USER MANUAL

Bravo inverter 120VAC in 19 inches shelf

**This document is subject to modification without prior notice from the manufacturer.
The present equipment is protected by several international patents and trademarks.**

Tables of contents

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 Installation Manual - 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 Installation Manual –§ 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

1

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

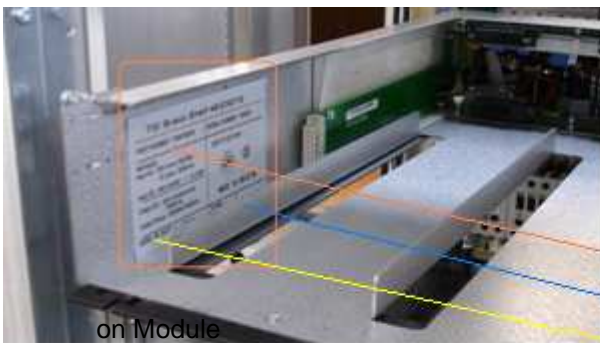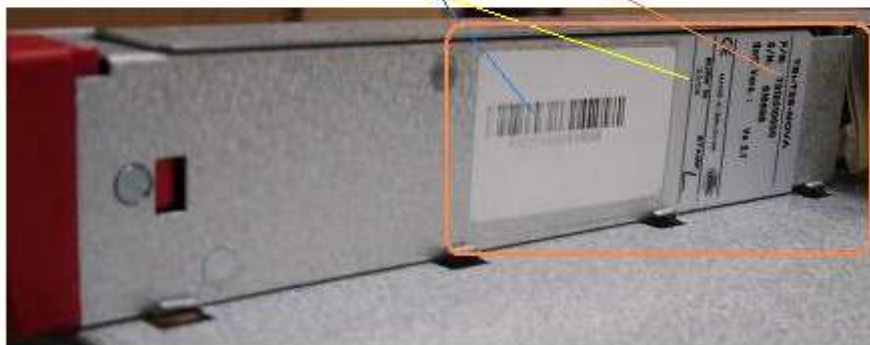**TSI System Identification plate:**

Identification Plates are located
On Shelf: **on Module**

on Module

(1) Part Number
(2) Serial Number
(3) Burn in week

On T2S

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℃ to + 50℃
Storage Temperature	-40℃ to + 80℃ 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 at nominal power for TSI Bravo

3. Remote Monitoring and Control

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 alarm are identify 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.
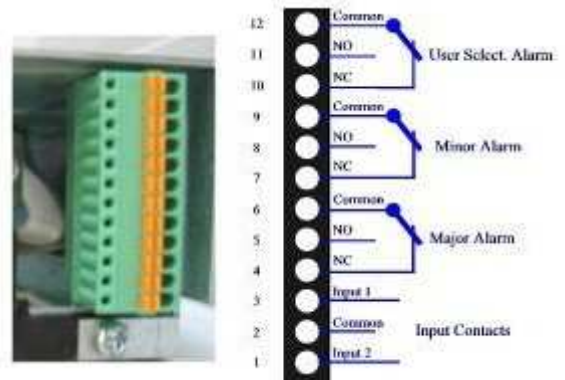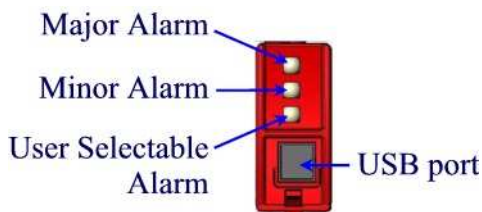
There are 3 free potential changeover contacts provided.

Maximum wire size is 0,5mm²

NB: Relays are energized while idle (i.e. relays de-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)
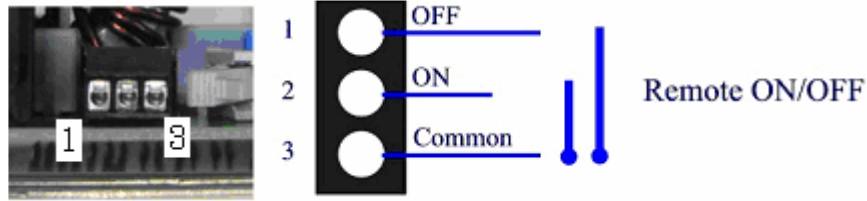
B) Digital output

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

3.2 Remote ON/OFF

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

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.

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

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

3.3 Monitoring by CanBus (in option)

CanBus protocol is available on the port "User Bus" located on the back of shelf. For pin out information and conversion table ask file "MODBUS_protocol_for_T2S".
The CANBUS can supply an optional CANDIS. See chapter 3.5
Other application shall be defined later on request.
Available since software version 2.3 on T2S

3.4. Monitoring by MODBUS (in option)

The Modbus protocol is available on the port "User Bus" located on the back of shelf. For pin out information and conversion table ask word file "MODBUS_protocol_for_T2S.doc".

Available since software version 2.3 on T2S

3.5 Monitoring by optional CANDIS (in option)

This CANDIS allows information on display(s) and by TCPIP interface. Following the requirement le CANDIS should be provide with one, two or three displays. The last slot is use to include the TCPIP interface.
The variables available on CANDIS are voltages, currents, frequency, inverter configured.

Refer to the specific operating manual for detail.
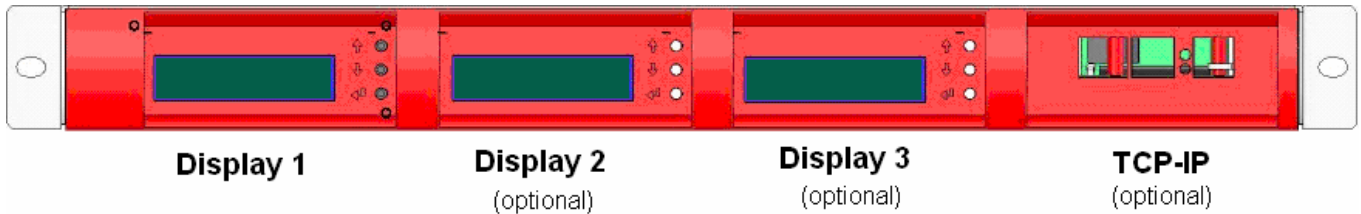
3.6 Monitoring by TCPIP (in option)

The TCPIP interface should be mounting on the extension CANDIS.

Refer to the specific operating manual for detail.

4 Getting started

Caution
Before connecting any power DC or AC to the system, Make sure you have followed instructions of previous section "Installation".

1. Check that both AC input and output breakers are switched off.
2. Check that maintenance by-pass switch, if any, is in position "MBP OFF"
3. Apply the DC power to the system, switch on DC input breakers.

STATUS INVERTER LED
Status LED's for DC/DC input converter and DC/AC output converter blink for a few seconds in orange = starting mode
After a short while the LED's turn to permanent green.
If these LED's start flicking or show different color refer to section 6.1 for troubleshooting.
If the default set of operating parameters (factory settings) is OK or if the system has been previously configured the TSI can be started without further concerns ➔ go directly to step (4).
Otherwise refer to section 7.2 for changing the configuration.
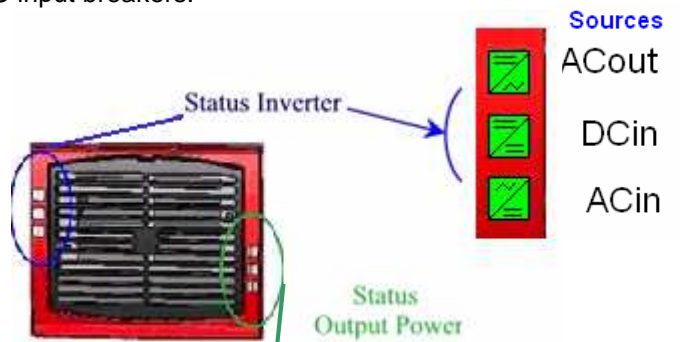
4. Start applications one by one with load MCB's

   Check bar graph display (Status Output Power). The number of bars lighting (1, 2 or 3) represents the percentage of full power delivered to the load. (2^d column where 1st bar is permanent shows that output power is between 5 and 40 %, if 1st bar is blinking than output power is less than 5 %)

5. Switch on the AC input mains breaker (if any).

   Status LED's for AC/DC input converter blinks for a few seconds in orange = starting mode
   After a short while the LED turns to permanent green.
   If this LED starts flicking or shows different color refer to section 6.1 for troubleshooting.

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*)

6. Check that system is operating under normal conditions.

CAUTION: Due to constant power load behavior, overload capabilities should be sometimes de-rated.

5 Service and maintenance

5.1 Plug in of inverters modules

(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**

Caution:

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

Caution:

Before any intervention on the TSI Rack, operator has to make sure that power is removed from both DC leads and AC input mains.
Maintenance has to be done by trained people only

5.2 Module TSI replacement

Thanks to the modularity concept, it is very easy to replace any module. The replacement can be done while the system is under operation = "hot swap solution".
➔ So to replace a module you are not supposed to switch down the load neither to access inside the TSI rack. Nevertheless if you decide to do so, remind that because of the AC input connection, **the TSI rack is a dual power supply system**.

