Leading AC Backup Technology

TSI NOVA - 230VAC

User Manual V7.3

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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Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
7.0	10/12/2012	-	First release of the Manual.
7.1 to 7.2	18/10/2013	-	Amendment and correction.
7.3	24/10/2016	-	Amendment and correction.

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.

2. Abbreviations

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

3. Warranty and Safety Conditions*

WARNING:

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

When installed in a dusty and/or corrosive environment, 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 understand 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 understand safety related work practices, including those by OSHA and NFPA, as well as knowing what personal protective equipment should be worn.
- All operators are to be trained to perform the emergency shut-down procedure.
- Never wear metallic objects such as rings, watches, or bracelets during installation, service and maintenance of the product.
- Insulated tools must be used at all times when working with live systems.
- When handling the system/units pay attention to sharp edges.

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

3.3 Installation

- This product is intended to be installed only in restricted access areas as defined by UL60950 and in accordance with the National Electric Code, ANSI/NFPA 70, or equivalent agencies.
- The Inverter System may contain output over current protection in the form of circuit breakers. In addition to these circuit breakers, the user must observe the recommended UL listed upstream and downstream circuit breaker requirements as defined in this manual.
- Please use extreme caution when accessing circuits that may be at hazardous voltages or energy levels.
- The modular inverter rack is a dual input power supply. The complete system shall be wired in a way that both input and output leads can be made power free.
- REG systems and EPC systems that have no AC input wired and connected can be seen as independent power sources. To comply with local and international safety standards N (output) and PE shall be bonded. The bonded connection between N (output) and PE must be removed once the AC input is connected.
- AC and DC circuits shall be terminated with no voltage / power applied.
- The safety standard IEC/EN62040-1-1 requires that, in the event of an output short circuit, the inverter must disconnect in 5 seconds maximum. The parameter can be adjusted on T2S; however, if the parameter is set at a value > 5 seconds, an external protection must be provided so that the short circuit protection operates within 5 seconds.
  Default setting is 60 seconds.
- The system is designed for installation within an IP20 or IP21 environment. When installed in a dusty or humid environment, appropriate measures (air filtering …) must be taken.

3.3.1 Handling

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

3.3.2 Surge and transients

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

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

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

3.3.3 Other

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

3.4 Maintenance

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

3.5 Replacement and Dismantling

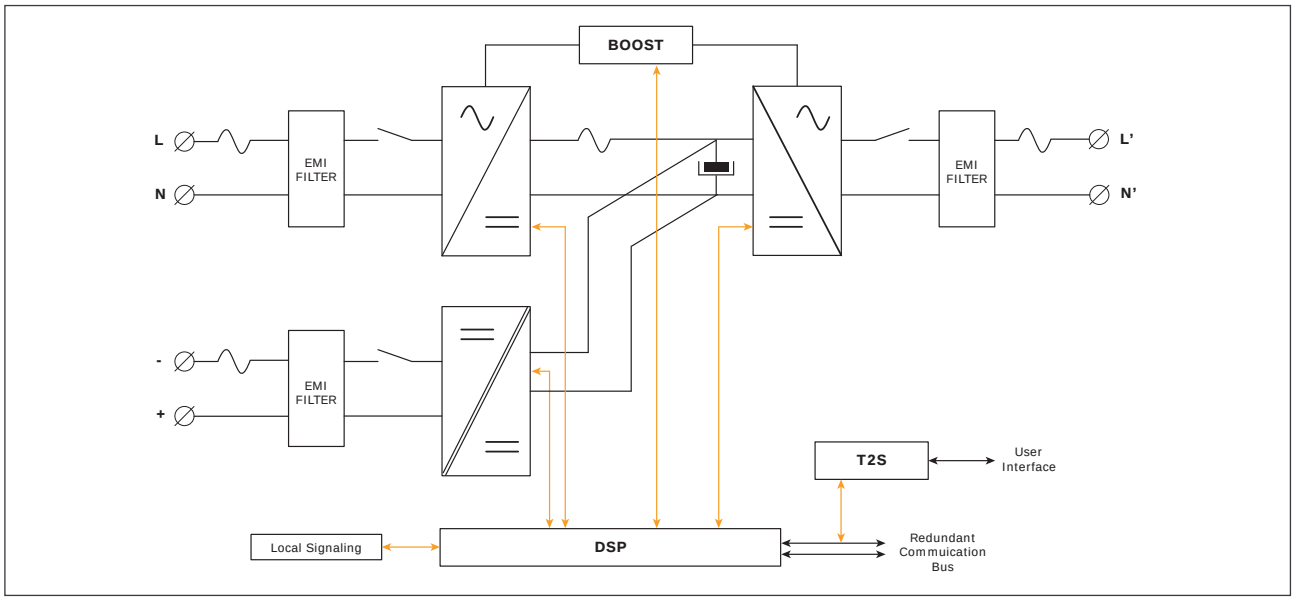
- ESD Strap must be worn when handling PCBs and open units.
- CE+T cannot be held responsible for disposal of the Inverter system and therefore the customer must segregate and dispose of the materials which are potentially harmful to the environment, in accordance with the local regulations in force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

Inverter modules carrying the TSI 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 downstream failures. The upstream breakers do not have to be oversized to prevent tripping. The overload capacity is 150% for 15 seconds.

The TSI works according to True Redundant Structure (TRS) that features decentralized and independent logic, redundant communication bus and three internal levels of disconnection to isolate a module after internal failure.

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.

* Information and data given in this chapter is intended to serve as an overview of the TSI 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 TSI 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 TSI 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 Inverter

Telecom / Datacom: -48VDC / 230VAC, 50/60Hz

- The TSI NOVA is a 750 VA/525 W triple port inverter.
- All versions available in EPC or REG.
- The TSI inverter modules are hot swappable and hot pluggable.
- The module operator interface comprises LEDs showing converter status and output power
- Inverter modules run in single phase or three phase configurations.
- The fan is equipped with an alarm and run time meter. The fan is field replaceable.
- 313 (D) x 104.5 (W) x 41.5 (H)
- 1.5 Kg

5.2 Sub-rack

- The NOVA shelf shall be integrated in min 600 mm deep cabinets, Inch/ETSI mounting.
- The NOVA shelf houses max four (4) inverter modules and one (1) monitor unit.
- The extension shelf houses max four (4) inverter modules and one (1) monitor blank.
- The NOVA shelf is designed with Common DC input, Common AC input and Common AC output.
- Optional rear cover for IP 20 in open rack
- Max 3 kVA per shelf
- 382 mm (D) x 19” (W) x 1U (H)
- 2.6 Kg empty

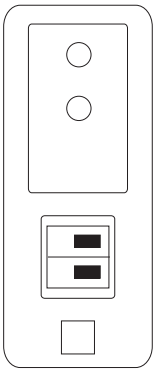
5.3 Monitor unit T1S/T2S

The T1S is the default monitor unit and T2S is the optional monitor unit for Nova pack

T2S is the default monitor unit for A la Carte; monitors max 32 inverters in one bus

The T1S provides

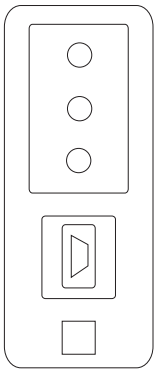
- Alarm monitoring
- 2 outgoing alarms
- 2 digital inputs
- Dip switch for local setting



T1S

The T2S provides

- Alarm monitoring
- Recording of the latest 200 events. Fi-Fo
- 3 outgoing alarms
- 2 digital inputs
- MOD bus (Default)
- CAN bus (Optional)
- USB front connector for local setting



T2S

6. Accessories

6.1 Cabinet

Powder coated (RAL 7035), 19“ welded steel sheet cabinet with 600x600 mm footprint. Cabinet designed for top cabling or bottom cabling.

- 1100 mm (600x600 mm) 21U
- 1800 mm (600x600 mm) 37U
- 2110 mm (600x600 mm) 44U

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

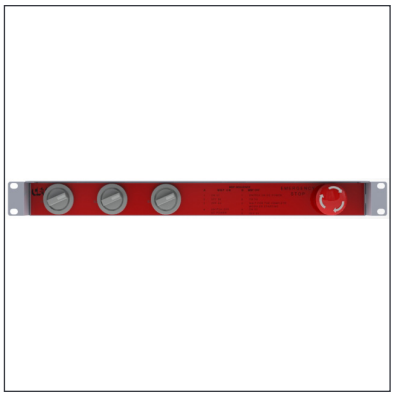
Door accessory optional.

6.2 Manual by-pass

The manual by-pass operates via manually operated switches that create a by-pass from mains input to output AC distribution. Inverter modules are by-passed and possible to remove without impacting the load. When in by-pass shelves and modules have no AC supply, DC is still present. This is maximum 20 A and only applicable up to 4.5 KVA A la Carte system/pack.

The manual by-pass is “Make before Break”

NOTE! When the system is in by-pass the load is subjected to mains disturbances.

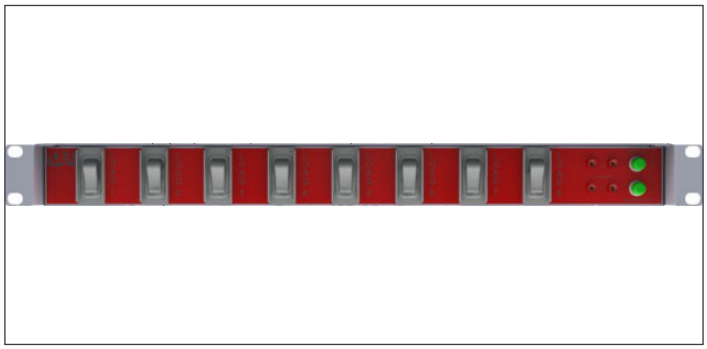


WARNING

IF AN ATS (automatic transfer switch) IS INSTALLED UPSTREAM, MAKE SURE THAT IT DOES NOT ALLOW TRANSFER BETWEEN AC SOURCES OUT OF SYNC. THE MAXIMUM ALLOWED PHASE SHIFT IS 10°.

6.3 AC distribution unit

6.3.1 Distribution Rack



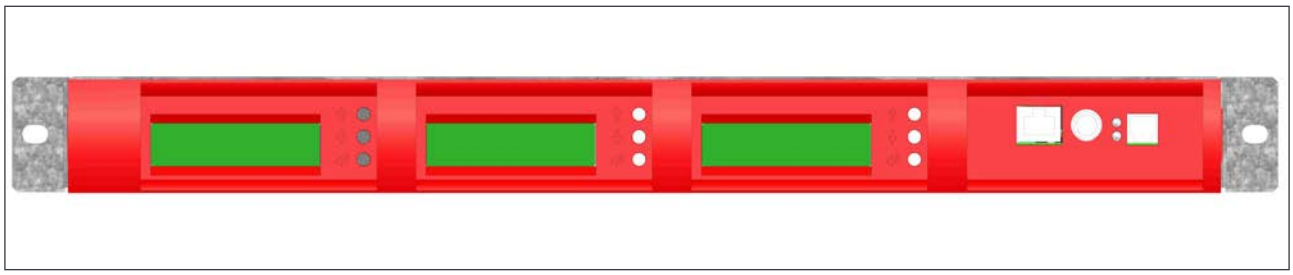
The standard AC output distribution unit is designed with a 8X6 A breaker with Lamp indication and Voltage test point

Max current per AC DU is 20 A, max current per output connector is 6 A, applicable only up to 4.5 KVA A la Carte system/pack.

