Leading Conversion Technology for Power Resilience

BRAVO 25 - 120 VAC

User Manual

BEYOND THE INVERTER

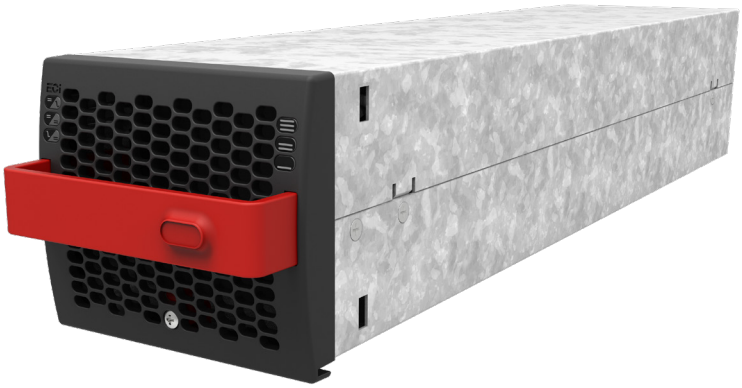
THE NEW GENERATION OF POWER CONVERTERS

- 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

INVERTERS

Bravo 25 - 48/120 &

Bravo 25 - 125/120



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Version 2.0

Leading Conversion Technology for Power Resilience

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Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
1.0	29/06/2022	-	First release of the manual.
2.0	06/03/2026	-	Added Bravo 25 - 125/120 product details. Updated to latest template.

1. CE+T Power at a glance

CE+T Power is your trusted partner in **advanced power solutions** engineered to meet the demands of modern and dynamic industrial applications. With over 60 years of experience in power conversion technology, CE+T Power nurtures the industry with **innovative solutions designed for critical power backup and energy management.**

Our complete range of power solutions includes **modular inverters** (DC to AC), UPS (securing AC loads with batteries), and **multi-directional converters** (inverter, rectifier, and UPS all-in-one). Coupled with our state-of-the-art **monitoring solution**, you have a real energy blender to connect multiple sources of energy seamlessly!

Whether you require **robust backup power solutions**, **energy management solutions**, **or a combination of both**, CE+T Power delivers tailored solutions to meet your specific needs. Our products are **designed with integration in mind, ensuring seamless compatibility with other components of your system**. CE+T Power is committed to providing you with the expertise and resources needed to maximize the performance of your power systems.

Thank you for choosing CE+T Power as your partner in advanced power management. Let's power the future together.

2. Abbreviations

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

3. Warranty and Safety Conditions*

WARNING:

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

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

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

Important Safety Instructions, Save These Instructions.

3.1 Disclaimer

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

3.2 Technical care

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

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

3.3 Installation

- This product is intended to be installed only in restricted access areas as defined by local regulations and in accordance with the National Electric Code, ANSI/NFPA 70, or equivalent agencies.
- The Converter 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 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 converter rack is a dual input power supply. The complete system shall be wired in a way that both input and output leads can be de-energized when necessary.
- The systems that have no AC input wired and connected can be seen as independent power sources. To comply with local and international safety standards N (input) and PE shall be bonded. The bonded connection between N (input) and PE must be removed once the AC input is connected.
- AC and DC circuits shall be terminated with no voltage / power applied (de-energized).
- The safety standard IEC/EN62040-1-1 requires that, in the event of an output short circuit, the converter 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 environment. When installed in a dusty or humid environment, appropriate measures (air filtering) must be taken.
- Environment Conditions:
  - Storage Conditions: -40 to 70°C
  - Relative Humidity: 95%, non-condensing
  - Altitude above sea without de-rating: Less than 1500 m
Greater than 1500 m – de-rating at 0.8% per 100 m
Should not be installed above 4000 m
- 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 converters. Mark converters clearly with shelf and position for correct rebuild. This is especially important in dual or three phase configurations.
- Empty converter positions must not be left open. Replace with module or blank cover.

3.3.2 Surge and Transients

The mains (AC) supply of the modular converter 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 converter system/rack can reach hazardous leakage currents. Grounding must be carried out prior to energizing the system. Grounding shall be made according to local regulations.

Note:

Choosing and installing surge arrestors must obey to precise technical rules. Distance to equipment to protect, cable gage and cable routing have significant influence on proper device service.

Some areas are more susceptible to be hit by electrical strikes, especially when altitude increases.

Good earthing is also crucial for surge arrestors to work properly.

CE+T declines any liability in regard to damaged caused to equipment not correctly or not sufficiently protected.

3.3.3 Other

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

3.4 Maintenance

- The converter 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 to a system/unit, make sure that AC input voltage and DC input voltage are disconnected.
- Prior to accessing the system or modules, make sure all source of supply is disconnected.
  CAUTION – Risk of electric shock. Capacitors store hazardous energy. Do not remove cover until 5 minutes after disconnecting all sources of supply.
- Some components and terminals carry high voltage during operation. Contact may result in fatal injury.

3.5 Replacement and Dismantling

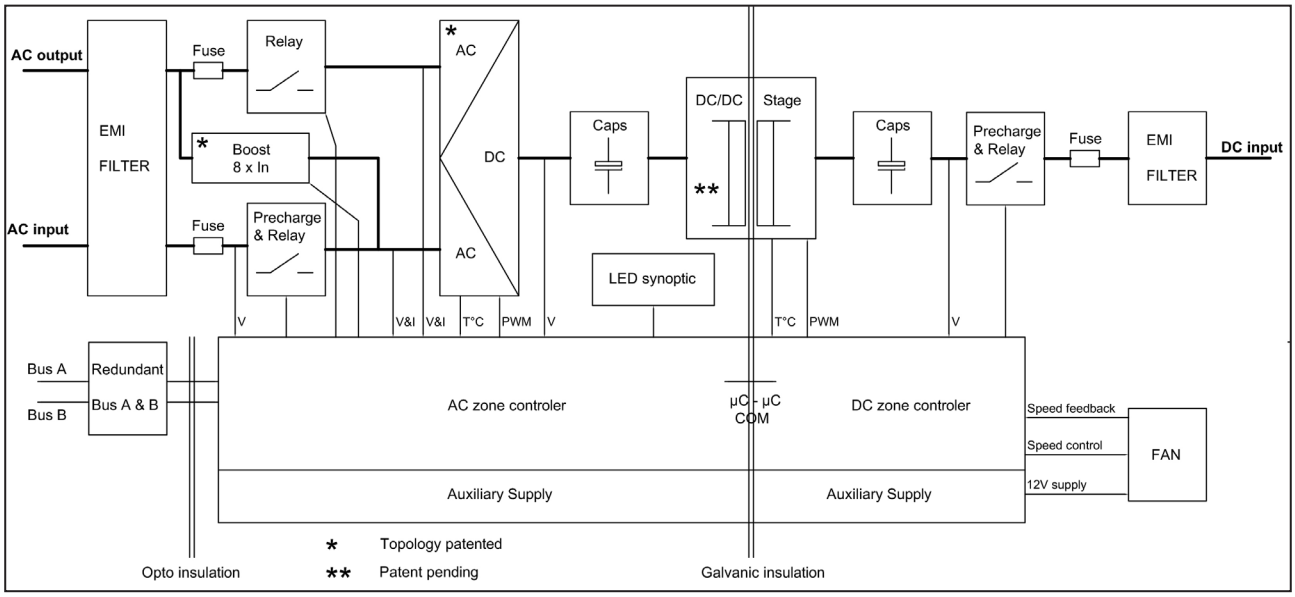
- ESD Strap must be worn when handling PCB's and open units.
- The converter system/rack is not supplied with internal disconnect devices on input nor output.
- CE+T cannot be held responsible for disposal of the converter system and therefore the customer must segregate and dispose of the materials 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.

Note: To download the latest documents, please visit our website www.cet-power.com and to download latest software visit our website my.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 125% 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.

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.

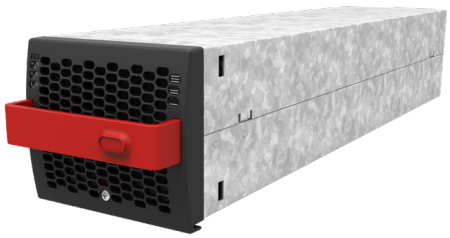
A specific example of Mix-mode is the Walk-in mode where the transfer from DC source to AC source is ramped up within a fixed and adjustable period of time.

5. Building Blocks

5.1 Bravo 25 - 120 Vac

Telecom / Datacom:

Input	48 and 125 Vdc 120 Vac, 50/60 Hz
Ouput	120 Vac
Power	2750 VA / 2250 W



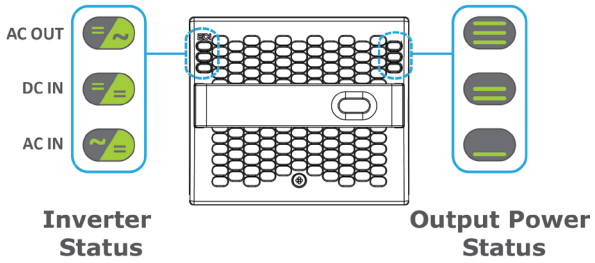
- The Bravo ECI is a 2750 VA / 2250 W triple port inverter.
- The Bravo ECI inverter modules are hot swappable and hot pluggable.
- The module operator interface is LEDs showing Inverter status and output power.
- The inverter modules is equipped with soft start.
- Fan is equipped with alarm and run time meter. The fan is field replaceable.
- 435 mm (D) x 102 mm (W) x 88 mm (H).
- 5 Kg.

