SELF-CONSUMPTION AND ZERO INJECTION MANAGER

ITR 2.0
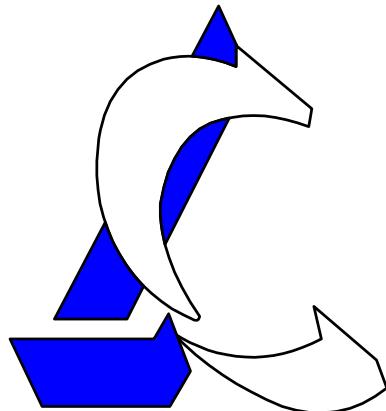
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2   PRECAUTIONS

The instructions in the manual marked with the following symbols must be followed with special attention:

⚠	Special attention should be paid to the enclosed information.

⚡	Indicates the existence of a risk that may result in personal injury and/or property damage.

If you are in charge of installing, maintaining or configuring the ITR 2.0 you should take the following precautions into account:

⚠	**Refer to the instruction manual before using the equipment.** Failure to comply with the instructions accompanying this symbol in the manual may result in personal injury, damage to the equipment or installations.

⚡	**Incorrect installation or handling of the equipment may result in personal injury or material damage.** Handling under voltage can result in death or serious injury due to electrocution. Faulty installation or maintenance may result in fire hazard. Read the manual carefully before connecting the equipment and observe the national electrotechnical regulations.

THE LACECAL ASSOCIATION RESERVES THE RIGHT TO MAKE MODIFICATIONS WITHOUT PRIOR NOTICE TO THE DEVICE OR TO T H E SPECIFICATIONS SET FORTH IN THIS MANUAL.

THANK YOU FOR THE TRUST YOU HAVE PLACED IN US BY ACQUIRING YOUR ITR2.0, TOTALLY DESIGNED AND MANUFACTURED IN SPAIN.

3   SYMBOLS

CE	Complies with applicable European standards.
▣	Equipment protected by double or reinforced insulation.
∿	Alternating current.
3∿	Three-phase alternating current.

4   DESCRIPTION

The ITR 2.0 system is a fully programmable and flexible control and monitoring system that will allow you to regulate the photovoltaic production to the value chosen by the user. In cases of self-consumption, this production will be regulated to approach the instantaneous consumption but without exceeding it, so that the energy discharged to the grid is zero.
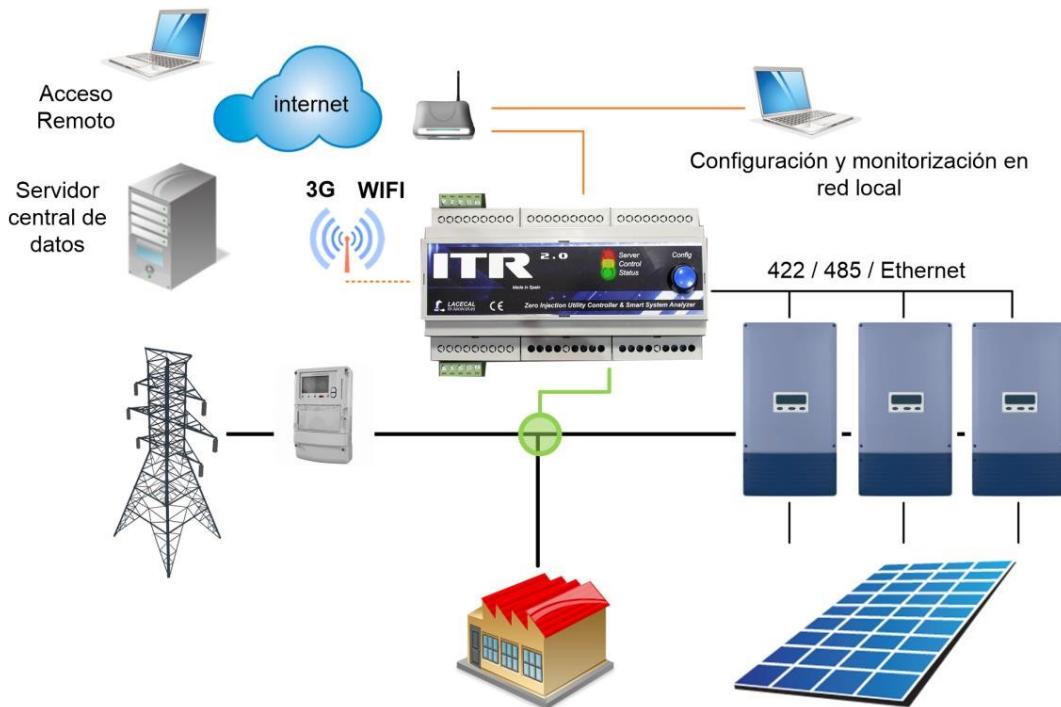
The ITR 2.0 system also offers an added value to the installation, since it performs consumption monitoring tasks, power quality control, and may also allow the user to control certain loads of the installation according to production, providing remote management capabilities. These loads can be ON/OFF or adjustable in consumption.

