic current. Such an installation also has a partial filtering effect, reducing the level of voltage distortion on the supply, and is recommended for all cases where the share & non linear loads is more than 10% of the rated transformer power.

Full set of essential component for capacitor bank.



THE HEART

Capacitors. Without them, PFC is impossible. They are the most sensitive and most important component.



THE MUSCLE

Switching is one of the key function in your PFC, and switching capacitors means maximum stress.



THE PROTECTION

Most PFC nowadays cannot do without detuning reactors for harmonic protection anymore.



THE BRAIN

The controller shall know what to do, and when.

CAPACITOR


Output Capacity KVAR	Phase	Volt	Output Capacity KVAR	Phase	Volt
Single Phase Modular MKP Type			Three Phase Modular MKP Type		
1.67	1	415	2.3	3	415
3.3	1	415	5	3	415
4.17	1	415	10	3	415


Three Phase Modular MKP-c Eco Series

12.5	3	415
15	3	415
20	3	415
25	3	415
30	3	415
40	3	415
50	3	415

Three Phase Modular MKPg Series

15	3	415
20	3	415
25	3	415
30	3	415
40	3	415
50	3	415



@415 V	MKP-c Type, 525 Volt Qn (kVAr) Three Phase Modular MKP-c Eco Series	@525 V
12.5		20
25		40

MKPg Type, 480 Volt Qn (kVAr)		MKPg Type, 525 Volt Qn (kVAr)	
@415 V	@480 V	@415 V	@525 V
20	26.7	12.5	20
25	33.3	25	40

CONTACTOR for CAPACITOR


220 - 240 V kvar	400 - 440 V kvar
8.5	16.7
10	20
15	25
20	33.3
25	40
27	50
40	60
45	75

REACTOR 415 V

BLOCKING REACTOR 7%

- 12.5 kVAr
- 25 kVAr
- 50 kVAr

POWER FACTOR REGULATOR


- Fully Automatic Regulator 6 step, 12 step and 14 step
- No Required to adjust c/k value

Table comparison between BLR GAE and RCG GAE

	BLR CX GAE	RCG GAE
Step number	6 / 12	8 / 12
Display	LCD	LCD
Measurement type	1P	1P
Basic measurement	Yes	Yes
Power quality measurement	Yes	Yes
	-Individual harmonics up to 31 -THD V, THD I	-Individual harmonics up to 51 -THD V, THD I
Digital input and digital output	No	Yes
Alarm relay output	No	Yes
Modbus communication (RS 485)	No	Yes
Free software monitoring	No	Yes



Advantage of Energy Management

- Enable predictive maintenance and effective working
- Intervene failures quickly and minimize stop periods
- Analyzed energy networks and minimize machinery faults caused by energy quality
- Design report templates, analyze and report data automatically
- Quickly access to historic data and compare to see your progress in energy efficiency
- Monitor and access to your system from anywhere through any device connected to the internet.



Web Based System

Users can gain access to the system regardless of the platform, simply through a standard web browser.



Modular Structure

Modular structure enable various expansion according to the needs of the customers.



Advanced Database

Advanced database features enable detailed device monitoring, parameter logging, analyzing and reporting.



Time Zone Support

Different time zone can be defined for the devices located at different regions with time zone support.



Security

HTTPS support, user password, function and profile based user authorization ensures a high-level system safety.



Load Share

Number of device that communicate is infinite with load share, a single server support more than 2.000 devices.

You can make real-time monitoring and see instant data from the system using main GAenergy monitoring module. It is possible to expand and add features to the GAenergy platform according to your needs.

Monitoring

You can get access to real-time device parameter and instant device data from anywhere with GEN fully-customizable monitoring module.

Reporting

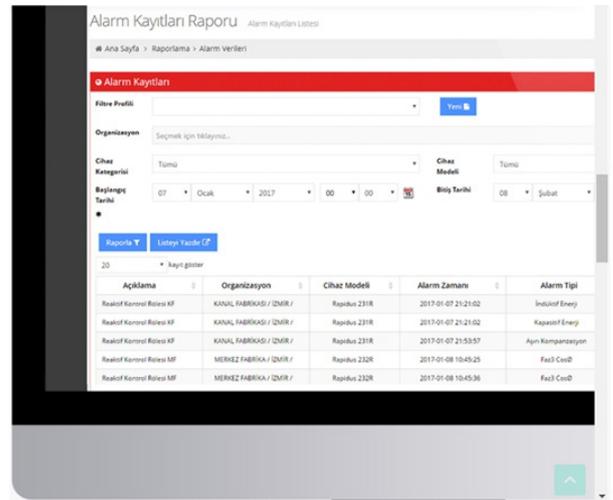
It is possible to access all historic data, search for a specific time period, design custom reports and automate reporting and invoicing activities.

Alarm Management

Alarm parameters can be set for all devices within the system, the systems logs alarm data with timestamp. All alarm activities can be monitored and managed through the system.

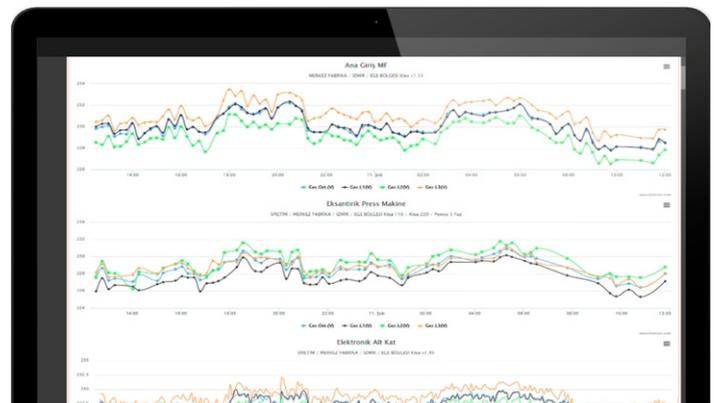
Map Screen

Enables over-the-map monitoring of devices located at different facilities or regions by simply pinning devices on the map.



Advanced Reporting

All parameter logged in real-time and can be displayed as table or graph data as needed.