5.1.1 Specifications

Model	Bravo 25 - 48/120	Bravo 25 - 125/120
General		
Part Number	T621330201	T621350201
Cooling / Audible noise	Fan forced cooling / <65db @1meter	
MTBF	240 000 hrs (MIL-217-F) at 30°C ambient and 80% load	
Dielectric strength DC/AC	4300 Vdc	2500 Vdc
RoHS	Compliant	
Operating T° / Relative Humidity (RH) non-condensing	Tested according ETS300-019-2-3 Class 3.1 -40°C to 65°C, power de-rating from 40°C to 65°C / Max RH 95% for 96 hours per year	
Storage T° / Relative Humidity (RH) non-condensing	Tested according ETS300-019-2-1 Class 1.2 -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 -40°C to 70°C / Max RH 95% for 96 hours per year	
Material (casing)	Aluzinc steel	
AC Input Data		
Nominal voltage (AC) / Current	120 Vac / 21.7 A	
Voltage range (AC)	90 - 144 Vac (derating from 108 to 90 Vac)	
Brownout	1600 W @ 90 Vac / 2550 W @ 100 Vac linear decreasing	1600 W @90 Vac / 2350 W @108 Vac linear decreasing
Power factor	> 99%	
Frequency range (selectable) / synchronization range	50 Hz (range 47 – 53 Hz) / 60 Hz (range 57 – 63 Hz)	

DC Input Specifications		
DC voltage: Nominal / range	48 Vdc / (40-60V)*	125 Vdc (90 – 150 Vdc)
Nominal current	50.4 A	19.5 A
Maximum input current (for 15 second) / voltage ripple	63 A / < 10 mV RMS	24.4 A / < 10 mV RMS
Reverse polarity protection	Yes	
Internal Low Voltage Disconnect (LVD)	Starts @ 44.4 V / Stops @ 43.2 V	Starts @ 99.9 V / Stops @ 97.2 V
AC Output Data		
Efficiency (Typical): Enhanced power conversion / on line (peak values @60% load)	95% / >93%	94.8% / 93.4%
Nominal voltage AC** (Adjustable)	120 V (100 - 130 Vac)	
Frequency / frequency accuracy	50 or 60 Hz / 0.03%	
Nominal Output power	2750 VA / 2250 W	
Short time overload capacity	125% (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	22.9 A	
Crest factor at nominal power	3 : 1 for load P.F. <=0.7	
Short circuit clear up capacity < 20 ms at AC input / On battery	200 A for 20 ms / 65Arms for 20 ms	145 Arms for 20 ms / 58.9 Arms for 20 ms
Short circuit current after >20 ms	42 Arms for 15 seconds	33.4 Arms for 15 seconds
AC output voltage stability	±1% from 10% to 100% load	
Static / Dynamic voltage regulation	±1% between 10% and 100% load / <5% from 0 to 100% to 0 load impact (100 ms)	
In Transfer Performance		
Max. Voltage interruption / total transient voltage duration (max)	0 s / 0 s	
Signaling & Supervision		
Display	Synoptic LEDs on module and touchscreen with Inview S and Inview X	
Supervision	Inview ranges: Inview X - T602004200, Inview S - T602004100 & Inview GW - T602004000	Inview ranges: Inview X - T602004200 and Inview S - T602004100
Remote on / off	On rear terminal of the shelf	
Battery Monitoring / Part number	MBB-500 (Measure Box Battery) - 4 dry contacts and 8 digital Inputs / T602006011	
Safety & EMC		
Safety	cUL recognized according UL1778	
EMC	FCCpart 15 class A	

5.1.2 Converter - LED Indications



Inverter Status LED	Description	Remedial action
OFF	No input power or forced stop	Check environment
Permanent green	Operation	
Blinking green	Inverter 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 80%	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)

5.2 Sub-rack

- The Bravo ECI shelf shall be integrated in min 600 mm deep cabinets, Inch/ETSI mounting.
- The Bravo ECI shelf houses a maximum of four inverter modules.
- The Bravo ECI shelf is designed with individual DC input, Common AC input and Common AC output.
- Optional rear cover for IP 20 in open rack.
- Max 11 KVA per shelf.
- 480 mm (D) x 19” (W) x 2U (H).
- 6 Kg empty.

6. Monitoring Device - Inview S, X and GW

Bravo 25 modules can be monitored through Inview S, X or Inview GW. For more details about these monitoring devices and the hardware connections, refer to the Inview and Inview GW user manuals.

Inview S and X - https://datasheet.cet-power.com/CET - Monitoring - User Manual - Inview - EN.pdf

Inview GW - https://datasheet.cet-power.com/CET - Monitoring - User Manual - Inview GW - EN.pdf

Inview GW

Inview S

Inview X

7. Accessories

7.1 Cabinet

Powder coated (RAL 7035), 19 inch Envent cabinet with 600 x 600 mm foot print. Cabinet designed for top cabling or bottom cabling.

- 1100(H) x 600(W) x 600(D) mm
- 1800(H) x (600(W) x 600(D) & 800(D) mm
- 2000(H) x (600(W) x 600(D) & 800(D) mm

The cabinet comes with a separable top cover to facilitate cabling. Tie strap support at cable entrance/exit.

Door accessory optional.

7.2 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.

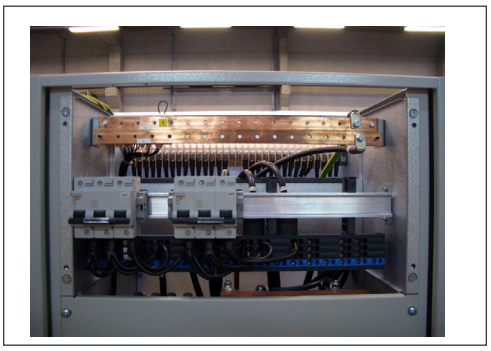
When MBP is engaged, converter modules are switched off and can be removed without impacting the load. The battery supply is not physically disconnected. After disconnecting the battery supply (by opening the battery breakers), the shelf section is safe for maintenance.

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.

7.3 AC Distribution Unit

7.3.1 Miniature Circuit Breakers

The standard AC output distribution unit is designed with a 35 mm DIN rail, Multi Clip termination board and N/PE copper terminal bars, and built as a part of the cabinet.



The Multi Clip offers unique flexibility during installation and expansion. The terminals are spring loaded and adapt contact pressure to the size of conductor. Only one cable can be inserted per spring loaded terminal.

The AC distribution unit is available with 1 pole, 2 pole or 3 poles.

Max current per AC DU is 200 A, max current per terminal connector is 40 A. Two adjacent terminal connectors shall be used for 63 A breakers.

If an alarm is required for AC output breakers, a help contact attached to each individual breaker is used (OF or SD). The alarm function is common and uses one of the digital inputs on the control unit. The help contact limits the breakers quantity.

	Single pole		Double pole		Three pole	
	w/o help contact	With help contact OF/ SD	w/o help contact	With help contact OF/ SD	w/o help contact	With help contact OF/ SD
Up to 40A	24	16	12	9	8	6

7.3.2 MCCB

AC output distribution via MCCB in the range up to 400 A (1p, 2p or 3p).

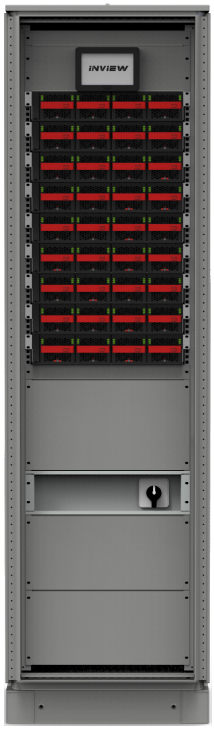
Max two MCCB per converter cabinet.

8. System Design

8.1 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, inverter modules, manual by-pass, monitor device and AC output distribution.

The A la Carte is available in EPC (Enhanced Power Conversion) or REG (Regular) mode.
The A la Carte (single phase) accommodates 1 to 32 modules, for max 88 kVA.
The A la Carte (three phase) accommodates 3 to 30 modules, for max 82.5 kVA.



By using TUS, the system can parallel up to 2475 kVA

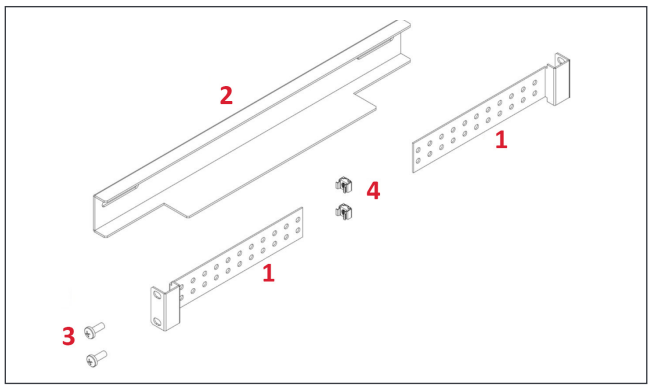
- Dual input (AC and DC) inverter modules (EPC).
- 96% efficiency during normal operation (EPC).
- Always conditioned and filtered output voltage.
- Seamless transfer (0 ms) between primary and secondary source of supply.
- No single point of failure.
- Flexible AC output distribution.
- Full modularity and redundancy.

9. Installation of Bravo ECI 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 (A, R), phase 2 (B, S) and phase 3 (C, T). 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.)

