



Leading Conversion Technology for Power Resilience

BRAVO ST - 120 VAC - UL

2 + 1 REDUNDANCY

User Manual V1.0

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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1.0	12/06/2020	-	Draft release of the Manual.

1. CE+T at a glance

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

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

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

AC	Alternating current
CB	Circuit Breaker
DC	Direct current
DSP	Digital Signal Processor
EMBS	External Maintenance Bypass Switch
EPC	Enhanced Power Conversion
ESD	Electro Static Discharge
ETH	Ethernet
G	Ground / Grounding
MBP	Manual By-pass
MCB	Miniature Circuit Breaker
MCCB	Molded Case Circuit Breaker
MET	Main Earth Terminal
N	Neutral
PCB	Printed Circuit Board
PE	Protective Earth (also called Ground Conductor)
REG	Regular
TCP/IP	Transmission Control Protocol/Internet Protocol
TRS	True Redundant Structure
TSI	Twin Sine Innovation
TUS	TSI Universal Synchronization
USB	Universal Serial Bu
UA	Urgent Alarm
NUA	Non-Urgent Alarm

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 de-rating 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 factory certified 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 electronic 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 product 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.
- The allowable operating temperature range is -20°C to +40°C.
- 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 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.
- 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 8.3.5, page 22.
- 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. Installation of filters may result in de-rating of module.
- 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 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 module or dummy 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 with installed Bravo ST units must be equipped with 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 (NEC - NFPA 70).
- 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.
- Some internal components may be deemed hazardous by the local jurisdiction. Ensure all local, state, and national guidelines are followed prior to disposal of the system or components.
- **WARNING: Certain components within this product may contain chemicals which are known to the State of California to cause cancer. For more information, go to www.P65Warnings.ca.gov**

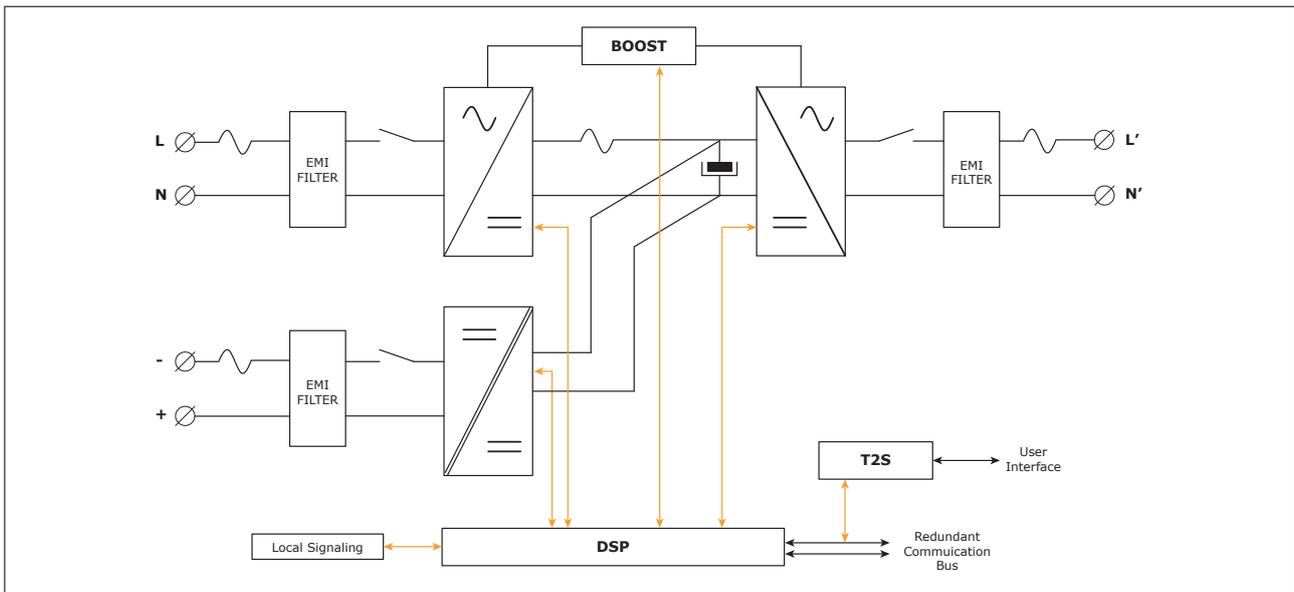
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- Softwares - my.cet-power.com

4. TSI TECHNOLOGY ¹

Inverter modules carrying the TSI logo and the EPC mark are triple port converters (AC in, DC in, AC out). Sinusoidal 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 function of the BOOST is for circuit protection in the event of a circuit fault condition on the output of the system. When a circuit fault is detected, the system will multiply the output current by approximately 10x to activate the load circuit protection device (breaker/fuse). The duration of the boost is limited to 20 ms. The power for the boost function comes primarily from the AC input through a diode bridge. This has been designed in such a way so that it will not trip the input AC/DC protection devices. This functionality is intended for circuit and equipment protection only. It is not for personnel safety.

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.

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.

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.
- To set EPC Mode in T2S ETH, go to Parameters > Power > General > Source power ratio DC vs AC (%) and enter the value “0”.

4.2 On-line Mode (REG 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.
- To set On-line Mode in T2S ETH, go to Parameters > Power > General > Source power ratio DC vs AC (%) and enter the value “100”.

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.
- To set Safe Mode in T2S ETH, go to Parameters > Power > AC In > Mode On Line (Safe) and select “Enable” from drop down list.

4.4 Mix Mode & Walk-in Mode

- Walk-in Mode allows the inverter to come back progressively on the AC priority source after an outage. This is to avoid block loading a generator.
 - To set Walk-in Mode in T2S ETH, go to Parameters > Power > Other > Walk In Mode Time (x10 s) and select “Enable” from drop down list.
- In Mix Mode, the total output load of the module will be shared by both DC and AC input sources.
 - To set Mix Mode in T2S ETH, go to Parameters > Power > General > Source power ratio DC vs AC (%) and enter the value between “0-100”. (0 - only AC, 100 - only DC)

5. Description

Bravo ST has been designed to give quality power, ease of use, and reliability. It provides up to 4 kW (Bravo ST 5 KVA) or up to 2 kW (Bravo ST 2.5 KVA).

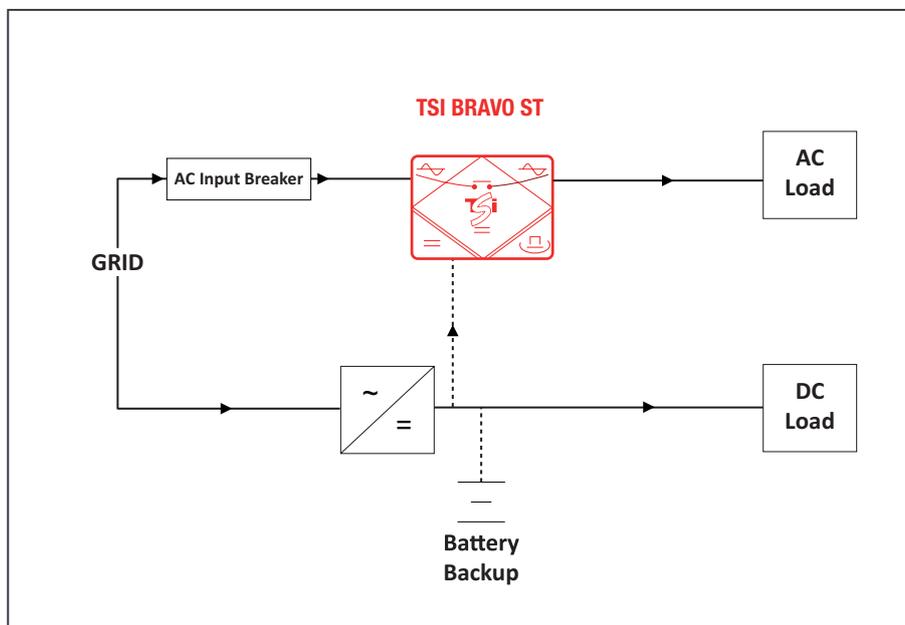
In normal operation:

- AC input present the TSI module will operate in EPC mode.
- AC input fail the TSI module will switch to DC (battery) and continue to feed the load.
- DC input fail the system operate on AC input.
- AC and DC input fail, the output turns off.

