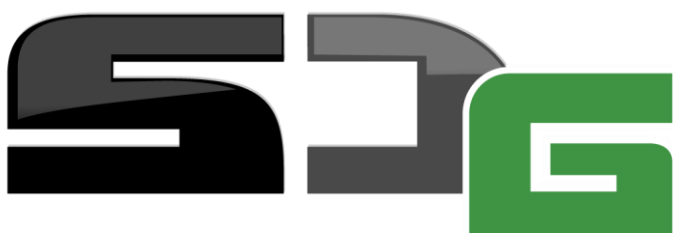


USER MANUAL



Treetech



SMART DEVICE GATEWAY



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1 Foreword

1.1 Legal information

The information contained in this document is subject to change without notice.

This document belongs to Treetech Sistemas Digitais Ltda. and may neither be copied, transferred to third parties nor used without express authorization, in terms of Brazilian law 9.610/98.

1.1.1 Disclaimer

Treetech Tecnologia reserves the right to make changes without prior notice in all products, circuits and functionalities described herein with the aim of improving their reliability, function or design. Treetech Tecnologia does not assume any liability resulting from application or use of any product or circuit described in here and does not transmit any licenses or patents under its rights, not even third-party rights.

Treetech Tecnologia may own patent or other types of registrations and intellectual property rights described in the content of this document. Possession of this document by any person or entity does not give such person or entity any right over these patents or registrations.

1.2 Presentation

This manual presents all the recommendations and instructions for installation, operation and maintenance of the Smart Device Gateway - SDG.

1.3 Typographical conventions

Throughout this text, the following typographical conventions were adopted:

- **Bold:** Symbols, terms and words that are in bold have greater contextual importance. Therefore, pay attention to these terms.
- *Italics:* Terms in foreign language, alternative or with their use outside the formal situation are written in italics.
- Underlined: References to external documents.

1.4 General and safety information

This section presents relevant aspects of safety, installation and maintenance of the SDG.

1.4.1 Safety symbols

This manual uses three types of risk classification, as shown below:



Warning

This symbol is used to alert the user of potentially dangerous operating or maintenance procedures in which higher caution must be taken. Minor or moderate injuries may occur, as well as damage to the equipment.



Caution

This symbol is used to alert the user of a potentially dangerous operating or maintenance procedure, which demands extreme caution in its conduction. There may occur serious injuries or even death. Possible damages to the equipment may be irreparable.



Risk of electric shock

This symbol is used to alert the user of an operating or maintenance procedure that may result in electric shock if not strictly overseen. There may be minor, moderate, serious injuries or death.

1.4.2 General symbols

This manual uses the following general symbols:



Important

This symbol is used to highlight important information.



Tip

This symbol represents instructions that facilitate the use or access to functions in the SDG.

1.4.3 Minimum profile recommended for SDG operator and maintainer

Installation, maintenance and operation of equipment in electric power substations require special cares and, therefore, all recommendations of this manual, applicable standards, safety procedures, safe work practices and good judgment must be used during all handling stages of the Smart Device Gateway - SDG.



Only authorized and trained staff – operators and maintainers – should handle this equipment.

To handle the SDG, the operator should:



- ✓ Be trained and authorized to operate, ground, turn on and off the SDG, following maintenance procedures in accordance with established safety practices, which are the sole responsibility of the SDG operator and maintainer;
- ✓ Be trained in the use of PPEs, CPEs and first-aid;
- ✓ Be trained in the working principles of the SDG, as well as its configuration;
- ✓ Follow regulatory recommendations regarding interventions in any type of equipment included in an electric power system;
- ✓ Have basic knowledge of TCP/IP networks to access the SDG web page through its IP in an internet browser.

1.4.4 Environmental and voltage conditions required to installation and operation

The table below lists important information on the environmental and voltage requirements.

Table 1 - Operation conditions

Condition	Range/description
Application	Equipment for sheltered use in substations, industrial and similar environments.
Indoor/outdoor use	Indoor use
Protection level (IEC 60529)	IP20
Altitude (IEC EN 61010-1)	Up to 2000 m
Temperature (IEC EN 61010-1)	
Operation	-40...+85 °C
Storage	-40...+85 °C
Relative humidity (IEC EN 61010-1)	
Operation	5...95 % - uncondensed
Storage	3...98 % - uncondensed
Supply voltage fluctuation (IEC EN 61010-1)	Up to ±10 % of rated voltage
Overvoltage (IEC EN 61010-1)	Category II
Pollution level (IEC EN 61010-1)	Level 2
Atmospheric pressure (IEC EN 61010-1)	80...110 kPa

1.4.5 Test and installation instructions

This manual must be available to those responsible for installation, maintenance and users of the Smart Device Gateway - SDG.

To ensure user safety, equipment protection and correct operation, the following minimum precautions must be followed during the SDG installation and maintenance:

1. Carefully read this manual before installing, operating and maintaining the SDG. Errors in the installation, maintenance or adjustments of the SDG can cause communication failures, errors in commands and even the shutdown (trip) of an asset;



2. The installation, adjustments and operation of the SDG must be carried out by trained personnel familiar with IEDs and control devices and command circuits of substation equipment;
3. Special attention must be given to the electrical installation of the SDG, including the type and gauge of the cables and terminal blocks used, as well as the procedures for putting into service (commissioning), including the correct parameterization of the equipment.



This IED must be installed in a sheltered environment (a panel without doors in a control room or an enclosed panel in cases of outdoor installation) that does not exceed the temperature and humidity specified for the equipment.



Do not install this IED near heat sources such as heating resistors, incandescent lamps and high power devices or with heat sinks. It is also not recommended to install it near ventilation holes or where it may be hit by forced airflow, such as the outlet or inlet of cooling fans or forced ventilation ducts.

1.4.6 Cleaning and decontamination instructions

Be careful when cleaning the SDG. Use **only** a damp cloth with soap or detergent diluted in water to clean the cabinet, front mask or any other part of the equipment. Do not use abrasive materials, polishes, or aggressive chemical solvents (such as alcohol or acetone) on any of its surfaces.



Turn off and unplug the equipment before cleaning any of its parts.

1.4.7 Inspection and maintenance instructions

For inspection and maintenance on the SDG, the following observations must be followed:



Do not open the equipment. There are no parts which can be repaired by the user inside it. This procedure must be done only by Treotech technical support, or professionals certified by Treotech. This equipment is completely maintenance free, and visual and operational inspections, periodic or not, can be done by the user. These inspections are not mandatory.



Opening the LAP at any time will lead to product warranty loss. In case of inappropriate opening, Treetech cannot ensure the product correct functioning, regardless of whether the warranty period has expired or not.



All parts of this equipment must be supplied by Treetech, or by one of its accredited suppliers, according to its specifications. If the users wish to acquire them in another way, they must strictly follow Treetech's specifications for this purpose. Thus, performance and safety for the user and the equipment will not be compromised. If these specifications are not followed, the user and the equipment may be exposed to unforeseen risks.

1.4.8 Disposal and end-of-life instructions for the product

This product is subject to the European Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE). To ensure responsible disposal in accordance with the law, please follow the guidelines below:



Upon reaching the end of its useful life, this equipment **should not be disposed of with regular household waste.**

Proper disposal:

- ✓ Dispose of the product at a collection point specializing in electronic waste or authorized recycling centers;
- ✓ Consult local authorities, distributors, or the manufacturer for information on the nearest collection points;
- ✓ Proper disposal helps protect the environment, allows for the recycling of materials, and reduces risks to human health caused by harmful substances present in electronic equipment.



1.5 EC Declaration of Conformity (ECD/EU Declaration of Conformity)

This equipment complies with the essential requirements of the following applicable European directives:

- Directive 2014/30/EU (Electromagnetic Compatibility – EMC);
- Directive 2014/35/EU (Low Voltage – LVD);
- Directives 2011/65/EU and 2015/863/EU (RoHS).

The product meets the corresponding harmonized standards and complies with the technical requirements established by the European Union.

The product meets the relevant harmonized standards and complies with the technical requirements established by the European Union. For more details, please refer to the [SDG Declaration of Conformity](#) document.

Authorized Representative in the European Union | EUAR:

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1.6 Technical support

Do you already know our online customer service platform?



On the CS page the fast and direct communication channel with our support team is available. Ask questions, solve problems and have up to date the application of your Treotech product. Moreover, Treotech's knowledge base is also available, including catalogs, manuals, application notes, frequent questions and other useful resources.



It may be necessary to send the equipment to Treotech's technical support in some cases. In the CS we present all the necessary procedure and contacts.



1.7 Warranty terms and conditions

The Smart Device Gateway – SDG, will be guaranteed by Treetech for a period of two (2) years from the acquisition date, exclusively against any manufacturing defects or quality defects that make it inappropriate for regular use.

The warranty will not cover product damage suffered as result of accidents, mistreatment, incorrect handling, incorrect installation and application, inadequate testing or in case of breach of the warranty seal.

Any need for technical assistance must be communicated to Treetech or its authorized representative, with the presentation of the equipment along with the respective purchase invoice.

No express or implied warranties other than those mentioned above are provided by Treetech. Treetech does not provide any guarantee of suitability of the SDG for a particular application.

The seller shall not be liable for any damage to property or for any loss and damage arising out of, connected with, or resulting from the purchase of the equipment, its performance or any services possibly provided along with the SDG.

In no event shall the seller be liable for damages incurred, including, but not limited to: loss of profits or income, impossibility of using the LAP or any associated equipment, capital costs, costs of purchased energy, costs of equipment, facilities or substitute services, downtime costs, buyers', customers' or employees' claims, regardless of whether such damages, claims or damages are based on contract, warranty, negligence, tort or otherwise. Under no circumstances will the seller be liable for any personal injury of any kind.



2 Introduction



Figure 1 - Smart Device Gateway - SDG

Modern substations integrate a lot of equipment into their systems, which often have different communication protocols. For these devices to communicate efficiently, it is necessary to have a flexible and efficient functionalities gateway that meets the most demanding speed and robustness requirements for the safe operation of the system.

Treotech's Smart Device Gateway - SDG meets this demand, performing efficient and secure communication to allow data transmission to supervisory, data acquisition or online monitoring systems using different communication protocols.

For this, Treotech's SDG was specially designed to integrate harmoniously and completely with any product that supports Modbus®, DNP3 and IEC 61850 protocols, acting as an extension of the same with the function of expanding its communication possibilities.

In this way, the SDG goes beyond a simple protocol converter, acting with greater efficiency and reliability compared to generic products on the market.



2.1 Characteristics

ROBUST HARDWARE

The SDG was designed to work in a substation electrical environment and can be installed directly on the transformer panel.

EMBEDDED OPERATING SYSTEM

The SDG has an embedded operating system, customized by Treetech. This ensures greater stability and reliability of operation of the product firmware.

MANAGEMENT OF USERS AND ACCESS PROFILES

To ensure data access security, the SDG works with profiles of different levels of operation, configuration, and administration access.

CUSTOMIZATION OF IEDS PROTOCOL MAPS

Through a friendly interface, the user is able to edit or create custom IED mappings, including merging IEDs and converting protocols.

CLOCK SYNCHRONISM

SDG allows configuration of clock synchronization via NTP or PTP protocol.

REMOTE UPDATE

Through the web interface, the firmware update process becomes extremely simple and intuitive.

SELF-DIAGNOSIS AND ALERTS

Self-diagnosis for detecting internal failures and RGB LED for signaling communication problems and alerts.

DIGITAL INPUTS AND OUTPUTS

There are a total of 7 fast-acting dry contact inputs for monitoring accessories and protections. They operate with an internal low voltage reference providing user safety. It also includes a self-diagnosis relay.

COMMUNICATION LOG DOWNLOAD

The SDG provides in its interface the download of the log of the communication protocols to facilitate the diagnosis of the network.

EXPERTISE IN EMBEDDED SYSTEMS

Treetech has experts in embedded operating systems with extensive experience in the area. This knowledge has been built into the SDG, making it an extremely safe and stable product, while remaining easy to operate.

REDUCED SIZE

Despite its advanced features, the SDG has an extremely small physical size, 38x114x155 mm (in the RJ45 model) and 38x 114x155 mm (in the FOFO or FO-Serial models).

STANDARD IP ACCESS BUTTON

The Smart Device Gateway includes a user-available button that allows the use of the factory default IP when network parameters are forgotten.



2.1.1 Inputs

- ✓ 7 inputs for monitoring dry contacts.

2.1.2 Outputs

- ✓ 1 relay for self-diagnosis indication.

2.1.3 Communication

- ✓ 1 RS-485 serial communication port;
- ✓ 1 RS-485 or RS-232 serial communication port;
- ✓ 2 Ethernet RJ45 ports (RJ45 model)*;
- ✓ 2 fiber optic Ethernet ports (FOFO model)*;
- ✓ 1 fiber optic Ethernet port and 1 serial fiber optic port (model FOSR)*;
- ✓ Modbus®, DNP3 and IEC 61850 communication protocol, with timestamp support, capable of signaling events with 1 ms precision.

* The customer must choose only one of the 3 configurations.

2.2 Web page

FRIENDLY WEB INTERFACE

Using the latest HTML5 and Bootstrap technologies, all SDG management and configuration are done directly on the equipment's web interface, without the need for a license or proprietary software installation.

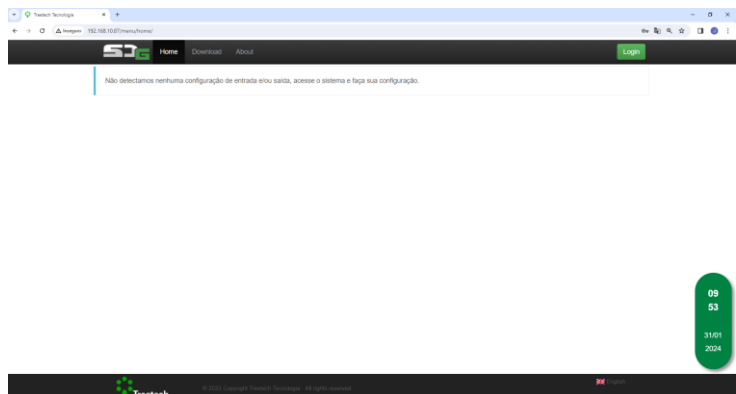


Figure 2 – Web page

REMOTE NETWORK SUPERVISION

It is possible to supervise the communication status and error statistics of the SDG.

Access to the details of the IEDs connected to the SDG allows you to follow the measurement values in real time.

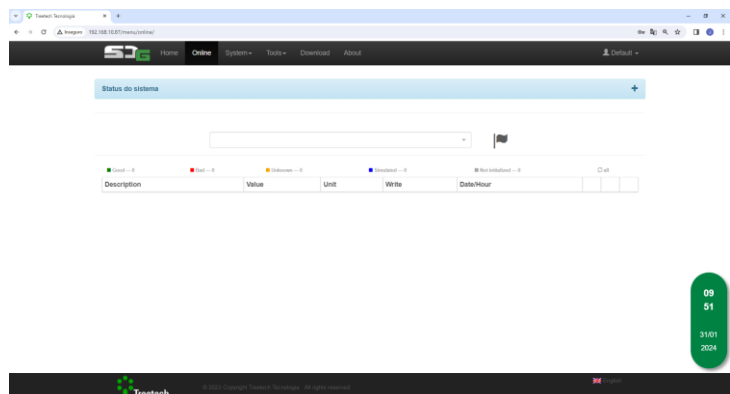


Figure 3 – Online tab



2.3 Basic operating philosophy

The Smart Device Gateway - SDG was designed to work directly with data acquisition and distribution from monitoring IEDs. It allows data acquisition from IEDs in Modbus® (RTU, TCP and/or RTU/TCP) and DNP3 (RTU and/or TCP) protocols. Once the acquisition is made, it is possible to redistribute this data into one or more protocols among Modbus® (RTU, TCP and/or RTU/TCP), DNP3(RTU and/or TCP) and IEC 61850.