9.1 Mounting kit for Bravo ECI shelf

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

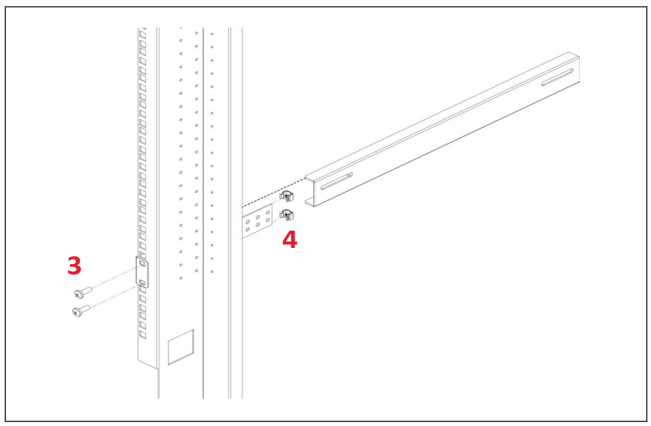


1 → Fixing brackets - 4 Nos

2 → Slider - 2 Nos

3 → Mounting screws - 12 Nos

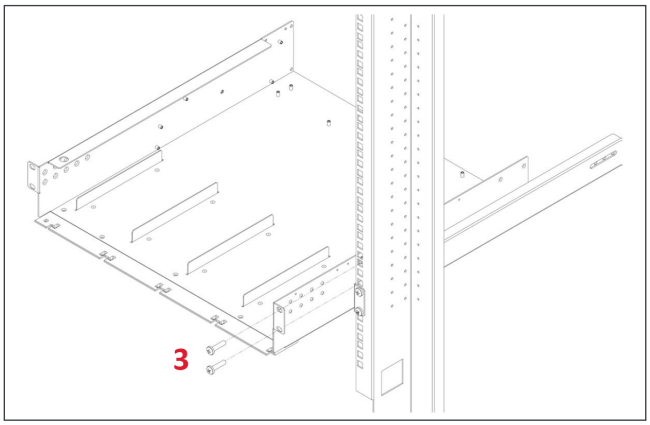
4 → Cage nuts - 12 Nos



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

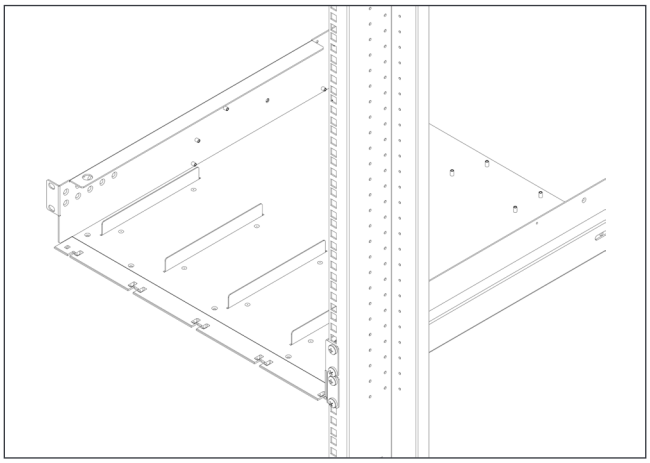
Fix cage nuts (4) in the cabinet front and rear frame of the left and the right side.

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).



Finished.

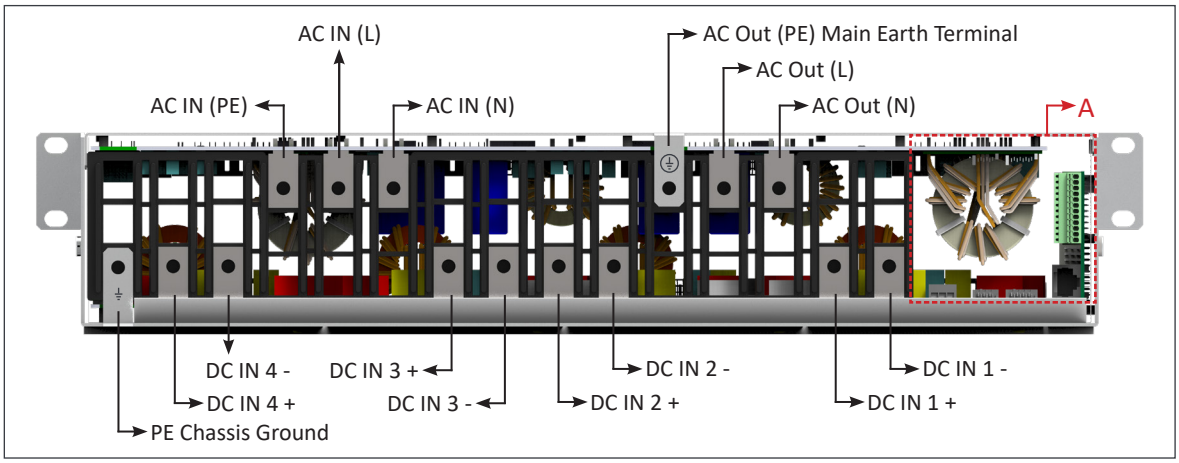
9.2 Electrical installation for Bravo Shelf

9.2.1 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 5Nm.
- All connection screws are M5 x 12 mm.
- DC Input-Individual (per module), observe polarity.
- AC Input / AC output-Common (per shelf), respect phases.
- 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.

9.2.2 Terminations

All terminations are clearly marked.



Bravo 25 - 120 Vac - Shelf Rear Details

9.2.3 Grounding

"PE CHASSIS GROUND" ⏚

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

9.2.4 DC Input

Model	MCB per inverter module	Cable, min	Connector	Torque
Bravo 25 - 48/120	80 A	2 x 16 mm^2	M5	5 Nm
Bravo 25 - 125/120	28 A	2 x 6 mm^2	M5	5 Nm

9.2.5 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.

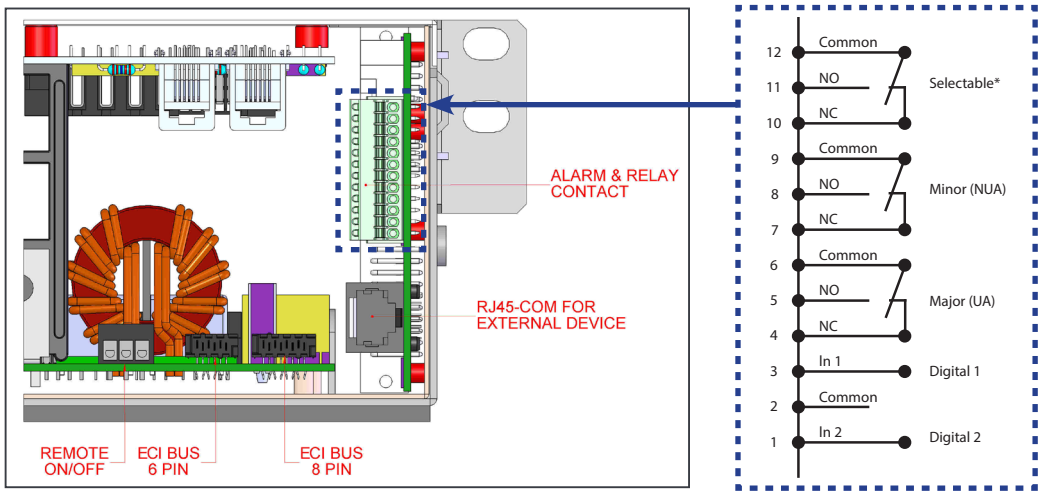
Model	Cable, min	Connector	Torque
Bravo 25 - 48/120 & Bravo 25 - 125/120	4 x 10 mm^2	M5	5 Nm

Note: Icc value measured as 140 A_{rms} per shelf with four modules.

9.2.6 AC Output

Model	MCB per shelf	Cable, min	Connector	Torque
Bravo 25 - 48/120 & Bravo 25 - 125/120	2P 114.5 A	4 x 10 mm²	M5	5 Nm

9.2.7 Signalling



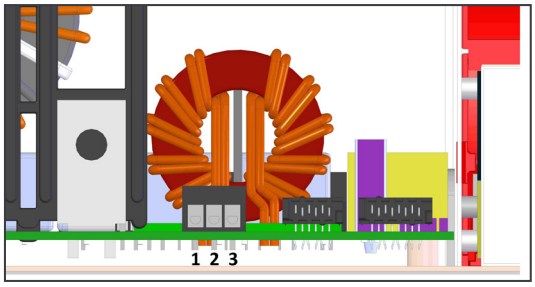
Relay characteristics (Selectable, Major, Minor)

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

Digital input characteristics (Digital In 1 / 2)

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

9.2.8 Remote ON/OFF

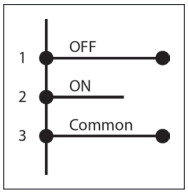


Notice: The shelf is by default equipped with a connection between pin 3 and 2. If remote ON/OFF is not used the strap shall remain in all connected shelves. Should the remote ON/OFF be used, all straps must be removed and in one (1) shelf replaced with a changeover contact or emergency button.

- 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) AC Input (Green) DC Input (Green)
3	Open	Closed	Normal operation	All (Green)
4	Closed	Closed	Normal operation	All (Green)

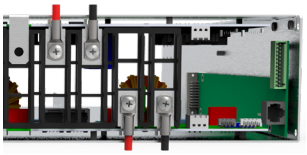
Warning:
If remote ON/OFF is not used, pin 2 and 3 MUST be bridged together!

