Leading AC Backup Technology

TSI BRAVO - 230VAC

User Manual V7.0

BEYOND THE INVERTER

THE NEW GENERATION OF POWER CONVERTERS

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

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1. 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

2. Safety instructions

- The modular inverter system/rack can reach hazardous leakage currents. Earthing must be carried out prior energizing the system. Earthing shall be made according to local regulations.
- Prior any work conducted to a system/unit make sure that AC input voltage and DC input voltage is disconnected.
- Inverter modules and shelves comprise capacitors for filtering and energy storage. Prior to accessing to the system/ modules wait min 5 minutes to allow capacitors to discharge.
- AC and DC circuits shall be terminated with no voltage / power applied.
- Some components and terminals carry high voltage during operation. Contact may result in fatal injury.
- Warning labels must not be removed.
- Never wear metallic objects such as rings, watches, 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.
- ESD Strap must be worn when handling PCBs and open units.
- The modular inverter system/rack is not supplied with internal disconnect devises on input nor output.
- 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 powerless in a single action.
- REG systems can be seen as independent power sources. To comply with local and international safety standards N (output) and PE shall be bonded.
- EPC system that have no AC input wired and connected to comply with local and international safety standards N (output) and PE shall be bonded. The bonded between N output and L must be removed once the AC input is being connected.
- The safety standard IEC/EN62040-1-1 requires that, in case of output short circuit, the inverter must disconnect in maximum 5 seconds. Parameter can be adjusted on T2S; however, if the parameter is set at a value > 5 seconds, an external protection must be provided in order that the short circuit protection operates within 5 seconds. Default setting is 60s.
- The equipment must be installed and commissioned by skilled technicians according to instructions in this manual.
- Local regulations must be adhered.
- The manufacturer declines all responsibilities if equipment is not- installed according to -instructions herein -by skilled technician -according to local safety regulation.
- Warranty does not apply if the product is not installed, used and handled according to the instructions in the manuals.
- CE+T cannot be held responsible for disposal of the Inverter system and therefore the customer must segregate and dispose 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 the products it consists of, you must stick to the local regulations in force in the country of destination and in any case avoid causing any kind of pollution.

2.1 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. This is especially important in three phase configurations.
- Empty inverter positions must not be left open. Replace with module or cover.

2.2 Surge and transients

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

2.3 Other

- Isolation test must not be performed without instructions from the manufacturer.

3. Twin Sine Innovation

Inverter modules carrying the TSI logo and the EPC mark is a triple port converter (AC in, DC in, AC out). Sinusoidal output converted from mains or/and DC.

Typical loads

- Resistive load
- Inductive and resistive
- Capacitive and resistive
- Non linear (electronic)

3.1 EPC-mode

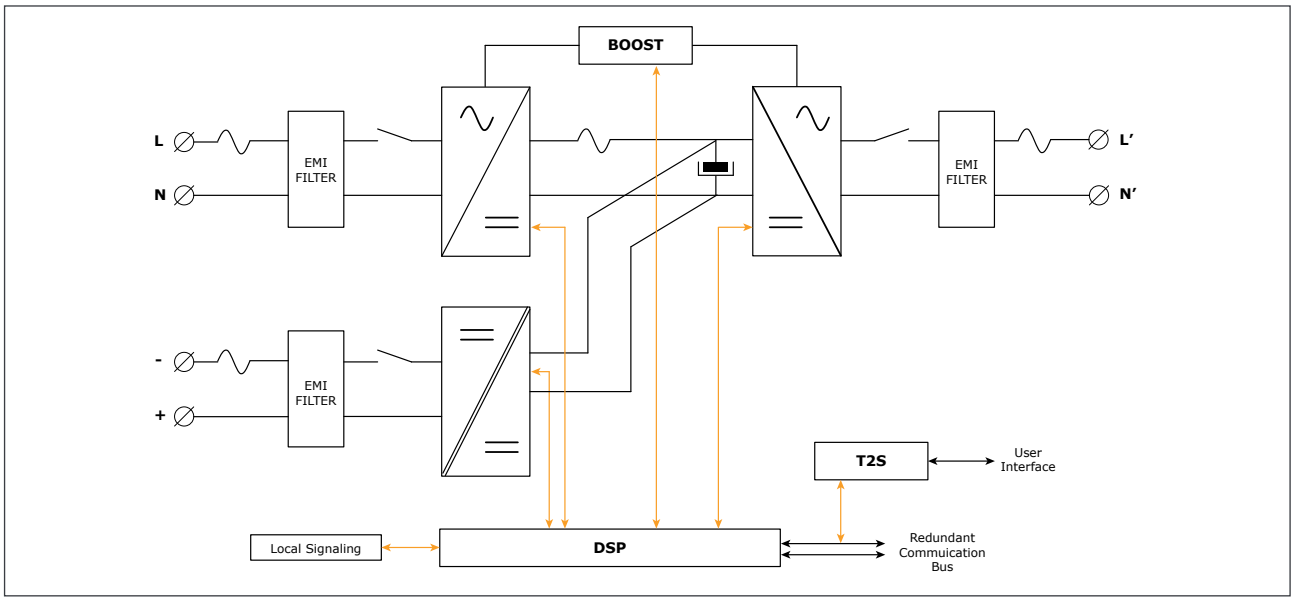
Mains input (AC) is by default priority whilst DC works as backup.
Switching time between AC input and DC input is 0ms (source transfer).
Regardless of supply source the output voltage is always conditioned, low THD (sineoidal output).

The BOOST functionality enables 10x Inom for a period of >20ms in the event of down stream failures. The upstream breakers does not have to be oversized to prevent tripping. The overload capacity is 150% for 15 seconds.

The system efficiency is 94-96%[1] which reduce the overall energy consumption. When running on backup typical efficiency is >91%.

The TSI works according to True Redundant Structure (TRS) that features decentralized logic, redundant communication bus and three levels of, individually independent, disconnection.

The functionality is all 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, 0ms source transfer time and controlled down stream clearing capacity.



1 | Nova EPC (94%), Media EPC (95%), Bravo EPC (96%)

3.2 On-line EPC

DC is the priority source of supply whilst mains (AC) work as the secondary source of supply.
Switching time between DC input and AC input is 0ms (source transfer).
Regardless of supply source the output voltage is always conditioned, low THD (sinusoidal output) Boost function is enabled without delay

3.3 Safe mode

Safe mode use DC as primary source of supply while mains (AC) is standby.

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

The transfer between DC and AC result in transfer time, typical 10ms

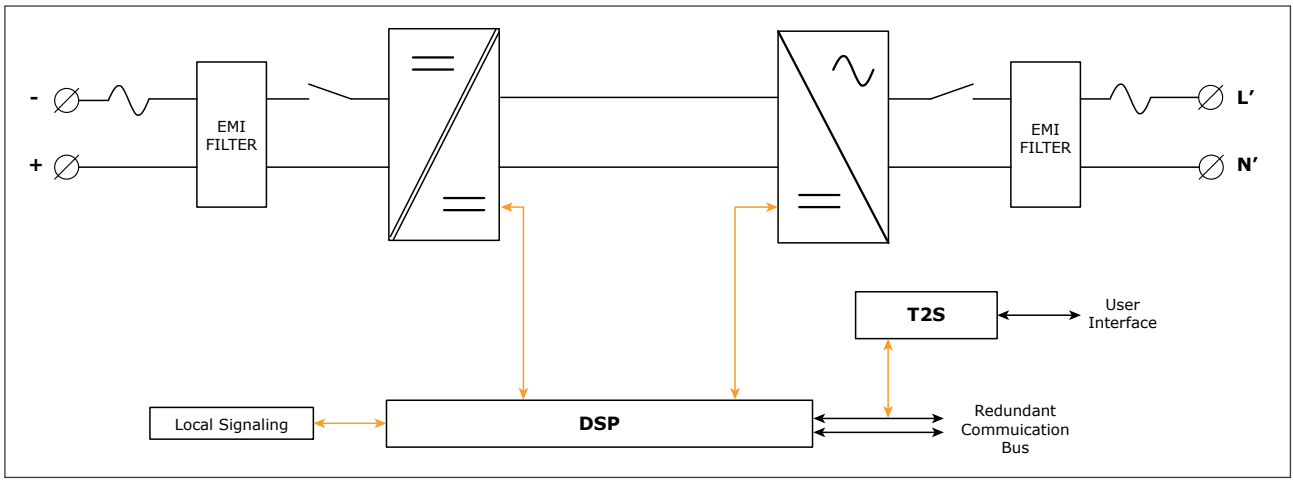
3.4 REG-mode

Inverter modules carrying the TSI logo and the REG mark is a traditional converter (DC in, AC out). Sinusoidal output converted from DC input.

- DC input only.
- The output voltage is always conditioned, low THD (sinusoidal output)
- The overload capacity is 150% for 15 seconds
- The inverter efficiency is >88-91%[2].

The TSI works according to True Redundant Structure (TRS) that features decentralized logic, redundant communication bus and three levels of, individually independent, disconnection.

Isolation test must not be performed without instructions from the manufacturer.



2 | Veda REG 88%, Nova/Media/Bravo REG 91%

4. Building blocks

4.1 Inverter

Telecom / Datacom:	+24VDC / 230Vac 50/60Hz
	-48VDC / 230VAC, 50/60Hz
	-60VDC / 230VAC, 50/60Hz
Industrial / Transport:	110VDC / 230VAC, 50/60Hz
	220VDC/ 230VAC 50/60Hz

- The TSI Bravo is a 2500VA/2000W (1500VA/1200W [1]) triple port inverter.
- All versions available in EPC or REG.
- The TSI inverter modules are hot swappable and hot pluggable.
- The module operator interface is LEDs showing converter status and output power
- Inverter modules run in single phase or three phase configurations.
- The inverter modules is equipped with soft start
- Fan is equipped with alarm and run time meter. The fan is field replaceable.
- 435 (D) x 102 (W) x 88 (H)
- 5 Kg

4.2 Sub-rack

- The BRAVO shelf shall be integrated in min 600mm deep cabinets, Inch/ETSI mounting.
- The BRAVO shelf house max four (4) inverter modules and one (1) monitor unit.
- The extension shelf house max four (4) inverter modules and one (1) monitor blank.
- The BRAVO shelf is designed with individual DC input, Common AC input and Common AC output.
- Optional rear cover for IP 20 in open rack
- Max 10kVA (6kVA [2]) per shelf
- 480 (D) x 19" (W) x 2U (H)
- 6 Kg empty

1 | +24VDC version
2 | +24VDC version

4.3 Monitor unit T2S

The T2S monitors max 32 inverters in one bus

The T2S provides

- Alarm monitoring
- Record the latest 200 events. Fi-Fo
- 3 outgoing alarms
- 2 digital input
- MOD bus
- CAN bus
- USB front connector

In depth, read the TxS manual xxx.xxx

5. Accessories

5.1 Cabinet

Powder coated (RAL 7032), 19 “welded steel sheet cabinet with 600x600mm foot print. Cabinet designed for top cabling or bottom cabling.