Such uniqueness is achieved thanks to a data architecture created in the SDG called abstract data. In it, the acquisition of data in a given protocol causes it to be stored in an abstract variable that is not linked to any protocol. Thus, the data can be manipulated in several ways: protocol conversion, joining or separating bits and even duplication. You can also configure abstracts to simulate user-determined values.

The data distribution part of the SDG output protocols is totally flexible, allowing the creation of virtual IEDs. These can compose data from one or more IEDs mapped to the input. In addition, the addressing in the output protocols can also be customized.

All configuration is done through a simple and intuitive web page. Once configured, it is possible to monitor the status of active communication networks and download communication logs.

The Smart Device Gateway (SDG) is a device that has two communication ports available for interconnection with other systems. These ports can be configured according to the following options: 2 fiber optic connections, or 1 fiber optic connection and 1 serial fiber optic connection, or even 2 RJ45 connections.

It is important to point out that the two communication ports are independent of each other, as long as the “Bridge” mode is selected in the “System” → “Network” section of the web page, which means that they operate in isolation and do not share network addressing or processing resources. Each port is associated with a unique Internet Protocol (IP) address, thus ensuring the individuality of each connection and allowing efficient and independent communication with other devices or systems on the network.

Through this versatile configuration and the availability of different communication interfaces, the SDG offers a flexible and adaptable solution to meet the specific connectivity needs of different scenarios and applications.

2.4 Intended use

The intended use of the Smart Device Gateway - SDG is to facilitate the acquisition and distribution of data from monitoring devices in industrial and automation environments. It was designed to work with different communication protocols on its inputs and outputs, including Modbus® (RTU, TCP and/or RTU/TCP), DNP3 (RTU and/or TCP) and IEC 61850.



3 Design and installation

3.1 System topology

The monitoring functionality integrated by the SDG allows the connection with IEDs in a fast and effective way, extending the reliability of these equipments to a new standard of communication.

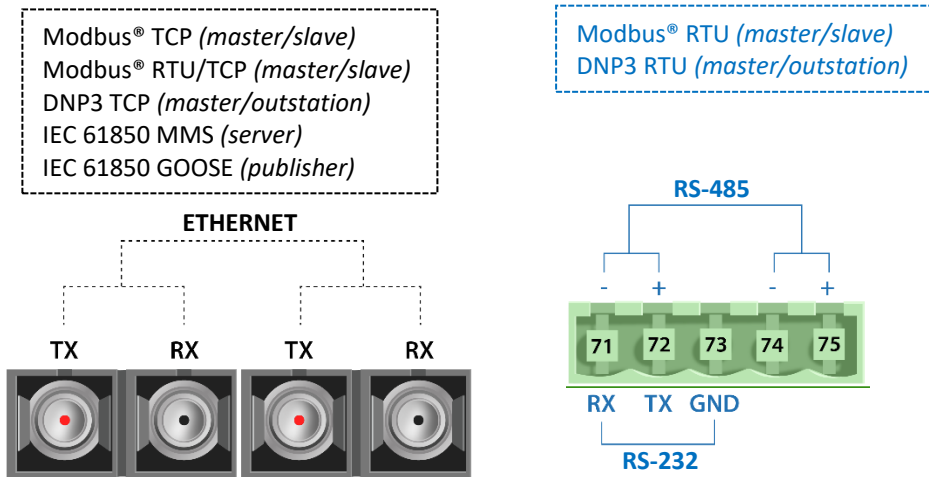


Figure 4 – Topology of the ports available in the fiber optic Ethernet model (FOFO)

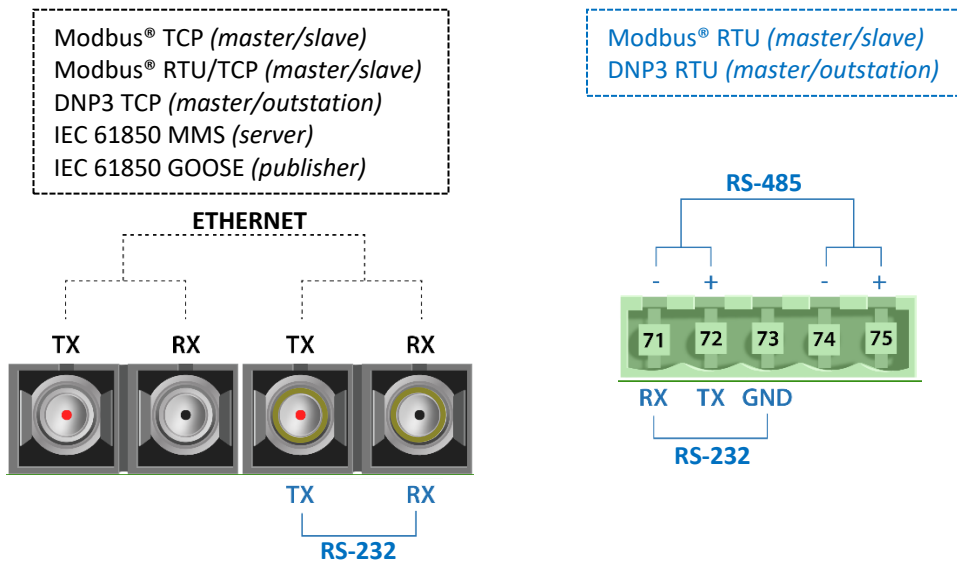


Figure 5 – Topology of the ports available in the fiber optic model Ethernet + serial (FOSR)

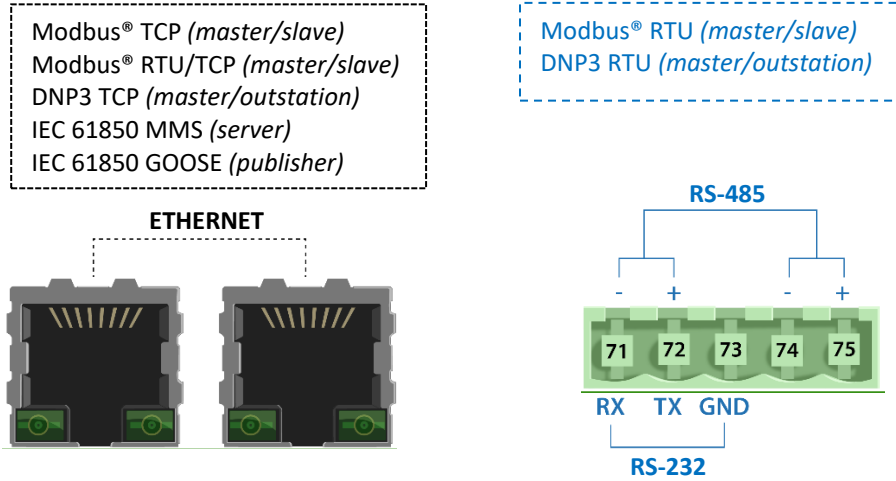


Figure 6 – Topology of the ports available in the RJ45 model (RJ45)

3.1.1 Application examples

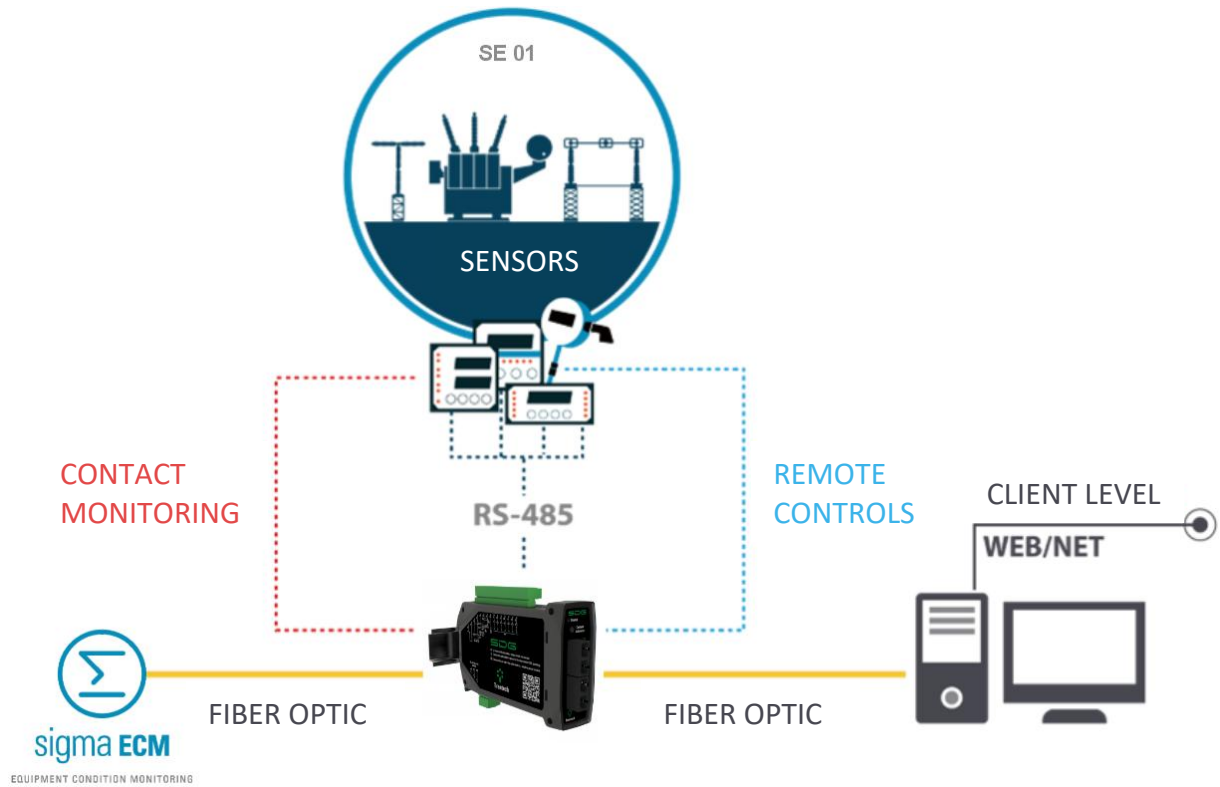


Figure 7 – Transformer scanning application example with SDG

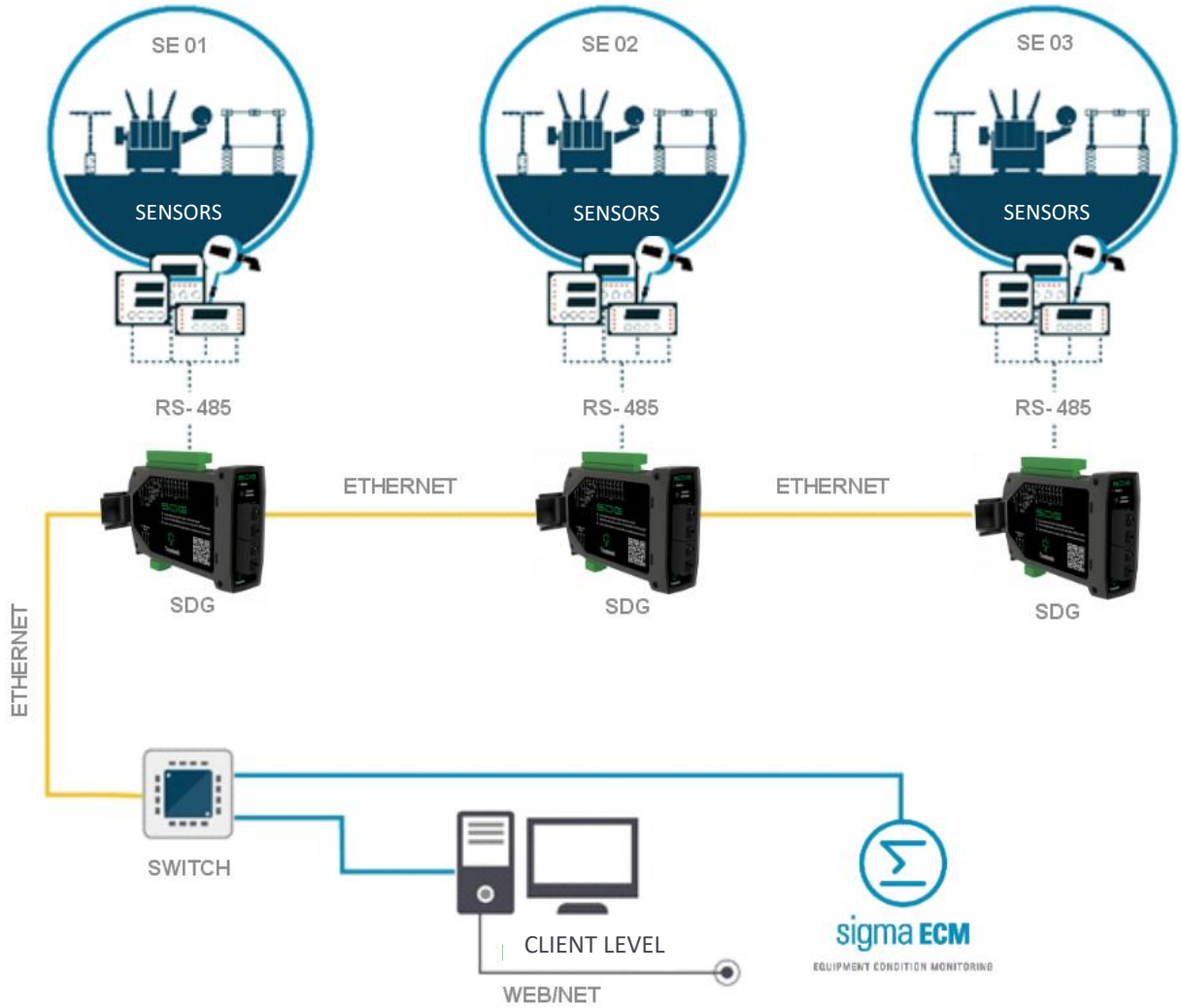


Figure 8 – Example of application that integrates several SDGs, which distribute data to more than one network



3.2 Mechanical installation

The Smart Device Gateway - SDG must be installed protected from the weather, inside panels or sheltered in a control room, for example. In either case, there must be an anti-condensation system.

The SDG is suitable for recessed installation and can be attached, for example, to doors or panel front plates. Fixing clips are supplied with the equipment. The following figures show the main dimensions of the equipment.

Special attention must be paid to the thickness of the paint layers on the plate where the cutout is made, because in some cases, when high-thickness paint is used, the reduction of the cutout area can even prevent the insertion of the equipment. The connection terminals are installed on the back of the SDG, in three removable connectors, in order to facilitate the connections. Cables from 0.3 to 2.5 mm², 22 to 12 AWG, bare or with pin (or needle) type terminals can be used.

