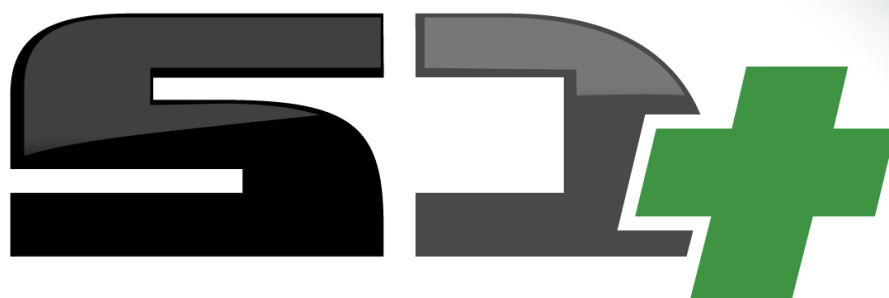


USER MANUAL



Treetech



FUNCTIONALITY GATEWAY SMART DEVICE



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1 Foreword

1.1 Legal Notice

The information contained herein is subject to change without prior notice.

Treetech Sistemas Digitais Ltda. may hold patents and other types of registrations and intellectual property rights described in the contents of this document.

The possession of this document by any individual or legal entity does not grant them any rights on these patents or registrations.

1.2 Introduction

This manual describes all recommendations and instructions for the installation, operation and maintenance of the SD Functionality Gateway.

1.3 Typographical Conventions

The following typographical conventions are used throughout this document:

Bold: Symbols, terms and words in bold have higher contextual relevance. Therefore, pay attention to these terms.

Italic: Foreign words, alternative terms or those used outside the formal situation are italicized.

1.4 General and Safety Information

This section outlines relevant aspects regarding SD safety, installation and maintenance.



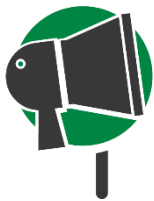
Safety Symbols

This manual uses three types of risk classification, as follows:



Caution

The **Caution** symbol is used to warn the user regarding potentially hazardous operating or maintenance procedure requiring higher precaution when performed. Minor or moderate injuries may result, as well as equipment damage.



Warning

The **Warning** symbol is used to warn the user regarding potentially hazardous operating or maintenance procedure requiring extreme care. Severe injuries or death may result. Possible equipment damages will be beyond repair.



Risk of Electrical Shock

The **Risk of Electrical Shock** symbol is used to warn the user regarding an operating or maintenance procedure that may result in electrical shock if not strictly followed. Minor, moderate, severe injuries or death may result.

General Symbols

This manual uses the following general symbols:



Important

The Important symbol is used to highlight relevant information.



Tip

The **tip** symbol represents instructions that render the use or access to SD functions easier.



Minimum recommend profile for SD operator and maintenance personnel.

Equipment installation, maintenance and operation in electricity substations require special precautions; therefore, all recommendations in this manual, applicable standards, safety procedures, safe work practices and reasonable judgment should be used during all handling stages of the SD Functionality Gateway.

For the purposes of this manual, an authorized and qualified individual is one who is aware of the risks involved - both electrical and environmental - in handling the SD.



Only authorized and qualified individuals - operators and maintenance personnel - should handle this equipment.

- a) Operator or maintenance personnel should be trained and authorized to operate, ground, switch on and off the SD, following the maintenance procedures according to the safety practices described in this document, such practices being the sole responsibility of SD operator and maintenance personnel;
- b) Training in the use of PPEs, CPEs and first aid;
- c) Training in SD working principles, as well as setting.
- d) Follow standard recommendations concerning interventions in any type of equipment which is part of a Power Electrical System.
- e) Have basic knowledge in TCP/IP networks and in the access to SD Functionality Gateway Web page via its IP on a web browser.

Environmental and voltage conditions required for installation and operation

The following table lists relevant information on environmental and voltage requirements:

Table 1 - Installation conditions

Condition	Interval / Description
Application	Equipment for indoor use in substations, industrial environments and similar.
Indoor / Outdoor Use	Indoor Use
Protection Class (IEC 60529)	Front panel IP 50, rear panel IP20
Altitude* (IEC EN 61010-1)	Up to 2000m
Temperature (IEC EN 61010-1)	
Operation	-40 °C to +85 °C
Storage	-40 °C to +85 °C
Relative Humidity (IEC EN 61010-1)	
Operation	5% to 95% – Non-Condensing
Storage	3% to 98% – Non-Condensing
Source Voltage Fluctuation (IEC EN 61010-1)	Up to $\pm 10\%$ Rated voltage
Overvoltage (IEC EN 61010-1)	Category II
Pollution Degree (IEC EN 61010-1)	Degree 2
Atmospheric Pressure** (IEC EN 61010-1)	80 kPa to 110 kPa

* Altitudes greater than 2000m already have successful applications.

** Pressures less than 80 kPa already have successful applications.

Test and installation instructions

This manual should be available to individuals responsible for installation, maintenance and users of the SD Functionality Gateway.

To ensure user safety, equipment protection and proper operation, the following minimum precautions should be taken during SD Functionality Gateway installation and maintenance:

Read this manual carefully before SD Functionality Gateway installation, operation and maintenance. Errors in SD Functionality Gateway installation, maintenance and settings may cause communication failures, alarm contact inconsistencies, command errors, as well as the tripping of an Asset.

SD Functionality Gateway installation, setting and operation should be performed by qualified personnel familiarized with IEDs and control devices and command circuits of substation equipment.



Special attention should be paid to SD (Electrical Installation) installation, including the type and gauge of cables and terminal blocks, as well as to start-up procedures (Commissioning), including proper equipment parameterization.



The SD should be installed indoors (a doorless board in a control room, or an enclosed panel in case of outdoor installation) in an environment where the temperature and humidity specified for the equipment is not exceed.



The SD should not be installed close to heat sources such as heating resistors, incandescent lamps, high-power devices or devices equipped with heatsink. Installing the equipment close to vents or in locations where it may be subject to forced air flow, such as cooling fan inlet and outlet or forced ventilation ducts is not recommended as well.

Cleaning and decontamination instructions

Use caution when cleaning the SD. Use ONLY a moist cloth with soap or detergent diluted in water to clean the cabinet, front part or any other equipment part. Do not use abrasive materials, polishing compounds, or aggressive chemicals (such as isopropyl alcohol or acetone) in any surface.



Switch off and disconnect the equipment before cleaning any of its parts.

Inspection and maintenance instructions

The procedures below should be followed for SD inspection and maintenance:



Do not open the equipment. It does not contain user-serviceable parts. This should be made by Treotech service personnel or authorized technicians.

This equipment is fully maintenance-free; user may perform visual and operational inspections, whether periodic or not. These inspections are not mandatory.



Opening the SD at any time will void the product warranty. In case the equipment is unduly opened, Treotech cannot guarantee its proper operation, whether the warranty term has expired or not.



All equipment parts must be provided by Treotech or by suppliers authorized by Treotech, according to its specifications. In case user wants to acquired parts by other means, Treotech specifications should be strictly followed. Therefore, user and equipment performance and safety are ensured. User and equipment may be exposed to unexpected risks in case these recommendations are not followed.

1.5 Service Department

To obtain service for the SD or any other Treotech product, contact us via the address below:

Treotech Sistemas Digitais Ltda. - Service Department

R. José Bonifácio, 661, Jd. Brazil

Atibaia – São Paulo – Brazil

ZIP Code: 12.940-210

Corporate Taxpayer ID (CNPJ): 74.211.970/0002-53

State Taxpayer ID (IE): 190.159.742.110

PHONE: +55 (11) 2410 -1190 x201

FAX: +55 (11) 4413-5991

Email: suporte.tecnico@treotech.com.br

Website: <http://www.treotech.com.br>



1.6 Warranty Term

The SD Functionality Gateway (hereinafter referred to as SD) is guaranteed by Treotech for two (2) years as from the purchase date solely against eventual manufacturing defects or quality defects that render the equipment improper for use.

Warranty does not cover product damages caused by accidents, misuse, incorrect handling, improper installation and application, improper testing, or in case the warranty seal is broken.

In case service is required, contact Treotech or its authorized representative and return the equipment together with the purchase invoice.

No express or implied guarantees are made by Treotech other than those provided above. No representations are made by Treotech as to SD fitness to a particular application.

Seller will not be held responsible for property damages of any nature or damages and losses arising from, related to, or resulting from equipment acquisition, performance or any service possibly provided together with the SD.

In no case shall vendor be held responsible for losses incurred, including, without limitation: loss of profit or income, impossibility to use the SD or any related equipment, capital costs, purchased power costs, equipment costs, replacement installations or services, shutdown costs, customer or buyer employee complaints, regardless if such damages, complaints or losses are based on contract, warranty, negligence, offense or any other. In no case shall vendor be held responsible for any personal damage of any kind.



1.7 Revision Log

Table 2 - Revision Log

Revision	Date	Description	Made by
4.00	8/10/2017	First issue, based on Portuguese Ver. 4.00	João Victor Miranda
4.10	10/5/2017	Fax and submenu 8.1 – Overall Navigation updated	João Victor Miranda
4.11	08/01/2018	Item 8.10 – Online updated	João Victor Miranda
4.12	08/27/2018	Chapter 3 updated	João Victor Miranda



2 Introduction



1 - SD Functionality Gateway

Modern substations have several devices integrated to their system that use different communication protocols. To allow an efficient communication between these devices, having a flexible and effective Functionality Gateway is critical, which allows meeting the most stringent speed and ruggedness requirements to ensure a safe system operation.

Treotech SD Functionality Gateway meets this requirement by enabling an effective and safe communication to allow data transmission to supervisory systems, data acquisition or online monitoring using different communication protocols.

For such, Treotech SD Functionality Gateway has been specially designed to allow a seamless and complete integration to any product supporting Modbus, DNP3 and IEC 61850 protocols, and works as an extension of these products so as to expand their communication capabilities.

Therefore, the SD Functionality Gateway is more than simply a protocol converter, operating with enhanced effectiveness and reliability in comparison with commercial off-the-shelf products.

2.1 Operating principle

The SD Functionality Gateway was designed to work directly with data acquisition and distribution from/to monitoring IEDs. The device allows data acquisition from IEDs using Modbus (RTU and/or TCP) and DNP3 (RTU and/or TCP) protocols. As soon as the acquisition is made it is possible to retransmit these data using one or more Modbus (RTU and/or TCP), DNP3 (RTU and/or TCP) and IEC-61850 protocols.

This unique feature is achieved thanks to a data architecture created inside the SD Functionality Gateway called Abstract data. By means of this architecture, the acquisition of



data in a given protocol stores these data in an abstract variable, which is not linked to any specific protocol. Thus, these data may be manipulated in different manners: protocol conversion, bit combination, separation and even duplication.

The data distribution section in SD Functionality Gateway output protocols is fully flexible, and allows creating virtual IEDs. These may be comprised of data from one or more IEDs mapped on the input. In addition, customization of output protocol addressing is also allowed.

Setting the Abstract data to simulate values predefined by the user is also possible.

All settings are performed by means of a user-friendly, intuitive *Web* page. After all settings are configured, the user may monitor the status of active communication networks and download communication logs.



3 Features

RUGGED HARDWARE

The SD has been designed to operate in the electrical environment of substations and may be installed directly in the transformer panel.

EMBEDDED OPERATING SYSTEM

The SD gateway has an embedded operating system, customized by Treotech. This ensures greater stability and reliability of product firmware operation, as well as being future-proof.

VFD DISPLAY (VACUUM FLUORESCENT DISPLAY)

High brightness, legible under any lighting and temperature condition;

MANAGEMENT OF USERS AND ACCESS PROFILES

To ensure access and data security the SD gateway uses profiles with different operation, setting and administration access levels.

CUSTOMIZATION OF IED PROTOCOL MAPS

By means of a user-friendly interface the user may edit or create customized IED mapping, including merging IEDs and converting protocols.

REMOTE UPDATE

The *firmware* update process is extremely easy and intuitive via the *Web* interface.

CLOCK SYNCHRONIZATION

The SD gateway allows setting clock synchronization via NTP protocol.

COMMUNICATION LOG DOWNLOAD

The SD interface allows downloading communication logs so as to render network diagnosis easier.

EXPERTISE IN EMBEDDED SYSTEMS

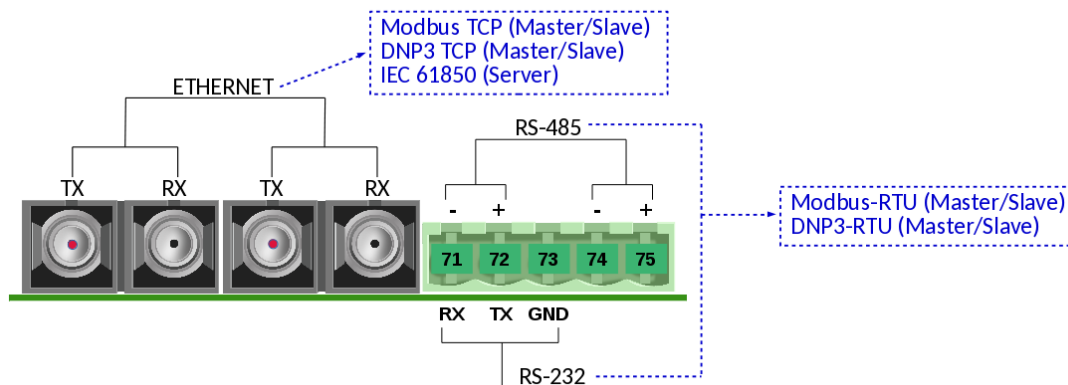
Treotech has experts in embedded operating systems with vast expertise in the field. This knowledge was added to the SD, making it an extremely safe and stable, but also easy-to-use product.

SMALL FOOTPRINT

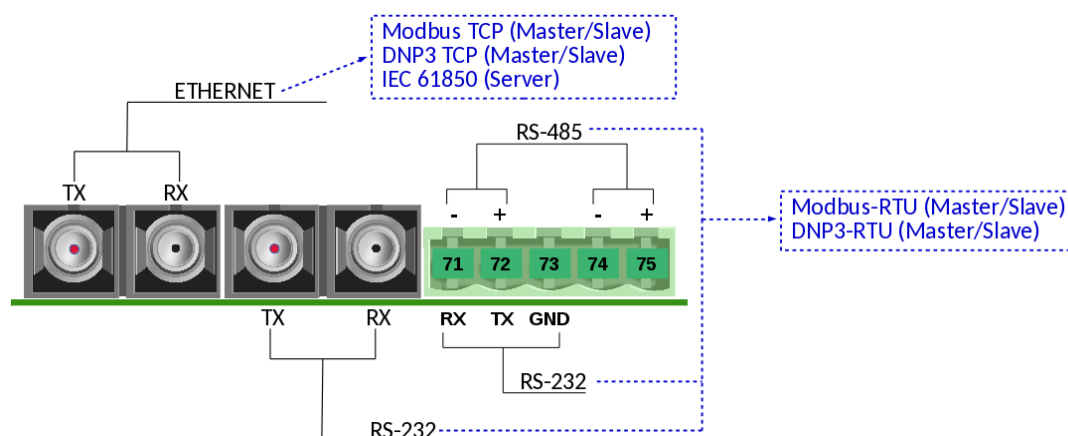
Despite its advanced functionalities, the SD has an extremely compact size, 96 x 96 x 125 mm.

4 System Topology

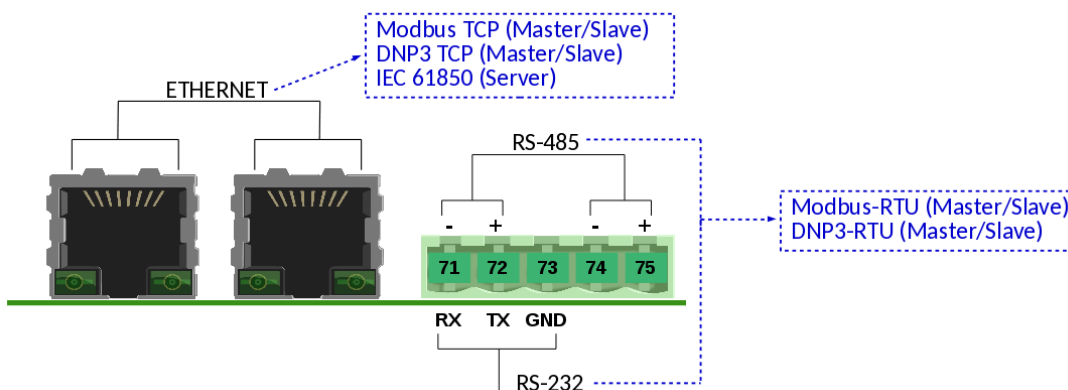
The monitoring features integrated by the SD allow using Treotech IEDs in a straightforward, effective, fast and easy manner, expanding the well-known reliability of these devices to a new communication standard.



