Leading Conversion Technology for Power Resilience

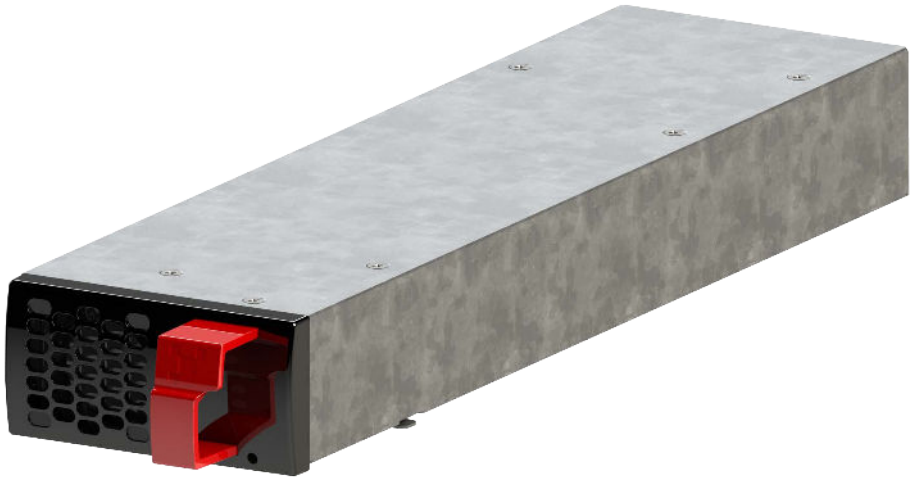
# BRAVO 10 - 48/230

## User Manual V1.2

### BEYOND THE INVERTER

THE NEW GENERATION OF POWER CONVERTERS

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



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Leading Conversion Technology for Power Resilience

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Release Note:

| Version | Release date (DD/MM/YYYY) | Modified page number | Modifications |
|---|---|---|---|
| 1.0 | 03/12/2018 | - | First release of the Manual |
| 1.1 | 19/08/2019 | - | Added Inview S Slot information |
| 1.2 | 25/11/2019 | 25 to 29, 34 & 35 | Updated inview S and MBP section |
| | | | |
| | | | |

# 1. CE+T Power at a glance

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

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

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

Our systems are:

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

CE+T 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

| | |
|---|---|
| ECI | Enhanced Conversion Innovation |
| EPC | Enhanced Power Conversion |
| REG | Regular |
| DSP | Digital Signal Processor |
| AC | Alternating current |
| DC | Direct current |
| PE | Protective Earth (also called Main Protective Conductor) |
| N | Neutral |
| PCB | Printed Circuit Board |
| TRS | True Redundant Structure |
| PWR | Power |
| ESD | Electro Static Discharge |
| MET | Main Earth Terminal |
| MBP | Manual By-pass |
| MBB | Measure Box Battery |
| TCP/IP | Transmission Control Protocol/Internet Protocol |
| USB | Universal Serial Bus |
| LAN | Local Access Network |
| ETH | Ethernet |
| SNMP | Simple Network Management Protocol |
| HTTP | HyperText Transfer Protocol |
| HTTPS | Secure HyperText Transfer Protocol |
| NTP | Network Time Protocol |
| MIB | Management Information Base |
| DHCP | Dynamic Host Configuration Protocol |

# 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 Inview; 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 should not be left open. Replace either with module or dummy 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 five 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

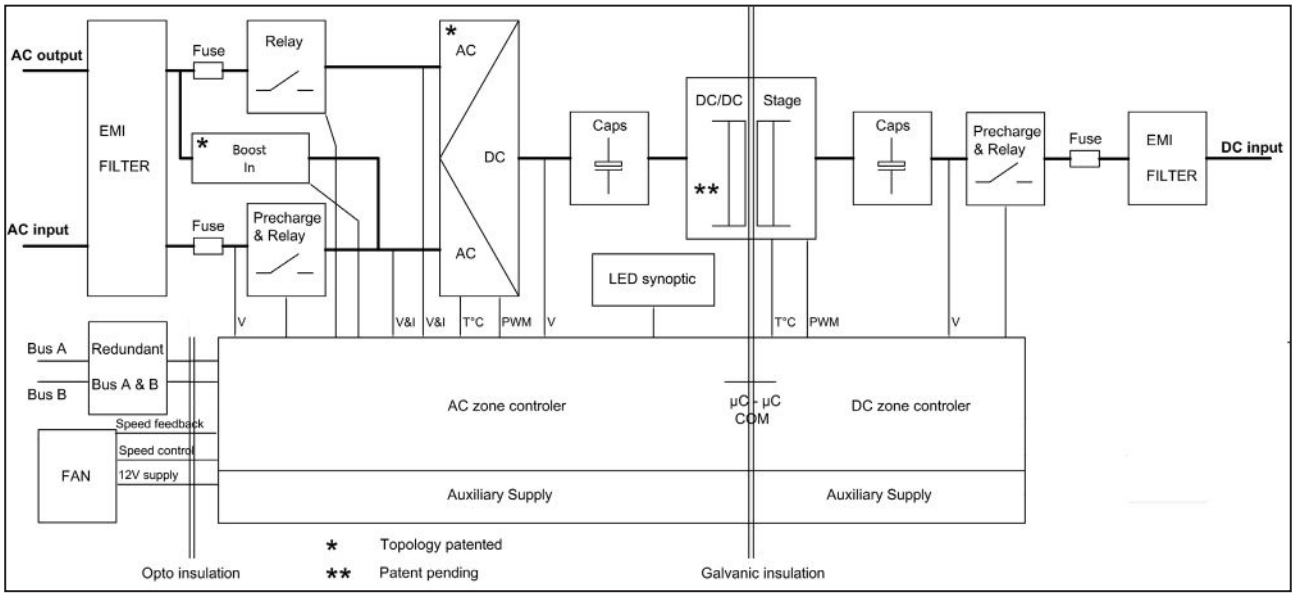
- ESD Strap must be worn when handling PCB's and open units.
- CE+T cannot be held responsible for disposal of the Inverter system and therefore the customer must segregate and dispose of the materials which are potentially harmful to the environment, in accordance with the local regulations in force 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. ECI TECHNOLOGY [1]

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

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




The module is built around the following sub-converters

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

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

The BOOST functionality multiples the nominal current for a period of 20 ms (max) in the event of down stream failures. The upstream breakers do not have to be oversized to prevent tripping. The overload capacity is 150% for 15 seconds.

The ECI 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.

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

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

## 4.1 On-line Mode

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

## 4.2 Safe mode

Safe mode uses DC as the primary source of supply while Mains (AC) is on standby.

Mains (AC) is normally disconnected through an internal inlet relay and is only connected when down stream clearance is required (boost) or if DC is unavailable.

The transfer between DC and AC results in a typical transfer time of 10 ms.

Typically the safe mode is used in extremely harsh environments such as railways. Under such conditions, it provides extra isolation against mains-borne disturbances.

## 4.3 EPC-mode

Mains input (AC) is the primary source whilst DC works as backup.

The ECI is designed to operate on Mains on a permanent basis and to deliver output voltage conditioned with low THD.

The output sine wave is physically independent of whether the source is AC (or) DC. If the Mains is out of tolerance or goes down, the converter seamlessly switches to DC and the converter operates in “Back-up mode” (Changeover switching time is 0 ms).

As soon as the Mains returns to its valid range, the EPC mode is automatically resumed.

The EPC mode offers higher efficiency (up to 96% depending on the model) without compromising the purity of the output sine wave.

Remarks: REG modules:

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

## 4.4 Mix mode & Walk-in mode

Under some circumstances the DC and AC sources can be combined. The sequence is defined by a user selectable set of parameters. Start, control and exit are fully automatic.

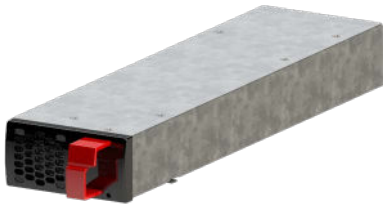
A specific example of Mix-mode is the Walk-in mode where the transfer from DC source to AC source is ramped up within a fixed and adjustable period of time.

# 5. Building Blocks

## 5.1 Bravo 10 - 48/230

### 5.1.1 Inverter

| | | |
|---|---|---|
| Telecom / Datacom: | Input | 48 Vdc<br>230 Vac, 50/60 Hz |
| | Output | 230 Vac |
| | Power | 1250 VA / 1000 W |



- The module is a triple port inverter.
- Hot-swappable and hot-pluggable.
- The module operator interface is LEDs showing converter status and output power.
- The module is equipped with a soft start.
- The fan in the module is equipped with alarm and run time meter, and it is field replaceable.
- 319 mm (D) x 87 mm (W) x 1U (H).
- 1.5 Kg.

