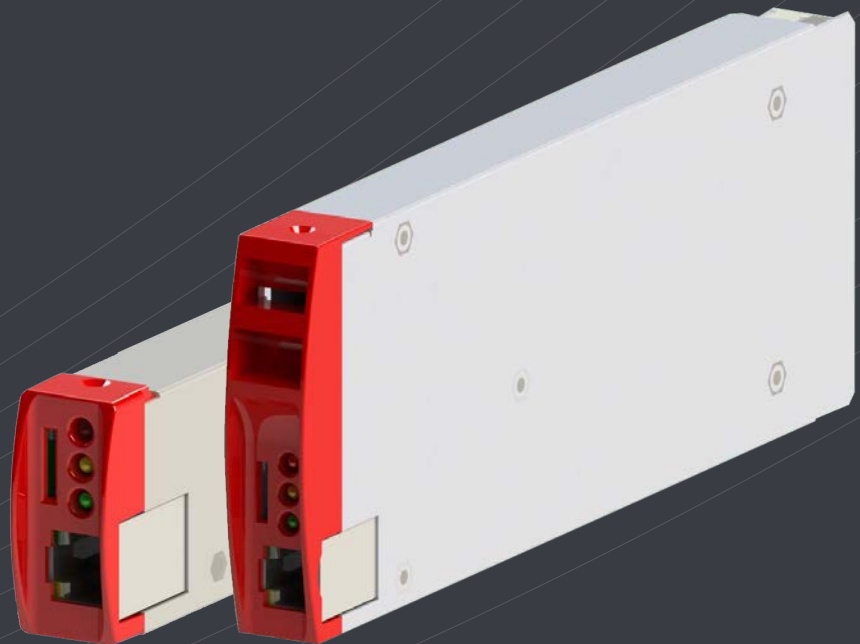**CE+T POWER**

Leading AC Backup Technology

MONITORING T2S - ETH
User Manual V1.4

THE NEW GENERATION OF MONITORING

» Web-based User Interface

» Extended Log Capabilities

» Compatible with Catena

Important Safety Instructions
Save these Instructions

www.cet-power.com

Table of content

Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
1.0	11/04/2016	-	First release of the manual.
1.1	27/01/2017	17, 32 and 39	Catena and SNMP details updated.
		46	Added Annex.
1.2	18/09/2017	42 - 47	Modbus Testing Procedure.
1.3	10/08/2018	-	Added SNMP Details.
1.4	03/10/2018	76	Updated Modbus details.

1. CE+T at a glance

CE+T Power designs, manufactures and markets a range of products for industrial operators with mission critical applications, who are not satisfied with existing AC backup systems performances, and related maintenance costs.

Our product is an innovative AC backup solution that unlike most used UPS's

- Maximizes the operator's applications uptime;
- Operates with lowest OPEX;
- Provides best protection to disturbances;
- Optimizes footprint.

Our systems are:

- Modular
- Truly redundant
- Highly efficient
- Maintenance free
- Battery friendly

CE+T power puts 60+ years expertise in power conversion together with worldwide presence to provide customized solutions and extended service 24/7 - 365 days per year.

2. Abbreviations

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

3. Warranty and Safety Conditions*

WARNING:

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

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

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

Important Safety Instructions, Save These Instructions.

3.1 Disclaimer

- The manufacturer declines all responsibilities if equipment is not installed, used or operated according to the instructions herein by skilled technicians according to local regulations.
- Warranty does not apply if the product is not installed, used and handled according to the instructions in the manuals.

3.2 Technical care

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

---

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

3.3 Installation

- This product is intended to be installed only in restricted access areas as defined by UL60950 and in accordance with the National Electric Code, ANSI/NFPA 70, or equivalent agencies.

- The Inverter System may contain output over current protection in the form of circuit breakers. In addition to these circuit breakers, the user must observe the recommended UL listed upstream and downstream circuit breaker requirements as defined in this manual.

- Please use extreme caution when accessing circuits that may be at hazardous voltages or energy levels.

- The modular inverter rack is a dual input power supply. The complete system shall be wired in a way that both input and output leads can be made power free.

- REG systems and EPC systems that have no AC input wired and connected can be seen as independent power sources. To comply with local and international safety standards N (output) and PE shall be bonded. The bonded connection between N (output) and PE must be removed once the AC input is connected.

- AC and DC circuits shall be terminated with no voltage / power applied.

- The safety standard IEC/EN62040-1-1 requires that, in the event of an output short circuit, the inverter must disconnect in 5 seconds maximum. The parameter can be adjusted on T2S; however, if the parameter is set at a value > 5 seconds, an external protection must be provided so that the short circuit protection operates within 5 seconds.
  Default setting is 60 seconds.

- The system is designed for installation within an IP20 or IP21 environment. When installed in a dusty or humid environment, appropriate measures (air filtering …) must be taken.

3.3.1 Handling

- The cabinet shall not be lifted using lifting eyes.

- Remove weight from the cabinet by unplugging the inverters. Mark inverters clearly with shelf and position for correct rebuild. This is especially important in dual or three phase configurations.

- Empty inverter positions must not be left open. Replace with module or cover.

3.3.2 Surge and transients

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

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

- Indoor sites Min Class II.

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

3.3.3 Other

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

3.4 Maintenance

- The modular inverter system/rack can reach hazardous leakage currents. Earthing must be carried out prior to energizing the system. Earthing shall be made according to local regulations.

- Prior to any work conducted on a system/unit make sure that AC input voltage and DC input voltage are disconnected.

- Inverter modules and shelves contain capacitors for filtering and energy storage. Prior to accessing the system/modules after power down, wait at least 5 minutes to allow capacitors to discharge.

- Some components and terminals carry high voltage during operation. Contact may result in fatal injury.

3.5 Replacement and Dismantling

- ESD Strap must be worn when handling PCBs and open units.

- CE+T cannot be held responsible for disposal of the Inverter system and therefore the customer must segregate and dispose of the materials which are potentially harmful to the environment, in accordance with the local regulations in force in the country of installation.

- If the equipment is dismantled, to dispose of its component products, you must comply with the local regulations in force in the country of destination and in any case avoid causing any kind of pollution.

To download the latest documentation and software, please visit our website at www.cet-power.com

4. Product Code and Identification

T2S-ETH product code with regards to sub rack:

A)   T2S-ETH Monitor

Product Description	Part Number
TSI-T2S-ETH-NOVA - VEDA	T312010010
TSI-T2S-ETH-BRAVO-MEDIA 24/48/60 Vdc	T322010100
TSI-T2S-ETH-BRAVO-MEDIA 110/220 Vdc	T322051000

B)   Filler (Blank module to cover empty slots)

Product Description	Part Number
TSI-T2S-ETH-NOVA - VEDA	T312010010
BLANK PLASTIC T2S ETH ECI RED	T522010001

4.1 Identification labels for T2S-ETH

Note:

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.

5. Introduction

The T2S ETH stands for T2S Ethernet. It replaces the former T2S with the same form factor but with a front Ethernet connector replacing the former USB one. Like his predecessor, T2S ETH is a monitoring solution for the full TSI inverter range and is able to monitor up to 32 inverters through a friendly web base interface. T2S also supports Modbus Serial communication (RTU) and SNMP v1 Communication.

This new monitoring device provides a graphical user interface, embeds a SNMPv2c/SNMP v3 agent and Modbus TCP support with Catena, if one needs a touch screen display Catena can be connected to T2S ETH and is Compatible. It also allows user to change the configuration of the system.

6. Hardware

T2S ETH provides 3 LEDs: Red for major alarm signaling, orange led for minor alarm signaling and green led for power and network connection status.

The RJ45 is a standard ETH connector that could be connected on any IPv4 network.

T2S ETH firmware can be upgrade using the Micro SD card. Device firmwares are available in my.cet-power.com
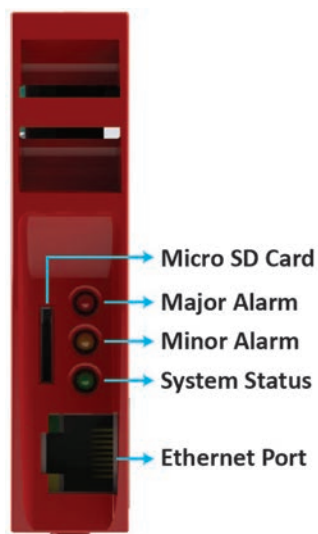
6.1 LEDs code during operations

S - Flash low

FS - Flash fast

SA - Sequence one after the other

X - Not used LED

6.1.1 LEDs code during normal operation

LEDs code below corresponds to system in operation and T2S ETH fully operational.

Green	Orange	Red	Status
S			Slave mode (when several T2S ETH on the same bus)
●			Master Mode « master »
	●		Minor alarm / Alarme Mineure
		●	Major alarm / Alarme Majeure

6.1.2 LED Error Code - upgrade or system start up

This section explains the state of the boot loader in function of his LED state. During start up, soft upgrade, configuration change or micro SD card changes.

Green	Orange	Red	Status
			Booting
	●	●	Cannot copy to flash
		FS	No micro SD card or file *.bcf not valid or not present
			File *.acf found
SA	SA		Installation *.saf please wait
		FS	System error or no micro SD card
S		FS	Configuration.ini found waiting network

Green	Orange	Red	Status
●		FS	Boot loader Web interface ON and in operation
	S	FS	System file OK but no config file *.ini
S	S	S	Error SD Card / File
S	S		Error no configuration.ini

6.2 Signaling Information

As it is designed to be used in the same shelf as former T2S, T2S ETH inherits the connections on the back.
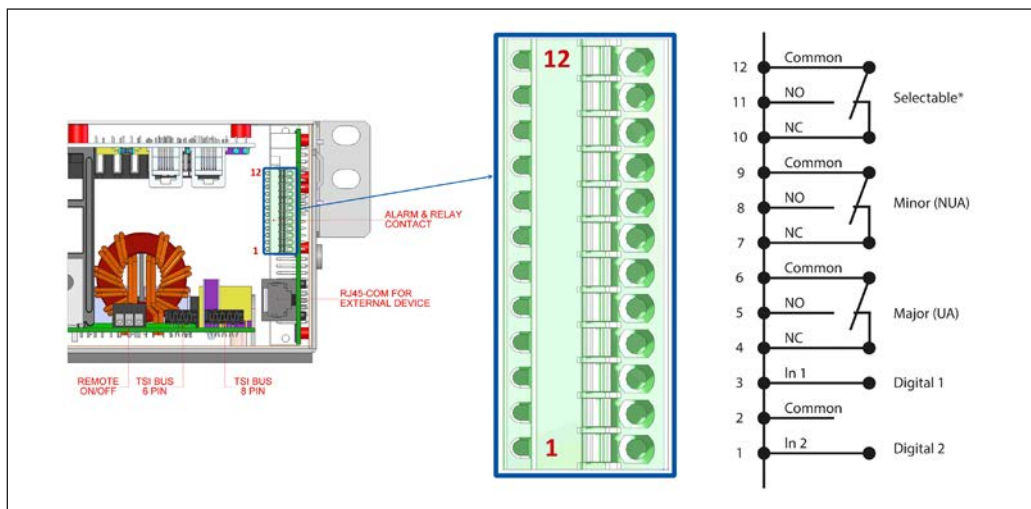
Note: The terminal connector accepts maximum wire size of 0.5 mm^2.

Important remarks:

In a system with several shelves, T2S ETH is usually located in the first one (although it's not mandatory) but relay signaling contacts will be terminated in the T2S ETH installed shelf. The above connection is just an example, actual connection will be based on your shelf design and connections.

If the T2S is included in one complete system including for example Termination box or some customers packages, the terminal will be located somewhere else. (Refer System user manual).

6.2.1 Alarm relay

There are 3 alarm contacts:

- Major
- Minor
- User selectable

As one can see in the picture: contacts 5 and 6 are closed when no major alarm is present, contact 8 and 9 are closed when no minor alarm is present.

Remark: Default mapping and level of each available alarm of the monitoring unit is available in "Annex 1: Supervisor alarms - T2S ETH", page 69.

NB: Alarm relay are active (energized) when no alarm are present.

- Alarms relay features
    - Max current: 2 A @ 30 VDC or 1A @ 60 VDC
    - Max Power: 60 W
    - Max Voltage: 60 VDC SELV

Note that for higher voltages, it is mandatory to install an additional relay with appropriate characteristics – especially for 60/110/220 VDC.
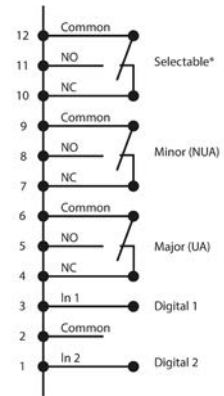
6.2.2 Digital Inputs

Two potential free Digital inputs are available for customer connections.

- Digital Input 1 is assigned for MBP operation if used.
- Digital Input 2 is assigned for Surge Arrester if used.

The voltage present on terminal 1 and 3 is +5 V (galvanic insulation). 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).

6.2.3 Communication

A RJ45 connector is present at rear of the shelf and can be used for **Candis** display and **Modbus** (RTU) communication.
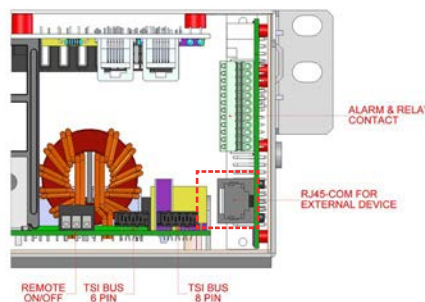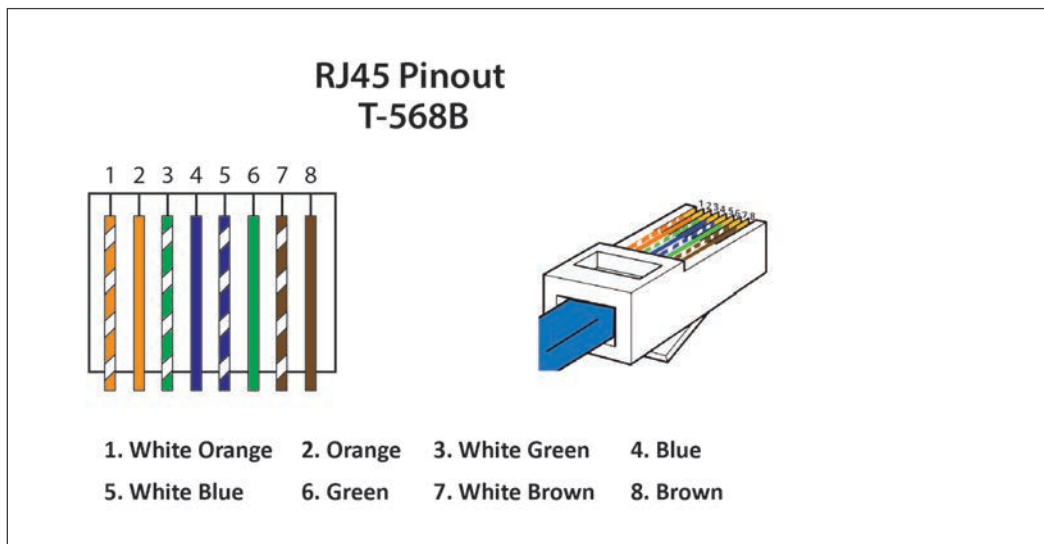
Note: The colour of wires is irrelevant and may vary, but make sure the position of wires is exactly crimped.

Pin Number	Name	Description
1	CANH	CANH pin for Candis
2	CANL	CANL pin for Candis
3	GND_IAX	Digital Communication Ground
4	GND_IAX	Digital Communication Ground
5	12V_IAX	+12 V unregulated
6	COM_A	RS 485 A
7	GND_IAX	Digital Communication Ground
8	COM_B	RS 485 B

Important remark:

T2S ETH comes in only one "flavor" in term of serial communication RS485 and support Modbus RTU (read-only).

Currently, no protocol is available for customer use on CAN bus connection and it is dedicated for Candis accessory.

The unregulated +12 V power supply is designed for powering CE+T accessories and should not be used for any other purpose.

6.3 Monitoring - Candis

T2S ETH also supports the Candis display and it is a monitoring device allowing the user to get information from inverter system.

To enable candis, connect RJ45 CAT cable at rear side of the T2S ETH installed shelf and Candis. Refer section 6.2.3, page 16.

6.3.1 Display and Buttons

TSI System with Candis

1 ➔ Display (2 lines provided to display information).

2 ➔ Up button to scroll UP in the menus.

3 ➔ Down button to scroll DOWN in the menus.

4 ➔ Enter button to change display or validate modifications.

6.3.2 Configuration

When more than one display is used on the same system, the CANBUS ID must be different and include values from 124 to 264 (i.e as 134; 144 ; 154, …264).

The other information that can be configured are the related phase, the AC group or DC group, and the adjustment the backlight.

If the installed system is multi-phase or has multiple DC groups, the T2S and the inverter modules must be correctly configured to display the correct value by phase or DC group.

For instance in three phase systems, the inverter modules must be configured to show the 3 phases' output information, but also the one related to the three AC group who correspond to each AC input phase. By doing so, the display will show the values phase by phase.

Warning: The Candis Display is powered from the auxiliary power supply of the modules which are limited in power.

V out= 233 V / I out= 3 A — The line beneath the first line indicates that display parameters can be changed for first line.

V out= 233 V / I out= 3 A — The line beneath the second line indicates that display parameters can be changed for second line.

Disp Param → Config

Backlight → CAN BUS ID → Phase Sel : → AC Group : → DC Group : → Main Menu

Back It +/- | ID CAN +/- 0124 | Phase +/- 0001 | AC grp +/- 0001 | DC grp +/- 0001
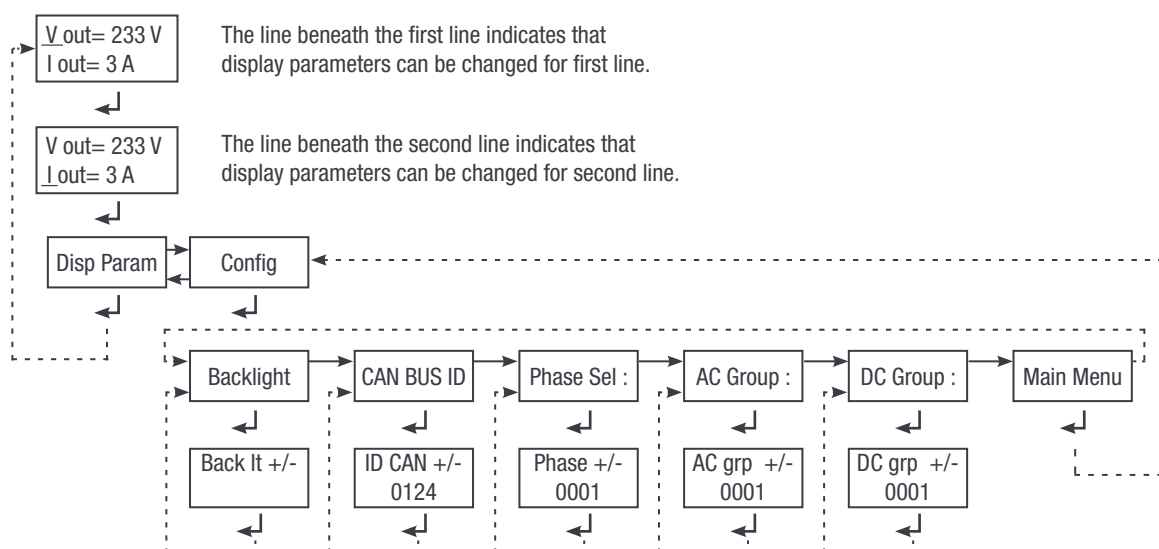
Candis Display - Block diagram

6.4 Graphical User Interface - Catena

The Catena display can be used with the T2S ETH. Catena is either available in rack mount or door mount version.
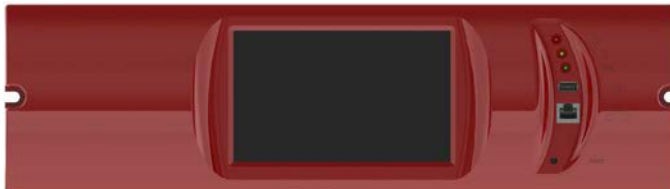
Catena - Rack Mount

Catena - Door Mount

6.4.1 Description

On front access, Catena has a wide 7" capacitive touch screen alongside 3 led following the same scheme as in T2S ETH and two connectors: USB type A and Ethernet (RJ45). A reset button is also provided. Catena firmware can be upgrade using the Micro SD card. Device firmware is available in my.cet-power.com

From the rear, there are two 12 VDC inputs that help Catena to be powered by two different sources, usually AC and DC. The PE is also available on power supply connector. Two Ethernet (RJ45) ports are available, one for connection to T2S ETH (see section 6.4.2, page 20) and one for permanent network connection.
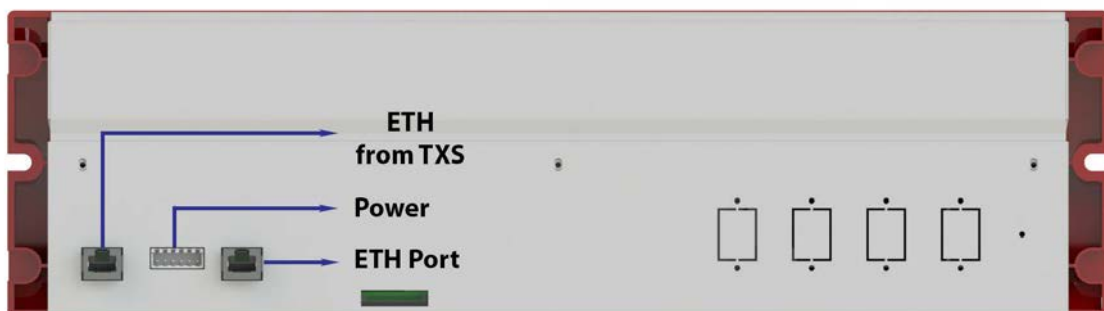
Important remark: this is the latest version released of Catena. If you have different version of Catena, refer to the system user manual.