Alarm for AC output breakers a inbuilt to each individual breaker is present (OF or SD). The alarm function is common and use one of the digital input on the control unit.

7. Monitoring accessories

7.1 Can Dis shelf



The CanDis shelf accommodates 1-3 display units and 1 TCP/IP agent.

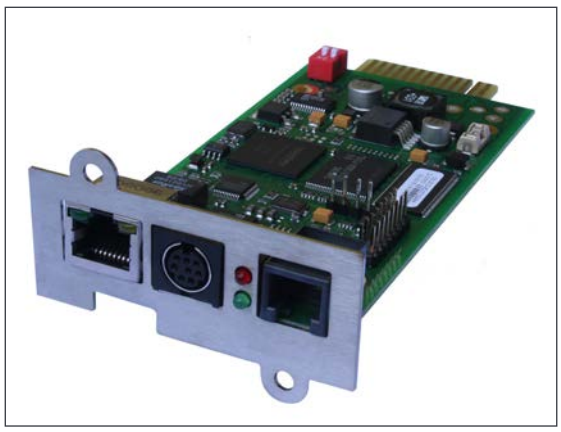
7.1.1 Display

Backlit 2 line dot matrix

The display shows two values simultaneously

7.1.2 TCP/IP Agent

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



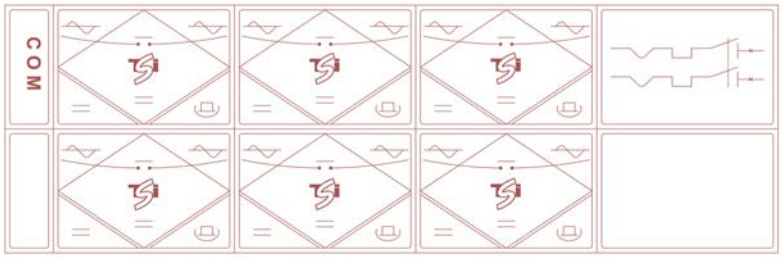
8. System Design

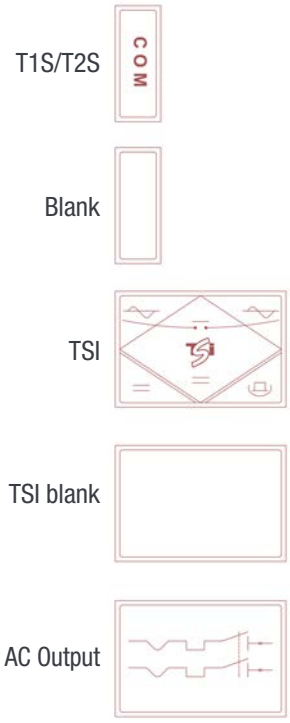
8.1 Pack / A la Carte

The systems designs are divided into two topologies.

8.1.1 Pack

The PACK is a pre-assembled and configured single phase inverter system comprising 19" inverter sub rack, inverter modules, monitor device and AC output distribution breaker.
The PACK is normally mounted in a 19" rack. A mounting kit is included in the delivery.
The PACK is only available as single phase, -48 VDC, EPC-mode.
A PACK comprises max 6 inverter modules.



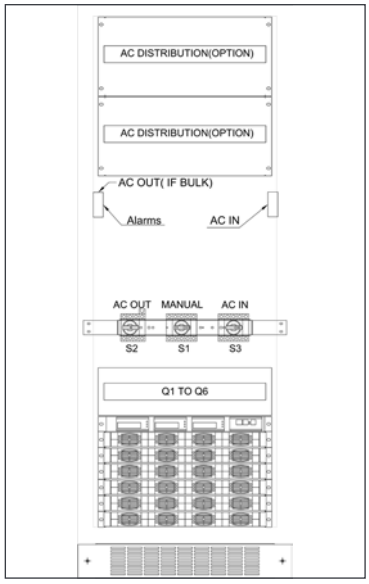


8.1.2 A la Carte

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 (T2S) and AC output distribution.

The A la Carte is available as EPC (Enhanced Power Conversion) or REG (Regular) operation.
The A la Carte (single phase) populate 1 to 24 modules, max 18 kVA
The A la Carte (three phase) populate 3 to 24 modules, max 18 kVA

- Dual input (AC and DC) inverter modules (EPC)
- 94% 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
- T2S MOD bus default, T2S CAN bus optional
- Full modularity
- Full redundancy

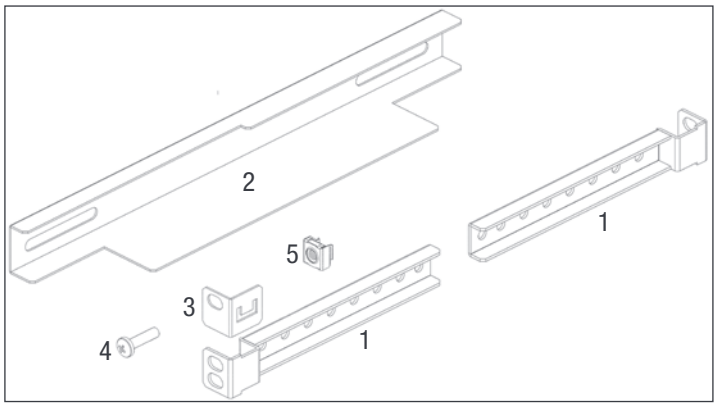


9. Installation of Nova PACK or Single shelf/shelves

- Read safety instructions prior to starting any work
- Do NOT attempt to use lifting eyes to erect the cabinet.
- System is preferably handled without modules.
- Pay attention to the module position; make sure that modules are repositioned in their original slot.
- T2S is always mounted in the first shelf, left hand position.
- In PACK the 4th inverter position (1st sub-rack) contains an output circuit breaker.
- In three phase systems modules are configured per phase 1 (A, R), phase 2 (B, S) and phase 3 (C, T). These are not interchangeable. Make sure that modules from one phase are not mixed with modules from another phase.
- The system is designed for installation in an IP20 or IP21 environment. When installed in a dusty or humid environment, appropriate measures (air filtering …) must be taken.

9.1 Mounting kit (Nova PACK or Single shelf)

The mounting guide rail is adjustable to fit different kind of cabinet depths.



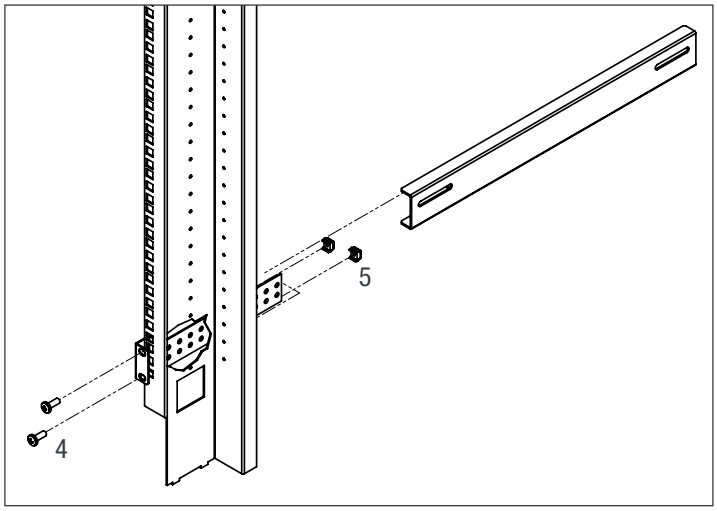
4x Fixing brackets (ref 1)

2x Slider (ref 2)

2x Mounting brackets (ref 3)

12x Mounting screws (ref 4)

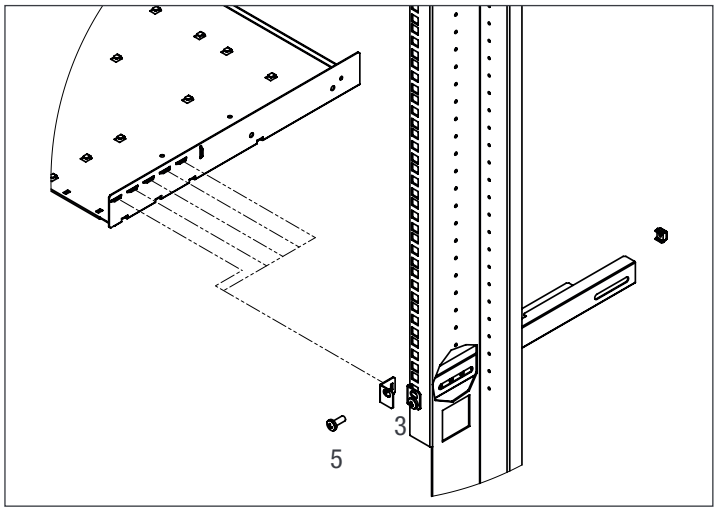
12x Cage nuts (ref 5)



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

Fix cage nuts (5) iin the cabinet front and left and the right side rear frame

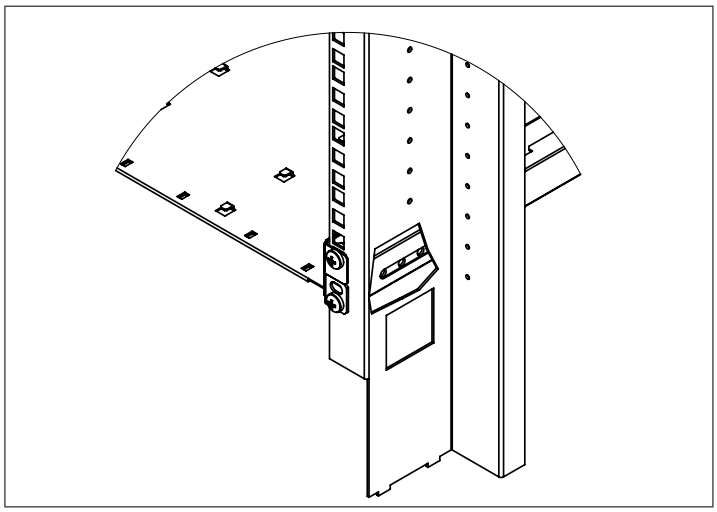
Fix the left and right cabinet slider with the supplied screws (4)



Fix cage nuts (4) in the mounting frame

Assemble the mounting bracket (3) in a suitable position.

Slide the shelf into position and fix it with the supplied screws (5)



Finished

9.2 Electrical installation (Nova PACK or single shelf)

9.2.1 Prerequisites

- The sub – rack has markings for all terminations.
- All cables shall be rated at min 90 deg C.
- Electrical terminations shall be tightened to 3 Nm
- All connection screws are M4 x 12 mm
- DC Input-Common (per shelf); 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 at 90 degree angles.

