



Leading Conversion Technology for Power Resilience

# TSI MEDIA 2I - 120 VAC

## User Manual V7.2

### BEYOND THE INVERTER

THE NEW GENERATION OF POWER CONVERTERS

- **DUAL INPUT INVERTER**  
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



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## Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
7.0	03/02/2010	-	First release of the Manual.
7.1	30/01/2015	-	Amendment and correction.
7.2	29/05/2020	-	New layout

# 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 power disturbances;
- Optimizes footprint.

Our systems are:

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

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

## 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. Warranty and Safety Conditions\*

### WARNING:

The electronics in the power supply system are designed for an indoor, clean environment.

When installed in a dusty and/or corrosive environment, indoor, it is important to:

- Install an appropriate filter on the enclosure door, or on the room's air conditioning system.
- Keep the enclosure door closed during operation.
- Replace the filters on a regular basis.

**Important Safety Instructions, Save These Instructions.**

### 3.1 Disclaimer

- The manufacturer declines all responsibilities if equipment is not installed, used or operated according to the instructions herein by skilled technicians according to local regulations.
- Warranty does not apply if the product is not installed, used or handled according to the instructions in the manual.
- This equipment is shipped with a SHOCKWATCH monitor. If the SHOCKWATCH shows that the equipment was exposed to excessive force the warranty will be void.

### 3.2 Technical care

- This electric equipment can only be repaired or maintained by a "qualified employee" with adequate training. Even personnel who are in charge of simple repairs or maintenance are required to have knowledge or experience related 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 are trained to recognize and avoid any dangers that might be present when working on or near exposed electrical parts.
- Qualified employees know how to lock out and tag out machines so the machines will not accidentally be turned on and injure employees working on them.
- Qualified employees also 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.
- Never wear metallic objects such as rings, watches, or bracelets during installation, service and maintenance of the product.
- Maximum operating ambient temperature is 40°C (104°F).
- Insulated tools must be used at all times when working with live systems.
- When handling the system/units pay attention to sharp edges.
- This product is suitable for use in a computer room.

\* 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

- This product is intended to be installed only in restricted access areas as defined by UL60950 and in accordance with the National Electric Code, ANSI/NFPA 70, or equivalent agencies.
- The 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.
- 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 de-energized when necessary.
- REG systems and EPC systems that have no AC input wired and connected can be seen as independent power sources. To comply with local and international safety standards N (input) and PE shall be bonded. The bonded connection between N (input) and PE must be removed once the AC input is connected. Refer section 8.3.1, page 20.
- AC and DC circuits shall be terminated with no voltage / power applied (de-energized).
- The safety standard IEC/EN62040-1-1 requires that, in the event of an output short circuit, the inverter must disconnect in 5 seconds maximum. The parameter can be adjusted on T2S ETH; however, if the parameter is set at a value > 5 seconds, an external protection must be provided so that the short circuit protection operates within 5 seconds. Default setting is 60 seconds.
- The system is designed for installation within an IP20 environment. When installed in a dusty or humid environment, appropriate measures (air filtering) must be taken.
- All illustrations in the manual are for general reference, refer to the technical drawing which is received along with the system for exact information.
- Environment Conditions:
  - Storage Conditions: -40 to 70°C
  - Relative Humidity: 95%, non-condensing
  - Altitude above sea without de-rating: Less than 1500 m  
Greater than 1500 m – de-rating at 0.8% per 100 m

#### 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.
- This equipment is shipped with a SHOCKWATCH monitor. If the SHOCKWATCH shows that the equipment was exposed to excessive force the warranty will be void.



### 3.3.2 Surge and transients

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

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. The modular inverter system/rack can reach hazardous leakage currents. Grounding must be carried out prior to energizing the system. Grounding shall be made according to local regulations.

### 3.3.3 Other

- Insulation 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. Grounding must be carried out prior to energizing the system. Grounding shall be made according to local regulations.
- Prior to any work conducted on a system/unit make sure that AC input voltage and DC input voltage are disconnected.
- Inverter modules and shelves contain capacitors for filtering and energy storage. Prior to accessing the system/modules after power down, wait at least 5 minutes to allow capacitors to discharge.
- Some components and terminals carry high voltage during operation. Contact may result in fatal injury.

## 3.5 Replacement and Dismantling

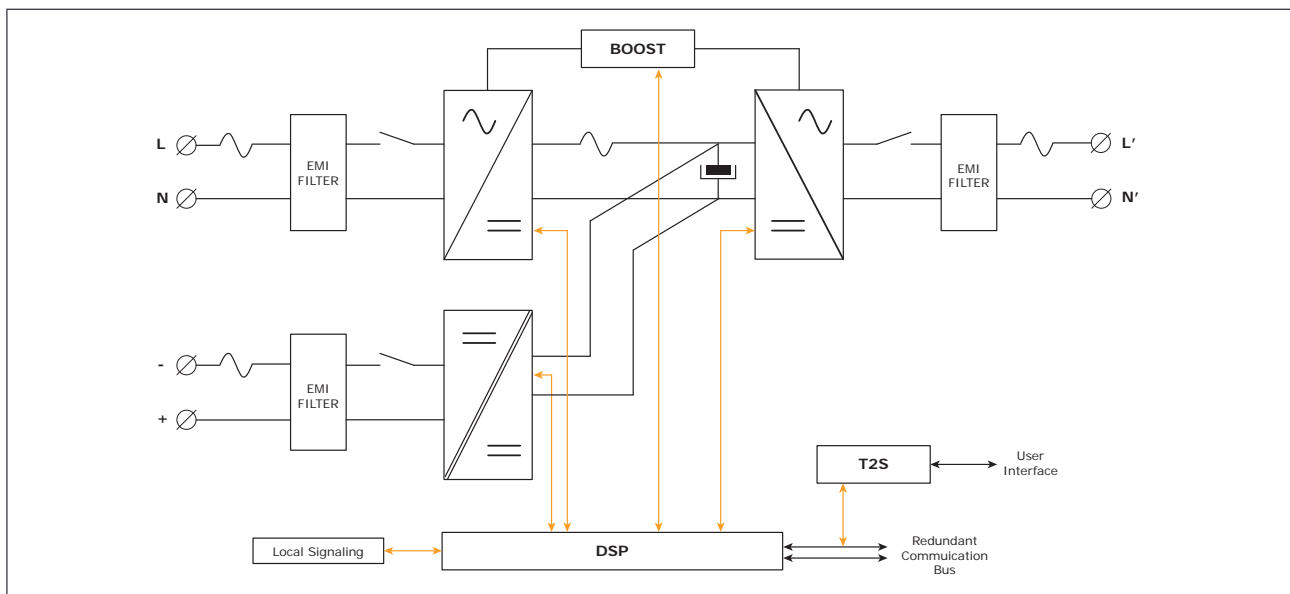
- ESD Strap must be worn when handling PCB's and open units.
- CE+T cannot be held responsible for disposal of the Inverter system and therefore the customer must segregate and dispose of the materials which are potentially harmful to the environment, in accordance with the local regulations in force in the country of installation.
- If the equipment is dismantled, to dispose of its component products, you must comply with 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](http://www.cet-power.com)

## 4. TSI Technology <sup>1</sup>

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

The block diagram 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. The output sine wave is constant and disturbance free regardless of the active source due to internal energy buffering,

The BOOST functionality multiplies the nominal current by 10 for a period of 20 ms (max) in the event of downstream current surge or fault. 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 TRS functionality is included in every inverter module. Running them in parallel provides a modular system with no single point of failure, 100% pure sinusoidal output, high system efficiency, and 0 ms source transfer time.

<sup>1</sup> Information and data given in this chapter intend to for an overview on the 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

- In EPC mode, the AC Main source is the primary source while the DC source is secondary.
- The TSI is designed to operate on the AC main source on a permanent basis and to deliver output AC voltage with low THD.
- There is no physical difference on the output sine wave whether the source is AC (or) DC. If the AC main source is out of tolerance or drops below acceptable level, the converter seamlessly switches to DC and the converter operates in “Back-up mode” (Transfer time is 0 ms).
- As soon as the AC main source returns to its normal operating 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 sine wave output.