6.4.2 Wiring

Catena configuration has to be selected in T2S ETH under monitoring, network, connection mode, hardware setup should be With Catena. This option has to be selected even before wiring.
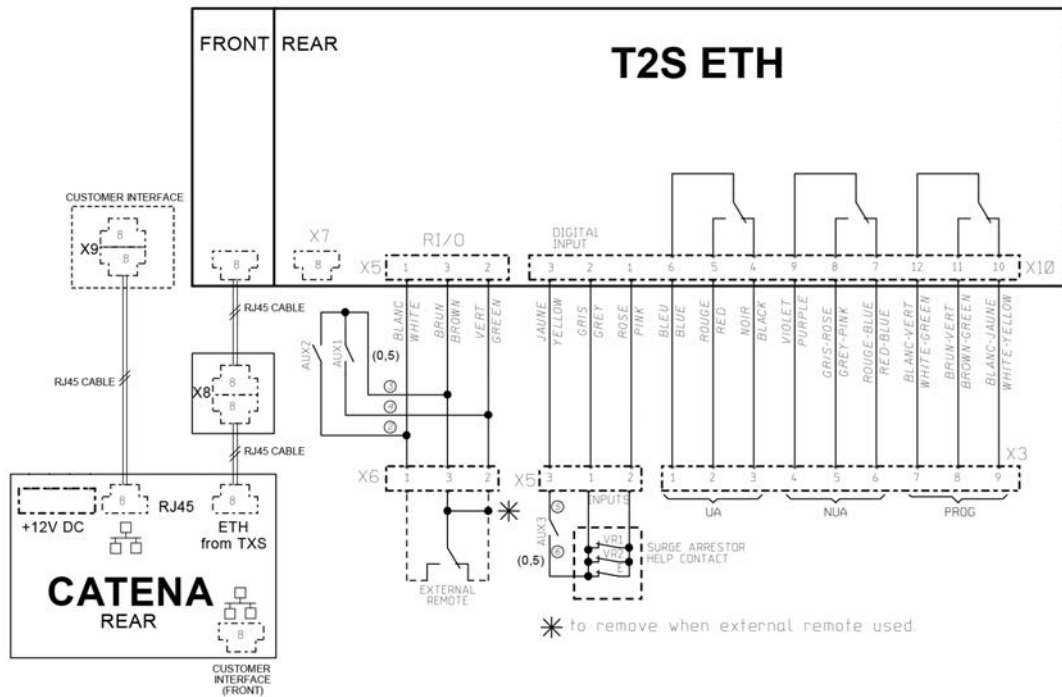
7. Graphical User Interface

The user interface is the same if accessed with a laptop connected on front ETH connection, remotely on network, or through catena if one is present.

The interface has a "top-down" philosophy: first screen gives a general overview, then one can go deeper and get more information on specific area by clicking the "magnifier icon".

7.1 Hierarchy
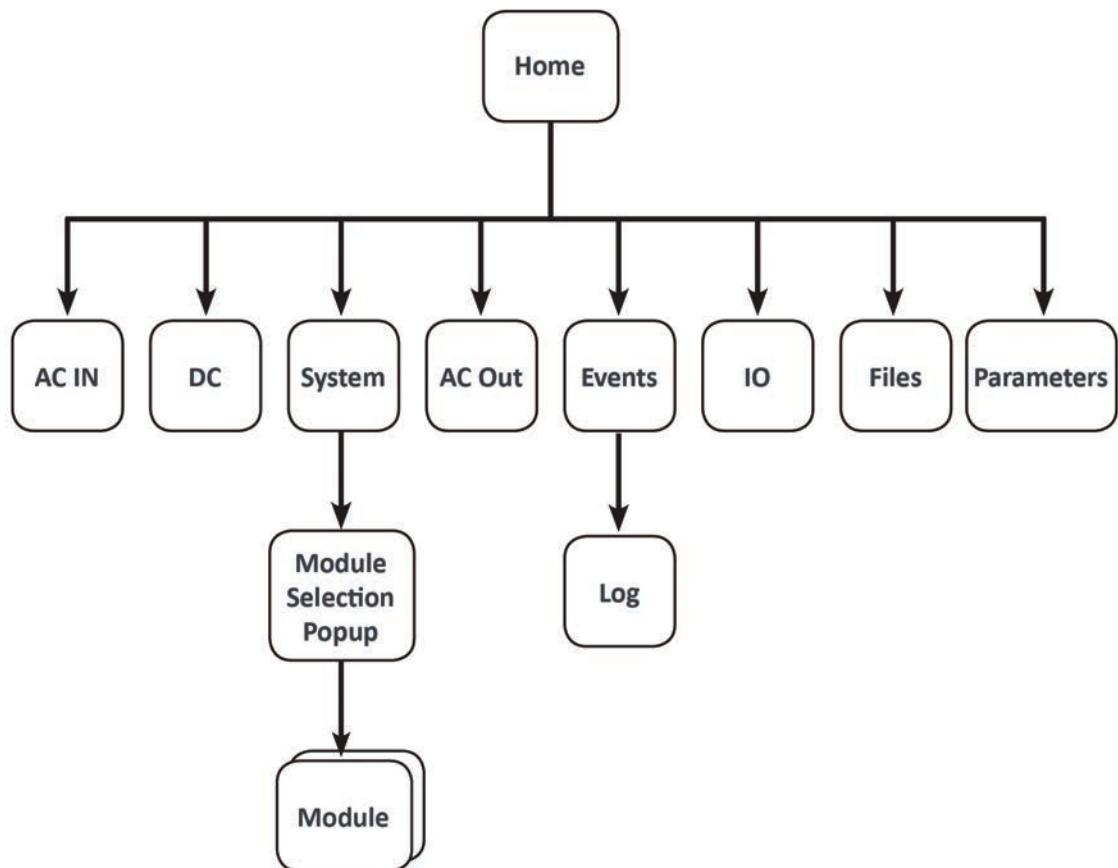
7.2 Login

The user interface is accessible by typing the IP address of the system in a web browser. The default IP address is **192.168.0.2**.

Important remark:

Web browser brand and version can change the interface proper behavior. It's strongly recommended to use Google Chrome, Mozilla Firefox, OSX Safari. If you wish to use Microsoft Internet Explorer, version should be 10 at least.

Before being able to do anything, user should select a user level and log in the system. Currently two users can be connected at same time in the system: one basic and one expert.

No password is required in basic while a password is needed in Expert.

Basic user can just browse the pages and download the files. Expert login can access and modify the parameter values.

An auto-logout feature is available to avoid a user being connected all the time, blocking the system. Refer section "Regional settings", page 31 for more information.

Default password for expert mode is *pass456.* This password can be modified, and the option is available in section "Passwords", page 32.

In case of lost password, please refer to FAQ at page 65
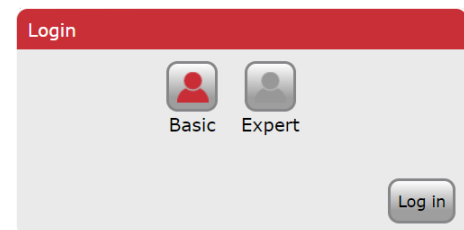
7.3 Interface Areas

1 → Banner

2 → Main Area

3 → Toolbar
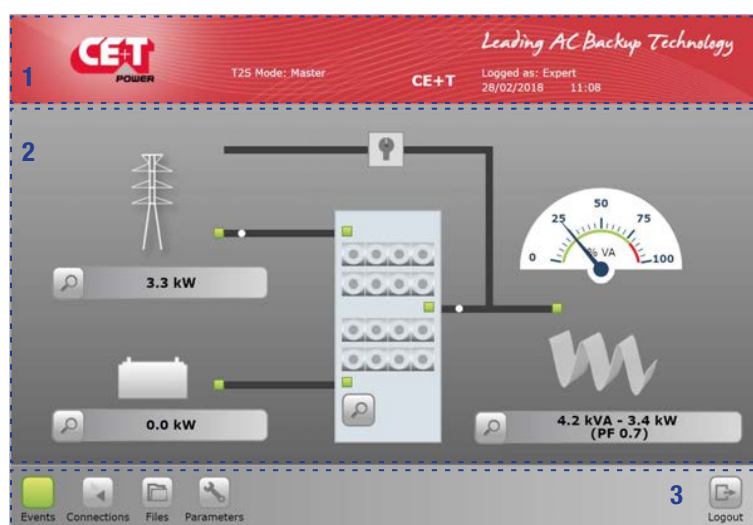
7.3.1 Banner
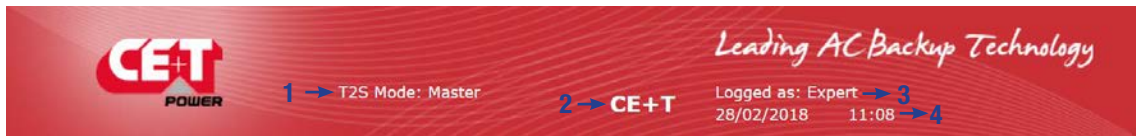
1 → T2S Mode

> T2S ETH can be used redundant (2 in the same system), one being master, the second is slave.
> When used alone, T2S ETH is automatically Master.

2 → Site name

> It's a customizable field from configuration menu. User can set any string he wants.

3 → Access level

> Display the level in use to browse the interface. It can be either Expert or Basic.

4 → Date and time

> This is the device time and date which can be adjusted in configuration menu.

7.3.2 Main Area
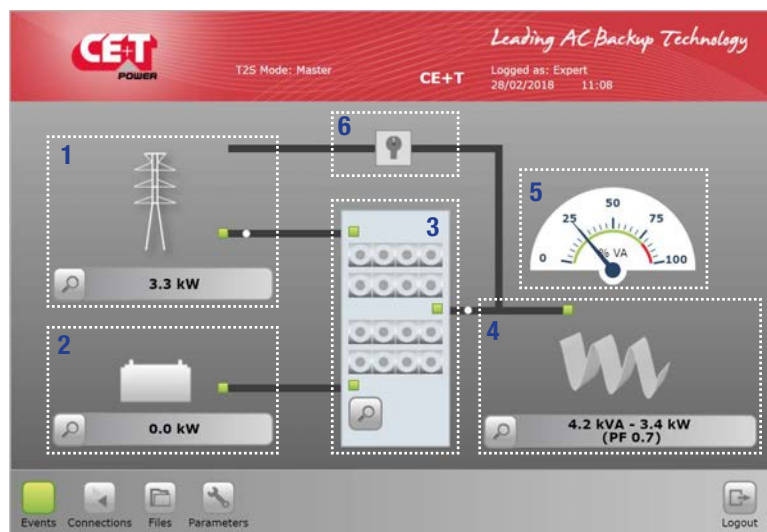
1 → AC IN

> Clicking the magnifier 🔍 will bring the user to all measurements regarding AC input.
> The LED's shows the status of the input: if the source is absent, this LED's becomes red.
> Flow (moving white ball) from this item to the system means power is taken from the source.
> Power displayed is the total power consumed, regardless system is 1P or 3P.

2 → DC input

> Clicking the magnifier 🔍 will bring the user to all measurements regarding DC input.
> Given the system can be configured with up to 2 DC groups, power is the total power consumption.
> Flow (moving white ball) from this item to the system means power is taken from the DC source.

3 → **System**

> Clicking the magnifier ⬚ will bring the user to information regarding the system such as redundancy, available power and so on. It is also the path to the module level monitoring.
> The three LEDs are showing the state of each converter.
> Example: if one converter of one module is in alarm, then the led will turn to orange.

4 → **AC out**

> Clicking the magnifier ⬚ will bring the user to all measurements regarding AC Out.
> Regardless of the system configuration (1P, 3P), displayed power is the total amount of power fed to the load.
> Power is expressed in both KW and KVA and the Power Factor (PF) is computed.

5 → **Gauge**

> In a 1P output system, the gauge depicts the percentage of power used in VA.
> In a "more than 1P" system, the gauge depicts the "worst case", i.e. if the system is unbalanced, it show the most loaded phase.

6 → **MBP**

> MBP is configured in the system.

7.3.3 Toolbar

The toolbar is always accessible and provides quick access to following pages:

- **Events page**
  The events icon has the colour of the highest priority alarm currently present in the system:

  - Green: system healthy, no event present.

  - Grey: at least one event is present in the system but not configured as major or minor.

  - Orange: at least one minor event present in the system. No major event but other events could be present also.

  - Red: at least one major event is present in the system. Other event or minor events could be present.

  If more than one event is present, regardless its level, a counter is present on the icon. It displays the total number of event currently present in the system.

- **Connections**
  This brings to digital input and relays status. For configuring these inputs and outputs, it's in configuration section.

- **Files**
  This leads to files management page. Files such as configuration, update, log download.

- **Parameters**
  The parameters page allows user to change every parameter related to the system.

Throughout the browsing, user can see following icons appearing:

When accessing a page of depth two or more (such as module or log page), user can go back to previous page by clicking "back".

When browsing away from home page, user can go back straight to it by clicking the home page.

Whenever a logged user click this button, he will be redirected to login page.

7.4 Pages and Feature

7.4.1 AC IN

This page displays the measurement made by the modules on the AC input.

Available values are:

Measure	Unit
Voltage (V)	Volts (V)
Current (I)	Ampere (A)
Frequency(f)	Hertz (Hz)
Input Power(P)	Kilo Watts (kW)

System also keeps track of last AC In failure timestamp.

Remark:

Modules have a Power Factor of 1, that's why power is only displayed in KW. This would be the same value in KVA. Last AC in failure is non-persistent information. It means that it will be lost if device is reset

7.4.2 DC IN

This page displays the measurement made by the modules on the DC input.

Available values are:

Measure	Unit
Voltage (V)	Volts (V)
Current (I)	Ampere (A)
Input Power(P)	Kilo Watts (kW)
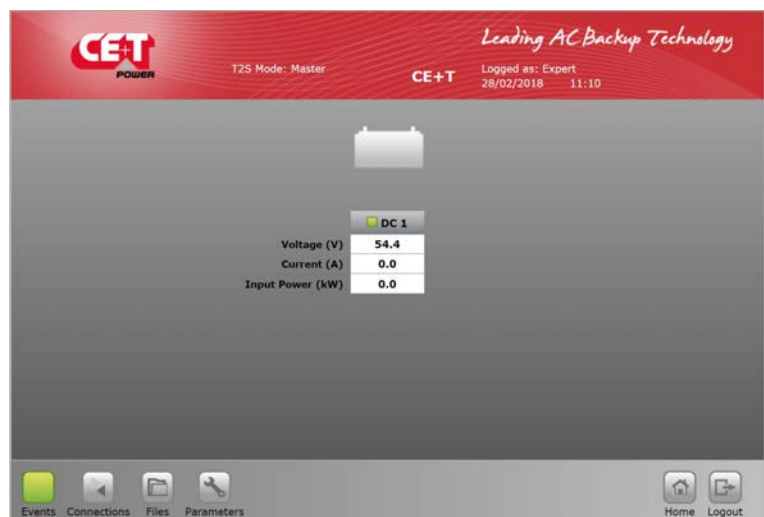
7.4.3 AC Out

This page displays the measurement made by the modules on the AC output

Available values are:

Measure	Unit
Voltage (V)	Volts (V)
Current (I)	Ampere (A)
Frequency(f)	Hertz (Hz)
Active Power(P)	Kilo Watt (KW)
Apparent Power(S)	Kilo Volt Ampere (KVA)
Power factor	-
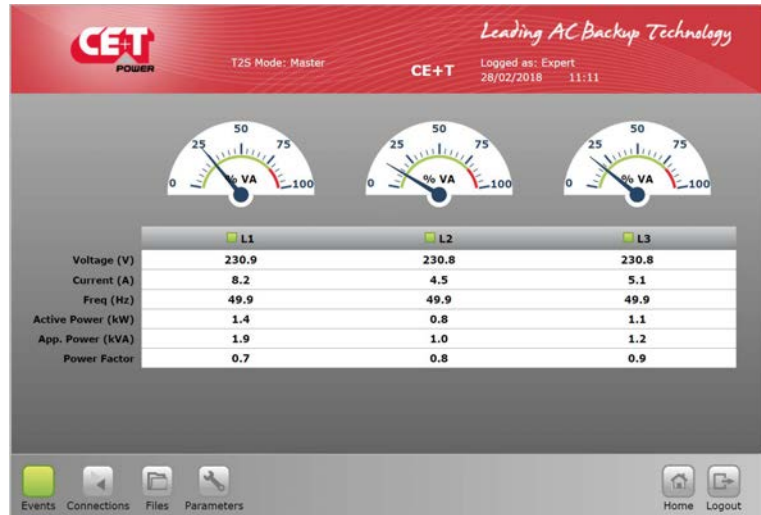
7.4.4 System

Clicking the system picture on home page brings the user to the related page where following information can be found:

System level:

- Installed power
- Available power

Phase level:

For each output phase, following information is given:

- Number of installed modules
- Redundancy: defined or not, satisfied or not
- Installed and available power following the same logic as per system level
- A.R.C. (Available Redundant Capacity) is the remaining available power before reach the redundancy level.

Clicking the [select module] button will launch the module selection popup. Each module information can be accessed by clicking the corresponding button. A legend is always present to recall the colour scheme:

- White: no module in slot
- Grey: module manually off
- Green: module OK
- Orange: module in recoverable error
- Red: module with unrecoverable error

For last two, refer to module manual for troubleshooting.
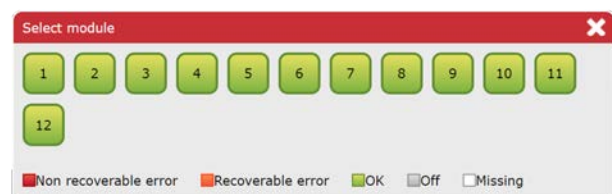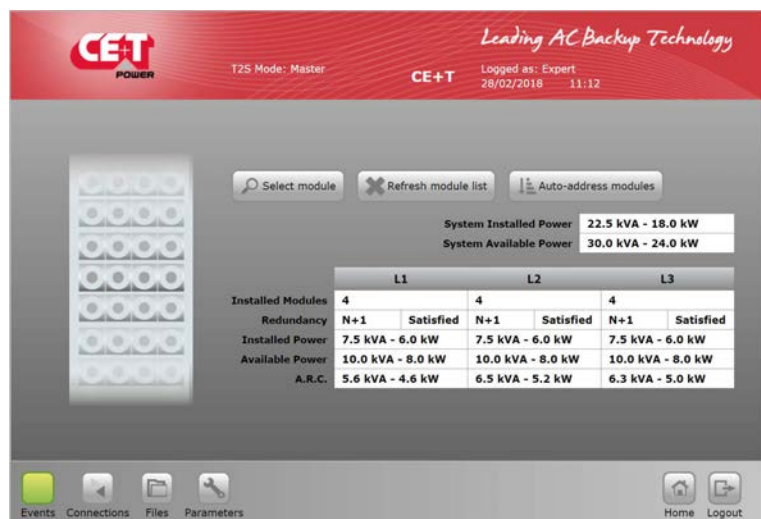
7.4.5 Module

This page gives module by module measurement.

T2S ETH is the monitoring solution for inverters which are all one phase modules.

Many controls are available from this page to manage the module:
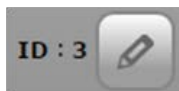
User can set the module address he wants between 1 and 32

  It's not always easy to identify a module in front of a system. Clicking this icon will blink all module's LEDs for few seconds.

  A module can be manually turned off by user interface. It will still be present on communication bus, but is output is turned off. When you click on it, it will change is state from display one to opposite.

  T2S ETH keeps track of all modules which appears on the bus which means no installation is needed when a new module is plugged in. But when a module is removed, it's mandatory to tell the system about it, by "uninstalling" it, clicking this button. If not, the system will detect a missing module and raise an alarm.

  For each of its converter, the module can be assigned an AC in phase, an AC out phase and a DC group. User can do so by using this control number to each converter measures. Module should be manually off to do changes for AC out phases.

  If module fan is replaced, click this icon to clear the corresponding alarm.

7.4.6 Events

Events page lists all events currently ongoing in the system. These are sorted by event occurrence time, latest event will be on top of the list. T2S ETH records maximum number of 2000 events as FIFO.

"Device" column provides the source of the alarm which can be down to converter of a given module (example: module 4 AC IN) to System or monitoring level.

Events appear with a colour corresponding to their alarm level (grey – event, orange – minor, red – major).

A filter as shown below is available to display only a subset of these events.

7.4.7 Log

Log file lists all events which have occurred in the system since last log clear.

Compared to event page, an extra column display if event has appeared or disappeared.

For each event, there are two log lines: one with the timestamp of the event appearing and the second one with the timestamp of the event disappearing.

User can filter the log like in event page.

User is able to see the difference between event and log page: no colour for alarm level is used in log page, a column states it.
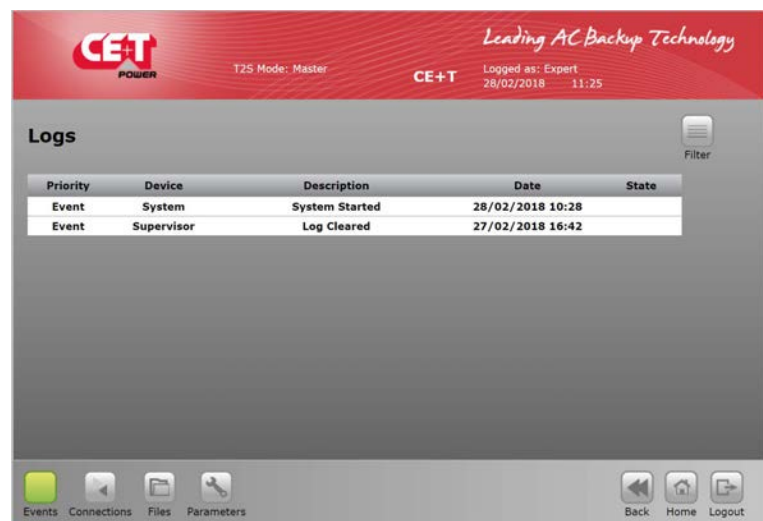
Log download and clear functions are available in "Files" menu.

