

User Manual

84000 Series
TYPE 3 (T3)

Indoor Power Plant

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EXICOM's power plants are equipped with in-house produced Switched Mode Rectifiers (SMR). We have power plants configurations with ampere ultimate capacity ranging from 100A up to 4000A (for instance 100A, 200A, 400A, 800A, 1000A, 2000A, 2500A, 3000A etc.), which provide regulated power to telecommunication equipment and also keep batteries floated across the load in fully charged condition so that uninterrupted operation of vital communication network continues even when AC mains fail.

Today's sensitive electronic loads and state of the art VRLA batteries require continuous electronic supervision and features like Temperature Compensation, Battery path current limiting etc. A micro-controller based Monitoring and Control Unit (M2000) carries out all these vital functions.

All the above modules and sub-assemblies are housed in a rack. Because of the modularity of the whole architecture the system is extremely flexible. A variety of combinations can be worked out to serve any kind of requirement and provision for future expansion.

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Safety Instructions and Symbols Used

Please read the safety instructions very carefully before operation to avoid harm to the personnel or the system. The special instructions laid in this book does not include all the safety points to be observed, and are only supplement to various safety points. Therefore, the installation and commissioning personnel must be strictly trained to correctly and cautiously operate the system.



Warns of a hazard the system operator will be exposed to, that will likely result in death or serious injury if not avoided.



Warns of a potential hazard the system operator may be exposed to, if not avoided, that may result in equipment damage or performance loss.



Notifies an action to the reader that must be avoided or performed in order to protect equipment, software, data, or service.



Hazardous Voltage

Some components of the power system carry hazardous voltage in operation. Direct or indirect contact through moist objects with these components will result in fatal injury. Safety rules in the industry must be observed when installing the power system. The installation personnel must be strictly trained to operate high voltage and AC power. In operation, the installation personnel are not allowed to wear conductive objects such as watches, bracelets, bangles, rings etc. When water or moisture is found on the Sub-rack, turn off the power immediately. In moist environment, precautions must be taken to keep moisture out of the power system.



Tools

In high voltage and AC operation, special tools must be used. No common or self-carried tools should be used.



Thunderstorm

Never operate on high voltage, AC, iron tower or mast in the thunderstorm. In thunderstorms, a strong electromagnetic field will be generated in the air. Therefore the equipment should be well earthed to avoid damage by lightning strikes.



ESD Logo

The static electricity generated by the human body will damage the static sensitive elements on PCBs, such as large-scale ICs. Before touching any plug-in board, PCB or IC chip, ESD wrist strap must be worn to prevent body static from damaging the sensitive components. The other end of the ESD wrist strap must be well earthed.



Short Circuit

During operation, never short the positive and negative poles of the DC distribution unit of the system or the non-grounding pole and the earth. The power system is a constant voltage DC power equipment, short circuit will result in equipment burning and endanger human safety. Check carefully the polarity of the cable and connection terminal when performing DC live operations. Never wear a watch, bracelet, bangle, ring, or other conductive objects during operation. Insulated tools must be used.



Battery

Before any operation on battery, read carefully the safety precautions for battery handling and the correct battery connection method. Non-standard operation on the battery will deteriorate battery efficiency and may cause danger to battery or operating personnel. In operation, precautions should be taken to prevent battery short circuit and overflow of electrolyte. The overflow of electrolyte will erode the metal objects and PCBs, thus causing equipment damage and short circuit of PCBs.

Before any operation on battery, pay attention to the following points:

- + Remove the watch, bracelet, bangle, ring, and other metal objects on the wrist.
 - + Use special insulated tools.
 - + Use eye protection device, and take preventive measures.
 - + Wear rubber gloves and apron to guard against electrolyte overflow.
 - + In battery transportation, the electrode of the battery should always be kept facing upward. Never put the battery upside down or slanted.
-



BLVD

The system has battery low voltage disconnection (BLVD) function. BLVD means when the mains fail and batteries supply power, the monitoring module cuts the load off when the battery voltage drops down to below 44.4V to prevent over-discharge. The BLVD voltage is settable through controller (M2000). The factory setting is enabling BLVD, which means that if power outage lasts for a long time or the power supply system fails, there might be BLVD. Users should classify the loads and connect the priority loads to BLVD routes. For vital loads, users can disable BLVD of these loads to insure reliability of the power supply.

The advantage of enabling BLVD is protecting the batteries from over-discharge when the battery voltage is low. The disadvantage of enabling BLVD is that when the battery voltage drops down to a certain value, all the loads (including non-priority loads and priority loads) will be cut off due to battery disconnection. The advantage of software disabling BLVD is prolonging the power supply of priority loads. The disadvantage is that software disabling cannot prevent unwanted power failure due to mis-operation or power supply system failure.



Sharp Objects

When moving equipment by hand, protective gloves should be worn to avoid injury by sharp object.



Cable Connection

Please verify the compliance of the cable and cable label with the actual installation prior to cable connection



Binding the signal lines

The signal lines should be bound separately from heavy current and high voltage lines, with binding separation of at least 150mm.



General Safety

A Good Earth. Typical earth resistance should be less than 1 ohm, for lightning protection; earth resistance should be periodically verified (once in three months).

In case of DG set supply, adequately rated DG set to cater for minimum 1.25 times of PowerPlant load and maximum of other loads (e.g. starting load of AC). In case of three phase DG set, load on DG set should be balanced on three phases within +/-10%.

The Power plant has unity power factor and does not require external PF correction. Use of switched capacitor bank at input results in switching transients which may damage the Power plant and is to be avoided.

Without LPU installation/integration with SMPS/PP, do not Switch ON the Power Plant.

