RELIABLE SOLUTIONS in POWER ELECTRONICS

PMI

INDUSTRIAL UPS

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INDUSTRIAL UPS SYSTEM

PMI & OES GROUP COMPANIES

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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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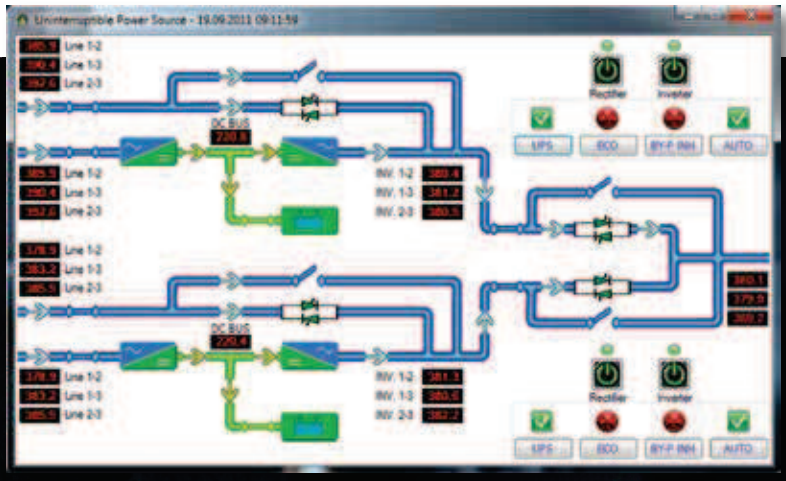

INDUSTRIAL UPS CONCEPT:

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

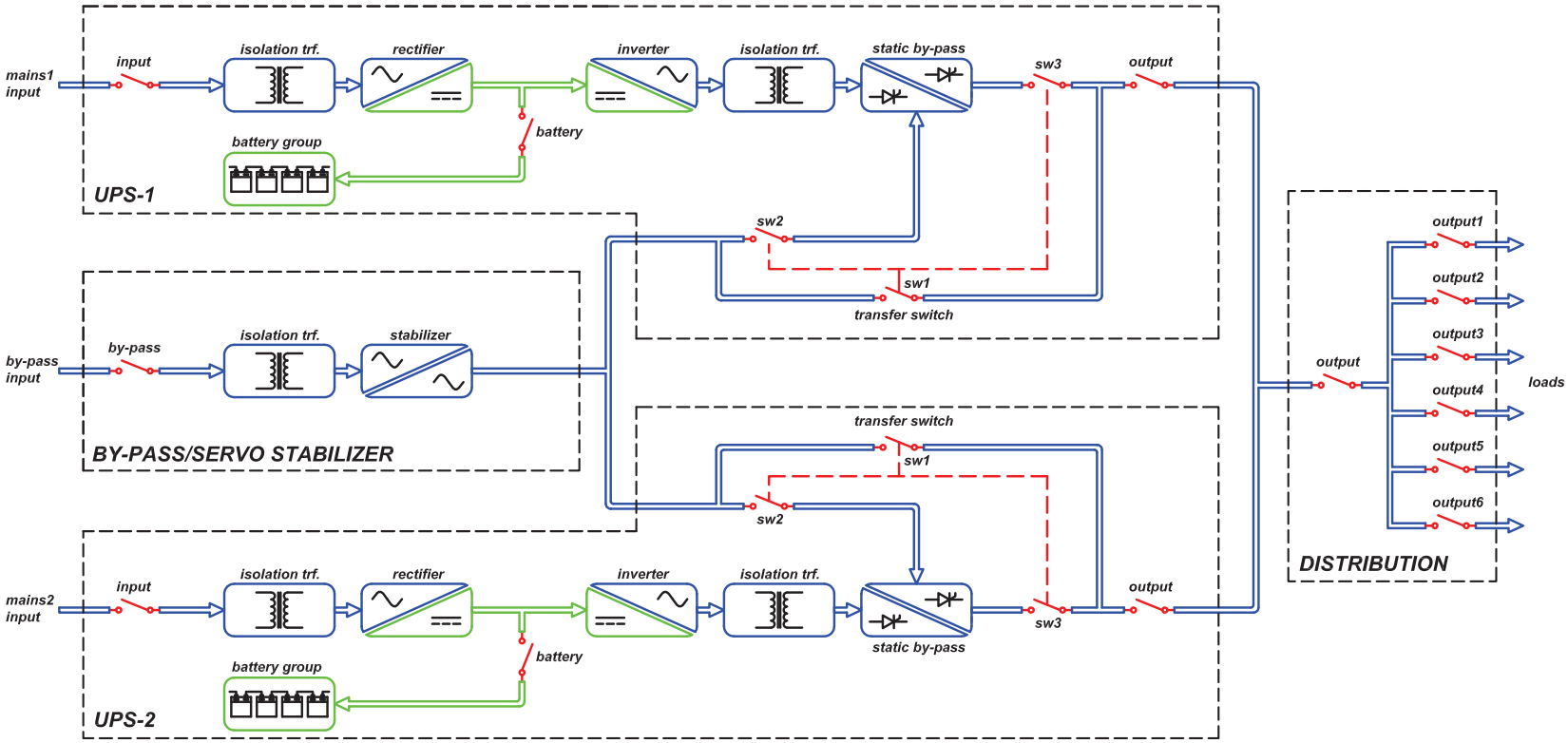
The inverter is provided with a sensing circuit which can detect transient overload, sustained overloads and short circuits. The sensing circuit initiates 'current limit', which causes the static switch to transfer the critical load to the bypass line without interruption for load security. There is 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