(1) Use screwdriver to release the latch

(2) Open the cover completely

(3) User the cover as a handle to remove the module

1. Identify the damaged module.
2. Release the module and slide it out of the rack as described here above.
3. Replace the damaged unit by the new one.
4. Push it firmly and latch it again.
5. if need be change the module address (see section …)
6. Check that normal operation is recovered.

The TSI inverter is hot swappable.
When new module is inserted it automatically adapt to working set of parameters. These values are exchanged by communication within inverters connected together.
When a new module is inserted in a running stack it automatically takes the next available address.
Normal operation is so resumed.

To move one inverter in 3 phases system, wait until the fan stop before insert the TSI in an other phase

However for monitoring and easy maintenance it may be useful to change the address with one more convenient. Refer to section 7.4 for procedure.

Caution:

When the module is removed energized terminations are accessible inside the shelf.
Keep hands off and insert blank module without delay.

5.3 Module T2S replacement

5.3

When a system is working with a T2S, the current customer configuration is saved in the inverters and in the T2S too.
If the system is powered, follow the procedure "A" here bellow, if system is not powered follow the procedure "B" here bellow

A) If system powered.

Replacement of T2S included in one running system (running means that the system is still fed by either the DC supply or the main; the output should be OFF)

Procedure:
Remove the old T2S from the system,
Insert the new T2S,
The new T2S will take the configuration from the inverters.
Exchange data can take 5 to 30 minutes depending data to be exchanged.

B) If system not powered.

When the T2S need to be replaced, the new one does not necessarily contain the good configuration similar to the old T2S if the inverters are not fed. This should keep the inverter in "OFF" position.
To avoid this, apply the following rules.
In this situation all LED's are OFF

    Procedure:
        Remove the old T2S from the system,
        Start the system without T2S,
        After about one minute, the 3 status LED's will be blinking orange, meaning the system has no T2S,
        Insert the new T2S,
        The new T2S will take the configuration from the inverters. Exchange data can take 5 to 30 minutes depending data to be exchanged.
        After this while, the exchanged data will read the configuration in T2S and control whether all parameters are correct.

N.B.:

    -When T2S is exchanging data, **DO NOT CHANGE or ADD** new inverters.

    -If T2S and inverters have to be changed:

                -   **FIRST** change the T2S (according to the procedure)
                -   **SECOND** (when T2S is running) change the inverters.

6 TSI User Interface

6

Full handling of the TSI system is provided with three standard resources:

- ‣ LED's located on each module
- ‣ LED's located on the T2S monitoring device (one per TSI system)
- ‣ Enhanced monitoring functions available through laptop

The TSI has been designed to propose at glance troubleshooting and diagnostic. Further information can be collected for monitoring, maintenance or more knowledgeable diagnostic by connecting a laptop to the T2S USB port. Section … describes handling with laptop.

6.1 Modules Troubleshooting (LED's meaning)

6.1
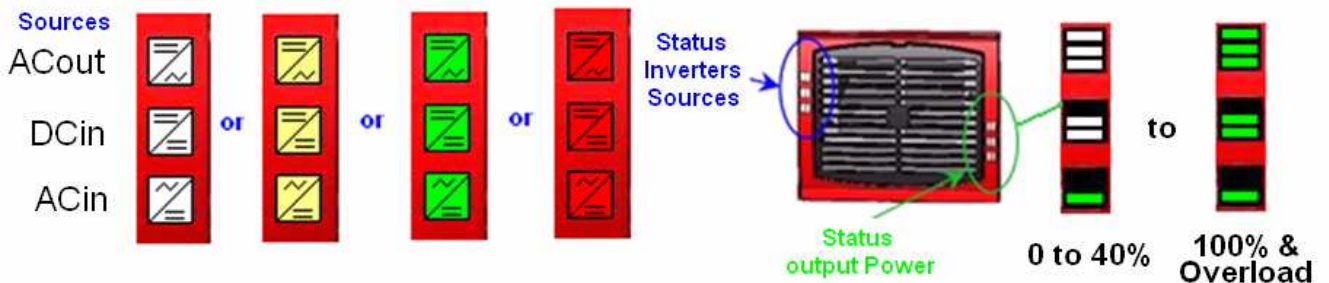
Status Inverter LED	Description	Remedial action
OFF	No input power or forced stop	Check environment
Permanent green	Fine working	Nothing to do
Blinking green	Converter OK but working conditions are not fulfilled to operate properly	Check upstream and surrounding equipments
Blinking green/orange alternatively	Recovery mode after boost (10 In short circuit condition)	Wait for a while
Permanent orange	Starting mode	Wait
Blinking orange	Modules cannot start	Insert T2S
Blinking red	Recoverable fault	Wait or attempt to clear default condition by removing and reinserting the module
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*)

6.2 System LED's

Major and minor alarms are signaling by LED
and, are user selectable refers to section 7.5
for configuration.
LED lit green for no alarm and lit red for related
alarm
User Selectable Alarm can be associated with any of internal operating alarm. Refer to section 7.5 for
configuration. The LED user selectable alarm lit green when the condition is done or flashing when the T2S write
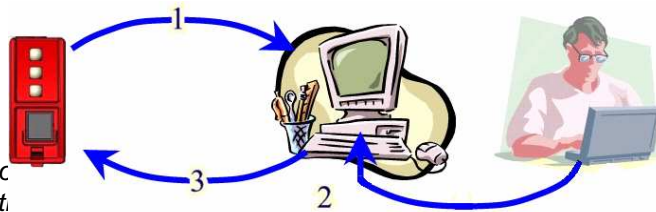in the TSI EEPROM
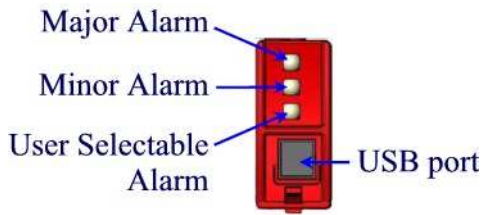
7 TSI System Configuration

7

The T2S together with a laptop can be used for configuring the TSI system and for advanced diagnostic.

Three important tasks can be performed:

‣   Changing system configuration
Project Engineer customizes the TSI system Co
Application Engineer check configuration and t
The file to the TS2

‣   Copy-paste the system configuration from one
    system to another

‣   Viewing internal parameter status for
    system evaluation and diagnostic

The TSI is delivered with factory settings.

Unless specific ordering default, set of parameters is in accordance with the configuration (Pack or

Cabinet System). When T2S is integrated in "A la Carte" system,

Default values of set of parameters are listed on pages 21 to 23.

On site change can be achieved through laptop.
You need:
1. PC running Windows 2000, Windows XP,
    Windows NT or VISTA
2. Equiped with "Hyper Terminal" software and
    having one USB port available.
3. USB cable type "A to B" as shown here
    ➔ Use preferably a cable with noise suppressor (ferrite nut). It prevents some communication bugs due to
    poor immunity of USB protocol
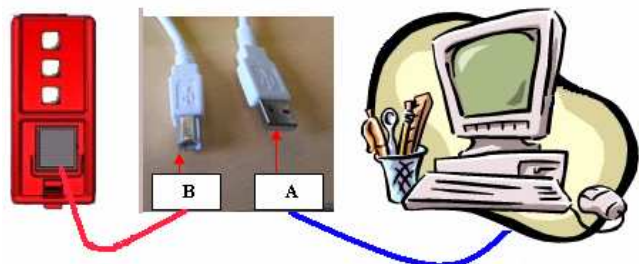
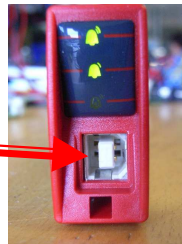4. Driver "CET_T2S.inf" to be downloaded from our portal

WEB SIDE ADDRESS : **http://www.acbackuptsi.com**

LOGIN : **T322010000** - NO PASSWORD

Start the TSI system without any cable connected to the front connection of the T2S

Wait for the T2S has actually started.

The two LED's in the upper part are lighting.

Connect the USB cable to the laptop and to the T2S.

The laptop shall find automatically the new device driver. Follow displayed instructions to indicate the right been actually installed.

connected and shall prompt for the path where the file "CET_T2S.inf" has

As soon as the T2S is recognized it is logged into your computer as new COM port.

It's name is "COMx" where "x" is automatically allocated by the laptop.

