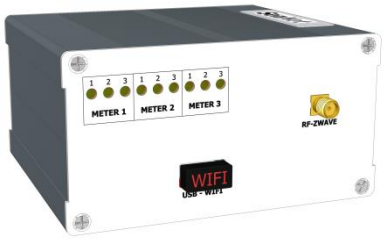
SenNet
Smart M2M Solutions

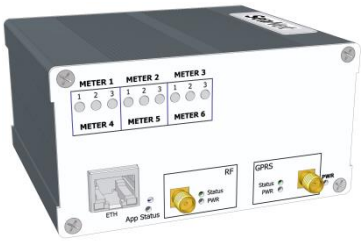
Dataloggers series & Device network

DL150

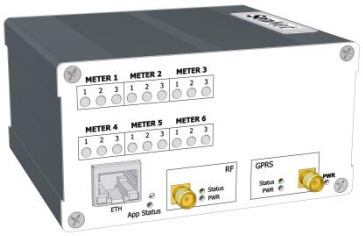


DL151

DL170



DL171



DL172

SATEL SPAIN

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WARNINGS

1. BEFORE INSTALLING YOUR SENNET DEVICE

Prior to installation, carefully read the technical specifications and the mode of handling.

	
Danger! Risk of damage to the device	Danger! Risk of electric shock or damage to humans

	For safety reasons, the case of the dataloggers must be grounded, preferably through DIN rail
	Improper handling, connection or maintenance may result into serious injury and risk of fire. Avoid any manipulation of the device while connected to the power supply
	The personnel involved in the installation must be properly trained and authorized to act according to the Electrical Code and the regulations on electricity in your country
	The wires installed in the electrical panels must be bridled and, if possible, fastened to the frame and away from the bus bar
	Always use the required personal protective equipment. At least (without prejudice to the applicable law), to install equipment in the electrical panels, the technician must be equipped with: goggles, gloves and boots approved for working on electrical installations
	Any internal modification of the device or the seal will void the warranty
	Operating temperature range of the dataloggers: -20°C to +60°C Storage temperature range of dataloggers: -30°C to +85°C
	Follow the installation and maintenance instructions throughout the life of the device
	SenNet dataloggers and radio frequency peripherals are precision electronic devices. Do not install them near heat/cold sources, radiating sources, corrosive environments or explosive atmospheres that could damage the device.

CHARACTERISTICS

2. ABOUT SENNET DATALOGGERS

The Dataloggers SenNet DL150, DL151, DL170, DL171 and DL172 are devices M2M (Machine to Machine) that can capture data, archive then locally and send them to a data management server to be processed.

SenNet dataloggers are designed to offer the maximum performance in the market. Their main features are:

- Scalability. Each datalogger can communicate with up to 100 metering devices
- Compatibility with other devices. SenNet has developed its own embedded software in order to be compatible with more than 120 different devices in the market. This number is continually growing, since the objective is to provide an open and versatile solution, able to connect with third-party devices, regardless of the mark or model.
- Compatibility with management software. SenNet dataloggers can operate with a large number of management platforms, thanks to the number of standard communication mechanisms supported by the device, such as:
  - Sending files in CSV format via FTP
  - Sending files in XML format via WEB Services
  - Sending files in JSON format via WEB services
  - Standard protocol MODBUS TCP for an easy integration with SCADA
- Standard architecture based on Linux. The concentrator (datalogger) does not use a proprietary operating system, which means it has greater stability and standardization.
- Internal electricity meters (models DL151, DL171 and DL172) with a wide metering range (5A - 5000A).

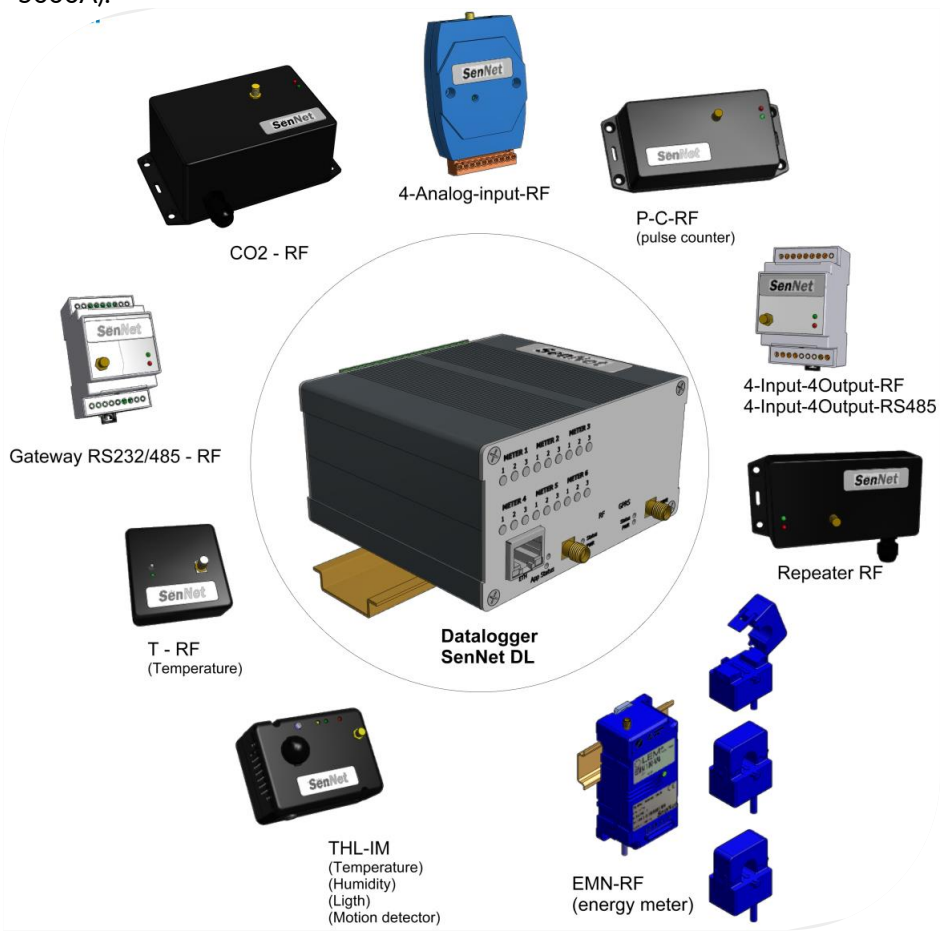


Figure 1. Along with the dataloggers, SenNet offers a wide range of peripherals to monitor a wide range of variables

3. TECHNICAL CHARACTERISTICS

Depending on the model, SenNet dataloggers have the following characteristics

Characteristics	DL150	DL151	DL170	DL171	DL172
Power supply	5Vdc	5Vdc	8..30Vdc	8..30Vdc	8..30Vdc
Connectivity					
CT or Rogowski	-	✓	-	✓	✓
Wi-Fi (USB port)*	✓	✓	✓	✓	-
Ethernet	✓	✓	✓	✓	✓
GPRS	-	-	✓	✓	✓
HDMI	optional	optional	optional	optional	-
Communications					
RS485	✓	✓	✓	✓	✓
RS232 Terminal (TTL levels)	-	-	✓	✓	✓
Accessories RF					
SenNet RF 868MHz	optional	optional	✓	✓	✓
Z-Wave®	optional	optional	optional	optional	-
Processor	ARM® Cortex ® -A8-based core (300MHz-1GHz)				
RAM memory	512 MB				
eMMC (SO) memory	2 GB / 4 GB				
Card slot (micro-SD) form memory expansion	✓	✓	✓	✓	✓
Internal battery (up to 45 min)	✓	✓	✓	✓	✓
RTC (real time clock)	✓	✓	✓	✓	✓
Internal energy meters Active and reactive energy, power, power factor, current, voltage, surges, power cuts	-	3 three-phase or 9 single phase **	-	3 three-phase or 9 single phase **	6 three-phase or 9 single phase ***
Inputs and outputs					
Current output (5V@300mA)	-	-	✓	✓	✓
Standard output (VinpUT@100mA)	-	-	4	4	4
Standard input	-	-	3	3	3
Software All-in-one	optional	optional	optional	optional	optional
Operating system	Linux 3.8.13				
Mounting	DIN rail				

* USB port for connection

** It is also possible to use it in the following combinations: 1 three-phase meter + 6 single-phase or 2 three-phase + 3 single- phase

*** It is possible to configure other combinations of single-phase and three-phase meters. For instance: 4 three-phase meters 6 single-phase meters.

3.1. Supported protocols

Depending on the model, SenNet dataloggers can have the following ports: RS485, Ethernet, RS232, GPRS, HDMI, USB and radio frequency. The dataloggers can capture data from external devices that have compatible interface. This can be done either via standard protocols, or via proprietary protocols implemented in the device.

SenNet dataloggers are compatible with a large number of protocols. The main ones are listed below:

- **Modbus RTU and TCP** for communication with electric meters, temperature sensors, weather stations, photovoltaic inverters, gateways to third-party radio networks, etc.
- **MBUS** for communication with electricity and thermal meters
- **IEC870-5-102** for electricity meters
- **DLMS/COSEM** for smart electricity meters.
- **IEC 62056-21 / IEC 61017** for electricity meters
- **KNX** for communication with home-automation equipment
- **Zwave** for radio communication at smart homes
- **Proprietary protocols**: Apart from the standard protocols, the dataloggers support specific proprietary protocols developed by other manufacturers.
- Other protocols...

Please, contact Satel Spain or your SenNet distributor for further information concerning compatibility and protocols supported.

3.2. Access to captured data

The data captured by the datalogger can be remotely obtained via:

- Integrated GPRS module (only in models DL170, DL171 and DL172)
- Optional 3G module (available for models DL170, DL171 and DL172)
- External router, connected to the Ethernet port.
- Wi-Fi (models DL150, DL151, DL170, DL171)
- HDMI (models DL150, DL151, DL170, DL171)

The mechanisms offered by the datalogger to access the data captured are:

- Request mechanisms (where the datalogger works as a server)
  - Webserver to see the latest data received and download files in CSV format
  - Modbus TCP for access from SCADA or BMS systems
  - XML to download the data in XML format

- Automatic delivery mechanisms: (where the datalogger works as a client)
  - Sending CSV files with the data captured to an FTP server
  - Sending the data to a TCP-IP server:
    - Via proprietary protocol, SenNet TLV
    - Via specific web services used by energy management platforms.
    - Using specific protocols for IoT platforms (Internet of Things), such as: Carriots, BlauLabs, Sofia2, DynDNS, etc.

The mechanisms listed above may be concurrent, so that the same datalogger can be configured to automatically send data via TCP-IP and via FTP, and simultaneously being asked via Modbus TCP.

In addition to the communication ports, some dataloggers include current measurement inputs to connect current transformers (CT 0,33V) or Rogowski coils.

The DL170, DL171 and DL172 models also have the following inputs and outputs:

- 3 inputs 8-30 Vdc
- 4 outputs 8-30 Vdc @ 100 mA (max.)

- Current output 5V @ 300mA

The dataloggers SenNet DL151, DL171 and DL172 also have the following inputs:

- Voltage measurement inputs and current metering inputs: neutral, phases 1, 2 and 3. To meter: energy (reactive, active and apparent), power (active, reactive and apparent), power factor, current, voltage, frequency. The device can also detect cuts or voltage drops thanks to the backup battery. It can also detect voltage spikes.

3.3. Compliance

SenNet dataloggers comply with the following standards

- ETSI EN 300 220-1

Electromagnetic compatibility:

- Directive 2004/108/EC and
- Directive 1999/5/EC (R&TTE Directive)

Electrical safety:

- Directives 2006/95/EC and 2001/95EC

Moreover, the internal electricity meters (DL151, DL171 and DL172 models), comply with the following standards:

- EN 50470-1
- EN 50470-3
- IEC 62053-21
- IEC 62053-23

3.4. SenNet Radio

Optional for DL150 and DL151
as standard for the models DL170, DL171 and DL172

- MESH wireless network, 10mW and SMA connector for antennas. The datalogger coordinates the network (master)
- As standard, the radio is set to work at 868 MHz (open frequency in the European Union); however, it can be configured to work at 915 MHz (for most countries in America) or 784 MHz (most countries in Asia).
- The dataloggers can connect via radio with a network of metering devices:
    - Gateway-RS232/485 to RF. To communicate with devices which have RS232 or RS485 ports. Transparent communication
    - THL-IM-RF. Temperature, humidity and luminosity sensor with two pulse counters. Battery powered
    - T-RF. Temperature sensor. Battery powered
    - P-C-RF. Pulse counter. To monitor old electricity, gas or water meters (not smart meters)
    - 4Analog Input-RF device with 4 analog inputs (mV / V / mA) for remote control
    - 4Input - 4Output - RF. Interface with 4 inputs and 4 digital outputs for remote control .Also available with connection via RS485 instead of Radio Frequency
    - RF-CO2. To meter the concentration of carbon dioxide (CO2) in parts per million (ppm)
    - Repeater-RF. Radio frequency router, to extend the coverage of the network
    - EMN-RF: three-phase electricity meter with CT (0,33 Vac) and radio frequency

3.5. Z-Wave Radio

Optional. Available for models: DL150, DL151, DL170 and DL171

- Module: Z-Wave Transceiver Sigma Designs ZM5202
- Frequency 868.4 MHz (EN 300 220). Free use in the European Union. Also available in 869.0 MHz for Russia (GKRCh/EN 300 200) and 908.4 MHz (FCC CFR47 P 15.249) for USA
- Range tested for up to 40 meters inside buildings and over 100 m in open field.

3.6. Internal electricity meters

Only for models DL151, DL171 and DL172

- For each phase:
  - Voltage, current, power factor (cos(phi))
  - Power (active / reactive / apparent)
  - Energy (active / reactive / apparent)
- For the three phases as a whole:
  - Power (active / reactive / apparent)
  - Energy (active / reactive / apparent)
- Frequency
- Power failure detection (voltage drops or interruptions)
- Voltage-peaks detection

3.6.1. Measurement options

DL151 and DL171 models

Up to 3 three-phase circuits or up to 9 single-phase circuits. Maximum permitted combinations:

- 3 x three-phase circuits
- 2 x three-phase + 3 x single-phase
- 1 x three-phase + 6 x single-phase
- 9 x single-phase

Model *172*

Up to 6 three-phase circuits or up to 18 single-phase circuits. Combinations of single-phase and three-phase are also possible.

3.6.2. Voltage

Up to 480 Vac

3.6.3. Frequency

50 or 60Hz

3.6.4. Current (intensity)

Current transformers: from 5A to 1500A (type 0.33V)

Rogowski coils: for currents from 100A to 5000A

3.6.5. Precision

1%

3.6.6. Indicators

SenNet dataloggers are equipped with pulse outputs that indicate the evolution of the active / reactive and apparent power in real time via LED diodes.

3.6.7. Calculation of the active and the reactive power

The SenNet dataloggers with internal electricity meters (DL151, DL171 and DL172) use an advanced method for calculating the active and reactive power (and consequently, for calculating the active and reactive energy). They use a DSP (Digital Signal Processor) that makes the calculations for the entire range of fundamentals and harmonics.

Calculation of the active power:

$$\sum_{k=1}^{\infty} V_k V_k \cos(\varphi_k - Y_k)$$

Calculation of the reactive power:

$$\sum_{k=1}^{\infty} V_k V_k \sin(\varphi_k - Y_k)$$

Where *k* goes from 1 (fundamental value) through all the harmonics (2, 3...).

3.6.8. Power Quality

The internal electricity meters included in the models DL151, DL171 and DL172 incorporate the function *Power Quality*. This function, automatically detects voltage drops, interruptions or surges; identifying and reporting the phase in which they occurred.

High-resolution measurement of the mains frequency (0.0195%). [mains frequency is also called power line frequency]

3.7. DL – 150 Technical specifications

Power supply	5 Vdc	
Connectivity	Ethernet	Wi-Fi (USB port) HDMI (optional)
Interface	RS485	Terminal (TTL levels)
Operating system / processors	Linux 3.8.13	ARM® Cortex ®-A-8- based core, 600 MHz to 1 GHz
RAM memory	512MB	
internal eMMC	2GB / 4GB	
Memory expansion (not included)	micro-SD 4 GB (optional, not removable)	Required for the use of the embedded platform All-In-One
Battery	Internal backup battery 45 min (approx.)	
RTC	*Real time clock*	
Radio Frequency	SenNet RF 868MHz (optional)	Zwave (optional)
Sizes	116x106x63 mm	(with terminals)
Weight approx.	400 g	(with terminals)
Mounting	DIN rail	

Figure 2. Front and back sides of the datalogger SenNet DL - 150

3.8. DL – 151 Technical specifications

Power supply	5 Vdc		
Connectivity	Ethernet	Wi-Fi (USB port)	HDMI (optional)
Interface	RS485	Terminal (TTL levels)	
Operating system / processors	Linux 3.8.13	ARM® Cortex ®-A-8- based core, 600 MHz to 1 GHz	
RAM memory	512MB		
Internal eMMC	2GB / 4GB		
Memory expansion (not included)	micro-SD 4 GB (optional not removable)	Required for the use of the embedded platform All-In-One	
Battery	Internal backup battery 45 min (approx.)		
RTC	*Real time clock*		
Radio Frequency	SenNet RF 868MHz (optional)	Zwave (optional)	
Internal electricity meters (x3)	Internal 3-phase meters (for CT 0.33 Vac or Rogowski coils). Voltage meters for each phase.	Energy (active / reactive / apparent) Power (active / reactive / apparent) Power factor Current Voltage Frequency	
Sizes	120x106x63 mm	(with terminals)	
Weight approx.	440 g	(with terminals)	
Mounting	DIN rail		

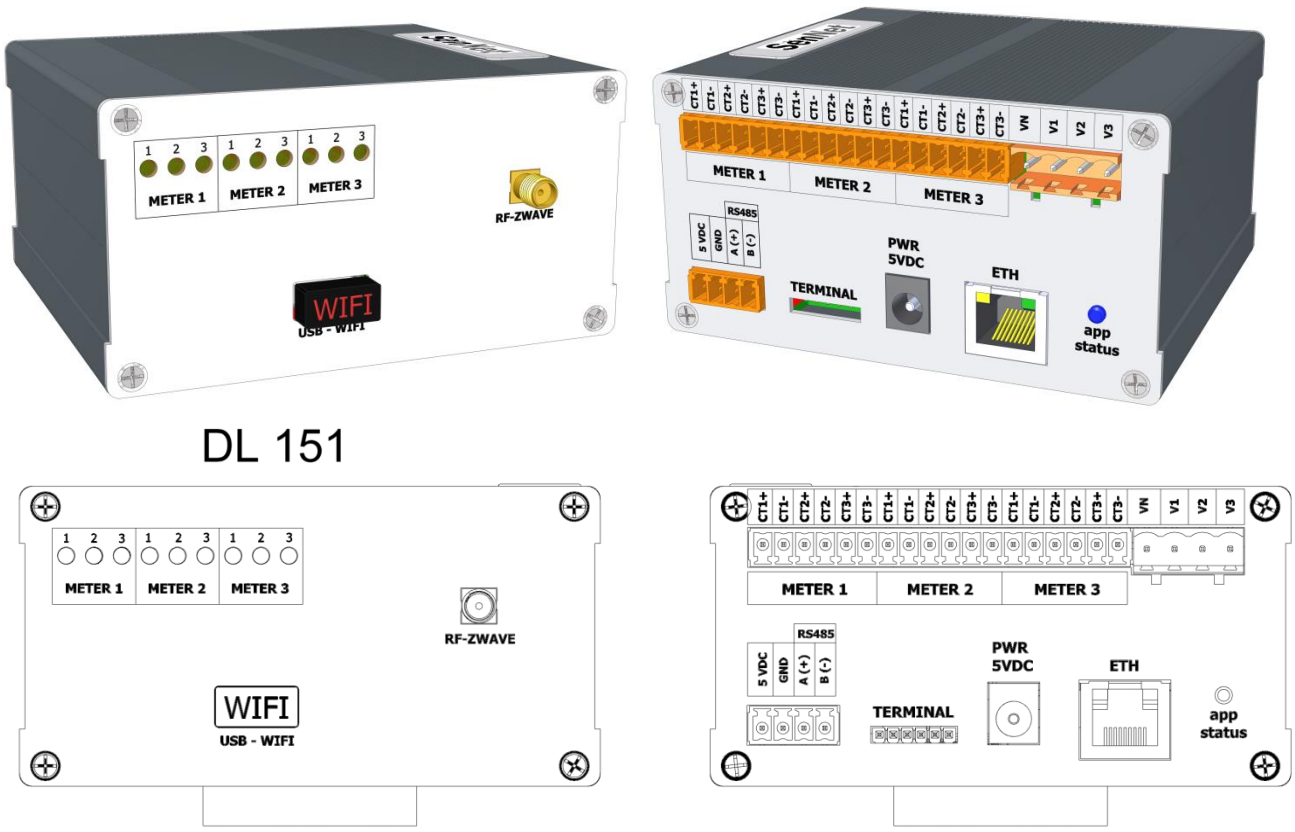


Figure 3. Front and back sides of the datalogger SenNet DL - 151

3.9. DL – 170 Technical specifications

Power supply	8..30 Vdc			
Connectivity	Ethernet	GSM-GPRS (2G) (3G) optional	Wi-Fi (USB port) optional	HDMI optional
Interface	RS485	RS232		RS232 (terminal)
Inputs and outputs	(x1) output (5V @ 300 mA)	(x3) standard output (Vinput @ 100 mA)		(x4) standard input
Operating system / processors	Linux 3.8.13		ARM® Cortex ®-A-8- based core, 600 MHz to 1 GHz	
RAM memory	512MB			
Internal eMMC	2GB / 4GB			
Memory expansion (not included)	External micro-SD		Required for the use of the embedded platform All-In-One	
Battery	Internal backup battery 45 min (approx.)			
RTC	*Real time clock*			
Radio Frequency	SenNet RF 868MHz		Zwave (optional)	
Sizes	116x106x63 mm		(with terminals)	
Weight approx.	400 g		(with terminals)	
Mounting	DIN rail			