- 1100mm (600x600mm) 24U
- 1800mm (600x600mm) 36U
- 2130mm (600x600mm) 44U

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

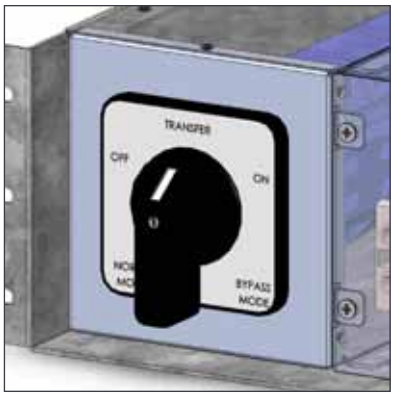
Door optional accessory

5.2 Manual by-pass

The manual by pass operates via manually operated switches that create a by-pass from mains input via 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.

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

5.3 AC distribution unit

5.3.1 Miniature circuit breakers

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

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

The AC distribution unit comes as 1 pole, 2 pole and 3 pole

Max current per AC DU is 200A, max current per terminal connector is 50A. Two adjacent terminal connectors shall be used for 63A breakers

If alarm is required for AC output breakers a held contact attached to each individual breaker is used (OF or SD). The alarm function is common and use one of the digital input on the control unit. The help contact limit the qty breakers

	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

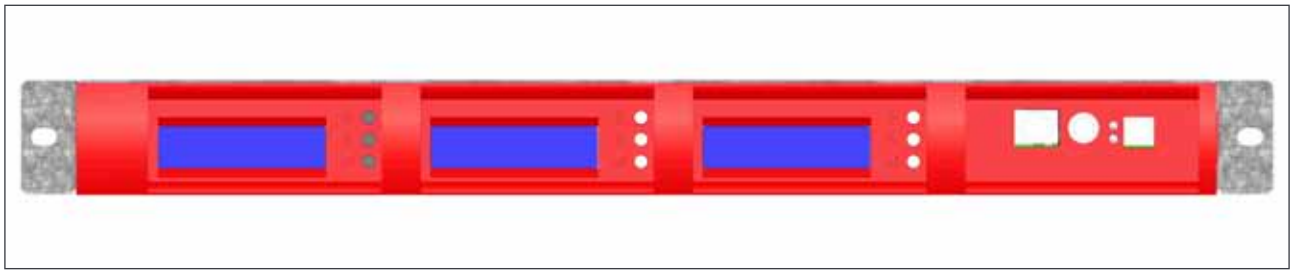
5.3.2 MCCB

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

Max two MCCB per inverter cabinet.

6. Monitoring accessories

6.1 Can Dis shelf



The CanDis shelf has room for 1-3 display units and 1 TCP/IP agent.

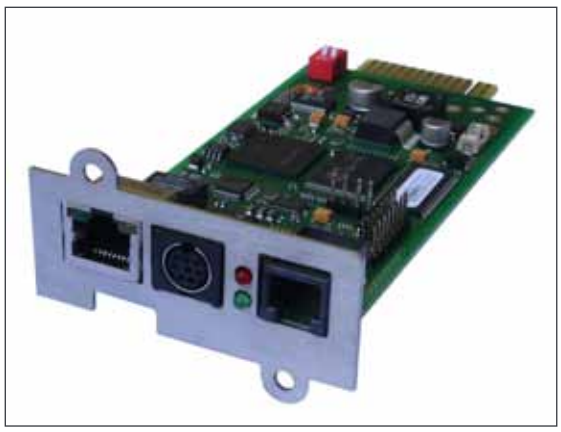
6.1.1 Display

Backlit 2 line dot matrix

The display show two values simultaneous

6.1.2 TCP/IP Agent

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



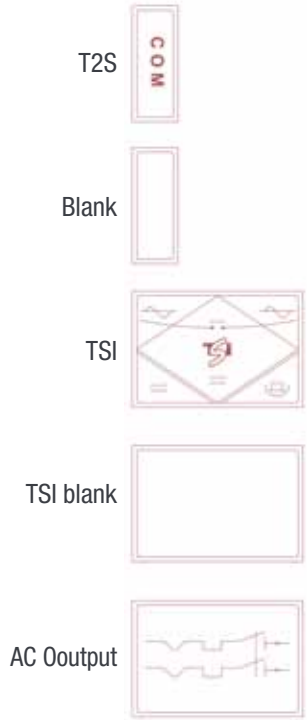
7. System Design

7.1 Pack / A la Carte

The systems designed are divided in two topologies.

7.1.1 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. Mounting kit is included in the delivery.
The PACK is only available as single phase, -48VDC, EPC-mode.
A PACK comprises of max 6 inverter modules.

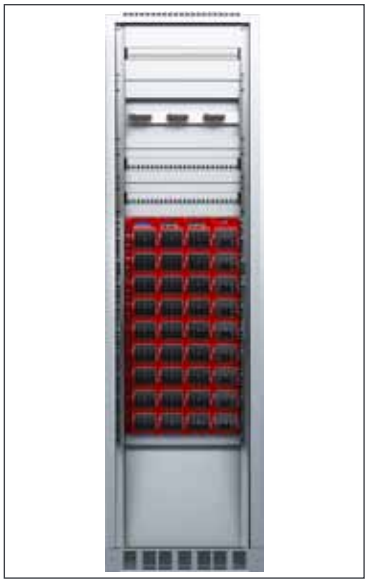


7.1.2 A la Carte

The A la Carte is pre assembled and configured as single phase or three phase systems. The system comprises cabinet, inverter sub rack, inverter modules (+24VD to 220VDC), manual by-pass, monitor device 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 32 modules, max 80kVA (48kVA[3])
The A la Carte (three phase) populate 3 to 30 modules, max 75kVA (45kVA[3])

- Dual input (AC and DC) inverter modules (EPC)
- 96% efficiency[4] at normal operation (EPC)
- Always conditioned and filtered output voltage
- Seamless transfer (0ms) between primary and secondary source of supply
- No single point of failure
- Flexible AC output distribution
- Full modularity
- Full redundancy



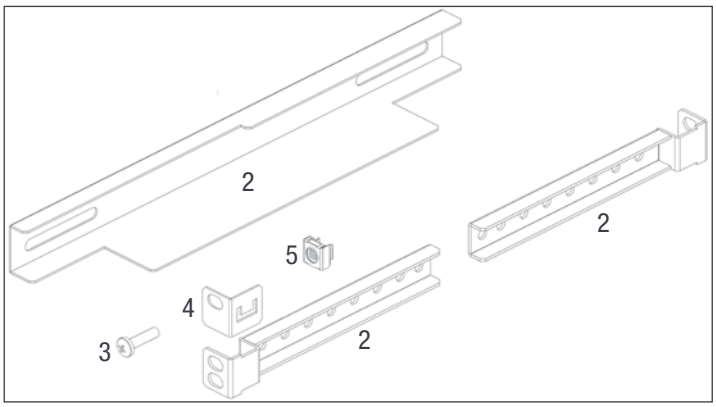
3 | +24V Version
4 | Bravo EPC -48VDC/230VAC

8. Installation of Bravo PACK or Single shelf/shelves

- 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.
- T2S is always mounted in the first shelf, left hand position.
- In PACK the 4th inverter position (1st sub-rack) comprise 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.

8.1 Mounting kit (Bravo PACK or Single shelf)

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



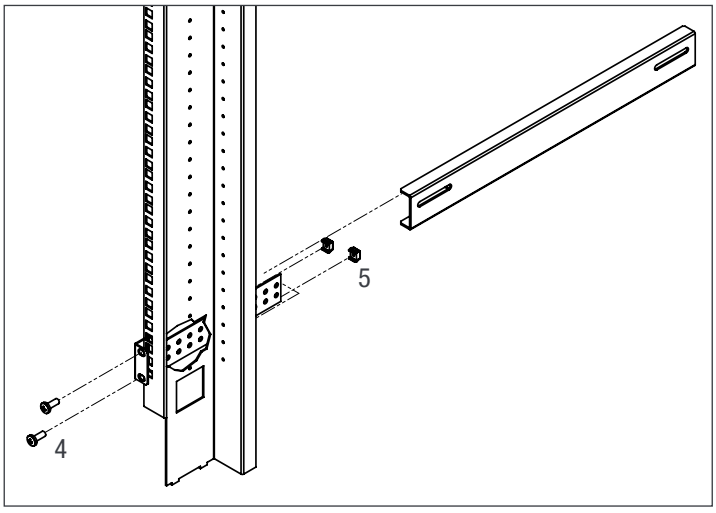
4x Fixing brackets (ref 1)

2x Slider (ref 2)

2x Mounting brackets (ref 3)

12x Mounting screws (ref 4)