TSI module fail (N+1):

- If N+1 configuration selected the third module will continue to feed the load up to 5 kVA.
- If the second module fail, the system output will be reduced to 2.5 kVA

The Bravo power modules are hot swappable without shut down of the AC output.



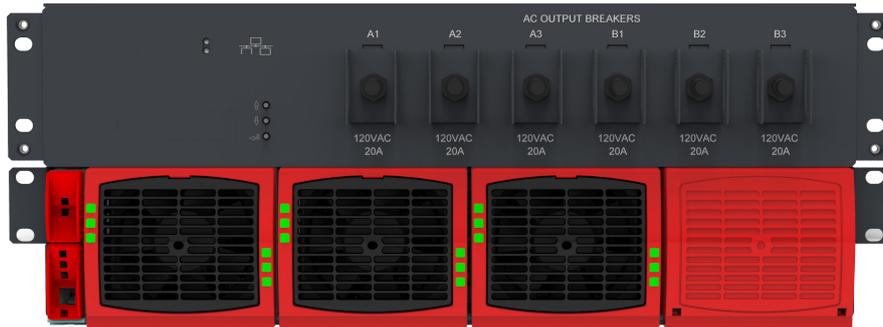
Warning:

If all modules fails and AC input not present, the system will stop to prevent "backfeed" protection upstream.

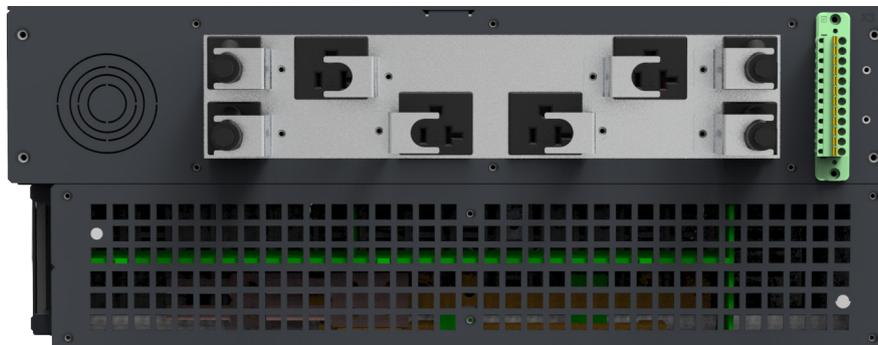
Bravo ST 120 Vac is a standalone Inverter with following capacity.

- Modular model 5 kVA, with redundancy.

120 Vac and 48/110 Vdc as Input and 120 Vac as Output fitted with Enhanced Power Conversion (EPC) mode.



Front View



Rear View

Note: Bravo ST 120 Vac has four different AC output connections. Refer to section 8.4, page 24, to identify the configuration which you received.

5.1 Typical load

- Resistive.
- Inductive and resistive.
- Capacitive and resistive.

6. Bravo ST Components

6.1 Inverter Module

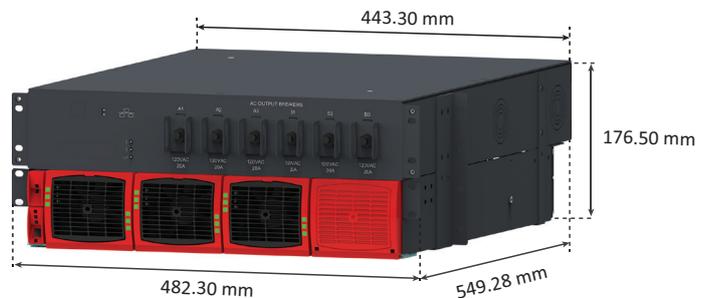
Bravo: 48 Vdc 2500 VA -120 Vac.
110 Vdc 2500 VA -120 Vac.



- The Bravo module shall have software version V208.4 or higher to operate with Bravo ST.
- The TSI Bravo is a 2500 VA / 2000 W converter based on the TSI technology (see section 4, page 10).
- 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.
- The inverter modules are equipped with soft start.
- The fan is equipped with an 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].

6.2 Sub-rack

- The Bravo ST 120 Vac shelf shall be integrated in min 600 mm deep cabinets, 19 inch / ETSI mounting.
- The Bravo ST 120 Vac shelf houses maximum three (3) inverter modules and one (1) T2S interface. Maximum 5 kVA per shelf.
- The Bravo ST 120 Vac shelf is designed with individual DC input, common AC input and common AC output.
- 549.28 mm (D) x 443.30 mm (W) x 176.50 mm (H).



7. Accessories

7.1 Monitoring - T2S ETH (Included)

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

The T2S ETH doesn't perform any control or management of the TSI system. It can be removed, replaced or moved to another live system without affecting the original TSI system operation nor the target system.

7.1.1 Parameters setting

The T2S ETH supports IPv4 network and featured with an ETH port at the front. Connected to a laptop, it enables TSI system settings, modules and phase assignments, and other various adjustments to allow TSI best fit with actual site conditions.

(Operation of T2S ETH is described in separate manual available on request)

7.1.2 System diagnostic and troubleshooting

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

Installers and maintenance technicians should always carry a proper laptop to access/reconfigure the system on-site. (Operation of T2S ETH is described in a separate manual available on request)

7.1.3 Monitoring

The T2S ETH monitors max of 32 system modules.

The T2S ETH is featured with

- 3 digital output alarm contacts.
- 2 digital input contacts.
- MODBUS.
- Alarm monitoring.
- Log file of the latest 2000 events as FIFO.
- SNMP v1 through T2S ETH.
- SNMP v2c and v3 through Catena (If T2S ETH is connected to Catena).
- Power: 2 W
- Part Number
 - 48 Vdc Model: T322010100
 - 110 Vdc Model: T322051000



7.2 Surge Arresters

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 with installed Bravo ST units must be equipped with 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.

7.3 External Maintenance Bypass

CE+T offers specialized bypass units compatible with your inverter system. If an external bypass is required, please consult your sales representative.

EMBS units from other manufacturers are not compatible due to UL restrictions.

Part number:

- Wall Mount Bypass: T30960W030
- Rack Mount Bypass: T30960R030

8. Bravo ST System Installation

8.1 Unpacking the system

Bravo ST is packed in a wooden box.

Modules are packed separately.