#### 5.1.1.1 Specifications

| Model | Bravo 10 - 48/230 |
|---|---|
| **General** | |
| Part Number | T611730201 |
| Cooling / Audible noise | Fan forced cooling / < 65 dBA at one meter |
| MTBF | 240 000 hrs (MIL-217IF) |
| Dielectric strength DC/AC | 4300 Vdc |
| RoHS | Compliant |
| Operating T° / Relative Humidity (RH) non-condensing | Tested according ETS300-019-2-3 Class 3.1<br>-20°C to 65°C, power de-rating from 40°C to 65°C /<br>Max RH 95% for 96 hours per year |
| Storage T° / Relative Humidity (RH) non-condensing | Tested according ETS300-019-2-1 Class 1.2<br>-40°C to 70°C / Max RH 95% for 96 hours per year |
| Public transport T°/Relative Humidity (RH) non-condensing | Tested according ETS300-019-2-2 Class 3.1<br>-40°C to 70°C / Max RH 95% for 96 hours per year |
| Material (casing) | Zinc coated steel |
| **AC Input Data** | |
| Nominal voltage (AC) | 230 V |
| Voltage range (AC) | 150 - 265 V |

| | |
|---|---|
| Brownout | 800 W @ 150 Vac / 1000 W @ >190 Vac linear decreasing |
| Power factor / THD | > 99% / < 3% |
| Frequency range (selectable) / synchronization range | 50 Hz (range 47 – 53 Hz) / 60 Hz (range 57 – 63 Hz) |
| **DC Input Data** | |
| DC voltage: Nominal / range | 48 VDC / (40-60V)* |
| Nominal current (at 48 Vdc and 1000 W output) | 22.3 A |
| Maximum input current (at 48 Vdc for 15 second) / voltage ripple | 34 A / < 10 mV RMS |
| **AC Output Data** | |
| Efficiency (Typical): Enhanced power conversion / on line | 96% / >92.5% |
| Nominal voltage AC** Adjustable) | 230 V (200 - 240 VAC) |
| Frequency / frequency accuracy | 50 or 60 Hz / 0.03% |
| Nominal Output power | 1250 VA / 1000 W |
| Short time overload capacity | 150% (15 seconds) |
| Admissible load power factor | Full power rating from 0 inductive to 0 capacitive |
| Total harmonic distortion (resistive load) | < 3% |
| Load impact recovery time (10% - 90%) | ≤ 0.4 ms |
| Nominal current | 5.4 A @ 230 Vac |
| Crest factor at nominal power | 3 : 1 for load P.F. ≤ 0.7 |
| Short circuit clear up capacity 0 - 20 ms | 21.7 A for 20 ms |
| Short circuit current after > 15 ms - 15 s | 8.1 A for 1 minute |
| AC output voltage stability | ±1% from 10% to 100% load |
| **In Transfer Performance** | |
| Max. voltage interruption / total transient voltage duration (max) | 0 s / 0 s |
| **Signalling & Supervision** | |
| Display | Synoptic LED |
| Supervision | Inview ranges / Inview S - T302004100, Inview S Slot - T602004110, Inview GW - T602004000 |
| Remote on / off | On rear terminal of the shelf |
| Alarms output | 2 dry contacts and 2 digital inputs |
| Safety & EMC | |
| Safety | EN62040-1 |
| EMC | EN 61000-4-2 / EN 61000-4-3 / EN 61000-4-4 / EN 61000-4-5 / EN 61000-4-6 / EN 61000-4-8<br>ETSI EN 300386 v1.9.1 |

* Permanent 1000 W / derating apply based on internal heatsink T°.

** Operation within lower voltage networks leads to de-rating of power performances.

### 5.1.2 Sub-rack

- The shelf can be integrated in min 600 mm depth cabinets, Inch/ETSI mounting.
- The shelf house max four (4) modules and one (1) Inview S Slot.
- The extension shelf house max five (5) modules.
- The shelf is designed with common DC input, AC Input and AC Output.
- Featured with rear protection cover (IP 20 ).
- Max 6.25 kVA / 5 kW per shelf.
- 370 mm (D) x 19” (W) x 1U (H).
- 2.5 Kg (without modules).

## 5.2 Controller Unit

### 5.2.1 Inview S

**Inview S** is an advanced monitoring and controller unit for **Bravo 25**, **Bravo 10**, **Sierra 25**, and **Sierra 10** power systems. It allows the user to easily access the system information through inbuilt powerful touch screen graphic display. In addition to the touch screen display, the user can also access the system information through the web interface and SNMP protocol.

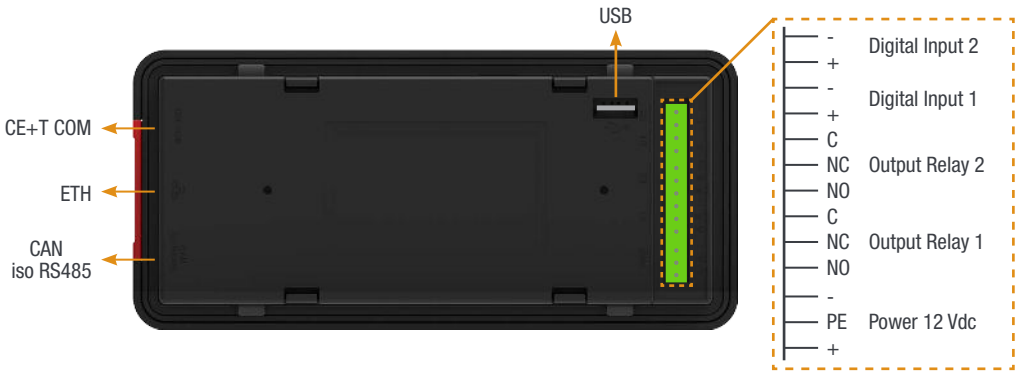
The Inview S interface provides the user to access the configuration and setup files of the modules in the system. Also, it is a controller for DC regulation.

Inview S can monitor up to 32 inverters/converters and featured with:

- LCD touch screen display
- 2 Digital Inputs
- 2 Output Relay contacts
- Records 5000 events as FIFO

### 5.2.2 Inview S - Connections

Inview S is composed of multiple network ports and inbuilt free potential contacts.



- **CE+T COM** port is dedicated to establish connection between Inview S and Bravo 10 - shelf.
- **ETH (** **)** port is used for network connectivity and user can access the system information in the Web Interface.
- **CAN / iso RS485** port is used to establish communication between Inview S and MBB.
  (Note: In future version, user can use this port for RS485-Modbus communication)
- **USB** port is used to access the Inview S configuration and setup files.
- **Digital Inputs (D1 and D2):** Two potential free Digital Inputs are available for customer connections.
  - Digital Input 1 is assigned for MBP operation if used.
  - Digital Input 2 is assigned for Surge Arrester if used.
- **Output Relays (K1 and K2):** Two output relays are available and can be used for Major and Minor Alarms.
- **Power:** The unregulated separate +12 V power supply is required for powering Inview S and this power should not be shared with other devices. (CET can provide Auxiliary Power Supply converter and the part number is T602004120).

### 5.2.3 Inview S Slot

**Inview S Slot** is an advanced monitoring and controller unit for Bravo 10 and Sierra 10 power systems. The product is specially designed in 1U height to accommodate in the module shelf and reduces the additional space in the cabinet.

It allows the user to easily access the system information through inbuilt powerful LCD touch screen graphic display. In addition to the touch screen display, the user can also access the system information through the web interface.

The Inview S Slot interface provides the user to access the configuration and setup files of the modules in the system.

Inview S Slot can monitor up to 32 inverters/converters and featured with:

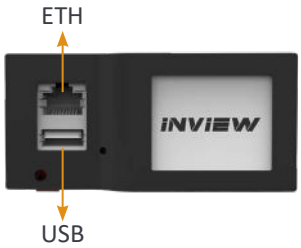
- LCD touch screen display
- 2 Digital Inputs
- 2 Output Relay contacts
- Records 1000 events as FIFO

Note: In the Bravo shelf, signalling connections are present at left first slot. So the Inview S Slot controller should be placed only at the left side of the first slot in the shelf, while you are looking from the front.

### 5.2.3.1 Inview S Slot - Connections

Inview S Slot has an ETH port and USB at the front. Output relays, free potential contacts, Modbus and power connections are present at the rear side of the Inview S Slot connected shelf.

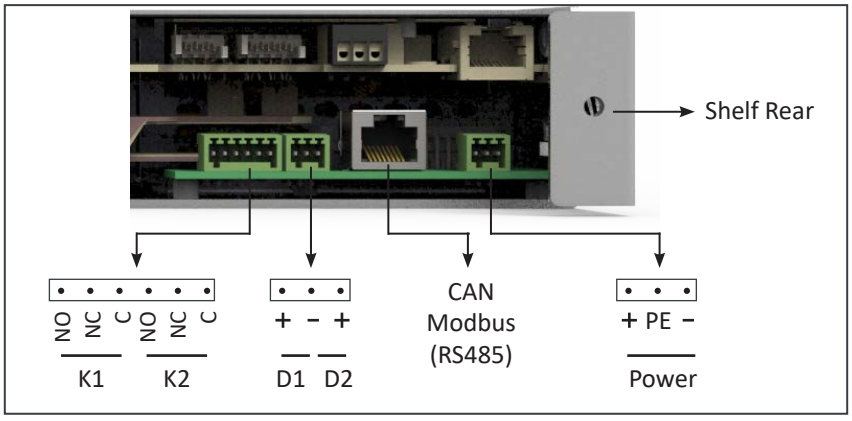
**Inview S Slot - Front connections**




- **LAN** port is used for network connectivity and user can access the system information in the Web Interface.
- **USB** port is used to access the Inview S configuration and setup files.