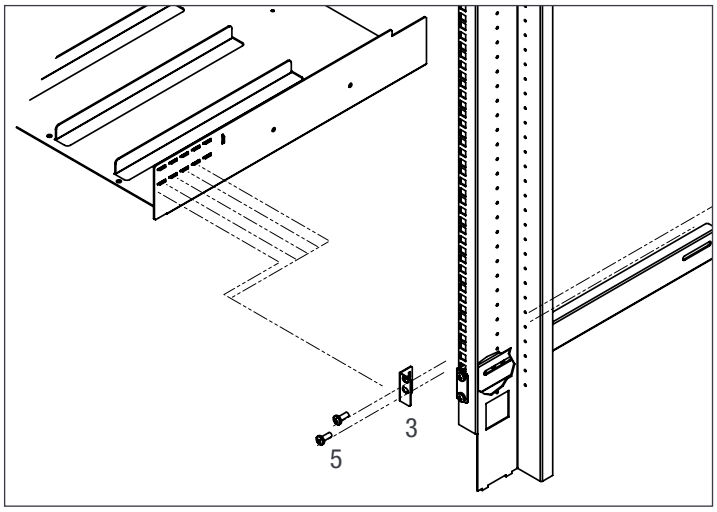
12x Cage nuts (ref 5)



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

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

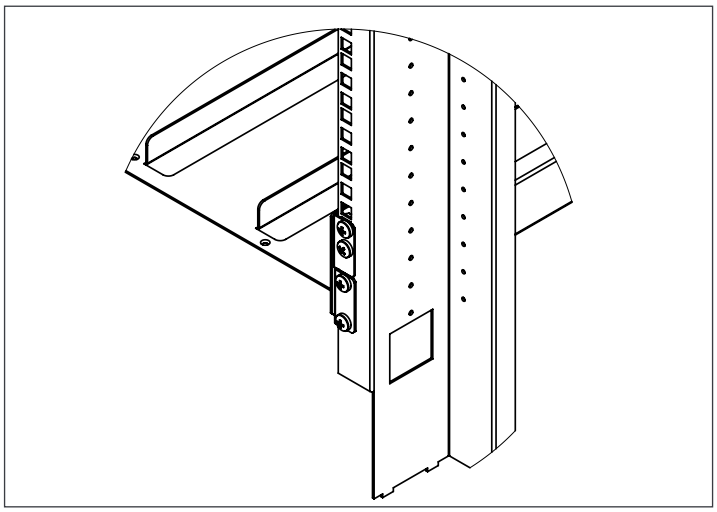
Fix the left and right slider of the cabinet with the supplied screws (4)



Fix cage nuts (4) in the mounting frame

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

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



Finished

8.2 Electrical installation (Bravo PACK or single shelf)

8.2.1 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 1,2 – 1,5Nm
- All connection screws are M5 x 12mm
- 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

8.2.2 Surge suppression

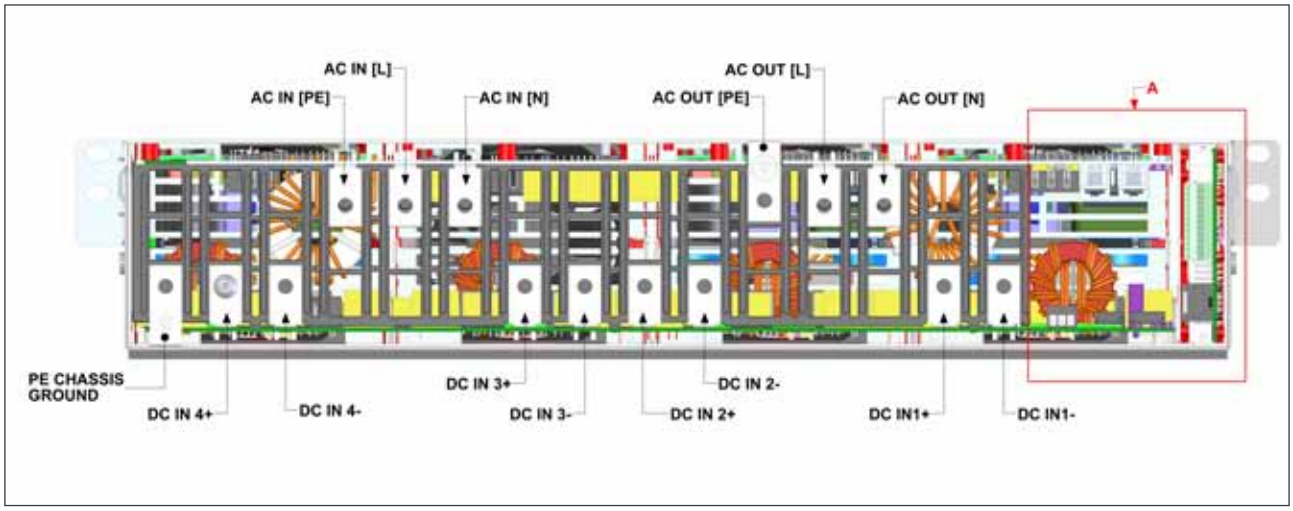
The mains (AC) supply of the modular inverter system shall be fitted with suitable Lightning surge suppression and Transient voltage surge suppression for the application at hand. Manufacturer's recommendations of installation shall be adhered. It is advisory to select device with alarm relay for function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

8.2.3 Terminations

All terminations are clearly marked.



8.2.4 Grounding

"PE CHASSIS GROUND"

PE Chassis ground shall be wired to MET or distributed earth bar connected to MET

According to local regulations.

8.2.5 DC input

	CB per inverter module	Cable, min	Connector	Torque
+24VDC	80A	2 x 25mm^2	M5	1.5Nm
-48VDC / Bravo pack	63A	2 x 16mm^2		
-60VDC	50A	2 x 10mm^2		
+110VDC	32A	2 x 6mm^2		
+220VDC	16A	2 x 2.5mm^2		

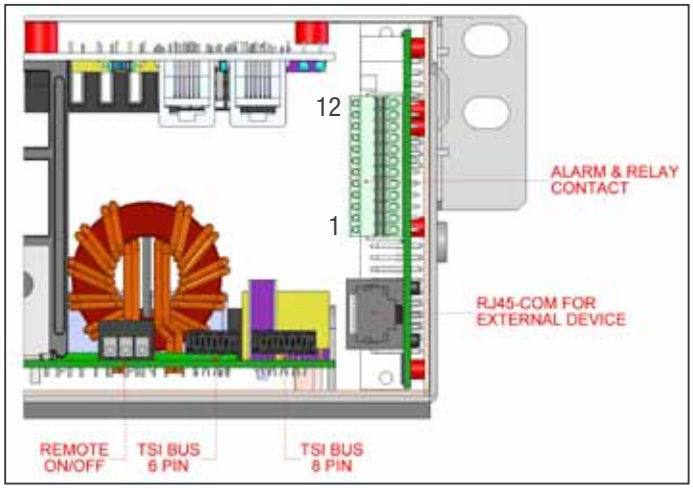
8.2.6 AC input

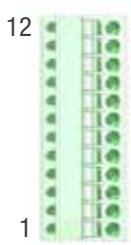
	CB per pack	CB per shelf	Cable, min	Connector	Torque
Bravo pack Single shelf	2p 32AC		3 x 6mm²	M5	1.5Nm
Bravo pack Double shelf	2p 63AC		3 x 16mm²		
+24VDC		2p 32AC	3 x 6mm²		
-48VDC to +220VDC		2p 40AC	3 x 10mm²		

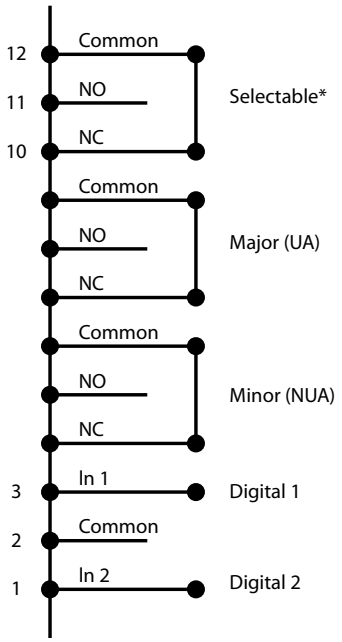
8.2.7 AC output

	Cable, min	Connector	Torque
Bravo pack Single shelf	3x6mm²	M5	1.5Nm
Bravo pack Double shelf	3x16mm²		
+24VDC	3x6mm²		
-48VDC to +220VDC	3x10mm²		

8.2.8 Signalling







Relay characteristics (Selectable, Major, Minor)

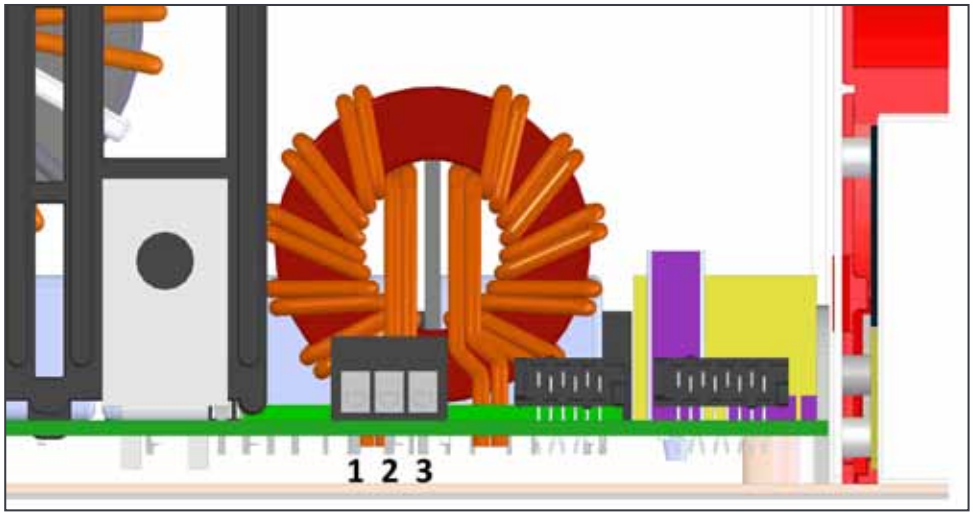
- Switching power 60W
- Rating 2A at 30VDC / 1A at 60VDC
- Max wire size 1mm²

Digital input characteristics (Digital In 1 / 2)

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

8.2.9 Remote ON/OFF

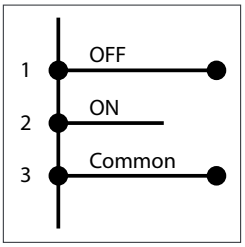
Notice: The shelf is by default equipped with a connection between pin 3 and 2. If remote ON/OFF is not used the strap shall remain in all connected shelves. Should the remote ON/OFF be used all straps must be removed and in one (1) shelf replaced with a changeover contact or emergency button.