## 4.2 On-line Mode

- In On-line Mode, the DC source is the primary source of supply while the AC main source 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 AC power to the load.
- In case of short circuit at the load side, the boost is automatically energized for a specific duration to trip downstream protective devices.

## 4.3 Safe Mode

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

## 4.4 Mix Mode & Walk-in Mode

- Under certain circumstances the 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 30 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. Design and Description

### 5.1 Introduction

Media 2I system is a shelf mounted power system that operates off both AC and DC input sources to provide conditioned and uninterrupted power to connected loads. Its unique packaging allows for easy installation and system management.

These products utilize CE+T's patented TSI technology within the MEDIA Inverters. The TSI with its Enhanced Power Conversion (EPC) mode is the industry's most energy efficient option to power conversion solutions.

### 5.2 TSI MEDIA Inverter System

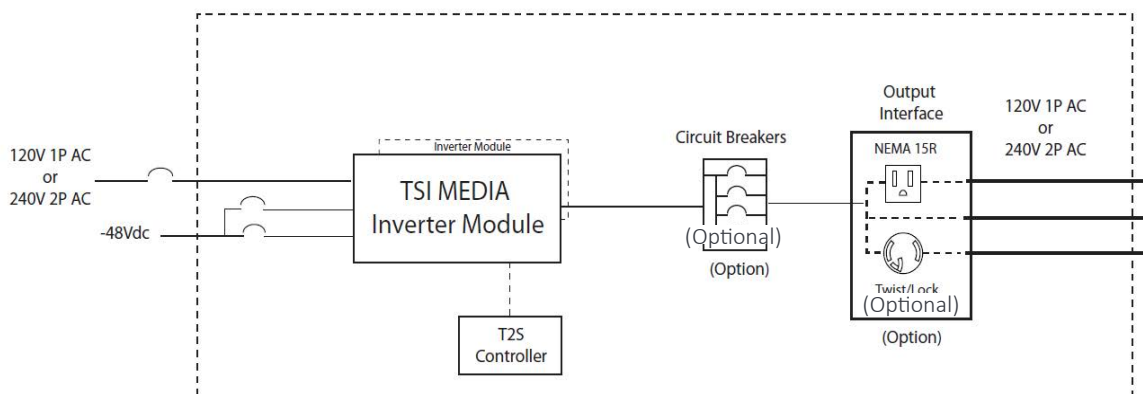
The TSI MEDIA Inverter System utilizes Twin Sine Inverters (TSI) technology to provide reliable power for critical AC loads (e.g. CATV headends, Telco central offices, local exchanges, industrial applications and data centers).

The system also provides the highest available efficiency among 48Vdc inverter systems, low Mean Time to Repair (MTTR) due the ability of the inverter modules to be "hot swapped" in the event of an N+1 redundancy, a small footprint and an integrated power system.

The system is designed to be installed in a climate-controlled environment.

### 5.3 Theory of Operation

Parallelable, rack-mounted inverter systems provide a pure AC sine wave output at 120V or 240Vac, 60 or 50Hz, with any kind of load. Utilizing both a 48Vdc and a 120/240V AC input, these high density systems range from 1500VA to 3000VA and are mountable in a standard 19 inch cabinet or either a 19 inch or 23 inch open relay rack.

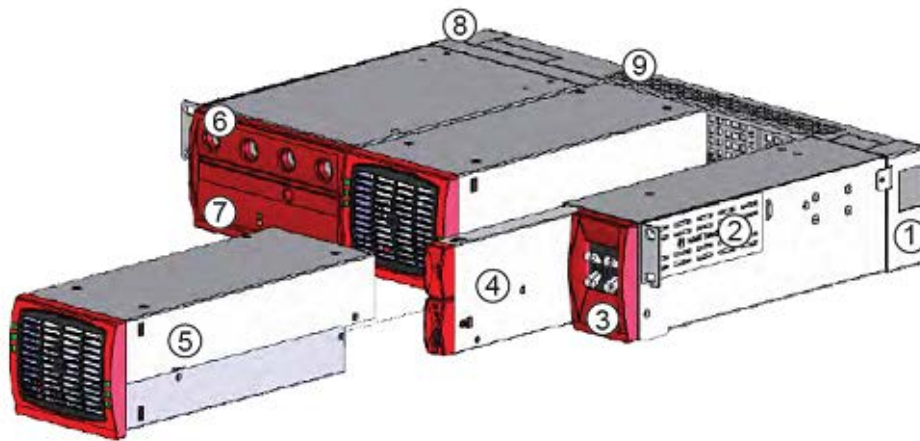


Media 2I System - Block Diagram

## 5.4 System Design

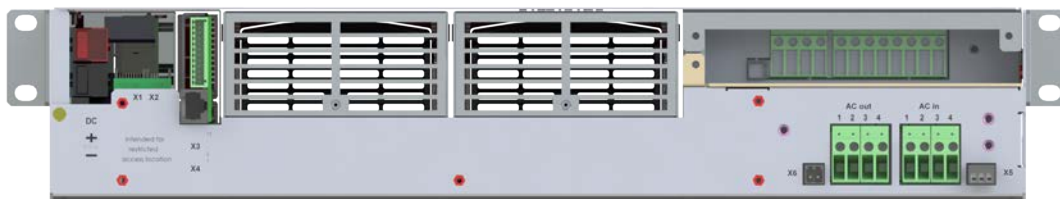
Media 2I is an application modular inverter system specifically designed for clean and temperature controlled environments.

- Telecom grade design.
- Based on MEDIA 48VDC-120VAC TSI module.
- Fully modular.
- Supports redundant configurations.
- Supports EPC mode.



### MEDIA SYSTEM COMPONENTS

- |  |   |
|--|---|
| ① Knockouts for DC wiring; provides access to DC terminal blocks | ⑥ Optional AC Output Circuit Breakers (1 per receptacle)                          |
| ② Mounting bracket   | ⑦ Optional Surge Protector  |
| ③ DC Input circuit breaker; 1 per each 1.5kVA Inverter Module    | ⑧ Knockouts for AC wiring; provides access to AC terminal blocks                  |
| ④ T2S Status Monitor   | ⑨ Optional Power Distribution Unit (PDU) panel; NEMA receptacles accessible here. |
| ⑤ 1.5kVA Inverter Module   |   |



Rear View

## 5.5 System Technical Description

Media 2I is a modular inverter system designed with the TSI technology. It can be configured as a single phase or dual phase system with a capacity range for 1.5kVA to 3kVA. All systems produce 120 Vac nominal outputs. Single phase systems are nominal 120 Vac input. Dual phase systems are 120/240Vac input (L1, L2, N, Gnd) and 120/240Vac output.

MEDIA 2I Inverter Systems are easily configurable to N+ 1 redundant configuration. N+ 1 redundant system can be achieved in single phase systems to 3kVA in single shelf systems. Dual phase systems can't be configured as N+1 redundant system.

Parameter	Value
System Capacity	1.5 kVA to 3.0 kVA
AC Input Voltage	120 Vac or 240 / 120 Vac
DC Input Voltage	-48 Vdc
AC Output Voltage	120 Vac or 240 / 120 Vac
Audible noise	< 35dB (A)
Cooling	Forced convection*

## 5.6 Environmental Parameters

Parameter	Value
Operating Temperature	-20°C to +40°C
Storage Temperature	-40°C to +70°C
Relative Humidity	95%, non-condensing
Vibration	IEC 721-3-3
Shock	IEC 721-3-2

\* Verify sufficient space is allowed for air circulation and the configuration of the system does not interfere with cooling air circulation

## 5.7 Typical loads supported

The TSI MEDIA Inverter System utilizes Twin Sine Inverters (TSI) to provide Telecom-grade reliable power for critical AC loads (e.g. CATV, Central Offices, local exchanges, industrial applications and Data Centers).

The system also provides the highest available efficiency among 48Vdc inverter systems. Serviceability and low Mean Time to Repair (MTTR) are minimized by the ability of the inverter modules to be "hot swapped". The architecture of the system can be configured for redundancy and a high power density in a smaller footprint resulting in a more efficient use of equipment space.