9.2.2 Surge suppression

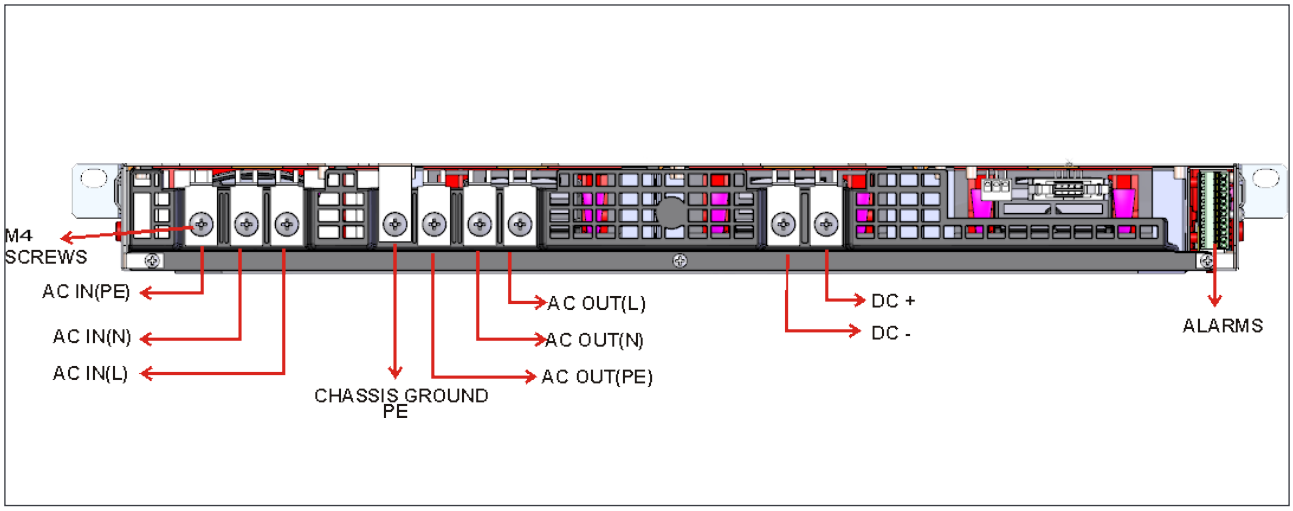
The mains (AC) supply of the modular inverter system shall be fitted with Lightning surge suppression and Transient voltage surge suppression suitable for the application at hand. Manufacturer's installation recommendations shall be followed. Selecting a device with alarm relay for function failure is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

9.2.3 Terminations

All terminations are clearly marked.



9.2.4 Grounding

"PE CHASSIS GROUND"

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

9.2.5 DC input

	CB per shelf	Cable, min	Connector	Torque
-48 VDC Nova pack	50 A	2 x 10 mm^2	M4	3 Nm

9.2.6 AC input

	Cable, min	Connector	Torque
230 VAC	3 x 1.5 mm^2	M4	3 Nm

To be EMC A class, the provided ferrite must be installed on the AC input (grid) side (see attached picture). Both “L” and “N” input wires have to go twice through the ferrite (loop).

One ferrite is mandatory by shelf.

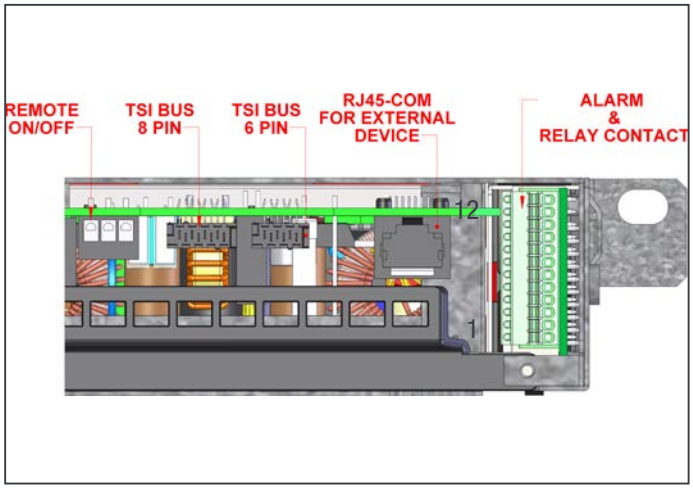
Ferrite will not be integrated in REG operation.

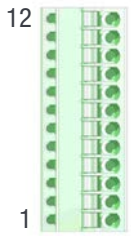
When two (2) shelves are fed from the same grid, the 2 provided ferrites must be installed in series with single pass through “L” and “N” wires (no loop).

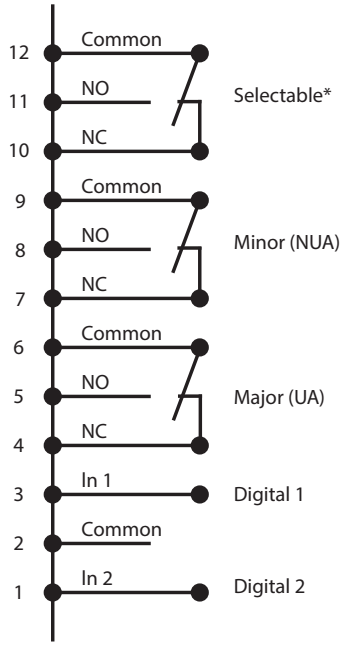
9.2.7 AC output

	CB per pack	CB per shelf	Cable, min	Connector	Torque
Nova pack Single shelf	2p 10 A		3 x 1.5 mm²	M4	3 Nm
Nova pack Double shelf	2p 20 A		3 x 2.5 mm²		
230 VAC		2p 16 A	3 x 1.5 mm²		

9.2.8 Signalling







Relay characteristics (Selectable, Major, Minor)

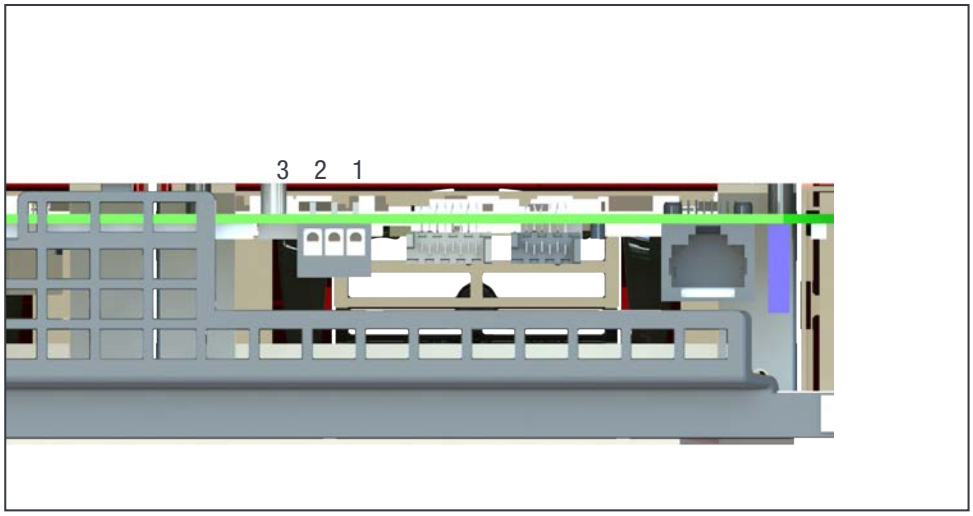
- Switching power 60 W
- Rating 2 A at 30 VDC / 1 A at 60 VDC
- Max wire size 1mm²

Digital input characteristics (Digital In 1 / 2)

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

9.2.9 Remote ON/OFF

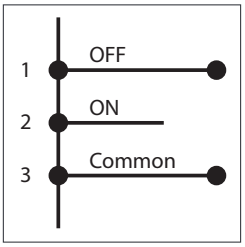
Notice: The shelf is by default equipped with a connection between pins 3 and 2. If remote ON/OFF is not used the strap shall remain in all connected shelves. Should the remote ON/OFF be used, all straps must be removed and replaced in one (1) shelf with a changeover contact or emergency button.



- 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 transitions are detected.

Relay 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)

9.2.10 Internal Bus (TSI Bus 6 pin / TSI Bus 8 pin)

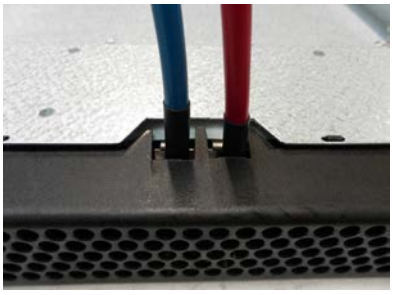
- In PACK/A la Carte systems the internal bus is pre-installed.
- The internal bus comprises a 6 pole ribbon cable and an 8 pole ribbon cable.
- The internal bus connectors are sensitive and special caution should be taken during installation to keep them out of harm's way.
- The internal bus is connected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

9.2.11 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 cables

Cut holes to allow cable access



Clip rear cover into place

10. Installation of cabinet (A la Carte)

10.1 Unpacking the system

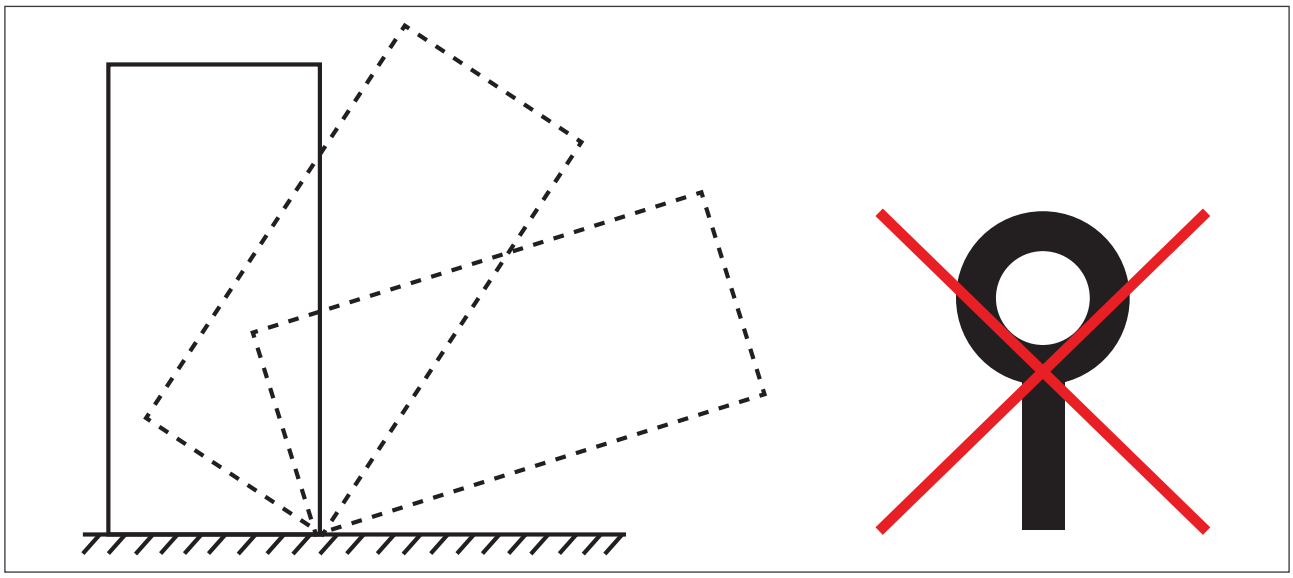
The cabinet is packed in a wooden box.

The packing material of the TSI system is recyclable.

Transport the cabinet in the box on the pallet.

10.2 Raising the cabinet

The top cover fixing bolts must NOT be replaced with lifting eye bolts. Mark and remove modules from the cabinet, that the modules can be replaced in the same slot, and raise the cabinet on location.



10.3 Fixing the cabinet to the floor

The cabinet is fixed through the base of the cabinet.