EMG SERIES MULTIFUNCTION POWER METER

SPECIFICATION

Accuracy Class According to IEC 61557-12

PARAMETER	EMG5		EMG10		EMG25		EMG50	
	Accu.	Measurement Range						
Voltage	0,2%	Direct: 300 V (P-N), 500 V (P-P)	0,2%	Direct: 300 V (P-N), 500 V (P-P)	0,2%	Direct: 300 V (P-N), 500 V (P-P)	0,2%	Direct: 300 V (P-N), 500 V (P-P)
		Ratio: 1-5000 Adjustable		Ratio: 1-5000 Adjustable		Ratio: 1-5000 Adjustable		Ratio: 1-5000 Adjustable
Current	0,5%	Ratio: 1-5000 Adjustable	0,5%	Ratio: 1-5000 Adjustable	0,5%	Ratio: 1-5000 Adjustable	0,2%	Ratio: 1-5000 Adjustable
Power - active	-	-	0,5%	10% $I_b \leq I \leq I_{max}$	0,5%	10% $I_b \leq I \leq I_{max}$	0,2%	10% $I_b \leq I \leq I_{max}$
Power - reactive	-	-	1,0%	5% $I_b \leq I \leq I_{max}$	1,0%	5% $I_b \leq I \leq I_{max}$	1,0%	5% $I_b \leq I \leq I_{max}$
Power factor	-	-	0,5%	0.5 Ind to 0.8 Cap	0,5%	0.5 Ind to 0.8 Cap	0,5%	0.5 Ind to 0.8 Cap
Frequency	0,1%	45 - 65 Hz						
Active Energy (kWh)	-	-	0,5%	99,999,999.999	0,5%	0-999,999,999.999	0,5%	49,999,999.999
Reactive Energy (kVarh)	-	-	2,0%	99,999,999.999	2,0%	0-999,999,999.999	2,0%	49,999,999.999
THD	-	-	1,0%	V: 0-20%, I: 0-100%	1,0%	V: 0-20%, I: 0-100%	1,0%	V: 0-20%, I: 0-100%

GENERAL INFORMATION	EMG5 & 10	EMG25	EMG50
Display	7 segment	LCD	LCD
Use system on LV and MV	✓	✓	✓
Supply Voltage	85-300 V	85-300 V	85-300 V
Connection Type	3P4W 3P3W	3P4W 3P3W	3P4W, 3P3W Aron
Memory			1 MB
Password Protection	✓	✓	✓
Realtime Clock			✓

COMMUNICATION	EMG10	EMG25	EMG50
RS485 MODBUS	✓	✓	✓
Profibus			

INPUT/OUTPUT (I/O)	EMG10	EMG25	EMG50
Digital Input & output		2	2
Analog output 4-20 mA			optional

BASIC MEASUREMENT	EMG 5 - 50
Voltage (phase to phase, phase-neutral)	✓
Current (per phase, neutral current)	✓
Frequency	✓

POWER ANALYSIS	EMG10	EMG25	EMG50
Power Factor (total and per phase)	✓	✓	✓
Power per phase (active, reactive and apparent)	✓	✓	✓
Total Power (active, reactive and apparent)	✓	✓	✓
Energy (active and reactive)	✓	✓	✓
THD (voltage and current)	✓	✓	✓
Individual Harmonic		1-31	1-51
Maximum Demand	✓	✓	✓
Multi-tariff (peak, day, off peak)			✓
Signal Waveform			✓
Phasor Diagram			✓

GATEWAY SERIES

ETG 485

Ethernet to RS485 Converter

ETG

- Sleek Housing
- 300-115.200 bps baudrate adjustment
- Easy configuration
- Quick view of status with LED


UTG 485

USB to RS485 Converter

UTG

- USB to RS 485
- 300-115.200 bps baudrate adjustment
- Isolation 2500 Vrms

METERING



Energy meter 3P kWh
Inductive Type
Voltage 3x 220/380 V,
Current .../5A or
direct 5 (20) A



Ammeter
Direct 10A~40A
or with CT.../5A



Voltmeter
Direct 250V, 500V
or with PT.../100V, 110V



Double Voltmeter
Direct 250V, 500V
or with PT.../100V, 110V



Zero Voltmeter
0 ... 800V,
for 380 - 400V



Watt meter
0... 10.000 kw with
CT.../5A



**Frequency
Pointer meter**
45-55 Hz, 46-54 Hz
48-52 Hz



**Double
Frequency LED meter**
45-55 Hz, 46-54 Hz
48-52 Hz



**Frequency
LED meter**
45-55 Hz, 46-54 Hz
48-52 Hz



Cos φ meter
0.5 cap - 1 -
0.5 ind



**Reliable Metering
with Economic Price**



Voltmeter AC 96
GEO-V96, 0 ... 500V



Ammeter AC 96
GEO-A96, 100/5A



**Frequency Meter
Pointer AC 96**
GEO-F96, 45-55 Hz



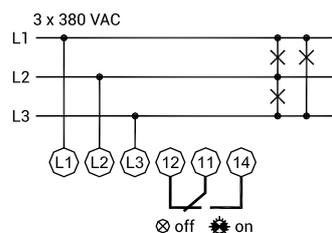
**Maximum Demand
Ammeter AC 96**
GEO-M96, 400/5A

PHASE FAILURE RELAY and WATER LEVEL CONTROL

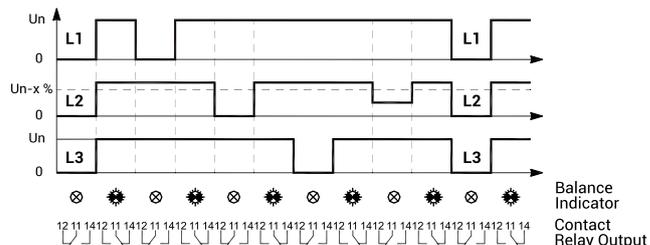


Phase Failure Relay
GC1100

Connection diagram:

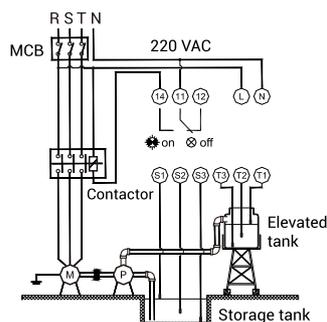


Timing diagram:

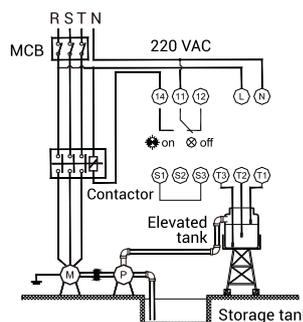


Water Level Control
GC2200

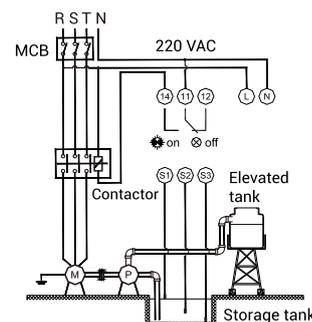
Figur 1



Figur 2



Figur 3



LOW VOLTAGE CURRENT TRANSFORMER



CT 50, 50/5A - 300/5A



CT 60, 50/5A - 400/5A



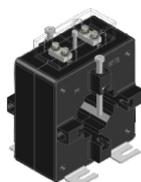
CT 70, 100/5A - 600/5A



CT 71, 60/5A - 300/5A



CT 72, 75/5A - 150/5A



CT 110
200/5A - 1600/5A



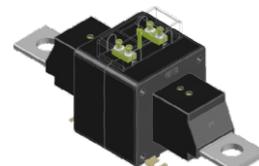
CT 150
200/5A - 2500/5A



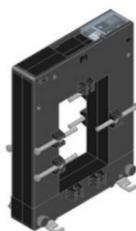
CT 101
5/5A - 50/5A



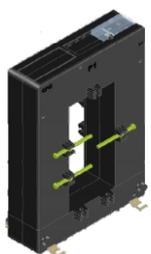
CT 102
50/5A - 150/5A



CT 103
200/5A - 300/5A



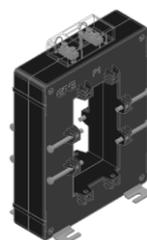
CT 204 SPLIT CORE
500/5A - 1500/5A



CT 205 SPLIT CORE
750/5A - 5000/5A



CT 301
500/5A - 3000/5A



CT 302
600/5A - 4000/5A



CT 303
1000/5A - 5000/5A



CT 41
50/5A - 100/5A



CT 42
30/5A - 100/5A



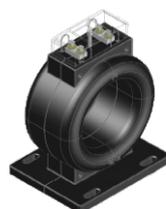
CT 43
15/5A - 100/5A



CT 44
15/5A - 100/5A



CT 403 RING
200/5A - 1600/5A



CT 404 RING
200/5A - 2500/5A

NT FUSES AND FUSE HOLDERS



NT FUSES 690V

- Type NT 00 6 - 160 A
- Type NT 0 50 - 160 A
- Type NT 1 50 - 250 A
- Type NT 2 250 - 400 A
- Type NT 3 355 - 630 A

NT FUSES 690V

- Type NT 4 800 - 1250 A



FUSE HOLDERS 690V

- Type Sist 106 - 160 A
- Type Sist 160 - 160 A
- Type Sist 201 - 250 A
- Type Sist 401 - 400 A
- Type Sist 601 - 630 A
- Type Sist 1001 - 1000 A

CYLINDRICAL FUSES (fuse protection)



FUSE CONTROLS 0.5 A - 32 A

- Size 10.8 x 38

**FUSE HOLDERS 1P & 3P
with LED or without LED**

- For DIN Rail Mounting

FUSE SWITCH DISCONNECTORS



MRO.DR2/DSL

MRO.DR2/TSL

FUSE SWITCH DISCONNECTORS

- 160 A - 630 A



MRO.DR1/1P

MRO.DR1/3P

MODULAR SWITCH DISCONNECTORS SD1 - SD3

3P

- SD1 : 16 A - 63 A
- SD2 : 80 A - 125 A
- SD3 : 160 A

CHANGE-OVER SWITCHES SD1 - SD2

4P

- SD1 : 16 A - 63 A
- SD2 : 63 A - 125 A

LOAD BREAK SWITCHES

3P & 4P

- VC1P : 160 A
- VC2P : 200 A - 315 A
- VC3P : 400 A - 500 A
- VC4P : 630 A - 800 A
- VC5P : 1000 A - 3150 A

CHANGE-OVER SWITCHES (Two layers)

4P

- CS1P : 160 A
- CS2P : 200 A - 315 A
- CS3P : 400 A - 500 A
- CS4P : 630 A - 800 A
- CS5P : 1000 A - 3150 A

MOTORIZED CHANGE-OVER SWITCHES (Two layers)

4P

- CS2 : 160 A - 315 A
- CS3 : 400 A - 500 A
- CS4 : 630 A - 800 A
- CS5 : 1000 A - 3150 A

ANALOG TIME SWITCH



SUL 180 a

- ON - OFF Switch / Normally Open contact 16A/250V~
- Program Segment 15 min
- Permanent ON - OFF Switch
- 24 Hour Time Switch



SUL 181 d

- Changeover Switch 16A/250V~
- Program segment 30 min
- Permanent ON - OFF Switch
- 24 Hour Time Switch

DIGITAL TIME SWITCH



SIMPLEXA SERIES

- 1 Changeover 28 memory locations
- Daily/weekly program function
- LCD Display
- Program segment 1 min
- Program block for weekday, weekend
- Sealable cover



TR 610 top3

- 1 Changeover 56 memory locations
- Daily/weekly program function
- LCD illuminated display
- Program segment 1 min
- Compatible with Obelisk Bluetooth stick programming
- 2nd Control Unit
- Hour counter

HOUR COUNTER



BZ 142 - 1

- Hour Counter with synchronous motor
- 5 digit hour counter
- 2 decimal accuracy

LUX SENSOR



LUNA 111 top3

- 1 channel
- Light level controller
- External light sensor included in delivery
- Switching brightness and switching delay can be set separately for switching On and Off
- Display back light (can be turn off)
- External input
- Up to 4 sensor can be attached
- Up to 10 devices can be connected to a digital sensor
- Onscreen display of channel and switching status as well as lux value

MOTION DETECTOR

General Specification

- Circle detection area
- Economic product range
- Lux sensor integration
- Available on 1 or 2 channel
- Wall mounted, ceiling mounted or internal and external corner
- Remote control (optional)



PRESENCE DETECTOR

General Specification

- Square detection area
- Premium product range
- Lux sensor integration
- Self learning time delay off
- Available on 1 or 2 channel
- Wall mounted, ceiling mounted
- Remote control (optional)
- Master slave connection
- Short presence detection
- Smart Switching



KNX SYSTEM

The KNX Association foundation in 1990

The driving force behind KNX is KNX Association, a group of leading companies active in many fields of home and building control.