7.4.8 Connections

As described before, T2S ETH has 2 digital inputs and 3 alarm relays.

State of each of these connections can be read through the "connections" page.

An extra button "toggle" allows the user to test each relay manually, toggling it for a few seconds with the aim of detecting a mechanically failing device over the time.

7.4.9 Files

Three tabs are displayed in Files page.

Transfer tab gives user the opportunity to download log file and configuration file.

It's also on that page that log file can be cleared when it's becoming too large.
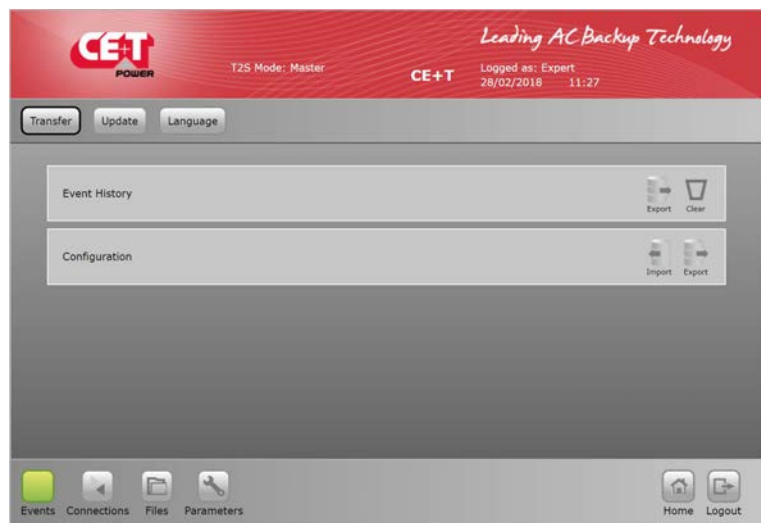
Update tab allows user to install the latest software version and get the latest features. Software is available through CE+T customer area in the website (my.cet-power.com).

Software are provided in a proprietary format called "*.saf" file. Once uploaded, the system will restart, installing the new application after verifications.

Dedicated procedure will be provided at the same location if needed.
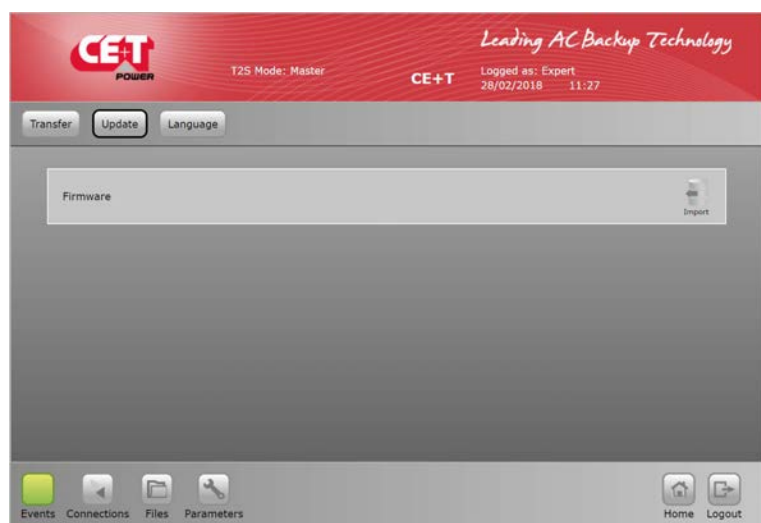
Language tab helps user so he can upload a language file and translate the whole interface in its own language. These files are available for certain languages in my.cet-power.com.

If the required language is not available, get in touch with sales representative to request the interface translation.

The first line **Install language file** allows uploading any language file while other lists are installed language. English is the default installed language. Apart from English user can install up to two different languages. Contact my.cet-power.com to find supported Language packs.

7.4.10 Parameters

Parameters page is divided in tab, which are compound of submenus. Here below, the whole list of parameters, organized as in the interface with remarks and comments about their use. Monitoring, Input relays, SNMP, Modbus, Power and Info are the submenus.

7.4.10.1 Monitoring Tab

- **Time**

  Time and Date information of the T2S ETH system can be configured
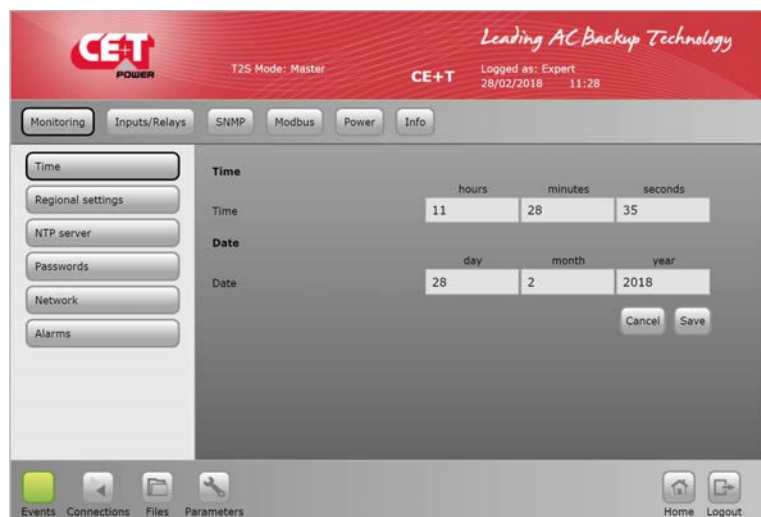
- **Regional settings**

  - **Language**: user can select a language among those installed. See files menu

  - **Sitename**: it's a standard string which is displayed in the banner.

  - **Location**: Location is the Place where the system is installed.

  - **Auto logout delay**: number of seconds after which any user will have to login again.
    When set to 0, auto-logout is disabled. A maximum value of 6000 seconds can be configured for Auto-logout option.

  - **Keyboard layout**: useful when using a Catena with the T2S ETH for in-display keyboard. It has two options AZERTY and QWERTY

  - **New module identifier**: Always Ask, Always replace and Never Replace are the options available for New Module Identifier.

  - **Home page**: Two different home page layouts are available One is the Classic home page and the default other is the Alternate home page.

  - **Display format**: DD/MM/YYYY, YYYY/MM/DD, MM/DD/YYYY are the different display format available

  - **Time format**: 24 Hours and 12 Hours options are available.

  - **Temperature format**: Celsius and Fahrenheit options are available.

- **NTP Server**

  NTP Server: System date and time can be synchronized with NTP server. NTP configuration parameters

  - IP Address of NTP server

  - Port Number

  - Time zone offset

  - Auto-refresh

  - Synchronization interval (days)

  - Force Synchronization.
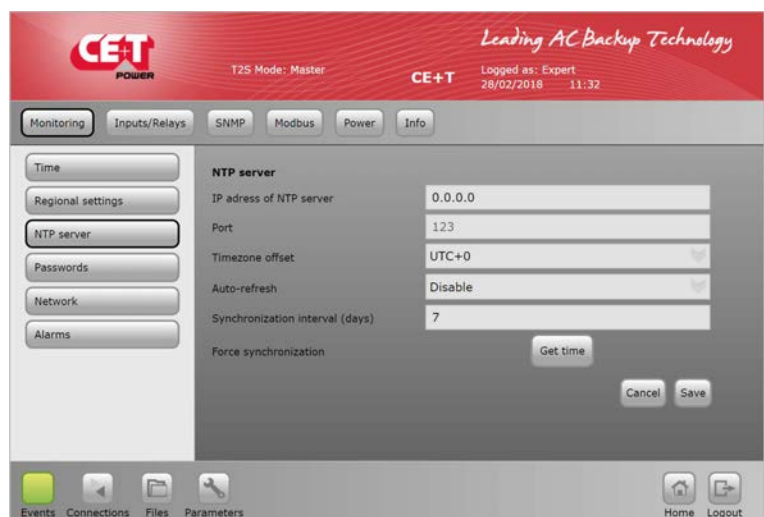
- **Passwords**

  Expert password: default is pass456 but it's strongly recommended to change it.

  Software update do not change your password.

  In case of lost password, please refer to FAQ at page 65
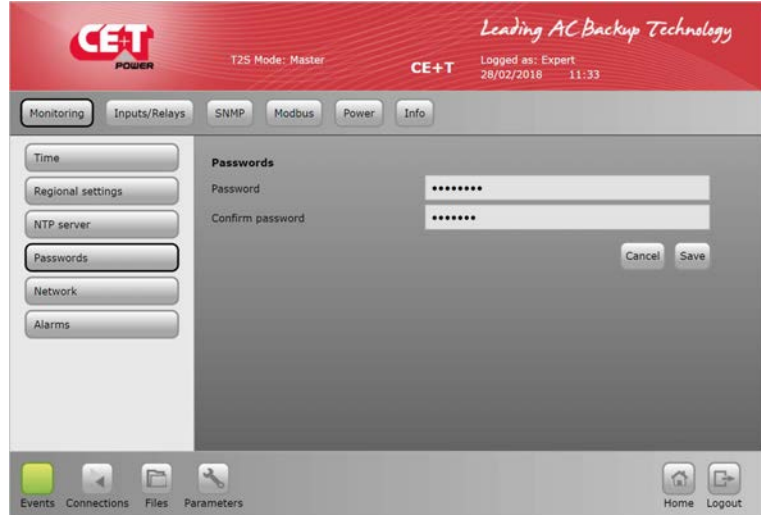
- **Network**

  In Connection mode, Select Hardware setup as
  - Standalone - System with T2S ETH or
  - With Catena - System with T2S ETH and display unit - Catena

  Network address is configuration of the T2S ETH
  - DHCP status: DHCP Disable allows to configure static IP to T2S ETH card. When DHCP is enable IP to T2S will be assigned by the DHCP server or the Router to which T2S ETH is connected. To find the IP address of T2S ETH card IP Scanner tools can be used. For more information refer section 9.2, page 57.
  - IP address
  - Subnet mask
  - Default gateway
  - Primary DNS
  - Secondary DNS

DNS has to be configured where server has host name.

- **Alarms**

MBP configured: should be configured and cabled to DigIn1 when a MBP is present. T2S ETH use this input to tell modules that MBP is engaged.

Remote MBP: Should be configured when a CE+T **external MBP unit** is present and it is applicable only for the systems in US market.
If it is enabled, the Relay 3 cannot be used.

Surge arrester configured: when configured and physically connected to DigIn 2, a specific alarm is risen in case of failure.

Log full alarms: Alarm will be generated once it reaches the maximum limit and record as FIFO.
It is recommended to download the log.

7.4.10.2 Input/Relays tab

- **Inputs Label**
  - **Digital Input 1:** label for DigIn1
  - **Digital Input 2:** label for DigIn2

- **Relays Label**
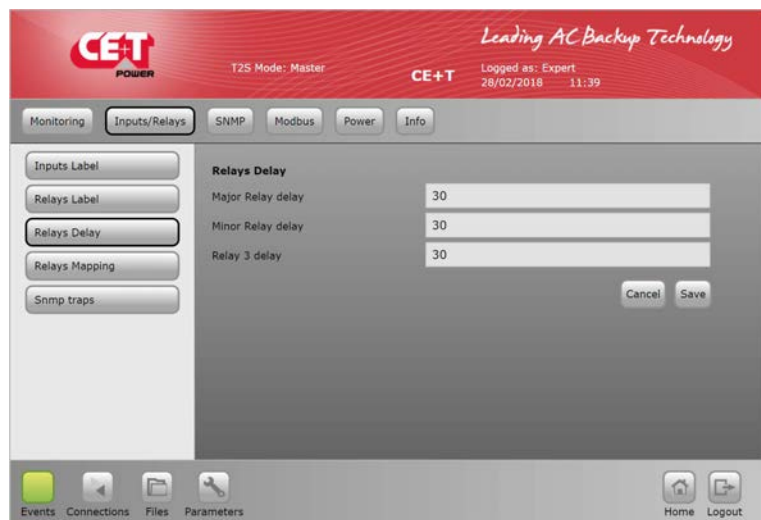
  - **Major Relay Name:** dedicated to major relay – not possible to change

  - **Minor Relay Name:** dedicated to minor relay – not possible to change

  - **Relay 3 name**: It is a programmable relay and user can select a particular alarm.
    Relay 3 cannot be used if remote MBP is enabled
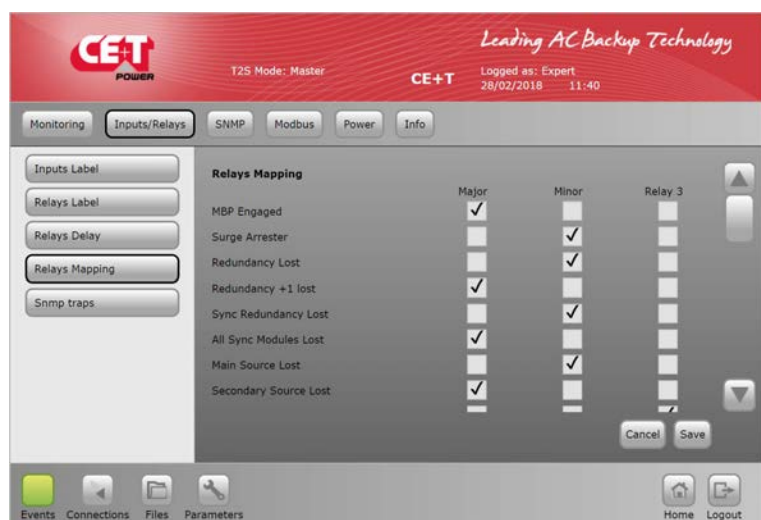
- **Relays Delay**

  - **Major Relay delay:** delay in seconds before toggling when condition is met (major alarm present)

  - **Minor Relay delay:** delay in seconds before toggling when condition is met (minor alarm present)

  - **Relay 3 delay:** delay in seconds before toggling when condition is met.

- **Relays Mapping**

  - Relay mapping page is a matrix: all events can be mapped on one relay, all relays can be mapped on one event, or any other combination the customer would like.

- **SNMP Traps**
  - Traps can be enabled for different events and alarms under this section. Trap receiver configuration has to be done under SNMP tab.
  - Test Traps can also verified.

7.4.10.3 SNMP

- **SNMP**

  SNMP configuration can be done from T2S ETH web page when logged in as expert login.T2S ETH when used as a standalone communication card it only supports SNMP V1. When T2S ETH is connected to Catena Display then User can configure SNMPV2C and SNMPV3.

  For configuration refer to section "SNMP", page 46.
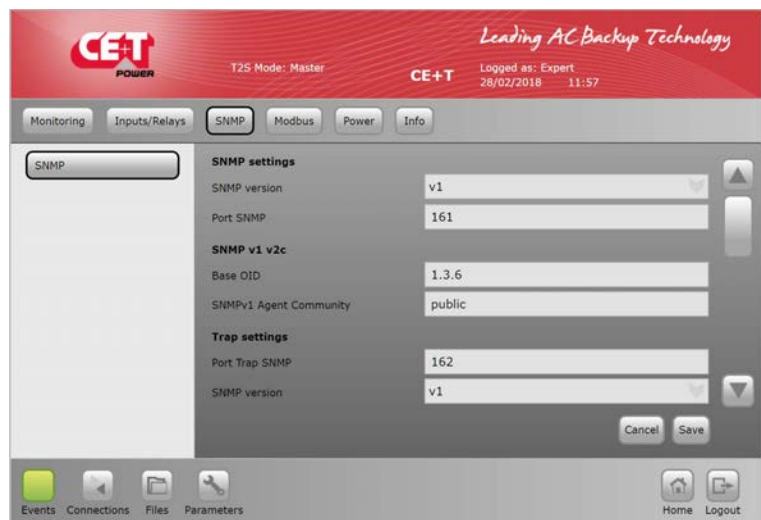
7.4.10.4 Modbus

- **Modbus**

  Modbus RTU configuration can be done from T2S ETH web page when logged in as expert login.T2S ETH when used as a standalone communication card it only supports Modbus RTU. When T2S ETH is connected to Catena Display then User can configure Modbus TCP.

  For configuration refer to section "Modbus Testing", page 90.
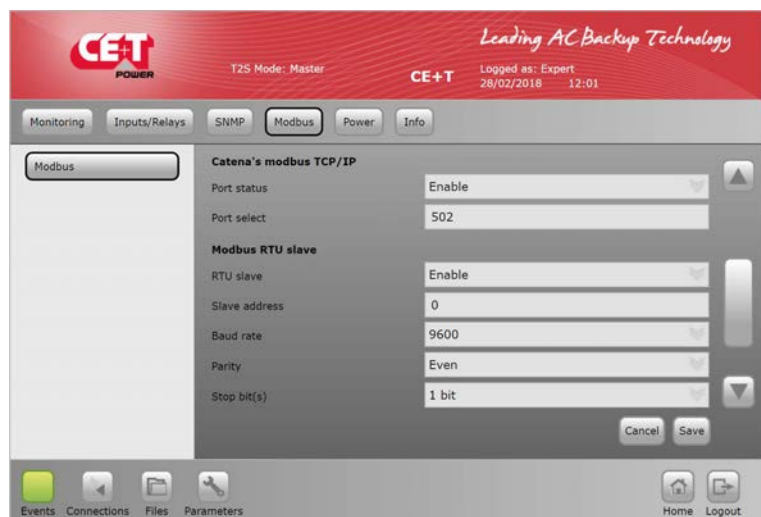
7.4.10.5 Power

- **General**

  Redundancy: number of redundant module can be set for each output phase.

  Source power ratio DC vs AC: percentage of power fed by DC. By default this parameter is set to 0, 100% on AC input.

  Booster 10x Iin: enable the boost (see manual of power module used for information on this feature).

  AC In grid feed Disable: enable this option if no power should be fed from the AC Input.

- **AC In**

  Threshold values for module operation on AC input side. User shall modify it ONLY if he has followed a proper training by CE+T.
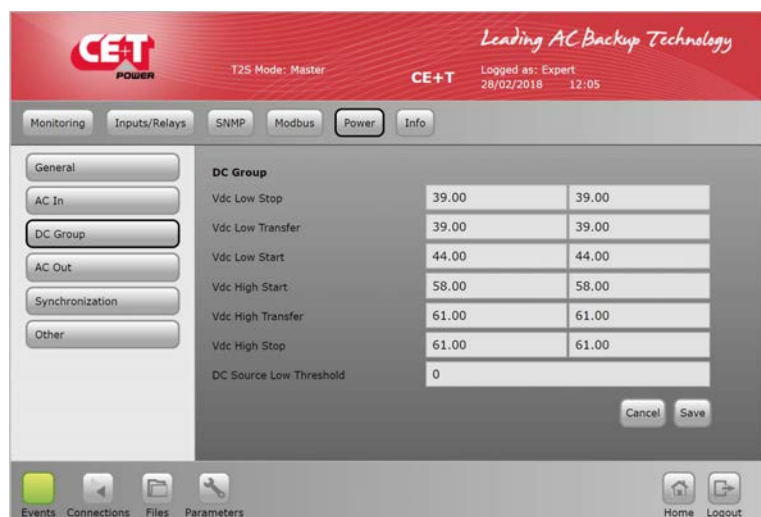
- **DC Group**

  User can configure the DC input as per the number of battery bank installed.

  Maximum two DC groups can be configured.

- **AC Out**

  Phase shift & Vout for each phase: define phase shift between phase.

  Nominal Freq: nominal frequency 50 or 60 Hz.

  Nb of phases: Number of phase single or three phase.
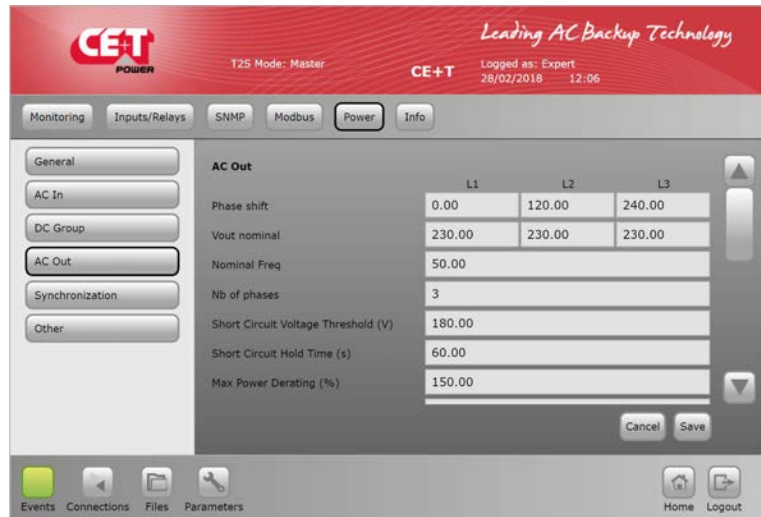
  Short circuit voltage & hold time: short circuit hold time before shut down 10 to 600 seconds (default 60).

  Max power/current derating.

  Max overload duration.

  Saturation Threshold: Saturation level (default 80%) generate alarm if AC output power exceed 80% of the total installed power.

  Delta mode: operation mode delta for 3 phase configuration only.

- **Synchronization**

  Synchronization parameters are used to configure in the higher capacity system (> 32 inverter modules) by using TUS.

  TUS is a synchronization kit.