## 5.8 EMC Standards

- EN 5502
- FCC 47 CFR Part 15

## 6. Building Blocks

### 6.1 Inverter module

Telecom / Datacom: -48VDC / 120VAC/240VAC, 60Hz.

- The TSI Media is a 1500 VA / 1200 W 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.
- 10.2" (D) x 4" (W) x 3.4" (H).
- 5.3 lbs (2.4 Kg).



### 6.2 Sub-Rack

- The MEDIA shelf shall be integrated in standard 19 inch network bay frames/relay rack mounting structures or enclosures.
- The MEDIA shelf house max two (2) inverter modules and one (1) monitor unit.
- The MEDIA shelf is designed with common DC input, Common AC input and Common AC output.
- Optional rear cover for IP 20 in open rack
- Max 3kVA per shelf.
- 12.5" (D) x 19" (W) x 2U (H).
- 18 lbs (7.9 kg) empty.



MEDIA 2I Inverter Systems are available in two base configurations, as follows:

1. Single Phase Output, with and without redundancy, with optional AC output receptacles.
2. Split Phase Output, without Redundancy, with optional AC output receptacles.

## 7. Accessories

### 7.1 T2S Interface

The T2S interface provides operator access to the configuration and setup files of the TSI modules that are connected together in any TSI system.

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 either system.

#### 7.1.1 Parameters setting

The T2S interface is featured with a USB connector or a Ethernet port at the front, it enables TSI system settings, module phase assignments, and other parameter settings to provide the best fit for site conditions.

#### 7.1.2 System diagnostic and troubleshooting

The T2S is featured with a built-in user interface to allow on-line diagnostics using a laptop.

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

#### 7.1.3 Section Monitoring

The T2S USB and T2S ETH monitors a maximum of 32 inverter modules.

The T2S USB and T2S ETH is featured with

- 3 outgoing alarm contacts.
- 2 digital inputs.
- MOD bus.
- CAN bus (optional).
- Alarm monitoring.
- Recording of the events as FIFO
  - T2S USB - 200 Events
  - T2S ETH - 2000 Events



*Monitoring - T2S USB / ETH*

**Note:** Operation of the T2S USB and ETH is described in a separate manual available on request.



## 8. Media 2I Shelves Installation

### 8.1 Packaging Information

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

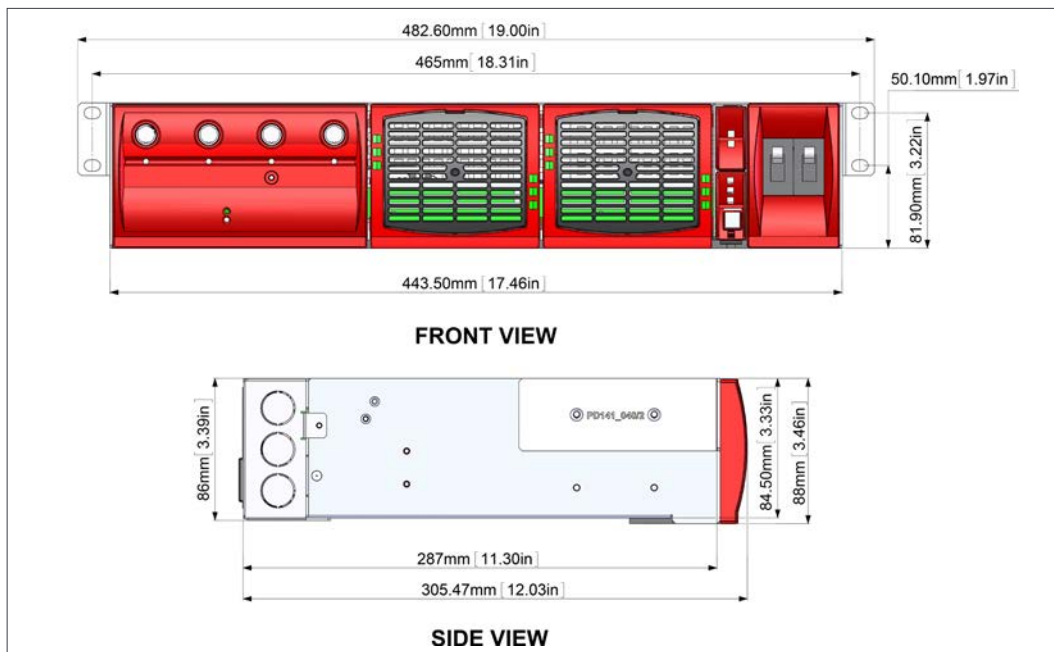
Module packing material should be taken apart and stored in case of return under warranty. Unproper packing may void the warranty.

The packing material of the TSI system is recyclable.

### 8.2 Mechanical Installation

- Sub-rack is preferable mechanically fixated without modules.
- Min two (2) fixing screws per side of the sub rack.
- Fixing holes for Inch and ETSI mounting frames.

#### 8.2.1 System Dimensions



#### 8.2.2 Mounting

The MEDIA Inverter System is designed to be mounted as part of either an open relay rack or cabinet. Mounting brackets are provided to allow installation in industry standard 19" or 23" equipment racks. Verify the mounting hardware provided is as required for your application prior to installation.

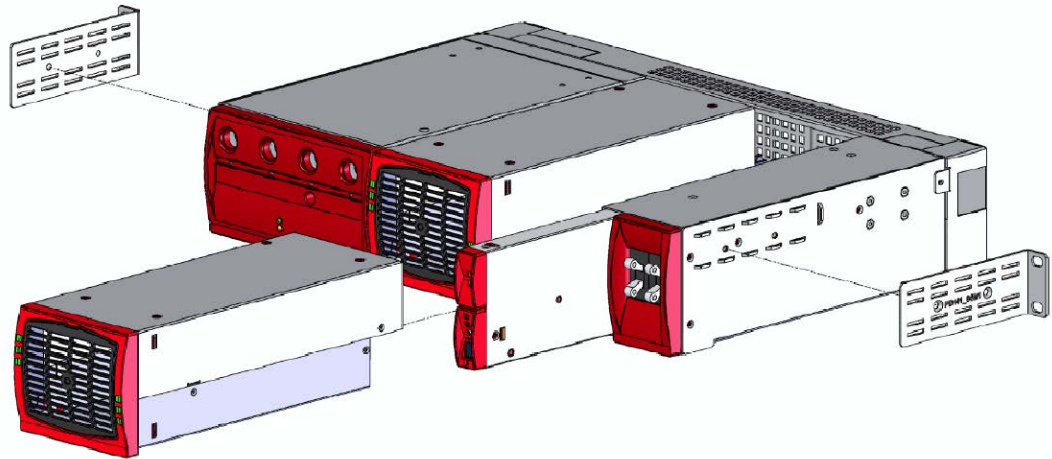
- Verify sufficient space is allowed for proper air circulation.
- Verify the following hardware is on hand.

- Brackets, 2 or 4 each.
- Screws, 2 or 4 each.