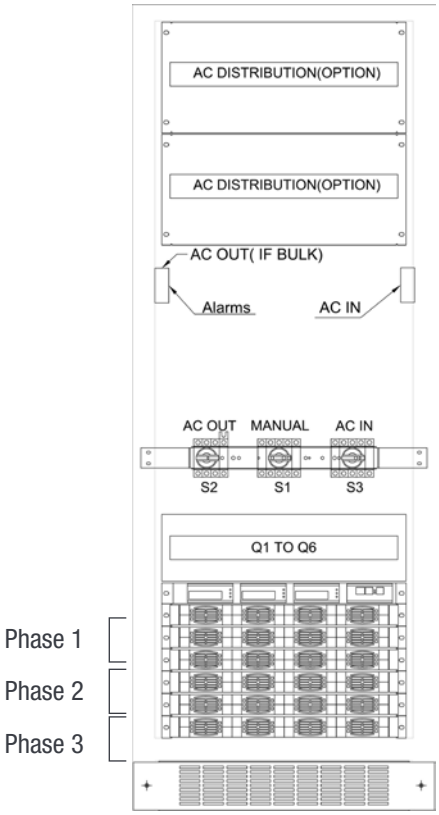
Remove lowest front cover to gain access to the fixing holes.

Max screw diameter is 22 mm. See Hole pattern, foot print for foot print measurements.

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 done in 90 deg angles.
- Empty inverter positions shall be covered with blanked off.

10.4.1 Positioning



AC Output distribution (X4)

DC Input (X1) / AC input (X2) / Alarm (X3) / Digital in (X5), Remote ON/OFF (X6), Bulk AC output (X4)

Manual by-pass (S2, S1, S3)

Internal DC distribution (Q1-Q6)

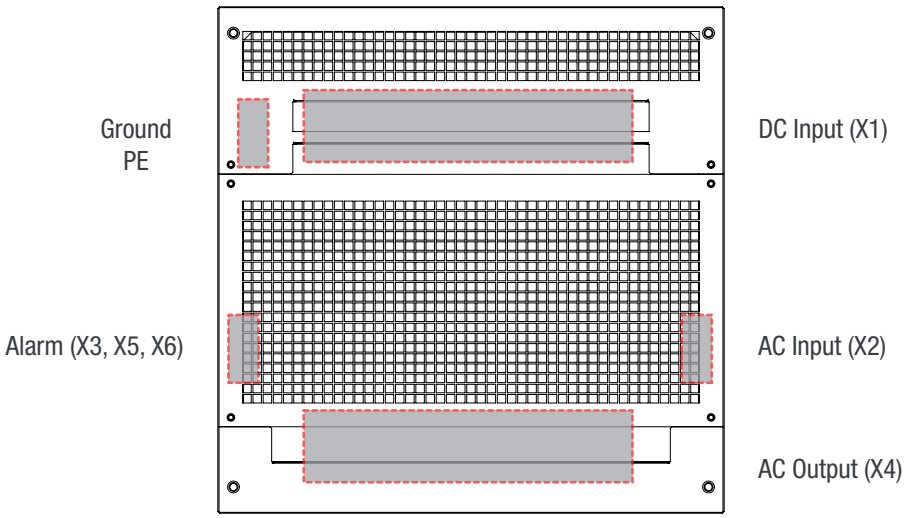
CanDis shelf (Option)

Phase 1
Inverter sub rack
Inverter modules

PLEASE! Refer to the technical drawings received with your cabinet for exact 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.



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.

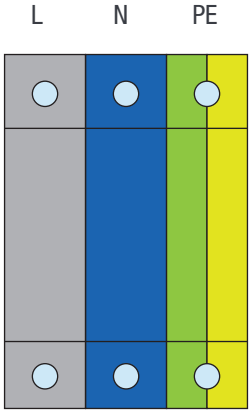
According to local regulations, Min 16 mm^2.

10.4.4 AC Input (X2)

The AC input is wired to a screw terminal.

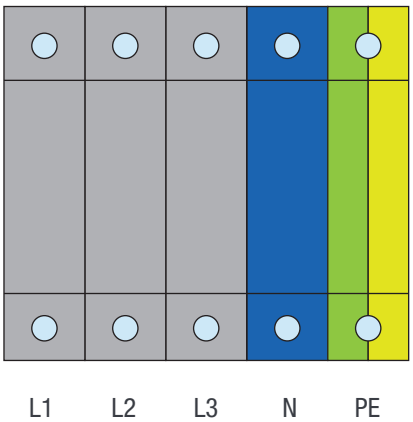
Max cable area is 16 mm^2

10.4.4.1 Single phase



10.4.4.2 Three phase

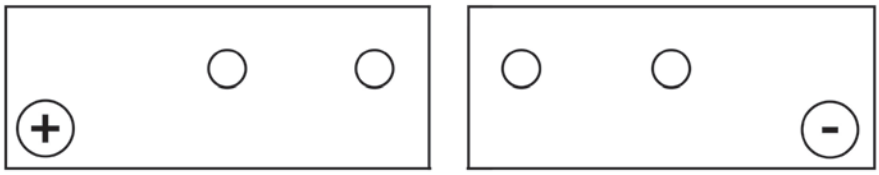
NOTE: The three phase input is 123, ABC, RST phase sensitive; clockwise rotation is recommended. Phase one starts at 0° phase shift, while the other phases will be at -120° phase shift and +120° phase shift resulting in three phase output.



10.4.5 DC input (X1)

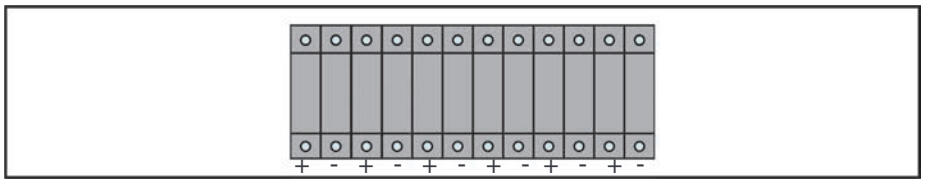
10.4.5.1 Bulk input

- Common DC input per system.
- Note: Screws and nuts are not included in the delivery.
- M12 holes
- Internal DC distribution with circuit breakers (Q01-Q6) per inverter shelf.
- Max 2x240 mm² per pole



10.4.5.2 Individual input

- Individual DC input per shelf and return.
- Max 16 mm² per connection terminal.



10.4.6 Connection Table – AC Input (X2)

The AC input supply breaker shall be 2p (for single phase) and min 3p (for three phase)

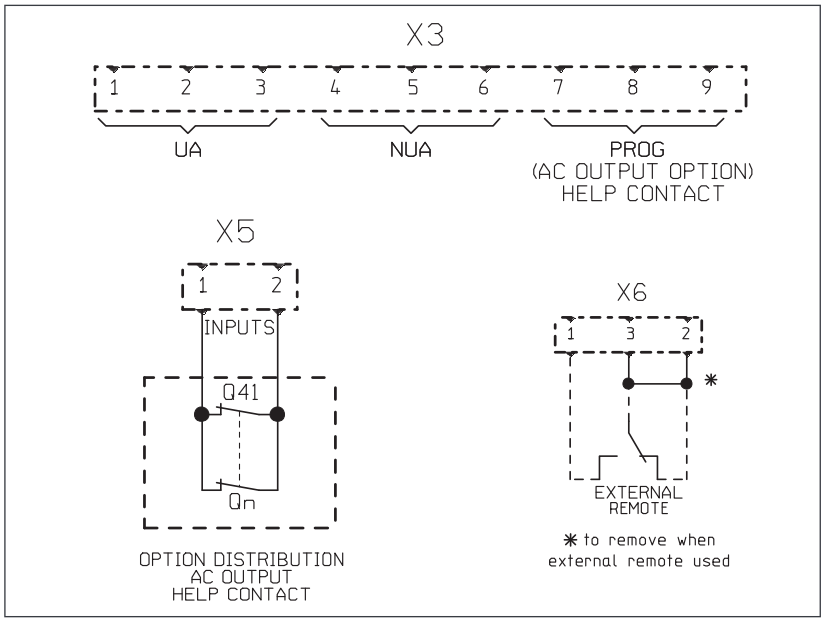
Power (kVA)		AC Input	
		Screw terminal	
1ph	3ph	Fuse/CB	Min Cable mm²
3		16 A	1.5
6		25 A	2.5
9		40 A	6
	9	3x16 A	3x1.5
12		50 A	10
15		63 A	10
18		80 A	16
	18	3x25 A	3x2.5

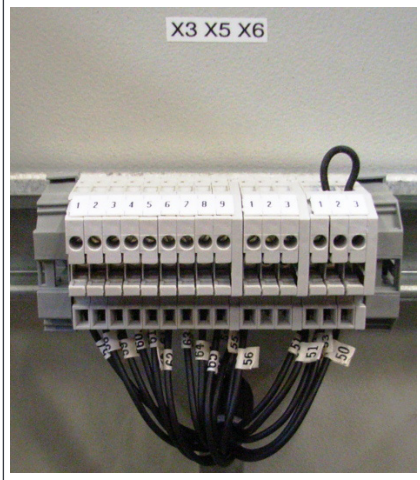
10.4.7 Connection Table DC Input -48VDC (X1)

Power (kVA)		DC Input Bulk		DC Input individual	
		Cable lug		Screw terminal/cable lug	
1ph	3ph	Fuse/CB	Min Cable mm²	Fuse/CB	Min Cable mm²
3		63	16		
6		125 A	35	63 A	Live: Screw terminal 10 mm² Common: Cable lug. M4-3 Nm torque
9		200 A	95		
	9				
12		250	120		
15		350 A	240		
18		400 A	240		
	18				

10.4.8 Signalling

All relays are in non energized position





10.4.8.1 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

10.4.8.2 Digital In (X5)

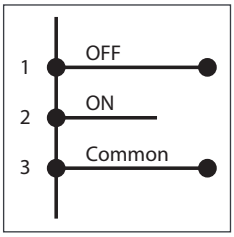
- Input characteristics X5 (Digital In 1, Digital In 2)

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

10.4.8.3 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 transitions 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)

10.4.8.4 Forced start

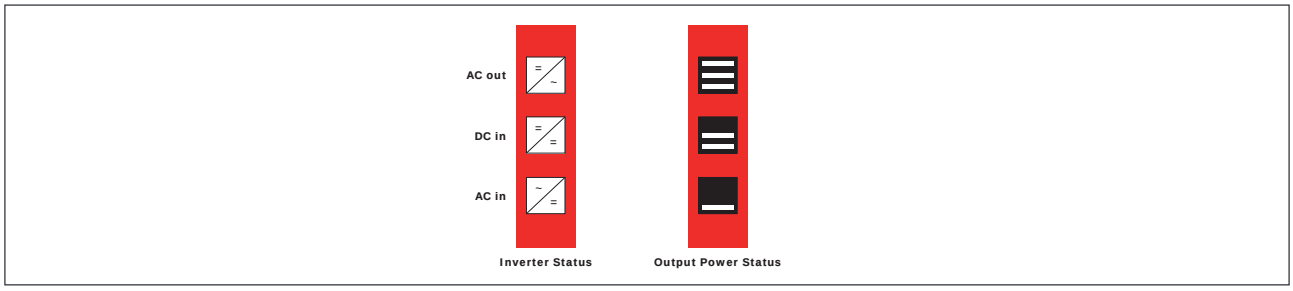
Initial system start must be performed with an operational T2S. If the T2S is missing at start-up the modules will fail to start.

The following sequence of the Remote ON/OFF will force the system to start without the T2S

#3 ==> #2 ==> #3 will force the modules to start.