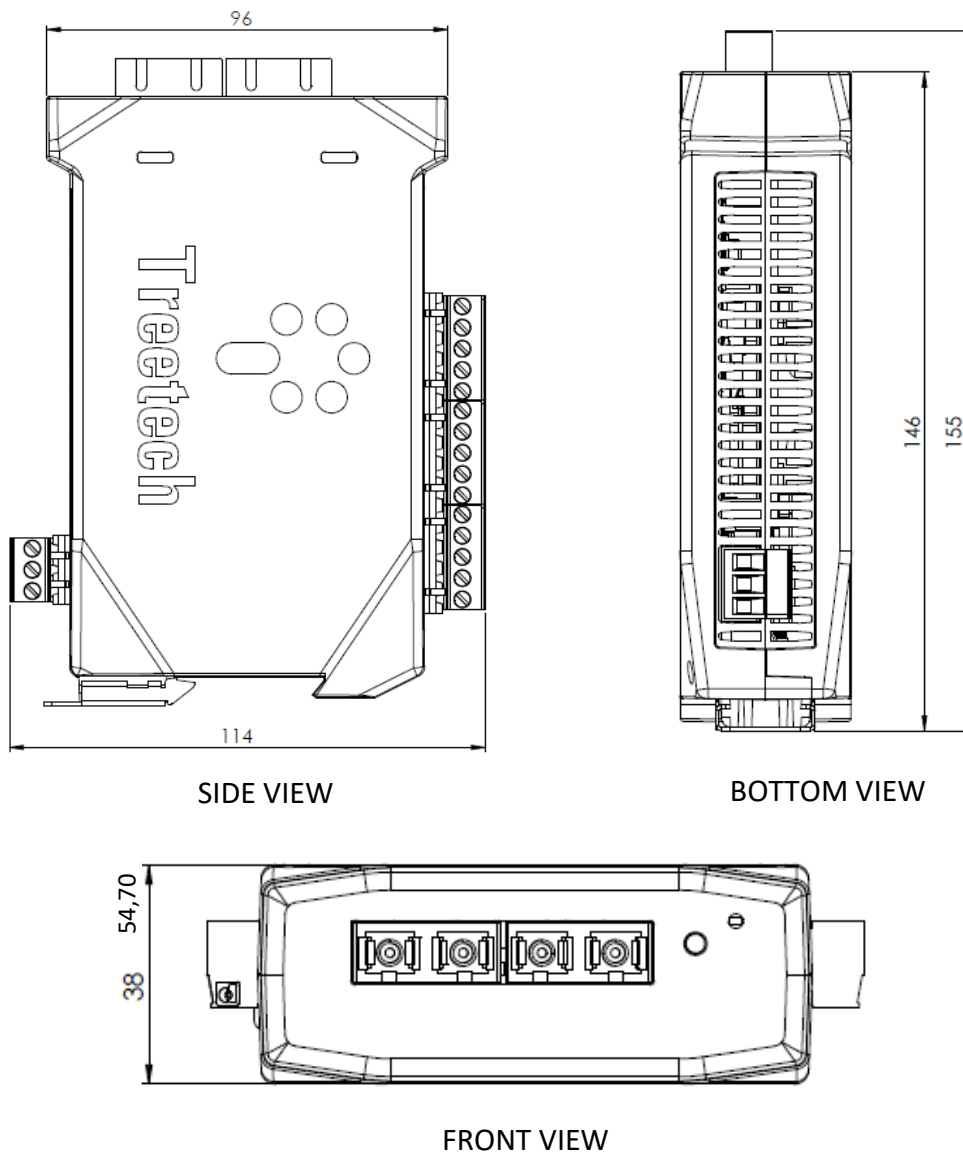


Figure 9 - Dimensions of SDG FOFO and FOSR (in mm)

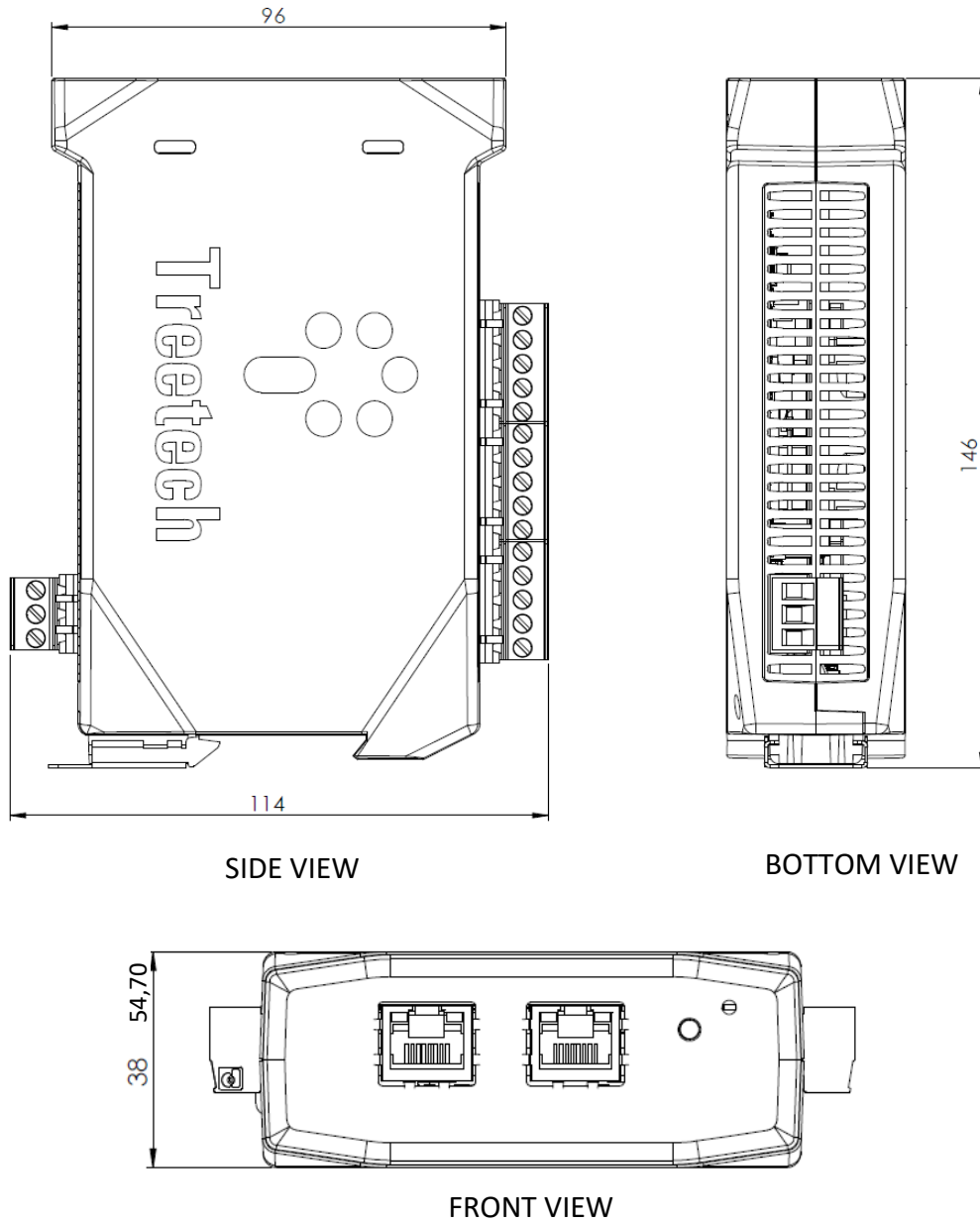


Figure 10 - SDG RJ45 Dimensions (in mm)



3.3 Electrical installation

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



Study and understand the application in which you intend to use the SDG. Get to know the functional, electrical and configuration characteristics of the SDG. In this way, you will be able to take full advantage of the equipment and minimize the risks to your safety.



This equipment works at dangerous supply voltage levels, which can cause death or serious injury to the operator or maintainer.



A circuit breaker must be used immediately before the power input (universal power - 85 to 265 Vac/Vdc, ≤ 13 W, 50/60 Hz), which corresponds to pins 2 and 3 of the SDG. This circuit breaker must have the number of poles corresponding to the number of phases used in the power supply - and the poles must only interrupt the phases, and never the neutral or ground - and provide thermal and electrical protection to the conductors that supply the equipment.

The circuit breaker must be close to the equipment and easily maneuvered by the operator. Additionally, it must have indelible identification showing that it is the SDG electrical disconnect device.



The following breaker specification is recommended when used exclusively for the SDG:

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

AC/DC Power, Phase-to-Phase: Bipolar circuit breaker, $1\text{ A} \leq I_n \leq 2\text{ A}$, curve B or C, standards NBR/IEC 60947-2, NBR/IEC 60898 or IEEE 1015:2006.



The minimum insulation for circuits connected to the SDG is 300 Vrms for auxiliary equipment and transducers and for equipment with its own power supply up to 50 Vrms. The minimum isolation is 1.7 kVrms for equipment powered up to 300 Vrms, according to IEC 61010-1.

These values are relative to the intrinsic isolation of the devices connected to the SDG. Cases in which this value does not apply to equipment or devices connected to the SDG will be explicitly informed in this manual.

The standard schematic diagram of the SDG connections shows all the connection possibilities that the equipment provides.

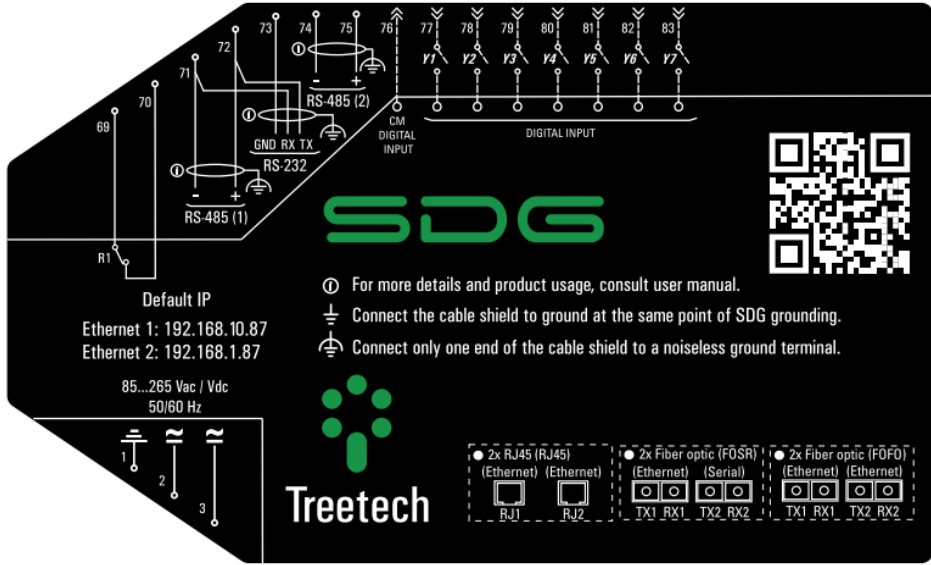


Figure 11 - Wiring diagram showing SDG input and output terminals



Special attention must be given to the correct connection of the components to the SDG at all stages of the installation. Errors in connecting the equipment can cause risks or even irreversible damage to the operator. Damage due to misuse is not covered by the warranty.



Figure 12 - Electrical connection diagram label in SDG



Below is the CE certification label, which identifies the product's compliance with European Union standards and technical requirements.

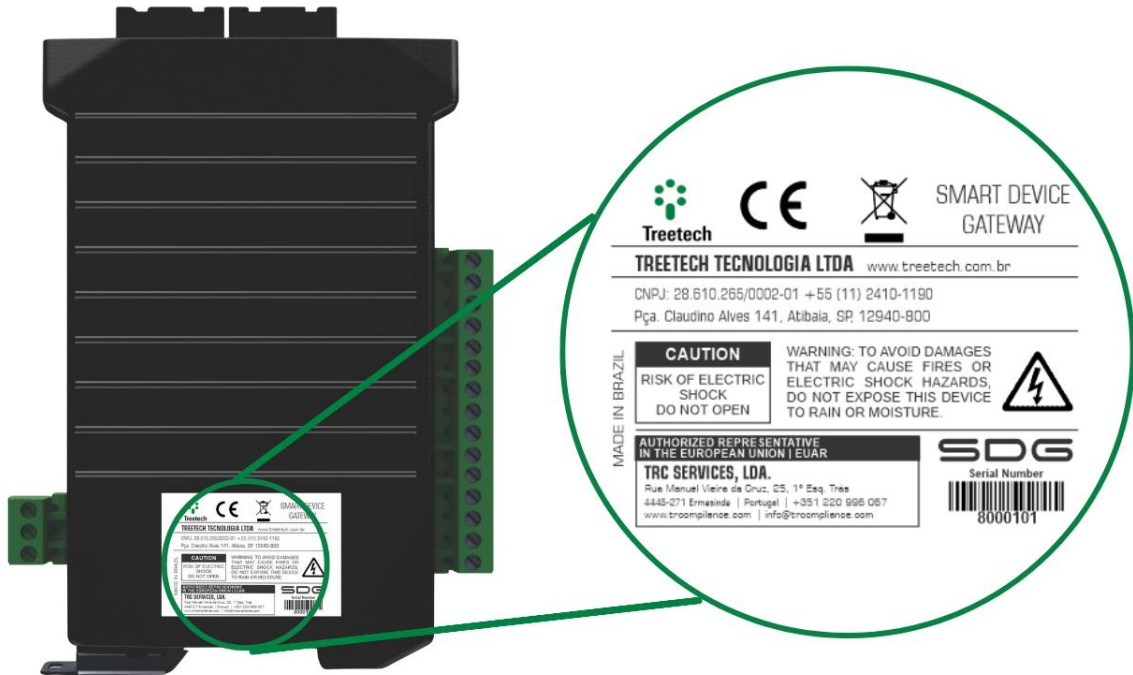


Figure 13 - CE certification label

In the following sections, the connections and functions of the inputs, outputs and communications of the equipment will be presented in more detail.

3.3.1 Input, output and communication terminals

Table 2 - SDG input terminals

Inputs	Terminals
Power and Grounding Inputs for universal power supply 85 to 265 Vac/Vdc, 50/60 Hz, ≤ 13 W.	1 – ground 2 – dc/ac 3 – dc/ac
Dry contact inputs These are the inputs for monitoring dry contacts.	76 – C1 (common) 77 – Y1 78 – Y2 79 – Y3 80 – Y4 81 – Y5 82 – Y6 83 – Y7

Table 3 - SDG output terminals

Outputs	Terminals
Self-diagnosis relay One potential free NC (Normally Closed) relay for self-diagnosis.	69 – NC 70 – Common



Table 4 - SDG communication terminals

Communication	Terminals
<p>Ethernet port</p> <p>Communication port via RJ45 or multimode fiber optic SC for communication between SDG and control/supervisory system or communication with IEDs.</p> <p>Input protocols: Modbus® TCP (master), Modbus® RTU/TCP (master) and DNP3 TCP (master).</p> <p>Output protocols: Modbus® TCP (slave), Modbus® RTU/TCP (slave), DNP3 TCP (outstation) and IEC 61850 (server/publisher).</p>	<p>RJ45 - 1 RJ45 - 2</p> <p>TX/RX - 1 TX/RX - 2</p>
<p>Serial fiber optic port</p> <p>Communication port via multimode SC optical fiber for communication between SDG and control/supervisory system or communication with IEDs.</p> <p>Input protocols: Modbus® RTU (master), DNP3 RTU (master).</p> <p>Output protocols: Modbus® RTU (slave), DNP3 RTU (outstation).</p>	<p>TX/RX - 3 TX/RX - 4</p>
<p>RS-485 communication ports</p> <p>The SDG has two RS-485 serial communication ports, which are intended to allow the connection between the SDG and any supervisory or monitoring system owned by the user or for communication with other IEDs.</p> <p>Communication is done using the Modbus® (master/slave) or DNP3 (master/outstation) protocol, via shielded twisted pair cable.</p>	<p>71 - (-) 72 - (+)</p> <p>74 - (-) 75 - (+)</p>
<p>RS-232 communication port</p> <p>The SDG has an RS-232 communication port for connection with any control, supervisory, monitoring or IEDs system.</p> <p>Communication is done using the Modbus® (master/slave) or DNP3 (master/outstation) protocol. It is recommended to use 3-way braided and shielded cable.</p>	<p>71 - RX 72 - TX 73 - GND</p>

3.3.1.1 Power and grounding

The SDG has a universal power input (85 to 265 Vac/Vdc 50/60 Hz). Powering the SDG through the substation auxiliary services is advisable especially when it is integrated into a communication network for data collection purposes for supervisory or monitoring systems.

