Leading AC Backup Technology

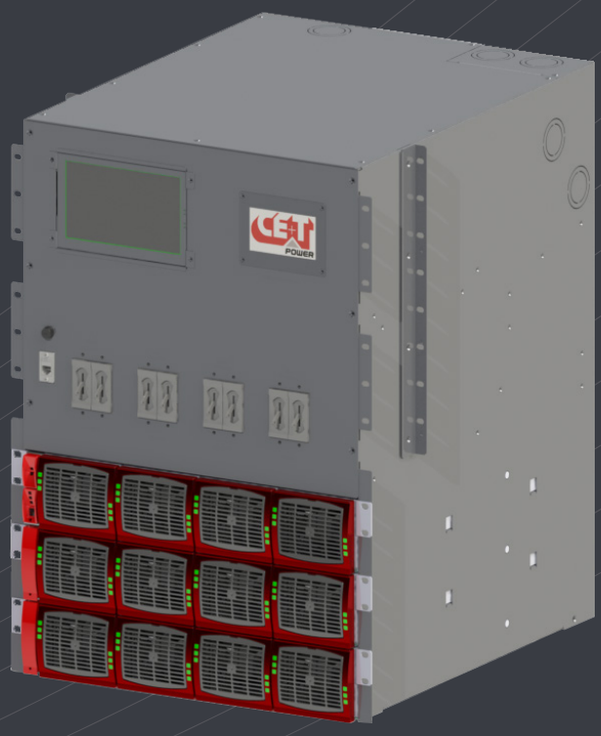
TSI REDUNDANT BRAVO SYSTEM (RBS)-120 VAC

User Manual V7.0

BEYOND THE INVERTER

THE NEW GENERATION OF POWER CONVERTERS

- DUAL INPUT INVERTER
  The Commercial Power as default source
- AC BACKUP IN A DC ENVIRONMENT
  Leverage your existing DC infrastructure
- ONE STOP SHOP
  Wide output power range
- HARSHEST AC INPUT CONDITIONS
  Without compromising the quality of the AC output



Important Safety Instructions
Save these Instructions

Address: CE+T S.a, Rue du Charbonnage 12, B 4020 Wandre, Belgium
www.cet-power.com - info@cet-power.com

www.cet-power.com

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Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
7.0	16/03/2016	-	First release of the Manual.

1. CE+T at a glance

CE+T Power designs, manufactures and markets a range of products for industrial operators with mission critical applications, who are not satisfied with existing AC backup systems performances, and related maintenance costs.

Our product is an innovative AC backup solution that unlike most used UPS's

- Maximizes the operator's applications uptime;
- Operates with lowest OPEX;
- Provides best protection to disturbances;
- Optimizes footprint.

Our systems are:

- Modular
- Truly redundant
- Highly efficient
- Maintenance free
- Battery friendly

CE+T puts 60+ years expertise in power conversion together with worldwide presence to provide customized solutions and extended service 24/7 - 365

2. Abbreviations

TSI	Twin Sine Innovation
EPC	Enhanced Power Conversion
REG	Regular
DSP	Digital Signal Processor
AC	Alternating current
DC	Direct current
ESD	Electro Static Discharge
MET	Main Earth Terminal
MBP	Manual By-pass
TCP/IP	Transmission Control Protocol/Internet Protocol
USB	Universal Serial Bus
PE	Protective Earth (also called Main Protective Conductor)
N	Neutral
PCB	Printed Circuit Board
TRS	True Redundant Structure
MCB	Miniature Circuit Breaker
MCCB	Molded Case Circuit Breaker
CB	Circuit Breaker

3. Safety Instructions*

Important safety instructions and save these instructions.

3.1 Disclaimer

- The manufacturer declines all responsibilities if equipment is not installed, used or operated according to instructions herein by skilled technician according to local regulations.
- Warranty does not apply if the product is not installed, used and handled according to the instructions in the manuals.

3.2 Technical care

- This electric equipment can only be repaired or maintained by “qualified employee” with adequate training. Even the personnel who are in charge of simple repair or maintenance are required to have the knowledge or experience in relation to electrical maintenance.
- Please follow the procedures contained in this Manual, and note all the “DANGER”, “WARNING” AND “NOTICE” marks contained in this manual. Warning labels must not be removed.
- Qualified employees should have the knowledge to know how to recognize and avoid any dangers that might be present when working on or near exposed electrical parts.
- Qualified employees should know how to lock out and tag out machines, so the machines will not accidentally be turned on and hurt the employees that are working on them.
- Qualified employees also should know safety related work practices, including those by OSHA and NFPA, as well as knowing what personal protective equipment should be worn.
- All operators are to be trained to perform the emergency shut-down procedure.
- This product is intended to be installed only in a restricted access area as defined by UL 60950 and in accordance with the National Electrical Code ANSI/NFPA 70, or equivalent local agencies.
- Maximum operating ambient temperature is 50°C (122°F).
- This unit is intended for installation in a temperature-regulated, indoor area that is relatively free of conductive contaminants.
- Never wear metallic objects such as rings, watches, bracelets during installation, service or maintenance of the product.
- This product is suitable for use in a computer room.
- CAUTION – Risk of electric shock. Capacitors store hazardous energy. Do not remove cover until 5 minutes after disconnecting all sources of supply.
- CAUTION – Risk of electric shock. This Inverter / UPS receives power from more than one source. Disconnection of the AC source and DC source is required to de-energize this unit before servicing.
- CAUTION - For continued protection against risk of fire, replace only with same type and rating of fuse.
- Insulated tools must be used at all times when working with live systems.
- When handling the system/units pay attention to sharp edges.

* These instructions are valid for most CE+T Products/Systems. Some points might however not be valid for the product described in this manual

3.3 Installation

- Inverter System may contain output over current protection in the form of circuit breakers. In addition to these circuit breakers, the user must observe the recommended UL listed upstream and downstream circuit breaker requirements as defined in this manual.
- UL listed (DIVQ) branch overcurrent protections have to be provided by others / by customer.
- Please use extreme caution when accessing circuits that may be at hazardous voltages or energy levels.
- The modular inverter rack is a dual input power supply. The complete system shall be wired in a way that both input and output leads can be made powerless.
- When AC Mains is not connected, the output AC circuit is considered as a separately-derived source. If local codes require grounding of this circuit, use the identified terminal for bonding this circuit to the enclosure. Ground the enclosure to a suitable grounding electrode in accordance with local code requirements.
  Ground the enclosure to the electrode terminal (see section 8.4.2, page 24).
- Remove output neutral-to-ground jumper when input AC MAINS is connected (see section 8.4.3, page 25).
- Use 90°C copper wires / conductors only.
- AC and DC circuits shall be terminated with no voltage / power applied.
- The safety standard IEC/EN62040-1-1 requires that, in case of output short circuit, the inverter must disconnect in maximum 5 seconds. Parameter can be adjusted on T2S; however, if the parameter is set at a value >5 seconds, an external protection must be provided in order that the short circuit protection operates within 5 seconds. Default setting is 60s.

3.3.1 Handling

- The cabinet shall not be lifted using lifting eyes.
- Remove weight from the cabinet by unplugging the inverters. Mark inverters clearly with shelf and position for correct rebuild. This is especially important in dual or three phase configurations.
- Empty inverter positions must not be left open. Replace with module or cover.

3.3.2 Surge and transients

The mains (AC) supply of the modular inverter system shall be fitted with suitable Lightning surge suppression and Transient voltage surge suppression for the application at hand. Manufacturer's recommendations of installation shall be adhered. It is advisory to select device with alarm relay for function failure.

Indoor sites are considered to have a working lightning surge suppression device in service.

- Indoor sites Min Class II.
- Outdoor sites Min Class I + Class II or combined Class I+II.

3.3.3 Other

- Isolation test (Hi-Pot) must not be performed without instructions from the manufacturer.

3.4 Maintenance

- The modular inverter system/rack can reach hazardous leakage currents. Earthing must be carried out prior energizing the system. Earthing shall be made according to local regulations.
- Prior to any work conducted to a system/unit make sure that AC input voltage and DC input voltage are disconnected.
- Prior to accessing the system or modules, make sure all source of supply is disconnected.
  CAUTION – Risk of electric shock. Capacitors store hazardous energy. Do not remove cover until 5 minutes after disconnecting all sources of supply.
- Some components and terminals carry high voltage during operation. Contact may result in fatal injury.

3.5 Replacement and Dismantling

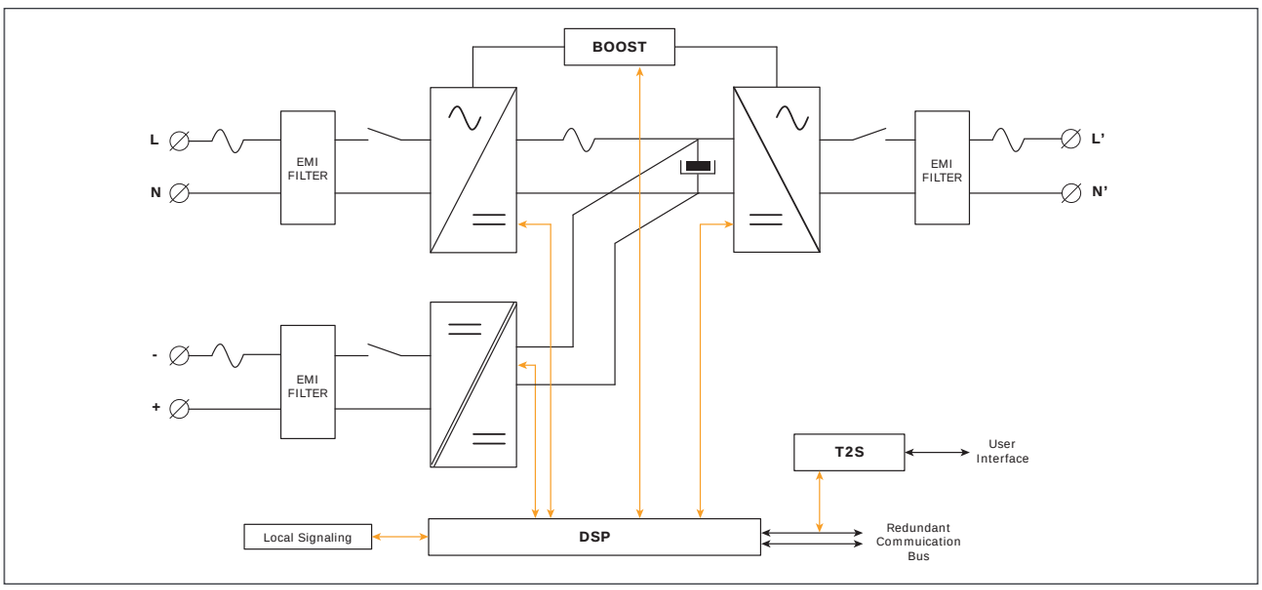
- ESD Strap must be worn when handling PCB's and open units.
- CE+T cannot be held responsible for disposal of the Inverter system and therefore the customer must segregate and dispose the materials which are potentially harmful to the environment, in accordance with the local regulations in force in the country of installation.
- If the equipment is dismantled, to dispose of the products it consists of, you must stick to the local regulations in force in the country of destination and in any case avoid causing any kind of pollution.

To download the latest documentation and software, please visit our website at www.cet-power.com.

4. TSI TECHNOLOGY [1]

Inverter modules carrying the TSI logo and the EPC mark are triple port converters (AC in, DC in, AC out). Sinusoidal output is converted from Mains or/and DC.

The block diagram here below gives an explicit description of the topology and operation.



The module is built around the following sub-converters

- AC to DC at input
- DC to DC at input
- DC to AC at output

The energy can flow either from the AC source or the DC source under the control of the local DSP controller. Thanks to internal energy buffering, the output sine wave is constant and disturbance free regardless of the active source.

The BOOST functionality multiplies the nominal current for a period of 20ms (max) in the event of down stream current surge. The upstream breakers do not have to be oversized to prevent tripping. After the boost has been activated or if the AC input is not present the overload capacity is 150% for 15 seconds regardless of the source currently used.

The TSI works according to True Redundant Structure (TRS) that features decentralized and independent logic, redundant communication bus and three internal levels of disconnection to isolate a module after internal failure.

The functionality is included in every inverter module. Running them in parallel provides a modular system with, no single point of failure, always conditioned output, high system efficiency and 0ms source transfer time.

1 Information and data given in this chapter is intended to serve as an overview of the TSI Technology. Detailed features and parameters for each individual module type of the range may differ and should be referred in the dedicated data sheet.

4.1 EPC Mode

- Mains input (AC) is the primary source whilst DC works as backup.
- The TSI is designed to operate on Mains on permanent basis and to deliver output voltage conditioned with low THD.
- There is no physical difference on the output sine wave whether the source is AC (or) DC. If the Mains is out of tolerance or drops, the converter seamlessly switches to DC and the converter operates in “Back-up mode” (Switching time back and forth is 0ms).
- As soon as the Mains returns to its valid range, the EPC mode is automatically resumed.
- The EPC mode offers higher efficiency (up to 96% depending on the model) without compromising the purity of the output sine wave.

4.2 On-line Mode

- DC is the primary source of supply whilst Mains (AC) works as the secondary source of supply. Switching time between DC input and AC input is 0ms (source transfer).
- The power delivered by the DC source (usually a battery , but it could be any other type of DC generator) is converted to provide regulated and transient free power to the load.
- In case of short circuit at the load side, the boost is automatically, timely and energized for a specific duration to trip downstream protective devices.

4.3 Safe Mode

- Safe mode uses DC as primary source of supply while Mains (AC) is in standby.
- Mains (AC) is normally disconnected through internal inlet relay and is only connected when down stream clearance is required (boost) or if DC is unavailable.
- The transfer between DC and AC results in typical transfer time of 10ms.
- Typically the safe mode is used in extremely harshed environments such as railways. Under such conditions it provides extra isolation against disturbances carried by the Mains.

4.4 Mix Mode & Walk-in Mode

- Under some circumstances DC and AC source can be combined. The sequence is defined by a user selectable set of parameters. Start, control and exit functions are fully automatic.
- A specific example of Mix-mode is the Walk-in mode where the transfer from DC source to AC source is ramped up within a fix and adjustable period of time.
- Setting for Walk-in mode and Mix-mode can be made through the T2S supervisor configuration file.
See Section 10, page 37 for more information on T2S supervisor.

Note: REG modules

Inverter modules carrying the TSI logo together with REG mark are modules working only with DC input. Sinusoidal output is converted from DC and the module operates as a traditional inverter. EPC mode and the boost are not available with REG modules.

5. Building Blocks

5.1 Inverter module

Bravo: 110 VDC / 120 VAC, 60Hz.

- The TSI Bravo is a 2500VA/2000W triple port inverter.
- The TSI inverter modules are hot swappable and hot pluggable.
- The module operator interface is LEDs showing converter status and output power
- Fan is equipped with alarm and run time meter. The fan is field replaceable.
- 17.13” (D) x 4.02” (W) x 3.46” (H)
- 11 lbs (5 Kg).

6. Accessories

6.1 T2S Interface

The T2S is an interface giving access to the TSI modules that are connected together in any TSI systems.

The T2S doesn't perform any control or management of the TSI system. It can be removed, replaced or moved to another live system without affecting neither the original TSI system operation nor the target system.

6.1.1 Parameters setting

The T2S interface is featured with a USB connector at the front. Connected to a laptop, it enables TSI system settings, modules and phase assignments, and other various adjustments to allow TSI best fit with actual site conditions.
(Operation of T2S is described in separate manual available on request).

6.1.2 System diagnostic and troubleshooting

The T2S is featured with built-in user interface to allow on-line diagnostic through laptop.

Installers and maintenance technicians should always carry proper laptop to access/reconfigure the system on site.