11. Interface

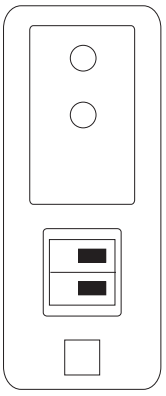
11.1 Inverter module



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

Output Power (redundancy not counted)						
<5%	5% to 40%	40 to 70%	80 to 95%	100%	100% = overload	Output Power (redundancy not counted)
×	×	×	≡	≡	≡	Status output power LED
×	×	=	=	=	=	
—	—	—	×	—	—	
1B	1P	2P	2P	3P	3B	Behavior (B = blinking – P = permanent)

11.2 T1S



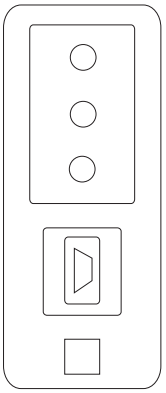
- Alarm indication on T1S (Urgent / Non Urgent / Configurable)
  - Green: No alarm
  - Red: Alarm
- Outgoing alarm relay delay
  - Urgent 60 seconds delay
  - Non urgent 30 second delay
- Parameter setting with DIP1 and DIP2.
- If inverters are removed for shorter or longer time the T1S must be reset to display valid alarms, unplug T1s and reinsert for a reset.
- Parameter set up (other than factory default) requires the use of T2S as an installation tool, see System set up
- In three phase applications replacement and extension inverter modules must be configured T2S

	Category	Left position	Right position
DIP 1	Digital in detection	Open for active	Close for active
DIP 2	Redundancy	No Redundancy	Redundancy

11.2.1 T1S alarm

	Description	Type
1	Redundancy plus one inverter lost by	Major
2	TSI Bus defect	Major
3	Incompatability parameter	Major
4	Main source lost (see configuration done by T2S)	Major
5	At least one digital input activated (*2)	Major
6	Redundancy lost	Minor
7	Secondary source lost	Minor
8	At least one invert in alarm	Minor

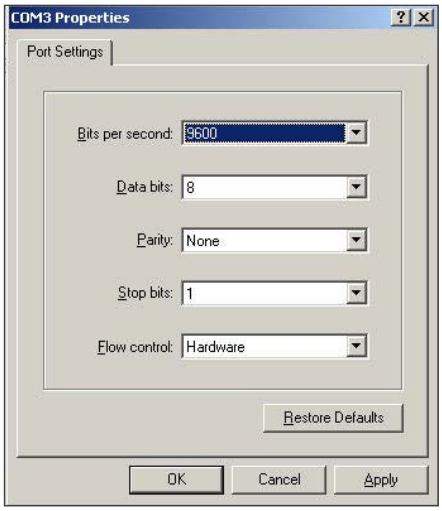
11.3 T2S



- Alarm indication on T2S (Urgent / Non Urgent / Configurable)
  - Green: No alarm
  - Red: Alarm
  - Flashing: Exchanging information with inverters (only Configurable alarm)
- Outgoing alarm relay delay
  - Urgent 60 seconds delay
  - Non urgent 30 second delay
- Parameter setting via Laptop or Copy/Paste.
- Factory default according to list of set values, see Table of set values

12. System set up

- Parameter set up requires HyperTerminal installed on laptop
- USB cable type A to B (not included)
- T2S driver “CET_T2S.inf“installed on laptop.
- Available for download at http://www.acbackuptsi.com
  - Username: T322010000
  - Password: No password required (enter)
- Read T2S manual for detailed setup



12.1 Communication settings

- Bits per second 9600
- Data bits 8
- Parity None
- Stop bits 1
- Flow control None

12.2 Menu access

Root Menu

- 1 > System configuration
  - 0 > Return to previous menu
  - 1 > Send config file to T2S
  - 2 > Read config file from T2S
  - 3 > Restore default settings (not available since version 2.5)
  - 4 > Restore factory settings (not available since version 2.5)
- 2 > System information's selection
  - 0 > Return to previous menu
  - 1 > Module information's
    - 0 > Return to previous menu
    - 1 > Variables set 1
    - 2 > Variables set 2
    - 3 > Variables set 3
    - 4 > Variables set 4
    - \+ > Next page
    - \- > Previous page
  - 2 > Phase information
    - 0 > Return to previous menu
    - 1 > Variables set 1
    - 2 > Variables set 2
    - 3 > Variables set 3
  - 3 > Groups information
    - 0 > Return to previous menu
    - 1 > Display AC group information
    - 2 > Display DC group information
  - 4 > Alarms information
    - 0 > Return to previous menu
    - 1-1 > Page selection
  - 5 > History of the log display
    - 0 > Return to previous menu
    - 1-14 > Page number selection
    - 16 > Clear log
    - 17 > Save log to a file
  - 6 > Module errors information
    - 0 > Return to preceding menu
    - 1-32 > detailed Modules errors
- 3 > System actions selection
  - 0 > Return to previous menu
  - 1 > System actions
    - 0 > Return to index
    - 1 > Turn ON system
    - 2 > Turn OFF system
    - 3 > Change Date and time setting
  - 2 > Inverter Module action
    - 0 > Return to previous menu
    - 1-4 > Page number selection
    - 5 > Identify selected Module
    - 6 > Turn ON selected Module
    - 7 > Turn OFF selected Module
    - 8 > Change address of sel. Module
    - 9 > Change phase of selected Module
    - 10 > Automatic address assignment
    - 11 > Change DC group of selected Module
    - 12 > Change AC group of sel. Module
    - 13 > Notify changed fan of sel. Module
    - \+ > Increment selector
    - \- > Decrement selector
  - 3 > T2S actions
    - 0 > Return to index
    - 1 > Force refresh of configuration texts and constants
    - 2 > Force refresh of events description texts
- 4 > Security Access
  - 0 > Return to index
  - 1 > Enable Password protection

13. Inserting/removing/replacing modules

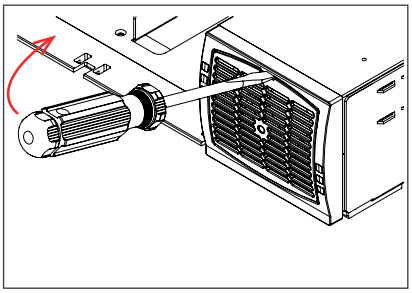
13.1 TSI Inverter

- The TSI 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.

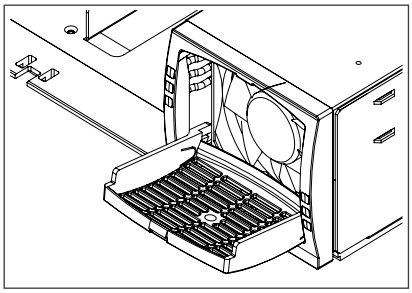
13.1.1 Removal

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

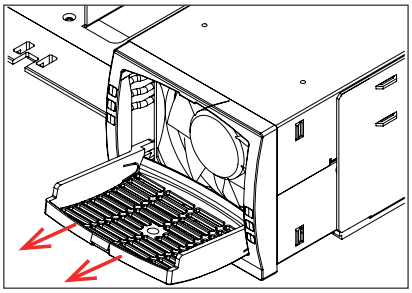
- The inverter module is not switched off when opening the handle. The handle only fixes the module to the shelf.
- Use a screwdriver to release the handle latch.
- Open the handle and pull the module out.
- Replace with a new module or blanking unit.



A) Use screwdriver to release the latch



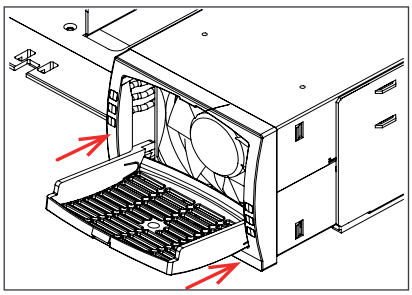
B) open the cover completely



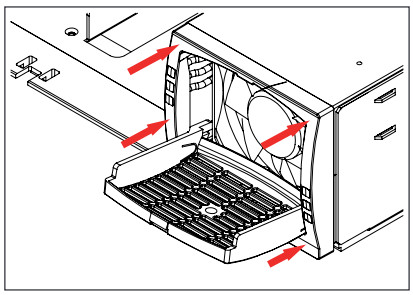
C) Use the cover as a handle to remove the module

13.1.2 Inserting

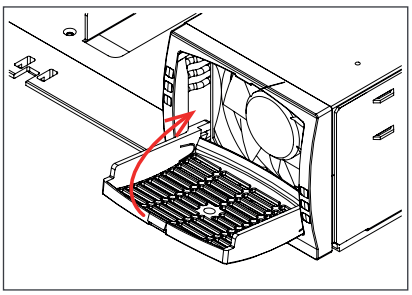
- Check module compatibility (DC Voltage!).
- Use a screwdriver to release the handle latch.
- Open the handle and push firmly until the unit is properly connected.
- Close the cover and latch in position.



A) Slide the module in



B) Push firmly till the connection is properly engaged

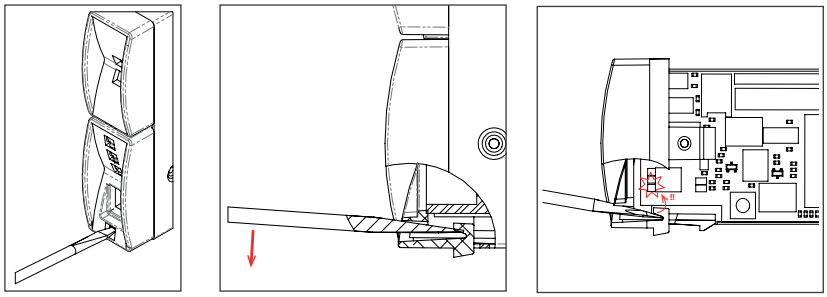


C) Close the cover and latch the module in place if too hard redo step B

13.2 T1S/T2S

13.2.1 Removal

- Use a small screw driver to release the latch keeping the T1S/T2S in position.
- Take care when inserting screw driver in T1S. If tip is not well engaged, there is a chance to damage dip switches
- Pull the module out.



13.2.2 Inserting

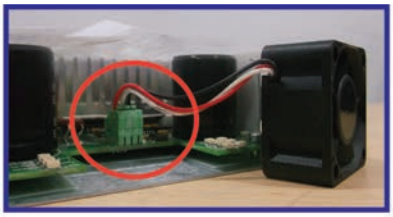
- Push the module firmly in place until the latch snaps into position.

13.3 Fan replacement

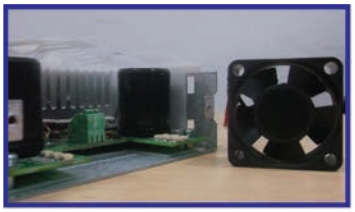
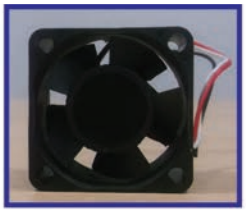
The FAN life is approximately 60,000 (Sixty Thousand) hours. The inverter modules have fan runtime meters and fan failure alarm. Fan failure can result from a failing fan or driver circuit.

1. Unplug the module from the system and let it rest at least 5 minutes prior to initiating work.
2. Remove the front cover by depressing the latches on all four sides of the module using a flat screwdriver.
3. Unscrew the four Torx screws (Two Torx screws in the front and two Torx screws at the rear).