**Inview S Slot - Shelf rear connections**

- **Digital Inputs (D1 and D2):** Two potential free Digital Inputs are available for customer connections.
  - Digital Input 1 is assigned for MBP operation if used.
  - Digital Input 2 is assigned for Surge Arrester if used.
- **Output Relays (K1 and K2):** Two output relays are available and can be used for Major and Minor Alarms.
- **CAN Modbus (RS485)** port is used to establish communication between Inview S Slot and MBB. It also provide the +12 Vdc power to one connected MBB.
- **Power:** The additional +12 V for Inview S Slot and it is from external Auxiliary power supply converter. This power should not be shared with other devices. By default, Inview S Slot works on output DC from modules. If DC is not present, it takes +12 V from external Auxiliary power supply converter (AC to DC).




## 5.3 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 is “Make before Break”. When engaged or disengaged, no disturbance is transmitted to the load.

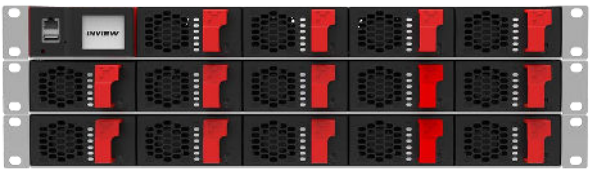
When MBP is engaged, inverter modules are switched off and can be removed without impacting the load. The battery supply is not physically disconnected. After disconnecting the battery supply (by opening the battery breakers), the shelf section is safe for maintenance.

Warning: When the system is in by-pass, the load is subjected to AC main disturbances. Before engaging manual bypass, make sure the voltage difference between AC IN and AC OUT should be less than 5 Vac to limit the inrush current.

# 6. A la Carte

The A la Carte is pre-assembled and configured as a single phase or three phase system. The system comprises cabinet, inverter sub rack, Bravo 10 inverter modules and controller.

*Bravo 10 System with Inview S*



*Bravo 10 System with Inview S Slot*

- A la Carte is available in both EPC and REG mode.
- Dual input (AC and DC) inverter modules (EPC).
- 96% efficiency during normal operation (EPC).
- Always conditioned and filtered output voltage.
- Seamless transfer (0 ms) between primary and secondary source of supply.
- No single point of failure.
- Full modularity and redundancy.

**Optional**

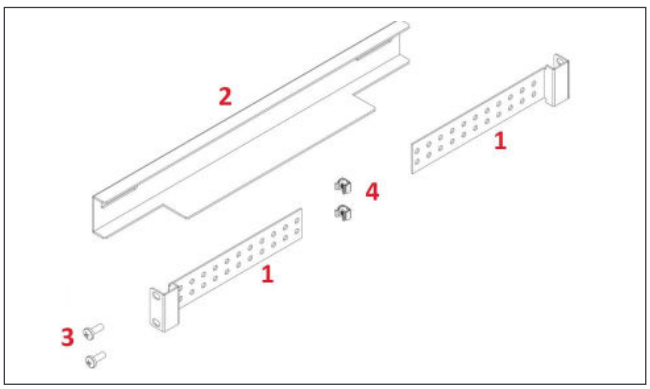
- Manual by-pass
- Monitoring device
- AC output distribution.

# 7. Installation of Bravo 10 - Shelf

- Read safety instructions prior starting any work.
- Do NOT attempt to use lifting eyes to erect the cabinet.
- System is preferable handled without modules.
- Pay attention to the module position, make sure that modules are repositioned in the same slot.
- In three phase systems, the modules are configured as per phase 1, phase 2 and phase 3.
- As long as the system is not in operation, make sure that modules from one phase are not mixed with modules from another phase. (When the system is running, modules can be moved from one phase to another without issue.)

## 7.1 Mounting kit for Bravo 10 - shelf

The fixing brackets, together with the sliders, allow for different cabinet depths.

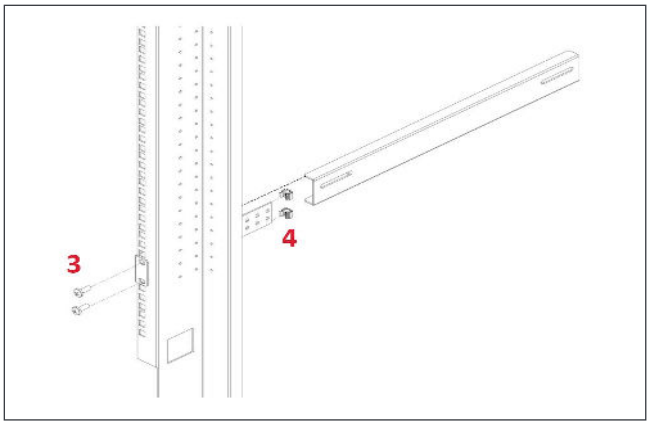



1 → Fixing brackets - 4 Nos

2 → Slider - 2 Nos

3 → Mounting screws - 12 Nos

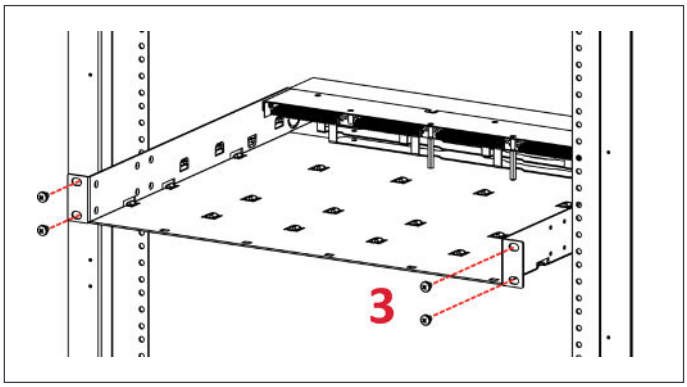
4 → Cage nuts - 12 Nos




Assemble the sliders and adjust the length to suit the mounting depth.

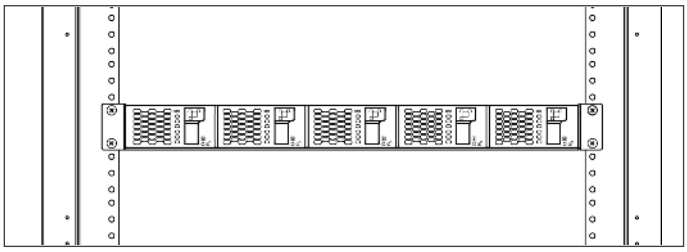
Fix cage nuts (4) in the cabinet front and rear frame of the left and the right side.

Fix the left and right slider of the cabinet with the supplied screws (3).

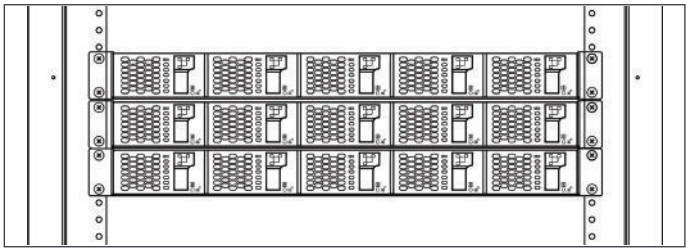



Fix cage nuts (4) in the mounting frame.

Slide the shelf in position and fix the shelf with the supplied screws (3).



Insert the modules.



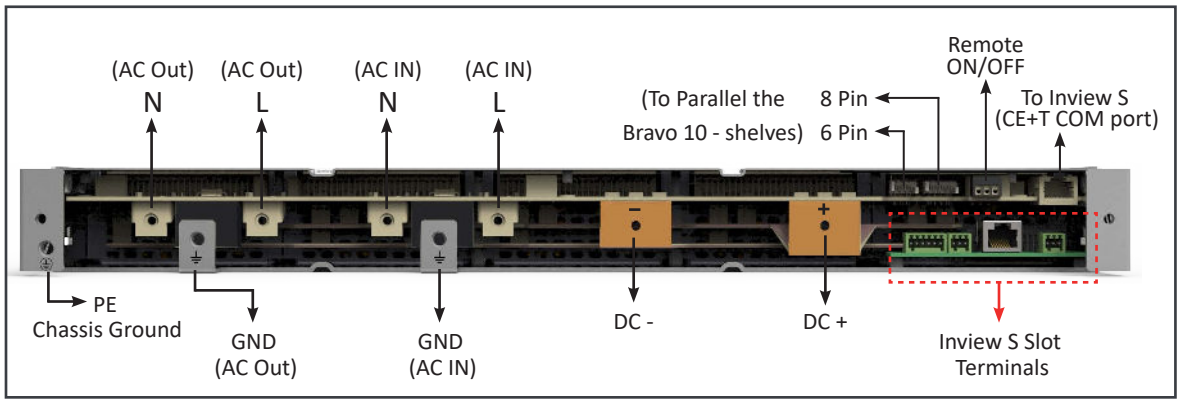
Repeat the steps for remaining shelves.

