Leading Conversion Technology for Power Resilience

BRAVO EQZ4 90 KVA

Inverter System 48 V - 3x400 VAC

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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Leading Conversion Technology for Power Resilience

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Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
1.0	19/11/2018	-	First release of the Manual.

1. CE+T at a glance

About CE+T

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

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

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

Our systems are:

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

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

2. Abbreviations

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

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, outdoor or indoor, it is important to:

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

Important Safety Instructions and 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 and handled according to the instructions in the manuals.

3.2 Technical care

- This electric equipment can only be repaired or maintained by a "qualified employee" with adequate training. Even personnel who are in charge of simple repairs or maintenance are required to have knowledge or experience related to electrical maintenance.
- Please follow the procedures contained in this Manual, and note all the "DANGER", "WARNING" AND "NOTICE" marks contained in this Manual. Warning labels must not be removed.
- Qualified employees are trained to recognize and avoid any dangers that might be present when working on or near exposed electrical parts.
- Qualified employees know how to lock out and tag out machines so the machines will not accidentally be turned on and injure employees working on them.
- Qualified employees also know safety related work practices, including those by OSHA and NFPA, as well as knowing what personal protective equipment should be worn.
- All operators are to be trained to perform the emergency shut-down procedure.
- Never wear metallic objects such as rings, watches, or bracelets during installation, service and maintenance of the product.
- Insulated tools must be used at all times when working with live systems.
- When handling the system/units pay attention to sharp edges.

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

3.3 Installation

- 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 made power free.
- 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 (output) and PE shall be bonded. The bonded connection between N (output) and PE must be removed once the AC input is connected.
- AC and DC circuits shall be terminated with no voltage / power applied.
- 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; 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 or IP21 environment. When installed in a dusty or humid environment, appropriate measures (air filtering …) must be taken.
- All illustrations in the manual are for general reference, Refer to the technical drawing which is received along with the system for exact information.

3.3.1 Handling

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

3.3.2 Surge and transients

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

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

- Indoor sites Min Class II.
- Outdoor sites Min Class I + Class II or combined Class I+II. The modular inverter system/rack can reach hazardous leakage currents. Earthing must be carried out prior to energizing the system. Earthing shall be made according to local regulations.

3.3.3 Other

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

3.4 Maintenance

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

3.5 Replacement and Dismantling

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

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

4. Introduction

Bravo EQZ4 90 kVA inverter system secure AC loads by taking the energy either AC input (Grid) or DC Input (Battery) to provide quality power.

This system is specifically designed to operate in clean and temperature controlled environments.

- Telecom grade design.
- BRAVO ECI module - 48 VDC, 230 VAC.
- Modularity Design.
- Redundant configurations.
- Support EPC mode.

4.1 System Specifications:

Specifications	90 kVA - 3x400Vac + N
General	
Part number (module excluded)	S62A83E3030HC10BH001
Typical efficiency: AC/AC – DC/AC	96% - 93.5%
Operating T° and relative humidity / Storage T°	-20 to 40°C and 95% non-condensing / -40 to 70 °C
Cooling	Forced air (required 200 mm clearance from rear to wall)
Altitude above sea without de-rating	Max. 1500 m / de-rating – 0.8 % per 100 m
Cable entrance	Top cable entrance
Cabinet	RAL7024 powder coated welded - Cabinet NEMA 1 (IP 20). / door and base frame available as option
Modules	
Model	ECI BRAVO 48 Vdc / 230 Vac – 3 kVA
Power converter type	Modular inverter (with AC and DC input)
Nominal power	3 kVA / 2.4 kW
AC output data	
Modules number	Max. 30
Nominal voltage (selectable)	3x400 Vac + N (3x380 Vac – 3x415 Vac)
Nominal power	90 kVA / 72 kW
Nominal current at 230VAC / 3x400VAC	130 A per phase
Overload capacity	125% for 15 seconds
Admissible load power factor	0.8 from 0 lagging to 0 leading
Frequency / frequency accuracy	50 / ± 0.03 %

Specifications	90 kVA - 3x400Vac + N
Total harmonic distortion (resistive load)	< 1.5 %
Turn on delay	20 s to 40 s depending on the number of modules installed
Crest factor at nominal power @ 0,7 Load PF (with short circuit management and protection)	3 : 1
Short circuit capacity	10 x In during 20 ms. while mains is available at AC input port 2.1 x In during 15 s and 1.5 x In after 15 s while mains is not available.
Distribution (standard configuration / option)	Ready-to-install MCBs (MCB not included) / Bulk AC out on breaker or terminals
DC Input Specifications	
Nominal voltage (range)	48 Vdc (40 – 60 Vdc*)
Nominal current at 48Vdc	1671 A
Maximum current (for 15 seconds)	2037 A
DC input connection	Single DC feed per cabinet
AC Input Specifications	
Nominal voltage (range)	3 x 400Vac + N (3 x 260 – 453 Vac**)
Frequency (synchronization range)	50 Hz (47 – 53 Hz)
Nominal current at 230Vac (MBP not engaged)	112 A per phase
Power factor	>0.99 (above 50% load)
Surge arrestor	Not included (available as option)
Source Transfer Performance	
Voltage deviation and duration	0 V, 0 s (no interruption)
Performance (EN62040-3)	VFI-SS-111
Monitoring	
Monitoring	Candis Display, T2S Ethernet Monitoring and LED on modules
Alarms output	3 Dry contacts (Major, Minor, Auxiliary)
Safety & EMC	
Safety	EN62040-1
Vibration	GR63 office vibration: 0 to 100 Hz - 0.1 g / transport vibration: 5 to 100 Hz - 0.5 g, 100 to 500 Hz -1.5 g
EMC immunity	EN 61000-4-2 / EN 61000-4-3 / EN 61000-4-4 / EN 61000-4-5 / EN 61000-4-6 / EN 61000-4-8
EMC emission (class)	EN 55022 (A)
Electrical isolation	Doubled isolation DC/AC 4.3 kV

Specifications	90 kVA - 3x400Vac + N
RoHS	Compliant RoHS 6 / REACH
System weight without modules	412 kg
System Dimensions (W x D x H mm)	600 x 700 x 2140 mm

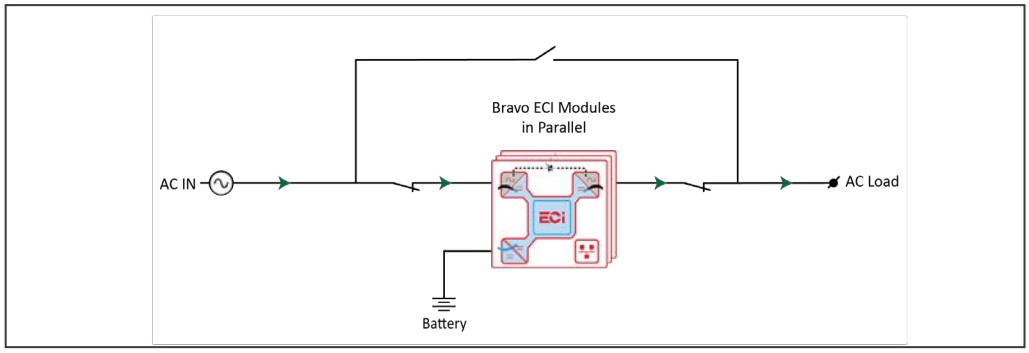
* Reduced performances from 40 to 45 Vdc

** De-rating below 329 Vac Input

4.2 Operation

4.2.1 EPC Mode (Normal Mode)

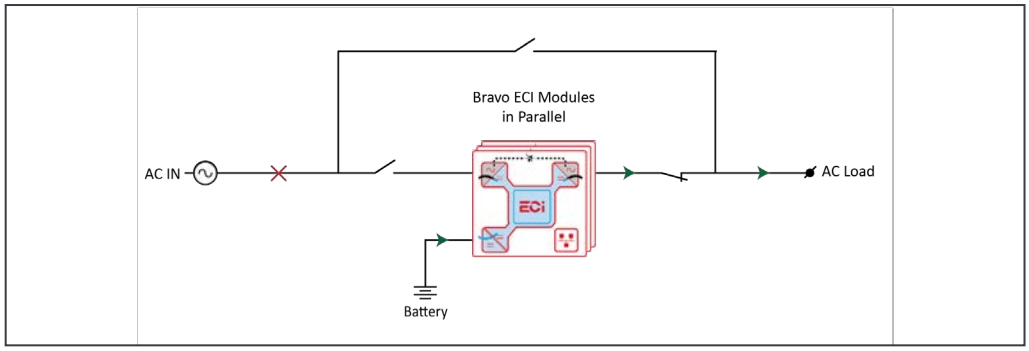
When AC input is present, the Bravo ECI module takes energy from AC source and feed AC Load via a double conversation to provide full sinusoidal output.