If you have some doubt what COM port has been allocated to your T2S, open your "Control Panel" [Start – Settings – Control Panel].
Select « System » « Hardware » - « Device Manager »:
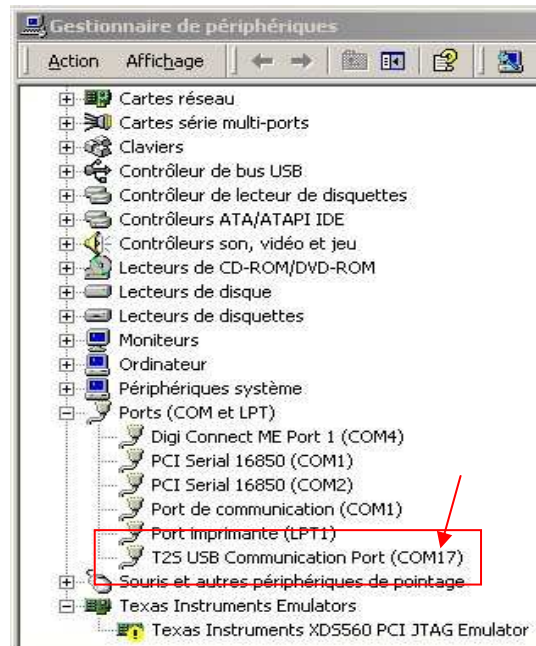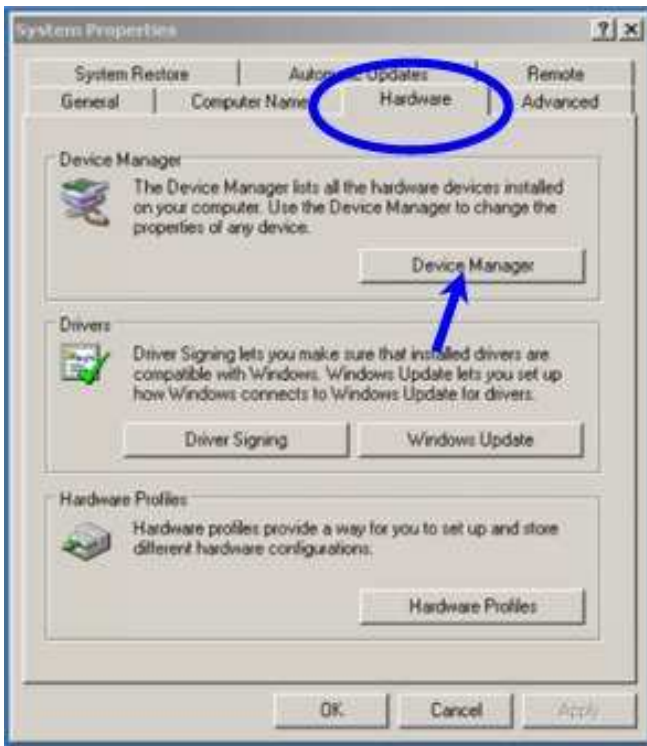
Find out « T2S USB Communication Port » in the directory « Ports (COM et LPT) ».

The COM port that has been allocated is clearly indicated.

Open "HyperTerminal" from your Microsoft Windows Application
and configure "COMx" as shown hereby.
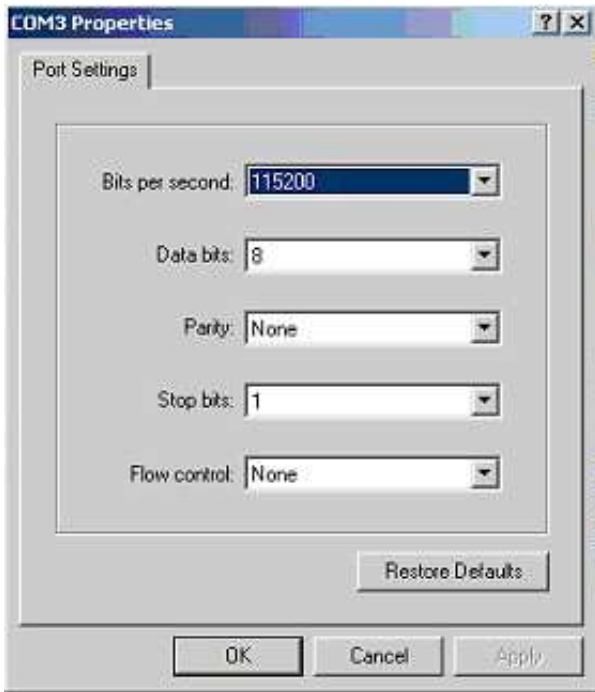
Baudrate: 115200

Databits: 8

Parity: No

Stop Bit: 1

Flow Control: No

Such screen should appear.
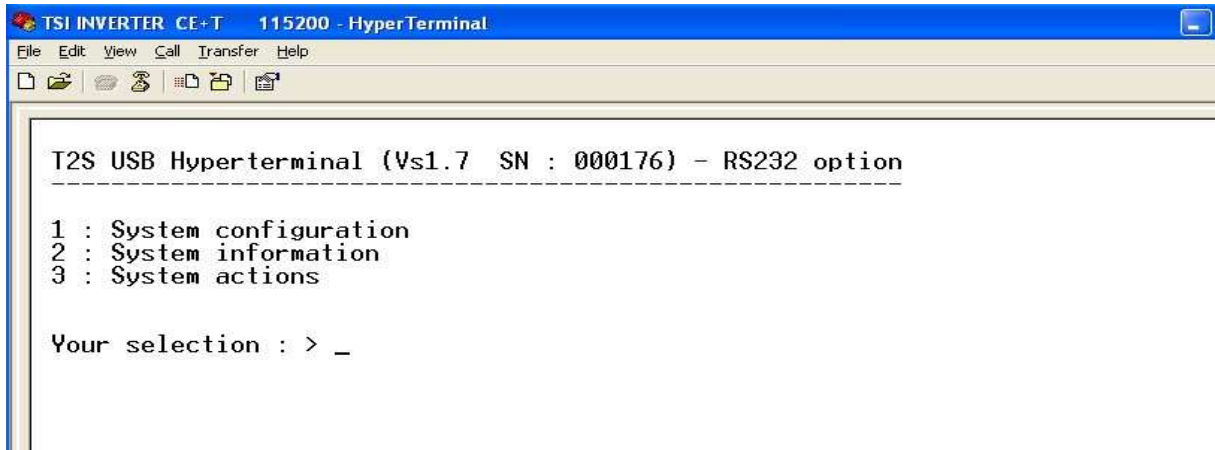
The software version of the T2S as well as its serial number is displayed on this screen.

You are ready to configure and/or to maintain your TSI system.

The menu tree is shown here below:

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**
  - **4→ Restore factory settings**
- **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→ Phases information**
    - **0→ Return to previous menu**
    - **1→ Variables set 1**
    - **2→ Variables set 2**
    - **3→ Variables set 3**
  - **3→ Groups information**
    - **0→ Return to preceding 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 log display**
    - **0→ Return to previous menu**
    - **1-14→ Page number selection**
    - **16→ Clear log**
    - **17→ Save log to a file**
  - **6→ Modules 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 settings**
  - **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**

7.1 Receive configuration from T2S

Select (1) in root menu « Configuration Menu »
   …then Select (2) « Read Configuration file from T2S »
   … the T2S prompts for downloading
      …Click "Transfer" and then "Receive File"
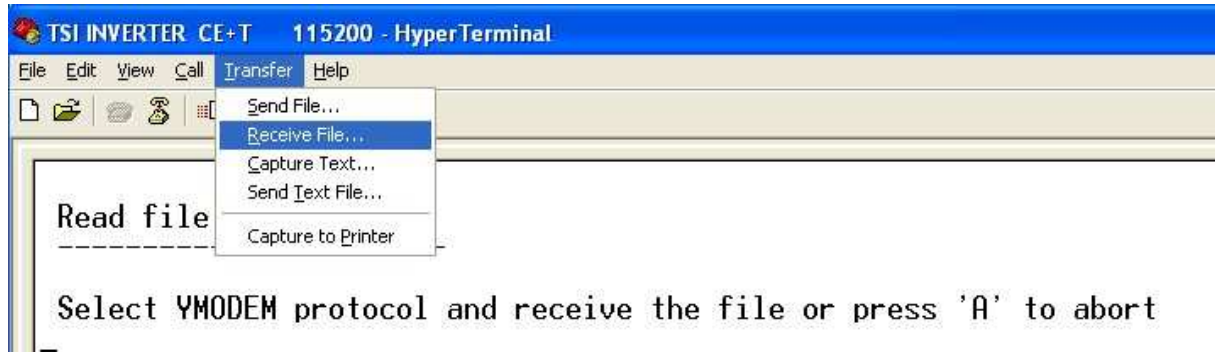
Following screen pops up

Use « Browse » button to select directory where you want to save the configuration file.
Select "Ymodem" from drop down list.

Press "Receive" to start downloading.

The file is named « T2S_config_file_hh_mm_ss__dd_MM_yyyy.txt »
Where « hh :mm :ss dd/MM/yyyy » stands for date and time.