9.2.9 Internal bus (ECI Bus 6 pin / ECI Bus 8 pin)

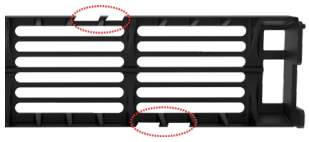
- In A la Carte systems the internal Bus is pre installed.
- The internal bus comprise of a 6 pole ribbon cable and an 8 pole ribbon cable.
- The internal bus connectors are sensitive and special caution should be taken during installation to keep them out of harms way.
- The internal bus is connected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

9.2.10 Rear cover

- The rear cover provides IP 20 protection for the rear terminations when required.
- The rear cover is snapped into position in the rear of the sub-rack.
- Remove material using a pair of side-cutters to allow cable entry and exit.
- The rear cover is ordered separately.



Connect the cables.

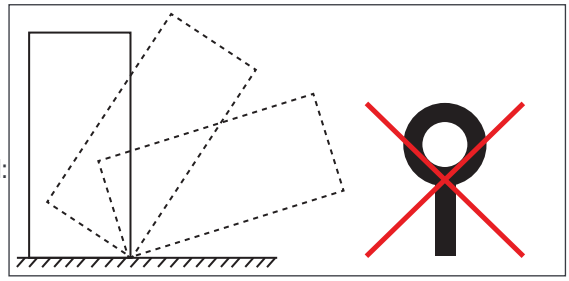


Cut appropriate size on the protection cover for cable access.

Fix the protection cover at rear side of the shelf.

10. Installation of Cabinet

10.1 Unpacking the system



CE+T cabinets are always fixed on a pallet, and then packed in a wooden crate.

These crates are usually delivered laying flat, horizontally.

To unpack your cabinet, we recommend the following method:

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

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

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

10.2 Module packing

When modules are ordered **together with a system**, they are either delivered in the cabinet or on a separate pallet.

- If you find the modules in the cabinet : you may want to remove them in order to raise the cabinet more easily, b**ut before you do so make sure to have identified in which slot was each module. Indeed, it is important to replace each module in the same slot** it was delivered in!
- If the modules have been delivered separately, in carton on pallet, they will be clearly identified in order to be placed in the right slot.
- It is important to place the modules in the right slot, as this will ensure that the addressing of each module in the config file corresponds to the physical slot. Without this, the system will of course function properly but you might find it difficult to identify on which modules your applying changes you would be bringing to the config file.
- Also, in 3 phase systems, replacing modules configured to function in a specific phase in a slot assigned to another phase will result in the module to be un-synchronized. Your system may not start and you will have to reconfigure manually each module that was misplaced.

If you ordered modules only:

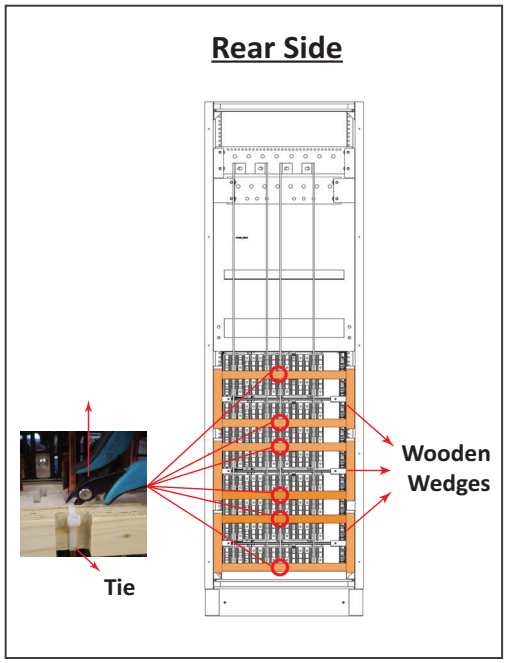
- If they are meant to be used in running systems or in a not operational single phase system, you may insert them in any slot.
- If they are meant to be placed in a not yet started 3 Phase system, follow these steps:
  - Insert one module per phase.
  - Start the system according to the start-up and commissioning procedure.
  - Insert the remaining modules progressively.

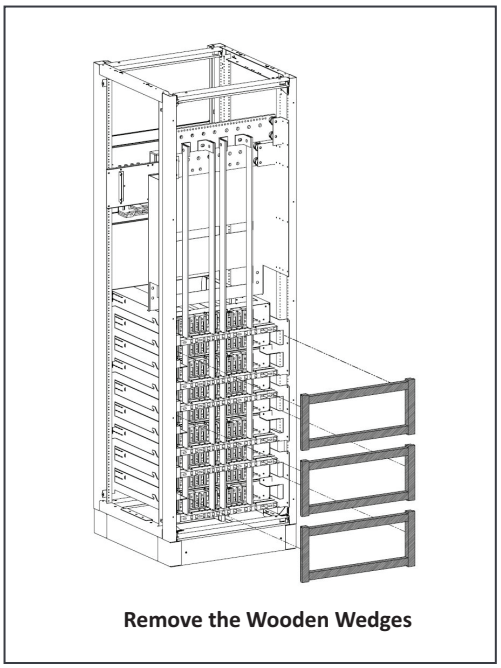
Module packing material shall be taken apart.

10.3 Removing the cabinet rear protection

Wooden wedges are fixed at the back of the cabinet to prevent parts from moving and sustaining damage 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 (see the following figure).
3. Cut the tie wraps holding the back wedges and remove them.

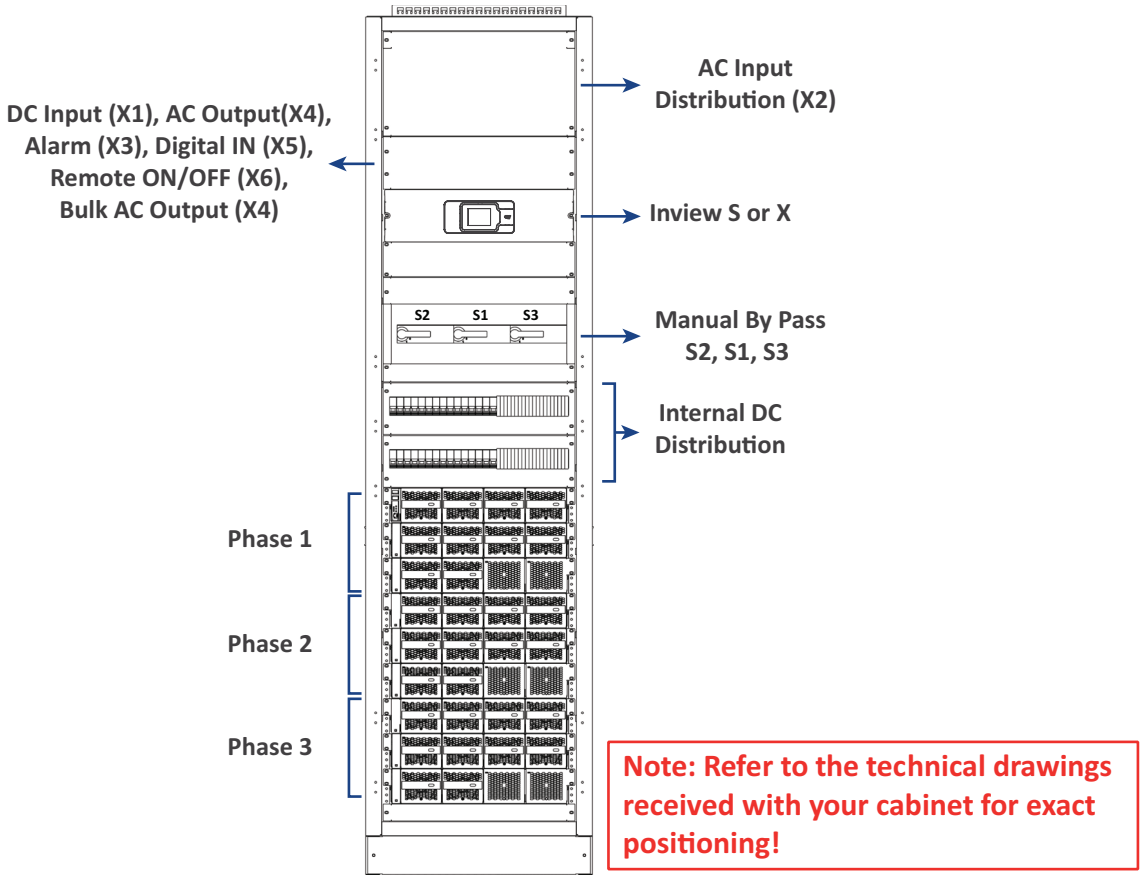




10.4 Electrical installation

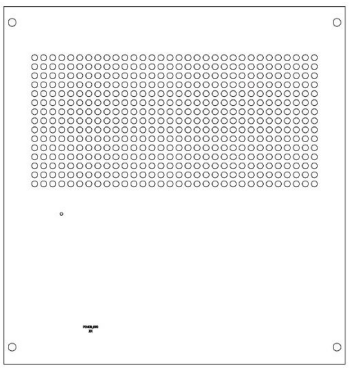
- All cables shall be halogen free and rated min 90 deg C.
- Wire all positions for future expansion.
- Input AC / Output AC / Input DC / Signal cables shall be separated.
- Cable crossings shall be made at 90 deg angles.
- Empty module positions shall be covered with blank or dummy module.