Bravo ECI System - Normal Mode Operation

4.2.2 REG Mode (No AC input)

In case of no AC input, the Bravo module take energy from the battery and feed AC load via a double conversation to provide full sinusoidal output.



Bravo ECI System - Reg Mode Operation

5. System Description

Bravo EQZ4 90 kVA inverter system is composed of three compartments:

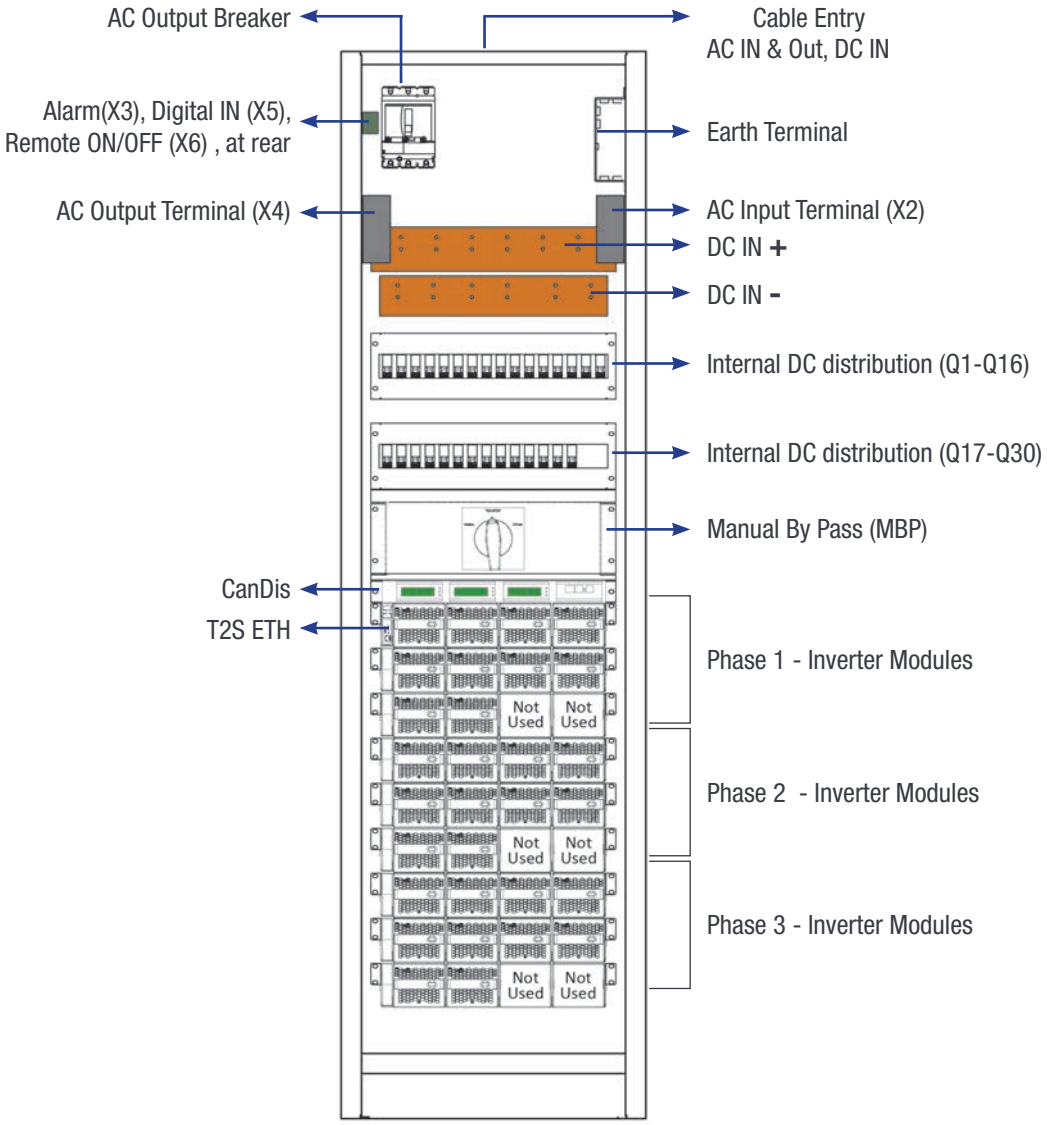
- Top Compartment
  - AC Input supply connections
  - AC Output supply connections
  - DC Input connections
  - Main Output Breaker
  - Remote alarm contacts connections

- Middle Section
  - MCB breakers for DC distribution to the modules
  - Manual By-pass
  - Monitoring device (Candis with T2S ETH)

- Bottom Compartment
  - 9 shelves with 4 slots for modules

Optional

- Door
- Surge Protection Device



Bravo EQZ4 90 kVA Inverter System - General Arrangement

Note:

Bravo EQZ4 90 kVA inverter system is designed as top cable entry.

5.1 Bravo Module

Input	48 VDC 230 VAC, 50 Hz
Output	230 VAC
Power	3000 VA / 2400 W

- The Bravo ECI is a 3000 VA / 2400 W triple port inverter.
- The ECI inverter modules are hot swappable and hot pluggable.
- The module operator interface comprises LEDs showing converter status and output power.
- The inverter modules are equipped with soft start.
- The fan is equipped with an alarm and run time meter.
  The fan is field replaceable.
- 435 (D) x 102 (W) x 88 (H).
- 5 Kg.

Note: About Bravo ECI module is described in separate manual available on request.

5.2 Monitoring - T2S ETH

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

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

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

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

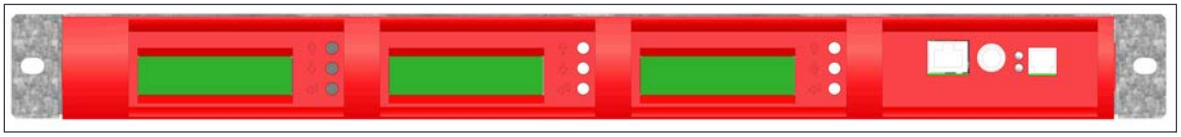
The T2S ETH monitors a maximum of 32 inverter modules and featured with:

- 3 outgoing alarm contacts.
- 2 digital inputs.
- MOD bus.
- CAN bus.
- Alarm monitoring.
- Recording of latest 2000 events as FIFO.

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

5.3 Display - Candis

Candis is a user interface which allows the user to get the system information through display.



- The Candis shelf has slots for up to 3 display units.
- Backlit 2 line dot matrix.
- The display shows two values simultaneously.

Note: Operation of Candis is described in separate manual available on request.

5.4 Manual By-pass

The manual by pass operates via manually operated switches to create a short circuit from the AC main input directly to the output AC distribution. Standard manual by-pass 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.

The operation of Manual By Pass is described at section 8, page 37.

Warning: When the system is in Manual By-pass, the load is subjected to AC main disturbances.

5.5 Surge Arresters

Class I and a class II Voltage Surge Protection devices, compliant with IEC31643-11, must be placed in low voltage distribution upstream to the inverter system.

Class II Surge Protection Device can be optionally integrated to the system on request.

Additional surge protection must be placed if installation area is more subject to lighting. Lightning currents conducted in inverter circuits can cause immediate and catastrophic equipment failure.

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

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

The selection of the surge arresters as well as their installation obeys to strict rules. Not matching these rules could simply void their action. The selection of the surge arrester and its physical implementation cannot be covered in this document. The installer must analyse the local conditions and do the needful; eventually he should require the site to be inspected to cover his liability.

In any case inverter damages that could be related to improper protection are not covered by CE+T product warranty.

Caution:
For continued protection against risk of fire, replace only with same type and rating of fuse.