3.3.1.2 Dry contact inputs

The SDG can continuously monitor the status of up to 7 external contacts.

3.3.1.3 Self-diagnosis relay

This relay is responsible for signaling power failures or any internal failure detected by the self-diagnosis system. When the SDG is energized, the contact of this relay changes state, returning to the off position in the event of internal faults or lack of power.



If the SDG processor temperature exceeds 90°C, a message will be displayed indicating that the update is not possible at this time for safety reasons; in this case, please wait for the temperature to decrease. However, if the SDG processor temperature is equal to or greater than 102°C, the self-diagnosis relay will be activated, and a warning will be displayed on the web page.



When all devices (IEDs) mapped to the input of an SDG experience communication failure (indicated in red on the web interface), the system will automatically activate the self-diagnosis relay.

3.3.1.4 RS-485 communication ports

The SDG can be connected to a data acquisition system (supervisory or monitoring system) or to other IEDs through the RS-485 serial communication ports. Up to 31 devices can be interconnected in the same communication network. The communication protocols available for this connection are Modbus® RTU (master/slave) or DNP3 RTU (master/outstation).

The interconnection of the RS-485 serial communication network must be carried out using a shielded, twisted pair cable, keeping the mesh without interruption throughout the route. If there is a need for intermediate terminals to interconnect the serial communication, also pass the cable shielding through the terminal, avoiding its interruption. The unshielded cable section due to the splice should be as short as possible, and it is advisable that the cable shield be grounded at only one end. It is advisable to use a 120 Ω terminating resistor at each end of the serial communication network to attenuate signal reflections.

In conjunction with the termination resistors, pull-up and pull-down resistors must be used at just one point in the network, as shown in the figure below. The 5 V direct voltage for powering the pull-up and pull-down resistors can be internal to the data acquisition system or IED. Note that some communication equipment may already have these resistors installed internally, dispensing with the use of external resistors. The maximum distance of 1200 m between the ends of the communication network must be obeyed.

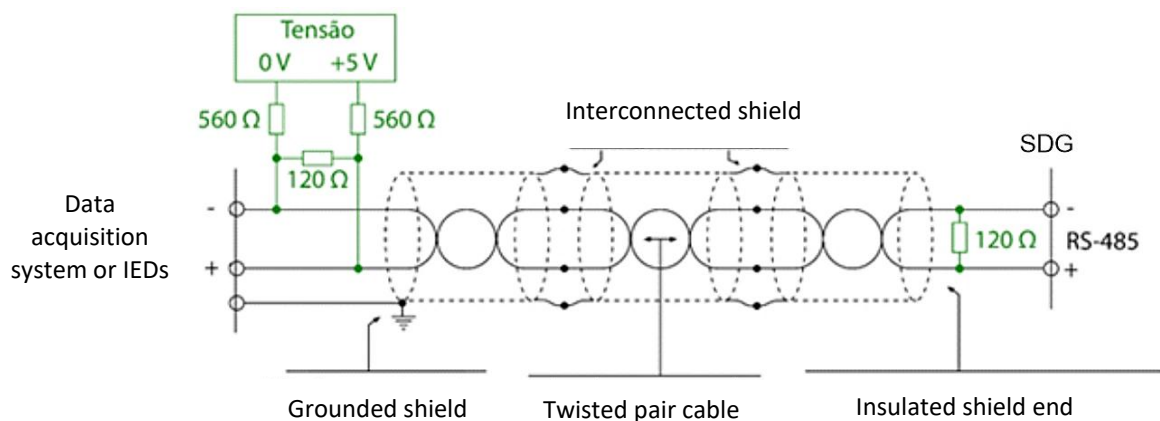


Figure 14 - RS-485 serial communication shield connection and grounding



4 Operation

Smart Device Gateway - SDG queries and configurations must be carried out through the web page. If there is any failure or intercurrent, the front LED will change color.

4.1 Button function

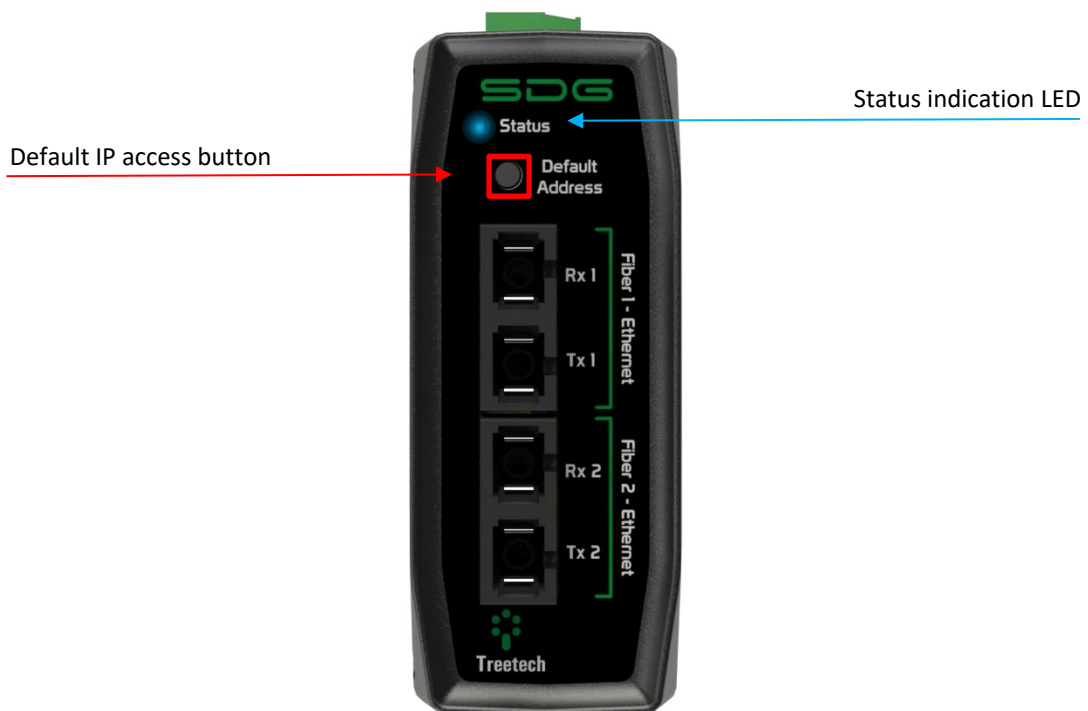


Figure 15 - "Default Address" button

The button located on the front of the SDG allows quick access to the device's default IP addresses. By default:

- ✓ IP "Fiber 1 - Ethernet": 192.168.10.87;
- ✓ IP "Fiber 2 Ethernet": 192.168.1.87.

If you forget the IP address configured on your device, follow the steps below:

- ✓ Press the front SDG button for 5 seconds;
- ✓ The LED will start flashing, indicating that the equipment is temporarily operating with the factory default IP address;
- ✓ Access the web interface using the default IP address corresponding to the desired interface;



- ✓ On the web interface, the user will be able to view the previously configured IP address;
- ✓ For the equipment to revert to the previous IP address, it will be necessary to confirm the change directly on the web page or restart it via the power supply.

4.2 Status LED

The SDG is equipped with an LED located on the front, which has crucial functionalities to indicate device status and communication. When turning on the board, the LED will show a green light, indicating that the SDG is working. During the boot process, once the kernel is loaded, the LED color will change to blue. After the system assumes its main function, the LED will start to replicate the color of the incoming communication, providing valuable information about the status of connected equipment.

Table 5 - Front LED color code

Color	Function
White	Waiting for input devices to initialize
Green	All input devices are communicating correctly
Orange	There is equipment in different conditions. It is necessary to enter the web page to see more details
Blue	SDG initialization
Red	All input devices are offline



5 Web interface

Using the latest HTML5 and Bootstrap technologies, the entire SDG management and configuration interface is done directly on the equipment's web page, without the need for a use license or installation of proprietary software.

With the Smart Device Gateway - SDG, it is possible to supervise the network status and communication statistics of the IEDs, both in master and slave protocols. Accessing the details of each input IED allows tracking measurement values in real time.

To access the SDG web page, just type the IP address of the equipment in a web browser with HTML5 support.

5.1 Login

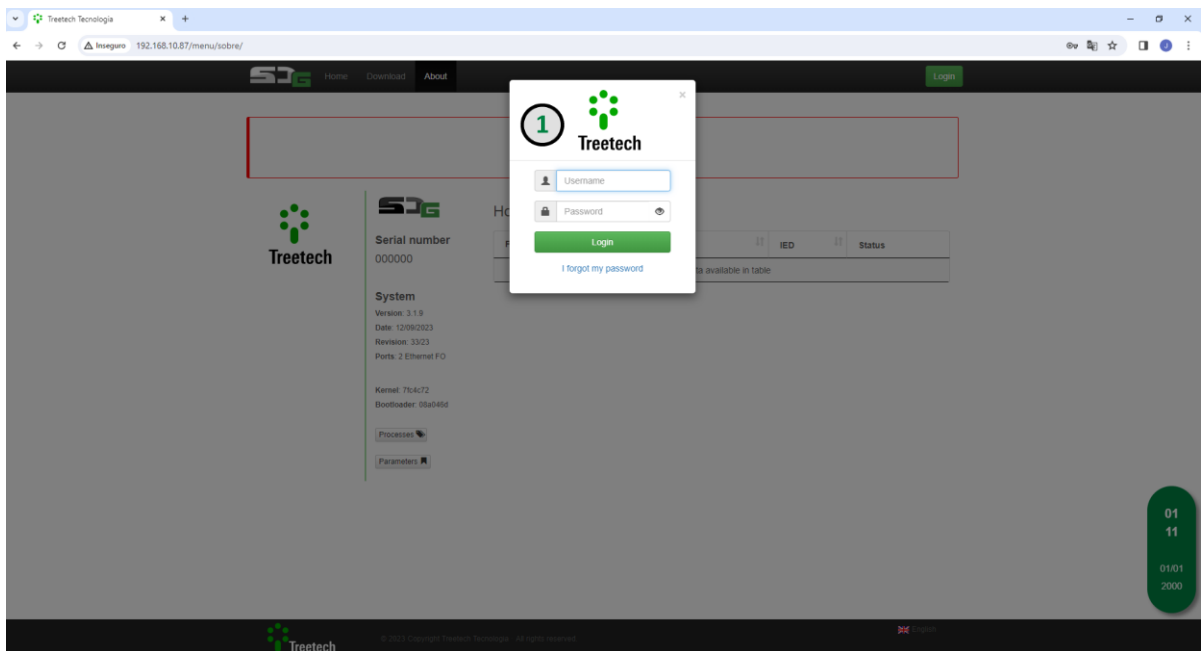


Figure 16 – Login tab

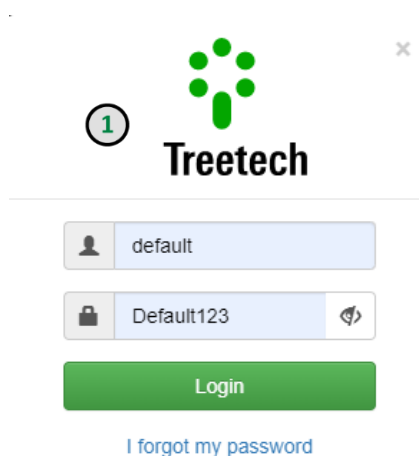


Figure 17 - Entering default login and password



1 Login and password

To access more details of the IED and acquire data online via the web page, you must have a valid username and password. To access this, just click on the green “Enter” button, located in the upper right corner of the screen.

A window will appear, with space for user identification and password. After filling in the spaces, just click on the green button “Enter” to access the system. Default login details are shown below.

- **Login:** default
- **Password:** Default123

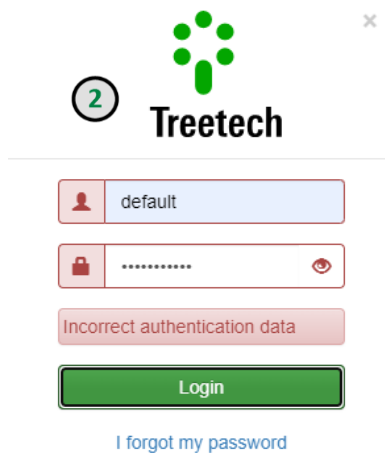


Figure 18 - Incorrect login username or password

2 Incorrect username and/or password

If the username and/or password are not correct, a message will be displayed inside a red text box, alerting to the error.

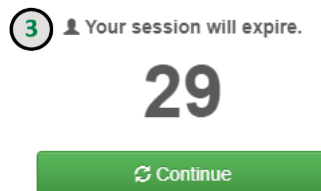


Figure 19 - Limit time

3 Limit time

If the user logs in, but does not remain active browsing the system, after ten minutes, the session expires. In the final thirty seconds, a countdown window alerts the user to the end of the session.



5.2 Home page

From this screen, it is possible to have an overview of the SDG communication status. This screen is accessed through the “Home” button located in the top menu.

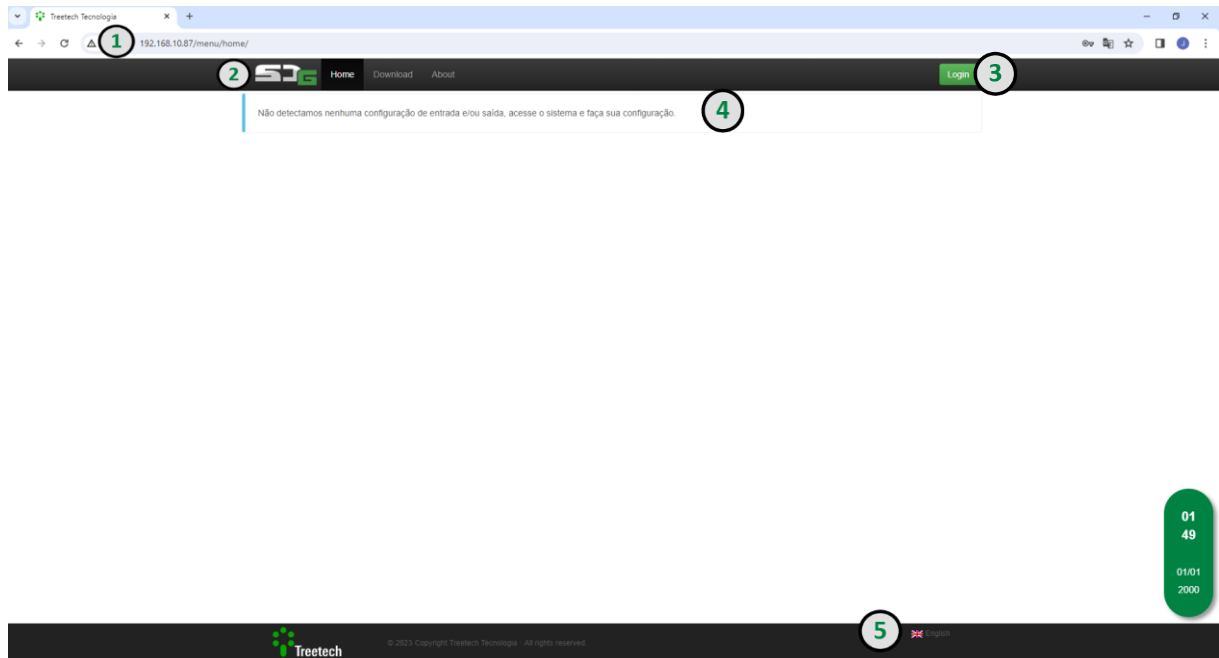


Figure 20 - Home screen of the SDG web page

1 IP address

The IP address displayed on the front of the product must be entered in a web browser with HTML5 support.