10.4.1 Positioning

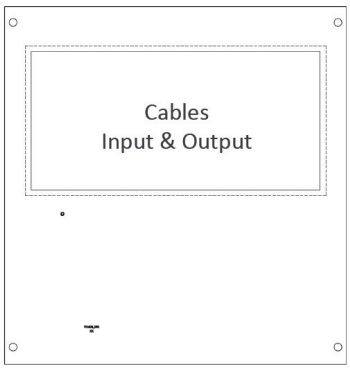


10.4.2 Cabling

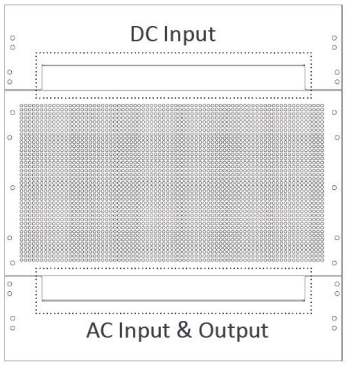
Note: Do not block the airflow through the top of the cabinet. Cables are run through the top or bottom of the cabinet. The top cover can be split into two parts to facilitate cabling. The top cover accommodates nylon tie straps used to strap the cables.



Top Plate - Type I



Top Plate - Type II



Top Plate - Type III

10.4.3 Grounding

Ground terminals are located in the top rear left corner, labelled“PE CHASSIS GROUND”

PE Chassis ground shall be wired to MET or distributed earth bar (MET). Ground must be terminated even if commercial mains is not available.

According to local regulations, Min 16 mm^2.

10.4.4 Surge Suppression

The mains (AC) supply of the modular inverter system shall be fitted with suitable Lightning surge suppression and Transient voltage surge suppression for the application at hand. Manufacturer’s recommendations of installation shall be adhered. It is advisory to select device with alarm relay for function 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.

10.4.5 AC Input (X2)

WARNING !!!
Recommendation of IEC 60364 4. 43

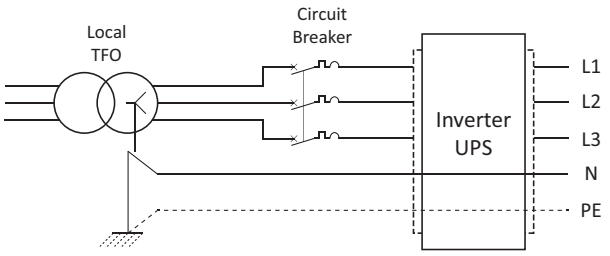
431.3 Disconnection and reconnection of the neutral conductor in multi-phase systems

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

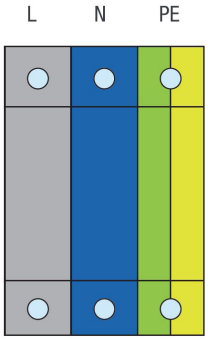
In TN-S System no 4 pole input switch or circuit breaker shall be used. If you have to use 4 pole protective device, be aware that the neutral against the ground is floating. The inverter, UPS will operate without problem but you may infringe the local regulation.



The AC input is wired to a screw terminal.

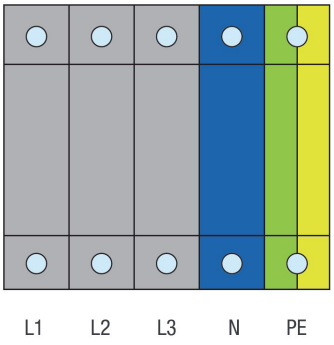
Max cable area is 180 mm^2

10.4.5.1 Single phase



10.4.5.2 Three phase

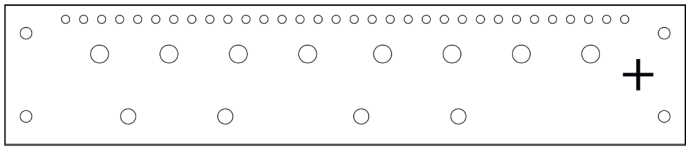
NOTE: The three phase input is 123, ABC, RST phase sensitive; clockwise rotation is recommended. Phase one starts at 0° phase shift, while the other phases will be at -120° phase shift and + 120° phase shift resulting in three phase output.

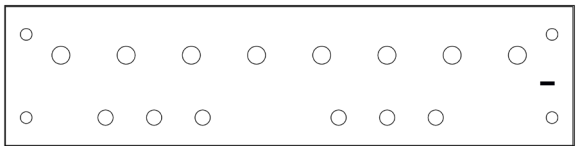


10.4.6 DC Input (X1)

10.4.6.1 Bulk Input

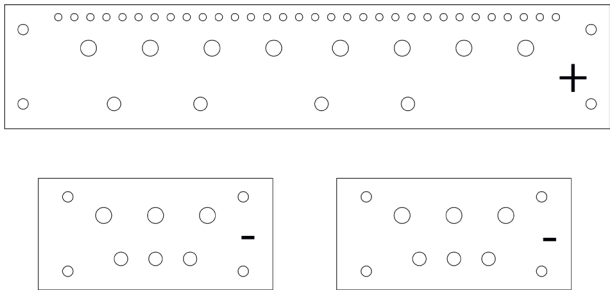
- Common DC input per system.
- **Note:** Screws and nuts are not included in the delivery.
- M12 holes.
- Internal DC distribution with circuit breakers (Q01-Q32) per inverter module.
- Max 8 x 240 mm^2 per pole (group).





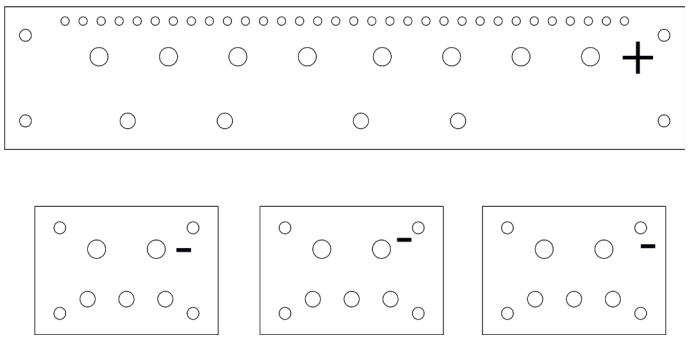
10.4.6.2 2 DC Input

- 2 x Common DC input per system.
- **Note**: Screws and nuts are not included in the delivery.
- M12 holes.
- Internal DC distribution with circuit breakers (Q01-Q32) per inverter module.
- Max 3 x 240 mm² per pole (group).



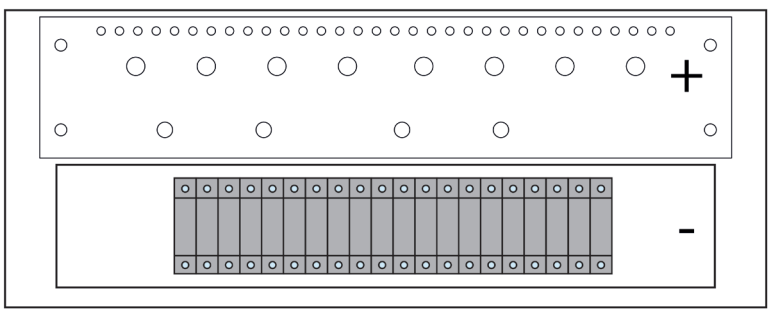
10.4.6.3 3 DC Input

- 3x Common DC input per system.
- Note: Screws and nuts are not included in the delivery.
- M12 holes.
- Internal DC distribution with circuit breakers (Q01-Q32) per inverter module.
- Max 2 x 240 mm² per pole (group).



10.4.6.4 Individual Input

- Individual DC input per module/shelf and common return.
- **Note:** Screws and nuts are not included in the delivery.
- M6 holes for positive bus bar per connection.
- Max 35 mm² per connection terminal.



10.4.7 Connection table – AC Input (X2) & Output (X4)

The AC input supply breaker shall be 2p for single phase, and minimum 3p for three phase.

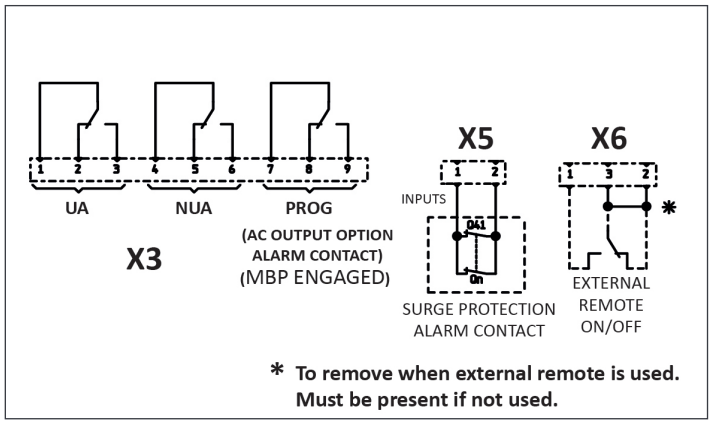
Power (kVA)			AC Input & Output (Screw terminal)		
1ph	2ph	3ph	Calculated	Fuse/CB	Min.Cable mm²
11	-	-	92A	100 A	35
22			183 A	200 A	95
-	22		2 x 92 A + N	100A	2 x 35
33	-		275 A	325 A	70
-		33	3 x 92 A + N	3 x 100 A	3 x 35
44	-	-	367 A	400A	180
-	44		2 x 183 A + N	2 x 200 A	2 x 95
55	-		458 A	500 A	95
66			550 A	600 A	150
-	66	-	2 x 275 A + N	2 x 300 A	2 x 150
-		66	3 x 183 A + N	3 x 200 A	3 x 95
77	-		642 A	700 A	180
-		82.5	3 x 229 A + N	3 x 250 A	3 x 150
88	-		733 A	800 A	2 x 180
-	88	-	2 x 367 A + N	2 x 400 A	3 x 180

