INSTALLATION MANUAL

Bravo inverter 120VAC in 19 inches shelf

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0 Safety Recommendations

Your safety is our major concern.

Read carefully all safety aspects listed in this manual prior any intervention on the appliance.

The manufacturer declines all responsibilities if equipment has not installed by skilled technician and in a proper way according to local safety regulation and as it is described herein.

TSI rack is not supplied with internal disconnect devises and it is dual input power supply. Refer to chapter 3 for safe installation and access to the system.

TSI rack can reach hazardous leakage currents if grounding is not made according to safety recommendations. Refer to § 3.4.2.

Caution:

For your easiness, the following picto will appear to highlight safety advices

Prior any handling of the shelf, wait a few minutes (min 5 minutes) for complete discharge of internal capacitors that have been energized

1 Introduction

This document applies to the TSI System. For product description, please refer to related document.

Please check that operating manual version you are reading is corresponding to TSI version running in your installation.

TSI Systems:

Based on BRAVO module install in 19 inches shelf

Single phase:
- 2.5 KVA to 27,5 KVA with redundancy n + 1
- 2.5 KVA to 30 KVA without redundancy
- 100/120Vac – 48Vdc
- With or without Enhanced Power Conversion (EPC) mode (grid connection)

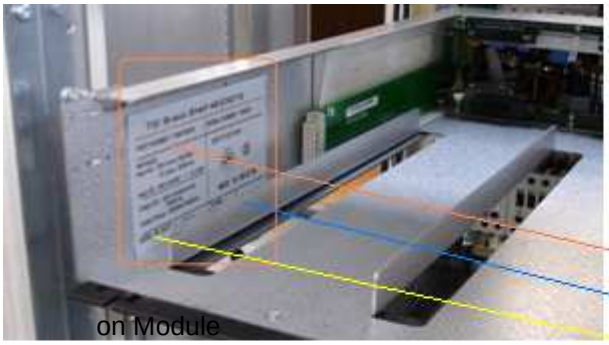
Dual phases:
- 5 KVA to 75 KVA with redundancy n + 1
- 5 KVA to 80 KVA without redundancy
- 100/120Vac – 48Vdc
- With or without Enhanced Power Conversion (EPC) mode (grid connection

Three phases:
- 7.5 KVA to 67,5 KVA with redundancy n + 1
- 7.5 KVA to 75 KVA without redundancy
- 100/120Vac – 48Vdc
- With or without Enhanced Power Conversion (EPC) mode (grid connection

TSI System Identification plate:

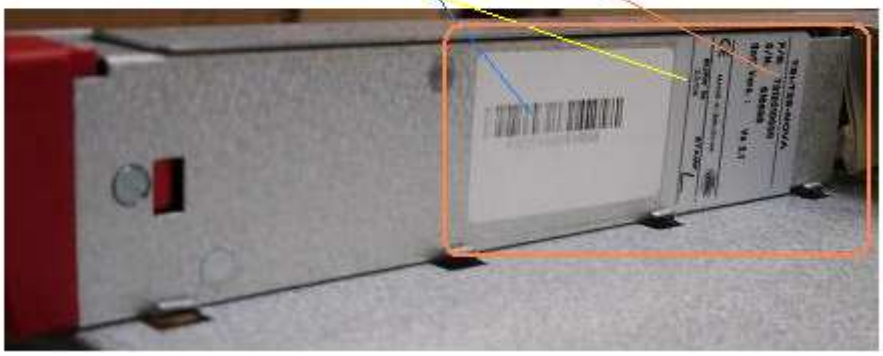
Identification Plates are located

On Shelf: **on Module**



on Module

On T2S



The PART NUMBER, SERIAL NUMBER and BURN IN DATE are essential information when you contact CE+T to get help in commissioning or in troubles or when item is sent back for repair.

2 System Technical Description

2

Certificates and testing details are available on request.

