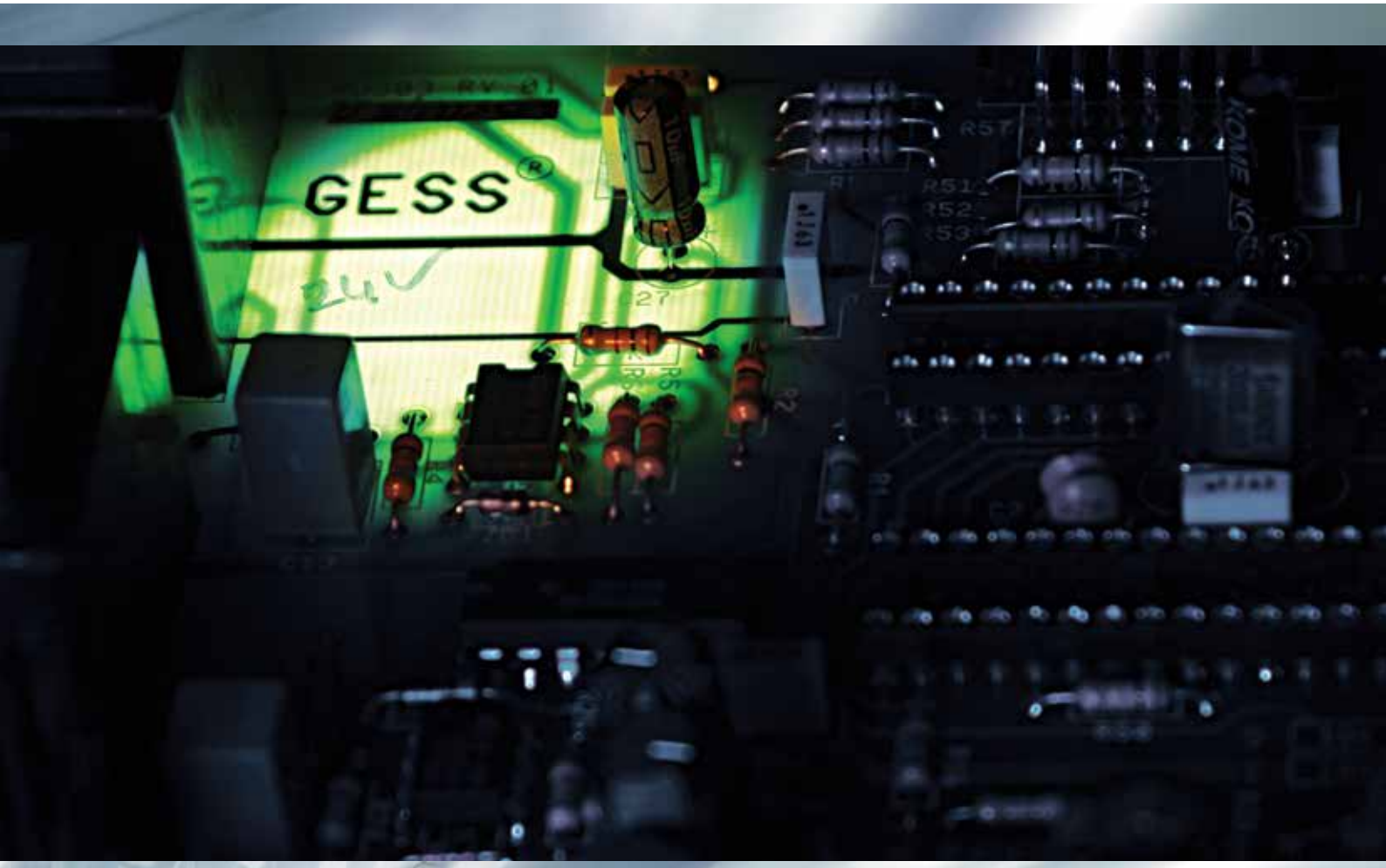
RELIABLE SOLUTIONS in POWER ELECTRONICS

PMI



Power Management Instruments

DC Rectifier / Battery Charger

Industrial UPS System

Thyristor Controlled PFC System

Electronic IGBT Controlled Voltage Stabilizer

Servo Controlled Voltage Stabilizer

On-Grid Inverter

PMI & OES GROUP COMPANIES

ABOUT US

Being fully abreast of the fact that in today's competitive environment, even millisecond power outages or distortions mean great deal of loss to your busines. PMI Group manufacture reliable and hi-tech energy solutions to industries where critical processes are in place. PMI has made great strides in developing and producing one of the most comprehensive portfolios to lead the power electronics industry including UPS, Voltage Regulator, DC Charger, ON-GRID Inverter and Electronic pf Corrector Systems. The Company is capable of safeguarding the critical processes of various markets such as Oil & Gas, petrochemicals, mining, process industries, energy transmission and distribution as well as healthcare thanks to its wide range of product portfolio.

GEOGRAPHIC EXPANSION

The group is actively operating in four continents around the globe.

GROUP COMPANIES

ORTADOGU Elektronik Sanayi Ltd. Sti.

KARMET Makina Elektronik Tasarim A.S.

PMI Elektrik ve Elektronik Sistemleri Dis Tic. Ltd. Sti

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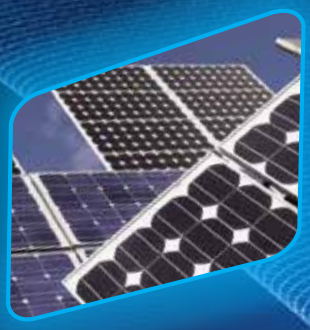
STRONG ROOTS OF DESIGN CAPABILITY

As group of companies, we have the full talent, capability and skill sets required to design and manufacture all power electronics products in our range. All parts from electronic cards to transformers and enclosures are designed and produced in integrated facilities, meaning that the company owns the technology to produce wide spectrum of power management instruments including Industrial UPS, DC Battery Charger, Electronic and Servo Voltage Stabilizer, On-Grid and Off-Grid Inverters as well as Thyristor Controlled PFC Systems. And yet, the group continues to build on its core competence that lies in its power to be able to develop innovative technologies, thanks to strenuous efforts put in R&D for more than 25 years. This is how the company developed trust within its heritage over the years.

MANUFACTURING THE FUTURE

Production philosophy is based on maximizing the customer value with its lean production system which works in perfect harmony with rigorous quality testing and strenuous research and development efforts. Although standardization and simplification are seen as the key going forward, custom requirements of customers from wide range of industries are catered well without comprimising on the reliability in power protection to stay on the competitive edge in today's most demanding environment.

Both factories in Ankara are fully integrated and are able to produce everything from electronic cards to chasis in order to minimize the associated risks of sourcing and using more components from overseas.



WIDE SPECTRUM OF PORTFOLIO IN POWER ELECTRONICS

Key Global References

6

RELIABLE SOLUTIONS in POWER ELECTRONICS

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RDAT SERIES

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BATTERY CHARGER / DC RECTIFIER

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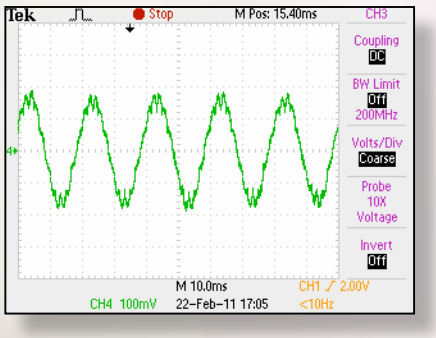
BATTERY CHARGER / DC RECTIFIER

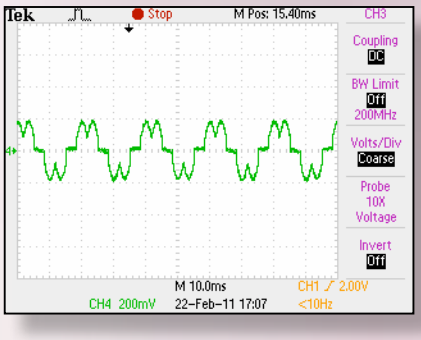
RDA / RDAT AUTOMATION TYPE SERIES

The rectifier is SCR controlled AC/DC rectifier with input isolation transformer and with automatic constant voltage and constant current ability. It comes with 6 Pulse or 12 pulse design options depending on user requirements. The advantages of employing 12 pulse rectifier in industrial DC UPS systems are to have lower THDi (<10%) and higher pf at input (>0.9) as well as to secure redundancy since 12 pulse rectifiers are designed with one delta and one star connected transformers, so the unit itself behaves as two redundant rectifiers by its nature. Output current, battery current, boost and Float Charge Voltages are adjustable on the user-friendly control panel. Detailed alarm indicators help you to monitor all alarms from the front panel and monitor the auxiliary contacts from the MIMIC diagram. On LCD panel, all key parameters can be set, and real time base events and failures can be tracked remotely via RS 485/ModBus, Profibus, TCP/IP or SMS/Mail Order.

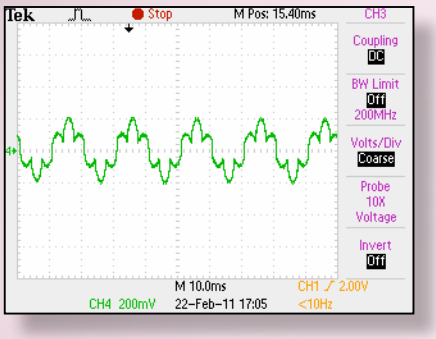
12 PULSE RECTIFIER CURRENT WAVE



6 PULSE RECTIFIER CURRENT WAVE (DELTA-DELTA CONNECTION)



6 PULSE RECTIFIER CURRENT WAVE (DELTA-STAR CONNECTION)



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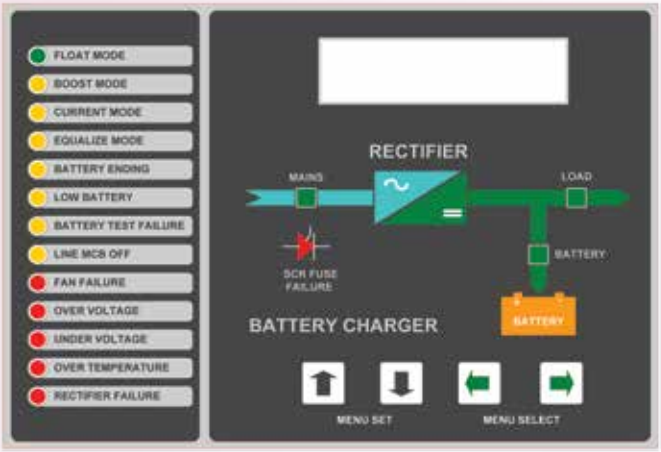
STANDARD FEATURES

- Adjustable Timer for Boost Charging
- Adjustable Boost and Float Charge Voltages
- Automatic Boost Charge Selection according to boost / float current set value
- Adjustable Rectifier Output Current and Battery Charge Current
- LCD Display for DC Load / Battery Voltage , DC Load / Battery Current , Input AC Voltage / Line Current / Frequency
- Event History for all Electrical values and failures
- Automatic and Manuel Battery Test
- Boost inhibit facility for interlock redundant application
- Output Filter Inductor and DC Longlife Capacitor
- Electronic Over / Under Voltage, Over Current and Short Circuit Protections
- Isolated Output by Input Transformer and output halleffect current module
- Parallel Redundant Operation
- Boost and Float dropper control output for Ni-Cd and Lead Acid Battery (Optional)
- Input Filter and input surge Voltage protection
- Internal Over Temperature protection
- Temperature Compensation for Battery
- Low Battery Indication and Alarm contacts
- Rectifier Failure Indication and Alarm contacts
- Rectifier Over Voltage Indication and Alarm contacts
- Over Temperature Indication and Alarm contacts
- Line Failure Indication and Alarm contacts
- Input MCB Indication and Alarm contacts
- Load MCB Indication and Alarm contacts
- Battery MCB Indication and Alarm contacts
- Earth Fault Indication and Alarm contacts
- Reverse Battery Connection Protection
- Reset Button



OPTIONS

RS 485/ModBus, Profibus, TCP/IP or SMS/Mail Order communication.

Silicon Dropper Module For Load Output

LVD Deep Discharge Battery Protection contactor.

Cabin options for Rectifier and Battery Group

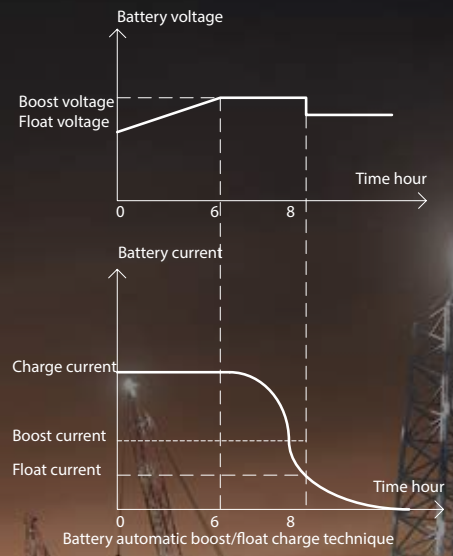
Analogue Meterings for Output and Battery

Power Analyzer option for Input

AUTOMATIC BOOST

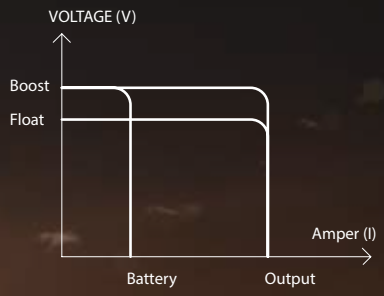
Automatic boost charge can also be selected on menu. The automatic boost menu has the options for selecting the boost and float current based on battery capacity. Suitable float and boost currents of the battery are set before selecting the automatic boost option. After the set-up, the automatic boost function will monitor the battery current and select boost or float option by referring to the set values. If the charging current is higher than the set boost current, the system will select boost and if the charging current is lower than the set float current the system will select float option. In case of low battery alarm, the automatic boost will select boost option until the battery charging current reaches to the set float value.

BATTERY CHARGING CHARACTERISTICS



Battery automatic boost/float charge technique

Ideal and safe charging of batteries is sustained by setting boost and float charge currents. In this way unnecessary boost conditions and deformation of batteries at changing load currents are prevented.



Constant voltage / constant current rectifier output V/I characteristics

Ideal output characteristic via fast microprocessor control

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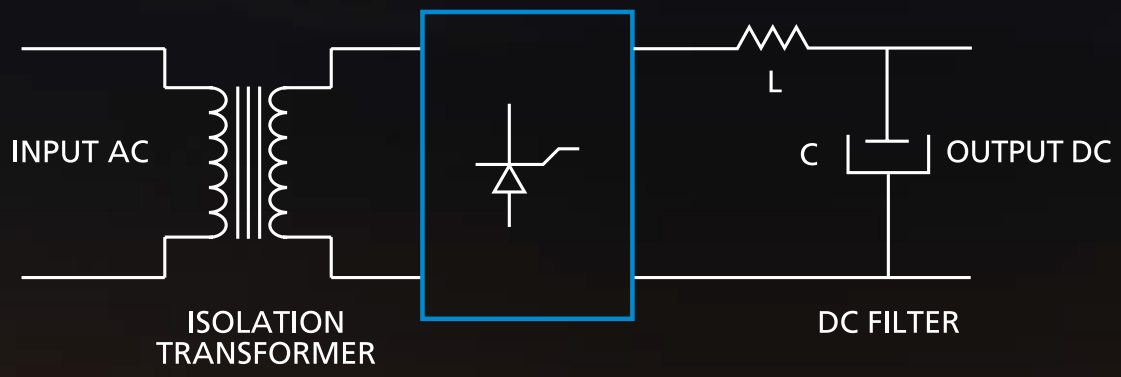
HIGH PROTECTION

FULLY CONTROLLED THRYSTOR RECTIFIER MODULE



COMPLETE ISOLATION

PMI DC Chargers are fully isolated since an isolation transformer is placed in between the input and output and because the DC current is controlled by a DC current module. Therefore, the load is always safe even at high input voltage and congested mains conditions. In addition, the failure risk is minimized as semi-conductors are used for the rectifier. Standard L-C filters at the output maintain safe charging of the battery groups.

PROTECTIONS

The input and output of the charger are protected against improper use and line disturbances electronically. Input and output can be switched by circuit breakers individually. It has self-protection against over temperature. The alarm contacts can be used for external system in the case of any anomaly. The output is fully isolated from the AC line input. The Charger has a modular design to provide service and maintenance simplicity.

DC RIPPLE < 1%

Input and output are protected with MCBs and all settings like boost charge, floating charge and battery charge current can be adjusted via front panel digitally. DC output is filtered by L/C, so DC ripple at full load always lower than 1% to increase battery life. All rectifiers have standards low-battery and rectifier failure alarm.

WIDE RANGE OF USE

DC chargers are ideal for transformer energy distribution centers, gas oil energy distribution centers, natural gas energy distribution centers, mining industry security and lighting, building automation systems and for special telecommunication applications.

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PARALLELING

The Charger has a modular design to provide service and maintenance simplicity. The outputs of the Battery Chargers can be connected in parallel. The parallel system can be active load sharing or hot-standby. Besides this, parallel system can be placed in one unit industrial cabin as seen from the picture on the right side or they can be placed in different cabins based on the requirement.

BOOST INHIBIT FUNCTION

Boost Inhibit Function is optionally employed when two DC Chargers with two battery groups operate in a parallel redundant mode. In parallel operation, if two rectifiers start boost-charging at the same time there is danger the load would be damaged by overvoltage. So, the principle idea of Inhibit facility is to block any one of the two chargers feeding the load in Boost mode when the other rectifier is charging the batteries in Boost mode; so the system prevents applying overvoltage to the load. This function is primarily handled by a powerful communication between two rectifiers and the use of contactors

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INTELLIGENT BATTERY TEST FUNCTION

The battery test function checks the battery performance by discharging the battery with a constant current for a periof of time. During the test time both the battery and charger delivers current to the load to ensure system performance. The system checks the battery health by comparing the battery voltage with set low battery voltage, which is indicated in battery discharge data. In case of failure, the alarm is provided with LED on the front panel. This fuction can be activated manually as well as automatically by entering test interval data via front panel or remote PC.

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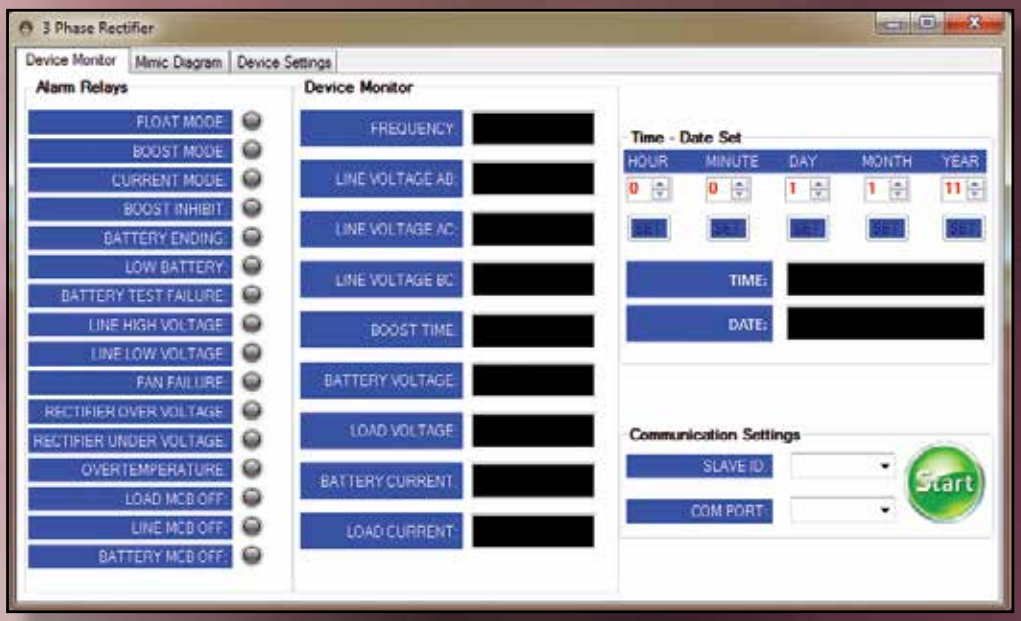
RECTIFIER COMMUNICATION INTERFACE



REMOTE MONITORING

On both LCD panel and communication interface, all key parameters can be set and real time base events and failures can be tracked. In parallel operation multiple rectifiers can be controlled by the help of same communication interface. The communication is executed via RS 485/ModBus, Profibus, TCP/IP or SMS/Mail Order.

