Leading AC Backup Technology

TSI MIPS - 120 VAC

Modular Inverter Power System

User Manual V7.4

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
- **LARGE PRODUCT SELECTION**
  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

Table of Contents

Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
7.0	19/02/2014	-	First release of the Manual.
7.1	30/04/2014	16	System description illustration (AC in & AC out representation changed).
		23	Cabinet inlets illustration (AC in & AC out location changed).
		24	Earth grounding and Neutral grounding illustration.
		36	MBP section updated with content.
7.2	23/03/2015	6, 7, 11, 22, 32, 34, 36, and 39	Added additional information's and updated the illustrations.
7.3	20/04/2016	-	Amendment and correction.
7.4	07/03/2018	-	Updated images and information.

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 performance and related maintenance costs.

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

- Maximizes the operator's applications uptime;
- Operates with lowest OPEX;
- Provides the best protection from power 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 days a 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 Bypass
TCP/IP	Transmission Control Protocol/Internet Protocol
USB	Universal Serial Bus
PE	Protective Earth (also called Ground / GND)
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, indoors, it is important to:

- Install an appropriate filter on the enclosure door, or on the room's air conditioning system. Installation of filters may result in derating of module.
- 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. Manufacturer may waive warranty if the system is not installed and commissioned by factory trained technician.
- 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 are trained in OSHA and NFPA safety related work practices, and NFPA 70E Arc Flash Protection and PPE requirements.
- 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.

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

- When handling the system/units pay attention to sharp edges.
- This product is suitable for use in a computer room.

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 8.5.4, page 28.
- 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 or equivalent device; 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.
- 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 removing the inverter modules. Mark inverter modules clearly with shelf and position for correct rebuild. This is especially important in dual or three phase configurations.
- Empty module positions must not be left open. Replace with blank module or cover.
- This equipment is shipped with a SHOCKWATCH monitor. SHOCKWATCH monitor should be inspected upon receipt of shipment. If the SHOCKWATCH shows that the equipment was exposed to excessive force the warranty will be void.

3.3.2 Surge and Transients Protection

The mains (AC) supply of the modular inverter system shall be equipped with Lightning surge suppression and Transient voltage surge suppression suitable for the application. Follow manufacturer's recommendation for installation. Selecting a device with an alarm relay for function failure is advised.

All sites are considered to have a working lightning surge suppression device in service and installed close enough to ensure effective protection in accordance with best industry practice.

- 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. Irreparable damage may occur.

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.

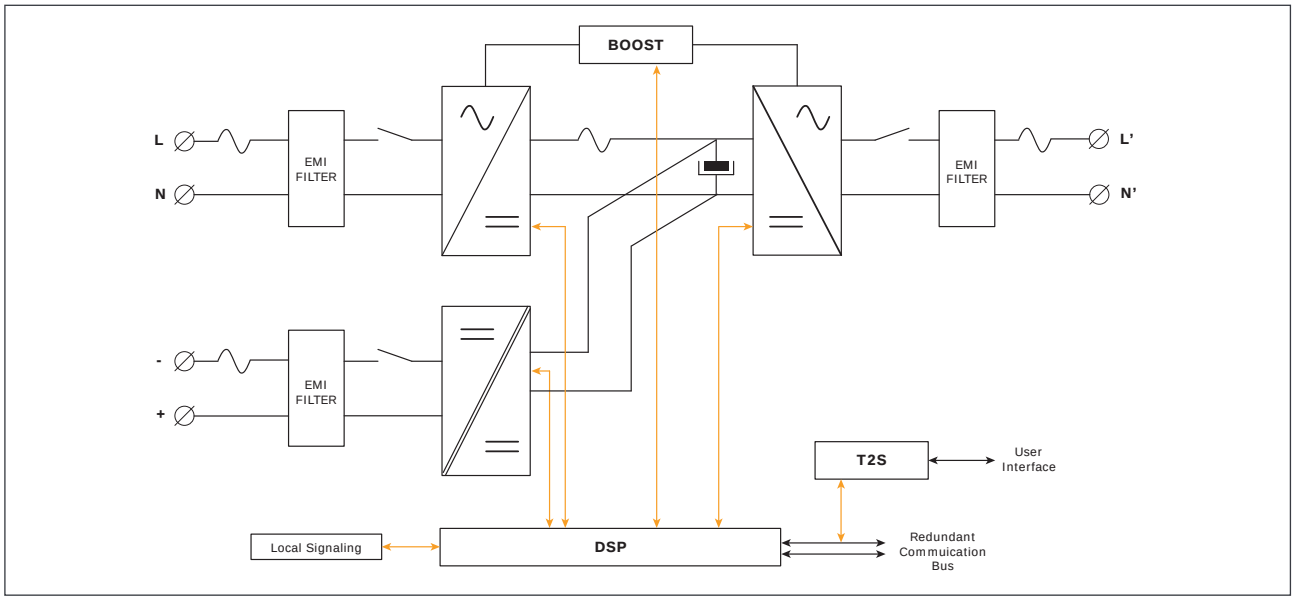
3.5 Replacement and Dismantling

- 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.

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 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.

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1 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 down stream 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 configuration file.
  See Section 10, page 41 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. Inverter Components

5.1 Inverter module

BRAVO: -48 VDC / 120 VAC, 60 Hz (50 Hz).

Figure 1. *TSI Bravo Module*

- The TSI Bravo is a 2500 VA / 2000 W converter based on the TSI technology (see section 4, page 11).
- The TSI inverter modules are hot swappable and hot pluggable. They are featured with self setting capabilities for easy plug-and-play operation.
- LED's on module front plate display the status of converter and output power.
- Inverter modules can be combined to build any single or multi-phase structures.
- The inverter modules are equipped with soft start.
- The fan is equipped with alarm and run time meter. It is field replaceable.
- 17.13" (D) x 4.02" (W) x 3.46" (H). [435 mm (D) x 102 mm (W) x 88 mm (H)].
- 11 Lbs [5 kg].

5.2 Sub-rack (Shelf)

- The cabinetized enclosure is built from supporting shelves (sub-rack) designed according to 19inch standard.
- The BRAVO shelf houses max four (4) inverter modules and one (1) T2S interface. Max 10 kVA per shelf.
- Additional shelves can be stacked and interconnected to build more powerful structures.
- The BRAVO shelf is designed with individual DC input, common AC input and common AC output.
- Each bravo shelf is designed for single phase input and output.
- Optional rear cover can be provided for enhanced safety in cabinet.
- 18.9" (D) x 19" (W) x 2U (H). [480mm (D) x 19" (W) x 2U (H)].
- 13 Lbs [6 Kg] empty.

Figure 2. *Bravo shelf with modules*

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 or an ethernet 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.

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 Section Monitoring

The T2S monitoring max of 32 inverter modules.

The T2S is featured with

- 3 outgoing alarms contacts.
- 2 digital inputs.
- MODBUS.
- T2S-ETH.
- SNMP v1.
- Alarm monitoring.
- Record the latest 200 events. FIFO

Figure 3. *Monitoring - T2S USB*

Note: Operation of T2S-USB is described in separate manual available on request.

6.2 CATENA

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

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

Figure 4. *Monitoring - CATENA*

- Measures
  - Power / Power Factor
  - AC IN
  - DC IN
  - AC OUT
  - Module Temperature.
- Alarms
  - Major/Minor
  - System Level
  - Phase Information
  - Module Information
- 7” touchscreen
- Web browser with laptop (ETH)
- Height: 3U
- SNMP v1, v2c, v3, and MODBUS.

Note: Operation of Catena is described in a separate Monitoring manual.

6.3 CANDIS

6.3.1 CANDIS shelf

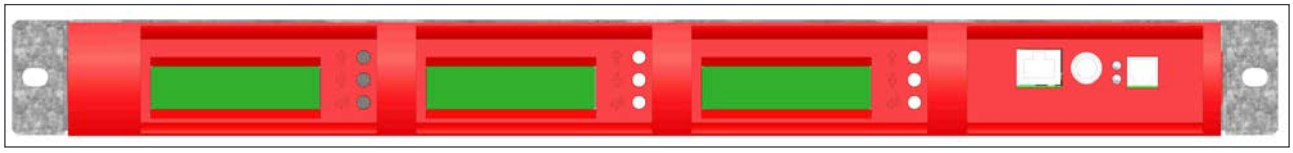


Figure 5. *Monitoring - CANDIS*

The CANDIS shelf has slots for up to 3 display units and 1 TCP/IP agent.

6.3.2 Display

Backlit 2 line dot matrix.

The display shows two values simultaneously.

6.3.3 TCP/IP Agent

The TCP/IP interface board is mounted on the CanDis shelf and is powered from within the system.

- Supports SNMP v1, v2c, v3.

Figure 6. *CS 121 SNMP AGENT*

Remark:

TCP/IP interface also exists as stand alone unit with protective enclosure. Features are identical. It can be mounted independently from the CANDIS shelf, fixed on a support or snapped-on to DIN rail.

6.3.4 CATENA with T2S-ETH

Figure 7. *Monitoring - T2S ETH*

Note: Operation of T2S-ETH is described in separate manual available on request.

6.4 Manual Bypass

Figure 8. *MBP Switch*

The Manual Bypass operates via manually operated switches to create a connection from the AC main input directly to the output AC distribution. Standard Manual Bypass are “Make before Break”. When engaged or disengaged, no disturbance is transmitted to the load.

When MBP is engaged, inverter modules are switched off and can be removed without impacting the load. The DC source is not physically disconnected. After disconnecting the DC source (By opening the DC Breakers), the shelf section is safe for maintenance.

NOTE:

When the system is in Bypass the load is subjected to AC main disturbances.

An internal MBP must be present if connection is made via a non-CE+T external MBP

6.4.1 EMBS

“See EMBS User Manual” for more information.

6.5 Surge Arresters

The mains (AC) supply of the modular inverter system shall be fitted with suitable Lightning surge suppression and Transient voltage surge suppression. Manufacturers installation guidelines shall be followed. It is advised to select a device with an alarm relay contact for notification.

All 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.

Surges from induced lightning and power switching operations are smaller but are more numerous and can result in equipment misoperation, lockup or damage.

Inverter damage caused by improper surge protection are not covered by CE+T product warranty.

7. MIPS Design and Description

7.1 System Design

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

- Telecom grade design.
- Based on BRAVO 48 VDC - 120 VAC TSI module.
- Fully modular.
- Supports redundant configurations.
- Supports EPC mode.
- Cabinet NEMA 1 (IP 20)
- The cabinet requires air flow out the rear of the modules and is not designed to be installed back against a wall. Maintain 36" space of air flow and maintenance access per NEC.

Picture is given for illustration only. Some accessories shown may be optional.

Figure 9. *MIPS 75 KVA Inverter System*

7.2 System Description

MIPS comes fully equipped with

- Individual DC protection for modules.
- MBP included by default (can be removed on request).
- EMBS available upon request.
- CATENA or CANDIS shelf and display (one display per phase configured).
- TCP-IP interface (included by default).
- T2S interface.
- AC input breaker (bulk)-supplementary type (can be removed on request).
- AC output breaker (bulk)-branch circuit protection (can be removed or replaced by supplementary type on request).

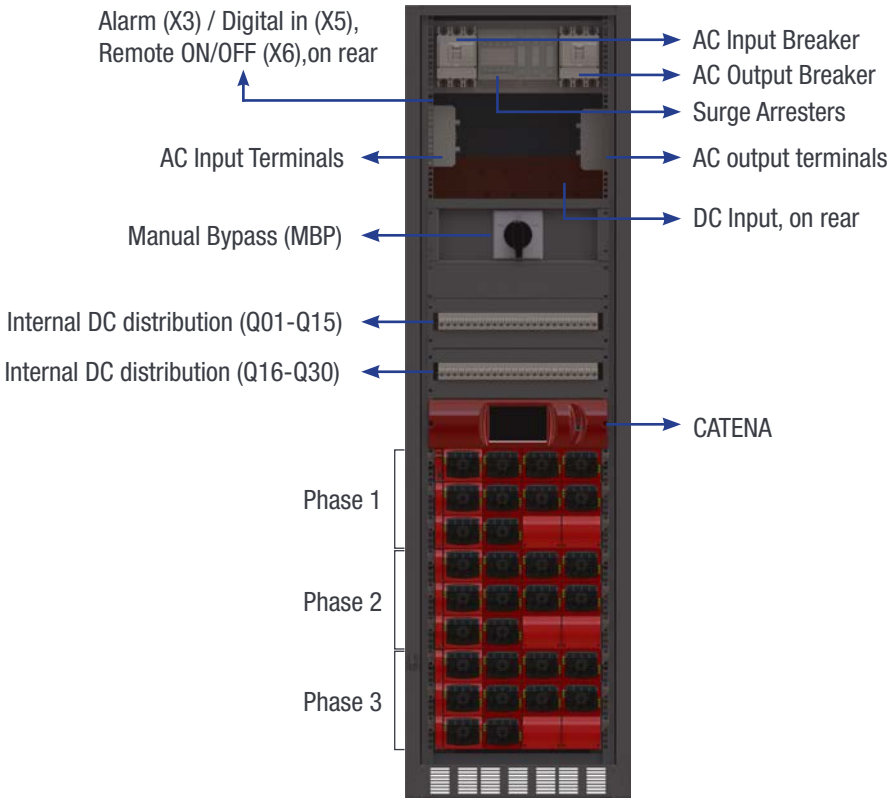


Figure 10. *MIPS 75 kVA System - General Arrangement*

Options

- Surge Arrestors (Installed by default).
- Door.
- DC Disconnect.
- External Manual Bypass Switch (EMBS).

7.3 MIPS Single phase configuration - 120 VAC

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

System Designation	Max Power (kVA)	Max power (KW)	Number of Shelves	Max number of Modules
MIPS-1-20-xx-08	20	16	2	8
MIPS-1-25-xx-10	25*	20*	3	10 (12**)

* : This configuration doesn't use all available slots.