If the transfer has done successfully the next message appear "Successfully uploaded"

If you want to copy-paste this configuration to another system, go directly to section 7.3

7.2 Changing TSI Configuration

The configuration file can be split in two parts:

‣ Operating parameters (thresholds, number of modules, redundancy, …)

‣ System parameters (modules addresses, phases, …)

> **The change of the TSI operating parameters cannot be achieved inside the T2S but within the laptop instead. The section hereafter describes the procedure to change these.**
>
> **Refer to section 7.4. for changing the system parameters.**

The file that has been downloaded (see previous section) can be changed with any kind of text editor or notepad. After completion the new file is uploaded to the T2S (see section 7.3)

```
ICFG_HDRI
-------    ------------------------------------    -------------------    --------
- ID: -    -          VAR DESCRIPTION         -    -      VALUE      -    - UNIT -
-------    ------------------------------------    -------------------    --------
  1                         2                              3                   4
-----------------------------------------
- Global Settings (ID : 1 - 50)
-----------------------------------------

;1;        ;Number of module in phase 1;          ;6;                    ;;
;2;        ;Number of module in phase 2;          ;0;                    ;;
;3;        ;Number of module in phase 3;          ;0;                    ;;
;4;        ;Number of module in phase 4;          ;0;                    ;;
;5;        ;Number of module in phase 5;          ;0;                    ;;
;6;        ;Number of module in phase 6;          ;0;                    ;;
;7;        ;Number of module in phase 7;          ;0;                    ;;
;8;        ;Number of module in phase 8;          ;0;                    ;;

;21;       ;Amount of redundancy in phase 1;      ;1;                    ;;
;22;       ;Amount of redundancy in phase 2;      ;0;                    ;;
;23;       ;Amount of redundancy in phase 3;      ;0;                    ;;
;24;       ;Amount of redundancy in phase 4;      ;0;                    ;;
;25;       ;Amount of redundancy in phase 5;      ;0;                    ;;
;26;       ;Amount of redundancy in phase 6;      ;0;                    ;;
;27;       ;Amount of redundancy in phase 7;      ;0;                    ;;
;28;       ;Amount of redundancy in phase 8;      ;0;                    ;;

;40;       ;Number of DC input groups;            ;1;                    ;;
;41;       ;Number of AC input groups;            ;1;                    ;;

-----------------------------------------
- Inverter parameters (ID : 51 - 550)
-----------------------------------------

;60;       ;Input Source (AC : 0, DC : 100) ;     ;0;                    ;%;

;70;       ;Number of phases                ;     ;1;                    ;;

;75;       ;Free running Frequency          ;     ;50.0;                 ;Hz;

;80;       ;Short Circuit voltage Threshold ;     ;80;                   ;V;
;81;       ;Short Circuit Hold Time         ;     ;60.0;                 ;s;

;90;       ;Max current (pc of nominal curr);     ;150;                  ;%;
;91;       ;Max power (pc of nominal power) ;     ;150;                  ;%;
   "                   "                              "                     "
   "                   "                              "                     "
   "                   "                              "                     "
   "                   "                              "                     "
;901;      ;Digital input 1 label;                ;DIG INP1 FAILURE;     ;;
;902;      ;Digital input 2 label;                ;DIG INP2 FAILURE;     ;;
```

1 : The content of the first column is used as an identifier for the parameter. It can never be changed.

2 : The second column is a parameter description. It is just skipped by the T2S compiler. It should not be changed but any modification has no consequences.

3 : The field of the third column is the parameter value. It can be changed. Decimal digits are separated by a dot. If the coma is used or any other character is used right handed digits will be ignored.

4 : The field of the last column is the unit. It is just ignored by the T2S compilator.

Remark :

Semi colons are separators. They must stay in place.

After any change, you can save the configuration file for backup.

List of factory settings (Default Values)

These settings are only available when the TS2 is ordered for spare parts, or when you apply a default configuration.

ID	TEXTUAL DESCRIPTION	Values			UNIT
		Min	Default	Max	
	Global Settings (ID : 1 - 50)				
1	Number of modules configured in phase 1	0	1	32	
2	Number of modules configured in phase 2	0	0	32	
3	Number of modules configured in phase 3	0	0	32	
4	Number of modules configured in phase 4	0	0	32	
5	Number of modules configured in phase 5	0	0	32	
6	Number of modules configured in phase 6	0	0	32	
7	Number of modules configured in phase 7	0	0	32	
8	Number of modules configured in phase 8	0	0	32	
21	Amount of redundancy in phase 1	0	0	n-1	
22	Amount of redundancy in phase 2	0	0	n-1	
23	Amount of redundancy in phase 3	0	0	n-1	
24	Amount of redundancy in phase 4	0	0	n-1	
25	Amount of redundancy in phase 5	0	0	n-1	
26	Amount of redundancy in phase 6	0	0	n-1	
27	Amount of redundancy in phase 7	0	0	n-1	
28	Amount of redundancy in phase 8	0	0	n-1	
40	Number of DC input groups	1	1	8	
41	Number of AC input groups	1	1	4	
	Inverter parameters (ID : 51 - 550)				
	AC common setting (ID : 51 - 100)				
60	Input Source (AC : 0, DC :100)	0	0	100	%
61	Acin Mode (0 : normal , 1 : safe)	0	0	1	
70	Number of phase	0	1	8	
75	Free running Frequency	50	60	60	Hz
80	Short circuit output voltage threshold	20	50	100	V
81	Short circuit hold time	0.1	60	600	S
82	Booster 10x Iin (0 : OFF, 1 : ON)	0	1	1	
90	Max current (pc of nominal curr)	30	150	150	%
91	Max power (pc of nominal power)	30	150	150	%
92	Max overload duration	0	15	15	s
100	Synchronization Tracking Speed	-2	0	2	
101	Remote OFF disable Acin Power	0	0	1	
102	Negative Power (0 : OFF , 1 ON)	0	1	1	
	AC Output (ID : 101 - 259)				
160	OUT 1 : phase shift	-180	0	360	Deg
161	OUT 1 : Nominal output voltage	100	120	140	V
170	OUT 2 : phase shift	-180	0	360	Deg
171	OUT 2 : Nominal output voltage	100	120	140	V
180	OUT 3 : phase shift	-180	0	360	Deg
181	OUT 3 : Nominal output voltage	100	120	140	V
190	OUT 4 : phase shift	-180	0	360	Deg
191	OUT 4 : Nominal output voltage	100	120	140	V
200	OUT 5 : phase shift	-180	0	360	Deg
201	OUT 5 : Nominal output voltage	100	120	140	V
210	OUT 6 : phase shift	-180	0	360	Deg
211	OUT 6 : Nominal output voltage	100	120	140	V
220	OUT 7 : phase shift	-180	0	360	Deg
221	OUT 7 : Nominal output voltage	100	120	140	V
230	OUT 8 : phase shift	-180	0	360	Deg
231	OUT 8 : Nominal output voltage	100	120	140	V

ID	TEXTUAL DESCRIPTION	Values			UNIT
		Min	Default	Max	
DC Input Related (ID : 260 – 369)					
260	DC 1 : vdc_in Low Start	39	44	61	V
261	DC 1 : vdc_in Low Transfer	39	39	61	V
262	DC 1 : vdc_in Low Stop	39	39	61	V
263	DC 1 : vdc_in High Start	39	58	61	V
264	DC 1 : vdc_in High Transfer	39	61	61	V
265	DC 1 : vdc_in High Stop	39	61	61	V
270	DC 2 : vdc_in Low Start	39	44	61	V
271	DC 2 : vdc_in Low Transfer	39	39	61	V
272	DC 2 : vdc_in Low Stop	39	39	61	V
273	DC 2 : vdc_in High Start	39	58	61	V
274	DC 2 : vdc_in High Transfer	39	61	61	V
275	DC 2 : vdc_in High Stop	39	61	61	V
280	DC 3 : vdc_in Low Start	39	44	61	V
281	DC 3 : vdc_in Low Transfer	39	39	61	V
282	DC 3 : vdc_in Low Stop	39	39	61	V
283	DC 3 : vdc_in High Start	39	58	61	V
284	DC 3 : vdc_in High Transfer	39	61	61	V
285	DC 3 : vdc_in High Stop	39	61	61	V
290	DC 4 : vdc_in Low Start	39	44	61	V
291	DC 4 : vdc_in Low Transfer	39	39	61	V
292	DC 4 : vdc_in Low Stop	39	39	61	V
293	DC 4 : vdc_in High Start	39	58	61	V
294	DC 4 : vdc_in High Transfer	39	61	61	V
295	DC 4 : vdc_in High Stop	39	61	61	V
300	DC 5 : vdc_in Low Start	39	44	61	V
301	DC 5 : vdc_in Low Transfer	39	39	61	V
302	DC 5 : vdc_in Low Stop	39	39	61	V
303	DC 5 : vdc_in High Start	39	58	61	V
304	DC 5 : vdc_in High Transfer	39	61	61	V
305	DC 5 : vdc_in High Stop	39	61	61	V
310	DC 6 : vdc_in Low Start	39	44	61	V
311	DC 6 : vdc_in Low Transfer	39	39	61	V
312	DC 6 : vdc_in Low Stop	39	39	61	V
313	DC 6 : vdc_in High Start	39	58	61	V
314	DC 6 : vdc_in High Transfer	39	61	61	V
315	DC 6 : vdc_in High Stop	39	61	61	V
320	DC 7 : vdc_in Low Start	39	44	61	V
321	DC 7 : vdc_in Low Transfer	39	39	61	V
322	DC 7 : vdc_in Low Stop	39	39	61	V
323	DC 7 : vdc_in High Start	39	58	61	V
324	DC 7 : vdc_in High Transfer	39	61	61	V
325	DC 7 : vdc_in High Stop	39	61	61	V
330	DC 8 : vdc_in Low Start	39	44	61	V
331	DC 8 : vdc_in Low Transfer	39	39	61	V
332	DC 8 : vdc_in Low Stop	39	39	61	V
333	DC 8 : vdc_in High Start	39	58	61	V
334	DC 8 : vdc_in High Transfer	39	61	61	V
335	DC 8 : vdc_in High Stop	39	61	61	V