## 7.2 Electrical installation for Bravo 10 - Shelf

### 7.2.1 Pre requisites

- The sub-rack have markings for all terminations.
- All cables shall be rated at Min 90 deg C.
- Electrical terminations shall be tightened with 5 Nm.
- All connection screws are M5 x 12 mm.
- DC Input - Common (per shelf), check DC polarity.
- AC Input / AC output - Common (per shelf), check AC phase angle.
- Wire all positions in the sub-rack for future expansion.
- Input AC / Output AC / Input DC / Signal cables shall be separated.
- Cable crossings shall be done in 90 deg angles.
- Empty inverter positions shall be covered with dummy.

### 7.2.2 Terminations




*Bravo 10 - 48/230 - Shelf Rear Details*

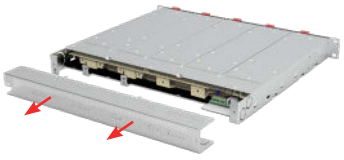
### 7.2.3 Cable Routing and Fixation

Terminations are present at rear side of the shelf and it is protected with IP 20 metal cover.

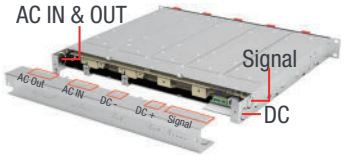
Perform the following steps to connect power and signal cables:

1. Remove rear protection cover by unscrewing two screws.
2. Break the required knock outs. (Warning: Take special attention while breaking knockouts to avoid damaging the connectors, terminals and PCB in the shelf.)
   - AC IN and OUT cables entry – Right end of the shelf (1 - Knock out)
   - DC and Signal cables entry – Left end of the shelf (2 - Knock outs)
   - Knock outs are also available at top and bottom of the protection cover.
3. Connect the power and signal cables with **supplied screws,** refer section 7.2.2, page 20 for terminals position.
4. Close the rear protection cover and tighten with two screws.

*Remove two screws*



*Remove protection cover*




*Cable entries*

### 7.2.4 Grounding

"PE Chassis Ground" ⏚

PE Chassis ground should be wired to MET (Main Earth Terminal) or distributed earth bar connected to MET, according to local regulations.

### 7.2.5 DC

| Model | MCB per Shelf | Cable, min | Lug | Torque |
|---|---|---|---|---|
| Bravo 10 - 48/230 | 160 A | 50 $mm^2$ | Insulated Ring type | 5 Nm |

Note: The Inner hole diameter of DC lug should be 6 mm (M6), and it is recommended to use only the supplied screws.

### 7.2.6 AC Input

WARNING !!!
Recommendation of IEC 60364 4. 43

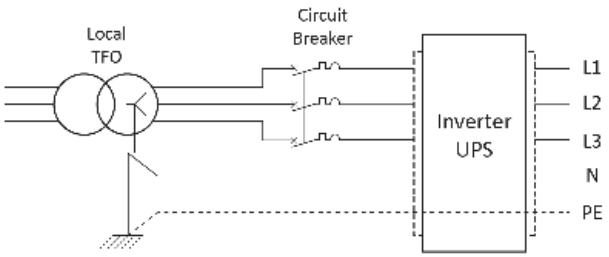
**431.3 Disconnection and reconnection of the neutral conductor in multi-phase systems**

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

WARNING !!!

**Input Neutral is required to operate the Inverter, UPS**

In TN-S System no 4 pole input switch or circuit breaker shall be used. If you have to use 4 pole protective device, be aware that the neutral against the ground is floating. The inverter, UPS will operate without problem but you may infringe the local regulation.




| Model | MCB per Shelf | Cable, min | Connector | Lug | Torque |
|---|---|---|---|---|---|
| Bravo 10 - 48/230 | 40 A | 6 $mm^2$ | M6 | Insulated Ring type | 5 Nm |

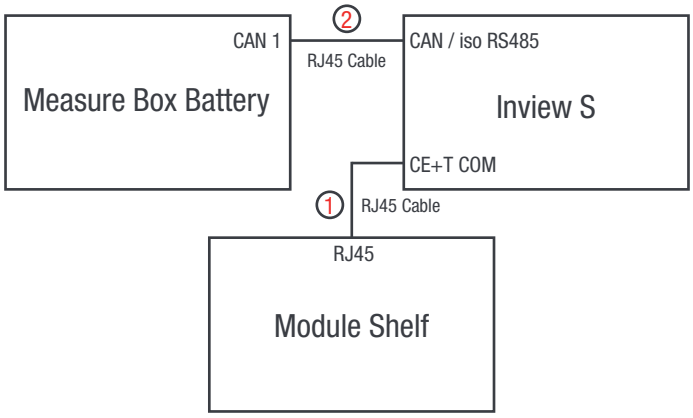
Note: Icc value measured as 50 $A_{rms}$ per shelf with five modules.

### 7.2.7 AC Output

| Model | MCB per Shelf | Cable, min | Connector | Lug | Torque |
|---|---|---|---|---|---|
| Bravo 10 - 48/230 | 32 A | 6 $mm^2$ | M6 | Insulated Ring type | 5 Nm |

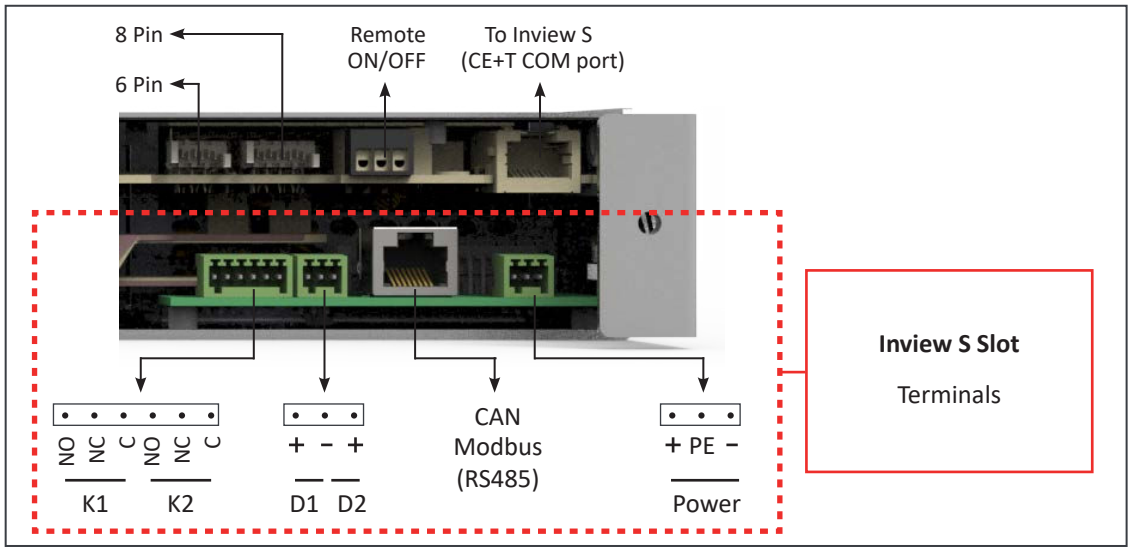
### 7.2.8 Inview S with Bravo 10 System - Connections

1. Connect module shelf **RJ45 port** and Inview S **CE+T COM** port using RJ45 straight cable.
2. Connect Inview S **CAN/iso RS485** port and Measure Box Battery **CAN1** port using RJ45 straight cable.




### 7.2.9 Signalling

Each shelf comprise of 8 and 6 pin connector, Remote ON/OFF and ETH port for communication. The PCB at the bottom of the rear shelf is for Inview S Slot. It can only be accessed if Inview S Slot connected to that shelf.



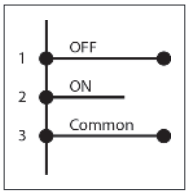

#### 7.2.9.1 Remote ON/OFF

The shelf is by default equipped with a connection between pin 3 and 2. If remote ON/OFF is not used the strap shall remain in all connected shelves. Should the remote ON/OFF be used, all straps must be removed and in one (1) shelf replaced with a changeover contact or emergency button.

- The remote ON/OFF switch the output AC OFF.
- Input AC and input DC is not affected by the remote ON/OFF.
- The remote ON/OFF can be connected to any shelf.

- The remote ON/OFF requires changeover contacts, one input opens as the other close. If both transitions are not picked up the status is not changed.