2 - Topology of the ports available in the Fiber Optic Ethernet model



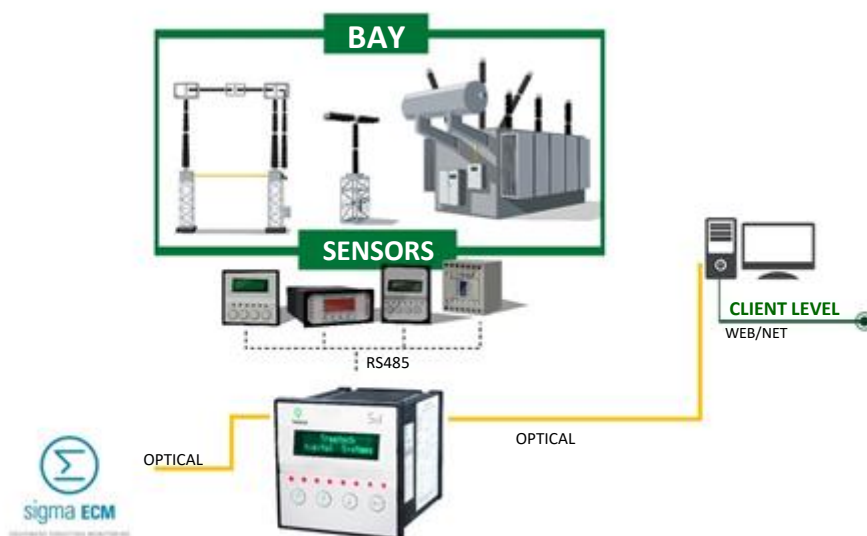
3 – Topology of the ports available in the Fiber Optic Ethernet + Serial model



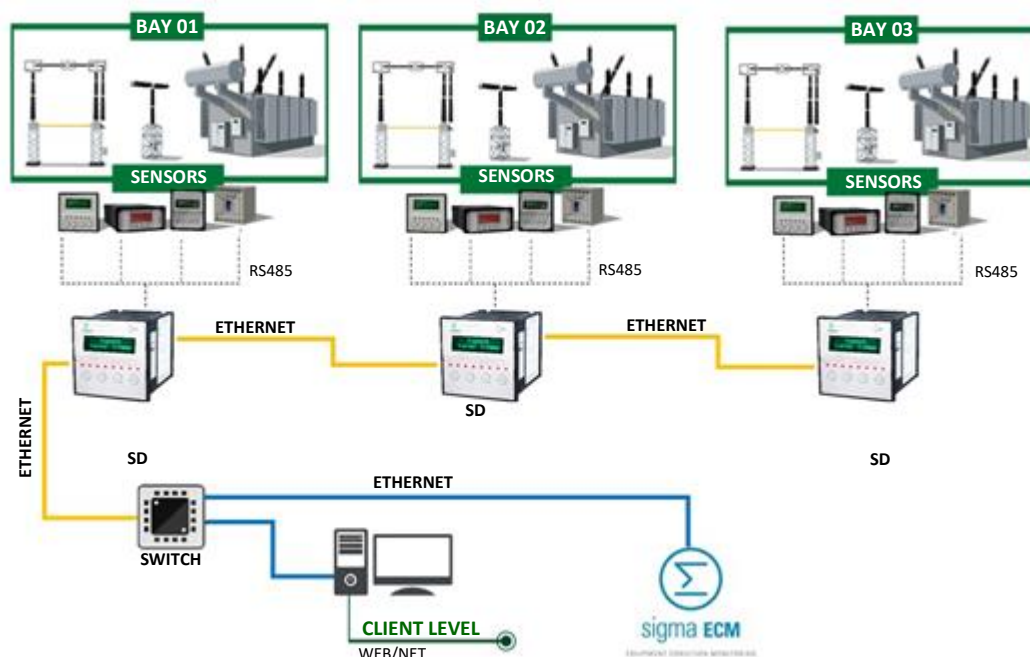
4 – Topology of the ports available in the RJ-45 model



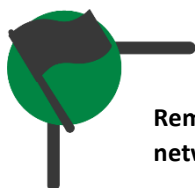
4.1 Typical Applications



5 – Typical application using the SD Gateway for transformer digitalization



6 - Typical application integrating several SD Gateways that distribute data to more than one network.

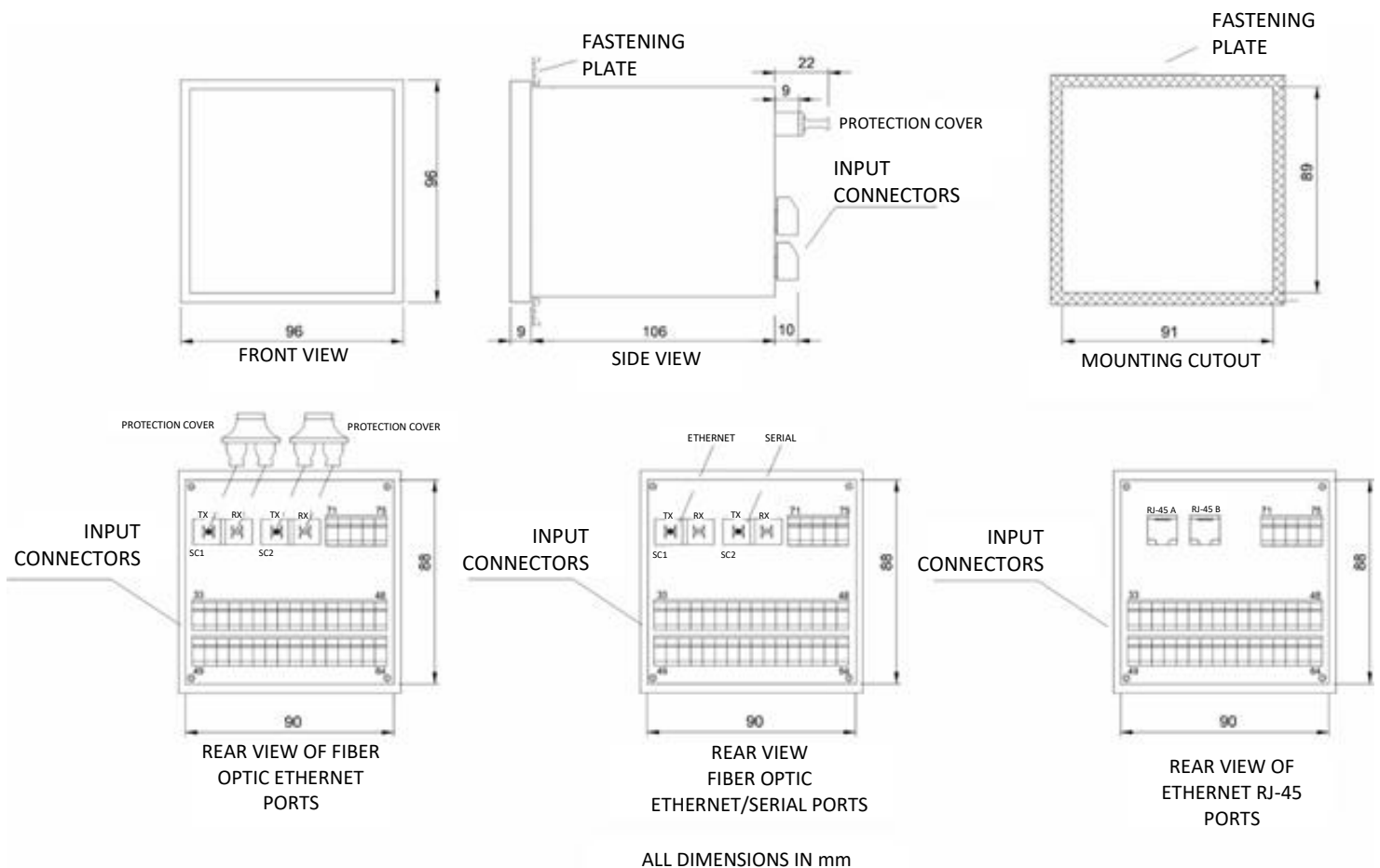


Remark: The maximum number of devices on the same physical serial network is 31 nodes.

5 Mechanical Installation

The SD Functionality Gateway must be installed in a weatherproof way, whether inside panels or sheltered in buildings. In any case, there should be an anti-condensing system. The Functionality Gateway is suitable for flush-mounted installation, and may be attached, for example, to panel doors or front plates. The fastening clips are supplied with the SD.

The following figure shows main equipment dimensions, as well as plate cutout dimensions to insert the equipment.



7 - Product dimensions

Special attention must be paid to the thickness of paint coats on the plate where the cutout is made, as in some cases, when using high-thickness painting, the reduction of the cutout area may even prevent the equipment insertion. The connection terminals are installed on SD rear panel, on two fixed connectors. Cables of 0.3 to 2.5mm² may be used, bare or with pin (or needle) type terminals.



6 Electrical Installation

Certain special precautions must be followed for the design and installation of the SD, as described below.



Please analyze and understand your intended application with the SD.
Get familiarized with SD functional, electrical, and configuration characteristics.
This will allow you to get the most of the equipment and to minimize risks to your safety.



This equipment works at dangerous level of power supply, and may cause death or serious injuries to the operator or maintenance staff.



A circuit breaker must be installed immediately before the power input (Universal supply - 85 ~ 265 Vac/38 ~ 275 Vdc, <5 W, 50/60 Hz), corresponding to SD pins 33 and 34. The number of poles in this circuit breaker should match the number of phases used in the supply – poles should break only the phases, never the neutral or earth – and provide thermal and electrical protection to the conductors supplying the equipment.

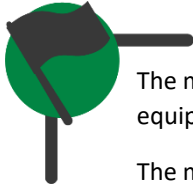
The circuit breaker must be close to the equipment and be easily switchable by the operator. In addition, such component should be clearly identified as the SD electrical disconnection device.



When used exclusively to the SD, the following specification is recommended for the circuit breaker:

AC/DC Supply, Phase-Neutral: Single-pole circuit breaker, $1\text{ A} \leq I_n \leq 2\text{ A}$, curve B or C, NBR/IEC 60947-2, NBR/IEC 60898 or IEEE 1015-2006 standards;

AC/DC Supply, Phase-Phase: Two-pole circuit breaker, $1\text{ A} \leq I_n \leq 2\text{ A}$, curve B or C, NBR/IEC 60947-2, NBR/IEC 60898 or IEEE 1015-2006 standards;



The minimum insulation for the circuits connected to the SD is 300 Vrms for ancillary equipment and transducers provided with own power supply of up to 50 Vrms.

The minimum insulation is 1.7 kVrms for equipment supplied with up to 300 Vrms, according to IEC EN 61010-1.

These values are related to the intrinsic insulation of the devices connected to the SD. Cases in which such value is not applicable to equipment or devices connected to the SD will be stated in this manual.

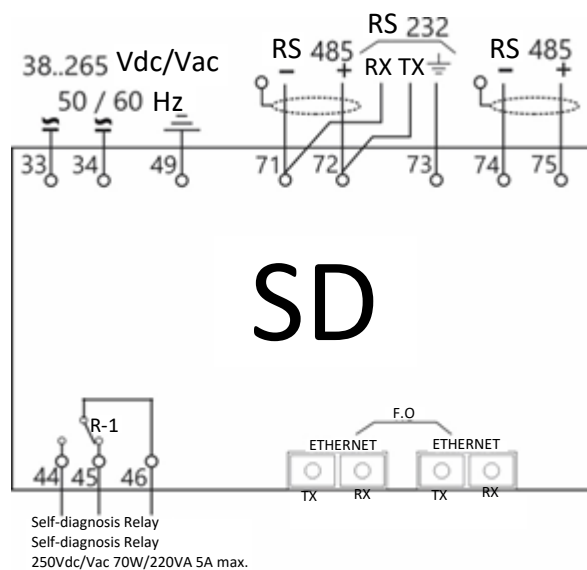


Pay special attention to the proper connection of the SD during all stages of the installation. Mistakes when connecting the equipment may impose risks to the operator and irreversible damages to the equipment. Damages due to misuse will not be covered by the warranty.

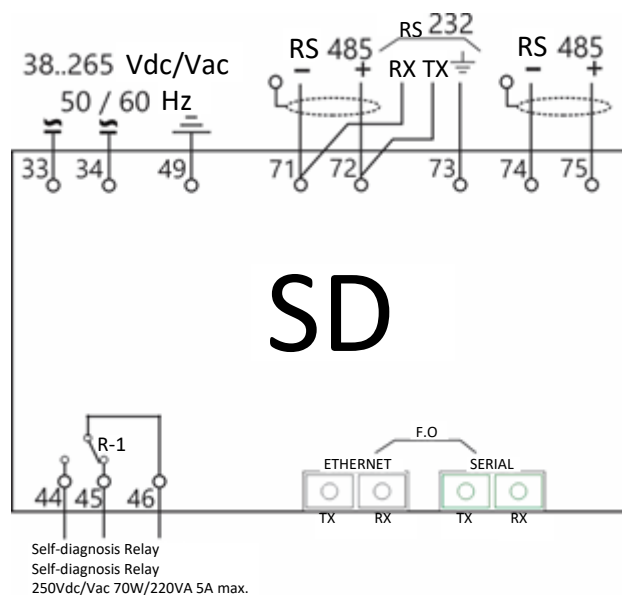
6.1 Wiring Diagrams

The SD Functionality Gateway has three types of hardware described below and shown in figures 6, 7 and 8:

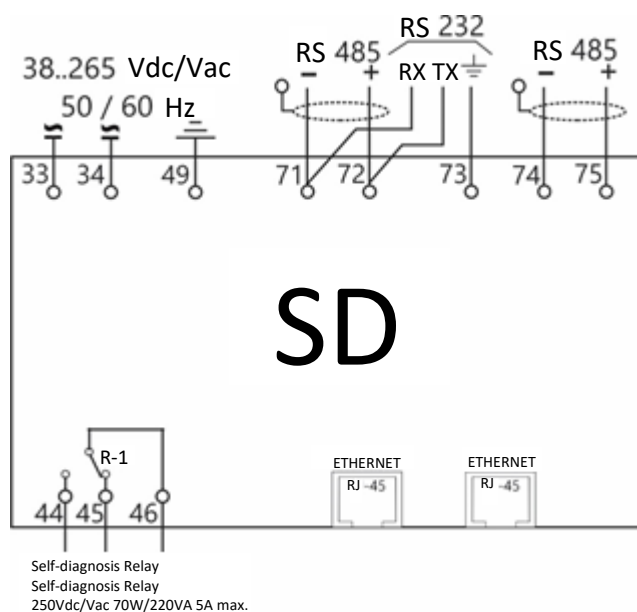
- 2x Ethernet MM 1310 nm optical connectors with SC connector;
- 1x Multimode 850 nm serial optical connector with SC connector + 1x Ethernet Multimode 1310 nm optical connector with SC connector;
- 2x Ethernet RJ45 connectors.



8 - 2x Ethernet MM 1310 nm optical connectors with SC connector



9 - 1x Multimode 850 nm serial optical connector with SC connector + 1x Ethernet Multimode 1310 nm optical connector with SC connector



10 - 2x Ethernet RJ45 connectors.

6.2 Supply and grounding

The SD is equipped with a universal supply input (38-265 Vac/38-275 Vdc 50/60 Hz).

Supplying the SD by means of substation ancillary services is recommended, especially when the device is interconnected to a communication network for the purposes of data collection for the supervisory or monitoring system.