6.1.3 On-the-fly monitoring

The T2S monitors max of 32 inverter modules.

The T2S is featured with

- 3 outgoing alarms contacts.
- 2 digital inputs.
- MOD bus.
- CAN bus (optional).
- Alarm monitoring.
- Record the latest 200 events. FIFO

Note: Operation of T2S is described in seperate manual available on request.

6.2 Catena

Catena GUI Interface is a powerful web based touch screen graphical display, it allows user to easily access and monitor the system.

In addition to the touch screen display, user can also access to same GUI by using an Ethernet port which is present on the catena.

- Measures
  - AC In
  - DC In
  - AC Out
- Alarms
  - Major/Minor
  - System Level
  - Phase Information
  - Module Information
- 7” touchscreen
- Web browser with laptop (ETH)
- Height: 3U

6.3 Candis

The Candis is an optional interface allowing the user to get system running information on display. The definition settings available on Candis are voltages, currents, frequency, inverter configured, and so on.

(Use a tip pen or a soft edge stick to push on buttons 2 , 3 or 4)

1 Display (2 lines provided to display information).

2 Up button to scroll UP in the menus.

3 Down button to scroll DOWN in the menus.

4 Enter button to change display or validate modifications.

6.4 Surge Arresters

The mains (AC) supply of the modular inverter system shall be fitted with suitable Lightning surge suppression and Transient voltage surge suppression for the application at hand. Manufacturer's recommendations of installation shall be adhered. It is advisory to select a device with an alarm relay for function failure.

Surge arrester(optional) is installed in the cabinet. (NOTE: Option not yet available)

Indoor sites are considered to have a working lightning surge suppression device in service.

- Indoor sites Min Class II.
- Outdoor sites Min Class I + Class II or combined Class I+II.

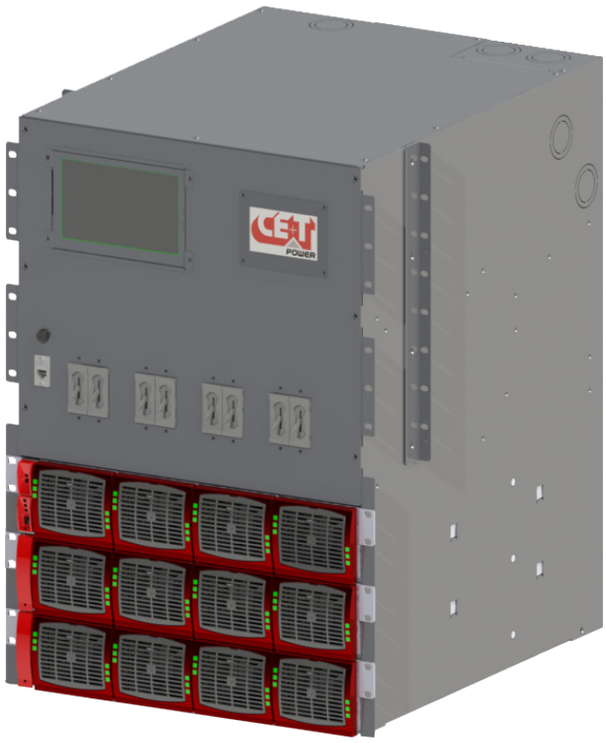
7. RBS Design and Description

7.1 System Design

RBS is a cabinetized modular inverter specifically designed for clean and temperature controlled environments.

- Industrial grade design.
- For airflow, provisions are provided at **Rear**.
- Based on Bravo 110VDC/120VAC TSI module.
- Fully modular.
- Support redundant configurations.
- Support EPC mode.
- Cabinet NEMA 1 (IP 20).
- 664.25 mm (H) X 482.30 mm (W) X 567.50 mm (D).

Please refer to the technical drawings receive with your cabinet for exact positioning!



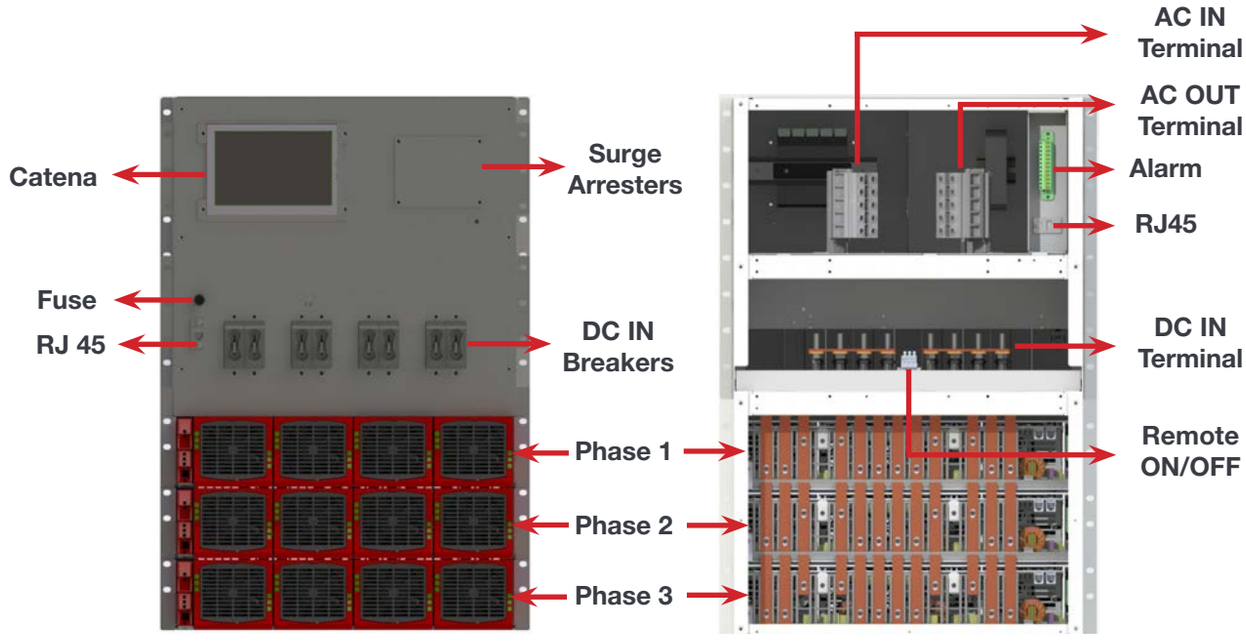
7.2 System Description

RBS comes fully equipped with

- DC individual branch protection is provided for each three modules connected vertically (UL 489A).
- T2S interface shall be 2C version (High Voltage) with USB/ETH.
- Surge Arresters.
- AC Input/ AC Output on Bulk Terminals.
- Alarms and Remote ON/OFF Terminals.

Options

- Catena.
- Candis.



7.3 RBS Single Phase Configuration

A single phase system is 120VAC from L to N. Input and output are the same, made upon 2 wires + (PE) Ground.

System Designation	Max Power (kVA)	Max power (KW)	Max number of Modules
RBS-1-10-XX-04-1DC	10	8	4
RBS-1-10-XX-04-2DC	10	8	4
RBS-1-10-XX-04-4DC	10	8	4

* This configuration doesn't use all available slots.

** Up to 2 modules can be allocated to redundancy.

System Designation	Single DC*** input		Tightening Torque (lbs/in)
	Fuse or Breaker	Cable Min	
RBS-1-10-XX-04-1DC	1x100 A	4 x 10 AWG	52 - 104
RBS-1-10-XX-04-2DC	2x50 A	2 x 10 AWG	52 - 104
RBS-1-10-XX-04-4DC	4x25 A	1 x 10 AWG	52 - 104

*** Refer Section 8.4.4, page 27

System Designation	AC Input		AC Output		Tightening Torque (lbs/in)
	Branch Protection		Branch Protection		
	Breaker	Cable Min	Breaker	Cable Min	
RBS-1-10-XX-04-1DC	100 A	1 x 1AWG	100 A	1 x 1AWG	24.9-26.7
RBS-1-10-XX-04-2DC	100 A	1 x 1AWG	100 A	1 x 1AWG	24.9-26.7
RBS-1-10-XX-04-4DC	100 A	1 x1AWG	100 A	1 x 1AWG	24.9-26.7

7.4 RBS Split Phase Configuration

A split phase system* is 120VAC from L to N and 240VAC from L1 to L2 are phase shifted by 180 degree (upon request, it can also be 208VAC. L1, L2 are phase shifted by 120 degree). Input and output are made upon 3 wires + (PE) Ground, cabling and phase shift must match.

System Designation	Max Power (kVA)	Max power (KW)	Max number of Modules
RBS-2-20-XX-08-1DC	20	16	8**
RBS-2-20-XX-08-2DC	20	16	8**
RBS-2-20-XX-08-4DC	20	16	8**

* Also known as “Single Phase 240VAC” (including UL). Number of wires is always meaningful to distinguish from other single phase.

** Number of modules must be even, with same number in each phase in order to comply with UL recommendations.

**** Up to 2 x 2 modules can be allocated to redundancy.

System Designation	DC***** Input		Tightening Torque (lb.in)
	Fuse or Breaker	Cable Min	
RBS-2-20-XX-08-1DC	1 x 200 A	4 x 4 AWG	52 - 104
RBS-2-20-XX-08-2DC	2 x 100 A	2 x 4 AWG	52 - 104
RBS-2-20-XX-08-4DC	4 x 50 A	1 x 4 AWG	52 - 104

***** Refer Section 8.4.4, page 27

System Designation	AC Input		AC Output		Tightening Torque (lb.in)
	Branch Protection		Branch Protection		
	Breaker	Cable Min	Breaker	Cable Min	
RBS-2-20-XX-08-1DC	100 A	1 x 1 AWG	100 A	1 x 1 AWG	24.9-26.7
RBS-2-20-XX-08-2DC	100 A	1 x 1 AWG	100 A	1 x 1 AWG	24.9-26.7
RBS-2-20-XX-08-4DC	100 A	1 x 1 AWG	100 A	1 x 1 AWG	24.9-26.7

7.5 RBS Three Phase Configuration

A Three phase system is 120VAC from L to N and 208 VAC from L1 to L2, L1 to L3, L2 to L3.

Input and output are made upon 4 wires + (PE) Ground, “Y” or “Star” connection.

All phases are phase shifted by 120 degree one to the other.

System Designation	Max Power (kVA)	Max power (KW)	Max number of Modules
RBS-3-30-XX-12-1DC	30	24	12 *
RBS-3-30-XX-12-2DC	30	24	12 *
RBS-3-30-XX-12-4DC	30	24	12 *

* Number of modules must be multiple of 3, with same number in each phase in order to comply with UL recommendations.

System Designation	DC** Input		Tightening Torque (lbs/in)
	Fuse or Breaker	Cable Min	
RBS-3-30-XX-12-1DC	1x300 A	4x2 AWG	52 - 104
RBS-3-30-XX-12-2DC	2x150 A	2x2 AWG	52 - 104
RBS-3-30-XX-12-4DC	4x80 A	1x2 AWG	52 - 104

** : Refer Section 8.4.4, page 27

System Designation	AC Input		AC Output		Tightening Torque (lb.in)
	Branch Protection		Branch Protection		
	Breaker	Cable Min	Breaker	Cable Min	
RBS-3-30-XX-12-1DC	100 A	1 x 1 AWG	100 A	1 x 1 AWG	24.9-26.7
RBS-3-30-XX-12-2DC	100 A	1 x 1 AWG	100 A	1 x 1 AWG	24.9-26.7
RBS-3-30-XX-12-4DC	100 A	1 x 1 AWG	100 A	1 x 1 AWG	24.9-26.7

Note:

Sometimes three phase systems with 2 legs instead of three can be requested. They can be called 1P/6 KVA or 2P/12 KVA. Effectively they are based upon same hardware than split phase (see 7.4, page 19) with 3 wires (L1-L2-N). Since phases are shifted by 120 degree the L1 - L2 output voltage is 208VAC.

Three phase configuration can be connected to 240VAC L-L(138VAC L-N) sources. Refer to supplier for specific recommendations and approval.

7.6 RBS Module based Current Ratings

Number of Modules	Rated AC Input/Output Current per Phase (Amps)	Rated DC Input Current (Amps)
120 Vac - Single Phase - 2 Wires + PE		
1	20.83	20.20
2	41.65	40.40
3	62.48	60.60
4	83.30	80.80
120/240 Vac - Single Phase - 3 Wires + PE		
2	20.83	40.40
4	41.65	80.80
6	62.48	121.20
8	83.30	161.60
120/208 Vac - Single Phase - 4 Wires + PE		
3	20.83	60.60
6	41.65	120.20
9	62.48	181.80
12	83.30	242.40
Upstream / downstream protections and field wiring should be based on the maximum number of modules		

8. System Installation

8.1 Site Preparation

- Refer to section 7 to identify type of system and configurations.
- Input and output protections

When installing RBS inverter systems, UL489 listed AC upstream (input) and downstream (output) circuit breakers are required.

Output distribution should be structured to guarantee tripping segregation. Contact manufacturer for recommendations and calculation methodology.

- Refer to Section 9, page 31 for sizing protections and connecting cables. All cable should be copper wire and must be rated for min 90°C (194°F).
- Wire all positions for future expansion.
- Input AC / Output AC / Input DC / Signal cables shall be separated.
- Cable crossings shall be done in 90 deg angles.
- Empty inverter positions shall be covered with blanks.
- System cooling - Air inlets at the front of the system must be in cold side. Air outlets are at the top and rear of the system.
- RBS is designed for temperature controlled (maximum operating ambient 50°C/122°F) and clean environments. Presence of airborne particles such as urban dust, sand and metallic dusts are forbidden. Appropriate filters shall be installed.

Warning:

Filters mounted to the air inlets reduce the air pressure and may cause inverters cut off by thermal runaway. De-ratings should apply. Refer to supplier for specific recommendations and approvals.

Corrosive chemicals and contaminants in the air or in the vicinity of the system are forbidden. Refer to supplier for specific treatments in industrial and maritime areas.

8.2 Unpacking the system

Modules are packed separately. They are normally marked to be replaced in the right slot (important for multi phase systems).

Module packing material should be taken apart and stored in case of return under warranty. Unproper packing may void the warranty.

The cabinet is packed in a wooden box.

The packing material of the TSI system is recyclable.

Transport the cabinet in the box on the pallet.

8.3 Fixing the System to Cabinet

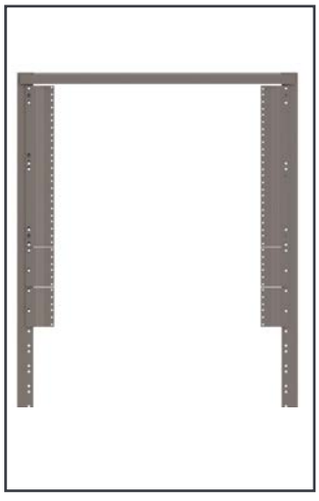
CE+T offer adapter plates to mount the RBS into the 23 inch open relay racks. These can be ordered by contacting CE+T.

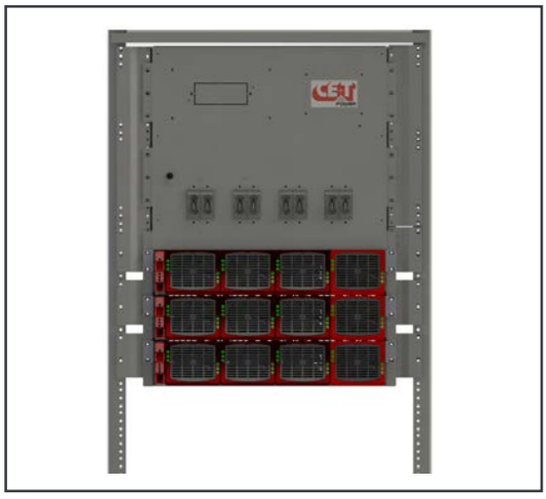
All RBS system is designed for 19 inch mounting applications, but it can be mounted in 23 inch, two post, open relay rack/network frame assemblies if required in application.