Module packing material shall be taken apart and stored in case of return under warranty. Improper 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.
- T2S-2U can be left in the system.
- Min two (2) fixing screws per side of the system.
- Fixing holes for inch and ETSI mounting frames.

8.2.1 Mounting

A full range of accessory is ready made to allow easy integration of the TSI in almost any kind of standard cabinets. Among other we provide fixing set for:

- 19" – 600 mm depth cabinets.
- 19" – 800 mm depth cabinets.
- ETSI – 600 mm depth cabinets.
- 19" and 23" mid mounting brackets is supplied by default.
- Mounting in a 23" rack is acceptable. Optional adapter plates may be ordered (Part number: PD6010018/1).

8.2.2 Mounting the system to rack

CE+T offers adapter plates to mount the Bravo ST System into the 23-inch open relay racks. These can be ordered by contacting CE+T.

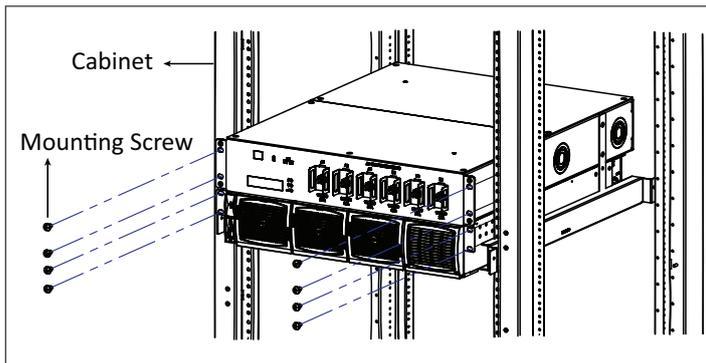
- Adapter Plate Part Number: PD6010018/1
- Adapter Plate is pre-threaded for use with SAE #10/32 bolts

All Bravo ST Systems are designed for 19-inch mounting applications, but it can be mounted in 23-inch, two post, open relay rack/ network frame assemblies if required in application.

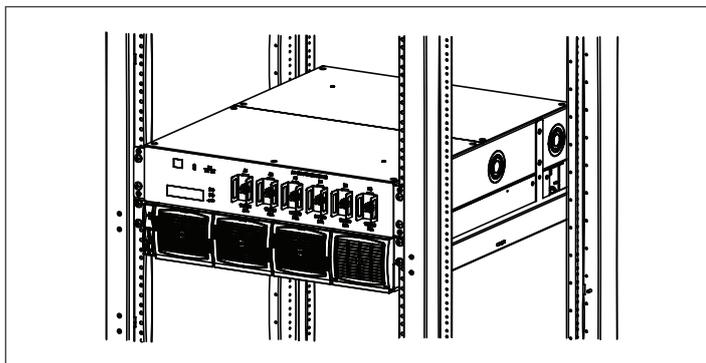
It is mandatory to use bottom support or slider when installing the system in 19-inch ETSI cabinet.

Fix the Brackets, Bottom Support / Slider to the rack using SAE #10/32 bolts, which is supplied along with the kit and then fix the system in the rack.

8.2.2.1 Mounting the system into 19 inch rack



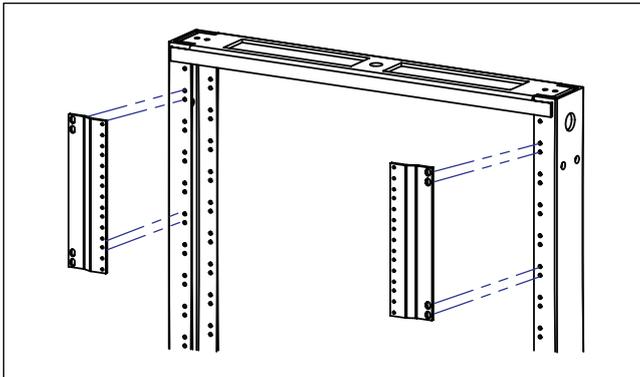
Place the System in the rack.



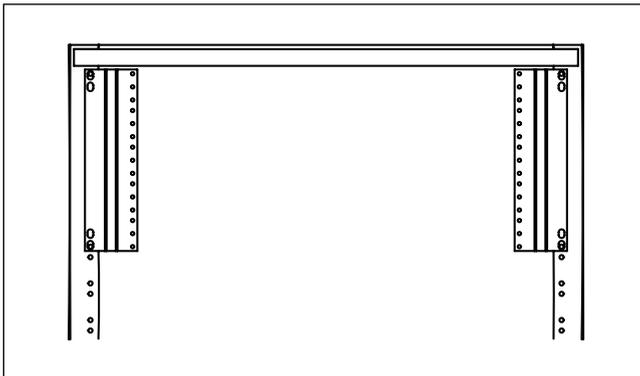
Fix the system in the rack with supplied mounting screws.

8.2.2.2 Fixing the system into 23 inch rack

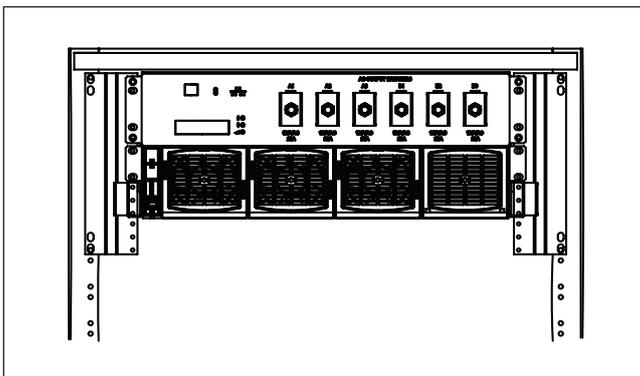
Note: Mounting adapters defined herein are not intended for use in 4 post relay rack.



Place the bracket in the rack.



Fix the bracket with supplied mounting screws.



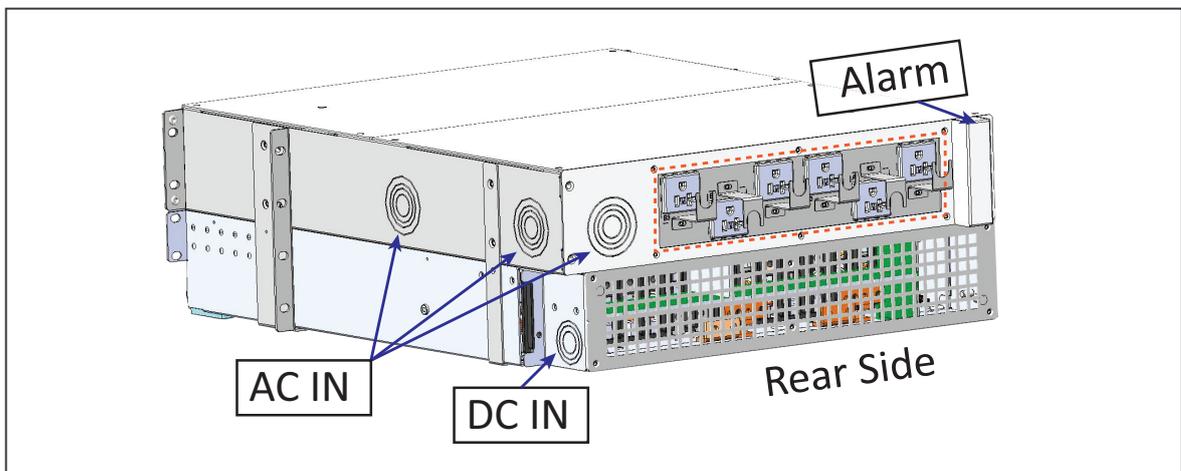
Fix the system with supplied mounting screws.