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

System Designation	Bulk DC*** input			2 DC*** input		
	Fuse or Breaker	Cable Min	Cable Max	Fuse or Breaker	Cable Min (per feed)	Cable Max (per feed)
MIPS-1-20-xx-08	500 A	2x300 kcmil or 3x3/0 AWG	9x500 kcmil	2x250 A	1x300 kcmil or 2x1/0AWG	3x500 kcmil
MIPS-1-25-xx-10	600 A	2x500 kcmil or 3x4/0 AWG	9x500 kcmil	2x300 A	1x500 kcmil or 2x2/0 AWG	3x500 kcmil

*** : Refer Section 8.5.5, page 29

System Designation	AC input & AC output				
	Branch Protection		Supplementary Protection		Cable Max Based on Terminal Size
	Breaker	Cable Min	Breaker	Cable Min	
MIPS-1-20-xx-08	225 A	250 kcmil	200 A	4/0 AWG	300 kcmil
MIPS-1-25-xx-10	250 A	300 kcmil	225 A	250 kcmil	300 kcmil

Note:

By default input and output breakers are installed in the cabinet with above mentioned rating.

Input breaker is "Supplementary", an additional branch protection, supplied by customer, should be installed in main switch gear.

Output breaker is "Branch" and can be directly connected to downstream distribution panel.

7.4 MIPS Single Phase Configuration - 240 VAC

A split phase system is 120 VAC from L to N and 240 VAC from L1 to L2 and L1 and L2 are phase shifted by 180 degrees. (For 208 VAC systems, the phase shift can be set to 120 degrees). Input and output are made upon 3 wires + Ground, cabling and phase shift must match.

System Designation	Max Power (kVA)	Max power (KW)	Number of Shelves	Max number of Modules
MIPS-2-20-xx-08	20	16	2	8**
MIPS-2-40-xx-16	40	32	4	16**
MIPS-2-50-xx-20	50***	40***	6	20**/*** (24****)

* : 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.

*** : This configuration doesn’t have all slots in use.

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

System Designation	Bulk DC***** input			2 DC***** input		
	Fuse or Breaker	Cable Min	Cable Max	Fuse or Breaker	Cable Min (per feed)	Cable Max (per feed)
MIPS-2-20-xx-08	500 A	2x300 kcmil or 3x3/0AWG	9x500 kcmil	2x250 A	1x300 kcmil or 2x1/0AWG	3x500 kcmil
MIPS-2-40-xx-16	1000 A	3x500 kcmil or 4x300 kcmil	9x500 kcmil	2x500 A	2x300 kcmil or 3x3/0 AWG	3x500 kcmil
MIPS-2-50-xx-20	1200 A	4x500 kcmil or 6x4/0AWG	9x500 kcmil	2x600 A	2x500 kcmil or 3x4/0 AWG	3x500 kcmil

***** : Refer Section 8.5.5, page 29

System Designation	AC input & AC output				
	Branch Protection		Supplementary Protection		Cable Max Based on Terminal Size
	Breaker	Cable Min	Breaker	Cable Min	
MIPS-2-20-xx-08	110 A	1 AWG	100 A	2 AWG	1 AWG
MIPS-2-40-xx-16	225 A	250 kcmil	200 A	4/0 AWG	300 kcmil
MIPS-2-50-xx-20	250 A	300 kcmil	225 A	250 kcmil	300 kcmil

Note:

By default input and output breakers are installed in the cabinet with above mentioned rating.
Input breaker is “Supplementary”, an additional branch protection, supplied by customer, should be installed in main switch gear. Output breaker is “Branch” and can be directly connected to downstream distribution panel.

Neutral must be landed on both input and output terminals.

7.5 MIPS Three Phase Configuration - 208 VAC

Three phase systems are 120 VAC 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 degrees one to the other.

System Designation	Max Power (kVA)	Max power (KW)	Number of Shelves	Max number of Modules
MIPS-3-30-xx-12	30	24	3	12 *
MIPS-3-60-xx-24	60	48	6	24 *
MIPS-3-75-xx-30	75	60	9	30 *

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

System Designation	Bulk DC** input			3 DC** input		
	Fuse or Breaker	Cable Min	Cable Max	Fuse or Breaker	Cable Min (per feed)	Cable Max (per feed)
MIPS-3-30-xx-12	700 A	3x300kcmil or 4x3/0AWG	9x500kcmil	3x250 A	1x300kcmil or 2x1/0AWG	2x500kcmil
MIPS-3-60-xx-24	1600 A	5x500kcmil or 7x300kcmil	9x500kcmil	3x500 A	2x250kcmil	2x500kcmil
MIPS-3-75-xx-30	2000 A	6x500kcmil or 8x300kcmil	9x500kcmil	3x600 A	2x500kcmil	2x500kcmil

** : Refer Section 8.5.5, page 29

System Designation	AC input & AC output				
	Branch Protection		Supplementary Protection		Cable Max Based on Terminal Size
	Breaker	Cable Min	Breaker	Cable Min	
MIPS-3-30-xx-12	110 A	1 AWG	100 A	2 AWG	1 AWG
MIPS-3-60-xx-24	225 A	250kcmil	200 A	4/0 AWG	300kcmil
MIPS-3-75-xx-30	250 A	300kcmil	225 A	250kcmil	300kcmil

Note:

Sometimes three phase systems with 2 legs instead of three can be requested. They can be called split phase or dual phase. Effectively they are based upon same hardware than split phase (see 7.4) 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. By default input and output breakers are installed in the cabinet with above mentioned rating.

Input breaker is "Supplementary", an additional branch protection, supplied by customer, should be installed in main switch gear. Output breaker is "Branch" and can be directly connected to downstream distribution panel.

Neutral must be landed on both input and output terminals.

7.6 MIPS Module Based Current Ratings

# Modules	Rated AC Input/Output Current per Phase (Amps)	Rated DC Input Current per Polarity (Amps)
120 Vac - Single Phase - 2 Wires + PE		
1	20.83	48.00
2	41.66	96.00
3	62.49	144.00
4	83.32	192.00
5	104.15	240.00
6	124.98	288.00
7	145.81	336.00
8	166.64	384.00
9	187.47	432.00
10	208.30	480.00
120/240 Vac - Single Phase - 3 Wires + PE		
2	20.83	96.00
4	41.66	192.00
6	62.49	288.00
8	83.32	384.00
10	104.15	480.00
12	124.98	576.00
14	145.81	672.00
16	166.64	768.00
18	187.47	864.00
20	208.30	960.00
120/208 Vac - Three Phase - 4 Wires + PE		
3	20.83	144.00
6	41.66	288.00
9	62.49	432.00
12	83.32	576.00
15	104.15	720.00
18	124.98	864.00
21	145.81	1,008.00
24	166.64	1,152.00
27	187.47	1,296.00
30	208.30	1,440.00
Upstream / downstream protections and field wiring should be based on the maximum number of modules		

8. System Installation

8.1 Site Preparation

- Input and output protection.

When installing MIPS inverter systems, UL489 listed AC upstream (input) and downstream (output) circuit breakers are required. Refer Section 7.3, page 20, 7.4, page 21, and 7.5, page 22 for breaker sizes.

At MIPS Input

Branch circuit protection breaker should be provided in upstream switchgear regardless of any protective device already installed at the input of the MIPS.

At MIPS Output

Whenever the MIPS is supplied with supplementary output breaker or without any protective device at all (see option listed in 7.2), appropriate protection should be provided on site according to following table:

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

- Refer to Section 7, page 18 for sizing over current protection and cables. All cables should be copper wire and must be rated for min 90°C (194°F).
- All cables must be C-UL-US or CSA Listed cables.
- All cables lugs must be C-UL-US or CSA listed. They must be sized according to the rated current of the inverter system and to the customer terminal connection.
- Wire all positions for future expansion.
- All AC input, AC output, DC input, and signal cables shall be kept separated.
- Cable crossings shall be arranged at 90 degree angles.
- Empty inverter positions shall be covered with blank module covers
- System cooling – The System should not be installed with the rear of the unit at, near, or up against a wall
  - **A minimum of 36 inch clearance is required at the rear of the unit**.
  - **A minimum of 6 inch clearance is required on top of the cabinet**.
- The System is designed to operate in a temperature controlled (maximum operating ambient 40°C/104°F) and clean environment. The presence of airborne particles such as dust, sand and metallic debris are forbidden. Appropriate filters shall be installed.
- Heat Load Calculation - The system heat loss can be calculated by taking the system size in KW and multiplying by 375.2 BTU/hr.

Warning:

Filters mounted to the air inlets reduce the air pressure and may cause inverters to 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.

8.1.1 Transformer and Generator Sizing

The inverter is capable of operating at 150% of rated capacity for 15 seconds. The boost function allows up to 10 times the rated inverter capacity for 20 ms to clear downstream faults.

- Transformers supplying AC to the inverter should be sized at a minimum of 1.5 times the kVA rating of the inverter to meet this requirement.
- Generators supplying emergency AC to the building and to the inverter should be sized at a minimum of 2 times the kVA rating of the inverter.

8.2 Packaging Information

CE+T cabinets are always fixed on a pallet, and then packed in a wooden crate. These crates are usually delivered laying flat, horizontally.

To unpack your cabinet, we recommend the following method:

1. Make sure that the crate is laying flat, with the correct side up. This side is identified by a double red arrow.
2. Remove the top cover in order to be able to identify the top and bottom sides of the cabinet.
3. Raise the crate vertically with the top side of the cabinet up. Make sure that the cabinet does not fall forward out of the crate while you do so.
4. Remove the cabinet and its attached pallet from the crate.

If you prefer to take the wooden crate apart before raising the cabinet, make sure you do not damage or dent the cabinet while doing so.

Warning : The top cover fixing bolts may NEVER be replaced with lifting eye bolts.

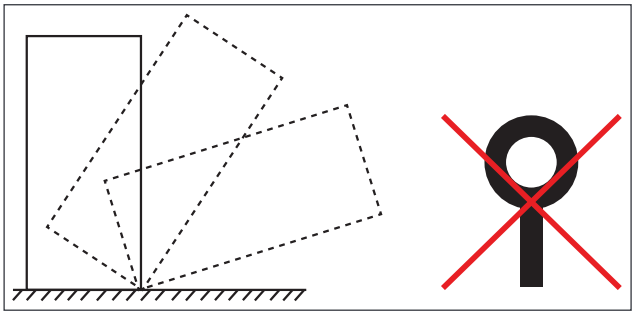


Figure 11. *Cabinet Lifting*

8.3 Module packing

Modules ordered with system are packed separately in a carton or a pallet. They come labelled. Please insert modules in the preassigned slots.

If the modules have been ordered separately they are packed in carton on pallet. Refer to installation procedure to address modules.

Module packing material shall be taken apart and stored in case of return under warranty. Improper packing of a returned module may void the warranty.

Figure 12. *Module Description*

8.4 Anchoring the cabinet to the floor

The cabinet is anchored through the base of the cabinet.

Remove lowest front cover to get access to the anchoring locations.

Max screw diameter is 0.8" (22 mm). See Hole pattern, foot print. For foot print measurements.

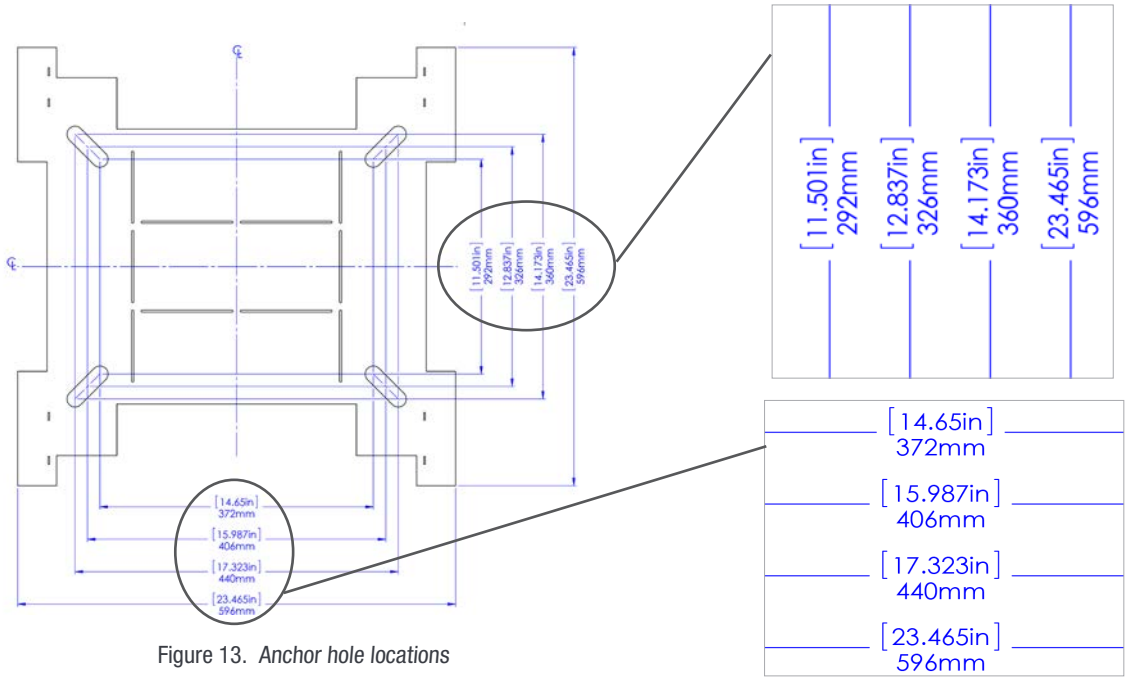


Figure 13. *Anchor hole locations*

8.5 Cabling

Check section 7, page 18 to identify system configuration and refer to section 7.3, page 20, 7.4, page 21 and 7.5, page 22 for cable sizes. Refer also to 8.1, page 24 for important safety notices.