Installing the system in 19 inch ETSI cabinet, it is mandatory to use bottom support or slider.

Note: Mounting adapters defined herein are not intended for use in 4 post relay rack.

Fix the Brackets, Bottom Support / Slider to the rack using the screws which is supplied along with the kit and then fix the system in the rack as shown in the following figure.





8.4 Cabling

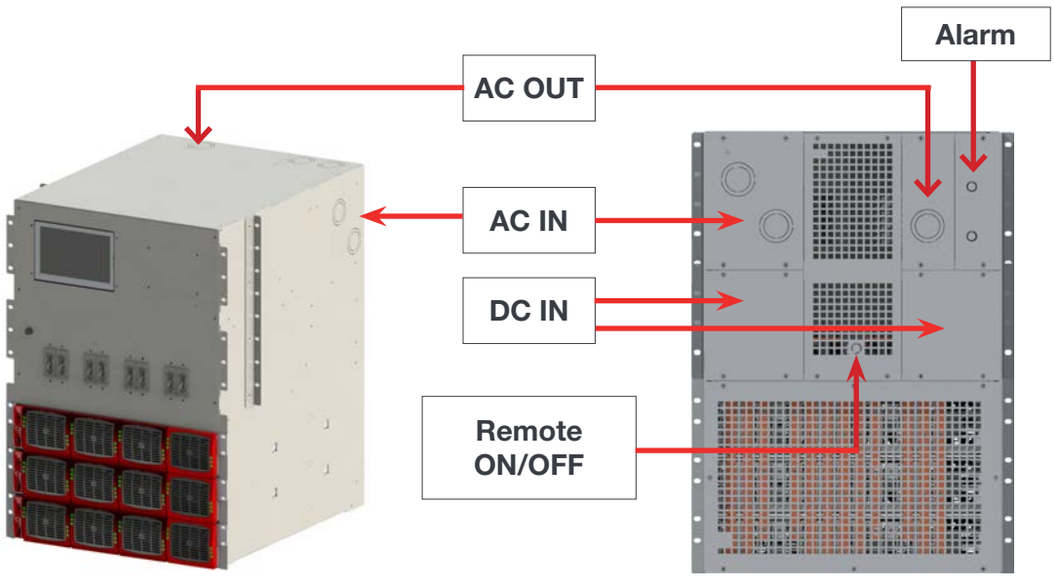
Check section 7 to identify system configuration and refer to section 7.3, page 18,7.4, page 19, and 7.5, page 20 for cable sizes. Refer also to 8.1, page 22 for important safety notices.

8.4.1 Cable Inlets

Use appropriate collar to fix the conduits to the cabinet ceiling. Use existing punch out to not block the airflow through the top of the cabinet. The ceiling can be split to facilitate the cabling.

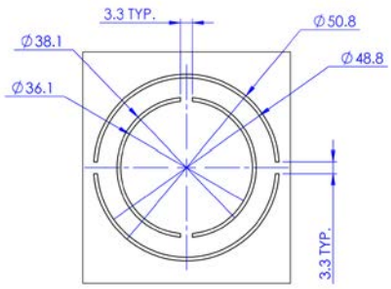
Knockout conduits for AC IN and OUT are same in dimension. Knockout conduits for Alarm and Remote ON/OFF are same in dimension.

For DC connection, the holes can be created depending on the cable size at allotted area in the cabinet as shown in the following figure and use appropriate bushes.

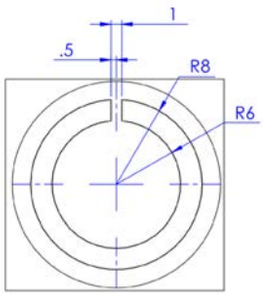


ISO View

Rear View



Dimensions - mm



AC IN/OUT Knockouts

Alarm, Remote ON/OFF Knockouts

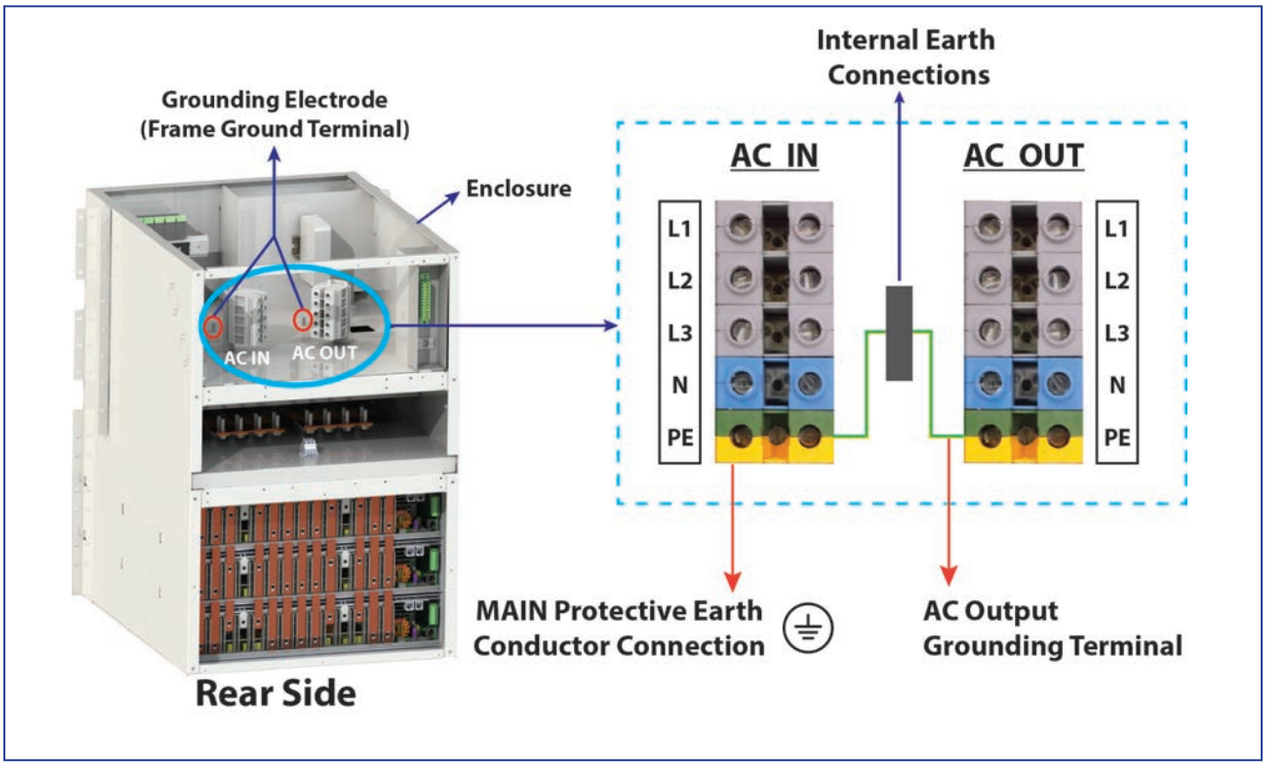
8.4.2 Grounding

Main protective conductor(PE) connection is made to the X2(AC IN) terminal block marked with symbol for identification.

PE must be terminated even if commercial Mains is not available and shall be connected to building or main panel ground. Recommended Cable cross section is the size equal(min) to Neutral cable cross section. Adhere to local regulations.
(see 8.4.3, page 25)

Ground has to be connected in accordance with local code.

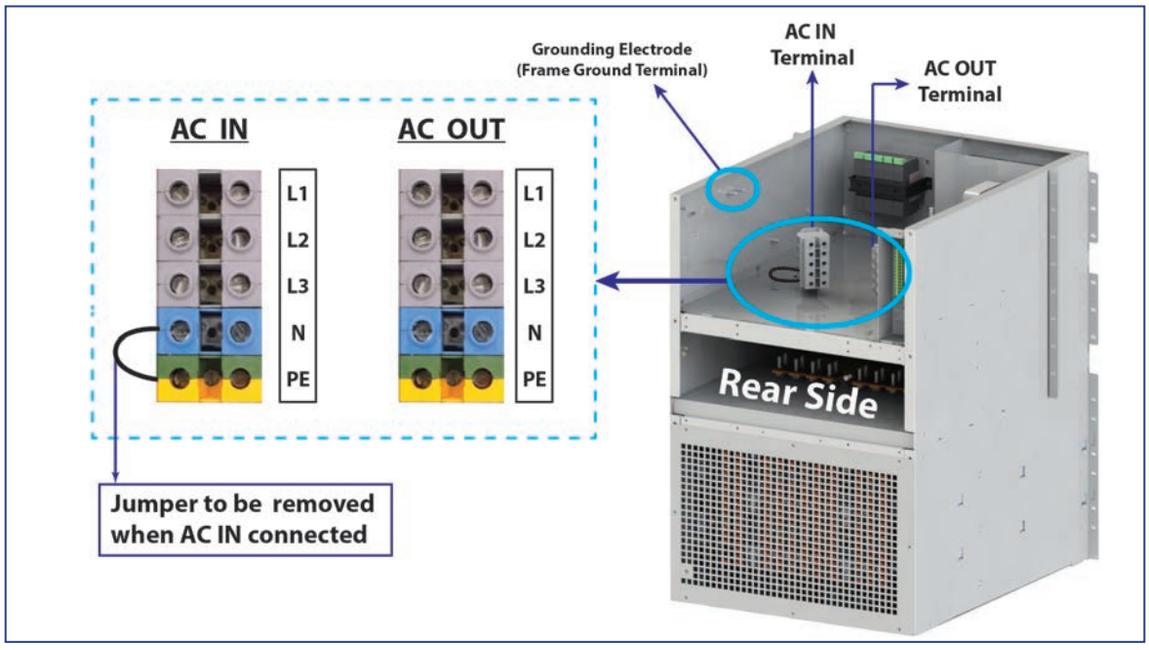
Both PE (Protective Earth) is connected to Earthing Stud. It is factory wired and shall not be removed.



8.4.3 AC Input and Output

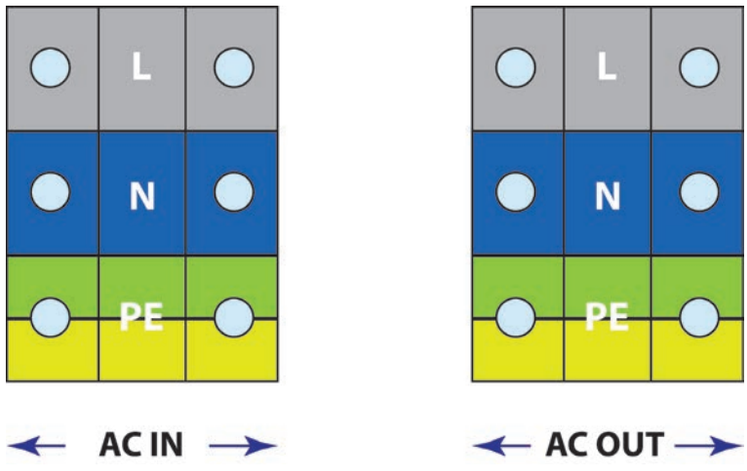
The pictorial representation of terminal blocks arrangement is as follows.

If AC IN is connected, remove the bonding neutral jumper cable between AC IN Neutral and PE terminal.

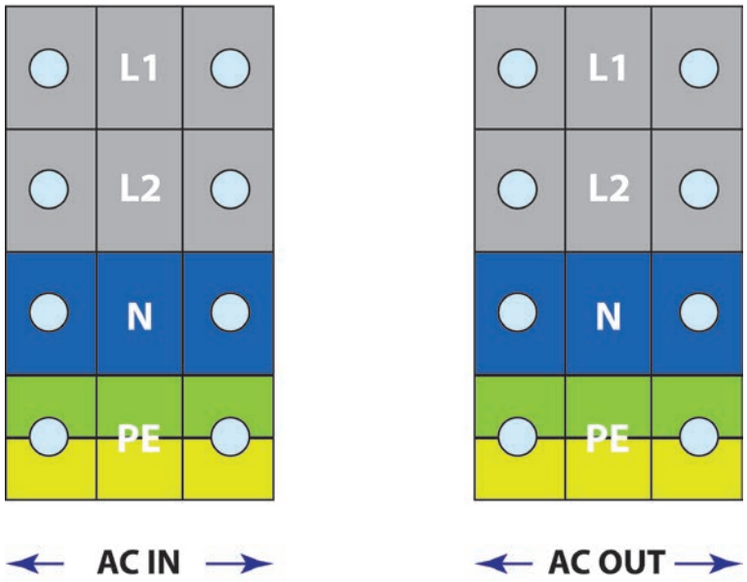


AC input and AC output should be wired to connecting terminal blocks as per following indications:

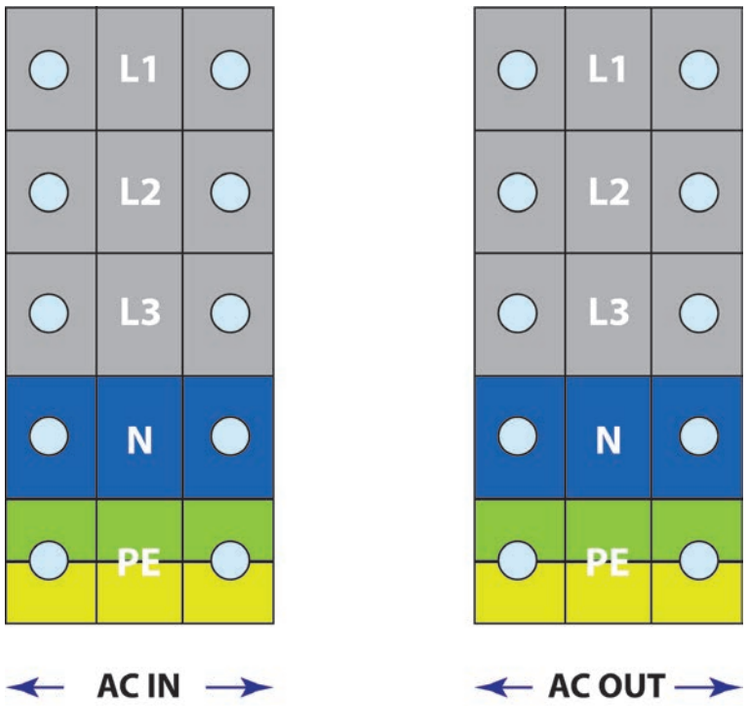
8.4.3.1 Single Phase



8.4.3.2 Split Phase



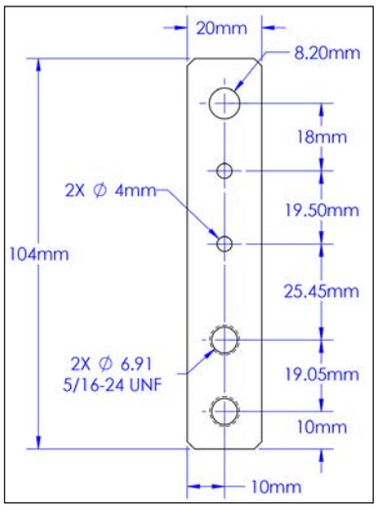
8.4.3.3 Three Phase



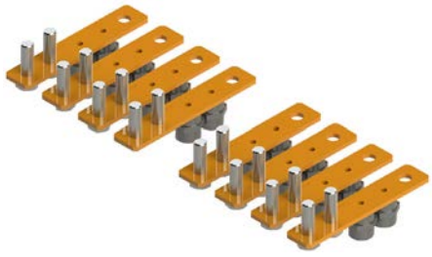
8.4.4 DC Input

8.4.4.1 Individual Feed DC Input

- It is mandatory to use only C-UL-US or CSA listed Cable Lugs.
- Individual DC connection.
- Note: Cable shoes are not included in the delivery.
- 2 hole 5⁄16” holes with ¾” (19.05 mm) between centre.
- The positive field wiring terminal shall be grounded on the rectifier.
- Internal DC distribution with circuit breakers to each shelf.
- Max of 4x1 AWG and double lug.