- **Other**
  - Remote OFF disable AC power.
  - Walk in mode time.
  - Airco mode.
  - Force start without T2S.
  - No power from AC IN phase 1
  - No power from AC IN phase 2
  - No power from AC IN phase 3

7.4.10.6 Info

- **T2S-ETH**

  This tab provides information about the T2S ETH:
  - Serial Number
  - Software version
  - Interface version
  - Bootloader version
  - MAC Address: In case of required support, it's mandatory to provide information listed in this page or a screenshot of it.
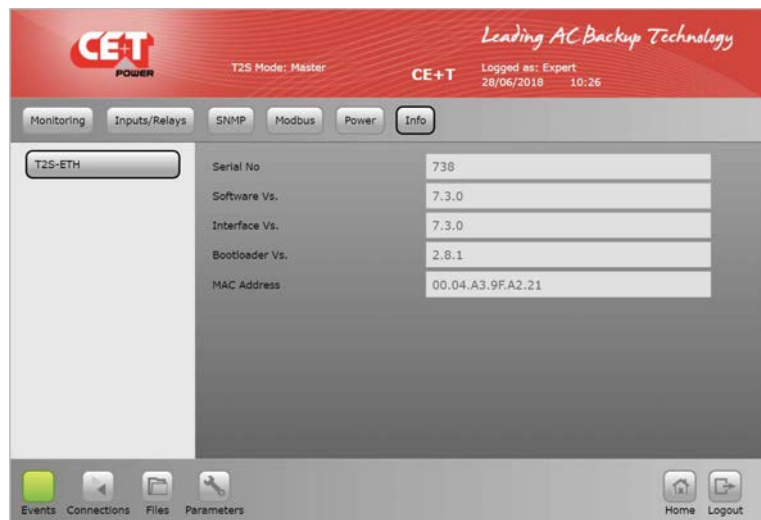
8. Catena

8.1 Introduction

Catena is the display solution for T2S ETH. Using it, you get access on a 7" display directly in the system, providing the same graphical user interface as the T2S ETH when accessed remotely.

8.2 User interface

As described before, the user interface is the same if the system is accessed remotely or directly on the 7" display.

The only limitation is the relay testing button, which is not available in Catena.

8.3 Ethernet connections

Catena has 3 ETH connections, two at rear and one at front.

8.3.1 Rear connections

One is dedicated to connection with T2S ETH while the second one is for permanent network connection. On this one, Catena offers extra protocols: SNMP v2c, v3 and Modbus over TCPIP. See following section "Protocols" about these.

8.3.2 Front connection

The front ETH connection is the maintenance access of the Catena. As it's providing a DHCP server, it's not needed anymore to change your laptop settings to connect point to point on the device.

When plugging an RJ45 cable between Catena and your laptop, the following popup will be displayed:
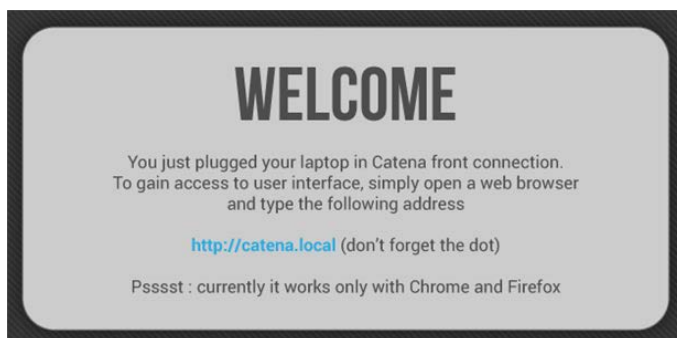
To get access to the user interface, just follow instruction from the popup:

- Open a web browser (Chrome or Firefox)
- Type http://catena.local in the address bar

When the cable is unplugged, the display is accessible again.

Important remark: this feature is only available in latest version (both Hardware and Software).

8.3.3 Troubleshooting

For any reason, if connection between Catena and T2S ETH cannot be established, the following popup will be displayed:
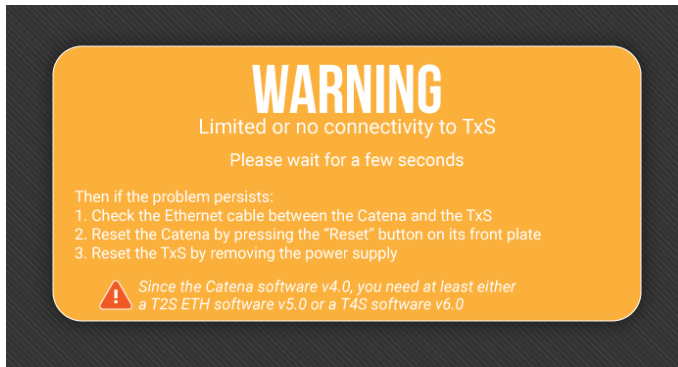
Follow the steps listed here. If the problem persists even after a reset (or hard reset by power supply), try to connect directly on T2S ETH and check that it's properly configured "With Catena" (See section 8.4, page 40).

8.4 Configuration

In Catena installed system, it is mandatory to set the option as "With CATENA" in Network page. (Parameters > Monitoring > Network > Connection mode > Hardware setup). Refer section "Network", page 32

8.4.1 Network architecture

When using Catena with T2S ETH, the network architecture is the following:
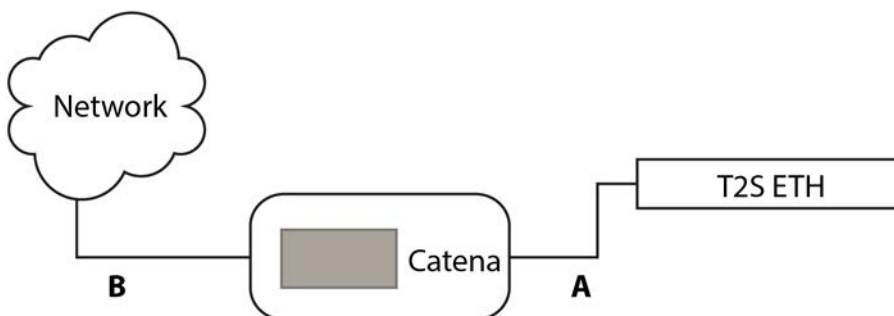
"A" is a private network between Catena and T2S ETH. Catena provides a DHCP server on this port to provide an IP address to T2S ETH. Even if not usable for user, the address range used there is 10.240.240.X and therefore, this address range is not available on interface B.

"B" is the user "permanent network connection" to the Catena. It can be either in DHCP client or in fixed IP address. When using a Catena, the network parameters in user interface are the ones used on interface B.

Important remark: when "With Catena" mode is selected, T2S ETH is listening for DHCP client. For any reason, if you want to connect on T2S ETH directly by removing the cable "A", then you have to wait for the DHCP client timeout of about 2 minutes. Only after that, T2S ETH will use the defined IP address in network parameters tend you can reach it.

8.5 Protocols

Using Catena SNMP V2C, SNMP V3 and Modbus TCP support is enhanced to monitor the system.

8.5.1 SNMP v2c

Implemented MIB file is CET-MIB.

For configuration refer to section "SNMP", page 46.

8.5.2 SNMP v3

Implemented MIB file is CET-MIB. Three different modes are available in SNMP v3 with subsequent parameters:

- No Auth/No Priv
- Auth/No Priv
- Auth/Priv

8.5.3 Modbus over TCP/IP

Only "read" mode is available, which means that Modbus can only be used for monitoring, not to execute actions on the system.

Port is fixed to standard Modbus TCP/IP port 502. This protocol can be either enabled or disabled.
The Reserved parameters are not implemented in the current version of T2S ETH and are for future use.

Address	Description	Unit	Type
600	Serial number H		U16
601	Serial number L		U16
602	Application version		U16
603	Application revision		U16
604	Application built		U16
605	Reserved		
606	Reserved		
607	Reserved		
608	Bootloader version		U16
609	Bootloader revision		U16
610	Bootloader built		U16
1002	Total AC output true power	W	S32
1004	Total AC output apparent power	VA	S32
1006	Worse phase load ratio	%	S32
1008	Reserved		
1010	Total configured AC output true power	W	S32
1012	Total configured AC output apparent power	VA	S32
1014	Total available AC output true power	W	S32

Address	Description	Unit	Type
1016	Total available AC output apparent power	VA	S32
1030	Total AC input true power	W	S32
1032	Total AC input apparent power	VA	S32
1034	Total DC input true power	W	S32
1080	Worse AC output load status		U16
1081	Worse AC output hardware status (inverters)		U16
1082	Reserved		
1083	Reserved		
1084	Worse AC input source status		U16
1085	Worse AC input hardware status		U16
1086	Worse DC input source status		U16
1087	Worse DC input hardware status		U16
1088	Redundancy lost		U16
1089	On DC		U16
1090	Reserved		U16
1091	MBP engaged		U16
1096	Number of events (all alarms types)		U16
1097	Number of major alarms		U16
1098	Number of minor alarms		U16
Output phase 1			
2050	Phase 1 true power	W	S32/float
2052	Phase 1 apparent power	VA	S32/float
2054	Phase 1 voltage	V/10	S32/float
2056	Phase 1 current	A/10	S32/float
2058	Phase 1 frequency	Hz/100	S32/float
2060	Reserved		
2062	Phase 1 worse power factor	%	S32/float
2064	Phase 1 worse temperature	°C/10	S32/float
2066	Phase 1 load ratio (W)	%	S32/float
2068	Phase 1 load ratio (VA)	%	S32/float
2070	Phase 1 available true power	W	S32/float
2072	Phase 1 available apparent power	VA	S32/float
Output phase 2			
2100	Phase 2 true power	W	S32/float
2102	Phase 2 apparent power	VA	S32/float

Address	Description	Unit	Type
2104	Phase 2 voltage	V/10	S32/float
2106	Phase 2 current	A/10	S32/float
2108	Phase 2 frequency	Hz/100	S32/float
2110	Reserved		
2112	Phase 2 worse power factor	%	S32/float
2114	Phase 2 worse temperature	°C/10	S32/float
2116	Phase 2 load ratio (W)	%	S32/float
2118	Phase 2 load ratio (VA)	%	S32/float
2120	Phase 2 available true power	W	S32/float
2122	Phase 2 available apparent power	VA	S32/float
Output phase 3			
2150	Phase 3 true power	W	S32/float
2152	Phase 3 apparent power	VA	S32/float
2154	Phase 3 voltage	V/10	S32/float
2156	Phase 3 current	A/10	S32/float
2158	Phase 3 frequency	Hz/100	S32/float
2160	Reserved		
2162	Phase 3 worse power factor	%	S32/float
2164	Phase 3 worse temperature	°C/10	S32/float
2166	Phase 3 load ratio (W)	%	S32/float
2168	Phase 3 load ratio (VA)	%	S32/float
2170	Phase 3 available true power	W	S32/float
2172	Phase 3 available apparent power	VA	S32/float
Input Group 1 Phase 1			
Reserved	Phase true power	W	S32
Reserved	Phase apparent power	VA	S32
Reserved	Phase voltage	V/10	S32
Reserved	Phase current	A/10	S32
Reserved	Phase frequency	Hz/100	S32
Input Group 1 Phase 2			
Reserved	Phase true power	W	S32
Reserved	Phase apparent power	VA	S32
Reserved	Phase voltage	V/10	S32
Reserved	Phase current	A/10	S32
Reserved	Phase frequency	Hz/100	S32
Input Group 1 Phase 3			
Reserved	Phase true power	W	S32
Reserved	Phase apparent power	VA	S32

Address	Description	Unit	Type
Reserved	Phase voltage	V/10	S32
Reserved	Phase current	A/10	S32
Reserved	Phase frequency	Hz/100	S32
Input Group 2 Phase 1			
Reserved	Phase true power	W	S32
Reserved	Phase apparent power	VA	S32
Reserved	Phase voltage	V/10	S32
Reserved	Phase current	A/10	S32
Reserved	Phase frequency	Hz/100	S32
Input Group 2 Phase 2			
Reserved	Phase true power	W	S32
Reserved	Phase apparent power	VA	S32
Reserved	Phase voltage	V/10	S32
Reserved	Phase current	A/10	S32
Reserved	Phase frequency	Hz/100	S32
Input Group 2 Phase 3			
Reserved	Phase true power	W	S32
Reserved	Phase apparent power	VA	S32
Reserved	Phase voltage	V/10	S32
Reserved	Phase current	A/10	S32
Reserved	Phase frequency	Hz/100	S32
DC Group 1			
Reserved	Group true power (flowing into system)	W	S32
Reserved	Group voltage	V/10	S32
Reserved	Group current (flowing into system)	A/10	S32
DC Group 2			
Reserved	Group true power (flowing into system)	W	S32
Reserved	Group voltage	V/10	S32
Reserved	Group current (flowing into system)	A/10	S32

Status (1080-1087):

These entries allow getting the status of power system, power inputs, and loading. The status is the one provided on web interface, main page, through status "LED".

Name	Description	Value
White	Missing	0 (bit 00000000)
Grey	OFF	1 (bit 00000001)
Green	OK. This means the input/output is OK	2 (bit 00000010)

Name	Description	Value
Orange	Recoverable Error	4 (bit 00000100)
Red	Non Recoverable Error	64 (bit 01000000)

9. SNMP

9.1 SNMP Configuration

9.1.1 Introduction

This document describes the Management Information Base (MIB) schema design for standalone T2S ETH for SNMP v1 configuration and T2S ETH with Catena for SNMP V2C and V3 configuration. A MIB schema describes the structure of information served by a Simple Network Management Protocol Subsystem (SNMP) agent.

9.1.2 General NMS, SNMP Agent and MIB Role

This section describes the Management Information Base's (MIB's) and SNMP Agent's roles.

9.1.2.1 NMS Role

SNMP's purpose is to report operational status information about networked computing devices to a centralized Network Management System (NMS) endpoint. The status information is typically polled from an SNMP Agent on regular intervals by a Network Management System (NMS) Endpoint. Internal status can also be checked by the SNMP Agent on regular intervals, and when status of certain metrics falls outside pre-defined acceptable tolerances, an asynchronous Notification is transmitted to the NMS. This notification is termed as a Trap.

9.1.2.2 MIB Role

The MIB file describes the specific format of data provided by the SNMP agent running within the subsystem. The data is grouped in terms of high level objects, and therefore models a top-down hierarchical design. There exist a high level object defined in a TOP LEVEL MIB file they are CET-TSI-MIB and CET-TSI-SMI

9.1.2.3 SNMP Agent Role

An agent is a network-management software module that resides on a managed device. An agent has local knowledge of management information and translates that information to or from an SNMP-specific form. A network management station (NMS) executes applications that monitor and control managed devices. As mentioned above, the SNMP agent's purpose is report data elements to a Network Management System tool, such as MG Soft, I reasoning on a periodic basis. Also, if the system is exhibiting non-ideal behavior, Notifications can be distributed to the NMS on a per incident basis called the Traps. After Notifications that denote non-conforming or malfunctioning behavior are triggered, the system may further distribute Notifications indicating the system is back to its normal state.

9.1.3 MIB General Design

This section describes the general design for the T2S ETH and Catena products

9.1.3.1 Industry Identification

The private CET MIB shall be represented by the object identifier 1.3.6.1.4.1.12551, or iso.org.dod.internet.private. enterprise.cetMIB.

The TSI MIB shall be named cetTSI and will be located as a child object of the cetMIB, using object identifier 1.3.6.1.4.1.12551.4, taking the next available spot at the top level of the cet MIB's Products node.

9.1.3.2 MIB Design in the T2S ETH and Catena Products

Each component in the system or device shall be monitored and therefore will be described by its own Management Information Base (MIB) structure file which describes the data provided by that MIB. The data elements in a MIB are grouped in objects, and each object may hold any number of child objects specified as either scalar values or tabular values.

In CET-TSI MIB Device objects are grouped to a high level table tsiObjects, a Table is effectively specified as a group of scalar values each scalar is a column in the table. Tables are used to provide multiple groups of information (multiple rows).The first child of tsiObjects are tsiModules,tsiPhases, tsiACGroups, tsiDcGroups, tsiAlarms, tsiTraps, tsiEventDescription, tsiT2SInfo, tsiConfiguration

For example, tsiModules is the table which holds all module information if there are multiple Module components on a given system, tsiModuleseen MIB table will provide an instance (row) for each module like tsiModuleSeen.1 (.1) is the instance referring to first module.

9.1.4 SNMP V1 Configuration
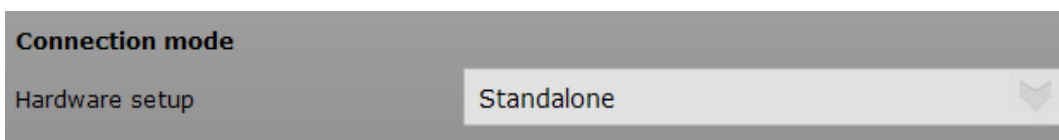
SNMP version 1: the oldest flavor. Easy to set up - only requires a plaintext community. A community string sent in plaintext, possibly from a restricted range of allowed IP addresses, is as good as the security gets.

9.1.4.1 T2S ETH web
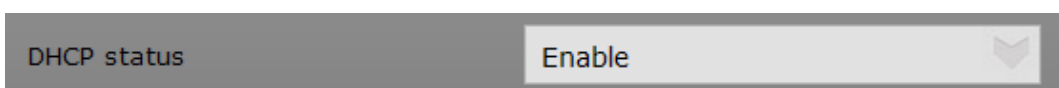
SNMP configuration can be done from T2S ETH web page when logged in as expert login.T2S ETH when used as a standalone communication card it only supports SNMP V1. When T2S ETH is connected to Catena Display then User can configure SNMPV2C and SNMPV3.

9.1.4.2 Network Configurations for T2S ETH Standalone

1. Login to T2S web link http://192.168.0.2/index.html as Expert login

2. Click on button "**Parameters**" at the end of the page

3. Go inside "**Monitoring**" menu

4. Click on "**Network**" sub menu

5. Connection mode Hardware setup should be Standalone

Connection mode

Hardware setup | Standalone

6. If you're on a network with DHCP You can just enable the DHCP inside the Network submenu of the "**Monitoring**" menu.

7. Turn DHCP to enable

DHCP status | Enable

8. Click "Save".

9. When DHCP is enabled IP to T2S will be assigned by the DHCP server or the Router to which T2S ETH is connected.

10. To find the IP address of T2S ETH card IP Scanner tools can be used.

11. Refer section 9.2, page 57 for more information.

12. If you have not DHCP Disable DHCP.

Network address

DHCP status	Disable

13. Configure Network

Network address

DHCP status	Disable
IP address	192.168.0.2
Subnet mask	255.255.255.0
Default gateway	192.168.0.254
Primary DNS	0.0.0.0
Secondary DNS	0.0.0.0

14. If your Trap receiver is a server with host name then configure DNS if you want your trap to be received.

9.1.4.3 SNMP V1 agent configuration

1. Once your network is ready, you can configure the SNMP server, and the TRAP

2. Click on button "**Parameters**" at the end of the page

3. Go inside "**Monitoring**" menu

4. Click on "**SNMP**" sub menu

5. As mentioned earlier T2S ETH standalone card only supports SNMP V1 configuration, here you can only select SNMP V1, ignore SNMP V2C and SNMP V3 in the drop down list. These Configurations will not communicate with T2S ETH card.

6. SNMP Port is configurable through **Expert login**

SNMP settings

SNMP version	v1
Port SNMP	161

7. SNMP Port number is standard port 161 for V1 communication

8. SNMP V1 will not communicate when port number is changed from default port number even if the same port number is configured at the NMS end.

9. SNMP Base OID need not be modified

10. SNMP Agent Community is configurable, the same agent community name has to be used in NMS SNMP V1 profile.

11. Community name accepts a maximum of 15 ASCII characters.

SNMP v1 v2c

| Base OID | 1.3.6 |
| SNMPv1 Agent Community | public |

9.1.4.4 SNMP V1 trap settings

1. Port Trap Chooses the port on which the trap is send and default port is port 162

2. Traps will not be received if the port number is changed.

3. Choose SNMP Version V1 as T2S ETH only supports SNMP V1 communication.

4. Community for V1 traps can be ignored as V1 traps does not consider community name.

5. Trap version for T2S ETH is CET MIB Traps

6. Traps will not be received when UPS MIB Traps are selected.

Trap settings

Port Trap SNMP	162
SNMP version	v1
Community v1 v2c	public
Traps version	CET MIB traps

9.1.5 SNMP V2C Configuration

SNMP v2C revises version 1 and includes improvements in the areas of performance, security, confidentiality, and manager-to-manager communications. It introduced GetBulkRequest, an alternative to iterative GetNextRequests for retrieving large amounts of management data in a single request.

9.1.5.1 Network Configuration from T2S ETH with Catena.

1. Login to T2S web link http://192.168.0.2/index.html as Expert login

2. Click on button "Parameters" at the end of the page

3. Go inside "Monitoring" menu

4. Click on "Network" sub menu

5. Connection mode Hardware setup should be with CATENA.

6. Ensure this option is selected before connecting T2S ETH to CATENA.

9.1.5.2 SNMP V2C agent configuration

1. SNMP V2C can be configured when T2S ETH is connected to Catena

2. Login to T2S web page in Expert login

3. Click on button "Parameters" at the end of the page

4. Go inside "Monitoring" menu

5. Click on "SNMP" sub menu

6. Configure SNMP version under SNMP settings SNMP version V2C

7. SNMP Port number is standard port 161 for V2C communication

8. SNMP V2C will not communicate when port number is changed from default port number even if the same port number is configured at the NMS end.

9. SNMP Base OID need not be modified

10. SNMP Agent Community is configurable, the same agent community name has to be used in NMS SNMP V2C profile. Keep public if you want that everybody can connect.

11. Community name accepts a maximum of 15 ASCII characters.

9.1.5.3 SNMP V2C trap settings

1. Port Trap Choose the port on which the trap is send and default port is port 162

2. Traps will not be received if the port number is changed.

3. Choose SNMP versions as SNMP V2C

4. Community for V2C traps can be ignored as V2C traps does not consider community name.

5. Trap version for T2S ETH is CET MIB Traps

6. Traps will not be received when UPS MIB Traps are selected.

9.1.6 SNMP V3 Configuration

SNMPv3 defines a secure version of SNMP and also facilitates remote configuration of the SNMP entities. SNMP V3 configuration is possible ONLY IF YOU HAVE A CATENA

Network Configuration is same as SNMP V2C.

The three possible configuration options are

- **No Auth + No Encrypt**: no authentication required, so anybody on the network can access or know what you're doing.

- **Auth + No Encrypt**: To have access one must be logged (authenticate). But anybody on the network knows what he is doing by reading the network packets.

- **Auth + Encrypt:** must be authenticate AND all the network packets send are encrypted and thus, nobody know what the user is doing except the user himself of course.