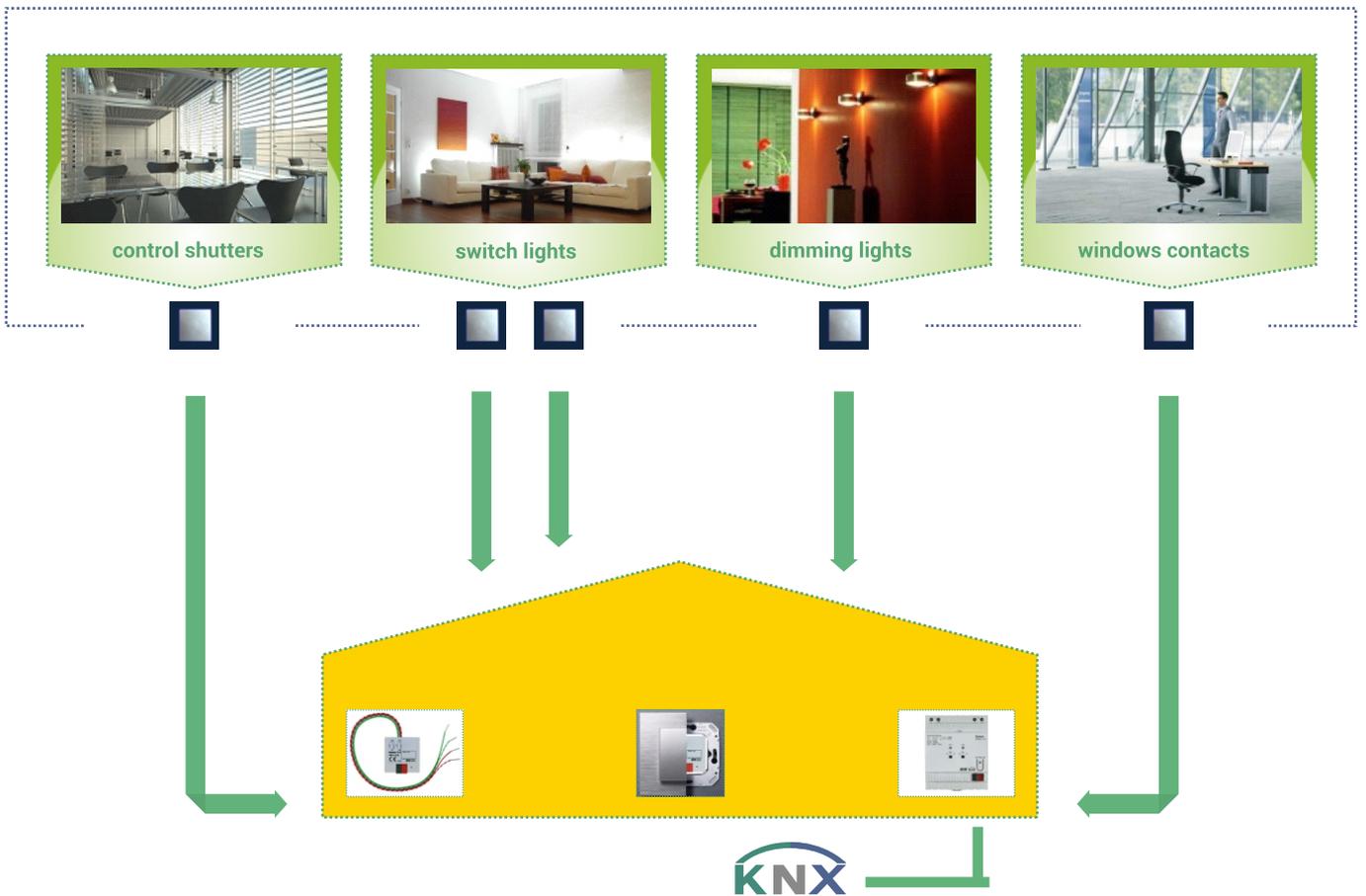
Currently, KNX Association has more than 300 members, accounting for more than 80% of the home and building control devices sold in Europe.



At a glance

KNX Actuators	KNX Sensors	KNX Controller	KNX Clocks Save clocks
------------------	----------------	-------------------	------------------------------

INTEGRATION



PANASONIC WHITE CONDUIT and CONDUIT FITTINGS



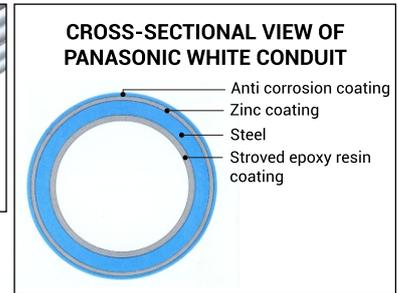
JIS
Plain Type E19 - E75
Thin Wall Type C19 - C75
Thick Wall Type G16 - G104



ANSI
EMT Size 1/2" up to 2"
IMC Size 1/2" up to 4"
RSC Size 1/2" up to 6"



STAINLESS STEEL
IMC Size 1/2" up to 4"



Standards

Panasonic WHITE CONDUIT is available in four types conforming to the following standard:

- UL/ANSI (EMT, IMC and RSC)
- BS (BS31-1940 and BS4568-1970)
- TIS
- JIS (Plain, Thin Wall and Thick Wall)



Coupling



Normal Bends



Bushing



Connector



Saddles Clamp



Lock Nut



Underwriters Laboratories Inc.®



JAPANESE INDUSTRIAL STANDARDS CERTIFICATION MARKING FACTORY



THAI INDUSTRIAL STANDARD

POLYETHYLENE-LINING STEEL PIPE



Non-Threaded

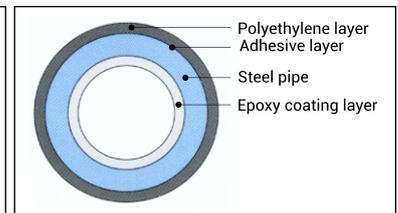


Threaded



Normal Bend

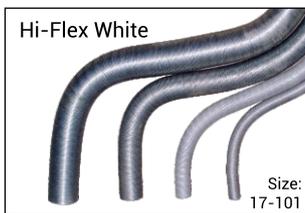
Coupling



Corrosions resistant steel pipe for cable

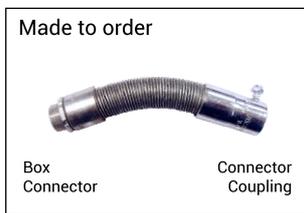
FLEXIBLE and ACCESSORIES

(Unit: mm)



Hi-Flex White

Size: 17-101



Made to order

Box Connector

Connector Coupling



Mecha Flexy + Accessories

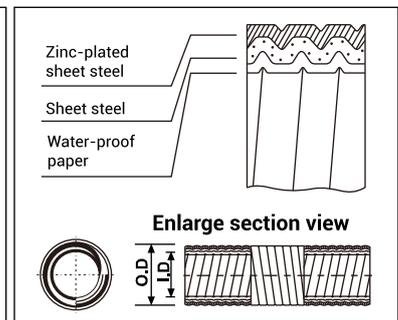
Size 16 - 42

WP

Connection Coupling

WP

Box Connector



Zinc-plated sheet steel

Sheet steel

Water-proof paper

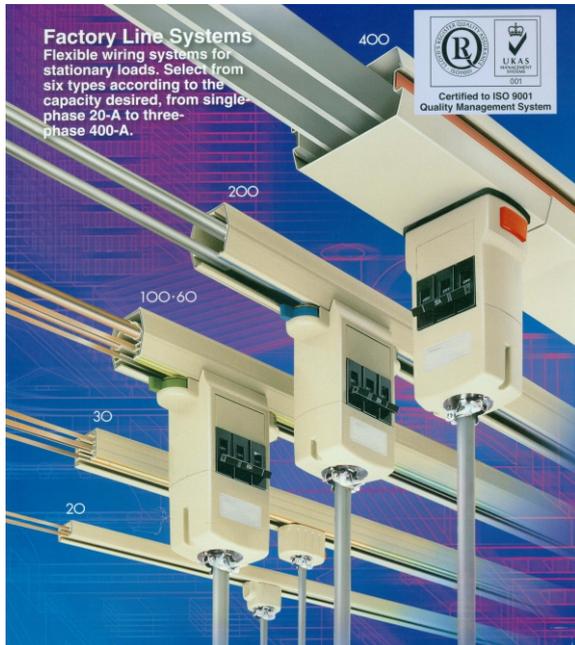
Enlarge section view

CABLE LUG (GAE)



Standard Type: 6 - 95 mm2
Heavy Duty Type: 2.5 - 500 mm2
Material: copper with 99.98% cu

FACTORY LINE SYSTEMS



The line can be branched and power can be accessed wherever necessary.