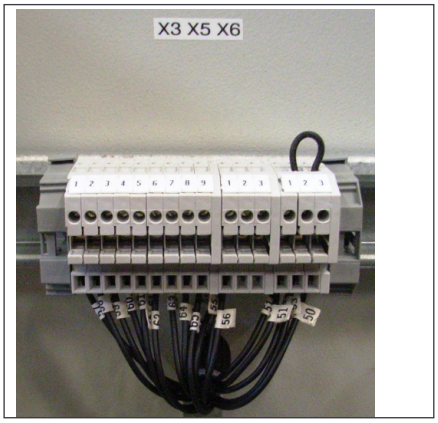
10.4.8 Connection Table DC Input 48 VDC / 125 VDC (X1)

	Bravo 25 - 48/120		Bravo 25 - 125/120	
Power (kW)	Current (A)	Min.Cable mm²	Current (A)	Min.Cable mm²
9	203	95 Sq mm	89	35 Sq mm
18	406	300 Sq mm	177	95 Sq mm
27	609	2 X 185 Sq mm	266	150 Sq mm
36	811	2 X 300 Sq mm	354	300 Sq mm
45	1014	3 X 185 Sq mm	443	2 X 120 Sq mm
54	1217	3 X 300 Sq mm	531	2 X 150 Sq mm
63	1419	4 X 240 Sq mm	620	2 X 185 Sq mm
67.5	1521	4 X 240 Sq mm	664	2 X 185 Sq mm
72	1622	4 X 300 Sq mm	708	2 X 320 Sq mm

10.4.9 Signalling

The illustration below shows the X3 relays contacts in a non-alarm state when the system is operational. In this case, the relays are energized and as below.





When an alarm occurs, the X3 relay contacts are de-energized and switch.

10.4.9.1 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 1 mm^2

10.4.9.2 Digital In (X5)

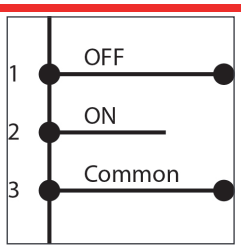
Input characteristics X5 (Digital In 1, Digital In 2)

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

10.4.9.3 Remote ON/OFF (X6)

Note: The system is by default equipped with a connection between pins 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 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 closes.
  The status is not changed unless both transactions are detected.



- Digital input characteristics (Remote ON/OFF)
  - Signal voltage +5 VDC (galvanically 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) AC Input (Green) DC Input (Green)
3	Open	Closed	Normal operation	All (Green)
4	Closed	Closed	Normal operation	All (Green)

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

11. Inserting/removing/replacing - modules

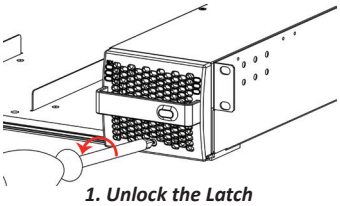
11.1 ECI Inverter

- 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.

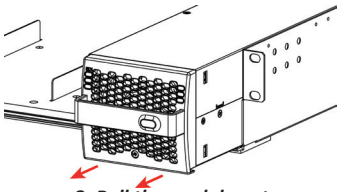
11.1.1 Removal

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

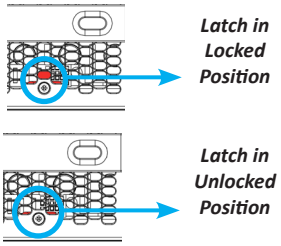
1. Rotate the screw in anti clockwise by using cross head screw driver to unlock the latch.
2. Hold the front handle and pull the module out.
3. Replace with a new module or a blind unit



1. Unlock the Latch

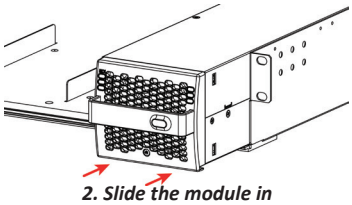


2. Pull the module out

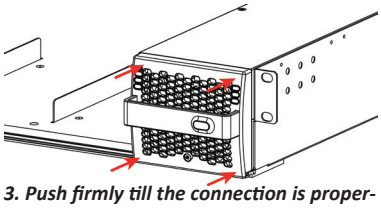


11.1.2 Inserting

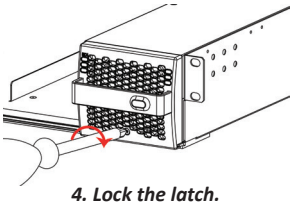
1. Check module compatibility (DC Voltage!).
2. Place the module in the shelf and slide in.
3. Using the module handle, push firmly until the unit is properly connected.
4. Rotate the screw in clockwise by using cross head screw driver to lock the latch.
5. The module will start up and take the first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



2. Slide the module in



3. Push firmly till the connection is properly engaged.



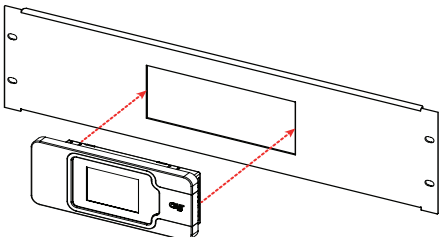
4. Lock the latch.

11.2 Inview S

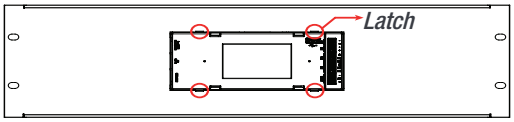
11.2.1 Panel Mounting

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.

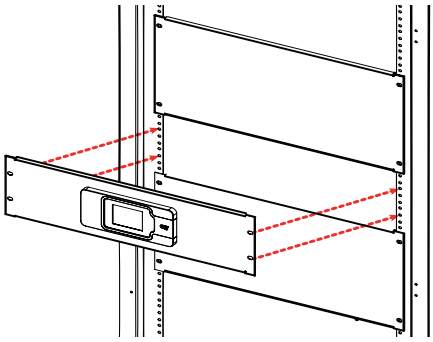
1. Place the Inview S in the panel sheet.
2. Lock all the four latches at the rear side of the Inview S in the panel sheet.
3. Connect required connection cables to the Inview S.
4. Place the panel sheet in the system and fix it with screws.



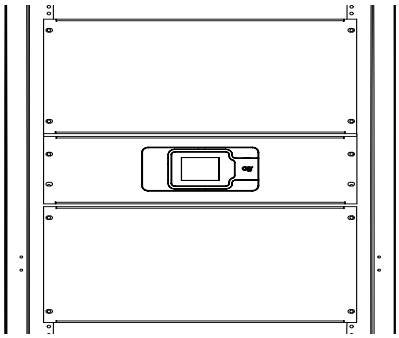
Place the Inview S in the panel sheet



Fix it with four latches



Connect wires and place the panel sheet in the cabinet



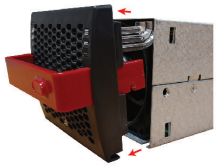
Fix the panel sheet with screws

11.3 Fan replacement

The FAN life is approximately 70,000 (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 Inview through web interface and reset the fan run time alarm.

Remove the screws



Remove the front cover

Disconnect the fan

Take the new fan

Make sure the fan is in the right position

12. AC Output Distribution

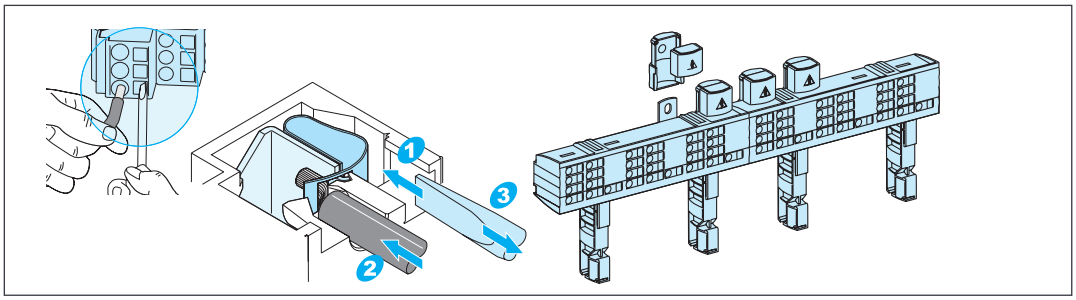
12.1 Miniature Circuit breaker Installation/Removal

Circuit breakers are normally factory installed.

How to add breakers:

1. Insert the short connection cable (10 mm^2 (included)) in the breaker Line-side and tighten.
   - Up to 40 A breaker - use one connection cable.
   - 63 A breaker - use two connection cables.
2. Clip breaker on to the DIN rail.
3. Insert insulated screw driver into the terminal to load the spring.
4. Insert connection cable and remove screw driver.
5. Connect load cable to breaker, Neutral and Ground.
6. Switch breaker ON.

Remove breaker in reverse order



12.2 MCCB

MCCBs are factory installed.

A wide range of breakers is used. Delivered breakers may vary from the example shown in the picture.

1. Make sure that the breaker is in OFF position.
2. Connect load cables to the terminal.
3. Switch the breaker ON.

13. Manual By-Pass (MBP)

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 13.2, page 38.

13.1 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 Inverter and the remote alarm terminal.