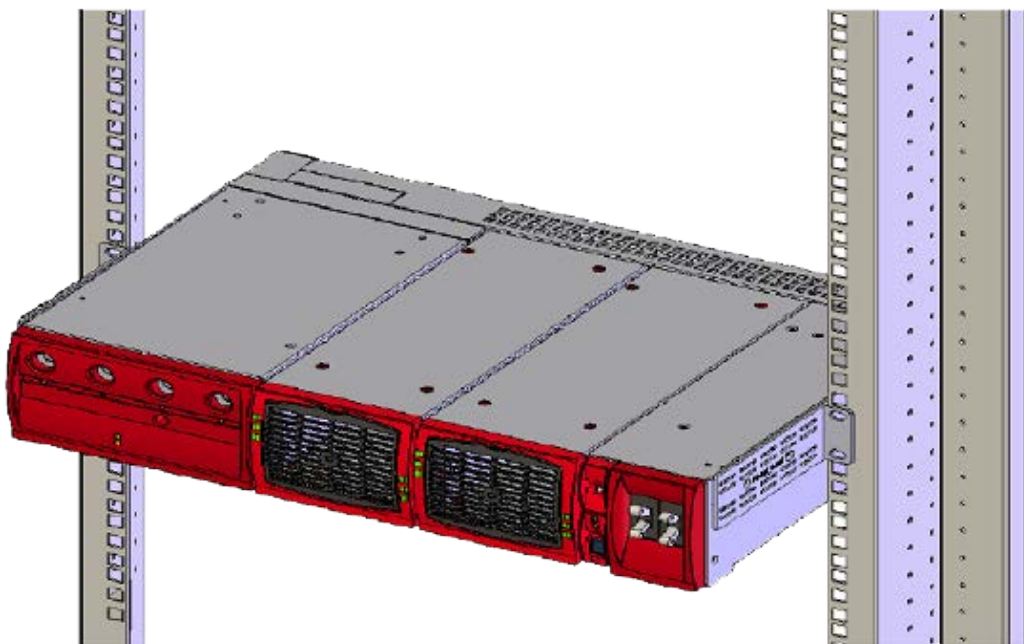
**Caution:** Installation and commissioning must be done and conducted by trained personnel only.  
Before conducting any isolation testing, contact the manufacturer for the approved procedure.

### 8.2.3 Mounting Kit

Step 1: Mount brackets to side of shelf with two supplied screws (Mid Mount shown)



Step 2: Mount shelf to uprights of relay rack or cabinet

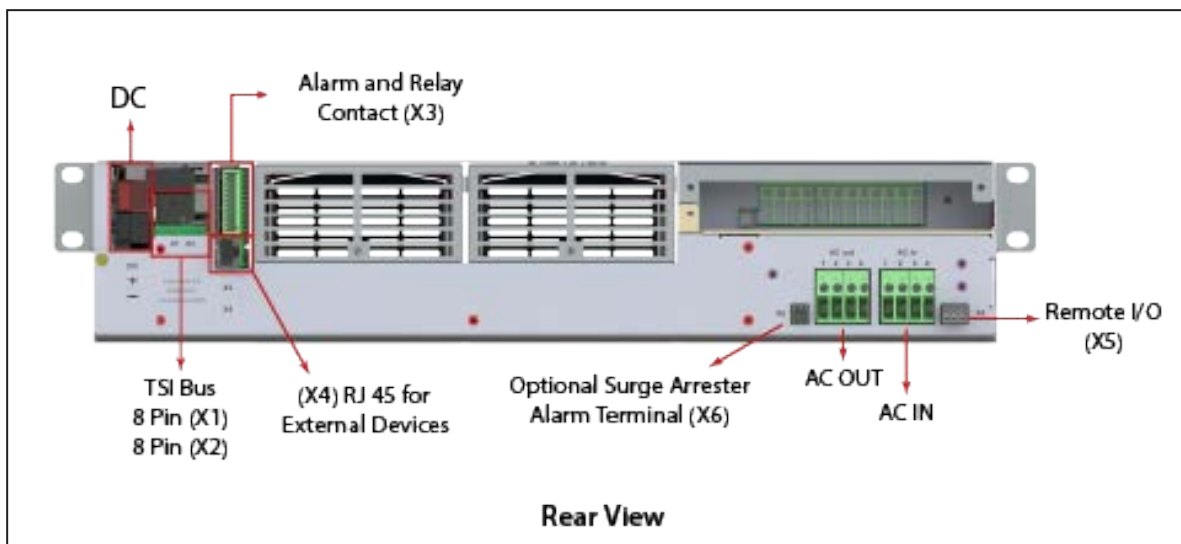


### 8.2.4 Pre-requisites

- The sub –rack have markings for all terminations.
- All cables should be rated at Min 90 deg C.
- Electrical terminations should be torqued to 5 N.m (3.68 ft-lbs).
- Input AC / Output AC / Input DC / Signal cables should be separated.
- Cable crossings should be done in 90 deg angles.
- It is recommended to install appropriate breaker at AC input and place a warning label near the breaker stating message as “**ISOLATE UNINTERRUPTIBLE POWER SUPPLY (UPS) BEFORE WORKING ON THIS CIRCUIT**”.

### 8.2.5 Terminations

Rear Side of Media 2I system terminations are clearly marked in the following figure



## 8.3 Electrical Installation

- The Earth Ground connection shall be made at the location referenced with the symbol.
- Input ground must be connected to the appropriate terminal.
- Once the frame is secured in its mounting, ensure that the proper earth grounds are made before connecting AC or DC circuits to the system.



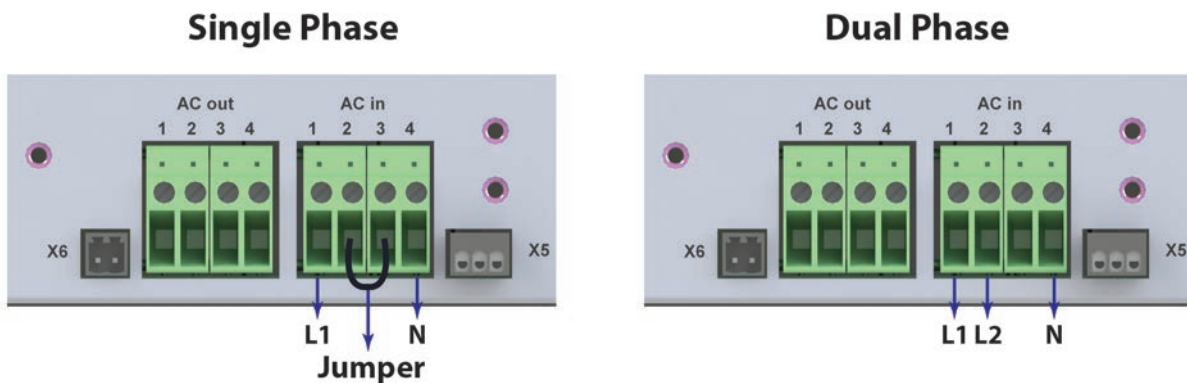
**Note:** At this point, the Inverter Modules are not installed in the shelf.  
If blank PDU extension is mounted, it must be removed to expose AC input connectors.

**Wiring the system is comprised of five operations that must be followed in sequence.**

### 8.3.1 Connecting AC Input Power

The AC input is wired to a screw terminal.

Verify Upstream and downstream AC circuit breakers are open, and make AC input connections as shown below. Verify jumper is removed before connecting Dual phase AC input wires.



AC Input Current 120 Vac	Upstream AC Breaker	Recommended Gauge*	Connector Type	Torque
12A per MEDIA Module @ nominal power (VA)	30A 1-Pole UL489	120V - #10AWG, 90°C Copper Wire	Screw Lock Connector	4.5 - 5.5 in-lbs
	20A 2-Pole UL489	240V - #12AWG, 90°C Copper Wire		

\*Actual size to be determined by, and in compliance with, local utility codes.

TSI shelf is supplied with screw terminal: Neutral, Line and Ground.

### 8.3.2 Connecting DC Input Power

Verify Upstream and downstream DC circuit breakers are open and connect the Anderson connector from the battery string(s) to the DC input connector indicated below.

**Caution:** When multiple shelves are installed in the cabinet, verify the cable sizes (cross section, mm<sup>2</sup>) and circuit breaker capacity are sufficient to allow safe connection and operation of the system and are in compliance with local utility codes.

#### Installation Notes:

Integrator must provide branch circuit protection with breaking capacity related to short circuit capacity of upstream DC source.

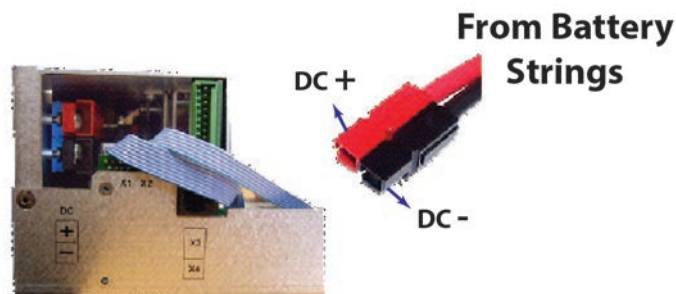
It must be installed close enough to permit easy Break before Make.