**Relay characteristics (Remote ON/OFF)**




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

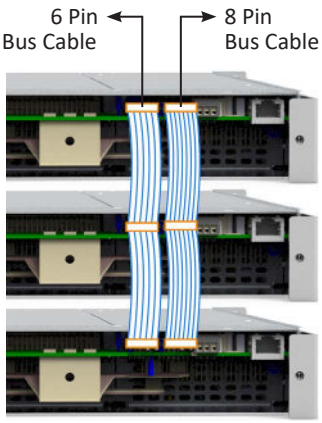
**Functional table for remote ON/OFF function**

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

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

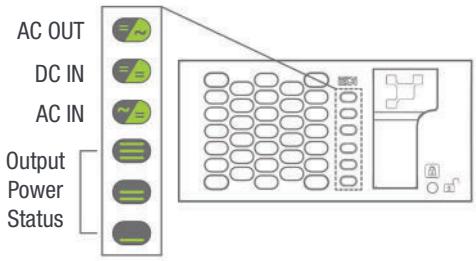
### 7.2.9.2 Internal bus (Bus 6 pin / Bus 8 pin)

- In a la carte system, Internal bus is pre installed and connected in series from the first shelf to last shelf.
- Internal bus is comprised of 6 and 8 pole CAN bus cables.
- If more than one shelf is ordered separately and installed in others cabinet, 6 and 8 pin connector of each shelf should be connected in series with all shelf using CAN bus cables.
- The internal bus connectors are sensitive and special caution should be taken during installation to keep them out of harms way.



# 8. Interface

## 8.1 Inverter module



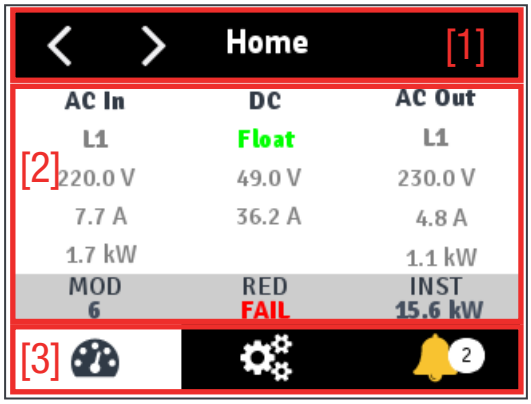

| Inverter Status LED | Description | Remedial action |
|---|---|---|
| OFF | No input power or forced stop | Check environment |
| Permanent green | Operation | |
| Blinking green | Converter OK but working conditions are not fulfilled to operate properly | |
| Blinking green/orange alternatively | Recovery mode after boost (10 In short circuit condition) | |
| Permanent orange | Starting mode | |
| Blinking orange | Modules cannot start | Check Inview |
| 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 I P - Permanent ) |

## 8.2 Inview S - LCD Display

Inview S LCD interface is a 2.8-inch touch screen. It does not have any have any user account, the user can only view the system details. The LCD interface is protected with the PIN during any action request.

Once system is powered upon, the Inview S is up and ready for operation.




- **[1] Header**

  Displays the title of the current page and navigation buttons for next and previous page. In some pages, Up and Down navigation buttons appear at the right side, indicating more contents are present.

- **[2] Information Area**

  Provides information about the corresponding page.

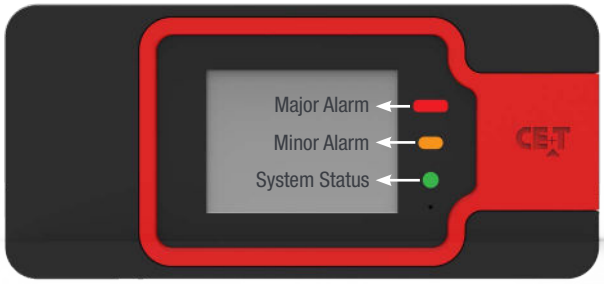
- **[3] Toolbar**

  The toolbar is present at the bottom throughout the interface, to provide quick access to following pages:

  - Measures
  - Settings
  - Alarms and Logs

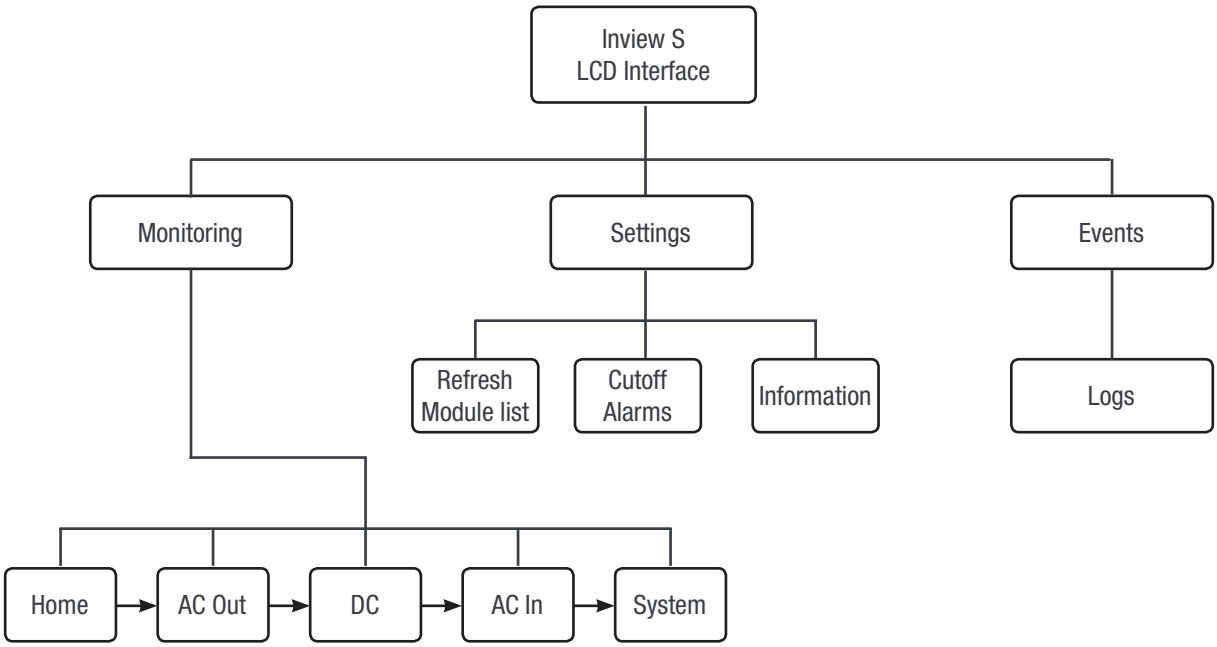
### 8.2.1 LED indications

Three LED's are present at front side of the controller to indicate major alarm, minor alarm, and system status



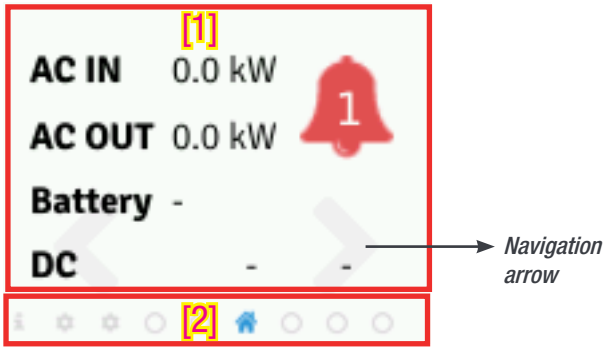
### 8.2.2 Menu structure

The home page is the default page in the LCD, and other pages display as below sequence in a circular list.




## 8.3 Inview S Slot - LCD Display

Once the system is powered upon, the Inview S Slot is up and ready for operation. The LCD is a 1.8-inch touch screen and user can only view the system details through the interface.




- **[1] Interface area**

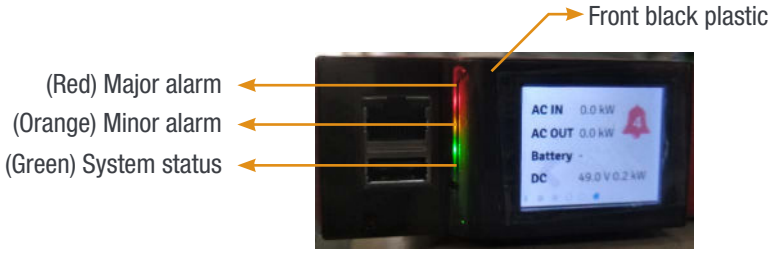
  Interface area provides information about the corresponding page. At the bottom of the screen, left and right arrows are present for moving next and the previous screen. In some screens, up and down arrows appear at the top of the page, indicating more contents are present

- **[2] Status bar**

  The status bar appears throughout the interface and illuminate the current page icon.