6. Installation

6.1 Site Preparation

- All cables should be copper wire and must be rated for minimum 90°C (194°F).
- All cables must be sized according to the rated current of the inverter system and to the customer terminal connection.
- All AC input, AC output, DC input, and signal cables should be routed properly.
- Empty inverter positions shall be covered with blank module covers
- **System Position**
  - The system should not be installed at close to the wall, mainly at rear side.
  - **A minimum of 36" (900 mm) clearance is required at rear of the unit**.
  - The System is designed to operate in a temperature controlled (maximum operating ambient 40°C/104°F) and clean environment.
  - If the **front door is present** in the system:
    - The presence of airborne particles such as dust, sand and metallic debris are forbidden.
      For that appropriate filters should be installed.

6.1.1 Transformer and Generator Sizing

The inverter is capable of operating at 125% of rated capacity for 15 seconds.

- 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.

6.2 Packaging Information

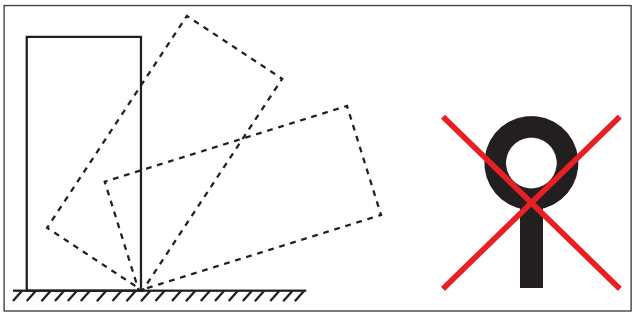
CE+T cabinets are always fixed on a pallet, and then packed in a wooden crate. These crates are usually delivered laying flat, horizontally.

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 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.



6.2.1 Module packing

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

If the modules have been ordered separately they are packed in carton on pallet and identified to be placed in the right slot (Important for dual or 3 phase system).

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.

6.3 Removing the cabinet rear protection

Wooden wedges are fixed at the back of the cabinet to make sure that no parts may move and be damaged during transportation.

These wooden wedges must be removed before going further with the cabinet's installation and commissioning.

1. Remove the rear panel.
2. Identify the protection (Refer Figure - 1).
3. Cut the tie wrap of the back wedges and remove them (Refer Figure - 2).

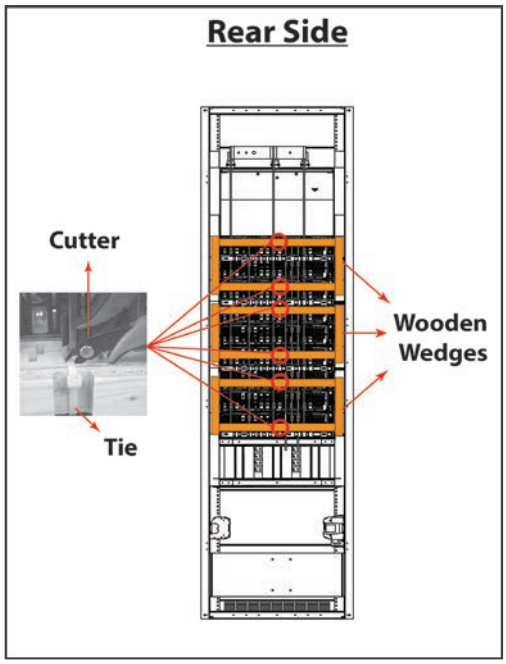


Figure - 1

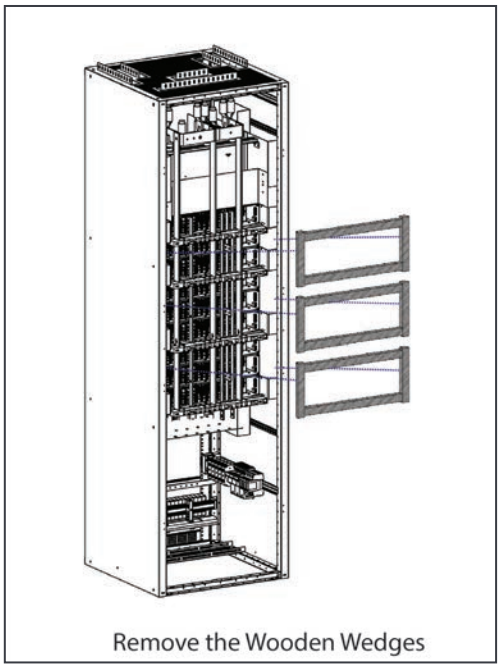


Figure - 2

Note: The number of wooden wedges varies depend upon the system configuration.

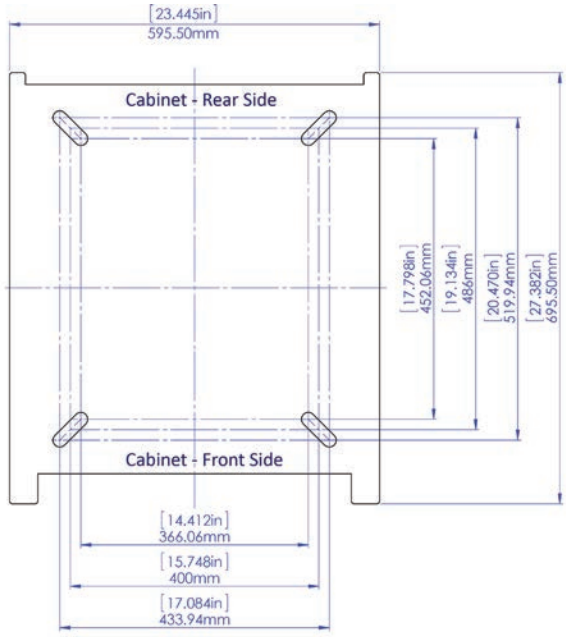
6.4 Fixing the cabinet in the floor

The cabinet is fixed through the base of the cabinet and remove lowest front cover to get access to the fixing holes.

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

The installer has to level and plumb the frames in order to compensate the variations in floor flatness.

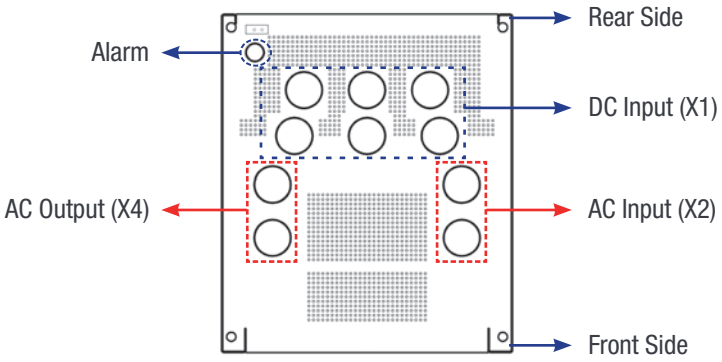
Note: A minimum of 900 mm clearance is required at rear of the cabinet.



Hole locations

6.5 Cable Entrance

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



Cable Inlet - Positions

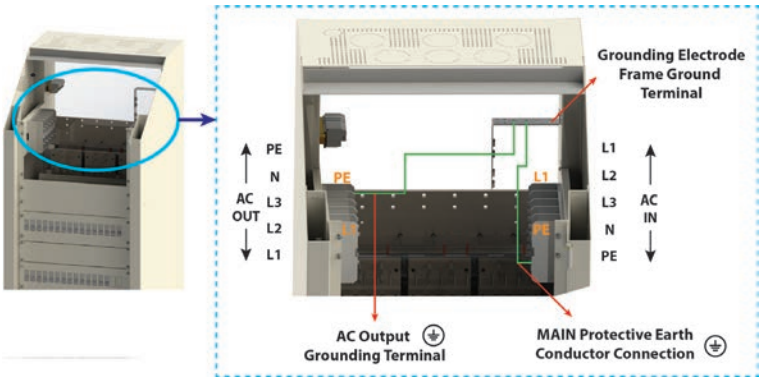
6.6 Grounding

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 should 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.

Connections in yellow-green wire are factory wired and shall not be removed. (In the following image the connection is shown in green colour).



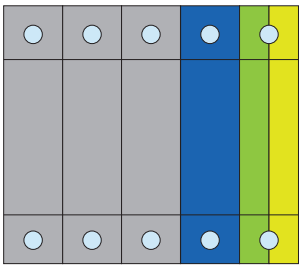
Earthing connections

6.7 AC Input and Output

The pictorial representation of AC input and output terminal blocks arrangement.