There is also a special type of ITR 2.0 capable of controlling systems incorporating diesel auxiliary generators (this type is not the subject of this manual).

The ITR 2.0 monitors the power at the point of connection between the grid, the consumption of the loads of the installation and the photovoltaic generation, regulating, through communication, the maximum power that can be generated by the inverters at any given moment so that energy is never dumped into the grid.

5   INSTALLATION

The ITR 2.0 includes the following connections:

- Two three-phase power meters with common voltages. They will be able to measure any two powers at the connection point between the electrical grid, the photovoltaic production and the consumption of the installation. By means of these two measurements, the entire installation will be monitored.
- RS485/RS422 communication connector for connection to inverters that require it.
- Load control connector.
- Ethernet communication for local network configuration and monitoring, as well as control of the inverters that require it.
- Optional WIFI and/or 3G communication via USB devices.
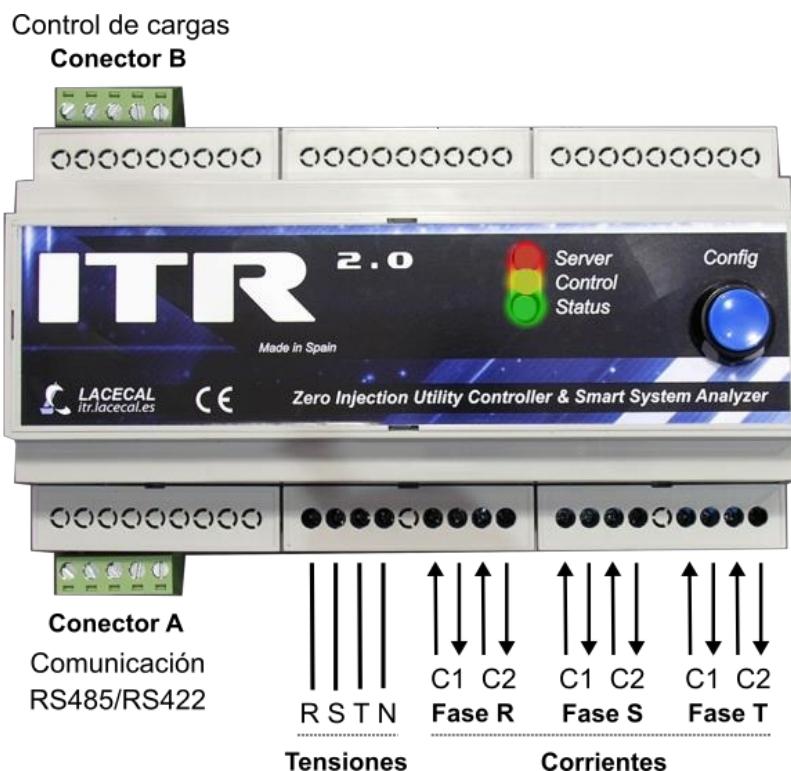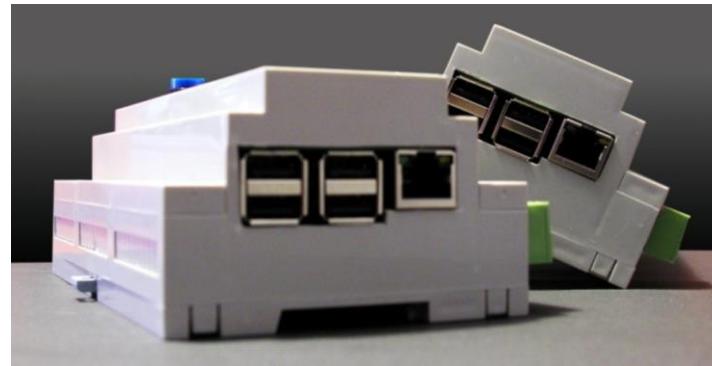
| ⚠ | **The equipment must be installed downstream of the general protections of the installation.** |