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

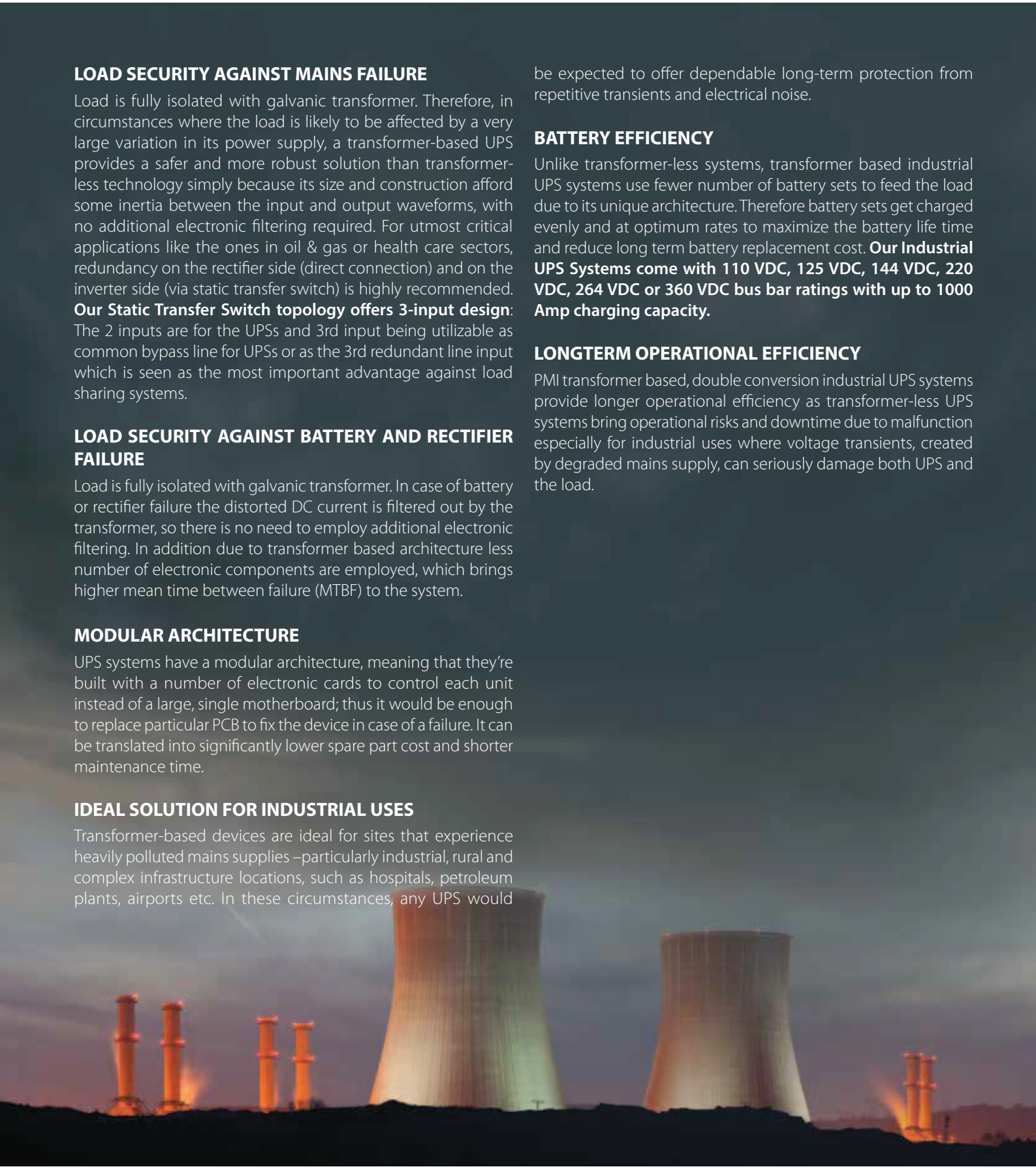
Transformer-based devices are ideal for sites that experience heavily polluted mains supplies –particularly industrial, rural and complex infrastructure locations, such as hospitals, petroleum plants, airports etc. In these circumstances, any UPS would be expected to offer dependable long-term protection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

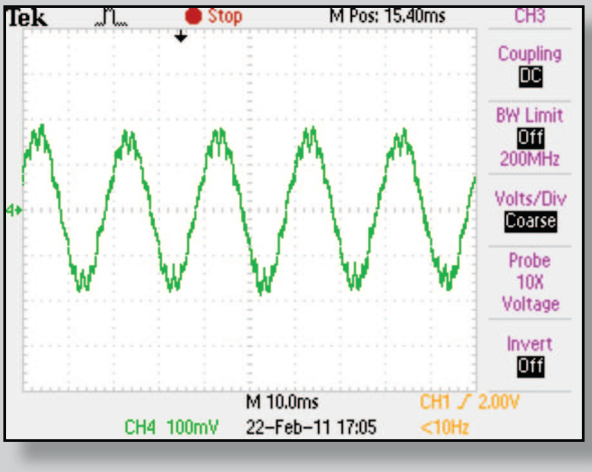
On LCD panel all measurement values, real time base events and failures can be viewed and communicate remotely via RS485-ModBus, TCP-IP or GSM Module. All operations are controlled and processed by micro controllers. Adjustable timer is used for boost charging the batteries automatically. Output current, 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.

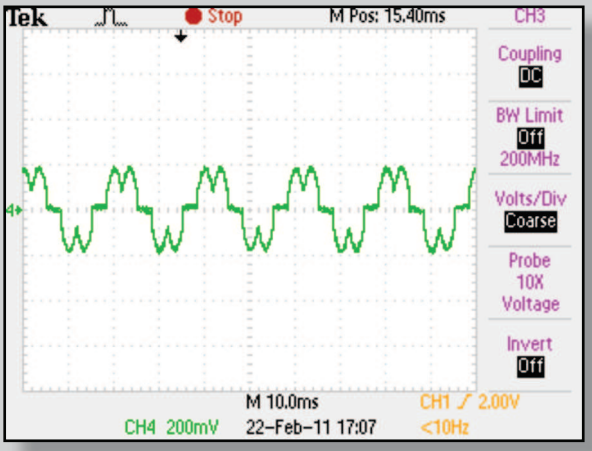
PROTECTIONS

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.