Abbreviations

Abbreviation	Description	Abbreviation	Description
A	Ampere	Indiv.	Individual
AC	Alternating Current	I/F	Interface
ACDB	AC Distribution Board (Panel)	KAH	Kilo Ampere Hour
Ah	Ampere Hour	KWH	Kilo Watt Hour
AUC	Ultimate Capacity	LED	Light Emitting Diode
Batt.	Battery	LLVD	Load Low Voltage Disconnect
BHMS	Battery Health Monitoring System	LVD	Low Voltage Differential
BLVD	Battery Low Voltage Disconnect	MCB	Main Circuit Board
CAN	Controller Area Network	MCM	Monitoring and Control Module
CB	Circuit Breaker	mm	Millimeter
CC	Constant Current	MOV	Metal Oxide Varistor
CV	Constant Voltage	PCA	Printed Circuit Assembly
Comm.	Communication	pfc	Power Factor Correction
Comp.	Compensation	PFC	Potential Free Contacts
Config.	Configuration	PN	Phase Neutral
DC	Direct Current	PP	Power Plant
DCEM	DC Energy Meter	RH	Relative Humidity
DG	Diesel Generator	SMPS	Switched Mode Power Supply
DisChrg.	Discharge	SMR	Switched Mode Rectifiers
DSP	Digital Signal Processing	SOC	State of Charge
EB	Electrical Board	Std.	Standard
HES	Hall Effect Sensor	Temp.	Temperature
HVLV	High Voltage Low Voltage	USB	Universal Serial Bus
Hz	Hertz (unit of frequency)	VRLA	Valve-Regulated Lead-Acid

Introduction

The Manual helps the personnel understand system, and take advantage of its capability It includes the following information:

- + A brief description of the unit supplied, and all its components;
- + Operations, maintenance and repair rules, necessary for maintaining the correct operational condition of the unit;
- + Installation and commissioning procedures;
- + Information for locating and identifying all spares of the systems.

The power plant information is divided into following ten chapters as briefed:

Section 1 – Inpacking Instructions

This section contains instructions to unpack the power plant and the rectifiers.

Section 2 – Product Description

This section provides information about the power plant physical dimensions, functionality and its technical specifications. It briefs about its components and their significance in the system. It contains block diagram to explain the system internal interfaces and gives a schematic into system functionality.

Section 3 – Rectifier Introduction

This section describes key features and benefits of the switched mode rectifiers installed on the system. It tabulates its technical specifications and also gives a physical overview to its front and rear panel provisions and alarm indications.

Section 4 – Controller M2000

This section provides information about the M1000 technical capabilities and its functionality in the system. A physical overview to its front and rear panel provisions and alarm indications is also provided. An introduction to the M2000 menu system, through menu tree and parameter configuration tables is provided. Each parameter is briefed with its primary settings, default values and extended settings (if applicable).

Section 5 – Installation

This section contains stepwise procedures to install and commission the power plant.

Section 6 – Commissioning

This section contains stepwise procedures to install and commission the power plant.

Section 7 – Troubleshooting

This section contains basic user level troubleshooting procedures. The table details fault, its cause and corrective action required.

Section 8 – Preventive Maintenance

This section contains the scheduled maintenance procedures, which shall be periodically carried out on the system to maintain correct operation and the performance within specification limits.

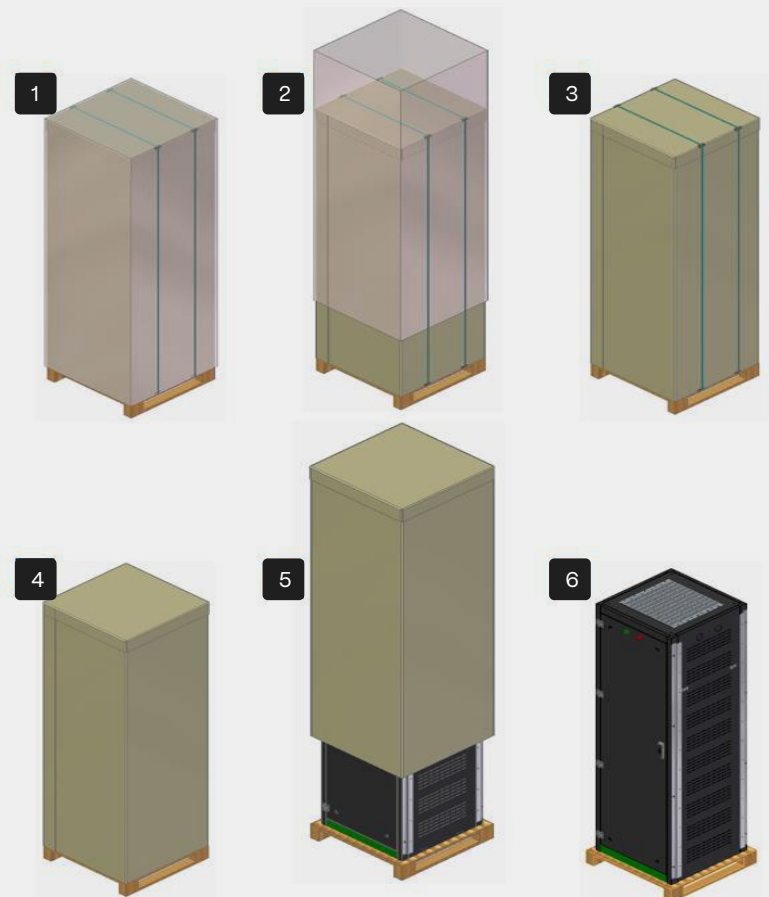
Unpacking Instructions

Upon delivery, examine the consignment for possible damage caused in transit. In case the packing material or the contents inside indicates rough handling, obtain pictures of the damaged area and report it to your Exicom representative.

Once the external review is completed carefully remove the protective packing cover and check the consignment content against the order list. Report any short shipment to your Exicom representative.