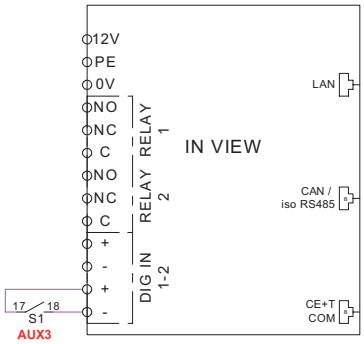
It is requested in order to reduce the inrush current during manual by pass operation to adjust the Inverter AC output voltage to the same value as AC input voltage. If the difference between AC input and AC output voltage exceed 5 Vac, there is a risk of shutdown of Inverter due to high inrush current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

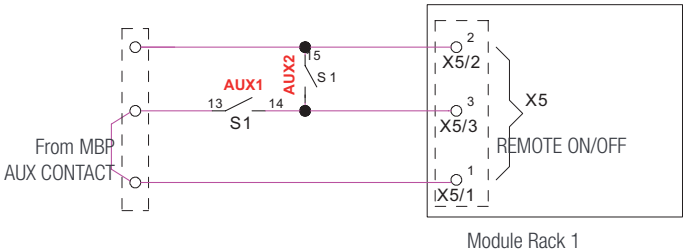
13.2 MBP Auxiliary connection

If manual by pass 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 controller. So that the controller gets information when MBP is engaged.
- Connect **Aux1** and **Aux2** of MBP to Remote ON/OFF terminal in the shelf where controller is installed.





13.3 Manual Bypass operation

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

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

The sierra system has a single rotary switch and it has three positions - Normal, Interim and Bypass.

13.3.1.1 Normal to Bypass

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

13.3.1.2 By-Pass to Normal

1. Switch **ON** the DC power and/or connect batteries.
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**.

14. 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.

15. 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.

15.1 Check list

DATA	
Date	
Performed by	
Site	
System serial number	
Module serial numbers	
Inview 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 must be adapted according to the site (LVD, load on AC, AC threshold level)	
Switch OFF ACin and check if system is working on DC	
Switch ON ACin and check if system correctly transferred load on AC	
Switch OFF system and start on AC only	
Switch OFF system and start on DC only	
Check if display working properly (if this CANDIS option is present)	
Check if TCPIP working properly (if this option is present)	
Test on load (if available)	
ALARM	
Switch ON AC input and DC input and check that no alarm are present	
Pull out one inverter and check alarm according to redundancy	
Pull out two inverters and check alarm according to redundancy	
Switch OFF AC input (commercial power failure) and check the alarm according to the configuration	
Switch OFF DC input (DC power failure) and check that the alarm according to the configuration	
Check the different digital input according to the configuration (when used)	

16. Trouble Shooting and Defective Situations Fixing

16.1 Trouble Shooting

Inverter module does not power up:	Check AC input present and in range (AC breakers)
	Check DC input present and in range (DC breakers)
	Check that the inverter is properly inserted
	Remove inverter to verify that slot is not damaged, check connectors
	Check that module(s) is (are) in OFF state
	Check for loose terminations
Inverter system does not start:	Check that 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

16.2 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!

17. Maintenance

Maintenance should be performed by properly trained people.

17.1 Access Inview S 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)

17.2 Manual check

- Check voltages of AC input, DC input, AC output and DC output using the multi-meter
- Replace door filter if more dust is accumulated.
- Take a snap shot of the cabinet and site condition

17.3 Optional

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

17.4 Manual By-Pass

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

18. Service

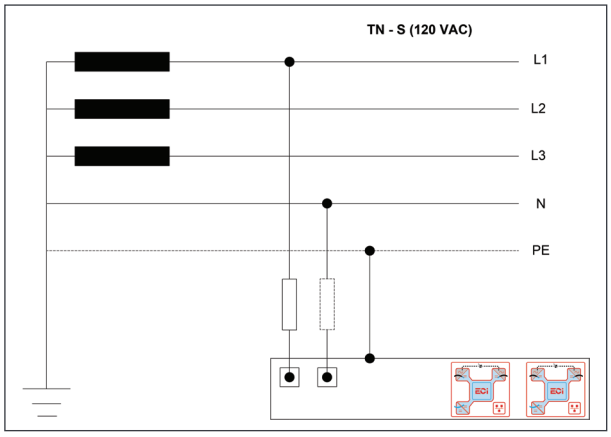
For Service

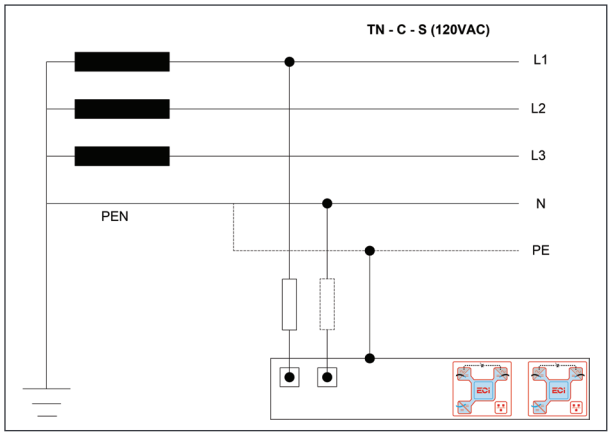
- Check Service Level Agreement (SLA) of your vendor. Most of the time they provide assistance on call with integrated service. If such SLA is in place, you must call their assistance first.
- If your vendor doesn't provide such assistance (*) you may contact CE+T through email:
    - USA and Canada: tech.support@cetamerica.com
    - Rest of the world: customer.support@cet-power.com

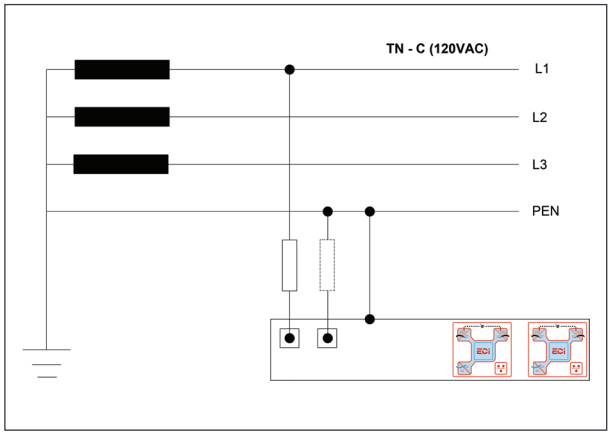
(*) CE+T will redirect your call to your vendor if he has such SLA in place.