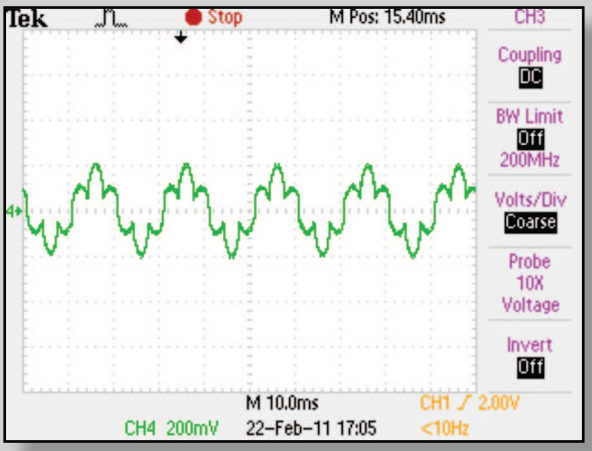
12 PULSE RECTIFIER CURRENT WAVE



6 PULSE RECTIFIER CURRENT WAVE
(DELTA-DELTA CONNECTION)



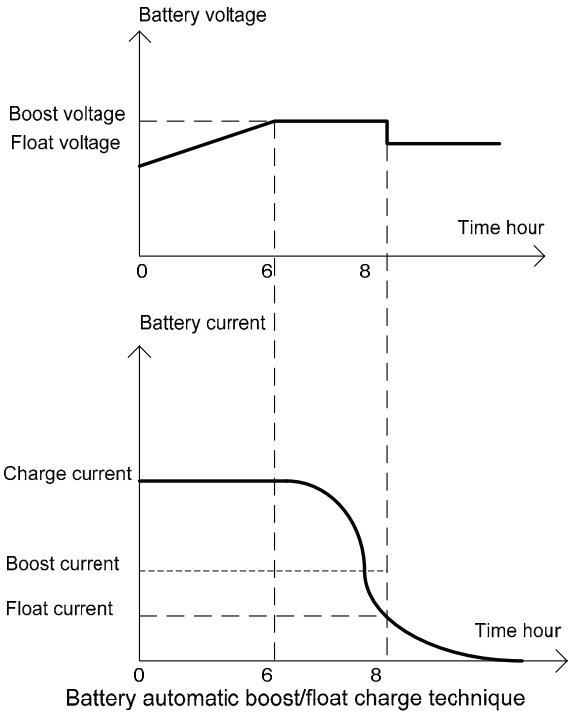
6 PULSE RECTIFIER CURRENT WAVE
(DELTA-STAR CONNECTION)



DC Ripple < 1%

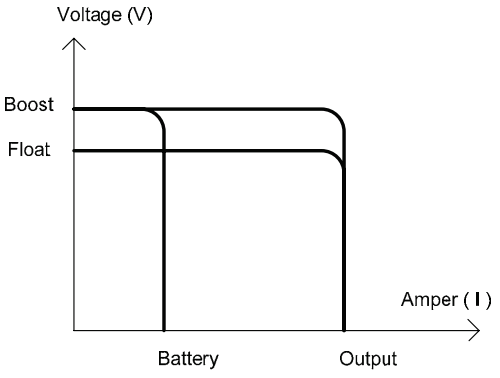
Input and output are protected with MCBs and all settings including boost charge, floating charge and battery charge current can be adjusted via front panel digitally. DC output is filtered by L/C, so DC ripple at full load always lower than 1% to increase battery life.

BATTERY CHARGING CHARACTERISTICS



Battery automatic boost/float charge technique

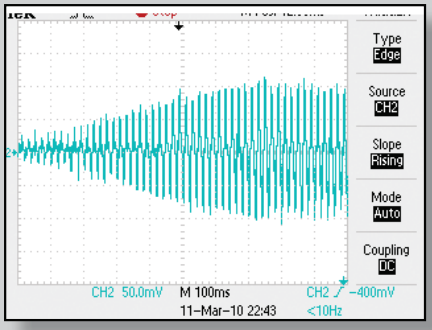
Ideal and safe charging of batteries is sustained by setting boost and float charge currents. In this way unnecessary boost conditions and deformation of batteries at changing load currents are prevented.