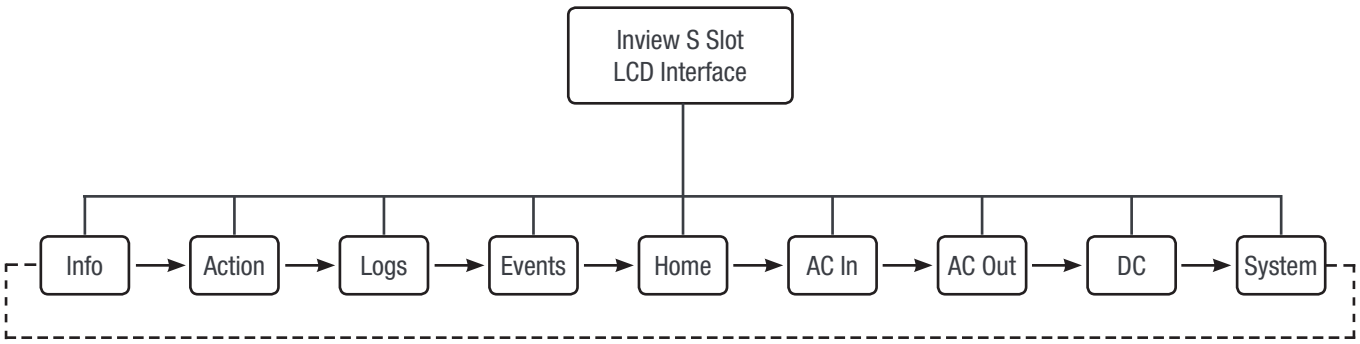
### 8.3.1 LED indications

Three LED's are present behind the front black plastic of the controller to indicate major alarm, minor alarm, and system status. These LED's are not visible until they illuminate during the corresponding action occurs.




### 8.3.2 Menu structure

The home page is the default page in the LCD interface, and other pages are arranged in the below sequence.

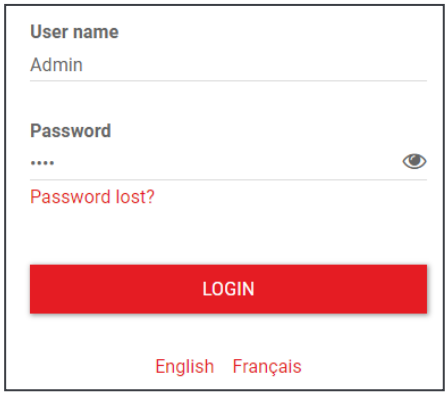



## 8.4 Inview S and Inview S Slot - Web Interface

The web interface of both controller Inview S and Inview S Slot is same, and the user can access the controller on the laptop through ETH port.

This section provides an overview of the web interface, refer Inview S user manual for detailed information.

### 8.4.1 Login




Open the web browser and type the default IP address **10.250.250.1** in the address field and press enter.

Note: Use any one of the following latest version of web browser: Google Chrome, Mozilla Firefox, Safari or Microsoft edge.

Inview S has three login – Basic, Expert and Admin. All three login is password protected.

The default password for all three logins is “1234”.

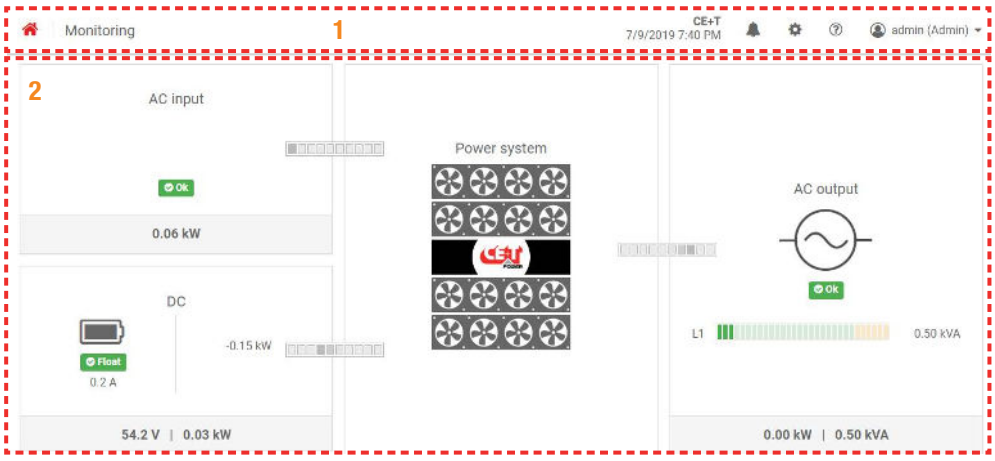
Basic login can only browse the pages and download the files, but Expert and Admin login can access and also modify the system parameter values.

An auto-logout feature is available to avoid a user being connected all the time. When no action is performed for more than **10 minutes**, the session will expire and goes to login screen.

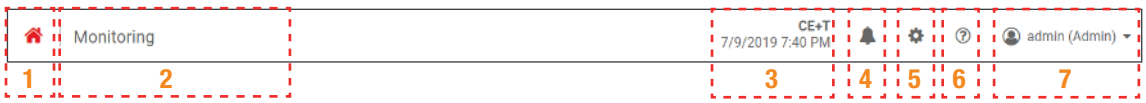
### 8.4.2 Interface Areas

1 → Header

2 → Main Page




#### 8.4.2.1 Header




The tabs in header provide quick access to the corresponding pages.

**1** → **Home**: Clicking on goes to the home page from any page you are accessing in the interface.

**2** → **Breadcrumbs:** Provide navigation of the page. It trails all levels so that user can know where you are within the interface and can go to any previous menu.

**3** → Display the date, time and the site name of the system.

4 → **Events:** Clicking on goes to Events and Logs page.

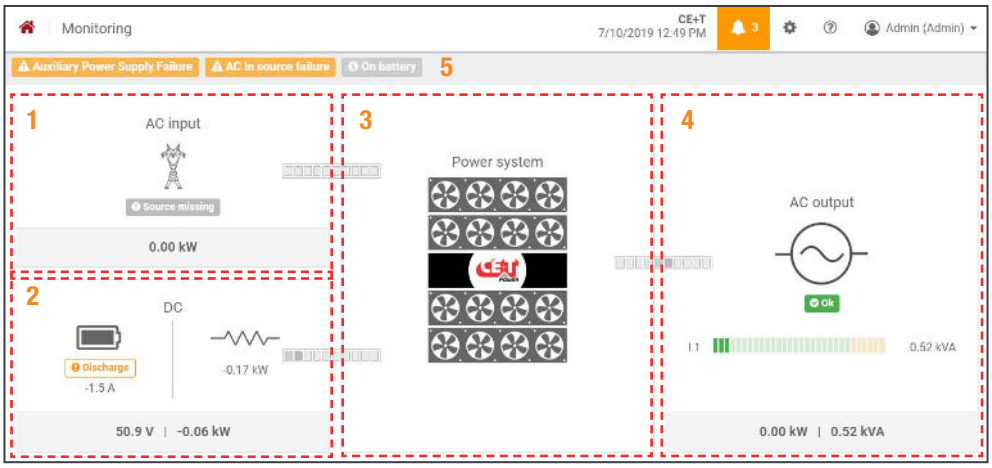
5 → **Settings:** Clicking on provide access to Users, Parameters and Maintenance pages.

6 → **Info**: Clicking on in the home page, provides brief information about the system, while in other pages provide the latest three ongoing events.

7 → **Account**: Provides the information of which account is logged in (Basic, Expert or Admin). Clicking on drop-down arrow user can access the following pages:

- **Administration** - Provide quick access to Users, Parameters and Maintenance pages. (Administration page will appear only in Expert login).
- **About** - Provides the information of Inview product details and network connectivity details.
- **Logout** - An act of logging out of an Inview S.

### 8.4.2.2 Home Page




1 → **AC Input**: Clicking on the AC Input region displays the page contain all measurements regarding AC Input.

2 → **DC:** Clicking on the DC region displays the page contain all measurements regarding Battery and DC Output.

3 → **Power System**: Clicking on the Power System region display the page contain regarding system information such as overall system power and also in each phase, configured modules, active modules, and list of detected modules and accessories.

4 → **AC Output**: Clicking on the AC Output region displays the page contain all measurements regarding AC Output. Regardless of the system configuration (1P, 3P), display the power fed to the load on each phase.

5 → **Notifications**: Display the current generated alarms and events.

Note: To know more about Inview S and Inview S Slot operation, refer to the Inview manual and it is available on request.

# 9. Replacement procedures

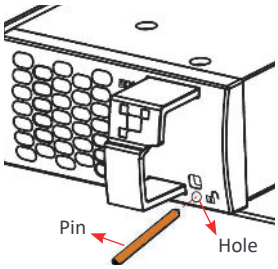
## 9.1 Module - Bravo 10

- The Bravo 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.

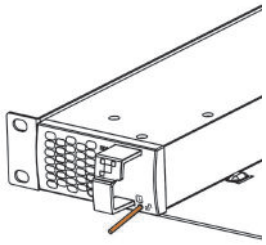
### 9.1.1 Removal

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

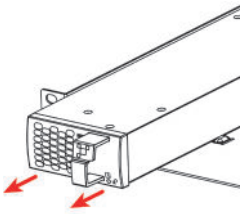
1. Insert a soft edged pin into the hole to unlock the latch. (Hole diameter is 3 mm)
2. Push the pin and simultaneously pull the module using front handle.
3. Remove the module from shelf and replace with a new module or dummy cover.