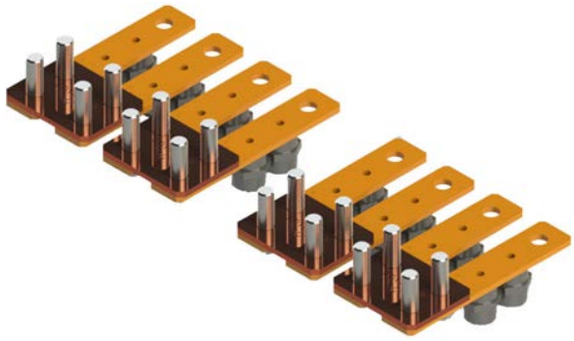


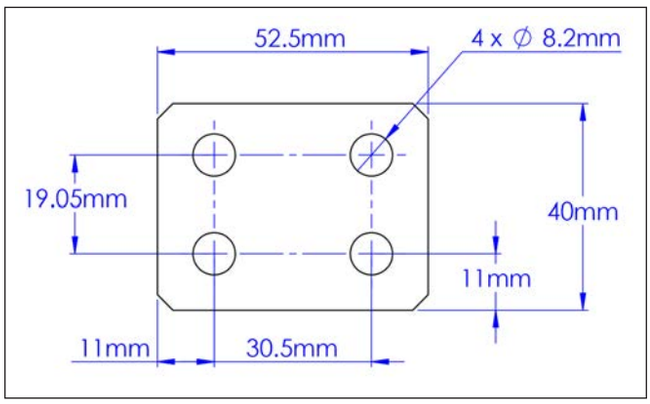
Note: Default configuration of the system is Individual Feed DC.



8.4.4.2 Dual Feed DC Input

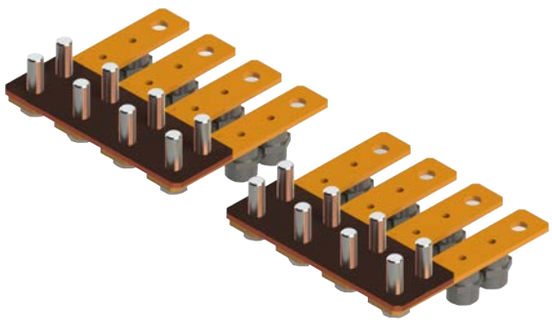
- It is mandatory to use only C-UL-US or CSA listed Cable Lugs.
- Dual DC connection.
- Note: Cable shoes are not included in the delivery.
- 2 hole 5⁄16” holes with ¾” (19.05 mm) between centre.
- Internal DC distribution with circuit breakers to each shelf.
- Max of 2x1 AWG and double lug.

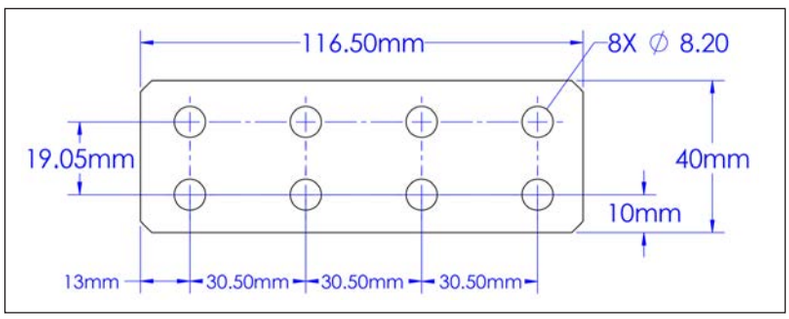




8.4.4.3 Common Feed DC Input

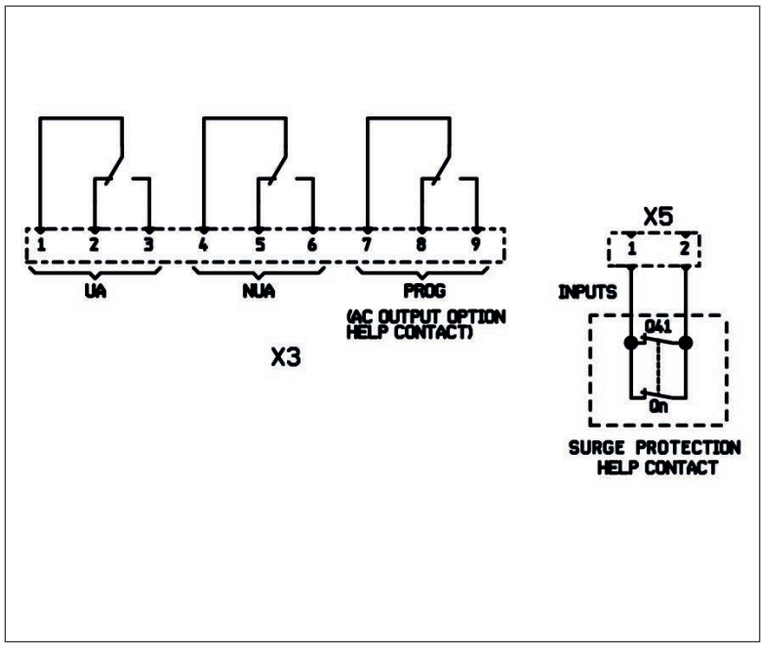
- It is mandatory to use only C-UL-US or CSA listed Cable Lugs.
- One (1) common DC connection.
- Note: Cable shoes are not included in the delivery.
- 2 hole 5⁄16” holes with ¾” (19.05 mm) between centre.
- Internal DC distribution with circuit breakers to each shelf.
- Max of 4x1 AWG and double lug.

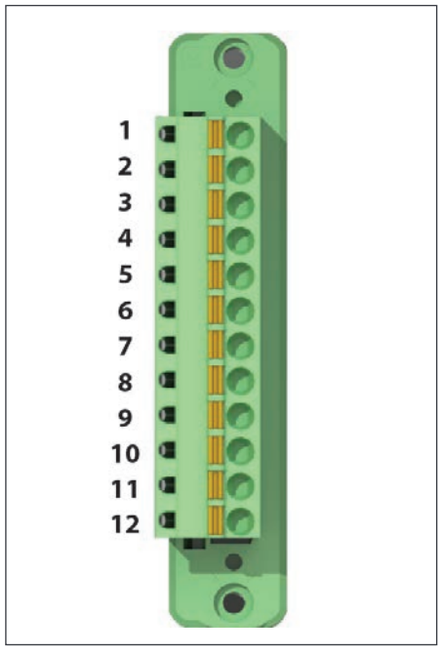




8.4.5 Signalling Connection and Purpose

All relays are shown in non energized state.





8.4.5.1 Alarm (X3)

- Relay characteristics X3 (Major (UA), Minor(NUA), Prog)

  - Switching power 60W
  - Rating 2A at 30VDC / 1A at 60VDC
  - Max wire size 17 AWG (1mm^2)

Relays are energized when idle and contacts are released when event occurs.

8.4.5.2 Digital In (X5)

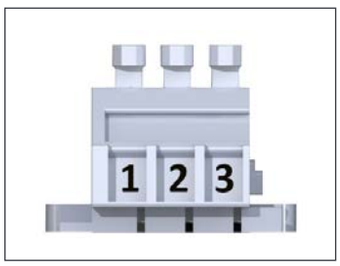
- Input characteristics X5 (Digital In 1, Digital In 2)

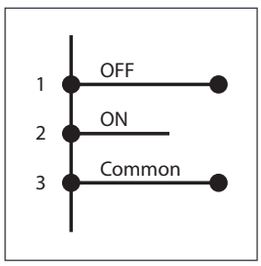
  - Signal voltage +5VDC (galvanically insulated)
  - Max wire size 17 AWG (1mm^2)

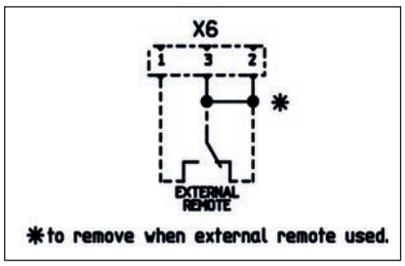
8.4.5.3 Remote ON/OFF (X6)

Note: The system is by default equipped with a connection between pin 3 and 2. If remote ON/OFF is not used the strap shall remain. Should the remote ON/OFF be used the strap must be replaced with a changeover contact or emergency button.

- The remote ON/OFF switch the AC output OFF.
- Input AC and input DC is not affected by the remote ON/OFF.
- The remote ON/OFF requires changeover contacts, one input opens as the other close.
  If both transitions are not picked up the status is not changed.
- Digital input characteristics (Remote On/Off)
  - Signal voltage +5VDC (galvanically insulated)
  - Max wire size 17 AWG (1mm^2)





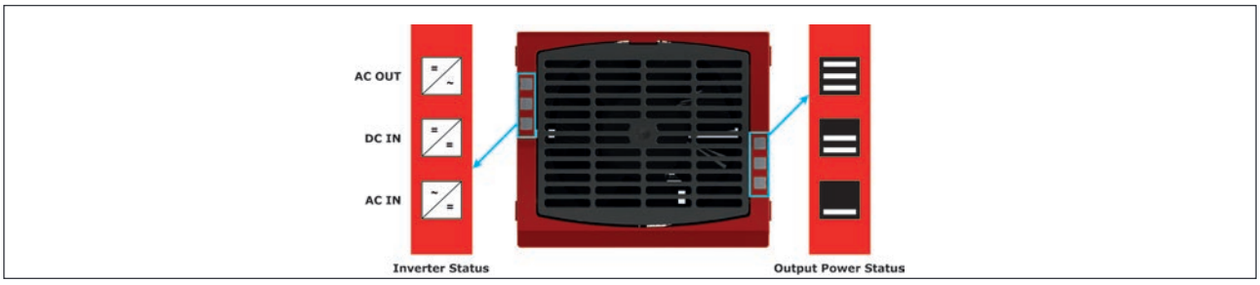


Functional table for remote ON/OFF function

#	Pin 1-3	Pin 2-3	Status	Indication
1	Open	Open	Normal operation	All (Green)
2	Closed	Open	OFF	AC output (OFF) AC Input (Green) DC Input (Green)
3	Open	Closed	Normal operation	All (Green)
4	Closed	Closed	Normal operation	All (Green)

9. Human-Machine Interface

9.1 Inverter module

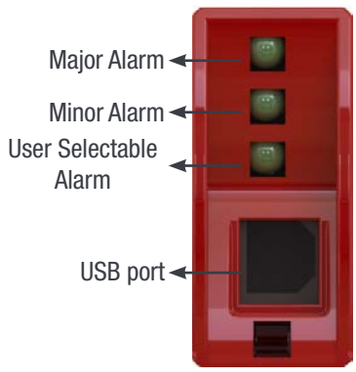


Inverter Status LED	Description	Remedial action
OFF	No input power or forced stop	Check environment
Permanent green	Operation	
Blinking green	Converter OK but working conditions are not fulfilled to operate properly	
Blinking green/orange alternatively	Recovery mode after boost (10 In short circuit condition)	
Permanent orange	Starting mode	
Blinking orange	Modules cannot start	Check T2S
Blinking red	Recoverable fault	
Permanent red	Non recoverable fault	Send module back for repair

Output Power (redundancy not counted)						
<5%	5% to 40%	40 to 70%	80 to 95%	100%	100% = overload	Output Power (redundancy not counted)
×	×	×	≡	≡	≡	Status output power LED
×	×	=	=	=	=	
—	—	—	×	—	—	
1B	1P	2P	2P	3P	3B	Behaviour (B = blinking – P permanent)

9.2 T2S

- Alarm indication on T2S (Urgent / Non Urgent / Configurable)
  - Green: No alarm
  - Red: Alarm
  - Flashing Exchanging information with inverters (only Configurable alarm)
- Outgoing alarm relay delay
  - Urgent 60 seconds delay
  - Non urgent 30 second delay
- Parameter setting via USB connection to Latptop.
- Factory default according to list of set values.



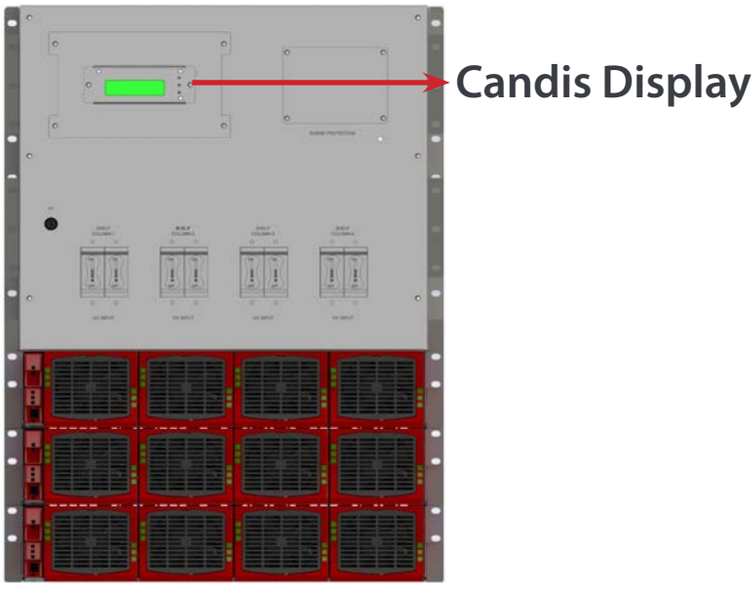
9.3 Candis Interface

The Candis is an optional interface allowing the user to get system running information on display. The definition settings available on Candis are voltages, currents, frequency, inverter configured, and so on.

The single display shows all parameters for the three phase system.

Canbus ID, phase, and group information have to be changed manually.

For detailed local monitoring with Candis, refer to Candis user manual.

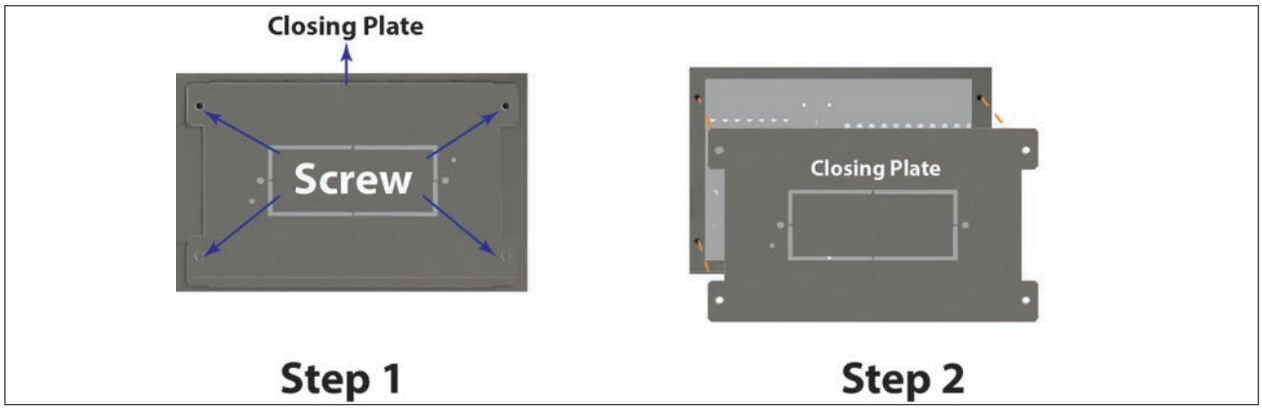


9.3.1 Installing Candis Display

Candis display can be installed into the system as per the following steps, if Candis display did not come along with system.