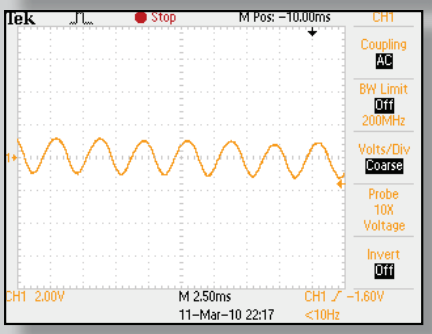


Constant voltage / constant current rectifier output
V/I characteristics

Ideal output characteristic via fast microprocessor control

LOW RIPPLE



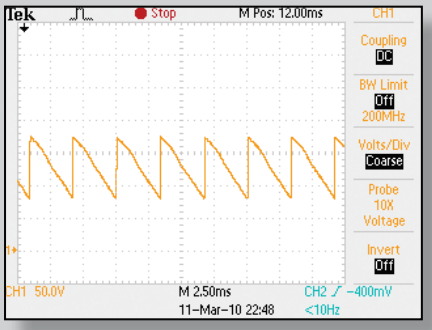


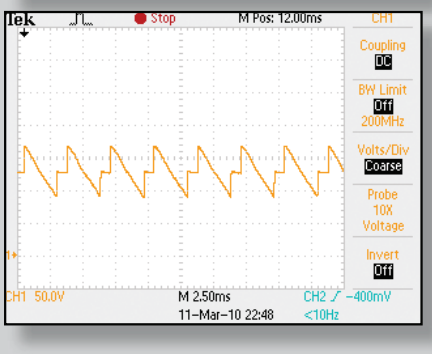
Soft Start Feature

- 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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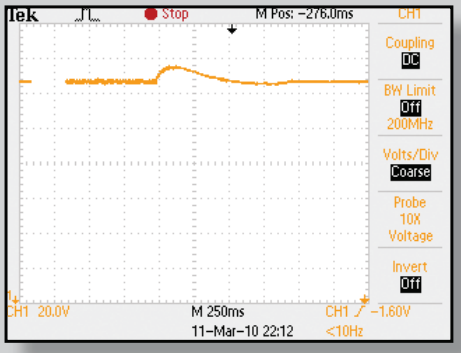
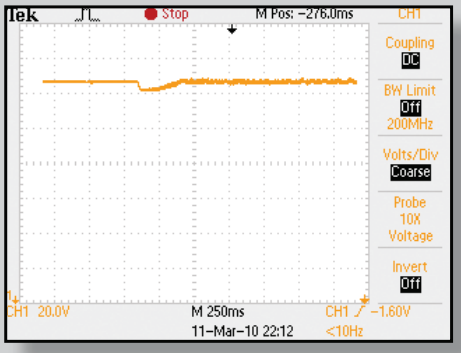
DYNAMIC RESPONSE

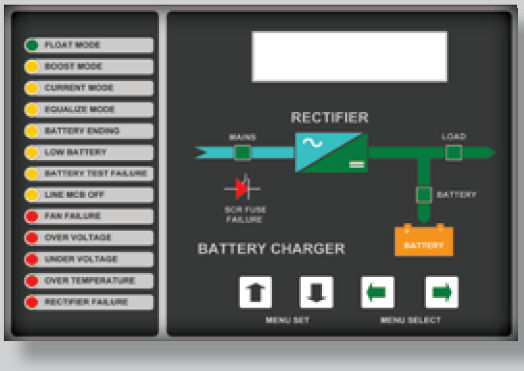


- In sudden load changes dynamic response is 300 msec without overshoot or undershoot to secure the load



- 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

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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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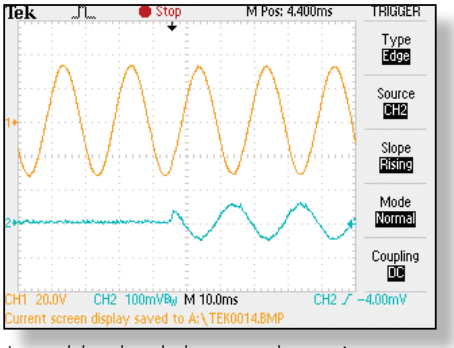
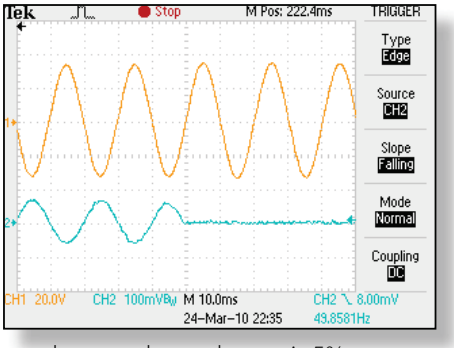
Dynamic Response

Output at 0-100% load change

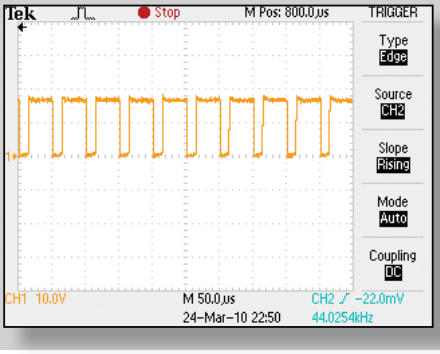


Output at 100% - 0 load change



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

Swiching wave form

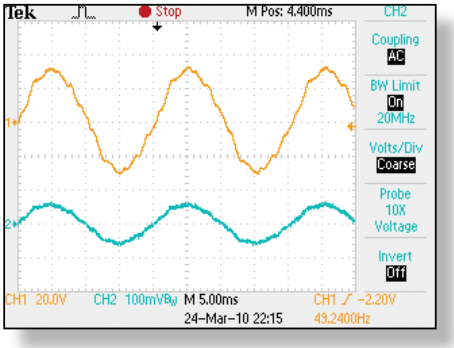


Swiching at 20 kHz

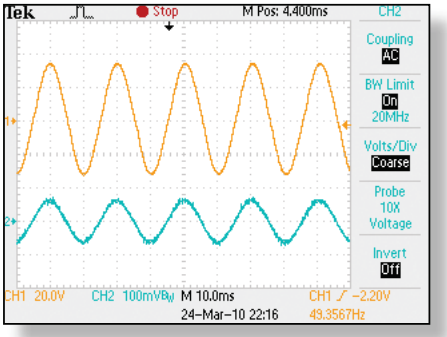
- There is no waveform distortion for reactive and nonlinear loads
- Low audible noise

Perfect output waveform with linear loads

Line voltage



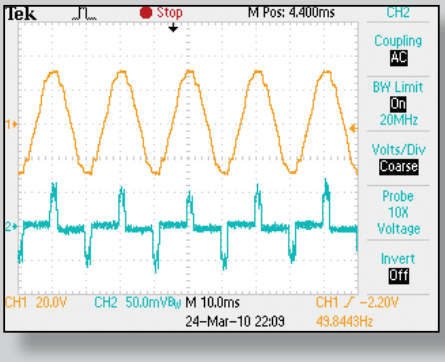
Output waveform



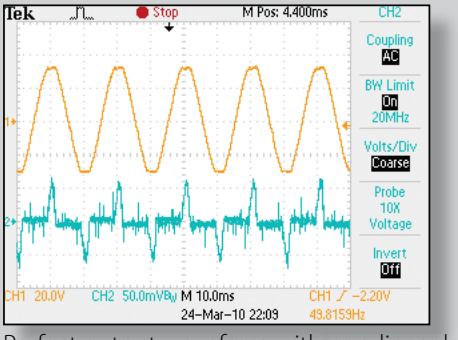
Perfect output waveform with linear loads