ID	TEXTUAL DESCRIPTION	Values			
		Min	Default	Max	UNIT
	AC Input Related (ID : 370 – 550)				
370	AC : Fac_in Low Start	47	57.3	63	Hz
371	AC : Fac_in Low Stop	47	57	63	Hz
372	AC : Fac_in High Start	47	62.7	63	Hz
373	AC : Fac_in High Stop	47	63	63	Hz
380	AC 1 : Vac_in Low Start	83	92.5	143.0	V
381	AC 1 : Vac_in Low Transfer	80	87.5	143.0	V
382	AC 1 : Vac_in Low Stop	80	87.5	143.0	V
383	AC 1 : Vac_in High Start	83	133.0	143.0	V
384	AC 1 : Vac_in High Transfer	83	138.0	143.0	V
385	AC 1 : Vac_in High Stop	83	138.0	143.0	V
390	AC 2 : Vac_in Low Start	83	92.5	143.0	V
391	AC 2 : Vac_in Low Transfer	80	87.5	143.0	V
392	AC 2 : Vac_in Low Stop	80	87.5	143.0	V
393	AC 2 : Vac_in High Start	83	133.0	143.0	V
394	AC 2 : Vac_in High Transfer	83	138.0	143.0	V
395	AC 2 : Vac_in High Stop	83	138.0	143.0	V
400	AC 3 : Vac_in Low Start	83	92.5	143.0	V
401	AC 3 : Vac_in Low Transfer	80	87.5	143.0	V
402	AC 3 : Vac_in Low Stop	80	87.5	143.0	V
403	AC 3 : Vac_in High Start	83	133.0	143.0	V
404	AC 3 : Vac_in High Transfer	83	138.0	143.0	V
405	AC 3 : Vac_in High Stop	83	138.0	143.0	V
410	AC 4 : Vac_in Low Start	83	92.5	143.0	V
411	AC 4 : Vac_in Low Transfer	80	87.5	143.0	V
412	AC 4 : Vac_in Low Stop	80	87.5	143.0	V
413	AC 4 : Vac_in High Start	83	133.0	143.0	V
414	AC 4 : Vac_in High Transfer	83	138.0	143.0	V
415	AC 4 : Vac_in High Stop	83	138.0	143.0	V
	Alarm Settings (ID : 551 - 950)				
	Global Parameters (ID : 551 - 600)				
551	Alarm on prog. relay option (255 means Not Used)	*	255	*	
553	Major relay temporization	2	60	65535	s
554	Minor relay temporization	2	30	65535	s
556	Saturation alarm threshold	0	80	100	%
558	AC in is present (1:true 0:false)	0	1	1	
560	Log near. Full thresh. (100-200)	100	180	200	
	Alarm Type (ID : 601 - 900) : Minor (1) - Major (2)- No Alarm (0)				
828	227 . DIG INP1 FAILURE	0	2	2	
829	228 . DIG INP2 FAILURE	0	2	2	
830	229 . REDUNDANCY LOST	0	1	2	
831	230 . REDUND + 1LOST	0	2	2	
832	231 . SYS SATURED (see parameter ID 556)	0	1	2	
833	232 . MAIN SOURCE LOST	0	2	2	
834	233 . SEC SOURCE LOST	0	1	2	
835	234 . T2S BUS FAIL	0	2	2	
836	235 . T2S FAILURE	0	2	2	
843	242 . LOG NEARLY FULL (see parameter ID 560)	0	0	2	
	User Input Alarm Labels (ID : 901 - 950)				
901	Digital input 1 label (max 16 characters)	text	DIG INP1 FAILURE**	text	
902	Digital input 2 label (max 16 characters)	text	DIG INP2 FAILURE**	text	
904	Input polarity (0:ShortCircuited-1; open)	0	0	1	
	ModBus Settings (ID : 951 - 1000)				
951	T2S Modbus slave address (1-247)	1	1	247	
955	Modbus write password (max 16 characters)	text	Modbus_T2S	text	

* ID 551: The default Value (255) means that this function is not used. When other value is recorded (acc. to TSI ALARMS Table – see Annex - TBD) a specific text will appears.
** ID 901 & 902: The customer is able to use these labels for specific customer message. Texts can be recorded (max 16 characters) like explained in 7.2.

7.3 Sending configuration to TSI

Select (1) in root menu « Configuration Menu »
   … Select 1 "Send configuration file to T2S"
   … the T2S prompts to send configuration
   …Click "Transfer" and then "Send File"
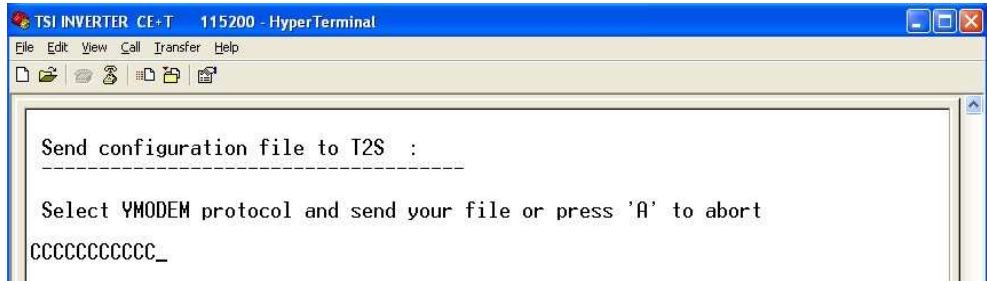
Use « Browse » button to select directory where you was saved the configuration file.
Select "Ymodem" from drop down list.

Press "Send" to start sending file.

The T2S acknowledges the upload.
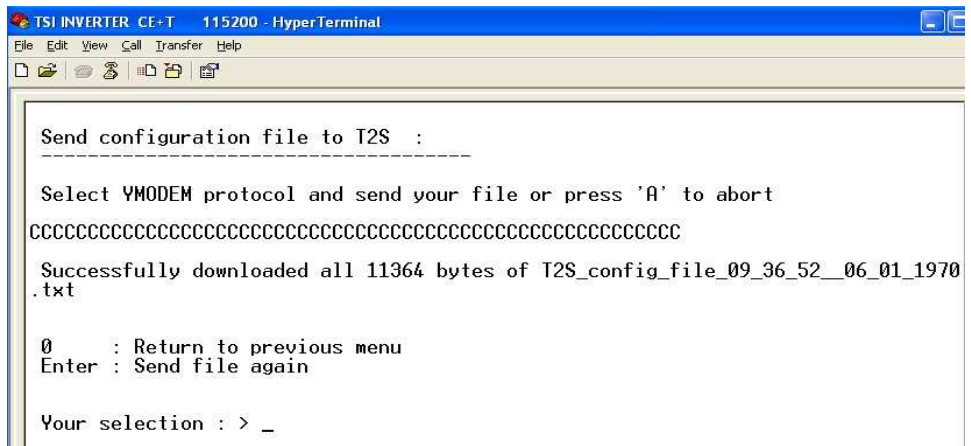
Whenever some parameters are not valid they are rejected and appropriate message is displayed.
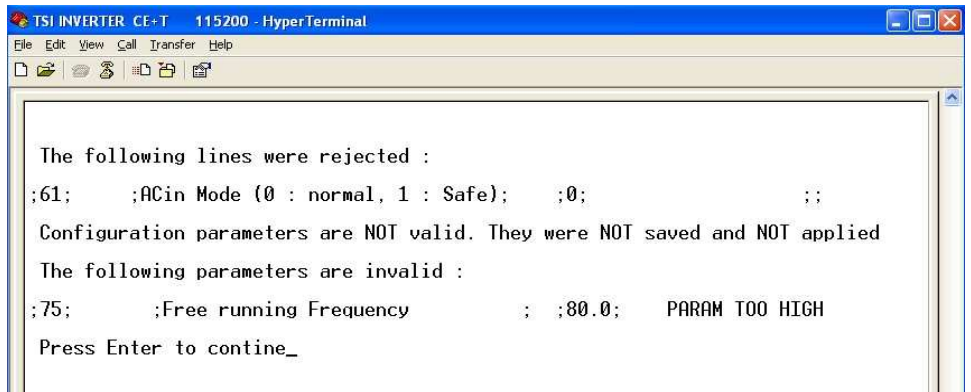
Default settings can be restored from the root menu:
                … Select (1) "Configuration Menu Selection"
                … then Select (3) "Restore Factory Settings"
                …then Confirm action (Y - N) : >