Three Phase

L1 L2 L3 N PE



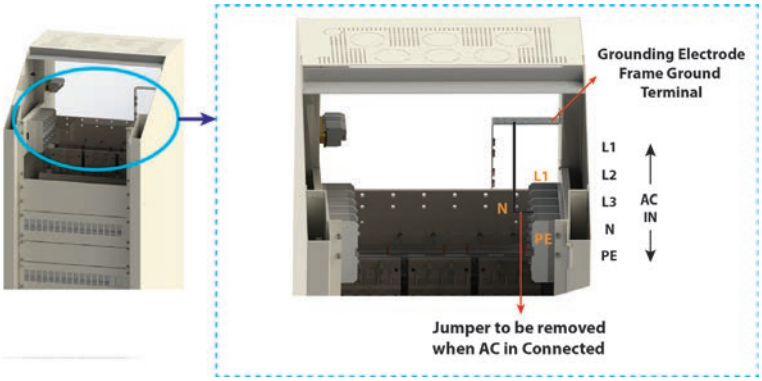
WARNING !!!

Recommendation of IEC 60364 4. 43

431.3 Disconnection and reconnection of the neutral conductor in multi-phase systems

Where disconnection of the neutral conductor is required, disconnection and reconnection should be such that the neutral conductor should not be disconnected before the line conductors and should be reconnected at the same time as or before the line conductors.

If AC IN is connected, remove the bonding neutral jumper, remove cable between X2 (AC IN) and frame Ground.



Neutral bonding jumper

Note: When an AC main is not connected, the output AC circuit is considered as a separately-derived source. If local codes require grounding of this circuit, use the PE output terminal bonding that circuit to the enclosure and ground the enclosure to a suitable grounding electrode in accordance with local code requirements.

System Model	AC Input and Output				
	External Protection		Maximum Terminal Capacity	Torque	Lug
	AC Input	AC Output			
Bravo EQZ4 - 90 kVA	MCCB 250 A	MCCB 200 A	120 mm^2	36.7 Nm	Insulated LUG

6.7.1 Main Output Breaker

Main output breaker is for AC output connections in this inverter system.

Before terminating the output cables to Main output breaker, make sure that the breaker is in OFF position and then:

1. Connect load cables to the breaker.
2. Switch ON the breaker.

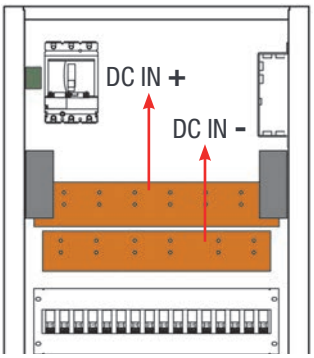
The below image illustrates an example of Main output breaker.

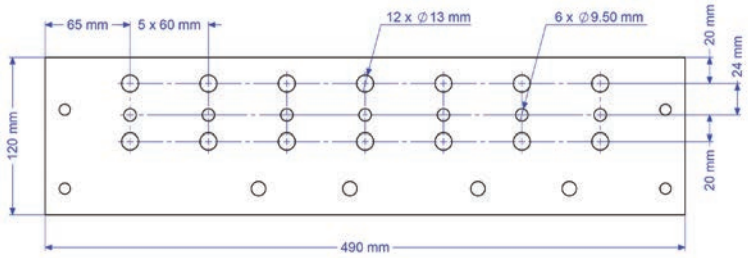
6.8 DC Input

DC input connections are present at top of the compartment.

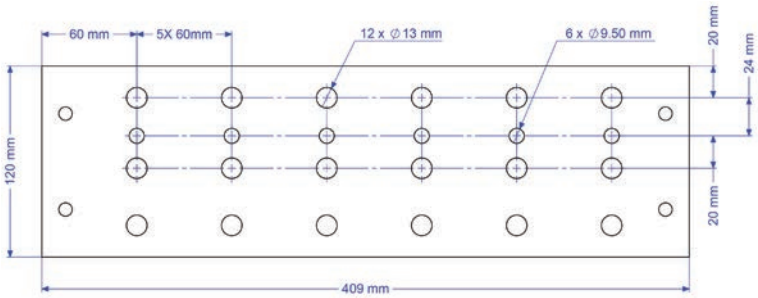
Internal DC distribution with circuit breakers (Q01-Q30) per inverter module.

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





Positive bar hole details



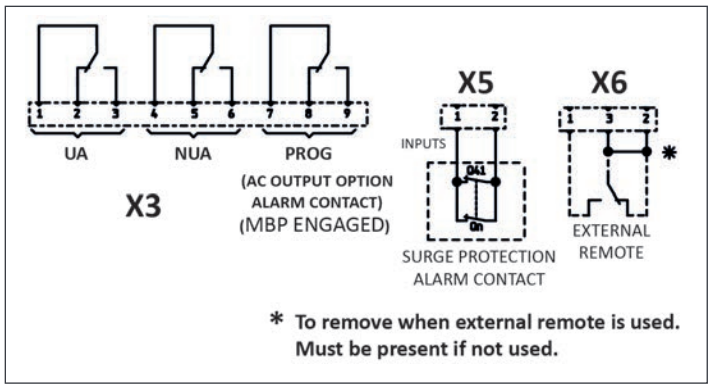
Negative bar hole details

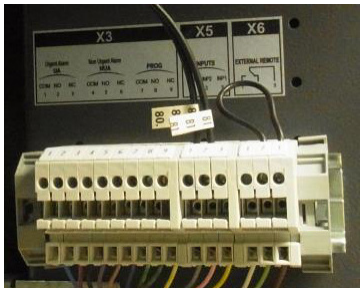
System Model	DC Input			
	Maximum DC Current	Connection Cable	Lug	Torque
Bravo EQZ4 - 90 kVA	2037 A	6 x 240 mm^2	Insulated Lug	25 Nm

6.9 Signalling

All relays are shown in non energized state

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





6.9.1 Alarm (X3)

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

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

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

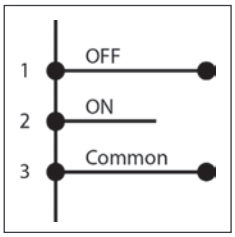
6.9.2 Digital In (X5)

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

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

6.9.3 Remote ON/OFF (X6)

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 switches the output AC OFF.
- 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 1mm^2

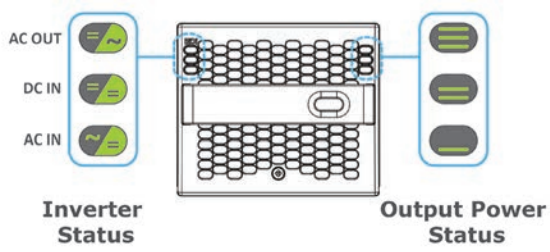
Functional table for remote ON/OFF function