- 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 +5VDC (galvanic insulated)
- Max wire size 1mm2



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)

8.2.10 Internal buss (TSI Bus 6 pin / TSI Bus 8 pin)

- In PACK/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.

8.2.11 Rear cover

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

Connect cables

Cut holes to allow cable access

Clip rear cover in place

9. Installation of cabinet (A la Carte)

9.1 Unpacking the system

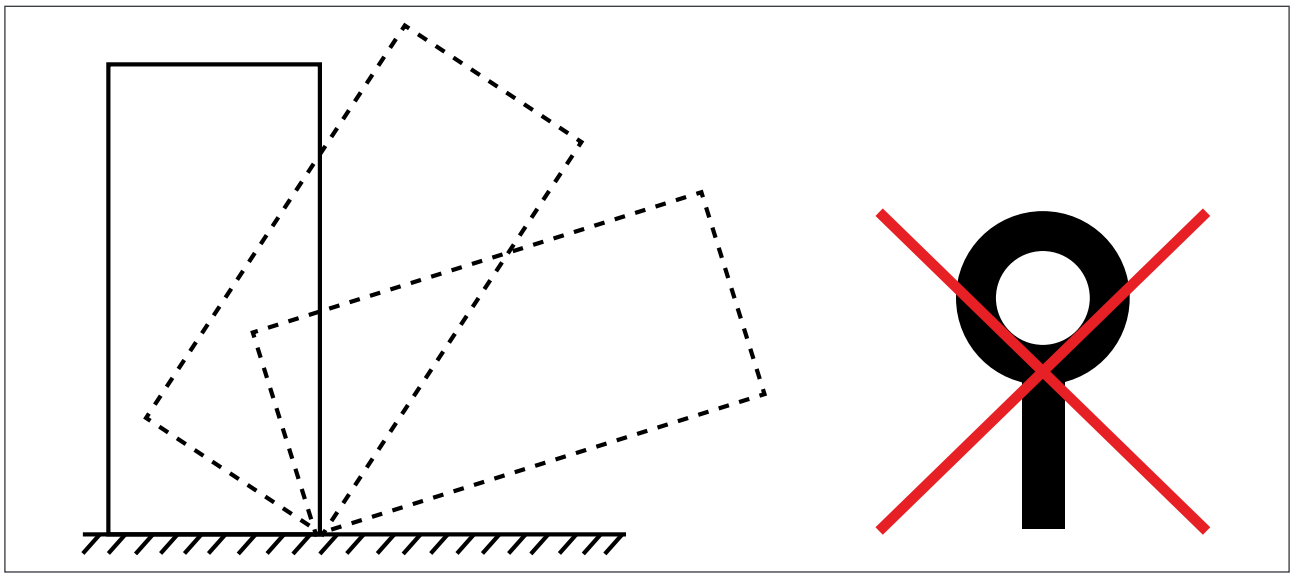
The cabinet is packed in a wooden box.

The packing material of the TSI system is recyclable.

Transport the cabinet in the box on the pallet.

9.2 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.



9.3 Fixing the cabinet to the floor

The cabinet is fixed through the base of the cabinet.

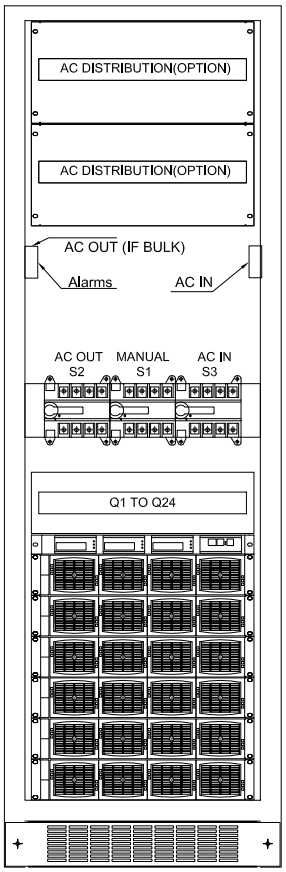
Remove lowest front cover to gain access to the fixing holes.

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

9.4 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 blanks

9.4.1 Positioning



Phase 1

Phase 2

Phase 3

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)

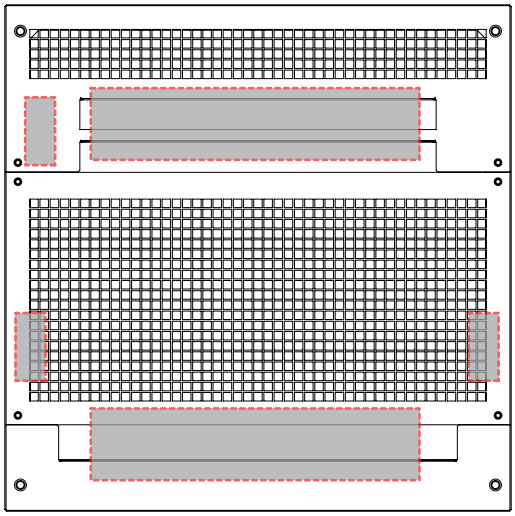
Internal DC distribution (Q1-Q24)
CanDis shelf (Option)

Phase 1
Inverter sub rack
Inverter modules

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

9.4.2 Cabling

Note: Do not block the airflow through the top of the cabinet.
Cables are run through the top of the cabinet or the bottom.
The top cover is possible to split in three parts to facilitate cabling.
The top cover has support to strap the cables with nylon tie straps.



Ground
PE

Alarm (X3, X5, X6)

DC Input (X1)

AC Input (X2)

AC Output (X4)

9.4.3 Grounding

Ground terminal are located in the top rear left corner.

“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.

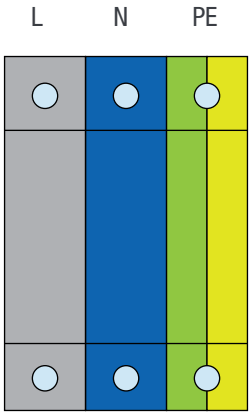
According to local regulations, Min 16mm^2.

9.4.4 AC Input (X2)

The AC input is wired to a screw terminal.

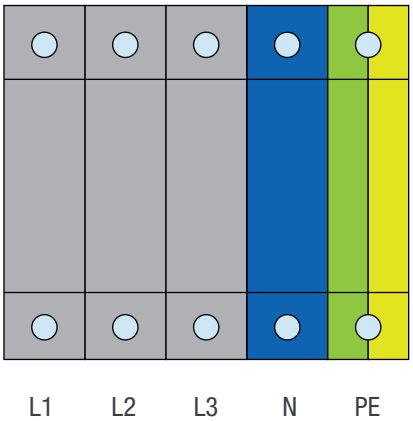
Max cable area is 180mm^2

9.4.4.1 Single phase



9.4.4.2 Three phase

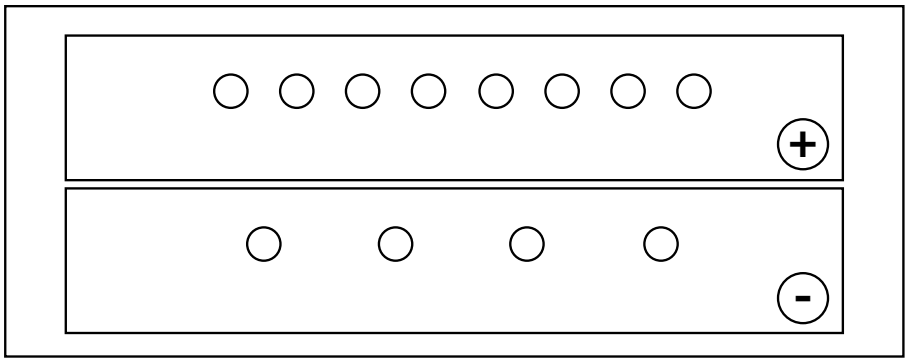
NOTE: The three phase input is 123, ABC, RST phase sensitive, clock wise rotation is recommended. Phase one to start shall be 0° phase shift, the other phases will organize -120° phase shift and + 120° phase shift resulting in three phase output.



9.4.5 DC input (X1)

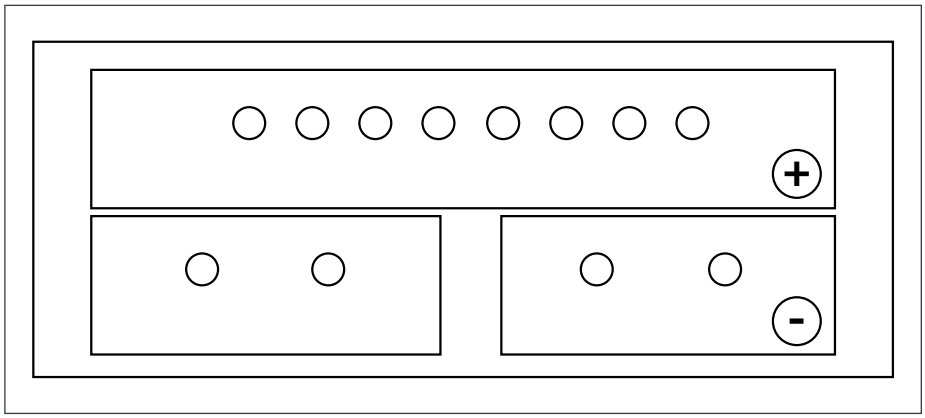
9.4.5.1 Bulk input

- Common DC input per system.
- Note: Screws and nuts are not included in the delivery.
- M12 holes
- Internal DC distribution with circuit breakers (Q01-Q32) per inverter module.
- Max 8x240mm² per pole