Perfect output waveform with non-linear loads

Line voltage



Output waveform



Perfect output waveform with non-linear loads

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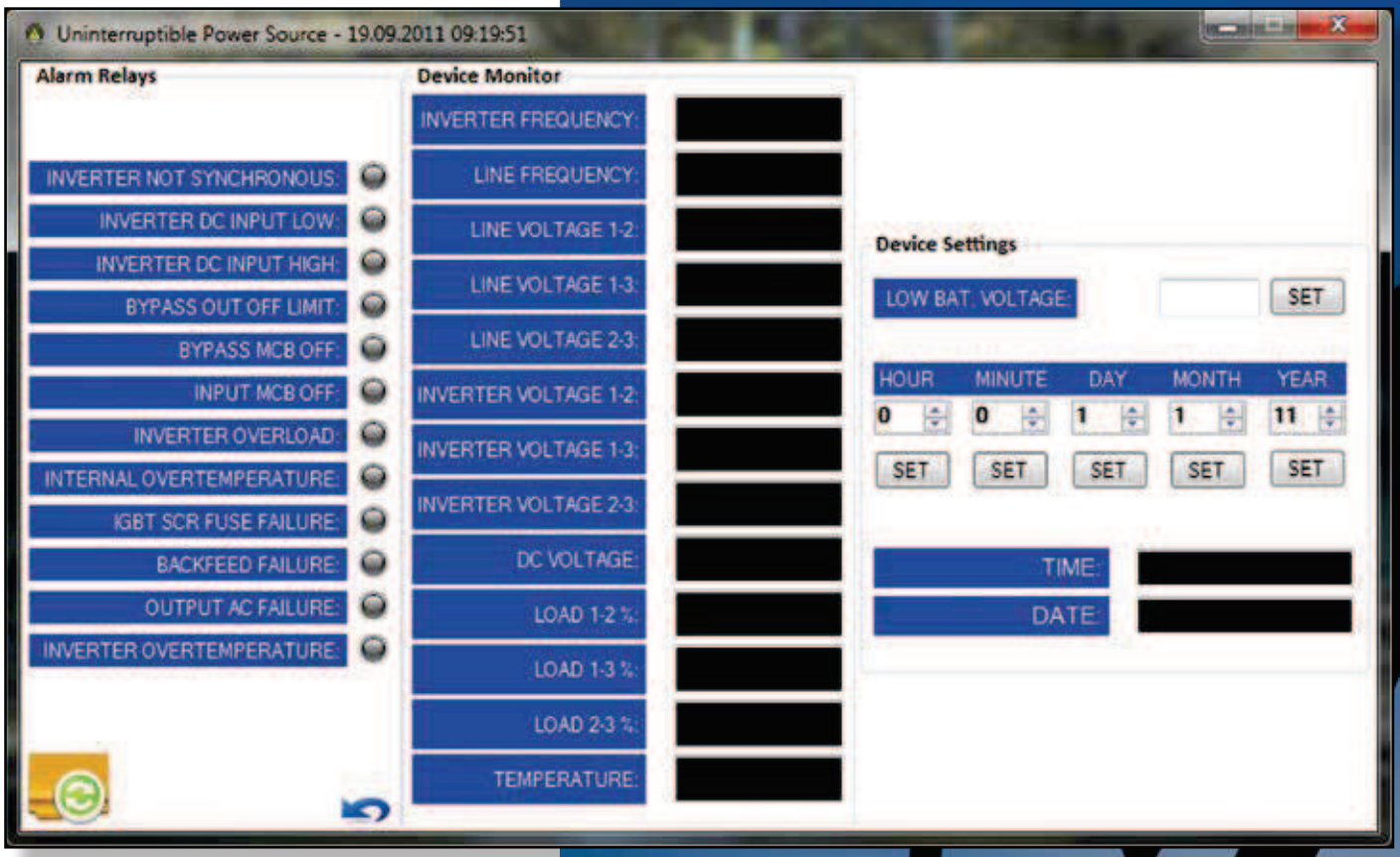
Inverter Communication Interface



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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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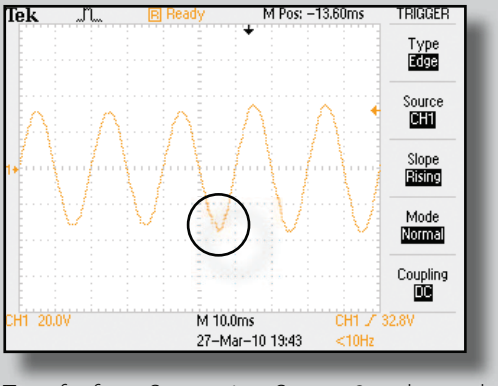
Perfect output waveform with non-linear loads