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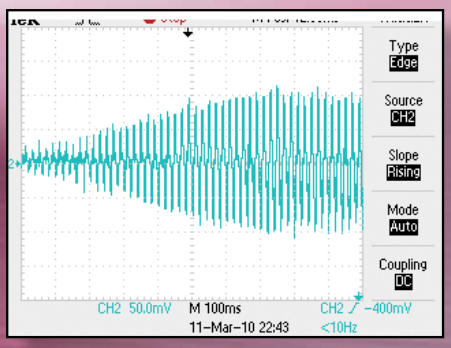
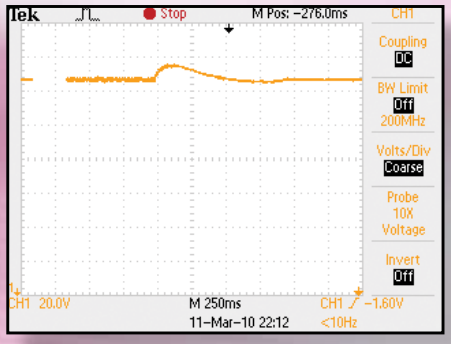
PRODUCT PERFORMANCE

SOFT START FEATURE



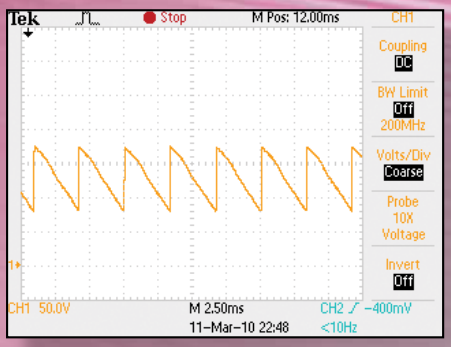
- No inrush current at start up

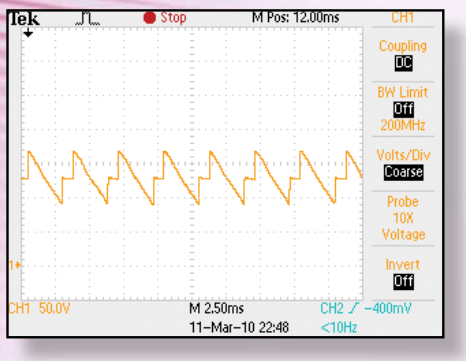
DYNAMIC RESPONSE



- In sudden load changes dynamic response is 300 msec without overshoot or undershoot to secure the load

MICROPROCESSOR CONTROL

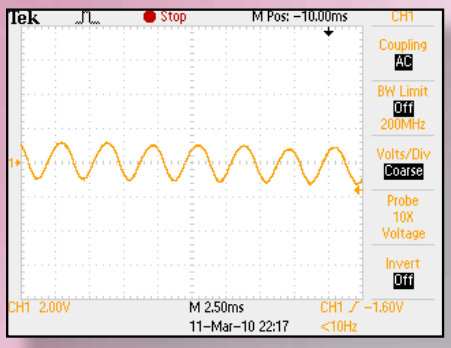




Fully microprocessor controlled rectifier

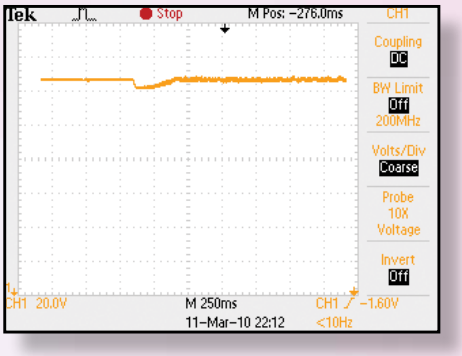
- Thyristor angle is adjusted with load change
- ½ Load: Phase angle shortened
- Full Load: Phase angle at max

AC RIPPLE AT FULL LOAD



AC Ripple at full load < 1 %

- Battery life is extended significantly via low ripple voltage due to low heat



- With this capability rectifier can be used as a power supply even without battery safely with DC Loads

DC CHARGER: TECHNICAL SPECIFICATIONS

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GENERAL		
Model	Monophase Input	Threephase Input
Topology	For 3 phase input 6 Pulse Thyristor controlled AC/DC Rectifier with input isolation transformer Optional 12 Pulse Thyristor controlled AC/DC Rectifier with input isolation transformer	
INPUT		
Nominal Voltage	110 VAC / 115VAC /208 VAC / 220 VAC / 230 VAC / 240 VAC ±15%	190 VAC / 200 VAC /380 VAC / 400 VAC / 415 / 480 VAC ±15%
Nominal Frequency	50 / 60 Hz ±5%	
Cosφ	>0.8 Inductive (>0.9 with 12 Pulse Rectifier)	
Transformer	Galvanically isolated	
ITHD	<35% (standard); <10% (with 12 Pulse Rectifier)	
Input Protection	Thermic-Magnetic Over Current Protection, Over Voltage Protection, Phase Sequence Free Operation (3 Phase), Soft Start, MCB	
OUTPUT		
Nominal Output Voltage	12 VDC / 24 VDC / 48 VDC / 110 VDC / 220 VDC	
Output Voltage Adjustment	24VDC output: 10VDC to 30VDC, 48VDC output: 48VDC to 60VDC, 110VDC output: 110VDC to 160VDC, 220VDC output: 220VDC to 300VDC	
Output Current Adjustment	0-100% of Nominal Output Current	
Battery Charge Current Adjustment	0-100% of Nominal Output Current	
Boost Charge Voltage	100% to 120% of Floating Output Voltage	
Boost voltage (V/C)	2,4 lead acid battery 1,60 NiCd Battery (Might change based on battery brand)	
Float voltage (V/C)	2,23 lead acid battery 1,40 NiCd battery (Might change based on battery brand)	
Output Static Voltage Tolerance	±1% (Lower values available upon request)	
Nominal Output Current	Available upto 1000 Amp (12 Pulse over 400 Amp)	
Maximum Output Current	100% of nominal output current	
Output Ripple	<1% RMS AC of Output Voltage	
Dynamic Response (with battery group)	±2% of Output Voltage (100% load change)	
Battery Charging Principle	Constant Current/ Constant Voltage	
Output Protection	Short Circuit Protection, Over Voltage Protection, Reverse Voltage Protection, Short Circuit, MCB or NH Fuse (based on current value)	
Battery Protection	L-C filters, Overcurrent Electronic protection, Over Voltage Protection and Thermic Fuse	
GENERAL		
Boost Timer	0 – 99.9 hours adjustable	
Cooling	Forced fans with smart fan controlling system (Natural Cooling Optional)	
Isolation Voltage	2500VAC input/chassis and output/chassis	
Efficiency at full load	>80% (Higher values optional)	>90% (Higher values optional)
MTBF	100,000 Hrs. (w/out battery group)	
Operating Temperature	-10 / + 40 ºC (Higher Temperature Control, Optional)	
Protection Level	IP20 (Standard); IP31 / IP42 / IP54 (Optional)	

Enclosure Material	Mild Steel, Zinc-phosphate coated; 100 µm electrostatic paint; 1.5 mm thickness
Cable Entry	From Bottom; Optional from Top
Access to Batteries	Batteries and rectifier in the same cabinet with front access (optional)
Relative Humidity	5% to 90% non condensing
Circuit Breakers	Thermic – magnetic circuit breakers for Input, Battery and Load (standard upto 60A; optional above 60A)
Silicon Dropper	Available on request (For load output)
Reset Button	Used for re-operation in case of failure of the system. (Without disconnecting the load from battery group)
Boost inhibit	Interlock application inhibits one of the rectifiers for boost operation in parallel redundant mode (optional)
DISPLAY PANEL	
Front Panel Measured Values	LCD Display for Load Output Voltage / Current , Battery Output Voltage / Current and Line Voltage / Line Current / Frequency
Front Panel Indicators	Float mode, Boost mode, Current mode, Equalize Mode, Battery ending, Low battery, Battery test failure, Line failure, Fan failure, Over voltage, Under voltage, Over temperature, Rectifier failure, SCR fuse failure (LED indication), Line MCB (LED indication), Load MCB (LED indication), Battery MCB (LED indication)
Front Panel Set Menu	Boost charge voltage, Float charge voltage, Low battery voltage , Battery test , Charger output current, Battery charge current, Battery automatic boost current and float current, Auto & Manual boost selection, Manual boost time, LED test and On - OFF.
Event History	Last 250 events recorded and displayed on front panel and on PC via remote communication
Time and Date	Adjustable
ALARM CONTACTS	
Charger Failure	Open or closed free contacts
Low Battery	Open or closed free contacts
Rectifier over voltage	Open or closed free contacts
Over temperature	Open or closed free contacts
Line Failure	Open or closed free contacts
Load MCB	Open or closed free contacts
Battery MCB	Open or closed free contacts
Line MCB	Open or closed free contacts
Earth Fault	Open or Closed free contacts
ENVIRONMENT	
Operating Temperature	-10 / +40 °C
Relative Humidity	5 - 90 %
Operating Altitude	Max. 2000 Mt.
Noise Level	Max. 60 db
Electrical Standards	IEC 60146-1-1 / EN 50091-1 (Security) / EN 50091-2 (EMC)
COMMUNICATION & PARALLELING	
Communication (Optional)	RS 485/ModBus, Profibus, TCP/IP or SMS/Mail Order: - Timer Setting, Boost Voltage Setting, Float Voltage Setting, Output current setting, battery current setting, automatic boost setting and Reset buttons.
Paralleling (Optional)	Parallel Redundant (No need for extra kit for paralleling)

Key Global References

RELIABLE SOLUTIONS in POWER ELECTRONICS

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INDUSTRIAL UPS

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INDUSTRIAL UPS SYSTEM

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Industrial UPS System

Complete Power Solution With Maximum Protection

> Individual Control panels for each unit
> AC & DC Distributions
> Optional Redundant Rectifiers
> Optional Redundant Inverters

INDUSTRIAL UPS SYSTEM UNITS

The system consists of rectifier / charger, inverter, static bypass, maintenance bypass, rectifier isolation transformer, inverter isolation transformer, bypass line isolation transformer, automatic line stabilizer, DC distribution, AC distribution, controls and monitoring. The AC output of the inverter is connected to the critical load, the storage battery is connected between the inverter input and rectifier / charger output through a battery isolation MCB. The normal AC input power is connected to the rectifier; the bypass circuit also takes power from the same power source to provide power for the critical load during bypass operation when the system is in maintenance mode.

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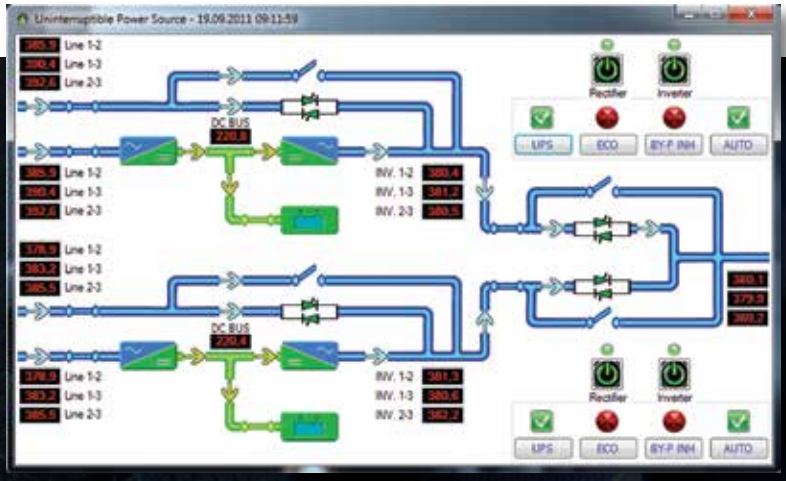

INDUSTRIAL UPS CONCEPT:

Industrial UPSs are regarded as fully customized power supply systems for rugged environments and designed particularly to safeguard critical loads in industrial applications where voltage transients, created by degraded mains supply, can seriously damage both UPS and the critical load. Industrial UPS Systems are fully flexible and customizable and designed for active–on line installation between the power source, by-pass source and critical load where the inverter delivers regulated AC voltage and frequency to the load and rectifier delivers regulated DC voltage / current to the DC load at all times without interruption.

The power conversion process isolates the critical load from the normal mains disturbances and isolates the mains from load induced reflected harmonics affecting other loads connected to the input mains feeder. The rectifier converts AC power into DC to charge maintenance free lead acid or nickel cadmium batteries; it also provides the necessary DC for continuously rated capacity of the inverter. IGBT semiconductor modules are used in PWM inverter and the control logic creates the precise sinusoidal output waveform with a very low harmonic content. Thyristor semiconductor modules are also used in rectifier for reliable operation.

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INDUSTRIAL UPS SYSTEM OPERATION MODES

NORMAL OPERATION

The rectifier with input isolation transformer converts normal input AC power info DC for the inverter and DC loads and for charging the battery group. The inverter is synchronized with the mains providing it is within the tolerances permitted by the logic, the inverter delivers its closely regulated frequency and voltage with output isolation transformer through the static switch to the load. Where the reference frequency and voltage are outside the permitted limits, the inverter will 'uncouple 'from the mains and will free run using its internal oscillator to assure the high stability power for the load.

LOSS OF INPUT POWER

In the event of input power failure, the inverter will free run using its internal oscillator and DC loads will operate from the battery until the low DC threshold is reached or the input power to the rectifier is restored. When the input AC power to the rectifier is restored, the rectifier resumes the provision of DC for the inverter, DC load and it will simultaneously recharge the battery. The critical AC load connected to the inverter and the critical DC load connected to the rectifier will not be disturbed during the loss and restoration of the input AC power feeding the rectifier.

BYPASS OPERATION

The inverter is provided with a sensing circuit which can detect transient overload, sustained overloads and short circuits. The sensing circuit initiates 'current limit', which causes the static switch to transfer the critical load to the bypass line without interruption for load security. There is also an isolation transformer with automatic line stabilizer. So, bypass line is also reliable source for the AC load across line fluctuations and disturbances.

Applications

Industrial UPS Systems are primarily designed to meet requirements for the applications;

- Oil and gas offshore and onshore,
- Petrochemical,
- Chemical,
- Power- and Substations
- Production process plants
- Offshore installations
- Pipeline control centers
- Airport, avionics and airfields
- Railways and metro lines
- Hospitals and healthcare
- Security and Alarm equipments
- Defense

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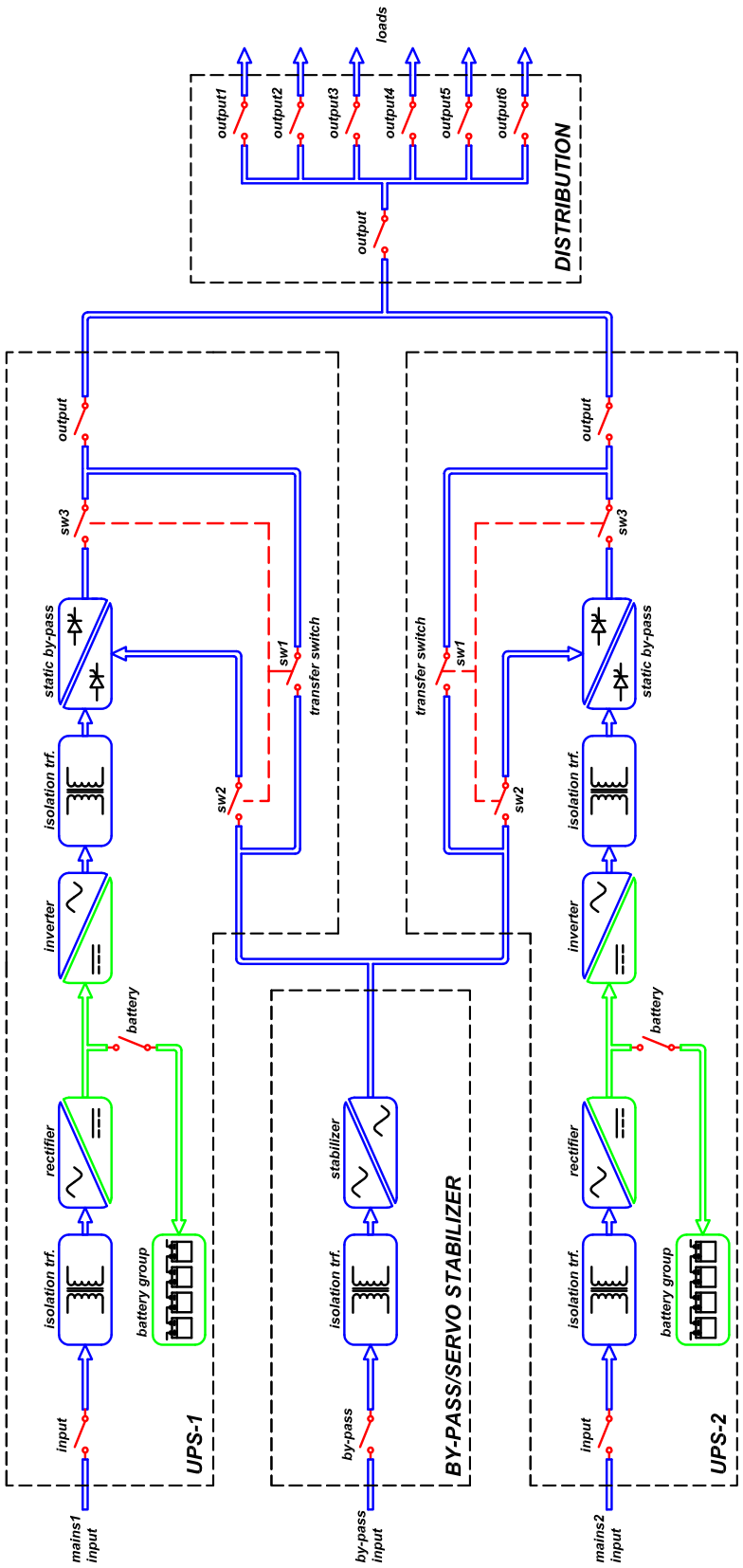
TYPICAL REDUNDANT AND FULLY ISOLATED DESIGN



BENEFITS

LOAD SECURITY AGAINST MAINS FAILURE

Load is fully isolated with galvanic transformer. Therefore, in circumstances where the load is likely to be affected by a very large variation in its power supply, a transformer-based UPS provides a safer and more robust solution than transformer-less technology simply because its size and construction afford some inertia between the input and output waveforms, with no additional electronic filtering required. For utmost critical applications like the ones in oil & gas or health care sectors, redundancy on the rectifier side (direct connection) and on the inverter side (via static transfer switch) is highly recommended. **Our Static Transfer Switch topology offers 3-input design**: The 2 inputs are for the UPSs and 3rd input being utilizable as common bypass line for UPSs or as the 3rd redundant line input which is seen as the most important advantage against load sharing systems.