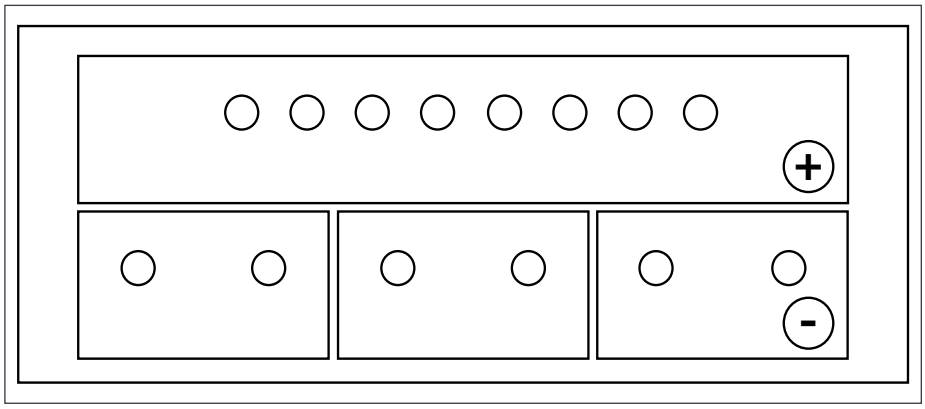
9.4.5.2 2 DC Input

- 2x Common DC input per system.
- Note: Screws and nuts are not included in the delivery.
- M10 holes
- Internal DC distribution with circuit breakers (Q01-Q32) per inverter module.
- Max 3x240mm² per pole



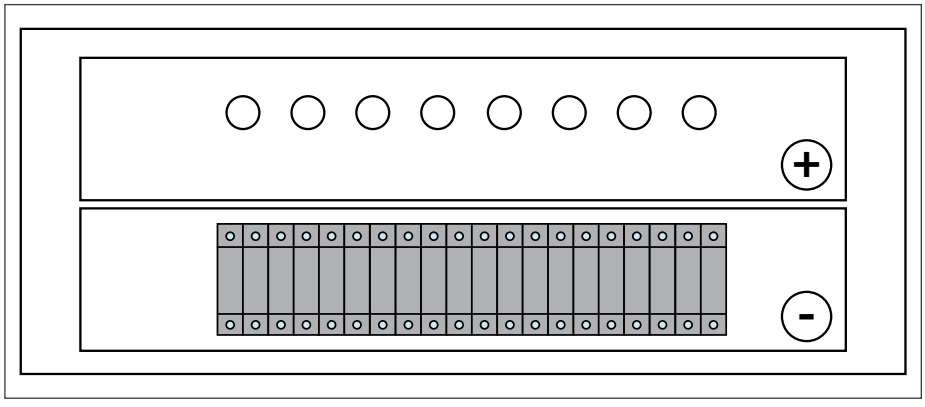
9.4.5.3 3 DC Input

- 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 2x240mm² per pole



9.4.5.4 Individual input

- Individual DC input per module/shelf and common return.
- Note: Screws and nuts are not included in the delivery.
- M5 holes , bus bar thickness (check)
- Max 35 mm² per connection terminal.



9.4.6 Connection Table – AC Input (X2) +24DC

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	Cable mm²
6		32A	6
12		63A	16
18		100A	35
	18	3x32A	3x6
24		125A	50
30		160A	70
36		200A	95
	36	3x63A	3x16
42		225A	150
	45	3x80A	3x25
48		250A	150

9.4.7 Connection Table – AC Input (X2) -48VDC to 220VDC

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	Cable mm²
6		40A	10
12		80A	25
18		125A	50
	30	3x40A	3x10
40		160A	70
50		200A	95
60		240A	150
	60	3x80A	3x25
70		280A	185
	75	3x100A	3x35
80		320A	

9.4.8 Connection Table DC Input +24VDC (X1)

Power (kVA)		DC Input Bulk		DC Input 2 Common		DC Input 3 Common		DC Input	individual
		Cable lug		Cable lug		Cable lug		Screw terminal/cable lug	
1ph	3ph	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable mm²
6		300A						80A 20mm²	Live: Screw terminal Common: Cable lug. M5-2,5Nm torque
12		600A		2x300A					
18		900A				3x300A			
	18								
24		1200A		2x600A					
30		1500A							
36		1700A		2x800A		3x600A			
	36								
42		2000A							
	45	2200A		2x1200A		3x800A			
48		2300A							

9.4.9 Connection Table DC Input -48VDC (X1)

Power (kVA)		DC Input Bulk		DC Input 2 Common		DC Input 3 Common		DC Input	individual
		Cable lug		Cable lug		Cable lug		Screw terminal/cable lug	
1ph	3ph	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable mm²
10		250A						63A 16mm²	Live: Screw terminal Common: Cable lug. M5-2,5Nm torque
20		500A		2x250A					
30		700A				3x250A			
	30								
40		900A		2x500A					
50		1100A							
60		1400A		2x700A		3x500A			
	60								
70		1600A							
	75	1650A				3x600A			
80		1800A		2x900A					

9.4.10 Connection Table DC Input -60VDC (X1)

Power (kVA)		DC Input Bulk		DC Input 2 Common		DC Input 3 Common		DC Input	individual
		Cable lug		Cable lug		Cable lug		Screw terminal/cable lug	
1ph	3ph	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable mm²
10		200A						50A 10mm²	Live: Screw terminal Common: Cable lug. M5-2,5Nm torque
20		400A		2x200A					
30		600A				3x200A			
	30								
40		750A		2x400A					
50		1000A							
60		1100A		2x600A		3x400A			
	60								
70		1300A							
	75	1400A				3x500A			
80		1500A		2x750A					

9.4.11 Connection Table DC Input +110VDC (X1)

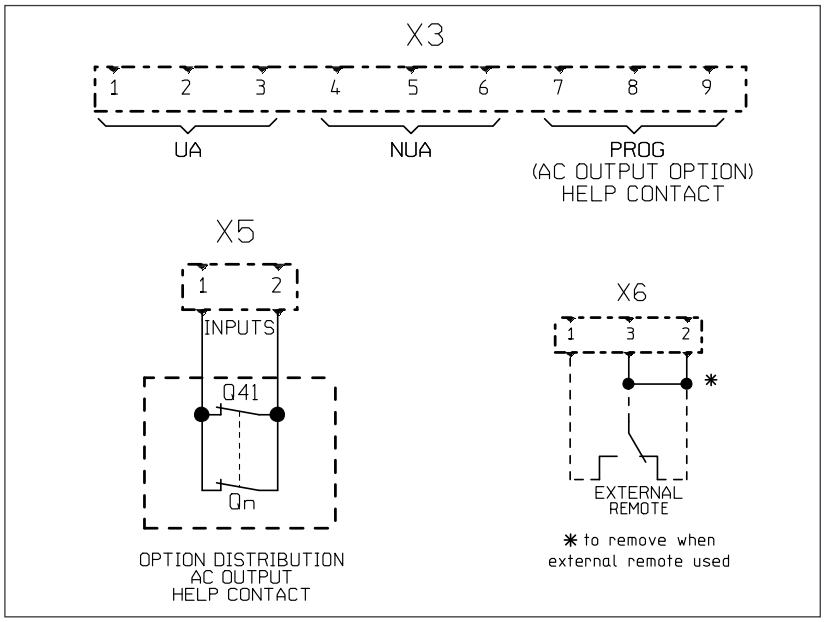
Power (kVA)		DC Input Bulk		DC Input 2 Common		DC Input 3 Common		DC Input	individual
		Cable lug		Cable lug		Cable lug		Screw terminal/cable lug	
1ph	3ph	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable mm²
10		100A						32A 6mm²	Live: Screw terminal Common: Cable lug. M5-2,5Nm torque
20		200A		2x100A					
30		300A				3x100A			
	30								
40		400A		2x200A					
50		500A							
60		600A		2x300A		3x200A			
	60								
70		700A							
	75	750A				3x300A			
80		800A		2x400A					

9.4.12 Connection Table DC Input +220VDC (X1)

Power (kVA)		DC Input Bulk		DC Input 2 Common		DC Input 3 Common		DC Input	individual
		Cable lug		Cable lug		Cable lug		Screw terminal/cable lug	
1ph	3ph	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable	Fuse/CB	Cable mm²
10		63A						16A 2.5mm²	Live: Screw terminal Common: Cable lug. M5-2,5Nm torque
20		120A		2x60A					
30		160A				3x60A			
	30								
40		220A		2x500A					
50		260A							
60		315A		2x750A		3x500A			
	60								
70		360A							
	75	400A				3x600A			
80		420A		2x1000A					

9.4.13 Signalling

All relays are in non energized position



9.4.13.1 Alarm (X3)

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

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

9.4.13.2 Digital In (X5)

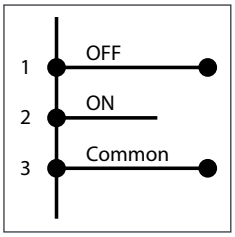
- Input characteristics X5 (Digital In 1, Digital In 2)

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

9.4.13.3 Remote ON/OFF (X6)

Note: The system is by default equipped with a connection between pin 3 and 2. If remote ON/OFF is not used the strap shall remain. Should the remote ON/OFF be used the strap must be replaced with a changeover contact or emergency button.

- The remote ON/OFF 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.
- Digital input characteristics (Remote On/Off)
  - Signal voltage +5VDC (galvanic insulated)
  - Max wire size 1mm^2



Functional table for remote ON/OFF function

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

9.4.13.4 Forced start

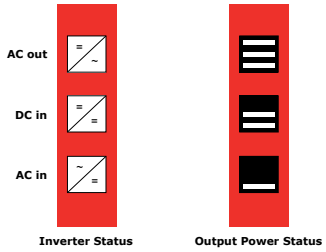
Initial start of system must be performed with operational T2S. Should the T2S be missing at start-up the modules will fail to start.