8.3 Electrical Installation

8.3.1 Pre-requisites

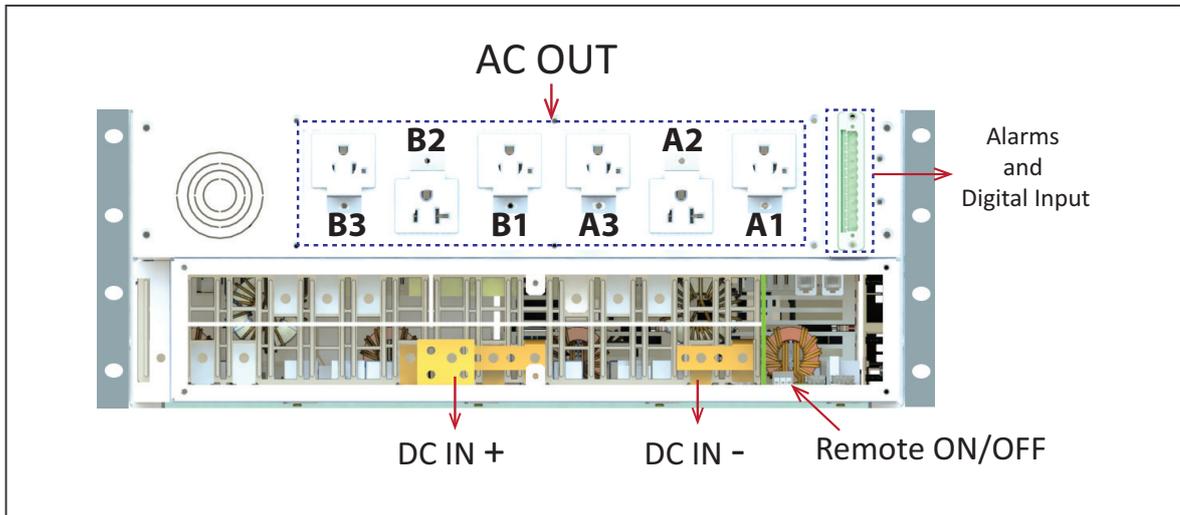
- The system have markings for all terminations.
- All cables shall be rated at min 90° C.
- Electrical terminations shall be tightened with 5 N.m (45 lbf.in).
- DC connection screws are M6 x 12 mm and AC connection with terminal block.
- DC Input-Individual (per module); observe polarity.
- AC Input / AC output – Bulk, respect phases.
- Wire all positions in the system as per markings.
- Input AC / Output AC / Input DC / Signal cables shall be separated.
- Cable crossings shall be done at 90° angles.
- It is recommended to install appropriate breaker at AC input and place a warning label near the breaker stating message as “**PROTECTED CIRCUIT: ISOLATE UNINTERRUPTIBLE POWER SUPPLY (UPS) BEFORE WORKING ON THIS CIRCUIT**”.

8.3.2 Cable Inlets



8.3.3 Terminations

Rear Side of Bravo ST 120 Vac terminations are clearly marked in the following figure.



Note: Bravo ST 120 Vac has four different AC output connections. Refer to section 8.4, page 24, to identify the configuration which you received.

8.3.4 Grounding

“PE CHASSIS GROUND”

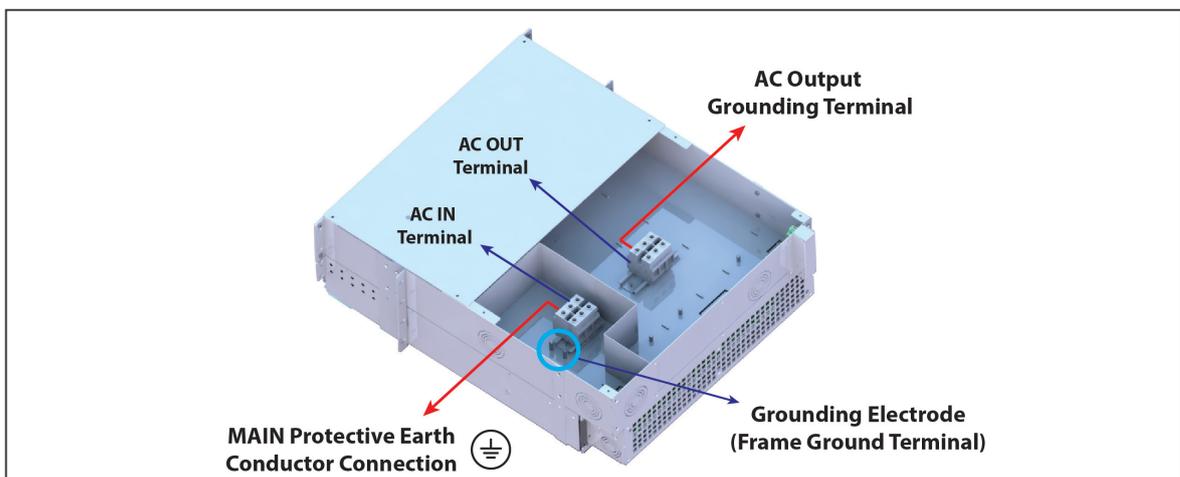


PE Chassis ground shall be wired to MET or distributed earth bar connected to MET, according to local regulations.

Main protective earthing/ground (PE/G) 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.

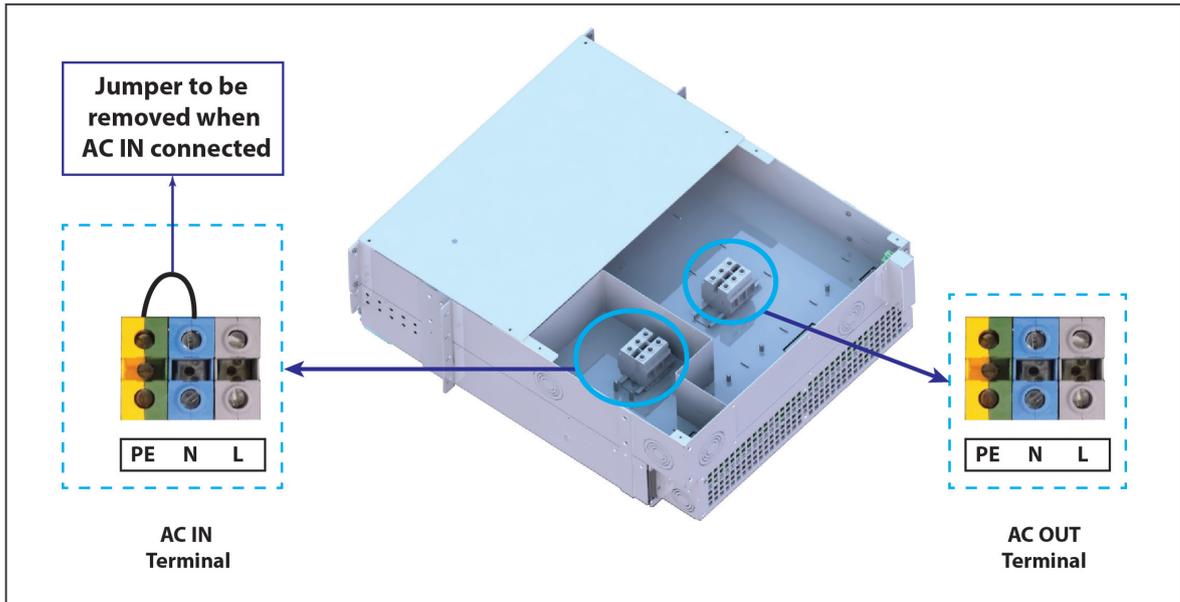
Ground has to be connected in accordance with local code.