*Insert the pin into the hole*



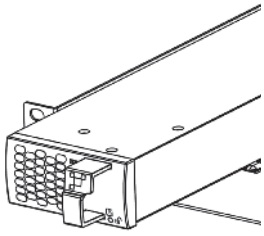
*Push the pin and pull the module*



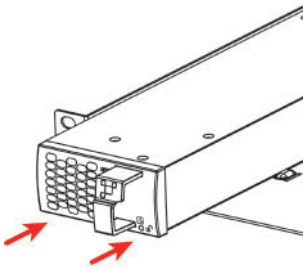
*Remove the module from shelf*

### 9.1.2 Inserting

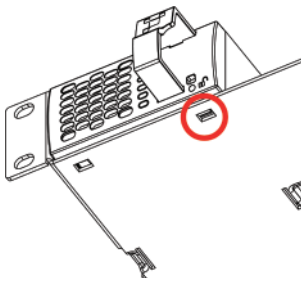
1. Check module compatibility (DC Voltage!).
2. Place the module and slide into the shelf.
3. Push the module firmly using the front handle, until the module rear is connected correctly with shelf.
4. Make sure the bottom latch in the module is locked in the shelf.
5. The module will start up and take the first address available on the bus.



*Place the module & slide into the shelf*



*Push firmly until module is engaged*



*Make sure the latch is locked in the shelf*

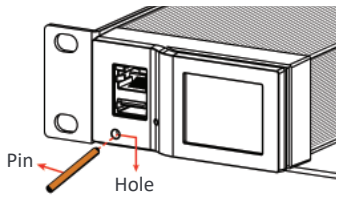
## 9.2 Controller - Inview S Slot

### 9.2.1 Removal

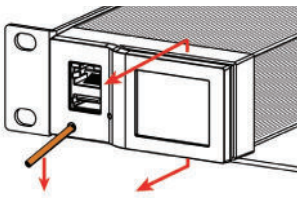
1. Insert a soft edged pin into the hole to unlock the latch. (Hole diameter is 3 mm)
2. Gently push and press down the pin to unlock the latch and then remove the controller.

Warning: while removing the controller from the shelf, hold the top and bottom part of front plastic. Do not press on the touch screen.

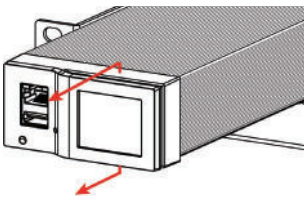
3. Remove the controller from shelf and replace with a new unit or dummy cover.




*Insert the pin into the hole*



*Push and press down the pin, and pull the unit*



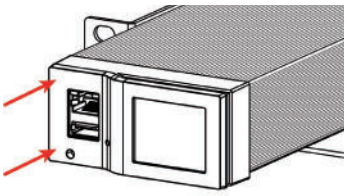
*Remove the module from shelf*

### 9.2.2 Inserting

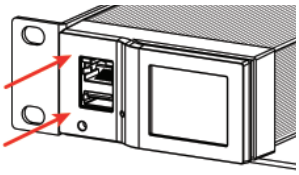
1. Place the Inview S Slot and slide into the shelf.
2. Push the unit firmly until the controller rear part is engaged correctly with shelf.

Warning: while inserting the controller into the shelf, push on the left side (ETH and USB port) of the controller. Do not press on the touch screen.

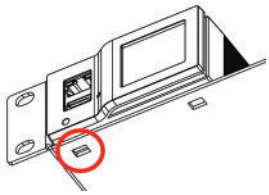
3. Make sure the latch is locked in the shelf.
4. The controller begins to start up and read the parameters from modules in the live system.



*Place the module & slide into the shelf*



*Push firmly until unit is engaged*



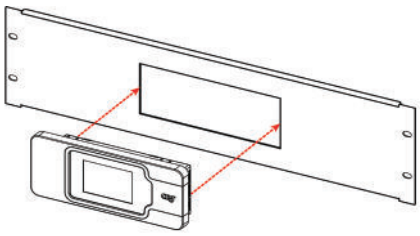
*Make sure the latch is locked in the shelf*

## 9.3 Controller - Inview S

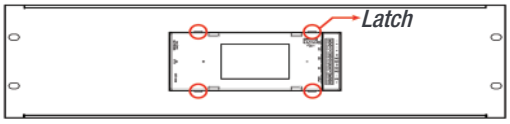
### 9.3.1 Panel Mounting

Before mounting the Inview S in the system, route all the required connection cables from the system and place near to the Inview S mounting location.

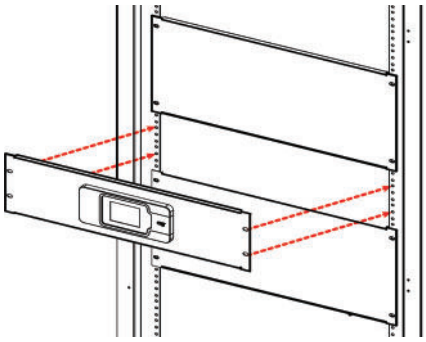
1. Place the Inview S in the panel sheet.
2. Lock all the four latches at the rear side of the Inview S in the panel sheet.
3. Connect required connection cables to the Inview S.
4. Place the panel sheet in the system and fix it with screws



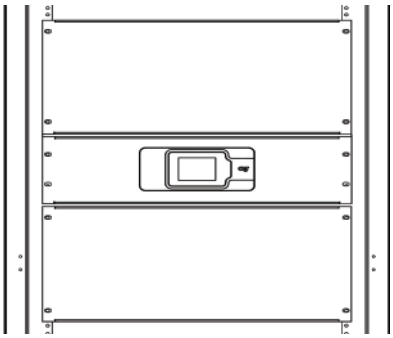
*Place the Inview S in the panel sheet*



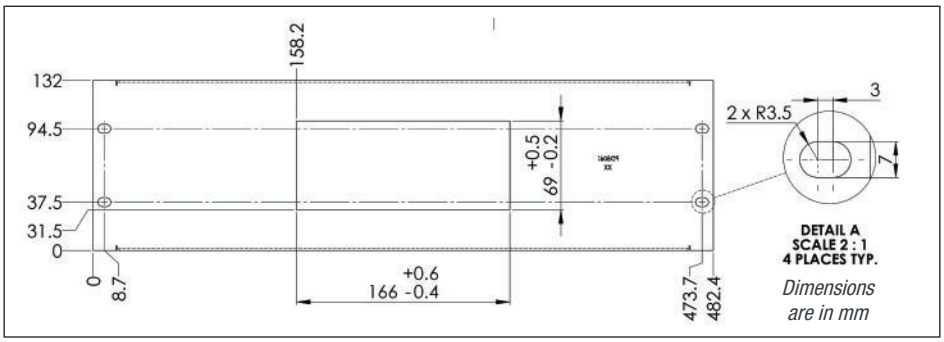

*Fix it with four latches*



*Connect wires and place the panel sheet in the cabinet*



*Fix the panel sheet with screws*




*Panel sheet - cut-out details*

## 9.4 Module Fan

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.

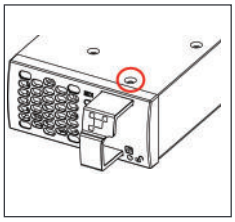
**Removal**

1. Remove the module from the shelf and place it on the flat surface.

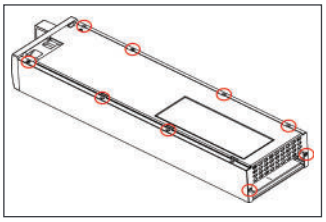
   Caution: Prior accessing the module, wait at least 5 minutes to allow internal capacitors to discharge.

   *Note: In order to remove the fan from module, front cover and bottom sheet has to be removed.*

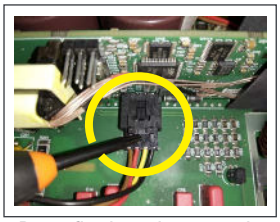
2. Remove the screw at top of the module using star screw driver.
3. Place the module upside down and remove the bottom sheet by removing 10 screws using T6 screw driver. *(8 screws at bottom sheet and 2 at rear).*
4. Using a screw driver, press firmly to release the lock of the fan connector and remove it from the board *(Note the fan connector position).*
5. Remove the front cover with fan *(Note the fan position).*



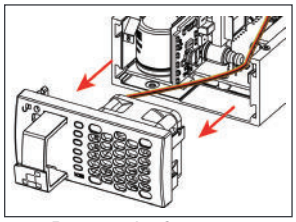
*Remove the screw at top of the module*



*Remove the 10 screws at bottom sheet and rear*



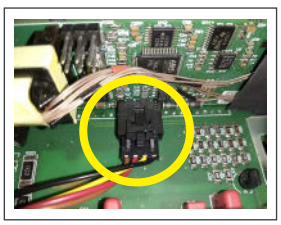
*Press firmly and remove the Fan Connector*



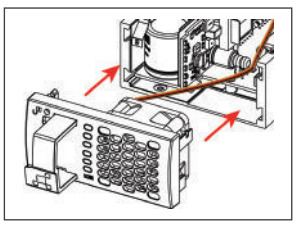
*Remove the front cover with Fan*

**Inserting**

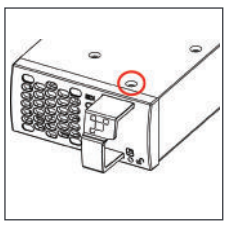
1. Replace with a new fan and connect the fan connector to the board (Make sure fan connector is locked).
2. Place the front cover with fan and fix the screw at top of the module using star screw driver.
3. Fix the bottom sheet by 10 screws using T6 screw driver.
4. Place the module in corresponding slot and check the fan operation.