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

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

10.Interface

10.1 Inverter module

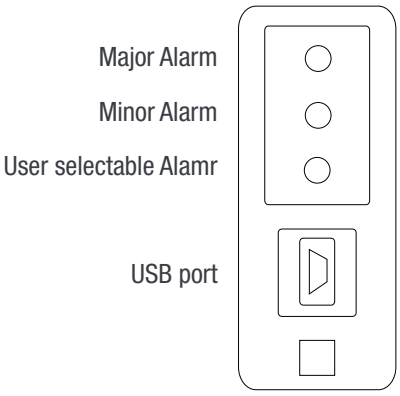


Inverter Status LED	Description	Remedial action
OFF	No input power or forced stop	Check environment
Permanent green	Operation	
Blinking green	Converter OK but working conditions are not fulfilled to operate properly	
Blinking green/orange alternatively	Recovery mode after boost (10 In short circuit condition)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

10.2 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

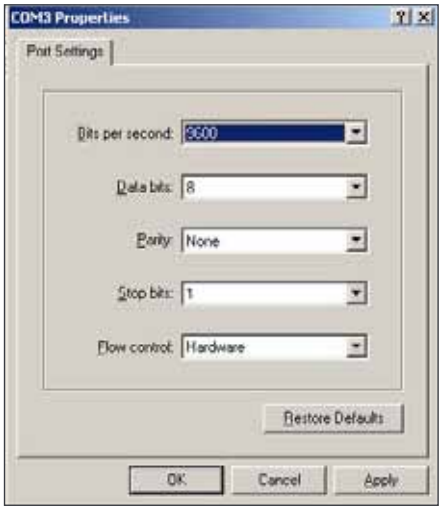


11.System set up

- Parameter set up requires Hyper terminal 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

11.1 Communication setting

- Bits per second 115200
- Data bits 8
- Parity None
- Stop bits 1
- Flow control None



11.2 Menu access

Root Menu

- 1 > System cinfiguration
  - 0 > Return to previous menu
  - 1 > Send config file to T2S
  - 2 > Read config file from T2S
  - 3 > Restore default settings (no more available since version 2.5)
  - 4 > Restore factory settings (no more 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 slection
  - 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 > detailled 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 textes and constants
    - 2 > Force refresh of events description texts
- 4 > Security Access
  - 0 > Return to index
  - 1 > Enable Password protection

12.Inserting/removing/replacing modules

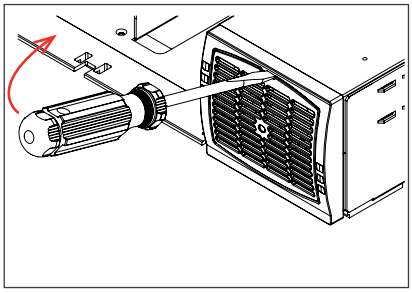
12.1 TSI Inverter

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

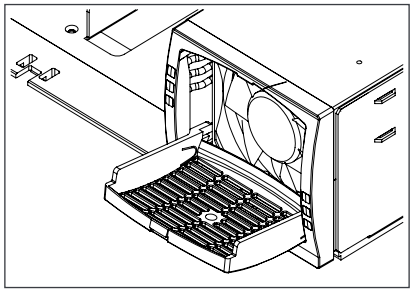
12.1.1 Removal

Notice: When one or several inverter modules is/are removed it gains access to live parts. Replace module with blinds without delay.

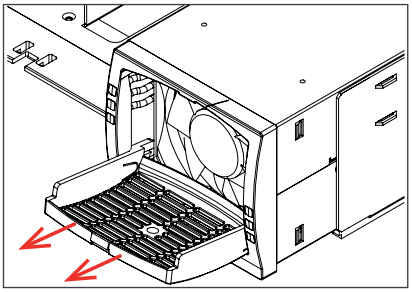
- Inverter module is not switched off when opening the handle. The handle only fixes the module to the shelf.
- Use a screw driver to release the latch of the handle
- Open the handle
- Pull the module out
- Replace with new module or blind unit



A) Use screwdriver to release the latch



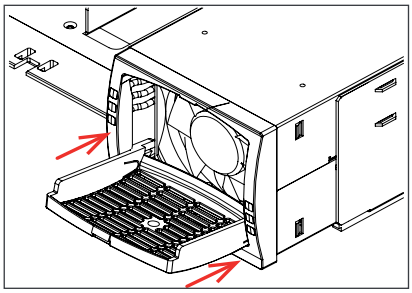
B) open the cover completely



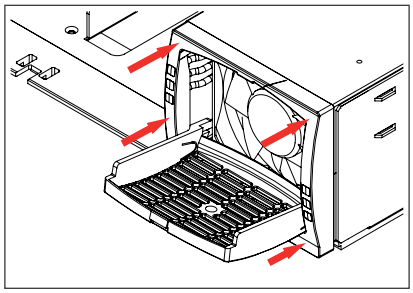
C) Use the cover as a handle to remove the module

12.1.2 Inserting

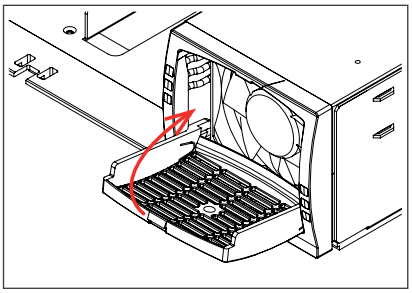
- Use a screw driver to release the latch of the handle
- Open the handle
- Push firmly until the unit is properly connected.
- Close the cover and latch in position



A) Slide the module in



B) Push firmly till the connection is properly engaged

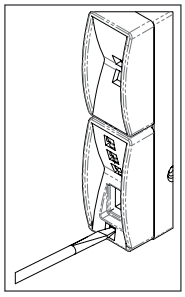


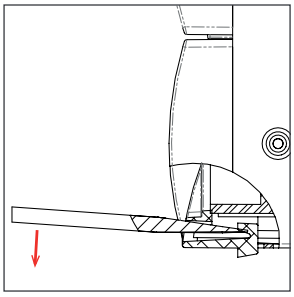
C) Close the cover and latch the module in place if too hard redo step B

12.2 T2S

12.2.1 Removal

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





12.2.2 Inserting

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

12.3 Fan replacement

The FAN life is approx 45.000hours. The inverter modules have fan runtime meters and fan failure alarm. Fan failure can result from failing fan or driver circuit.

- Let the module rest at least 5 minutes prior to initiating work.
- The inverter front must be removed. Use a blunt tool to depress the latches on the module side fixing the front to the module.
- Remove the fan and unplug the supply cord.
- Replace with new fan and connect supply cord
- Replace front, make sure that the front latch properly.
- Plug in
- Check fan for operation
- Access T2S and reset the fan run time alarm from within the action menu

Push on side hooks to release front cover | Remove the front cover | Free up the fan assembly | Disconnect the fan | Replace the fan | Make sure the fan is in the right position

13.AC output distribution

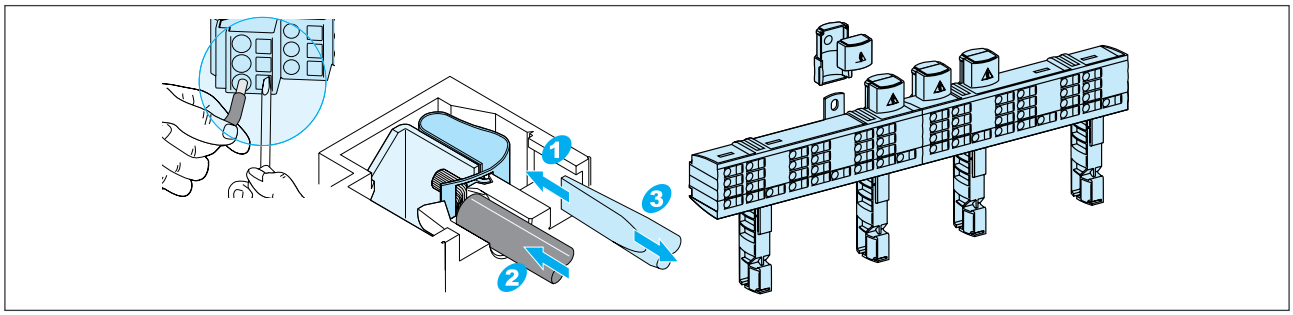
13.1 Miniature Circuit breaker installation/removal

Circuit breakers are normally installed from factory.

How to add breakers

1. Insert the short connection cable (10mm2 (included)) in the breaker Line-side and tighten.
   - Up to 50A breaker use one connection cable.
   - 63A breaker use two connection cables.
2. Clip breaker on to the DIN rail
3. Insert Insulated screw driver in 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



13.2 MCCB

MCCBs are installed from factory.

A wide range of breakers is used. Breakers in picture may be different upon delivery.

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

14.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 when system is in manual by-pass

The manual by-pass is not possible to operate remotely

14.1 Pre requisites

Commercial AC must be present, and 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 nominal power of the inverter.

The inverter might be overloaded during MBP procedure, depending on voltage network and output inverter voltage setting.

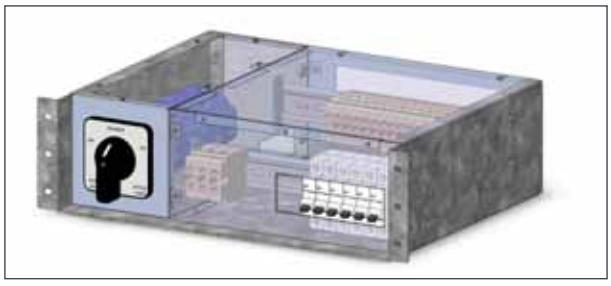
To reduce the overload impact, the inverter power and current will be reduced from 150% to nominal value.

The by-pass switch disconnect all AC voltage on the shelves but has no action on the DC feeding on inverter and on remote alarm terminal.