Table 3 - SD Supply and grounding terminals

INPUTS	TERMINALS
SUPPLY AND EARTH Universal power supply input. Specification: 85-265 Vac/38-275 Vac, 50/60 Hz, <5 W	49 – ground 33 – dc/ac 34 – dc/ac

6.3 Self-diagnosis Relay

The SD is equipped with a self-diagnosis relay that provides indication in case of equipment internal failure.

Table 4 - Relay Output Terminals

OUTPUTS	TERMINALS
SELF-DIAGNOSIS RELAY: Relay for indication in case of SD Functionality Gateway internal self-diagnosis. Specification: 250 Vdc/Vac 70W/220VA 5A max.	44 – NO 45 – NC 46 – Common

6.4 Communication

Ethernet Outputs

The SD is provided with one or two Ethernet (10/100Mbps) communication ports with support to RJ-45 cable or optical fiber cable with SC connector. These ports may be used to integrate the equipment to the supervisory via one of the available communication protocols: Modbus TCP Master, Modbus TCP Slave, DNP3 TCP Master, DNP3 TCP Slave and IEC 61850 MMS Server / Report.

Serial Optical Fiber Output

The SD may be equipped with an optical port for Serial communication (Ethernet Optical Fiber + Serial Optical Fiber Model) according to the 850nm standard and SC connector. This port may be configured according to customer request in any of the serial communication protocols available: Modbus RTU (Master / Slave) and DNP3 RTU (Master / Slave).

Serial Ports

The Functionality Gateway may be connected to Treotech or third-party IEDs via the serial communication port. It may also be connected to a data acquisition system (supervisory or monitoring system). The communication protocols available include Modbus RTU (Master / Slave) and DNP3 RTU (Master / Slave). For details of the communication protocol, see the specific document of the product to be integrated.

Table 5 - SD Communication Terminals

COMMUNICATION	TERMINALS
ETHERNET PORT: Communication port via RJ 45 or multimode SC optical fiber for communication between the SD and the control / supervisory system or communication with IEDs. Modbus TCP (Master / Slave), DNP3 TCP (Master / Slave) and IEC 61850 (MMS Server / Report) output protocols.	<i>TX/RX - 1</i> <i>TX/RX - 2</i> <i>TX/RX - 1</i> <i>TX/RX - 2</i>
SERIAL OPTICAL FIBER PORT: Communication port via multimode SC optical fiber for communication between the SD and the control / supervisory system or communication with IEDs. Modbus RTU (Master / Slave) and DNP3 RTU (Master / Slave) output protocols.	<i>TX/RX - 1</i> <i>TX/RX - 2</i>
RS-485 PORTS: Communication port for connection to the control / supervisory system or communication with IEDs. Modbus RTU (Master / Slave) and DNP3 RTU (Master / Slave) protocols via shielded twisted-pair cable.	<i>71 - (-)</i> <i>72 - (+)</i> <i>74 - (-)</i> <i>75 - (+)</i>
RS-232 PORTS: Communication port for connection to the control / supervisory system or communication with IEDs. Modbus RTU (Master / Slave) and DNP3 RTU (Master / Slave) protocols via 3-way cable.	<i>71 - (RX)</i> <i>72 - (TX)</i> <i>73 - (GND)</i>



In RS-485 networks, using a 120 Ω resistor in each RS-485 serial communication network end is highly recommend to prevent signal reflection in the cable.

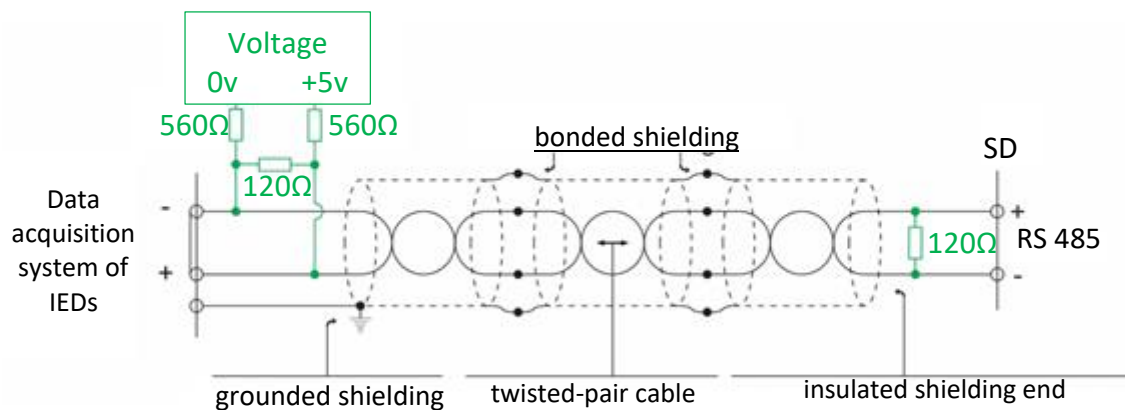
The installation of 560 Ω pull-up and pull-down resistors supplied by a 5Vdc power source on a single network point is also recommended, as shown in **Figure 9**. Hence, the network remains polarized and communication issues are prevented, specially in locations with long networks (distance greater than 1000m) and high baud rate (greater than 9600 bps).



The connection to RS-485 networks should be performed using a shielded twisted-pair cable, maintaining the mesh without interruption along its entire extension. In case intermediate terminals are required to connect the serial communication, the cable shielding should also be passed through the terminal, thus preventing its interruption. Keep the unshielded cable section due to splicing as short as possible, and we recommend grounding only one end of the cable shielding. Follow the maximum distance of 1200m between the ends of the communication network, according to figure 9.



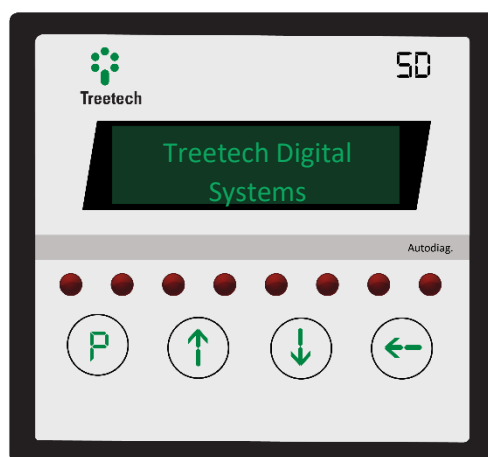
As the RS-232 network connection is more vulnerable to noise than the RS-485 standard, the first is not recommended for long connections. The use of RS-232 standard should be limited to indoor environments, away from electrical noise.



11 - Connection and grounding of RS-485 serial communication shielding

7 Operation

SD Functionality Gateway queries and settings may be performed using the display and keyboard located in the front panel.



12 - SD front panel

7.1 Function of the keys

KEY	FUNCTION
	Programming Key: Allows access to the password to enter the settings menu. In these menus, the system quits the current menu and returns to the previous level. In case you access this menu when changing any parameter, the system returns to the previous menu without saving the changes made.
	Up Key: menu navigation and increase of set values.



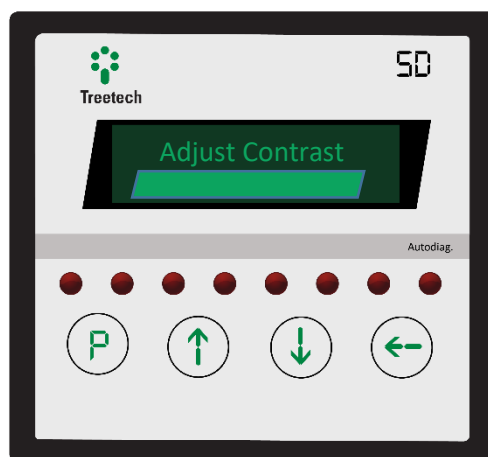
	Down Key: menu navigation and decrease of set values.
	Enter Key: Selects then menu option and parameters shown in the display, saves set values.

7.2 Contrast adjustment

In the measurements home screen, press and hold the key: The contrast adjustment screen will open.

Use the and keys to increase and decrease the luminosity, respectively.

Press the key or to save the new adjustment and return the indication screens.



13 - SD contrast adjustment

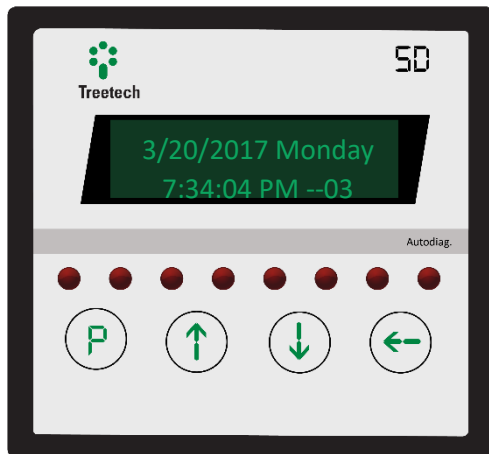
7.3 Reference Screens

The SD Functionality Gateway display shows some screens for reference only in its front panel. Information such as date, time, time zone and network information.

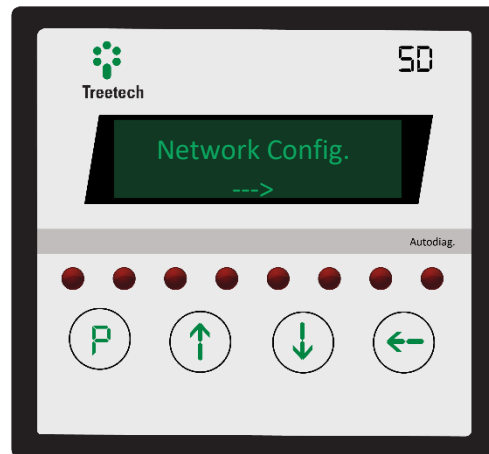
The home screen shows date and time information followed by the time zone.

Press or to access the Network Setting screen. Then, press and use the and keys again to view the primary (1) and secondary (2) IP addresses and their corresponding Network Masks, DNS addresses and Gateway.

Press at any time to return to the home screen.



Press the  or  key. The Network Settings screen will display.



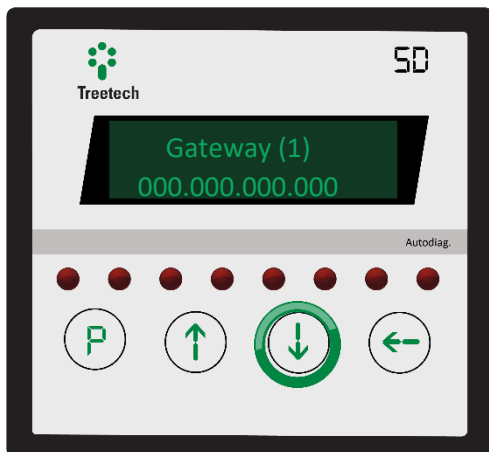
To view the Network Settings, press .



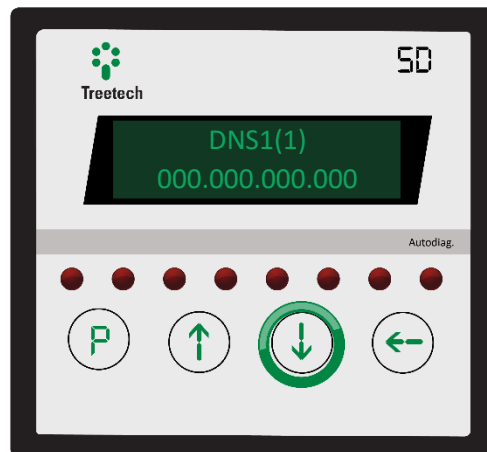
Press the  key to continue the visualization.



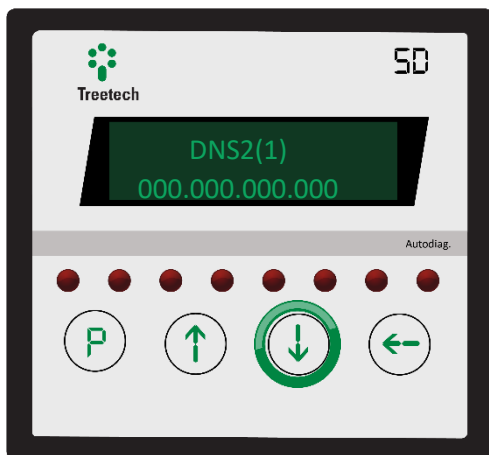
Press the  key to continue the visualization.



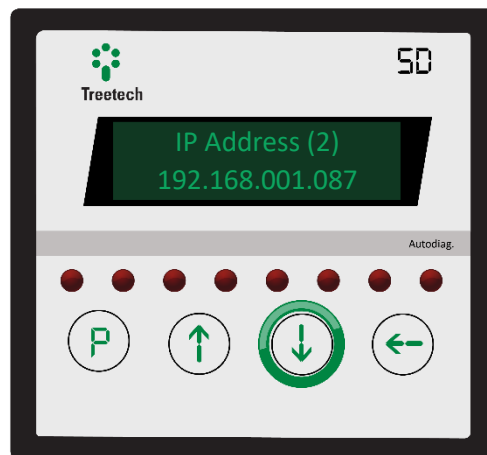
Press the  key to continue the visualization.



Press the  key to






Press the  key to continue the visualization.

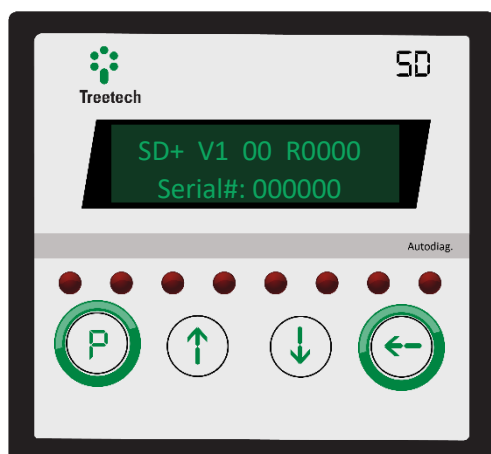


Press the  key to continue the visualization.

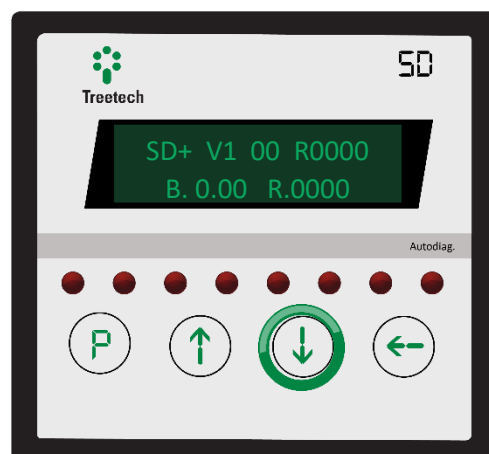
Checking the Firmware Version


The Functionality Gateway allows the user to check other useful information in the front display, such as firmware version and release, serial number, as well as Bootloader version and release.

In the home screen, hold  and press . The display shows the firmware version and the serial number. Then, press the  key to see the Bootloader version and release.





Simultaneously press  and hold  to view the Serial No.




Press  to view *Bootloader* information

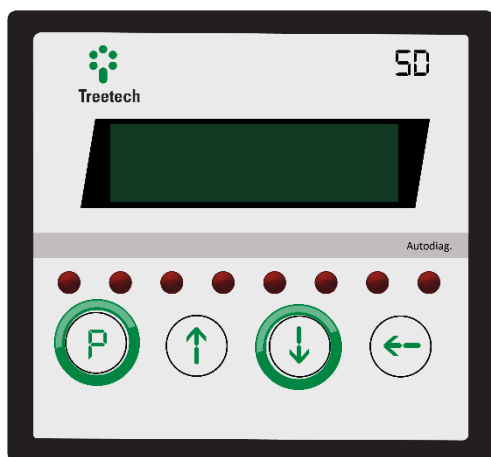
Checking the Self-Diagnosis Memory

All internal self-diagnosis messages identified by the SD are stored in the IED memory and may be checked by the user on the equipment display.