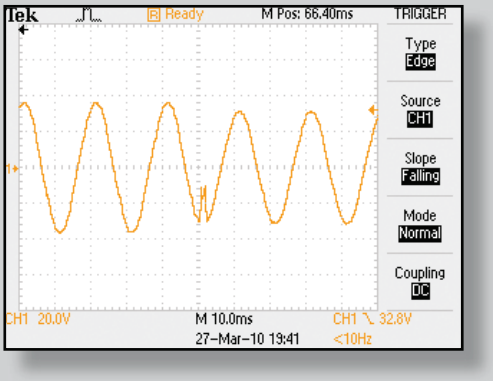
Source 1 is off limits



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

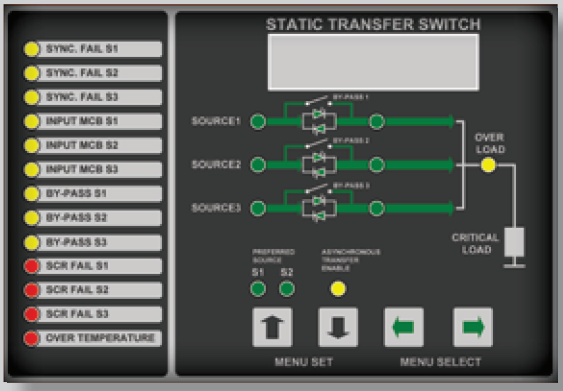
Blackout on Source 1 at peak

(Worst case scnario)

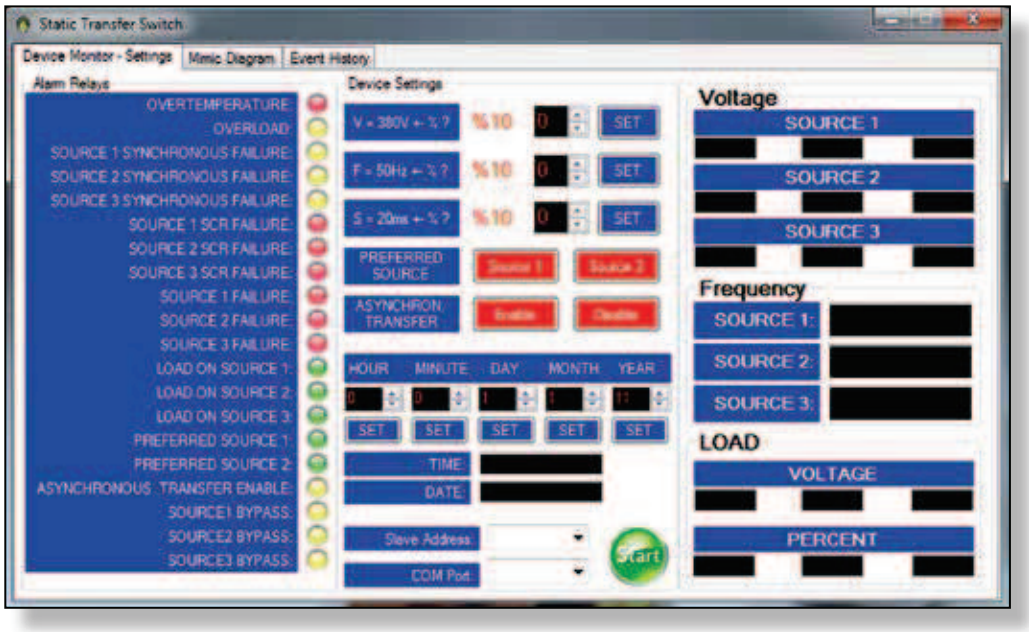


Perfect synchronized transfer to Source 2 at 2 msec

STS FRONT PANEL



STS COMMUNICATION INTERFACE



VOLTAGE STABILIZER AND ISOLATION TRANSFORMER AT BYPASS (OPTIONAL)

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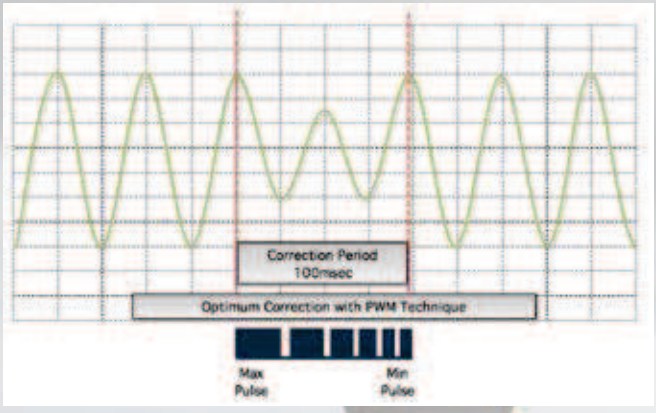
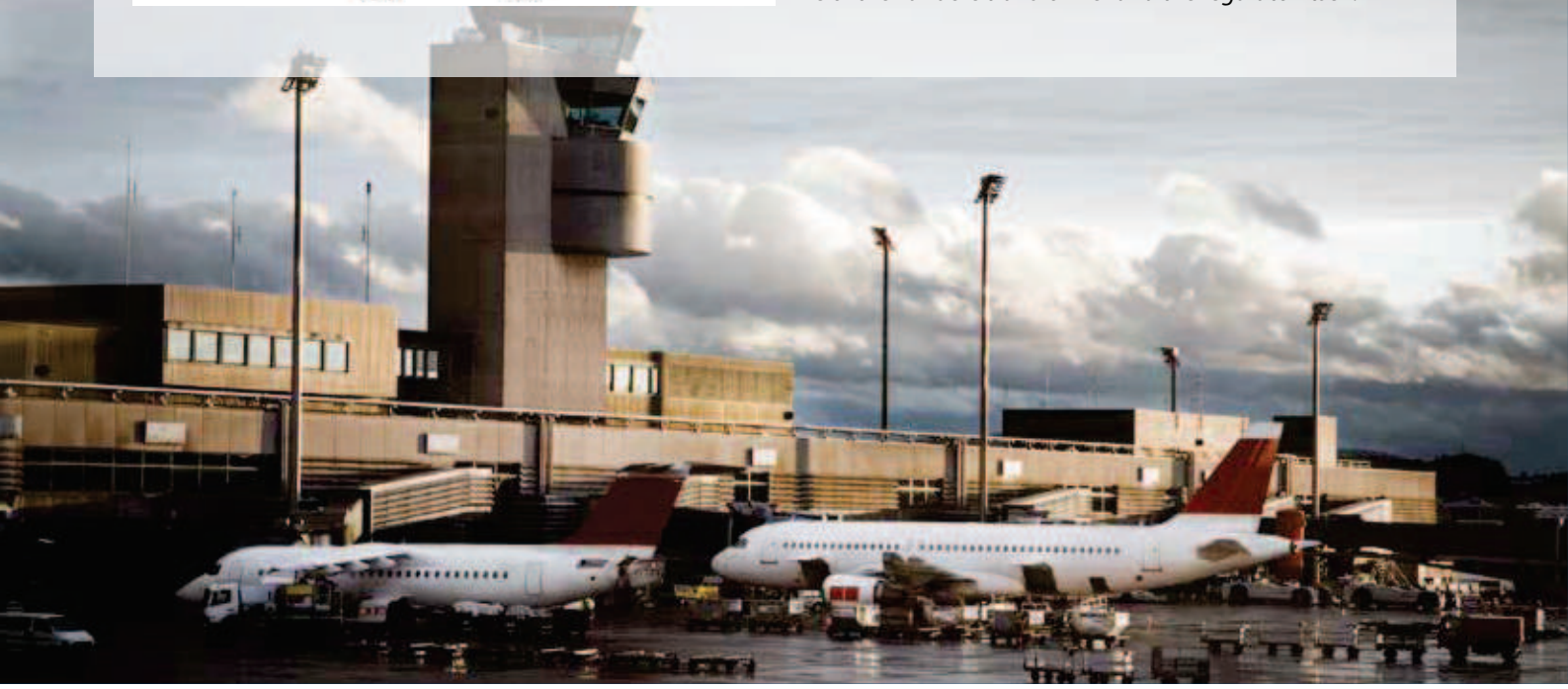
In-house developed Servo & Electronic Type regulators stabilize the mains changes ideally when the Industrial UPS system is on bypass mode. It is particularly employed when differences exist at input and output voltage in the bypass mains. In this case, the bypass transformer adjusts the input to the 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.