14.2 Manual by-pass <20kVA

14.3 Normal to By-pass

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



14.4 By-pass to Normal

1. Switch DC ON
2. Turn switch to INERMEDIATE (mid position)
3. PAUSE, wait until the inverter modules have come to full operation (30-60seconds)
4. Complete twist to ON

14.5 Manual by-pass >20kVA

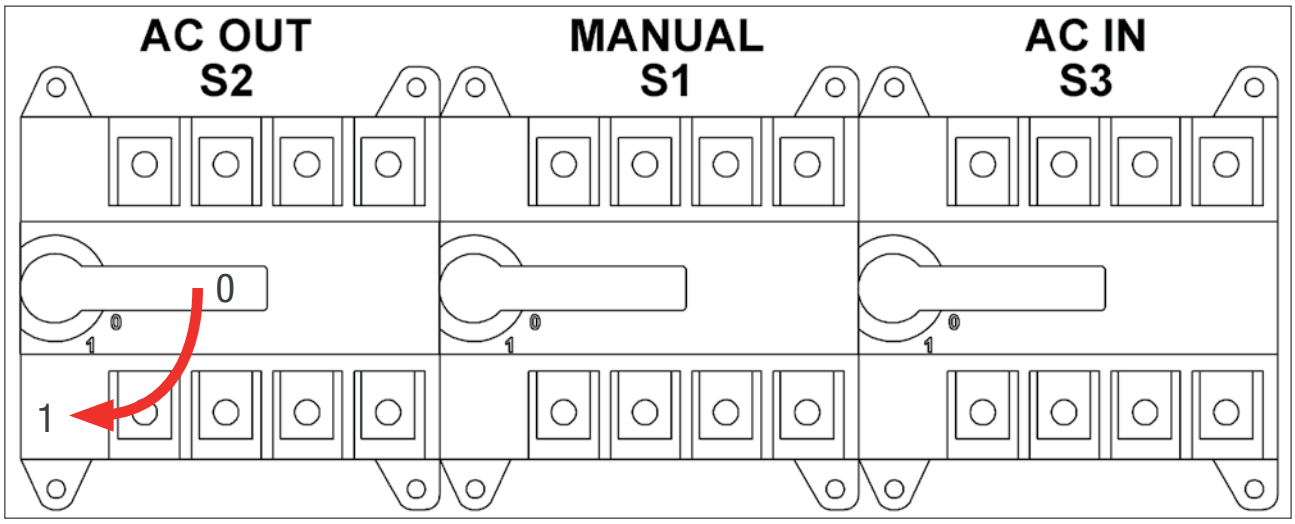
The manual by pass operates via three individual switches (S2, S1, S3) that creates a by-pass from mains input via output AC distribution. Inverter modules are by-passed and possible to disconnect without impacting the load.

14.5.1 Normal to By-pass

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

14.5.2 By-pass to Normal

1. DC ON
2. S3: 0 ⇨1
3. PAUSE, wait until the inverter modules have come to full operation (30-60 seconds)
4. S2: 0 ⇨1
5. S3: 1 ⇨0



15.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 blanks.
- Make sure that the Remote ON/OFF is appropriately wired according to local regulations.
- Make sure that the point of AC supply meets local regulations.

16.Commissioning

The DC breaker is a protection device. When modules are plugged in a system 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 cover by warranty if procedures are not respected.

16.1 Check list

DATA	
Date	
Performed by	
Site	
System serial number	
Module serial numbers	
T2S 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)	

17.Trouble shooting

Inverter does not power up:	Check that the inverter is properly inserted
	Reposition inverter to verify that slot is not damaged
	Check AC input present and in range (AC breakers)
	Check DC input present and in range (DC breakers)
	Check for loose terminations
Inverter does not start:	Check that T2S is present and properly inserted
	Check remote ON/OFF terminal
	Check that Manual By-pass is in normal position
	Check the configuration and setting
	Check threshold level
Inverter only run on AC or DC:	Check the configuration and setting
	Check threshold level
No output power:	Check output breaker
All OK but I have alarm:	Check configuration file and correct No of modules
	Download/clear log file
No output alarm:	Mind the default time delay (UA: 60s, NUA: 30s)
	Check configuration file
No information on CanDis:	Check that T2S is present and properly inserted
	Check that the RJ45 cable is connected between T2S shelf and CanDis shelf
No value on TCP/IP:	Check that the RJ45 cable is connected between T2S shelf and CanDis shelf
	Wait approx 2 minutes to allow the system to collect serial data.

18.Maintenance

Maintenance shall only be performed by properly trained people.

18.1 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 operation conditions
  - Check/correct alarm configuration
- Check module internal temperature for deviation between modules
  - Temperature deviation may indicate build up 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 what actions will generate alarm