LOAD SECURITY AGAINST BATTERY AND RECTIFIER FAILURE

Load is fully isolated with galvanic transformer. In case of battery or rectifier failure the distorted DC current is filtered out by the transformer, so there is no need to employ additional electronic filtering. In addition due to transformer based architecture less number of electronic components are employed, which brings higher mean time between failure (MTBF) to the system.

MODULAR ARCHITECTURE

UPS systems have a modular architecture, meaning that they're built with a number of electronic cards to control each unit instead of a large, single motherboard; thus it would be enough to replace particular PCB to fix the device in case of a failure. It can be translated into significantly lower spare part cost and shorter maintenance time.

IDEAL SOLUTION FOR INDUSTRIAL USES

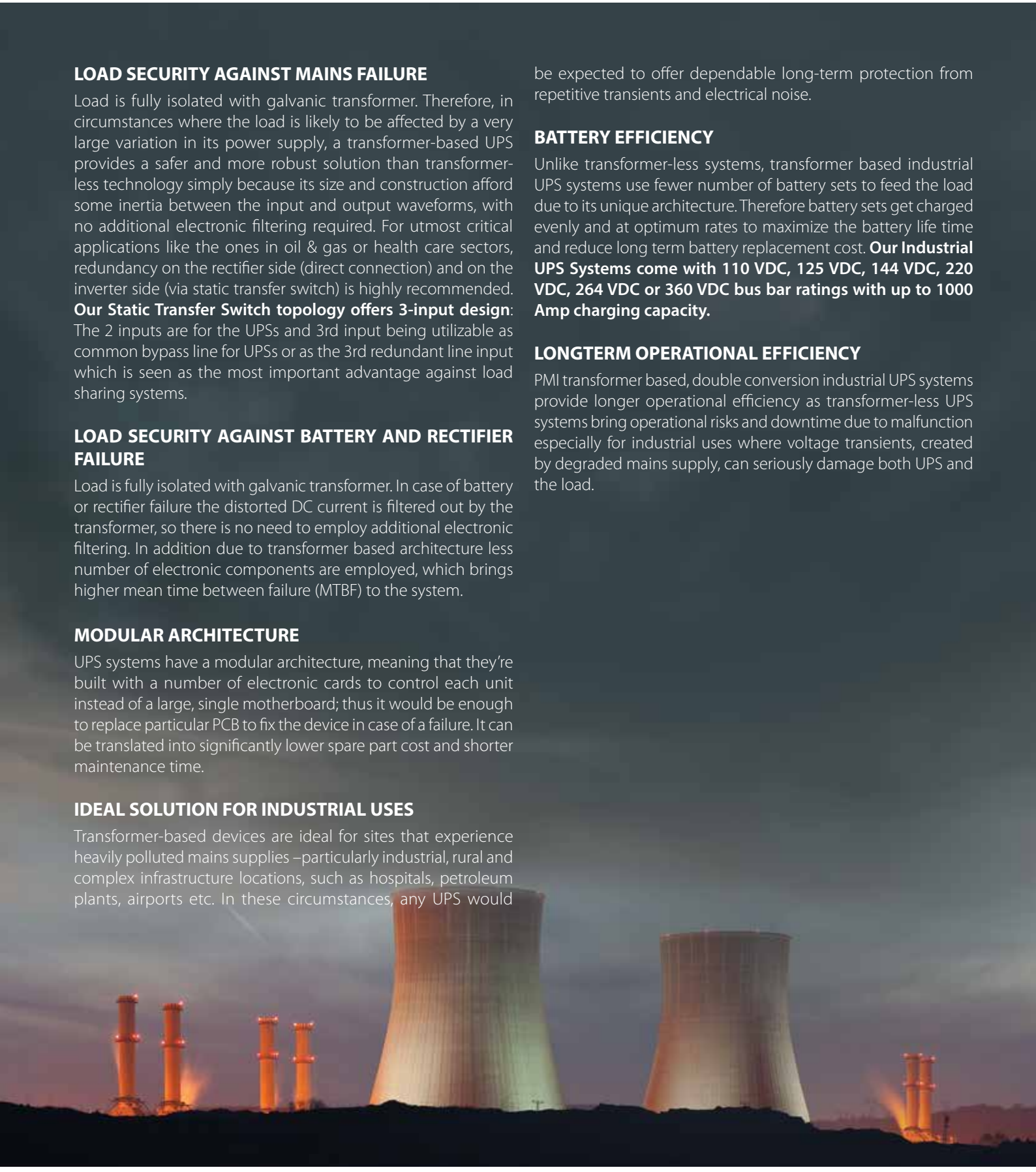
Transformer-based devices are ideal for sites that experience heavily polluted mains supplies –particularly industrial, rural and complex infrastructure locations, such as hospitals, petroleum plants, airports etc. In these circumstances, any UPS would be expected to offer dependable long-term protection from repetitive transients and electrical noise.

BATTERY EFFICIENCY

Unlike transformer-less systems, transformer based industrial UPS systems use fewer number of battery sets to feed the load due to its unique architecture. Therefore battery sets get charged evenly and at optimum rates to maximize the battery life time and reduce long term battery replacement cost. **Our Industrial UPS Systems come with 110 VDC, 125 VDC, 144 VDC, 220 VDC, 264 VDC or 360 VDC bus bar ratings with up to 1000 Amp charging capacity.**

LONGTERM OPERATIONAL EFFICIENCY

PMI transformer based, double conversion industrial UPS systems provide longer operational efficiency as transformer-less UPS systems bring operational risks and downtime due to malfunction especially for industrial uses where voltage transients, created by degraded mains supply, can seriously damage both UPS and the load.



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RECTIFIER BLOCK

The rectifier is SCR controlled AC/DC rectifier with input isolation transformer and with automatic constant voltage and constant current ability. It comes with 6 Pulse or 12 pulse design options depending on user requirements. The advantages of employing 12 pulse rectifier in industrial UPS systems are to have lower THDi (<10%) and higher cosφ at input (>0.9) as well as to secure redundancy since 12 pulse rectifiers are designed with one delta and one star connected transformers, so the unit itself behaves as two redundant rectifiers by its nature as demonstrated in graphs.

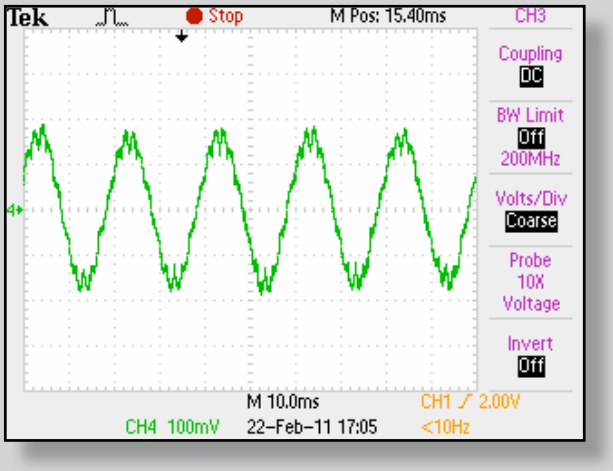
On LCD panel all measurement values, real time base events and failures can be viewed and communicate remotely via RS485-ModBus, TCP-IP or GSM Module. All operations are controlled and processed by micro controllers. Adjustable timer is used for boost charging the batteries automatically. Output current, battery current, boost and Float Charge Voltages are adjustable on the user-friendly control panel. Also automatic boost charge can be selected on menu. The automatic boost menu has the options for selecting the boost and float current according to battery capacity.

For dual operations boost inhibit facility is also provided. Boost Inhibit Function is necessarily employed when two DC Chargers with two battery groups operate in a parallel redundant mode. In parallel operation, if two rectifiers start boost-charging at the same time there is danger the DC load would be damaged by overvoltage. So, the principle idea of Inhibit facility is to block any one of the two chargers feeding the load in Boost mode when the other rectifier is charging the batteries in Boost mode; so the system prevents applying overvoltage to the load. This function is primarily handled by a powerful communication between two rectifiers and the use of contactors.

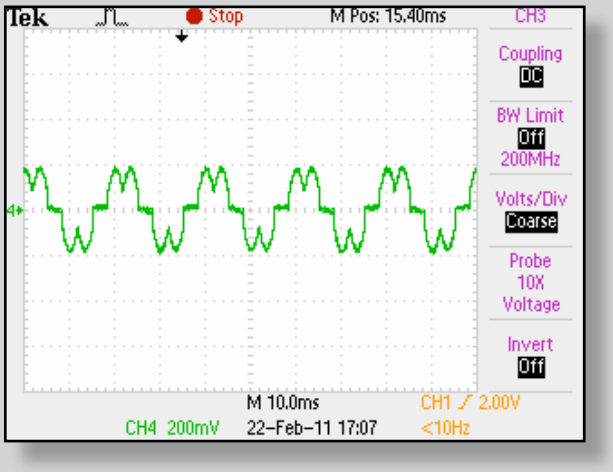
PROTECTIONS

The input and output of the charger are protected against improper use and line disturbances electronically. Input and output can be switched by circuit breakers individually. It has self-protection against over temperature. The alarm contacts can be used for external system in the case of any anomaly. The output is fully isolated from the AC line input.

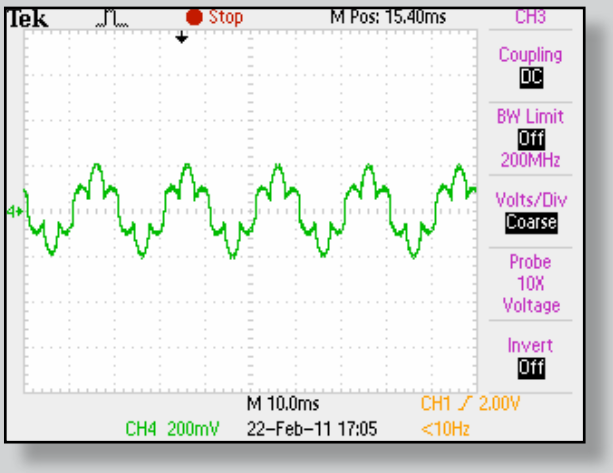
12 PULSE RECTIFIER CURRENT WAVE



6 PULSE RECTIFIER CURRENT WAVE (DELTA-DELTA CONNECTION)



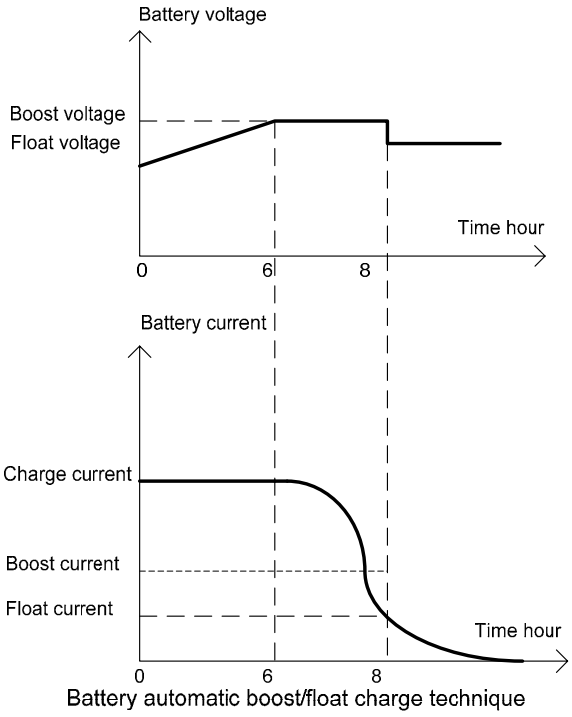
6 PULSE RECTIFIER CURRENT WAVE (DELTA-STAR CONNECTION)



DC Ripple < 1%

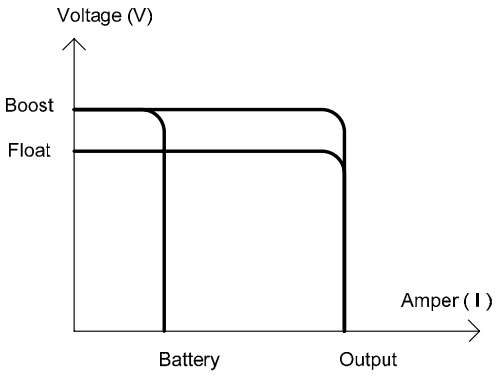
Input and output are protected with MCBs and all settings including boost charge, floating charge and battery charge current can be adjusted via front panel digitally. DC output is filtered by L/C, so DC ripple at full load always lower than 1% to increase battery life.

BATTERY CHARGING CHARACTERISTICS



Battery automatic boost/float charge technique

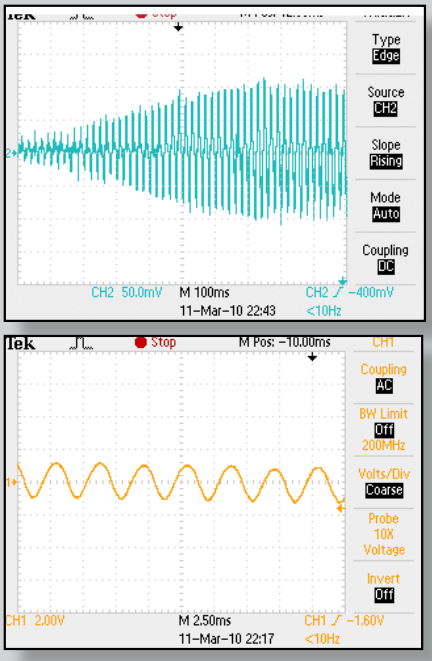
Ideal and safe charging of batteries is sustained by setting boost and float charge currents. In this way unnecessary boost conditions and deformation of batteries at changing load currents are prevented.



Constant voltage / constant current rectifier output
V/I characteristics

Ideal output characteristic via fast microprocessor control

LOW RIPPLE

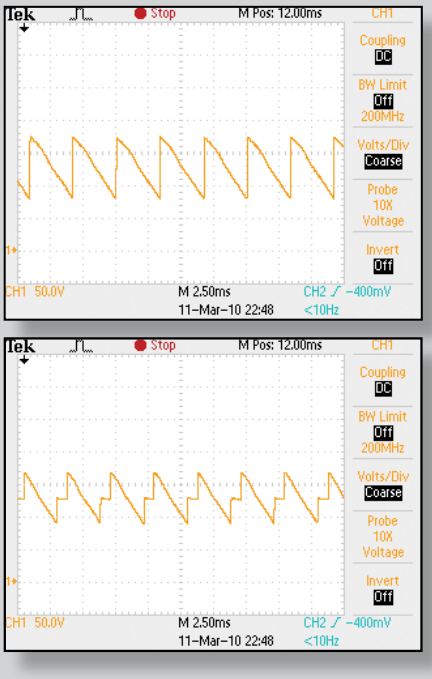


Soft Start Feature

- No inrush current at start up

AC Ripple at full load < 1%

- Battery life is extended significantly via low ripple voltage due to low heat



Fully microprocessor controlled rectifier

- Thyristor angle is adjusted with load change
- ½ Load: Phase angle shortened
- Full Load: Phase angle at max

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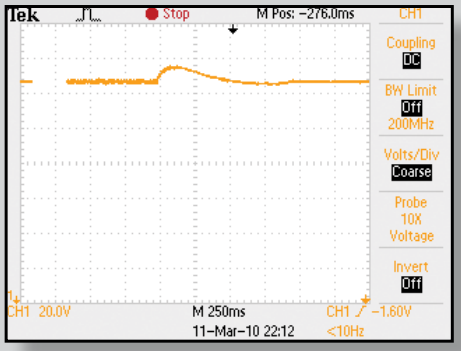
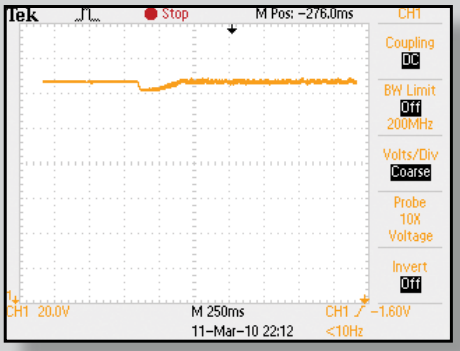
DYNAMIC RESPONSE

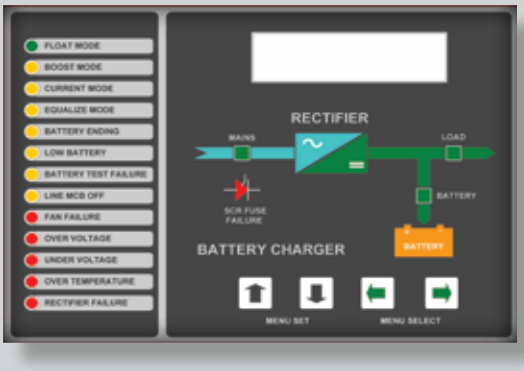


- In sudden load changes dynamic response is 300 msec without overshoot or undershoot to secure the load

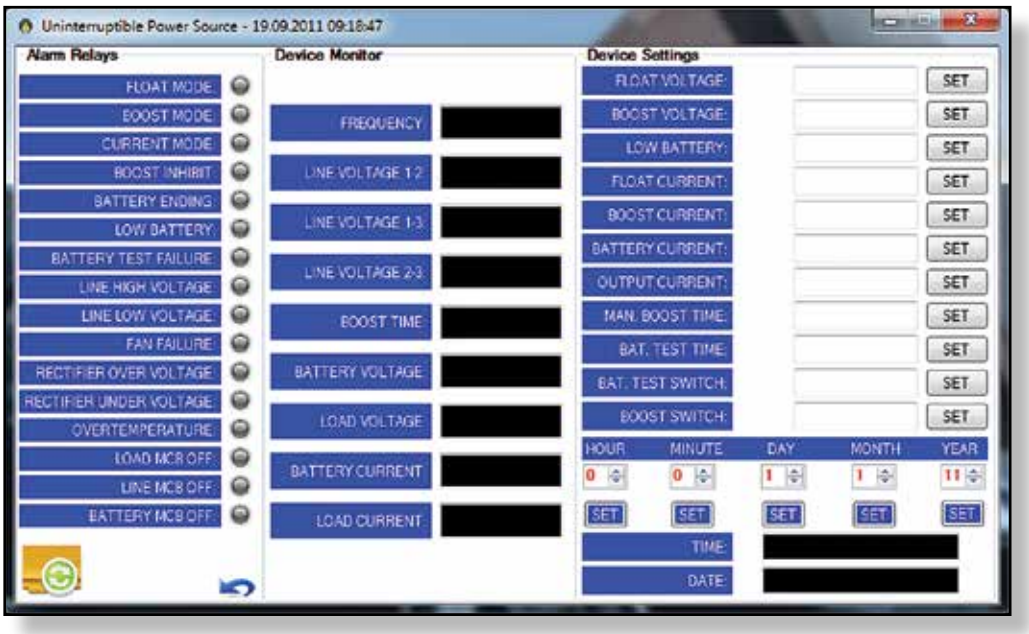


- With this capability rectifier can be used as a power supply even without battery safely with DC Loads

RECTIFIER FRONT PANEL SCREENSHOT



RECTIFIER COMMUNICATION INTERFACE



INVERTER BLOCK

The inverter converts DC voltage into pure sinusoidal AC voltage with constant amplitude and stable frequency. The unit works with an IGBT inverter bridge with PWM (pulse width modulation) having high efficiency in the partial load range as well as achieving a low distortion factor at non linear load. Inverter output encompasses 6 IGBT modules, boosting the instant power capacity of the UPS by double fold with comparison to regular systems. This feature allows the UPS to handle higher capacity loads (inrush currents) with smaller capacity devices. In addition, switching at high frequency - 20 KHz. – keeps the output sin wave (THD) undistorted providing reliable solutions for nonlinear loads. On LCD panel all measurement values, real time base events and failures can be viewed and communicate remotely with RS485 port.