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

7. Operation

7.1 Bravo ECI 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)

7.2 T2S ETH

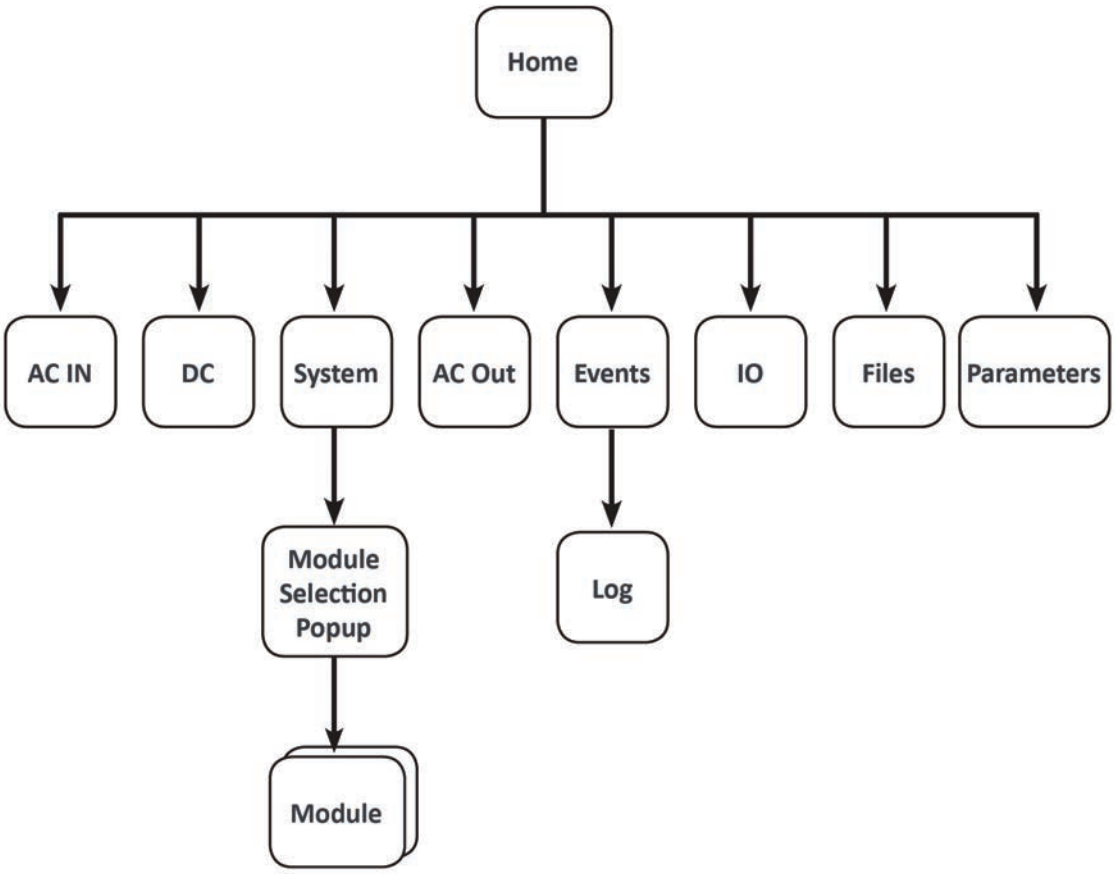
- Alarm indication on T2S (Urgent / Non Urgent / Configurable)
  - Green: No alarm
  - Red: Alarm
  - Flashing Exchanging information with inverters (only Configurable alarm)
- Outgoing alarm relay delay
  - Urgent 60 seconds delay
  - Non urgent 30 second delay

7.3 Web Interface via T2S ETH

The user interface is the same if accessed with a laptop connected on front ETH connection, remotely on network, or through catena if one is present.

The interface has a “top-down” philosophy: first screen gives a general overview, then one can go deeper and get more information on specific area by clicking the “magnifier icon”.

7.3.1 Hierarchy



7.3.2 Login

The user interface is accessible by typing the IP address of the system in a web browser. The default IP address is **192.168.0.2**.

Important remark:

Web browser brand and version can change the interface proper behaviour. It's strongly recommended to use Google Chrome, Mozilla Firefox, OSX Safari. If you wish to use Microsoft Internet Explorer, version should be 10 at least.

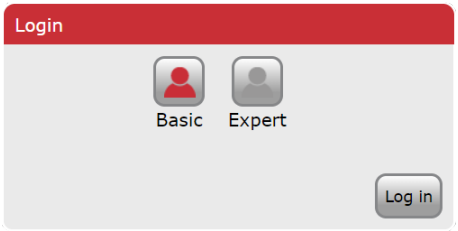
Before being able to do anything, user should select a user level and log in the system. Currently two users can be connected at same time in the system: one basic and one expert.

No password is required in basic while a password is needed in Expert.

Basic user can just browse the pages and download the files. Expert login can access and modify the parameter values.

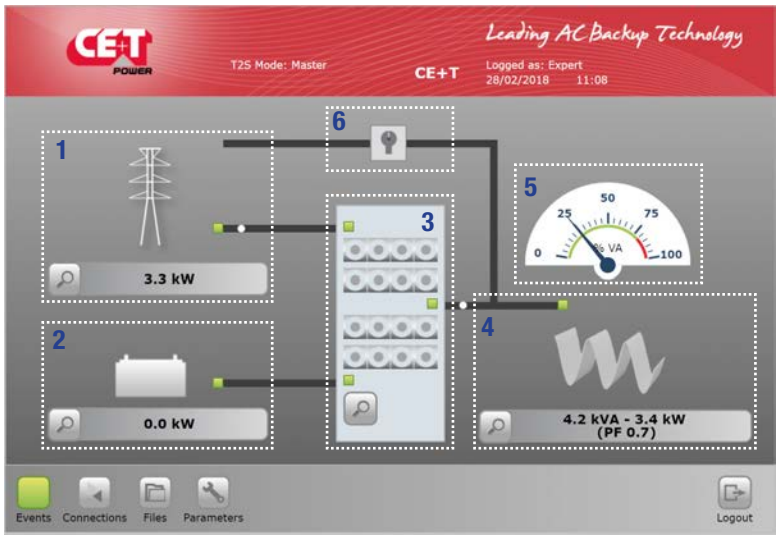
An auto-logout feature is available to avoid a user being connected all the time, blocking the system.

Default password for expert mode is ***pass456.*** This password can be modified.



7.3.3 The Home page

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



1 → AC IN

Clicking the magnifier will bring the user to all measurements regarding AC input.
The LED's shows the status of the input: if the source is absent, this LED's becomes red.
Flow (moving white ball) from this item to the system means power is taken from the source.
Power displayed is the total power consumed, regardless system is 1P or 3P.

2 → DC input

Clicking the magnifier will bring the user to all measurements regarding DC input.
Given the system can be configured with up to 2 DC groups, power is the total power consumption.
Flow (moving white ball) from this item to the system means power is taken from the DC source.

3 → System

Clicking the magnifier will bring the user to information regarding the system such as redundancy, available power and so on. It is also the path to the module level monitoring.
The three LEDs are showing the state of each converter.
Example: if one converter of one module is in alarm, then the led will turn to orange.

4 → AC out

Clicking the magnifier will bring the user to all measurements regarding AC Out.
Regardless of the system configuration (1P, 3P), displayed power is the total amount of power fed to the load.
Power is expressed in both KW and KVA and the Power Factor (PF) is computed.

5 → Gauge

In a 1P output system, the gauge depicts the percentage of power used in VA.
In a "more than 1P" system, the gauge depicts the "worst case", i.e. if the system is unbalanced, it show the most loaded phase.

6 → MBP

MBP is configured in the system.

7.3.4 Toolbar

The toolbar is always accessible and provides quick access to following pages:

- **Events page**
  The events icon has the colour of the highest priority alarm currently present in the system:
  - Green: system healthy, no event present.
  - Grey: at least one event is present in the system but not configured as major or minor.
  - Orange: at least one minor event present in the system. No major event but other events could be present also.
  - Red: at least one major event is present in the system. Other event or minor events could be present.

If more than one event is present, regardless its level, a counter is present on the icon. It displays the total number of event currently present in the system.

- **Connections**
  This brings to digital input and relays status. For configuring these inputs and outputs, it's in configuration section.
- **Files**
  This leads to files management page. Files such as configuration, update, log download.
- **Parameters**
  The parameters page allows user to change every parameter related to the system.

Throughout the browsing, user can see following icons appearing:

When accessing a page of depth two or more (such as module or log page), user can go back to previous page by clicking “back”.

When browsing away from home page, user can go back straight to it by clicking the home page.

Whenever a logged user click this button, he will be redirected to login page.

7.3.5 Pages and Feature

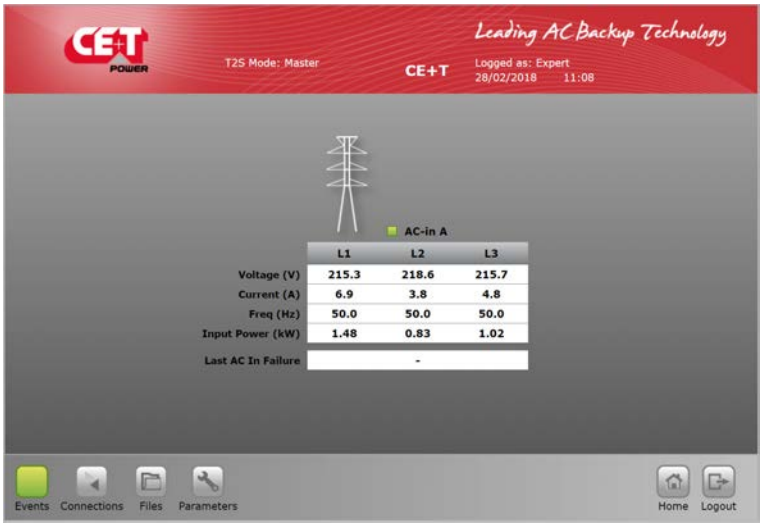
7.3.5.1 AC input page

This page displays the measurement made by the modules on the AC input.