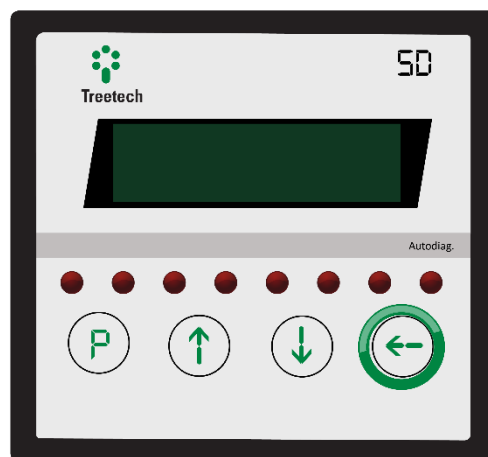
To view the self-diagnosis memory, just hold  and press .


The value displayed for each code digit is the sum of the values of each error that has already occurred for that position, and not only the values of currently active errors. Therefore, you can see all errors that have occurred since the last self-diagnosis memory reset.

To reset the values stored in the memory, press and hold  for a few seconds until the self-diagnosis memory is reset. Active codes cannot be cleared.



Press and hold  and  simultaneous to view the Self-diagnosis memory.



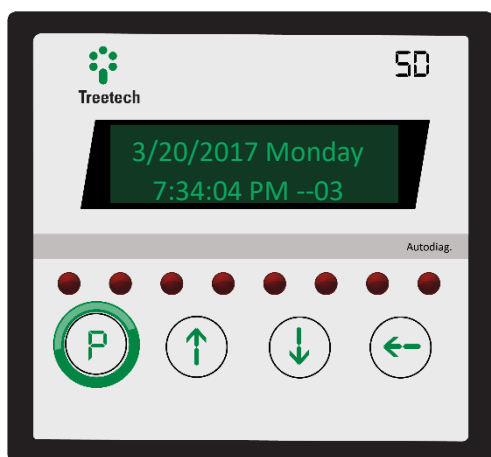
Press and hold  to clean the Self-diagnosis memory.


7.4 Parameterization menus

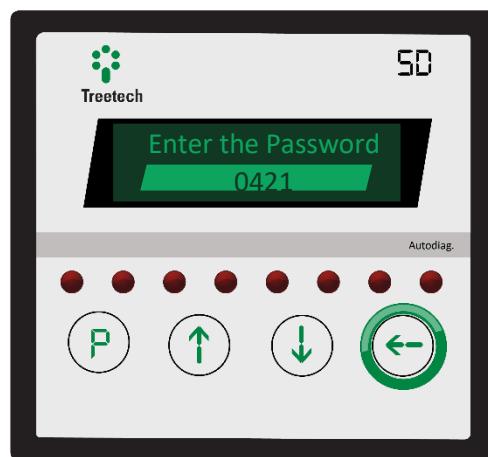
The SD allows configuring some parameters via the display, such as the equipment language and time.

The settings may be made by using the front keyboard, with the aid of the display or via the web page.

To access the SD parameterization menu, just follow the procedure below:







Press the  key for five seconds to access the parameterization menu.










Use the  and  keys to set the password.
Then, press  to proceed.




To access a menu

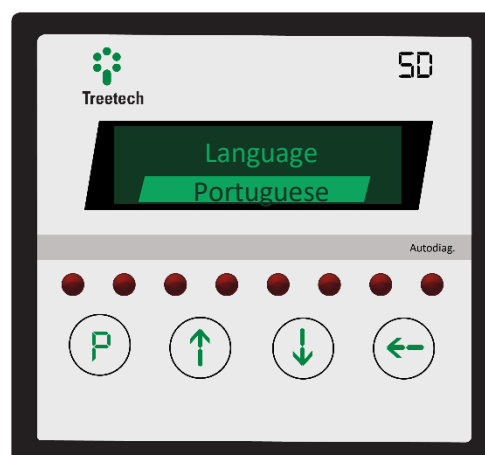


Use the  key to select a menu or parameter; in each menu, use the  or  keys to navigate between parameters and/or select and set them. Use the  key to return to the previous parameter or quit the menu at any time.

Use the  or  keys to navigate between menu parameters; press  to select the parameter you wish to set; use the  or  to set the desired parameter valor; press  to save the parameter change. Press the  key at any time to quit the parameter and return to the main menu without saving the eventual changes made to the parameter.

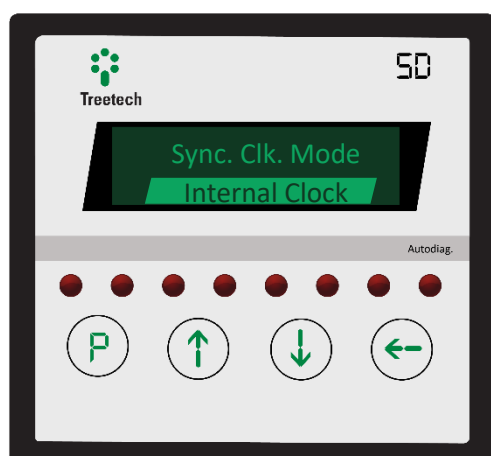
Language Menu





Selection of the interface language in which device legends will be shown in the display and on the web page. The user may choose Portuguese, English and Spanish. Use the  or  key to navigate through options and the  key to select the desired option.



Set Clock Menu

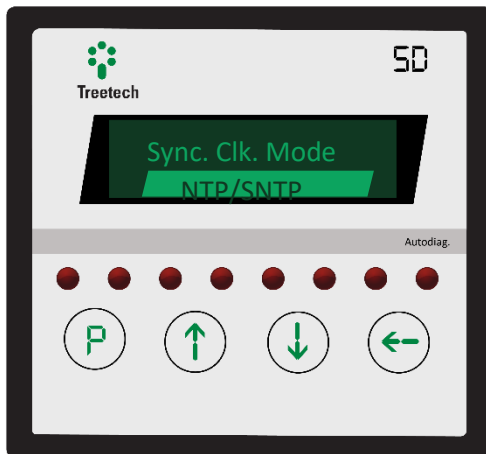
Allows the user to set the clock between "Internal Clock" or "NTP/SNTP".



In case Internal Clock is selected, use the  or  to set the value in the highlighted field, and press the  key to navigate between the Day, Month, Year, Hour, Minute and Time Zone fields. Press  to return to the main menu. Now the clock will be reset with the seconds starting with zero. The date format is set according to the language.

- Portuguese and Spanish: *DD/MM/YY*;
- English: *MM/DD/YY*.

The day of the week is automatically calculated.



An alternative to set the clock is to synchronize it with the network via NTP or SNTP protocols, thus providing higher accuracy for SD Functionality Gateway clock setting. NTP/SNTP IP Address setting should be made via the equipment web page. This parameter may also be changed via web page.

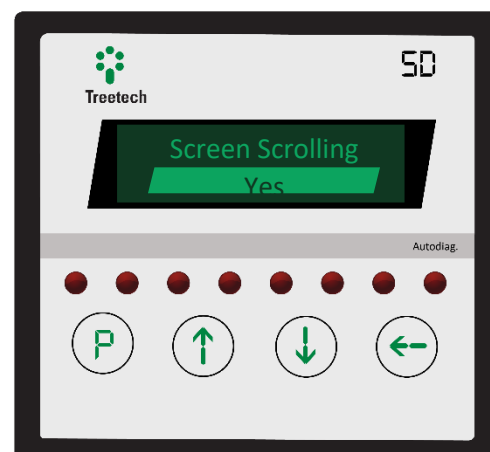
Settings Menu

This menu gives access to parameters related to SD operation settings: Screen Scrolling and New Password.






The Screen Scrolling feature allows the user to choose the display mode of SD information screens, as well as other options:

NO: The last screen viewed will remain on the screen indefinitely.

YES: All measurement screens will be cyclically shown on the display, at an interval of approximately 15 seconds between each screen.



The New Password parameter allows to user to set a new number to access SD parameterization menus.

Use the  or  keys to set the new password value, and press the  key to confirm. Press  to return to the previous menu and  again to return to the main menu.





Factory Only Menu

This menu is for the exclusive use of Treotech Service Department.



Attempting to access this menu using a wrong password may block the equipment and void its warranty.





8 Web Interface

USER-FRIENDLY WEB INTERFACE



Using cutting-edge HTML5 and Bootstrap technologies, the entire SD management and setting interface is deployed directly via the equipment Web page, without the need for proprietary software use or installation license.

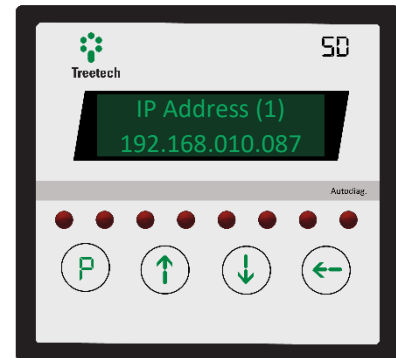
REMOTE NETWORK SUPERVISION

The SD Functionality Gateway allows supervising the network status and IED communication statistics, both in master protocol and slave protocols.

By accessing the details of each input IED the user may follow-up the measurement values in real-time.

ACCESS TO THE WEB INTERFACE

To access SD web page, just type the equipment IP address on a web browser with HTML5 support. The user may check the IP addresses set via the equipment front panel. For that, press the  key. When the equipment screen shows "Network Setting", press . The IP will be displayed according to the adjacent figure.

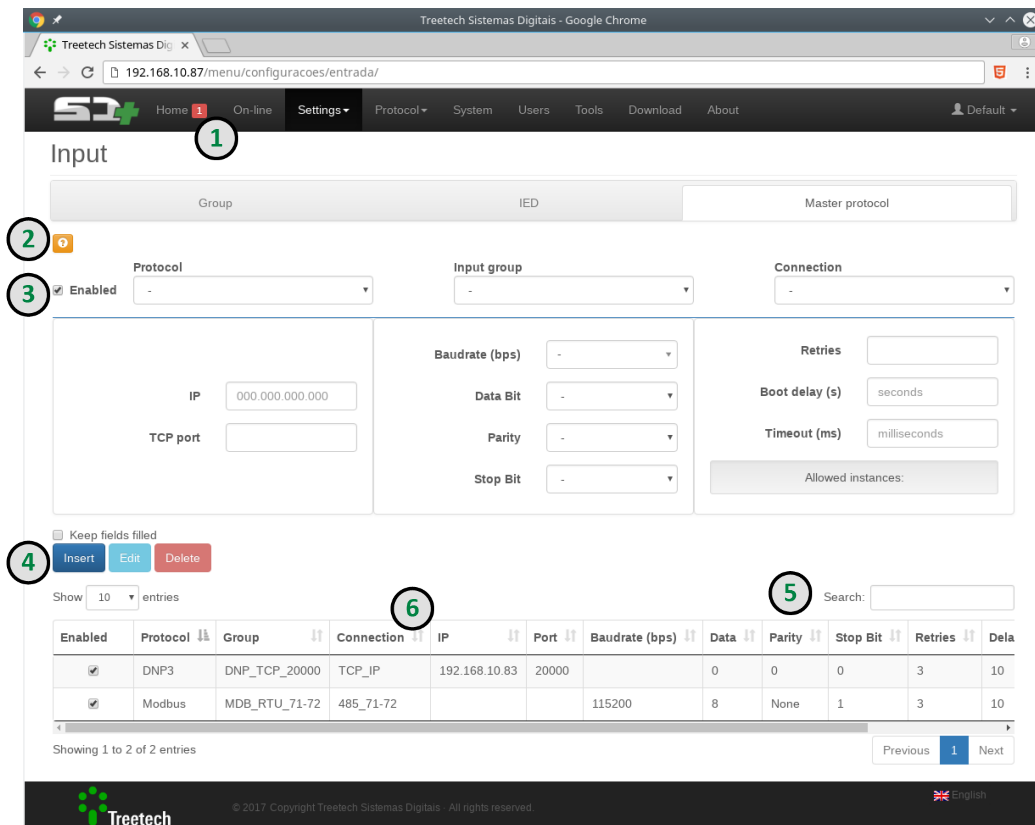


14 - Illustration of SD front panel showing the IP to access the Web page

8.1 Overall Navigation

To render the navigation easier, SD web page has general symbols that are repeated on several pages.

Depending on the user profile permissions, some fields may not be available.



1

2

3

4

5

6

Enabled	Protocol	Group	Connection	IP	Port	Baudrate (bps)	Data	Parity	Stop Bit	Retries	Delay
<input checked="" type="checkbox"/>	DNP3	DNP_TCP_20000	TCP_IP	192.168.10.83	20000		0	0	0	3	10
<input checked="" type="checkbox"/>	Modbus	MDB_RTU_71-72	485_71-72			115200	8	None	1	3	10

1 – WARNINGS

On the screen upper bar, where the menus are located, the user is warned at any time about communication failures with the Input Group IEDs. In front of the Home menu, the warnings are listed in a color box showing the number of inconsistent IEDs.

2 – HELP BUTTONS

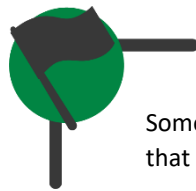
A small orange button with a question mark located in strategic, easy-to-spot areas on the screen helps user navigation, providing information on each of the fields to be completed.

3 – ENABLED

This check-box identified as “Enabled” is constantly show in some forms. It is used to enable or disable the items related thereto.



These items appear also inside the table and may be used as a quick way to enable or disable the items.



Some of the “Enabled” check-boxes have an interlocking system that impede it from being enabled.



4 – ACTION BUTTONS

Three buttons, one dark blue, one light blue, and one red below the completion fields are designed for actions.

Insert

Fill the fields and then click on the button “Insert”. In case any mandatory field **is not filled in**, such field will be marked in red. After the fields are completed, a message of **success** or **error** will be displayed.

Delete

To delete an item, simply click in the table, at the desired line, which will be selected, and the button will be enabled. Then click on “Delete” and a message will be displayed to confirm the action, after which a message of **success** or **error** will appear.

Edit

To edit an item, simply click in the table, at the desired line, which will be selected, and the button will be enabled. Then click on “Edit” to complete the fields with the data, and buttons “**Insert**” and “**Delete**” will change to “**Change**” and “**Cancel**”, respectively.

Change

Edit the fields and then click on the button “Change” In case any mandatory field **is not filled in**, such field will be marked in red. After the fields are completed, a message of **success** or **error** will be displayed.

Cancel

When canceling editing, the fields will be cleared, and buttons “**Change**” and “**Cancel**” will return to their previous options. Buttons “Edit” and “Delete” will be disabled. And the line will be deselected.

☐ Keep fields filled

When this check-box is available, the user may mark it so that the fields completed after the inclusion or editing remain as such; thus facilitating the inclusion of other items in the table.

5 – SEARCH BOX

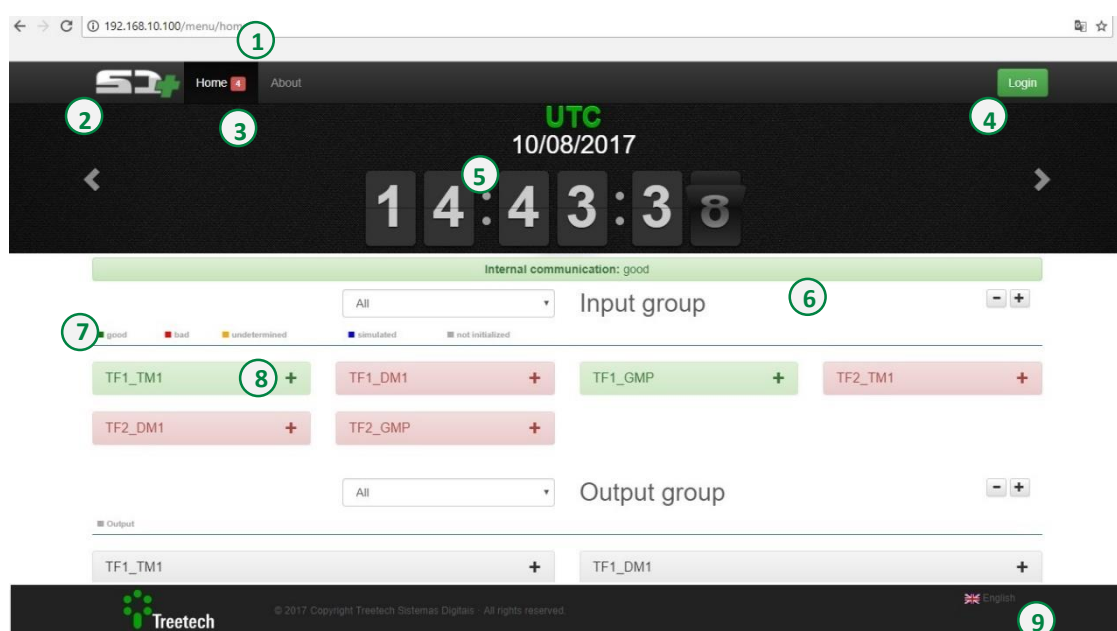
In order to find an existing system user/register/IED use the search box, which is normally located above a table.