2.1 EMC standards

2.1

ETSI EN 300 132-2 (date 2003 – 01)

2.2 Safety Standards

2.2

The power supply system fulfils the mentioned international and national safety standards according to grounding, fire protection and other safety matters:

IEC EN60950-1 (date 2001 – 10) for inverter
IEC EN62040-1-1 for the shelf(ves)

2.3 Environment

2.3

Operating temperature	-25°C to + 50°C
Storage Temperature	-40°C to + 80°C no condensing.
Packaging	Conform to NEBS GR63
Vibration	IEC 721-3-3
Shock	IEC 721-3-2
Audible noise	< 35dB (A)
Cooling	Forced convection

Since inverter modules are forced cooling good air circulation has to be guaranteed.
TSI racks can be stacked with other equipments provided that airflow is kept free.

2.4 Typical load

2.4

- Resistive
- Inductive and resistive
- Capacitive and resistive
- Non linear load with a maximum crest factor of 3.5 for TSI Bravo

3 Installation

3

Caution:

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

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

3.1 Overview

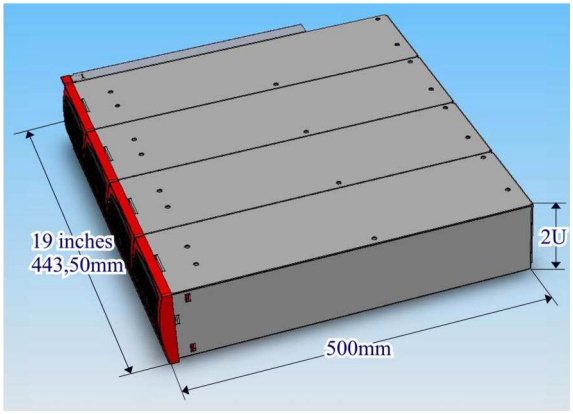
3.1

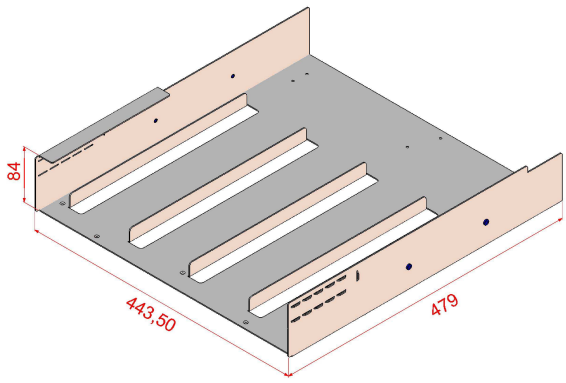
The Various TSI II Racks are foreseen to be recessed into an electrical cabinet of 19" standard.

3.2 System dimensions

3.2

BRAVO type shelf:





3.3 Fixing

3.3

A full range of accessory is ready made to allow easy integration of the TSI in almost any kind of standard cabinets. Among other we provide fixing set for:

- 19" – 600mm depth cabinets (most standard solution, which is supplied by default - shown here)
- 19" – 800mm depth cabinets
- ETSI – 600mm depth cabinets

Many other combinations are possible including some for specific brands. Just ask.

3.3.1

3.3.1 TSI BRAVO Rack integration in 19” – 600mm depth

Furniture KIT :

Make sure that you have received the proper accessories for TSI BRAVO which consist of 1 pair of 19” kit as shown below :

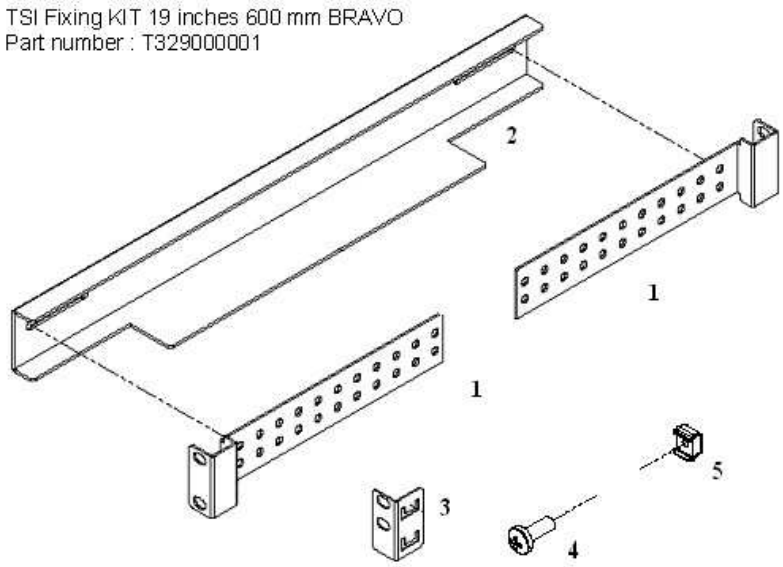
2 slider (ref 2)