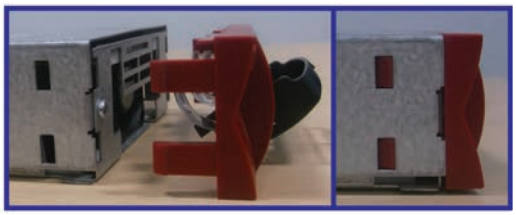
4. Open the top cover of the module.
5. Please note the position of the small plastic sheet on the front side of the module.
6. Remove the faulty fan from the module.
7. Disconnect fan wire from the terminal, by gently pushing with the tip of a small screwdriver on the green protuberance.



8. Take a new fan.
9. Connect the fan wire to the terminal by gently pushing on the green protuberances with the tip of a small screwdriver.

10. Put the fan in place.
11. Close the top cover of the module and tight the all four Torx screws (Two Torx screws in front and two Torx screws at rear).
    Note: Place the Mylar sheet (plastic cover) in exact position before tightening the Torx screws at front side of the module.
12. Place the front cover and push gently, make sure the front cover latch is locked properly.



13. Insert the Nova module back in its slot in the cabinet and let it start.
14. Check if the new fan starts to operate.*
15. Access T2S and reset the fan run time alarm from within the action menu.
16. Once the FAN is replaced and module installed back in your system, You will need to clear the FAN alarm of the module. This can be done through the T2S menu 3 Action then 2 inverter action then 13 Notify change FAN.
17. Refer to T2S manual for more details.

* If the fan does not start, go once more through the procedure. If the problem persists, try with another new fan. Still problem persists, sent the module back for repair.

14. AC output distribution

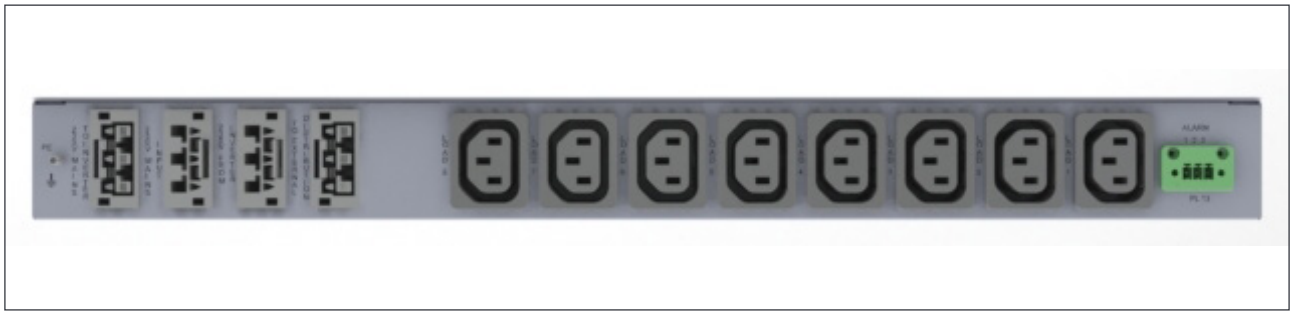
14.1 DU connection installation/removal

Output connection is provided with 8 IEC connector which is connected to each 6A rated breaker

IEC connector can be plugged in for the output connection of load cable

Unplugged for removing output connection

Switch breaker ON



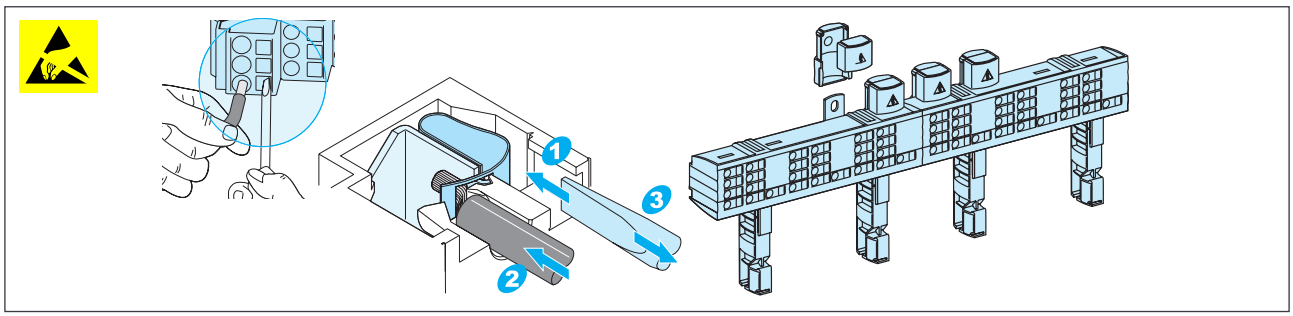
14.2 Miniature Circuit breaker installation/removal

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



15. Manual By-pass

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.

15.1 Prerequisites

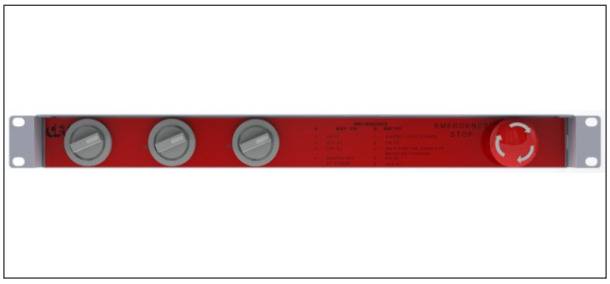
Commercial AC power must be present, and the inverter must be synchronized with it, before operating MBP. The upstream commercial breaker must be correctly sized to accept the overload, and if the AC is supplied by a Gen-set, the minimal required power will be twice the nominal power of the inverter.

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

15.2 Single Phase systems

15.2.1 Manual by-pass <4.5kVA



15.2.1.1 Normal to By-pass

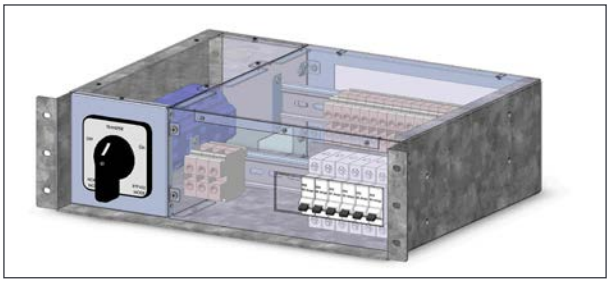
1. Turn switch S1 to ON
2. Turn switch S2 to OFF
3. Turn switch S3 to OFF
4. Switch DC OFF

Please note that instructions is printed in text (English) on front of MBP

15.2.1.2 By-pass to Normal

1. Switch DC ON
2. Turn switch S3 to ON
3. PAUSE: Wait until the inverter modules reach full operation and have synchronized (30-60 seconds)
4. Turn switch S2 to ON
5. Turn switch S1 to OFF

15.2.2 Manual by-pass 4.5kVA to 20 KVA



15.2.2.1 Normal to By-pass

1. Turn switch to ON passing intermediate
2. Switch DC OFF

15.2.2.2 By-pass to Normal

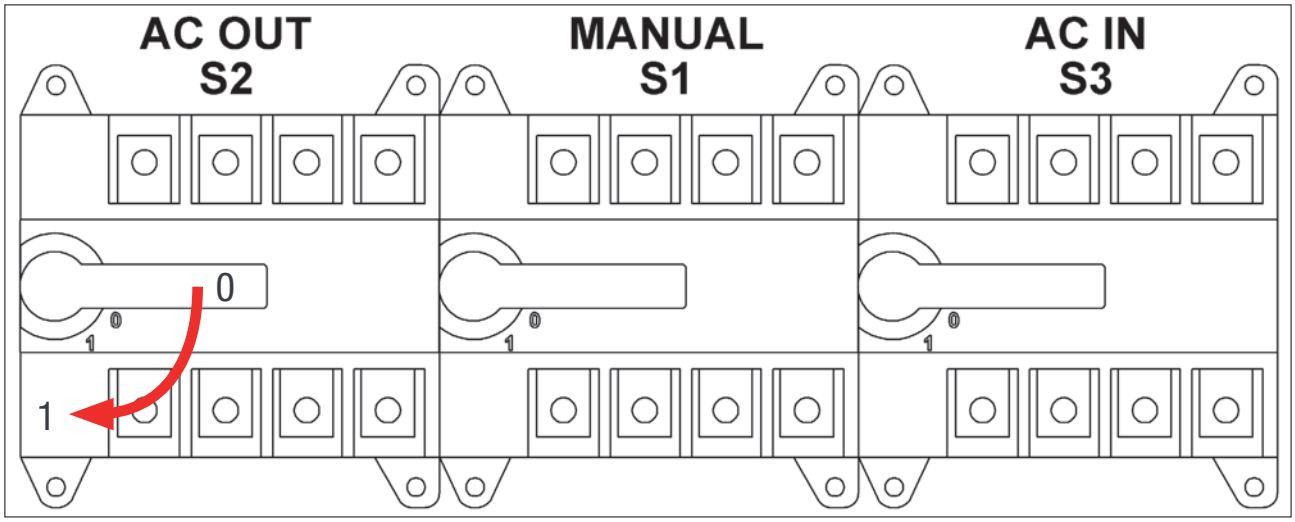
1. Switch DC ON
2. Turn switch to INTERMEDIATE (mid position)
3. PAUSE: Wait until the inverter modules reach full operation and have synchronized (30-60 seconds)
4. Complete twist to OFF

15.2.3 Manual by-pass >20kVA

The manual by pass operates via three individual switches (S2, S1 and S3). It creates a by-pass from the mains input to the output AC distribution. Inverter modules are by-passed, allowing disconnection without impacting the load.

15.2.3.1 Normal to By-pass

1. S1: 0 ⇨1
2. S2: 1 ⇨0
3. S3: 1 ⇨0
4. DC OFF



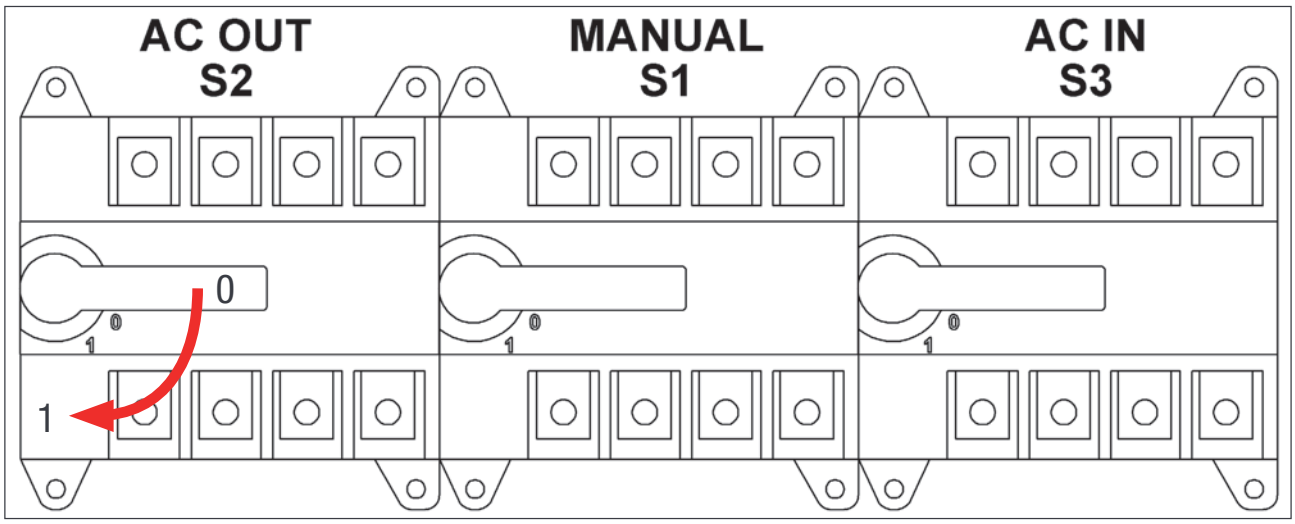
15.2.3.2 By-pass to Normal

1. DC ON
2. S3: 0 ⇨1
3. PAUSE: Wait until the inverter modules reach full operation (30-60 seconds)
4. S2: 0 ⇨1
5. S1: 1 ⇨0

15.3 Three Phase systems

15.3.1 Manual by-pass

The manual by pass operates via three individual switches (S2, S1 and S3). It creates a by-pass from the mains input to the output AC distribution. Inverter modules are by-passed, allowing disconnection without impacting the load.