9.1.6.1 SNMP V3 Configuration No Auth + No Encrypt.

1. SNMP V3 can be configured when T2S ETH is connected to Catena

2. Login to T2S web page in Expert login

3. Click on button "**Parameters**" at the end of the page

4. Go inside "**Monitoring**" menu

5. Click on "**SNMP**" sub menu

6. Configure SNMP version under SNMP settings select v3 No Auth. + No Encrypt.

SNMP settings

SNMP version	v3 No Auth. + No Encrypt.
Port SNMP	161
Context	ctx_t2s

SNMP v3 No Auth. + No Encrypt.

NoAuth base OID	1.3.6
NoAuth user	snmp3reader

7. SNMP Port number is standard port 161 for V3 communication

8. SNMP V3 will not communicate when port number is changed from default port number even if the same port number is configured at the NMS end.

9. SNMP Base OID need not be modified

10. Context name has to match the name used in NMS, Context name accepts a maximum of 15 ASCII characters.

11. SNMP NoAuth user is configurable, the same user name has to be used in NMS SNMP V3 profile.

12. User name accepts a maximum of 15 ASCII characters.

9.1.6.2 SNMP V3 No Auth + No Encrypt trap settings.

1. Port Trap Choose the port on which the trap is send and default port is port 162

2. Traps will not be received if the port number is changed.

3. Choose SNMP versions as SNMP V3 No Auth. + No Encrypt.

4. Only for SNMP V3 trap mode: specify the "engineID". Identifier that allows you to know which device is sending you the trap. EngineID should not be modified.

Note: SNMPv3 mandates that the message is rejected unless the SNMPv3 user sending the trap already exists in the user database. The user database in a SNMPv3 application is actually referenced by a combination of the user's name (called a "security Name") and a identifier for the given SNMP application your talking to (called an "engineID").
(source : http://www.net-snmp.org/tutorial/tutorial-5/commands/snmptrap-v3.html)

Trap settings

Port Trap SNMP	162
SNMP version	v3 No Auth. + No Encrypt.
Trap engine ID	0x0102030405
Traps version	CET MIB traps

5. Standard user name for SNMP v3 No Auth. + No Encrypt. User is "snmp3TrapUser" this not configurable, But this username has to be added in NMS to receive traps.

6. Trap version for T2S ETH is CET MIB Traps.

7. Traps will not be received when UPS MIB Traps are selected.

9.1.6.3 SNMP V3 Configuration Auth + No Encrypt.

1. SNMP V3 can be configured when T2S ETH is connected to Catena

2. Login to T2S web page in Expert login

3. Click on button "Parameters" at the end of the page

4. Go inside "Monitoring" menu

5. Click on "SNMP" sub menu

6. Configure SNMP version under SNMP settings select v3 Auth. + No Encrypt.

SNMP settings	
SNMP version	v3 Auth. + No Encrypt.
Port SNMP	161
Context	ctx_t2s

SNMP v3 Auth. + No Encrypt.	
NoPriv base OID	1.3.6
NoPriv user	snmp3user
NoPriv password	snmp3password
NoPriv authentication	MD5

7. SNMP Port number is standard port 161 for V3 communication

8. SNMP V3 will not communicate when port number is changed from default port number even if the same port number is configured at the NMS end.

9. Context name has to match the name used in NMS, Context name accepts a maximum of 15 ASCII characters.

10. SNMP Base OID need not be modified

11. NoPriv user name has to match the name used in V3 profile in NMS, user name accepts a maximum of 15 ASCII characters.

12. When No Auth same user name used for NoPriv user Error (109) will be displayed. Try creating new user name.

```
Error (109): "Wrong monitoring parameter value"
Param (598): "NoAuth user"
```

13. NoPriv password has to match the password used in V3 profile in NMS, Password accepts a maximum of 15 ASCII characters.

14. NoPriv authentication is the hash method used to login (take care that MD5 is the weakest of the list. SHA recommended).

9.1.6.4 SNMP V3 Auth + No Encrypt trap settings

1. Port Trap Choose the port on which the trap is send and default port is port 162

2. Traps will not be received if the port number is changed.

3. Choose SNMP versions as SNMP V3 Auth. + No Encrypt.

4. Only for SNMP V3 trap mode specify the "engineID". Identifier that allows you to know which device is sending you the trap, engineID is not to be modified.

5. Trap user name is configurable has to match the name created in Trap receiver, User name accepts a maximum of 15 ASCII characters.

6. Trap password is configurable has to match with the password created in Trap receiver, Password accepts a maximum of 15 ASCII characters.

7. Trap authentication is the hash method used to login (take care that MD5 is the weakest of the list. SHA recommended).

8. Trap version for T2S ETH is CET MIB Traps

9. Traps will not be received when UPS MIB Traps are selected.

Trap settings	
Port Trap SNMP	162
SNMP version	v3 Auth. + No Encrypt.
Trap engine ID	0x0102030405
Trap user	snmp3TrapUser
Trap password	snmp3password
Trap authentication	MD5
Traps version	CET MIB traps

9.1.6.5 SNMP configuration Auth + Encrypt

1. SNMP V3 can be configured when T2S ETH is connected to Catena

2. Login to T2S web page in Expert login

3. Click on button "Parameters" at the end of the page

4. Go inside "Monitoring" menu

5. Click on "SNMP" sub menu

6. Configure SNMP version under SNMP settings select v3 Auth. + Encrypt.
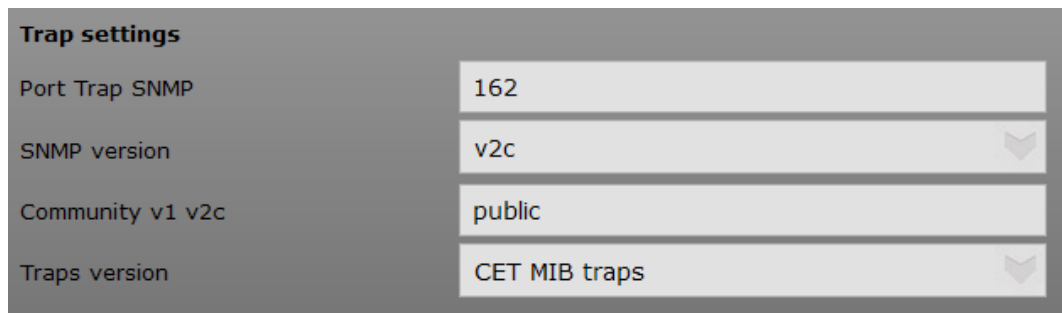
7. SNMP Port number is standard port 161 for V3 communication

8. SNMP V3 will not communicate when port number is changed from default port number even if the same port number is configured at the NMS end.

9. Context name has to match the name used in NMS, Context name accepts a maximum of 15 ASCII characters.

10. SNMP Base OID need not be modified

11. Priv user name has to match the name used in V3 profile created in NMS, user name accepts a maximum of 15 ASCII characters.

12. Priv password has to match the password used in V3 profile created in NMS, Password accepts a maximum of 15 ASCII characters.

13. Priv authentication is the hash method used to login (take care that MD5 is the weakest of the list. SHA recommended).

14. Priv encryption key has to match the key used in V3 profile created in NMS, encryption key accepts a maximum of 15 ASCII characters. It is the passphrase to encrypt the data.

15. Priv encryption: The encryption method used to secure the channel (note DES is weak protection; use AES if you can choose to).

9.1.6.6   SNMP V3 Auth + Encrypt trap settings.

1. Port Trap Choose the port on which the trap is send and default port is port 162

2. Traps will not be received if the port number is changed.

3. Choose SNMP versions as SNMP V3 Auth. + Encrypt.

4. Only for SNMP V3 trap mode specify the "engineID". Identifier that allows you to know which device is sending you the trap, not to be modified.

5. Trap user name is configurable has to match the name created in Trap receiver, User name accepts a maximum of 15 ASCII characters.

6. Trap password is configurable has to match with the password created in Trap receiver, Password accepts a maximum of 15 ASCII characters.

7. Trap authentication is the hash method used to login (take care that MD5 is the weakest of the list. SHA recommended).

8. Trap priv encryption key is configurable has to match the name created in Trap receiver, encryption key accepts a maximum of 15 ASCII characters.

9. Trap priv encryption: Only for SNMP V3+ auth+ encryption: method used to encrypt packet! Use AES if you have the choice.

10. Trap version for T2S ETH is CET MIB Traps

11. Traps will not be received when UPS MIB Traps are selected.

Trap settings	
Port Trap SNMP	162
SNMP version	v3 Auth. + Encrypt.
Trap engine ID	0x0102030405
Trap user	snmp3TrapUser
Trap password	snmp3password
Trap authentication	SHA
Trap priv encryption key	snmp3key
Trap priv encryption	DES
Traps version	CET MIB traps

9.1.6.7 SNMP Traps receiver settings

SNMP allow sending trap when event occur. This section is here to explain how to configure them

1. First configure the target IP, Each time a trap is send, you have to specify to whom. So always in the same menu SNMP, go to the bottom and enter the target IP.

2. You can configure up to 5 trap receivers.

Trap receivers	
IP for trap 1	0.0.0.0
IP for trap 2	0.0.0.0
IP for trap 3	0.0.0.0
IP for trap 4	0.0.0.0
IP for trap 5	0.0.0.0

9.2 Advanced IP Scanner

This section helps you indentify your T2S ETH IP when DHCP is enabled. Advanced IP Scanner open source software available online, this application need not be installed in local machine. It is a reliable and free network scanner to analyze LAN. The program shows all network devices, gives you access to shared folders, provides remote control of computers

Download the application from https://www.advanced-ip-scanner.com

Run the exe file when the application opens click on RUN scan.
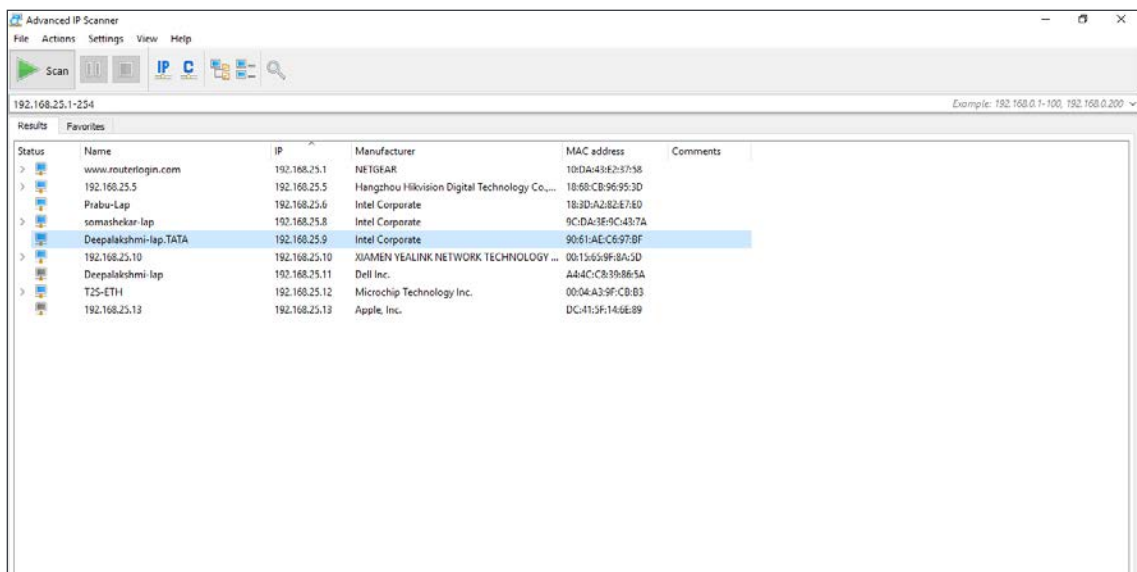
9.3 SNMP V1 Testing

This section helps you to test the SNMP of your T2S ETH unit. Lots of software (free or not) is available online. Current example is given using "*iReasoning MIB Browser*".

Here are the steps to follow:

1. Click *File* > Load MIBs and browse to locate on your hard drive the files downloaded on my.cet-power.com portal (CET-TSI-MIB.mib & CET-TSI-SMI.mib).
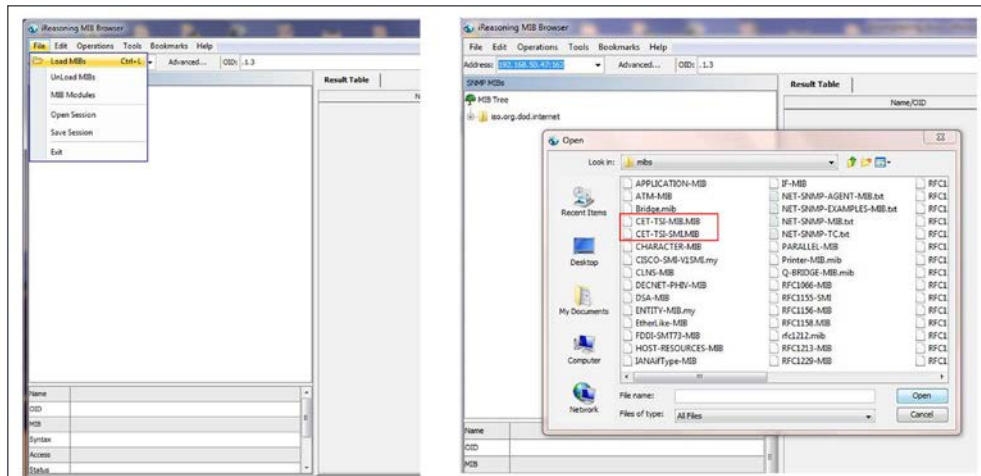
2. Once it's done, you can browse the MIB content under
    MIB Tree > iso.org.dod.internet > private > enterprises > cetMIB > cetTSIMIB

3. Fill the address field with your unit IP address.
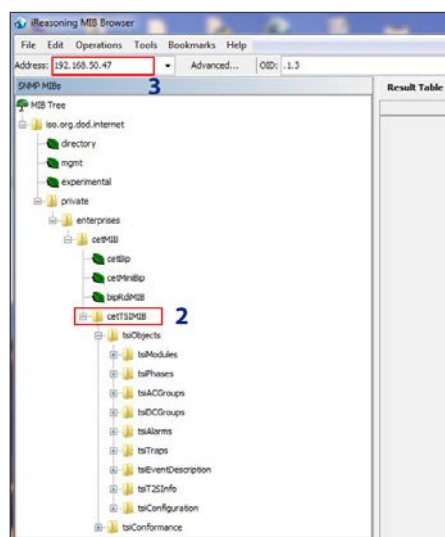
4. Click "*advanced*" if you changed settings like Read Community.
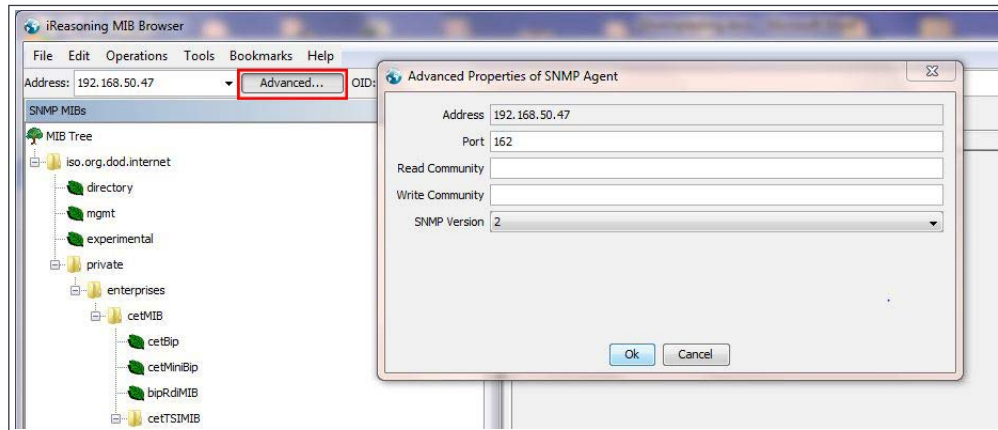
5. Select the operation, for example "WALK" and click "Go".

6. The result looks like

9.4 SNMP V1 Traps

To check the SNMP V1 traps,

1. Click *Tools* > *Trap Receiver* on the menu bar.
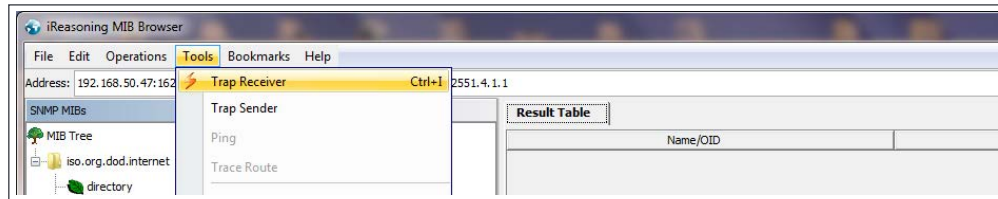
2. You should have defined the IP address of the laptop running MIB Browser in the T2S ETH configuration in order to retrieve trap.
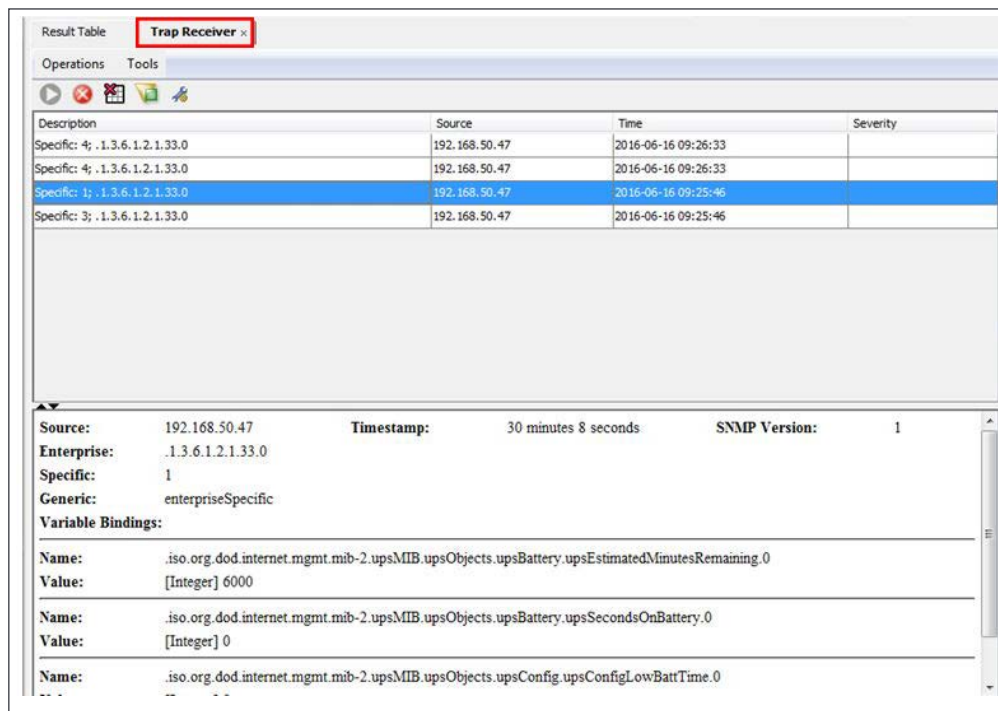
9.5 SNMP V3 Testing

Snmpb-0.8.exe is the latest version of snmpb tool. Download the file from this URL https://sourceforge.net/projects/snmpb/ and Run the exe to install the application.