4 brackets (ref 1)

2 latches (ref 3)

12 bolts (ref 4)

12 removable nuts (ref 5)

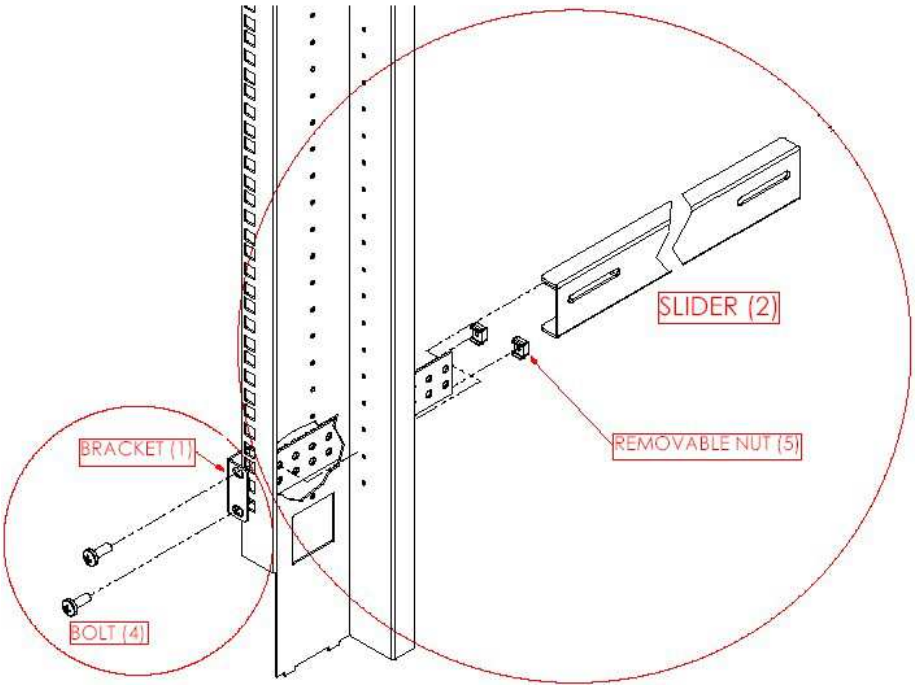


Mounting steps :

STEP A:
Mount front and rear brackets (1) on the slider (2). Adapt the length to your cabinet. Clips the 4 front and rear removable nuts (5) on the frame.

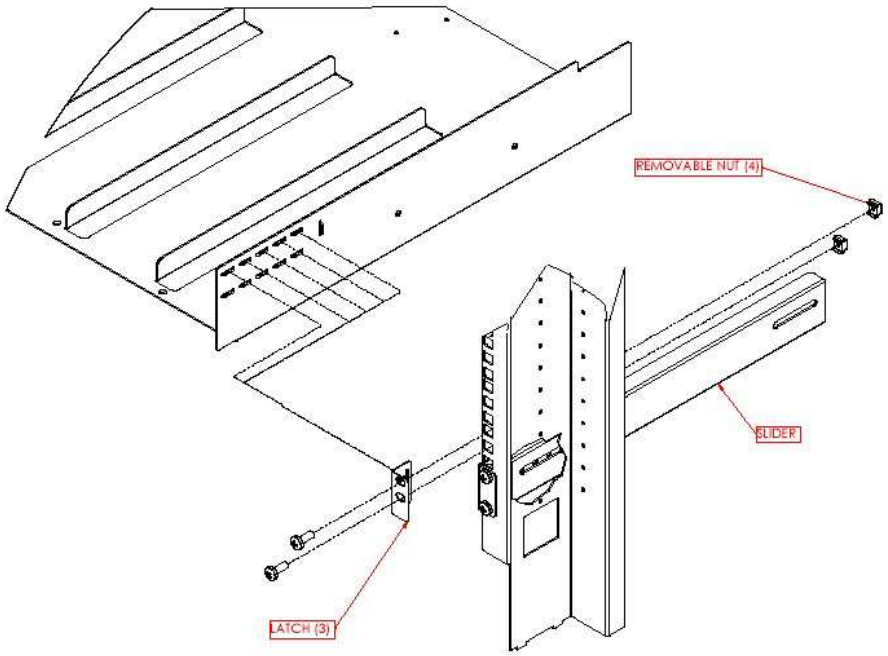
STEP B:
Fix the brackets and slider on the frames, using supplied bolts (4)