6 – LIST OF ITEMS

Below the search box there is a table showing the list of items found. They may be sorted according to the filters available in the first lines of the table.

8.2 Home Page

This is the Functionality Gateway home page. This page provides an overview of the communication status of the acquisition and distribution network IEDs.



15 - SD+ web page home screen

1 – IP ADDRESS

The IP address shown in product front panel should be entered on a web browser with HTML5 support.

2 - PRODUCT IDENTIFICATION

In the upper left corner of the screen, the SD+ logo identifies that the IED is the SD Functionality Gateway. The SD line features a wide range of different IED models offered by Treotech.

3 – TAB NAVIGATION

On the top of the screen, next to the IED logo, the user may navigate by means of tabs. Before the login, only the Home and About tabs are enabled.



4 – LOGIN

A green button located on the upper right corner of the screen allows the user to login into the system and access other screens.

5 – TIME

The times in local and GMT format are highlighted on the home screen.

6 – IEDs SELECTION

Below the clock, the user may filter the Input Groups and the Output Groups to be shown on the screen.

This tool allows the user to follow-up the status of a given IED group, with details of protocol settings.

7 – LEGENDS

Below the Group names small color labels show the possible status of each IED: Good, Bad, Not Determined, Initializing and Inactive.

8 – LIST OF CONNECTED IEDs

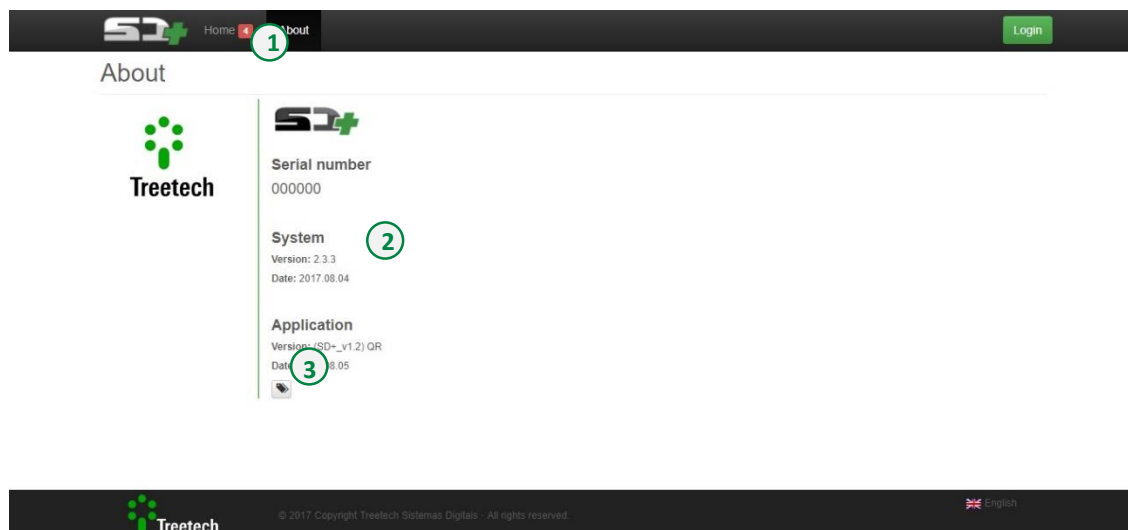
The IEDs selected by the user are shown in an expandable, color block according to the product condition.

9 – LANGUAGE

The user may select the language on the lower right corner of the home screen. For that, just click the flag of the country of origin of the desired language.

8.3 About

This is the system information reference table. Here the user will find data such as equipment serial number, system firmware version and installed application version.



16 - SD web page About Tab



1 – TAB NAVIGATION

To access another menu, just click another tab in the upper bar where the product identification logo and the login button are also located. In addition, there is a red warning button related to the number of IEDs with communication failure.

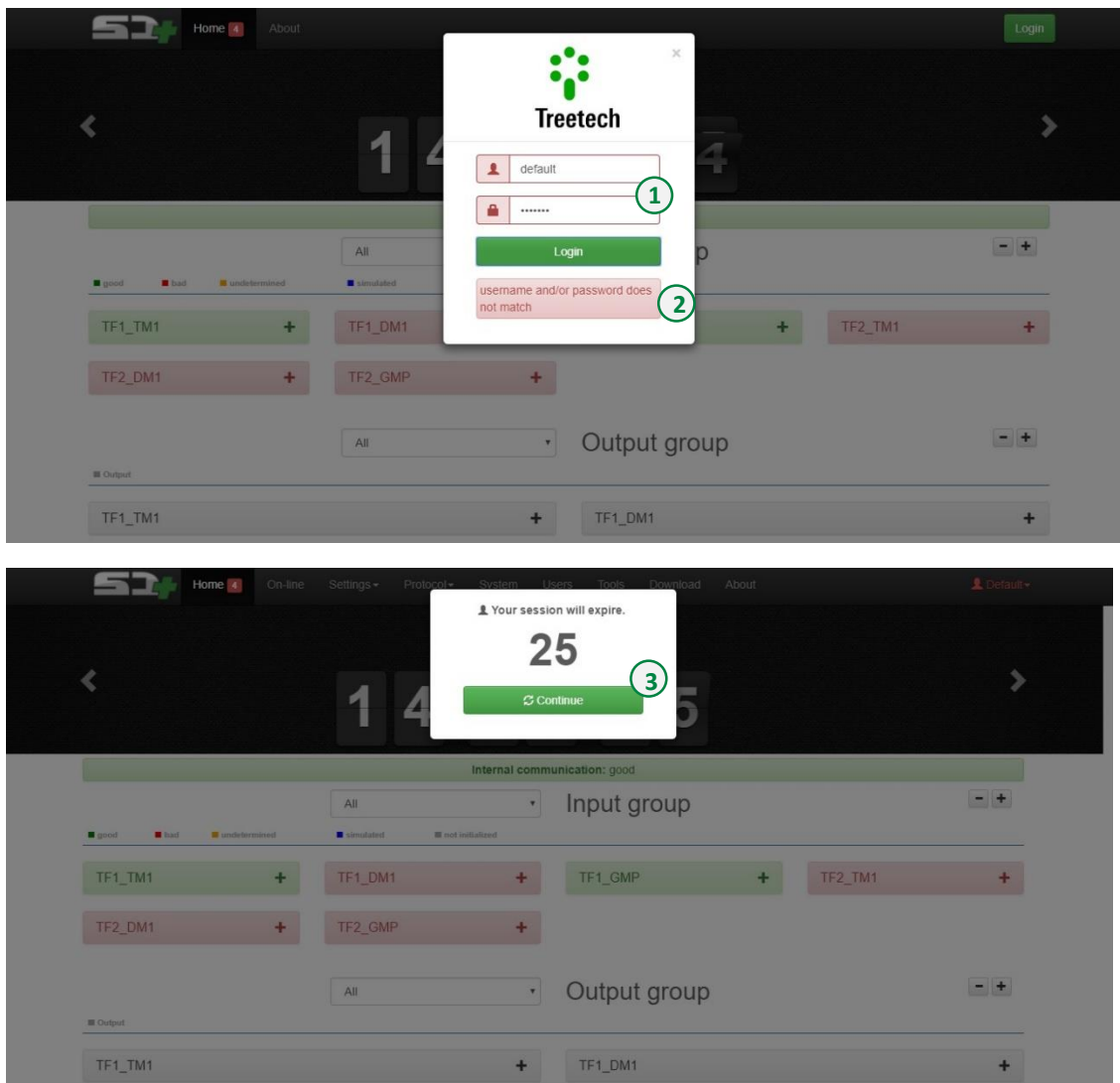
2 – SYSTEM VERSION

The about page shows information on the version of the firmware installed, equipment serial number and data on product application version.

3 – VERSION DETAILS

A gray button below the Application information allows the user to view the detailed version of each system process.

8.4 Login



17 - Entering Login and Password

1 – LOGIN AND PASSWORD

The user should have a valid login and password to access further details on the IED and perform online data acquisition via web page. To make this access, just click the green "Enter" button located on the upper right corner of the screen.

A window will open with fields for user identification and password. After completing the fields, just click the green "Enter" button to access the system.

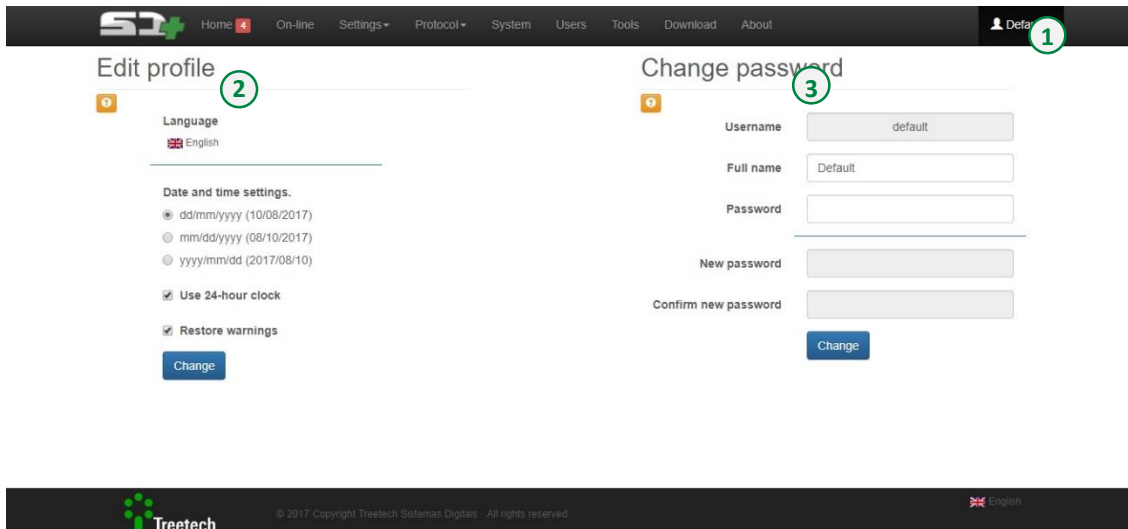
2 – WRONG LOGIN AND/OR PASSWORD

In case the login and/or password are incorrect, a red text message inside a red box will be displayed warning about the error.

3 – TIMEOUT

In case the user performs the Login, but the system remains idle for ten minutes, the session will timeout. In the final thirty seconds a window showing a countdown informs the user about the session expiration.

8.5 Editing the profile



18 - Editing the Profile on SD web Page

1 – ACCESS

In case you wish to modify your profile by changing the password or login, just click your user name available on the upper right corner of the screen. In the drop-down menu, click the "Edit profile" button to access the page shown above.

2 – LANGUAGE, DATE FORMAT, CLOCK AND WEB PAGE WARNINGS

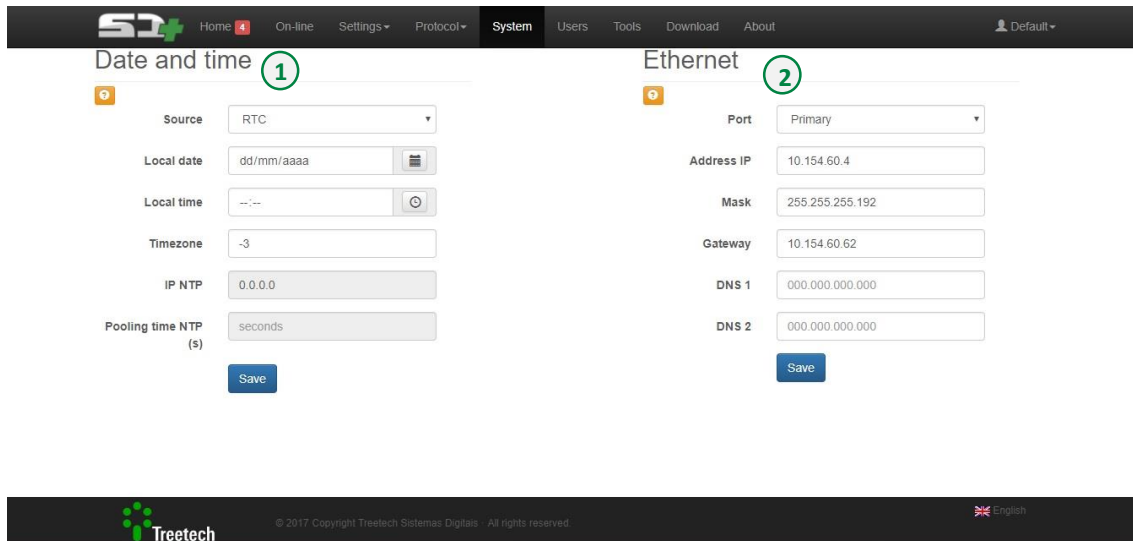
On the left corner of the screen, the Edit Profile heading allows the user to setup the display preferences. In this section you can choose the language and date format (dd/mm/yyyy, mm/dd/yyyy or yyyy/mm/dd). In addition, the clock display format (12 or 24hrs) may be changed, as well as the permission to open dialog boxes with warnings. Click the blue "Change" button to confirm the changes.

3 – PASSWORD

You can change your user password on the right side of this screen. For such, the user identification has to be provided by entering your current login and password. Then, the new password may be changed and confirmed. Click the blue "Change" button to confirm the changes.

8.6 System

This page allows changing network configurations and system clock and date settings.



The screenshot shows the 'System' tab in the SD web interface. It is divided into two main sections: 'Date and time' (labeled with a green circle 1) and 'Ethernet' (labeled with a green circle 2). The 'Date and time' section includes fields for Source (RTC), Local date (dd/mm/yyyy), Local time (HH:MM:SS), Timezone (-3), IP NTP (0.0.0.0), and Pooling time NTP (seconds). The 'Ethernet' section includes fields for Port (Primary), Address IP (10.154.60.4), Mask (255.255.255.192), Gateway (10.154.60.62), DNS 1 (000.000.000.000), and DNS 2 (000.000.000.000). Both sections have a 'Save' button at the bottom. The footer of the page shows the Treotech logo, copyright information (© 2017 Copyright Treotech Sistemas Digitais), and a language selector (English).

19 - SD web page System Tab

1 – EQUIPMENT DATE AND TIME

On the left corner, the user may change the SD Functionality Gateway date and time.

Two options are available in the source field: NTP, which uses Ethernet settings to update the clock; and RTC, which allows manual clock setting.

In case NTP is selected, the user should also select the time zone, IP and update interval. You may have to configure an IP address in the IP setting Gateway setting so that the SD Functionality Gateway have access to NTP IP.

In case the source is RTC, in addition to selecting a time zone the user should set the equipment date and time manually. To make this process easier, you may copy the local computer date and time clicking the icons related to the setup fields.

2 – ETHERNET

Ethernet settings are available for the user on the right corner of the page. The port to configured (primary or secondary) may be selected in the first field.

The user may change the IP Address and Mask manually in any of the ports. Additionally, the primary port allows changing the Gateway address and DNS 1 and 2.



8.7 User Registration

In this page, you can check which users are currently registered to use the system, as well perform user changes and register other users. Different access profiles may be assigned to each user.

The screenshot shows the 'Users' tab in the SD web interface. At the top, there's a navigation bar with 'Home', 'On-line', 'Settings', 'Protocol', 'System', 'Users' (selected), 'Tools', 'Download', and 'About'. Below the navigation bar, the 'Sign up' section is highlighted with a circled '1'. It contains a form with fields for 'Full name', 'Username', 'Password', and 'Confirm password'. There's a checkbox for 'User enabled'. To the right of the form is a table for selecting profiles and their access levels. Below the form are buttons for 'Insert', 'Edit', and 'Delete', with 'Delete' circled with a '2'. Below these buttons is a 'Show' dropdown set to '10' entries and a search bar. At the bottom left, a circled '3' points to a table of existing users. The table has columns: 'Enabled', 'Full name', 'Username', and 'Profiles'. The first row shows a user named 'Default' with username 'default' and various profile access levels. At the bottom right, there are 'Previous', '1', and 'Next' buttons.