Available values are:

Measure	Unit
Voltage (V)	Volts (V)
Current (I)	Ampere (A)
Frequency(f)	Hertz (Hz)
Input Power(P)	Kilo Watts (kW)

System also keeps track of last AC In failure timestamp.



Remark:

Modules have a Power Factor of 1, that’s why power is only displayed in KW. This would be the same value in KVA. Last AC in failure is non-persistent information. It means that it will be lost if device is reset

7.3.5.2 DC input page

This page displays the measurement made by the modules on the DC input.

Available values are:

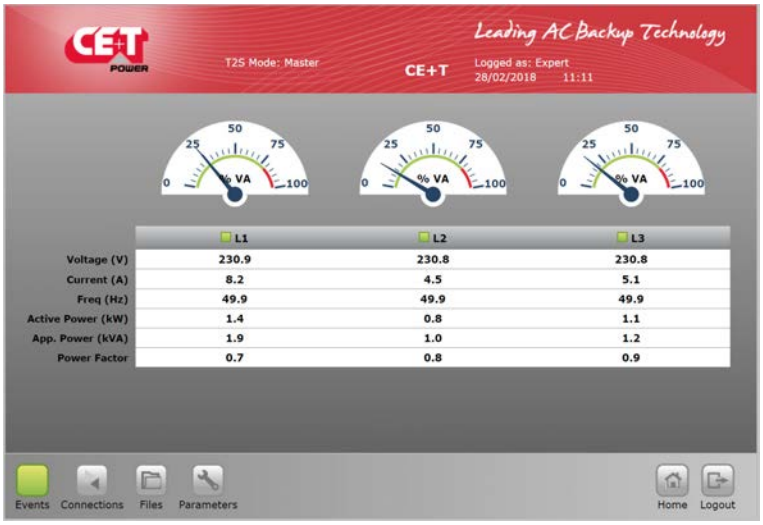
Measure	Unit
Voltage (V)	Volts (V)
Current (I)	Ampere (A)
Input Power(P)	Kilo Watts (kW)

7.3.5.3 AC output page

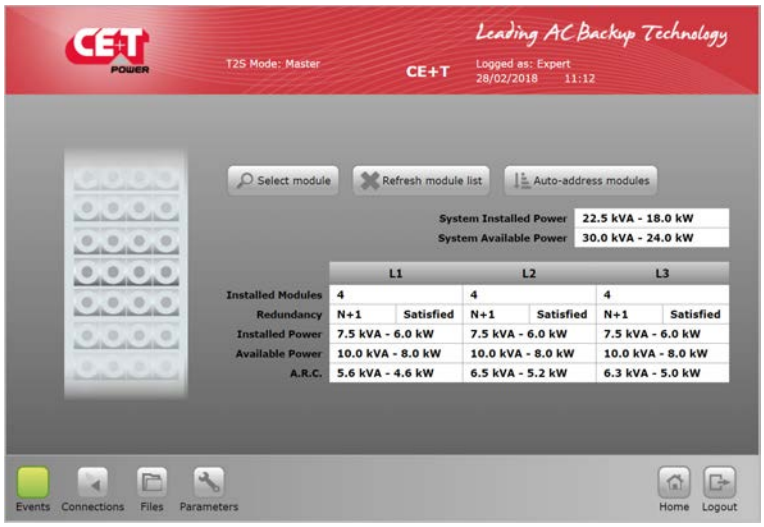
This page displays the measurement made by the modules on the AC output

Available values are:

Measure	Unit
Voltage (V)	Volts (V)
Current (I)	Ampere (A)
Frequency(f)	Hertz (Hz)
Active Power(P)	Kilo Watt (KW)
Apparent Power(S)	Kilo Volt Ampere (KVA)
Power factor	-



7.3.5.4 System page



Clicking the system picture on home page brings the user to the related 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.

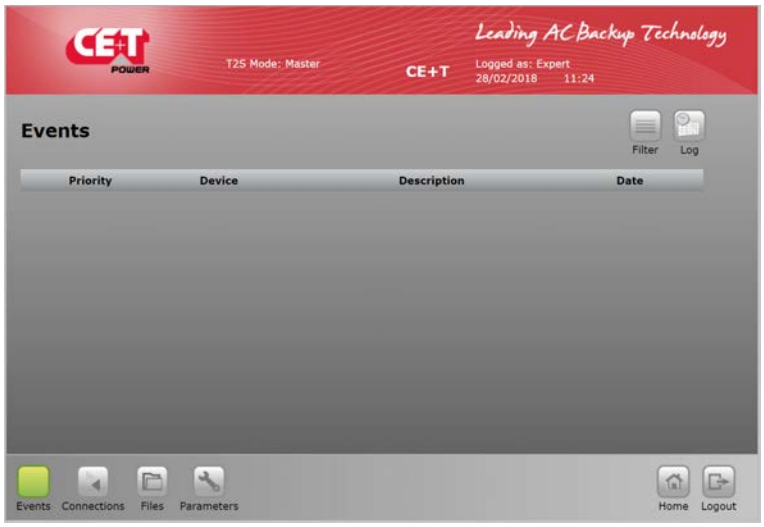
Clicking the 

button will launch the module selection pop-up. Each module information can be accessed by clicking the corresponding button. A legend is always present to recall the colour 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.

7.3.5.5 Events



Events page lists all events currently ongoing in the system. These are sorted by event occurrence time, latest event will be on top of the list. T2S ETH records maximum number of 2000 events as FIFO.

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

Events appear with a colour 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.

7.3.5.6 Log

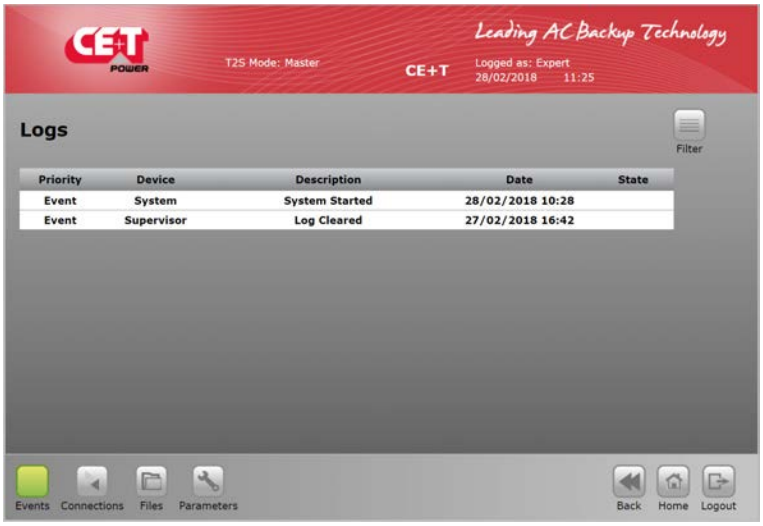
Log file lists all events which have occurred in the system since last log clear.

Compared to event page, an extra column display 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 in event page.

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



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

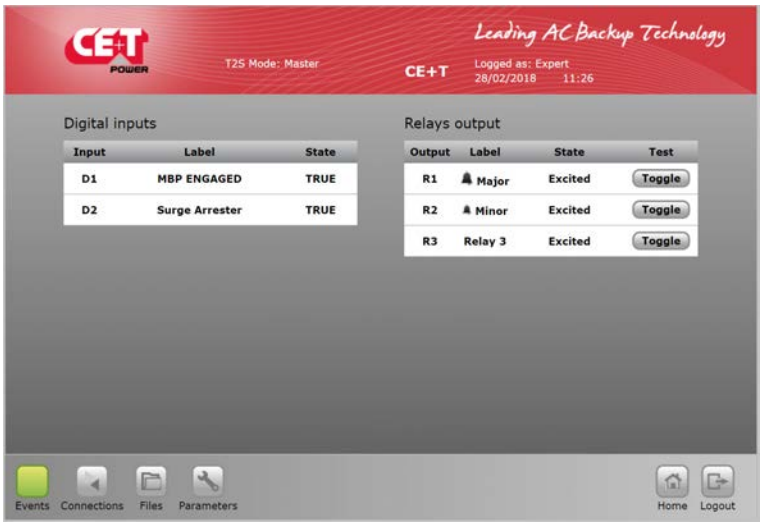
7.3.5.7 Connections

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.



7.3.5.8 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.