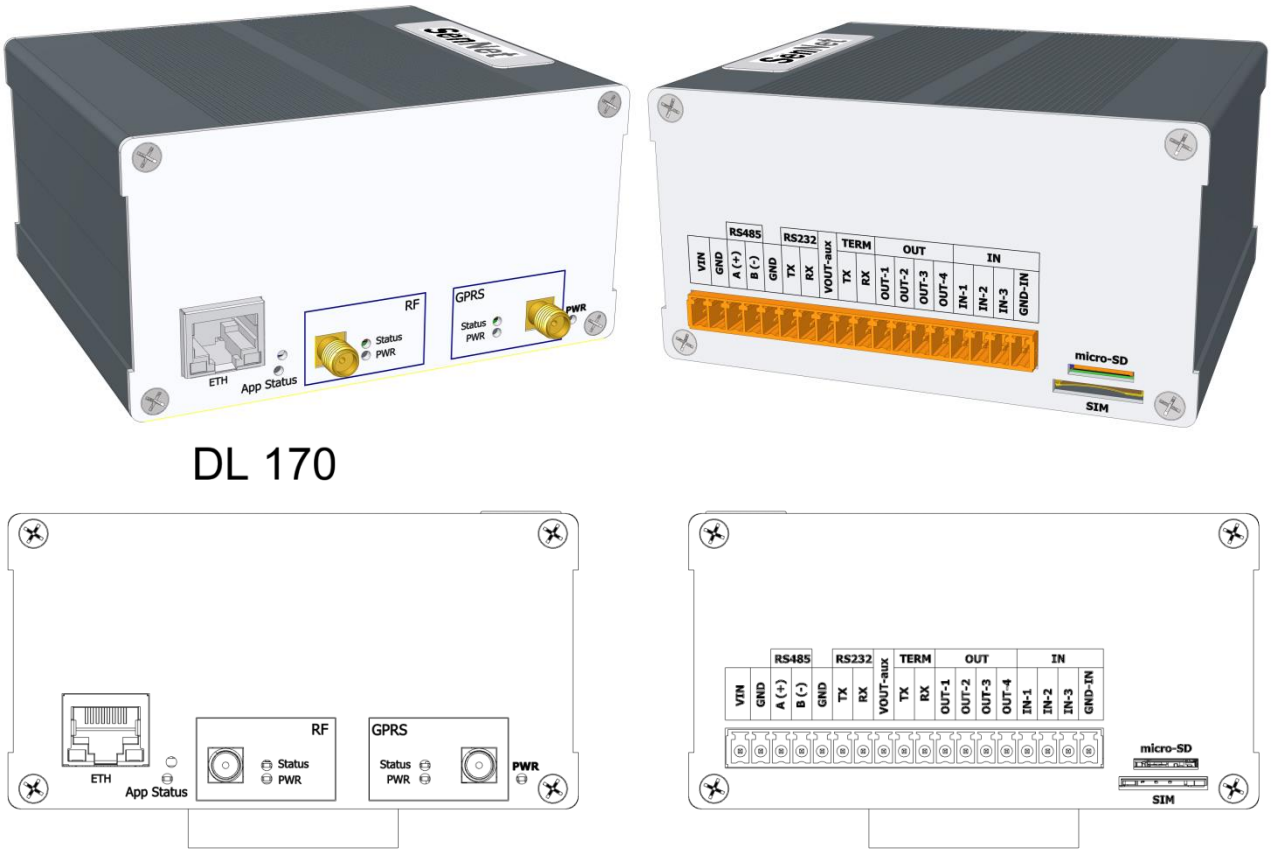


Figure 4. Front and back sides of the datalogger SenNet DL - 170

3.10. DL – 171 Technical specifications

Power supply	8..30 Vdc			
Connectivity	Ethernet	GSM-GPRS (2G) (3G) optional	Wi-Fi (USB port) optional	HDMI optional
Interface	RS485	RS232		RS232 (terminal)
Inputs and outputs	(x1) output (5V @ 300 mA)	(x3) standard output (Vinput @ 100 mA)		(x4) Standard input
Operating system / processors	Linux 3.8.13		ARM® Cortex ®-A-8- based core, 600 MHz to 1 GHz	
RAM memory	512MB			
Internal eMMC	2GB / 4GB			
Memory expansion (not included)	External micro-SD		Required for the use of the embedded platform All-In-One	
Battery	Internal backup battery 45 min (approx.)			
RTC	*Real time clock*			
Radio Frequency	SenNet RF 868MHz		Zwave (optional)	
Internal electricity meters (x3)	Internal 3-phase meters (for CT 0.33 Vac or Rogowski coils). Voltage meters for each phase.		Energy (active / reactive / apparent) Power (active / reactive / apparent) Power factor Current Voltage Frequency	
Sizes	120x106x63 mm		(with terminals)	
Weight approx.	440 g		(with terminals)	
Mounting	DIN rail			

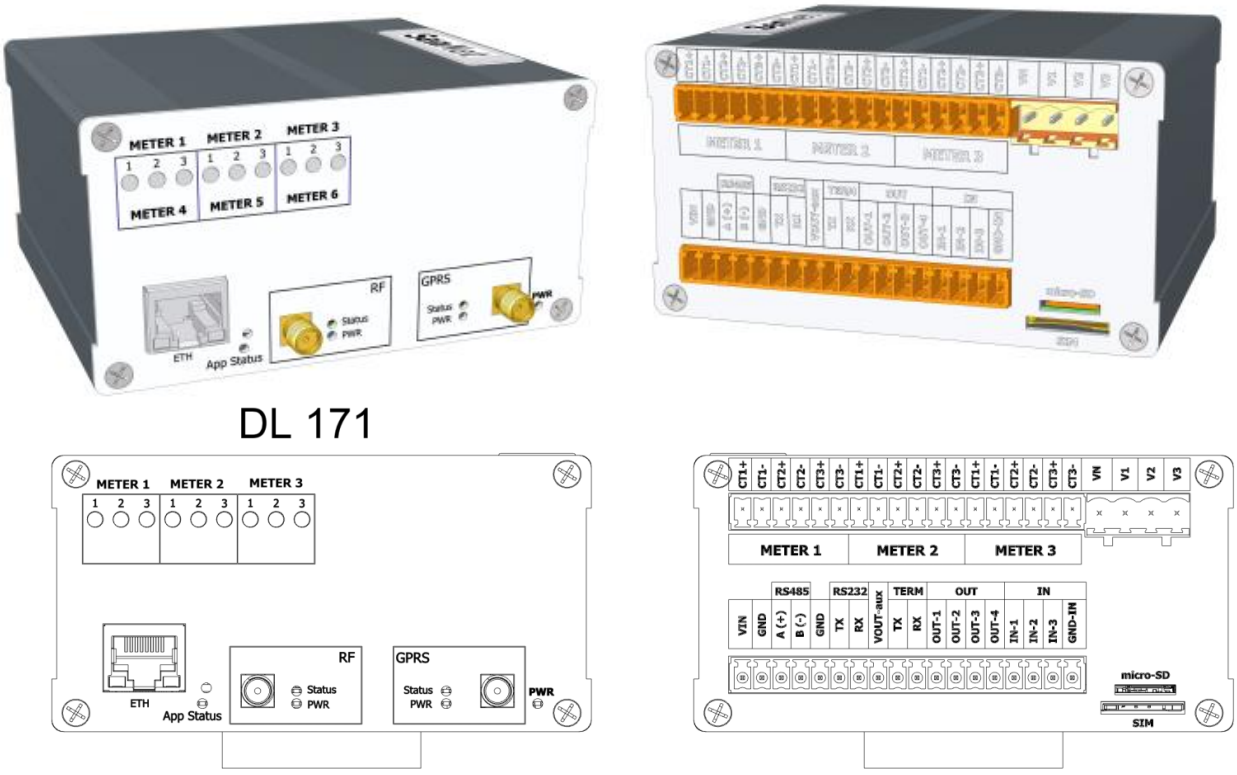


Figure 5. Front and back sides of the datalogger SenNet DL - 171

3.11. DL – 172 Technical specifications

Power supply	8..30 Vdc		
Connectivity	Ethernet	GSM-GPRS (2G) (3G) optional	
Interface	RS485	RS232	RS232 (terminal)
Inputs and outputs	(x1) output (5V @ 300 mA)	(x3) standard output (Vinput @ 100 mA)	(x4) standard input
Operating system / processors	Linux 3.8.13	ARM® Cortex ®-A-8- based core, 600 MHz to 1 GHz	
RAM memory	512MB		
Internal eMMC	2GB / 4GB		
Memory expansion (not included)	External micro-SD	Required for the use of the embedded platform All-In-One	
Battery	Internal backup battery 45 min (approx.)		
RTC	*Real time clock*		
Radio Frequency	SenNet RF 868MHz		
Internal electricity meters (x3)	Internal 3-phase meters (for CT 0.33 Vac or Rogowski coils). Voltage meters for each phase.	Energy (active / reactive / apparent) Power (active / reactive / apparent) Power factor Current Voltage Frequency	
Sizes	120x106x63 mm	(with terminals)	
Weight approx.	520 g	(with terminals)	
Mounting	DIN rail		

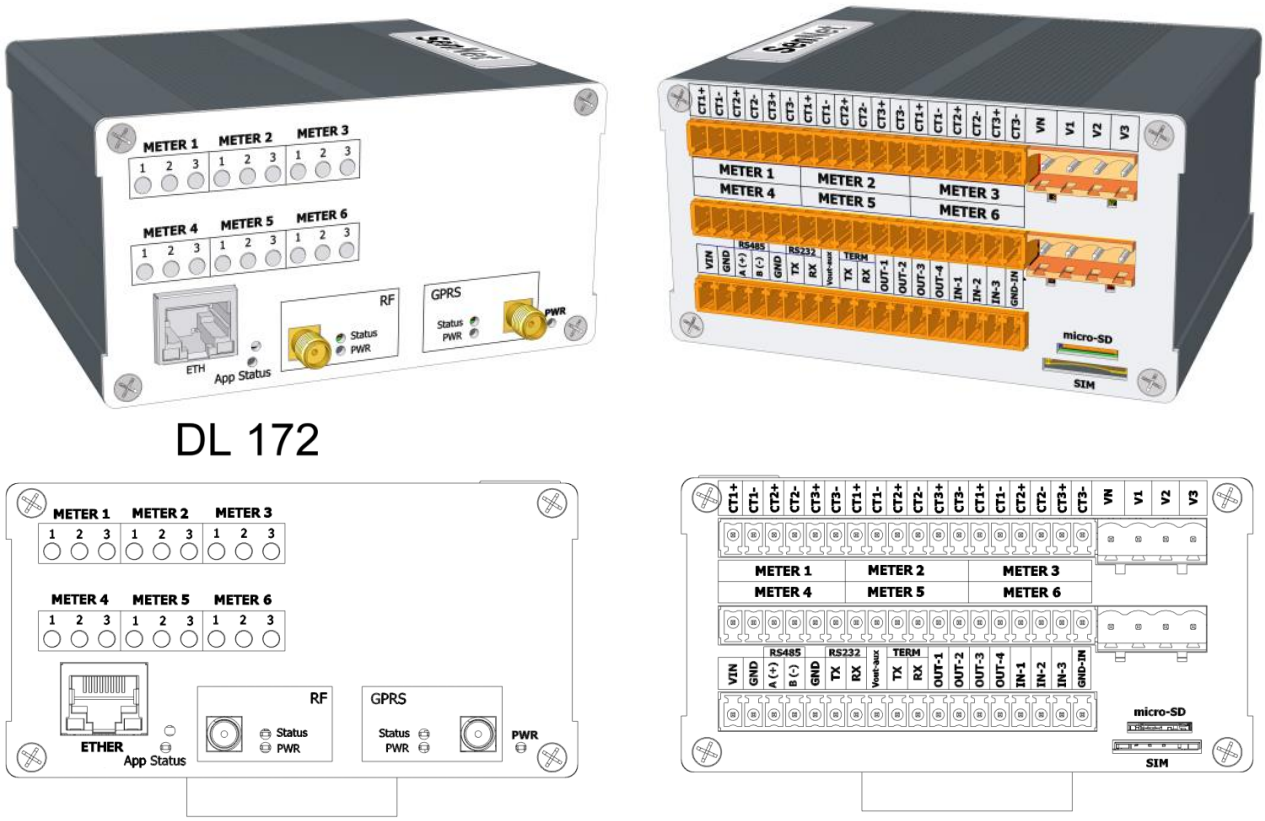


Figure 6. Front and back sides of the datalogger SenNet DL - 172

CONNECTION OF THE DATALOGGER

4. CONNECTION OF THE DL-150

4.1. Connection to the power supply

There are two possibilities to connect the datalogger to the power supply.

- Through DC jack (5Vdc, input 'PWR')
- Through terminals '5 VDC' and 'GND' (ground)

The device can be powered with an external battery or with a stabilized power source. Your local distributor of SenNet can provide you a suitable power supply.

For greater safety it is recommended to use a 2A fuse in the power supply line

Terminals		Description
1	+	Power supply 5 VDC! (the use of a 2Afuse is recommended)
2	-	
3	A	RS485 port
4	B	

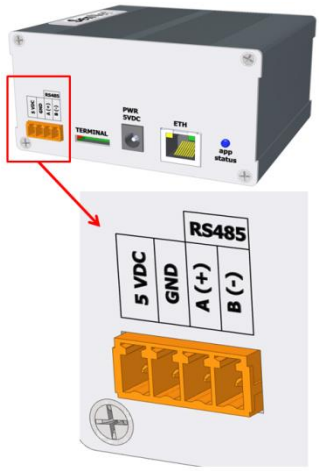


Figure 7. Terminals: Power supply, ground and RS485 port

4.2. Connection of the RF and Z-Wave antennas (both optional)

The terminals of the radio frequency and Z-Wave antennas are SMA (Sub Miniature version A).

The Z-Wave and RF antennas should be installed following the ESD protections to prevent damage to the device

4.3. USB / Wi-Fi port connection

The USB – Wi-Fi port may be used only with devices provided by Satel Spain or your SenNet supplier

4.4. Ethernet port connection

The Ethernet port is on the side of the terminals and the power supply.

4.5. RS485 port connection

The terminals of the RS485 port are located next to the power-supply terminals. See “Figure 7. Terminals: Power supply, ground and RS485”.

5. CONNECTION OF THE DL-151

5.1. Connection to the power supply

The same instructions as for the DL150 model should be followed (see section 4.1 24Connection to the power supply, p. 24).

5.2. Connection of the RF and Z-Wave antennas (both optional)

The terminals of the radio frequency and Z-Wave antennas are SMA (*SubMiniature version A*).

The GPRS, Z-Wave and RF antennas should be installed following the ESD protections to prevent damage to the device

5.3. USB / Wi-Fi port connection

The same instructions as for the DL150 model should be followed (see section 4.3 USB / Wi-Fi port connection, p. 24).

5.4. Ethernet port connection

The Ethernet port is on the side of the terminals and the power supply.

5.5. Connection of the electricity meters

The personnel involved in the installation must be properly trained and authorized to act according to the Electrical Code and the regulations on electricity in your country

To verify that the correct connection of the device, please, follow the ABC method (explained in section

14. Menu“Internal Meters” menu on p. 51

A phase meter might be useful for a correct installation

For a successful installation, we recommend to first check the phases of the electricity meters are connected correctly, before installing the Rogowski coils (Section A from the ABC method), see section 14. Menu“Internal Meters” on p. 51.

A phase meter might be useful for a correct installation

The wires installed in the electrical panels must be bridled and, if possible, fastened to the frame and away from the bus bar.

At least (without prejudice to the applicable law), to install equipment in the electrical panels, the technicians must be equipped with: goggles, gloves and boots approved for working on electrical installations.

- During the installation, at least two technicians must be present. Never let an installer work alone.
- All technicians must be equipped with gloves, safety glasses and boots suitable for electrical installations.
- Verify that there are no explosive or flammable substances in the surroundings and prevent the contact with conductive materials

5.5.1. Preliminary considerations for connecting the electricity meters

Please, note that the personnel involved in the installation must be properly trained and authorized to act according to the Electrical Code and the regulations on electricity in your country.

In order to install the electricity meters, you must first identify the elements of the electrical panel:

1. Identify the distribution board (electric panel)
2. Identify the main switch on the board
   Identify the phases R, S and T (V1, V2 and V3) if the arrangement is 3-phase. In single-phase systems this step is not required.
   The phases must be identified with the help of a phase meter, knowing that in Europe between phase and neutral, the voltage must be 220 V and between two phases, there should be 380 V.
3. In case you want to install submeters (for example, for: lighting, A/C or other parts of the plant), you must also identify the phases to which the meter is connected (whether it is connected to R, S or T). This step is done as follows:
   a. With the help of a multimeter. Connect one of the terminals of the multimeter to the phase you want to know.
   b. Connect the other terminal to the R phase.
   c. If the lecture is 0, then it is the same phase, if not, then it could be S or T. Repeat the process connecting the terminal to phase S or T.

The device has to be connected to a current and voltage reference:

- Three 3-phase meters
- 9 single-phase meters
- A combination of three-phase and single-phase meters

The device has to be connected to a current and voltage reference.

- Voltage reference (terminals 19-22 named VN, V1, V2 and V3). Connect the terminals to the three-phase or single phase line using an electrical protection, respecting the order of the phases
- Current reference (terminals 1-18, named CT1+, CT1-, CT2+, CT2-, CT3+ and CT3-)

In the terminals for current reference, it is possible to use CT (0.33Vac) or Rogowski coils (for the latter, a prior factory calibration is required).

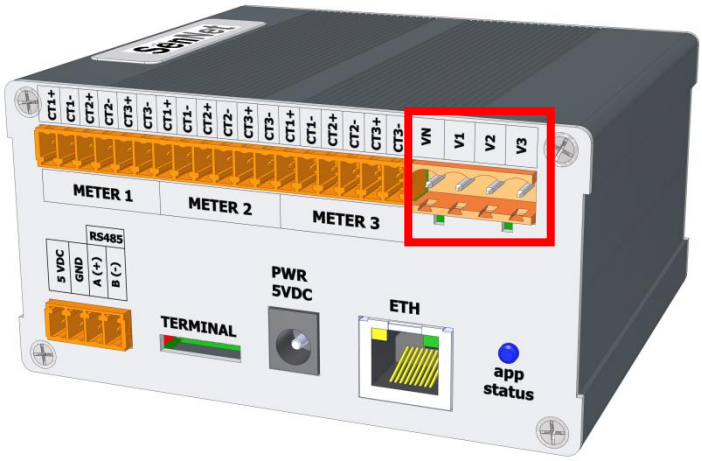


Figure 8. Terminals for the current reference (in a red rectangle)

In case SenNet CT probes (0.33Vac) are used, they must be installed with the label pointing toward the black wire connected to the terminal CT- and the white one to CT+

Use a cable with a maximal cross section of 1.5 mm ^{2} for CT and 2.5 mm^2 for the intensity reference terminals.

There is a pulse output that indicates the evolution of active, reactive and apparent power in real-time. Opposite to the terminals, there is a LED display for each phase.

5.5.2. Configuration as 3 three-phase meters

The instrument can meter the consumption of 3 three-phase circuits, named T1, T2 and T3.

For the purpose of this manual, the three-phase meters have the following id's:

- T1: id 1
- T2: id 2
- T3: id 3

The reference voltage is common to the three meters and must be connected to the terminals VN, V1, V2 and V3 (the 4 terminals on the right).

- Neutral wire to terminal VN
- Phases 1, 2, and 3 (or R, S, T) to terminals V1, V2 and V3 respectively

All current transformers or Rogowski coils connected to a meter must be of the same type (the same amperage).

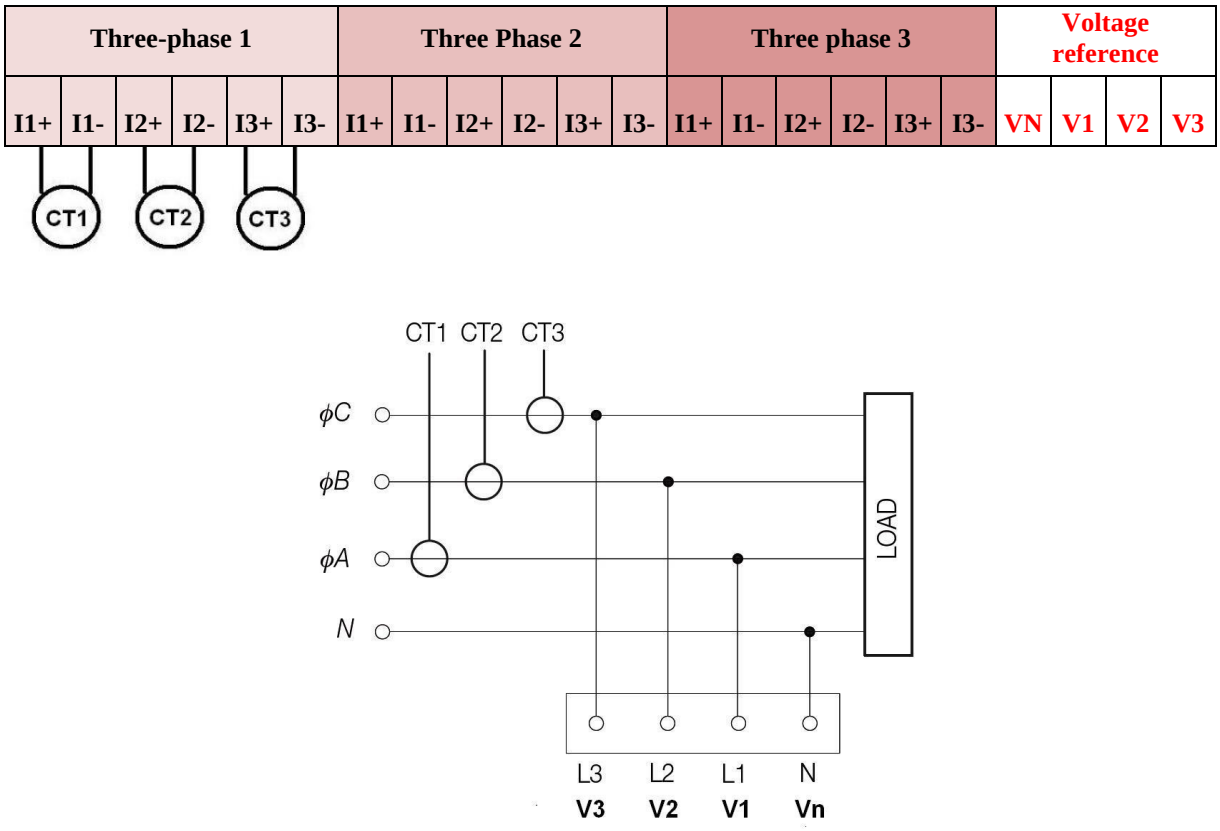


Figure 9. Terminals 1-22 of the electricity meters

5.5.3. Configuration as 9 single-phase meters

When used to measure single-phase circuits, the instrument can capture consumption data of 9 single-phase circuits, with the designation M11, M12, M13, M21, M22, M23, M31, M32, M33.