STEP C:
Repeat Steps A and B for the other side (left or right)



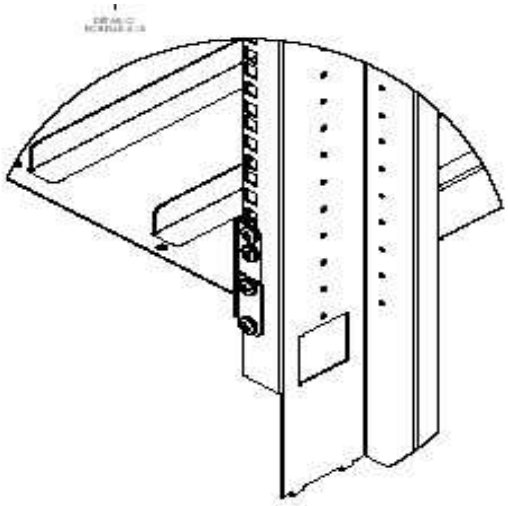
STEP D:

Clips the 2 rights and 2 lefts removable nuts on the front frame. Hook the 2 latches (3) to the TSI BRAVO shelf. Several positions are available. Chose the most appropriate to align the shelf with the other devices in the cabinet. Lay down the shelf on the sliders and push firmly to the end. Fix the shelf using supplied bolts



Even if it is preferable to mount the TSI in the factory, it has been designed to allow installation on site.. Fixing has to be performed first. Then wiring can be done.

Here beside a subrack mounting on a 19" frame



REMARKS:

When Fixing Devices are used for fixing **Pack** (off the shelf pack), **ONLY ONE PAIR OF PROFILE** is supplied **PER PACK**.

When Fixing Devices are used for fixing **Spare Shelves** (A la carte system), **ONE PAIR OF PROFILE** is supplied **PER SHELF**.

3.4 Wiring

Caution:

The TSI Rack does not include any protecting and/or disconnecting devices neither on DC input nor on AC input. These would be installed outside the shelf. Before any intervention on the TSI Rack, operator has to make sure that power is removed from both DC leads and AC input mains.

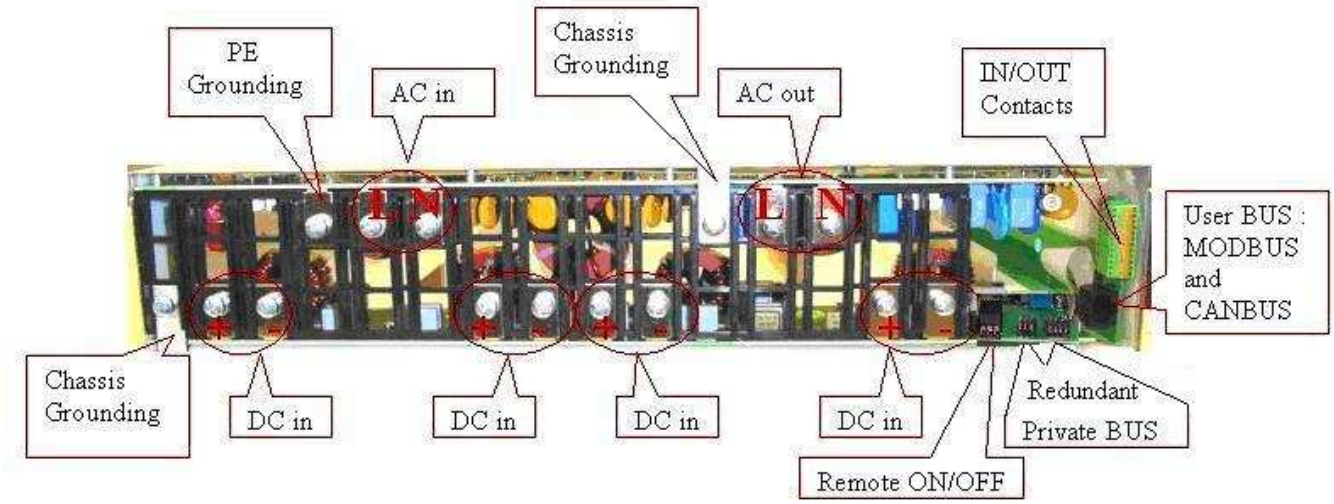
All breakers, cables and wires must be CE and classified for min 90°C (194°F) operation