8.5.1 Tightening Torque

Torque recommendation for cable termination are:

8.5.1.1 AC Connections (per Mfg)

Terminal Block	Tightening Torque Nm
MIPS (Small TB*)	10
MIPS (Large TB**)	20

Figure 14. *Torque Table - AC Connections*

* For MIPS, small terminal block is for MIPS-1-10, MIPS-1-20, MIPS-2-20, MIPS-3-30

** For MIPS, large terminal block is for MIPS-1-25, MIPS-2-40, MIPS-2-50, MIPS-3-60, MIPS-3-75

8.5.1.2 DC Connections (per NEC)

Size of wire [AWG/kcmil]	Tightening Torque Nm
2 - 1	16.9
1/0 - 2/0	20.3
3/0 - 4/0	28.2
250 - 350	36.7
500	42.4
600	
750	

8.5.2 Cable Inlets

Use appropriate conduit fitting to attach the conduits to the top of the cabinet. Use existing knock outs and do not block the airflow through the top of the cabinet. The top panel can be removed to facilitate wiring.

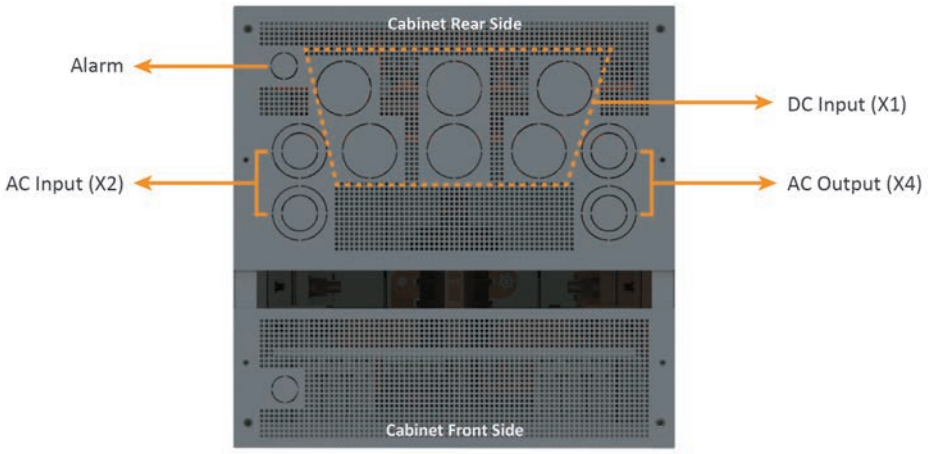


Figure 15. *Cable Inlet - Positions*

8.5.3 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 section 8.5.4, page 28)

Ground has to be connected in accordance with local code.

Note: Connection in yellow-green are factory wired and shall not be removed. (In the below image the connection is shown in green color).

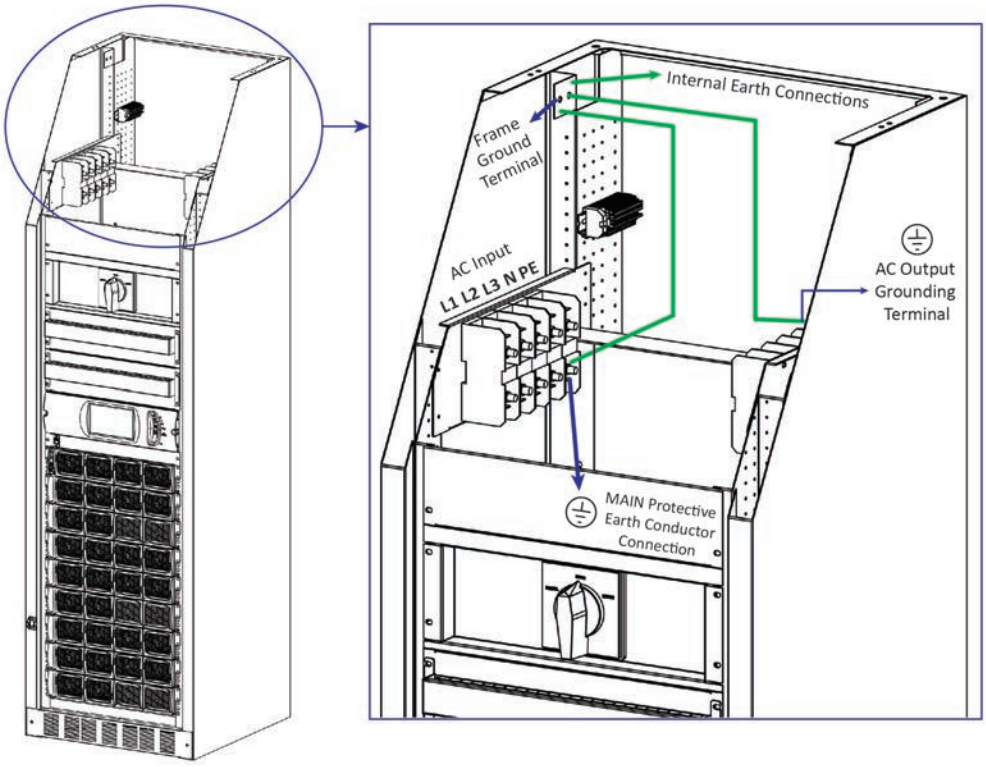


Figure 16. *Earthing connections*

8.5.4 AC Input and Output

The pictorial representation of terminal blocks arrangement is as follows.

Note: If AC IN is connected, remove the Neutral bonding jumper cable between X2 (AC IN) and frame ground.

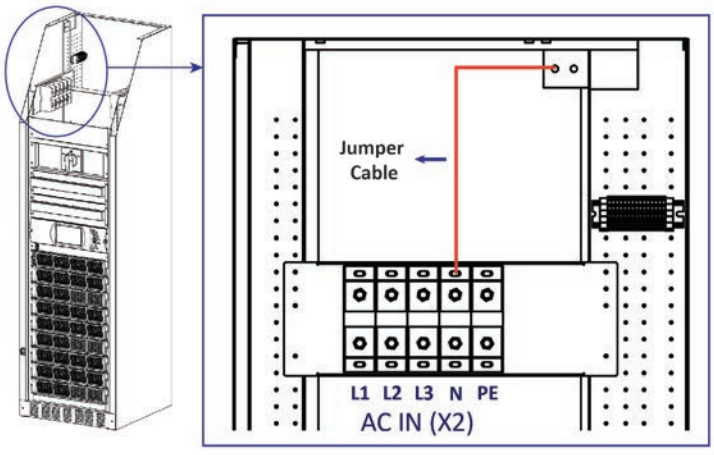
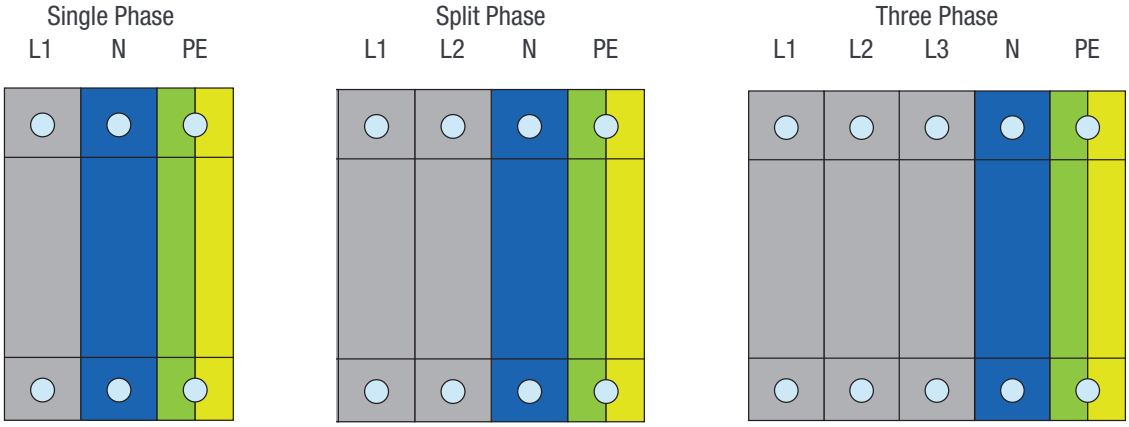


Figure 17. *Neutral bonding jumper*

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



8.5.5 DC Input

8.5.5.1 Single feed DC Input

- One (1) common DC connection.
- Two holes of $^{3}/_{8}$" threaded hole with 1"(25.4 mm) between center.
- Internal DC distribution with circuit breakers (Q01-Q30) to each inverter module.
- Max 9 x 500 kcmil (240 mm^2) cables.
- Can be single or double lug (refer to site requirement).

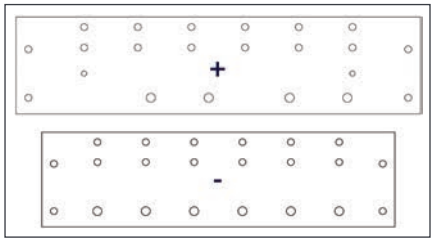


Figure 18. *Single Feed DC - Bus Bar*

Note: Screws, nuts and cable shoes are not included in the delivery.

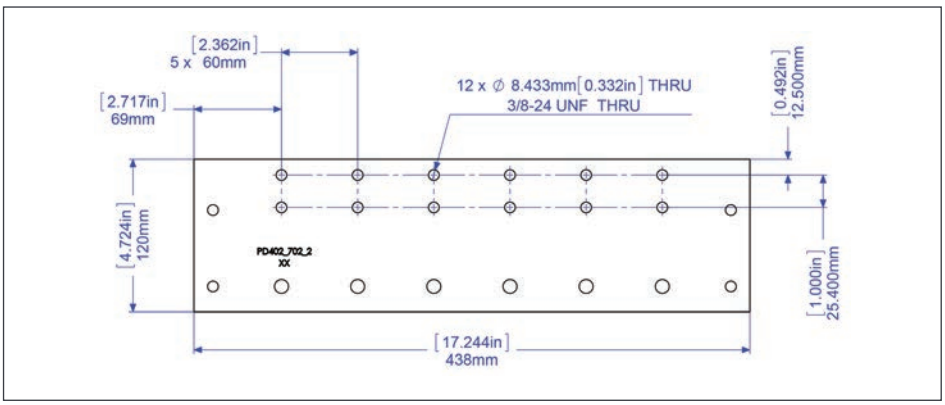


Figure 19. *Single Feed DC - Negative bar hole details*

8.5.5.2 Dual DC Feed Input

- 2 x DC input connection per system.
- Two holes of $^{3}/_{8}$" threaded hole with 1"(25.4 mm) between center.
- Internal DC distribution with circuit breakers (Q01-Q30) to each inverter module.
- Max 3 x 500 kcmil (240 mm^2) per pole (group).
- Can be single or double lug (refer to site requirement).

Note: Screws, nuts and cable shoes are not included in the delivery.

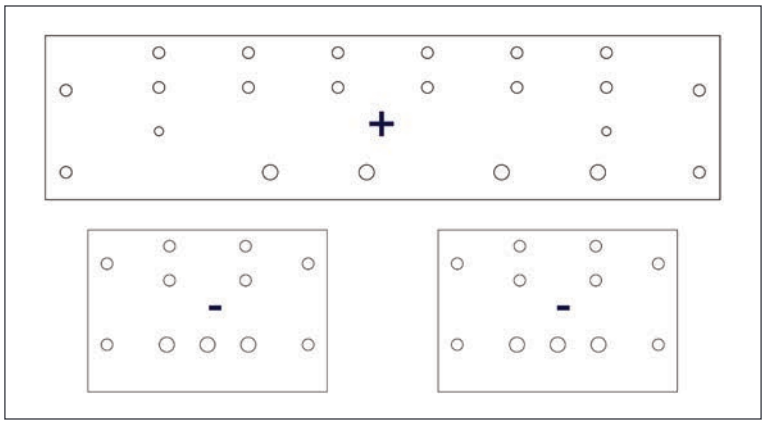


Figure 20. *Dual DC Feed - Bus Bar*

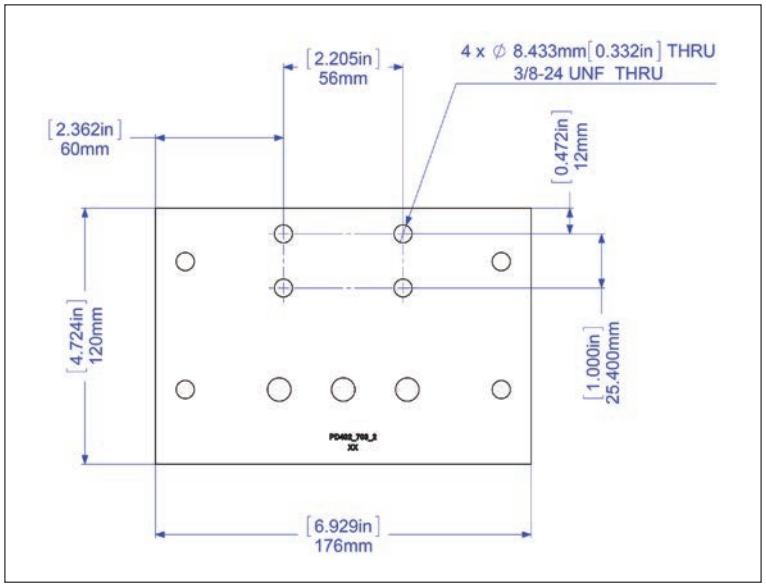
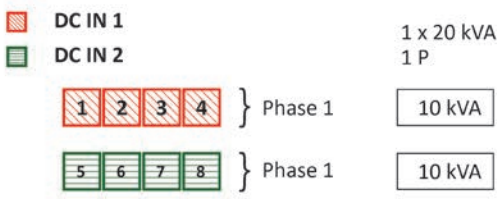
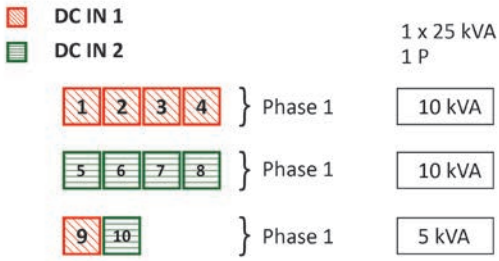