In the event of mains interruption or failure, the battery connected to the DC input feeds the load automatically and without interruption. If the battery discharge limit is exceeded, the inverter automatically turns off and a warning is given shortly before the discharged voltage limit is reached. Automatic change-over of the load to the bypass mains or a suitable spare supply occurs if the supply from the inverter falls outside the preset tolerances.

WARNING LEDS:
Inverter not Synchronized
Inverter DC Input High/Low
Bypass Out of Limit
Battery Fuse OFF
Bypass MCB OFF
DC Input MCB OFF
Inverter Overload
Internal Overtemperature
Inverter Failure
IGBT SCR Fuse Failure
Bypass SCR Fuse Failure
Inverter Output High / Low
Fan Failure
Inverter Overtemperature
Backfeed Failure

SET MENU:
Cold Start ON / OFF
Automatic Start ON / OFF
ECO Mode ON / OFF
Automatic Retransfer Bypass Bypass Inhibit
DC Cut off Low Battery Level
Output Adjustment
Bypass Voltage Tolerance
DC Cut off High Voltage Level
Set Output Frequency

MEASUREMENT VALUES:
Input Voltage / Current / Frequency
Output Voltage / Current / Frequency
DC Voltage / Current
Internal Temperature

ALARM CONTACTS (1 OPEN 1 CLOSED):
Inverter Failure
Inverter Overtemperature
Inverter Overload
Load on Bypass / Inverter
Bypass out of Limit
Inverter not Synchronized
Low Battery / Low DC Input
High DC Input
Battery Fuse OFF

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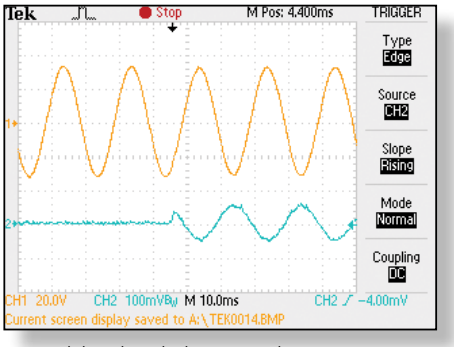
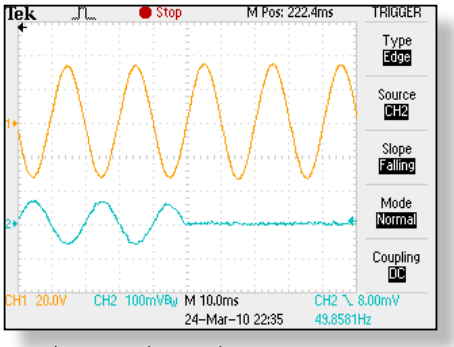
Dynamic Response

Output at 0-100% load change

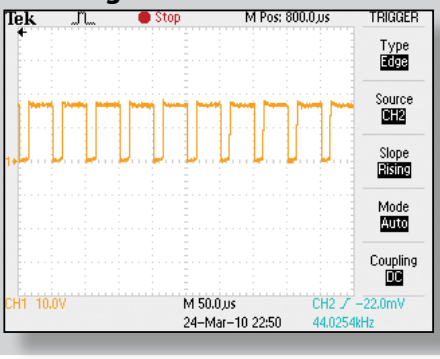


Output at 100% - 0 load change



In sudden load changes dynamic response recovery time is 5 msec and max. voltage change is 5%

Swiching wave form

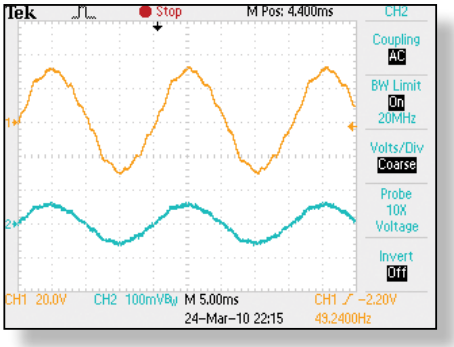


Swiching at 20 kHz

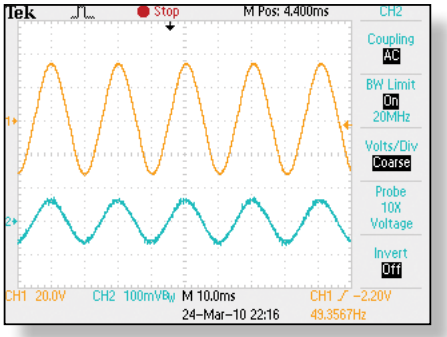
- There is no waveform distortion for reactive and nonlinear loads
- Low audible noise

Perfect output waveform with linear loads

Line voltage



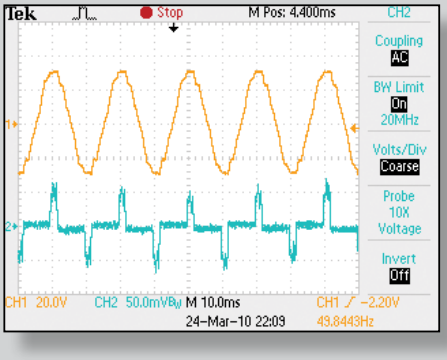
Output waveform



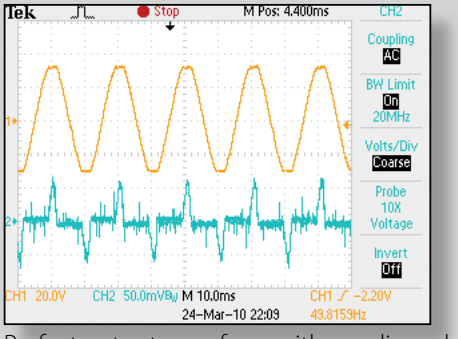
Perfect output waveform with linear loads

Perfect output waveform with non-linear loads

Line voltage



Output waveform



Perfect output waveform with non-linear loads

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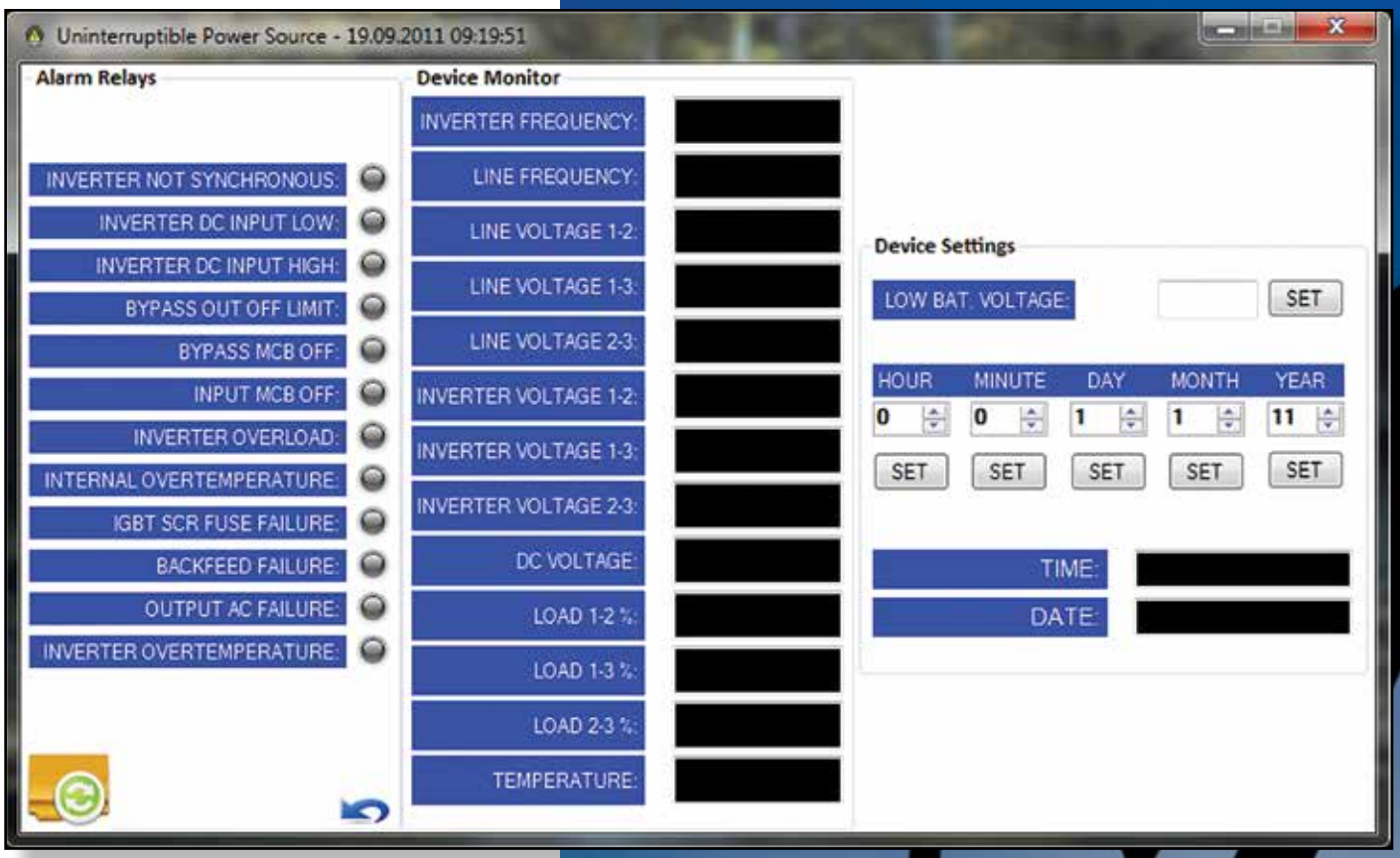
Inverter Communication Interface



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STATIC TRANSFER SWITCH BLOCK (OPTIONAL)

The microprocessor-controlled static transfer switch constantly monitors the sources connected to the inputs; checks whether they remain within the current and frequency limits and decides if they are synchronized with each other. If the prioritized source is within the determined limits, critical load is transferred over to the prioritized source. If the prioritized source is not within the determined limits, load is then transferred to the 2nd source which is within the determined limits. When the prioritized source reverts to the determined limits, load is transferred back to it. Source priority can be set via front panel. For synchronization-controlled transfers, the static transfer switch transfers the critical load between sources without interruption. In case of an interruption in the source that feed the critical load, critical load is transferred to the other source within less than 5 ms. If sources are asynchronous to each other and asynchronous transfer is allowed, load is transferred to the other source within less than 11 seconds. If asynchronous transfer is not allowed, asynchronous transfer will not take place. Asynchronous transfer can be enabled via front panel.

Thanks to the 3rd source input on the static transfer switch, a 3rd source or line power can be connected to the system. If a 3rd source is to be used, it can be utilized as the last priority. The 3rd source can also be used as a redundant source input instead of failed lines. This ensures reliability through redundant operation. When static transfer switches are to be used as parallel redundant uninterruptable power sources (UPS), the 3rd source input becomes important because in normal operations, both UPSs first transfer the critical load to the line, namely the bypass lines, in case one of them fails and then the UPS in good condition takes over the load. Even though this happens within a short period of time, the risk of interruption or fluctuation will be present for the line. For static transfer switches with a 3rd source input, the critical load is transferred to the line only if both UPSs fail.

Since the static transfer switches have 3 inputs, the 3rd source input functions as the common bypass line of the UPS's when parallel redundant UPSs are employed. This ensures true parallel redundant operation without utilizing bypass from UPSs. Also if the critical load exceeds 100% on the static transfer switches, the load is uninterruptedly transferred to the 3rd source thus preventing unnecessary shutdown or interruption.

Static transfer switches are capable of detecting thyristor failure and transfer the load to a convenient source thanks to the microprocessor control. It indicates a failure warning and shows the failed thyristor module block on the front panel. If the failure of this source's thyristor block can not be eliminated, the load is not transferred to this source again.

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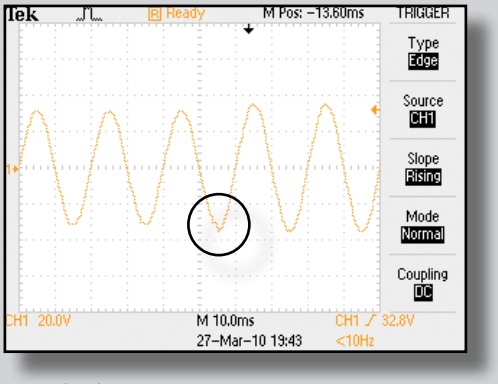
Perfect output waveform with non-linear loads

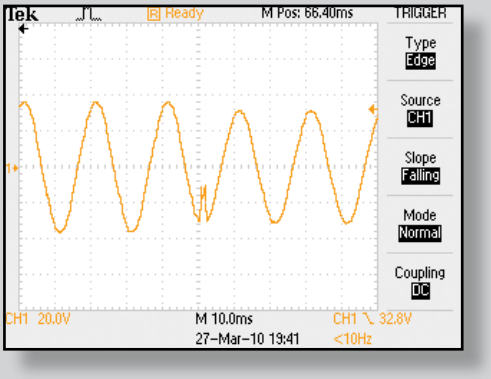
Source 1 is off limits



Transfer from Source 1 to Source 2 at the peak value of the line with forced commutation

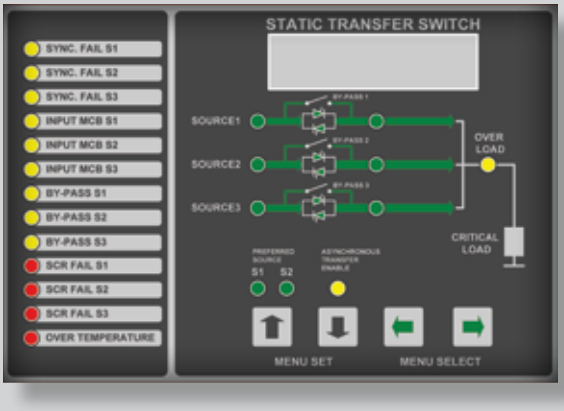
Blackout on Source 1 at peak

(Worst case scnario)



Perfect synchronized transfer to Source 2 at 2 msec

STS FRONT PANEL



STS COMMUNICATION INTERFACE

VOLTAGE STABILIZER AND ISOLATION TRANSFORMER AT BYPASS (OPTIONAL)

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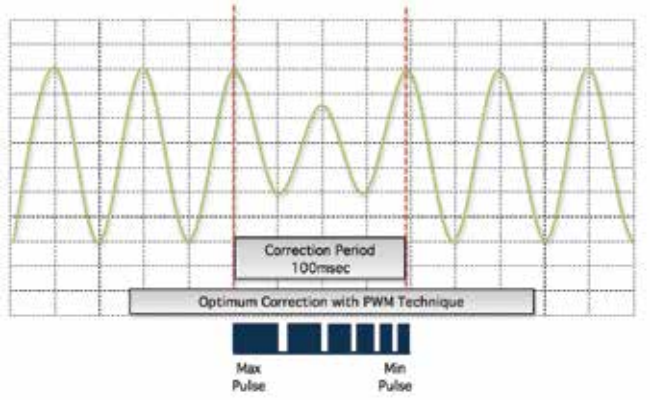
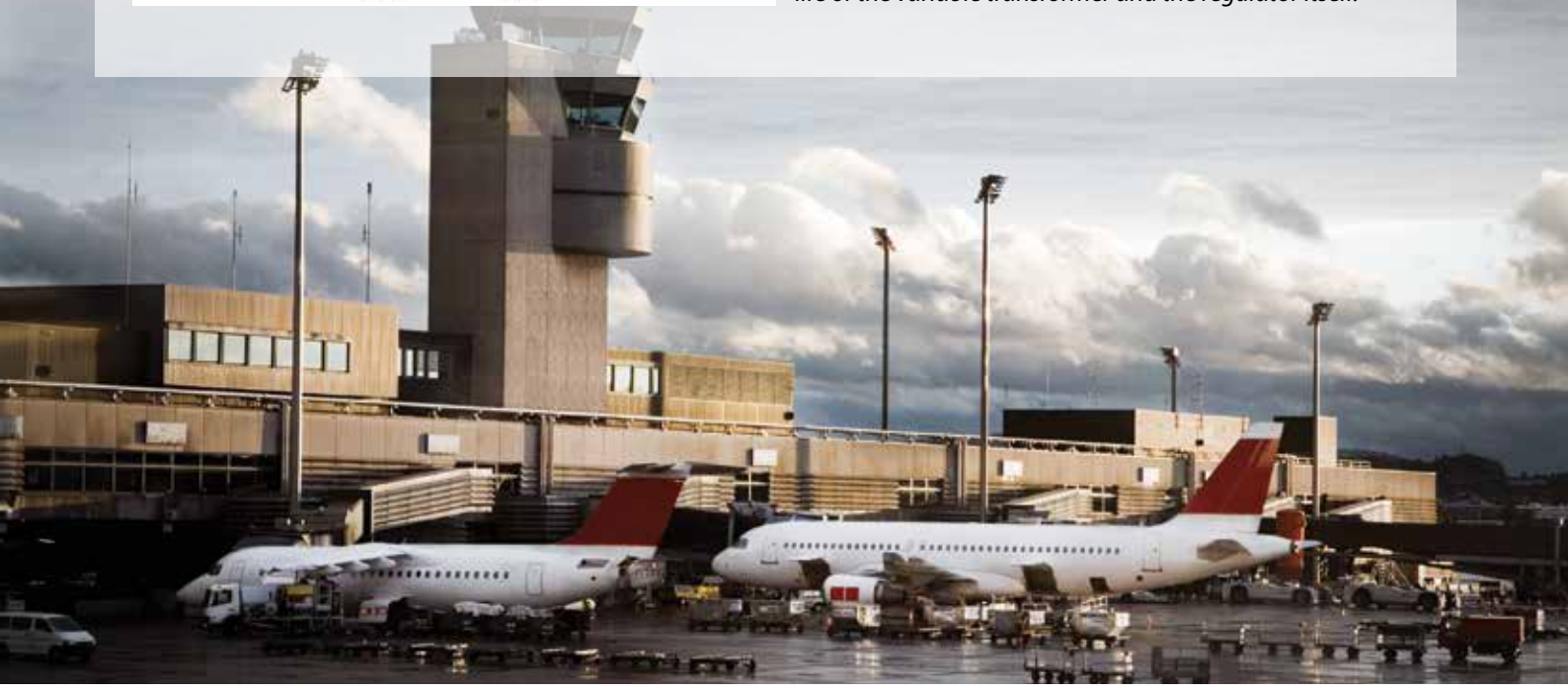
In-house developed Servo & Electronic Type regulators stabilize the mains changes ideally when the Industrial UPS system is on bypass mode. It is particularly employed when differences exist at input and output voltage in the bypass mains. In this case, the bypass transformer adjusts the input to the output voltage; the stabilizer offsets the input mains variations and keeps the output voltage stable; so the voltage between the phases and voltage varieties are stabilized by these safe systems.

Since the output voltage tolerance is low (±1 %) for Servo Type Stabilizers, it is an ideal solution for protecting loads when the UPS is on Bypass Mode. However places where the mains changes frequently (20-50 VAC), the mechanical fault possibility increases as the mechanical servo needs to move frequently to compensate the input voltage variations. In addition, the regulation speed may not be enough to stabilize line input. In such cases Electronic Stabilizer may be a better solution which has no mechanical failure risk because Electronic stabilizers don't include any moveable parts. Also for static stabilizers the speed of regulation is higher than servo stabilizers (1000V/sec) so the response of the system is better for instant mains changes. However output voltage tolerance (± 2 %) is worse than servo stabilizers.