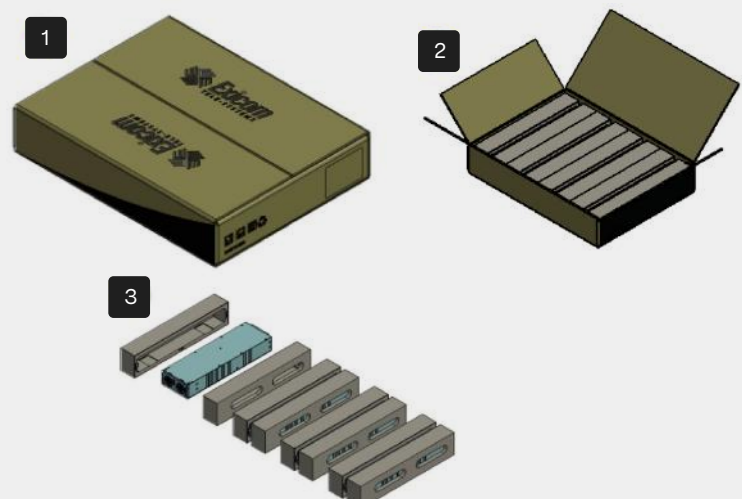
Power Plant Unpacking Procedure

- 1 Power Plant, as you receive.
- 2 Remove the shrink wrap.
- 3 Cut the nylon strap, using scissors.
- 4 Remove the nylon strap and the edge boards.
- 5 Remove the corrugate cover.
- 6 Remove the corner thermocol.
- 7 Remove all the four fasteners, to detach the power plant unit from palette.



Rectifier Unpacking Procedure

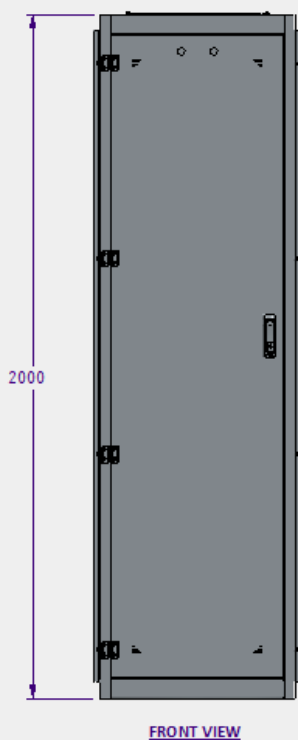
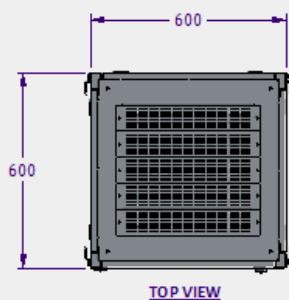
- 1 Packing of four rectifiers.
- 2 Open the corrugated box.
- 3 Carefully, take out each rectifier.



Product Description

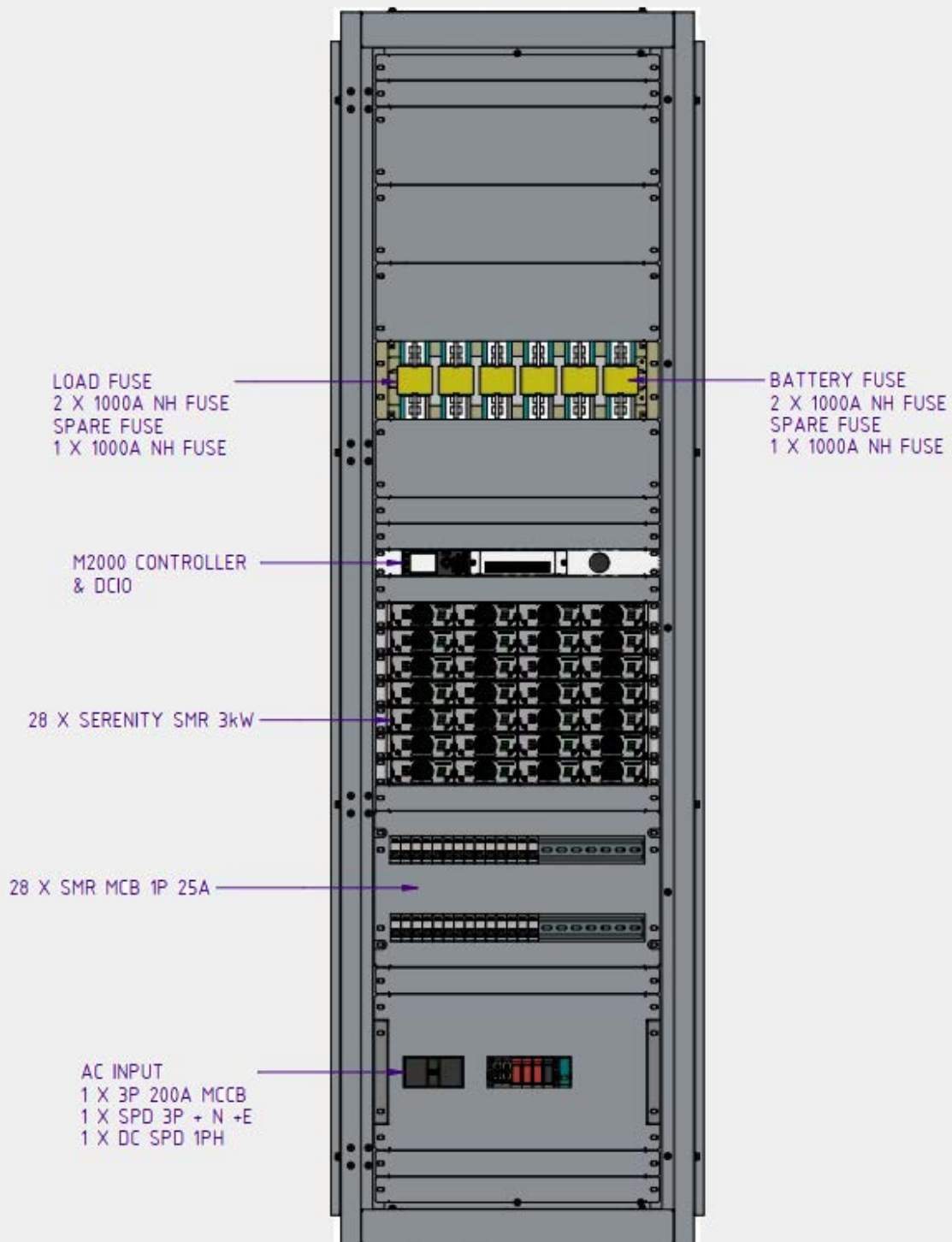
- + The cabinet frame is made of rust-proof, non-corrosive, fire-resistant, and chemical-resistant steel that is also painted with anti-static paint before coating.
- + The cabinet comes with shielded door to ensure safety operation, reduce the noise to the environment and provides anti-static protection.
- + Cable management within the cabinet is designed to be flexible so that top entry or bottom entry cables can be accessed.
- + All non-current metal parts are grounded through the ground position in the cabinet.
- + Busbar systems are made of copper that is coated with a special material to prevent it from rusting or corroding and is designed to be able to handle the maximum amount of electricity that the system can produce.