Figure 21. *Dual DC Feed - Negative bar hole details*

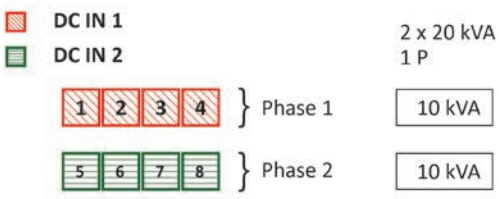
8.5.5.3 Dual DC Feed - Internal Wiring Pattern

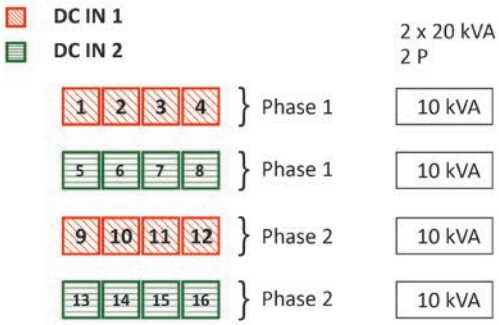
Single Phase System

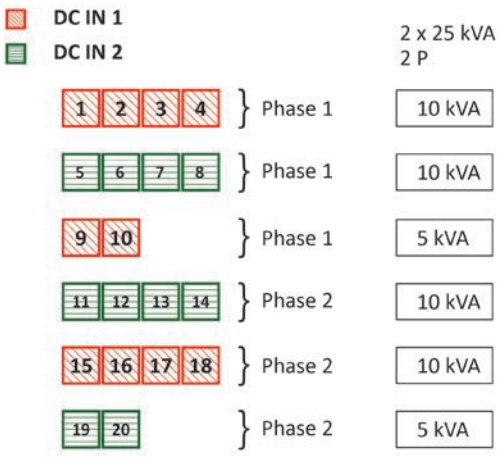




Split Phase System







8.5.5.4 Triple DC Feed Input

- 3 x DC input connection per system.
- Two holes of $^{3}/_{8}$" threaded hole with 1"(25.4 mm) between center.
- Internal DC distribution with circuit breakers (Q01-Q32) to each inverter module.
- Max 2 x 500 kcmil (240 mm^2) per pole(group).
- Can be single or double lug (refer to site requirement).

Note: Screws, nuts and cable shoes are not included in the delivery.

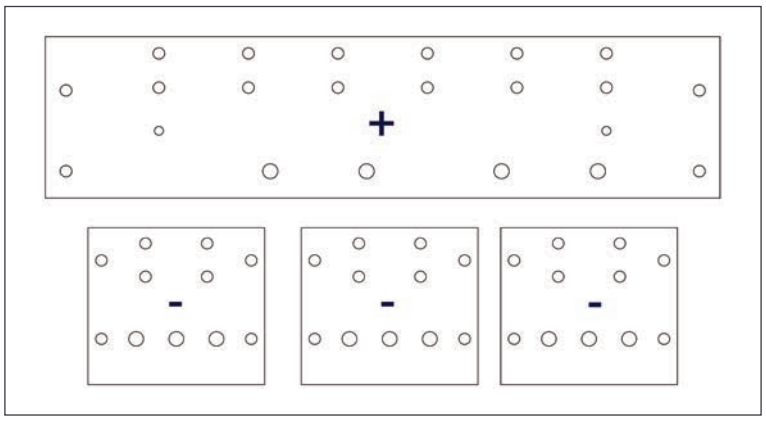


Figure 22. *Triple DC Feed - Bus bar positions*

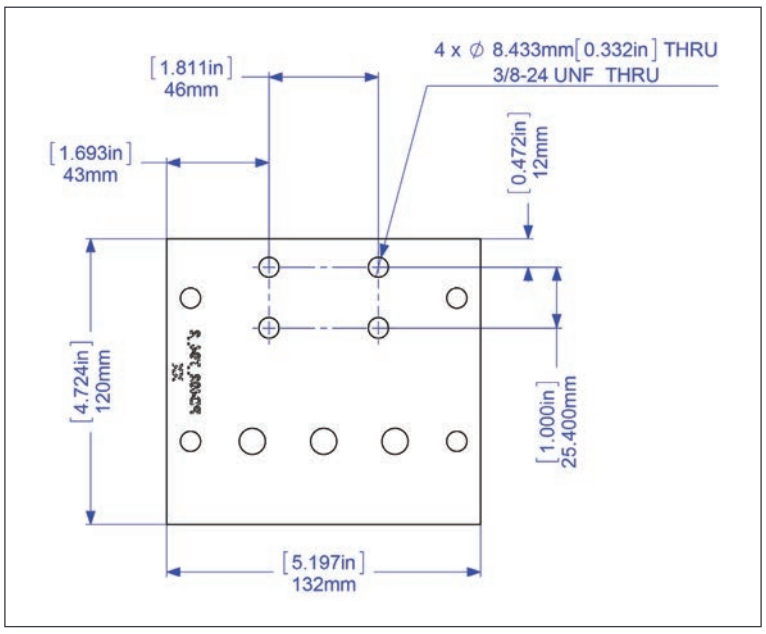
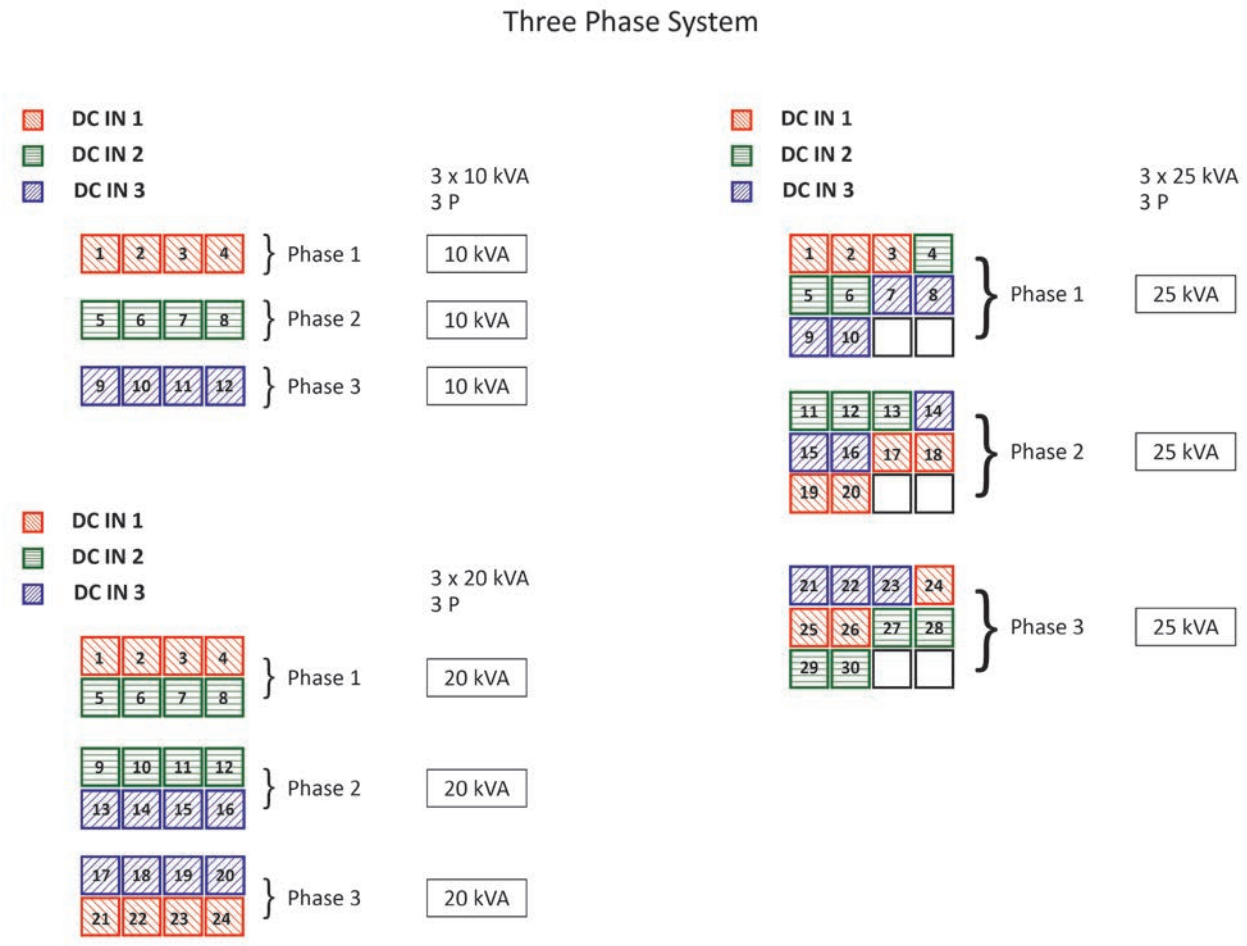


Figure 23. *Triple DC Feed - Negative bar hole details*

8.5.5.5 Triple DC Feed Input - Internal Wiring Pattern



8.5.6 Signaling

All relays are shown in non energized state.

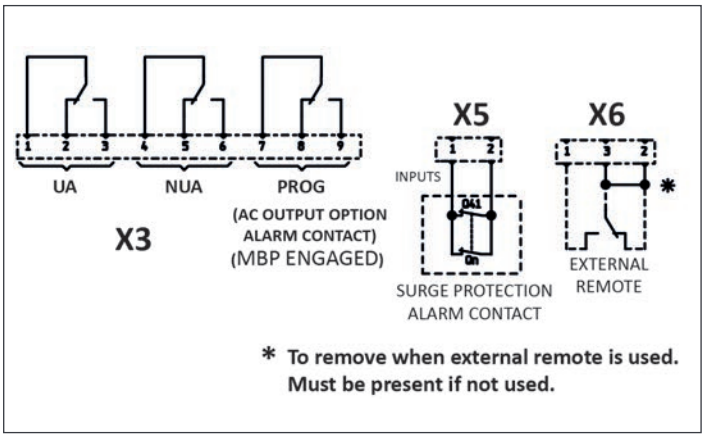


Figure 24. *Alarm dry contacts*

Note:

Output relays are time delayed factory default set to 30 seconds, User settable from 2 to 30 seconds.

To connect "Inverter in Bypass" status signal from inverter to External Manual Bypass (MBP) Switch, connect external MBP to X3 terminals 7 and 9.

8.5.6.1 Alarm (X3)

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

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

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

8.5.6.2 Digital In (X5)

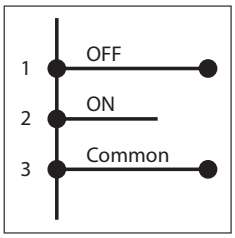
- Input characteristics X5 (Digital In 1, Digital In 2)

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

Note: Not available if internal MBP is installed.

8.5.6.3 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 turns 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 closes. If both transitions are not picked up the status is not changed.
- Digital input characteristics (Remote ON/OFF)
  - Signal voltage +5 VDC (galvanically insulated)
  - Max wire size 17 AWG (1mm^2)

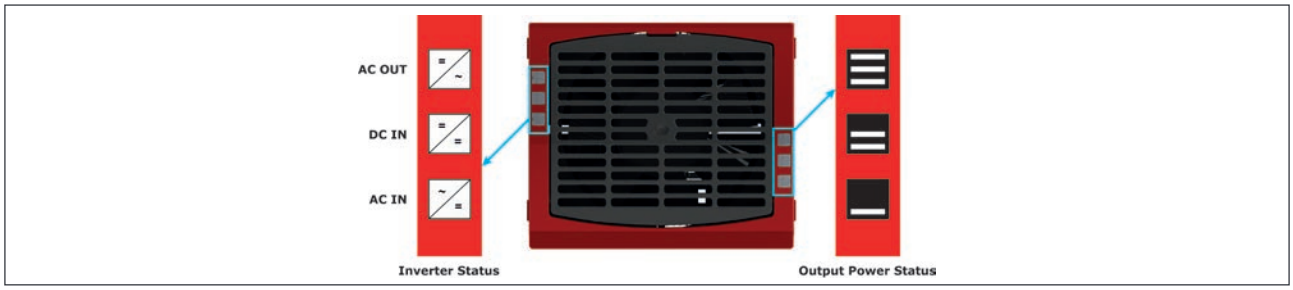
Functional table for remote ON/OFF function

#	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)

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

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 ETH

- 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.

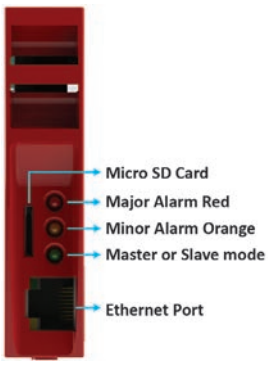


Figure 25. *T2S ETH Front details*

9.3 T2S USB

- 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.

Figure 26. *T2S USB - Front details*

9.4 CANDIS

The CANDIS is an optional interface allowing the user to get information concerning the running system on display(s) and/or to access to the TSI inverter system from a remote computer/site using a web browser or SNMP protocol.

Depending on the requirements the Candis would consist in one, two or three displays and/or TCP-IP interface. When provided as a system, it comes with the shelf and a TCP-IP connection.

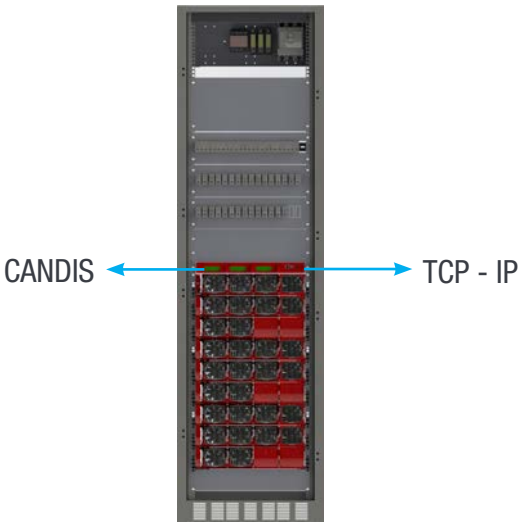


Figure 27. *MIPS System with a CANDIS shelf housing Three displays and a TCP-IP communication port*

The parameters available on CANDIS are voltages, currents, frequency, inverter configured etc.