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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)

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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

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RDAT SERIES

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BATTERY CHARGER / DC RECTIFIER

PMI & OES GROUP COMPANIES

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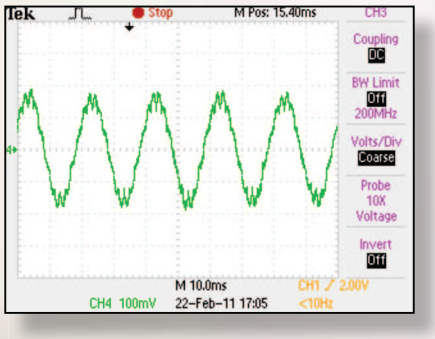
BATTERY CHARGER / DC RECTIFIER

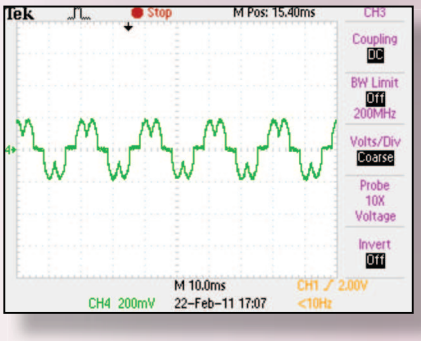
RDA / RDAT AUTOMATION TYPE SERIES

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.

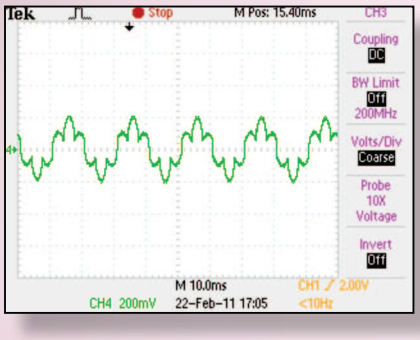
12 PULSE RECTIFIER CURRENT WAVE



6 PULSE RECTIFIER CURRENT WAVE (DELTA-DELTA CONNECTION)



6 PULSE RECTIFIER CURRENT WAVE (DELTA-STAR CONNECTION)



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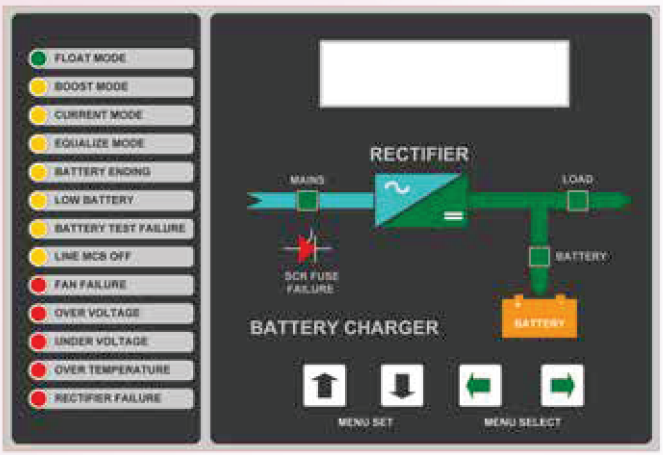
STANDARD FEATURES

- 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

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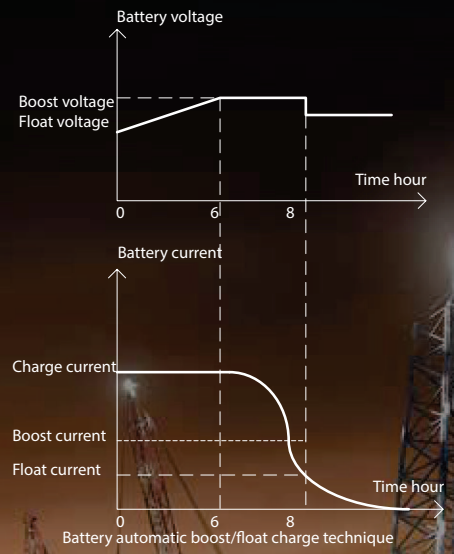
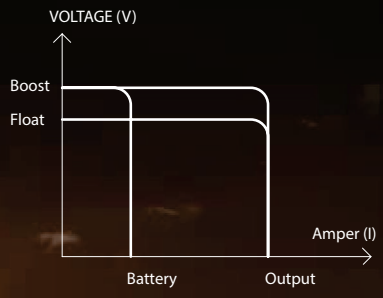
AUTOMATIC BOOST

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



Constant voltage / constant current rectifier output V/I characteristics

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.