1. Addressing modules
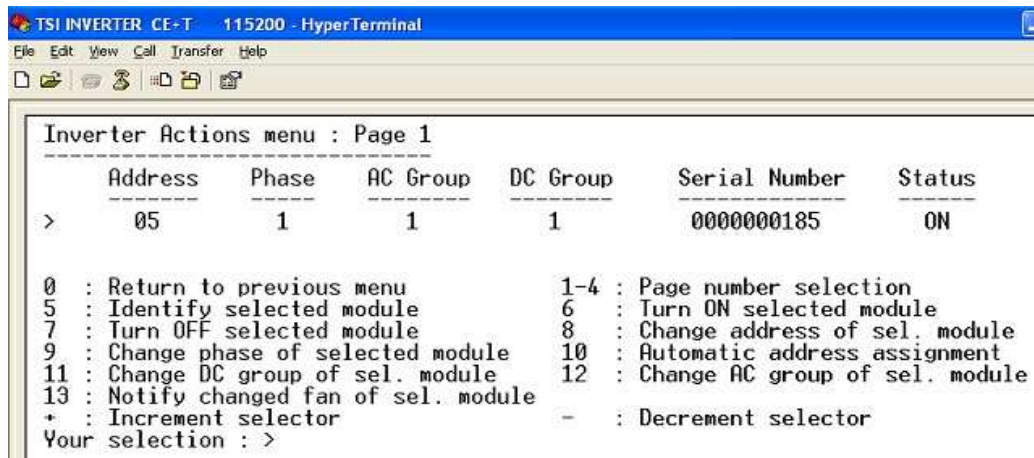
Modules inside the TSI system have an internal address that is not visible to the users. Thanks to this as soon as the power is turned on the TSI starts operation normally.

However for maintenance and monitoring it is far more convenient to set a relation between the physical position of the module inside the rack and the operating parameters that are displayed.

From the root menu
  … Select (3) "System Actions Selection"
  … then (2) "Inverter module action"

Following screen is displayed:

The inverters that are recognized by the system are successively displayed in 4 lists of 8 modules.

- The cursor [>] on the left hand side points on the inverter actually selected

- Type « 5 » to force blinking all LED's **for 5 seconds** of the corresponding module

- Type "8". The T2S prompts for the new address of the module. Choose something convenient f.i. a sequential from left to right and from top to bottom. Only digit between 1 and 32 can be used. All other characters will be rejected. Refresh screen by "**enter**" toggle after e few seconds to see the new address.

- Type "10" to use the automatic address assignment feature. The addresses are allocated in the sequence that the modules are inserted (switched on).

- Use "+" and "-" to move up and done the cursor and to select another module

- Type "1", "2", "3" and "4" for scanning the 4 x 8 modules that are part of the TSI system

Remarks:
1. If two modules share the same address a warning is displayed

2. The new module address is immediately stored in module's EEPROM. It will be used for any further reference to this module until you decide to change it again.

3. This address sticks to the module. It has nothing to do with the slot. Consequently if the module is replaced by a new one the configuration shall be repeated.

2. Changing Date-Time

From the root menu
  … Select (3) "System Actions"
  … then (1) "System Actions"
  … then (3) "Change Date and Time settings"

Following screen is displayed:

- "2" and "3" allow to activate or deactivate respectively the daylight saving

- "1" forces the T2S to prompt for Date-Time change. See example for format and casing.
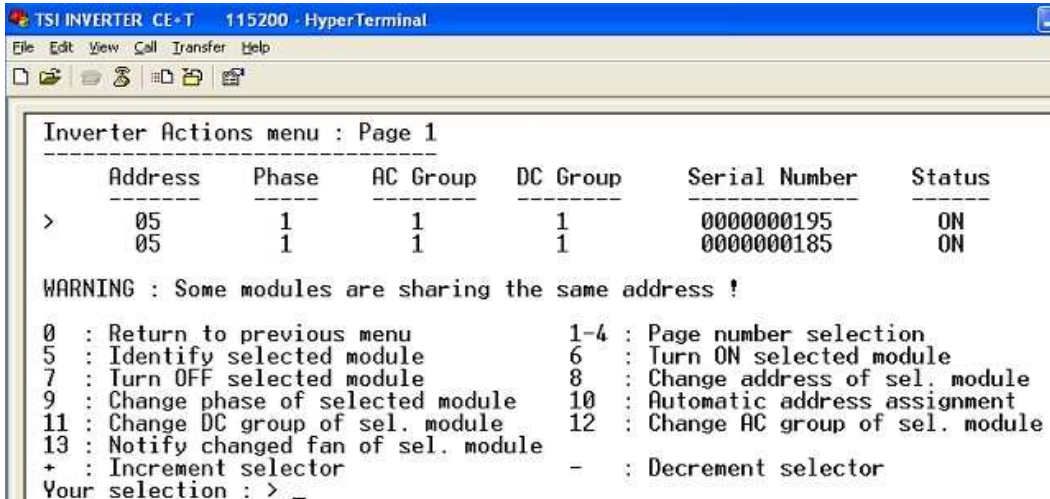
Remarks:
  Date and Time values are lost as soon as the T2S is removed from its slot

Changing the phase, the DC group, the AC group

From the root menu
  … Select (3) "System Actions"
  … then (2) "Inverter Module Actions"

Following screen is displayed:

The inverters that are recognized by the system are successively displayed in 4 lists of 8 modules.

- The cursor [>] on the left hand side points on the inverter actually selected

- Type « 5 » to force blinking all LED's **for 5 seconds** of the corresponding module

- Use "+" and "-" to move up and done the cursor and to select another module

- Type "9", "11" and "12" to change respectively the phase, the DC group and the AC group the module is part of. (Refer to TSI Technical Sheets for how to use groups)

3. Changing operating mode (EPC/On Line)

Refer to configuration file.

The parameter with the reference 60 allows to set the operating mode:

- Equal to "0" ➔ AC input default feeding (100% AC feed the load)

- Equal to 100 ➔ DC input default feeding (100% DC feed the load)

7.5 Alarm status and operating parameter
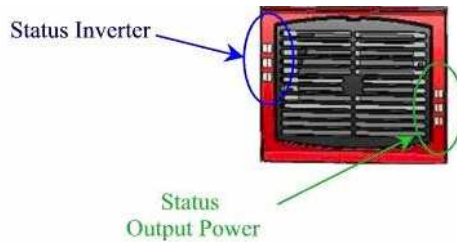
7.5.1 Alarm classification

Internal errors are reported to the "Status Inverter" LED's. They can be classified as such:

7.5.1.1 Non recoverable error

As we have already seen (section 6.1) one of the LED's at least stays permanently red.
Thanks to its double input port the TSI module will actually stop when either the output stage found a non recoverable or when both input stages are faulty.
In one given TSI system some module may run on one input stage whereas the other run on the other input stage. There is no consequence at all in operating in this mode.
Generally a non-recoverable error cannot be erased and the module shall be returned for repair.

7.5.1.2 Recoverable error

That kind of protection acts when, some parameters exit temporarily from their proper limit range.
Stopping the module or removing temporary it from its slot may solve the problem.
If not, check the surrounding system.
Those protections are activated when:
- DC input voltage out of range
- Over T°protection

Fine diagnostic must be performed through the laptop. Connect it as described in section 7 and refer to following description for viewing internal parameters.

7.5.2 Displaying operating parameters

7.5.2.1 Module Information

From the root menu
        … Select (2) "System Information"
        … then (1) "Inverter Information"
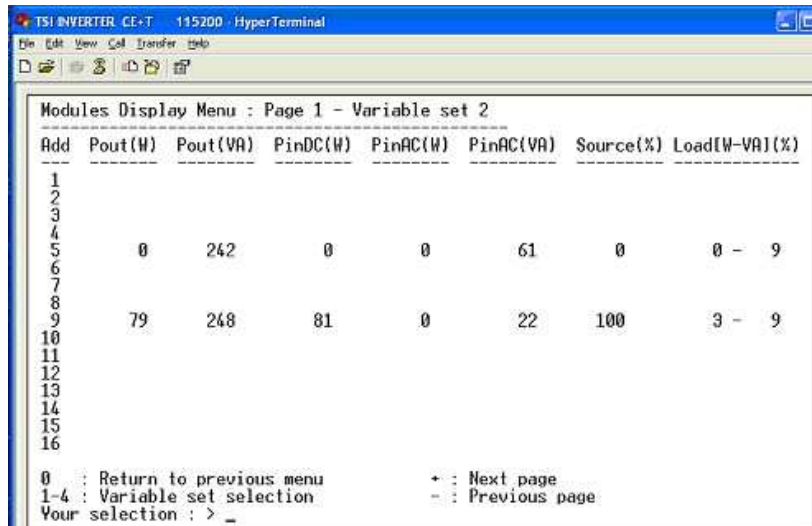
Following screen is displayed:

Set #1 :

The inverters that are recognized by the system are listed in 2 groups of 16 modules and 4 sets of parameters.