5.1   CONNECTION OF THE VOLTAGES

Cables conforming to IEC60227 or IEC60245, with a minimum cross-section of 1.5mm^2 , must be used to connect the measuring voltages. The ITR 2.0 takes its power supply from the measuring voltage of phase R, so in single-phase systems this voltage phase must always be connected.
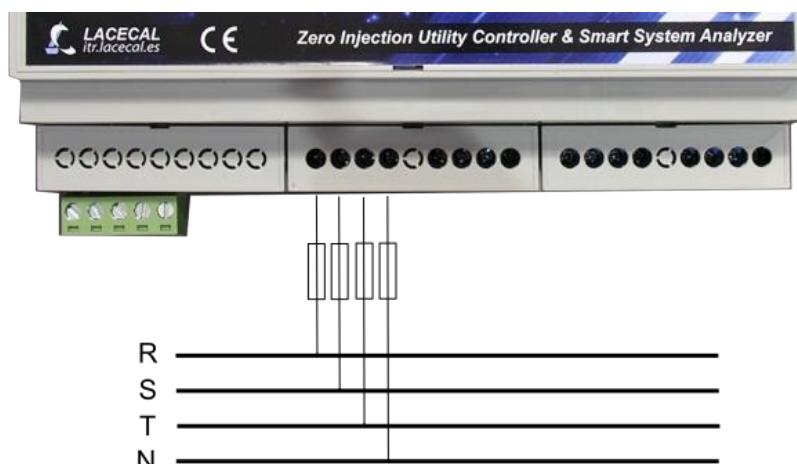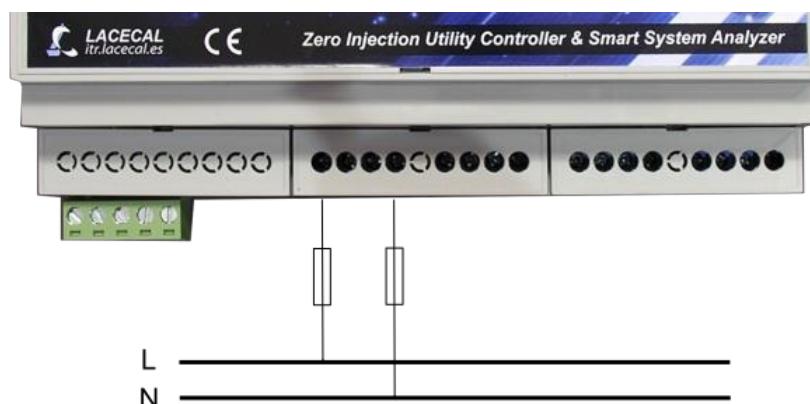
5.2   CONNECTION OF THE CURRENTS

Current transformers must be used to measure the currents of the installation. Two models of ITR 2.0 are available depending on the secondary current of the transformers used:

- **ITR 2.0 /5A**   for transformers with 5A secondary.
- **ITR 2.0 /0,25A**   for transformers with 250mA secondary.

⚡	**Be sure to install the appropriate current transformers for the ITR 2.0 model purchased.** The use of incorrect current transformers can cause damage to the equipment and the installation.

The ITR 2.0 has two current measurement channels, **C1** and **C2**, for each of the phases. Each channel will be used to measure the current of one of the branches of the installation: grid consumption, load consumption or photovoltaic production.

It is indifferent which size is connected to each of the channels, and can be adapted to the characteristics of each installation depending on accessibility or required wiring lengths.

When configuring the software, the measurement connected to each of the channels must be indicated.

|	
⚠	**The current transformers used in measuring channels C1 and C2 must have the same secondary current.** The primary current of the transformers is configured by software. Transformers with different primary current can be used in each of the channels to suit the measured power.

The cable cross-section to be used in the connection of the current transformers to the ITR 2.0 must be adapted to the rated current and secondary power of the transformers used and the length of the wiring.

In case of doubt, consult your distributor about the specific characteristics of your installation so that he can advise you on the most suitable configuration.

The three possible current measurement configurations in a single-phase installation (in which the measurement phase R will always be used) are shown below.