9.5.1 Steps to Load CET MIB

1. Open the Application and navigate to Editor.

2. Open CET-TSI-MIB Paste it in the editor

3. Press Ctrl + S to save the file with the same file name

4. Open CET-TSI-SIM Paste it in the editor

5. Press Ctrl + S to save the file with the same file name

6. Navigate to Modules Tab

7. Check CET-TSI-MIB and CET-TSI-SIM are listed under available MIB Modules

8. Select the above files and Press right arrow to move the files to Loaded MIB Module

9. By doing this CET MIB files are loaded to SNMPB MIB tree

10. Navigate to tree tab and check for CET MIB under iso-org-dod-internet-private-enterprises-cetMIB
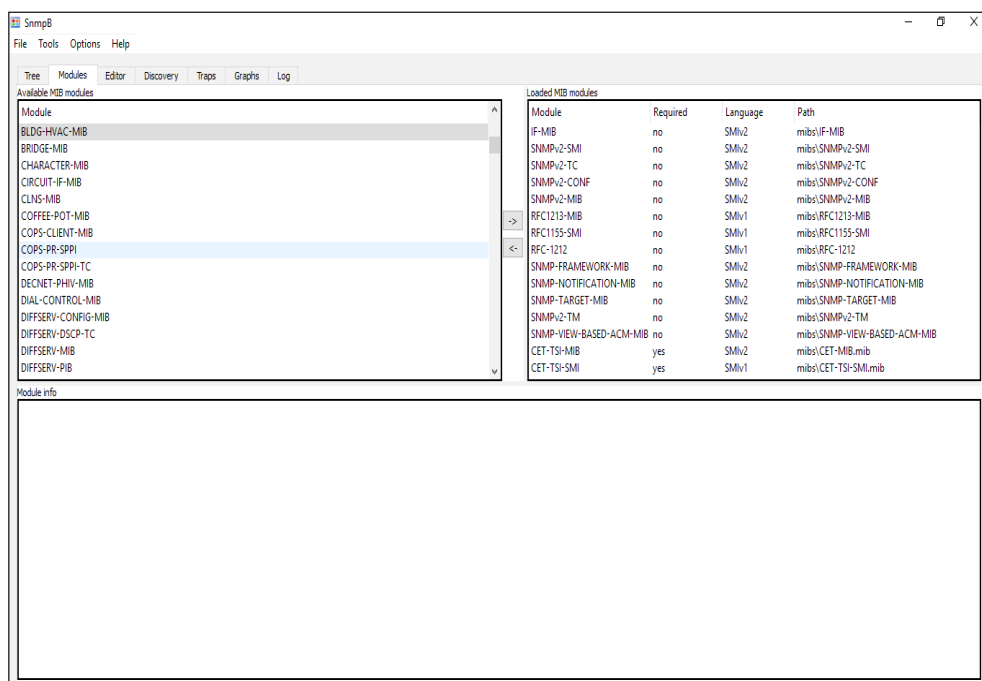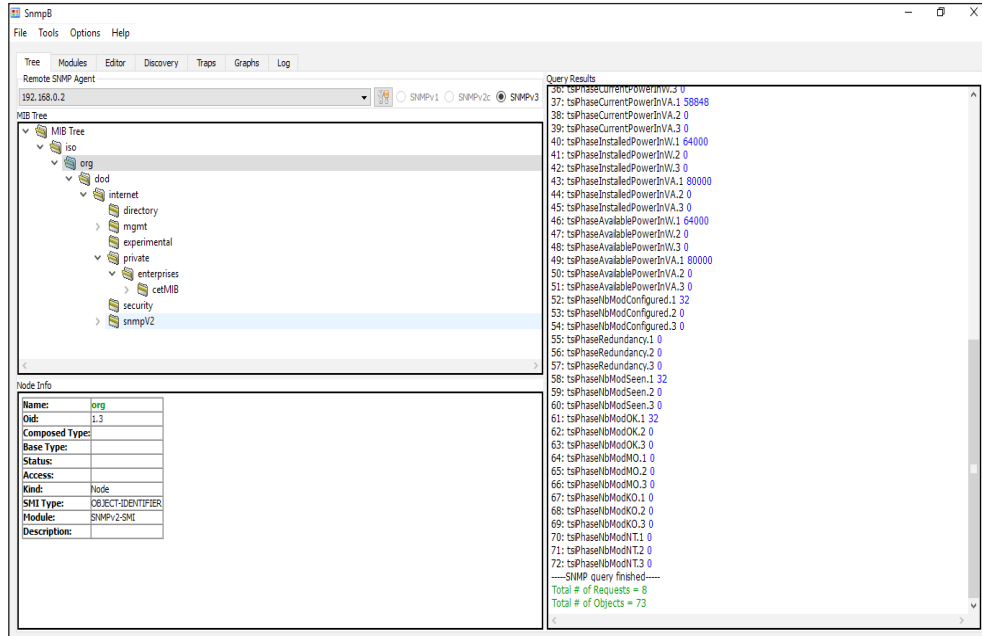
9.5.2 Steps to Discover Device

1. Navigate to Discovery tab

2. Select IP option and enter From and To IP addresses, this would be the IP address range of T2S ETH IP

3. SNMP Agent profile to be selected based on the type of SNMP communication

4. Click on discover device

5. T2S device will be discovered

6. Right click on the device and add device to agent profile list
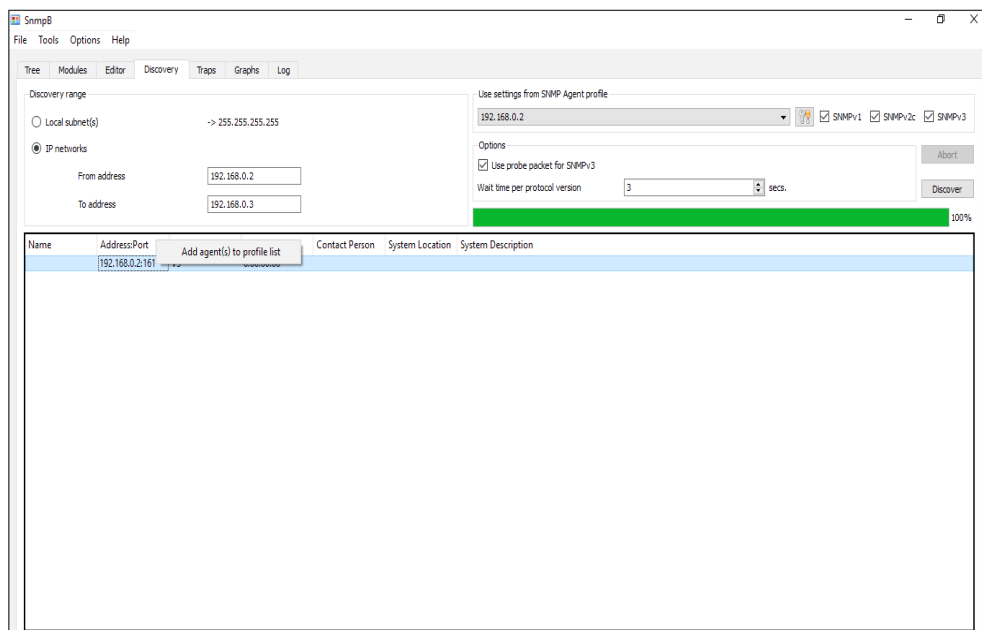
9.5.3 Steps to Get / Walk OID
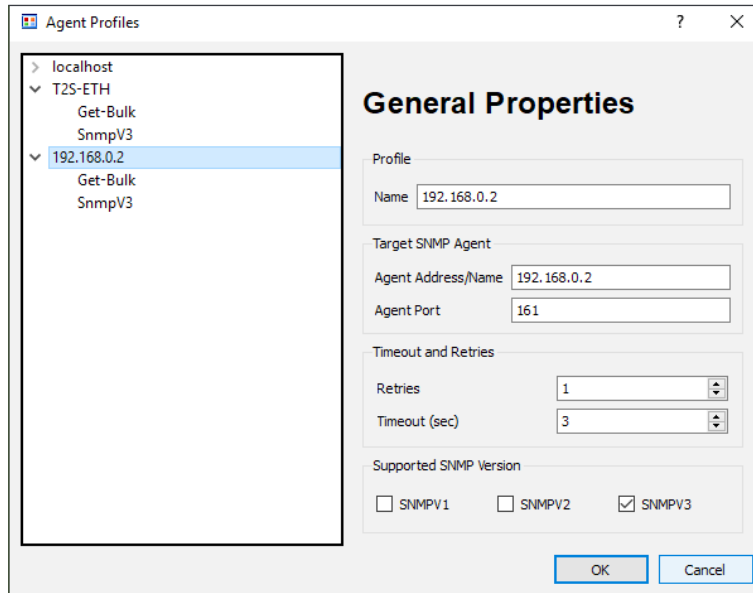
1. Select the SNMP Agent under remote SNMP agent

2. The Added SNMP Agent has to be listed in the list

3. Right click on the OID to perform walk or Get
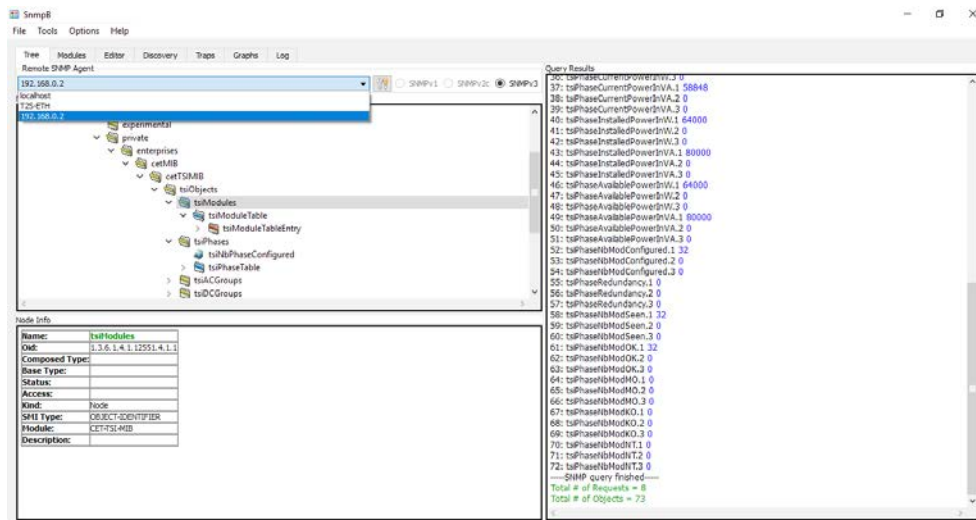
9.5.4 Steps to Add SNMP V3 User

1. Navigate to Options – manage Agent Profile

2. Select the Agent Profile and select the supported SNMP Version

3. Select Manage SNMP3 USM User

4. Right click on User profile and add new user profile

5. Security username should be the Priv user name given in T2S ETH web page
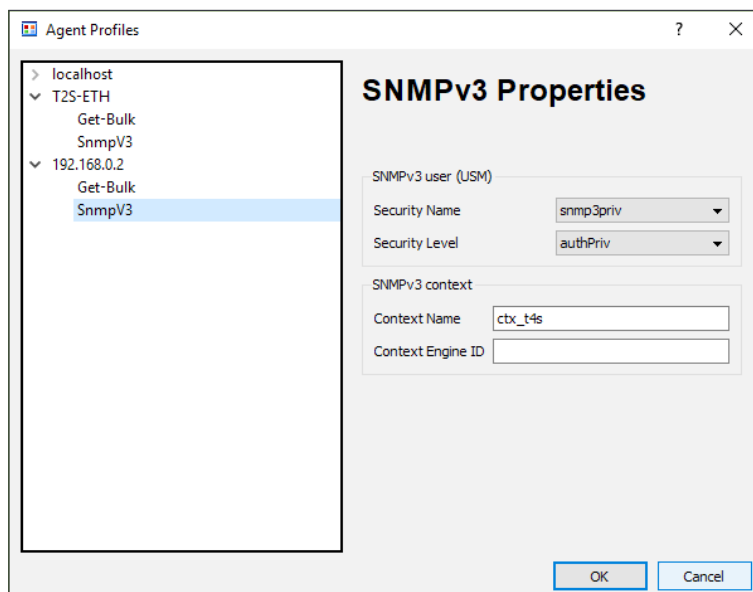
6. Authentication protocol, Authentication password, Privacy Protocol and Privacy password should also match with the values given in T2S ETH web page

7. Click OK

8. Navigate to Options – manage Agent Profile

9. Select SNMP agent and select SNMP v3, under SNMP properties security name drop down list select the USM user created

10. Select Security level NoAuth/NoPriv or Auth/NoPriv or AuthPriv as the once configured in T2S ETH web page

11. Enter SNMP content text same as in T2S ETH web page

10. FAQ

1. I'm unable to change the output phase of a module

   - Check that the number of phase is correctly configured in Configuration > Power > AC OUT > Nb of phase
   - Module should be manually turned off (module page)
   - Don't forget to turn the module back on when phase is changed!

2. I have a system properly running with T2S USB, can I replace it with T2S ETH

   Of course T2S ETH and T2S are 100% compatible. Once the load is fed, monitoring cannot cause any issue to it. Feel free to replace your old T2S by a new T2S ETH.

   Pay attention to:

   - MBP monitoring is a T2S configuration parameter which should be re-configured in your new T2S ETH once it's up and running.
   - Candis is not compatible with T2S ETH. A new version will be available soon, get in touch with your local sales representative for more info about availability and retrofit possibilities.
   - As their features are redundant, T2S ETH is not compatible with former TCP-IP module.
   - Operating parameter need to be cross check, and IP setting must reconfigured.

3. I want to replace a power module in my system, what should I do?

   - Remove the module
   - Browse to module selection popup.
   - The removed module appears in red. Click on it.
   - This brings you to module page. Unsinstall the module by clicking the uninstall button.
   - Insert the new module.
   - Module will appears on module selection popup.
   - Its address can be changed by browsing to module page.

4. How can I reset my admin password if I have unfortunately forgotten it?

   In case of password lost, a new temporary password (valid 24 hrs after creation) can be issued by CE+T Power. To receive a temporary password, send an email with your T2S ETH serial Number and the date at which you expect to go back on site to change the password to customer.support@cet-power.com specifically requesting a new temporary password. The serial number can be found on the sticker on the T2S ETH, or on screen in 'Parameters' then 'Info'.

11. Trouble Shooting and Defective Situations Fixing

11.1 Defective T2S ETH

11.1.1 Return defective T2S interface

A T2S totally dark (indication area) or that cannot interface with your laptop are evidence of failure.

11.1.2 Return defective T2S ETH

- 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!

- Information on failure occurrence as well as module status given through Menu 2-1 shall be attached to defective unit return package or recorded in RMA.

12. Service

For Service

- Check Service Level Agreement (SLA) of your vendor. Most of the time they provide assistance on call with integrated service. If such SLA is in place, you must call their assistance first.

- If your vendor doesn't provide such assistance (*) you may call CE+T directly. Toll free Number **1(855) 669 - 4627**(**)

Service is available from 8:00 A.M. to 10:00 P.M. EST, Monday through Friday, except closing periods for holidays or inclement weather.

Major Incidents and Emergency conditions can be invoked for immediate handling of same number or by dropping a mail on customer.support@cetamerica.com (***)

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

(**)   Valid in USA and Canada only.

(***)   Messages that are not Major Incident or Emergency will be served at the next scheduled working a day.

13.Maintenance Task

As maintenance will perform on live system, all task should perform only by trained people with sufficient acknowledge on TSI product.

Tasks:

- Identify the site, customer, responsible, cabinet number, product type.

- Download and save configuration file for back up.

- Check configuration file to be in accordance with operational site conditions.

- Read and save log file for back up.

- Check and analyze log file, and if alarm are present.

- Replace dust filter if present. Filter is mandatory in dusty environment.

- Check module temperature and log value. If internal temperature is higher then previous year, it should be interesting analyze if it is due an increasing load or dust effect. It is common to have a delta of 15°C by 30% of load between the ambient and the internal temperature. If temperature increase due internal dust built up clean the TSI with vacuum cleaner and/or soft compressed air.

- Clean cabinet (vacuum cleaner or dry cloth)

- Control the inverter mapping (AC Group, DC Group, Address)

- Check load level and record the rate value (print in word document the 4 screen modules information for the 32 modules, the 3 screen for the phases value and the 2 screens for the group AC and DC value)

- Change the configuration file for AC and DC mix mode to check that all TSI work on both power supply

- Check alarm operation (e.g., redundancy lost, mains failure, DC failure) on dry contact and through SNMP system or web interface.

- Switch OFF AC IN and check alarms.

- Check temperature terminal and temperature wiring. If possible use an infrared camera.

- Read and record value as wave form, power factor, Crest factor, THD I from power analyzer.

- Take cabinet picture

- Keep track of report and provide end user with a copy.

- Perform a MBP procedure. This task is not really recommended*, but could be demanded by site manager.

* It is not recommended because when you perform a By-pass procedure, generally there is no back up on AC input line, and the load shutdown if mains disappear.

14. Annex 1: Supervisor alarms - T2S ETH

This is the list of alarms issued by supervisor. Other alarms are issued by other modules (see section 15, page 72). The supervisor is able to generate alarms that are related to the system, to inverter modules, or to itself. Alarms related to inverters will be seen as system alarms when module alarm is present on all inverters. Each alarm has a priority level. The level can be (disabled, event, minor, major). If the level can be configured in user interface, then it is marked as "mappable".

System Alarms				
Text ID	**Name**	**Level**	**Def. Map**	**Description**
256	MBP Engaged	mappable	major	Digital input 1 is in low state and digital input 1 is used for MBP signaling.
257	Surge Arrester	mappable	minor	Digital input 2 is in low state and digital input 2 is used for surge arrester signaling.
258	Redundancy Lost	mappable	minor	Redundancy is configured and redundancy is lost on any output group.
259	Redundancy +1 Lost	mappable	minor	Redundancy is configured and more than redundancy is lost on any output group.
260	Main Source Lost	mappable	major	Any of the groups from main source is not conform. Example: there are 3 AC input groups and AC source is main source. If one AC input is offline, the alarm is triggered.
261	Secondary Source Lost	mappable	minor	Any of the groups from secondary source is not conform.
262	AC Source Lost	mappable	R3	Any AC input group is not conform.
263	DC Source Lost	mappable	disabled	Any DC input group is not conform.
264	AC Source Not Sync	mappable	minor	Any AC input group is not synchronized with AC output or has an out of range frequency.
265	DC Source Low	mappable	major	Any DC input group has a voltage lower that defined threshold.
266	Output Saturated	mappable	disabled	The load on any output group is higher than the saturation threshold (80% of configured output power).
267	Output Overloaded	mappable	major	The load on any output group is higher than the configured output power.
268	Output Failure	mappable	major	Any output group has 0 seen modules, or no module running (and they are not manually off).
269	System Started	event		System just started.
272	Missing Module	event		No module is detected on system bus.
273	New Module	event		All modules have just been detected on system bus.
274	Manually OFF	mappable	disabled	All modules outputs are manually turned off.
275	Output Fault	event		All modules outputs are turned off because of a fault.
276	Brownout Derating	event		All modules AC inputs are derated because of a brown-out.

System Alarms

Text ID	Name	Level	Def. Map	Description
277				
278	Temperature Derating	event		All modules outputs are derated because of an over temperature.
279	Overtemperature	event		All modules outputs are turned off because of an over temperature.

Inverter Modules Alarms

Text ID	Name	Level	Def. Map	Description
256	MBP Engaged	-		Not used at module level.
257	Surge Arrester	-		Not used at module level.
258	Redundancy Lost	-		Not used at module level.
259	Redundancy +1 Lost	-		Not used at module level.
260	Main Source Lost	-		Not used at module level.
261	Secondary Source Lost	-		Not used at module level.
262	AC Source Lost	-		Not used at module level.
263	DC Source Lost	-		Not used at module level.
264	AC Source Not Sync	-		Not used at module level.
265	DC Source Low	-		Not used at module level.
266	Output Saturated	-		Not used at module level.
267	Output Overloaded	-		Not used at module level.
268	Output Failure	-		Not used at module level.
269	System Started	-		Not used at module level.
272	Missing Module	mappable	minor	The module is not detected on system bus.
273	New Module	event		A new module is detected on system bus.
274	Manually Off	mappable	disabled	The module output is manually turned off.
275	Output Fault	mappable	minor	The module output is turned off because of a fault.
276	Brownout Derating	mappable	disabled	The module has a brown-out derating.
278	Temperature Derating	mappable	disabled	The module output is in derated because of an over temperature.
279	Overtemperature	mappable	disabled	The module output is turned off because of an over temperature.

Supervisor Module Alarms

Text ID	Name	Level	Def. Map	Description
512	Digital Input 1	lappable	disabled	Digital input 1 is in low state and digital input 1 is NOT used for MBP signaling.
513	Digital Input 2	mappable	disabled	Digital input 2 is in low state and digital input 2 is NOT used for surge arrester signaling.

Supervisor Module Alarms				
Text ID	Name	Level	Def. Map	Description
514	Log Nearly Full	mappable	disabled	Log file is nearly full.
515	Log Full	mappable	disabled	Log file is full (with information loss).
516	Log Cleared	event		Log file has just been cleared.
517	Config modified	event		Configuration has just been modified.