9.4.1 Display and Buttons

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

Figure 28. *CANDIS Display*

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.

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

9.4.2 Display Configuration

9.4.2.1 Configuration block diagram.

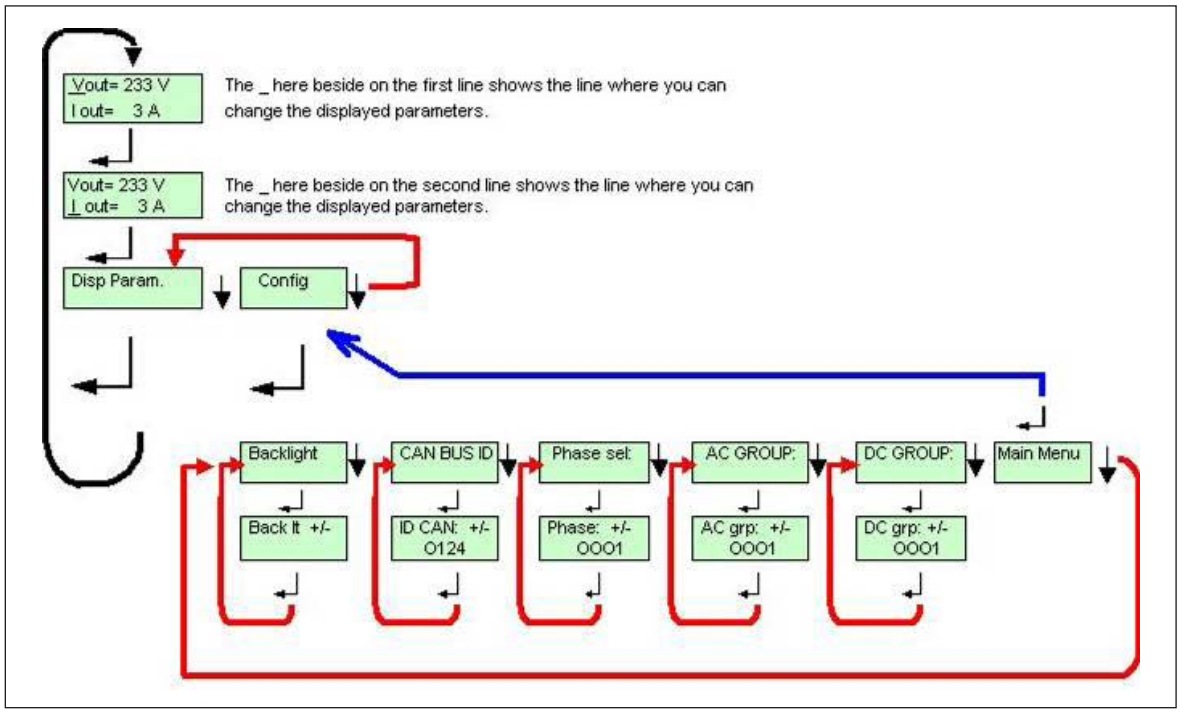


Figure 29. *CANDIS Display - Functional Menu*

9.4.2.2 Configuration

When more than one display is used on the same system, the CANBUS ID must be different and include values from 124 to 264 (i.e as 134; 144 ; 154, …264).

The other information that can be configured are the related phase, the AC group or DC group, and the adjustment the backlight.

If the installed system is multi-phase or has multiple DC groups, the T2S and the inverter modules must be correctly configured to display the correct value by phase or DC group.

For instance in three phase systems, the inverter modules must be configured to show the 3 phases' output information, but also the one related to the three AC group who correspond to each AC input phase. By doing so, the display will show the values phase by phase.

9.5 CATENA GUI Interface

CATENA GUI interface allows the user to easily access the system monitoring via a powerful web based graphic display.

In addition to the touch-screen display the user can also access to the same GUI using an Ethernet port present on the T2S ETH or CATENA.

Figure 30. *CATENA Rack Mount - Front Details*

Remark: Reset will only reset the CATENA, not the T2S ETH and will have no effect on the system.

Power supply and connectivity are provided on the back of the unit:

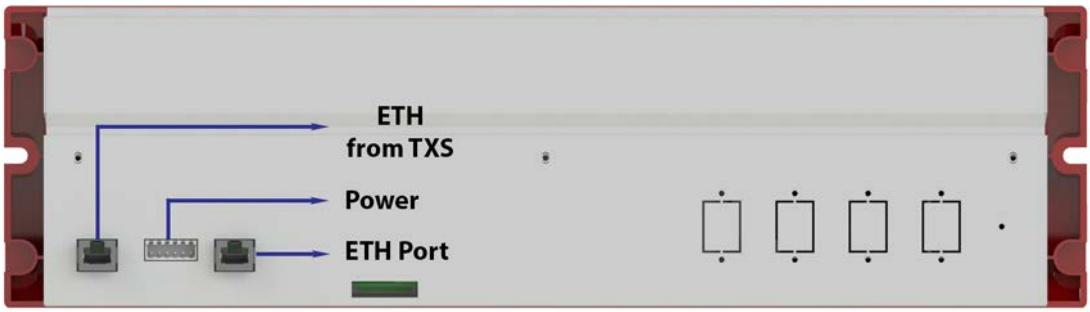


Figure 31. *CATENA Rack Mount - Rear Details*

9.5.1 Software Overview

The software embedded in T2S ETH and CATENA allows complete system supervision through “touchscreen display” or via web browser, and provides functionalities such as :

- System setting and configuration (password protected).
- System status and information display.
- System alarms and events log file.
- System self-maintenance (battery test, battery boost charge,….).

10. System set up

MIPS 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 V1_8” 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

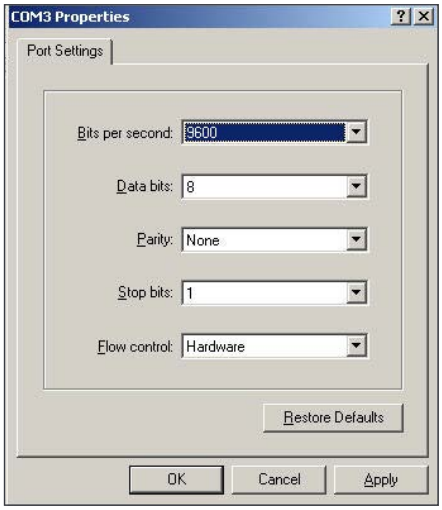


Figure 32. *T2S USB - Port Settings*

10.1.2 Menu access

Root Menu

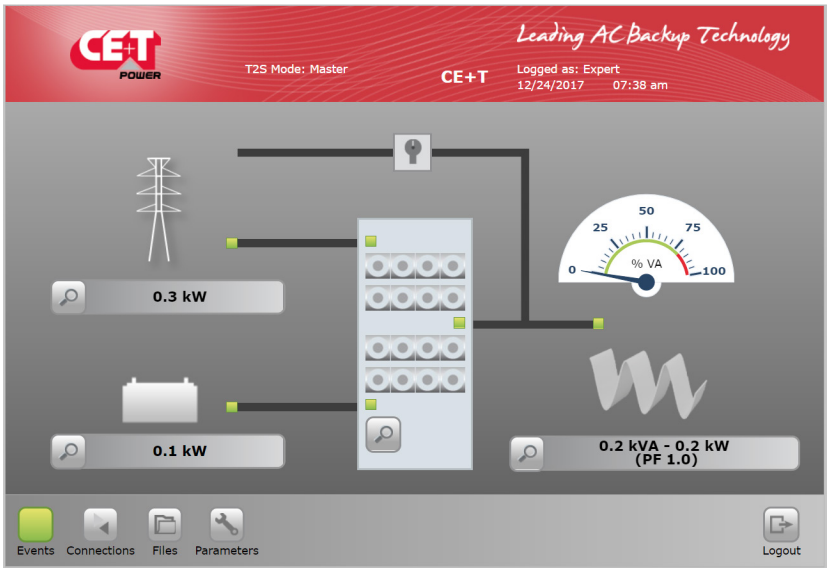
- 1 > System configuration
  - 0 > Return to previous menu
  - 1 > Send config file to T2S
  - 2 > Read config file from T2S
  - 3 > Restore default settings (no more available since version 2.5)
  - 4 > Restore factory settings (no more available since version 2.5)
- 2 > System information's selection
  - 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.

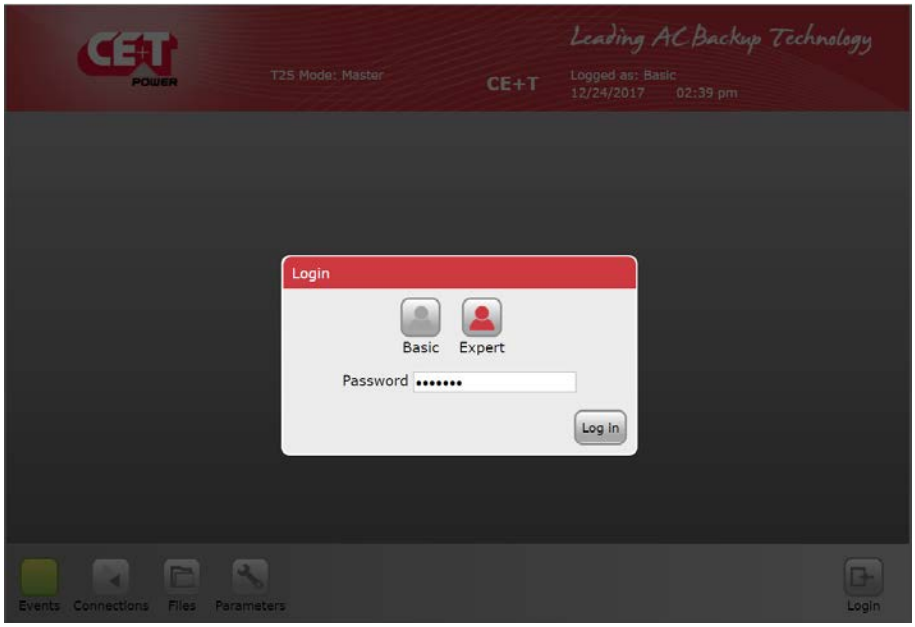
Since CATENA software v4.4.0, units equipped with a front RJ45 port; set computer to "obtain IP automatically" and direct web-browser to http://catena.local (don't forget the dot).

Customer network connect (with static IP) is on rear of unit.

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

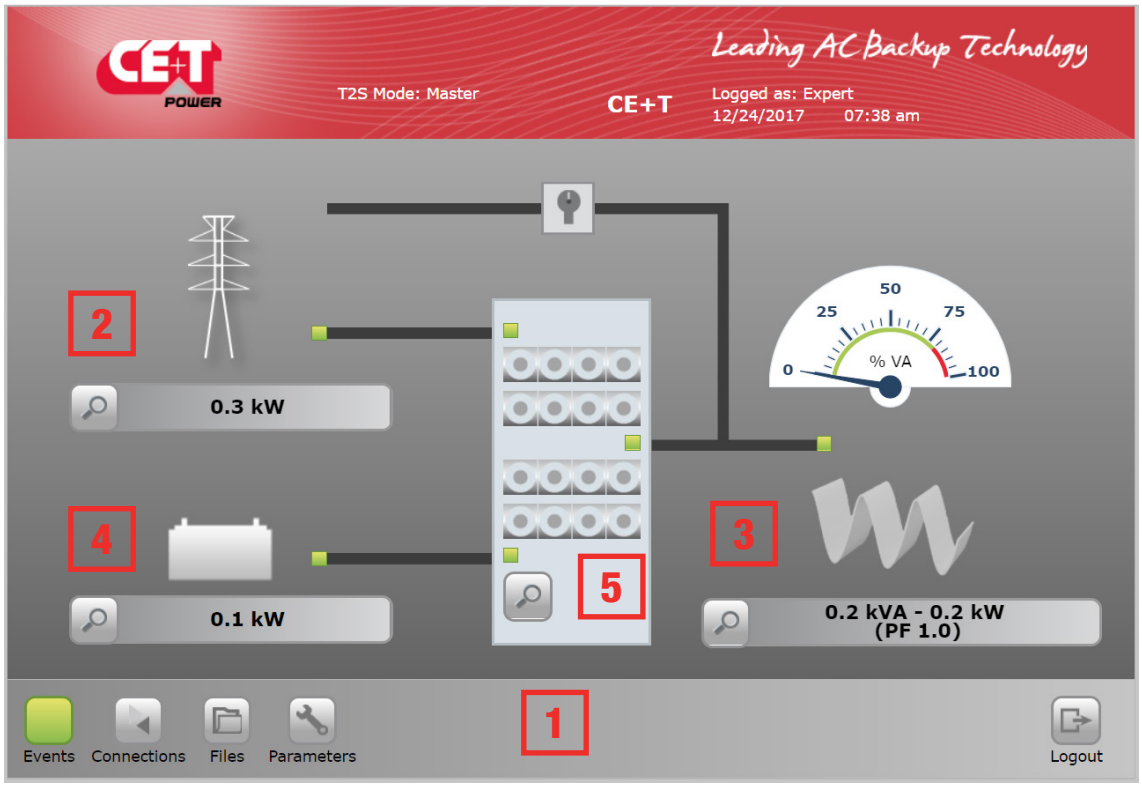
5. Point your browser to 192.168.0.2 (default address).
6. Choose a user type (Basic or expert) and enter your password. Default password is "pass123" for basic, "pass456" for expert.

Note: Default keyboard entry setting is with "CAPS LOCK ON", Password must be entered in lower case, change keyboard to lower case setting before entering password.