Appropriate type can be chosen within the table here below.

TSI is supplied with safety labels, which must be applied to the breaker in a visible way.

The insulation cover of connecting cables must meet the local and international standards and the cross section related to the upstream protections.

Anderson Power Pole connectors for the incoming DC power are included. Proper crimping tools should be provided at job site.



DC Input current at 40Vdc	DC breaker	Allowable Gauge*	Connector Type
34A (By MEDIA module)	40A by Inverter	#6AWG** to #16AWG	Anderson PP75 Powerpole®

(Verify the circuit breaker capacity matches the installation with regard to cable length, battery capacity).

DC Input Connector Specifications	
Current Rating (A)*	75
Voltage Rating (AC/DC)*	600
Contact Barrel Wire Size**	
AWG / mm3	#6 to #16
Max wire insulation diameter**	
in / mm	0.437 / 11.10

\* UL Rated for 65°C largest wire or cable size

\*\* Actual size to be determined by, and in compliance with, local utility codes

### 8.3.3 Grounding the System

#### Grounding Connection Notes

In order to provide a ready, reliable source of backup power it is necessary to connect the system to an effective grounding and earthing system that not only provides for the safety of the service personnel responsible for its operation and maintenance, but also facilitates the proper operation and protection of the equipment within the network. Such a grounding system provides protection with respect to operator safety, system communication, and equipment protection.

#### Safety Ground

The safety ground is a two-part system, comprised of the utility service and the Media Inverter System.

##### 1. Utility service

As a minimum requirement for the protection of equipment, the local utility service must provide a low-impedance path for fault current return to Earth. This must meet or exceed the requirements of the US National Electrical Code. The connection between the system and the utility must also meet or exceed the requirements of the US National Electrical Code.

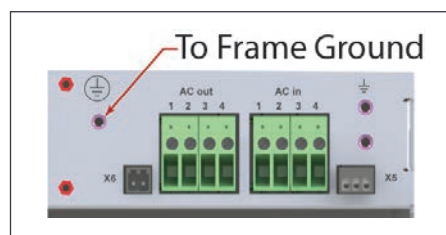
##### 2. Grounding system

The grounding system consists of a low-impedance connection between the enclosure and an Earth Ground (located at least 6' away from the Utility Earth connection). This impedance between the system and Earth must be 25 Ohms or less at 60 Hertz.

#### Strike (Lightning) Ground

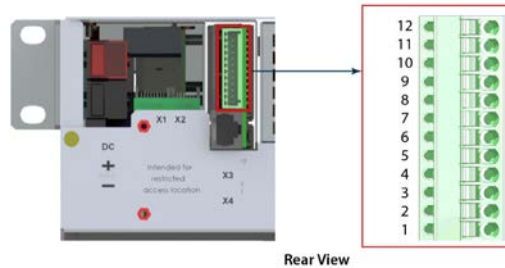
Lightning strikes, grid switching, or other aberrations on the power line and/or communications cable have the potential to cause high-energy transients which can damage the powering or communications systems. Without a low-impedance path to ground, the current, when traveling through wires of varying impedance, can produce damaging high voltage. The most viable method available to protect the system from damage is to divert these unwanted high-energy transients along a low-impedance path to ground. A low-impedance path to ground prevents these currents from reaching high voltage levels and posing a threat to equipment. The single-point grounding system provides a low-impedance path to ground, and the key to its success is the proper bonding of the ground rods, so the components of the grounding system appear as a single point of uniform impedance. CE+T America recommend the use of a surge arresting device electrically bonded to the ground System.

**WARNING:** Low impedance grounding is mandatory for personnel safety, critical for the proper operation of the system and must be in place and connected to the system before the supply cables are connected.



### 8.3.4 Alarm and Remote Monitoring

#### 8.3.4.1 Alarm



Alarm Connector Pin - Out

##### T2S digital input connection (alarm connector pins 1-3)

Two external input contacts can be monitored through the T2S. They can be used for rack alarms such as Door Opening, Over-temperature, Fan status, Manual BYPASS engaged, etc.

The voltage present on terminal 1 and 3 is +5V (galvanically insulated). Care should be taken to avoid connecting any external voltage on terminal 1 to 3.

External signals should be applied to these terminals via Voltage-free contacts.

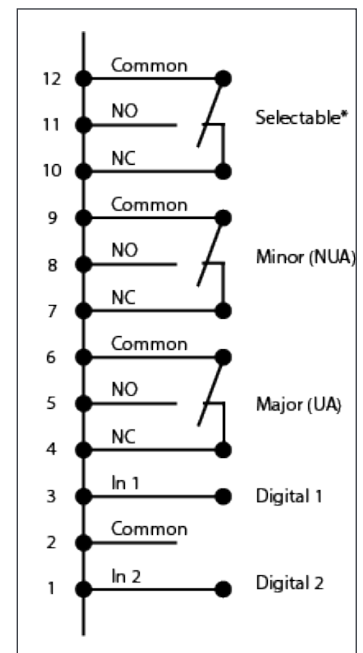
The function is activated when the 2 terminals concerned are short-circuited (i.e. when the external Voltage-free contact is closed)

##### T2S digital output connection (alarm connector pins 4-12)

MAJOR, MINOR and selectable relays provide an open or closed free potential contact.

##### **Relay characteristics:**

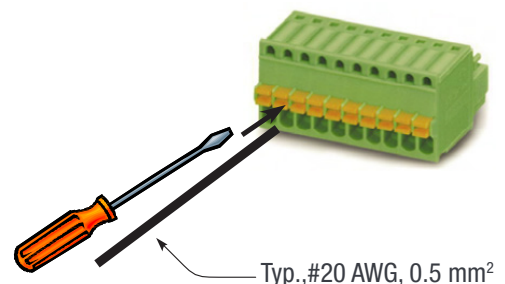
- Maximum switching capacity: 2A @ 30VDC, (1A @ 60VDC )
- Maximum switching power: 60W
- Maximum voltage: 60VDC
- Maximum switching current: 2A



##### Connecting input/output alarm wires

To connect the input and output alarm wires, follow the procedure below.

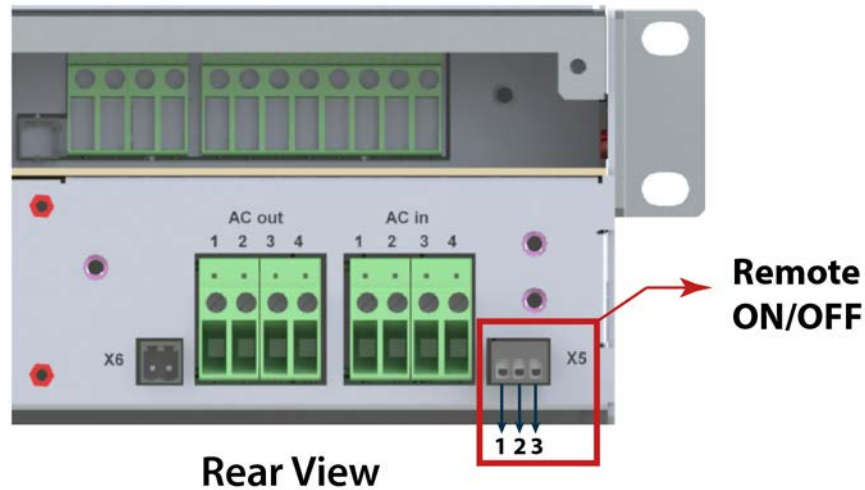
1. Strip approximately 0.25" (6mm) of insulation from the alarm wire\*.
2. Use a small-tipped flat blade screwdriver or similar tool and press inward on the Orange capturing tab.
3. Insert wire into opening, and release.
4. Reverse procedure to remove wire.



\* For this connector, the allowable wire gauge range is #20AWG to #28AWG. The actual size to be determined by, and in compliance with, local utility codes.