Dimensional Information



Power Plant Overall Dimensions

System Architecture



Front View without Front Door

Specifications

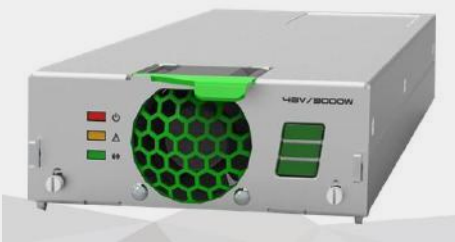
System Capacity	84,000W
AC input voltage Range	90–300VAC, System Main Input : 3 phase +N 380VAC – 400VAC (Output derating from 185 VAC)
Input Frequency	45Hz to 66Hz
Power Factor	>0.99 for more than 50% load
Output Voltage	42Vdc to 58Vdc
Max Output Current	1750A@–48VDC
Type of Rectifier	28 Slots x Serenity SMR 3kW
Surge Protection	SPD Class C Maximum operating voltage U_c 385V(L–N)/255V(N–PE). Protection structure for each input phase Operating temperature range: –40 degrees C to 85 degrees C Response time: $\leq 20\mu s$ Normal discharge current: 20kA(L–N;N–PE) Maximum discharge current: 40kA(L–N;N–PE) Temporary Overvoltage (TOV) Protection ability: 1430V/200ms(L–PE), 1200V/200ms(N–PE)
DC Distribution	Copper Bus-bars for Positive Copper Bus-bars riser for load distribution 2 x Load Fuse Range (500A–1000A) 1 x Load Fuse Range (500A–1000A) (Optional)
Controller	M2000
Battery Termination	2 x Range (500A – 1000A) Fuse 1 x Range (500A–1000A) (Optional)
Mechanical dimensions	2000mm(H)x600mm(W)x600mm(D)
Cable Entry/Service	Top/Bottom Entry
Mounting arrangement	Floor mount
Degree of Protection	IP–20
Potential Free Contacts	8 nos. configurable
Operating Temperature	–40°C to +75°C, Linear derating from 40°C onwards
Operating RH	0% to 95% Non–Condensing
Cooling /SMR Cooling	Natural cooling for System/ Forced cooling for rectifiers
Environmental	As per QM333, Cat–B
Peak efficiency	96%
Dynamic load regulation	<5% for 10% – 90% & 90% – 10% (load change over)
Line voltage regulation	<1%

Rectifier Serenity 3000W

Telecom operators and infrastructure companies look for reliable, high quality, high efficiency cost effective power solutions. Exicom is proud to introduce one of the first commercially available bridgeless, dynamically and digitally controlled ultra-high efficiency rectifiers, the Serenity 3.0kW.

Features & Benefits

Serenity SMR 3000W



High efficiency

Extensive use of DSP controls, managing a dynamically optimized topology that yields very high efficiency. Peak efficiency achieved is 96%.

Ultra-high power density

The single phase, hot pluggable fan cooled rectifier provides outstanding power density while its intelligent & advanced protection features allow users to deploy it in any kind of environment – urban / rural/ poor grid etc.

Active load sharing

The rectifier uses advanced digital active load sharing technology. The output current of each rectifier is $<\pm 5\%$ of the average current of all rectifiers from 10% to 100% load.

Hot Swappable

The rectifier is designed to be plug-and play. It can be inserted or removed from a live DC power system with no damage. When the rectifier is plugged into the system, the system output voltage will not be affected.

Paralleling

This rectifier may be connected in parallel with any other SERENITY 3000W rectifier. M1000/2000 can support up to 120 rectifiers.

Wide input voltage range Operational: 90V 300V; self-protection up to 400V; auto restart

Intermittent, HV grid conditions are a norm in the developing nations and even in the developed ones. Rugged, high reliability, robust protection is designed into all SERENITY products, to combat abnormal AC input.

Specifications

Rectifier Serenity 3000W

Input

Voltage: 90 – 300 VAC
Frequency: 45Hz–66Hz
Current: 18A
THD: < 5%
Power Factor: > 0.99 for more than 50% load
Protection: Internal fuse / MOV / GDT

DC Input

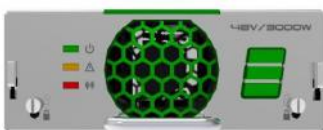
Voltage: 42 – 58V DC
Output Power: 3000 W above 185VAC, Derating below 185VAC
Max. Current: 62.5 A at 48V DC
Current Sharing: ± 5% of max. current above 10% Load
Static Voltage Regulation: 0.5% from 10% – 100% load
Ripple and Noise: <300mV peak to peak / GDT / 30MHz bandwidth / <2mV rms Psophometric
Output Protection: Overvoltage shutdown / Output Fuse Protection / Hot-plug Inrush Current limiting / Overload fold back / Over temp. shut-off / Short Circuit

Other Specifications

Operating Temp.: -10°C to +75°C linear de-rating from +45°C
Storage Temp.: -40°C to +85°C
Humidity: 5% to 95% RH non-condensing
Efficiency : Peak 96%
Acoustic Noise: <55dBA
MTBF: 320,000 hrs
Alarms: AC input abnormal / AC over-under voltage / Rectifier OK-Fail / Communication fail / Fan Fail / Temp. Shut-off / Output over-under voltage

Applicable Standards

Electrical Safety: EN 60950 / EN 300 019-2-1/2-2/2-3
EMC: EN 61000 – 6-1/6-2/6-3/6-4 / EN 61000 – 3 – 2
Environment: RoHS Compliance



LED Indications



OFF – AC Fail
ON – AC OK
Flash – SMR Comm. OK, Sleep Mode (Slow Flash)



OFF – Normal
ON – AC Low/High Cut-Off, I/P AC Derating, Temp. Derating, O/P Derating
Flash – SMR Comm. Fail



OFF – Normal
ON – High Temp. Shutdown, O/P Over /Under Volt, AC Low/High Cut Off
Flash – SMR Fan Fail