SAFER LOAD (SERVO STABILIZER OPTION)



Since Servo Motor is set in motion with PWM technique, Servo Regulator responds to voltage spikes at optimum pulses to prevent overshoot & undershoot type corrections. As a result, the load is safer against voltage surges and short circuit current. In addition optimum corrections extend the life of the variable transformer and the regulator itself.



TECHNICAL SPECIFICATIONS

GENERAL	
Power Range	1-1 PHASE/ 1, 2, 3, 4, 5, 6, 7.5, 10, 15, 20 KVA
	3-1 PHASE / 10, 15, 20, 30, 40, 60 KVA
	3-3 PHASE / 10, 15, 20, 30, 40, 60, 80, 100, 125,150, 200 KVA"
Topology	Double Conversion Online System with Output Isolation Transformer
Control	Microprocessor Controlled System
RECTIFIER	
Topology	Full Bridge Phase Angle Controlled Thyristor Module Rectifier (6 Pulse / 12 Pulse Options)
Control	Microprocessor Controlled System
Nominal Input Voltage	110 VAC / 220 VAC / 230 VAC / 240 VAC / 380 VAC / 400 VAC / 415 VAC / 480 VAC ±15%
Nominal Input Frequency	50 hz. ±5% or 60 hz. ±5%
Input Cosφ	>0.8 Inductive (>0.9 with 12 Pulse Rectifier)
Nominal DC Voltage	110 VDC / 125 VDC / 144 VDC / 220 VDC / 264 VDC / 360 VDC
Nominal DC Current	Available upto 1200 Amp (12 Pulse over 400 Amp)
Static Tolerance	<1%
Output Voltage Ripple RMS	<1% (at full load)
Input Isolation Transformer	Galvanically Isolated (optional)
Serial Dropper Diodes	Optional depending on DC load input voltage range
Total harmonic Distortion (ThDi)	<35% (standard); <10% (with 12 Pulse Rectifier)
Battery Charging Principle	Constant Current Constant Voltage
Battery Charging Current Range	0-20 Adjustable based on Battery Current (standard); Can be higher based on Battery Capacity
Float Charge Voltage	100% to 115% of Floating Output Voltage Programmable
Boost Charge Voltage	100% to 125% of Floating Output Voltage Programmable
Boost voltage (V/C)	2,4 lead acid battery 1,55 NiCd Battery
Float voltage (V/C)	2,23 lead acid battery 1,40 NiCd battery
Equalize voltage (V/C)	2,7 lead acid battery 1,7 NiCd battery with reduced current
Front Panel Measured Values	LCD Display for Load Output Voltage / Current , Battery Output Voltage / Current and Line Voltage / Line Current / Frequency
Alarm Contacts (1 Open 1 Closed)	Open or closed; rectifier failure, over voltage, low battery, over temperature, line failure, Input MCB, Load MCB, Battery MCB
Front Panel Indicators	Float mode, Boost mode, Current mode, Equalize Mode, Battery ending, Low battery, Battery test failure, Line failure, Fan failure, Over voltage, Under voltage, Over temperature, Rectifier failure, SCR fuse failure (LED indication), Line MCB (LED indication), Load MCB (LED indication), Battery MCB (LED indication)
Front Panel Set Menu	Boost charge voltage, Float charge voltage, Low battery voltage , Battery test , Charger output current, Battery charge current, Battery automatic boost current and float current, Auto & Manual boost selection, Manual boost time, LED test and On - OFF.
Event History	Last 250 events recorded and displayed on front panel and on PC via RS 485
Communication (Optional)	Parameter monitoring and setting through RS 485/Modbus over local area network or through RS485/TCP-IP over internet

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TECHNICAL SPECIFICATIONS

Protections	Input: Thermic-Magnetic Over Current Protection, Over Voltage Protection, Phase Sequence Free Operation (3 Phase), Soft Start, MCB
	Output: Short Circuit Protection, Over Voltage Protection, Reverse Voltage Protection, optional MCB
	Battery: L-C filters, Overcurrent Electronic protection,Over Voltage Protection and Thermic Fuse, optional MCB
INVERTER	
Topology	3 Full Bridge 6 high Frequency IGBT Inverter Modules (3 Phase); 1 Full Bridge 2 high Frequency IGBT Inverter Modules (1 Phase)
Power Factor	0.8
Nominal Input Voltage	110 VDC / 125 VDC / 144 VDC / 220 VDC / 264 VDC / 360 VDC
Operating Input Voltage	±15%
Nominal Output Voltage	110 VAC / 220 VAC / 230 VAC / 240 VAC / 380 VAC / 400 VAC / 415 VAC / 480 VAC
Voltage Tolerance	
static	± 1%
dynamic with 100% load change	± 10% in 50 msec.
Overload	
at 125% Load	10 minutes
at 150% Load	1 minute
at 300% Load	1 second
Waveform	Pure Sinusoidal
Total Harmonic Distortion (ThDv)	
at Linear Load	< 3%
at Non-Linear Load	<7%
Crest Factor	3 : 1 (1 second)
Angle Deviation / Static Tolerance Deviation	
symmetric load	- - < 1° / <1%
50% asymmetric load	- - < 1° / <1%
100% asymmetric load	- - < 1° / <1%
Nominal Output Frequency	
while synchronized with the line	50 hz ±2% or 60 hz ±2%
while not synchronized with the line	50 hz ± 0.1% or 60 hz ± 0.1%
Switching Frequency	20 Khz.
Efficiency with Nominal Load	>85% / >90% depending on DC Bus Voltage
Isolation Transformer	Galvanically Isolated (standard)
Short-circuit behaviour:	3 x Nominal Output Current
Protection	Short Circuit Protection, Over Voltage Protection, Under Voltage Protection, Over Current Protection and Over Temperature Protection
Paralleling (Optional)	Provided through precision synchronizing technique OR through Static Transfer Switch
Communication (Optional)	Parameter monitoring and setting through RS 485/Modbus over local area network or through RS485/TCP-IP over internet

TECHNICAL SPECIFICATIONS

Front Panel Warnings	Inverter not Synchronized, Inverter DC Input High/Low, Bypass Out of Limit, Battery Fuse OFF, Bypass MCB OFF, Main MCB OFF, Inverter Overload, Internal Overtemperature, Inverter Failure, IGBT SCR Fuse Failure, Bypass SCR Fuse Failure, Inverter Output High / Low, Fan Failure, Inverter Overtemperature,
Front Panel Set Menu	Cold Start ON / OFF, Automatic Start ON / OFF, ECO Mode ON / OFF, Automatic Retransfer Bypass, Bypass Inhibit, DC Cut off, Low Battery Level, Output Adjustment Bypass Voltage Tolerance, Set Output Frequency, DC Cut off High Voltage Level
Alarm Contacts (1 Open 1 Closed)	Inverter Failure, Inverter Overtemperature, Inverter Overload, Load on Bypass / Inverter, Bypass out of Limit, Inverter not Synchronized, Low Battery / Low DC Input, High DC Input, Battery Fuse OFF
STATIC TRANSFER SWITCH (OPTIONAL)	
Topology	Thyristor controlled transfer switch
Nominal Voltage	110 VAC / 220 VAC / 230 VAC / 240 VAC / 380 VAC / 400 VAC / 415 VAC / 480 VAC ±10%
Nominal Frequency	50 Hz or 60 Hz
Operational Current	50 A / 100 A / 200 A – 1 Phase; 3x50 A /3x100 A /3x200 A /3x 300 A-3 Phase
Operation Voltage Interval	± 10% Adjustable
Synchronization Interval	± 10% Adjustable
Frequency Interval	± 10% Adjustable
Load Power Factor	0,7 – 1 Inductive
Overloading Capacity	
Between 100% - 125%	10 min.
Between %125 - 150%	5 sec.
Between %150 - 300%	100 msec.
Transfer Management	Break before make
Synchronous Transfer Time	< 5 msec. (¼ cycle at 50 Hz)
Asynchronous Transfer Time	< 11 msec.
Other Controlled Transfers	0 msec.
Efficiency	>99%
Communication (Optional)	Parameter monitoring and setting through RS 485/Modbus over local area network or through RS485/TCP-IP over internet
Protection	Over temperature Protection, Thermal Fuse Protection at Source Inputs , Overvoltage Protection at Source Inputs
Front Panel Indications and Warnings	Synchronization Failure (Light), Asynchronous Transfer Enabled (Light), Prioritized Source Preference (Light), Input Source Fault (Light and Sound), Over current (Light and Sound), Over temperature (Light and Sound), Thyristor Failure (Light and Sound)

Power Management Instruments

TECHNICAL SPECIFICATIONS

Buttons	"Asynchronous Transfer Enable" Button, "Manual Transfer Enable" Button, " Reset" Button, "Source 1 or Source 2 Preferred" Button
Manuel Bypass	0 (Off) / 1 (1st Source) / 2 (STS Output) / 3 (2nd Source) Selector Switch
STATIC BY-PASS	
Topology	Uninterruptible static switch with back-feed protection
Bypass System	No break semiconductor thyristor
Nominal Voltage	110 VAC / 220 VAC / 230 VAC / 240 VAC / 380 VAC / 400 VAC / 415 VAC / 480 VAC ±10%
Nominal Frequency	50 hz ± 2% or 60 hz ± 2%
Load Level	300% 1 second
Bypass Isolation Transformer	Galvanically Isolated (optional)
Voltage Stabilizer	Servo or Static Controlled with front panel (optional)
Inverter/Bypass transfer time	
Inverter failure	Max. 5 msec.
Overload or manual transfer	0 msec.
Bypass/Inverter transfer time	0 msec.
Efficiency	>99%
Voltage Tolerance	± 10%
SAFETY	
Over Voltage Protection	IEEE 587 4500 A, 110 Joules (standard), 40 kA 1000 joules surge arrestor (optional)
Electrical Interference Reduction	FCC Part 15 Class B
Electrical Standards	EN 50091-1 (Security) / EN 50091-2 (EMC)
Protection Level / Color	IP 20 / RAL7035, available upto IP42
MTBF	100,000 hrs. (w/out battery group)
Enclosure Material	Mild Steel, Zinc-phosphate coated; 100 µm electrostatic paint; 1.5 mm thickness
Panel Lighting	Optional
Cooling	Forced fans with redundant fans (optional natural cooling)
Cable Entry	Bottom (optional top entry)
Distribution	AC and DC available on request
Output Connections	1 Ph 2W, 3 Ph 3W, 3Ph 4 W
Dimensions	Range of options available and vary based on customized configuration
Operating Temperature	-10 / +40 °C
Relative humidity	5 - 90 %
Operating Altitude	Max. 2000 Mt.
Noise Level	Max. 60 db

The information contained herein is solely intended for general use purpose. Please refer to product datasheets of specific projects. For more information, please contact your local representative.

Key Global References

RELIABLE SOLUTIONS in POWER ELECTRONICS

PMI

EKM-EKT SERIES

Power Management Instruments

ELECTRONIC PF CORRECTOR SYSTEMS

PMI & OES GROUP COMPANIES

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NEW GENERATION ELECTRONIC THYRISTOR CONTROLLED PF CORRECTOR SYSTEMS

Improved operating efficiency is crucial and topical subject around the world. Reduction of energy costs is regarded worldwide as one of the crucial challenges to all branches of the industry. Reactive energy is chiefly regarded as one of the causes for the consumption of unusable energy and that is why reducing reactive energy usage has traditionally been one of the simplest ways to conserve energy. Today, Conventional PF Corrector Systems are the most common solution providers to eliminate the reactive energy. However, Conventional PF Corrector Systems kick in within 5 to 10 seconds when there is a need for reactive energy correction. Such a long time interval causes overloading and significant losses on the network. Considering the sum of all losses caused by hundreds and thousands of end users, the amount of total loss reaches to intolerable levels to electrical distribution companies. This is why it has become a common practice for them to confine the end users in their reactive energy consumption and even reflecting the fines on their electrical bills for their excess usage of reactive energy. Conventional PF Corrector Systems take the current in one phase to correct other two phases. At unbalanced loads it causes capacitive penalty when the current is high and also insufficient compensation when the current is low.

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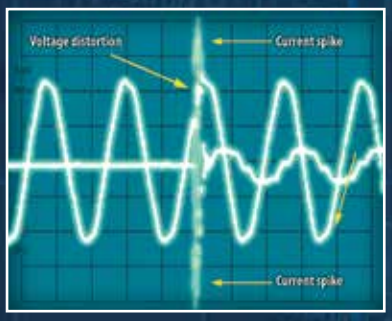
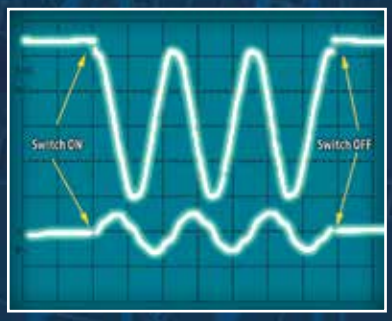
THYRISTOR CONTROLLED PFC: BENEFITS

Since current PF corrector systems make correction by activating / deactivating capacitor blocks with contactors, they cause voltage transients, arcs, spikes and electrical noises during switching. The clear-cut difference between contactor-controlled and thyristor controlled systems is shown in the oscilloscope screen shots 1 and 2. When this situation is extrapolated for all industrial users, the corollary is that the mains get congested and it can give drastic damage to critical loads. This uncontrolled switching at capacitor blocks can even cause short circuit, contactor switches getting fused, and even fires. This is why hundreds of contactor switches and capacitor blocks are replaced each year.



Screen Shot 1: Capacitor Activation with Contactor



Screen Shot 2: Capacitor Activation with Thyristor

OVERALL FEATURES

- Each phase controlled independently enabling the device to handle unbalanced loads at optimum level.
- Response time is 20 msec. for fast changing loads
- Increased capacitor life with zero current switching.
- 32 step or 64 step capacitive and 2 step inductive sensitivity correction
- Semiconductor switching increases reliability.
- Periodic test of capacitors and semiconductors gives prior failure detection.
- Modular construction and easy service.
- Remote communication supervision and monitoring.
- Parallel operation with old compensation system to improve total performance.
- Easy construction with standard current transformer.
- Energy saving with unbalanced loads.
- Solves current harmonics with harmonic filters.
- No current peaks, no dangerous transients and line pollution.
- Series inductors for damping PFC capacitors.

With PMI Electronic PF Corrector Systems (EKM), switching is made through 5 thyristor - diode modules positioned at 5 arms with binary logic, which means 32-step capacitive correction. At each arm, also harmonic filters, connected serial to capacitors are used, which not only limits the current going to capacitors but also suppress the system harmonics perfectly. In some models 64-step capacitive correction is used. The performance of this new generation systems during its operation with the line is recorded to Fluke 435 Analyzer (Table 1 and Table 2). Unbalances or distortions are eliminated by the separate correction of each phase.

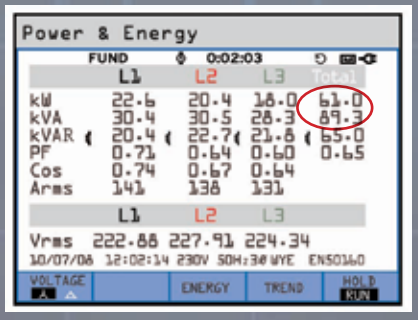


Table 1: Electronic PF Corrector System is OFF

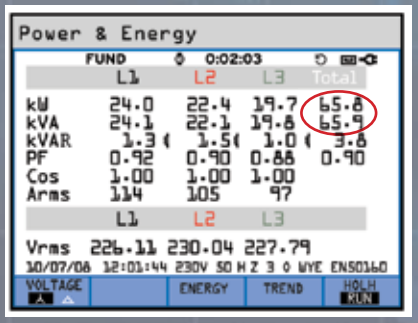


Table 2: Electronic PF Corrector System is ON

As can be observed in Tables 1 and 2, while the active total power is steady (61 kW – 65 kW), total active and reactive power drops significantly to prevent the overloading at mains and transformers.

CUTTING EDGE TECHNOLOGY

Thyristor controlled three phase electronic PF corrector with 32 step and 64 step sensitivity

New generation Electronic PF Corrector Module (EKM) and Electronic PF Corrector Three Phase (EKT) are designed in such a way that they completely eradicates the energy losses caused by classical PF Corrector systems.

32 & 64 Step

at 5 Arms/6 Arms with Binary Logic

The 5 arms are switched via thyristor-diode modules with binary logic, thus the resulting step value is calculated to be $2^5 = 32$. For example, when the capacitor value at first arm starts with 200 uF (4 kvar), the value at the final arm would be 3200 uf (64 kvar) and the resulting total capacity of the module becomes 124 kvar (4+8+16+32+64) with 4 kvar sensitivity. To match 75 kvar need, 1.,2. and 5. arms are switched and the 76 kvar monophase capacitor is activated.
6 arms are used in higher powers for 2^6=64 step correction and better sensivity.

HARMONIC SUPPRESSION

At each arm, installed harmonic filters (being serial to capacitors) not only limit the current going to capacitors but also suppress the system harmonics and the resulting harmonics of fast switching perfectly.

SEPARATE CORRECTION OF EACH PHASE (EKM) – CAPACITIVE AND INDUCTIVE CORRECTION WITH 20 MSEC. CORRECTION SPEED (EKM-EKT)

Load unbalances among phases are perfectly eliminated with separate correction of each phase. The number of activated capacitors is limited to the actual requirement at each phase. Capacitive reactive load correction is also maintained at each phase with a similar logic. Added reactor to sixth arm can also be set in motion via thyristor module if inductive kvar is needed.

LONGER COMPONENT LIFE WITH ZERO CURRENT SWITCHING

Zero current switching of thyristor diode modules enables the current at capacitors to increase gradually, starting from zero to maximum level, which in turn prolongs the overall lifetime of capacitors significantly. In addition, the current is also limited thanks to harmonic filters that are connected serial to capacitors.

MODULAR ARCHITECTURE, EASY INSTALLATION

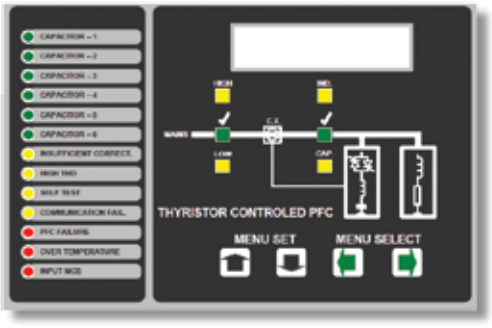
Thanks to its modular configuration, modules can be connected in parallel to EKM and EKT series when there is a need for capacity increase, bringing lower investment cost for the long term. Its configuration is with wiring to current modules and bars only. In case of a failure with one of the modules, the other two continue to operate with no disruption.

PARALLEL OPERATION

The system can work in parallel up to 4 units. This allows us to increase the power and allow redundancy. In addition to that when the system comprises fast changing loads with stable ones, EKM module working in parallel with the conventional system would be the best solution to correct the changing load.

NETWORK ANALYZER AND EASY CONTROL

All energy parameters ((i.e. cosφ, PF, KVAR, KVA, kW...) can be observed and tracked via LCD panel. In addition all parameters can be monitored and reported via remote communication interface through RS232, RS485, TCP/IP, Modbus and Profibus.