For the purpose of this manual, the single-phase meters have the following id's:

- M11: id 11
- M12: id 12
- M13: id 13
- M21: id 21
- M22: id 22
- M23: id 23
- M31: id 31
- M32: id 32
- M33: id 33

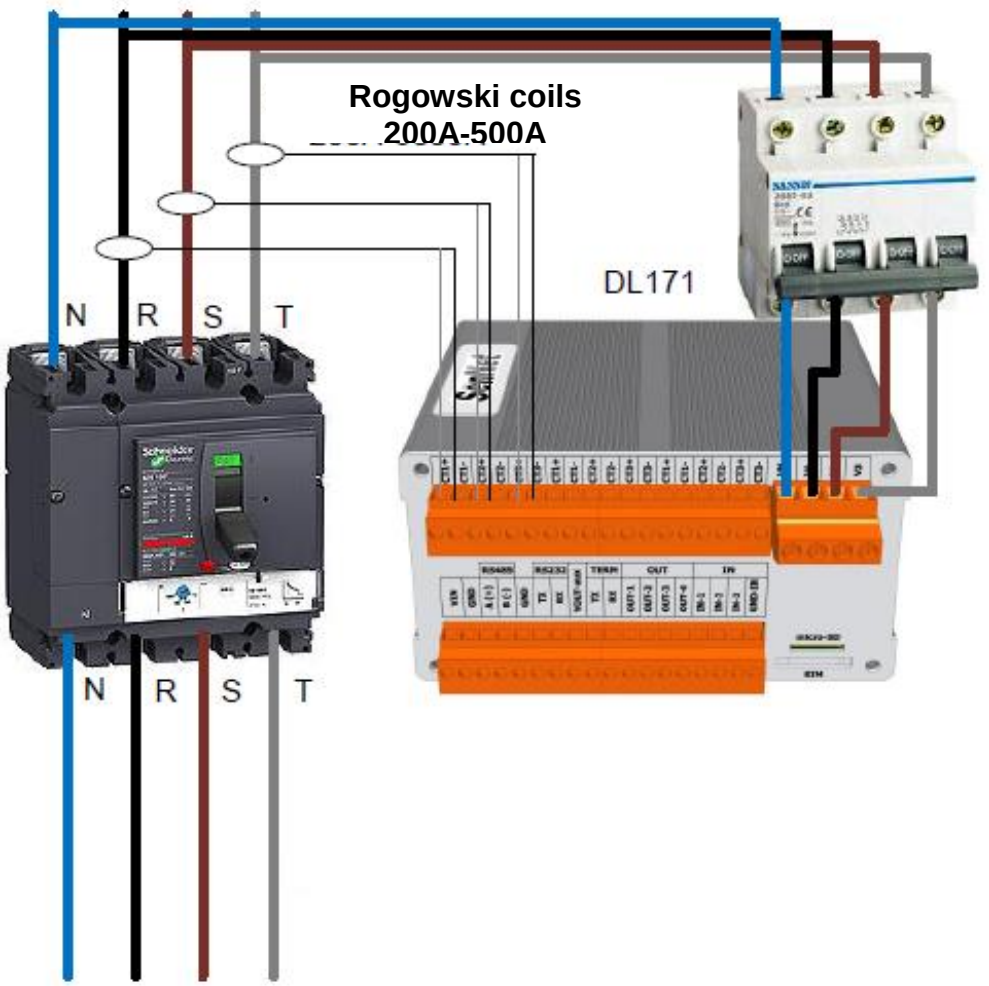


Figure 10. Example: Connection of a three-phase electricity meter

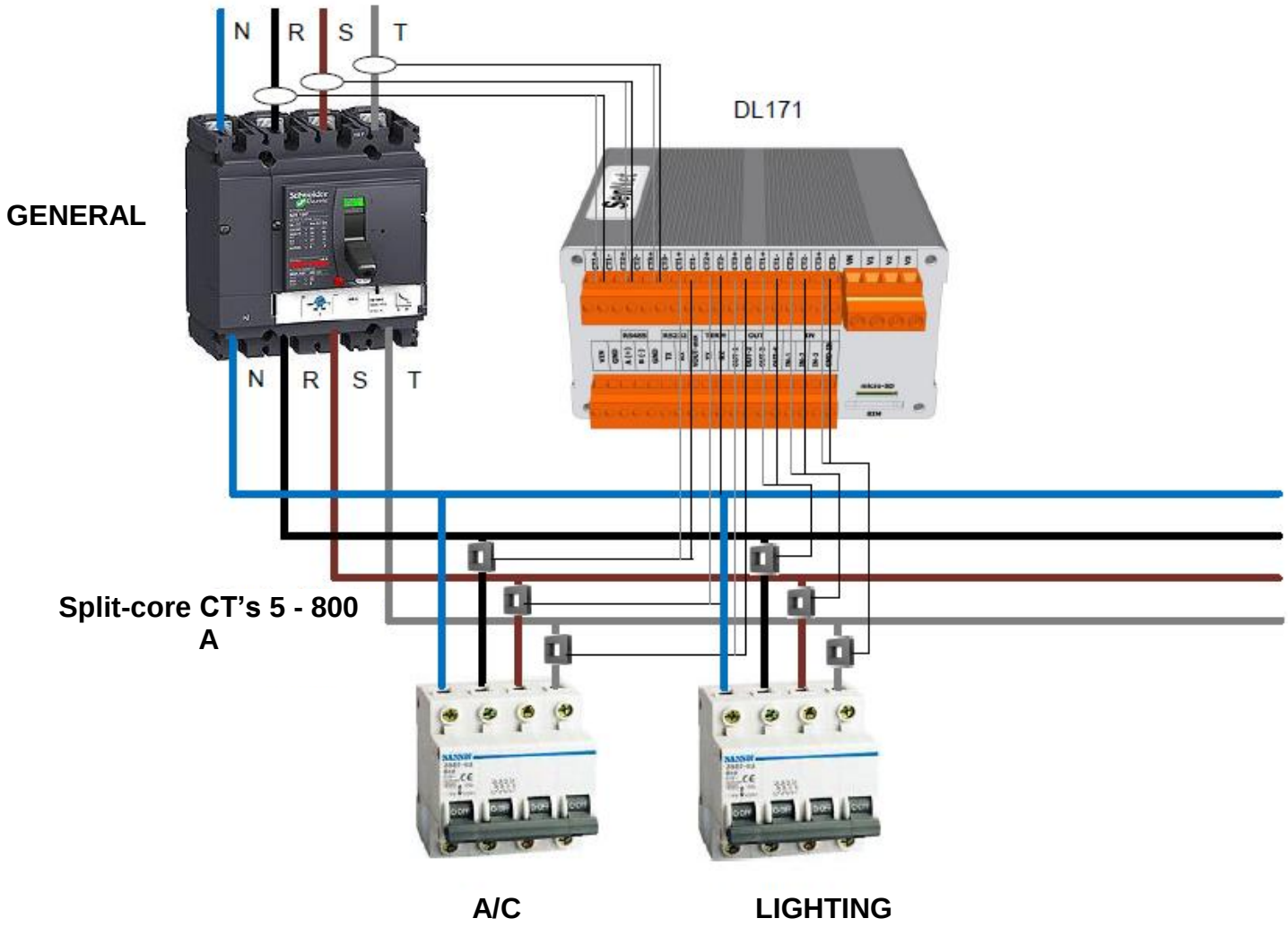


Figure 11. Example. Connection of 3 three-phase electricity meters

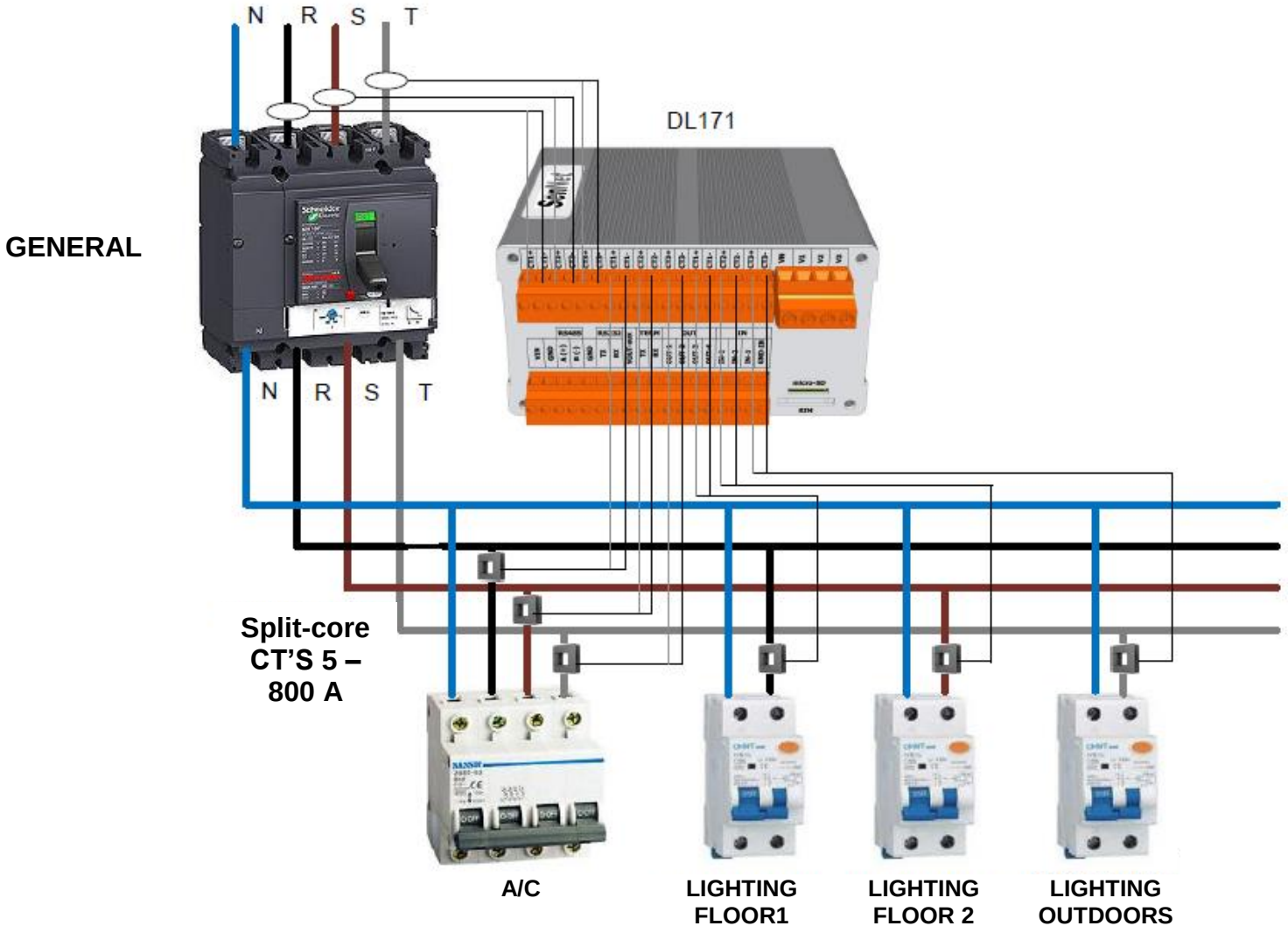


Figure 12. Example. Connection of 2 three-phase meters and 3 single-phase. The single-phase meter must be connected to different phases (R, S or T).

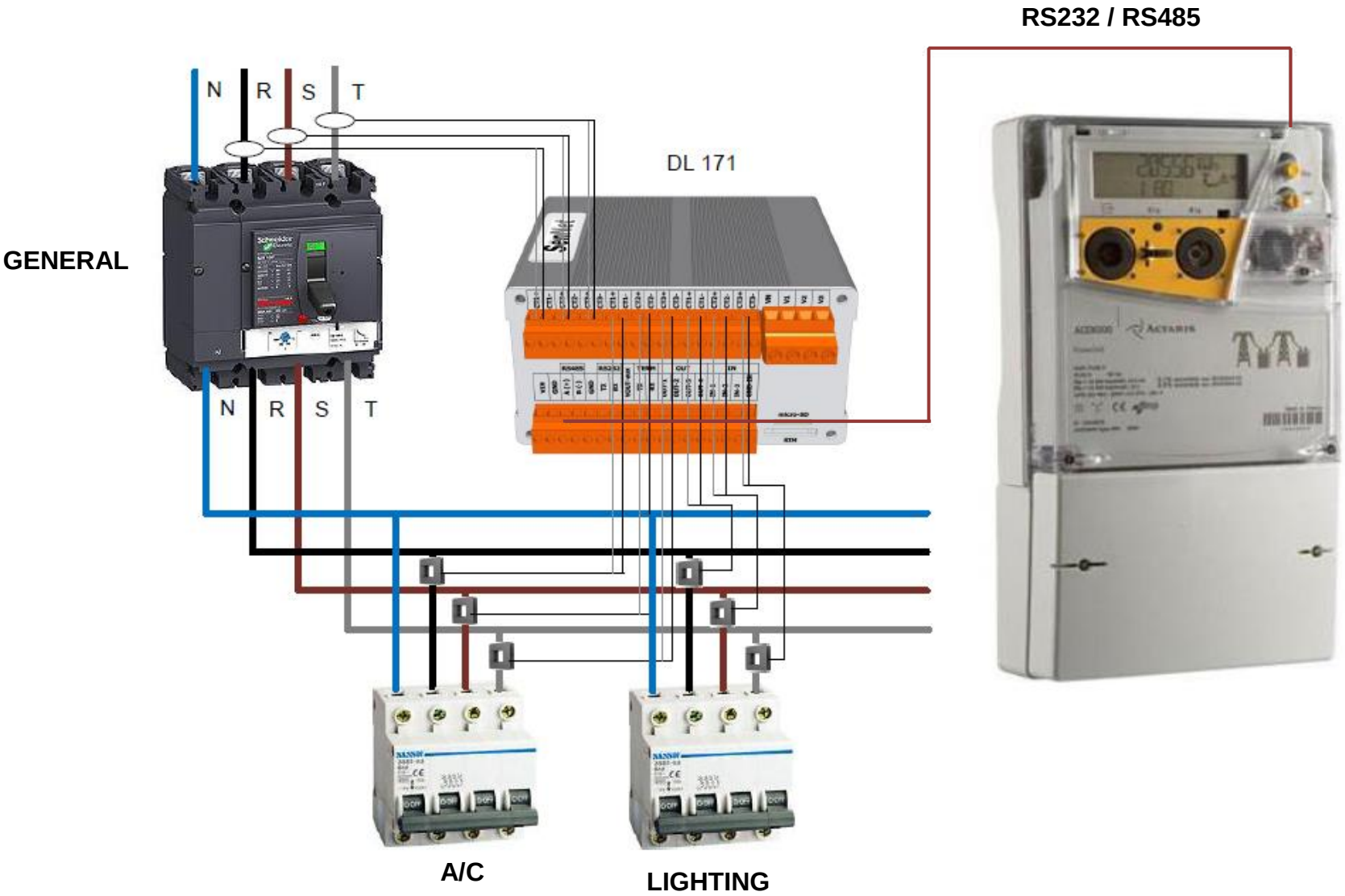


Figure 13. Example. Connection of 3 three-phase meters and a meter from the utility company via RS232 or RS485 (serial port).

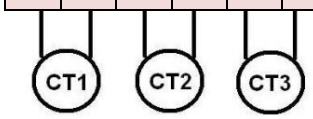
In single-phase circuits, the terminals V1, V2 and V3 should be connected to the load, and the terminal VN to the neutral wire. L can be connected for example to the terminal V1 and then with a jumper to the terminals V2 and V3.

Each meter has an input for current transformers or Rogowski coils, as follows:

All current transformers or Rogowski coils connected to the same group of meters must be of the same type (the same amperage). The groups are:

- Group 1: M11, M12, M13
- Group 2: M21, M22, M23
- Group 3: M31, M32, M33

SP1.1		SP1.2		SP1.3		SP2.1		SP2.2		SP2.3		SP3.1		SP3.2		SP3.3		Voltage reference			
I+	I-	I+	2-	I+	I-	I+	I-	I+	2-	I+	I-	I+	I-	I+	2-	I+	I-	VN	V1	V2	V3



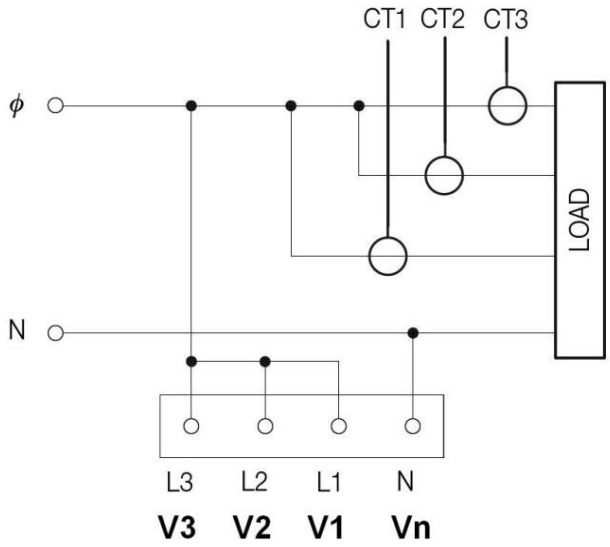


Figure 14. Example. Connection of three single-phase electricity meters (to the current and voltage references)

5.5.4. Configuration as a combination of three-phase and single-phase meters

Apart from the configuration as 3 three-phase or nine single-phase meters, the instrument can meter systems in which it is necessary to measure three-phase circuits as well as single-phase ones.

The following rules must be kept in mind:

Each meter can be either used as one three-phase or as 3 single-phase meters.
When used as three single-phase, the three loads monitored must belong to the same phase (either R, S or T)

That is, the possible combinations are:

- 9 single-phase,
- 3 single-phase + 2 three-phase,
- 6 single-phase + 1 three-phase
- or 3 three-phase meters

If you want to measure a single-phase load that is associated with a particular phase, the current transformer must be connected to the terminal of the same phase.

For example, if the meter is associated with V3 (or T), the current transformer (or Rogowski coil) must be connected to the phase V3 (T) (see figure below).

It is important to note that the single-phase meters M11, M21, and M31 are associated with the V1 phase, the single phase meters M12, M22 and M32 to the V2 phase, and M13, M23 and M33 to the V3 phase.

For example, in this case, M13 is associated with V3, so the current transformer or Rogowski coil must be installed on V3.

In the following diagram, there is an example in which only T2 and M13 are used.

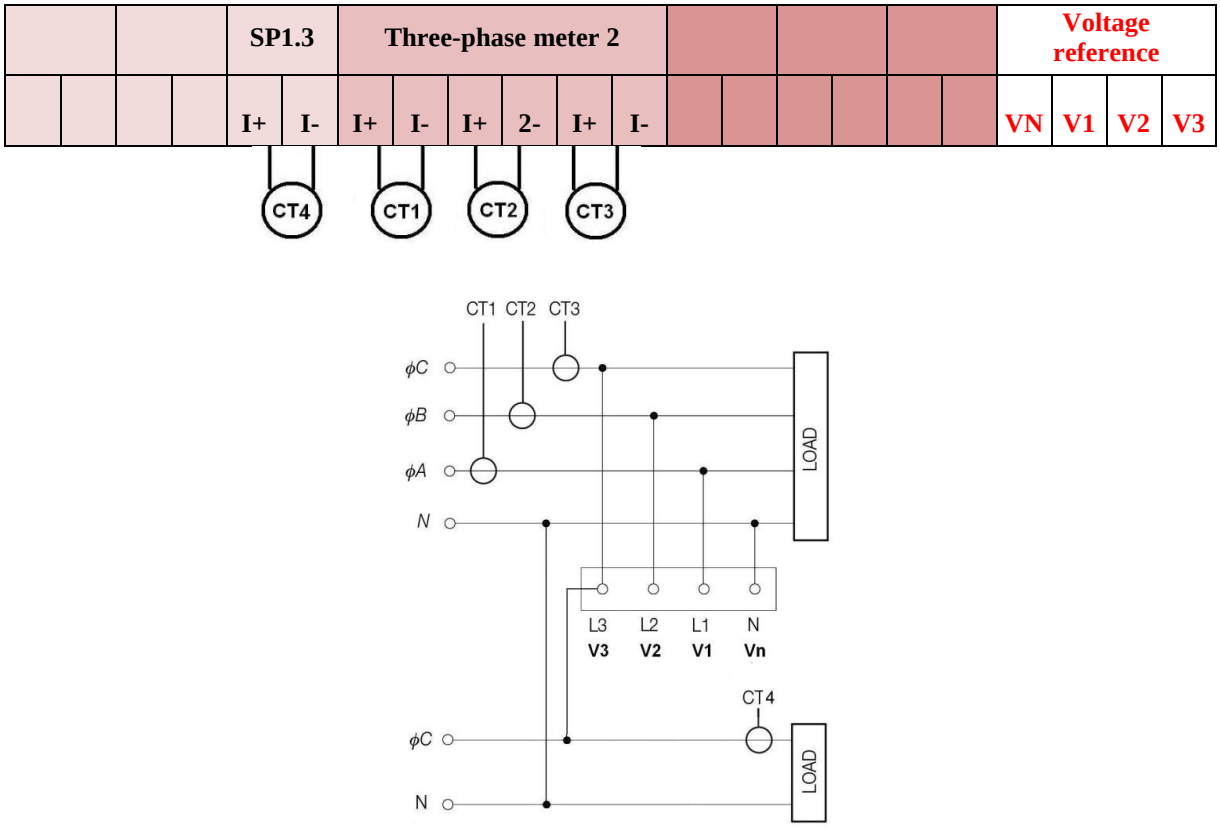


Figure 15. Example. Connection of a three-phase electricity meter and a single-phase one

5.5.5. Current transformers and Rogowski coils

All meters, either used as three-phase (T1, T2, T3) or single-phase (M11, M12, M12, M21, M22...), can be connected to current transformers or Rogowski coils as follows:

- Current **transformers** with 0.333V output, standardized for the following amperages (currents):

  - 5A
  - 50A
  - 100A
  - 150A
  - 400A
  - 800A
  - 1500A

- Connection of the CT's:

  - Black: negative
  - White: positive

- **Rogowski coils** for rated currents up to 5000A

It is recommended for currents between 100A and 5000A. Never use these type of coils for loads with rated currents lower than 5A.

Connection to the terminals:

- Black wire: to the negative terminal
- Red wire: to the positive one.
- The arrow in the label must be oriented towards the load

6. CONNECTION OF THE DL-170

6.1. Connection to the power supply

The models DL170, DL171 and DL172 are powered with a battery or with a stabilized power source 8-30 Vdc. For greater safety it is recommended the use of a 2A fuse in the power supply line.

The device can be powered with an external battery or with a stabilized power source. Your local distributor of SenNet can provide you a suitable power supply

For greater safety it is recommended to use a 2A fuse in the power supply line

Terminals		Description
1	+	¡Power supply 8...30 VDC! (a 2A-fuse is recommended)
2	-	
3	A	RS485 port
4	B	

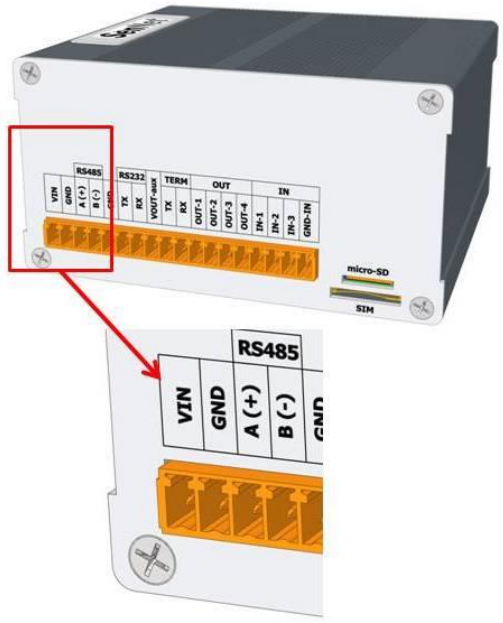


Figure 16. Power supply and RS485 terminals

6.2. Connection of the antennas: GPRS/3G, Z-Wave (optional) and RF

The terminals of the radio frequency and Z-Wave antennas are SMA (Sub Miniature version A). You should verify which antenna corresponds to RF and which to GPRS. All dataloggers DL170 have RF and GPRS outputs.

The Z-Wave and RF antennas should be installed following the ESD protections to prevent damage to the device

There are two LED lights that show the status of the RF module. If the radio is active, the bottom LED will be on. The upper LED will blink whenever the datalogger makes a shipment by RF.

6.3. USB / Wi-Fi port connection

The same instructions as for the DL150 model should be followed (see 4.3 USB / Wi-Fi port connection p. 24).

6.4. Ethernet port connection

The Ethernet port is in the opposite side to terminals and close to the GPRS and RF antennas.

6.5. GSM / GPRS port connection

The slot for the SIM card is located in the lower right part. A SIM card is needed for the GSM/GPRS communications.

GPRS LEDs: there are two leds to check the status of the GSM / GPRS module. This module is controlled by the operating system of the datalogger. If the activation is not configured, the LEDs' status will be off. If the GPRS is enabled, the bottom LED will light when the module is initialized, and the top LED will blink in each GPRS session.