Changes to the power supply positions of equipment due to changes in the layout and increases in the number of power supplies required due to an increase in the amount of equipment used are supported by the capability to change the positions of and increase the number of plugs.

This electrical circuit system does not require rewiring, which leads to a decrease in costs, and is also recommended for wiring in advance.



Basic advantages
Layouts can be changed simply by reconnecting plugs, significantly reducing effort and cost.



Rewiring is not required even after a change inside the manufacturing line.



Basic advantages
Cabling and floor are kept in order. Also appealing during factory tours.



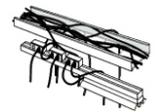
Simplifies wiring and appearance. Effective for productivity improvement.



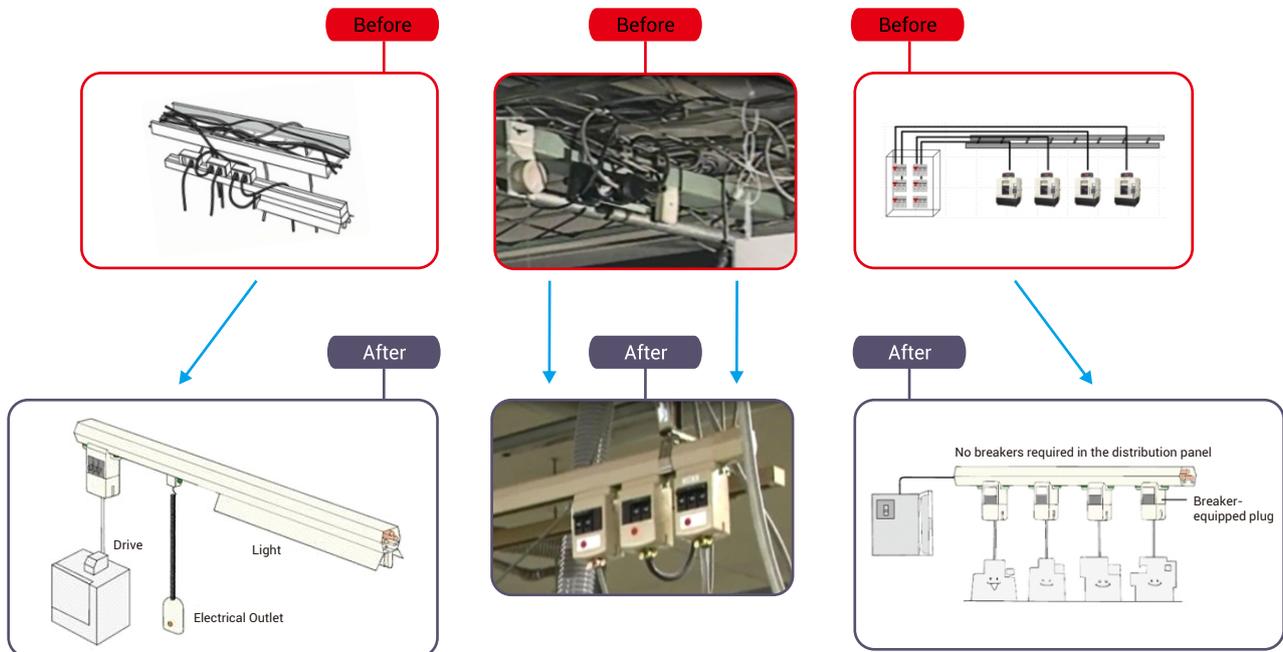
Basic advantages
Wiring from the ceiling keeps the floor area unobstructed. Plugs with breakers can provide safety in the event of unforeseen emergencies.



No risk of tripping over or damaging a cable on the floor.



- FACTORY LINE SYSTEMS - EXAMPLE 1



TROLLEY DUCTS



These products can be used to easily construct various electrical circuits, which provide improved safety, power consumption, and efficiency.

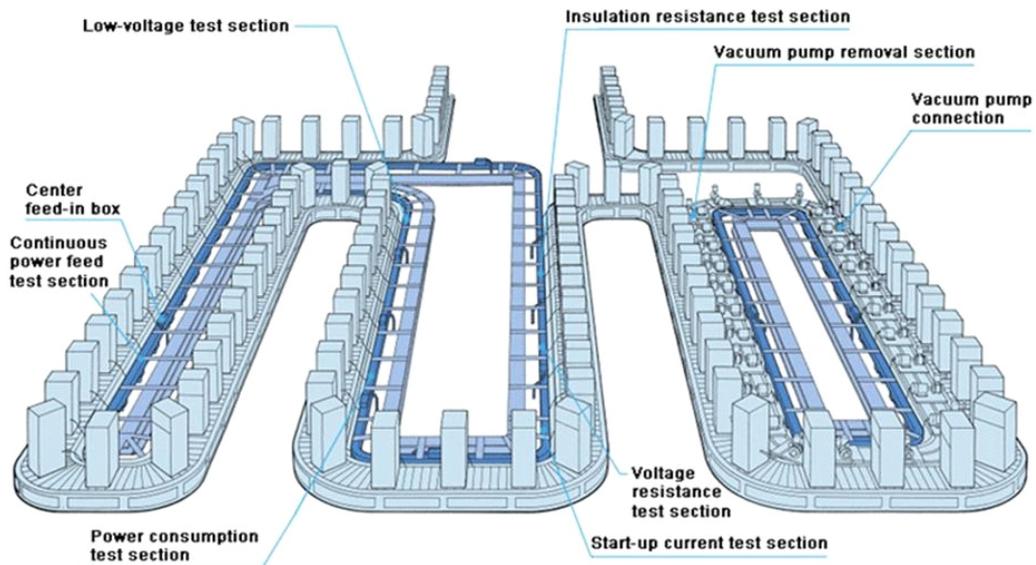
Curved sections, point switching, circuit separation, and other complex circuits can be easily integrated to automate and streamline the manufacturing process.

This product can be applied to a variety of situations such as use with turn tables and other switching devices, automated conveyor lines of assembly factories, automatic doors, overhead traveling cranes, shipping and conveyance of materials between indoor and outdoor areas, inspection and aging lines, and automated warehouses without human presence.