8.3.5 AC Input and Output

The pictorial representation of terminal blocks arrangement is as follows.

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



8.3.6 DC Input

Model	Individual Feed		Common Feed		Torque lb.in
	Breaker	Cable Min	Breaker	Cable Min	
48 VDC	2 X 60 A / 1P	1 X 4 AWG	1 X 125 A / 1P	2 X 4 AWG	26.1 - 52.0
110 VDC	2 x 30 A / 2P	1 X 8 AWG	1 x 60 / 2P	2 X 8 AWG	

Recommended Lugs for DC Input cable:

Company	Part Number	Cable	Lug	Sleeve
Panduit	LCCF4-14B-L	4 AWG		Min 1 inch Length 600 V / 105°C
	LCCF8-14B-L	8 AWG		
Cembre	CL4-D141	4 AWG		
	CL8-D141	8 AWG		

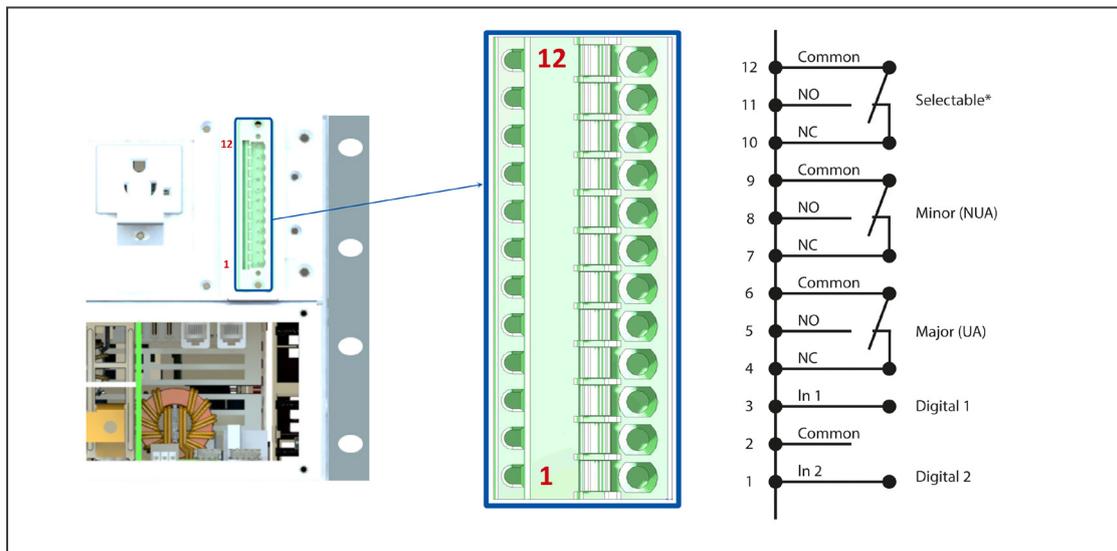
8.3.7 AC Input (AC Input protection mandatory)

Model	Breaker	Cable Min	Cable Max	Torque lb.in
48 VDC	60 A / 1P	1 X 4 AWG	1 X 2 AWG	24.9 - 26.7
110 VDC				

8.3.8 AC Output

Model	Cable Min	Cable Max	Torque lb.in
NEMA Receptacles 5 - 15R	14 AWG	NA	NA
NEMA Receptacles 5 - 20R	12 AWG		
Bulk Output	1 X 4 AWG	1 X 2 AWG	24.9 - 26.7

8.3.9 Signalling



Relay characteristics (Selectable, Major, Minor)

- Switching power 60 W
- Rating 2 A at 30 Vdc / 1 A at 60 Vdc
- Max wire size 1 mm²

Digital input characteristics (Digital IN 1/2)

- Signal voltage +5 Vdc (galvanically insulated)
- Max wire size 1 mm²

Note: In this system Remote ON/OFF function is not accessible to the customer connection.

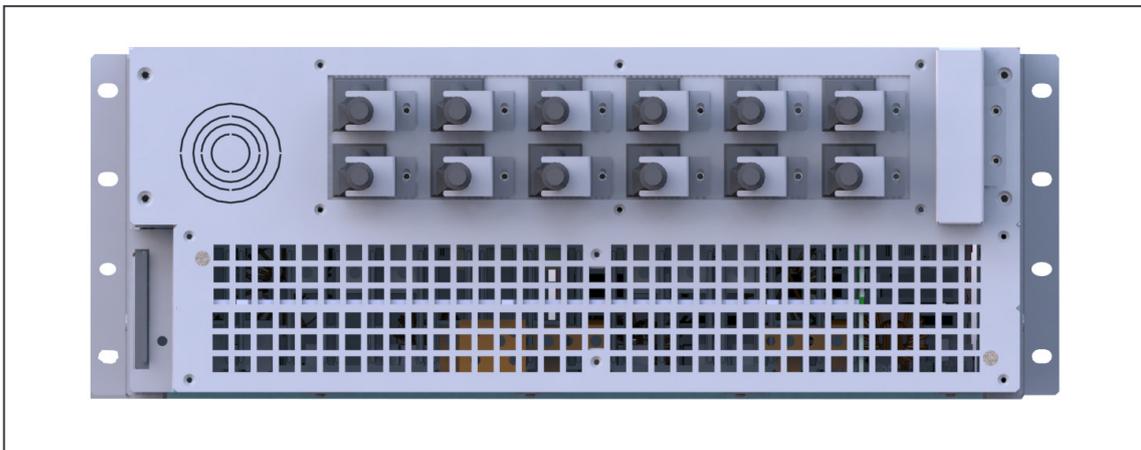
8.4 Wiring - Receptacle

TSI Bravo ST 120 Vac can be configured with NEMA or with hardwired AC Output connection.