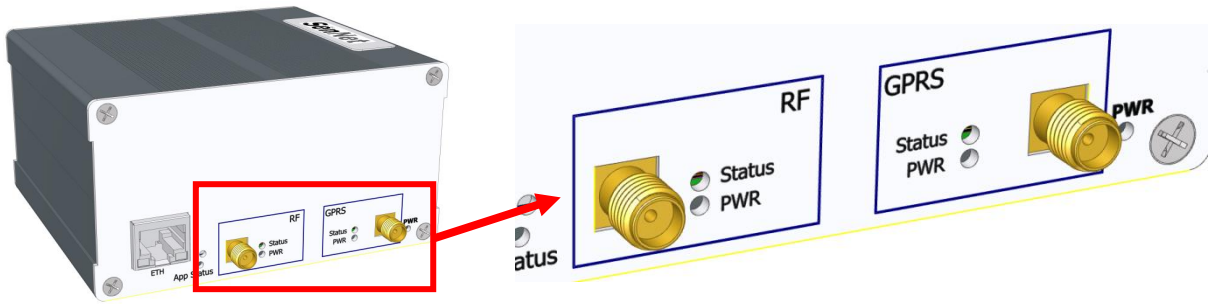


Figure 17. Location of the radio frequency and GPRS connector and the status LEDs

The terminal of the GSM/GPRS antenna is SMA (Sub Miniature version A).

The GSM/GPRS antenna should be installed following the ESD protections to prevent damage to the device

6.6. Digital outputs connection

The models DL170, DL171 and DL172 can operate with digital inputs and outputs:

The terminals 15, 16 and 17 are the digital inputs. The operation range must be <0.5V for 0 and> 2V for 1. The value can be read by the internal Web Server, by a Modbus TCP server or by the application for event controlling.

There are two types of digital outputs:

- Terminal 8 operates as an open collector, providing maximum 300mA. 5V-Output
- Terminals 11, 12, 13 and 14, max output 100mA

The outputs can be configured through the internal Web Server, through a ModbusTCP server or through the application for event controlling.

6.7. RS485 port connection

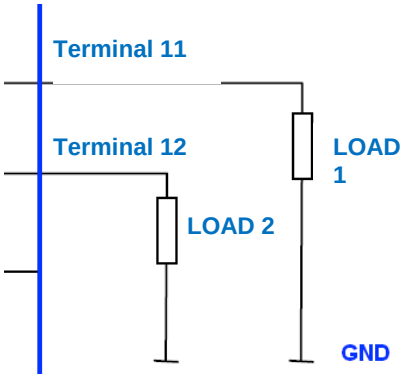


Figure 18. How to connect the outputs. Wiring diagram

The device has 5 LEDs with the functions specified below:

- **Application Status LED** (App Status): this LED should flash at a frequency of 1 Hz. It will take approximately 60s to start blinking since the datalogger is switched on. If the LED does not blink and it is either permanently off or permanently on, it is a sign of a malfunction.

Description of the terminals of the model DL170

Terminals	Reference	Description
1 2	+ -	Power 8-30 Vdc (the use of a 2A fuse is recommended)
3 4	A B	RS485 port
5	GND	GND
6 7	TX RX	RS232 port
8	Vout-aux	Auxiliary digital output 5V @ 300mA
9 10	TX RX	RS232 port (console)
11 12 13 14	Out-1 Out-2 Out-3 Out-4	Digital outputs 8-30 Vdc @ 100 mA (max.)
15 16 17	IN-1 IN-2 IN3	Digital inputs 8-30 Vdc
18	GND-In	GND input (optional isolation of digital inputs)

7. CONNECTION OF THE DL-171

7.1. Connection to the power supply

The same instructions as for the DL170 model should be followed (see section **Error! Reference source not found.**6.1 Connection to the power supply, p. 37).

7.2. Connection of the antennas: GPRS/3G, Z-Wave (optional) and RF

The terminals of the radio frequency and Z-Wave antennas are SMA (Sub Miniature version A). You should verify which antenna corresponds to RF and which to GPRS. All dataloggers DL171 have RF and GPRS outputs.

There are two LED lights that show the status of the RF module. If the radio is active, the bottom LED will be on. The upper LED will blink whenever the datalogger makes a shipment by RF.

7.3. USB / Wi-Fi port connection

The same instructions as for the DL150 model should be followed (see section 4.3 USB / Wi-Fi port connection, p. 24).

7.4. Ethernet port connection

The Ethernet port is in the opposite side to the terminals and close to the GPRS and RF antennas.

7.5. GSM/GPRS port connection

The terminals of the radio frequency and Z-Wave antennas are SMA (Sub Miniature version A). You should verify which antenna corresponds to RF and which to GPRS.

The GSM/GPRS antenna should be installed following the ESD protections to prevent damage to the device

For further information, see the connection of the GSM / GPRS port for the model DL170 (section 6.5 GSM / GPRS port connection p. 38).

7.6. Digital-outputs connection

The same instructions as for the DL170 model should be followed (see section 6.6 Digital outputs connectionDigital , p. 38).

7.7. Connection of the electricity meters

The same instructions as for the DL151 model should be followed (see section 5.5 Connection of the electricity meters, p. 26).

8. CONNECTION OF THE DL172

8.1. Connection to the power supply

The same instructions as for the DL170 model should be followed (see section 6.1 Connection to the power supply, p. 37).

8.2. Connection of the antennas: GPRS/3G, Z-Wave (optional) and RF

The terminal of the radio frequency antenna is SMA (Sub Miniature version A). You should verify which antenna corresponds to RF and which to GPRS. All dataloggers DL172 have RF and GPRS outputs.

The RF antenna should be installed following the ESD protections to prevent damage to the device

There are two LED lights that show the status of the RF module. If the radio is active, the bottom LED will be on. The upper LED will blink whenever the datalogger makes a shipment by RF

8.3. Ethernet port connection

The Ethernet port is in the opposite side to the terminals.

8.4. GSM/GPRS port connection

The slot for the SIM card is located in the lower right part. A SIM card is needed for the GSM/GPRS communications. There is a second slot for the µSD card.

The terminals of the radio frequency and Z-Wave antennas are SMA (Sub Miniature version A). You should verify which antenna corresponds to RF and which to GPRS.

The GSM/GPRS antenna should be installed following the ESD protections to prevent damage to the device

8.5. Digital outputs connection

The same instructions as for the DL170 model should be followed (see section 6.6 Digital outputs connection, p. 38).

8.6. Connection of the electricity meters

The model DL172 incorporates six internal 3-phase electricity meters. There are three meters in each row, each one, with 6 terminals to measure the current (intensity). In addition, in each row there are 4 terminals for the voltage reference (VN, V1, V2 and V3). The same instructions as for the DL151 model should be followed see section 5.5 Connection of the electricity meters, p. 26).

For easier installation, we recommend not to use ferrules (end sleeves) to connect the cables to the electricity meters 4, 5 and 6 in the model DL172

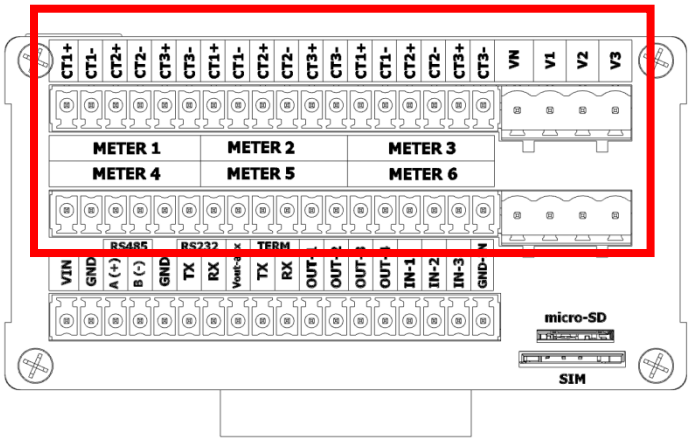


Figure 19. Electricity meters of the model DL172. Terminals diagram

CONNECTION

DATALOGGER'S SETTING

9. ACCESS TO THE DATALOGGER'S INTERFACE

In order to start the set-up of the datalogger, you must follow these steps:

- Connect the datalogger to a PC using an Ethernet cable (or connect the datalogger to an Ethernet network).
- Connect the datalogger to a power supply. After approximately one minute, you should see the status LED blinking once per second.
- By default, the datalogger is supplied with an IP 192.168.1.35. If you haven't changed it, you can access to the datalogger typing in your web browser: http://192.168.1.35:8080 . We recommend the use of Google Chrome or Safari. After pressing enter, you should see an screen similar to the following:

At the home screen you can see the model of the datalogger, the serial number (which is the same serial number that is written on the sticker of the device), the type of license (code that depends on the number of electricity meters and the number of devices to be licensed) and the software version.

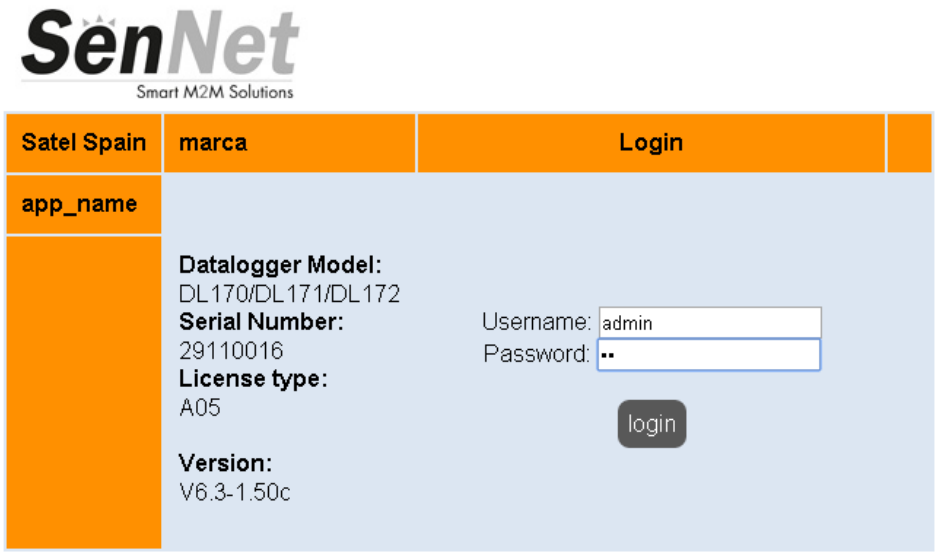


Figure 20. Start screen to access to the datalogger's interface (the screen may slightly vary depending on the model and type of license)

There are three access levels:

- **User** (users can view but they cannot modify data)
  Username: "user"
  Password: "logger"
- **Administrator** (Administrators can view and modify data)
  Username: "admin"
  Password: contact your supplier of SenNet products or contact the technical department of Satel Spain
- **Customizer** (this user can customize the logo, the company and the product name):
  Username: "admin"
  Password: contact your supplier of SenNet products or contact the technical department of Satel Spain

10. MAIN INTERFACE MENU

Once you enter the correct user and password, you will see a screen similar to this:

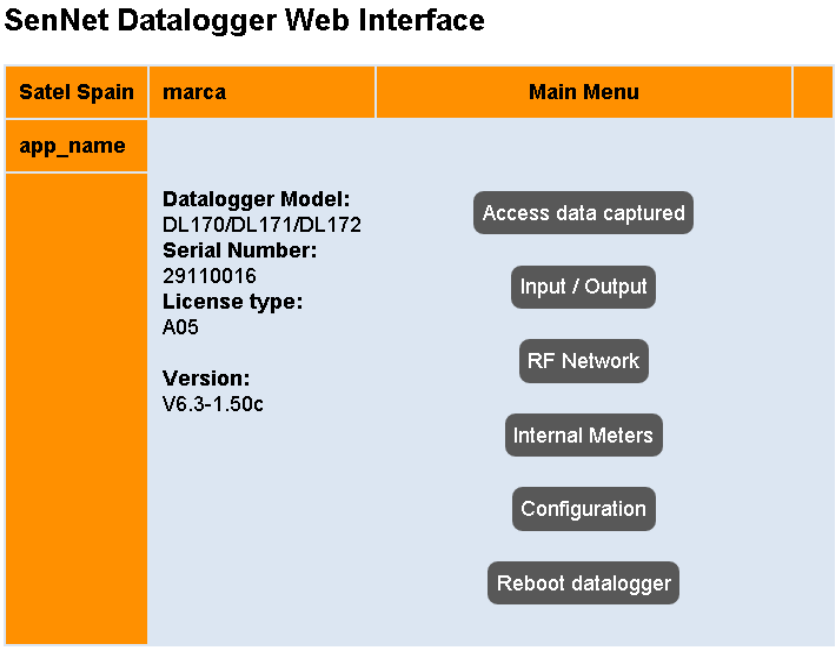


Figure 21. Interface menus

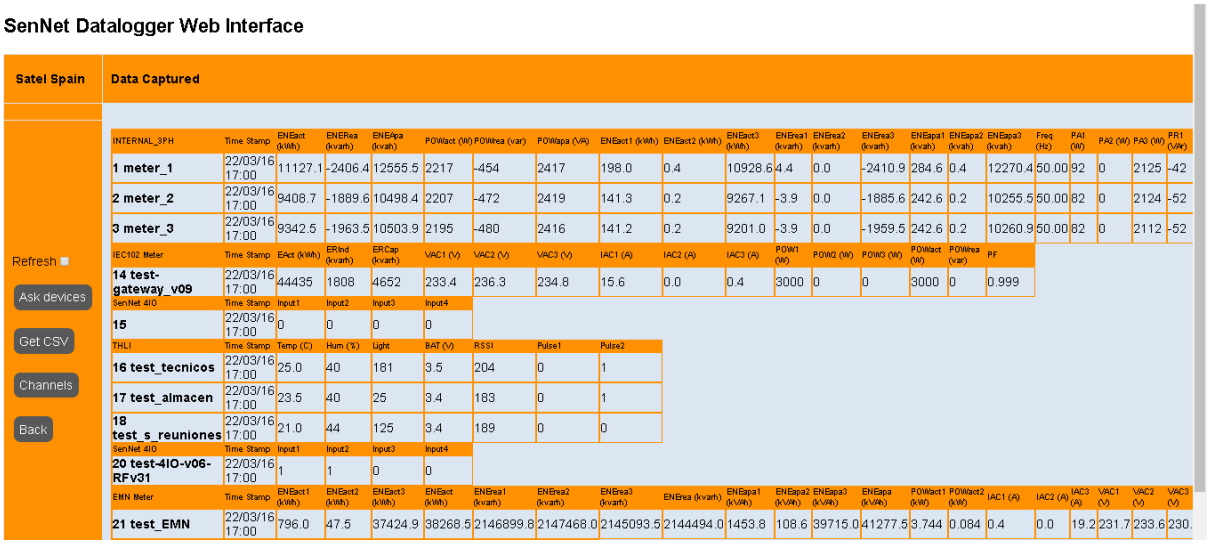
The interface menus may vary depending on the model and license. In this manual only the most common options are described

Common menus:

- Access data captured: Allows to visualise the data captured
- Input / output: Allows to read inputs or action the outputs
- RF Network: Allows to see the devices connected to the Radio Frequency network of the datalogger
- Internal Meters: Internal electricity meters (this menu is not visible in the models without internal electricity meters: DL150 and DL170).
- Configuration: Allows to set up the equipment
- Datalogger **Reboot:** Allows to reboot the datalogger
- GPRS **Status:** This button appears once you have already set up the connection to GPRS. Please, note that not all models of datalogger have a GPRS module.

11. MENU "ACCESS DATA CAPTURED"

The datalogger allows you to view the data captured directly in your web browser clicking on the button "Access Data Captured".



SenNet Datalogger Web Interface

Satel Spain | Data Captured

Refresh ☐ | Ask devices | Get CSV | Channels | Back

INTERNAL_3PH	Time Stamp	ENEact (kWh)	ENERea (kvarh)	ENEApa (kvah)	POWact (W)	POWrea (var)	POWapa (VA)	ENEact1 (kWh)	ENEact2 (kWh)	ENEact3 (kWh)	ENERea1 (kvarh)	ENERea2 (kvarh)	ENERea3 (kvarh)	ENEapa1 (kvah)	ENEapa2 (kvah)	ENEapa3 (kvah)	Freq (Hz)	PA1 (W)	PA2 (W)	PA3 (W)	PR1 (VAr)
1 meter_1	22/03/16 17:00	11127.1	-2406.4	12555.5	2217	-454	2417	198.0	0.4	10928.6	4.4	0.0	-2410.9	284.6	0.4	12270.4	50.00	92	0	2125	-42
2 meter_2	22/03/16 17:00	9408.7	-1889.6	10498.4	2207	-472	2419	141.3	0.2	9267.1	-3.9	0.0	-1885.6	242.6	0.2	10255.5	50.00	82	0	2124	-52
3 meter_3	22/03/16 17:00	9342.5	-1963.5	10503.9	2195	-480	2416	141.2	0.2	9201.0	-3.9	0.0	-1959.5	242.6	0.2	10260.9	50.00	82	0	2112	-52

IEC102 Meter	Time Stamp	EAct (kWh)	ERInd (kvarh)	ERCap (kvarh)	VAC1 (V)	VAC2 (V)	VAC3 (V)	IAC1 (A)	IAC2 (A)	IAC3 (A)	POW1 (W)	POW2 (W)	POW3 (W)	POWact (W)	POWrea (var)	PF
14 test-gateway_v09	22/03/16 17:00	44435	1808	4652	233.4	236.3	234.8	15.6	0.0	0.4	3000	0	0	3000	0	0.999

SenNet 4IO	Time Stamp	Input1	Input2	Input3	Input4
15	22/03/16 17:00	0	0	0	0

THLI	Time Stamp	Temp (C)	Hum (%)	Light	BAT (V)	RSSI	Pulse1	Pulse2
16 test_tecnicos	22/03/16 17:00	25.0	40	181	3.5	204	0	1
17 test_almacen	22/03/16 17:00	23.5	40	25	3.4	183	0	1
18 test_s_reuniones	22/03/16 17:00	21.0	44	125	3.4	189	0	0

SenNet 4IO	Time Stamp	Input1	Input2	Input3	Input4
20 test-4IO-v06-RFv31	22/03/16 17:00	1	1	0	0

EMN Meter	Time Stamp	ENEact1 (kWh)	ENEact2 (kWh)	ENEact3 (kWh)	ENEact (kWh)	ENERea1 (kvarh)	ENERea2 (kvarh)	ENERea3 (kvarh)	ENERea (kvarh)	ENEapa1 (kVAh)	ENEapa2 (kVAh)	ENEapa3 (kVAh)	ENEapa (kVAh)	POWact1 (kW)	POWact2 (kW)	IAC1 (A)	IAC2 (A)	IAC3 (A)	VAC1 (V)	VAC2 (V)	VAC3 (V)
21 test_EMN	22/03/16 17:00	796.0	47.5	37424.9	38268.5	2146899.8	2147468.0	2145093.5	2144494.0	1453.8	108.6	39715.0	41277.5	3.744	0.084	0.4	0.0	19.2	231.7	233.6	230.

Figure 22. Menu 'Access data captured', overview

On the left side of the screen you have the following options:

- Refresh box. When the box is selected, the data are updated every minute.
- Ask devices: Allows to force a call to the devices
- Get CSV: Allows to access to the folder structure and to the CSV files
- Channels: Allows to access channels of different devices indicating the id of each channel. The id is used both to calculate the MODBUS TCP channel register and to define events.
- Back: back to the main menu.

12. MENU "INPUT / OUTPUT"

In this menu you can see the digital inputs and outputs of the datalogger. The buttons available are 3:

- Digital inputs: Overview of the inputs and its status. On/Off.
- Outputs: Overview of the digital outputs. You can activate and deactivate them by pressing the buttons.
  - If the button is red: the output is disabled.
  - If the button is green: the output is enabled.
- Back: back to the main menu.

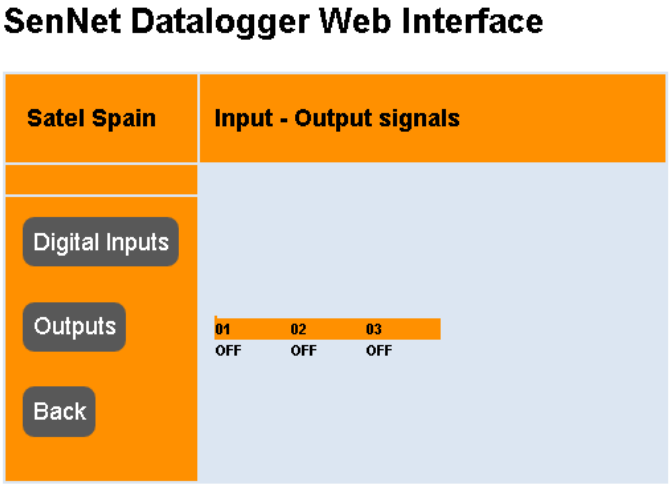


Figure 23. Overview of the menu **'digital inputs'**

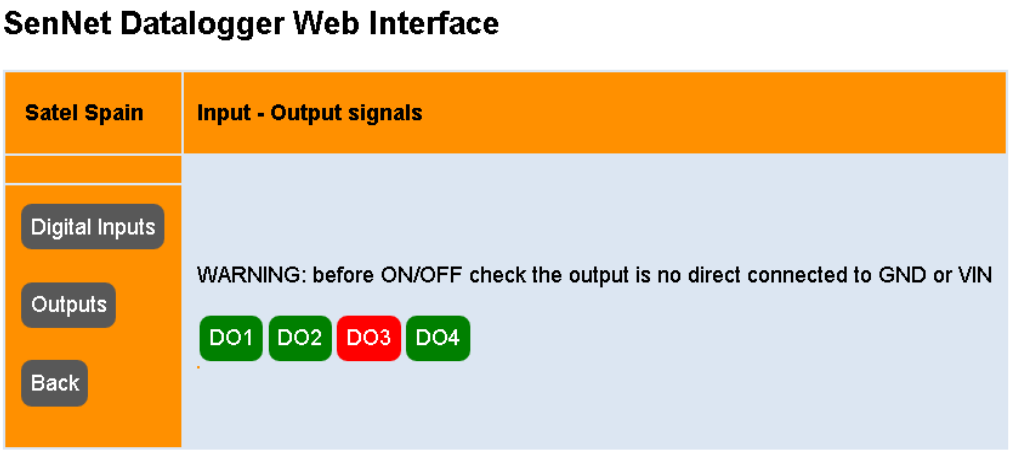


Figure 24. Overview of the menu '**Outputs**'. In this case, the digital outputs DO1, DO2 and DO4 are enabled (green) and DO3 is disabled (red)

The inputs and outputs of the datalogger can be controlled in other ways:

- Through MODBUS TCP (see 15.1.3. Modbus TCP, page XXXXXXXXXXX)
- Through events (see 15.3. Events page XXXXXXXXXXXX)

SETTING

13. MENU "RF NETWORK"

By default, the radio network is enabled. If the radio network is disabled, you will see the message: "RF Network disabled!"

This menu provides information on the devices connected to the datalogger by radio frequency. For each appliance it reports:

- SN: serial number. For example "SN: 19983".
- Signal: signal level. To ensure the correct reception of the data, the signal level must be > 160. If the signal level is not correct, the green LED of the device will blink. If the signal of the device is not strong enough, it will be necessary to install a repeater between the device and the datalogger.
- Link Quality: signal quality. It should be> 200. In general, if the signal level is correct, the quality will be too; however, in environments with engines or machines that create "noise" the quality may not be enough.
- Connections: number of connections. It is used to see the signal stability. If it's 0, it means there have been 0 connections with the device.
- Version: the version of the internal software.
- ROL: it could be either "router" or "end". If *it is router*, the device sends its own data to the datalogger and it also functions as a router that receives and forward signals from other devices. If it is *end*, the device only sends its own signals, but it does not receive or routes signals from other devices.
- Only the devices EMN-RF, Repeater-RF, 4IO-RF, 4-Analog-Input-RF, CO2-RF and Gateway-RF can work as a router. See the chapter: "SenNet devices network" p. 89 for more information. The routers enlarge the radio network so that they route the signals of faraway devices to the datalogger. The devices rely on other devices to get their way to the datalogger.
- Last ping: the last time the datalogger was connected to the device.