Controller (M2000)

The most advanced controller platform for managing DC systems in all types of telecom environments

Key Features



- + Powerful controller built on RTOS
- + 2.2" high resolution color display and easy to use navigation via joystick
- + Site automation and renewable hybrid support
- + Li-ion battery support and advanced battery management features
- + Ethernet for local or remote monitoring via secure web browser and optional modem
- + User configurable analog and Boolean logic alarms
- + User configurable performance logging, event logging and energy data logging
- + USB interface for configuration file update and log download
- + Multi language support (English/Additional language)
- + Hot pluggable and global compliance
- + Upload of software would not affect power system usage of T3

Applications

- + Telecom: Base station sites, LTE / WiMax, hub sites, renewable hybrid sites, and central offices
- + Smart Cities: Smart poles, surveillance etc.
- + Power utilities: Control & protection and communication equipment
- + Railways: Signaling, communication equipment and control & protection

Specifications

Controller (M2000)

Operating Voltage	38 – 60Vdc
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Power Consumption	4W (max)
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Dimensions (h x w x d)	43mm x 111mm x 130mm
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Operating Environment	-20°C to 65°C; humidity: 95%RH, non-condensing
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Compliances	EN 60950-1, IEC 60950-1, EN 61000-6-1/-2/-3/-4, Class B, RoHS and REACH
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Battery	<ul style="list-style-type: none">+ Float, boost and equalise charge modes, configurable battery temperature compensation, manual charge mode+ Low voltage disconnect and under voltage pre-warning+ Back up time and Soc monitoring+ Automatic battery health test, battery isolation for maintenance, symmetry supervision+ Li-ion battery support, settable charge profiles and communication with battery BMS
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System	<ul style="list-style-type: none">+ AC voltage measurement, grid power /phase failure detect+ Integrated support for renewable (solar) hybrid system+ Site automation control, DG control and monitoring+ Alarm grouping, alarm output mapping and alarm naming+ User configurable analog alarm engine and boolean logic alarms+ User profile configuration & password protection+ Application and configuration update locally or remotely, offline configuration tool+ Support for up to 5 battery and 4 Load LVDs
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Rectifiers	<ul style="list-style-type: none">+ Individual rectifier current, temperature and status monitoring+ Power limited walk in, configurable power control in case of controller communication loss+ Linear or cyclic rectifier sleep mode for system efficiency+ Active current sharing and system overload monitoring+ Support for up to 120 rectifiers
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Number of IO's supported	4
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Voltage sensing	Bus Voltage + 5 channels, $\pm 72V$
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Current sensing	3 channels, $\pm 50mV$
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Specifications

Controller (M2000)

Temperature sensing	2 channels, -20°C to 100°C
LVD control	3, NO/NC, 10A@60VDC
Digital inputs	8, optoisolated
Relay outputs	8, NO/NC, 1form C, 1A @48Vdc Up to 10,000 event logs, performance logs on SD card or internal memory based on user configurable parameters, 1,000 change logs, and energy & run hour logs for grid, battery and DG
System control bus	2 x CAN V2.0b for communication with rectifiers and system units
Serial bust	2 x RS 485, modbus RTU master & device modes
Modem interface	1x RS232, modem interface for remote monitoring over GPRS/GSM and SMS alarms
Display	2.2", 320x240 resolution, 65k colour TFT, w/ intensity control and power save mode, Joystick, multi-language support
Ethernet	10/100 Base T, MDI/ MDI-X, IP protocols: HTTP, HTTPS, SNMP V2c/V3, SNTP, FTP, IPV4, IPV6 (Static, Stateless & State full, DHCPv6)
USB	USS 2.0, Type A, USB Flash Drive support
Web Interface	HTML5, Java script based secure web interface, encrypted w/TLS
SNMP	SNMP V2c/V3, Get/ Get Bulk/ Set/ TRAPS, multiple user profiles
Email	Severity & time based alarm reporting along with system parameters
Modem	Alarm SMS for GSM and data monitoring over GPRS
Hardware	Configurable alarm group mapping to PFC
MTBF	350,952 Hours

Controller (M2000)

The Best in Class!

With combination of several feats and innovations, made for global requirements; Exicom Controller outperforms its peers in, functionality, flexibility, control and user interface.

 Innovation

 Intelligent

 Flexible

Key Features

- + Energy Management
- + Rectifier Management
- + Renewable Integration
- + DG Genset Control
- + System customization
- + For small & large system
- + Battery Charge Management
- + Battery Dis-charge Management
- + Advanced battery tests
- + Li-ion Battery Integration
- + Eco Energy Mode
- + Advanced Communication Options
- + Encrypted and Secured
- + Multi Language Support
- + TFT Display
- + Mobile App Support
- + System Logs
- + Remote Management
- + Over the air upgrades
- + Alarm Management
- + Smart Alarms
- + SMS/Email for Alarm Reporting
- + Unstable grid protection
- + Overvoltage protection
- + Overload protection
- + Temperature protection
- + Communication failure protection



Product Overview –System Controller

Applications

- + Telecom: Small Cell Sites / Cellular base stations / LTD / Wi-Max; Hub Sites & Central Office
- + Renewable or Hybrid Sites
- + Li-ion Battery Management
- + Smart Cities: Smart Poles & Surveillance
- + Power Utilites: Control & Protection equipment
- + Railways: Signalling, communication equipment, control protection

Salient Features

- + Backlit High resolution colour display and easy to use joystick navigation
- + 10/100 Mbps Ethernet for local or remote monitoring via web browser and NMS. Remote firmware upload
- + Ethernet interface supports webserver (http / https), IPv4, IPv6, TCP / UDP, DHCP client, SNMP agent (V2c&V3), Sntp and SMTP
- + Supports email and SNMP alarm reporting
- + Site infrastructure control and renewable hybrid system support
- + Li-ion battery support and advanced battery management & testing methods
- + User configuration performance logging, event logs and energy logs
- + Configurable alarm grouping, PFC mapping and alarms names
- + USB interface for configuration file update and log download