- Type "1", "2", "3" or "4" to select the right set of parameters

    1. The set #1 shows current and voltage of each module

    2. The set #2 shows power variables of each module

    3. The set #3 shows the phase, the working temperature, the serial number, the software version and the status of DC/AC ports for each module
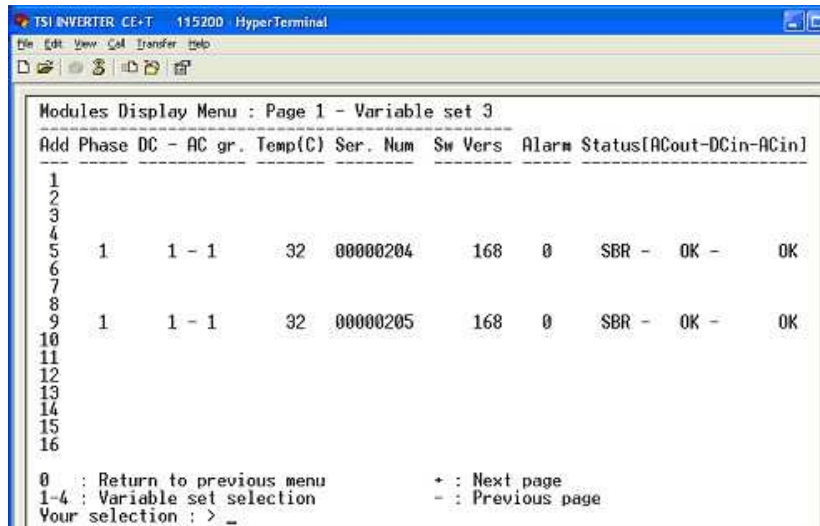
    4. The set #4 shows the nominal values of each module
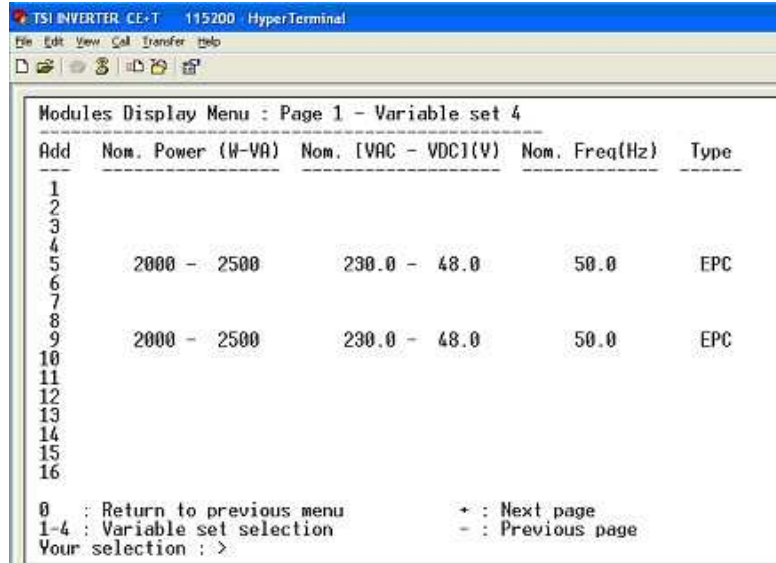
Set #2 :

Set #3 :

Second and third columns show groups and phase ownership.

Next columns show module serial number and software version

Last columns show the alarm code and the status of each module port:

- List of alarm codes is available at the end of present manual

- Status acronyms are as such:

    1. SBR = Stand by running. The module is idle and ready to feed the load on request

    2. OK = normal operation

    3. OFF = the module is manually stopped

Set #4 :
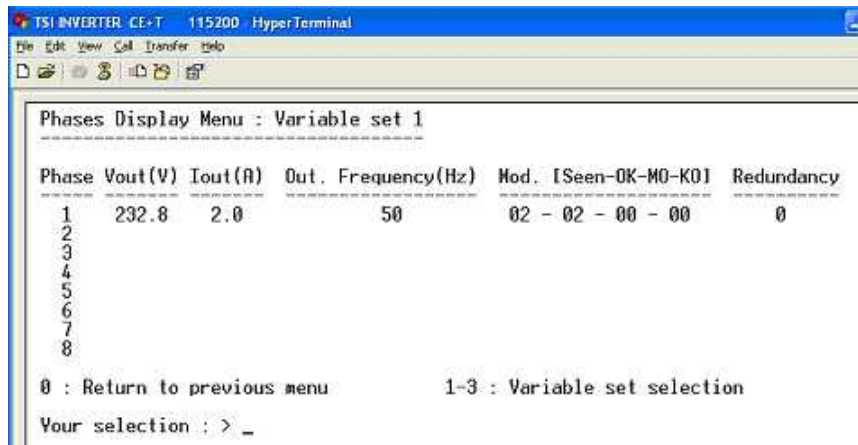
7.5.2.2 Phase Information

From the root menu
        … Select (2) "System Information"
        … then (2) "Phase Information"

Following screen is displayed:

Set #1 :

The phases that are recognized by the system are here listed and show 3 sets of parameters.

- Type "1", "2" or "3" to select the right set of parameters

    1. The set #1 shows current, voltage and frequency of each phase

        ▪ plus a string of digits showing the list of modules recognized by the system in this particular phase:

            • Number of module configured

            • Number of module in operation

            • Number of modules set manually to off state

            • Number of modules out of service

        ▪ The last column shows the number of modules set for redundancy

    2. The set #2 shows power transfer of each phase and each TSI ports (DCin – ACin – ACout) plus the same list of digits as above showing the status of the modules

    3. The set #3 shows the installed power, the available power and a string of the percentage of each power currently in use

Set #2 :

Set #3 :

7.5.2.3 Groups Information

7.5.2.3.1 AC Groups

From the root menu
      … Select (2) "System Information"
      … then (3) "Groups Information"
      … then (1) "AC Groups"

Following screen is displayed:

The screen gives an overall view of all parameters with regards to AC input groups.

The last column displays a string of digits showing the list of modules recognized by the system in this particular group:

- Number of module configured
- Number of module in operation
- Number of modules set manually to off state
- Number of modules out of service

7.5.2.3.2 DC Groups

From the root menu
    … Select (2) "System Information"
    … then (3) "Groups Information"
    … then (2) "DC Groups"

Following screen is displayed:

The screen gives an overall view of all parameters with regards to AC input groups.

The last column displays a string of digits showing the list of modules recognized by the system in this particular group:

- Number of module configured

- Number of module in operation

- Number of modules set manually to off state

- Number of modules out of service

7.5.2.4 Alarms

From the root menu
    … Select (2) "System Information"
    … then (4) "Alarms information"

Following screen is displayed:

- Active alarms are listed
  The column "Source" indicates whether the alarm is present in one module only (Module Address is displayed) or present in all modules simultaneously (SYSTEM is displayed).

- Three counters are shown:

  1. Number of minor alarms

  2. Number of major alarms

  3. Total number of alarms

- Temporization refers to time delay between the occurrence of the alarm and its transmission for remote monitoring purpose

- "Prog. Relay option" displays the alarm that triggers the related LED and relay. "256" stands for idle = no alarm condition.

- Changing the status of these alarms can be achieved through the configuration file (see section 7.4).