- TROLLEYS DUCT-PRODUCT SPECIFICATION

Rated current	Rated voltage	No. of Poles	
30A 60A	300V	2P	
		3P	
		4P	
		5P	
100A	600V	3P	<p>2P type is custom-made</p>

- TROLLEYS DUCT EXAMPLE 1



Aging and product inspection circuits

The Trolley Duct is used for aging and product inspection circuits that come after assembly processes at electrical appliances manufacturing facilities, contributing to line automation and labor-savings.

INSULATED TROLLEY SYSTEMS



This system can be selected to meet a variety conditions for supplying power to moving equipment. Some examples of such conditions include use with multi circuits line such as those used with high-speed conveyors and monorails, conservation of space for hoists and cranes, and use with lines that require high capacity.



This product not only supplies power to high-speed conveyors but also meets a variety of conditions for supplying power to other moving equipment

1. Tro-Reel HS (Non-Tension Type, for Indoor Use Only)

Ideal for high-speed monorails.



2. High-Tro-Reel (Non-Tension Type, for Indoor Use Only)

Ideal for auto conveyors and monorails.



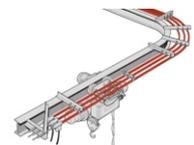
3. Tro-Reel HS (for Indoor and outdoor Use)

Jointless installation of up to 100m.



4. High-Tro-Reel (Tension Type, for Indoor Use Only)

Ideal for supplying power to confined spaces in hoists and cranes.

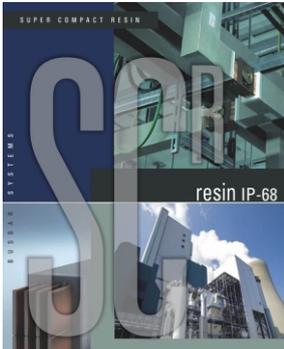


Four types and eleven different versions of insulated trolleys available for various power supply needs in moving equipment.

TABLE OF INSULATED TROLLEYS BASED ON RATED CAPACITY

Rated voltage (V)	600V																			
	60A					90A						150A			200A			300A		500A
Rated current (A)	1P	3P	4P	5P	6P	1P	3P	4P	5P	6P	7P	8P	1P	3P	4P	1P	3P	4P	1P	1P
Tro-Reel HS (non-tension type)						●	●	●	●	●	●									
High-Tro-Reel (non-tension type)		●	●	●	●															
Tro-Reel	●											●			●			●		
High-Tro-Reel (tension type)		●	●	●		●	●	●					●	●	●	●				

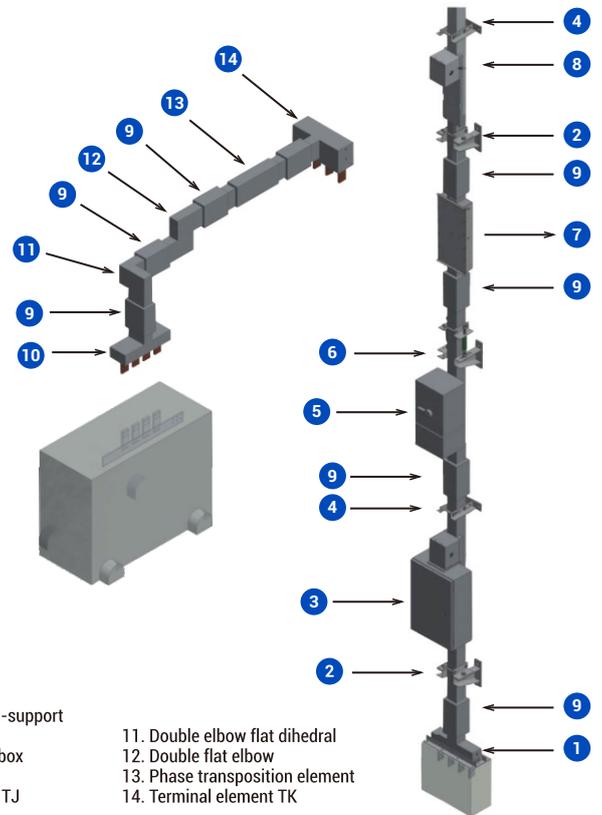
SUPER COMPACT RESIN



MAJOR ADVANTAGES

Wide range from 400A-6150A/1000V

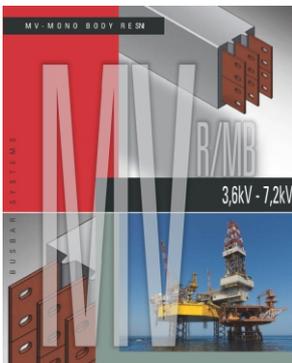
- Outdoor IP68 swissmade
- High short circuit-withstand
- Overload capacity 20% during 2 hours
- Full encapsulated in epoxy resin
- Electromagnetic compatibility EMC
- Electro erosion resistance
- Low voltage drop
- Tailor made terminal elements
- High mechanical strength
- Small dimensions
- Air- and watertight wall bushings
- Chemical resistance
- Resistance against fungi, animal, insects, rodent
- UV - Resistance
- Self-extinguishing insulation IEC 60332
- Fire retarding wall bushings- DIN 4102-9 up to 120 min
- Non chimney effect
- Tropical resistance
- > 50 years life time and maintenance free



Legend:

- | | | |
|----------------------------------|---------------------------------|---------------------------------|
| 1. Cable terminal box IP55 | 6. Vertical wall spring-support | 11. Double elbow flat dihedral |
| 2. Vertical wall fix-point | 7. Expansion element | 12. Double flat elbow |
| 3. Slide in box IP55 | 8. Tap off for slide in box | 13. Phase transposition element |
| 4. Vertical wall guiding-support | 9. Straight joint | 14. Terminal element TK |
| 5. Polyester Tap off-box IP67 | 10. Terminal element TJ | |