15. Annex 2: Module alarms - T2S ETH

Module not Recoverable Alarms				
Text ID	Name	Level	Def. Map	Check and Action
1	Fan Failure	Minor		Fan replacement
2	Permanent Fault (2)	Minor		
3	Permanent Fault (3)	Minor		
4	Permanent Fault (4)	Minor		
5	Permanent Fault (5)	Minor		
6	Permanent Fault (6)	Minor		
7	Too Many Starts	Minor		10 starts in 10 min (one a min)-Unplug and replug inverter and check status
8	Permanent Fault (8)	Minor		
9	Permanent Fault (9)	Minor		
10	Permanent Fault (10)	Minor		
11	Permanent Fault (11)	Minor		
12	Permanent Fault (12)	Minor		
13	Output Polarity	Minor		
14	Overload Too Long	Minor		Check load condition
15	Output Fuse	Minor		
16	Permanent Fault (16)	Minor		
18	Permanent Fault (18)	Minor		
19	Permanent Fault (19)	Minor		
28	Permanent Fault (28)	Minor		
29	Permanent Fault (29)	Minor		
30	Permanent Fault (30)	Minor		
31	Permanent Fault (31)	Minor		
32	Permanent Fault (32)	Minor		

Module Recoverable Alarms				
Text ID	Name	Level	Def. Map	Check and Action
33	Output Synchronization	Minor		Check frequency TSI and Mains
34	Temperature Too High	Minor		Check temperature inside inverter
35	Com. Bus Failure	Minor		T2S bus failure or no T2S seen. TSI blinks red - hardware problem
36	Com. Bus Conflict	Leinor		When two TSI have the same ADX - will self repair
37	No Power Source	Minor		No input AC and inout DC availlable
38	Com. Bus Failure	Minor		TSI has not started must have a T2S - orange LED

Module Recoverable Alarms

Text ID	Name	Level	Def. Map	Check and Action
39	Parameter Query	Minor		Inverter is updating his parameters
40	Parameter Mismatch	Minor		Parameters incompatible with configuration file
41	Parameter Not Ready	Minor		Check AC, configuration and allocated phases
42	Recoverable Fault (42)	Minor		
43	Inv Mismatch	Minor		Inverter incompatible with inverter installed in system (pack with "a la carte")
44	Backfeed Error	Minor		Inverter OFF due backfeed error
45	Recoverable Fault (45)	Minor		
46	Ext. Clock Fault	Minor		System OFF due external clock failure
47	Overload Triangle	Minor		Inverter OFF due internal failure

Module Alarms

Text ID	Name	Level	Def. Map	Check and Action
65	TSI Com. Bus Failure	Minor		synchronization problem
66	T2S Com. Bus Failure	Minor		problem will be stored in internal black box- return for investigation
67	TSI Com. Bus Failure	Minor		cabling or module problem
68	T2S Com. Bus Failure	Minor		Problem will be stored in internal black box- return for investigation
69	Recoverable Fault (69)	Minor		
70	Recoverable Fault (70)	Minor		
71	Output Volt. Changing	Minor		Happens when there is a config change to the voltage- lasts 1 min for a change from 100V to 120V - never insert a new module while this is happening!
72	Output Overload (I)	Minor		Check load condition
73	Com. Bus Mismatch	Minor		Alarm- triggered when it sees more or less modules on bus A vs bus B - used to identify a module problem while the module is still running - module needs to be replaced
74	Imminent Start	Minor		reported from a stopped module 10 seconds before it is going to start
75	Booster Not Ready	Minor		Wait 1 minute to recover the situation
76	Overload Not Ready	Minor		Wait 1 minute to recover the situation

Module Alarms				
Text ID	Name	Level	Def. Map	Check and Action
77	Temperature Derating	Minor		temperature measured from the heat sink - 88C for bravo and 70C for media
78	Output Overload (P)	Minor		Check load condition
79	Recoverable Fault (79)	Minor		
80	Brownout Derating	Minor		AC in below 180V - reduce power from the AC input and pulls power form the DC input
81	Fan Life	Minor		Write an event "FAN LIFE ELAPSED" in log file when the counter elapsed time is reach for one inverter.
82	Remote Off	Minor		Write an event "REMOTE OFF" in log file when inverter is set OFF through REM ON/OFF terminal
83	Manual Off	Minor		Write an event "MANUALLY OFF" in log file when module is set OFF through hyperterminal
84	Triangle Off	Minor		Inverter in OFF position due triangle mode failure
85	Recoverable Fault (85)	Minor		
86	Recoverable Fault (86)	Minor		
88	Recoverable Fault (88)	Minor		

Module AC Input Alarms				
Text ID	Name	Level	Def. Map	Check and Action
160	Ok			No error on AC IN
161	Source V Too Low Transfert	Minor		Check AC IN configuration and live value
162	Source V Too High Transfert	Minor		Check AC IN configuration and live value
163	Error (163)	Minor		
164	Error (164)	Minor		
165	Source V Too Low Transfert	Minor		Check AC IN configuration and live value
166	Source V Too High Transfert	Minor		Check AC IN configuration and live value
167	Source Not conform	Minor		Check AC IN configuration and live value
168	Source Not conform	Minor		Check AC IN configuration and live value
169	Source Not conform	Minor		Check AC IN configuration and live value
170	Power Disabled	Minor		AC input converter is only use for synchronization
171	Source Not conform	Minor		Check AC IN configuration and live value

Module AC Input Alarms				
Text ID	**Name**	**Level**	**Def. Map**	**Check and Action**
172	THD Too High	Minor		Check AC IN configuration and live value
173	Output Synchronization	Minor		Check AC IN configuration and live value
174	Error (174)	Minor		
175	Output Synchronization	Minor		Check synchronization between AC IN and AC OUT
176	Inv. Synchronization	Minor		Check synchronization between AC IN and AC OUT
177	Synchronization failure	Minor		Check synchronization between AC IN and AC OUT
179	Source V Too Low Stop	Minor		Check AC IN configuration and live value
180	Source V Too High Stop	Minor		Check AC IN configuration and live value
181	Source Frequ. Too Low	Minor		Check AC IN configuration and live value
182	Source Frequ. Too High	Minor		Check AC IN configuration and live value
183	Phase Not Ready	Minor		Check AC IN configuration and live value
184	Backfeed Error	Minor		Inverter in backfeed protection
188	Error (188)	Minor		
189	Error (189)	Minor		
190	Error (190)	Minor		
191	Error (191)	Minor		

Module DC Input Alarms				
Text ID	**Name**	**Level**	**Def. Map**	**Check and Action**
193	Ok			No error on DC IN
194	Source V Too Low Transfert	Minor		Check VDC parameter and live value
195	Source V Too High Transfert	Minor		Check VDC parameter and live value
196	Error (196)	Minor		
202	Source V Too Low Transfert	Minor		Check VDC parameter and live value
203	Source V Too High Transfert	Minor		Check VDC parameter and live value
204	Source V Too Low Stop	Minor		Check VDC parameter and live value

Module DC Input Alarms				
Text ID	**Name**	**Level**	**Def. Map**	**Check and Action**
210	Source V Too Low Stop	Minor		Check VDC parameter and live value
211	Source V Too High Stop	Minor		Check VDC parameter and live value
217	Error (217)	Minor		
220	Error (220)	Minor		

16. Annex 3: Modbus

16.1 Hardware Requirements

16.1.1 Cabling:

ModBus RTU is available on the on RJ45 connector located on the back plane of the rack containing the T2S ETH controller. The pin out of this connector is the following:
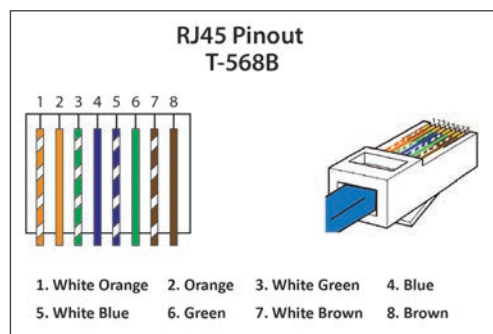
Pin Number	Name	Description
1	CANH	CANH pin for Candis
2	CANL	CANL pin for Candis
3	GND_IAX	Digital Communication Ground
4	GND_IAX	Digital Communication Ground
5	12V_IAX	+12 V unregulated
6	COM_A	RS 485 A
7	GND_IAX	Digital Communication Ground
8	COM_B	RS 485 B

16.1.2 Baud rate, parity and mode

Only RTU mode is supported.

Item	Value	Default
Slave address	From 1 to 247	1
Baud Rate	9600, 19200, 38400 or 115200	19200
Parity	Even, odd, none	Even
Stop bits	One, two	One
Mode	RTU	-
Electrical interface	RS485	-

16.2   Database Description

16.2.1 Typographic convention:

In this document the following naming convention will be used to represent the type of a variable:

The first letter will indicate if the variable is signed (S) or unsigned (U). Then the following digit(s) will indicate the number of bits needed to store the variable.

Thus:

- U8 will represent an unsigned variable stored in a 8-bit wide memory
- U16 will represent an unsigned variable stored in a 16-bit wide memory
- U32 will represent an unsigned variable stored in a 32-bit wide memory

And:

- S8 will represent a signed variable stored in a 8-bit wide memory
- S16 will represent a signed variable stored in a 16-bit wide memory
- S32 will represent a signed variable stored in a 32-bit wide memory

What is more, Modbus RTU register base type is a 16-bit wide variable. This means it is possible to store two 8-bit variables in a register. These two variables will be accessed using the same index in the structure. Thus in order to know if the variable is stored in the upper byte or in the lower byte, letter **H(High)** or **L(Low)** is added to the index.

As specified by the protocol, variables longer than 8-bit are always represented in big-Endian format (MSB first).

16.2.2 Data types:

Modbus RTU protocol defines four types of variables class described in the following table

Name	Type	Access	Supported by T2S ETH
Discrete input	1-bit wide	Read-only	No
Coil	1-bit wide	Read-write	No
Input register	16-bit wide	Read-only	Yes
Holding register	16-bit wide	Read-write	No

Data address mapping and signification are described in the following sections.

16.2.3 Supported function:

Accordingly to Modbus RTU specification, supported functions by the T2S ETH controller are the following:

- Read Input registers (0x04)

16.2.3.1 INPUT REGISTERS ELEMENTS (Read-Only 16-bit wide)

Module table (0x0000)

The table described below represents the information that can be retrieved regarding a particular module. Maximum amount of module is set to 32. Each of them is identified by an address ranging from 1 to 32.

BASE ADDRESS: 0(0x0000) + 31*(Module address – 1).

Index	Name	Description	Type
0H	eStatusACOut	AC output status number (see 16.3.1.1, page 84)	U8
0L	eStatusACIn	AC input status number (see 16.3.1.2, page 84)	U8
1H	eStatusDCIn	DC Input status number (see 16.3.1.3, page 84)	U8
1L	bAddress	Configured address	U8
2H	bLoadPosition	Position of the load regarding input power sources (0:AC, 100:DC, 50:mixed, 101:unknown)	U8
2L	bLoadRatioW	Loading ratio regarding power in watts (%)	U8
3H	bLoadRatioVA	Loading ratio regarding power in VA (%)	U8
3L	bPhaseNumber	Number of the phase module is belonging to	U8
4	wVout	Output voltage value (0.1V)	U16
5	wIout	Output current value (0.1A)	U16
6	wPoutW	Output power value (W)	U16
7	wPoutVA	Output power value (VA)	U16
8	wVinAC	AC input voltage value (0.1V)	U16
9	wIinAC	AC input current value (0.1A)	U16
10	wPinACW	AC input power value (W)	U16
11	wPinACVA	AC input power value (VA)	U16
12	wACInFreq	AC input frequency value (0.1Hz)	U16
13	wVinDC	DC input voltage value (0.1V)	U16
14	wIinDC	DC input current value (0.1A)	U16
15	wPinDC	DC input power value (W)	U16
16	wTemperature	Temperature value (K)	U16
17	wSoftVersion	Software version number	U16
18	lSerialNumber	Serial number	U32
22H	bStatusMod	Event number of the status related to the output stage and the module internal status	U8
22L	bStatusAC	Event number of the status related to the AC input stage	U8
23H	bStatusDC	Event number of the status related to the DC input stage	U8
23L	bPresent	Flag (true or false) that indicates if module is seen by T2S ETH or not	U8
24H	bGroupAC	AC input group number module is belonging to	U8
24L	bGroupDC	DC input group number module is belonging to	U8
25H	bRestrained	Flag (true or false)that indicates if module cannot cope with more than five other module or not	U8

Index	Name	Description	Type
25L	bNoEPC	Flag (true or false) that indicates if module has an AC input (EPC) or not	U8
26	wPoutNominalW	Nominal output power (W)	U16
27	wPoutNominalVA	Nominal output power (VA)	U16
28	wVinNominalAC	Nominal AC input voltage (0.1V)	U16
29	wVinNominalDC	Nominal DC input voltage (0.1V)	U16
30	wVinNominalFreqAC	Nominal AC frequency (0.1Hz)	U16

Phase table (0x0640)

The following table described represents the information that can be retrieved regarding a particular phase. Maximum amount of phase is set to 8. Each of them is identified by a label ranging from 1 to 8.

BASE ADDRESS: 600(0x0640) + 27*(Phase label – 1).

Index	Name	Description	Type
0H	bRatioAvailableW	Ratio between output load and available power in watts (%)	U8
0L	bRatioAvailableVA	Ratio between output load and available power in VA (%)	U8
1H	bRatioInstalledW	Ratio between output load and installed power (Nb modules – redundancy) in watts (%)	U8
1L	bRatioInstalledVA	Ratio between output load and installed power (Nb modules – redundancy) in VA (%)	U8
2	wVout	Output voltage value (0.1V)	U16
3	wIout	Output current value (0.1A)	U16
4H	bNbOndCfg	Number of modules configured in the phase	U8
4L	bRedundancy	Amount of redundancy configured in the phase	U8
5	wACOutFreq	AC output frequency value (0.1Hz)	U16
6	lPinDC	DC input power value (W)	U32
8	lPinACW	AC input power value (W)	U32
10	lPinACVA	AC input power value (VA)	U32
12	lCurrentPowerInVA	Output power value (VA)	U32
14	lCurrentPowerInW	Output power value (W)	U32
16	lInstalledPowerInW	Installed power value (W)	U32
18	lInstalledPowerInVA	Installed power value (VA)	U32
20	lAvailablePowerInW	Available power value (W)	U32
22	lAvailablePowerInVA	Available power value (VA)	U32
24H	bNbInvSeen	Number of module seen by T2S ETH in that phase	U8
24L	bNbInvOK	Number of modules that are delivering output in the phase	U8
25H	bNbInvMO	Number of modules manually off in the phase	U8
25L	bNbInvKO	Number of modules that are not delivering output due to a failure in the phase	U8

Index	Name	Description	Type
26H	bNbInvNT	Number of modules not seen by T2S ETH in the phase (accordingly to bNbOndCfg)	U8

AC group table (0x0730)

The table described below represents the information that can be retrieved regarding a particular AC group. Maximum amount of AC group is set to 4. Each of them is identified by a label ranging from 1 to 4.

BASE ADDRESS: 1840(0x0730) + 10*(AC group label – 1).

Index	Name	Description	Type
0H	bNbInvOK	Number of modules that are delivering output in the group	U8
0L	bNbInvMO	Number of modules manually off in the group	U8
1H	bNbInvKO	Number of modules that are not delivering output due to a failure in the group	U8
1L	bNbInvSeen	Number of module seen by T2S ETH in that group	U8
2	lPinACW	AC input power value (W)	U32
4	lPinACVA	AC input power value (VA)	U32
6	wVinAC	AC input voltage value (0.1V)	U16
7	wIinAC	AC input current value (0.1A)	U16
8	wACInFreq	AC input frequency value (0.1Hz)	U16
9H	bACInOk	Number of modules stating that their AC input stage is fully functional	U8

DC group table (0x076C)

The table described below represents the information that can be retrieved regarding a particular DC group. Maximum amount of DC group is set to 8. Each of them is identified by a label ranging from 1 to 8.

BASE ADDRESS: 1900(0x076C) + 7*(DC group label – 1).

Index	Name	Description	Type
0H	bNbInvOK	Number of modules that are delivering output in the group	U8
0L	bNbInvMO	Number of modules manually off in the group	U8
1H	bNbInvKO	Number of modules that are not delivering output due to a failure in the group	U8
1L	bNbInvSeen	Number of module seen by T2S ETH in that group	U8
2	lPinDC	DC input power value (W)	U32
4	wVinDC	DC input voltage value (0.1V)	U16
5	wIinDC	DC input current value (0.1A)	U16
6H	bDCInOk	Number of modules stating that their DC input stage is fully functional	U8

Miscellaneous information table (0x07BC)

The table described below represents the miscellaneous information that can be retrieved regarding T2S ETH and system.

BASE ADDRESS: 1980(0x07BC)

Index	Name	Description	Type
0H	bOldVersionNumber	Deprecated. Always 0x00	U8
0L	ePhaseNumber	Number of phase configured in the system	U8
1	lSerialNumber	T2S ETH serial number	U32
3	wTempoMajorAl	Temporization of major alarm relay	U16
4	wTempoMinorAl	Temporization of minor alarm relay	U16
5H	bNbMajor	Number of major alarm in the system	U8
5L	bNbMinor	Number of minor alarm in the system	U8
6H	bNbTotalAlarmNumber	Total number of alarm in the system	U8
6L	bACInputPresent	Flag (true or false) that indicates if AC input should be considered as present or not	U8
7H	bSaturationThresh	Value of the ratio over which the saturation alarm will be raised (%)	U8
7L	bNbGroupsDC	Number of DC groups configured in the system	U8
8H	bNbGroupsAC	Number of AC groups configured in the system	U8
8L	bProgRelay	Always 0xFF	U8
9	wSoftMainRevision	Main revision software number of T2S ETH	U16
10	wSoftSubRevision	Sub revision software number of T2S ETH	U16
11H	bSystemLoadPosition	Position of the load at the system level (0:AC, 100:DC, 50:mixed, 101:unknown)	U8
11L	bT2S ETHMaxKnownParameters	Version number of TSI modules configuration parameters	U8
13H	bNbrModConf	Total number of module configured on the installation	U8
13L	bNbrModSeen	Total number of module configured on the installation	U8

Date and time table (0x07D0)

The table described below represents the information that can be retrieved regarding date and time.

BASE ADDRESS: 2000(0x07D0)

Index	Name	Description	Type
0	lTime	Time in epoch	U32
2H	bSeconds	Seconds number	U8
2L	bMinutes	Minutes number	U8
3H	bHours	Hours number	U8
3L	bDay	Day of the month	U8
4H	bMonth	Month number	U8

Index	Name	Description	Type
4L	bDaylightSaving	Flag (true or false) that specify if daylight saving is enable or not	U8
5	wYear	Year number	U16

Alarm table (0x07DA)

The table described below represents the information that can be retrieved regarding alarms. Maximum amount of entries is set to 50. A valid entry represents an alarm present in the system. An invalid entry is an entry where all bits of each field are set. All entries following an invalid entry will be invalid.

BASE ADDRESS: 2010(0x07DA) + 2*(Entry number – 1)

Index	Name	Description	Type
0H	bDeviceNumber	Identifier that specifies which device is responsible of this alarm (see 16.3.1, page 84)	U8
0L	bEventType	Type of the alarm (Major or minor) (see 16.3.1, page 84)	U8
1	wEventNumber	Alarm number identifier	U16

Rem: See alarm types in the annexes for *bEventType* description.

Configuration table (0x1040)

The table described below represents the information that can be retrieved regarding parameters that can be configured in the T2S ETH controller. Maximum amount of entries is set to 500. Not all entries are valid. An invalid entry is an entry where all bits of each field are set. Invalid entries might be interleaved with valid entries.

BASE ADDRESS: 4160(0x1040) + 20*(Entry number – 1)

Index	Name	Description	Type
0	swParameter	Configured value of the parameter	S16
1	wValidity	Value indicating if last configured parameter value is valid (see 16.3.4, page 85)	U16
2	wIdentifier	Unique value identifying the parameter	U16
3	wUnit	Value indicating in which units the parameter is expressed (see 16.3.4, page 85)	U16
4	strParamDescription	Textual description of the parameter	32*U8

Event string table (0x4114)

The table described below represents the information that can be retrieved regarding event textual description. Maximum amount of entries is set to 300. Each event is identified by an unique number (Event 0 exists!).

BASE ADDRESS: 16660(0x4114) + 8*Event number

Index	Name	Description	Type
0	strEventTxt	Textual description of event	16*U8

16.3   Status and Constants Description

16.3.1 Module status explanation (A1):

16.3.1.1 eStatusACOut:

Name	Description	Value
SBR	Standby running. This means that the module is delivering output	0
SB	Standby. This mean that the module is manually OFF	1
SBWE	Standby with error. This means that the module is not delivering output due to an unrecoverable error	2
SBWRE	Standby with recoverable error. This means that the module is not delivering output due to a recoverable error.	3
UNKNOWN	Unknown. This means status is unknown	4

16.3.1.2 eStatusACIn:

Name	Description	Value
OK	OK. This means the AC input is OK for the module	0
SAFE	Safe. This means the AC input is not considered as "good" but some power can still be drawn from it.	1
NOT_SYNC	Not synchronized. This means that the AC input and output are not synchronized together thus invalidating AC input.	2
OFF	Off. This means that the AC input stage of the module has been turned off due to an invalid AC input (maybe not safe).	3
UNKNOWN	Unknown. This means the status is unknown	4

16.3.1.3 eStatusDCIn:

Name	Description	Value
OK	OK. This means the AC input is OK for the module	0
FAIL	Fail. This means the DC input voltage is out of valid range.	1
UNKNOWN	Unknown. This means the status is unknown	2

16.3.2 Alarm types:

Name	Description	Value
NO_ALARM	Defines an event that is not considered as an alarm	0
MINOR	Defines an event that is to be considered as a minor alarm	1
MAJOR	Defines an event that is to be considered as a major alarm	2

16.3.3 Alarm sources:

Name	Description	Value
T2S ETH	Device responsible of the alarm is the T2S ETH controller.	0
MOD XX	Device responsible of the alarm is the module number XX where XX is the value	1-32
SYSTEM	Source of the alarm is the whole system (e.g. if all module are sharing the same alarm).	33

16.3.4 Validity and Unit description (A2):

wValidity should be interpreted as follow:

Name	Description	Value
PARAM_OK	Parameter value is valid	0
PARAM_TOO_LOW	Parameter value is too low	1
HYST_TOO_LOW	Parameter value is in an acceptable range but is too close from another related parameter value	2
PARAM_TOO_HIGH	Parameter value is too high	3
TSI_MUST_BE_OFF	Parameter value can only be changed if TSI modules are not delivering output	4
BAD_VALUE	Parameter value is not acceptable	5
INV_MISMATCH	Parameter cannot be configured for that type of module	6

wUnit is divided in two part:

- ▪ High byte is exponent value for parameter conversion (e.g. 2 means to be divided by $10^2 = 100$).

- ▪ Low byte represents the unit in which the parameter is expressed. This unit can be one of the one represented in the array below.

Name	Description	Value
NO_UNIT	No unit. Represented by a blank character	0
VOLT	Volt. Represented by the "V" character	1
AMPERE	Ampere. Represented by the "A" character	2
HERTZ	Hertz. Represented by the "Hz" characters	3
SECOND	Second. Represented by the "s" character	4
ANGLE	Angle. Represented by the "deg" or "°" characters	5
WATT	Watt. Represented by the "W" character	6
VA	VA. Represented by the "VA" character	7
PERCENT	Percent. Represented by the "%" character	8
DEGREE	Degree. Represented by the "deg" or "°" characters	9
OHM	Ohm. Represented by the "Ohm" character	10
Example: if wUnit value is 0x0201 the parameter is expressed in centiVolts.		

16.4   Examples

16.4.1 Introduction

In all the following examples, assumption will be made that T2S ETH controller Modbus RTU slave address is 1 (0x01).

16.4.1.1 Reading simple variables:

Ex 1: Reading output voltage of module #5

Field	Value	Description
Function	4 (0x04)	Read input register
Address	128 (0x0080)	31*(5-1) + 4 = 128 (see module table, page 79)
Number of registers	1 (0x01)	Vout value is 16-bit wide

    Master frame: 0x01 0x04 0x00 0x80 0x00 0x01 0x71 0xE3
    T2S ETH frame: 0x01 0x04 0x02 0x09 0x1B 0xFF 0x6B

Received value: 0x091B = 2331 ➔ Output voltage is 233.1V (see module table, page 79)

Ex 2: Reading T2S ETH serial number

Field	Value	Description
Function	4 (0x04)	Read input register
Address	128 (0x0080)	31*(5-1) + 4 = 128 (see module table, page 79)
Number of registers	1 (0x01)	Vout value is 16-bit wide

    Master frame: 0x01 0x04 0x07 0xC5 0x00 0x02 0x60 0x82
    T2S ETH frame: 0x01 0x04 0x04 0x00 0x01 0x00 0x07 0xEB 0x86

Received value: 0x0001 and 0x0007 ➔ T2S ETH revision is Vs1.7

16.4.1.2 Reading alarm and history log:

Reading entry #1

Field	Value	Description
Function	4 (0x04)	Read input register
Address	2010 (0x07D4)	2010 + 2*(1-1) = 2010 (see alarm table, page 83)
Number of registers	2 (0x02)	Alarm entry is 2 registers wide

    Master frame: 0x01 0x04 0x07 0xDA 0x00 0x02 0x51 0x44
    T2S ETH frame: 0x01 0x04 0x04 0x21 0x01 0x00 0xB3 0xE1 0xCD

Alarm entry #1 is a minor (0x01) alarm generated by the system (0x21) and this alarm has the ID 179 (0x00B3)

Reading an invalid entry

Let's assume that there are only 2 alarms present in the system. Then reading alarm entry #3 should return an invalid entry

Field	Value	Description
Function	4 (0x04)	Read input register
Address	2014 (0x07DE)	2010 + 2*(3-1) = 2014 (see alarm table, page 83)
Number of registers	2 (0x02)	Alarm entry is 2 registers wide

Master frame: 0x01 0x04 0x07 0xDE 0x00 0x02 0x10 0x85

T2S ETH frame: 0x01 0x04 0x04 0xFF 0xFF 0xFF 0xFF 0xFA 0x10

Conclusion, there is no alarm entry #3 and nor are there further entries. This leads to the conclusion that only 2 alarms are present at the time in the system.