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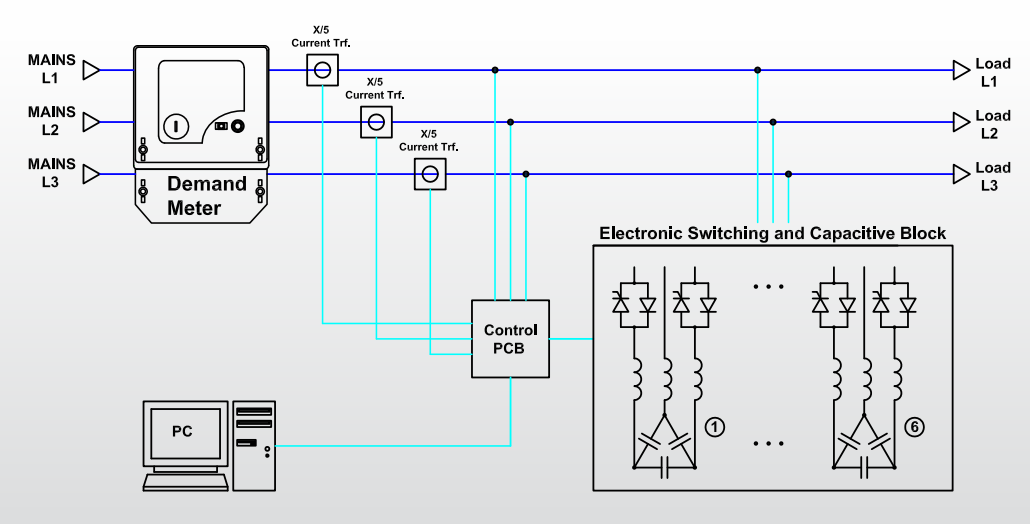
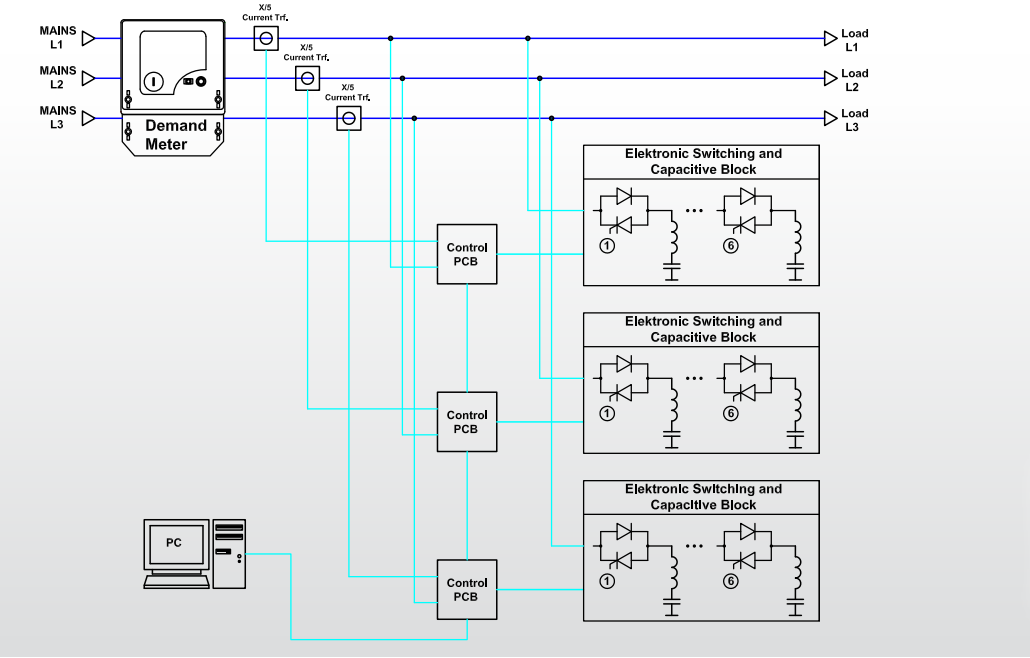
EKT SERIES - SINGLE PHASE CONTROL PFC



EKM SERIES - INDEPENDENT PHASE CONTROL PFC



ELECTRONIC PF CORRECTOR MODULE (EKKM)

EKM MODULE 360 kVAR

UNIQUE SOLUTION for ELECTRIC PANEL APPLICATIONS

- Relay and 64 Step Thyristor Block in a Single Module
- Thyristor switching technology and high speed control relay in a single module
- Three phase power control module: 64 Step sensitivity with binary logic (2^6)
- Longer component life with zero current switching
- Switching at 20 msec.
- Integrated power control relay
- Off-set setting to eradicate phase displacement caused by current transformer
- Easy service with self test
- Compact structure, easy connection
- 2 years guarantee

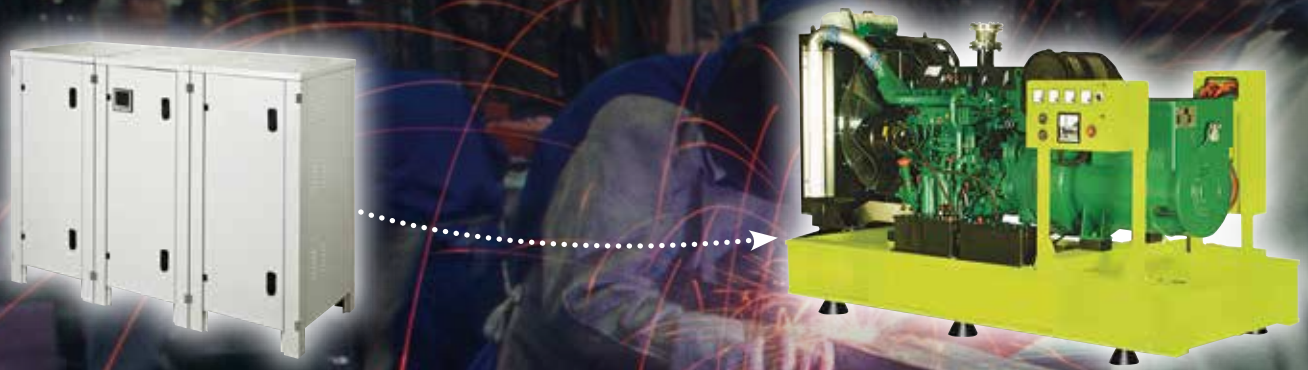
THE OPERATION OF EKM AND EKT SERIES PF CORRECTOR SYSTEMS WITH GENERATORS

Classical pf corrector systems are widely used being directly connected to mains with no link to generator sets. The reasons for such an application are shown as;

1 – Resonance current at generator mainly caused by generator's limited output power and its higher impedance than the mains

2 – Voltage harmonics at contactor controlled pf corrector systems due to uncontrolled switching

Contrary to above, with zero current switching and harmonic filter topology, thyristor controlled EKM-EKT series electronic pf corrector systems create no distortion on generator output values and boost power factor value. Tables on the next page illustrate the active power (kW) and the power (kVA) when electronic pf corrector system is ON and OFF while connected to a generator set.

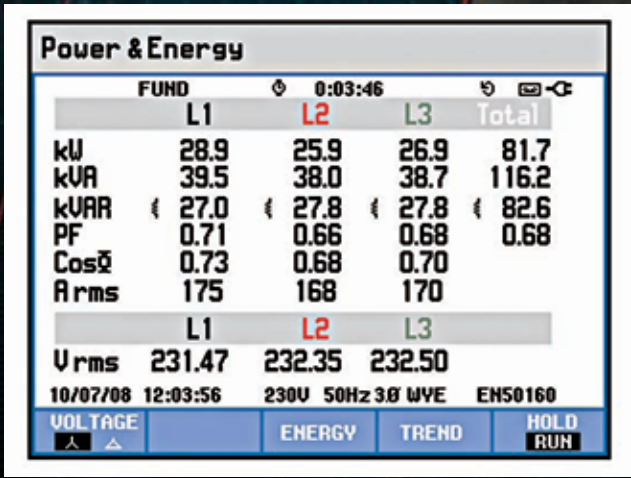


As demonstrated below, while the active power remains stable (81 kW-83 kW), the kVA value diminishes by more than 25% (116 kVA – 84 kVA). Such a significant difference can be explained by as follows;

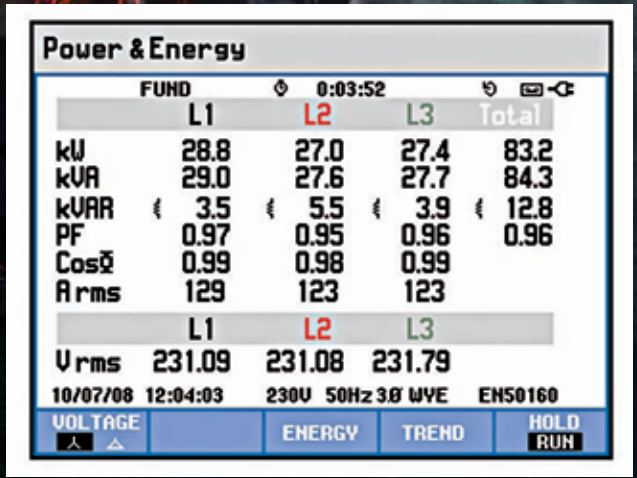
1. Additional Power Capacity: Generator's consumed power for reactive energy (over 25%) can be used for active energy (pf corrected from 0.7), so that it will be possible to have more loads with the same generator set.

2. Energy Saving: Since the reactive power is eliminated, the current at mains will decrease at the same rate, which will bring savings on energy usage.

3. More efficient Operation of the Generator Set: Thanks to the drop in phase current values, overheating of the alternator is prevented.



Electronic PF Corrector System is OFF



Electronic PF Corrector System is ON

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THYRISTOR CONTROLLED PFC CORRECTOR DATASHEET

GENERAL	
Model	EKM (Independent Phase Control) / EKT (Single Phase Control)
Monophase Powers	22,5 / 45 / 90 / 135 / 180 / 270 / 360 kVAR at 440VAC
Threephase Powers	75 / 150 / 230 / 310 / 460 / 620 kVAR at 440VAC
Operation	Diode/Thyristor: Zero Current Switching
Measurement Technique	Current level for each phase independently
Control	DS PIC controlled
Isolation Voltage	2.500 VAC (Input-Input, Input-Chassis, Output-Chassis)
Harmonic Filters	Suppression at 189 Hz, %p = 7
Correction Tolerance	±2% VAR (up to 5% adjustable)
Capacitive Step	32 Steps upto 75 kVAR / 64 Steps above 150 kVAR
INPUT	
Input Voltage	220/230 VAC (1 Phase) ; 380/400 VAC (3 Phase)
Input Voltage Window	±15%
Input Frequency	50 or 60 Hz (To be specified)
Input Frequency Tolerance	±5%
Input Protections	MCB (Optional), Overvoltage and EMI-RFI Filter
Surge Protection Class	IEEE 587 (4500 A, 110 Joules)
DIGITAL FRONT PANEL	
Front Panel	2 x 16 LCD Panel, Menu Selection and Parameter Setting Buttons
Warning Messages	Line Normal/High/Low, Input Fuse Close/Open, Overtemperature, Temperature Normal, Insufficient Correction, High THD, Correction Normal, Communication Normal, System Failure/Normal, Self Test Start/Finish
Monitored Parameters	Cos Fi L1/L2/L3, PF L1/L2/L3/TOTAL, Line Voltage L1/L2/L3, Apparent Power (VA) L1/L2/L3/TOTAL, Active Power (W) L1/L2/L3/TOTAL, Reactive Power (VAR) L1/L2/L3/TOTAL
Set Parameters	Capacitive / Inductive Operation, Date/Hour, Alarm Sound Level, Communication Address
Sound Alarm	For Warning Messages in each 2 sec
Communication (Option)	Remote monitoring via RS-485 Module, Parameter Setting and Event History for the last 256 Events, GSM Module (Real time failure detection and messaging)
ENVIRONMENTAL DATA	
Cooling	Forced Fans
Electrical Noise Reduction	FCC Part 15 Class B
Enclosure Protection Degree	IP20 / IP31 (Option) / IP 42 (Option)
MTFB	50000 Hours
Color	RAL 7035
Operational Temperature	-10 / +50 °C
Relative Humidity	90%
Operational Altitude	Max 2.000 Mt
Noise Level	Less than 60dB

Key Global References

RELIABLE SOLUTIONS in POWER ELECTRONICS

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VRST SERIES

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ELECTRONIC STABILIZER

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ELECTRONIC STABILIZER

Today, as technology evolves, Electrical, Electronic and Electromechanical devices are also developing and become widespread. As the electrical power needed by these devices requires expensive investments, consumptions keep going up and voltage fluctuations, which stem from insufficient electrical energy, increasingly persist. Devices like CNC machines, motor drives of plants, medical devices at hospitals, workplace computers and electronic equipment, electronic white goods used in households, air conditioners and combination boilers all receive serious impact from the fluctuations at hand.

They might even end up breaking down, causing a lot of financial loss and downtime. Due to simultaneous turning on and off of devices in various regions, voltage fluctuations occur. In addition, at specific times of the day, voltage drops too low because of overloading, preventing operation of such devices completely or causing breakdowns. In that sense, voltage stabilizers, which are insurance for those devices, keep voltage fixed and ensure that they operate reliably.

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SELECTION OF AN ELECTRONIC STABILIZER

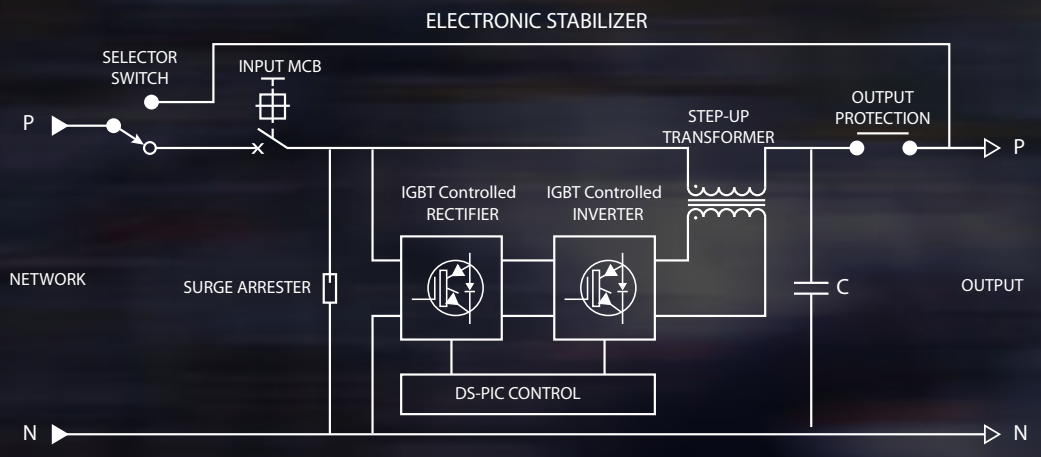
A high-performance servo stabilizer regulates ordinary grid fluctuations in the best way possible. With adequate regulation speed (1000 V/sec.) and full protection, by compensating the difference between phases as well as voltage fluctuations, It ensures the connected systems to operate reliably. Since the output voltage tolerance is ±1%, electronic stabilizer is an ideal solution to secure electronic load. However, for applications that the network voltage changes momentarily and frequently (between 20VAC and 50VAC) the mechanical servo motor will move continuously and because of this, the risk of a breakdown goes up and the regulator's speed might turn out to be insufficient. In cases of the network voltage changes momentarily and frequently, an Electronic Stabilizer could be the solution.

In such cases, there is no risk of a mechanical breakdown since electronic stabilizers do not have any moving parts. They also yield better results in comparison to servo stabilizers, due to the fact that their regulation speed is 1000 V/sec. and output voltage tolerance ±1%.

Therefore, electronic stabilizers should be used applications where the network voltage changes frequently and for sensitive & critical machinery that needs high speed regulation and electronics devices. Servo stabilizers are more suitable for general applications (lighting, modulation of plant/building voltage, non-critical loads etc.), yet electronic stabilizers are still essential to counter frequent and momentary changes in voltage during such general applications as well.

OPERATIONAL PRINCIPLES

ELECTRONIC STABILIZER BLOCK DIAGRAM



OPERATIONAL PRINCIPLES OF AN ELECTRONIC REGULATOR

As can be seen on the block diagram, voltage is increased or reduced from the input AC voltage through the use of a serial connected transformer to the network. The function of the AC/AC converter block is to provide positive and negative AC voltage required for the step-up transformer by monitoring input AC voltage, and allow for flow of power in the negative and positive directions.

The AC/AC convertor is capable of controlling energy flow in the negative and positive directions. For that purpose, two IGBT bridge circuits are used. The first bridge is an IGBT-controlled active rectifier and the second one is an IGBT-controlled inverter.

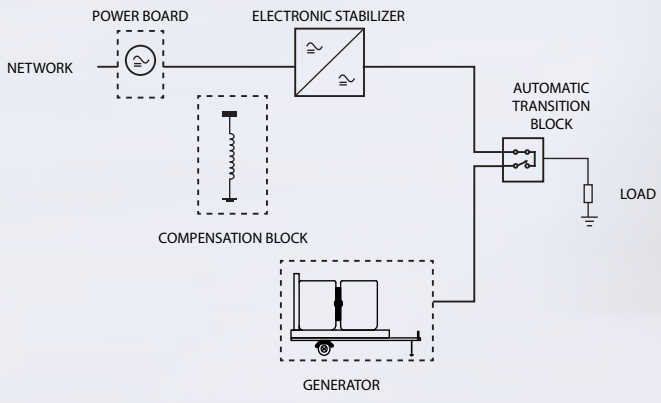
In case of voltage addition, the first bridge acts as a rectifier and the second one as an inverter. In case of voltage reduction, the first bridge ensures that the excess energy is transferred to the network and functions as an on-grid inverter in a sense. In the meantime, the second bridge acts as an inverter that transfer energy to the negative direction just like an IGBT boost rectifier.

As required due to the stabilizer design, it is pointless for the stabilizer circuit to operate without network connection. Therefore, the AC/AC converter does not include a DC filter.

This prolongs longer service time due to less number of components and lower IGBT switching noise at high DC frequencies.

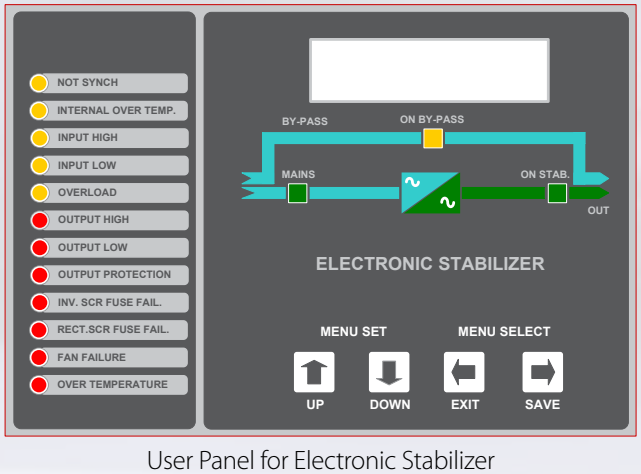
As the electronic stabilizer is controlled via DS-PIC at high frequency using the PWM method, its electrical performance is far superior in comparison to other type stabilizers. For example, its regulation speed is 1000 V/sec. at minimum and regulation time is 50 msec. Also, the input voltage regulation interval is at the same value (±25%) from below and above. It can be monitored and controlled remotely thanks to the communication function.