The button Refresh network topology serves to force a restart of the topology of the mesh network.

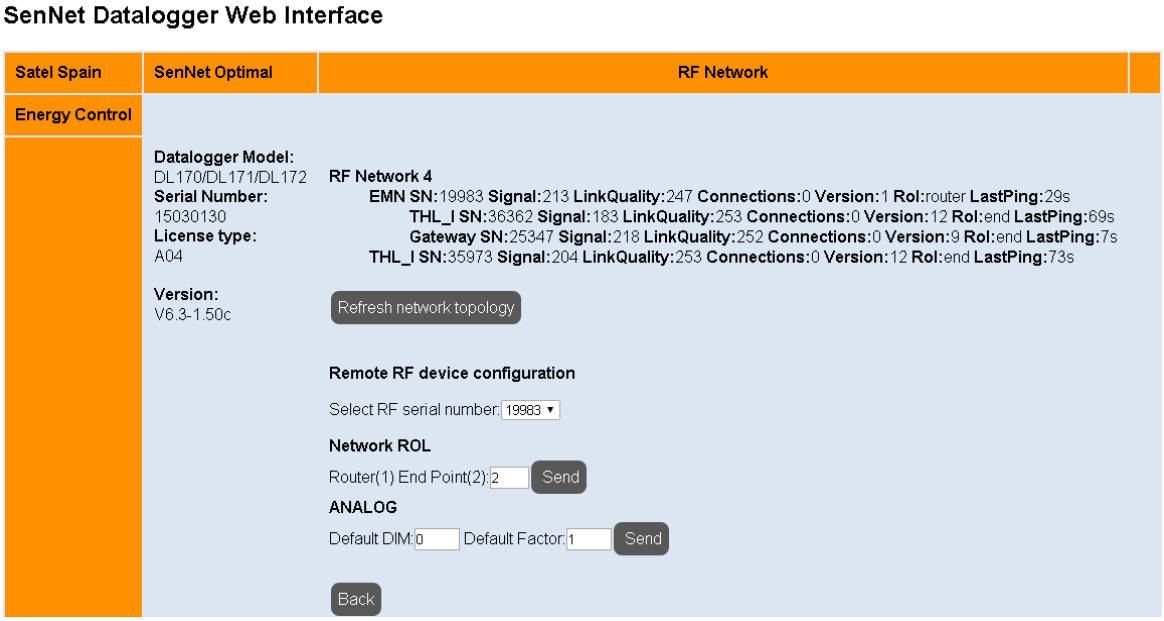


Figure 25. Overview of the menu **RF Network**. In the example, 8 radio devices have been found

In the section Remote RF device configuration you can select the role of each device. To do so, you must select the serial number of the device you want to set up and in the field Network ROL you must enter "1" for *router* or "2" for *endpoint*.

SETTING

14. MENU“INTERNAL METERS” ABC METHOD

The DL151, DL171 and DL172 models incorporate a function to check the correct connection of voltages and currents, called ABC METHOD.

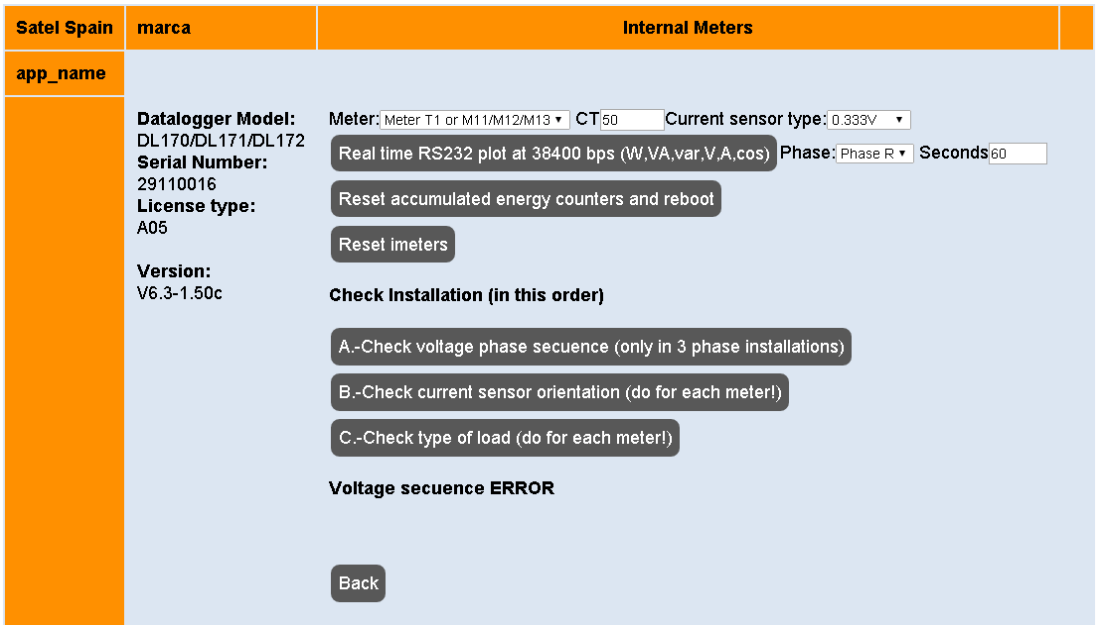


Figure 26. Overview of the menu **Internal Meters**, used to apply the ABC method to check the connection of the internal electricity meters.

For **each meter** you want to check, you must follow the following steps:

- Meter: to select the meter.
- CT: to select the current of the current transformer /Rogowski coil.
- Current sensor **type:** the type of sensor can be 0,333V or Rogowski coil.
- Reset accumulated energy counters and **reboot.** To reset the readings. It is important to perform this operation:
  - Whenever the installation is completed
  - When the datalogger is moved to different facilities
- Reset imeters. To reset the counters after making any configuration changes (current transformers...).

Then the ABC steps should be followed.

- A, check the voltage phase sequence. To test the phases. It is done only once and allows you to check in three-phase installations that connection to voltage phase sequence R, S, T has been respected. Do not pass to step B until the configuration of this step is correct. You should see the message: Voltage sequence OK
  To connect the phases correctly you can enlist the help of a phase meter. Usually, the colour code that works on most installations is: Black for V1 (R) phase, brown for V2 (S) and grey for V3 (T). The phase V0 (N) is usually blue. However, such classification sometimes fails. After making a change in the configuration of the installation, you must press reset imeters before pressing again A. - Check voltage phase sequence.

Do not go to Step B if you do not see the message "Voltage sequence OK" as a result of step A

SETTING

- B, Check current sensor orientation. Checking the polarity (this step must be carried out for each of the meters that will be used). For each phase the system will display a message about what you are measuring. CONSUMPTION (if consumption is being metered), GENERATION (if the CT are metering energy generated) or NO LOAD. In general terms, if there is no energy production at the facilities (no solar panels, wind turbines ...) the result for all phases should be consumption. If it were not, you have to check the polarity of the connection of the probe or the orientation of the cable.

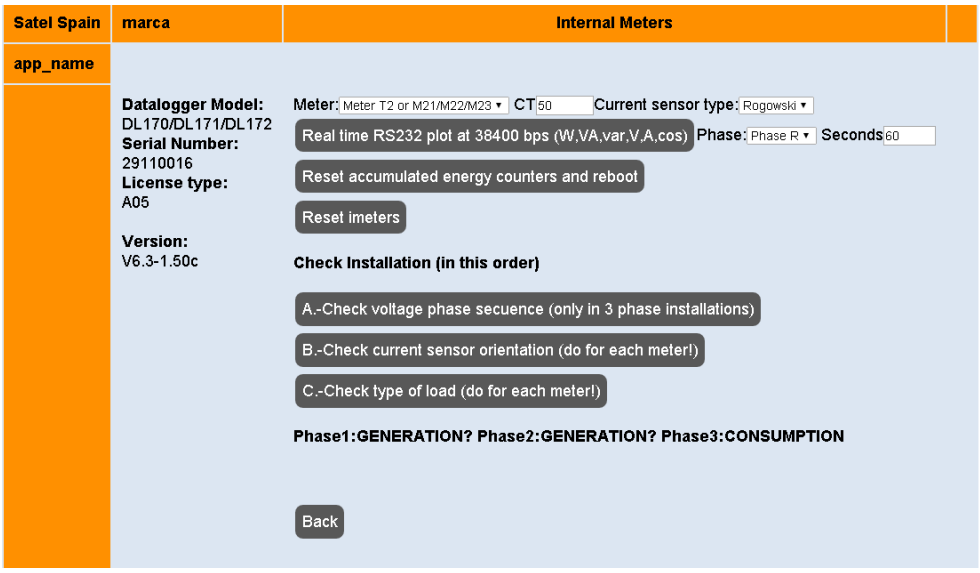


Figure 27. Message shown at step B. In this case, there are two phases that measure generation and one phase that measures consumption (Phase 3). This is a signal that the meter is not properly connected.

- C, check type of load: Check the type of load (inductive, capacitive or resistive). It should be done for each electricity meter.
  The datalogger will show whether the type of load that is metering (INDUCTIVE, CAPACITIVE, RESISTIVE or NO LOAD). To interpret the results of this step one must have electrical knowledge and must know the project in order to identify whether the result is as expected. If it not, the error will be that one for the CTs (or Rogowski coils) has been connected to a different phase and not to the correspondent one. For instance, it may be that the CT 1 has been connected to the phase S or T (instead of R) or it may be that the probe 2 has been connected to R or T (instead of S).

Upon completion of the installation of the datalogger or after changing it to another installation, you must press the button: Reset accumulated energy counters and reboot

NO LOAD detection

The dataloggers SenNet DL151, DL171 and DL172 incorporate the function no load detection, so that whenever the load measured is less than 5 per thousand of the nominal value of the load, it is assumed that there is no load (0 intensity and 0 power). Thus the possibility of false measures or small load values produced by noise is eliminated.

The following additional criteria are applied:

- If the resulting value of 5 per thousand is less than 300mA, then 300mA is used as the smallest threshold

- If the nominal value of the probe is less than 1000A and the resulting value of 5 per thousand is higher than 1A, then 1A is used as the smallest threshold.
- For Rogowski coils the minimal value taken into account is 5A.

15. MENU "CONFIGURATION"

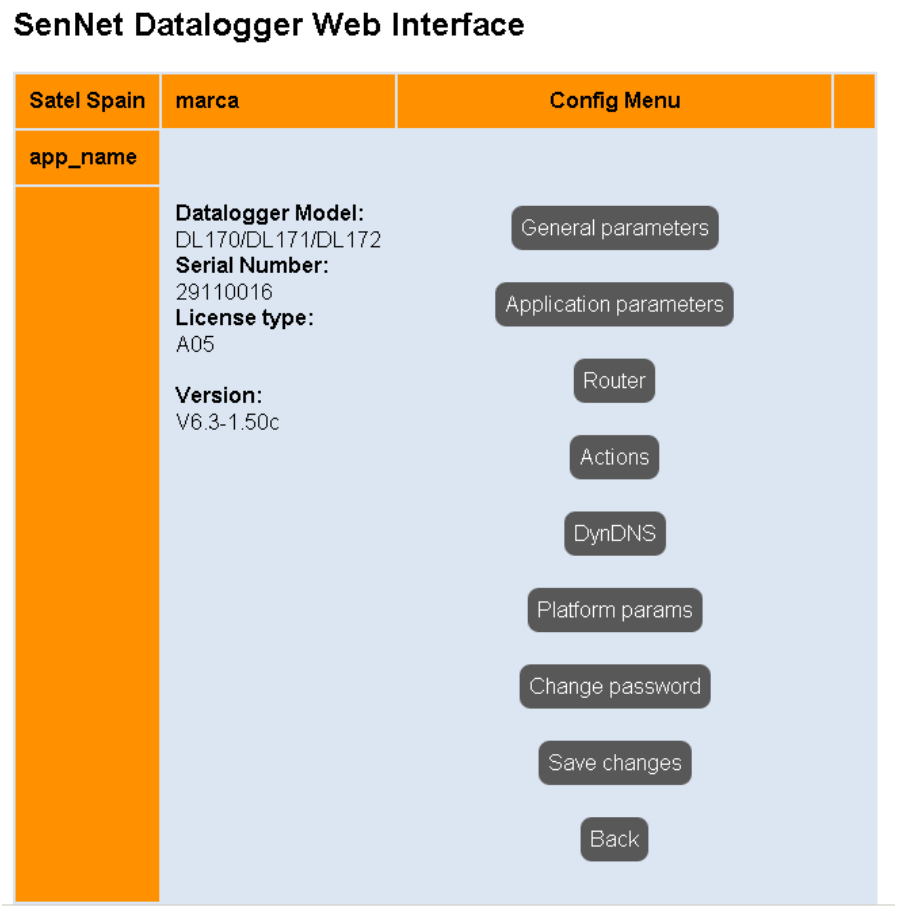


Figure 28. Overview of the menu "**Configuration**"

NOTE: The options vary from one version to another. This manual only describes the main options:

- General **parameters:** configure the general operation parameters of the datalogger.
- Application **parameters:** configure the specific parameters of the application installed in the datalogger.
- Events: definition of events.
- **Router.**
- **Actions.**
- DynDNS: to configure a DynDNS account
- Platform **parameters:** access to the configuration of the main energy and IoT platforms
  - Carriots: set the specific parameters of the platform Carriots.
  - SenNet **API:** set the specific parameters of the platform SenNetAPI.
  - Sofia2 **credentials:** set the specific parameters of the platform SOfia2.
- Change password: modify the password to access the datalogger.
- Save **changes:** save the changes.
- Back: return to the main menu.

The buttons available will vary depending on the model and license. In this manual only the most common options are described

15.1. General parameters

In this menu you will find the (Network Parameters), the general metering parameters of the datalogger (Operating Parameters), Modbus TCP, the GPRS Parameters, the DNS Parameters, the connection to a server FTP (FTP Parameters), the radio frequency parameters (RF Parameters) and the storage Parameters.

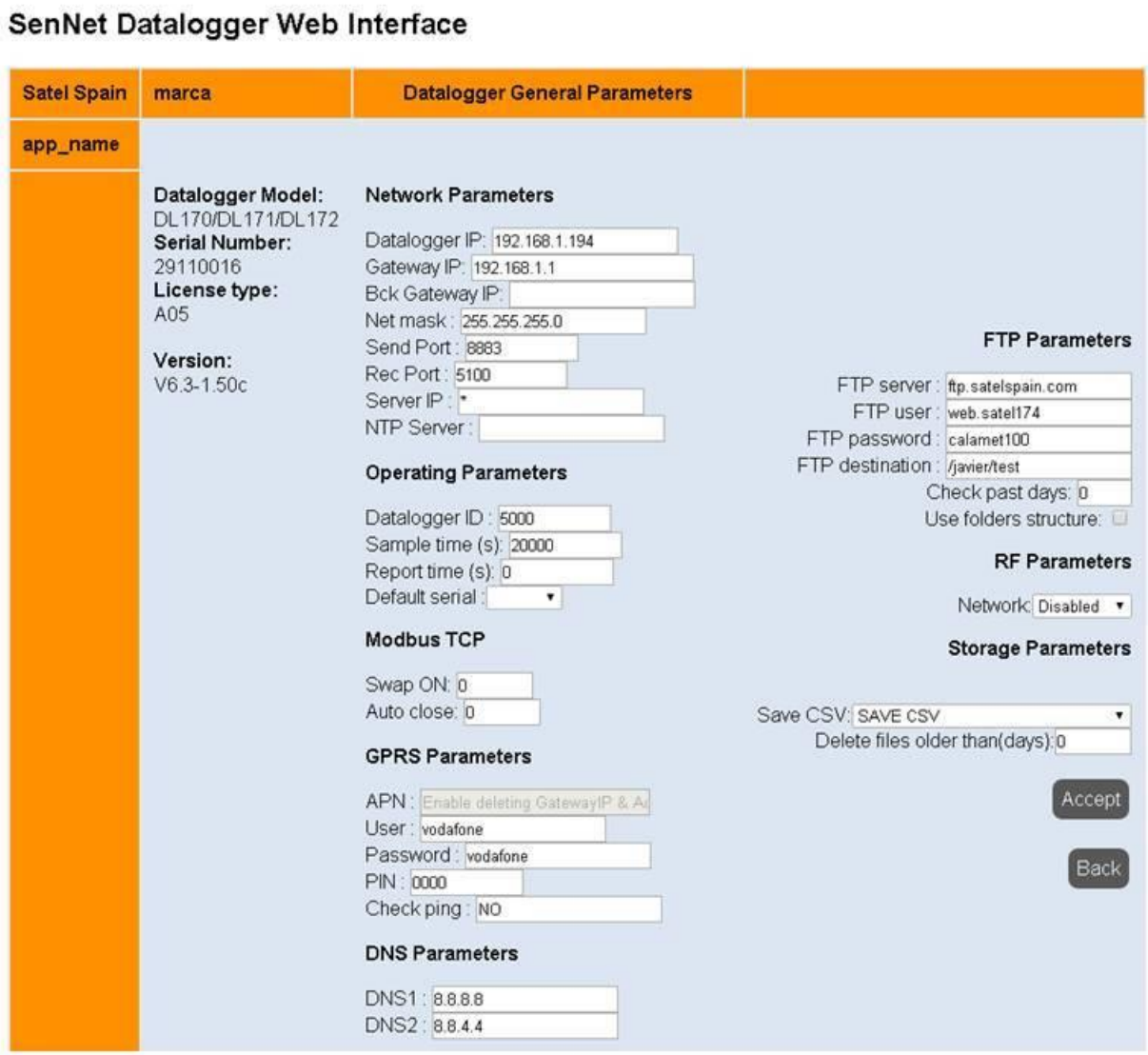


Figure 29. Overview of the button **General parameters**, within the menu **Configuration**.

The fields in the section can be different depending on the version of the app

In order to save the changes made in this screen, it is necessary to click on **Accept** and then click on the **Save Changes** button in the **Configuration menu**. See 15.9Save changes, p. 72

15.1.1. Network Parameters

- Datalogger IP: The IP address you want to assign to the datalogger.
- Gateway IP: To access to the datalogger through Ethernet. If you want to access through GPRS (or GSM), then put an asterisk * and reboot the datalogger. You cannot simultaneously access the datalogger through GPRS and Ethernet. You must choose between the two options.
- Bck Gateway IP: IP address of the second router. If this field is assigned the same value as in gateway IP, then the device will periodically check the Ethernet connection and in case it does not work, the device will be rebooted. It can be useful to configure two networks. In case the first one falls, the device will communicate through the second one.

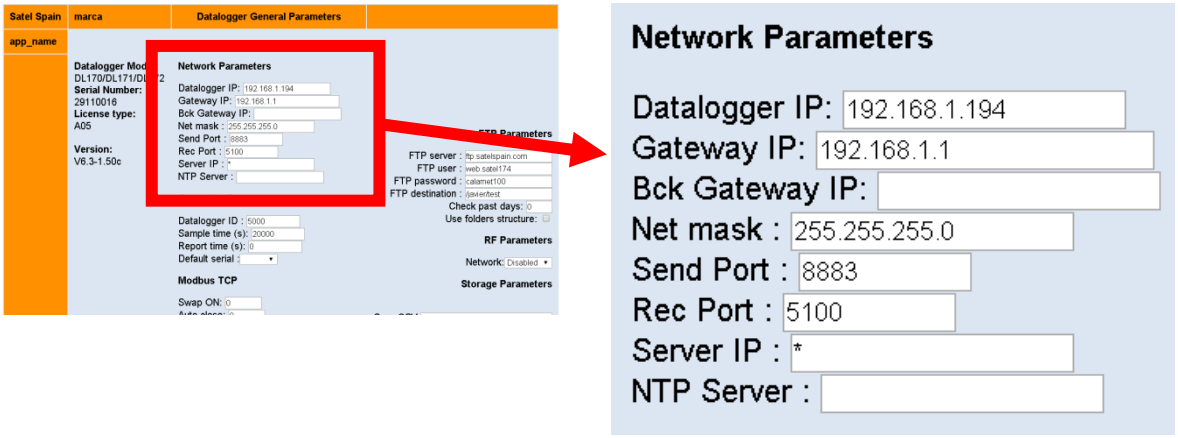


Figure 30. Detail view of the **Network parameters**

- Net Mask: Mask of the LAN network of the datalogger
- Send Port: Port with TCP-IP protocol (depending on the platform used) to send the data. It only works if the platform permits the use of a send port.
- Rec Port: receiving port server with TCP-IP protocol (depending on the platform used).
- Server IP: IP URL of the sending server (type * if it is not necessary to send data to a server).Only a few platforms require it.
- NTP Server: URL or IP address of the server used to synchronize the clock. By default, the internal clock uses time.mit.edu if nothing is specified. The time is checked once a day. If no synchronisation is needed, then type "NO".

If you want to set a GPRS connection, the field Gateway IP must be filled with an asterisk * (delete all numbers)

15.1.2. Operating Parameters

- Datalogger ID: depending on the server and on the platform used, it may be necessary to assign an identifier to the datalogger.
- Sample time: It is expressed in seconds. It indicates how often the data logger should start an interrogation cycle to ask the devices configured in the "Application parameters" section. The beginning of the interrogation cycle will coincide with minute point, for example if the sample time is 300s, the beginning of the interrogation will match the minutes 0, 5, 10, 15, 20...
- Report time: how often should the data captured be sent to the server. If no value is specified, the datalogger will take the same value for "report time" and "sample time".
- Default serial: Since the datalogger has serial port RS485 and in some models it has RS232, this field specifies which one should be used as a transparent IP-serial gateway. For this function, the port “Rec port” is used. If no port has been set, the port by default is the datalogger ID plus 100.

15.1.3. Modbus TCP

This section must be configured only in case you want to interrogate an external server. The options are:

- Swap ON: the datalogger includes a Modbus TCP server. For example, it can be interrogated by a SCADA. Since each value is expressed by two 2-bit registers, this field allows for specifying which register is the upper one and which is the lower one. It is explained in more detail in the section Modbus TCP Server.
- Auto close: Time, in seconds, to close the socket in case the status of the port Modbus TCP is inactive.

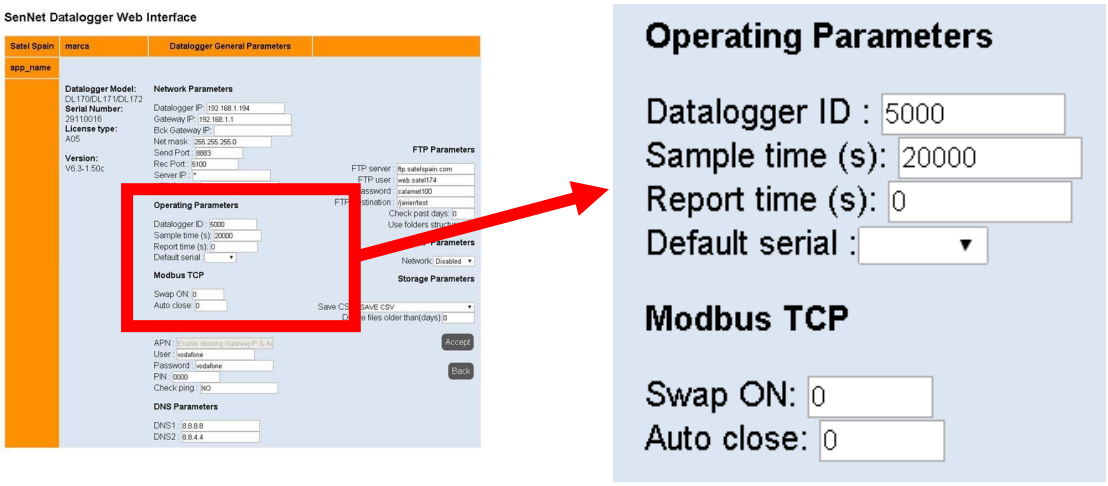


Figure 31. Detail view of Operating Parameters and Modbus TCP

15.1.4. GPRS parameters

To configure the GPRS connection of the datalogger delete the field Gateway IP and type an asterisk * instead. Then, save the changes and restart the datalogger.