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

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

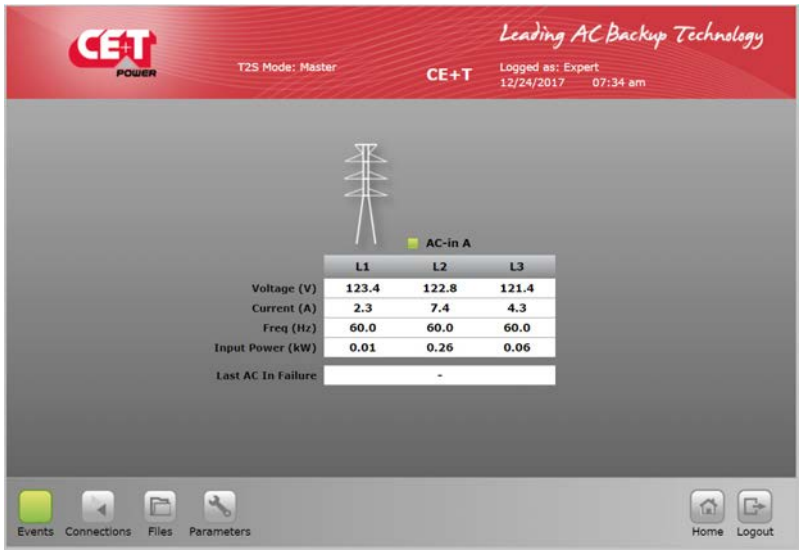
All LED symbols indicate if there are any alarms present in the system.

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

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

10.2.1.3 The AC input page

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



This screen provides the following information:

- 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

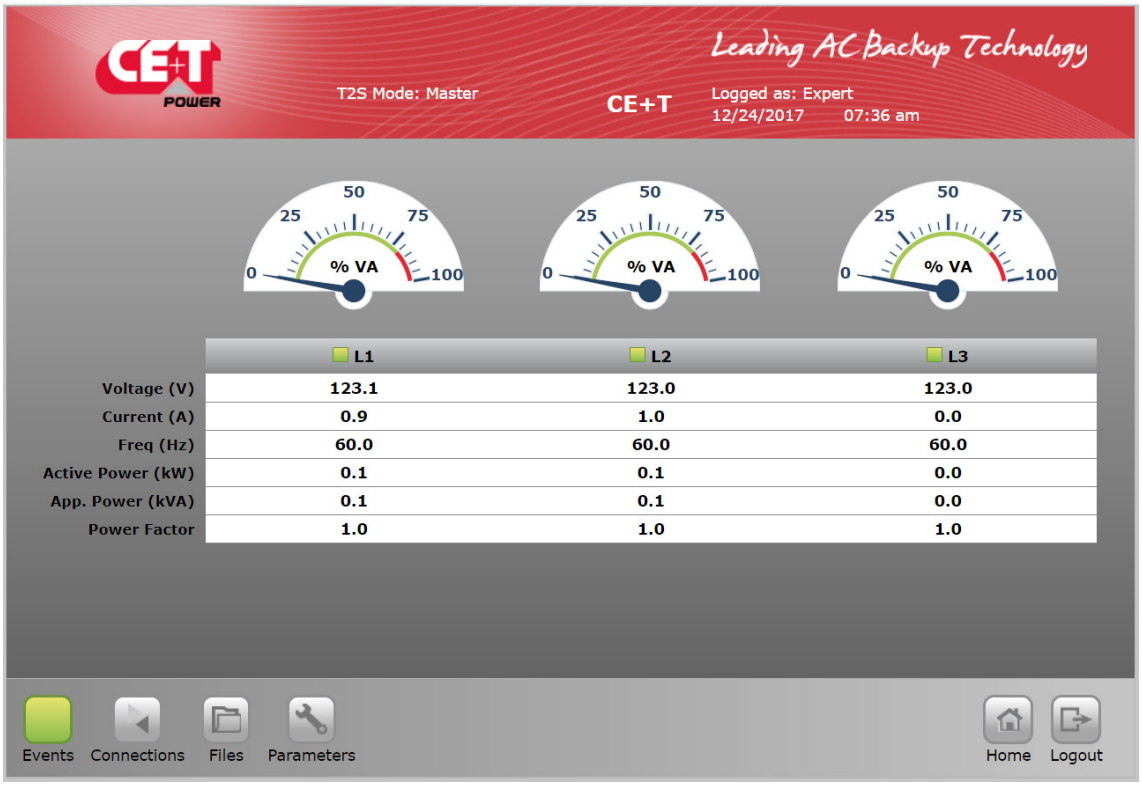
Click the **Search** button  at DC input to obtain detail DC input information:

This screen provides the following information:

- 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



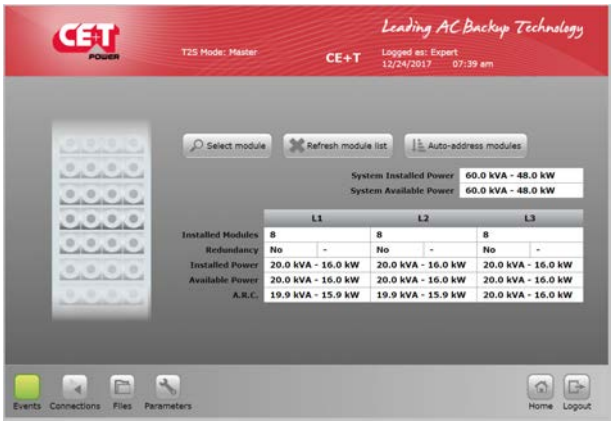
This screen provides the following information:

- Graph indicating the power per phase of N (Not N+1), system capacity calculation does not includes redundant modules.
- 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 where following information can be found:



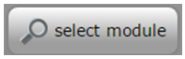
System level:

- Installed power
- Available power

Phase level:

For each output phase, following information is given:

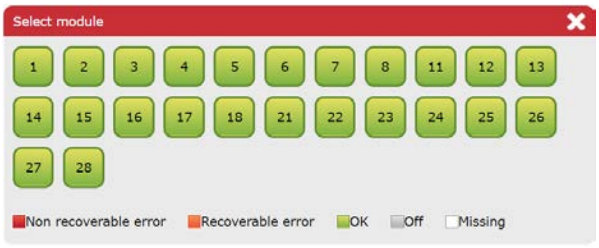
- Number of installed modules
- Redundancy: defined or not, satisfied or not
- Installed and available power following the same logic as per system level
- A.R.C. (Available Redundant Capacity) is the remaining available power before reach the redundancy level.

Clicking the 

button will launch the module selection popup.

Each module information can be accessed by clicking the corresponding button.

A legend is always present to recall the color scheme:



- White: no module in slot
- Grey: module manually off
- Green: module OK
- Orange: module in recoverable error
- Red: module with unrecoverable error

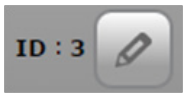
For last two, refer to module manual for troubleshooting.

Module Page

This page gives module by module measurement.

T2S ETH is the monitoring solution for inverters which are all one phase modules.

Many controls are available from this page to manage the module:



The T° probe is the average T° of the inverter module heat sink

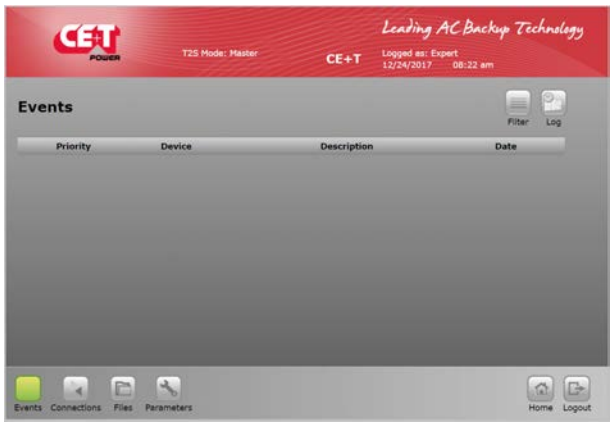
10.2.2 The TOOLBAR

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

10.2.2.1 Events

The circled number on the icon indicates the number of active alarms.

Click the **Events** button  , Events page opens and list all events currently ongoing in the system. These are sorted by appearing time, newer on top of the list.



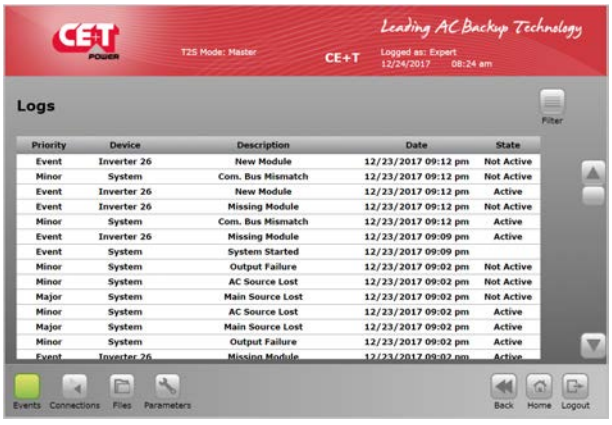
“Device” column provides the source of the alarm which can be down to inverter of a given module (example: module 4 AC IN) to System or monitoring level.

Events appear with a color corresponding to their alarm level
(grey – event, orange – minor, red – major).

A filter as shown below is available to display only a subset of these events.

10.2.2.2 Log

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



Compared to event page, an extra column is displayed if event has appeared or disappeared.

For each event, there are two log lines: one with the timestamp of the event appearing and the second one with the timestamp of the event disappearing.

User can filter the log like the event page.

User is able to see the difference between event and log page: no color for alarm level is used in log page, a column states it.

Log download and clear functions are available in “Files” menu.

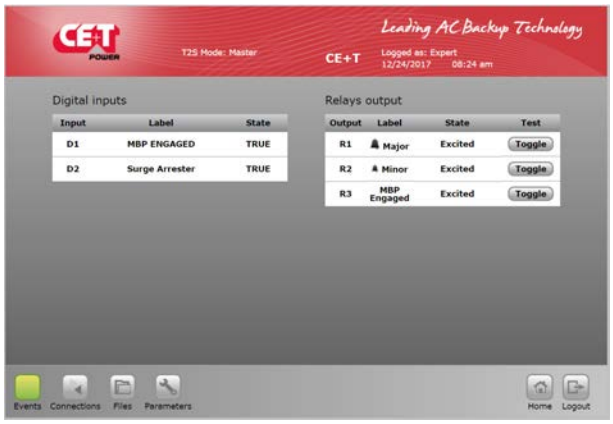
10.2.2.3 Connections

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

T2S ETH has 2 digital inputs and 3 alarm relays.

State of each of these connections can be read through the “connections” page.

An extra button “toggle” allows the user to test each relay manually, toggling it for a few seconds with the aim of detecting a mechanically failing device over the time.



10.2.2.4 Files

Click on Files to:

- Export the log file
- Clear the log file (only possible in expert mode)
- Upgrade the software of the T2S ETH unit.
- Upload a language file.

10.2.2.5 Parameters

To define and setup all communication parameter listed below and please do not change setting below unless necessary.

The Parameters page is divided into tabs which are a compound of sub menus:

- Monitoring
- Input/Relays
- Power
- Info

10.3 Switching OFF MIPS System

Perform the following steps to Switch OFF the MIPS System.

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

1. Switch OFF AC Output Breakers.
2. Switch OFF AC Input Breakers.
3. Switch OFF DC Input Breakers.
4. Switch OFF the Upstream and Downstream and Bypass Breakers. (As applicable)

CAUTION - Risk of electric shock. Capacitors store hazardous energy. Do not remove any modules from the cabinet for at least 5 minutes after disconnecting all sources of AC or DC supply.

Caution - Risk of electric shock. This inverter receives power from more than one source. Disconnection of AC source and DC source is required to de-energize this unit before servicing.

11.Inserting/removing/replacing modules

11.1 TSI Inverter Module

- When a new module is inserted in a system, it is automatically assigned the configuration file from the existing modules or from the T2S-ETH.
- When a new module is inserted in a 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 blank covers without delay.

Inverter module is not switched off when opening the handle. The handle only hooks the module to the shelf.

Step 1. Use a screw driver to release the latch of the handle.

Step 2. Open the handle and Pull the module out.

Step 3. Replace with new module or blank cover.

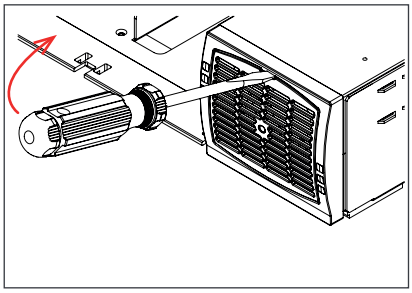


Figure 33. *Use screwdriver to release the latch*

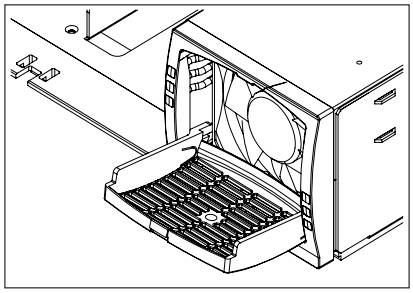


Figure 34. *Open the cover completely*

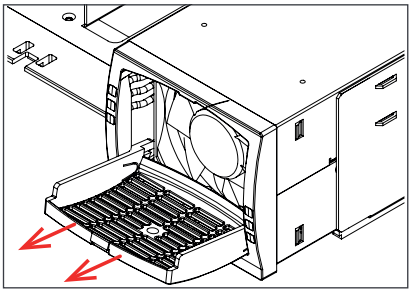


Figure 35. *Use the cover as a handle to remove the module*

11.1.2 Inserting

Step 1. Check module compatibility (DC Voltage!).

Step 2. Use a screw driver to release the latch of the handle.

Step 3. Open the handle and Push firmly until the unit is properly connected.

Step 4. Close the cover and latch in position.