### 8.3.4.2 Remote ON/OFF



TSI system can be remotely activated or stopped (stand-by mode).

**Note:** Changeover contacts must be used. For transition, the TSI verifies one input is released while the other is short-circuited. If both transitions are not detected, the inverter does not change its operating status

The voltage present on terminals 1 and 3 are +5 V (galvanically insulated). Care should be taken to avoid connecting any external voltage on terminals 1 and 3. Maximum wire size is 1 mm (#22 AWG)

Functional table for remote ON/OFF function

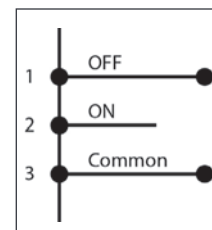
#	Pin 1-3	Pin 2-3	Status	Indication
1	Open	Open	Normal operation	All (Green)
2	Closed	Open	OFF	AC output (OFF) AC Input (Green) DC Input (Green)
3	Open	Closed	Normal operation	All (Green)
4	Closed	Closed	Normal operation	All (Green)

**Warning:** If remote ON/OFF not used, pin 2 and 3 **MUST** be bridged together!

These 3 wires must be used for the redundancy on the remote ON/OFF. Use NO/NC relay contact.

**Note:** State #3 should be implemented by default. Changing status of these inputs (State #3 State #2 State #3) forces the TSI modules to start running without T2S.

**Note:** Mating connectors supplied as part of shelf assembly. Maximum wire gauge is #22 AWG.



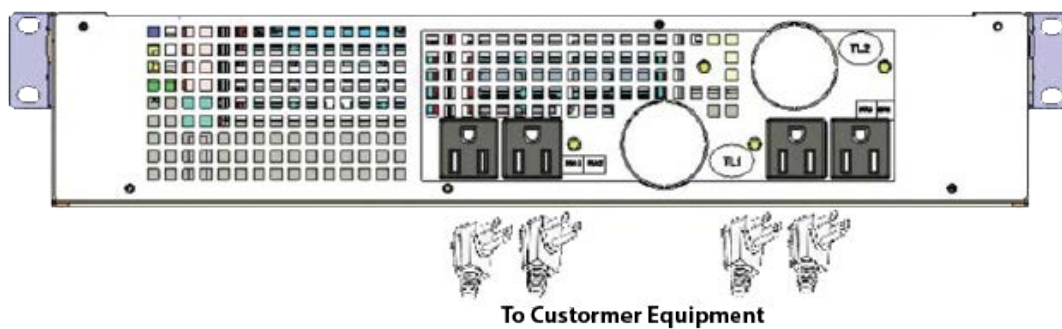


### 8.3.5 AC Output Wiring – Receptacle

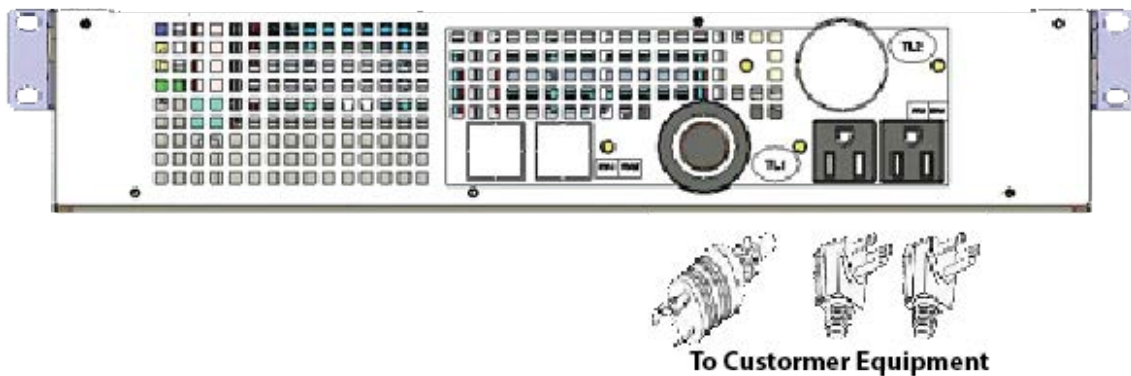
The TSI Media Inverter System can be configured with NEMA and Twist-lock style output connectors or with a hardwired AC output connection.

Verify Upstream and downstream AC circuit breakers are open and make AC output connections as shown below.

Four NEMA 15R Receptacles in PDU Extension, Single phase AC out connections



Two NEMA 15R, one twist lock Receptacles in PDU Extension, Single and Dual phase AC out connections

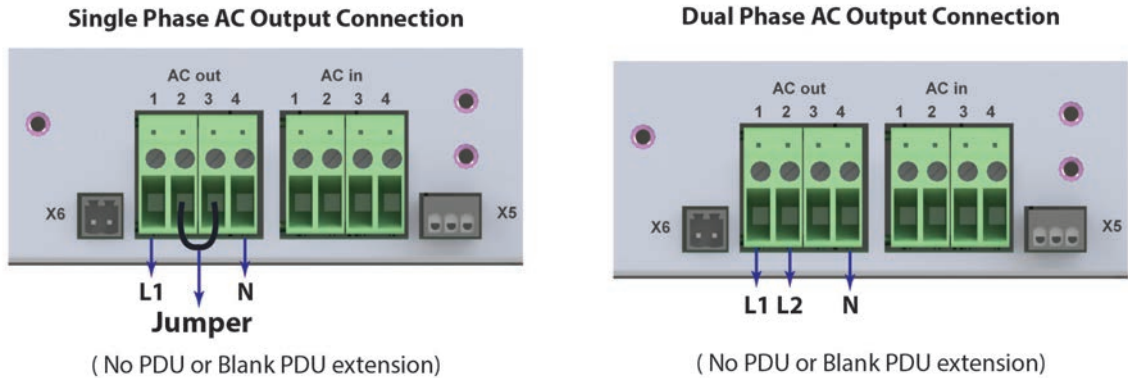


Two twist lock Receptacles in PDU Extension, Dual phase AC out connections



### 8.3.6 AC Output Wiring - Hardwired (Bulk Output)

Verify Upstream and downstream AC circuit breakers are open and make AC output connections appropriate to your system configuration as shown below.



**Note:** If blank PDU extension is mounted, it must be removed to expose AC output connectors

AC Output Current 120 VAC	Downstream AC Breaker	Recommended Gauge*	Connector Type	Torque
12.5A per MEDIA Module @ nominal power (VA)	30A 1-pole UL 489	120V - #10AWG 90°C Copper Wire	Screw lock connector	4.5 - 5.5 in-lbs
	20A 2-pole UL489	240V - #12AWG 90°C Copper Wire		

\*Actual size to be determined by, and in compliance with, local utility codes

TSI shelf is supplied with screw terminal: Neutral, Line and Ground.

#### Caution:

The bulk output shelf does not include any disconnect or protecting devices for AC output, they must be provided in the field according to local practices. Prior to any intervention on AC output make sure DC input & AC Input have been actually disconnected.

The shelf with receptacles solution includes protecting devices for AC output.  
The shelf is not hot plug device

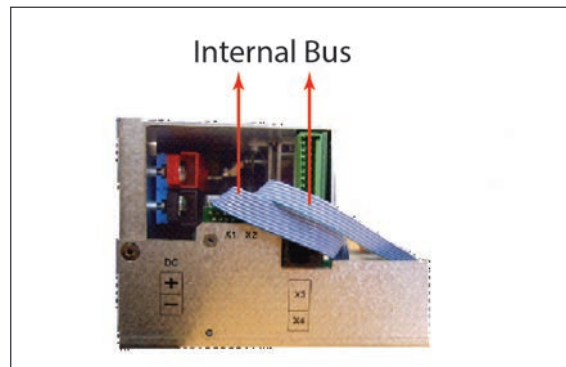
Prior any handling of the shelf, wait a few minutes (min 5 minutes) for complete discharge of internal capacitors that have been energized.

The safety standard IEC/EN62040-1-1 requires that, in case of output short circuit, the inverter must disconnect within 5 seconds. This parameter can be adjusted in 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

The default value is set at 60 seconds.