All DC cables and alarm cables as well must be kept minimum 10mm away AC cables

Some safety labels are stuck on the TSI rack. They must not be removed.

Respect Line and Neutral connection.

The insulation cover of conductors must meet the local and international standards and the cross section must be related to the upstream protections.



DC and AC conductors connected to screw terminals must be tied with torque between 1,2 and 1,5 Nm.

DC and ground conductors connected to copper plates with bolts must be tied with torque between 5 and 7Nm.

NOTE : : When several shelves BRAVO are installed in the cabinet, a set of copper bars, cables, accessories and BUS communication are used for connecting shelves together . Drawings are supplied for explaining the way to assemble the copper bars.

3.4.1 Disconnecting and protecting devices

Caution:

When several Shelfs are mounted in the cabinet, cables sizes (section in mm2) and the breakers capacity must be adapted

3.4.1.1 DC input connection

Integrator must provide branch circuit protection with breaking capacity related to short circuit capacity of upstream DC source.

- ⇨ It must be installed close enough to permit easy “Break Before Make”.
- ⇨ Appropriate type can be chosen within the table here below.
- ⇨ TSI is supplied with safety labels, which must be applied to the breaker in a visible way.

The insulation cover of connecting cables must meet the local and international standards and the cross section related to the upstream protections.

DC input current at 40VDC	DC breaker	Cable size	Screws size
55A (By BRAVO module)	63A C curve by inverter	AWG 5 by inverter	M5 X 12mm by inverter

Adapt the breaking capacity of your breaker in relation to your installation (length cable, battery capacity). By default we install 5KA.

BRAVO is individual feeding by default.
Common feeding can be achieved with appropriate bus bar or daisy chain wiring.

Optional accessories will be provided with commercial versions.

3.4.1.2 AC input connection

For single-phase equipment, the disconnect devise shall disconnect both poles simultaneously.

Except that a single-pole disconnect devise can be used to disconnect the line conductor where it is possible to rely on the identification of the neutral in the AC MAINS SUPPLY.

AC input connection only exists whenever TSI system has been foreseen with static transfer switch function (EPC mode).

120 Vac model	AC breaker	Cable size	Screws size
70.1 A (BRAVO shelf) @ nominal power (W)	80A C curve by shelf	AWG 3	M5 X 12mm

3.4.1.3 AC output distribution

Caution:

The TSI Rack does not include any disconnect or protecting devises for AC output. Prior any intervention on AC output make sure DC input & AC Input have been actually disconnected.
But TSI pack solution includes protecting device for AC output.

The shelf is not hot plug device
➔Prior any handling of the shelf, wait a few minutes (min 5 minutes) for complete discharge of internal capacitors that have been energized.

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.
NB Default value is set at 60 seconds.

120 Vac model	Cable size	Screw size
83A (BRAVO shelf) @ nominal power (VA)	AWG 3	M5 X 12mm

TSI rack is supplied with screw terminal: Neutral, Line and Ground.

Remark:

⇨ Sub-racks without static transfer switch function (REG type) can be seen as independent power sources. To comply with international safety standards Neutral and PE may have to be connected together.

3.4.2 Grounding

3.4.2

Caution:

Current leakages can reach hazardous values.
For your personal, SAFETY earth connections must be done before energizing the system.