Communications

Digital

- + 2 x Isolated CAN 2.0b for system communications. Supports up to 120 SMR.
- + 2 x Isolated RS485 for peripheral devices / Modbus interface
- + RS232 for GSM / GPRS Modem for remote monitoring
- + 10/100 Mbps Ethernet MDI/MDX
- + USB Host 2.0

Analog

- + Up to 20 Voltage Channels – system bus, battery and external voltage monitoring
- + Up to 12 Current Channels – for battery, multiple load, external sources current monitoring
- + Up to 40 PFC Inputs & 40 Outputs
- + Basic Analog interface until supports 6 voltage, 3 current (shunt), 3 LVD and 8 PFCI/O. Four such interface units can be used together

M2000 Physical Overview

Controller (M2000)

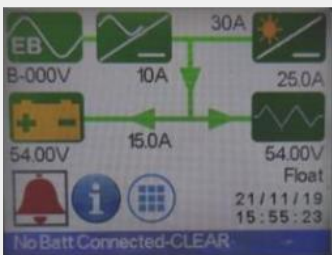
- 1 Power LED/normal conditions
- 2 Major Alarm
- 3 Info Alarm
- 4 Display Screen
- 5 Left Key / Scroll / Back
- 6 Right Key / Scroll
- 7 Up Key / Scroll / Parameter Value Change / Latch reset
- 8 Down Key / Scroll / Parameter Value Change
- 9 Enter Key
- 10 Ethernet Port
- 11 SUB Port



Front Panel Controls

Home Screen

The Home screen displays important system parameter values and system block status. Block nomenclature and colour relations are as given below



Color	Nomenclature
Green	Ok
Grey	Not Active
Red	Alarm

Item	Nomenclature
Green	AC Input
Grey	Rectifier
Red	Solar Input
Battery icon	Battery Bank
Current flow arrow	Current Flow
Bell icon	Alarms
Square icon	Selection Indicator
Info icon	System Status
Grid icon	Menu
Waveform icon	Load

Navigation Keys

M2000 provides a Joystick for navigation. For Navigation towards Right push the joystick rightwards, for Left push leftwards and similarly, for Up and Down directions. To select an option or Enter, press the joystick towards the center.

User can navigate through all enabled screen using the joystick. Joystick functions may change as per context. Important functions are given below

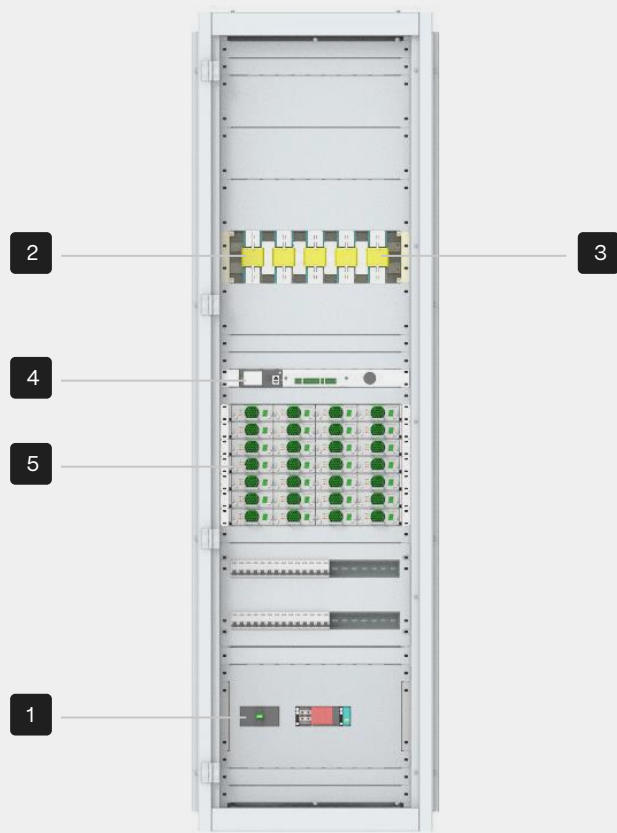
Item	Key Operation / Key Direction
To Select an Option (Yes/No)	Select using Left / Right and then Enter.
To Select a sub menu	Select using Up / Down and then Enter. On Main menu use Left / Right and then enter
Previous Menu Item	Left
Scroll through sub menus	Up / Down
Edit a parameter	Up /Down to change value, Enter to select current displayed value
Increase / decrease number of characters	When at last location of string, right press will add one-character location. when at last display location, left press will reduce string length.
Fast Scroll	Push and hold the joystick in the respective direction
Buzzer mute	When at Home screen, move joystick in any direction to turn off Buzzer (if sounding). On new event, Buzzer will again start to beep, unless Buzzer is permanently disabled under System settings.

Installation

Follow the instructions carefully, before starting installation of the power plant.



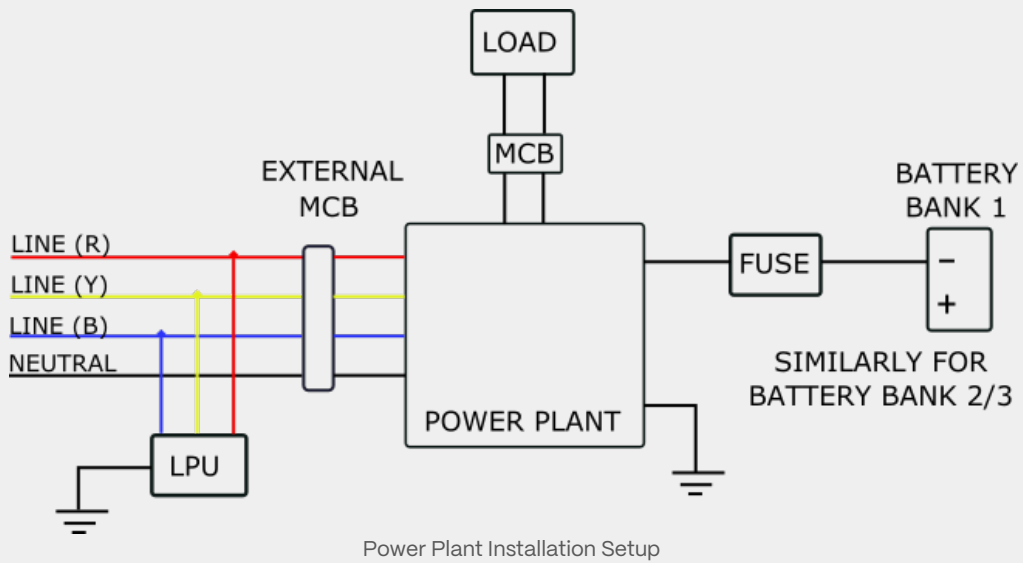
- + To be carried out by trained and authorized personnel only.
- + Ensure the mains are well within the range.
- + Ensure proper earthing connections.
- + Check voltage between neutral and earth. Ideally it should not be more than 5 volts in any case.