Step 1: Unscrew all the four screws of the closing plate.

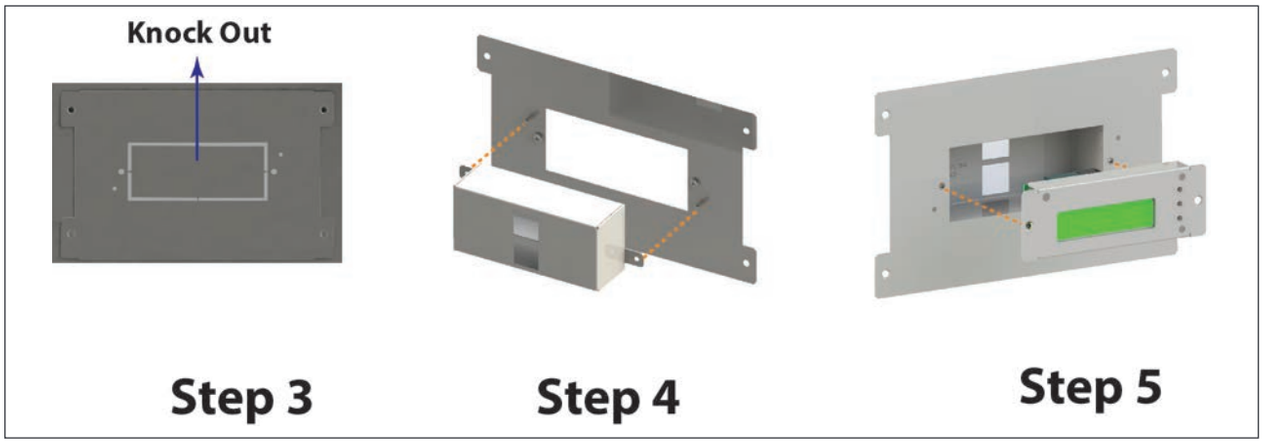
Step 2: Remove the closing plate.



Step 3: Remove the knock out.

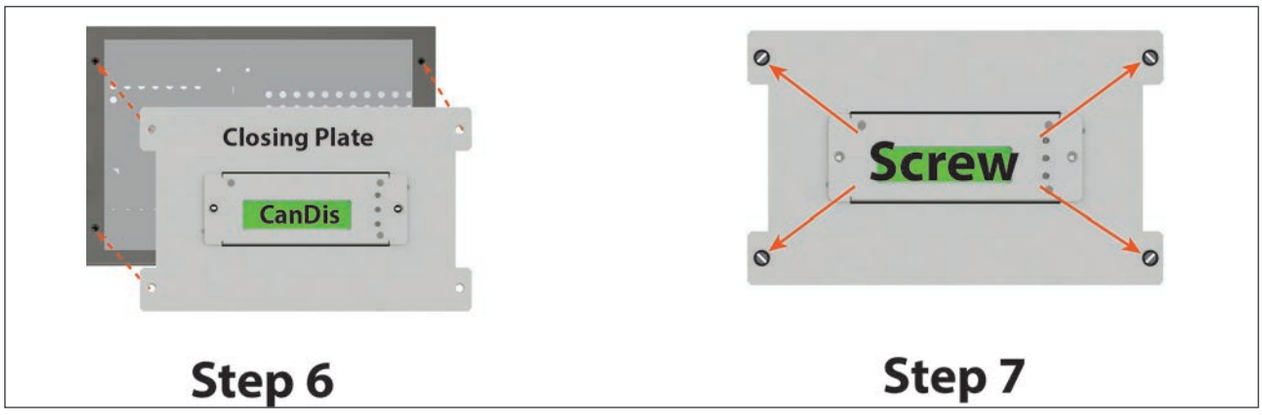
Step 4: Place the Candis protection cover at rear side of the closing plate.

Step 5: Place the Candis display at front side of the closing plate and tight the both screws.



Step 6: Connect the appropriate RJ45 cable to the Candis display from the system and place the closing plate into the slot.

Step 7: Tight all the four screws on the closing plate.



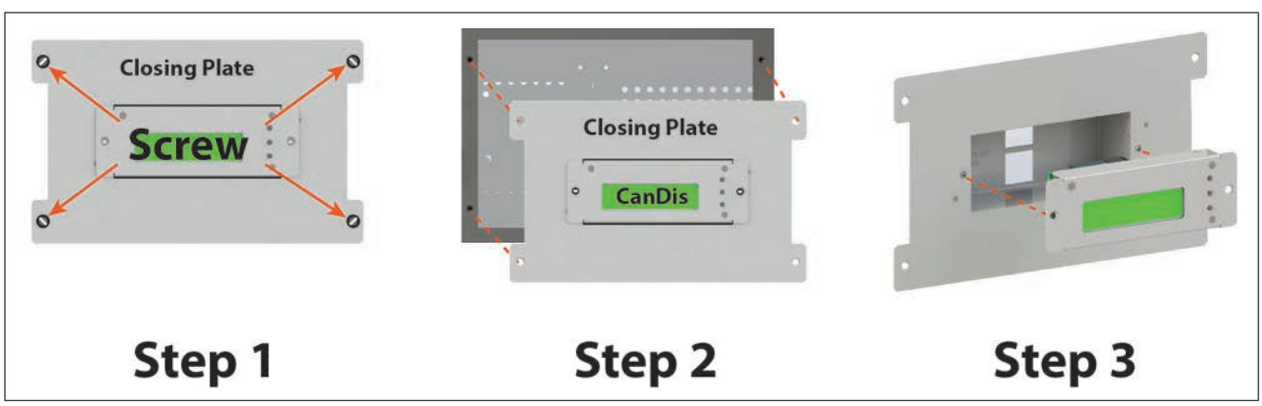
9.3.2 Replacing Candis Display

Candis Display can be replaced into the system as per the following steps.

Step 1: Unscrew all the four screws on the closing plate.

Step 2: Disconnect the RJ45 cables in the Candis Display and remove the closing plate from the system.

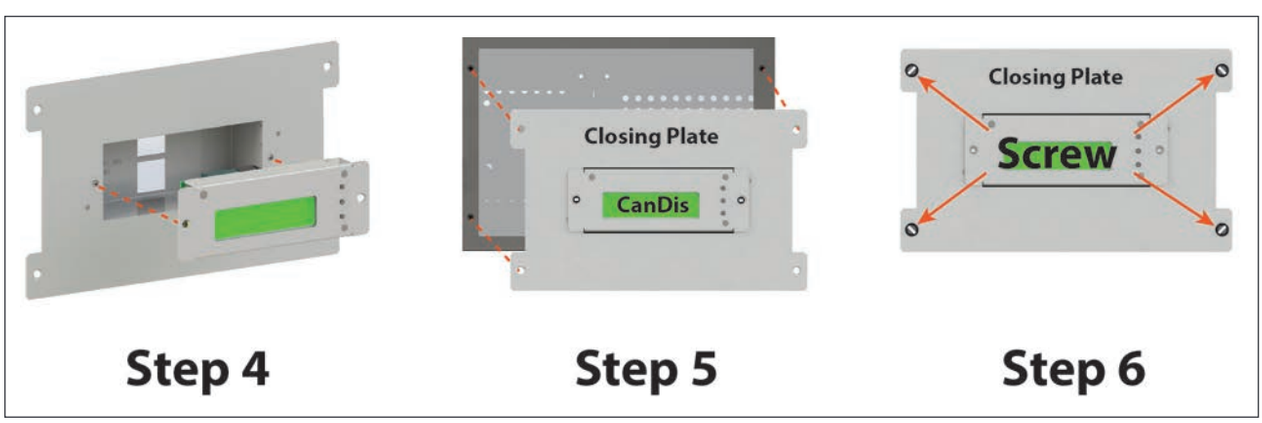
Step 3: Unscrew the both screws on the Candis Display and remove it from the closing plate.



Step 4: Place the new Candis display on the closing plate and tight the both screws.

Step 5: Connect RJ45 cable to the new Candis Display from the system and place closing plate into the slot.

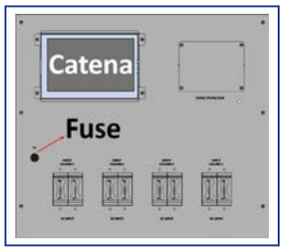
Step 6: Tight all the four screws on the closing plate.



Note: If Candis display is not present in the system, Candis display slot have to be covered using Closing Plate.

Warning - Risk of electric shock. Do not install or replace Candis display, while system in running condition. Make sure that AC input voltage and DC input voltage are disconnected.

9.4 Catena GUI Interface



Catena GUI Interface is a powerful web based touch screen graphical display, it allows user to easily access and monitor the system.

In addition to the touch screen display, user can also access to same GUI by using an Ethernet port which is present on the catena.

Catena takes power from shelve one. DC supply to shelf one is necessary to power on the Catena.

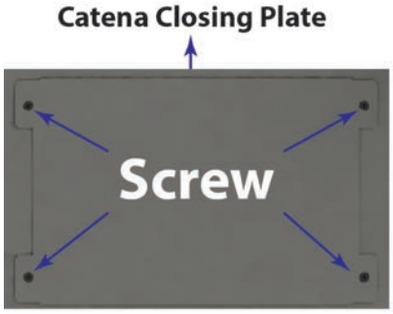
The Catena GUI Interface is protected with Fast Acting Fuse, which is present at front left side of the Catena. In case of fuse failure, replace with same type and rating of fuse.

9.4.1 Installing Catena GUI Interface

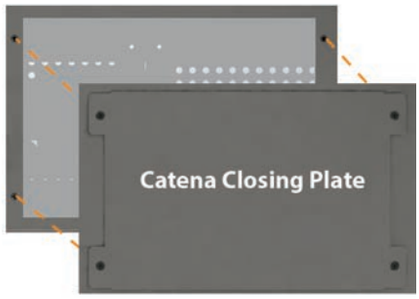
Catena GUI Interface can be installed into the system as per the following steps, if Catena GUI interface did not come along with system.

Step 1: Unscrew all the four screws of the catena closing plate.

Step 2: Remove the Catena closing plate.



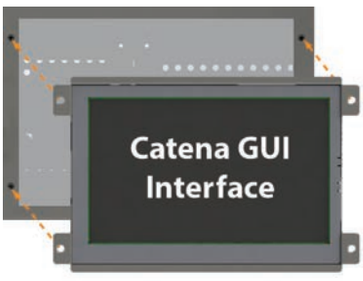
Step 1



Step 2

Step 3: Connect appropriate cable to the Catena GUI Interface from the system and place it into the slot.

Step 4: Screw all the four screws on the Catena GUI Interface.



Step 3

Step 4

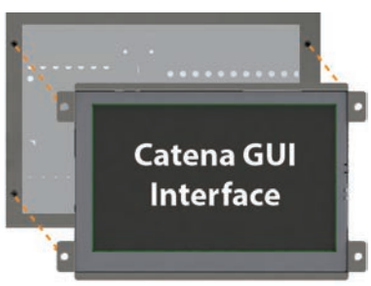
9.4.2 Replacing Catena GUI Interface

Catena GUI Interface can be replaced into the system as per the following steps.

Step 1: Unscrew all the four screws on the Catena GUI interface.

Step 2: Disconnect appropriate cables in the Catena GUI Interface and remove it from the system.

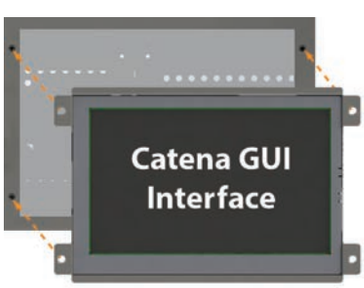
Step 1



Step 2

Step 3: Connect appropriate cable to the new Catena GUI Interface from the system and place it into the slot.

Step 4: Screw all the four screws on the Catena GUI Interface.



Step 3

Step 4

Note: If Catena GUI Interface is not present in the system, Catena GUI Interface slot have to be covered using Catena Closing Plate.

Warning: Risk of electric shock, do not replace the Fast Acting Fuse in system running condition.

Warning: Risk of electric shock. Do not install or replace Catena GUI Interface, while system in running condition. Make sure that AC input voltage and DC input voltage are disconnected.

10. System set up

RBS System is delivered with default set of parameters referred as factory settings.

The standard supply will be represented as below:

- Candis with T2S USB
- Catena withT2S ETH

**There is a possibility to have above configuration changed upon customer request.

10.1 T2S USB

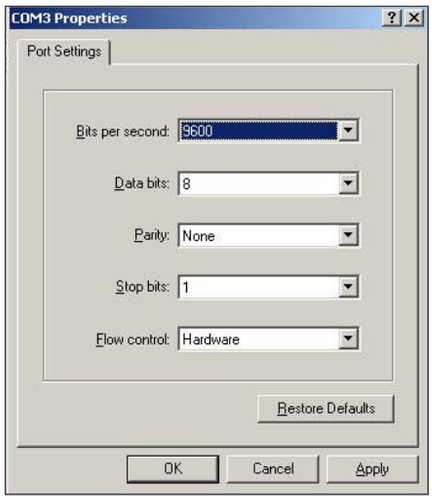
Upon various site operating conditions or Site Manager requirements some parameters might have to be adjusted.

Refer to “TSI T2S 120VAC User Manual Vx_x” for detailed description of system status reading and changing as well as parameter adjustment.

- Parameter set up requires Hyper terminal installed on laptop.
- USB cable type A to B (not included).
- T2S driver “CET_T2S.inf” installed on laptop.
- Available for download:
  - On my.CET for direct customers, in the “Document” section.
  - At the following URL for everyone else:
    http://www.cet-power.com/uploads/Driver_T2S/Driver_T2S_for_Windows_and_hyperterminal.zip.

10.1.1 Communication Setting

- Bits per second 9600
- Data bits 8
- Parity None
- Stop bits 1
- Flow control None



10.1.2 Menu access

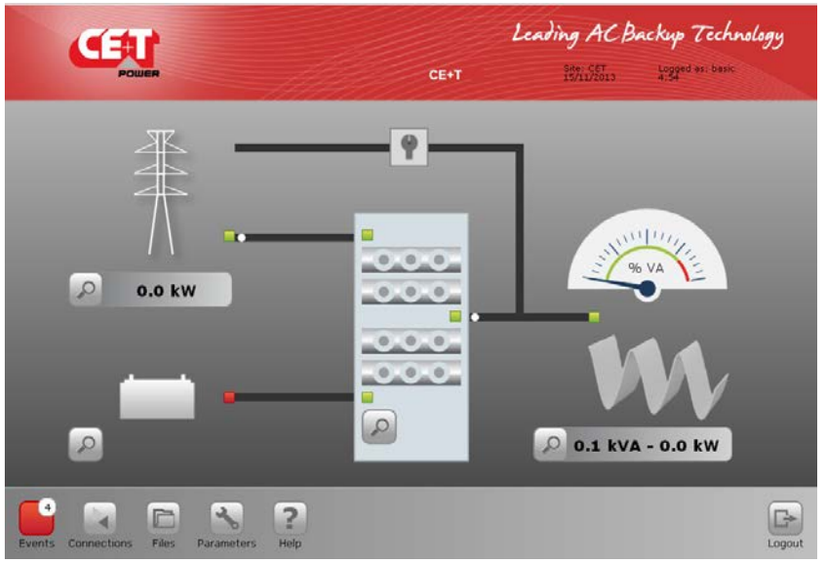
Root Menu

- 1 > System configuration
  - 0 > Return to previous menu
  - 1 > Send config file to T2S
  - 2 > Read config file from T2S
  - 3 > Restore default settings (no more available since version 2.5)
  - 4 > Restore factory settings (no more available since version 2.5)
- 2 > System information's selection
  - 0 > Return to previous menu
  - 1 > Module information's
    - 0 > Return to previous menu
    - 1 > Variables set 1
    - 2 > Variables set 2
    - 3 > Variables set 3
    - 4 > Variables set 4
    - \+ > Next page
    - \- > Previous page
  - 2 > Phase information
    - 0 > Return to previous menu
    - 1 > Variables set 1
    - 2 > Variables set 2
    - 3 > Variables set 3
  - 3 > Groups information
    - 0 > Return to previous menu
    - 1 > Display AC group information
    - 2 > Display DC group information
  - 4 > Alarms information
    - 0 > Return to previous menu
    - 1-1 > Page selection
  - 5 > History of the log display
    - 0 > Return to previous menu
    - 1-14 > Page number selection
    - 16 > Clear log
    - 17 > Save log to a file
  - 6 > Module errors information
    - 0 > Return to preceding menu
    - 1-32 > Detailed Modules errors
- 3 > System actions selection
  - 0 > Return to previous menu
  - 1 > System actions
    - 0 > Return to index
    - 1 > Turn ON system
    - 2 > Turn OFF system
    - 3 > Change Date and time setting
  - 2 > Inverter Module action
    - 0 > Return to previous menu
    - 1-4 > Page number selection
    - 5 > Identify selected Module
    - 6 > Turn ON selected Module
    - 7 > Turn OFF selected Module
    - 8 > Change address of sel. Module
    - 9 > Change phase of selected Module
    - 10 > Automatic address assignment
    - 11 > Change DC group of selected Module
    - 12 > Change AC group of sel. Module
    - 13 > Notify changed fan of sel. Module
    - \+ > Increment selector
    - \- > Decrement selector
  - 3 > T2s actions
    - 0 > Return to index
    - 1 > Force refresh of configuration texts and constants
    - 2 > Force refresh of events description texts
- 4 > Security Access
  - 0 > Return to index
  - 1 > Enable Password protection

10.2 T2S Ethernet via Catena

Once system is powered upon, the Catena is up and ready for operation.
Configuration and other parameters can be changed using the Catena interface.