Ideal output characteristic via fast microprocessor control

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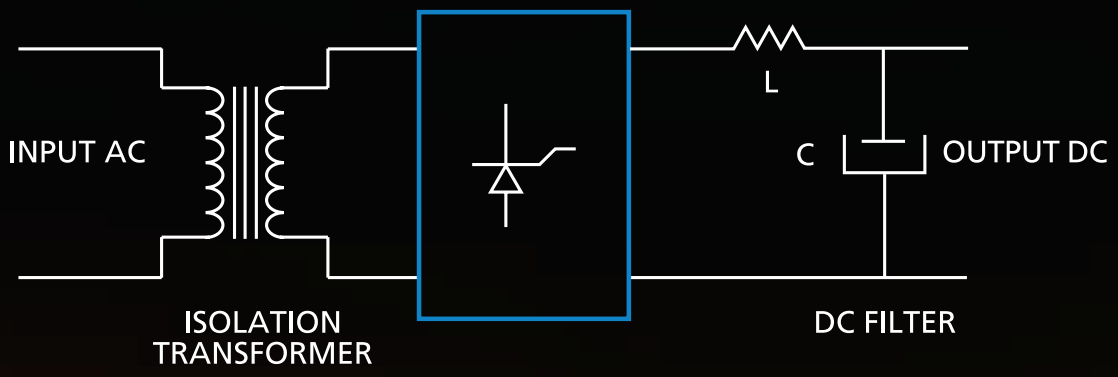
HIGH PROTECTION

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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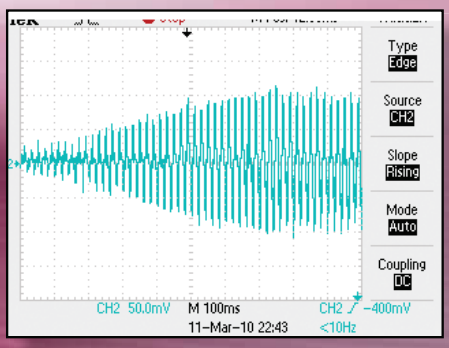
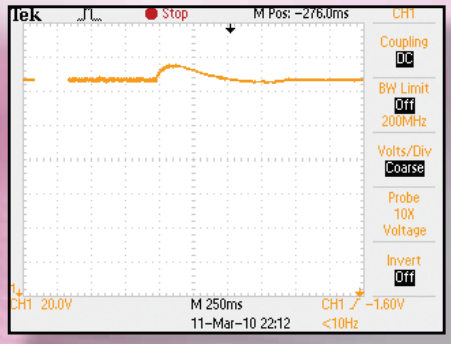
PRODUCT PERFORMANCE

SOFT START FEATURE



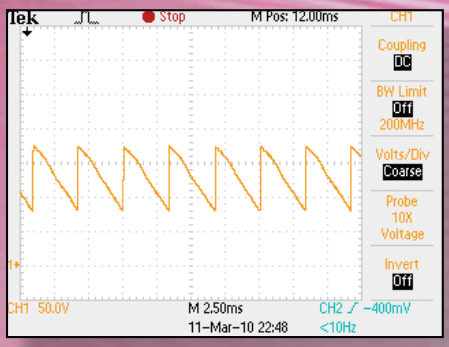
- No inrush current at start up

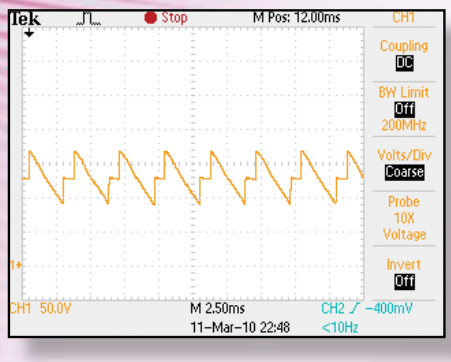
DYNAMIC RESPONSE



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

MICROPROCESSOR CONTROL

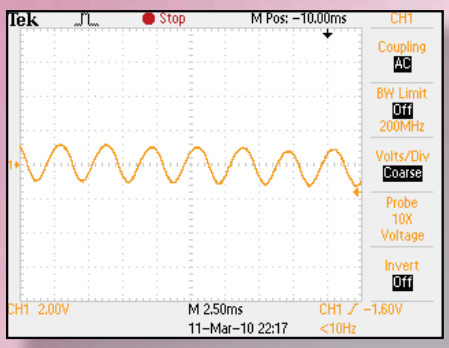




Fully microprocessor controlled rectifier

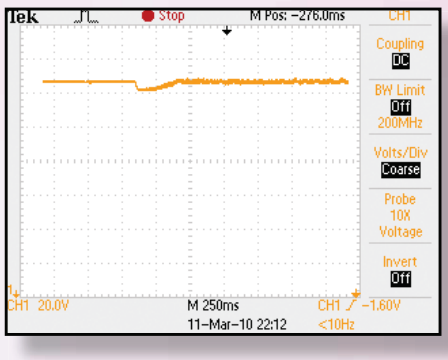
- Thyristor angle is adjusted with load change
- ½ Load: Phase angle shortened
- Full Load: Phase angle at max

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