- APN: the Access Point Name of the telephone operator of your SIM card. If you do not want the datalogger to use the GPRS connection, write an asterisk *.
- User: the user set by the telephone operator
- Password: the password set by the telephone operator
- PIN: it is recommended to disable the PIN of the SIM card. This field must be always filled in. If the card does not have PIN, then, type for zeros 0000.
- Check ping: IP or URL address to which the datalogger will ping every 5 minutes in order to verify that the GPRS connection is working. There are three possible values: zero (0), if you want the datalogger to connect to the URL set by default; NO, if you don't want the datalogger to check the ping (this can lead to faults); or, if wanted, the user can type a particular URL.
- If after 3 pings the datalogger does not receive any reply, the GPRS connection is restored.

The fields: APN, User and Password from the section GPRS Parameters must always contain something. If you are not going to use the GPRS connection, put an asterisk (*)

- If the SIM card is associated with a dynamic IP connection, in order to remotely communicate with the datalogger the following methods can be used:

- Get the current IP by sending to the SIM card in the datalogger an SMS with the text "sennet ip". You will receive an SMS with the current IP address of the datalogger.
- Get the current IP through the sending server if the server facilitates the IP of the last connection.
- Use the DynDNS service. To do this you must have a DynDNS account or create it at https://account.dyn.com/entrance . Then, register the account in the menu "Configuration> DynDNS". You will see a screen like this:

Contact Satel Spain or your SenNet supplier to know how to configure the datalogger depending on the telephone operator.

The field PIN must always be filled in. If the PIN of the SIM card is not enabled (recommended), introduce 0000 (four zeros).

It is recommended to disable the PIN, as it tends to give less connection problems.

Always introduce some value In the field "check ping". The option NO is not recommended, since the datalogger will not check that the connection is working, so it can lead to connection failures

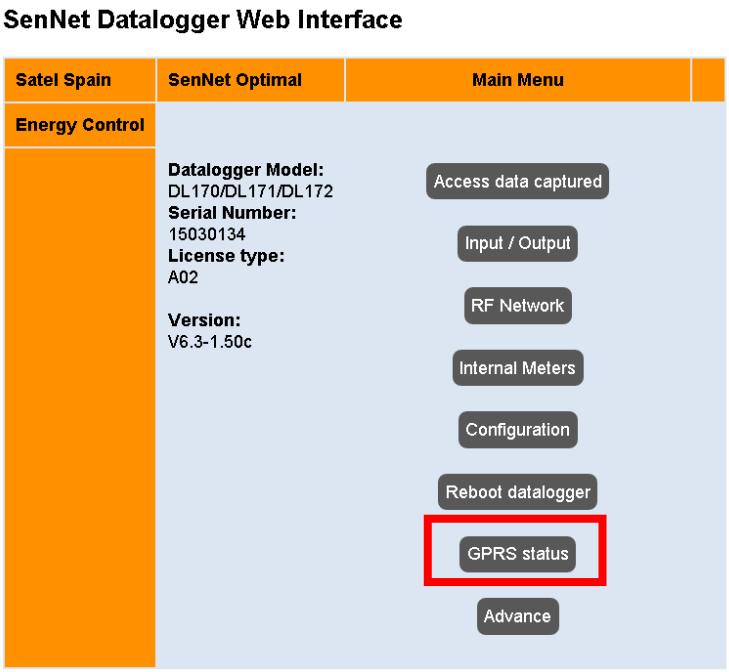


Figure 32. GPRS status menu

After setting the access parameters to configure the GPRS you must save changes clicking on **Configuration>** Save changes and restart the datalogger clicking on Reboot datalogger at the initial screen.

Once this is done, you should see a new button in the initial menu of the datalogger interface (button: GPRS status).

Clicking on GPRS status you will see the signal level of the connection. For a proper operation, a value > 10 is recommended. However, some devices can operate with lower signal levels.

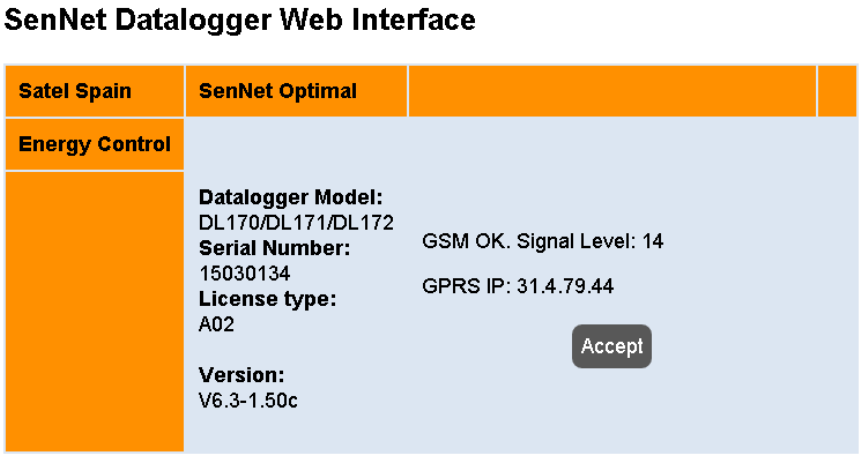


Figure 33. GPRS status button

15.1.5. DNS parameters

- DNS1: main DNS server IP
- DNS2: second DNS server IP

If no IP of DNS server is specified, the datalogger does not resolve the DNS. It is recommended to leave the default values.

- DNS1: 80.58.61.250
- DNS2: 80.58.61.256

If the connection is through Ethernet, the DNS used as default will be:

If the connection is through GPRS the IP's will be the ones given by the telephone operator when establishing the GPRS session.

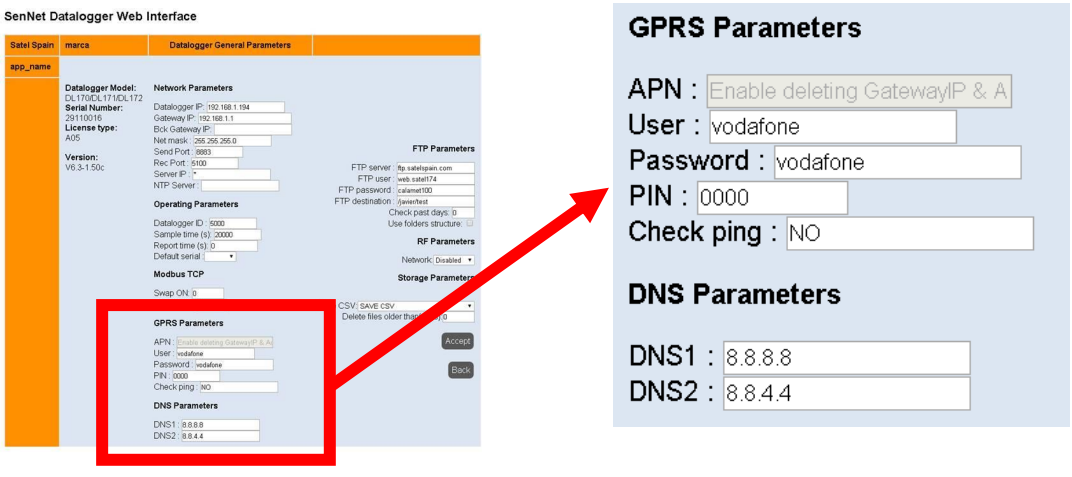


Figure 34. Detail view of the sections GPRS Parameters and DNS Parameters

15.1.6. FTP parameters

- FTP server: the server FTP to send the data stored in the SD card

- FTP user: name of the user of the FTP server
- FTP password: password associated to the user
- FTP destination: destination folder of the FTP
- Check past days: if the value is not 0, the device will check the files created in the n past days to check whether there are files that have not been sent to the FTP server. If it is 0, the datalogger will send the files created during the current day. It is recommended to set as the default value 7 days.
- Use folders structure: if this option is marked, the datalogger will send the files to the FTP server using the folder structure: year/month/day.

The datalogger sends through FTP the data captured if and only if it is configured to store the data in the SD card and with the time interval indicated. (see section 15.1.8. Storage parameters, p. 60)

15.1.7. RF Parameters

Here it is possible to define the radio network that is going to be used (1 to 4). It must match the radio network configured in the remote devices (peripherals). The default is Network is number 1.

15.1.8. Storage parameters

In order to configure the storage parameters it is essential to have a microSD card. Ask Satel Spain or your SenNet supplier in case you want a special card for industrial uses.

- Save CSV: in this field is you can define the data storage in CSV format and whether you need to send the data to the FTP server previously specified in the field "FTP parameters".
- Delete files older than (days): if you want the datalogger to automatically delete the files older than the number of days specified.

To configure the storage parameters, it is essential to have a µSD card.

15.2. Application parameters

If you click on the button "Application parameters" you will be taken to a screen that will vary depending on the application installed in the datalogger.

You will be given detailed information in the specific application manual, but for information purposes an image is attached in this example.

Number of devices: total number of sensors (peripherals) in the network.
NOTE: If you change this value, click on the refresh button of your browser.

- IEC 102 Measuring point / Meter key: data to access the meter from the utility company (tariff meter). This is only in case the protocol IEC 102 is used.
- LP date time: it can be configured to take the data at the end of the quarter of hour (End of quarter) or at the beginning (Beginning of the quarter).
- Listen before send: the lapse of time between the measurement and the shipment.
- Site name: name of the site (facilities). The name is provided by the energy distribution company.
- kW to generate 1 blink/s: it is possible to set the power reference to blink 1 Hz.
- Analog conversion: conversion parameters for the signals from the analog inputs, if applicable.
- Voltage control imeters: maximum and minimum values to control the quality of the mains voltage.
- imeters 3 phase mode: the way in which the three phase meters are connected

- Street Lighting: select if the application is for street lighting.
- CSV name format: name format of the CSV files.
- CSV fields: indicate the list of the range of files that are going to be stored in the CSV. Click on the interrogation (?) to see the format.
- Management Platform: the type of the platform to send the data.
- List of devices: table that contains one record per device. The columns of the table are:
- Type of device. Select displaying the list of available.
- Comm id: (physical identifier of the communications): the id for communications.
    - If it is a device with Modbus RTU protocol, the Comm id will be the Modbus id (e.g. the devices 'SenNet 4Input-4Output-RF','SenNet 4Input-4Output RS485' or 'SenNet 4analog-input-RF').
    - If it is a meter with IEC 870-5-102 protocol, the id will be the link address, etc.
    - If it is a device that forms part of the SenNet radio network, you should write the serial number included on the label of the device (e.g. the devices 'SenNet CO2-RF','SenNet PC-RF', 'SenNet THL-IM' or 'SenNet T-RF').
    - Click on the symbol "?" for further details.
- App id (application identifier): it is the id with which you want the data to be sent to the platform. It is also used to store the data in CSV files if wanted. Usually, devices are assigned the numbers 1, 2, 3... n in the order in which they are appearing. Click on the symbol "?" for further details.
- Communication params: here you should indicate the port through which the device is connected to the datalogger. The valid options are: *RS232*, *RS485*, *RF*, an IP address or a port in the form *IP / port*. You can also indicate the communications parameters: 9N81, 9600 bps, No parity, 8 data bits, 1 stop bit.
  Contact the technical department of Satel Spain for each specific device. In the case of the SenNet RF network you should indicate the serial number of the radio peripheral after RF. For example RF2030. Click on the symbol "?" for further details.
- Name: name of the device to be shown in the screen 'datos capturados'. Click on the symbol "?" for further details.
- Additional param: specific parameters of the device. For example, for an internal electricity meter here you should write the nominal current of the current transformer that is going to be used. Click on the symbol "?" for further details. For the internal meters the valid values are 5, 50, 100, 150, 400, 800 or 5000.
- Box Able. To enable / disable the device.

SenNet Datalogger Web Interface

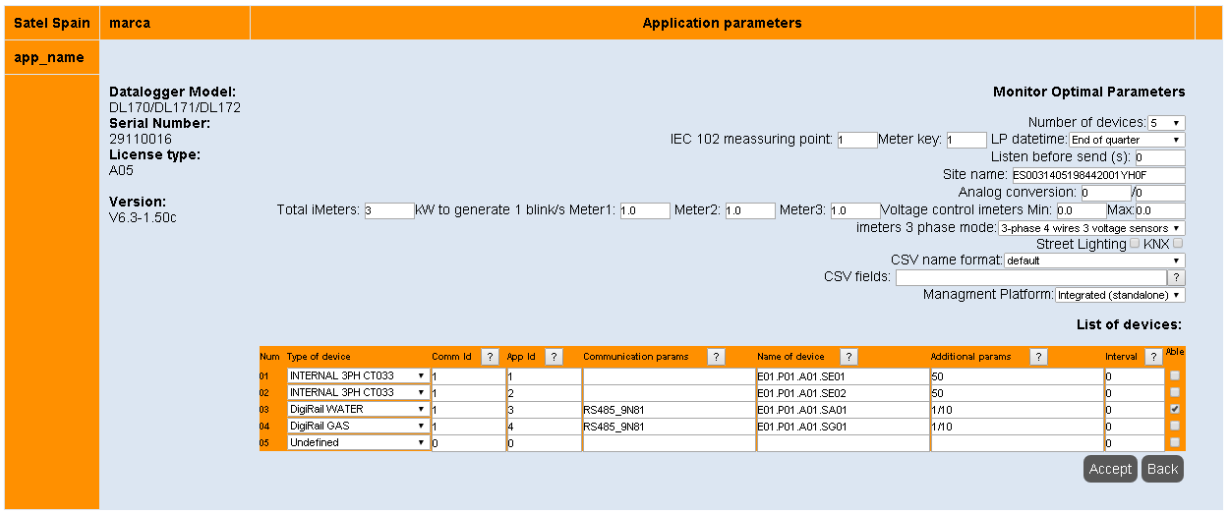


Figure 35. Overview of the application parameters menu

In order to save the changes made in this screen, it is necessary to click on **Accept** and then click on the **Save Changes** button in the **Configuration menu**. See 0. To change the password you will be asked to introduce your old password and the new password twice.

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See 15.9 Save changes, p. 72

Save changes.

15.2.1. Configuring a device Modbus TCP / RTU Generic

In order to connect a device from other manufacturer through Modbus TCP or RTU, you should select "Modbus TCP generic" or "Modbus RTU generic" respectively (table List of Devices field Application parameters). See the image below.

You should consult the manufacturer's specifications of your device

- In Comm id you must put the Modbus ID of your device.
- In App Id you should write the identification that you wish to give to your device. Usually, subsequent numbers are used: 1, 2, 3, 4...
- In communication params indicate how the meter is connected. The options are: *RS232 or RS485*.
- Name of device: the name you want to give to your device.
- Additional params: in this field you should write a code with the following format:

Function number/initial address/number of variables/type of variable

Where

- Function number should be:
  - 3 for Holding register and
  - 4 for Input Register
- Initial address, the register from which the datalogger will start reading.
- Number of variables: the number of variables read from the beginning.
- Type of variable:
  - signed
  - unsigned
  - long
  - longinv
  - float
  - floatinv

- Box: Able. To enable the device.

For example:

3/1 / 20 / long

It means it is a *Holding register*, which starts reading in 1, and it reads 20 variables and the data type is long.

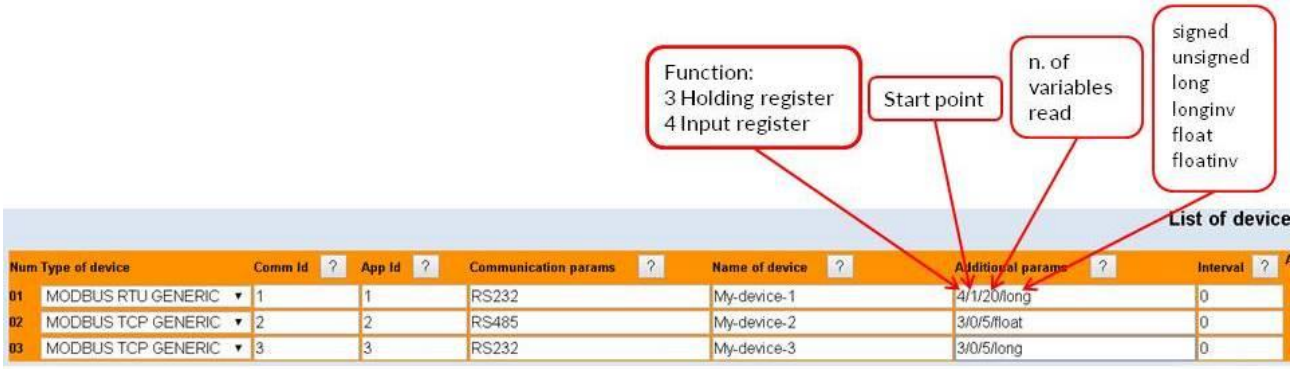


Figure 36. Example of connection of a generic device using Modbus RTU or Modbus TCP

15.2.2. Connecting a KNX device

Not all devices with KNX protocol are implemented to be directly connected to the datalogger. Ask your SenNet supplier or contact Satel Spain if you need to connect to any particular device.

To connect a KNX device, first select the box KNX from Configuration>Application parameters, so the datalogger can start seeking the KNX network.

Then, add the device to the table List of devices:

- Type of device: select the type of KNX device. If your device was not in the list, it will be necessary to implement it.
- Comm id: address of the device within the KNX installation.
- App id: the sending ID (the ID to send the data to the platform). In general, subsequent numbers are used (1, 2, 3... n) according to the order of the devices in the table.
- Communication params: in this case this field must be left empty because the datalogger can communicate with the KNX network only through a KNX router that converts the KNX signals into RS232. This connection is internally configured in the application.
- Name: the name you wish to assign to the device.
- Additional param: addresses where the devices host the data to be read. They depend on the device and the configuration of the KNX installation.
- Box: Able. To enable the device.

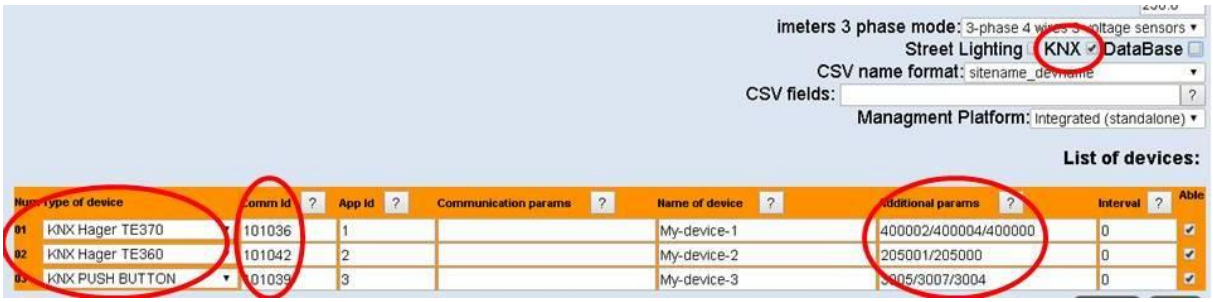


Figure 37. Example of connection of three KNX devices

15.2.3. Connecting a Z-Wave device

For connecting a device with Z-Wave, your datalogger must have the Z-Wave radio model installed. For more details, please check the chapter on Z-Wave (p. 132 *et seq*).

The datalogger can read the data sent by the Z-Wave-devices only if they are already added to the Z-Wave network. This must be done at the standard Z-Wave platform. Then you have to access to the visualization mode to get the device code. This code is required to configure the device in the datalogger's interface.

- Visualization mode http://192.168.1.35:8083
- Press the configuration icon (gear wheel).

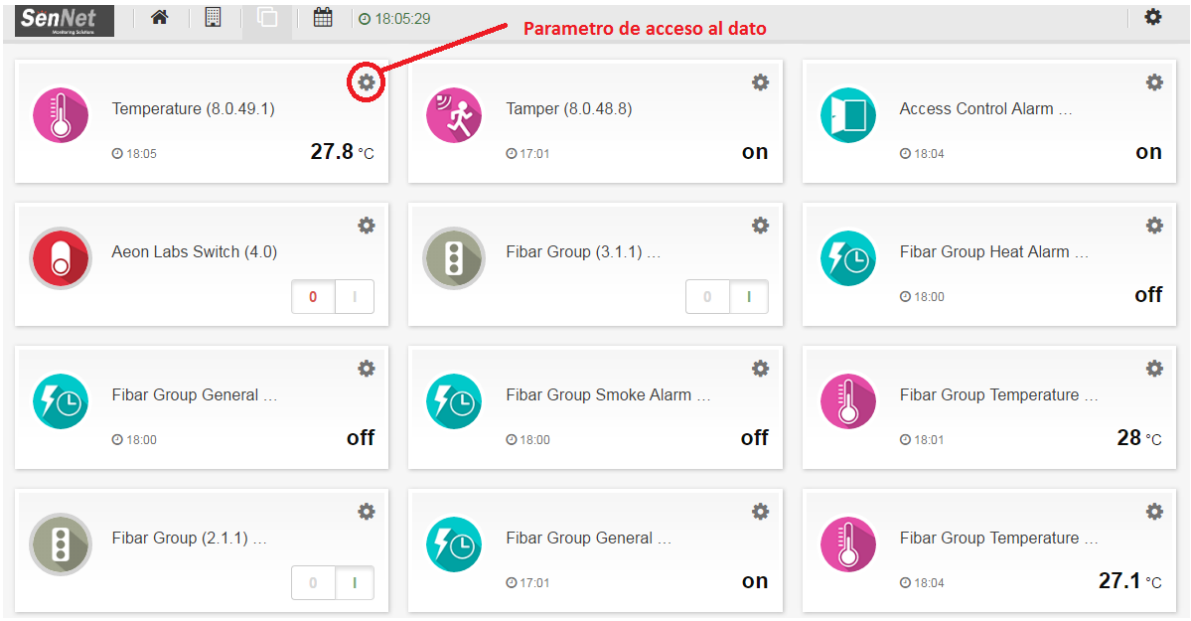


Figure 38. Display mode of the Z-Wave platform

- You have to copy the code shown next to the name of the device (see image below).
- Then, add the device in Configuration>Application parameters in the table named List of devices. Once this is done, and the changes are saved, the datalogger will start recording the data collected by the device.