7.3.5.9 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:

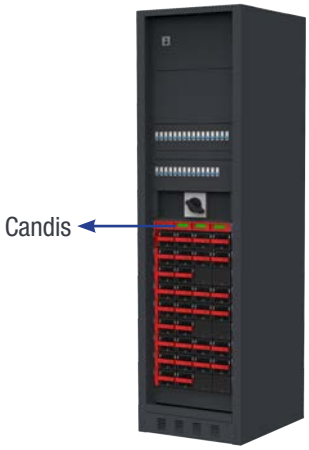
- Monitoring
- Input/Relays
- Power
- Info

Note: Detailed operation of T2S ETH is described in separate manual available on request.

7.4 Candis

The Candis is an interface allowing the user to get information concerning the running system on display(s) and/or to access to the ECI 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.



Bravo EQZ4 90 kVA Inverter System with a Candis shelf housing three Displays

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

7.4.1 Display and Buttons

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

1 Display (2 lines provided to display information).

2 Up button to scroll UP in the menus.

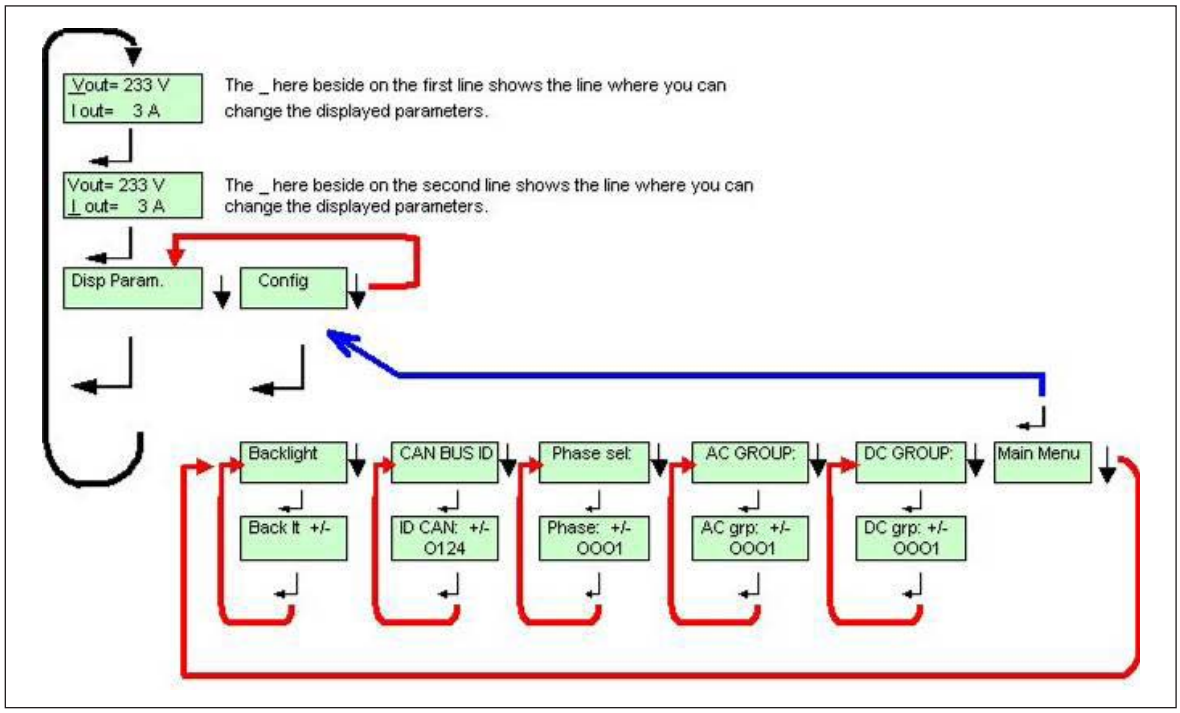
3 Down button to scroll DOWN in the menus.

4 Enter button to change display or validate modifications.

Note: Operation of Candis is described in separate manual available on request.

7.4.2 Display Configuration

7.4.2.1 Configuration block diagram.



7.4.2.2 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 back-light.

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.

7.5 Switching OFF Inverter System

Perform the following steps to Switch OFF the Inverter 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 By-Pass Breakers. (As applicable)

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

8. Manual By-Pass Operation

- Manual By-Pass has to be operated by trained people only.
- When system is in manual by-pass the load is subjected to mains AC voltage without active filtering.
- An MBP Engaged output alarm will occur when the system is in manual by pass.
- The Manual By-Pass is not possible to operate remotely.

8.1 Pre-requisites

Before engaging the MBP following conditions have to be fulfilled and actively checked.

- Commercial AC must be present.
- Inverter must be synchronized with commercial power.
- 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.

It is requested in order to reduce the inrush current during manual by pass operation to adjust the inverter AC output voltage to the same value as AC input voltage. If the difference between AC input and AC output voltage exceed 5 Vac, there is a risk of shut down of inverter due to high inrush current during the return to normal operation from Manual By Pass engaged.

8.2 Manual By-Pass Operation

The Manual By-Pass operates via individual switch that creates a by-pass from mains input via output AC distribution. Inverter modules are by-passed and possible to disconnect without impacting the load.

Manual By-Pass operation is “Make before Break” logic.

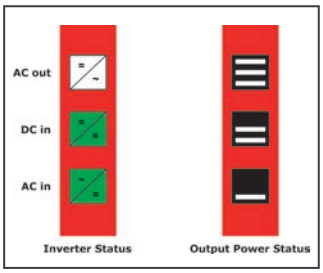
8.2.1 Engage MBP (Normal to By-pass)

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

Manual By-Pass 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.

8.2.2 Disengage MBP (By-pass to Normal)



1. Switch DC ON, wait for DC IN LED to turn green.
2. Turn switch from **BYPASS** to **INTERIM** (mid position).
3. PAUSE: Wait until the inverter modules have come to full operation and have synchronized (less than 20 seconds).
4. Turn switch 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°.

9. Inserting/removing/replacing - modules

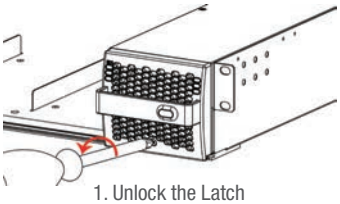
9.1 ECI Inverter

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

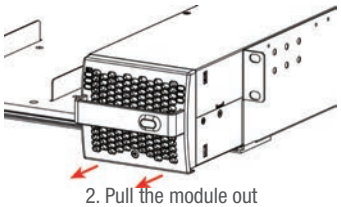
9.1.1 Removal

Notice: When one or several inverter modules is/are removed access to live parts becomes possible. Replace module(s) with blanks without delay.

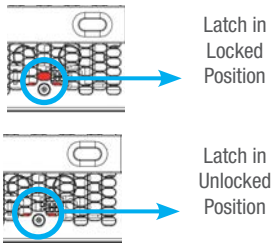
1. Rotate the screw in anti clockwise by using cross head screw driver to unlock the latch.
2. Hold the front handle and pull the module out.
3. Replace with a new module or a blind unit



1. Unlock the Latch

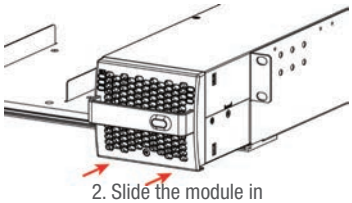


2. Pull the module out

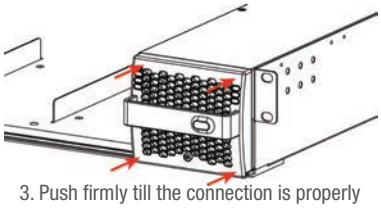


9.1.2 Inserting

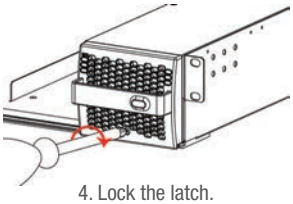
1. Check module compatibility (DC Voltage!).
2. Place the module in the shelf and slide in.
3. Using the module handle, push firmly until the unit is properly connected.
4. Rotate the screw in clockwise by using cross head screw driver to lock the latch.
5. The module will start up and take the first address available on the bus.