MV MONO BODY RESIN

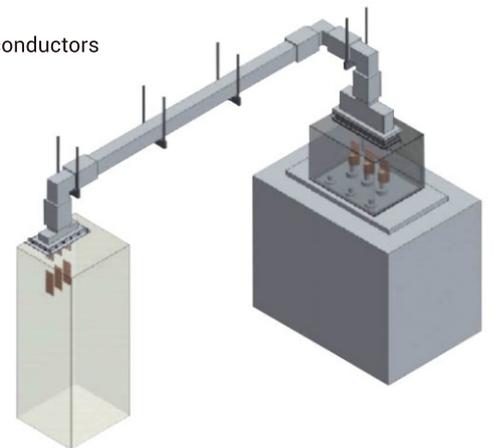


SYSTEM DESCRIPTION

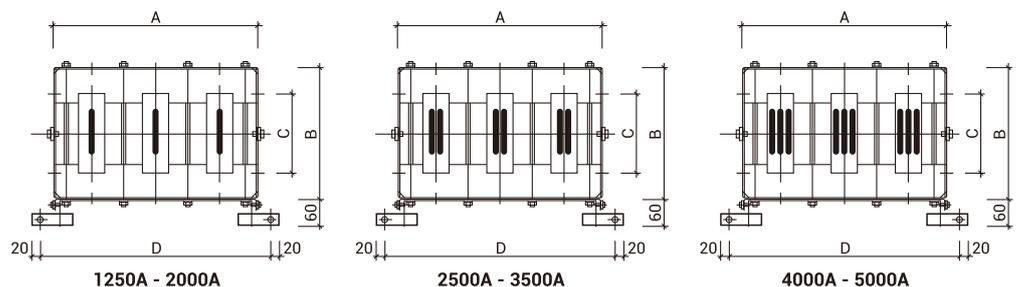
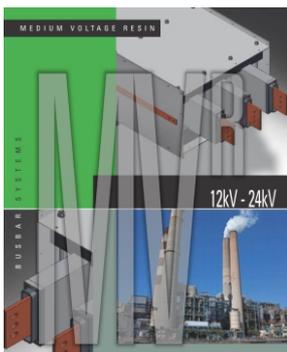
MV-Mono Body Resin busbar system consist of copper conductors or Aluminium conductors, embedded in an enclosure of homogeneous insulation compound (BIC) based on epoxy resin mixed with a high content of selected inert mineral fillers, insulation compound is free of occlusions which may cause leaks and partial discharges, with a high mechanical, chemical and fire resistance level.

System with a high degree of protection IP68 the ideal solution for use in outdoor installation and tropical, saline and corrosive environment.

The system is simple to design, easy to install and ultimately maintenance free.



MEDIUM VOLTAGE RESIN



**DATA SHEET
SUPER COMPACT RESIN**

SC-R with ALUMINIUM Conductor

Rated Current (In)	Amps	400	630	800	1000	1200	1400
		SC-R	SC-R	SC-R	SC-R	SC-R	SC-R
		SB	SB	SB	SB	SB	SB
		060A-3	060A-4	060A-6	080A	100A	120A
Rated Current (In)	Amps	1600	2000	2500	3200	4000	5000
		SC-R	SC-R	SC-R	SC-R	SC-R	SC-R
		SB	SB	SB	SB	SB	SB
		DB080A	DB100A	DB120A	QB080A	QB100A	QB120A

SC-R with COPPER Conductor

Rated Current (In)	Amps	630	800	1000	1350	1600	1700
		SC-R	SC-R	SC-R	SC-R	SC-R	SC-R
		SB	SB	SB	SB	SB	SB
		060K-3	060K-4	060K-6	080K	100K	120K
Rated Current (In)	Amps	2000	2500	3200	4000	5000	6300
		SC-R	SC-R	SC-R	SC-R	SC-R	SC-R
		DB080K	DB100K	DB120K	QB080K	QB100K	QB120K

**DATA SHEET
MV MONO BODY RESIN**

MV-R/MB ALUMINIUM Conductor

Type	Ampere Rating	H	micro ohm/m/50hz			kA	
			R20	Rt	X	icw/1sec.	Idyn
MV-R/MB 060-1A	800	100	80,5	103,1	110,0	27	56
MV-R/MB 080-1A	1000	120	60,4	77,8	95,5	27	56
MV-R/MB 100-1A	1250	140	48,3	62,5	84,5	53	117
MV-R/MB 060-2A	1600	200	30,2	63,2	63,2	53	117
MV-R/MB 080-2A	2000	240	24,2	54,2	54,2	65	142
MV-R/MB 100-2A	2500	280	20,1	47,5	47,5	65	143

MV-R/MB COPPER Conductor

Type	Ampere Rating	H	micro ohm/m/50hz			kA	
			R20	Rt	X	icw/1sec.	Idyn
MV-R/MB 060-1K	1000	100	49,0	64,7	109,7	38	80
MV-R/MB 080-1K	1250	120	36,6	49,1	95,1	44	95
MV-R/MB 100-1K	1600	140	29,2	39,7	84,0	50	108
MV-R/MB 060-2K	2000	200	18,3	25,2	62,6	67	144
MV-R/MB 080-2K	2500	240	14,6	20,3	53,7	84	181
MV-R/MB 100-2K	3200	280	12,2	16,9	47,1	100	220

**DATA SHEET
MEDIUM VOLTAGE RESIN**

12 kV 60Hz/50Hz

Type	Rating (A)	Voltage (kV)	A	B	C	D
MV-R 060-01	1250	12	600	320	140	660
MV-R 080-01	1600	12	600	320	140	660
MV-R 100-01	1750	12	600	360	180	660
MV-R 120-01	2000	12	600	360	180	660
MV-R 080-02	2500	12	660	320	140	660
MV-R 100-02	3000	12	660	360	180	660
MV-R 120-02	3500	12	660	360	180	660
MV-R 100-03	4000	12	720	360	180	780
MV-R 120-03	5000	12	720	360	180	780

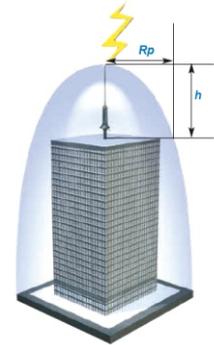
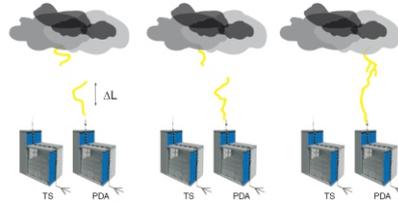
17.5 kV - 24 kV 60Hz/50Hz

Type	Rating (A)	Voltage (kV)	A	B	C	D
MV-R 060-01	1250	12	740	380	140	800
MV-R 080-01	1600	12	740	380	140	800
MV-R 100-01	1750	12	740	420	180	800
MV-R 120-01	2000	12	740	420	180	800
MV-R 080-02	2500	12	800	380	140	860
MV-R 100-02	3000	12	800	420	180	860
MV-R 120-02	3500	12	800	420	180	860
MV-R 100-03	4000	12	860	420	180	860
MV-R 120-03	5000	12	860	420	180	860

SAINT-ELME SERIES LIGHTNING CONDUCTOR

Introduction to ESE (Early Streamer Emmission)

- Short reminder on ESE lightning conductor
- Simple rod equipped with a device reducing the excitation time
- **Better probability** to capture the descending tracer



Radius of Protection

Radius of protection R_p are theoretically calculated following NF C 17-102 French standard and depending on

- Excitation advance time (in μs)
- Lightning conductor height h
- Level of protection (I, II, III or IV)



Rp	Active 1D 12				SE6				SE9				Active 1D 60 ; SE15			
	$\Delta T=12\mu s$				$\Delta T=15\mu s$				$\Delta T=30\mu s$				$\Delta T=60\mu s$			
H(m)	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
2	11	16	16	19	13	15	18	20	19	21	25	28	31	34	39	43
4	23	32	32	37	25	29	36	41	38	43	51	57	63	69	78	85
5	28	41	41	46	32	37	45	51	48	55	63	71	79	86	97	107
6	28	41	41	46	32	38	46	52	48	55	64	72	79	87	97	107
8	28	41	41	46	33	39	47	54	49	56	65	73	79	87	98	108
10	30	45	45	52	34	40	49	56	49	57	66	75	79	88	99	109
20	32	51	51	60	35	44	55	63	50	59	71	81	80	89	102	113
30	32	55	55	65	35	45	58	69	50	60	73	85	80	90	104	116
60	32	57	57	72	35	34	58	75	50	60	75	90	80	90	105	120

LIGHTNING COUNTER

LIGHTNING COUNTER

Impact Controller 1 kA to 100 kA, Conformity test carried by LCIE

The impact controller or lightning counter is designed for detecting and counting lightning strikes received by structures with lightning conductor. It is fitted in general to a down conductor.