### 8.3.7 Internal bus (TSI Bus 6 pin / TSI Bus 8 pin)

- In A la Carte systems the internal Bus is pre installed
- The internal bus comprise of a 6 pole ribbon cable and an 8 pole ribbon cable.
- The internal bus connectors are sensitive and special caution should be taken during installation to keep them out of harms way
- The internal bus is connected from the first shelf to the last shelf.



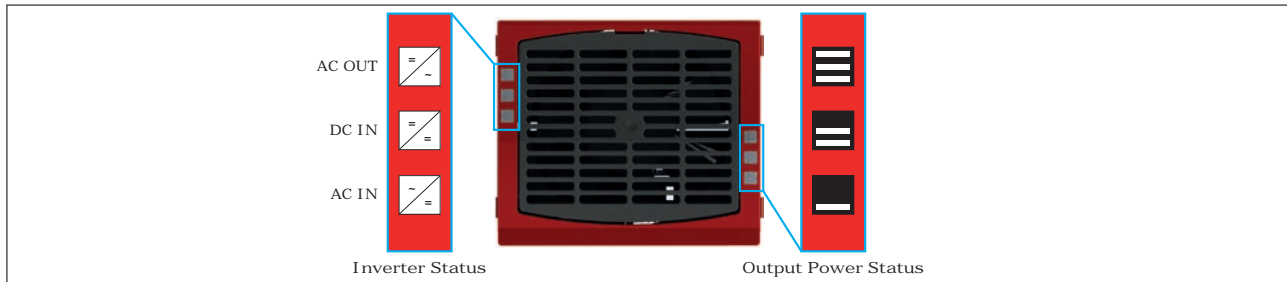
## 8.4 Installing Inverter Modules

Once the shelf has been fully wired, the Inverter Modules can be installed. Before installation of any of the modules, verify all upstream and downstream circuit breakers are in the OFF (open) position

Refer Section 11.1.2, page 34 for module inserting procedure.

## 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	No action required
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

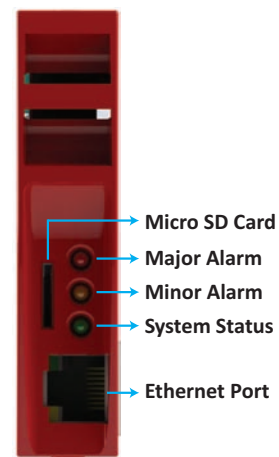
Output Power (redundancy not counted)						
<5%	5% to 40%	40 to 70%	80 to 95%	100%	100% = overload	Output Power (redundancy not counted)
×	×	×	≡	≡	≡	Status output power LED
×	×	≡	≡	≡	≡	
—	—	—	×	—	—	
1B	1P	2P	2P	3P	3B	Behaviour (B = blinking – P = permanent )

## 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 Laptop.
- Factory default according to list of set values.



*T2S USB - Front details*



*T2S ETH - Front details*

## 10. System Set up

Media 2I System is delivered with default set of parameters referred as factory settings.

The standard configuration will be as shown below:

- System with T2S USB
- System with T2S ETH

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

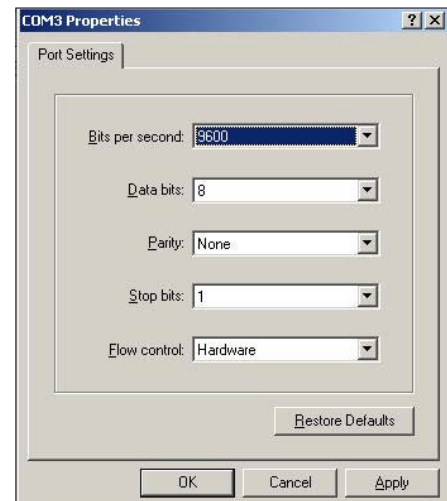
Refer to “TSI T2S 120 VAC User Manual Vx\_x” for detailed description of system status reading and changing as well as parameter adjustment.

### 10.1 T2S USB

- 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\\_hypercentinal.zip](http://www.cet-power.com/uploads/Driver_T2S/Driver_T2S_for_Windows_and_hypercentinal.zip)
- Refer T2S USB user manual for detailed setup.

#### 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

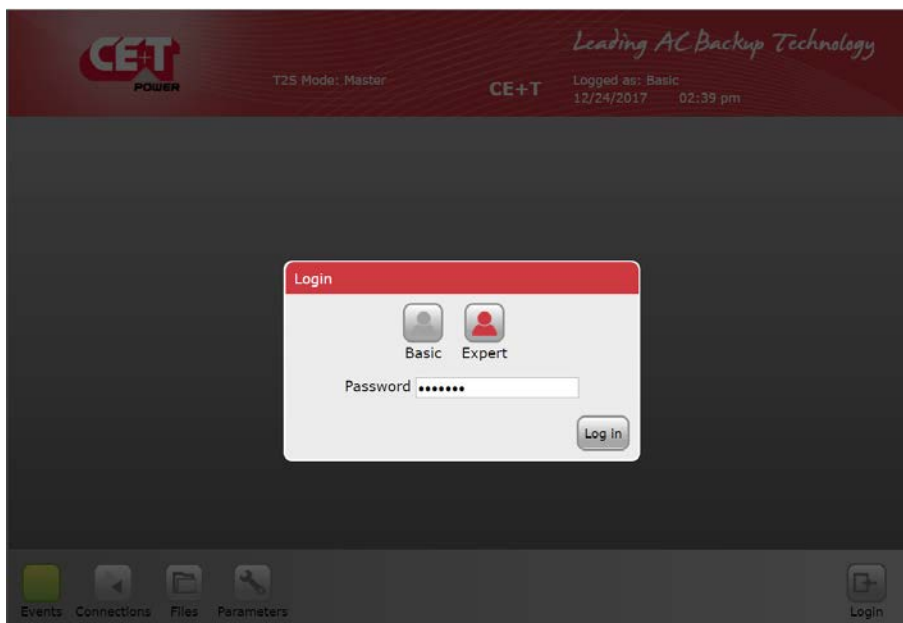
- 0 > Return to index
- 1 > Enable Password protection

## 10.2 T2S ETH

The configuration and other parameters can be changed using the web interface

Connect the laptop and T2S ETH through network cable (not included).

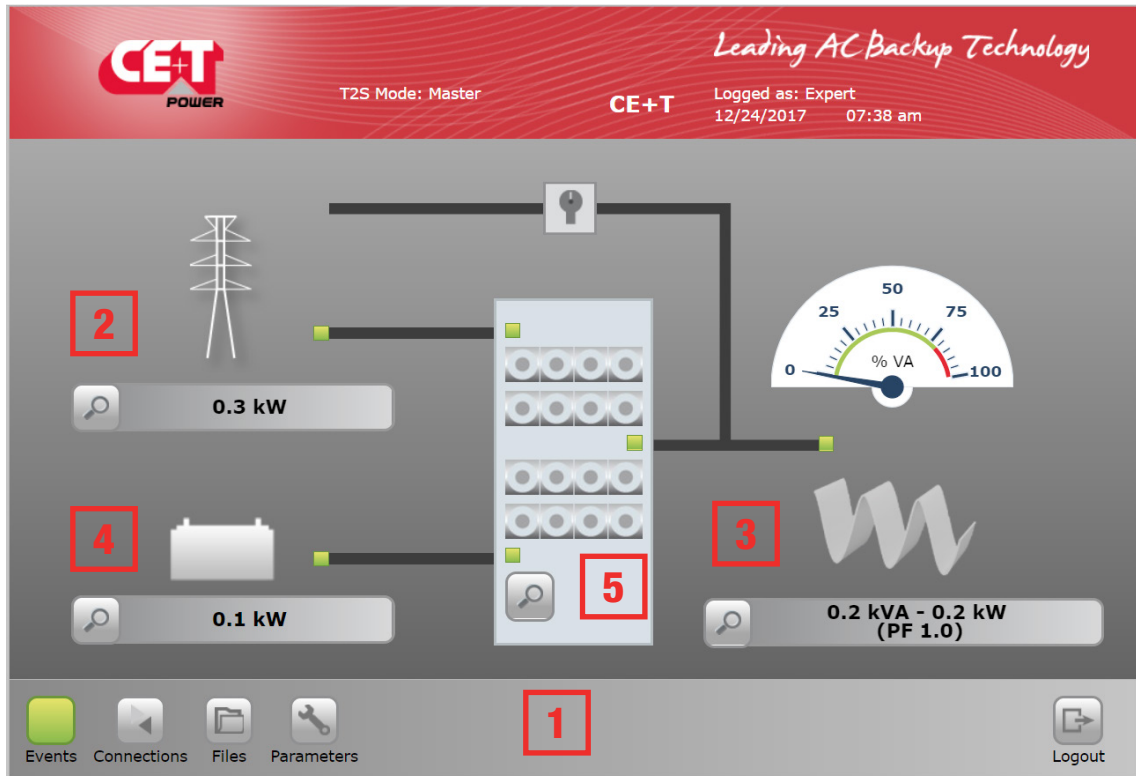
1. In the web browser, enter the default IP address 192.168.0.2
2. Choose a user (Basic or Expert) and click “Log in”.
  - No password is required for Basic
  - Expert is protected with default password “*pass456*”