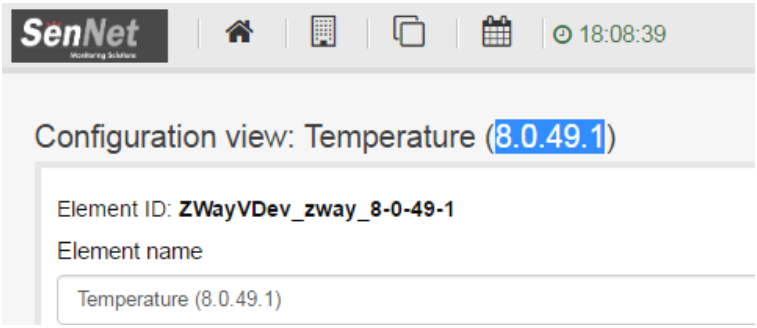


Figure 39. The code needed to configure a Z-Wave device

Num	Type of device	Comm Id	App Id	Communication params	Name of device	Additional params	Interval	Able
01	ZWAVE temp	1	1		ojo_temp	2-0-49-1	15	✓
02	ZWAVE lux	2	2		ojo_lux	2-0-49-3	1	✓
03	ZWAVE switch	3	3		ojo_presencia	2-0-156-0-A	1	✓
04	ZWAVE temp	4	4		co2_temp	3-0-49-1	15	✓
05	ZWAVE temp	5	5		sensor_puerta_temp	8-0-49-1	1	✓

Figure 40. How to introduce the code in the table List of Devices in the menu: Configuration> Application parameters

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See 15.9 Save changes, p. 72

15.2.4. Connecting an IEC 62056 (DLMS / COSEM)

The IEC 62056 standard is the international version of the DLMS / COSEM protocol (Device Language Message Specification / Companion Specification for Energy Metering).SenNet dataloggers are compatible with this protocol.

15.3. Events

On the Events screen it is possible to see a decimal value. To be able to interpret it, it is necessary to convert it into binary, with the following key:

- 1st digit from the right: sag (dip) event in phase 1
- 2nd digit from the right: sag (dip) in phase 2
- 3rd figure on the right: sag (dip) event in phase 3
- 4th figure on the right: swell event in phase 1
- 5th figure on the right: swell event in phase 2
- 6th figure on the right: swell event in phase 3

For example if you see that the number of the event is 42, it is possible to convert it into binary:

42 decimal → 101010 binary

This means mean that there has been a sag event in phase 2 and a swell event in phases 1 and 3.

15.4. Router

This feature, allows the datalogger to work also as a router for the signals sent by other devices. It is only applicable if the datalogger is configured to send the data through GPRS. It allows setting NAT rules that allow devices or connections to go through the datalogger.

15.5. Actions

With the datalogger, it is possible to define actions that generate an SMS or email. Actions can be defined using a powerful syntax that supports arithmetical and statistical operations, logical rules, functions, etc.

If you click on the help option, you can view some examples to help you to understand the syntax of the events:

The actions are defined by establishing a text associated with the event, an action type (email, SMS or action on something), a recipient (email address, telephone or output) and a period (whenever it happens, every hour, every day...), and a condition. If the condition is met, the event is triggered.

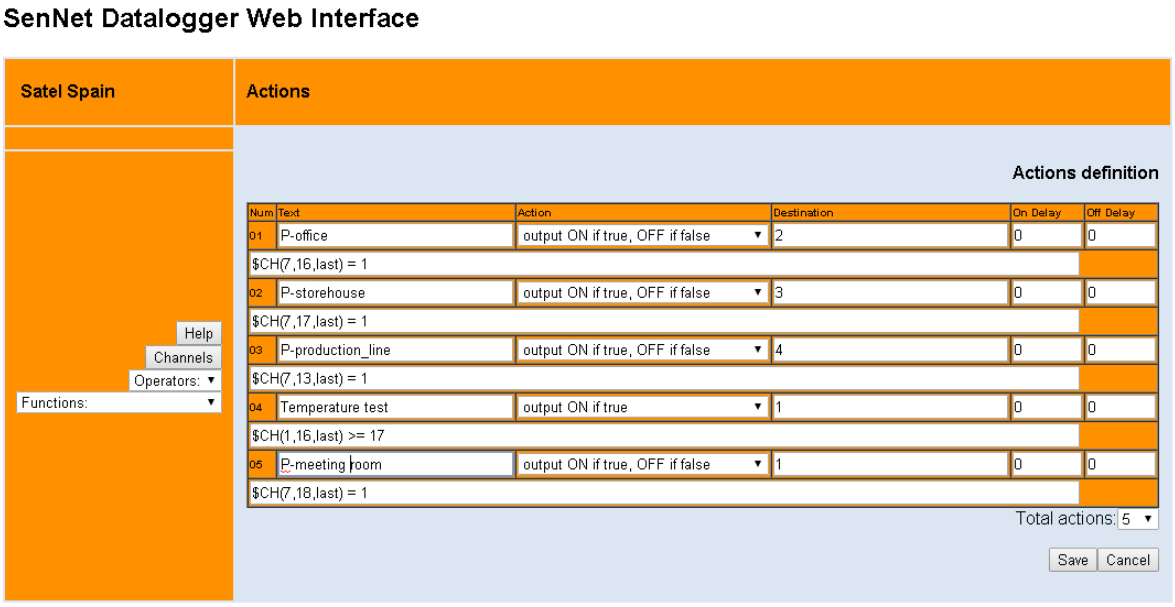


Figure 41. Overview of the submenu **actions**, within the menu **Configuration**. In this example, 5 have been set for 5 presence detectors

Select how many actions you want to define and for each action indicate:

- Text: description of the action
- Action: select the type of action:
  - EMAIL: to send an email
  - SMS: to send an SMS
  - OUTPUT: act on an output of the datalogger
  - SENNET 4IO: act on an output of a device SenNet 4Input-4Output
- Destination: Indicate the recipient of the action as appropriate:
  - EMAIL: indicate the recipient's email
  - SMS: indicate the recipient's phone number
  - OUTPUT: Indicate the output number (if it's a datalogger's output)
  - SENNET 4IO: Indicate the device's ID and separated by a comma the output on which to act. For example:
  - For SenNet 4IO-RF: 4529.1 where, in this example, 4529 is the serial number of the device and 1 is the output number 1.
  - For SenNet 4IO-RS485: 203,1 where, 203 is the Modbus ID set and 1 is the output number 1.
- In the next line indicate the expression that defines the action following the instructions in the menu Help. For example:

  $dig(1) and ($timer(MTWTF__,09:00,18:00) or $timer(_____SS,09:00,15:00))

  This expression means that the datalogger must act if the digital input number 1 is active and if the time is between 9 and 18 pm from Monday to Friday or between 9 and 15 hours from Saturday to Sunday.

In the buttons on the left you have information on the channels, operators and functions available.

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See 15.9 Save changes, p. 72

15.6. Dyn DNS

The datalogger can use the DynDNS service through GPRS.

To use it, first connect the GPRS antenna (see 6.5 GSM / GPRS port connection, p. 38). Then, introduce the SIM card and set the GPRS (see 15.1.4 GPRS parameters, p. 57).

- If the SIM card is associated with a dynamic IP connection, in order to remotely communicate with the datalogger the following methods can be used:
  - Get the current IP by sending to the SIM card in the datalogger an SMS with the text "sennet ip". You will receive an SMS with the current IP address of the datalogger.
  - Get the current IP through the sending server if the server facilitates the IP of the last connection.
  - To do this you must have a DynDNS account or create it at https://account.dyn.com/entrance Then, register the account in the menu "Configuration> DynDNS". You will see a screen like this:

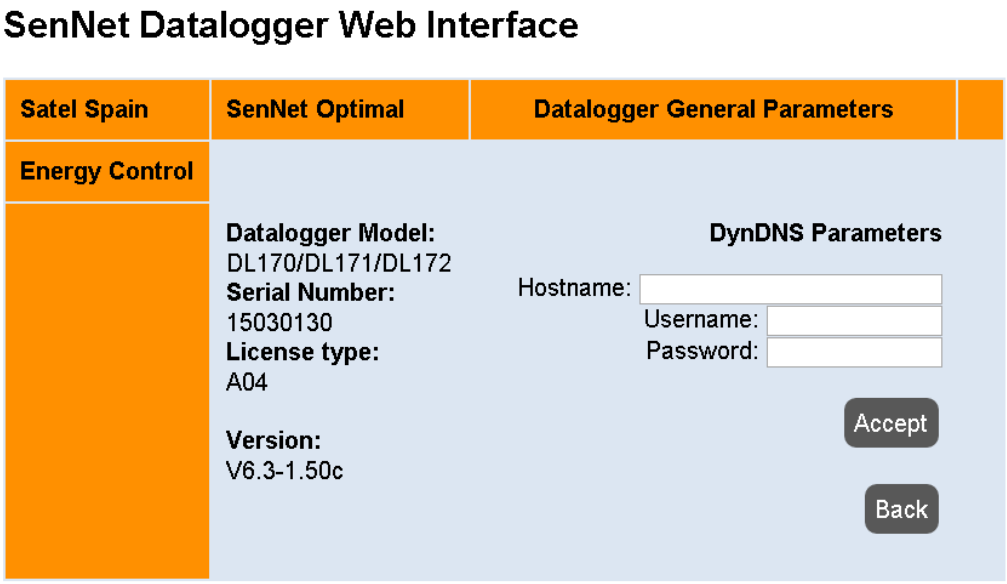


Figure 42. Overview of the menu Configuration>DynDNS

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See 15.9 Save changes, p. 72

15.7. Platform params

This menu contains the main fields required to connect to various platforms of energy monitoring, such as: Carriots, SenNet API, Flythings or Sofia2. Clicking on: Platform params you will see a button for each energy management platform.

Ask your SenNet supplier or contact Satel Spain if you need to connect to any particular platform.

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See 15.9 Save changes, p. 72

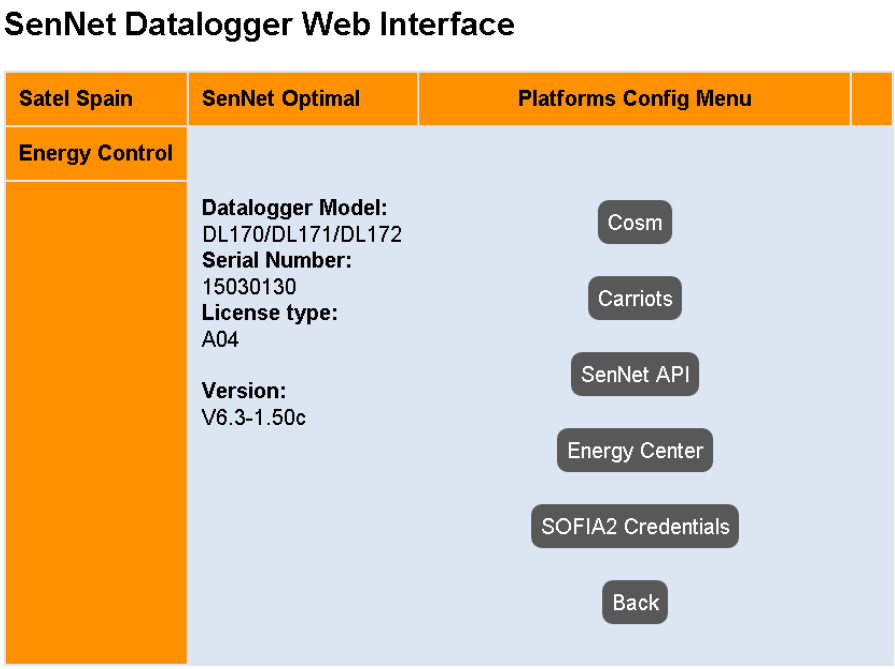


Figure 43. Overview of the submenu **Platform params**, within the menu **Configuration**. The platforms' buttons may vary depending on the model of datalogger and on the integrator's specifications

15.7.1. Carriots

Carriots is an IoT platform (Internet of things). It is used to connect and control devices and to manage the data transmitted.

You can obtain more information about the platform on the manufacturer's website:

www.carriots.com

The information required to connect the datalogger to Carriots is:

- ApiKey: in order to load data into Carriots, administrator permissions are required. You need also a password (this appears in the section MY ACCOUNT in Carriots)
- User: Carriots' user

Apart from these data, the datalogger must be uploaded into the platform (with the MAC address entered without spaces or points and with capital letters). The device with the MAC address with the datalogger-app id configured in the datalogger.

For example, for the device 1:

- datalogger with MAC: 0050C2681819
- device with datalogger-app id: 0050C2681819-1

If these two devices are not uploaded, the error "Unauthorized user" will appear.

Then, in Application Parameters>Management platform, choose Carriots.
Finally, you must save the data in the menu Configuration>Save Changes.

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See 15.9 Save changes, p. 72

15.7.2. SenNet API

If the customer wants to send the data to their own server without depending on third-party software or hardware, they can use SenNet API. To use the SenNet API you have to fill in the following fields:

- ApiKey: the server's key
- Path: server's path

Furthermore, in the menu General Parameters you have to specify the server's IP (Server IP) and you should choose the sending port number 80 (Send port = 80)

Afterwards, in Application Parameters>Management platform, you should choose SenNetAPI V1 or SenNetAPIV2.
Finally, you must save the data in the menu Configuration>Save Changes.

To set the SenNet API, you must use HTTP POST with JSON format. Both the server and the URL used by the datalogger to send the data are configurable at the interface.

Request:

Method: POST

Headers:

- **User-Agent**: sennet
- **Content-Type**: application/json
- **Sennet_Key**: my_api_key

Where: *my_api_key* is a key that can be configured in the datalogger. You can use this key to disable or enable the POST. It should be a string of up to 64 bytes.

JSON msg format

```
{
        “version”:”v1”,
        “datalogger_id”:”D85034C02445”,
        “device_type”:"83",
        “device_desc”:”SenNet Meter”,
        “device_name”:”general consumption”,
        “device_id”:003,
        "at":1356390000,
        “data”:{
                “Values”:{
                        “1”:”23.34”,
                        “2”:”456.30”,
                        “3”:”43.23”
                        },
                "Descriptions": {
                        “1”:”ActivePower kW”,
                        “2”:”ActiveEnergy kWh”,
                        “3”:”ReactiveEnergy kvar”
```

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```
                    }
            }
}
```

Where:

- version: the SenNet API's version (*V1* or *V2*)
- datalogger_id: the MAC address (without colon ":"). For example, if the MAC is "D8: 50: 34: C0: 24: 45"
- then, it should be used D85034C02445 instead
- device_id: It must be a value between 001 and 100 and it is configurable for each device the datalogger.
- device_type: The ID associated with the type of device.
- device_desc: Description of the type of device.
- device_name: the name of the device defined by the user (configurable in the datalogger's interface)
- at: date (timestamp) in UNIX format. You can use a date converter like http://www.unixtimestamp.com/
- Values: list of captured channels with the channel's ID and the value.
- Descriptions: list of captured channels with the channel's ID and the description

The list of available device types (id / descriptions) and channels (id / descriptions) can be downloaded from the datalogger's interface. It can be found at:

> Access Data Captured > Channels

Server Response:

If the reception is correct, you should check the server response. Ask:

200 OK

If the answer is:

Response OK

Then, the configuration is correct.

Examples of responses in cases when the connection is not correct are:

- Not authorized
- Processor error

Version V2

The difference between the V1 and the V2 versions is that the underscore character should be replaced by a hyphen.

Header:

"*sennet-key*" instead of "sennet_key"

Body:

"*datalogger-id*" instead of "datalogger_id"
"*device-type*" instead of "device_type"
"*device-desc*" instead of "device_desc"
"*device-name*" instead of "device_name"

"*device-id*" instead of "device_id"

-

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See 15.9 Save changes, p. 72

15.7.3. Sofia2 credentials

You can find more information about platform at the developer's website

http://sofia2.com/

Before connecting to Sofia 2 you should set the general parameters in Configuration> General parameters

- In the field Server IP introduce the IP provided by Sofia2
- The value introduced in the field Send port depends on whether you want to send the data in encrypted form or not:
  - Introduce 1883 for the unencrypted data submission.
  - Introduce 8883 for the encrypted data submission

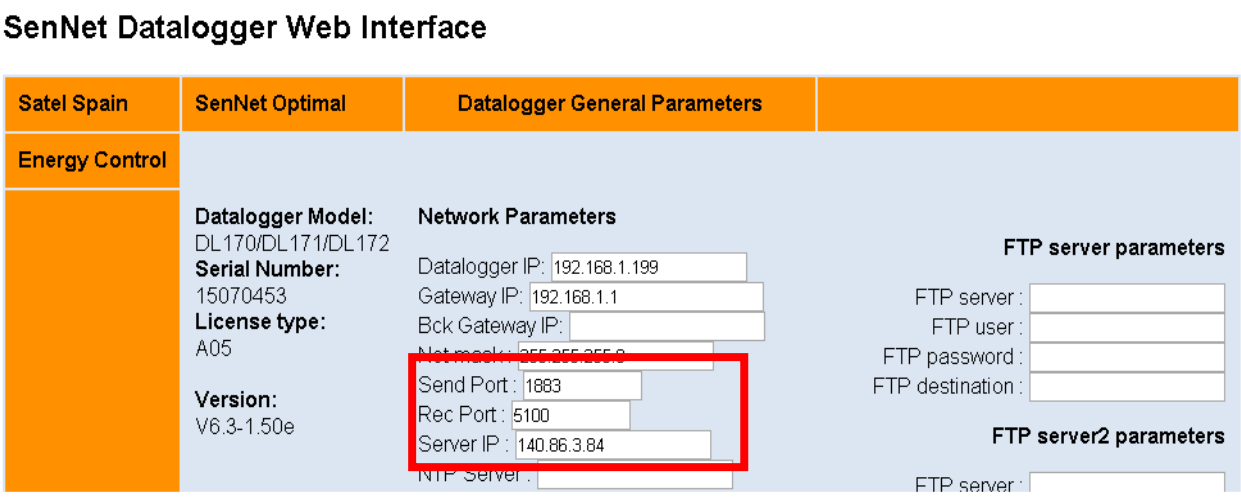

Figure 44. Overview of the menu Configuration > General parameters to configure Sofia 2

Then, in Configuration > Application parameters you sold introduce the following information:

- Site name: enter the name provided by Sofia2
- Management platform: select Sofia2

Then, access to Configuration>Platform params>Sofia2 credentials. The information required is:

- User: the user provided by Sofia2
- Pass: the password provided by Sofia 2

Finally, you must save the data in the menu Configuration>Save Changes.

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See See 15.9 Save changes, p. 72

15.7.4. Flythings

To connect to the platform Flythings, you should go to Configuration>Platform Params> Flythings.

Fill in the following fields:

- Token: token code
- Path:

Then, in Application Parameters>Management platform, choose Flythings.

Finally, you must save the data in the menu Configuration>Save Changes.

Satel Spain is not the developer of this platform. You can find more information at

https://viridityenergy.com/

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See 15.9 Save changes, p. 72

15.8. Change password

To change the password you will be asked to introduce your old password and the new password twice.

After doing the any change on this screen, click on **Accept** and then on the **Save Changes** button on the **Configuration menu**. See 15.9 Save changes, p. 72

15.9. Save changes

Pressing this button, the program will ask you to confirm if you really want to save the changes. With this button you can change any changes made in any section of the menu Configuration.

16. ACCESS TO DATA THROUGH MODBUS TCP

The datalogger allows you to send the data to a server through a standard Modbus TCP protocol. With this type of connection the datalogger can be used, for instance, to monitor a SCADA. This functionality can simultaneously operate with the automatic submission to a server.

In this operating mode, the datalogger works as a server that listens to the standard Modbus TCP port (502).

The register map consists of:

- Datalogger's data.
- Device's data:
  - A part common to all devices
  - A specific part of each type of device

The addresses are listed in Modicon format. To get them for instance in 0 based format, you must subtract 40001

16.1. Datalogger's data

Address (Modicon format)	Description
40001	Datalogger's ID
40002	Software installation code
40003	Datalogger's software version
40004	SenNet Optimal's software version
40005	Seconds that remain until the next interrogation cycle
40006	Year for the date/time setting
40007	Month for the date/time setting
40008	Day for the date/time setting
40009	Hour for the date/time setting
40010	Minute for the date/time setting
40011	Second for the date/time setting
40012	Signal of the digital input n. 1
40013	Signal of the digital input n. 2
40014	Signal of the digital input n. 3
40022	Signal of the digital output n. 1 (it is also a writing register)
40023	Signal of the digital output n. 2 (it is also a writing register)
40024	Signal of the digital output n. 3 (it is also a writing register)
40025	Signal of the digital output n. 4 (it is also a writing register)

16.2. Device's data

16.2.1. Common to all devices

Address (Modicon format)	Description
4nn01	Device's ID
4nn02	Year in which the data was captured
4nn03	Month in which the data was captured
4nn04	Day in which the data was captured
4nn05	Hour in which the data was captured
4nn06	Minute in which the data was captured
4nn07	Second in which the data was captured
4nn08	Device's status
4nn09	Event failure (0r not failure)
4nn10	Not used

16.2.2. Device-specific data

In order to obtain a map of the device, you should see the device's list of channels (in the datalogger's interface click on Access Data Captured > Channels) and apply the following criteria:

Channel records with report id = ID

- 4nnXX and 4nnYY where:
  - nn is the ID meter
  - XX is = 9+ID*2
  - YY is XX+1

For example, the registers of the channel whose ID = 16 of the device with report id = 3:

- 40341 and 40342

Both registers are the value of the channel 16 of the device number 3 in LONG format.

The long format can be used with the lower bit first and then the high one or vice versa depending on the "MODBUS SWAP" parameter that can be defined in the menu "General parameters"

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17. ACCESS TO DATA THROUGH XML

Using the port 8080 you can request the datalogger to send the data in XML format. Below are described the types of files that can be requested.

17.1. version.xml

Information about the datalogger's version

Tags:

- dl: datalogger's data. Attributes:
- id: MAC address
- sn: serial number
- version: datalogger's version. Without attributes.

Example of a request made to a datalogger:

http://192.168.1.35:8080/services/version.xml?user=ADMIN?password=MYPASSWORD?

Mandatory parameters:

- user: in this case, the user is ADMIN. In other dataloggers it can be different
- password: In this case, the password used is MYPASSWORD, but each datalogger can have a different one

Answer (example):

```
<!-- SenNet -->
▼<dl id="00:50:C2:68:13:4F" sn="A04WBC">
  <version>SenNet_Optimal V5.09e-1.32f Energy_Control</version>
</dl>
```

17.2. gprs.xml

Data about the GSM / GPRS session

Tags:

- dl: datalogger data. Attributes:
  - id: MAC address
  - sn: serial number
- GPRS: data on the datalogger's GPRS session. Attributes:
  - status: It indicates whether the GSM / GPRS module is started
  - ip: Indicates the acquired IP address ("na" if it is not available)
  - rssi: Indicates the signal level ("na" if it is not available)

Data about the GSM / GPRS session

Tags:

- dl: datalogger data. Attributes:
  - id: MAC address

    - sn: serial number
- GPRS: data on the datalogger's GPRS session. Attributes:
    - status: It indicates whether the GSM / GPRS module is started
    - ip: Indicates the acquired IP address ("na" if it is not available)
    - rssi: Indicates the signal level ("na" if it is not available)

Example of a request made to a datalogger:

http://192.168.1.35:8080/services/gprs.xml?user=ADMIN?password=MYPASSWORD?

Mandatory parameters:

- user: in this case, the user is ADMIN. In other dataloggers it can be different
- password: In this case, the password used is MYPASSWORD, but each datalogger can have a different one

Answer (example):