ORDERING CODE	AFV 0907 CF
Counting range	00 to 99
Counter threshold IEC 60-1 and 1180-1 (minimal discharge current detected)	1 kA in 8/20 wave (no detection below 150 A)
Maximum discharge current detected in compliance with IEC 60-1 and 1180-1	100 kA in 8/20 wave* (150 kA in 4/10 wavv)
Permanent working current	None
Terminal capacity	$\varnothing 8 \text{ mm (50mm}^2\text{)}$
Necessary circuit breaker	No
Operating temperature range	- 30° C / + 80° C
Protection index	Ip53
Dimensions	165 x 92 x 47 mm
Weight	430 g

EARTHING EQUIPMENT

CONTROL JUNCTIONS

NF C 17-100 and NFC 17-102 standards:

A control junction must be inserted on each down conductor to allow disconnection from its earth terminal. The 2F control junction, featuring very low impedance and perfect conductivity, is designed for easy installation and inspection



GIM GROUNDING IMPROVEMENT MATERIAL

GIM Ground Improving Material is an earthing backfill compound consisting of highly conductive materials, which increase the earthing system's efficiency. It is most useful for area with high soil resistance and also when the probability of erosion due to the flow of water exists.



FOUR POLE TRANSIENT SURGE PROTECTOR

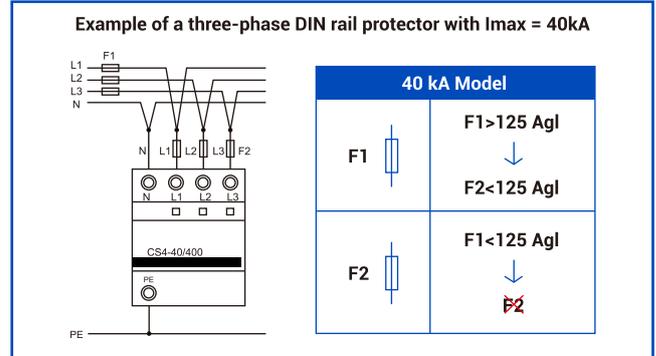
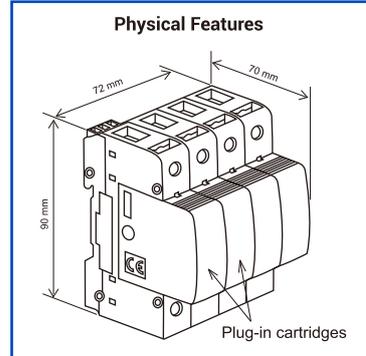

12 11 14

End of life



12 11 14

Protector OK

GSM4-40 TNS Series

TECHNICAL FEATURES

IR MODELS		GSM4-40/400 TNS	
Designation according to EN 61643-11		Type 2	
Designation according to IEC 61643-1		Class II	
Nominal voltage AC 50-60 Hz	U_N [V]	230/400	
Max. continuous operating voltage (L-PE)	U_c [V]	275	
Maximum discharge current (8/20)	I_{max} [kA]	40	
Nominal discharge current (8/20)	I_n [kA]	20	
Voltage protection level (L-PE) at I_n	U_p [kV]	< 1,3	
Maximum back-up fuse	A gL	125	
Short circuit withstand	I_{cc} [kA]	25	
Response time (L-PE)	t_A [ns]	25	
Insulating material & flammability class		PA66 CT1 ; V - 0	
Remote monitoring		IR MODELS	
End of life indication		YES	
Dynamic thermal disconnection (L-PE)		YES	
Certifications			

BREAKERS Series



AIR CIRCUIT BREAKER

M-Pact Series

Rating: 800A up to 4000A,
3 & 4 Poles
Breaking capacities
50kA up to 80kA

Fixed Pattern and withdrawable type
in accordance with IEC 60947-2

Entelliguard Series

Rating: 5000A up to 6400A
Breaking capacities 100kA

Fixed Pattern and withdrawable type
in accordance with IEC 60947-2



MCB'S SERIES REDLINES

Miniature Circuit Breaker
From 0.5A up to 125A -
1P to 4P configuration.
From 4.5kA up to 50kA
breaking capacities.
1, 2, 3 & 4 Poles, According to
IEC 60898 and IEC 60947-2.



MCCB SERIES RECORDPLUS

A full range of thermal-magnetic and
electronic moulded case circuit breakers
from 16A to 1250A. In 3 and 4 poles, fixed
or withdrawable versions.

Breaking capacities from 25kA up to 150kA



MCCB SERIES RECORD SL

Non adjustable MCCB's from 16A up to
250A, 3 Poles and 4 Poles.

Breaking capacities from 16kA up to 25kA



RCCB'S SERIES REDLINES

Residual current operated circuit breakers
without integral overcurrent protection.
From 16 to 100A and 10mA to 300mA
(IEC 61008), 2 & 4 Poles.

CONTROL AND AUTOMATION



CONTACTORS

Three ranges, 3 and 4 poles:
Series M :
from 6A to 9A in AC3
Series CL:
from 9A to 105A in AC3
Series CK:
from 150A to 825A in AC3

THERMAL OVERLOAD RELAYS

To fit on the three contactor ranges :
Series MT :
from 0.11A to 14A setting
Series RT :
from 0.16A to 110A setting
Series RT :
from 55A to 850A setting



CONTAX - CONTACTORS

Contactors are electromechanically
controlled switches used to control single or
multi-phase (high) power loads while the
control itself can be low power from 20 to
63A - 1, 2 & 3 Modules.



CONTACT R - RELAYS

Relays are electromechanically controlled
switches used to control low power loads.

Nominal Current 16A, 1 & 2 Modules



MANUAL MOTOR STARTER SERIES SURION

Thermal and magnetic protection.
From 0.1A to 63A
From 25kA to 100kA
Standard and high breaking capacity



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Affiliated company of PT Guna Elektro

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