TYPICAL POWER PLANT – FRONT VIEW
WITHOUT FRONT DOOR

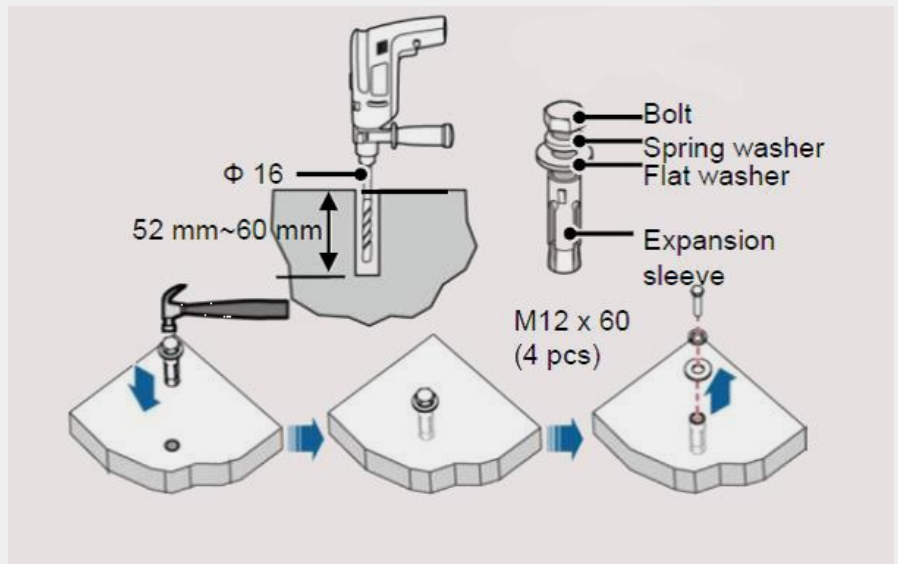
-
- 1** AC Distribution
 - 2** Load Fuse x 2 + Spare
 - 3** Battery Fuse x 2 + Spare
 - 4** M2000 Controller & DCIO
 - 5** 3kW Serenity Rectifier x 28

Power System Typical Wiring Diagram

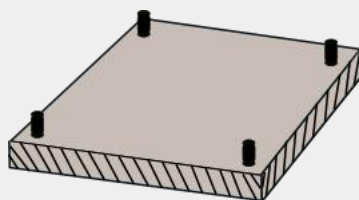


Unit installation should be done on a plane surface. Attach the unit using grouting fasteners.

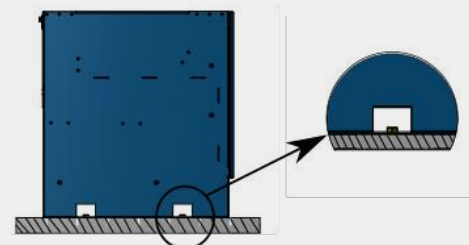
Step 1 Grouting Procedure



Step 2 Grouting Preparation



Step 3 Unit Grouting



Step 4 Temperature Sensor Connections

- + Access the battery temperature sensor cable (provided with the system) from the top panel and untie it.
- + Route the cable, through dust brush, to the battery bank or near it.

Step 5 AC INPUT Connections



Before AC input connections, ensure that the respective external MCB for each phase line are in "off position".



Route the AC Supply cables through the top panel dust brush. For AC input connections, 4 cores with each core $\geq 16\text{sqmm}$ to be used.

Step 6 Battery Connections



Before making battery connections, PULL OUT its respective fuse. Battery connection cable size depends upon the battery capacity and the load.

- + Connect negative terminal of battery 1 to the respective battery 1 bus bar.
- + And positive terminal to the common positive bus bar.
- + Similarly connect battery 2 and 3.

Step 7 Load Connections



Before load connections, ensure that the respective external mcb for each load is in "off position".

- + Connect negative cable of load to the load bus bar (-48V).
- + And positive terminal to the common positive bus bar.
- + Repeat above procedure for each load connections.

Step 8 Rectifier Installation



Rectifiers will not work in case of improper earthing. Gently press the rectifier in the magazine to ensure proper connectivity with the connector.



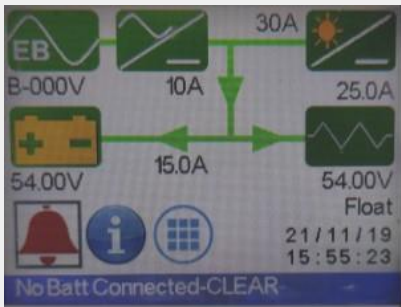
Commissioning

Follow the instructions carefully, for complete commissioning of the power plant.



Before Commissioning:

- + Make sure all the connections are tight and secure.
- + Visually inspect cables for proper crimping of terminals.
- + Make sure cable insulation is not damaged.



Step 1 Insert Battery Fuse

- + Insert the fuses for each battery bank.
- + M2000 will automatically turn ON
- + Check voltage for each battery in M2000.
- + Voltage should be 51.6V (approx.) for each battery. (Battery 1 voltage will be displayed on the Home Screen)
- + Compare the M2000 voltage readings with multimeter readings.



M2000 navigation chart for reading battery voltage:

Menu →System Status →Battery →Battery Voltage 1/2/3

Step 2 Battery Parameter Configuration in M2000

Configure Battery Capacity for each battery – Range 40AH-5000AH



M2000 navigation chart for battery parameter settings:

Menu →Settings →Battery Settings →General Settings →
Battery Capacity

Step 3 De-register all SMRs in M2000

De-register all SMRs in M2000.