8.4.1 6 X (2 x NEMA 15R Receptacles)

Part number:

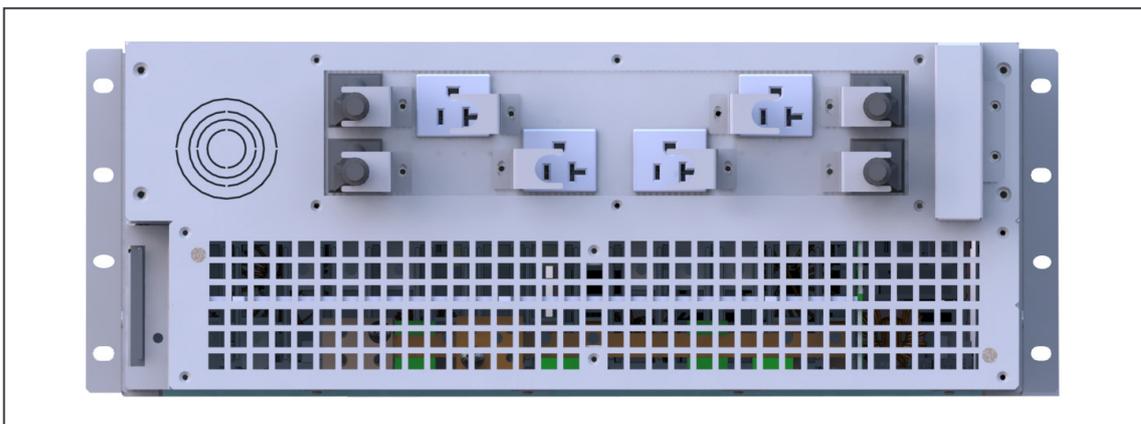
- 48 Vdc model: S32A33E0003SC0BBE001
- 110 Vdc model: S32A35E0003SC0BBE001



8.4.2 2 X (2 X NEMA 15R Receptacles), 4 X (1 X NEMA 20R Receptacles)

Part number:

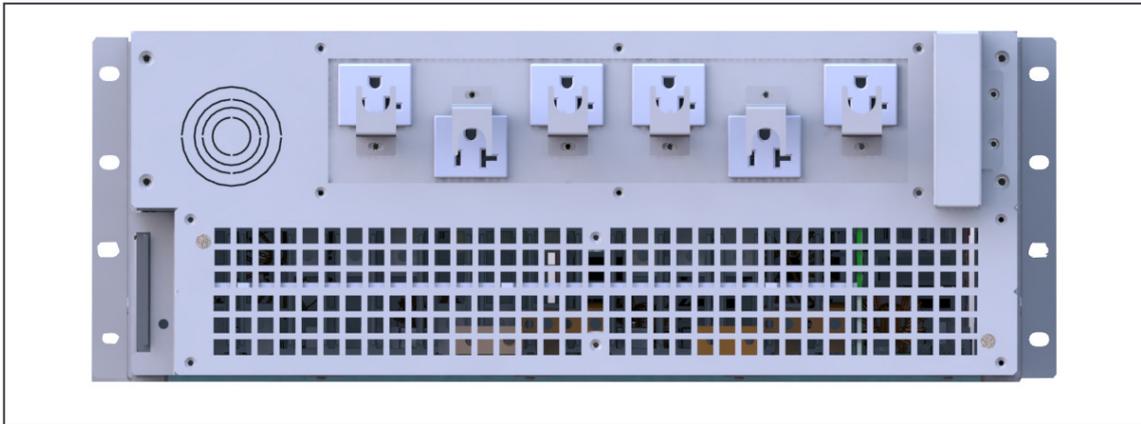
- 48 Vdc model: S32A33E0003SC0BEE001
- 110 Vdc model: S32A35E0003SC0BEE001



8.4.3 6 X (1 x NEMA 20R Receptacles)

Part number:

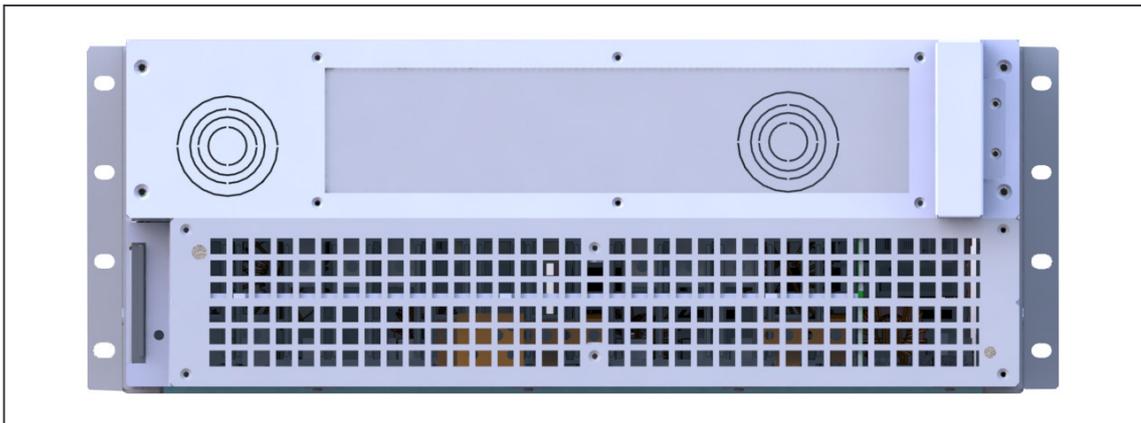
- 48 Vdc model: S32A33E0003SC0EEE001
- 110 Vdc model: S32A35E0003SC0EEE001



8.4.4 Bulk Output

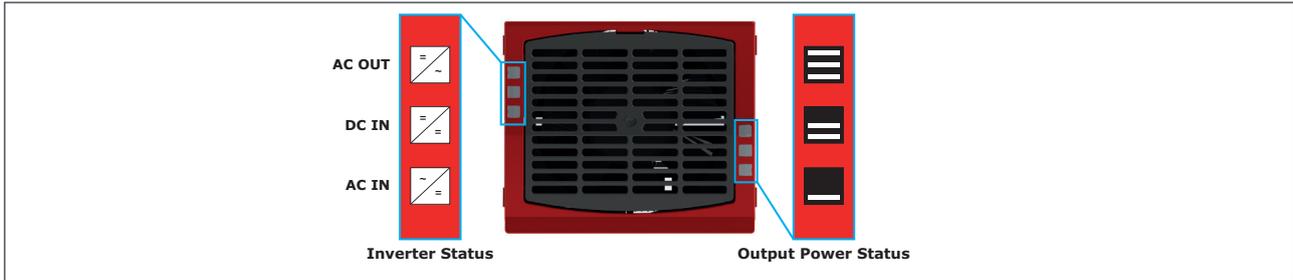
Part number:

- 48 Vdc model: S32A33E0003SC0TNE001
- 110 Vdc model: S32A35E0003SC0TNE001



9. Human-Machine Interface

9.1 Inverter module (Requires firmware V208.4 or higher)

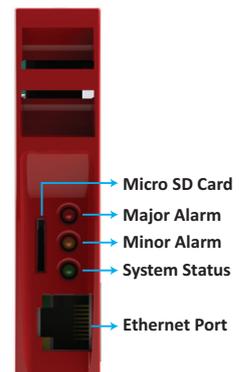


Inverter Status LED	Description	Remedial action
OFF	No input power or forced stop	Check environment
Permanent green	Normal operation	
Blinking green	Converter OK but working conditions are not fulfilled to operate properly	
Blinking green/orange alternatively	Recovery mode after boost (10 In short circuit condition)	
Permanent orange	Starting mode	
Blinking orange	Modules cannot start	Check T2S configuration or Module with wrong firmware. Need firmware V208.4 or higher.
Blinking red	Recoverable fault	
Permanent red	Non recoverable fault	Send module back for repair

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

9.2 T2S ETH

- Alarm indication on Catena (Urgent / Non Urgent / Configurable)
 - Green: No alarm
 - Red: Alarm
 - Flashing Exchanging information with inverters (only Configurable alarm)
- Outgoing alarm relay delay time
 - Major and Minor Adjustable from 2 to 60 seconds
- Parameter setting via Laptop.
- Factory default according to list of set values.