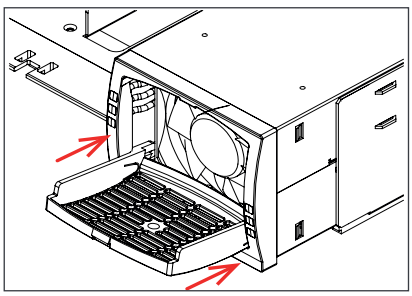


Figure 36. *Slide the module in*

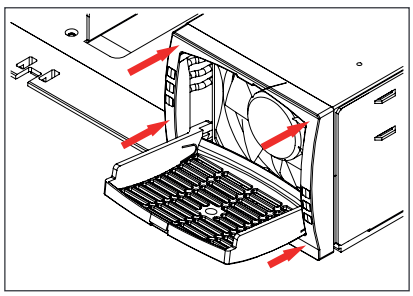


Figure 37. *Push firmly until the connection is properly engaged*

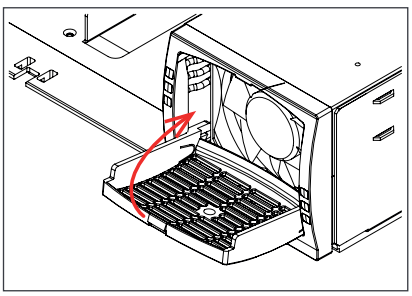


Figure 38. *Close the cover and latch the module in place. if too hard redo step 3*

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.

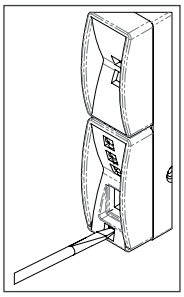


Figure 39. *Insert screw driver*

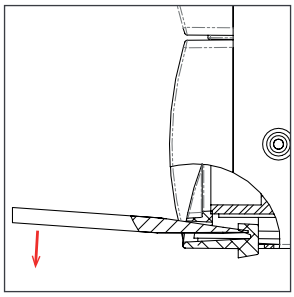


Figure 40. *Release the latch*

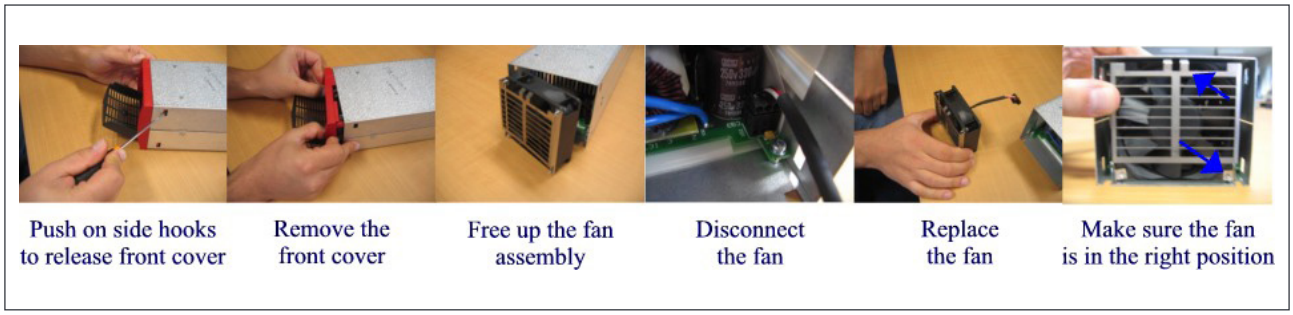
11.2.2 Inserting

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

11.3 Fan replacement

The FAN life is approximately 60,000 (Sixty thousand) hours. The inverter modules have fan runtime meters and fan failure alarm. Fan failure can result from failing fan or driver circuit.

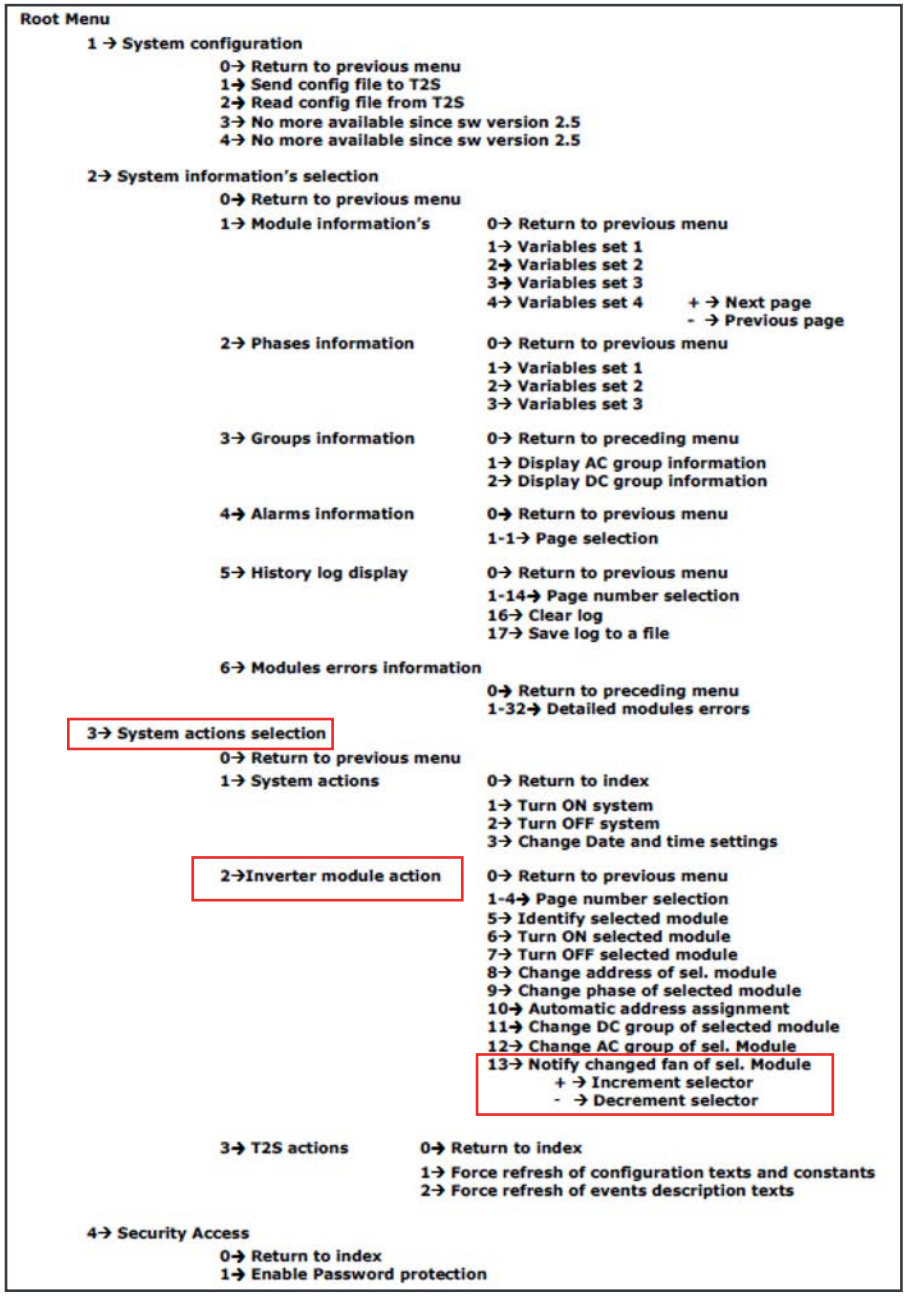
- Let the module rest at least 5 minutes prior to initiating work.
- The inverter front must be removed. Use a blunt tool to depress the latches on the module side fixing the front to the module.
- Remove the fan and unplug the supply cord.
- Replace with new fan and connect supply cord.
- Replace front, 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. Refer “Clearing FAN Alarm”, page 54



11.3.1 Clearing FAN Alarm

Action to clear the FAN alarm for Fan Failure and Fan life elapsed is indicated in

System actions selection ➔ Inverter module action ➔ and select the address of the Fan replaced module ➔ select **Notify changed fan of sel. Module**.



12. Manual Bypass Operation

- Manual Bypass has to be operated by trained personnel only.
- When system is in Manual Bypass the load is connected to AC main voltage without filtering.
- An MBP Engaged output alarm will occur when the system is in Manual Bypass.
- The Manual Bypass is not possible to operate remotely.
- MBP switch is optional.
- An internal MBP switch must be present to cancel the output phase shift prior to operating a non-CE+T wraparound MBP.

12.1 Pre-requisites

Before engaging the MBP, the following conditions have to be fulfilled and actively checked. Failure to follow this procedure could result in loss of power to Critical Load.

1. The AC Input breaker must be closed.
2. Inverter must be synchronized with commercial power.
   - Use Voltmeter to measure voltage between L1- commercial and L1 - inverter output.
   - Do same measurement with L2 – L2 and L3 – L3.
   - In all cases, voltage must be less than 20 V.
3. The upstream AC & DC breaker must be correctly sized to accept possible overload, The inverter might be overloaded during MBP procedure, depending on voltage network and output inverter voltage setting and if the AC is supplied by a Gen-set, the minimal required power will be twice nominal power of the inverter.

12.2 Manual Bypass Operation

The Manual Bypass operates via individual switch that creates a bypass from mains input via output AC distribution. Inverter modules are bypassed and possible to disconnect without impacting the load.

Operation is “Make before Break”.

12.2.1 Normal to Bypass, Engage MBP

1. Turn the switch from **Normal** to **Bypass**.
   (Do not stop at **INTERIM** Position)
2. Switch **DC** OFF.

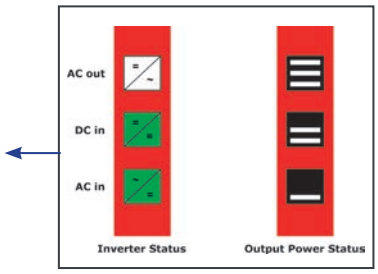
Figure 41. *MBP Switch*

Manual Bypass puts the module in OFF state but doesn’t disconnect the DC.
Make sure DC is disconnected before any intervention inside the system.

Warning: Risk of electric shock. Power will be available at AC Input terminal, AC Output terminal, DC Input terminal, and Surge Arresters.

Warning: Always engage MBP on inverter before operating wraparound external bypass.

12.2.2 Bypass to Normal, Disengage MBP



1. Switch **DC** ON.
2. Turn switch to **INTERIM** (mid position).
3. **PAUSE**: Wait until the inverter modules have come to full operation and have synchronized (30-60seconds).
4. Complete twist to NORMAL.

WARNING

IF ATS (automatic transfer switch) IS INSTALLED UPSTREAM TO SELECT AC SOURCE. MAKE SURE THAT THE ATS SWITCH DOES NOT ALLOW TRANSFER BETWEEN AC SOURCE OUT OF SYNC. THE MAXIMUM ALLOWED PHASE SHIFT IS 10°.

13.EMBS

“See EMBS User Manual” for more information.

14. Final Check

- Make sure that the sub-rack and cabinet is properly anchored 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 all cables are sized and installed according to NEC guidelines and the local authority having jurisdiction.
- Make sure all cables have proper strain relief installed.
- Make sure that all breakers are sized according to the NEC guidelines and the local authority having jurisdiction.
- Make sure that the DC cable polarity is verified and installed according to the DC terminal designations.
- 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.

15. Installation & Commissioning of TSI Systems

CAUTION!

- Installation and commissioning must be completed by factory trained personnel.
- It is prohibited to perform any High Potential (HI-POT) insulation test without instruction from the manufacturer.

General Information					
Date / Time of Installation:					
Commissioning Contractor: **Company:**					
Electrical Contractor: **Company:**					
Site Address: **City, State, Zip:**					
End User Contact & Phone:					
System Part Number:	ABC - # - ## - XX - ##				
System Serial Number:	#### / ####				
Inverter Modules Serial # **Phase 1**					
Phase 2					
Phase 3					
HMI (Circle one)	CANDIS			CATENA	
T2S Serial Number					
IP Setting	IP Address		Subnet mask	Default gateway	

The scope of this document is to provide a general guide for the installation contractor. Please refer to the operation manual for more details. Specific manuals for inverter systems and monitoring devices are available upon request at tech.support@cetamerica.com.

For any step resulting in a failure on the procedure, an explanatory note must be included. Failure to include explanatory note may result in delay in processing any future warranty claim.

15.1 Installation Check List

	Electrical Contractor (Pre-Startup) Checklist	PASS	FAIL	NA
1	Check if the AC source transformer is 1.5 X maximum capacity of inverter system.			
2	Check if the generator is 2 X maximum capacity of inverter system.			
3	Verify cable entry supports are properly secured.			
4	Verify input utility breakers will not be overloaded based on additional AC load added to the building.			
5	Check conductor size and breaker protection rating for AC input and Output cables, and DC input cables.			
6	Verify that the inverter chassis is correctly bonded to GROUND / EARTH.			
7	Verify all contractor field connected cable terminations are torqued properly per **"TABLE 1"**.			
8	Verify that the inverter cabinet is properly secured, anchored and has proper rear clearance. (Minimum 36" per NEC 110.26).			
9	Verify AC input cables are terminated properly on input terminal X2.			
10	Verify AC output cables are terminated properly on output terminal X4.			
11	Verify Ground / Earth (PE) connection is terminated properly even if AC input is not connected.			
12	If AC input is connected to the system, remove the Neutral to Ground bonding jumper on input terminal X2.			
13	If no AC input is connected to the system, verify the Neutral to Ground bonding jumper is installed on input terminal X2.			