2 Product identification

In the upper left corner of the screen, the SDG logo identifies the IED.

3 Login

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

4 Inputs and outputs groups

In the central part of the screen, the user can consult and interact with the expansive blocks that represent the SDG input and output connections, their information, status and communication history.

5 Language

In the lower right corner of the home screen, the user can select the language. To do this, just click on the flag of the country of origin of the desired language.



5.3 General navigation

To facilitate navigation, the SDG website has a general symbology, which is repeated on several pages.

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

1 Navigation

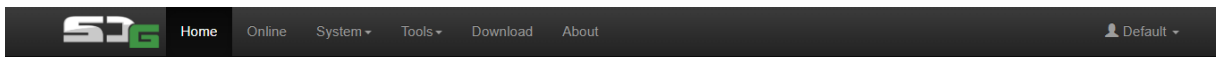


Figure 21 – Navigation tab

At the top of the screen, next to the IED logo, the user can navigate using buttons. Remember that before logging in, only the “Home”, “Download” and “About” buttons will be available.

2 Help buttons



Figure 22 – Help button

A small orange button with a question mark is located at strategic points that are easy to see on the screen. By clicking on the button, the user will have access to explanatory information about the fields and elements contained in the corresponding screen.

3 Search box



Figure 23 – Search box

To filter the content shown in the table, use the search box, usually located above a table.

4 Lists of items

Description	Value	Unit	Write	Date/Hour			
-------------	-------	------	-------	-----------	--	--	--

Figure 24 – Example of list of items

Below the search box, a table shows the list of items found. They can be sorted according to the filters in the first rows of the table.

5 Action buttons

Keep fields filled



Figure 25 – Action buttons



Three buttons, one green, one light blue and one red, located above the table, serve to execute actions. In addition, a checkbox to keep the fields filled in will be available just above the buttons, so that, when the action is finished, the fields are or are not preserved in the form.

⑥ Time

The green panel located on the bottom right shows the time in local format and the date. This panel is responsive, so the user can access local time and UTC information by hovering the cursor over the panel.



5.4 Online

Through this page, the user has access to all read variables and their respective values. It is also possible to make changes (writes) to the write or simulated variables.

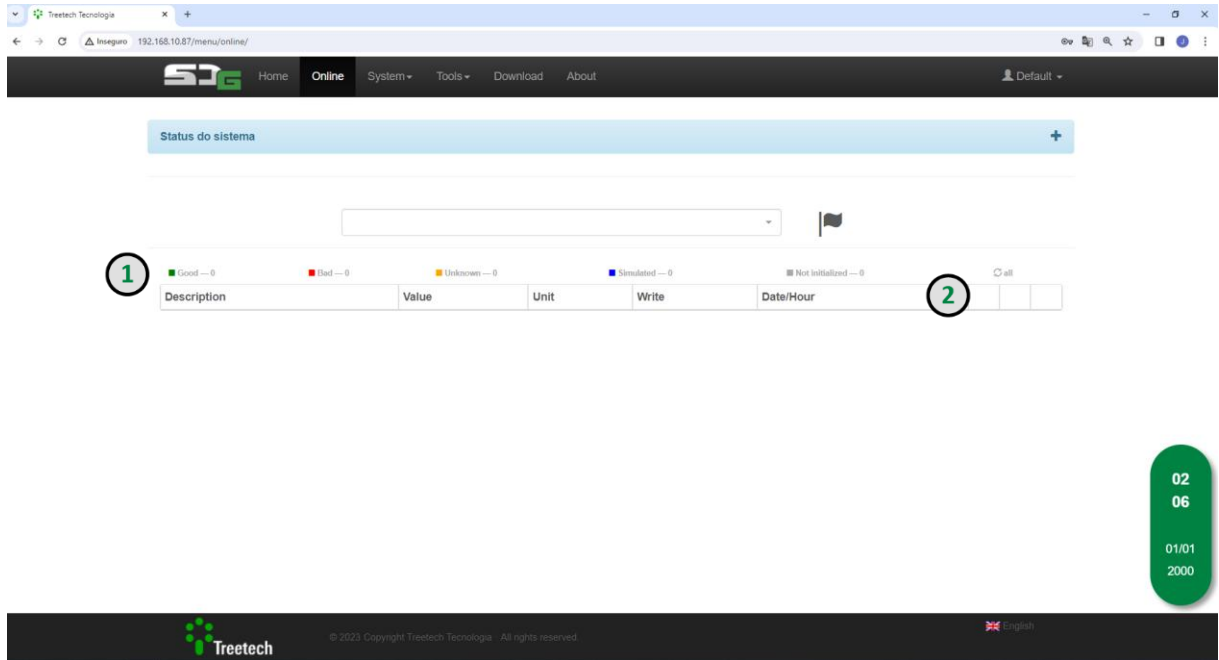


Figure 26 - "Online" button on the SDG website

1 Status

Color captions show the status of each abstract, as shown in the table below:

Table 6 - Points status caption

Color	Meaning
Green	Good communication
Red	Bad communication
Orange	Unstable communication (undetermined)
Blue	Abstract is set to simulated
Grey	Abstract has never been read

2 Filters and table navigation

The table header allows the user to sort the abstracts by "Name", "Value", "Unit", "Writing", "Description" and "Date/Time".



5.5 System

Through the “System” button, the user will be able to access the network settings, the system clock and date adjustments, the process manager, the system reset and restore commands, the update screen and the functions of exporting and importing configurations.

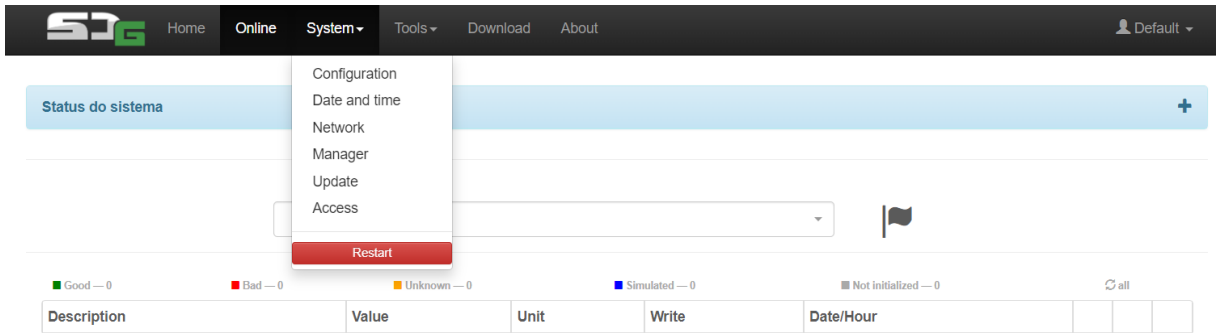


Figure 27 - Items from the “System” button on the SDG web page

5.5.1 Settings

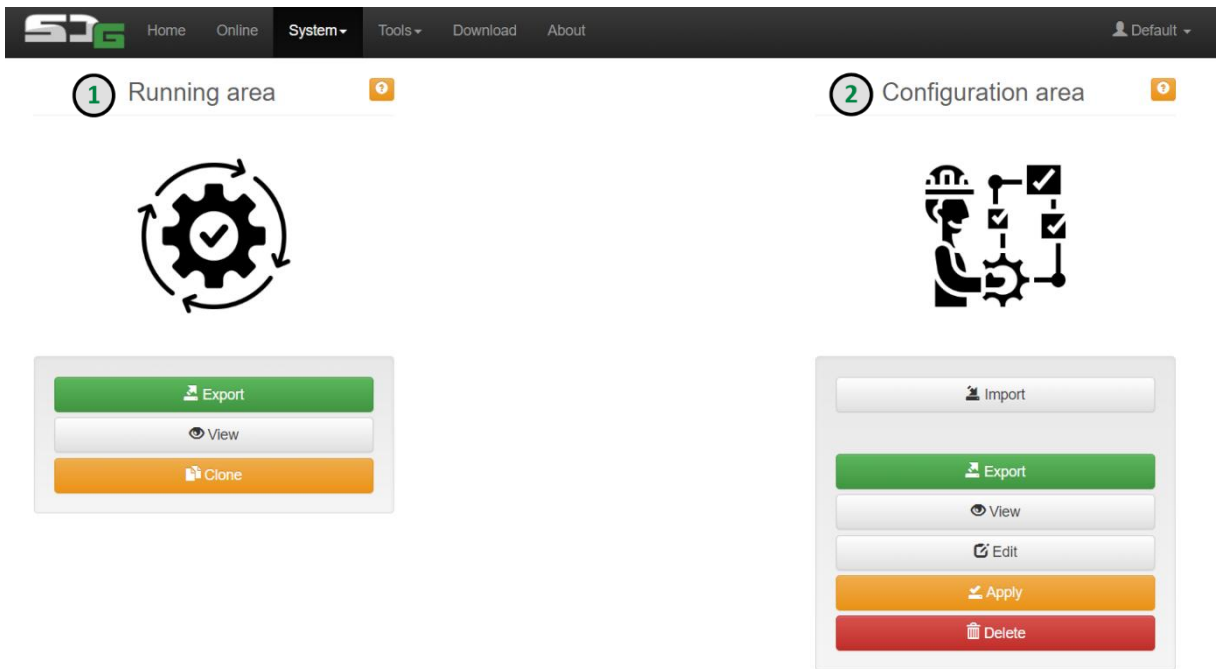


Figure 28 - System screen → Configuration



1 Running area

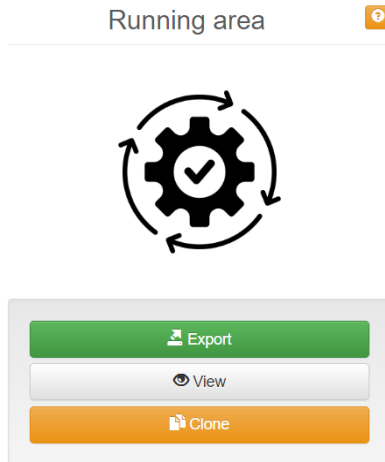


Figure 29 – Running area

The running area stores current data being used by system processes. It is a non-volatile area, however it cannot be edited at runtime.

- **Export:** Download a copy of the current data, in encrypted format (.back) that serves as a backup for any updates;
- **View:** Allows you to observe the data that is running for inputs and outputs. Changes are not allowed;
- **Clone:** Makes a copy of the data to the configuration area that allows changes.

2 Configuration area

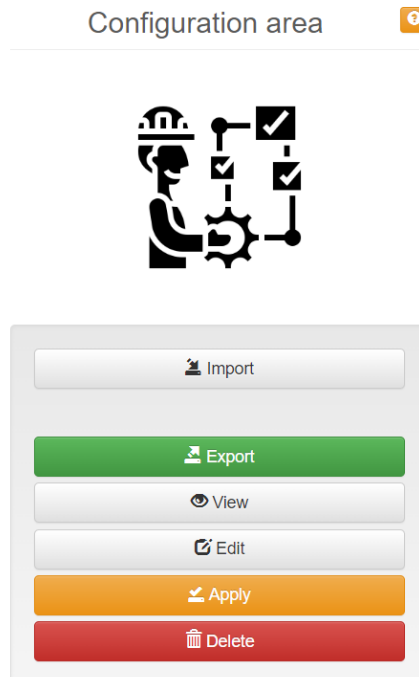


Figure 30 – Configuration area



The configuration area stores data that will help with future changes to the system. This data, while not applied, does not interfere with the execution of the system. It is a non-volatile area and can be edited at any time.

- **Import:** Action that allows importing the file (.back). For security, it is encrypted;
- **Export:** Download a copy of the data from the configuration area, in encrypted format (.back) that serves as a backup for any updates;
- **View:** Allows you to observe the data that is in the configuration area. Changes are not allowed;
- **Edit:** This mode allows only one user at a time to make changes to the system, this will ensure consistency. The access time will be the same as the session when logging into the system. After the time expires, it will be used by a new user. Any change will only take effect after applying the modifications from the configuration area to the running area;
- **Apply:** It makes a copy of the data to the running area, this command changes the data that will be used by the processes, therefore it demands the restart of the IED;
- **Delete:** Action that allows you to erase configuration data, keeping in mind that this data does not interfere with the execution of processes that will continue to function normally.

5.5.1.1 Configuration area (Mapping)

5.5.1.1.1 Definitions

Area for defining equipment input and output protocols and connections.

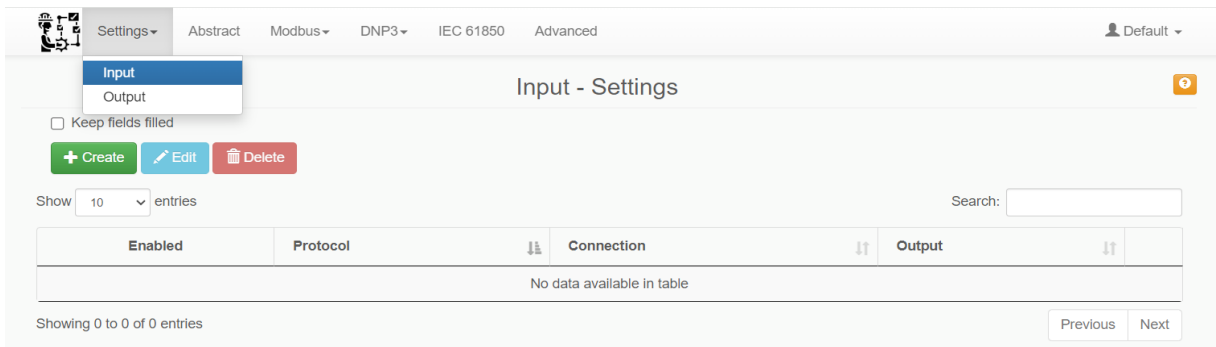


Figure 31 - Configuration area → Definitions → Input

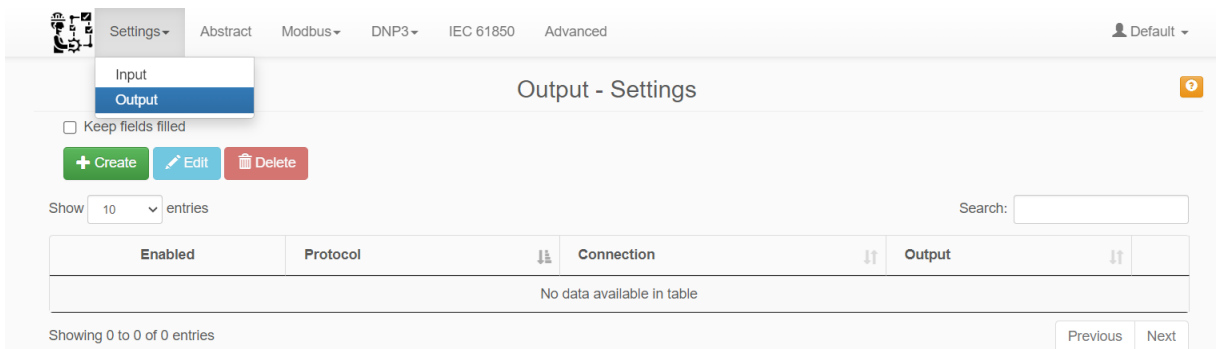


Figure 32 - Configuration area → Definitions → Output



5.5.1.1.2 Abstract

Register the abstract independently of any protocol, dispensing with the use of bit masks or specific configurations. The purpose is to configure the data in a unique way, considering, for example, that if an IED has 3 alarms, it is necessary to register 3 alarm abstracts instead of each alarm in a separate bit.