10.2.1 User GUI Interface Catena



CATENA provides a quick and efficient user interface to:

- Get and overview of the system information
- Detail information on
  - AC input power at system level
  - AC output power at system level
  - DC information at system level
  - Inverters information module level

10.2.1.1 CATENA Start up

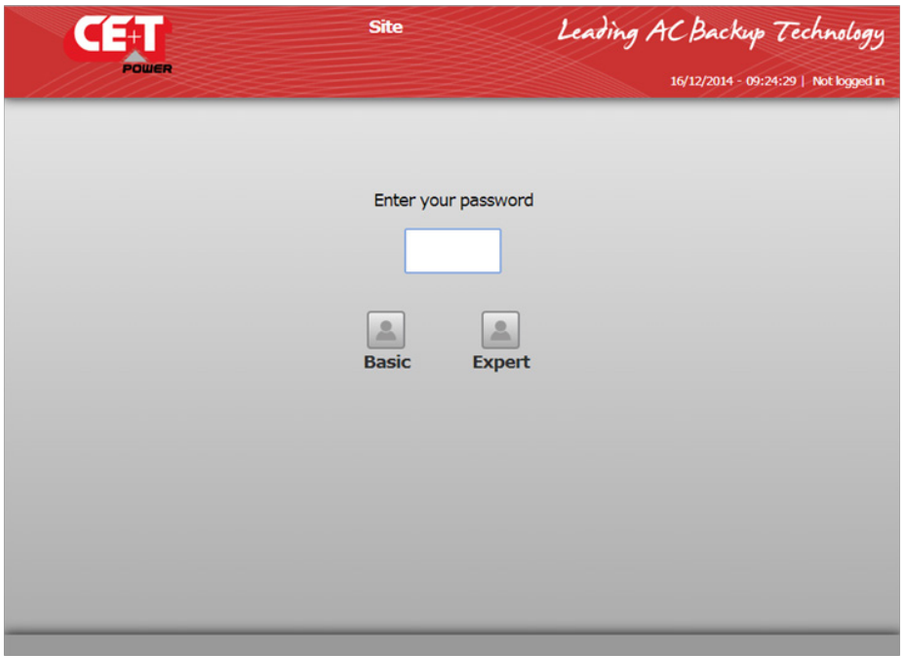
Applying start-up power – web interface

Initiate the start-up routine by applying power to the CATENA

NOTE: The controller will perform a short self-test as it boots up. Alarm alerts are normal.

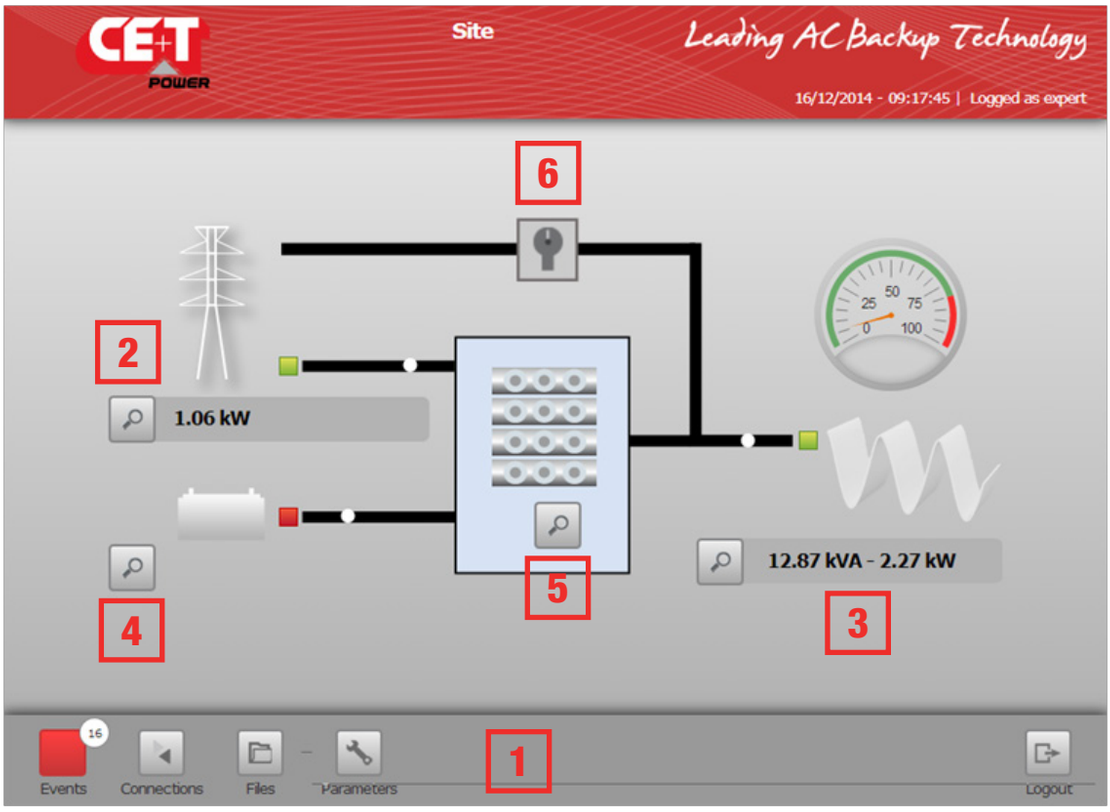
Use the touchscreen or connect the computer to the ETHERNET port and start your web browser.

1. Point your browser to 192.168.0.2 (default address).
2. Choose a user type (Basic or expert) and enter your password. Default password is “pass123” for basic, “pass456” for expert.



10.2.1.2 The Home page

After connecting in basic or expert level the catena will display the home page below



1. Tool bar to access to event, connections, files or parameters
2. AC input menu display AC input power in kW
3. AC output menu display level of AC output power in kW/kVA
4. DC input menu
5. System menu and further module menu
6. Manual by pass status engaged / not engaged (if present)

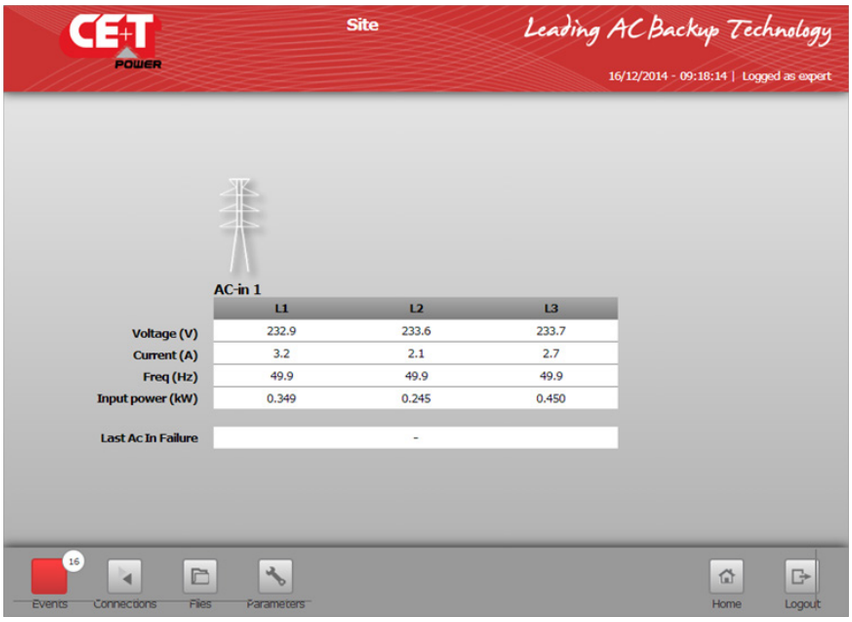
All LED symbol indicate if there any alarm present in the system

- Green No alarm present normal operation
- Alarm present minor (orange) , major (Red)

Click the **Search** button  to obtain more details.

10.2.1.3 The AC input page

Click the **Search** button  at AC input to obtain detail AC input information of the 3 phase

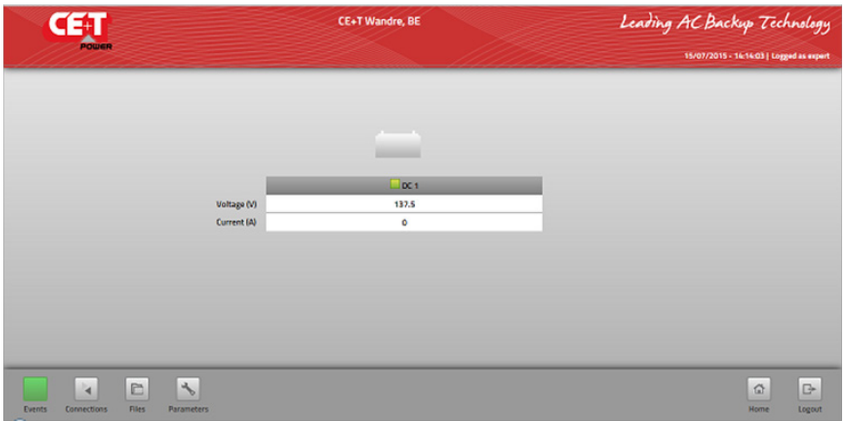


Provide

- AC input voltage for each phase
- AC input current per phase
- Frequency
- Input power going to the Media inverter
- Record the last AC input failure date and time

10.2.1.4 The DC input page

Click the **Search** button  at DC input to obtain detail DC input information

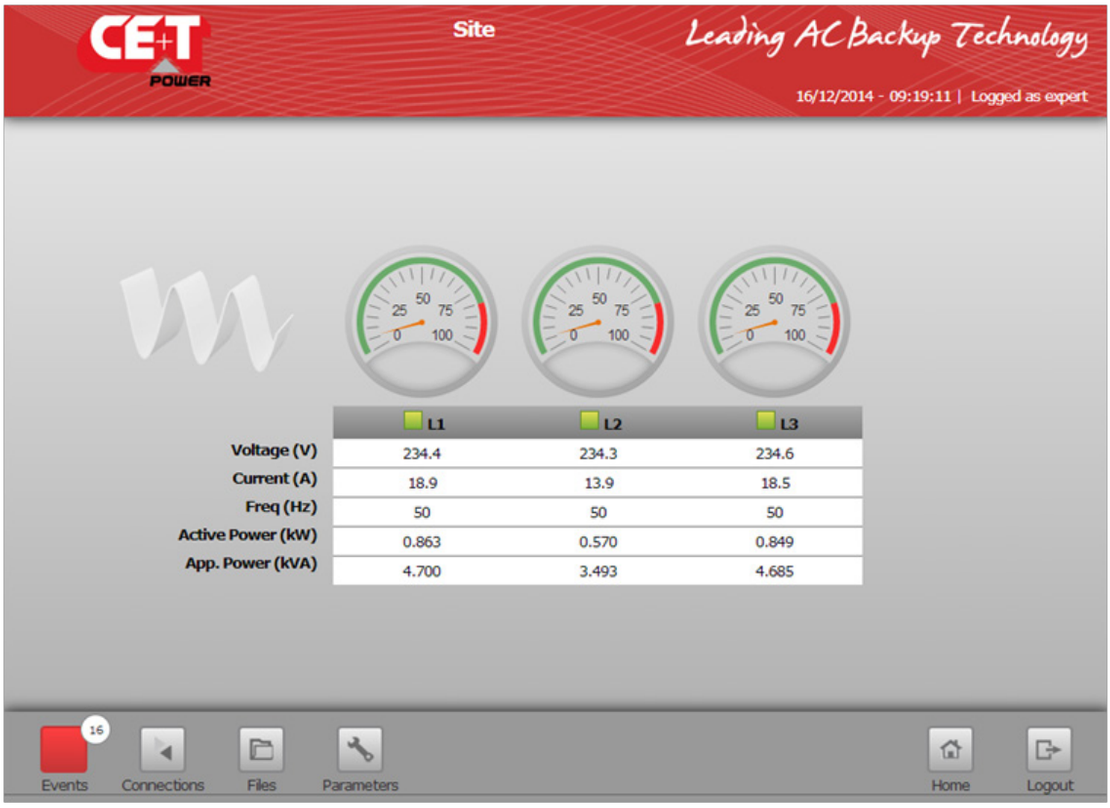


Provide

- DC input voltage VDC
- DC input current

10.2.1.5 The AC output page

Click the **Search** button  at AC output to obtain detail AC output information



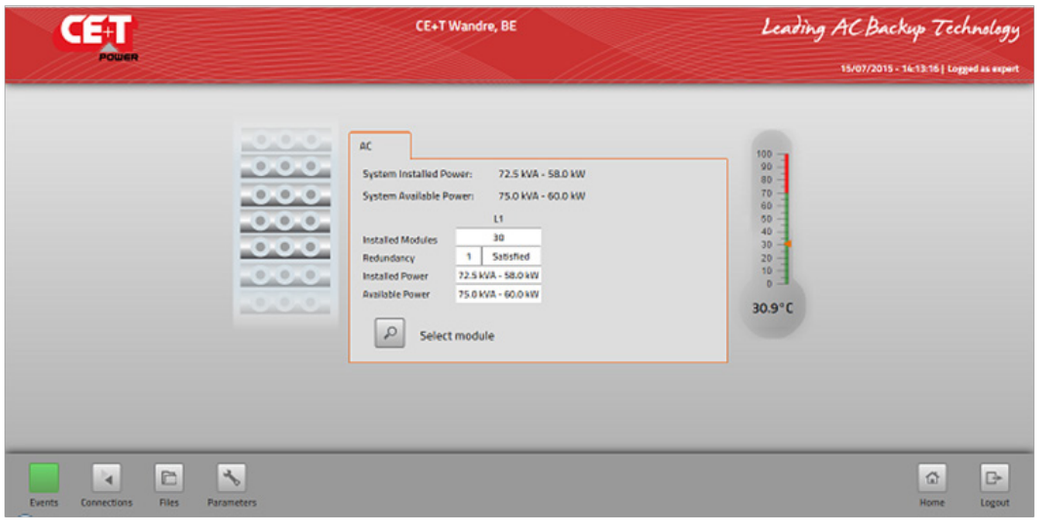
Provide

- Graph indicating the level of power per phase
- AC output voltage for each phase
- AC output current per phase
- Frequency
- AC output power (kW)
- Apparent power (kVA)