Linking alarm ID to alarm description text:

If we consider the alarm ID #179 of example above, we can get description text for this alarm by reading related entry in the "Event string table".

Field	Value	Description
Function	4 (0x04)	Read input register
Address	18092 (0x46AC)	16660 + 8*179 = 18092
Number of registers	8 (0x08)	Event description string is 16 characters long

Master frame: 0x01 0x04 0x46 0xAC 0x00 0x08 0x24 0xA5

T2S ETH frame: 0x01 0x04 0x10 0x56 0x61 0x63 0x5F 0x69 0x6E 0x20

0x54 0x4F 0x4F 0x20 0x4C 0x4F 0x57 0x20 0x20 0x36 0x7C

String description: Vac_in TOO LOW

16.4.1.3 Reading configuration:

Reading entry #1

Field	Value	Description
Function	4 (0x04)	Read input register
Address	4160 (0x1040)	4160 + 20*(1-1) = 4160
Number of registers	20 (0x14)	Alarm entry is 20 registers wide

Master frame: 0x01 0x04 0x10 0x40 0x00 0x14 0xF5 0x11

T2S ETH frame: 0x01 0x04 0x28 0x01 0xB8 0x00 0x00 0x01 0x04 0x01

0x01 0x44 0x43 0x20 0x31 0x20 0x3A 0x20 0x56 0x64

0x63 0x5F 0x69 0x6E 0x20 0x4C 0x6F 0x77 0x20 0x53

0x74 0x61 0x72 0x74 0x20 0x20 0x20 0x20 0x20 0x20

0x20 0x20 0x20 0x64 0x36

Configured Value:	0x01B8 ➔ 440
Validity:	0x0000 ➔ PARAM_OK (see 16.3.4, page 85)
Parameter ID:	0x0104 ➔ 260
Units:	0x0101 ➔ unit is dV (0.1V) (see 16.3.4, page 85)
String description:	DC 1 : Vdc_in Low Start

Reading an invalid entry

Let's assume that entry #189 is invalid

Field	Value	Description
Function	4 (0x04)	Read input register
Address	7920 (0x1EF0)	4160 + 20*(189-1) = 7920
Number of registers	20 (0x14)	Alarm entry is 20 registers wide

Master frame: 0x01 0x04 0x1E 0xF0 0x00 0x14 0xF6 0x1E

T2S ETH frame: 0x01 0x04 0x28 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF

0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF

0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF

0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF

0xFF 0xFF 0xFF 0xF0 0x04

Due to internal memory organization, the configuration might have valid entries interleaved with invalid ones. Thus, in order to read all configurations, one should read all entries to determine which ones are valid and which ones are not.

Exceptions: Textual parameter

As one can see, the configured value field is 16 bit wide. Consequently, only integer values can be read (or further configured) using this way. There are 3 parameters that are not integer values but strings. Thus, the values returned in the "Configured value" field of the configuration table for those 3 IDs are dummy values that have no meaning.

Those IDs are the following

ID	Description	Remark
901	Digital input 1 label	Can be read in the digital inputs table in the holding registers (0x0686)
902	Digital input 2 label	Can be read in the digital inputs table in the holding registers (0x0686)

Note 1:

Caution should be taken while changing module address because it will affect the addresses where to retrieve information regarding this module. What is more there can be a delay between the moment where the change address order is received and the moment where the module address has been physically changed. Moreover, a module address can be changed to a new address that is already assigned to another module! In this case, the modules will swap their addresses.

For all those reasons, the best and secure way to change a module address is the following one:

1. Get module serial number using "Module information table" using the current address to calculate the index.

2. Send to the new address for this module using the "Module action table" using the current address to calculate the index.

3. Poll the serial number using "Module information table" using the new address as index until there is a match with the serial number collected at point 1.

16.5 Modbus Testing

In order to test the Modbus communication functionalities, please install the program "**Radzio ! Master Modbus Simulator**" on your computer.

- **Website**: http://en.radzio.dxp.pl/modbus-master-simulator/

- **Direct download**: http://en.radzio.dxp.pl/modbus-master-simulator/RMMS.zip

16.5.1 Requirement:

- USB to RS485 interface cable (For example USB-RS485-WE cable, FTDI chip), Fig 1
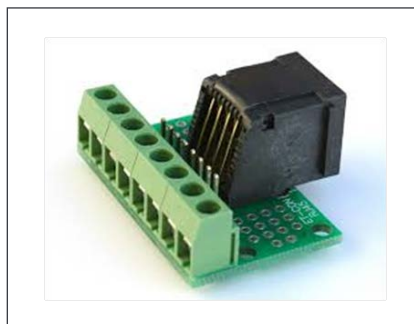

Fig 1: FTDI cable

- RJ45-TERM (Gravitech.us) Fig 2

Fig 2: Adapter for RJ45

16.5.2 Modbus Testing procedure

Perform the following steps to test the Modbus

1. Connect FTDI cable on the **RJ45 port** at the back plane of the T2S-ETH with

   ○ Yellow on pin 8.

   ○ Orange on pin 6.

   ○ Black on pin 7.

2. Use RJ45-TERM to help you.

3. Read the COM port number in your computer settings (In the device manager), Fig 3.
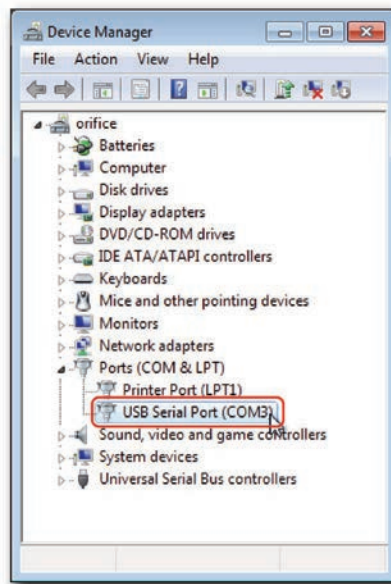
Fig 3: COM port number

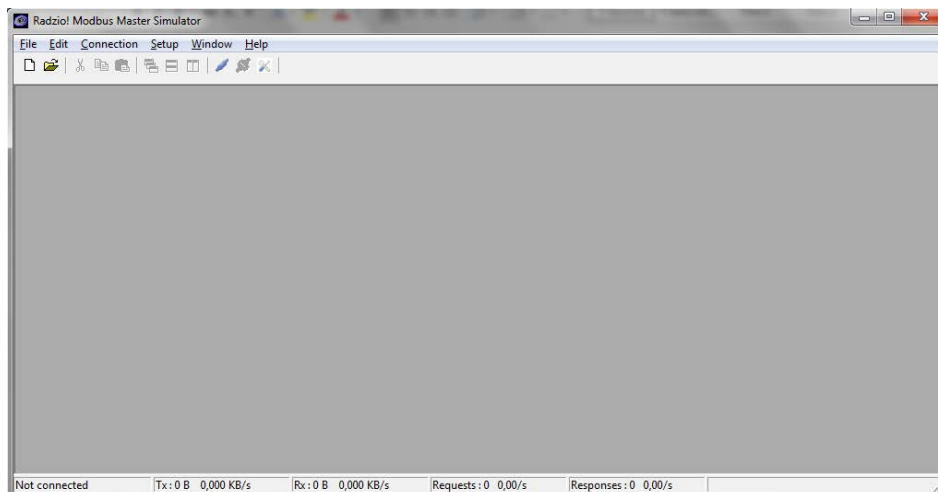4. Open the downloaded **Radzio!**, Fig 4

Fig 4: Radzio! Home Screen

5. Click on the **Connection settings** icon in the tool bar.
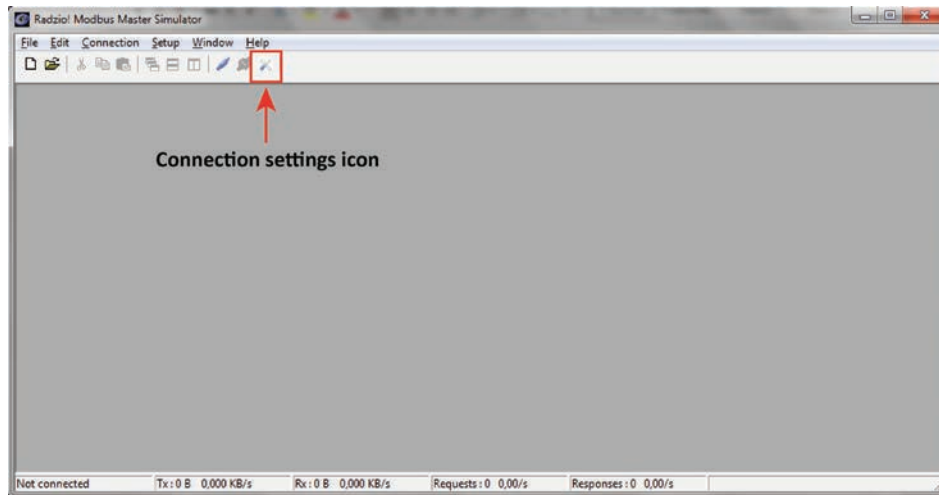
Fig 5: Connection settings icon

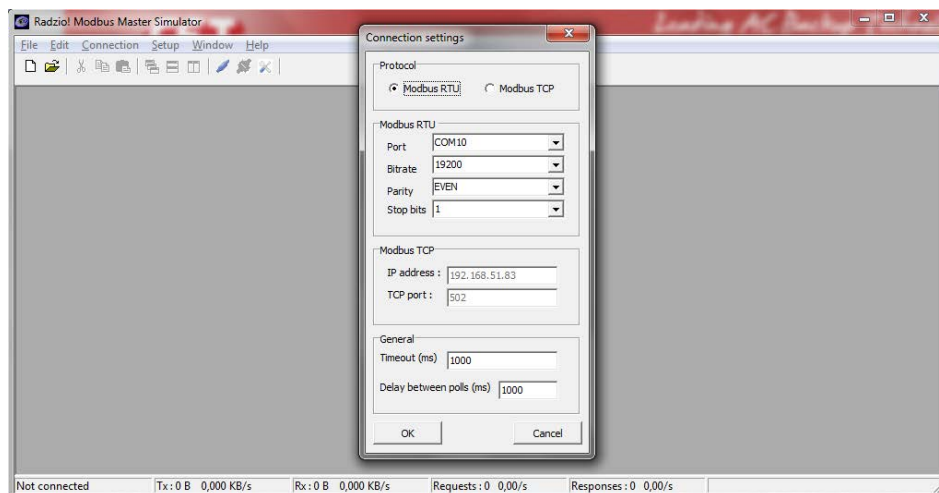6. Select **Modbus RTU** in the Connections settings window

Fig 6: Connection settings window

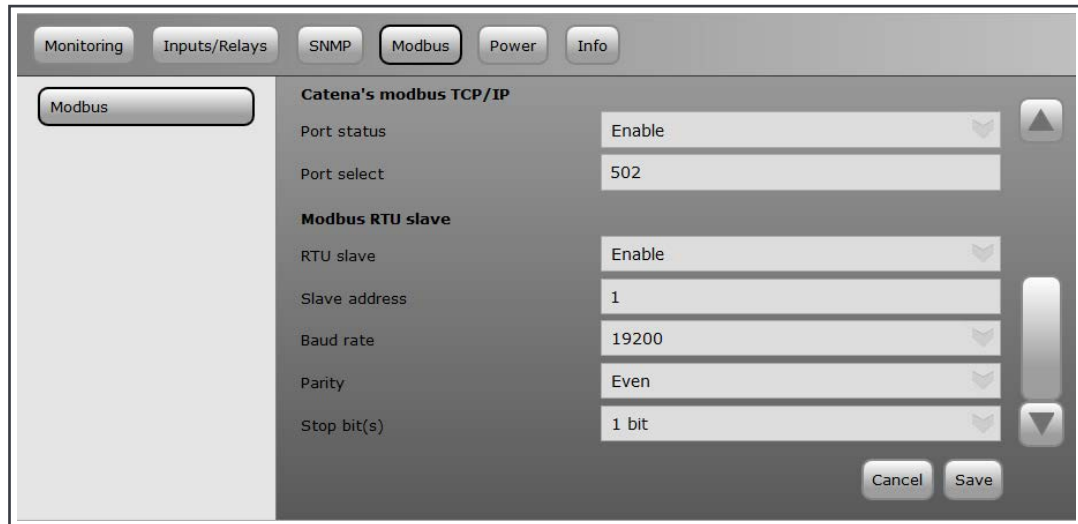7. Verify the **Modbus RTU** parameters are matching with the **T2S-ETH** in the Modbus section (Fig 7).

Fig 7: Modbus settings in T2S ETH

8. Close the **Connection settings window** in Radzio!.

9. Click on the **Connect** icon in the Radzio tool bar in order to establish the connections. (Fig 8)
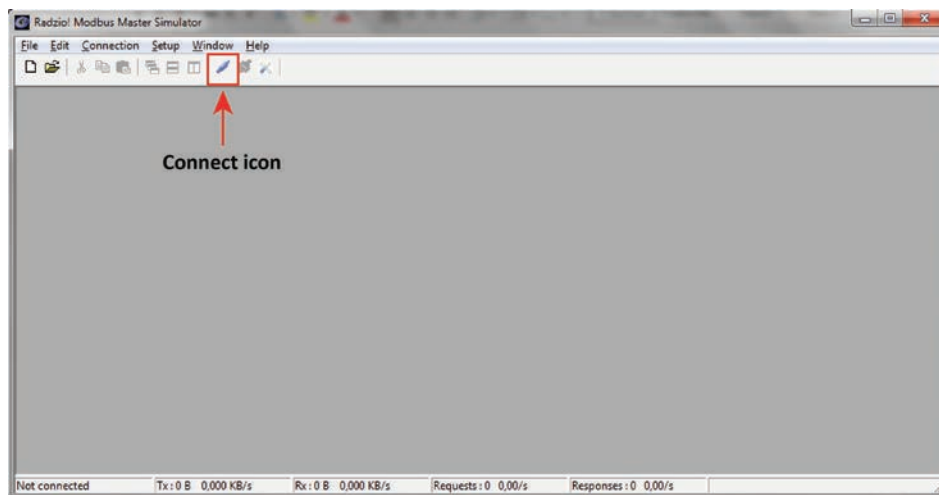

Fig 8: Connect icon

10. Click **New Modbus sheet** icon, to open the new Modbus sheet. (Fig 9)
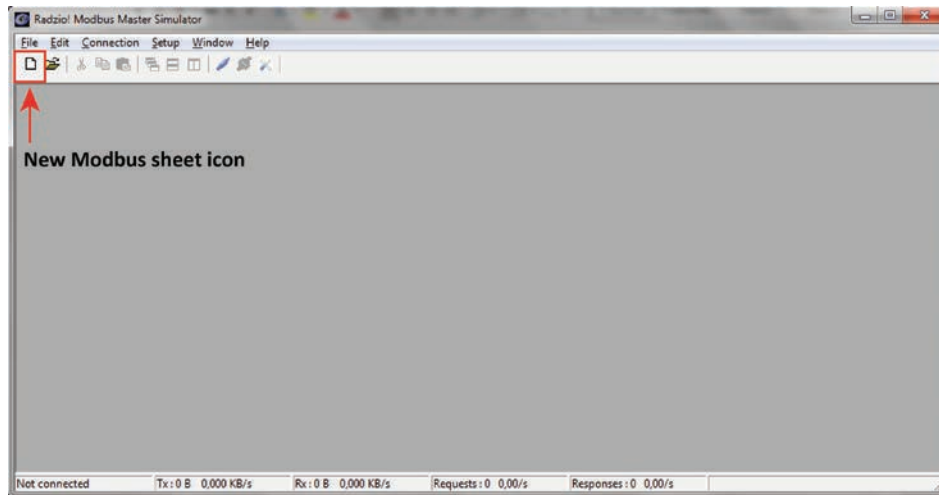

Fig 9: New Modbus sheet icon

11. Modify the **Device Settings** in the new modbus sheet. (Fig 10)

      ○   Set the **Device ID** (Default value is 1)

      ○   Set the **entity** of Device ID as **Input Register** (Default value is Coil status)
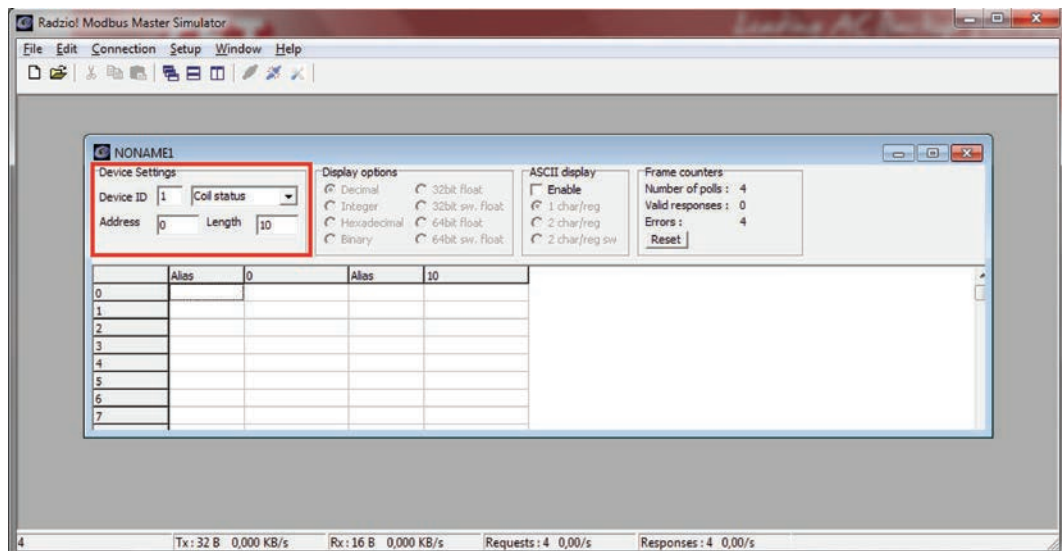

Fig 10: Default Radzio settings to Modify

12. Access the desired addresses at the Modbus sheet in Radzio (Fig 11) as described in the Modbus document (Fig 12).

    If you only see zeros or bad values, check the Frame counter (Fig 11) to be sure that you receive "Valid responses".
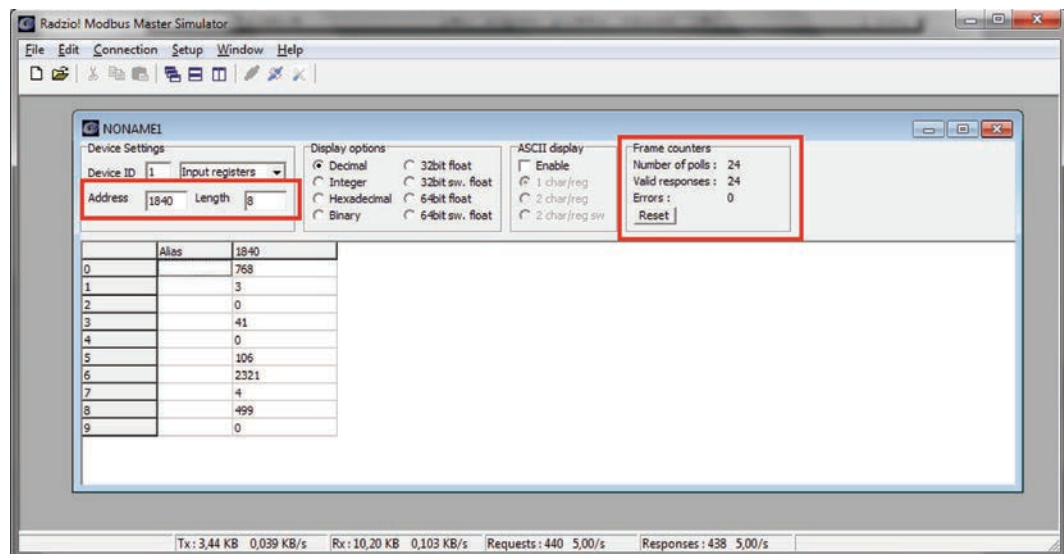   If not, the settings may be wrong.

Fig 11: Modbus Example

4	1PinACVA	AC input power value (VA)	U32
6	wVinAC	AC input voltage value (0.1V)	U16
7	wIinAC	AC input current value (0.1A)	U16
8	wACInFreq	AC input frequency value (0.1Hz)	U16

Fig 12: MODBUS_protocol_for_T2S_Vs4.pdf

For example, you can read from base address 1840 (AC input L1)

AC input power value (U32 so address 4 will be MSB and address 5 LSB) = 106 [VA]

- Input voltage (U16)   at address 6   = 2321 [0.1 V]   = 232.1 [V]
- Input current (U16)   at address 7   = 4 [0.1 A]   = 0.4 [A]
- Input frequency (U16) at address 8   = 499 [0.1 HZ]   = 49.9 [Hz]