CONNECTION



Sample Connection

LCD PANEL



User Panel for Electronic Stabilizer

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GENERAL FEATURES

- True RMS value measurement
- DS-PIC microprocessor-controlled system
- Excellent dynamic and static regulation
- Wide input voltage interval, 130-270 VAC
- Electronic protection against overload and short circuits
- Regulation at 220 V ±1%, 1000V/sec. regulation speed
- LCD Panel with load level, input and output voltages displays
- Programmable lower and upper overvoltage protection
- Each Phase can be independently regulated. In case of a phase is out of the tolerance range, all phases are shut down at the same time. Once voltage is applied to the system again, all phases are turned on at the same time. After each phase checked separately, when all phases are in balance then output voltage is applied to the load. Thanks to this control, output voltage is applied to the load in a delayed manner. In case of any failure of the phases, all phases are simultaneously shut down to protect the system.
- Thanks to the semi-conductive technology, risk of breakdown is low. Also service time is prolonged and maintenance free.
- Protects itself and the system in case of sudden voltage impact or changes. If necessary, it automatically interrupts its output.
- Monitors grid voltage changes and indicates that connected systems are protected and output voltage is fixed.
- Output voltage is measured, adjusted and displayed to the user as TRUE RMS.
- Displays network voltage values and notifies the user with an audible alert in case of sudden increases or drops, so that precautions can be taken.
- Audibly notifies the user in case of overheating and overloading.
- In case output voltage goes above the adjusted value, it shuts itself down by turning the output contactor off, thus protecting the system. Also indicates this situation through audio and LED notifications.
- Displays output load and provides audio notification in case of overloading or short circuits. Protects itself by turning the circuit off through the output contactor.

RS485-MODBUS COMMUNICATION INTERFACE

Device Monitoring Window

Monitoring and Incident History

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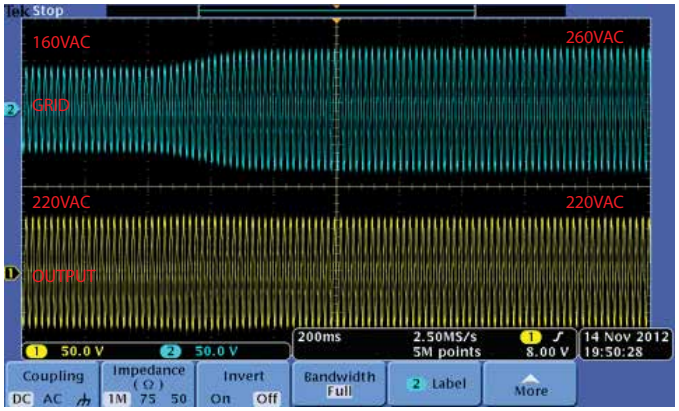
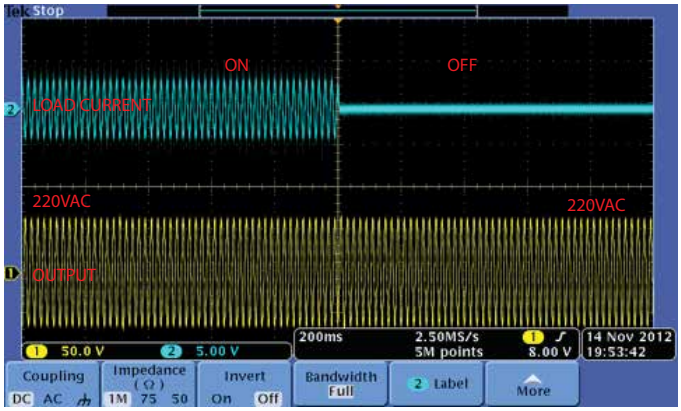
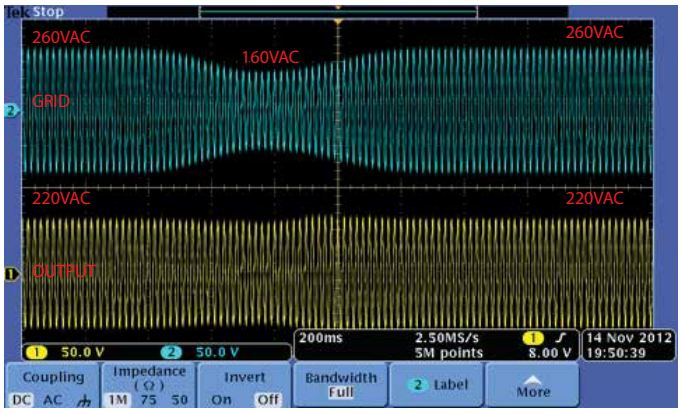
ELECTRONIC STABILIZER PERFORMANCE DATA

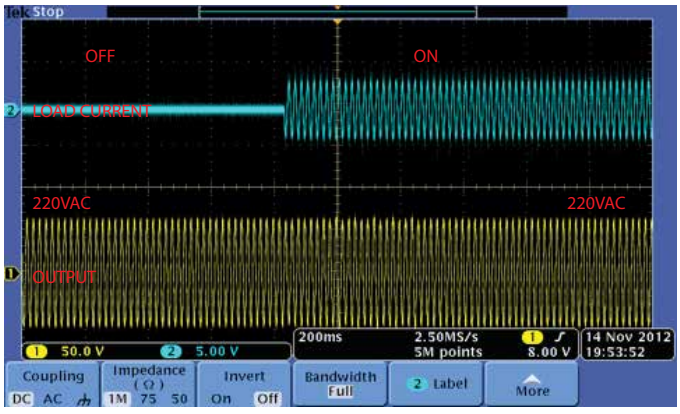
PERFORMANCE OF OUTPUT VOLTAGE VERSUS INPUT VOLTAGE



PERFORMANCE OF OUTPUT VOLTAGE VERSUS LOAD CHANGE







220VAC 160VAC 260VAC

GRID

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ELECTRONIC STABILIZER: Technical Specifications

GENERAL	
Model	VRS series (1-phase) 10kVA-100kVA / VRST series (3-phase) 30 kVA-400 kVA
Topology	Fully Automatic Voltage Stabilizer with High frequency switching IGBT semiconductor active rectifier and inverter
Control	DSP microprocessor-controlled
Efficiency	> 97%
Mechanical By-Pass	Manually-controlled network / stabilizer selector switch
INPUT	
Input Voltage	230/400V (3-phase) , 230V (1-phase); Optional 115/200VAC
Input Voltage Regulation Interval	±25%; Optional ±50%
Operational Frequency	50 Hz / 60 Hz ±5%
Isolation Transformer	Optional
Input Protection	Varistor protection for over voltage, SCR Fuse for Overcurrent; Optional: Class 1 Surge Arrester and Input MCB
OUTPUT	
Output Power Factor	0.8 inductive and capacitive
Output Voltage	230/400V (3-phase), 230V (1-phase); voltage is adjustable through the front panel (Ex: if the load voltage is 240V for 220V system then the output voltage can be adjusted as 240V from the front panel)
Output Voltage Tolerance	Adjustable between ±1% and ±5%
Regulation Speed	>1000 V/sec.
Dynamic Response	<50 msec.
Dynamic Response Voltage Tolerance	±10% (at 100% input voltage change)
Overload Capacity	125% 10 min., 150% 1 min., 300% 10 sec.
Output Frequency	Same with input
Total Output Harmonic Distortion	Same with input
Output Protection	Short circuit, Overvoltage, Over Temperature (electronic protection), High and Low Voltage Interruption
Load Power Factor	Independent from Inductive and Capacitive load, and unlimited
LCD FRONT PANEL	
Indicators and Buttons	2 x 16 LCD Panel, Menu Selection and Parameter Adjustment Buttons
Warning Messages	High/Low Input Voltage, High/Low Output Voltage, Overload, Over Temperature, SCR Fuse Failure, Fan Failure
Monitored Values	Input Power, Output Voltage and Load Percentage (%)
Output Tolerance Adjustment	Between 1% and 5%
Output High Voltage Protection Adjustment	Adjustable between +10% and +20% in intervals of 1V
Output Low Voltage Protection Adjustment	Adjustable between -10% and -20% in intervals of 1V
Audio Alarm	2 short "BEEPS" in every 2 seconds for Warning Messages
Alarm Relay	Over Temperature, High 0utput Voltage, Low Output Voltage, Overload, Fan Failure, SCR Failure, Low Input Voltage, High Input Voltage
COMMUNICATION	
Optional	Remote Monitoring through RS-232 and RS-485 Modules, Parameter Adjustment, Last 250 events recorded and displayed on front panel and on PC via remote communication
ENVIRONMENTAL	
Cabinet	Indoor, Optional Outdoor
Cooling	Built-in fan
Operational Temperature	-10 / +40 °C
Protection Level/Color	IP20 / RAL 7035 (optional IP42 Front Access)
Relative Humidity	90%
Operational Height	Maximum 2000m
Noise Level	Lower than 60dB at a distance of 1 m
Electrical Standards	EN 50091-1 (Safety) / EN 50091-2 (EMC)

The information contained herein is solely intended for general use purpose. Please refer to product datasheets of specific projects. For more information, please contact your local representative.

Key Global References

RELIABLE SOLUTIONS in POWER ELECTRONICS

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SRV-SVRT SERIES

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MICROPROCESSOR CONTROLLED SERVO VOLTAGE REGULATOR

PMI & OES GROUP COMPANIES

IQNet Environmentally Certified ISO 14001 JAS-ANZ ISO9001:2008 OHSAS TRB

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MICROPROCESSOR CONTROLLED SERVO VOLTAGE REGULATOR

FULL PROTECTION WITH MICROPROCESSOR CONTROLLED ARCHITECTURE LONGTERM OPERATIONAL EFFICIENCY

Servo Voltage Regulators are RISC microprocessor controlled devices. The microprocessor controlled PWM technology prevents the unnecessary movements of servo motor and the variable transformer. Due to its mechanical architecture there are no tap changes providing perfect instant current reaction and output voltage sensitivity. This brings low risk of break downs, long lasting operation and low maintenance

LOW OUTPUT VOLTAGE TOLERANCE

Servo Voltage Regulators operate mechanically at 100V/sec correction speed with low output voltage tolerance as low as ±1 %. Thus they are ideal solutions for protecting electronic loads. In general applications they are highly recommended for no critical loads such as lighting, and for stabilizing input voltage in buildings and factories.

ENERGY SAVING SOLUTION

The Servo Voltage Regulators are also ideal to be used in connection with generators where the network voltage is too low and fluctuation is high. Normally, a standalone generator starts operating below 200V, however a generator coupled with a Servo or Static Voltage Stabilizer kicks in below 165V since the Servo Voltage Regulator corrects the network voltage down to 165V level. Regulator's correction capability within this margin would prevent unnecessary operation of generators and increase system's efficiency.

FEATURES AT A GLANCE

- Measuring true RMS
- Controlling with RISC Microprocessor
- Perfect static and dynamic regulation
- Wide input operating voltage range 130-270 VAC
- Electronic protection against over-load and short circuit
- 220V ± 1% static regulation 100V/Sec regulation speed
- Programmable upper and lower limit for protecting over voltage
- Load level, input and output voltage display

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MICROPROCESSOR CONTROLLED SERVO VOLTAGE REGULATOR: Technical Specifications

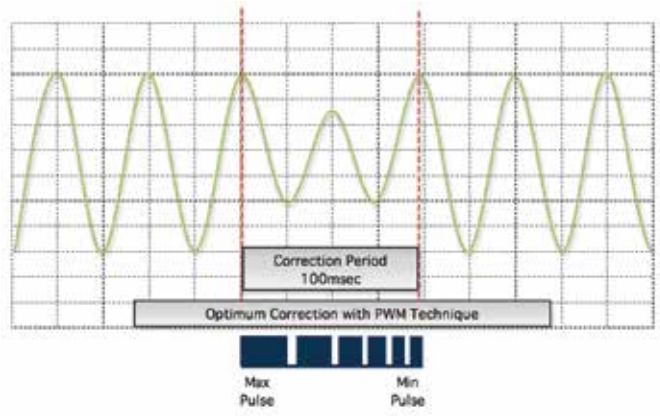
INPUT	
Input Voltage Regulation Range	285 - 440 VAC (3 phase), 165-255 VAC (1 phase)
Input Voltage Operating Range	230 - 470 VAC (3 phase), 130-270 VAC (1 phase)
Operating Frequency	50 Hz ± %5
System Input Protection	Over Current Thermic Fuse, Instant Over Voltage Protection, Optional MCB
Instant Voltage and Pulse Protection	IEEE 587 (4500 A, 110 Joules)
OUTPUT	
Output Voltage	380 VAC RMS ± %1 (3 Phase), 220 VAC RMS ± %1 (1 Phase)
Overloading	10 Seconds at % 200 Load
Regulation Speed	100 V/sec
Output THD	Equal to Input THD
Recovery Time	500 ms (165-225 VAC)
Operating Technique	RISC Microcontrolled Full Automatic Servo Controlling
Output Protection	Short Circuit, Over Current Electronic Protection, Over and Lower Voltage Protection, Optional MCB
DIGITAL CONTROLLING PANEL (0-45kVA)	
Indicator and Buttons	True RMS Digital Voltmeter, Alarm Reset Button
Warning Messages	Input High/Low, Output High/Low, Overload, Output Protection, Over Temperature
Viewing Measured Values	Output, Input and Load
Setting Output Tolerance	% 1,5 - 2,5 - 3,5 – 5 Selectable by DIP Switch
Setting Lower Output Voltage Limit	180 – 190 – 200 – 210 V Selectable by DIP Switch
Setting Upper Output Voltage Limit	230 – 240 - 250 – 260 V Selectable by DIP Switch
DIGITAL CONTROLLING PANEL (60-600kVA)	
Indicator and Buttons	2x16 LCD, Menu Scanning Button, Selecting Button,
Warning Messages	I/O Low/High, Load > %100, Motor Error, Over Temperature
Viewing Measured Values	Mains Power and Output Voltage, Load Level
Setting Output Tolerance	% 1-5 Selectable Front LCD Panel
Stand-By Duration	1 – 10 Sec. Selectable Front LCD Panel
Output Upper Protection Voltage	230 - 250 VAC Selectable Front LCD Panel
Output Lower Protection Voltage	180 - 210 VAC Selectable Front LCD Panel
Regulation Voltage	220 – 240 VAC Selectable Front LCD Panel
Sound Alarm	On Warning Messages 2 Short 'beep' per 2 seconds Selectable Front LCD Panel
GENERAL	
Total Efficiency	>% 98 (At Full Load)
Mechanical By-pass	Manuel "Mains – Line Stabilizer" Selector
Electrical Noise Reduction	FCC Part 15 Class B
Protection Level / Color	IP20 / RAL 7035 (standard); Optional IP31 / 42 with front access
COMMUNICATION	
RS232 Communication (option)	Compatible with Windows NT, XP, Vista; Remote ON-OFF; Key parameters can be monitored over Local Area Network & Internet
ENVIRONMENT	
Operating Temperature	-10 / +50 °C
Relative Humidity	90%
Operating Attitude	Max. 3000 Mt.
Noise Level	Max. 60 db
Electrical Standards	EN 50091-1 (Security) / EN 50091-2 (EMC)

* Custom production available up to 1000KVA

The information contained herein is solely intended for general use purpose. Please refer to product datasheets of specific projects. For more information, please contact your local representative.

SAFER LOAD

Since Servo Motor is set in motion with PWM technique, Servo Regulator responds to voltage spikes at optimum pulses to prevent overshoot & undershoot type corrections. As a result, the load is safer against voltage surges and short circuit current. In addition optimum corrections extend the life of the variable transformer and the regulator itself.



Key Global References

RELIABLE SOLUTIONS in POWER ELECTRONICS

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INV SERIES

Power Management Instruments

ON-GRID INVERTER

PMI & OES GROUP COMPANIES

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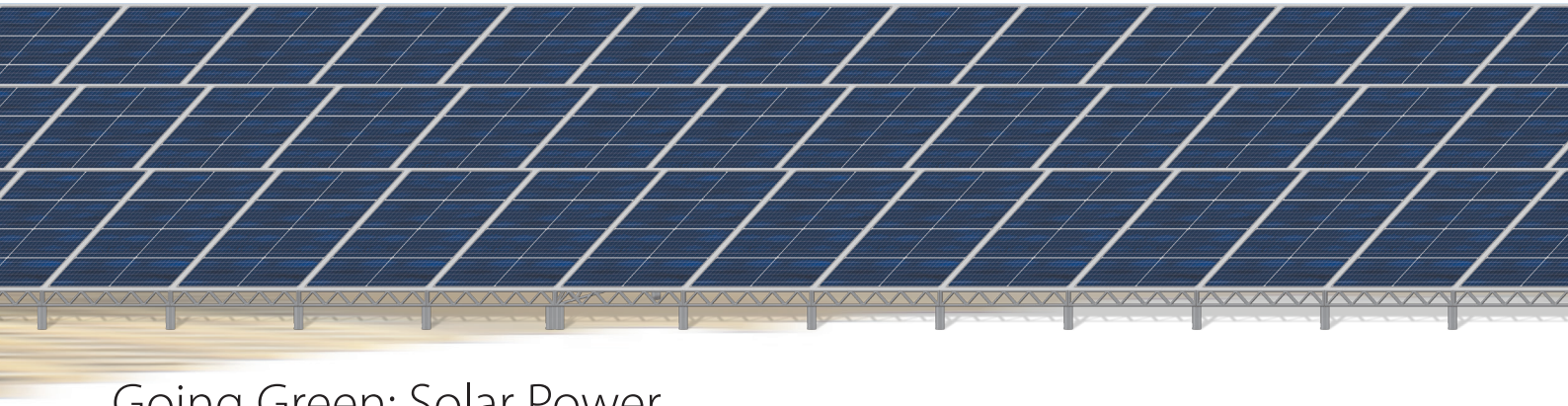

Going Green: Solar Power

Solar power generation has emerged as one of the most rapidly growing renewable sources of electricity following continuous rise in environmental and economic concerns over fossil fuels that is currently the world's major electricity source. Among the other forms of electricity generation sources, solar energy has vast advantages: it has reduced dependence on fossil fuels; it matches peak time output with peak time demand especially in summer; it is modular and scalable as the size and generating capacity is directly linked with the number of installed solar modules; it can be used in remote areas which significantly brings down the cost of transportation and production infrastructure; it is supported by many countries with various forms of incentive programs in place such as the laws allowing investors sell electricity back to the grid, directly subsidizing users to compensate the initial investment and offering tax incentives for the establishment of photovoltaic plants. These grid-tie systems, containing photovoltaic panels and inverters, are connected in parallel to the network grid generates mono-phase or tri-phase electricity and feeds abundant energy back to the grid after supplying the load(s). Then, the net metering calculates and deducts the total sum of energy input to the grid from what the users consumed.

ULTIMATE POWER GAIN WITH MPPT

With an estimated 30 years life time, photovoltaic panels or generators are main source of producing direct current which is transformed to alternating current via inverters that form the heart of the system as their robust design should ensure the continuity of the supplied energy by also leveling up the output voltage to the electricity network voltage of the grid, staying synchronized with the mains frequency. The inverter must as well optimize the energy production with respect to the solar radiation by tracking the Maximum Power Point (MPP). Maximum Power Point Tracking, frequently referred to as MPPT, is a system that operates the Photovoltaic (PV) modules in a way that allows the modules to produce all the power they are capable of.

The sizing of photovoltaic panel power is generally more than the maximum power supplied by the inverter in order to offset the loss of power of the PV modules due to high operating temperature, dirt, cables and ageing. To obtain the desired power it is possible to connect more inverters in parallel to the Grid. Utilizing more inverters means placing more MPPTs with the result of being able to run each unit separately, optimizing the configuration and consequently the performance of the entire plant. Furthermore in the event of inverter malfunction, only the part involved in the malfunction is affected and not the entire production as in the case of the single inverter.