15.3.1.1 Normal to By-pass

1. S1: 0 ⇨1
2. S2: 1 ⇨0
3. S3: 1 ⇨0
4. DC OFF

15.3.1.2 By-pass to Normal

1. DC ON
2. S3: 0 ⇨1
3. PAUSE: Wait until the inverter modules reach full operation (30-60 seconds)
4. S2: 0 ⇨1
5. S1: 1 ⇨0

16. Finishing

- Make sure that the sub-rack/cabinet is properly mounted in 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 comply with recommendations and local regulations
- Make sure that all cables are strain relieved.
- Make sure that all breakers comply with recommendations and local regulations.
- Make sure that DC polarity complies with marking.
- Re-tighten all electrical terminations.
- Make sure that no inverter/controller positions are left open.
- Cover empty inverter positions with blanks.
- Make sure that the Remote ON/OFF is wired appropriately for local regulations.
- Make sure that the point of AC supply meets local regulations.

17. Commissioning

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

Installation and commissioning must be done and conducted by trained people fully authorized to do so. Performing any isolation test is prohibited without instructions from the manufacturer.

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

17.1 Check list

DATA	
Date	
Performed by	
Site	
System serial number	
Module serial numbers	
T1S/T2S serial number-Specify T1S/T2S	
ACTION	**OK/ N.OK**
Unplug all inverters except one inverter per phase (Just pull the inverter out from the shelf, to break electrical contact)	
Check the commercial AC power before closing the AC input breaker	
Switch the commercial AC ON	
Check if inverters are working (Green LED)	
Check the DC power supply and switch the DC breakers ON	
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 to site conditions (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 alarms 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)	

18. Trouble Shooting and Defective Situation Resolution

18.1 Trouble Shooting

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

19. Maintenance

Maintenance shall only be performed by properly trained people.

19.1 Access T2S with lap top

- Download system LOG FILE and save
  - Analyze log file and correct errors
- Download system CONFIGURATION FILE and save
  - Check/correct configuration file according to operating conditions
  - Check/correct alarm configuration
- Check module internal temperature for deviation between modules
  - Temperature deviation may indicate buildup of dust. Clean with compressed air.
- 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 to see which actions will generate alarm

19.2 Manual check

- Validate input voltage (AC input, DC input, AC output) with multi-meter
- Replace dust filter
- Take a snap shot of the cabinet

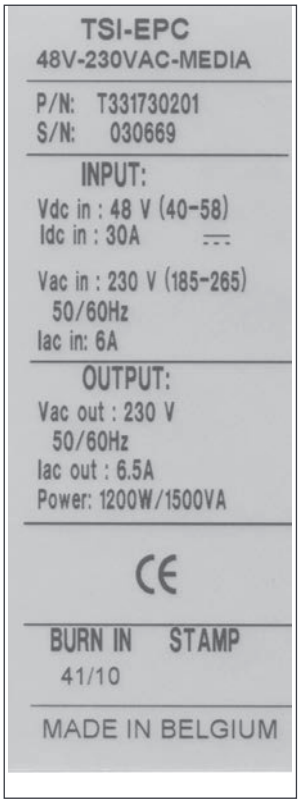
19.3 Optional

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

19.4 Manual by-pass

- If mains failure occurs during operation, the load is lost
- Perform a manual by-pass operation

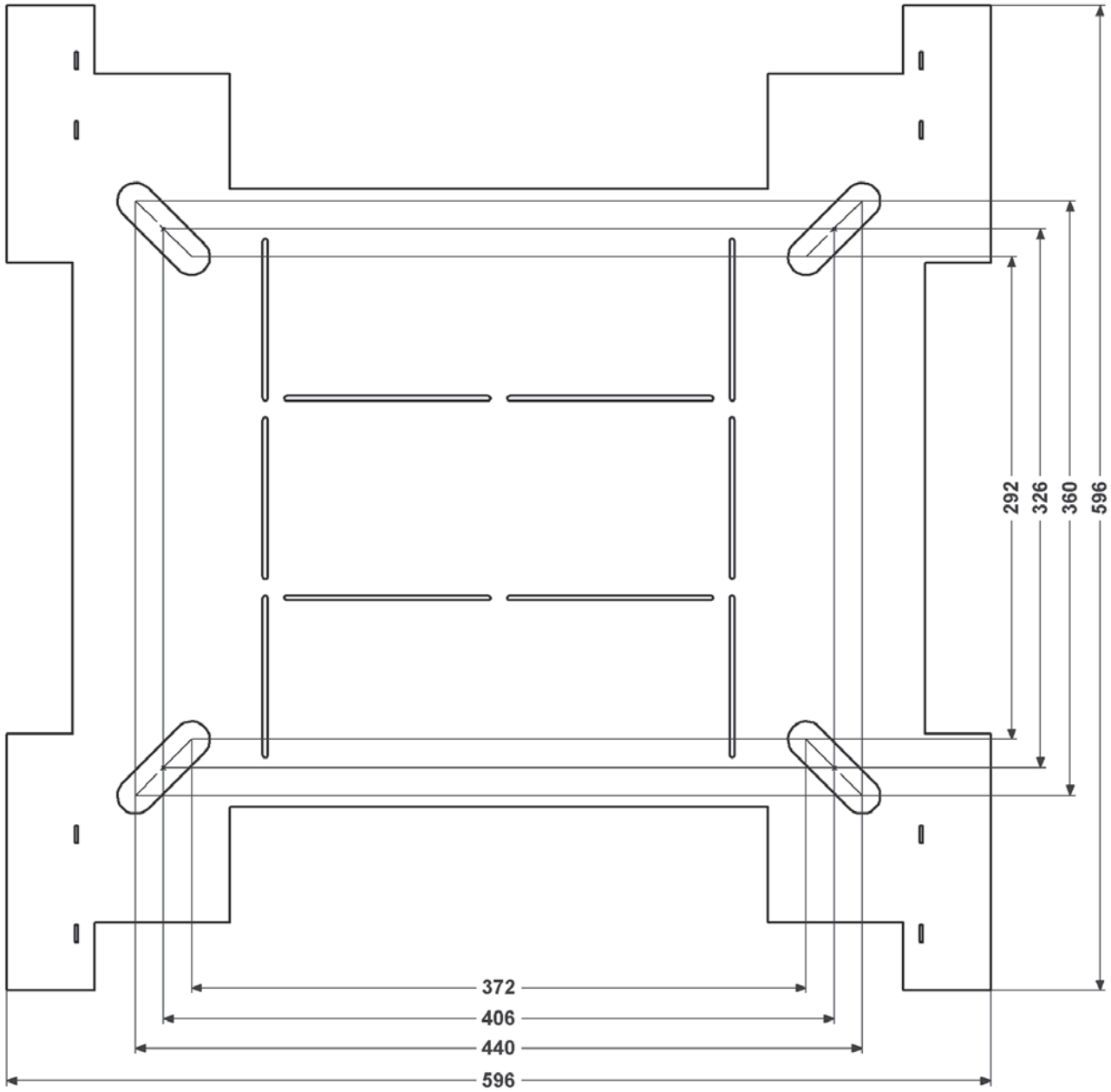
20. Defective modules



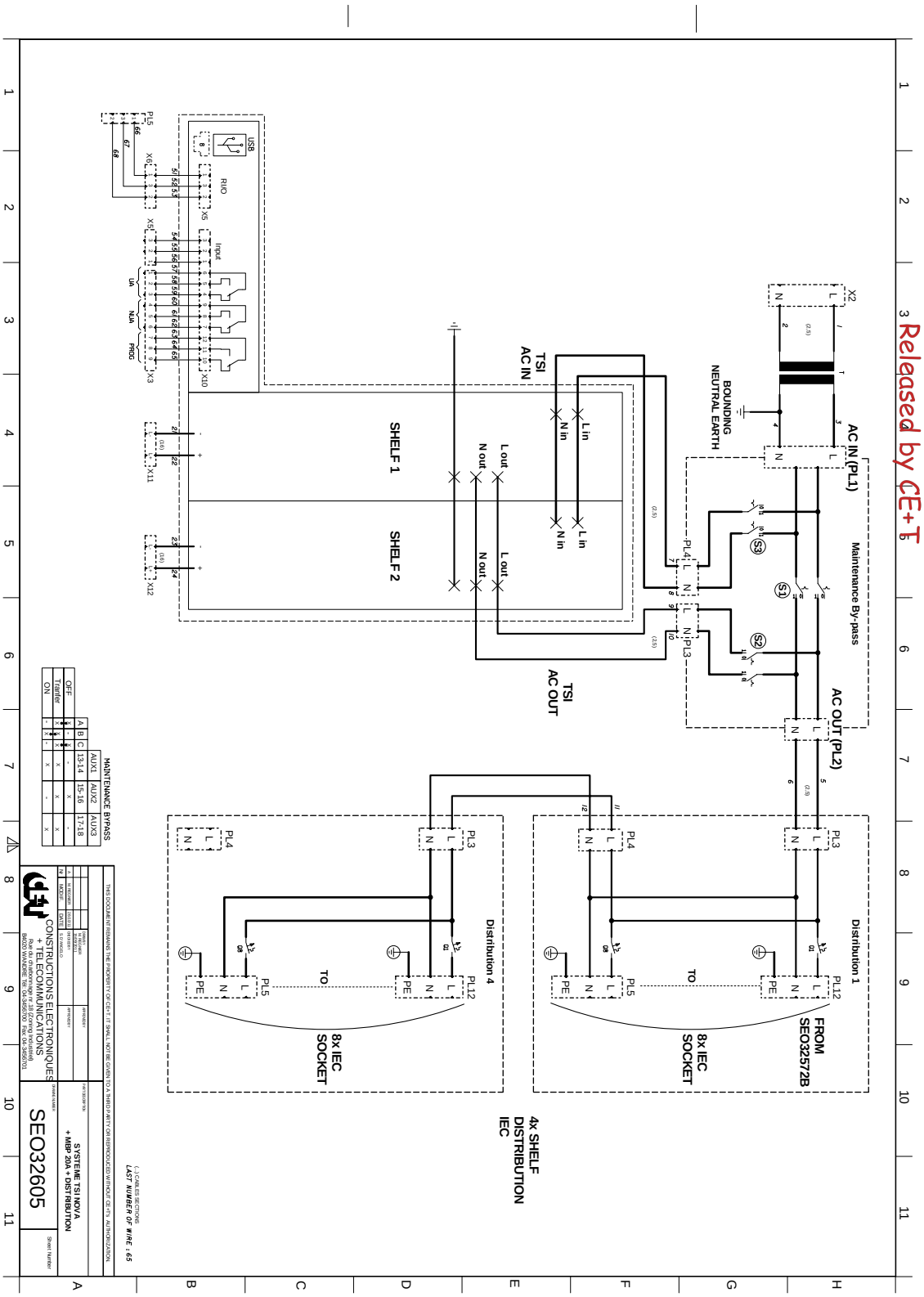
- A repair request should follow the regular logistics chain:
  End-user => Distributor => CE+T Power.
- Before returning a defective product, a RMA number must be requested through the http://my.cet-power.com extranet. Repair registering guidelines may be requested by email at repair@cet-power.com.
- 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)