Figure 33 – Configuration area → Abstract

5.5.1.1.3 Modbus

In this menu it is possible to configure the input and output of the Modbus protocol.

The Input menu is responsible for associating the input IED tables according to the type and reading method.

The Output menu, in turn, is responsible for associating the IED fields with the record.

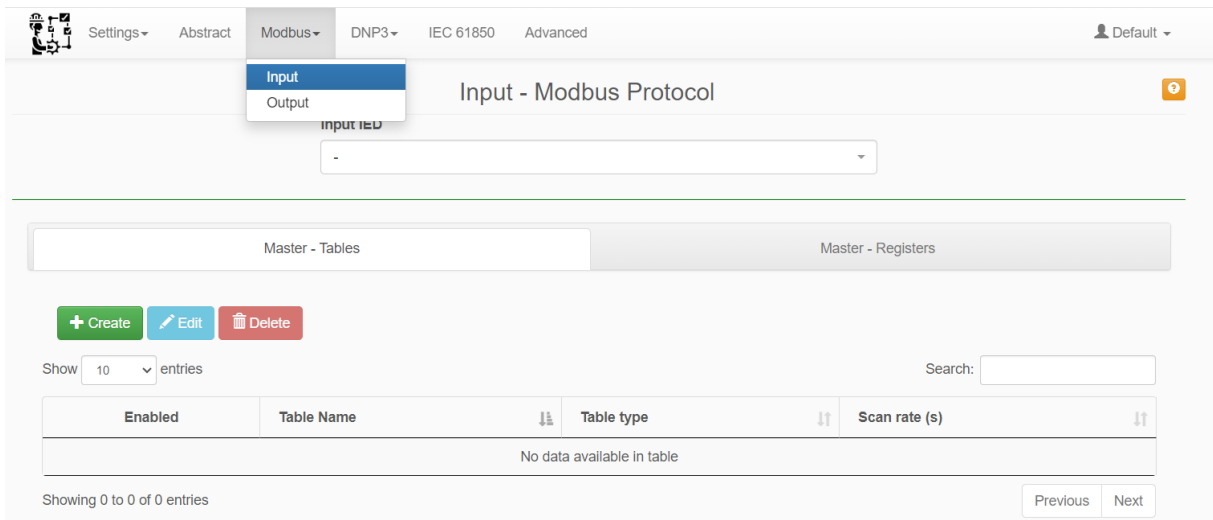


Figure 34 – Modbus → Input

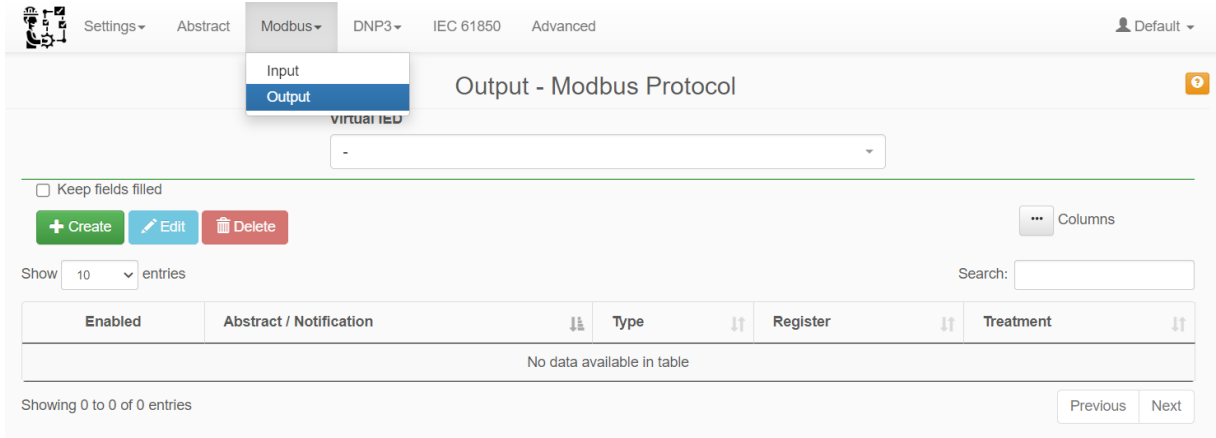


Figure 35 – Modbus → Output

5.5.1.1.4 DNP3

In this menu it is possible to configure the input and output of the DNP3 protocol.

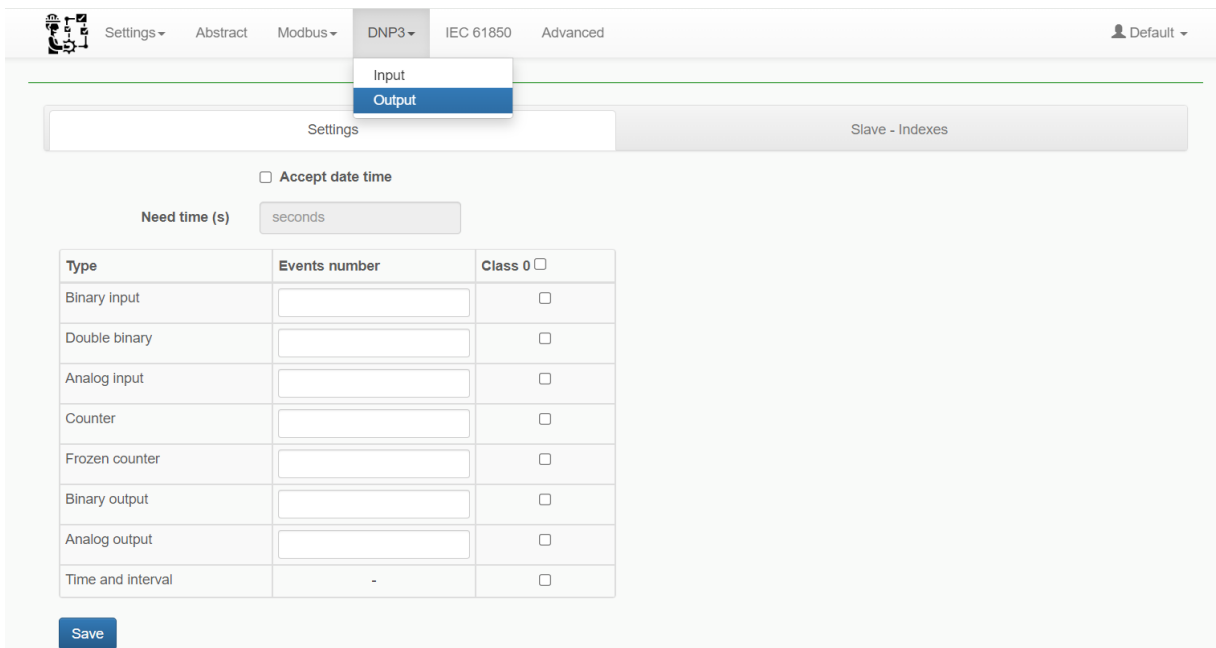


Figure 36 - DNP3 configuration area

5.5.1.1.5 IEC 61850

In this menu it is possible to configure the output settings of the IEC 61850 protocol.

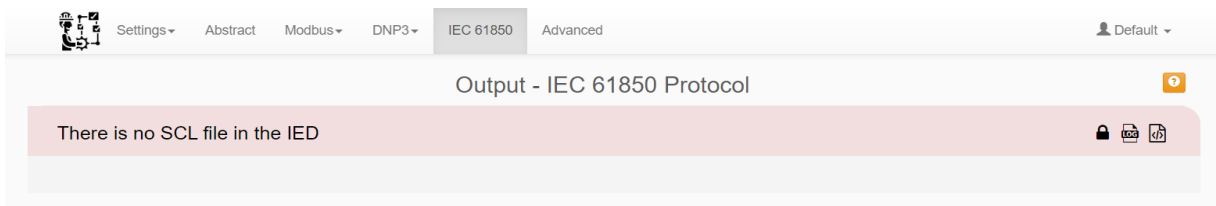


Figure 37 - Configuration area - IEC 61850



5.5.1.1.6 Advanced

The Advanced menu writes the system clock to the selected IED.

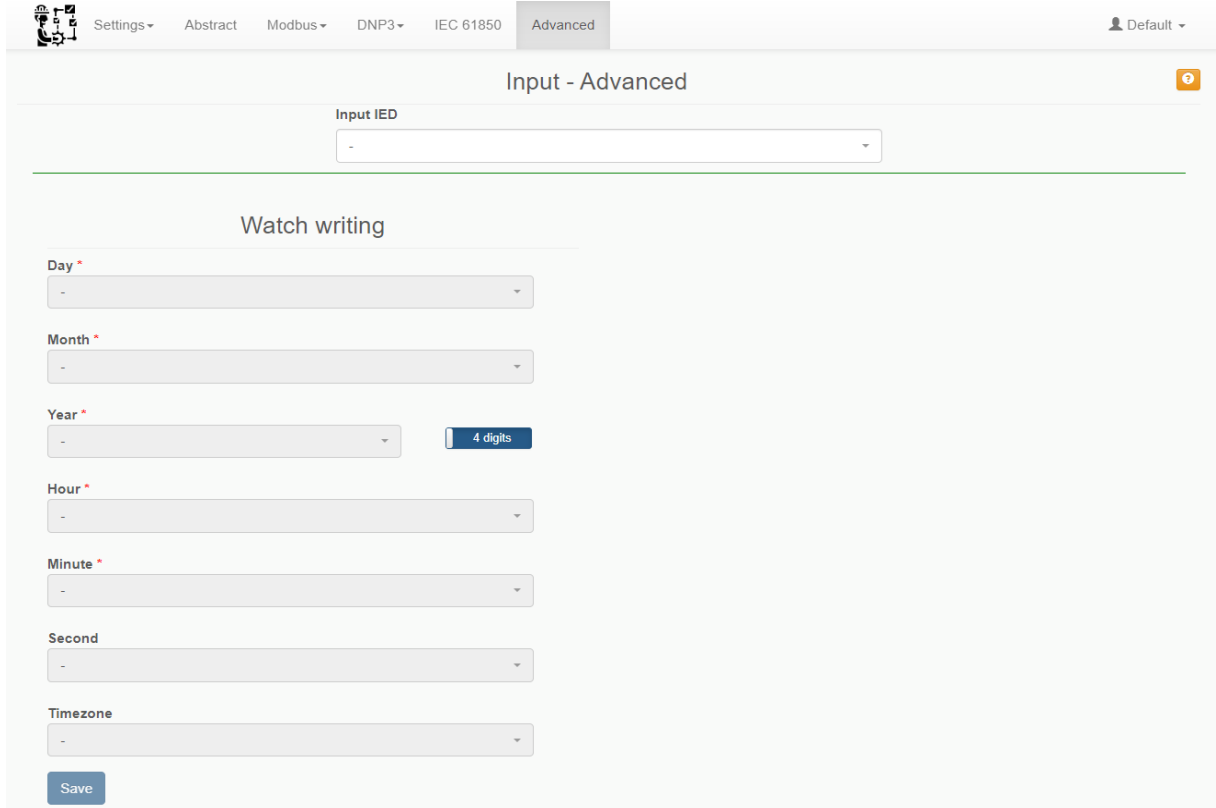


Figure 38 – Configuration área - Advanced

5.5.2 Date and time

On this screen, the user can modify the date and time of the SDG.

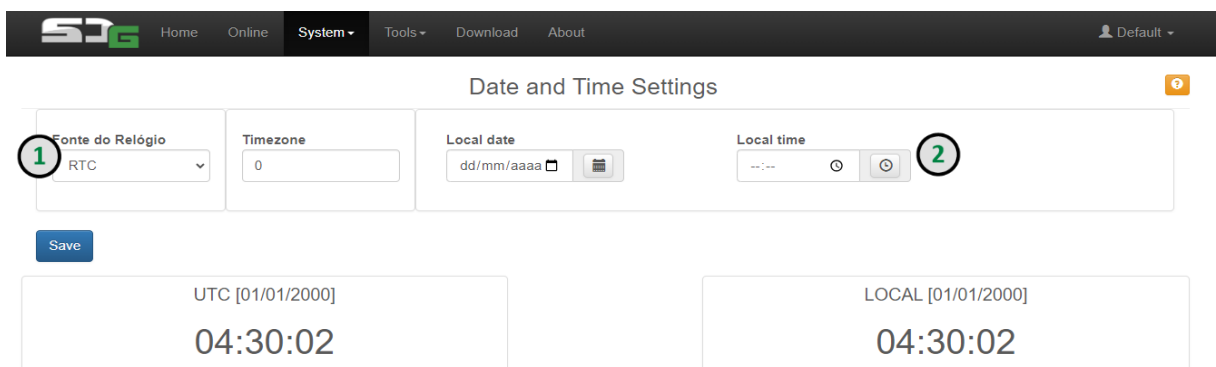


Figure 39 - "System" button, "Date and time" item on the SDG web page



1 Clock source

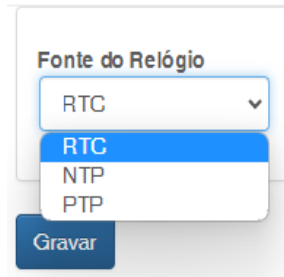


Figure 40 – Clock source

In the source button, three options are available:

- NTP: which uses Ethernet settings to update the clock;
- RTC: which allows manual adjustment of the time;
- PTP: used to synchronize device clocks in real-time networks, providing high accuracy in measuring time between systems.

If the chosen option is NTP, the user must also choose the time zone, the IP and the interval for the update.

If the source is RTC, the user, in addition to selecting a time zone, must manually adjust the date and time of the equipment. To make it easier, it is possible to copy the date and time from the local computer by clicking on the icons attached to the adjustment fields.

If the PTP protocol is chosen, the time zone and the IP address must be configured.

2 Settings form

By toggling the previously mentioned source button, the form will be readjusted to the necessary settings for the chosen source.

5.5.3 Network

On this screen, the network settings are available.



Figure 41 - "System" button, "Network" item on the SDG web page

User can manually modify IP address and netmask of both primary and secondary IP. In addition, it is possible to change the gateway address, DNS 1 and DNS 2.

1 Operation mode

Figure 42 - Bridged and Standalone operating mode

The operation mode has two ways of configuration, which are:

- **Bridge:** the two Ethernet communication ports have the same IP address, mask and gateway;

Figure 43 - Bridge mode of operation



- **Standalone:** the two Ethernet communication ports are independent and have a different IP address, mask, gateway, and MAC address.

Figure 44 – Standalone mode of operation

5.5.4 Manager

This screen contains the SDG process manager.