Earth connection must be done to the point referenced with symbol 

Input ground must be connected to the appropriate terminal

3.4.3 Remote Monitoring and Control

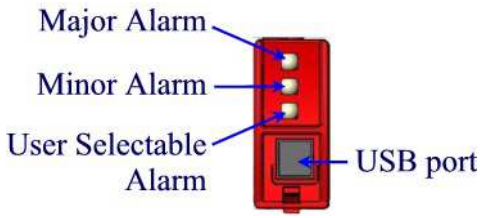
3.4.3.1 Basic monitoring

TSI systems are equipped with relays outputs for remote alarms:

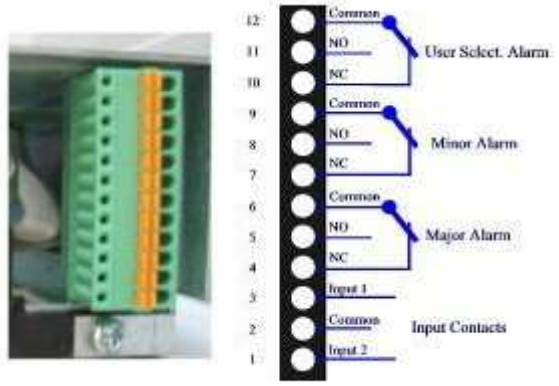
- Major Alarm (contact 5-6 closed when **No** alarm)
- Minor Alarm (contact 8-9 closed when **No** alarm)
- User selectable Alarm

All alarms are qualified in Minor alarm except those configurable by T2S. These configurable alarms are identified by the ID601 to 900. Refer to list of factory settings

Those alarms are available on the main shelf. They are reported on the front through the T2S.



There are 3 free potential changeover contacts provided. Maximum wire size is 0,5mm²



NB: Relays are energized while idle (i.e. relays dé-energized when event occur).

When TSI system consists in several shelves, the alarm must be connected on the shelf where T2S is located.

A) Digital input

Two external input contacts can be monitored through the T2S. They can be used for rack alarms such as “Door Opening”, “Temperature too high”, “Fan status” …
The voltage present on terminal 1 and 3 is +5V (galvanically insulated). Care should be taken to avoid connecting any external voltage on terminal 1 to 3.
External signals should be applied to these terminals via Volt-free contacts.
The function is activated when the 2 terminals concerned are short-circuited (i.e. when the external Volt-free contact is closed)

B) Digital output

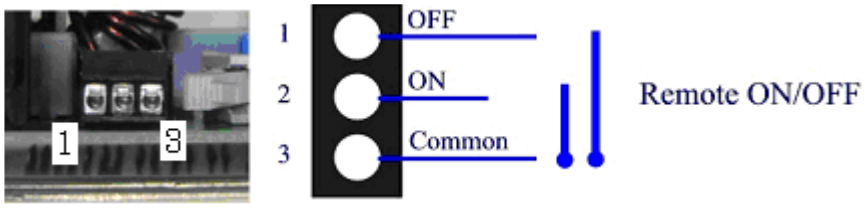
MAJOR, MINOR and selectable relay provide an open or close free potential contact

Relay characteristics:

Maximum switching capacity:	2A @ 30VDC or 1A @ 60VDC
Maximum switching power:	60W
Maximum voltage:	60VDC SELV
Maximum switching current:	2A

3.4.3.2 Remote ON/OFF

TSI system can be remotely activated or stopped (stand-by mode).



When TSI system consists in several shelves, the remote ON/OFF can be connected on any shelf.

> Changeover contacts must be used. For transition the TSI checks actually that one input is released whilst the other is short circuited.
> If both transitions are not picked up the inverter does not change its operating status.

The voltage present on terminal 1 and 3 is +5V (galvanically insulated). Care should be taken to avoid connecting any external voltage on terminal 1 to 3. Maximum wire size is 1 mm²

Functional table for remote ON/OFF function

States	Pin 1-3	Pin 2-3	
1	Open	Open	System working normally
2	Close	Open	TSI output switched off DC AC LED off DC DC LED solid green AC DC LED solid green
3	Open	Close	System working normally
4	Close	Close	System working normally

The 3 wires must be used for the redundancy on the remote ON/OFF. Use NO/NC relay contact.