2. Slide the module in



3. Push firmly till the connection is properly engaged.

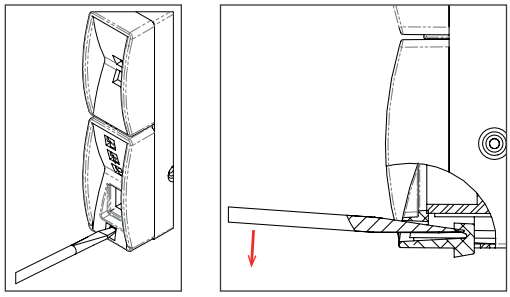


4. Lock the latch.

9.2 T2S ETH

9.2.1 Removal

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



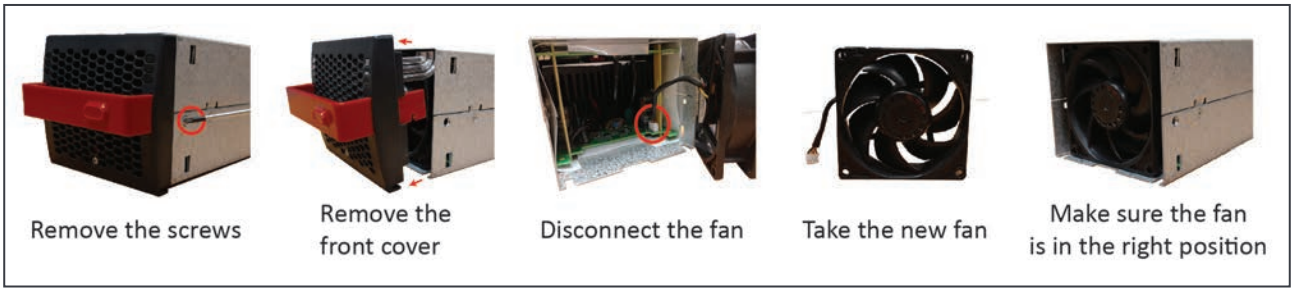
9.2.2 Inserting

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

9.3 Fan replacement

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

1. Let the module rest at least 5 minutes before initiating work.
2. The inverter front cover must be removed. Use a screw driver and remove the screws on both side of the module.
3. Free up the fan. (Note the fan connector and wires position).
4. Disconnect the supply cord, and remove the fan..
5. Replace with new fan and connect supply cord.
6. Place the front cover and tighten the screws on both sides of the module.
7. Check fan for operation.
8. Access T2S ETH and reset the fan run time alarm from within the action menu.



10. Final Check

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

11. Installation & Commissioning

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:					
Performed By:					
Site Details:					
Address:					
Contact:					
System Model & Ratings:					
Inverter System Serial #					
Inverter Modules Serial #					
Phase 1					
Phase 2					
Phase 3					
Display	CANDIS	☐ Yes		☐ No	
T2S ETH Serial Number					
IP Setting	IP Address	Subnet mask	Default gateway		

11.1 Installation Check List

The scope of this document is to provide a general guide for the installation contractor. Please refer to the operation manual for more details. Steps highlighted in YELLOW to be performed by authorized electrical personnel.

	Pre-Start Up Checklist	OK	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 that the inverter cabinet is properly secured, anchored and has proper rear clearance. (Minimum 900 mm at rear of the unit).		
4	Verify cable entry supports are properly secured. (Input and output terminals are bottom of the system and ensure the cables routed from top through duct which is inside the system.)		
5	Ensure system is de-energized (input / output / bypass / battery disconnects open).		
6	Verify input utility breakers will not be overloaded based on additional AC load added to building.		
7	Positive bus bar connection « + » connected to DC input « + » terminal (check individual or common connection)		
8	Negative bus bar connection « - » connected to DC input – terminal (check individual or common connection)		
9	Check conductor size and breaker protection rating for AC Input and Output cables.		
10	Verify AC input connection is terminated properly (L1, L2, L3, N, G) on Input terminal.		
11	Verify AC output connection terminated properly (L1, L2, L3, N, G) on output terminal.		
12	Verify that the inverter cabinet is correctly bonded to GROUND/EARTH. ⏚		
13	Ensure all modules are not seated on the backplane of the system (sticking out approx.3 cm).		
14	Verify that empty slots are covered with blank face plates. (Safety)		
15	Verify GROUND connection is terminated properly even if main is not connected.		
	If no AC main is connected to the system, verify that the input Neutral conductor is bonded/connected to GROUND/EARTH.		
16	Check for short circuits between Phase & Neutral and between Phases on the AC Input & AC Output wiring in Normal & Bypass.		
17	Verify all Power and Control cable terminations are torqued properly.		

11.2 Commissioning Procedure

Start Up Checklist		OK	N/A
18	Check if commercial AC is present in the AC distribution source.		
19	Switch ON the commercial AC breaker and check: • 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 (UVW)		
20	Turn off commercial AC breaker.		
21	Check if DC power supply is present in the DC Power Plant.		
22	Turn ON the DC breaker from DC Power plant and check if the voltage is present on the DC Bus - Verify proper voltage & polarity for the system ratings.		
23	Verify polarity of DC « + » and DC « - »		
24	Insert one module on each phases (Ph-1, Ph-2 and Ph-3) and wait for 20 - 60s. Verify DC-IN LEDs turns Green.		
25	Connect laptop and review configuration via T2S ETH Connection and review all parameters. (Number of phases & phase rotation). Refresh Module List. Three phase 400Vac L-L L1 Phase shift: 0° L2 Phase shift: 120° L3 Phase shift: 240°		
26	Verify module Addressing, Input & Output Phase assignment, and DC Group assignment via T2S-ETH.		
27	Turn ON commercial AC breaker and local AC input breaker (if equipped) for the ECI system. If “Synchronization Error”, may be phase sequence problem.		
28	Check AC output voltage (L-N) on inverter output terminal or line side of output breaker.		
29	Install all remaining modules one by one in all phases		
30	Check if the AC IN LEDS are Green. Correct any errors on the system.		
31	Verify all LEDS on all modules are Green.		
32	Verify absence of alarms on the T2S ETH (LEDS are Green) and via the interface.		
33	If T2S ETH: Verify that Delta Mode is disabled.		
34	Switch OFF commercial AC input breaker & check if system is working on DC.		
35	Switch ON commercial AC input breaker & check if system correctly transferred load back to AC.		
36	Set Date / Time / 12H or 24H & °C or °F..		
37	Set AC / DC primary according to customer preference.		
38	Verify all modules addressed correctly according to numeric sequence		

Start Up Checklist		OK	N/A
39	Set local IP, Subnet Mask, & Default Gateway as provided by customer. Then reconnect laptop with given settings.		
40	Set Password according to customer preference.		
41	Clear event log [Files > Event Log > Clear]		

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):**

12.Trouble shooting and defective situations fixing

12.1 Trouble shooting

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

12.2 Defective modules

Unless input power is down all LEDs on each module should be green (see section 7, page 25). No light, orange light , red or flashing light are abnormal conditions. Refer to Log section 7.3.5.6, page 32 to collect and record module information. If no fix can be found, replace module.

12.2.1 Replacing modules

Refer to section 9, page 39 to remove and re-insert modules.

12.2.2 Return defective T2S interface

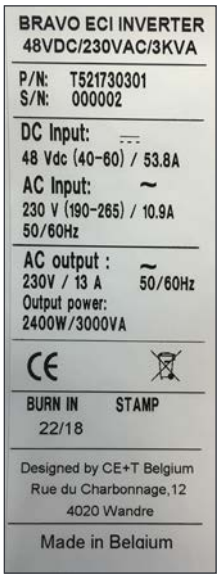
A T2S totally dark (indication area) or that cannot interface with your laptop are evidence of failure. Proceed as per section 12.2.4, page 47.

12.2.3 Return defective shelf

The shelf is passive. Failure is unlikely to happen. In turn defective situation are barely always visible. After depose proceed as per section 12.2.4, page 47.

12.2.4 Return defective modules

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



13.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 contact CE+T through email: customer.support@cet-power.com

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

14.Maintenance Task

As maintenance will be performed on live system, all tasks should be performed only by trained personnel with sufficient acknowledge on ECI 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 analyse 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 analyse 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 ECI with vacuum cleaner and/or soft compressed air.
- Clean system (vacuum cleaner or dry cloth).
- Control the inverter mapping (AC Group, DC Group, Address).
- Check load level and record the rate value (print in word document the 4 screen modules information for the 32 modules, the 3 screen for the phases value and the 2 screens for the group AC and DC value).
- Change the configuration file for AC and DC mix mode to check that all ECI 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.