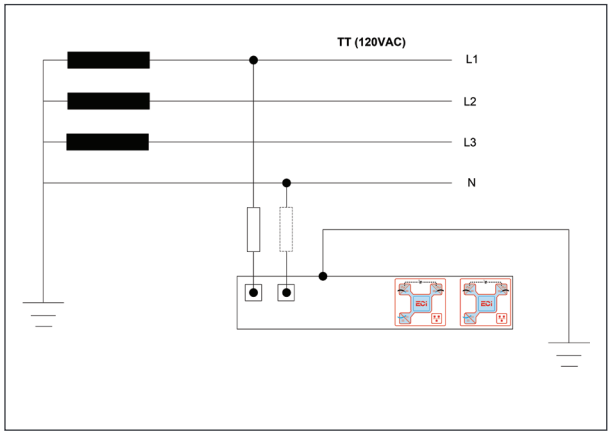
19. Appendix

19.1 Mains connection, Single phase

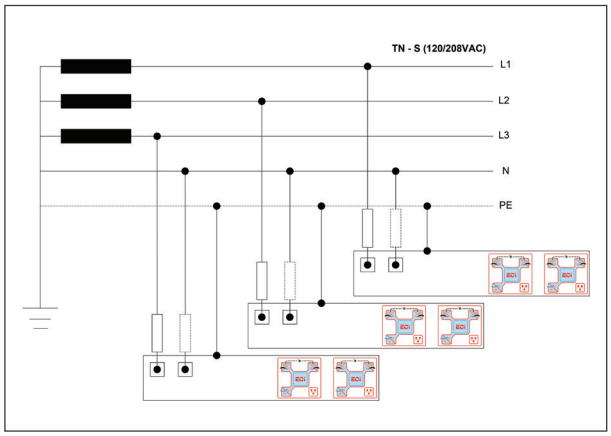


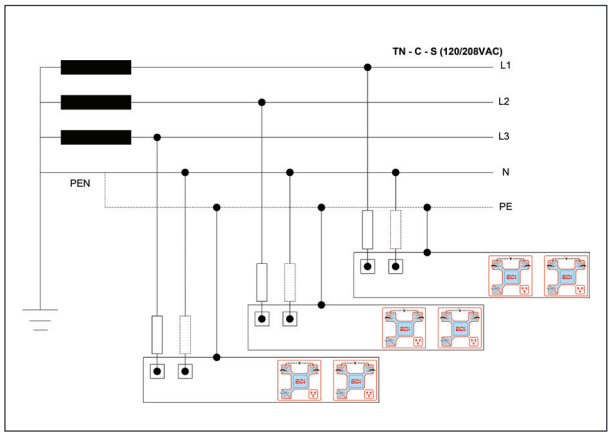


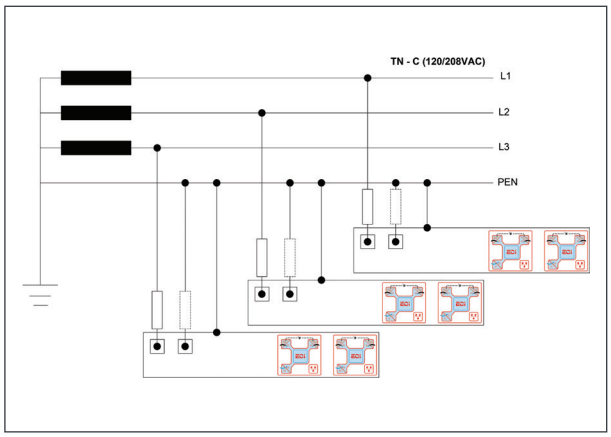


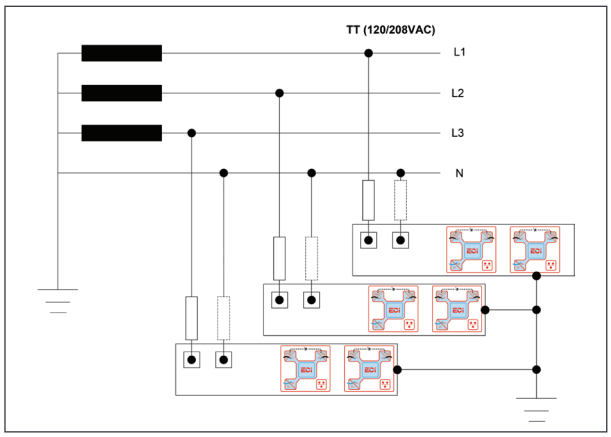


19.2 Mains connection, Three phases



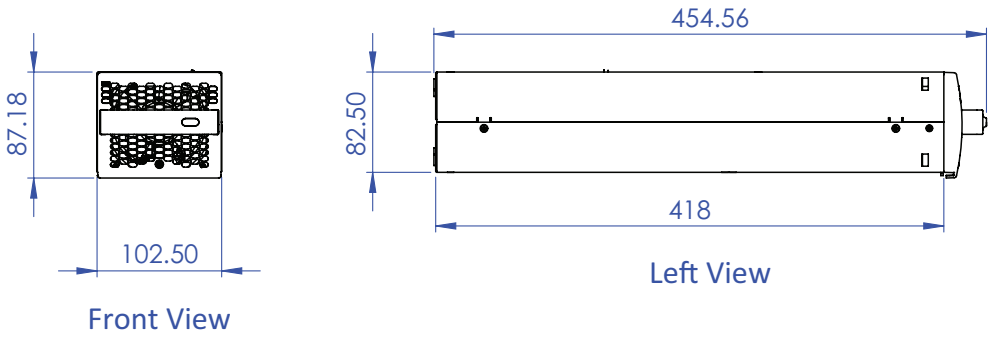




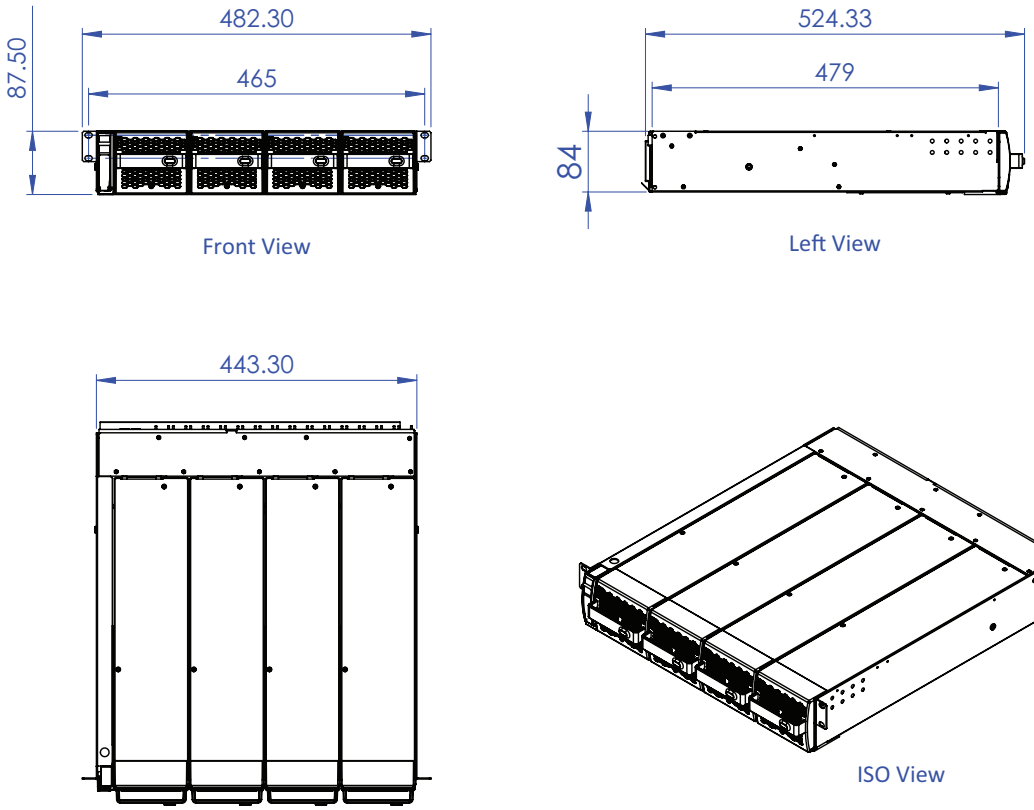


19.3 Bravo ECI - Dimensions

19.3.1 Module

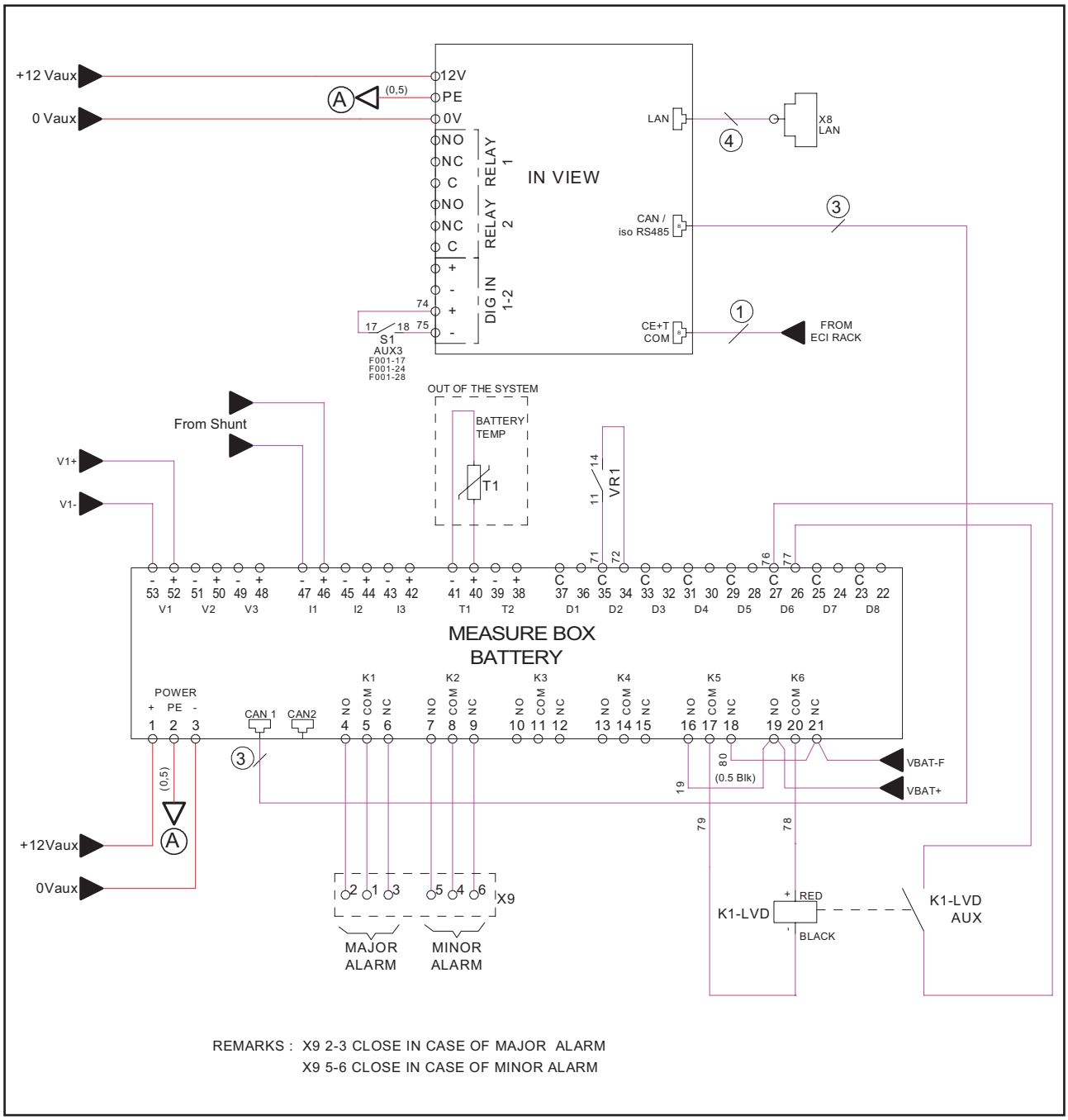


19.3.2 Shelf



All dimensions are in mm

19.4 Inview S with MBB - Wiring diagram



REMARKS : X9 2-3 CLOSE IN CASE OF MAJOR ALARM
X9 5-6 CLOSE IN CASE OF MINOR ALARM

19.5 Modules - Parameter List

With Inview, you can access the modules' parameter list and descriptions. Refer to the Inview and Inview GW user manuals to access the Inview web interface.

Inview S and X - https://datasheet.cet-power.com/CET - Monitoring - User Manual - Inview - EN.pdf

Inview GW - https://datasheet.cet-power.com/CET - Monitoring - User Manual - Inview GW - EN.pdf

If you want to have an overview of standard systems' parameters, you can also view the parameters in our Monitoring Emulator - https://www.cet-power.com/en/monitoring-emulator/.

Do not hesitate to use the help buttons to get more information about the parameters.