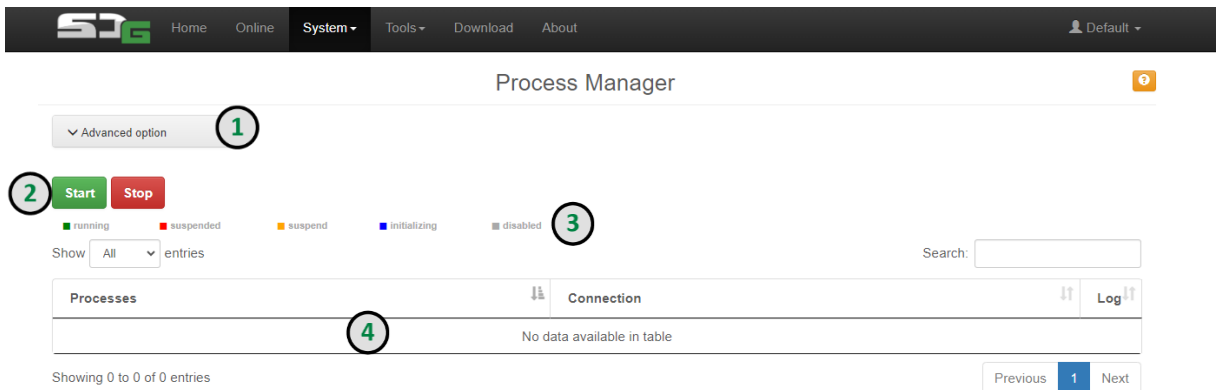


Figure 45 - “System” button, “Manager” item on the SDG web page

1 Advanced option

Figure 46 – Advanced option

When clicking on “Advanced option”, two checkboxes, “Input” and “Output”, allow the user to choose the group to be managed. Both groups can be selected simultaneously.

2 Action buttons





Figure 47 - Start and stop buttons

The buttons “Start”, in a green box, and “Stop”, in a red box, allow the user to start or stop the processes of the input and/or output groups of the SDG.

3 Captions



Figure 48 – Color captions

Below the buttons, small colored labels show the possible states of each process: running, suspended, suspend, initializing and inactive.

4 List of processes

In the white frame with blue borders and in the frame below the search box, a list of found processes is shown.

5.5.5 Update

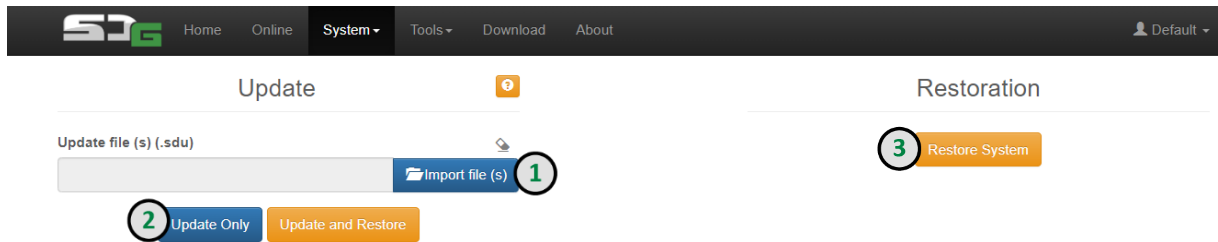


Figure 49 - “System” button, “Update” item on the SDG web page

1 Import file

By clicking on the blue “Import file(s)” button, a window will be displayed, allowing the user to select the file in “.sdu” format for updating the equipment.

2 Update only/update and restore

After importing the update file, just click on one of the options below to update the equipment.

- Update only: will perform the update without restoring factory defaults;
- Update and restore: will perform the update and restore the factory defaults, this is necessary in cases where the update includes changes in the application version.

When updating by restoring factory defaults, the user login password will be requested and it will be possible to check the option “Keep IP address”. If this option is not checked, the equipment will return to the default IP (192.168.10.87).



3 Restore system

The SDG web page guarantees the possibility to restore all the product's factory settings. To do this, click on the orange “Restore System” button. The user's login password will be requested. Only users with permission will be able to perform such an operation. It will also be possible to check the “Keep IP address” option so that the user maintains access to the same address that is already configured. If this option is not checked, the equipment will return to the default IP.

5.5.6 Access

On this screen, you can configure secure access to the web page via the HTTPS protocol.

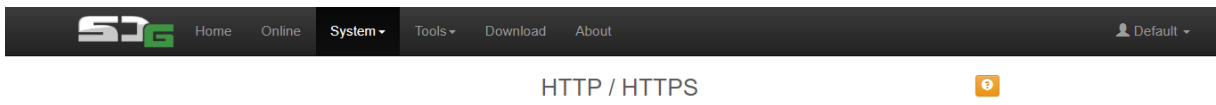


Figure 50 - “System” button, “Access” item on the SDG web page

5.5.7 Restart

The SDG web page allows the user to restart the equipment remotely. To do this, just click on the “System” button and then on the “Restart” item.

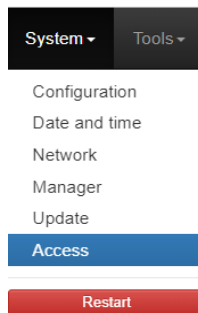


Figure 51 – Restart button



5.6 Tools

5.6.1 DNP3 decoder

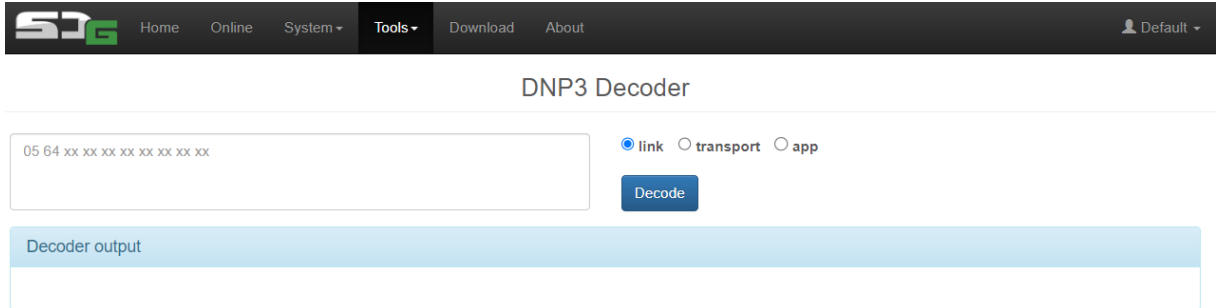


Figure 52 - DNP3 decoder

A DNP3 decoder is used to analyze the received DNP3 messages, interpret the different fields and data structures, and extract the relevant information contained in these messages. It can be used to debug DNP3 networks, monitor data traffic, log events and analyze system performance. The decoder is also useful for testing compliance of DNP3 implementations and verifying that devices are communicating correctly within the network.

5.6.2 Mirroring

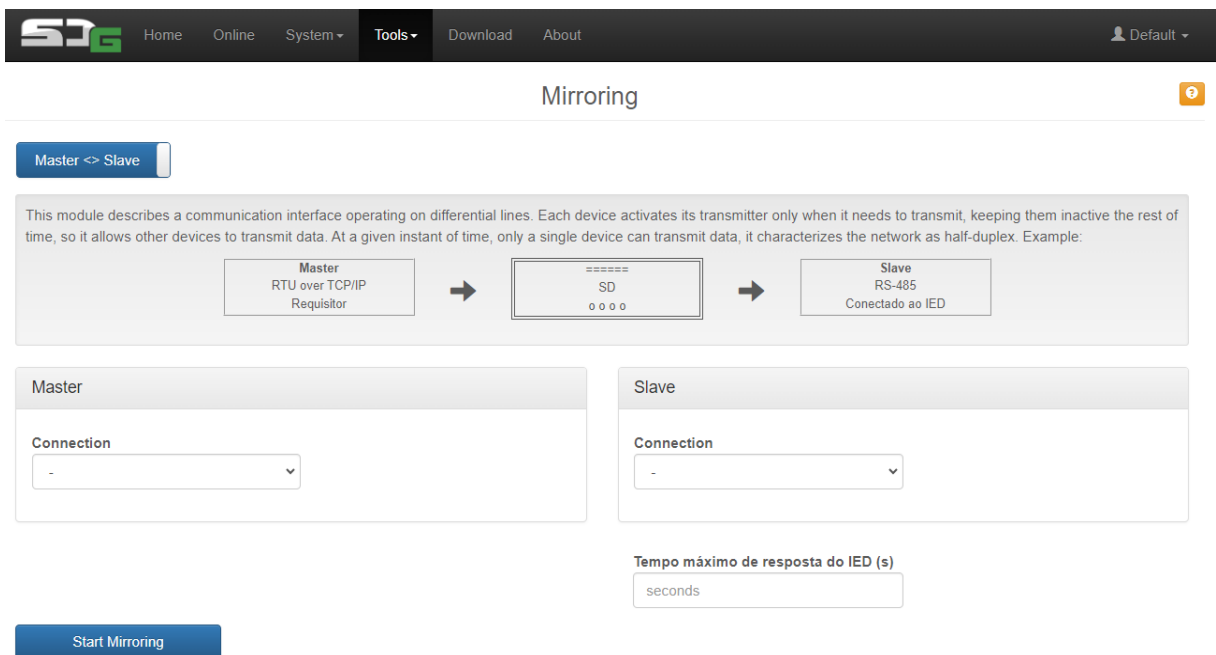


Figure 53 - Mirroring

This module describes a communication interface operating on differential lines. Each device turns on its transmitter only when it needs to transmit, keeping it off the rest of the time to allow other devices to transmit data. At a given instant of time, only one device can transmit, which characterizes this network as half-duplex.



5.6.3 Download log

Through the SDG website, it is possible to download the Treetech equipment log. Within the page, select the banks of interest for download (if the chosen equipment is the Bushing Monitor - BM). Then, select an already mapped connection or configure the connection in the fields below. Select the type of connection, configure the fields “Retries”, “Timeout (ms)”, “Address” and the parameters “Data bit”, “Parity”, “Stop bit” and “Speed (bps)”, or “IP” and “TCP port”, depending on the selected connection type.

Figure 54 - BM log download via SDG web page

The SDG stores only one BM log download in its memory, therefore, on each new request, the previous log is overwritten.

After configuring the connection, click the “Start Download” button. At this time, a pop-up message will appear warning you that previously downloaded files will be deleted, confirm to continue with the download. During the log download, all SDG communication is stopped momentarily and is automatically re-established after the download is complete.



5.6.4 Loader

SDG Home Online System Tools Download About Default

Loader

Updating File (.img) Import file

Board
-

Baudrate
-

Connection
-

Address
min: 1 max: 65535

Advanced Configurations +

Log Read Save

Figure 55 - Loader

On this screen it is possible to perform the firmware update using an .img file as a base.



5.7 Download

5.7.1 Log

The “Log” item, accessed by the “Download” button, allows the user to download, in a text file, the communication log of all ports and protocols used. It is also possible to download the application log, the system log and current configurations to be sent to Treotech in case of a help request.

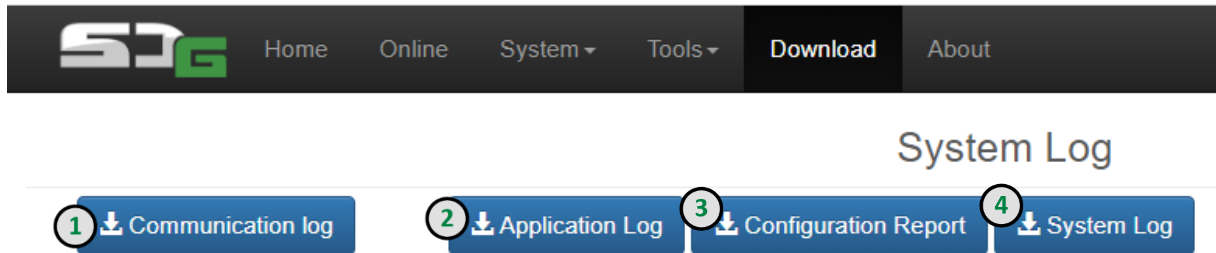


Figure 56 - “Download” button, “Log” item on the SDG web page

① Download communication log

To download the communication log, the user must click on the first blue button, on the left of the screen. The downloaded text file represents the history of input and output communication.

② Download application log

The application log is also recorded and a report can be downloaded by the user. Just click on the second blue button. Although the user can download it, **access to this log is restricted to Treotech technical support.**

③ Download configuration report

The last type of log available for download is the configuration log. Located in the upper right corner of the screen, a blue button allows you to download this report. Although the user can download it, **access to this report is restricted to Treotech technical support.**

④ Download system log

Another log available for download is the system log. To download it, just click on the third blue button. Although the user can download it, **access to this log is restricted to Treotech technical support.**



5.7.2 Oscillography

Some Treotech IEDs, such as the IDM, the IDX and the IDS, for example, are capable of generating oscillography. By accessing the “Oscillography” item through the “Download” button, the user can download these records. Downloading oscillograms via SDG is only compatible with Treotech IEDs.

The IED is identified with its name in the top bar, representing its status, according to the page's general caption. The user is informed of the number of the last oscillogram generated by the equipment (current oscillogram), the number of the oscillogram read at the moment by the SDG (synchronizing oscillogram) and the number of downloads not completed by the SDG, caused by possible errors in the download process.

1 Resynchronize

The SDG clears the oscillogram history and starts a new download process. When clicking on the “Resync” button, a message will be displayed on the screen alerting the user that the process will delete all previous files and will download again, confirm to continue.

2 Oscillograms available for download

A table with oscillograms available for download will be displayed inside the IED block. It brings detailed information for each oscillogram, allows filtering and ordering by different variables that form the table header.

3 Bulk download

To download more than one oscillogram at once, the user must select the desired oscillograms in the table by checking the checkboxes of the corresponding lines and then click on the “Download Selected Items” button located on the right above the table.

4 Individual download

To download just one oscillogram, just click on the green button located on the same line as the desired oscillogram.



5.8 About

This is the query screen for the system information. Here the user finds data such as: serial number of the equipment, version of the system and of the installed application. In addition, when interacting with the buttons below the screen, the user has access to some information from “Parameters” and “Changelog”.