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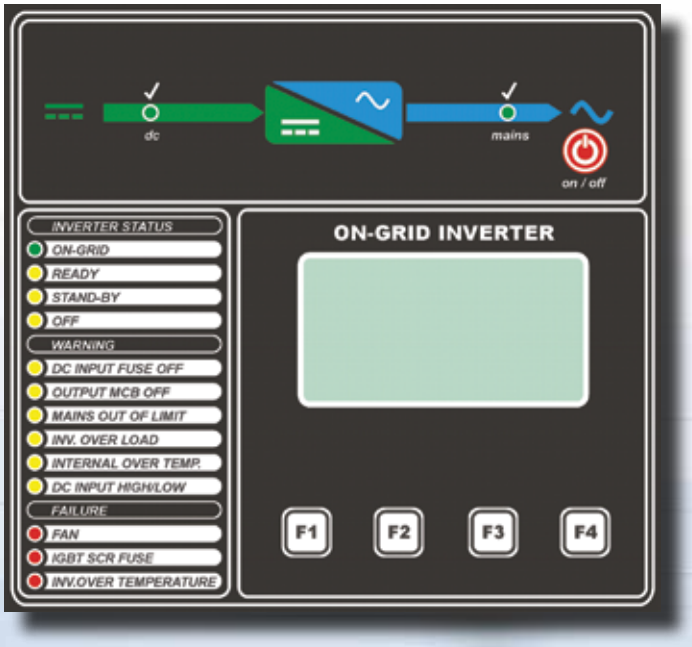
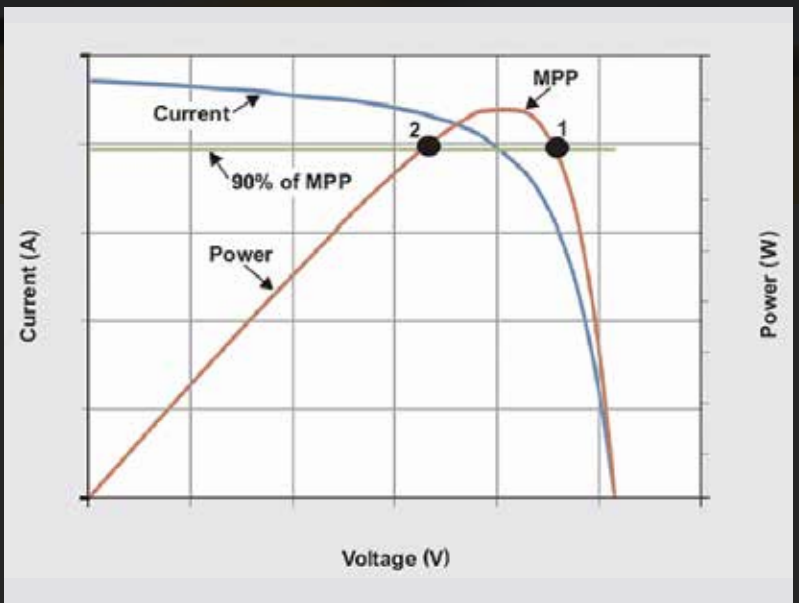
FEATURES AT A GLANCE

- Optimum power distribution independent of each phase voltage
- 6 pulse IGBT module topology
- Low filter loss thanks to 20 kHz switching frequency
- High conversion efficiency
- High accuracy MPPT technology
- High yield at low irradiance levels
- Automatic reactive current and power factor control
- Sinusoidal inverter output with < 3 % total harmonic current distortion (ITHD)
- Display advanced parameter graphical display
- Short Circuit, Over Current, Over Voltage Protections at Output
- Thermic Over Current Fuse with Indicator, DC Over Voltage and EMI-RFI Filter at Input
- More than 200.000 hrs MTBF with More than 20 years life time
- Industrial grade front access cabins, easy maintenance
- Customized output isolation transformer design to suit different voltage levels and frequency
- Advanced communications via Modbus TCPIP or Modbus RTU with local or remote configuration and monitoring
- Power ratings from 10 kW up to 200 kW with N+1 configuration
- Full nominal power up to 45 °C Smart fan controlling system to optimize the efficiency

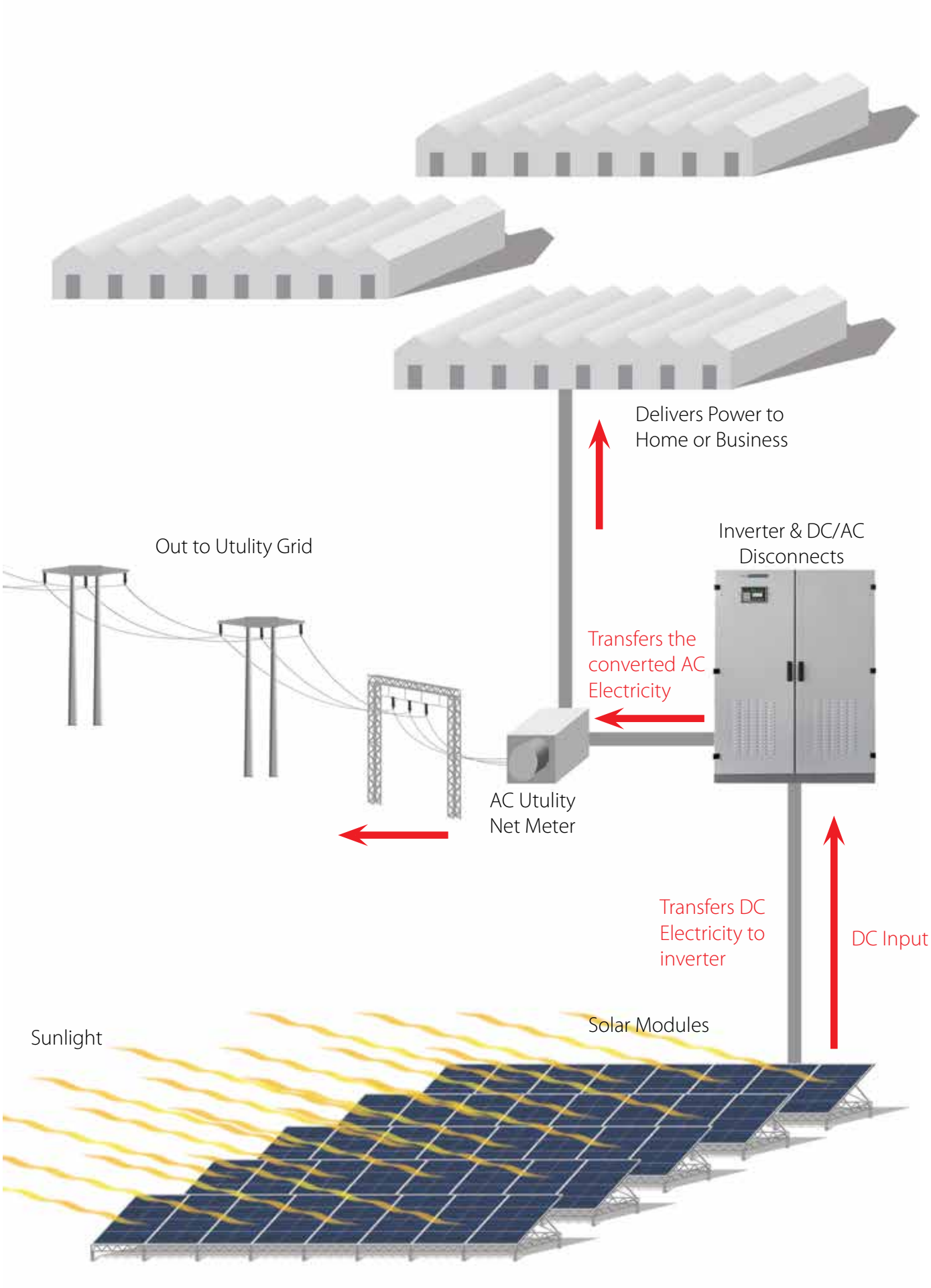
GRAPHICAL DISPLAY PANEL



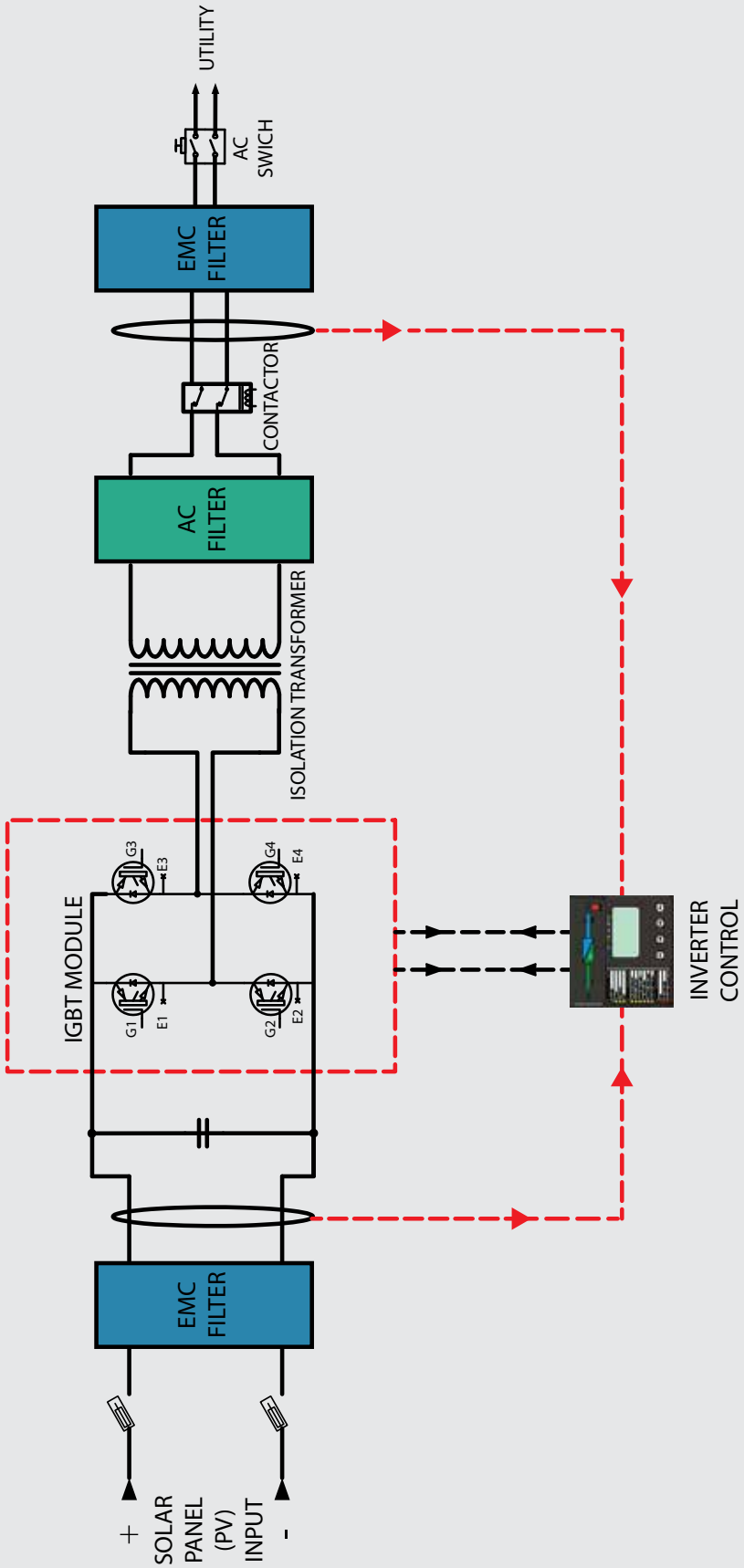


With its 30 year design and manufacturing experience in industrial AC & DC power conversion systems, PMI – GESS has developed its new grid-tie inverters for photovoltaic plants that are connected to the grid network. PMI grid-tie inverters use an algorithm to identify instant by instant maximum power point (MPPT) that continually changes throughout the day depending on latitude, orientation of the solar panels, the season and hour of the day that in turn directly affects the temperature and irradiation hitting each photovoltaic cell. Smart Software powered system calculates the voltage at which the module is able to produce maximum power and operates at this voltage to extract maximum power from the panels. In other words, the smart controller adjusts the voltage by a small amount from the array and measures power; if the power increases, further adjustments in that direction are tried until power no longer increases. Typical Ipv x Upv graph is shown on the left.

GRID-TIE SOLAR APPLICATION: OPERATION OF THE SYSTEM

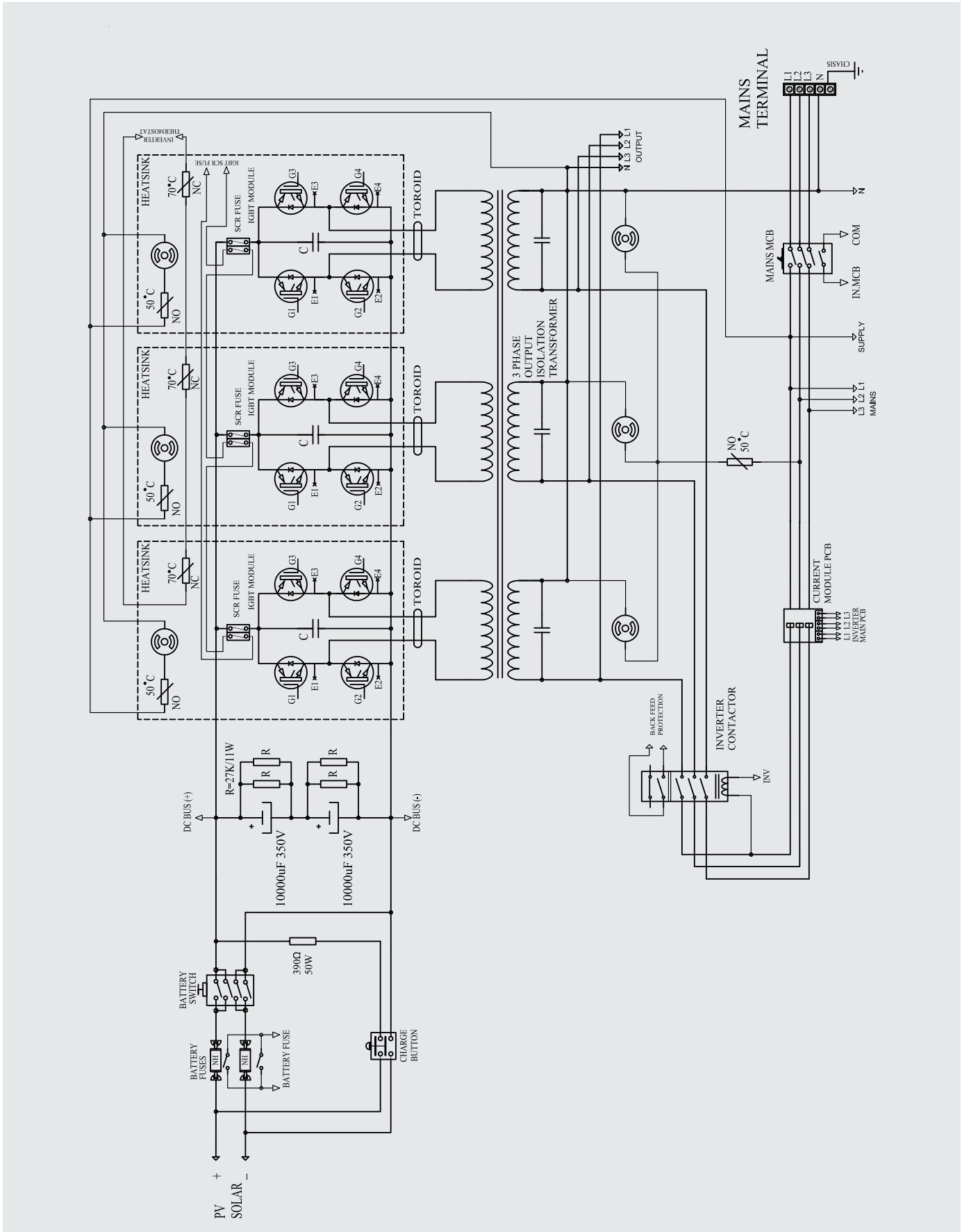


OPERATING LOGIC OF THE INVERTER



PMI On-Grid Inverter topology is based on 1 Full Bridge 2 High Frequency IGBT Inverter Modules (3 full-bridge 6 high frequency IGBT modules for 3 Phase output) using PWM (pulse width modulation) and control logic based on DSP. Monitoring of electrical values and parameter adjustments can be done through Graphical Display and Mimic diagram of the PMI On-Grid Inverter system. EMC filters decrease the radio frequency emissions on the AC network and photovoltaic modules while Full Bridge High Frequency IGBT Inverter Modules convert direct current to alternating current. Isolation of DC input and AC output is ensured by galvanic Isolation Transformer at the output of the inverter. No load losses of the transformer is avoided by separating the inverter from AC output by contactor while inverter is in "OFF" position. All operations are controlled through Control PCBs and Graphical Display monitors the whole system.

POWER WIRING DIAGRAM OF THE INVERTER



ON-GRID INVERTER TECHNICAL SPECIFICATIONS

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GENERAL	
Model	INV Series
1Phase Power Options	6 / 10 / 20 / 30 /40 kW
3Phase Power Options	10 / 20 / 30 / 40 / 60 / 80 / 100 kW / 200 kW
Topology	Six Module IGBT High Frequency Switching Inverter With Output Isolation Transformer
Control	DS PIC Controlled
Overall Efficiency	>%90 (1 Phase) / >%93 (3 Phase)
Over Load Capacity	10 min for 110%
Isolation Voltage	2.500 VAC (Input-Output, Input-Chassis, Output-Chassis)
Grid DC Connection	Sequence Rail Terminal (+/- DC)
INPUT	
Input DC Voltage, MPPT	300-350 VDC (1 Phase) ; 500-600 VDC (3 Phase)
Min-Max Input DC Voltage	250-450 (1 Phase); 300-700 (3 Phase)
Input Protection	Thermic Over Current Fuse With Indicator, Over Voltage and EMI-RFI Filter
Instant Voltage and Pulse Protection	IEEE 587 (4500 A, 110 Joules)
OUTPUT	
Output Voltage	120/220/230 /240 VAC (1 Phase) ; 208/380/400/415/480 VAC (3 Phase, independent phase controlled)
Output Voltage Tolerance	±10%
Output Frequency	50 or 60 Hz
Output Frequency Tolerance	±2% Synchronized on Mains
Output Waveform	Fully Sinusoidal, THD <3%
Output Protection	Short Circuit, Over Current, Over Voltage and Over Temperature
Output Transformer	Galvanically Isolated
ON-GRID GROUP	
Grid Number 1 Phase	12 Grid In Series, MPPT Grid Voltage 26-28 VDC, 10 Grid In Series, MPPT Grid Voltage 33-36VDC
Grid Number 3 Phase	20 Grid In Series, MPPT Grid Voltage 26-28 VDC, 16 Grid In Series, MPPT Grid Voltage 33-36VDC
FRONT PANEL	
Indicator and Buttons	Graphic LCD Panel, Menu Select and Menu Set Buttons
Warning Messages	Input Fuse/Operating Mode/Inverter Synchronization/DC Input High- Low/Inverter Over Load/Internal Over Temperetaure /Inverter Over Temperature/IGBT SCR Fuse Fail/Inverter Output High-Low
Viewing Measured Values	Output Voltage/Output Frerquency/Inverter Load Level/DC Bus Voltage/Internal Temperature /Event History
Adjusting Parameters	Date/Time /Alarm Sound Level/Communication Slave Number/Led Test
Sound Alarm	On Warning Messages 2 Short 'beep' per 2 seconds
Communication	RS 485 - Modbus - TCP/IP communication are available to monitor and remote parameter setting (Optional)
Protection devices and environmental conditions	
Access to Cabin	Front Access
Level of protection	IP 21 as Standard; IP42 with Front Access as Option
Permitted temperature range	-10°C - +45°C
Non condensing relative humidity range	<95%
Maximum height above sea level	1000 m ASL

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GROUP COMPANIES

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