De-register is done to erase any previous settings saved in the rectifier.



M2000 navigation chart for de-registering all SMRs: (Default Password: 1234)

Menu →Settings →Rectifier Settings →ID De-register →All Rectifier → Yes

Step 4 AC MAINS ON

Turn ON the respective external MCB for each phase line.

Step 5 Input AC voltage checks

Check voltages across following points using multimeter.

Points	Permissible Range
Neutral and Earth	<5V
Each Line and Neutral	90–300V
Load Bus bar and Positive Bus bar	48V

Step 6 Rectifier MCB ON

- + Sequentially turn On MCBs for each rectifier.
- + Wait 5 seconds (approx.) for each SMR to get registered.
- + Make sure Green LED for each rectifier is blinking. (This indicates successful communication with M2000).
- + In Normal condition when all SMRs are working, check voltage across Load Bus bar and Positive Bus bar, the voltage should be 48V (approx.).

Step 7 LOAD MCB ON

Turn ON the respective external MCB for each Load line.

BHMS (Battery Health Monitoring System) – Optional as per requirement

List of hardware/Software of BHMS Module

Software

Description	Version	Check Sum
BHMS	V.1.0	0xCA2A

Hardware – BMS Part No: HE517115

Part No.	Description	Qty	UOM
HE410101	Ribb.cbl.assy 25W-cntrl. Mod to BI mod.	1	EA
HE412341	Cable Assembly	1.000	EA
HE512940	MCM Module for BMS 3BA	1.000	EA
HE514942	Assy for battery interface unit	1.000	EA

Troubleshooting

Fault	Probable Cause	Corrective Action
MCM does not come ON.	DC interface cable to MCM not connected. Fuse blown in DC interface card	Connect cable properly. Change fuse.
MCM does not come ON when mains fail.	Fuse in the DC interface card or Power supply card is blown. Battery is not connected	Replace fuse. Connect battery.
Voltage or current display erratic	Cable from DC interface card to MCM not connected. Check DC interface card.	Insert connector properly. Check connections.
Temp. Comp fails alarm.	Probe not connected. Probe cable broken.	Connect probe. Check cable for damage.
AC abnormal alarm.	+ AC mains out of range + Rectifiers are switched off. + Rectifiers are not communicating with MCM.	Check mains voltages. Switch ON rectifiers. Check comm. cable between controller and rectifier.
Display not responding to commands/Switches.	MCM membrane switch malfunction.	Call service engineer.
Battery current limiting not working	Error in system configuration. MCM not reading battery current.	Check battery related entries. Check Hall effect sensor connection with DC interface card.
Rectifier not turning ON.	Input Voltage out of range Rectifier input MCB is OFF. Rectifier is faulty.	Switch ON rectifier input MCB.
Rectifier not taking load.	Rectifier may be sleep mode. Rectifier not fitted properly in its slot. Rectifier faulty.	Please release command of sleep mode from MCM. Drag the rectifier out & then re-insert. Replace the rectifier.

For System wiring diagram refer Section1.1

Preventive Maintenance

This system is conservatively designed. It is equipped with all advance digital circuits. This system will provide trouble free service with minimum maintenance. However, a regular periodic maintenance program should be followed. Table given below provides the schedule of maintenance procedure in detail.

Items	Inspection Period	Procedure
Ventilation and opening	Monthly	Check that intake and exhaust air openings are not obstructed.
Cabinet Assemblies	Monthly	Remove dust and foreign particles within the chassis using compressed air or blower. Check mounting bolts and terminals for looseness. Tighten them carefully.
Controls and indications	Six month	Check switches and controls for operability. Replace if any damage or malfunctioning is observed.
	Twelve months	Check the cable for Input & output power and internal wiring to components. Check for cracks or broken insulation. Replace as indicated. Inspect the general condition of PCBs. Check the components for evidence of overheating cracks or peeling. Repair or replace board if necessary. Tighten screw or nuts.
Internal components	Twelve months	Inspect PCB, connectors for loose electrical connects. Tighten the mounting screw and replace defective sockets, if any. Inspect electric wiring for broken solder connections, evidence of peeled insulation and general deterioration, repair or replace damaged wiring. It carries no serviceable part hence no part should be tampered on site

Safety Precautions

Strange as it may seem, most fatal electrical shocks happen to people who should know better. Here are some electro medical facts that should make you think twice before taking chances.

Currents between 100 and 200 mill amperes (0.1 ampere and 0.2 ampere) are fatal. Anything in the neighborhood of 10 mill amperes (0.01) is capable of producing painful to severe shock. Take a look at table:

Readings

Safe current values

1 mA or less

1 mA to 8 mA

Effects

Causes no sensation – not felt.

Sensation of shock, not painful; Individual can let go at will since muscular control is not lost.

Unsafe current values

8 mA to 15 mA

15 mA to 20 mA

50 mA to 100 mA

100 mA to 200

mA200 mA and over

Painful shock; individual can let go at will since muscular control is not lost.

Painful shock; control of adjacent muscles lost; victim cannot let go.

Ventricular fibrillation – a heart condition that can result in death – is possible.

Ventricular fibrillation occurs.

Severe burns, severe muscular contractions – so severe that chest muscles clamp the heart and stop it for the duration of the shock. (This prevents ventricular fibrillation).

Prevention is the best medicine for electrical shock. Respect all voltages, have knowledge of the principles of electricity, and follow safe work procedures. Do not take chances.

These are the following first-aid steps upon acquiring electrical burns:

- + Burned skin should be soaked in cold water for about 10 minutes.
- + Wash the affected area with soapy water and gently tap it with clean towel.
- + A clean bandage should cover the burned skin, which should be cleansed every now and then. Be sure to replace the bandage with a new one regularly. If your doctor prescribed treatment then apply the medicine as desired.
- + If the burned part is your leg or arm, be sure to position it in a raised position within the first 24 hours to minimize the swelling.
- + Over-the-counter medications like acetaminophen, ibuprofen, or aspirin are helpful as pain relievers.
- + Treat yourself with water therapy.
- + Be sure to protect the burned area of the skin, as you may all know, it can be very sensitive to touch