Profile	View	Operate	Setup
Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
System	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Users	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communication	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Modbus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
DNP3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Enabled	Full name	Username	Profiles
Yes	Default	default	Tools(C) System(C) Users(C) Communication(C) Modbus(C) DNP3(C)

20 - SD web page User Tab

1 – ADDING A NEW USER

To allow other users access to the web page, the administrator user should access the Users tab located on the upper bar of the screen.

Four fields should be completed to add the new user: Full name, User, Password and Password Confirmation.

The permissions for the new user are selected in a four-column table on the right corner of the screen. In the Profile column, the tabs which the new user may access: Tools, System, Users, Communication, Modbus, DNP3 and IEC 61850.

In the other columns, the each tab access level is further detailed in the View, Operate and Configure options.

VIEW: The user will only be allowed to view the settings and will not be able to change, delete or create anything.

OPERATE: The user will be able to enable and disable existing settings, as well as change the protocol address of any IED.

CONFIGURE: The user will have full control to change, delete and create system settings.



2 – ACTION BUTTONS

Three buttons, a dark blue, a light blue and a red button below the completion fields are designed for actions. By clicking them the new user may be added or an existing user may be edited or deleted.

3 – LIST OF USERS

Below the search box a list containing the users found is shown. They may be sorted according to the filters available in the first lines of the table: Active, Full Name, User, Profiles.

8.8 Tools

This page offers basic tools for the IED operation: Restart, Restore default settings, Update and an SD Functionality Gateway process manager.

Manager

Tools

Manager Commands Update

Advanced option

Start Stop Suspend

running stop suspend initializing disabled

Show All entries

Processes	Group	Connection
dnp3-master	DNP3-71-72	485_71-72
dnp3-slave	SIGMA	TCP_IP
dnp3-slave	SCADA	485_74-75

Showing 1 to 3 of 3 entries

Previous 1 Next

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21 - SD web page Tools Tab - Manager

1 – TAB NAVIGATION

In the Tools page, the user will find three tabs with different functions: Manager, Commands and Update. The Manager tab allows following up the status of processes setup by the user in the SD, as well as start and stop processes.

2 – ADVANCED OPTION

Below the help button, two selection boxes, Input and Output, allow the user to choosing the group to be managed. Both groups may be selected simultaneously.

3 – ACTION BUTTONS

The Start (inside a green box) and Stop (inside a red box) buttons allow the user to start or stop the processes related to the input group and/or output group.

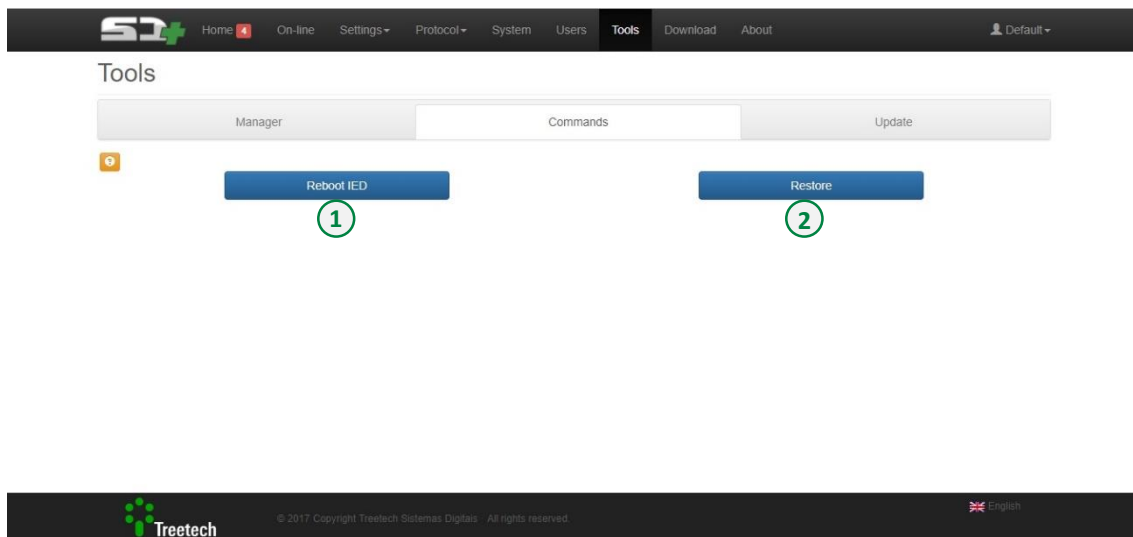
4 – LEGENDS

Below the buttons, small color labels show the possible status of each process: Good, Bad, Not Determined, Initializing and Inactive.

5 – LIST OF PROCESSES

Below the search box a list containing the processes found is shown. These may be sorted according to the name of the columns shown in the table header: Processes, Group, Connection.

Commands



22 - SD web page Tools Tab - Commands

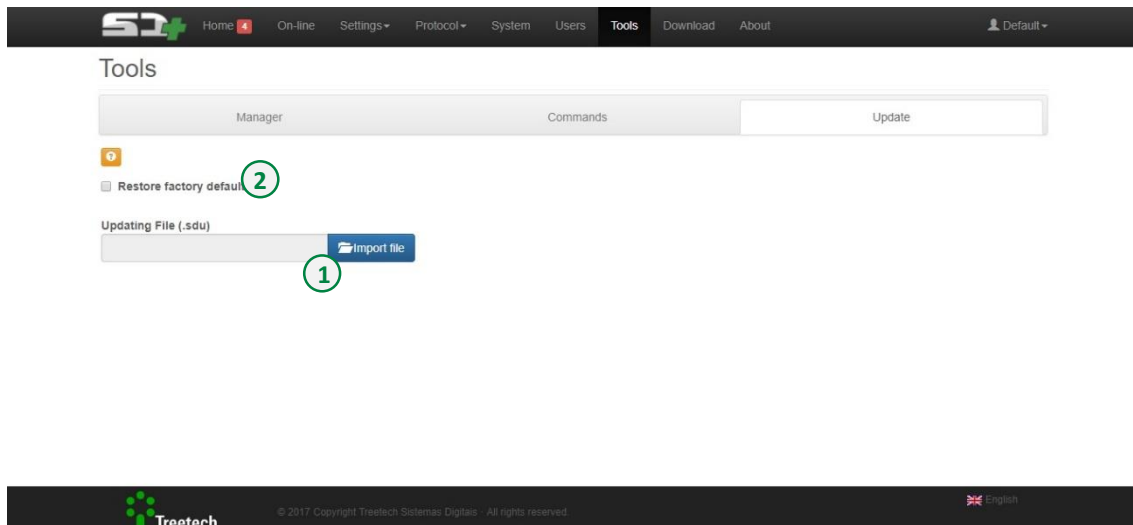
1 – RESTART IED

The SD web page allows the user to restart the SD Functionality Gateway remotely. For that, just access the Commands tab and click the button on the right-side of the screen: Restart IED.

2 – RESTORE

The SD web page not only allows the user to restart the IED, but also to restore all product default settings. For such, click the blue Reset button. The user login password will be requested. Only users with permissions can perform such operation.

Update



23 - SD web page Tools Tab - Update

1 – UPDATE

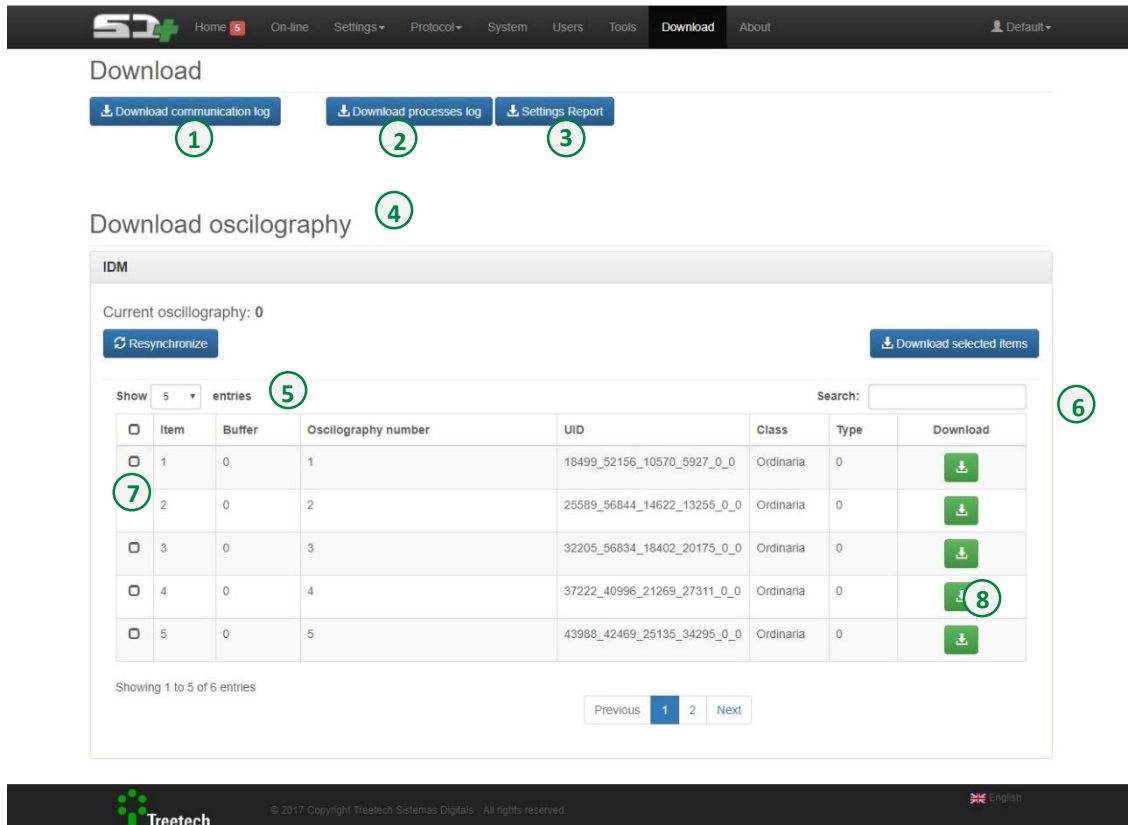
Pressing the blue Import File button a window opens and allows the user to select the .sdu file to update the equipment.

2 – RESTORE DEFAULT SETTINGS






The Restore Default Settings checkbox allows the user to update the product and, concurrently, restore product settings according to the new firmware written. In case the user leaves the box unchecked, the update will be performed and the current settings will be maintained.

8.9 Download

The Download page allows the user to download a communication log text file regarding all ports and protocols used. You may also download current process and settings logs and send them to Treotech in case support is requested.



The screenshot shows the 'Download' page of the SD web interface. At the top, there is a navigation bar with links: Home, On-line, Settings, Protocol, System, Users, Tools, Download, and About. The 'Download' link is highlighted. Below the navigation bar, the 'Download' section contains three blue buttons: 'Download communication log' (1), 'Download processes log' (2), and 'Settings Report' (3). Below these buttons is the 'Download oscilography' section (4). This section includes a 'Resynchronize' button and a 'Download selected items' button (6). A table (5) displays the current oscilography with columns: Item, Buffer, Oscilography number, UID, Class, Type, and Download. The table contains 6 entries. The first entry (7) is selected, and its 'Download' button (8) is highlighted. The footer of the page shows the Treotech logo and copyright information.

Item	Buffer	Oscilography number	UID	Class	Type	Download
1	0	1	18499_52156_10570_5927_0_0	Ordinaria	0	
2	0	2	25589_56844_14622_13255_0_0	Ordinaria	0	
3	0	3	32205_56834_18402_20175_0_0	Ordinaria	0	
4	0	4	37222_40996_21269_27311_0_0	Ordinaria	0	
5	0	5	43988_42469_25135_34295_0_0	Ordinaria	0	

24 - SD web page Download Menu

1 – DOWNLOAD COMMUNICATION LOG

Click the leftmost blue box to download the communication Log.

2 – DOWNLOAD PROCESS LOG

Process logs are also recorded and a report may be downloaded and reviewed by the user. Just click the blue box containing this option located at the center of the screen. While the user may download the log, **the access to the log is restricted to the Technical Support.**

3 – DOWNLOAD SETTING REPORT

Another type of log is the setting log. A blue button located on the upper right corner of the screen allows downloading this report. While the user may download the log, **the access to the log is restricted to the Technical Support.**



4 – OSCILLOGRAPHY *DOWNLOAD*

Some Treotech IEDs such as SDM, SDX and SDS, for example, are capable of generating oscillographic records. In this menu, the user have access to these records as well. The IED is identified with its name on the upper bar representing its status, according to the page general legend.

The download of SD oscillographic records is supported only by Treotech IEDs.

The user is informed the number of the last oscillography generated by the equipment (Current Oscillography), the number of the oscillography currently read by the SD (Synchronizing Oscillography) and the number of downloads not completed by the SD - caused by eventual errors in the download process.

5 – RESYNCHRONIZING

The SD clears the oscillography history and starts a new download process.

6 – OSCILLOGRAPHIC RECORDS AVAILABLE FOR DOWNLOAD

A table containing the oscillographic records available for download is displayed in the blue Resynchronizing box. This table described detailed information about each oscillography, allows filtering and sorting according to different variables that comprise the table header.

7 – BATCH ACTIONS

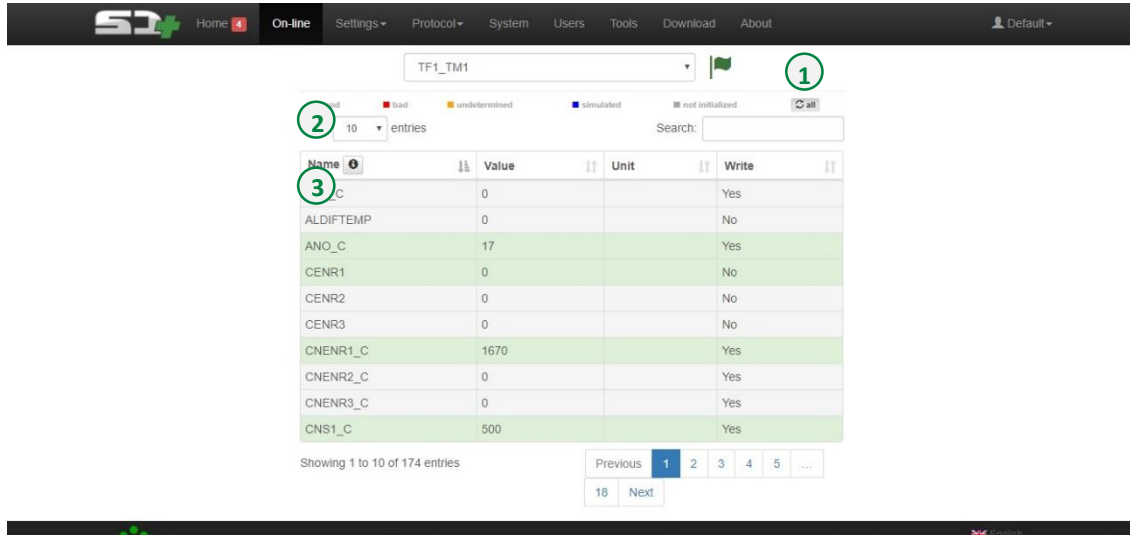
In order to download more than one oscillography at once, the user should select the oscillographic records desired and click the blue button located on the right corner of the screen, above the table: Download Selected Items.

8 – INDIVIDUAL ACTIONS

In order to download a single oscillography, just click the green button located in each table line.

8.10 Online

This page allows access to each IED specific screen, which shows all variables (Abstract data) read and their corresponding value.