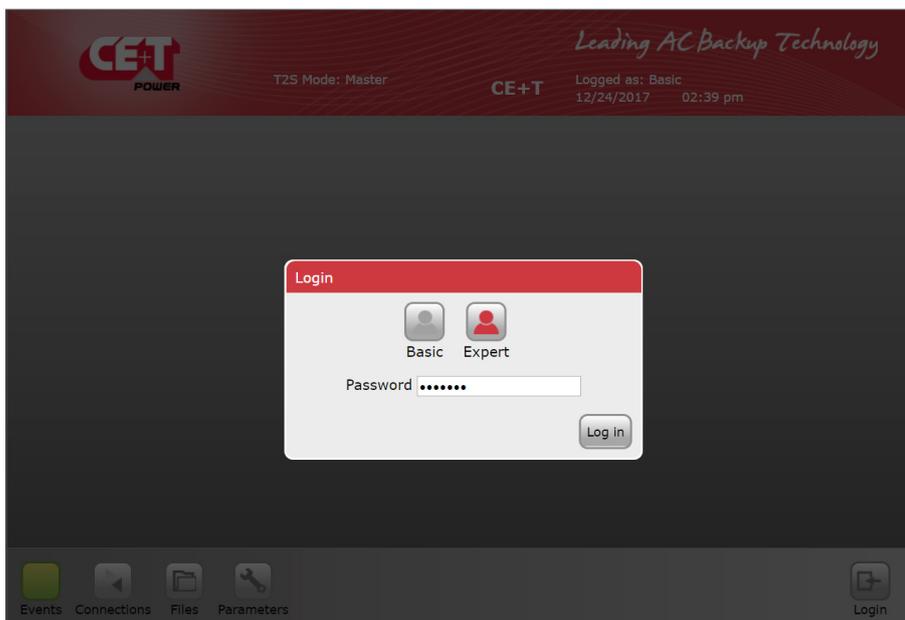


9.2.1 T2S ETH via Web Interface

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

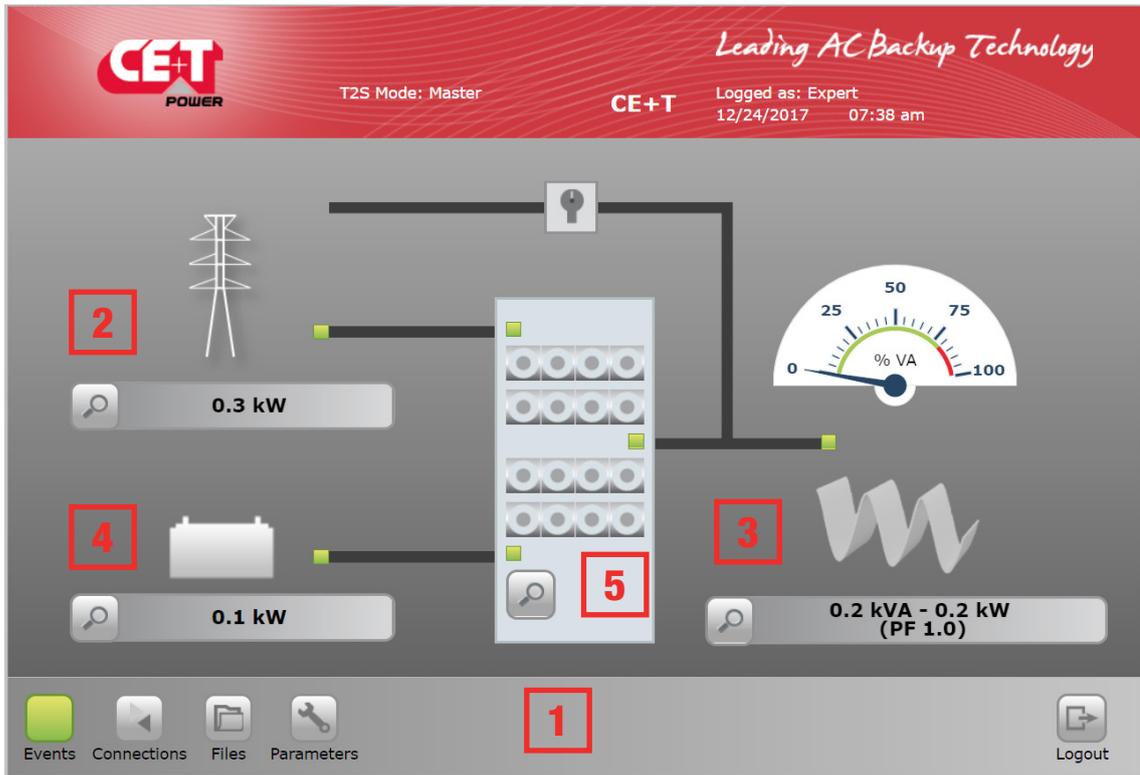
Connect the laptop and T2S ETH through network cable (not included).

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*”



9.2.1.1 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.

10. Inserting/removing/replacing modules

10.1 TSI Inverter

- The TSI inverter module is hot swappable. Bravo ST operate with module having firmware V208.4 or higher.
- 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.
- While swapping the modules, power to load will be vary depending upon the models and are listed below.

Note:

Before swapping Inverter module, make sure the commercial grid is available to prevent any shut down of the AC output voltage.

The commercial grid shall be within the limit in voltage (105 Vac to 140 Vac) and frequency between 47.5 Hz to 52.5 Hz for 50 Hz nominal and 57.5 Hz to 62.5 Hz for 60 Hz nominal.

If the load is supplied by “relay box” and the AC commercial input is not within the range (voltage and frequency) please DO NOT INSTALL NEW module. Risk of shutdown of the LOAD is present !!!

Module inserted in Bravo ST with firmware below V208.4 cannot be used. They will not operate properly and will heat up abnormally.

Bravo ST 5000VA - 3 Inverter Modules present

- Any Inverter Modules can be removed or added.

10.1.1 Module removal

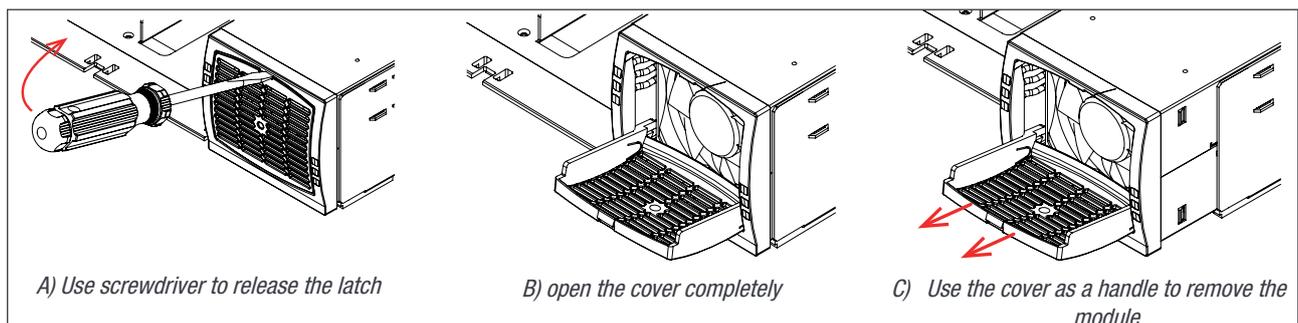
Note: When one or several inverter modules is/are removed, live parts become accessible. Replace module with dummy cover without delay.