LEDs indicate any alarm and on which phase (Green no alarm) Red (Alarm)

10.2.1.6 The System page

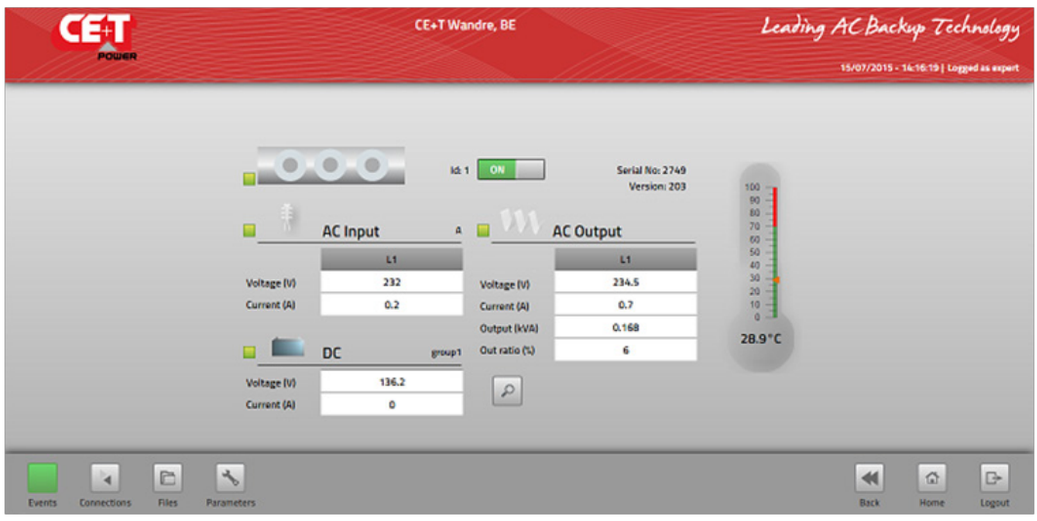
Click the **Search** button  at the cabinet in the home page will bring you to the system page



- AC folder is related to the inverter module with detail per phase
  - Number of module installed per phase
  - Redundancy 0 (No redundancy 1 one module redundant)
  - Installed power per phase
  - Available power per phase

If you want to browser each module separately, click again on “Select module” 

A popup will display and allow you to browse the module you want. The module page will then display as follow:



- The T° probe is the average T° of the inverter module heatsink

10.2.2 The TOOLBAR

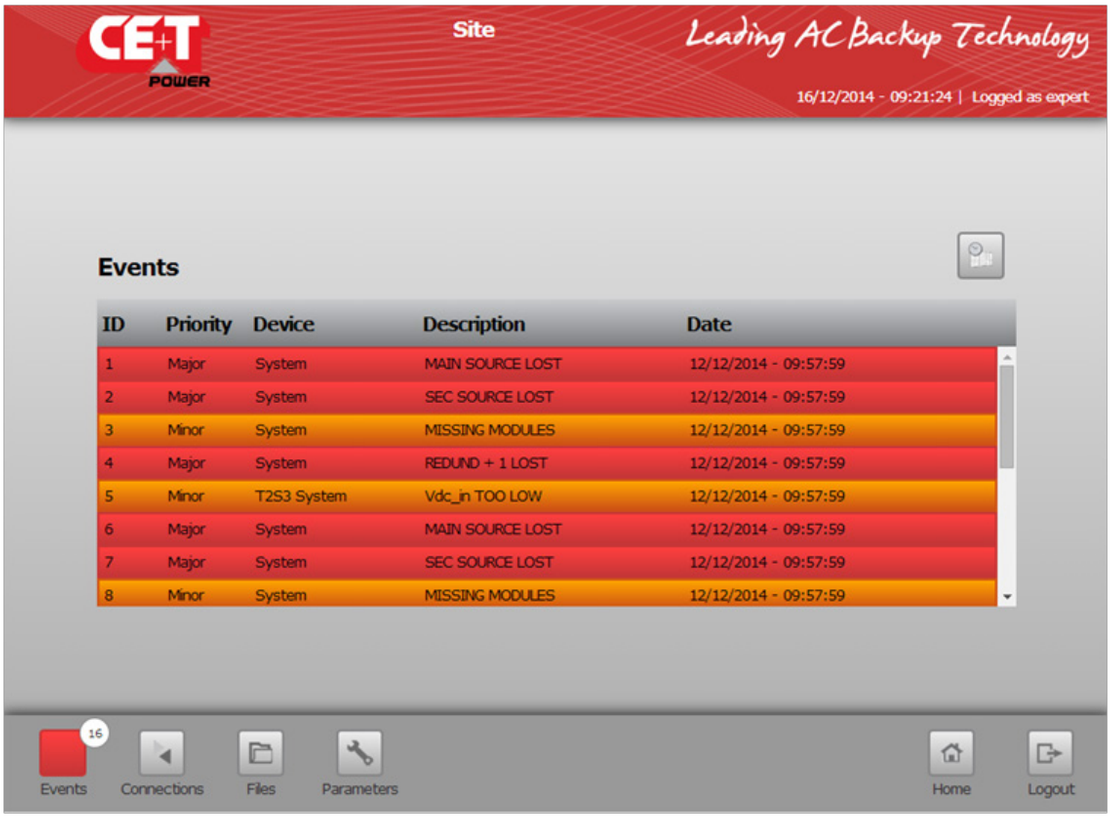
10.2.2.1 Event

At the bottom of the screen a permanent “Tool bar” populated with different button:

Events present in the system the circled number indicate how many “active event” are present.

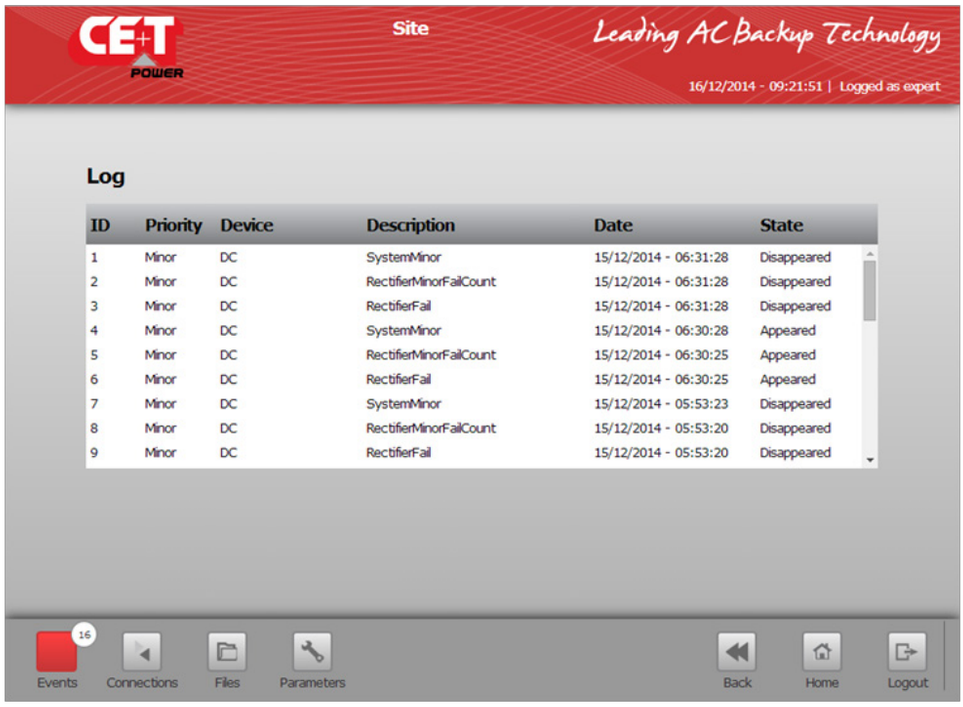
The color indicate the severity of the event. Green is OK, Orange is Minor and Red is Major.

Figure below gives list of active event /alarm Red is Major, Orange is Minor



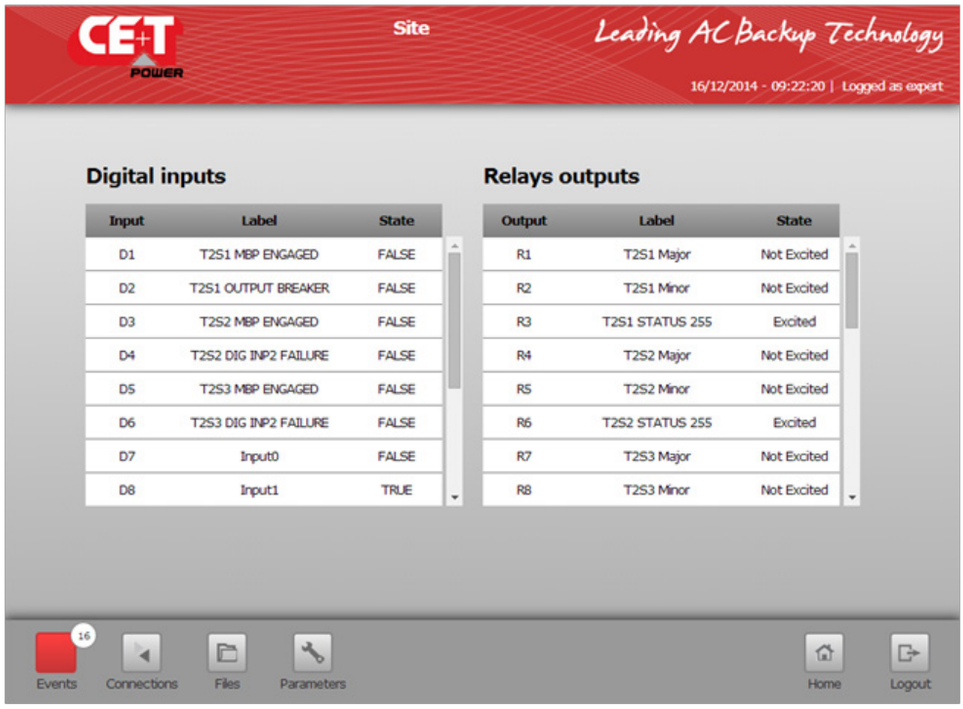
Click the **Log** button  to access the log file which is a record of last 500 event with date and time the occurred in the system.

Figure below show a screen of the log file.



10.2.2.2 Connections

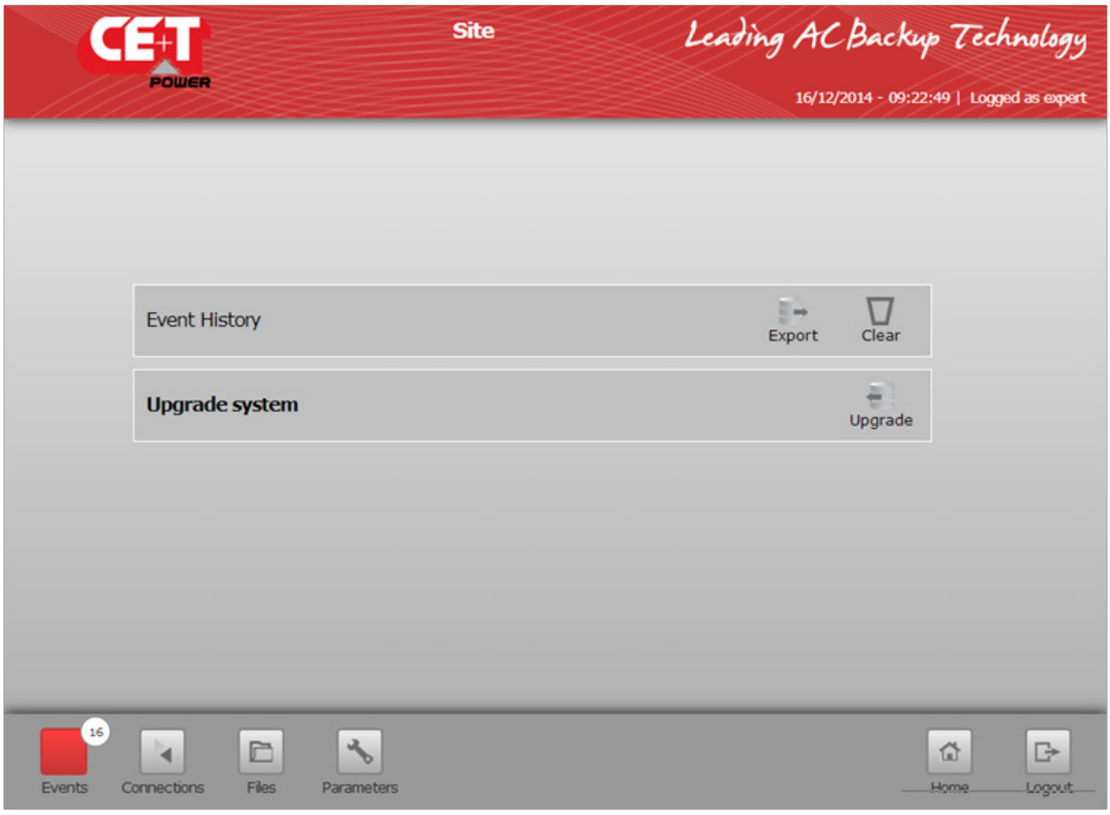
Click on **Connections** button to access the mapping of the digital inputs and relays output



10.2.2.3 Files

Click on Files to:

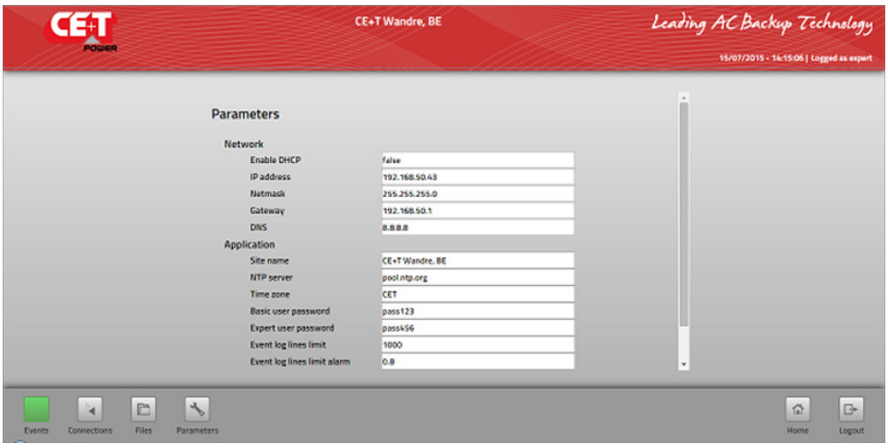
- Export the log file
- Clear the log file (only possible in expert mode)
- Upgrade the software of the CATENA supervisor

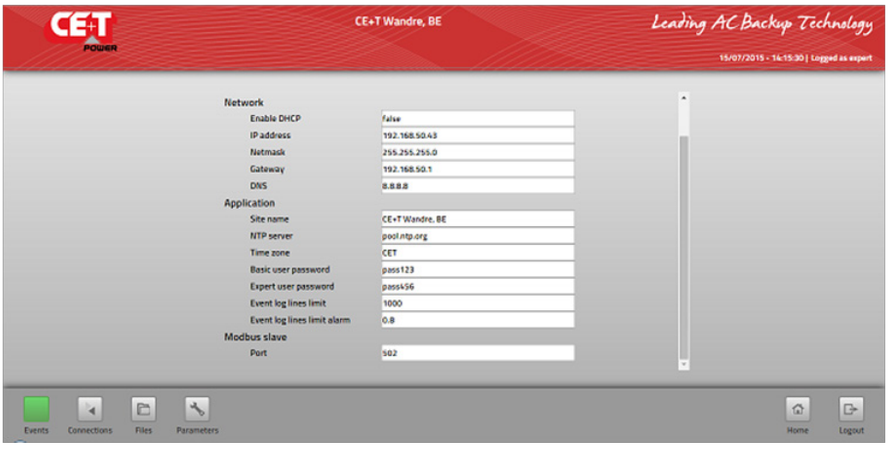


10.2.2.4 Parameters

To define and setup all communication parameter listed below

Please do not change setting below unless necessary.