7.5.2.5 Log File - History

From the root menu

… Select (2) "System Information"

… then (5) "History log display"

The screen is :

```
TSI INVERTER CE+T    115200 - HyperTerminal
File  Edit  View  Call  Transfer  Help

History log menu : Page 1 - Event number : 200
-----------------------------------------------------------
Index    Type    Source      Description            Date and time
-----    ----    ------      -----------            -------------
001      No Al   T2S         DATE & TIME MOD (240)   11/10/2007 10:10:10
002      MIN     MOD 06      NO TRANSMISSION (226)   06/01/1970 22:05:04
003      MIN     MOD 08      NO TRANSMISSION (226)   06/01/1970 22:04:38
004      MIN     MOD 04      NO TRANSMISSION (226)   06/01/1970 22:04:34
005      MIN     MOD 03      NO TRANSMISSION (226)   06/01/1970 22:04:30
006      MAJ     SYSTEM      REDUND + 1 LOST (230)   06/01/1970 22:04:30
007      MIN     MOD 07      NO TRANSMISSION (226)   06/01/1970 22:04:29
008      MIN     MOD 02      NO TRANSMISSION (226)   06/01/1970 22:04:27
009      MIN     MOD 01      NO TRANSMISSION (226)   06/01/1970 22:04:25
010      No Al   SYSTEM      SYS SATURATED   (231)   06/01/1970 21:08:11
011      No Al   SYSTEM      DCin OK         (193)   06/01/1970 21:08:11
012      MIN     SYSTEM      SYS SATURATED   (231)   06/01/1970 21:08:08
013      MIN     MOD 01      STATUS 196      (196)   06/01/1970 21:08:08
014      MIN     MOD 09      STATUS 196      (196)   06/01/1970 21:08:08
015      MIN     MOD 06      STATUS 196      (196)   06/01/1970 21:08:08

0  : Return to previous menu        1-14 : Page number selection
16 : Clear log                      17   : Save log to a file

Your selection : > _
```

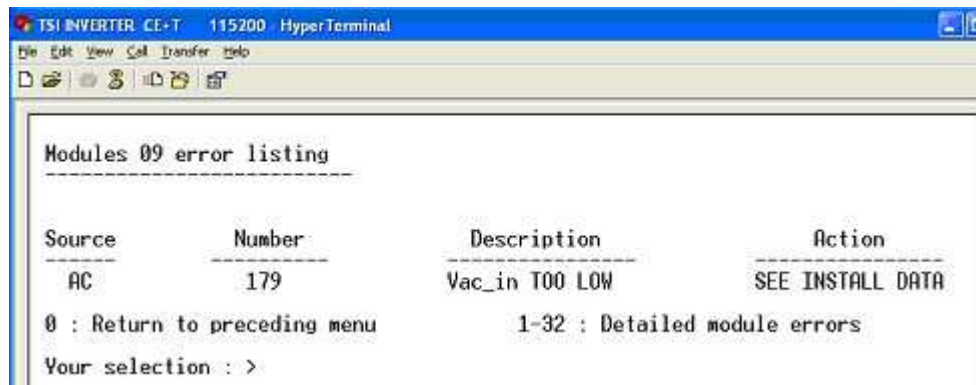The history is displayed. It can also be downloaded in a laptop file.

It can also be erased.

The internal memory is sized for about 200 events.

7.5.2.6 Modules Errors Information

From the root menu
… Select (2) "System Information"
… then (6) "Modules Errors Information"

The screen is :

```
TSI INVERTER CE+T    115200 - HyperTerminal
File  Edit  View  Call  Transfer  Help

Modules 09 error listing
-------------------------

Source      Number        Description            Action
------      ------        -----------            ------
 AC          179          Vac_in TOO LOW         SEE INSTALL DATA

0 : Return to preceding menu        1-32 : Detailed module errors

Your selection : >
```
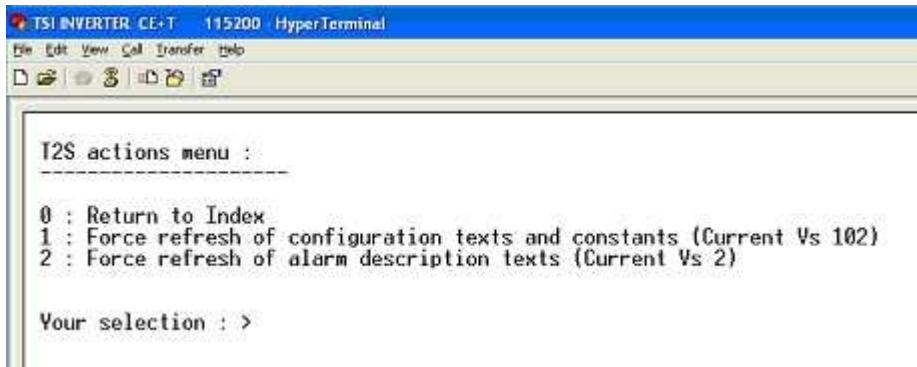
It gives access to internal status of each module individually. Column "Action" gives indication for troubleshooting when possible.

7.6. Update texts and constants

From the root menu
        … Select (3) "System Actions"
        … then (3) "T2S actions menu"

Following screen is displayed:

By default the T2S detects automatically when more recent TSI modules are inserted in the system. It updates accordingly the internal description of parameters and messages.

Nevertheless if the update must be forced the above screen allow to do so.

8 TSI Technical features

Bravo modules

TSI BRAVO 48/120 — *Technical features* — Version 02

GENERAL

EMC (immunity)	EN 61000-4
EMC (emission)	EN 55022 (Class B)
Safety	UL 60950
Cooling	Forced
Isolation	Doubled
MTBF	230000 hrs
Efficiency (Typical)	
Enhanced Power Conversion	95%
On Line	90%
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% 5 second
Permanent overload capacity	110%
Admissible	Full power rating from
load power factor	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 5 second)	84 A
Voltage ripple	2mV
Input voltage boundaries user selectable	

AC INPUT SPECIFICATIONS

Nominal voltage (AC)	120 V
Voltage range (AC)	83 – 140 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) (Adjustable)	90 – 130 V
Voltage accuracy	2 %
Frequency	50 - 60 Hz
Frequency accuracy	0.03 %
Total harmonic distortion (resistive load)	<1.5 %
Load impact recovery time	0.4 ms
Turn on delay	20 s
Nominal current	20.8 A
Protected against reverse current	
Crest factor at nominal power	3.5
With short circuit management and protection	
Short circuit clear up capacity	$10 \times I_n$ for 20msec
Available while Mains is available at AC input port	
With magnitude control and management	

TRANSFER PERFORMANCE

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

ENVIRONMENT

|	
Altitude above sea	< 4,900 Ft
Ambient temperature	-4 to 122 °C
Storage temperature	-40 to 158 °C
Relative humidity	95% , non condensing

SIGNALING & SUPERVISION

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

WEIGHT & DIMENSIONS

Width	4"
Depth	17.2"
Height	2 U
Weight	5 Kg (176.4 Oz)
Material (casing)	Coated steel

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

9 Legends for TSI Pins

BRAVO Identification pin

POWER SOURCES LEDS

POWER LEVEL LEDS
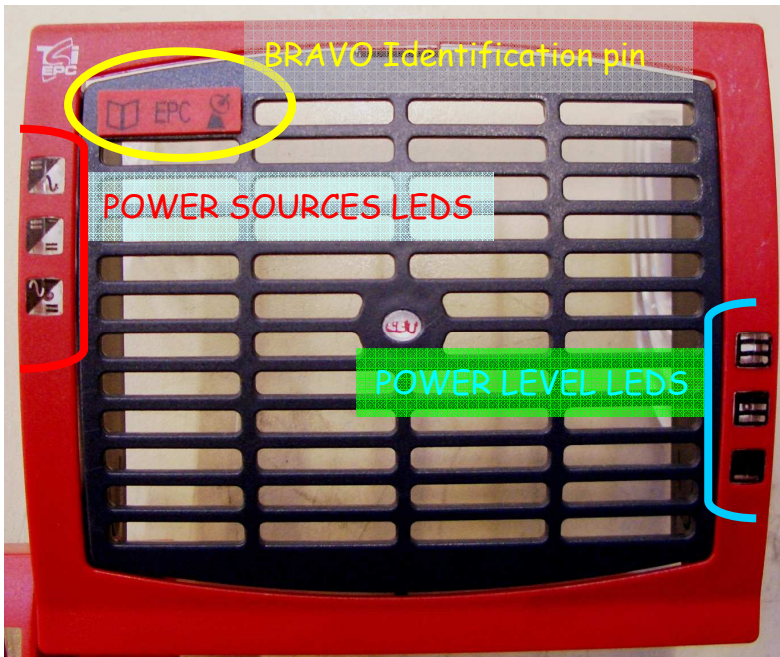
BRAVO FRONT PLATE

Pins legend (Logos can be mixed)

PACK

REG (REGULAR)

TELECOM APPLICATIONS (48VDC)

A LA CARTE

EPC (Exhausted Power Conversion)

INDUSTRIES APPLICATIONS (110VDC)

Meaning of terms:

PACK or A LA CARTE Design

PACK Limited numbers of shelves (for 230VAC Bravo)

A LA CARTE: Numbers of shelves limited to 3 in 1PH, 8 in dual phase and 9 in 3PH.

Expansion limited to 30 KVA for BRAVO 1PH

ACout Protection in option.

CanDis Display, Termination Box and other options on request

EPC or REGULAR Mode

EPC mode = Enhanced Power Conversion

DCin & ACin on inverter

Static switch function

Filtration

Higher efficiency

REG = Regular

Only DCin on inverter (NO ACin)

TELECOM or INDUSTRIES DC Voltages

TELECOM APPLICATIONS with 48V DCin

INDUSTRIES APPLICATIONS with 110 V DCin