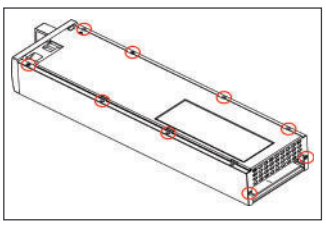
*Replace the new fan and Fix the connector*



*Place the front cover with Fan*



*Fix the screw at top of the module*



*Fix the 10 screws at bottom sheet and rear*

# 10. Manual By-Pass (Optional)

Manual By-Pass has to be operated by trained people only.

When system is in manual by-pass the load is subjected to mains voltage without active filtering. Output alarm is activated when system is in manual by-pass.

The Manual By-Pass cannot be operated remotely.

The Manual By-Pass can be integrated into the CE+T cabinet if requested at time of order. A Manual By-Pass purchased separately must comply with the instructions within section 10.3, page 35.

## 10.1 Pre-requisites

Commercial AC power must be present, and the inverter must be synchronized with it, before operating MBP. The upstream commercial breaker must be correctly sized to accept the overload, and if the AC is supplied by a Gen-set, the minimal required power will be twice the nominal power of the inverter.

The inverter may be overloaded during the MBP procedure, depending on voltage network and output. Inverter voltage setting: to reduce the impact of an overload, the inverter power and current will be reduced from 150% to nominal value.

The by-pass switch disconnects all AC voltage on the shelves but has no effect on the DC feeding the converter and the remote alarm terminal.

It is requested in order to reduce the inrush current during manual by pass operation to adjust the converter 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.

## 10.2 Manual By-Pass Operation

Manual Bypass operation creates a bypass from mains input via output AC distribution. Converter modules are bypassed and possible to disconnect without impacting the load.

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

### 10.2.1 Normal to By-pass (Engage MBP)

1. Rotate the MBP Switch (S1) from **NORMAL** to **BYPASS**. **(Do not stop at INTERIM Position)**
2. Switch OFF the DC power and/or disconnect batteries..

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.

### 10.2.2 By-pass to Normal (Disengage MBP)

1. Switch ON the DC power and/or connect batteries, and wait for module DC IN LED to turn green.
2. Rotate the MBP Switch (S1) from **BYPASS** to **INTERIM**.
   (Wait until the modules turn on and synchronized, approximately 30-60 seconds).
3. Rotate the MBP Switch (S1) from **INTERIM** to **NORMAL**.

WARNING

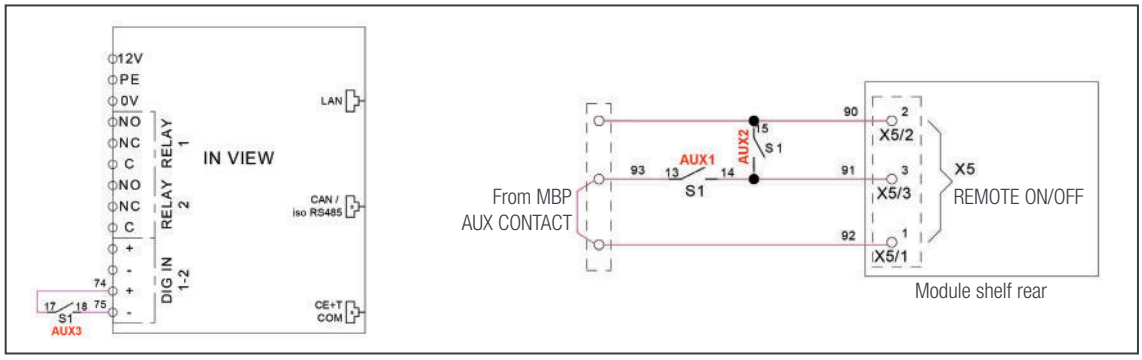
IF ATS (automatic transfer switch) IS INSTALLED UPSTREAM TO SELECT AC SOURCE. MAKE SURE THAT THE ATS SWITCH DOES NOT ALLOW TRANSFER BETWEEN AC SOURCE OUT OF SYNC. THE MAXIMUM ALLOWED PHASE SHIFT IS 10°.

## 10.3 MBP Auxiliary connection

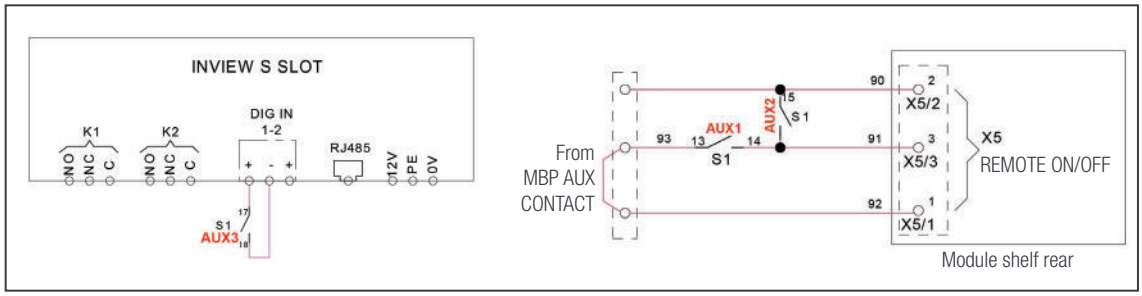
If manual by pass (Single rotary switch) is installed in the system and its auxiliary should be wired as per the following:

Note: The below connection is for a sub-rack system, and auxiliary (Aux) number varies depending upon the MBP switch. So it is recommended to refer the technical sheet received along with the system.

- Connect **Aux3** of MBP to **Digital Input 01** of the controller. So that the controller gets information when MBP is engaged. (The digital input terminal of Inview S Slot is present at rear side of the shelf).
- Connect **Aux1** and **Aux2** of MBP to Remote ON/OFF terminal in the shelf where controller is installed.




*MBP auxiliary connection in Inview S*




*MBP auxiliary connection in Inview S Slot*

# 11. Finishing

- Make sure that the sub-rack/cabinet is properly fixed to the cabinet/floor
- Make sure that the sub-rack/cabinet is connected to Ground.
- Make sure that all DC and AC input breakers are switched OFF.
- Make sure that all cables are according to recommendations and local regulations.
- Make sure that all cables are strained 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 dummy cover.
- Make sure that the Remote ON/OFF is appropriately wired according to local regulations.
- Make sure that the point of AC supply meets local regulations.

# 12. Commissioning

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

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

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

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

## 12.1 Check list

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

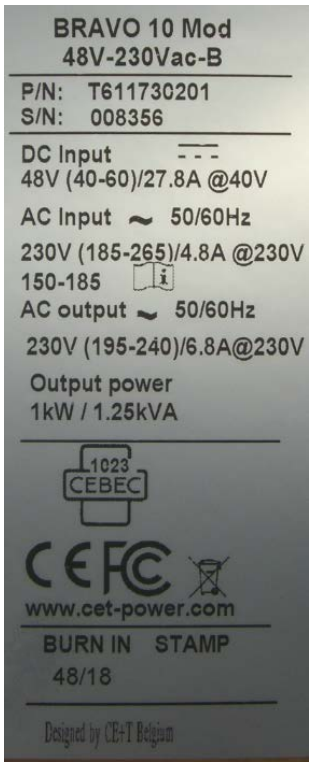
# 13. Trouble Shooting and Defective Situations Fixing

## 13.1 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 Inview 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 |

## 13.2 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!(Label shown here is only for representation)



# 14. Maintenance

Maintenance shall only be performed by properly trained people.

## 14.1 Access Inview with Laptop

- Download system LOG FILE and save.
  - Analyze log file and correct errors.
- Download system CONFIGURATION FILE and save.
  - Check/correct configuration file according to operation conditions.
  - Check/correct alarm configuration.
- Check module internal temperature for deviation between modules.
  - Temperature deviation may indicate build up of dust. Clean the module by air suction blower or vacuum cleaner.
- Check module/system load.
- Check/Correct inverter mapping (DC group/AC group/ Address).
- Change configuration file to validate that system operates on both supply sources.
- Check outgoing alarm, consult configuration file what actions will generate alarm.

## 14.2 Manual check

- Validate input voltage (AC input, DC input, AC output) with multi-meter.
- Replace dust filter.

## 14.3 Optional

- With an infrared camera check termination hot spots.
  - Tighten terminations.

## 14.4 Manual By-Pass

- Make sure AC input source is available during MBP operation. Otherwise the LOAD will be affected.

# 15. Service

For Service

- Check Service Level Agreement (SLA) of your vendor. Most of the time they provide assistance on call with integrated service. If such SLA is in place, you must call their assistance first.
- If your vendor doesn't provide such assistance (*) you may 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.