18.2 Manual check

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

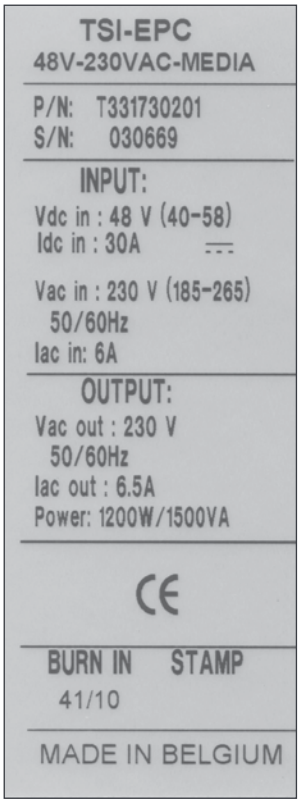
18.3 Optional

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

18.4 Manual by-pass

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

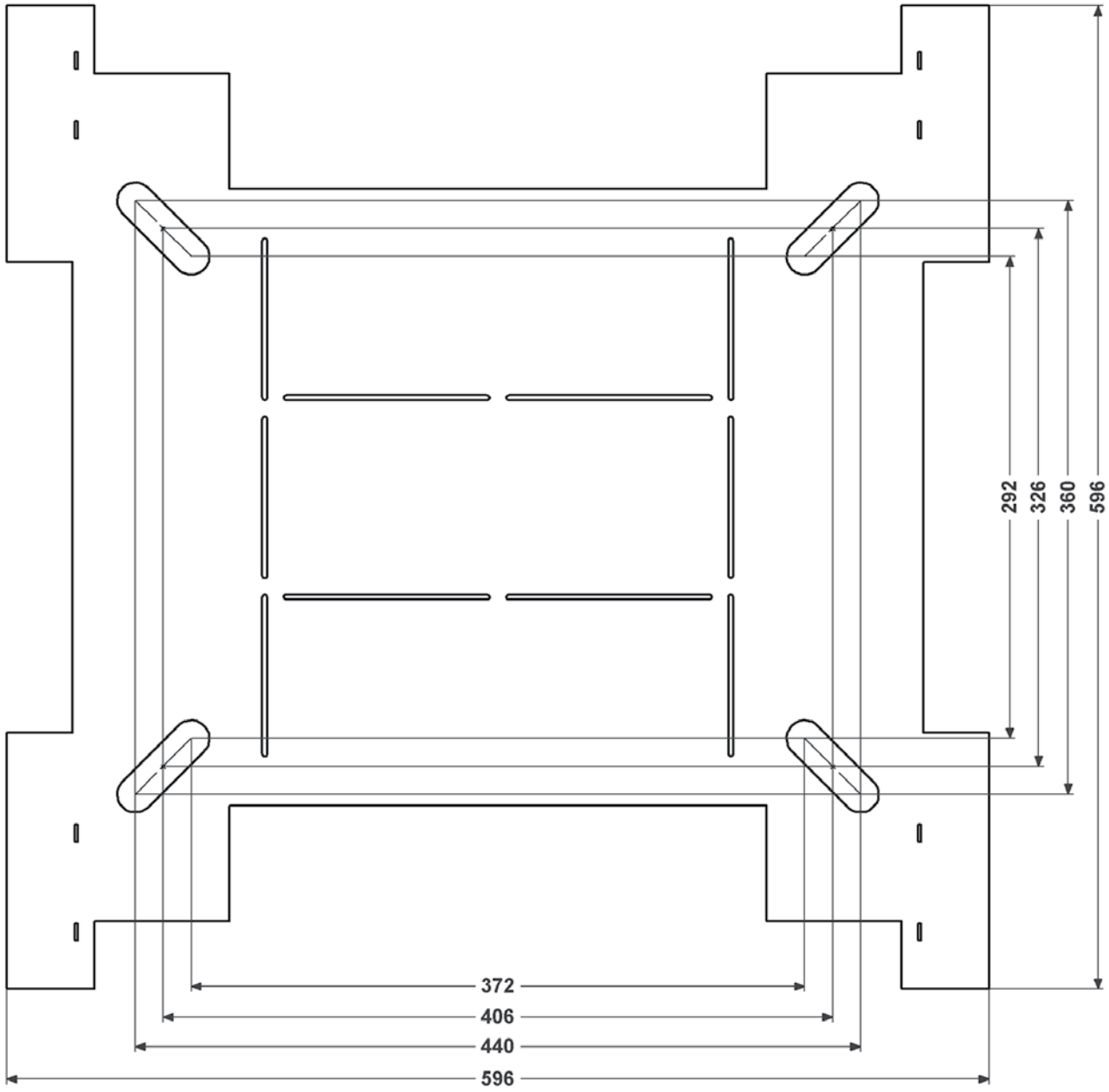
19.Defective modules



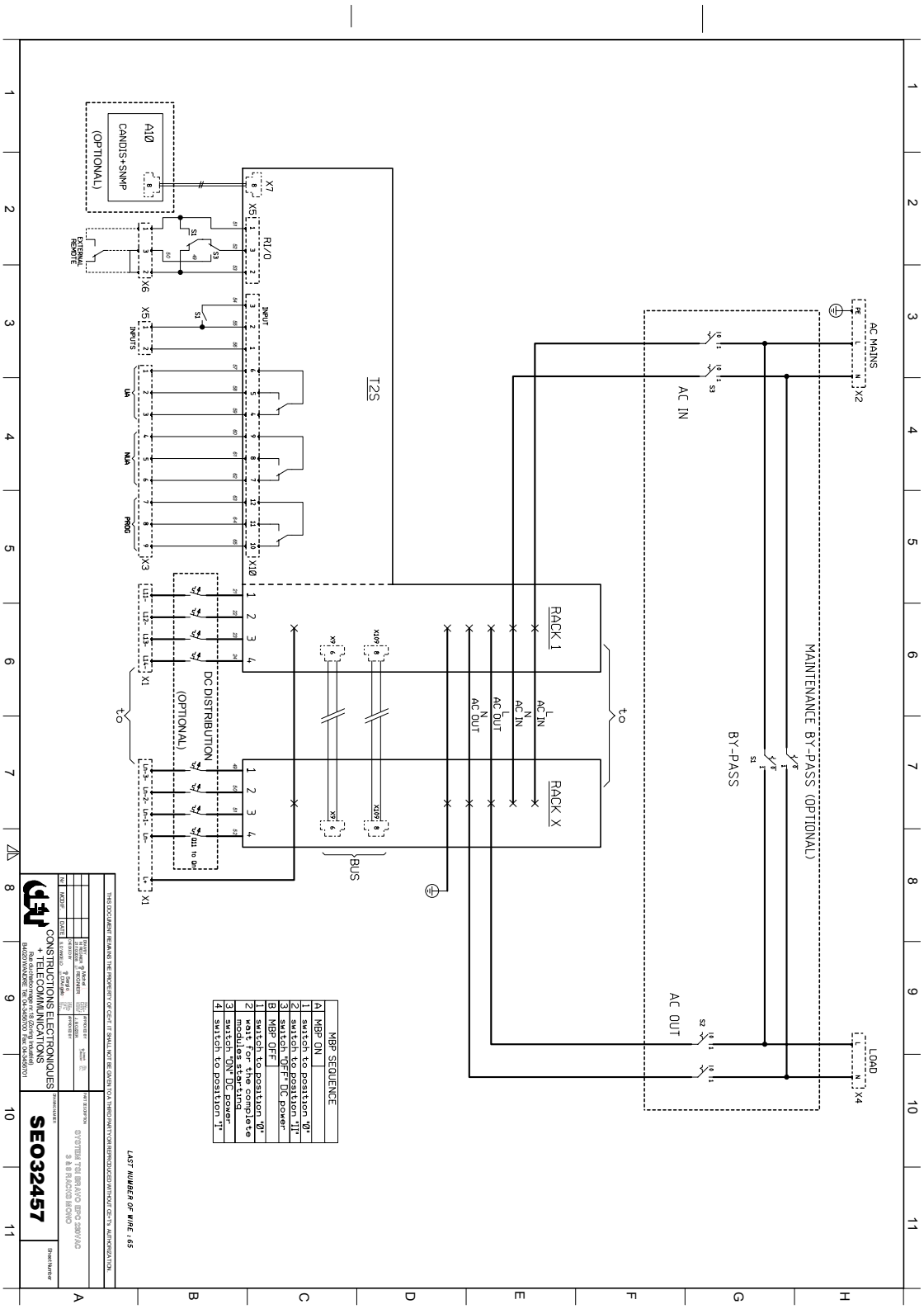
- A repair request should follow the regular logistics chain:
  End-user => Distributor => CE+T Power.
- Before returning a defective product, a RMA number must be requested through the http://my.cet-power.com extranet. Repair registering guidelines may be requested by email at repair@cet-power.com.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

20.Appendix

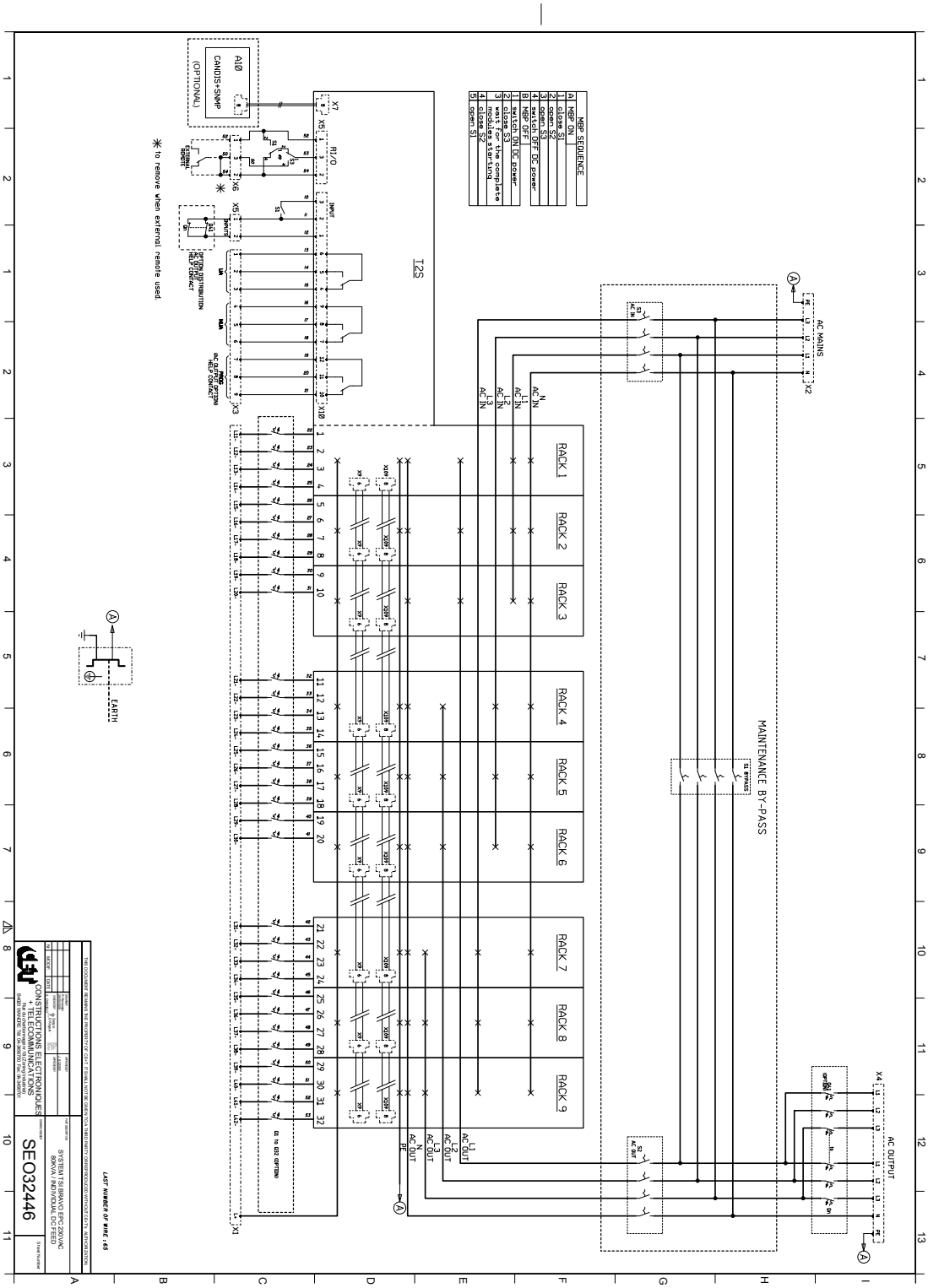
20.1 Cabinet foot print, layout



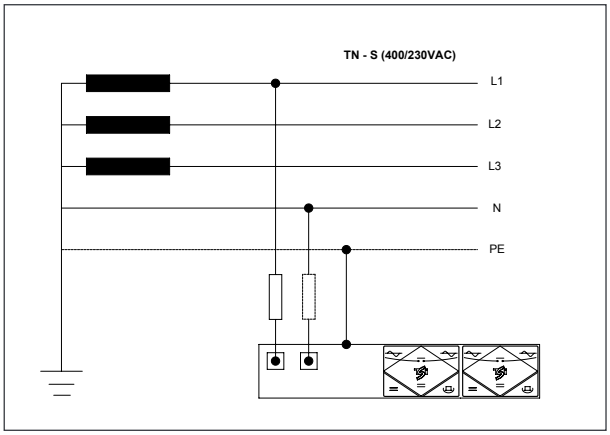
20.2 Single phase circuit diagram

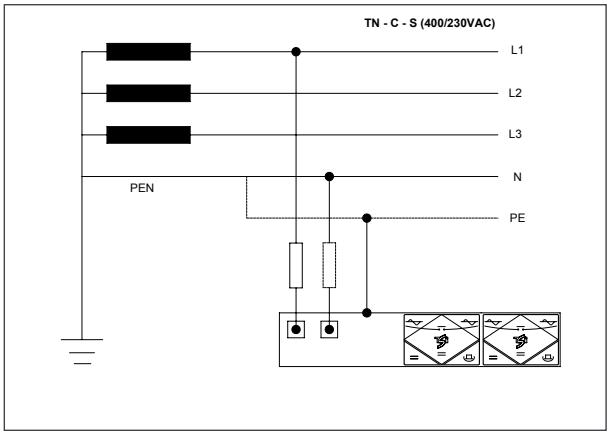


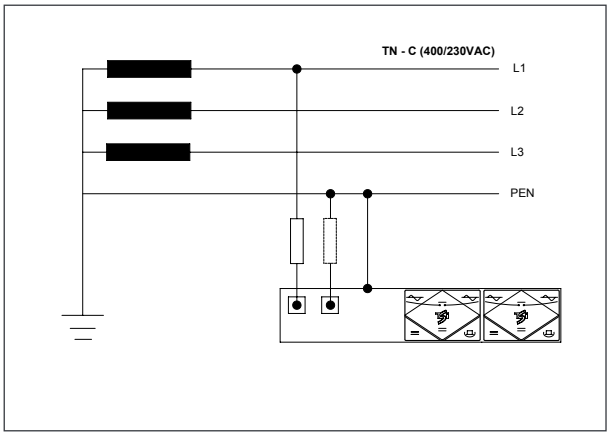
20.3 Three phases circuit diagram

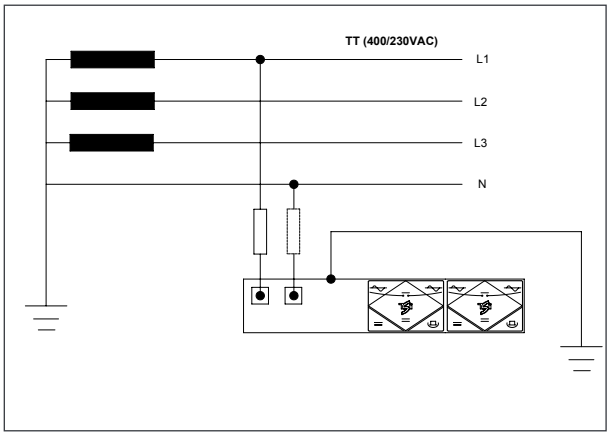


20.4 Mains connection, Single phase









20.5 Mains connection, Three phases