> State #3 should be implemented by default.
>
> NB: Changing status of these inputs (State #3 ➔ State #2 ➔ State #3) forces the TSI modules to start running without T2S

3.5 Plug in of inverters modules

3.5

(1) Slide the module in

(2) Push firmly till the connection is properly engaged

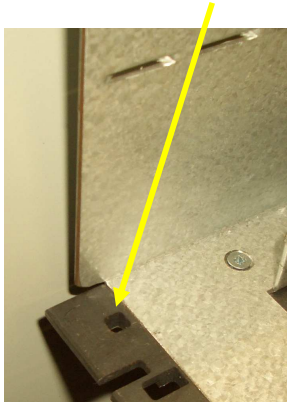
(3) Close the cover and latch the module in place If too hard redo step (2)

(4) Check that the cover is properly closed

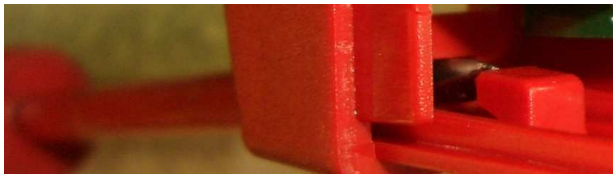
3.6 Release the T2S Monitoring

3. 6

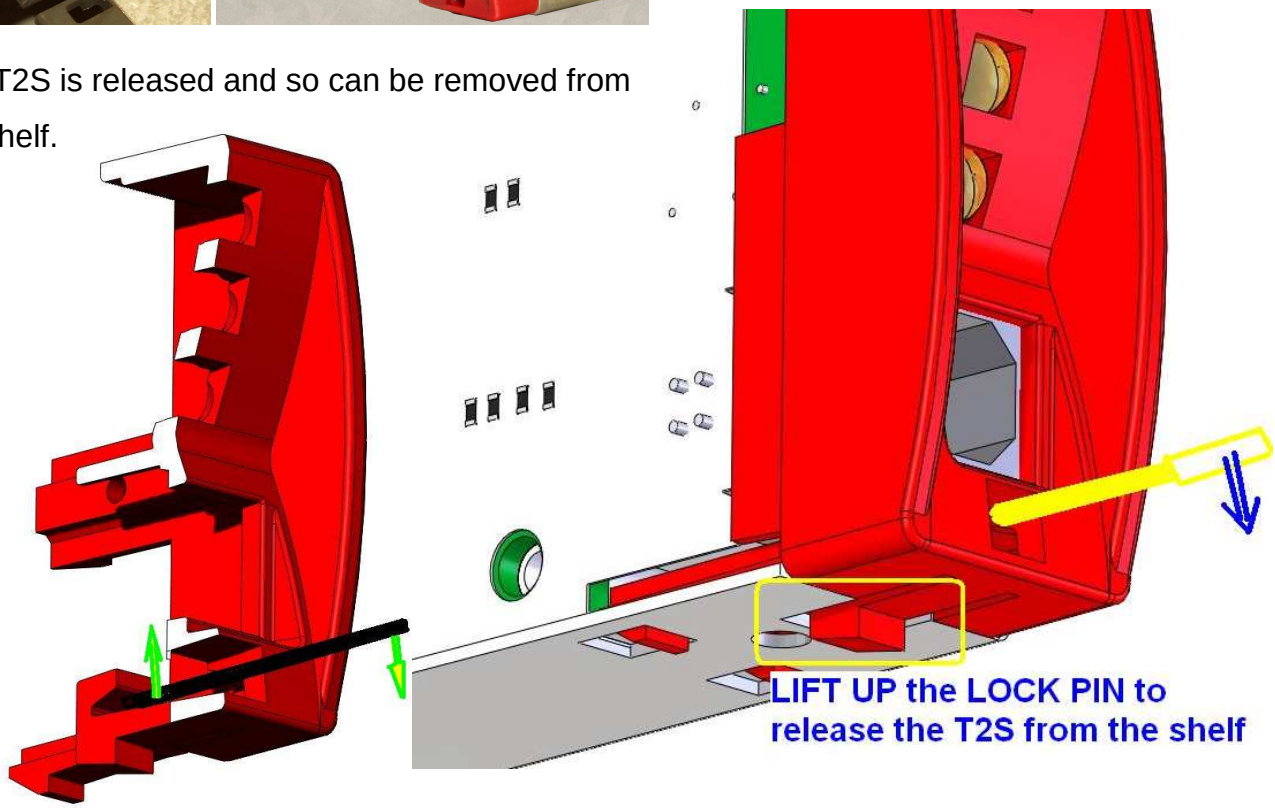
The T2S is locked in the shelf by a lock pin.