TF1_TM1

10 entries

Search:

Name	Value	Unit	Write
C	0		Yes
ALDIFTEMP	0		No
ANO_C	17		Yes
CENR1	0		No
CENR2	0		No
CENR3	0		No
CNENR1_C	1670		Yes
CNENR2_C	0		Yes
CNENR3_C	0		Yes
CNS1_C	500		Yes

Showing 1 to 10 of 174 entries

Previous 1 2 3 4 5 ...

18 Next

25 - SD web page Online Menu

1 – IED

On the top of the screen, just below the menu bar, the user may select the IED to be followed up in real time.

2 – STATUS

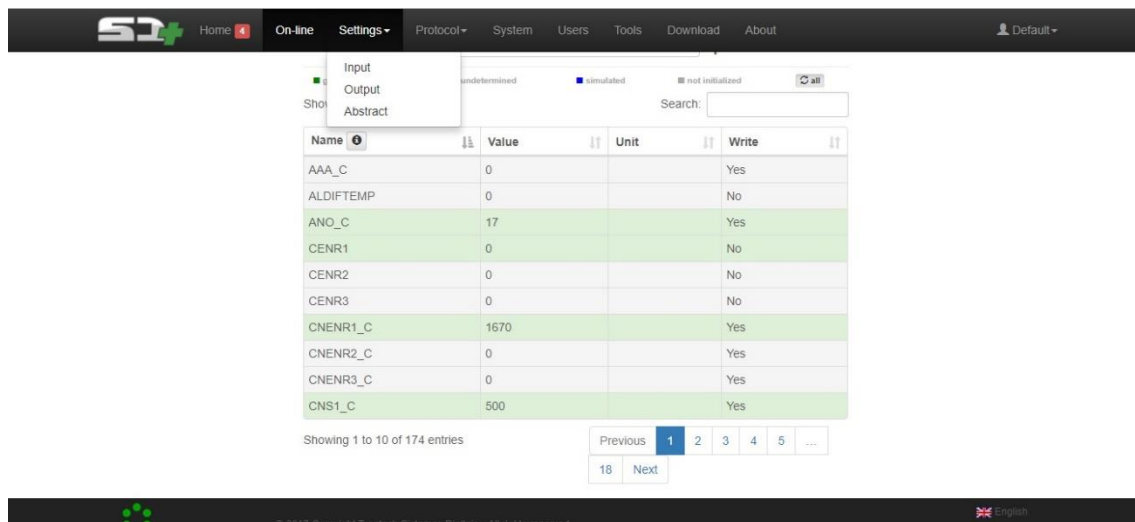
Further down the screen, the legends explain the colors of each Abstract variables in the table: green lines represent good communication; red lines, bad communication; yellow lines, unstable communication, which is called herein not determined communication; the blue lines are used when the corresponding Abstract is set as Simulated; the gray lines indicate that the corresponding Abstract has never been read.

3 – TABLE FILTERS AND NAVIGATION

The table header allows the user to sort the Abstracts per Name, Value, Unit and Writing. A small button next to the Name box shows further details on the Abstracts.

8.11 Settings

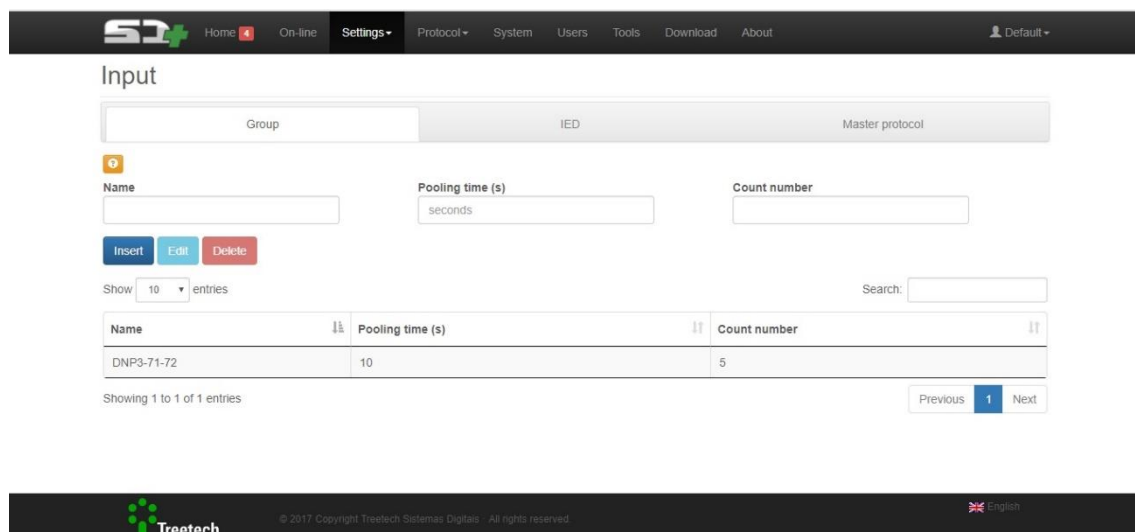
In this section the IEDs are created as well as the Abstract variables of IED to be mapped on the desired doors and protocols. For further details about this menu see the [IED Setup Guide](#).



26 - SD web page "Settings" Menu

Input Settings

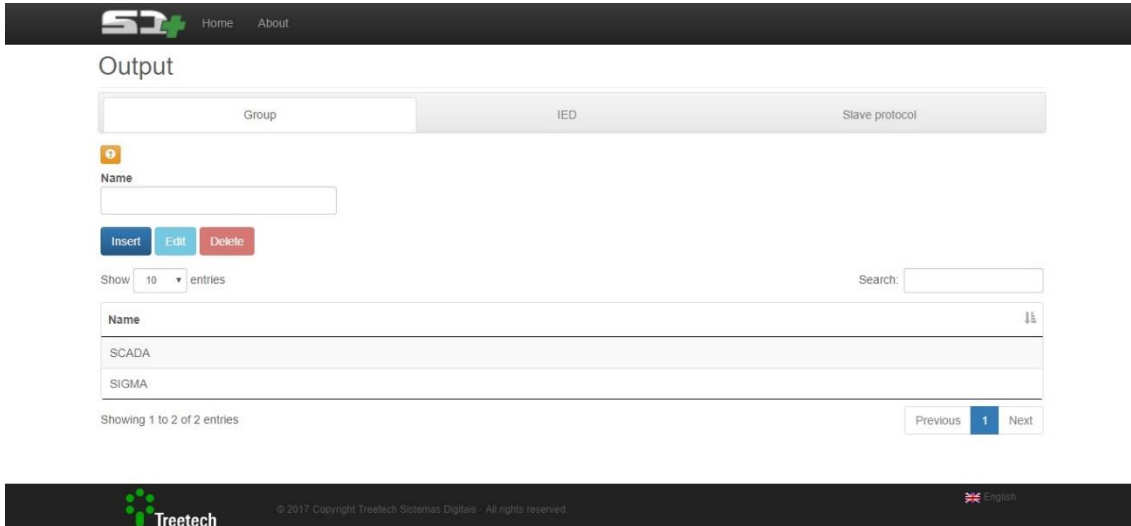
The input settings are associated to groups, IEDs and protocols related to the SD acquisition section. Here the IEDs are created that will be assigned to acquisition groups and that may be subsequently mapped within the input protocol selected. For further details about this menu see the [IED Setup Guide](#).



27 - SD web page Input Settings Menu

Output Settings

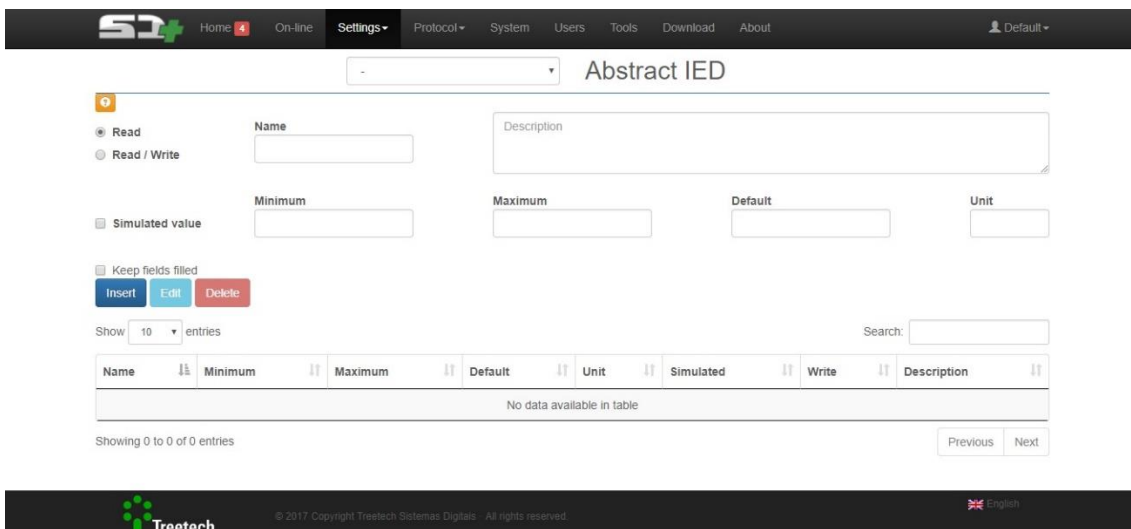
The output settings are associated to groups, IEDs and protocols related to the SD distribution section. Here the IEDs are created that will be assigned to distribution groups and that may be subsequently mapped within one or more output protocols. For further details about this menu see the [IED Setup Guide](#).



28 - SD web page Output Settings Menu

Abstract Settings

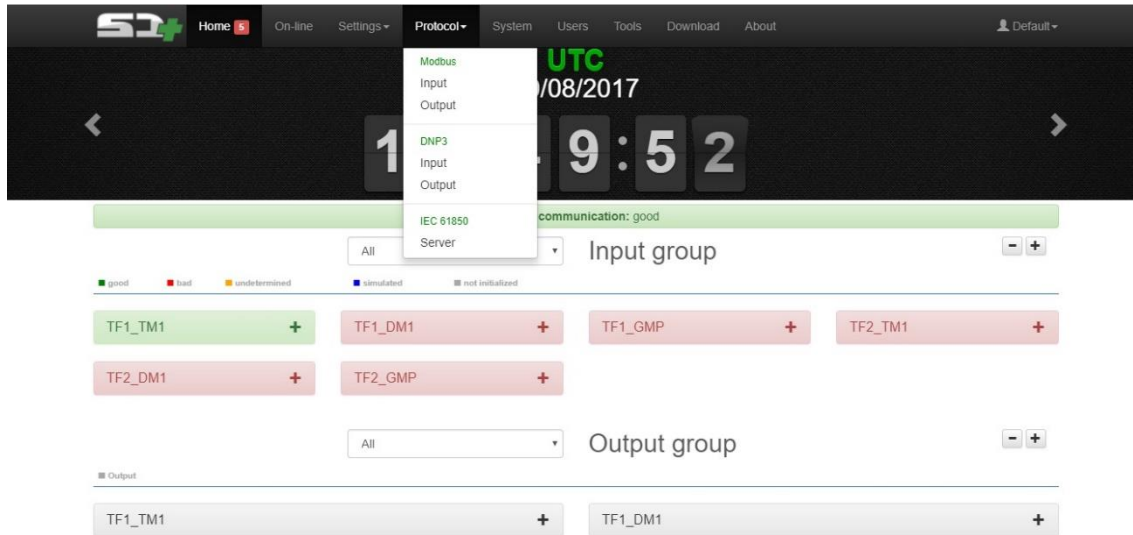
After creating an input IED, this IED abstract variables should be generated - the pure variables without protocol link related to that IED. Subsequently, these variables may be linked to a Master protocol or an output IED. For further details about this menu see the [IED Setup Guide](#).



29 - SD web page Abstract Settings Menu

8.12 Protocol

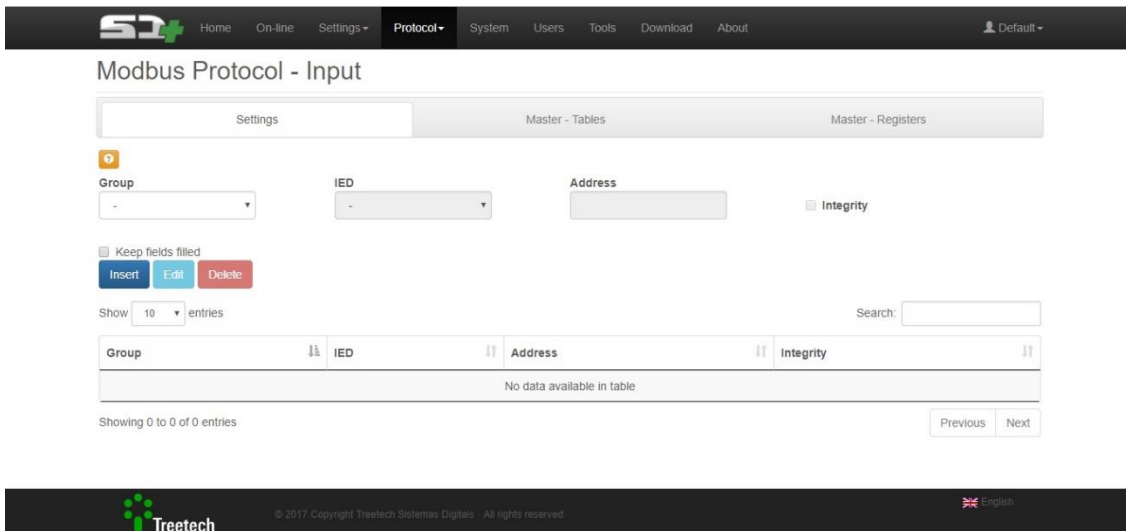
In this section the abstracts created in the Settings tab may be assigned to the protocols desired. From this point on, the acquisition and distribution is performed by the SD Functionality Gateway. For further details about this menu see the [Modbus, DNP3 and IEC 61850 Protocol Guide](#).



30 - SD web page "Protocol" Tab

Modbus Protocol – Input

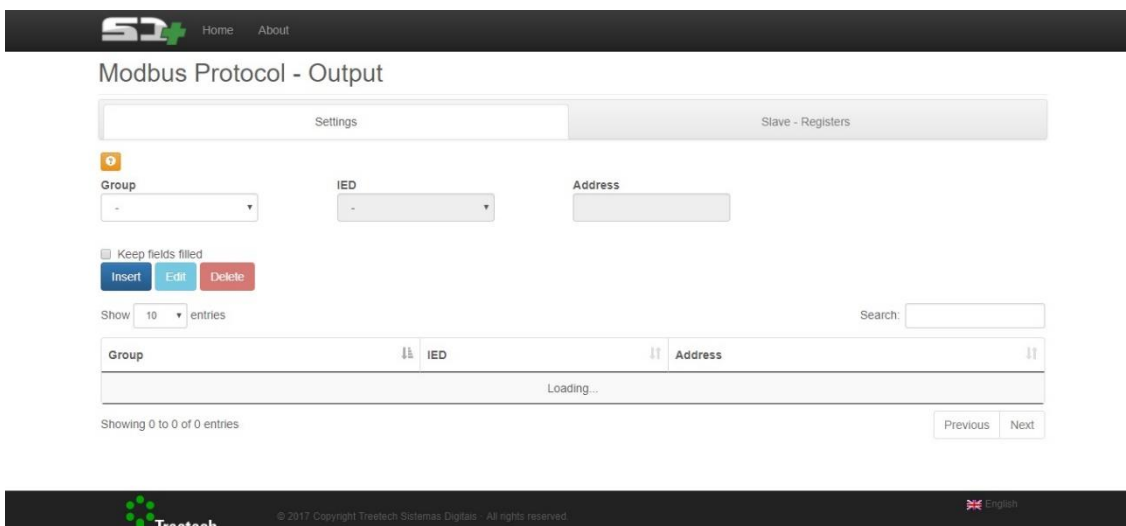
Upon creating an input IED and generating its abstract variables, these may be mapped so that the acquisition is performed by means of Modbus protocol. For further details about this menu see the [Setup Guide - Modbus Protocol](#).