```
<!-- SenNet -->
▼<dl id="00:50:C2:68:13:4F" sn="A04WBC">
  <gprs status="GSM no activated" ip="na" rssi="na"/>
</dl>
```

data.xml

Latest data captured from the devices.

Tags:

- dl: datalogger's data. Attributes:
    - id: mac address
    - sn: serial number
- dev: device. Attributes:
    - id: device ID
    - name: name of the device in the facility
    - type: type of device
    - t: timestamp of the capture
- ch: information channel of the device's attributes:
    - id: channel ID
    - des: channel description
    - u: unit of measurement of the channel
    - db: indicates whether there are historical data in the database or not

Example of a request made to a datalogger:

http://192.168.1.35:8080/services/data.xml?from_id=1?to_id=3??user=ADMIN?password=MYPASSWORD?

Optional parameters (if not specified, the request will be for all devices):

- from_id: from which device ID
- to_id: to which device id

Mandatory parameters:

- user: in this case, the user is ADMIN. In other dataloggers it can be different

- password: In this case, the password used is MYPASSWORD, but each datalogger can have a different one

Sample answer:

In this example there are two different types of devices (SenNet Meter and MK Meter). Each device has its corresponding information channels: 18 channels for SenNet Meter and 5 channels for MK Meter.

Each device is identified by a unique ID. The device ID cannot be repeated within the same datalogger.

Each channel is identified by a specific device ID.

An example of response devices from the devices with ID 1 to 3 is shown below:

```
<!-- SenNet -->
▼<dl id="00:50:C2:68:13:4F" sn="A04WBC">
 ▼<dev id="1" name="General" type="SenNet Meter" t="10/02/12T19:23:57">
    <ch id="1" des="ENEact (kWh)" u="kWh" db="Y">8714.0</ch>
    <ch id="2" des="ENEapa (kVAh)" u="kVAh" db="N">10002.2</ch>
    <ch id="3" des="ENEind (kvarh)" u="kvarh" db="N">543.2</ch>
    <ch id="4" des="ENEcap (kvarh)" u="kvarh" db="N">1548.5</ch>
    <ch id="5" des="POWact (kW)" u="kW" db="N">7.849</ch>
    <ch id="6" des="POWapa (VA)" u="VA" db="N">7.969</ch>
    <ch id="7" des="POWrea (var)" u="var" db="N">-0.340</ch>
    <ch id="8" des="PF" u="" db="N">0.984</ch>
    <ch id="9" des="FRE (Hz)" u="Hz" db="N">49.9</ch>
    <ch id="10" des="POW1 (kW)" u="kW" db="N">4.289</ch>
    <ch id="11" des="POW2 (kW)" u="kW" db="N">3.129</ch>
    <ch id="12" des="POW3 (kW)" u="kW" db="N">0.439</ch>
    <ch id="13" des="IAC1 (A)" u="A" db="N">19.2</ch>
    <ch id="14" des="IAC2 (A)" u="A" db="N">14.4</ch>
    <ch id="15" des="IAC3 (A)" u="A" db="N">2.6</ch>
    <ch id="16" des="VAC1 (V)" u="V" db="N">223.6</ch>
    <ch id="17" des="VAC2 (V)" u="V" db="N">217.3</ch>
    <ch id="18" des="VAC3 (V)" u="V" db="N">217.4</ch>
  </dev>
 ▼<dev id="2" name="Fuerza 1" type="MK Meter" t="10/02/12T19:23:57">
    <ch id="1" des="ENEact (kWh)" u="kWh" db="Y">1876.161</ch>
    <ch id="2" des="Pow (W)" u="W" db="N">141</ch>
    <ch id="3" des="VAC (V)" u="V" db="N">217.2</ch>
    <ch id="4" des="IAC (A)" u="A" db="N">0.718</ch>
    <ch id="5" des="Fre (Hz)" u="Hz" db="N">50.0</ch>
  </dev>
 ▼<dev id="3" name="Fuerza 2" type="MK Meter" t="10/02/12T19:23:57">
    <ch id="1" des="ENEact (kWh)" u="kWh" db="Y">6198.791</ch>
    <ch id="2" des="Pow (W)" u="W" db="N">429</ch>
    <ch id="3" des="VAC (V)" u="V" db="N">217.5</ch>
    <ch id="4" des="IAC (A)" u="A" db="N">2.609</ch>
    <ch id="5" des="Fre (Hz)" u="Hz" db="N">50.0</ch>
  </dev>
</dl>
```

data_saved.xml

Captured data stored in the µSD card.

Tags:

- dl: datalogger's data. Attributes:
  - id: MAC address
  - sn: serial number
- dev: device. Attributes:
  - id: device ID
- ch: information channel of the device. Attributes:

- channel: channel name
- date: date of the data
- time: time of the data
- value: value of the data
- id: channel ID

Example of a request made to a datalogger:

http://192.168.1.35:8080/services/data_saved.xml?dev_id=1?channel=[2][5]?date_ini=2013-9-20?date_end=2013-9-25?user=ADMIN?password=MYPASSWORD?

Optional parameters:

- channel: channels' ID list. For example, if you indicate [3] [8] [1] the IDs 1, 3 and 8.will be downloaded. The order is not relevant.
- mode:
  - all: all the captures of the day
  - first: only the first one of the day
  - last: only the last one of the day. This mode can be used if a single channel is requested.
- sincehh: mm: ss from what time. For example, from "10:30:00" the datalogger will only return registers from 10:30:00
- DATE_END: End date of the capture in format yyyy-mm-dd

Mandatory parameters:

- user: in this case, the user is ADMIN. In other dataloggers it can be different
- password: In this case, the password used is MYPASSWORD, but each datalogger can have a different one
- device_id: ID of the device
- date_ini: start date of the capture in format yyyy-mm-dd

The maximum interval allowed is 365 days and the maximum file size downloadable is 500KB. If the size is greater, will skip all records from 500KB; however, the days transmitted will be complete.

If you want to know the list of channels, it is recommended to make a request of a single day, specifying the mode as: mode = first.

Example of a downloaded file:

```
<!-- SenNet -->
<dl id="00:50:C2:68:51:53" sn="A056U2">

<!-- SenNet -->
<dl id="00:50:C2:68:51:53" sn="A056U2">
<dev id="100">
<ch date="2013/11/01" time="21:15:00" channel="EAct exp(kWh)" value="0" id="2"/>
<ch date="2013/11/01" time="21:30:00" channel="EAct exp(kWh)" value="30" id="2"/>
<ch date="2013/11/01" time="21:45:00" channel="EAct exp(kWh)" value="0" id="2"/>
<ch date="2013/11/01" time="22:00:00" channel="EAct exp(kWh)" value="23" id="2"/>
<ch date="2013/11/01" time="22:15:00" channel="EAct exp(kWh)" value="0" id="2"/>
<ch date="2013/11/01" time="22:30:00" channel="EAct exp(kWh)" value="0" id="2"/>
<ch date="2013/11/01" time="22:45:00" channel="EAct exp(kWh)" value="12" id="2"/>
<ch date="2013/11/01" time="23:00:00" channel="EAct exp(kWh)" value="0" id="2"/>
<ch date="2013/11/01" time="23:15:00" channel="EAct exp(kWh)" value="0" id="2"/>
<ch date="2013/11/01" time="23:30:00" channel="EAct exp(kWh)" value="12" id="2"/>
<ch date="2013/11/01" time="23:45:00" channel="EAct exp(kWh)" value="7" id="2"/>
<ch date="2013/11/01" time="23:59:00" channel="EAct exp(kWh)" value="0" id="2"/>
```

```
</dev>
</dl>
```

The maximum interval allowed is 365 days and the maximum file size downloadable is 500KB.

If the size is greater, will skip all records from 500KB; however, the days transmitted will be complete.

18. ACCESS TO THE DATALOGGER THROUGH THE CONSOLE PORT (RS232)

The datalogger has an RS232 port for maintenance and supervision. To use it, you must connect it to the RS232 of a PC, either directly or via an RS232 to USB converter.

To interact with the datalogger via console, use a terminal application configured as follows:

- 11500 bps
- No parity
- 8 data bit
- 1 stop bit

The datalogger is constantly sending operating information through the RS232 console port. Likewise, it can perform some special maintenance functions, such as:

Pressing the 'm' key, the device will ask for a password. Enter "sennet" and you will access the options menu. There, it is possible to modify the basic settings, such as, changing the network settings.

- By pressing the 'v' key you will get information on the version of datalogger and application.
- Pressing 'i' will get information on the GPRS connection.
- Pressing 's' will force an interrogation to the configured devices.

When the datalogger is connected via USB, the external power must be also connected to be fully functional.

19. ACCESS TO THE DATALOGGER THROUGH SSH

The datalogger integrates an SSH server that will allow you to remotely access its Linux shell.

This access should be used only by experts in Linux that know the internal structure of the datalogger files.

For special maintenance operations, and if the datalogger access to internet is via external router, it is important to enable the port 22, because it is the port used with SSH.

It is important to enable the port 22 used with SSH

Access through SSH should be used only by experts in Linux that know the internal structure of the datalogger files

20. ACCESS TO THE DATALOGGER THROUGH LOGGERCONTROL

LoggerControl is an application developed by Satel Spain that allows monitoring and remote control of the datalogger.

LoggerControl allows operations such as:

- Remote monitoring of the operation, including log recording for further analysis in case of incidents in operation.
- Parameters' display and modification
- Software update
- Time setting

The program LoggerControl uses TCP / IP through the receiving port configured on the datalogger. By default, the port is the result of adding 100 to the datalogger id, which is, by default, 5000. That is, if no specific port has been configured, the 5100 will be used.

There is an available version of LoggerControl for Systems Integrators (some features are exclusive for Satel Spain's technical staff).

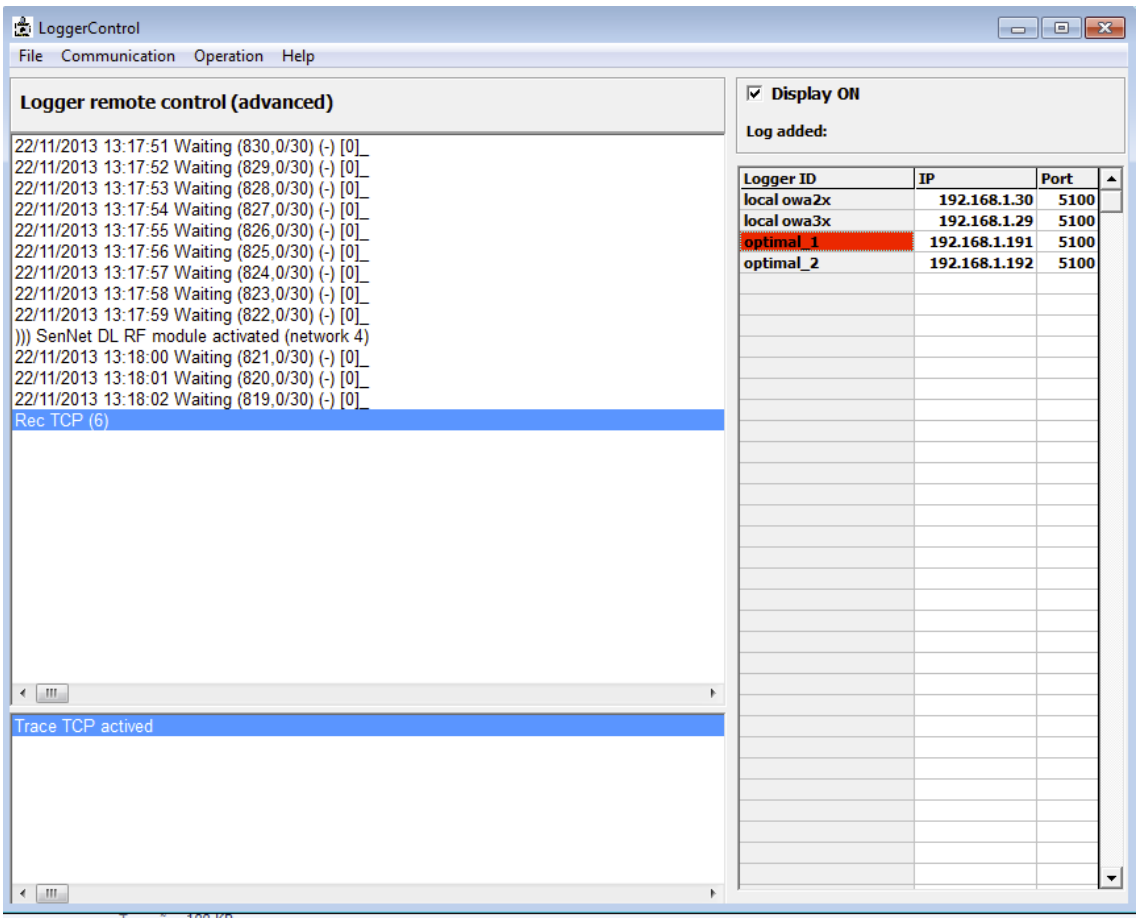

Figure 45. Overview of the Loggercontrol programme

21. EXAMPLES: CONFIGURATION OF CONNECTED DEVICES

When a new electricity meter is added to the datalogger's network, it must be indicated, whether it is 0.33V or Rogowski type, as well as the rated intensity (current) of the CT or Rogowski probe. The way to indicate in the application the rated current is in the "param" field and the valid values are 5, 50, 100, 150, 400, 800 and 5000.

In the example below we can see that three meters have been defined:

1. Three-phase in T1 (INTERNAL 3PH with App id = 1) for 0.33 V current transformers with 50A rated current
2. Single phase (mono-phase) in M23 (INTERNAL MPH with App id 23) for 0.33 V current transformers with 150A nominal value
3. Three-phase T3 (INTERNAL 3PH with id 3) for Rogowski coils with 5000 A of rated current

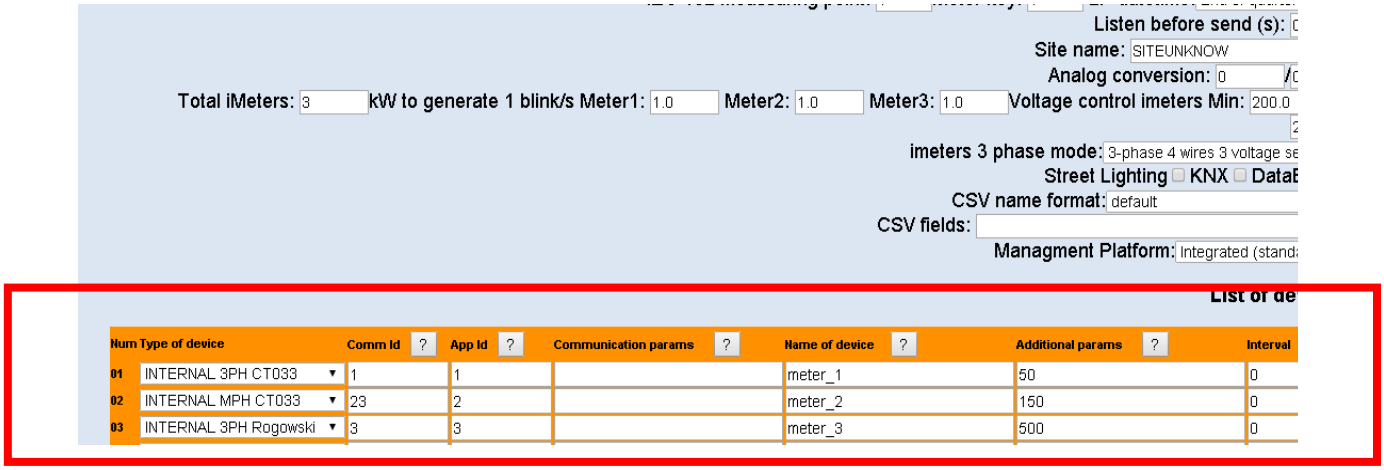

Figure 46. Example of configuration of three meters (one three-phase, one single-phase and another one three-phase with Rogowski). Path: Configuration>Application parameters

21.1. Real time monitoring

The "Internal Meters" option has an option to make a "plot" in real time (approx. 5 lectures per second) of the variables: Power (active, reactive and apparent), voltage, current and power factor.

With this feature you can see in real time how the different channels react to events such as, devices' switch on and off. Analysing these channels is useful to identify patterns and system behaviour.

This feature requires the datalogger's RS232 port to be connected to a PC. It is also necessary to use a free app that can be found at:

http://www.fast-product-development.com/real-time-serial-data-plot.html

Software instructions can be also found following the link.

The data, apart from being displayed in real time, are also recorded in CSV format.

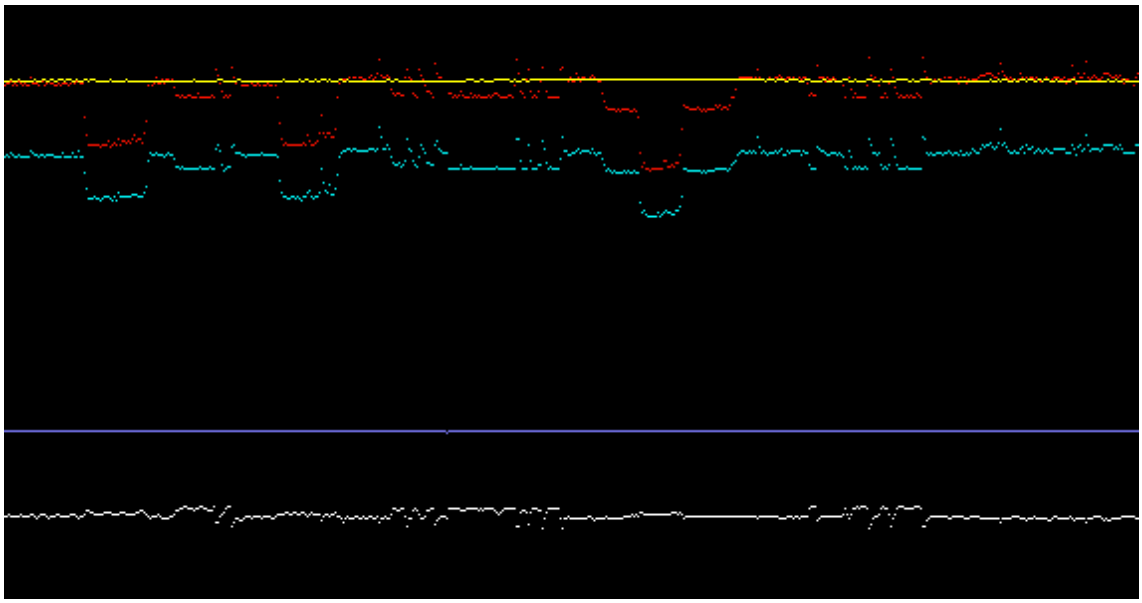

Figure 47. Example of real-time monitoring with Real Time Serial Data Plot

The valid parameters for RS232 configuration are:

- Speed: 38400
- Parity: NONE
- Data bits: 8
- Stop bits: 1

22. DATALOGGER'S CUSTOMIZATION

Systems integrators have the option to customize their dataloggers putting their own logo, the text displayed in the header, the company name and the app name.

To do this, in the interface's home screen, you must log in with a special user name and password to customize the device. By default the datalogger is supplied with the IP 192.168.1.35. If you have not changed it, the way to access to the interface's home screen is by typing into your browser: http://192.168.1.35:8080

If you are a Systems integrator, ask Satel Spain for a special username and password to customize the datalogger.

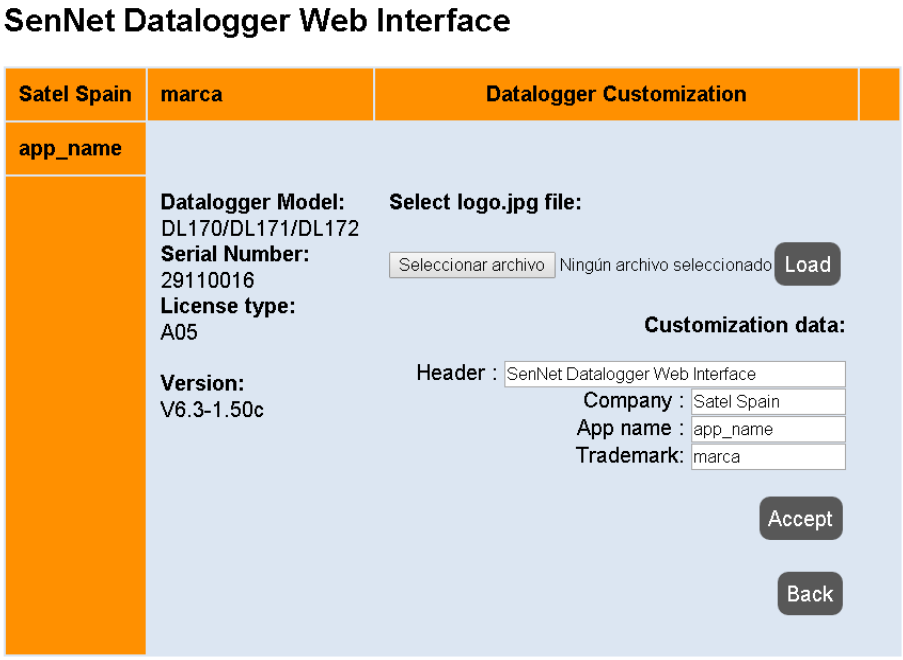

Figure 48. Overview of the configuration screen

The logo file that is imported from your PC should be renamed as "logo.jpg".

SenNet
Smart M2M Solutions

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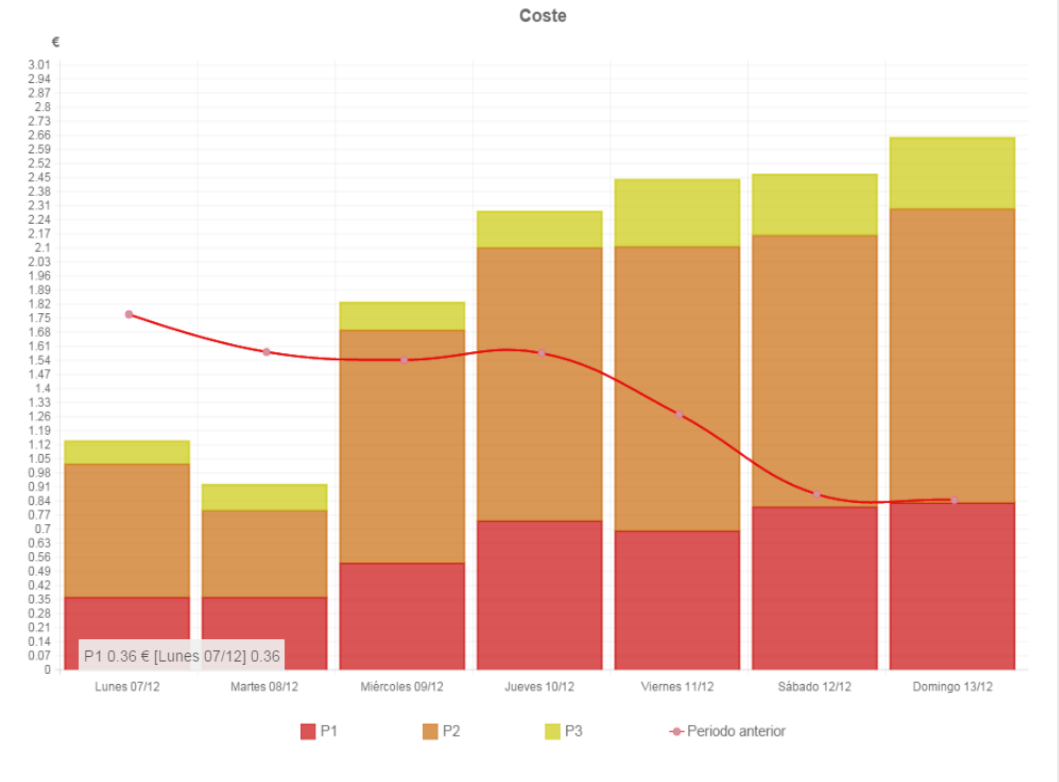
sales@satelspain.com
www.sennetmonitoring.com

For technical support
support@satelspain.com

info@satelspain.com
www.sennetmonitoring.com

Periodo	Coste
P1	4.32 €
P2	7.848 €
P3	1.551 €
Total	13.719 €



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