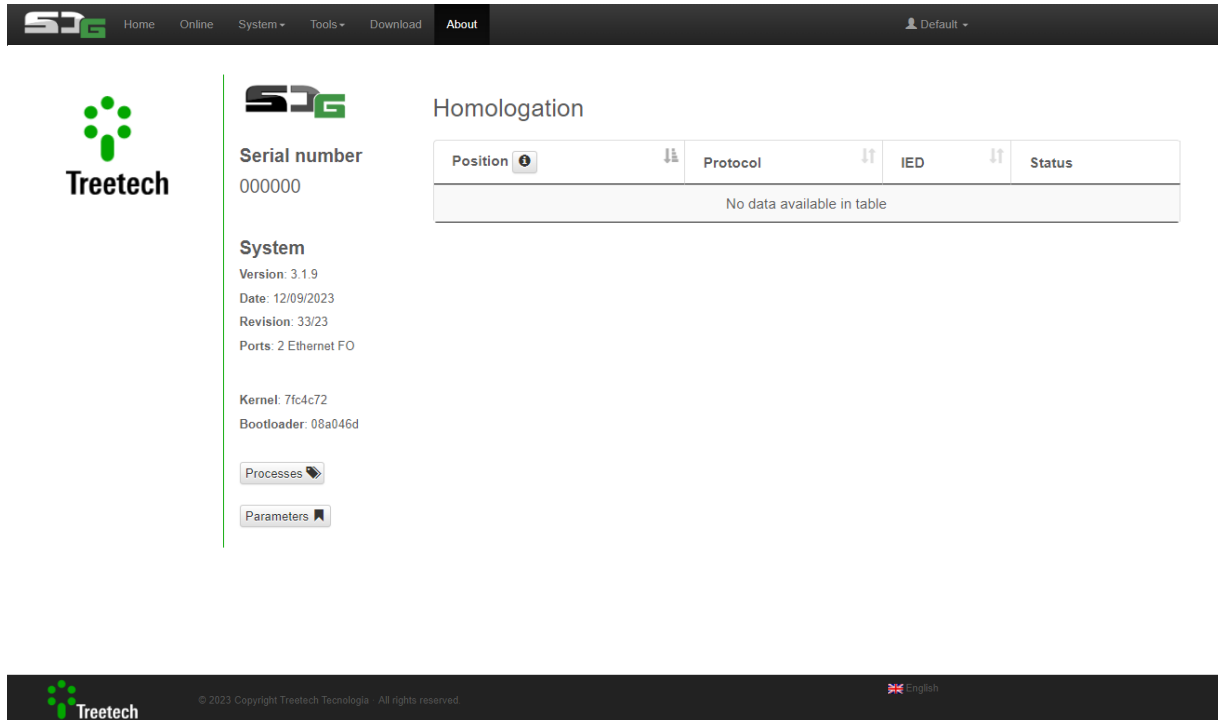


Figure 57 - “About” button on the SDG web page



5.9 Editing the profile

Profile	View	Operate	Setup
Online	✓	✓	✓
Modbus	✓	✓	✓
DNP3	✓	✓	✓
IEC 61850	✓	✓	✓
System	✓		✓
Users	✓		✓
Tools		✓	

Figure 58 - "Edit profile" item on the SDG web page


1 Access


Figure 59 - Access to the "Edit profile" item

If the user wants to make changes to the profile, changing the password or login username, just click on the corresponding username available in the upper right corner of the upper menu. In the expandable menu, the user must click on the item "Edit profile" to access the page shown above.



2 Language, date format, clock and website notifications

Preference 

Language
 English

Date format

dd/mm/yyyy (31/01/2024)

mm/dd/yyyy (01/31/2024)

yyyy/mm/dd (2024/01/31)

Use 24-hour clock


Restore warnings

[Change](#)

Figure 60 - "Preference" field

On the left side of the screen, just below the title "Preferences", the user can configure preferences for viewing. In this space, it is possible to select the language and date format (dd/mm/yyyy, mm/dd/yyyy or yyyy/mm/dd). In addition, the clock display format (12 or 24h) can be changed, as well as allowing or disallowing the opening of dialog boxes with warnings. Click on the blue "Change" button to confirm the changes.

3 Password

Change password 

Username

Full name

Password

New password

Confirm new password

[Change](#)

Figure 61 - "Change password" field

On the right side of this screen, the user can change his password. For this it is necessary that he identifies himself first, typing his login and his current password. From there, the new password can be changed and confirmed. Click on the blue "Change" button to confirm the changes.



4 Permissions and optional settings

Permissions

Profile	View	Operate	Setup
Online	✓	✓	✓
Modbus	✓	✓	✓
DNP3	✓	✓	✓
IEC 61850	✓	✓	✓
System	✓		✓
Users	✓		✓
Tools		✓	

Figure 62 - “Permissions” field

In the lower left part of the screen, a table is displayed that indicates the ongoing user's permissions in each of the functionalities. Just below the table, there is a checkbox that enables or disables a set of advanced optional settings for some screens.



5.10 User registration

On this page, you can check which users are registered to use the system, as well as make changes to them and even register new ones. Different access profiles can be allocated to each user.

To access these settings, just click on your username, available in the right corner of the top menu, and then click on the "Users" item.

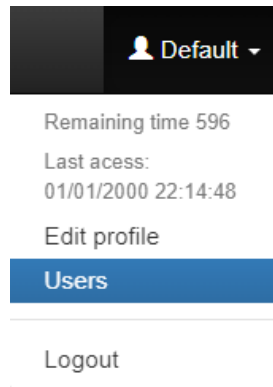


Figure 63 - Access to the "Users" item

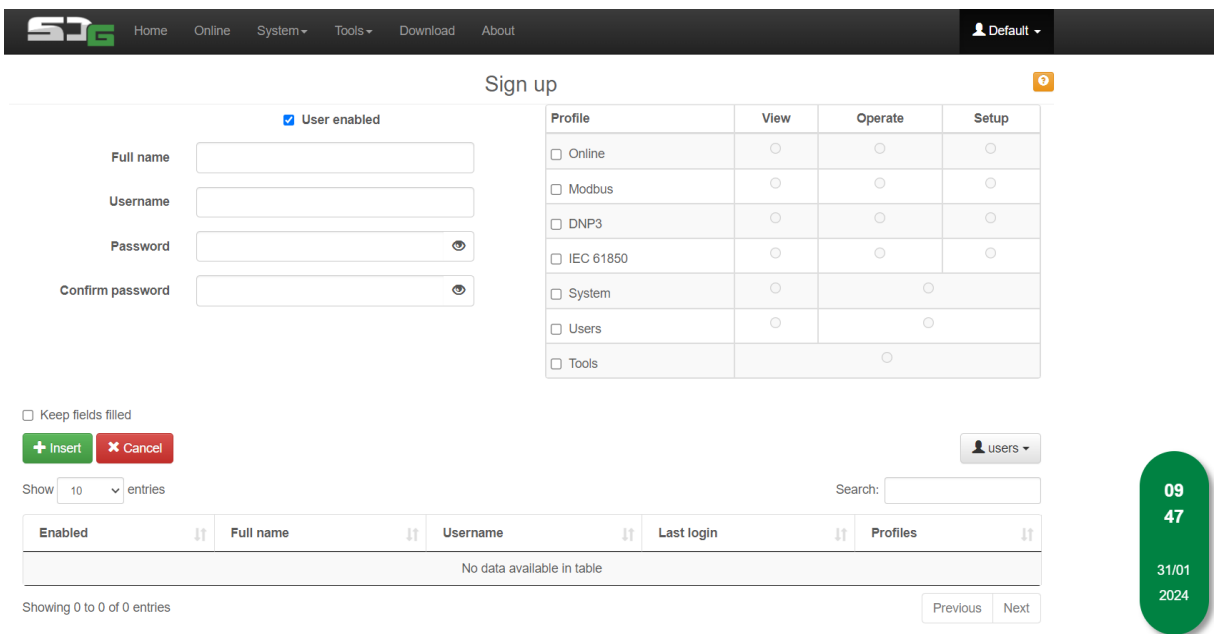


Figure 64 - "Users" item on the SDG web page

5.10.1 Adding a New User

To allow other users to access the web page, the administrator user must access the "Users" item, located in the top menu.

Four fields must be filled in to include the new user: "Full name", "User", "Password" and "Confirm password".



In the right corner of the screen, the permissions for the new user are selected from a table with four columns. The “Profile” column displays the tabs that the new user can access: “Online”, “Modbus”, “DNP3”, “IEC 61850”, “System”, “Users” and “Tools”.

In the other columns, the level of access to each tab is detailed between the options “View”, “Operate” and “Configure”.

- **View** - the user will be able to see the settings but will not be able to modify, delete or create anything;
- **Operate** - the user will be able to activate and deactivate the existing settings, and even change the protocol address of any IED;
- **Configure** - the user has full control to modify, delete and create configurations in the system.



6 Troubleshooting

Troubleshooting the SDG (Smart Device Gateway) involves identifying and correcting issues related to the communication and network configuration of devices connected to it. The SDG plays a crucial role in converting communication protocols, allowing interoperability between different devices in a system.

When any alert or warning messages occur on the page in the SDG, it is important to perform a series of checks to troubleshoot the problem. First of all, it is necessary to examine the entire communication circuit, checking the integrity of the cables, connections and devices involved. Make sure there are no physical issues that could be causing the communication to fail.

In addition, it is essential to review the network settings, such as address and baud-rate, of equipment connected to the SDG.

Check that the IP address, subnet mask, default gateway and other network settings are correctly configured and compatible with the network infrastructure in use.

In addition to the measures mentioned above, it is essential that the SDG user is aware of the color of the LED located on the front of the equipment. The LED plays an important role in signaling communication problems and alerts, providing visual information about the state of the system.

The LED features different colors such as white, green, orange and red, each indicating a specific status. Thus, the white LED indicates waiting for the equipment to start, the green LED indicates that all input devices are communicating correctly, while the orange LED informs that there are devices in different conditions. The red LED signals that all input devices are offline.

Observing the LED color and associating it with specific problems can help you quickly identify communication failure situations. This information can be used as a starting point to guide troubleshooting steps and direct the appropriate action, whether it be performing additional checks on connected devices, network settings or contacting the appropriate technical support...

If, after these checks, the problem persists and cannot be resolved internally, it is recommended to contact Treotech's Customer Service Center (CS). The CS is prepared to deal with technical questions related to the SDG and offer additional support in solving more complex problems.

It is important to emphasize the importance of following the manufacturer's guidelines and using the support resources available. By relying on the support of Treotech's CS, it is possible to obtain specialized assistance and ensure an efficient problem resolution process at the SDG, minimizing interruptions and maintaining the proper functioning of the communication system.



7 Commissioning

Once the installation of the equipment has been carried out according to the instructions in this manual, the commissioning must follow the basic steps below:

- ✓ Check mechanical and electrical installations;
- ✓ Check, with the aid of a multimeter, the correct electrical connection of the equipment;
- ✓ Connect the ground cable to terminal 1 of the SDG;
- ✓ Power the SDG on terminals 2 and 3 with a supply voltage of 85 to 265 Vac/Vdc, 50/60 Hz;
- ✓ Carry out all the SDG configuration according to the instructions in the previous chapters, via the web page;
- ✓ With a computer, communication converters and suitable software, as applicable, check the operation of the SDG communication ports according to the application used;
- ✓ Simulate the performance of monitored external contacts and observe whether the outputs are operating correctly according to programming.



8 Technical data and type tests

8.1 Technical data

Table 7 - Technical data

Hardware	Range/description
Supply voltage	85...265 Vac/Vdc, 50/60 Hz
Maximum consumption	< 12 W
Operating temperature	-40... 85°C
Degree of protection	IP20
Connections	0,3...2,5mm ² , 22...12 AWG
Fixation	Panel
Inputs	
Dry contacts	7 inputs and 1 common
Contacts power supply	Internal reference supply
Outputs	
Relay output	1 NC relay (normally closed)
Maximum switching power	70 W (dc) / 200 VA (ac)
Maximum switching voltage	250 Vdc / 250 Vac
Maximum switching current	5 A
Network interface	
Serial communication ports	1 RS-485 (TIA-485-A), 1 RS-485 (TIA-485-A) or 1 RS-232 (TIA-232-F)
Communication ports IEEE 802.3 (10/100 Mbps) ¹	Available in models: RJ45: 2 Ethernet RJ45 (10/100BASE-T) FOFO: 2 Ethernet Fiber Optic (10/100BASE-FX; MM 1310nm SC connector) FOSR: 1 Ethernet Fiber Optic (10/100BASE-FX; MM 1310nm SC connector) + 1 Serial Fiber Optic (MM 850nm SC connector)
Master / Client protocols	Modbus [®] (RTU and TCP) and DNP3 (RTU and TCP)
Slave / Server protocols	Modbus [®] (RTU and TCP) and DNP3 (RTU and TCP) IEC 61850 (MMS server / GOOSE Publisher) ²
Dimensions	
SDG Dimension (Fiber Optic)	54,70 mm x 114 mm x 155 mm
SDG Dimension (RJ45)	54,70 mm x 114 mm x 146 mm



8.2 Type tests

Table 8 - Type tests

Immunity to high energy surges (IEC 60255-22-5)	
Differential mode	1 kV (+/-)
Common mode	2 kV (+/-)
Immunity to electrical transients (1 MHz Burst, IEC 60255-22-1)	
Peak value 1st cycle	2,5 kV common mode, 1 kV differential mode
Frequency	1 MHz
Repetition rate	200 bursts/s
Applied voltage (IEC 60255-5)	
Dielectric strength	2 kV at 60 Hz for 1 minute
Voltage impulse	5 kV (+/-)
Immunity to radiated electromagnetic fields (IEC 60255-22-3)	
Frequency	80... 2500 MHz
Repetition rate	10 V/m
Immunity to conducted electromagnetic disturbances (IEC 60255-22-6)	
Field strength	10 Vrms
Frequency	0.15 to 80 MHz
Index of modulation	80% and 1 kHz sinusoidal
Sweep frequency	150 kHz to 80 MHz
Fixed frequencies	27 to 68 MHz
Duration	20 s
Power supply	220 V / 60 Hz
Immunity to industrial frequency magnetic fields (IEC 61000-4-8)	
Magnetic field strength and direction	30 A/m 3 orthogonal axes
Electrostatic discharges (IEC 60255-22-2)	
Intensity and voltage	15 kV air mode 220 V / 60 Hz
Immunity to fast electrical transients (IEC 60255-22-4)	
Power, inputs and outputs	4 kV (+/-)
Current outputs	2 kV (+/-)



Emission tests (IEC 60255–25)	
Conducted emission limits (Class A)	79 dB (uV) @ 150 kHz... 500 kHz (QP) 73 dB (uV) @ 500 kHz... 30 MHz (QP) 66 dB (uV) @ 150 kHz... 500 kHz (AV) 60 dB (uV) @ 500 kHz... 30 MHz (AV)
Radiated emission limits (Class A)	40 dB (uV/m) @ 30 MHz... 230 MHz (QP) 47 dB (uV/m) @ 230 MHz... 1 GHz (QP)
Power failure (IEC 61000-4-11)	
Voltage drops	0-80 of U ½... 300 cycles 85V and 265V 50/60 Hz
Short interruptions	5 seconds 85V and 265V 50/60 Hz
Cold withstand (IEC 60068-2-1)	
Temperature	-40
Test time	16 hours
Dry heat withstand (IEC 60068-2-2)	
Temperature	+85 °C
Test time	16 hours
Moist heat withstand (IEC 60068-2-78)	
Temperature	+40 °C at 85% RH
Test time	24 hours
Thermal cycle (IEC 60068-2-14)	
Temperature range	-40... 85 °C
Total test time	120 hours
Response to vibration (IEC 60255-21-1)	
Application mode	Sinusoidal
Amplitude	0,075 mm (10... 59 Hz) 1 G (59... 150 Hz)
Duration	8 min/axis
Vibration durability (IEC 60255-21-1)	
Application mode	Sinusoidal
Amplitude	2G (10... 150 Hz)
Duration	160 min/axis



9 Order specification

In the SDG purchase order, it is necessary to specify the following items:

1. Product's name

Smart Device Gateway - SDG.

2. Quantity

The number of units.

3. Communication setup

Choose one of the following options:

- **FOFO** - 2x *Ethernet* F.O. (10/100BASE-FX; MM 1310 nm SC connector; MM 1310 nm SC connector).
- **FOSR** - 1x *Ethernet* F.O. (10/100BASE-FX; MM 1310 nm SC connector) + 1x Serial F.O. (MM 850 nm SC connector).
- **RJ45** - 2x *Ethernet* RJ45 (10/100BASE-T).



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