21. Appendix

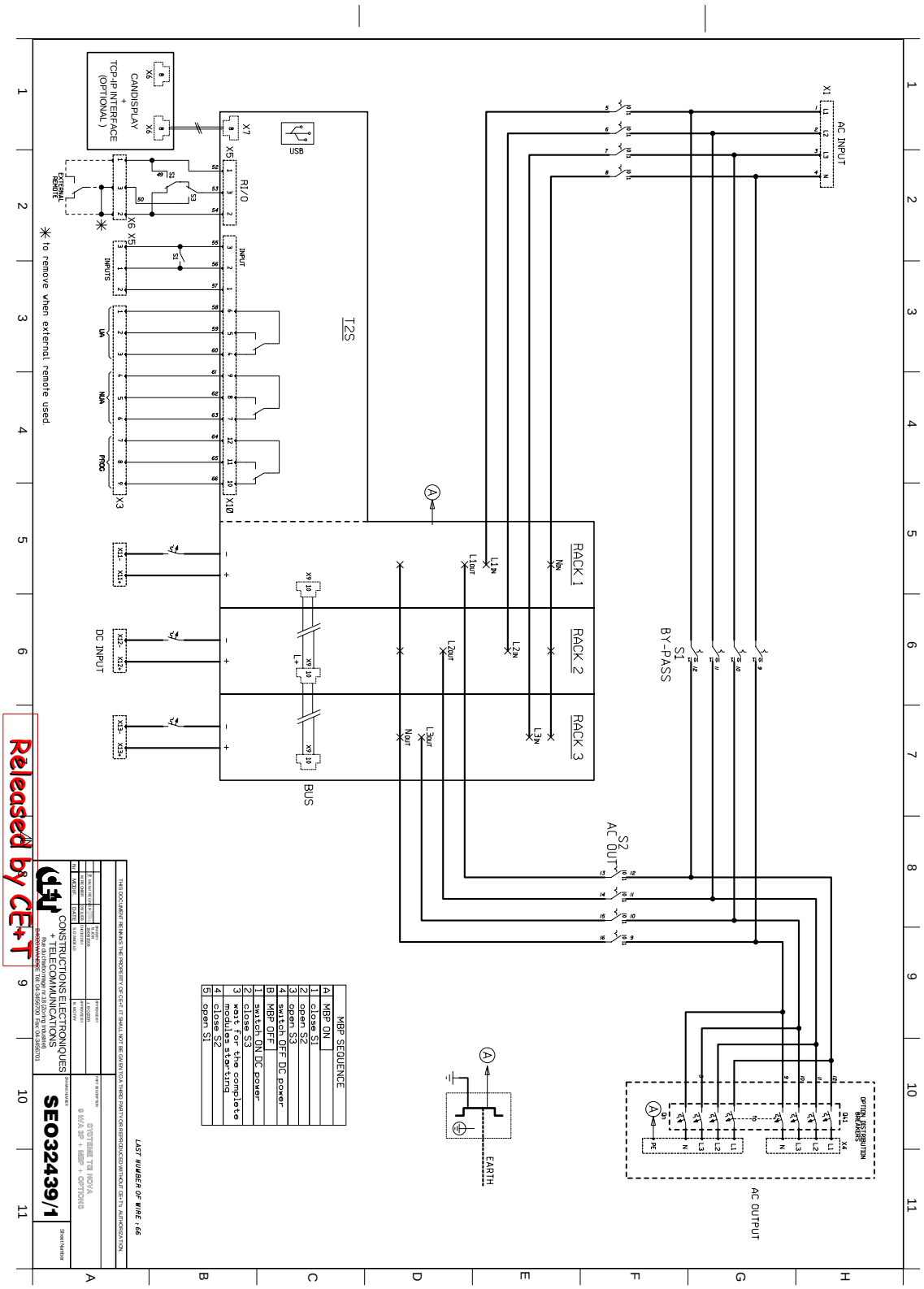
21.1 Cabinet foot print, layout



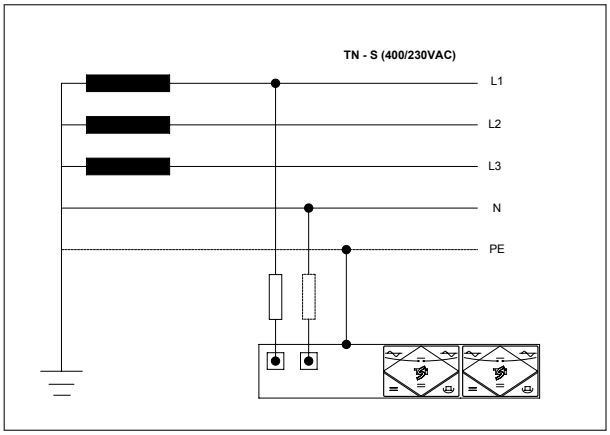
21.2 Single phase circuit diagram

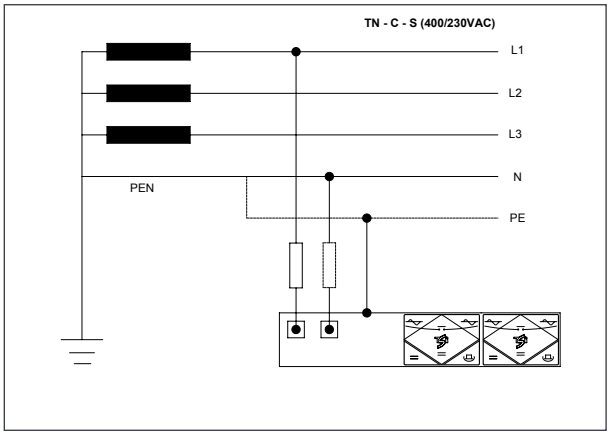


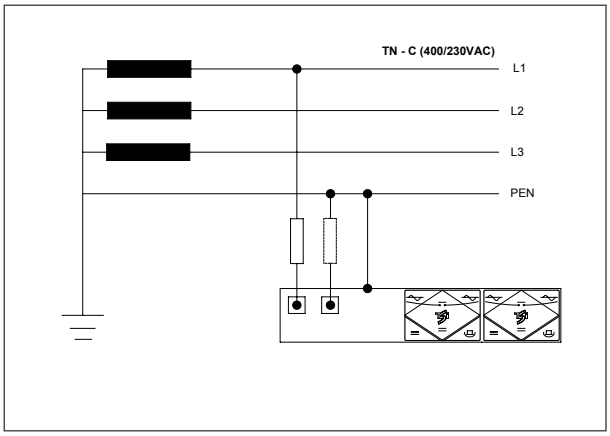
21.3 Three phases circuit diagram

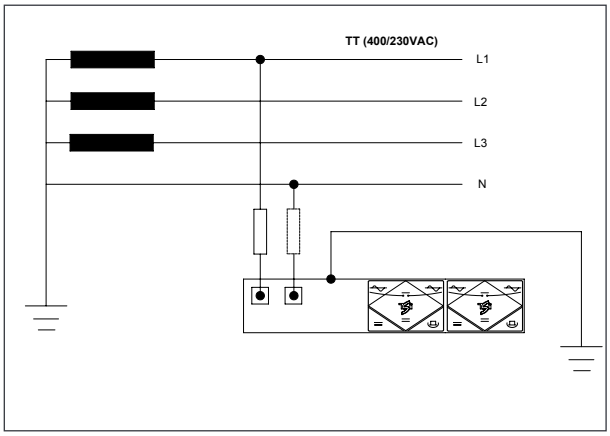
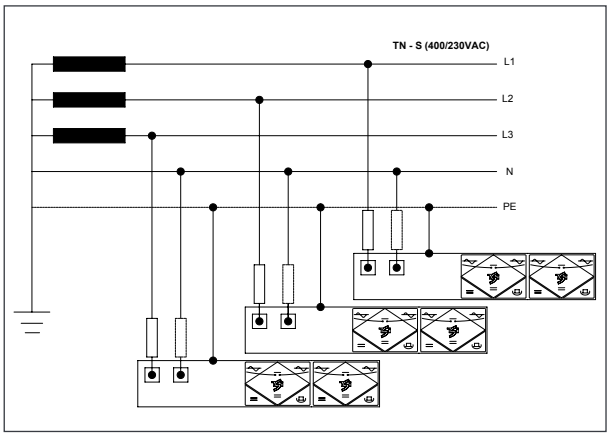
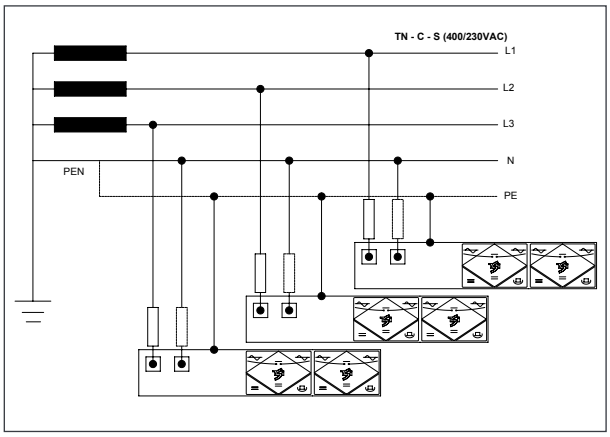
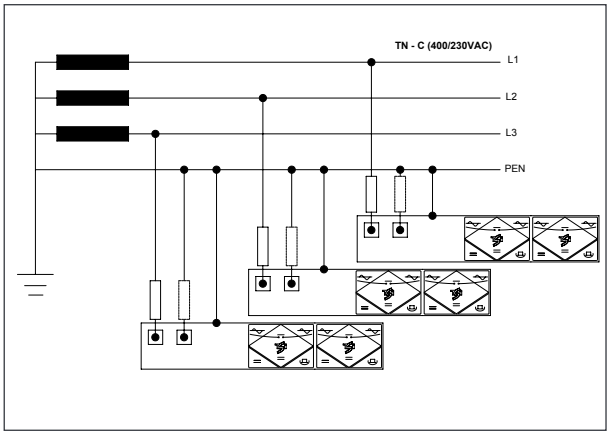
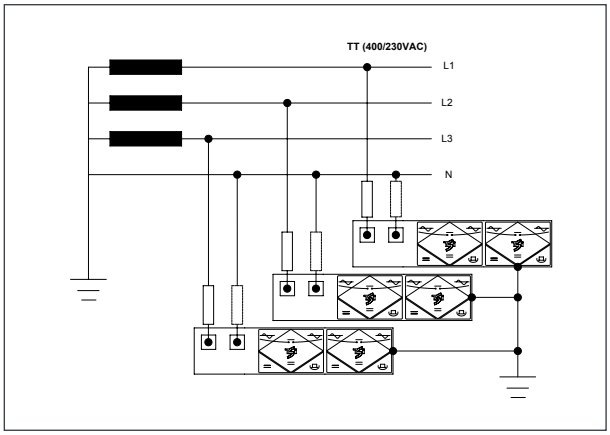


21.4 Mains connection, single phase









21.5 Mains connection, three phases