For pulling off the T2S from the shelf, insert a small flat screwdriver in the square hole under the USB port and lift up the lock pin.



The T2S is released and so can be removed from the shelf.



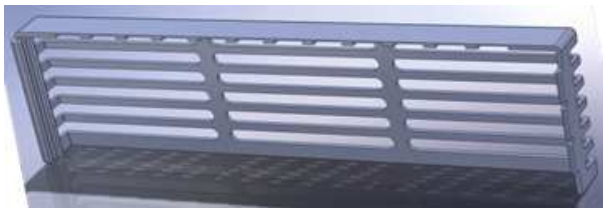
Caution:

For safety reasons, any slot without module must be filled with a blank housing.

SAFE SOLUTION

UNSAFE SOLUTION

To avoid any risk to touch voltage on the back of shelf, it is advised to use back protection (in option)



4 TSI BRAVO 48 / 120 *Technical features*

GENERAL

EMC (immunity)	EN 61000-4-3 EN 61000-4-6
EMC (emission)	FCC Part 15 (Class A) EN 55011-CISPR11-(CLASS A)
Safety	UR1778 IEC EN 62040-1-1
Cooling	Forced
Isolation	Doubled
MTBF	240000 hrs
Efficiency (Typical)	
Enhanced Power Conversion	95%
On Line	91%
Dielectric strength DC/AC	4300Vdc
True Redundant Systems	Compliant
3 disconnection levels on AC_{out} and DC_{in} power ports	
4 disconnection levels on AC_{in} port	
RoHS	Compliant
Connection I/O	Terminal block
Protected against inversion of polarity	
Self adaptive to wide operating conditions and comprehensive table of troubleshooting codes	

AC OUTPUT POWER

Nominal Output power	2500 VA
Output power (resistive load)	2000 W
Short time overload capacity	150% 15 second
Permanent overload capacity	110%
Admissible load power factor	Full power rating from 0 inductive to 0 capacitive
Internal temperature management and switch off	

DC INPUT SPECIFICATIONS

Nominal voltage (DC)	48 V
Voltage range (DC)	40 - 60 V
Nominal current (at 40Vdc)	56 A
Maximum input current (for 15 second)	84 A
Voltage ripple	< 2mV
Input voltage boundaries user selectable	

AC INPUT SPECIFICATIONS

Nominal voltage (AC)	120 V
Voltage range (AC)	80 – 138 V
Brownout	80 to 95 V 1684 W @ 80 V
Conformity range	Adjustable
Power Factor	>99%
Frequency range (selectable)	50 - 60 Hz
Synchronization range	47 – 53 Hz 57 – 63 Hz

AC OUTPUT SPECIFICATIONS

Nominal voltage (AC) (*)	120 V
Voltage range (AC)	100 – 130 V
Voltage accuracy	2 %
Frequency	50 - 60 Hz
Frequency accuracy	0.03 %
Total harmonic distortion (resistive load)	<2.5 %
Load impact recovery time	0.4 ms
Turn on delay	40 s
Nominal current	20.9 A
Protected against reverse current	
Crest factor at nominal power	3.1
Short circuit clear up capacity	10 x I_n for 20msec
Available while Mains is available at AC input port	
With magnitude control and management	
Short circuit current after clear up capacity	2.1 In
Short circuit current after 15sec	1.5 In

TRANSFER PERFORMANCE

Maximum voltage interruption	0 s
Total transient voltage duration (max)	0 s

ENVIRONMENT

Altitude above sea without derating	<1500m
Derating slope upper than 1500m	0.8% by 100m
Ambient temperature	-20 to 50 °C
Storage temperature	-40 to 70 °C
Relative humidity	95% , non condensing

SIGNALING & SUPERVISION

Display	Synoptic LED
Alarms output	Dry contacts on shelf
Supervision	Use optional devices

WEIGHT & DIMENSIONS

Width	102 mm
Depth (mm)	Module: 435 Shelf: 515
Height	2 U
Weight	Module 5 Kg Shelf 6 Kg
Material (casing)	Coated steel

(*) Operation within lower voltage networks leads to derating of power performances.