10.3 Switching OFF RBS System

Perform the following steps to Switch OFF the RBS System.

Caution: While switching OFF the RBS System, the power to load will be disconnected.

1. Switch OFF AC Output Downstream Breakers.
2. Switch OFF AC Input Upstream Breakers.
3. Switch OFF DC Input System Breakers.

Caution – Risk of electric shock. Capacitors store hazardous energy. Do not remove the system from the cabinet atleast five minutes after disconnecting all sources of supply.

11. Inserting/removing/replacing modules

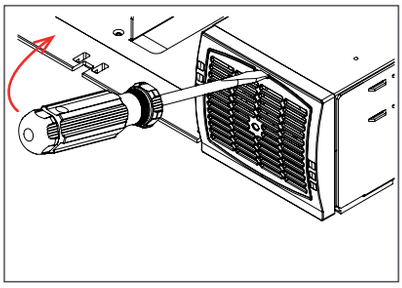
11.1 TSI Inverter

- The TSI inverter module is hot swappable.
- When a new module is inserted in a live system it automatically takes the working set of parameters.
- When a new module is inserted in a live system it is automatically assigned to the next available address.

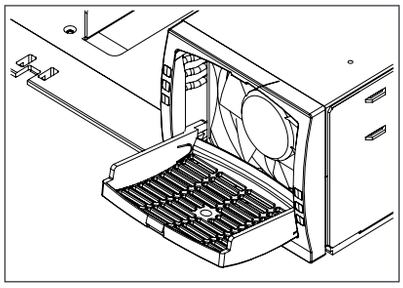
11.1.1 Removal

Notice: When one or several inverter modules is/are removed, live parts become accessible. Replace module with blinds without delay.

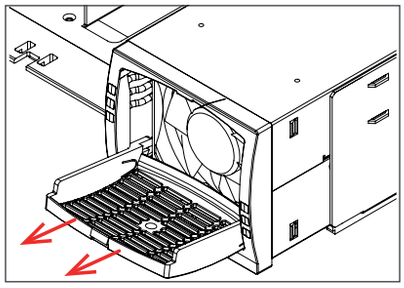
- Inverter module is not switched off when opening the handle. The handle only hooks the module to the shelf.
- Use a screw driver to release the latch of the handle.
- Open the handle and Pull the module out.
- Replace with new module or blind unit.



A) Use screwdriver to release the latch



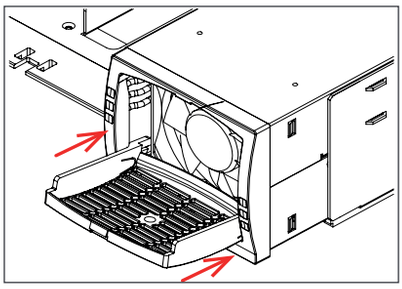
B) open the cover completely



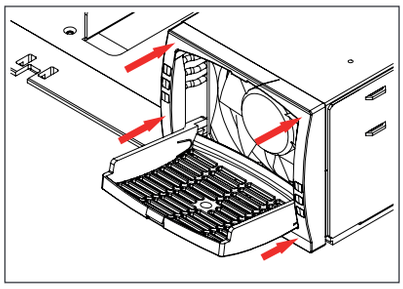
C) Use the cover as a handle to remove the module

11.1.2 Inserting

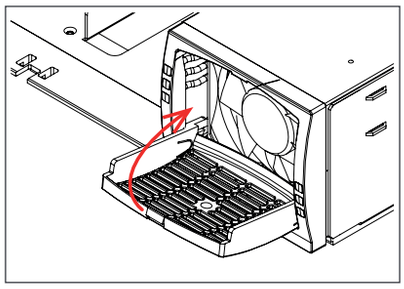
- Check module compatibility (DC Voltage!).
- Use a screw driver to release the latch of the handle.
- Open the handle and Push firmly until the unit is properly connected.
- Close the cover and latch in position.



A) Slide the module in



B) Push firmly till the connection is properly engaged

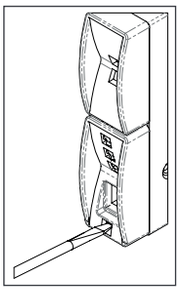


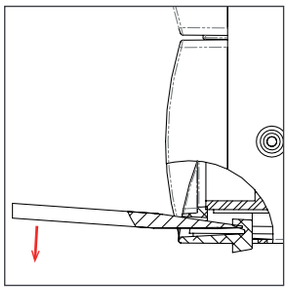
C) Close the cover and latch the module in place if too hard redo step B

11.2 T2S

11.2.1 Removal

- Use a small screw driver to release the latch keeping the T2S in position.
- Pull the T2S out.





11.2.2 Inserting

- Push the T2S firmly in place until the latch snaps in position.

11.3 Fan replacement

The FAN life is approx 45.000hours. The inverter modules have fan runtime meters and fan failure alarm. Fan failure can result from failing fan or driver circuit.

- Let the module rest at least 5 minutes prior to initiating work.
- The inverter front must be removed. Use a blunt tool to depress the latches on the module side fixing the front to the module.
- Remove the fan and unplug the supply cord.
- Replace with new fan and connect supply cord.
- Replace front, make sure that the front latch properly.
- Plug in.
- Check fan for operation.
- Access T2S and reset the fan run time alarm from within the action menu.

Push on side hooks to release front cover | Remove the front cover | Free up the fan assembly | Disconnect the fan | Replace the fan | Make sure the fan is in the right position

12. System Start-up and Shut down

12.1 Final Check

- Make sure that the sub-rack and slidings/cabinet is properly fixed to the cabinet/floor.
- Make sure that the sub-rack/cabinet is connected to Ground.
- Make sure that all DC and AC input breakers are switched OFF.
- Make sure that all cables are according to recommendations and local regulations.
- Make sure that all cables are strained relived.
- Make sure that all breakers are according to recommendation and local regulations.
- Make sure that DC polarity is according to marking.
- Re tighten all electrical terminations.
- Make sure that no inverter/controller positions are left open.
- Cover empty inverter positions with blanks.
- Make sure that the Remote ON/OFF is appropriately wired according to local regulations.
- Make sure that the point of AC supply meets local regulations.

12.2 START UP

- Verify AC input/output and DC input connections.
- Verify Load is connected to output of inverter system.
- Switch ON the upstream DC supply.
- Verify presence of DC supply by using multimeter before closing the DC input breaker.
- Insert one module in the first slot.
- Switch ON the DC breakers per shelf/column and wait for at least 30 seconds.
- Check inverter modules LED
  - AC-in LED: Off
  - AC-out LED: Green
  - DC-in LED: Green

NOTE: It is recommended that each module is put in its factory assigned position (EX: “Module 2, Phase 3” should be inserted in the 3rd slot of the second shelf), however it is not mandatory as the system will automatically configure itself.

- Switch ON the upstream AC supply.
- Verify presence of AC supply by using multimeter.
- Wait for at least 30 seconds.
- Verify all inverter modules LED
  - AC-in LED: Green
  - AC-out LED: Green
  - DC-in LED: Green
- Once each module in each phase is steady, verify monitory device (Catena or Candis) and T2S module (Ethernet or USB). The Catena or Candis should initiate start up. Refer section 10.2, page 39 for more information on the CATENA.
- Verify, using the CATENA interface or T2S USB using laptop, that each module has been assigned to its respective phase.
- Populate remaining modules.
- On the Catena interface or T2S USB using a Laptop, verify all there are no alarms (Disable the alarms if any, all T2S LED should be green).
- Read configuration file and review all parameters. Some parameters must be adapted according to the site (LVD, load on AC, AC threshold level).
- Verify presence of AC output supply by using multimeter.
- Switch ON the downstream AC Load breakers.

13.Commissioning

The DC breaker is a protection device. Modules are plugged in a system and DC breaker is then engaged. Please make sure the corresponding DC breaker is engaged in the ON position. Failure to observe this rules will result not to have all module operating when running on DC and have module failure when AC input recover from fault condition.

Installation and commissioning must be done and conducted by trained people fully authorized to act on installation.

It is prohibited to perform any isolation test without instruction from manufacturer.

Equipments are not covered by warranty if procedures are not respected.

13.1 Check list

DATA	
Date	
Performed by	
Site	
System serial number	
Module serial numbers	
T1S/T2S serial number-Specify T1S/T2S	
ACTION	**OK/ N.OK**
Unplug all inverters except one inverter per phase (Just pull off the inverter from the shelf, to interrupt electrical contacts)	
Check the commercial AC before closing the AC input breaker.	
Switch ON the commercial AC	
Check if inverters are working (Green led)	
Check the DC power supply and switch ON the DC breakers	
Plug in all inverters one by one	
Check output voltage (on bulk output or on breaker)	
Check if inverters are working properly	
Check if system has no alarm (Disable the alarm if any)	
Read configuration file and review all parameters. Some parameters must be adapted according to the site (LVD, load on AC, AC threshold level)	
Switch OFF ACin and check if system is working on DC	
Switch ON ACin and check if system correctly transferred load on AC	
Switch OFF system and start on AC only	
Switch OFF system and start on DC only	
Check if display working properly (if this CANDIS option is present)	
Check if TCPIP working properly (if this option is present)	
Test on load (if available)	
ALARM	
Switch ON AC input and DC input and check that no alarm are present	
Pull out one inverter and check alarm according to redundancy	
Pull out two inverters and check alarm according to redundancy	
Switch OFF AC input (commercial power failure) and check the alarm according to the configuration	
Switch OFF DC input (DC power failure) and check that the alarm according to the configuration	
Check the different digital input according to the configuration (when used)	

14.Trouble Shooting and Defective Situations Fixing

14.1 Trouble Shooting

Inverter module does not power up:	Check AC input present and in range (AC breakers)
	Check DC input present and in range (DC breakers)
	Check that the inverter is properly inserted
	Remove inverter to verify that slot is not damaged, check connectors
	Check that module(s) is (are) in OFF state
	Check for loose terminations
Inverter system does not start:	Check that T2S is present and properly inserted
	Check remote ON/OFF terminal
	Check the configuration and setting
	Check threshold level
Inverter only run on AC or DC:	Check AC input present and in range (AC breakers)
	Check DC input present and in range (DC breakers)
	Check the configuration and setting
	Check threshold level(s)
No output power:	Check output breaker
All OK but I have alarm:	Check configuration file and correct No of modules
	Download/clear log file
No output alarm:	Mind the default time delay (UA: 60s, NUA: 30s)
	Check configuration file
No information on CanDis:	Check that T2S is present and properly inserted
	Check that the RJ45 cable is connected between T2S shelf and CanDis shelf
No value on TCP/IP:	Check that the RJ45 cable is connected between T2S shelf and CanDis shelf
	Wait approx 2 minutes to allow the system to collect serial data.

14.2 Defective modules

Unless input power is down all LEDs on each module should be green (see section 9, page 31). No light, orange light , red or flashing light are abnormal conditions. Refer to section 10.1.2, page 38 to collect and record module information. If no fix can be found, replace module.

14.2.1 Replacing modules

Refer to section 11, page 49 to remove and re-insert modules.

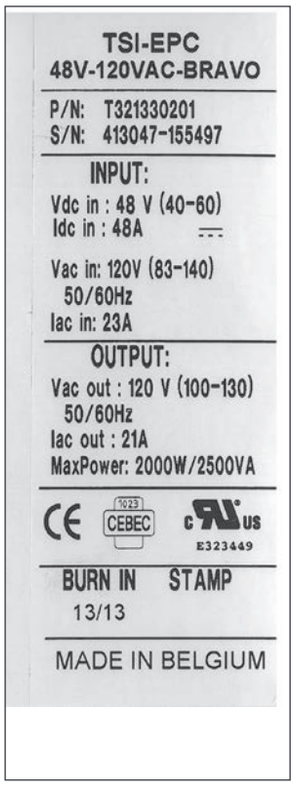
14.2.2 Return defective T2S interface

A T2S totally dark (indication area) or that cannot interface with your laptop are evidence of failure. Proceed as per section 14.2.4, page 56.

14.2.3 Return defective shelf

The shelf is passive. Failure is unlikely to happen. In turn defective situation are barely always visible. After depose proceed as per section 14.2.4, page 56.

14.2.4 Return defective modules



- A repair request should follow the regular logistics chain:
  End-user => Distributor => CE+T Power.
- Before returning a defective product, a RMA number must be requested through the http://my.cet-power.com extranet. Repair registering guidelines may be requested by email at repair@cet-power.com.
- The RMA number should be mentioned on all shipping documents related to the repair.
- Be aware that products shipped back to CE+T Power without being registered first will not be treated with high priority!
- Information on failure occurrence as well as module status given through Menu 2-1 shall be attached to defective unit return package or recorded in RMA.

15. Service

For Service

- Check Service Level Agreement (SLA) of your vendor. Most of the time they provide assistance on call with integrated service. If such SLA is in place, you must call their assistance first.
- If your vendor doesn't provide such assistance (*) you may call CE+T directly. Toll free Number **1(855) 669 - 4627**(**)

Service is available from 8:00 A.M. to 10:00 P.M. EST, Monday through Friday, except closing periods for holidays or inclement weather.

Major Incidents and Emergency conditions can be invoked for immediate handling of same number or by dropping a mail on customer.support@cetamerica.com (***)

(*) CE+T will redirect your call to your vendor if he has such SLA in place.

(**) Valid in USA and Canada only.

(***) Messages that are not Major Incident or Emergency will be served at the next scheduled working day.

16.Maintenance Task

As maintenance will be performed on live system, all tasks should be performed only by trained personnel with sufficient acknowledge on TSI product.

Tasks :

- Identify the site, customer, rack number, product type.
- Download and save configuration file for back up.
- Check configuration file to be in accordance with operational site conditions.
- Read and save log file for back up.
- Check and analyze log file, and if alarm are present.
- Replace dust filter if present. Filter is mandatory in dusty environment.
- Check module temperature and log value. If internal temperature is higher then previous year, it should be interesting analyze if it is due an increasing load or dust effect. It is common to have a delta of 15°C by 30% of load between the ambient and the internal temperature. If temperature increase due internal dust built up clean the TSI with vacuum cleaner and/or soft compressed air.
- Clean system (vacuum cleaner or dry cloth)
- Control the inverter mapping (AC Group, DC Group, Address)
- Check load level and record the rate value (print in word document the 4 screen modules information for the 32 modules, the 3 screen for the phases value and the 2 screens for the group AC and DC value)
- Change the configuration file for AC and DC mix mode to check that all TSI work on both power supply
- Check alarm operation (e.g., redundancy lost, mains failure, DC failure) on dry contact and through SNMP system or web interface.
- Switch OFF AC IN and check alarms.
- Check temperature terminal and temperature wiring. If possible use an infrared camera.
- Read and record value as wave form, power factor, Crest factor, THD I from power analyzer.
- Take system picture
- Keep track of report and provide end user with a copy.
- Perform a MBP procedure. This task is not really recommended*, but could be demanded by site manager.

* It is not recommended because when you perform a By-pass procedure, generally there is no back up on AC input line, and the load shutdown if mains disappear.