31 - SD web page Input Modbus Submenu

Modbus Protocol – Output

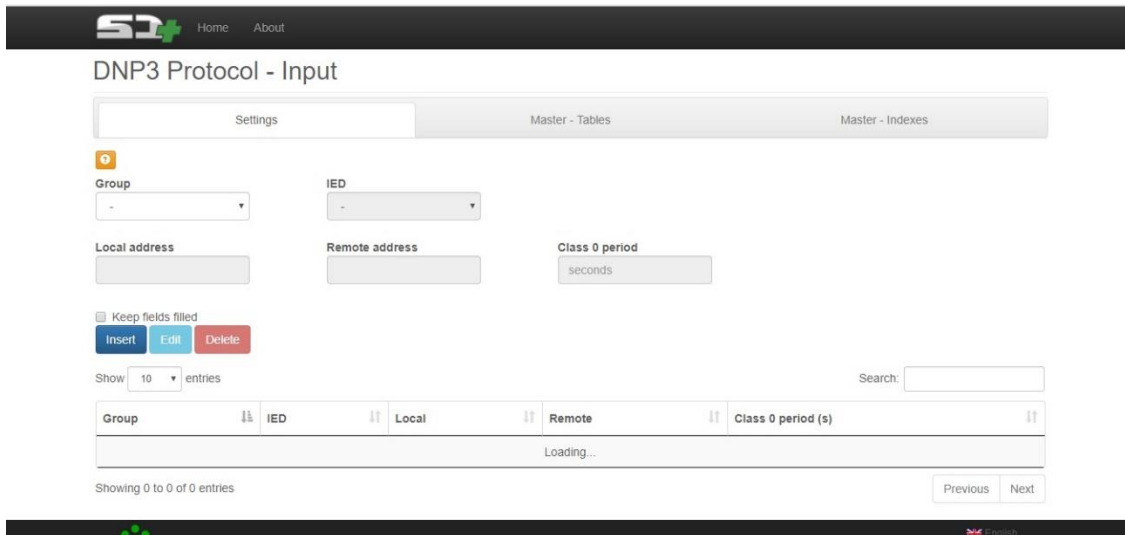
Upon creating an output IED in the Settings->Output section, abstract variables may be mapped based on one or several input IEDs, thus comprising a virtual IED which data may be distributed in the Modbus protocol. For further details about this menu see the [Setup Guide - Modbus Protocol](#).



32 - SD web page Output Modbus Submenu

DNP3 Protocol – Input

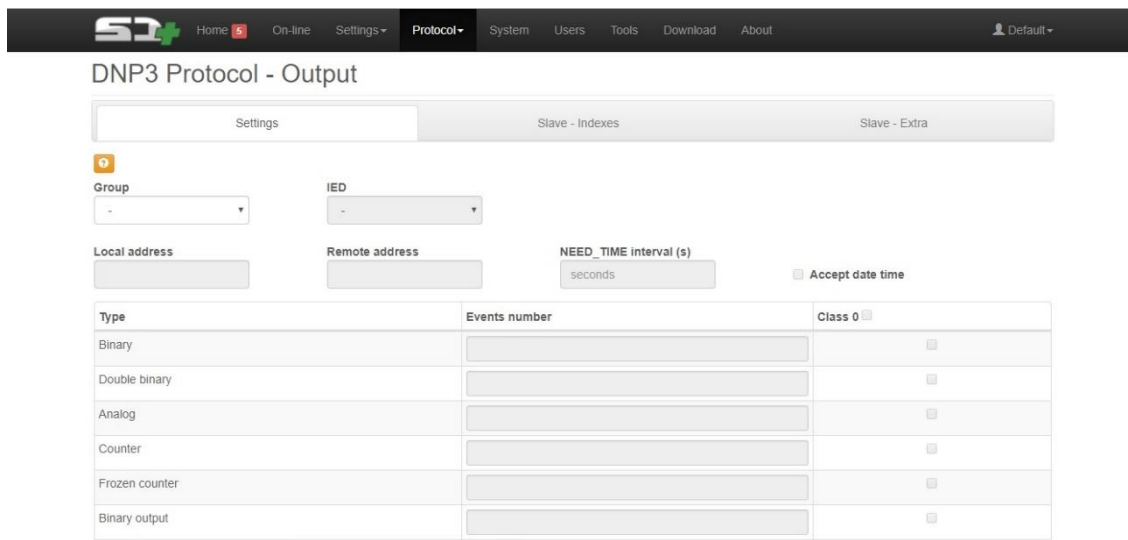
Upon creating an input IED and generating its abstract variables, these may be mapped so that the acquisition is performed by means of DNP3 protocol. For further details about this menu see the [Setup Guide - DNP3 Protocol](#).



33 - SD web page Input DNP3 Submenu

DNP3 Protocol – Output

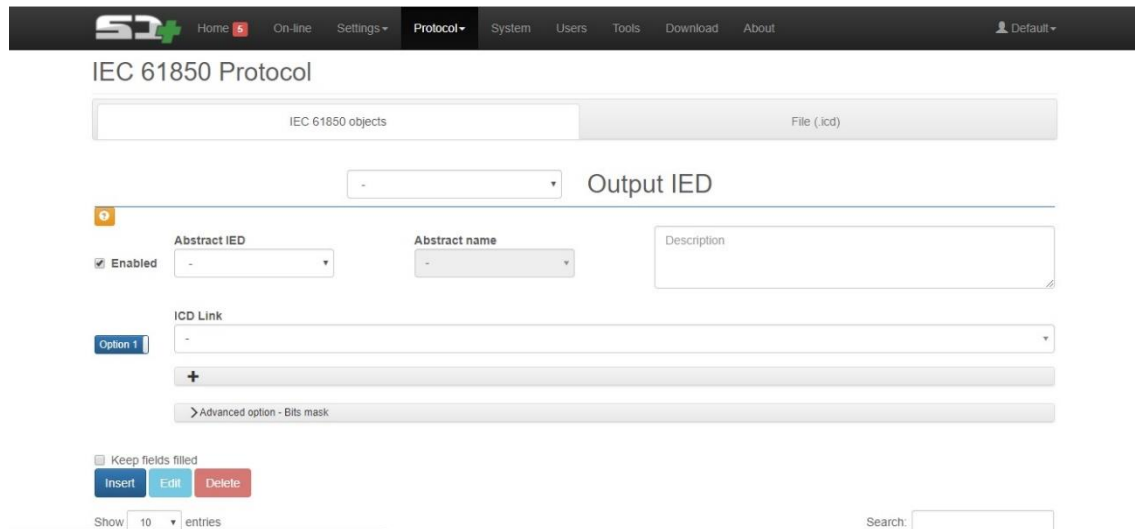
Upon creating an output IED in the Settings->Output section, abstract variables may be mapped based on one or several input IEDs, thus comprising a virtual IED which data may be distributed in the DNP3 protocol. For further details about this menu see the [Setup Guide - Modbus Protocol](#).



34 - SD web page Output DNP3 Submenu

IEC 61850 Protocol – Server

Upon creating an output IED in the Settings->Output section, abstract variables may be mapped based on one or several input IEDs, thus comprising a virtual IED which data may be distributed in the IEC 61850 protocol. For further details about this menu see the [Setup Guide - IEC 61850 Protocol](#).



The screenshot shows the 'IEC 61850 Protocol' submenu. At the top, there's a navigation bar with 'SD' logo and links: Home, On-line, Settings, Protocol (selected), System, Users, Tools, Download, About. A user profile 'Default' is on the right. Below the navigation bar, the title 'IEC 61850 Protocol' is displayed. A search bar contains 'IEC 61850 objects' and a 'File (.icd)' button. A dropdown menu shows '-'. The main section is titled 'Output IED'. It contains a table with columns: 'Abstract IED', 'Abstract name', and 'Description'. The first row has 'Enabled' checked, a dropdown with '-', and an empty description field. Below the table, there's an 'ICD Link' dropdown with 'Option 1' selected. A '+' button is next to it. Below that, there's a link '> Advanced option - Bits mask'. At the bottom, there's a 'Keep fields filled' checkbox, 'Insert', 'Edit', and 'Delete' buttons, a 'Show 10 entries' dropdown, and a 'Search:' input field.

35 - SD web page IEC61850 Server Submenu



9 Commissioning

Following equipment installation according to chapters 5 and 6 of this manual, start-up should follow the basic steps below; the complete SD inspection and test procedure is available in document "PIT - SD":

- ✓ Check the mechanical and electrical installations according to the Design and Installation recommendations in this manual;
- ✓ Check proper equipment wiring with the aid of a multimeter;
- ✓ Connect the grounding cable to SD terminal 49;
- ✓ Energize the SD with supply voltage of 85-265 Vac - 38-275 Vdc - 50/60 Hz;
- ✓ Connect the earth cable to SD terminal;
- ✓ Supply SD terminals 33 and 34 with supply voltage of 85-265 Vac or 38-275 Vdc - 50/60 Hz;
- ✓ Configure all SD settings according to the instructions in the previous chapters using the front keyboard and via the embedded web page;
- ✓ Using a proper PC, communication converters and software, as applicable, check the operation of SD RS-485 port and product communication according to the application used.

10 Troubleshooting

10.1 Self-diagnosis messages and possible solutions

The SD Functionality Gateway continuously checks the integrity of its functions by means of its self-diagnosis circuits and algorithms. Any detected anomaly is indicated by means of a fault contact and the self-diagnosis messages indicated in the equipment's display, supporting the diagnosis process and fault resolution.

The self-diagnosis codes indicated in the SD display have four digits.

The meanings of each digit are indicated in the following tables. Please, provide the self-diagnosis code to Tretech Service Department.

Table 6 - List of self-diagnosis codes

Code	Description	Possible Cause	Recommended Procedure
Self-diagnosis table			
0001	Flash memory fault	Internal Fault	Restart SD (disconnect the power supply for a few seconds and reconnect). If the failure persists, contact Tretech service department.
0002	Internal communication fault	Internal fault	Restart SD (disconnect the power supply for a few seconds and reconnect). If the failure persists, contact Tretech service department.

10.2 Issues without indication in the self-diagnosis

In case difficulties or problems are found related to SD operation, see the possible causes and basic solutions described next. If this information is not sufficient to remedy the issue, please contact Tretech service department or your authorized representative.



SD fails to communicate with IEDs:

Table 7 - Troubleshooting IED connection problems

Possible Causes	Possible Solutions
Improper connection of the communication cable	Check proper connection of communication cables (polarity, possible short-circuits, open cable, shielding grounding) between SD and IED.
Improper setting of serial communication parameters.	Check the proper setting of the following parameters: Communication, Protocol, Address and Baud Rate Standard.
Distance between network ends greater than 1,200 meters.	In case the circuit exceeds the distance of 1,200 meters, it might be required using repeater modules or applying optical fiber.
Lack of shielding grounding, grounding interruption or cable with shielding grounded on both ends of the communication network.	Grounding failure may cause the corruption of the data transmitted due to induced noise and transients. Proceed with the inspection of cables and connections (junction lugs) and grounding.



11 Attachments

11.1 Technical data

Hardware	Interval / Description
Supply Voltage	85-265 Vac - 38-275 Vdc, 50/60 Hz
Max. consumption	≤ 13w
Working Temperature	-40 to +85°C
Protection Class	IP20
Connections	0.3 to 2.5 mm ² , 22 to 12 AWG
Mounting	Panel mounted

Network interfaces	Description
Serial Communication Ports:	1x RS-485 1x RS-485/RS-232
IEEE 802.3 (10/100 Mbps) Communication Ports: <i>*Customer should select one of the three settings.</i>	2x <i>Ethernet RJ45</i> 2x <i>Ethernet F.O (MM 1310 nm plug SC)</i> 1x <i>Ethernet F.O (MM 1310 nm plug SC) + 1x Serial F.O (MM 850 nm plug SC)</i>
Master / Client Protocols:	Modbus RTU Modbus TCP DNP3 RTU DNP3 TCP
Slave / Server Protocols:	Modbus RTU Modbus TCP DNP3 RTU DNP3 TCP IEC 61850 ¹

¹ The .icd may be created using any software that generates .icd files and then imported via the SD web interface.



11.2 Order specification

The following should be specified in the purchase order:

- **SD Functionality Gateway:**

1. Product quantity required.
2. Master/Client protocol desired (more than one option may be combined):
 - a. Modbus RTU;
 - b. Modbus TCP;
 - c. DNP3 RTU;
 - d. DNP3 TCP.
3. Quantity of IEDs to be read by each Master / Client of each serial port (maximum 31 IEDs per serial port).
4. Slave / Server protocol desired (more than one option may be combined):
 - a. Modbus RTU;
 - b. Modbus TCP;
 - c. DNP3 RTU;
 - d. DNP3 TCP;
 - e. IEC 61850.
5. Type of Hardware desired (one option possible only):
 - d. 2x Ethernet MM 1310 nm optical ports with SC connector;
 - e. 1x Multimode 850 nm serial optical port with SC connector + 1x Ethernet Multimode 1310 nm optical port with SC connector;
 - f. 2x Ethernet RJ45 ports.

11.3 Optional accessory

Quick Installation Panel (PIR)

The SD Functionality Gateway should always be installed protected against weather exposure; therefore, it is usually installed inside a control panel or inside a building. For cases in which this is not possible, such as in upgrades of old transformers, the SD may be supplied inside a weatherproof, easy-to-install cabinet.

FEATURES	
Models	PIR-1 for one monitor (SD) PIR-2 or PIR-3 for other Treotech monitors.
Attachment to the Transformer	Bolted or using high-performance magnets.
Attachment to the SD	Removable rack
Wiring connection	Multipole plugs removable from the cabinet bottom
Protection Class	IP55
Insulation Test	2kV, 50/60 Hz, 1 min



SD installed with the Cabinet

11.4 Type tests

The SD is an equipment developed based on the *SmartSensor 3* platform; therefore, the tests performed and corresponding results follow the table below:

Surge Immunity (IEC 60255-22-5 and IEC 61000-4-5)	
Differential mode	1kV 5 per pole (+/-)
Common mode	2kV 5 per pole (+/-)
Electrical Transient Immunity (IEC 60255-22-1, IEC 61000-4-12 and IEEE C37-90-1)	
1 st cycle peak value, frequency, time and repetition rate, decay to 50%	2.5 kV common mode 1kV differential mode 1MHz, 2 sec 200 surges/sec 5 cycles
Voltage impulse (IEC 60255-5)	
Wave form, Amplitude, Number of pulses	1.2/50 μ s 5kV 3 negative and 3 positive 5-sec interval
Insulation Voltage (IEC 60255-5)	
Industrial frequency insulation voltage	2kV 60Hz 1 min. to ground
Irradiated electromagnetic field Immunity (IEC 60255-22-3 and IEC 61000-4-3)	
Frequency, Field intensity	80-2500 Mhz 10V/m
Immunity to conducted electromagnetic disturbances (IEC 60255-22-6 and IEC 61000-4-6)	
Frequency, field intensity	0.15-80 MHz 10 V/m
Industrial Frequency Magnetic Field Immunity (IEC 61000-4-8)	
Magnetic field strength and direction	30 A/m 3 orthogonal axes
Electrostatic Discharges (IEC 60255-22-2, IEC 61000-4-2 and IEEE C37.90.3)	
Strength and repetitions	Air mode, 15 kV Ten discharges per polarity
Electrical fast transient immunity (IEC 60255-2-4, IEC 61000-4-4 and IEEE C37-90-1)	
Power supply, inputs and outputs	4kV
Power supply failure (IEC 60255-22-11 and IEC 61000-4-11)	
Voltage drops	0-80% of U 1/2-300 cycles 85V-265V 50/60 Hz



Short interruptions	5 seconds 85V-265V 50/60 Hz
Cold test (IEC 60068-2-1)	
Temperature, test duration	-40°C 16 hours
Dry heat test (IEC 60068-2-2)	
Temperature, test duration	+85°C 16 hours
Moist heat test (IEC 60068-2-78)	
Temperature and humidity, Test duration	+40°C, 85% RH 24 hours
Damp heat, cyclic (IEC 60068-2-14)	
Temperature range, total test duration	-40°C, 85°C 96 hours
Vibration response: (IEC 60255-21-1)	
Application mode, duration, amplitude, intensity	3 axes, Sinusoidal 160 min/axis 10 to 150 Hz 2G
Electric safety (EN 61010-1)	
Protections against electric shock, mechanical damage, liquid damage and flame propagation	
Heat resistance and protection devices	



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