Warning: Inverter module is not switched off while opening the handle. The handle only hooks the module to the shelf.

Step 1. Use a screwdriver and lightly rotate to release the latch of the handle.

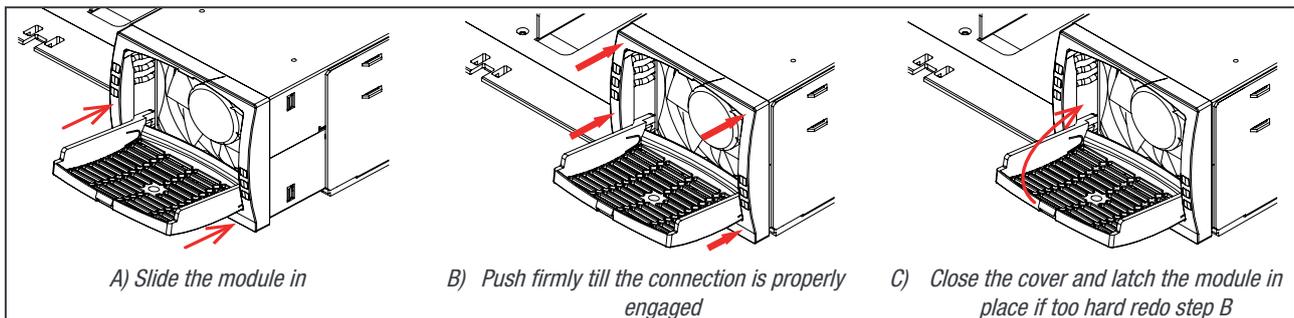
Step 2. Open the handle and pull the module out.

Step 3. Replace with a new module or blank cover.



10.1.2 Inserting

- Step 1.** Check module compatibility (DC Voltage, Firmware version, AC Voltage).
- Step 2.** Use a screwdriver and lightly rotate 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.



Once the module is inserted correctly and locked, it will restart automatically and begin to share the load. The sequence might take 10 to 40 seconds.

10.2 T2S ETH

T2S ETH is hot-swappable. It can be removed or replaced without affecting the operation of the system. If a new T2S ETH is inserted in the live system, the modules will automatically configure the system parameters within the T2S ETH.

10.2.1 Removal

- Step 1.** Use a small screwdriver to release the latch keeping the T2S in position.
- Step 2.** Pull the T2S ETH out.

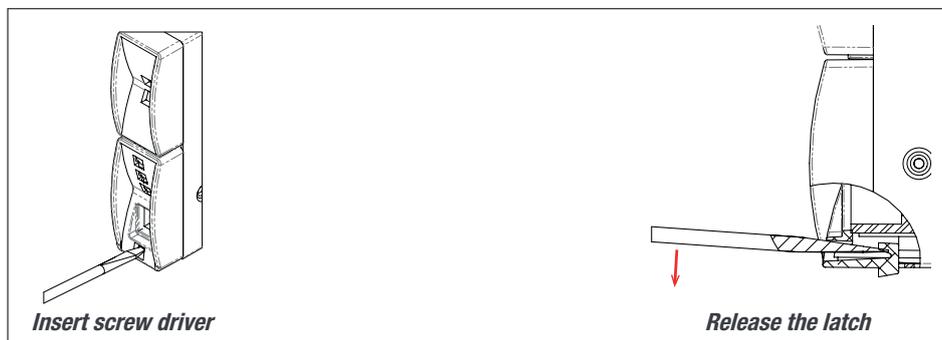


Figure 1. T2S Removal

10.2.2 Inserting

- Step 1.** Push the T2S firmly in place until the latch snaps in position.

10.3 Fan replacement

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



- Let the module rest at least five minutes before initiating work.
- The inverter front cover must be removed. Use a flat screwdriver, release all the four latches on side of the module and remove the front cover.
- Disconnect the fan supply cord and remove the fan.
- Replace with a new fan and connect the supply cord.
- Fix the front cover and make sure all the four latches are locked.
- Insert the module in corresponding slot in the shelf in accordance with section 10.1.2, page 30.
- Check the fan for operation.
- Access T2S ETH and reset the fan run time alarm. Refer to T2S ETH user manual for more details.



11. 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 sized according to recommendations and local regulations.
- Make sure that all cables have strain relieved.
- Make sure that all breakers are sized according to recommendation and local regulations.
- Make sure that DC polarity is according to marking.
- Torque all electrical terminations according to recommendation and local regulations.
- Make sure that no inverter/controller bays are left open.
- Cover empty inverter bays with dummy cover.
- Make sure that the Remote ON/OFF is appropriately wired according to local regulations, if used.
- Make sure that the point of AC supply meets local regulations.

12. Commissioning

The inverter module DC input breaker acts as a protective device. When the modules are inserted into a system the DC breaker can then be turned ON to activate the DC input of the module.

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

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

Equipment is not covered by warranty if procedures are not followed.

12.1 Check list

Refer the document “Commissioning Procedure” and available on request.

13. Trouble shooting

13.1 Trouble shooting

Inverter module does not power up:	<ul style="list-style-type: none"> 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:	<ul style="list-style-type: none"> Check that T2S ETH is present and properly inserted Check remote ON/OFF terminal Check the configuration and setting Check threshold level
Inverter only run on AC or DC:	<ul style="list-style-type: none"> 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:	<ul style="list-style-type: none"> Check output breaker
All OK but I have alarm:	<ul style="list-style-type: none"> Check configuration file and correct No of modules Download/clear log file
No output alarm:	<ul style="list-style-type: none"> Check the default time delay (UA “Major Alarm” - 60s, NUA “Minor Alarm” - 30s) Check configuration file
No information on Web interface:	<ul style="list-style-type: none"> Check that T2S ETH is present and properly inserted Check that the RJ45 cable is connected between T2S ETH shelf and Laptop

13.2 Defective modules

Unless input power is down, all LED's on each module should be green (see section 9, page 26). No light, orange light, red or flashing light are abnormal conditions. Collect and record the module information. If no fix can be found, replace the module.

13.2.1 Replacing modules

Refer to section 10, page 29 to remove and re-insert modules.

13.2.2 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 13.2.4, page 35.

13.2.3 Return defective shelf

There are no active devices on the inverter module shelf. Due to this failure of the shelf is uncommon and difficult to validate. If it is determined that the shelf is faulty please dispose as per section 13.2.4, page 35.

13.2.4 Return defective modules

- A repair request should follow the regular logistics chain:
End-user => Distributor or Value Added Reseller => CE+T Power.
- Before returning a defective product, a RMA number must be requested by email at 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!
- While returning the defective module, should mention all the details in the RMA document.

TSI-EPC	
48V-120VAC-BRAVO	
P/N: T321330201	
S/N: 413047-155497	
INPUT:	
Vdc in : 48 V (40-60)	
Idc in : 48A	---
Vac in: 120V (83-140)	
50/60Hz	
Iac in: 23A	
OUTPUT:	
Vac out : 120 V (100-130)	
50/60Hz	
Iac out : 21A	
MaxPower: 2000W/2500VA	
  	
<small>E323449</small>	
BURN IN STAMP	
13/13	
MADE IN BELGIUM	

14. Service

For Service

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

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

Major Incidents and Emergency conditions can be invoked for immediate handling of same number or by dropping a mail on 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.

15. Maintenance Task

As maintenance will be performed on live system, all task 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 cabinet (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.