TABLE 1

AC Connections (per Mfg)	
Media 2i	0.5-0.6 Nm
MPC (L1, L2, L3)	3 Nm
MPC (N & G)	7 Nm
HD	22.5 Nm
RBS	2.8-3.0 Nm
MIPS (see note 1)	6 Nm
MIPS (see note 2)	20 Nm
Dry Contacts Terminal Block	0.4-0.6 Nm

DC Connections (per NEC)	
Wire Size	**Torque**
2 – 1	16.9 Nm
1/0 – 2/0	20.3 Nm
3/0 – 4/0	28.2 Nm
250 – 350	36.7 Nm
500	42.4 Nm
600	42.4 Nm
750	42.4 Nm

Note 1: For MIPS, small terminal block is for MIPS-1-10, MIPS-1-20, MIPS-2-20, MIPS-3-30

Note 2: For MIPS, large terminal block is for MIPS-1-20, MIPS-1-25, MIPS-2-40, MIPS-2-50, MIPS-3-60, MIPS-3-75

Notes:

Commissioning Contractor (Pre-Startup) Checklist		PASS	FAIL	N/A
14	Ensure steps 1 – 13 are complete.			
15	Verify external AC input breaker / switch is open (OFF).			
16	Verify external AC output breaker / switch is open (OFF).			
17	Verify external DC input breaker / switch is open (OFF) – if fused, remove DC input fuse at DC distribution.			
18	Remove covers to obtain access to AC and DC terminal connections. (See step 42)			
19	Wearing appropriate PPE, verify system is de-energized.			
20	Visually check internals of inverter for debris. Clear any found debris with a vacuum prior to proceeding. Do not use compressed air.			
21	Visually check internals of inverter for damaged components. Notify CE+T of any found damaged components. Any damage must be corrected prior to proceding. (855.669.4627)			
22	Ensure all modules are not seated on the backplane of the system. Sticking out approximately 1.25 inch or 3 cm.			
23	Verify that empty slots are covered with blank face plates. (per UL)			
24	If system is equipped with internal isolation breakers, shut all internal breakers on the inverter system (AC & DC).			
25	If system is equipped with an internal bypass switch, ensure bypass switch is in the NORMAL position.			
26	Check for short circuits between Input Phases, Output Phases, Neutral, Ground, & DC in accordance with **“Table 2 (MBP in Normal)”, page 62**.			
27	If system is equipped with an internal bypass switch, move bypass switch to the BYPASS position.			
27 a)	Check for short circuits between Input Phases, Output Phases, Neutral, Ground, & DC in accordance with **“Table 3 (MBP in BYPASS)”, page 62**.			
28	If system is equipped with an internal bypass switch, return bypass switch to the NORMAL position.			
29	If system is equipped with internal isolation breakers, open all internal breakers on the inverter system (AC & DC).			

Table 2 (MBP in Normal)

		Input TB					Output TB					DC Bus			
		L1	L2	L3	N	G	L1	L2	L3	N	G	+	-	-	-
Input TB	L1	X													
	L2		X												
	L3			X											
	N				X	X				X	X	P			
	G				X	X				X	X	P			
Output TB	L1						X								
	L2							X							
	L3								X						
	N				X	X				X	X	P			
	G				X	X				X	X	P			
DC Bus	+				P	P				P	P	X			
	-												X	S	S
	-												S	X	S
	-												S	S	X

Table 3 (MBP in BYPASS)

		Input TB					Output TB					DC Bus			
		L1	L2	L3	N	G	L1	L2	L3	N	G	+	-	-	-
Input TB	L1	X					X								
	L2		X					X							
	L3			X					X						
	N				X	X				X	X	P			
	G				X	X				X	X	P			
Output TB	L1	X					X								
	L2		X					X							
	L3			X					X						
	N				X	X				X	X	P			
	G				X	X				X	X	P			
DC Bus	+				P	P				P	P	X			
	-												X	S	S
	-												S	X	S
	-												S	S	X

Note 1: X designates points where continuity is required.

Note 2: P is for configurations where the Positive DC bus is grounded.

Note 3: S is for systems where multiple DC - bus pads may or may not be bonded together at either the inverter or the DC distribution bay.

Note 4: All positions which are blank are required to read Infinite, Open, or OL.

	Commissioning Contractor Start Up Checklist	PASS	FAIL	N/A
30	Ensure steps 1 – 29 are complete.			
31	Ensure all inverter modules are not seated on the backplane of the system. Protruding approximately 1.25 inch or 3 cm from the front of the shelf.			
32	Check if commercial AC is present in the AC distribution source.			
33	If step 32 is PASS, switch ON the commercial AC breaker and check on Terminal X2:			
	• L-L Voltage L1-L2 _____ L2-L3 _____ L3-L1 _____			
	• L-N Voltage L1-N _____ L2-N _____ L3-N _____			
	• If 3 phase, clockwise rotation on input (ABC)			
34	Turn off commercial AC breaker.			
35	Verify all module AC ratings match measured values for Line-Neutral.			
36	Check if DC power supply is present in the DC Power Plant.			
37	Remove CATENA fuse or turn off switch on DC power supply.			
38	Turn ON the DC breaker / switch (or insert DC fuse) at DC Power plant and check the voltage and polarity on the Inverter DC Bus. If DC power plant has more than one feed for the inverter, check each feed voltage & polarity one at a time.			
39	Verify all module DC ratings match measured voltage at the DC connections.			
40	Re-install CATENA fuse or turn on switch on DC power supply.			
41	Turn OFF the DC breaker / switch (or remove DC fuse) at DC Power plant.			
42	Re-install all covers removed in step 18.			
43	Turn ON the DC breaker / switch (or insert DC fuse) at DC Power plant. **NOTE**: Some inverter systems have group or individual breakers for each module; in this case turn on each breaker as needed.			
44	Insert inverter module in first open slot and wait for 20 - 60sec. Verify DC-IN LEDs turns Green. **NOTE**: Modules may be labeled, ex: Module labeled “Phase 1 Mod 1” sits in the first slot of the first phase.			
45	Connect laptop and review the following (configuration file if T2S-USB or web interface if T2S-ETH): • Input and Output number of phases must match number of phases in model number. • Phase shift for each Line must be set as follows: • L1 Phase shift is always 0.0 • Split Phase 240Vac L-L L2 Phase shift 180 • Dual Phase 208Vac L-L L2 Phase shift 120 -or- 240 • Three Phase 208Vac L-L L2 Phase shift 120 L3 Phase shift 240			

	Commissioning Contractor Start Up Checklist	PASS	FAIL	N/A
46	If system has a T2S-ETH, refresh module list. (Log In > Module Info Screen)			
47	Ensure module is addressed as #1.			
48	Verify module input and output phase assignment.			
49	Verify module is set to DC group 1.			
50	Repeat steps 44, 48 & 49 for the remaining inverter modules (Left to right, top to bottom) and confirm the status of inverter function after each module is inserted.			
51	Check AC output voltage (L-N) on inverter output matches voltages (L-N) measured in step 33.			
52	Turn ON the AC breaker to the Inverter. If “Synchronization Error”, change L2 Phase shift (step 45).			
53	Verify absence of alarms on the system. Correct any errors on the system.			
54	Switch OFF AC INPUT breaker and check if system is working on DC.			
55	Switch ON AC INPUT breaker and check if system correctly transferred load back to AC.			
56	Switch OFF both AC and DC INPUTs and start system on AC only. Verify Output is working correctly.			
57	Switch OFF AC INPUT and start system on DC only.			
58	Switch ON AC INPUT and verify system output is working properly.			
59	Set Date / Time.			
60	Set 12H / 24H & °C/°F.			
61	Set AC / DC primary according to customer preference.			
62	Set local IP, Subnet Mask, & Default Gateway as provided by customer. Then reconnect laptop with given settings.			
63	Set Password according to customer preference. (default: pass456)			
64	Set SNMP data values are per **“TABLE 4”, page 67**. Perform SNMP MIB query with iReasoning MIB Browser. • IP Address: [IP as defined per customer preference] • OID: .1.3 • Operation: Walk			
65	If present, connect customer Ethernet to TCP/IP or T2S ETH/Catena, verify connections. “See CATENA or CANDIS user manual for more details”			
66	Check if Ethernet communication is working properly by confirming status with customer NOC. Verify Voltage and current metering is visible at NOC and force SNMP Traps on Catena to test alarms.			
67	If required by customer MOP, test on load bank. (Do not perform this step prior to completing steps 1-53)			

15.2 Alarm Test

	Alarms Testing	PASS	FAIL	N/A
B1	Ensure system is running with no alarms. Verify all alarms either with remote monitoring (NOC) or on dry-contacts terminal strip. Ensure all alarms are clear prior to completing each step.			
B2	Pull out one inverter and verify minor alarm. [Terminal X3, pins 4 & 6] Reinsert module when complete. /!\ *Before reinserting the module, ensure fan is not spinning (approx. 60 sec). Otherwise, module can be damaged when re-energized*			
B3	Pull out two inverters on different phases and verify minor alarm. [Terminal X3, pins 4 & 6] Reinsert modules when completed. /!\ *Before reinserting the module, ensure fan is not spinning (approx. 60 sec). Otherwise, module can be damaged when re-energized.*			
B4	Pull out two inverters on same phase and verify major alarm. [Terminal X3, pins 1 & 3] Reinsert modules when completed. /!\ *Before reinserting the module, ensure fan is not spinning (approx. 60 sec). Otherwise, module can be damaged when re-energized..*			
B5	Switch off AC input (simulate commercial power failure) and verify the alarm. (AC Primary = Major Alarm / DC Primary = Minor Alarm) [Terminal X3, pins 1 & 3 (major)] [Terminal X3, pins 4 & 6 (minor)] Restore AC input when completed			
B6	Switch off DC bulk input (simulate DC power failure) and verify the alarm. AC Primary = Minor Alarm DC Primary = Major Alarm [Terminal X3, pins 4 & 6 (minor)] [Terminal X3, pins 1 & 3 (major)] Restore DC bulk input when completed.			
B7	Check the digital input alarms according to the configuration setup. (Default input alarm timer is set for 30 sec. delay) Input 1: MBP Engaged [Terminal X5, pins 2 & 3] /!\ *For MBP Engaged: Perform MBP Procedure as described in this document* Input 2: Surge Arrestor [Terminal X5, pins 2 & 1] /!\ *For Surge Arrestor: Remove top front panel & pull surge arrestor. Reinsert when finished.*			

15.3 Maintenance Bypass Switch (MBP) Test

MBP Test Procedure		PASS	FAIL	N/A
M1	Perform this test only after phase rotation and phase wiring has been verified in the **Start Up Checklist.**			
M2	**To Place inverter MBP in Bypass Mode**- Switch the MBP switch on the inverter from “NORMAL” to “BYPASS” position. Do not stop in “INTERIM”			
M3	Verify the “MBP ENGAGED” status message is shown in the event log and on customer network as selected by customer.			
M4	If applicable, have customer (or electrical contractor) verify wiring and operation of external maintenance bypass panel.			
M5	**To Return inverter MBP** to **Normal Mode-** Rotate MBP switch on the inverter from “BYPASS” to “INTERIM” position.			
M6	Verify all LED’s on the inverter modules are green. (Approximately 5-10 seconds)			
M7	Once all inverter module LED’s are green, rotate MBP switch on the inverter from “INTERIM” to “NORMAL” position. Inverter is now in “NORMAL” mode.			
M8	Clear event log			

TABLE 4

SNMP settings	
SNMP version	[any]
Port SNMP	161
SNMP v1 v2c	
Base OID	1.3.6
SNMPv1 Agent Community	public
Context	ctx_t4s
Note: Settings are for minimum software version: • T2S v 6.0.0 • Interface v 6.0.0 • Bootloader v 2.8.1 • CATENA v 4.2	

Trap settings	
Port Trap SNMP	162
SNMP version	[any]
Community v1 v2c	public
Traps version	CET MIB traps
Trap receivers	
Trap 1	0.0.0.0
Trap 2	0.0.0.0
Trap 3	0.0.0.0
Trap 4	0.0.0.0
Trap 5	192.168.0.3

Note:

If load bank test is required, the load bank must have a neutral connection. Load bank tests shall be performed with the inverter running in both AC and DC and tests should be performed changing primary source (AC and DC).

Refer to the User Manual, Test Reports, Schematic/Mechanical Layout & Configuration file for any clarifications.

Remarks:

Any changes in the configuration file should be approved from the authorized person/customer in charge for the site.

Commissioning Contractor:
Company:

Date:	**Customer (Print):**	**Customer (Sign):**

Date:	**End User (Print):**	**End User (Sign):**

16.Trouble Shooting

16.1 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 runs 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:	Check 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.

16.2 Defective modules

Unless input power is off all LEDs on each module should be green (see section 9, page 36). No light, orange light , red or flashing light are abnormal conditions. Refer to section 10.1.2, page 42 to collect and record module information. If no fix can be found, replace module.

16.2.1 Replacing modules

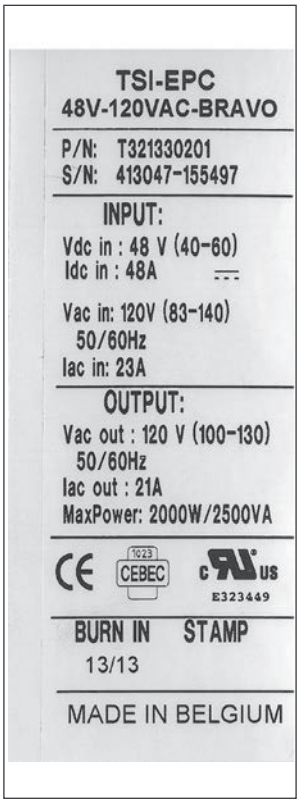
Refer to section 11, page 52 to remove and re-insert modules.

16.2.2 Return defective T2S interface

A T2S with LEDs that are off or cannot interface with your laptop is the indication that T2S could be defective. Proceed as per section 16.2.3, page 69.

16.2.3 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.



17.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 reported for immediate response by calling Tech Support or by sending an email to 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.

18. Preventive Maintenance

All tasks shall be performed only by factory trained personnel.

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.
- Clean system (vacuum cleaner or dry cloth)
- Check 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, THDI from power analyzer.
- Take photograph of system.
- Save copy of report and provide customer 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 Bypass procedure, generally there is no back up on AC input line, and and the load could be dropped if there is a loss of AC power.