## 10.2.1 The Home page

After connecting at the basic or expert level, the catena will display the home page as below.



1. Toolbar provides access to events, connections, files, and parameters
2. AC input menu display AC input power in kW
3. AC output menu display the level of AC output power in kW/kVA
4. DC input menu
5. System menu and further module menu



If a MBP is configured in the system, it will be depicted on top of system, from AC IN to AC OUT.

All LED symbols indicate if there are any alarms present in the system.



Green No alarm present normal operation



Alarm present minor (orange), major (Red)

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

**Note:** To know more details, refer T2S ETH user manual.

# 11. Inserting/removing/replacing modules

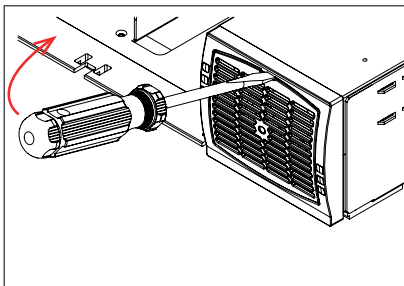
## 11.1 TSI Inverter

- 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.

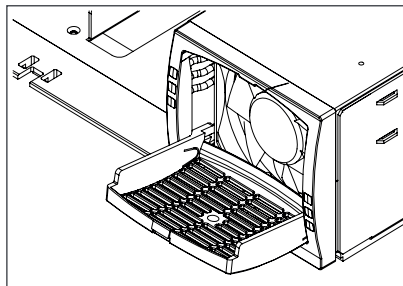
### 11.1.1 Removal

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

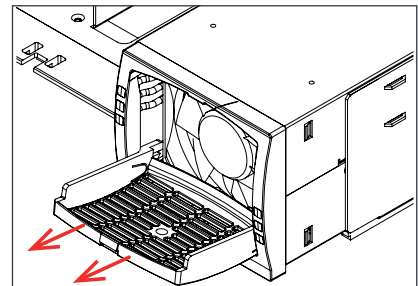
- Inverter module is not switched off when opening the handle. The handle only hooks the module to the shelf.
- Use a screw driver to release the latch of the handle.
- Open the handle and Pull the module out.
- Replace with new module or blind unit.



A) Use screwdriver to release the latch



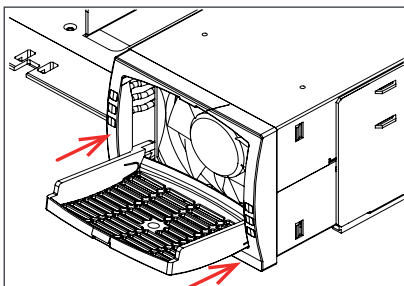
B) open the cover completely



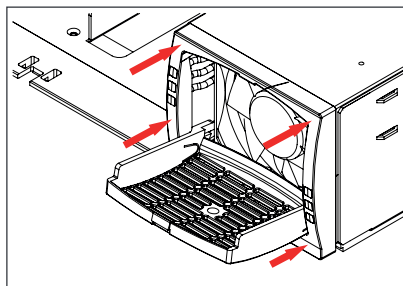
C) Use the cover as a handle to remove the module

### 11.1.2 Inserting

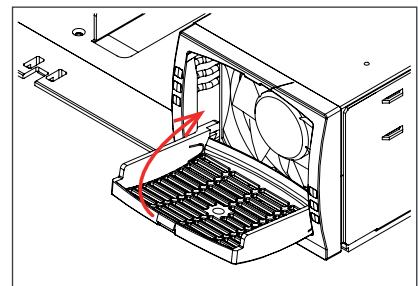
- Check module compatibility (DC Voltage!).
- Use a screw driver to release the latch of the handle.
- Open the handle and Push firmly until the unit is properly connected.
- Close the cover and latch in position.



A) Slide the module in



B) Push firmly till the connection is properly engaged

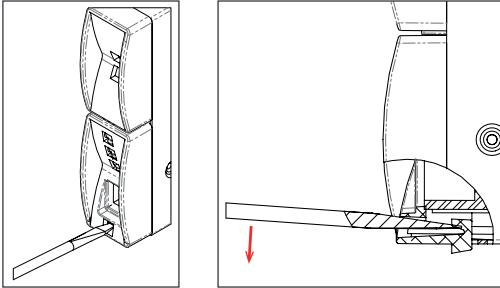


C) Close the cover and latch the module in place if too hard redo step B

## 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. Final Check

---

- Make sure that the sub-rack/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 relieved.
- 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 dummy cover.
- 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.

## 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:	<ul style="list-style-type: none"> <li>Check AC input present and in range (AC breakers)</li> <li>Check DC input present and in range (DC breakers)</li> <li>Check that the inverter is properly inserted</li> <li>Remove inverter to verify that slot is not damaged, check connectors</li> <li>Check that module(s) is (are) in OFF state</li> <li>Check for loose terminations</li> </ul>
Inverter system does not start:	<ul style="list-style-type: none"> <li>Check that T2S is present and properly inserted</li> <li>Check remote ON/OFF terminal</li> <li>Check the configuration and setting</li> <li>Check threshold level</li> </ul>
Inverter only run on AC or DC:	<ul style="list-style-type: none"> <li>Check AC input present and in range (AC breakers)</li> <li>Check DC input present and in range (DC breakers)</li> <li>Check the configuration and setting</li> <li>Check threshold level(s)</li> </ul>
No output power:	<ul style="list-style-type: none"> <li>Check output breaker</li> </ul>
All OK but I have alarm:	<ul style="list-style-type: none"> <li>Check configuration file and correct No of modules</li> <li>Download/clear log file</li> </ul>
No output alarm:	<ul style="list-style-type: none"> <li>Mind the default time delay (UA: 60s, NUA: 30s)</li> <li>Check configuration file</li> </ul>
No information on CanDis:	<ul style="list-style-type: none"> <li>Check that T2S is present and properly inserted</li> <li>Check that the RJ45 cable is connected between T2S shelf and CanDis shelf</li> </ul>
No value on TCP/IP:	<ul style="list-style-type: none"> <li>Check that the RJ45 cable is connected between T2S shelf and CanDis shelf</li> <li>Wait approx 2 minutes to allow the system to collect serial data.</li> </ul>

### 14.2 Defective modules

Unless input power is down all LEDs on each module should be green (see section 9, page 28). No light, orange light, red or flashing light are abnormal conditions. Refer to section 10.1.2, page 31 to collect and record module information. If no fix can be found, replace module.

#### 14.2.1 Replacing modules

Refer to section 11, page 34 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 40

#### 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 40

#### 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 by email at [tech.support@cetamerica.com](mailto:tech.support@cetamerica.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

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### 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 [tech.support@cetamerica.com](mailto:tech.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 knowledge 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, clean the module by air suction blower or vacuum cleaner.
- 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.