Single-phase installation measuring load consumption and photovoltaic production
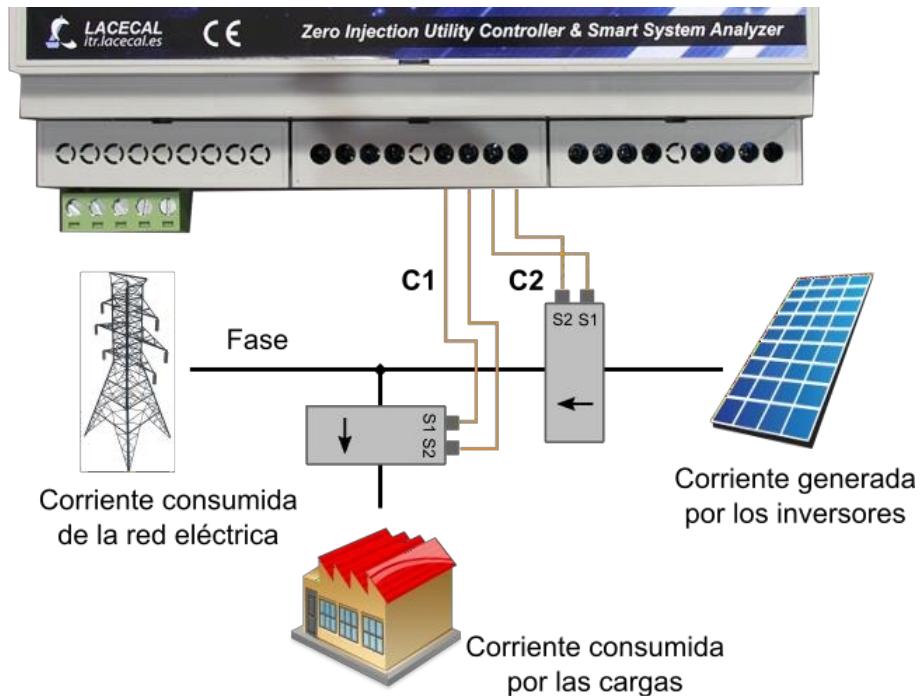
Single-phase installation measuring grid consumption and photovoltaic production
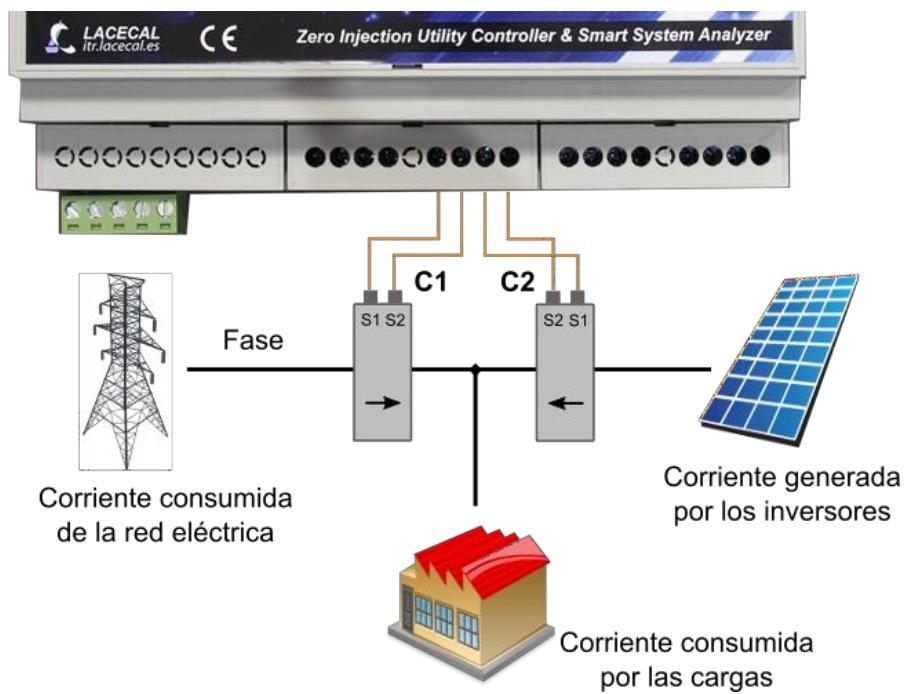
Single-phase installation measuring consumption of the network and consumption of the loads.
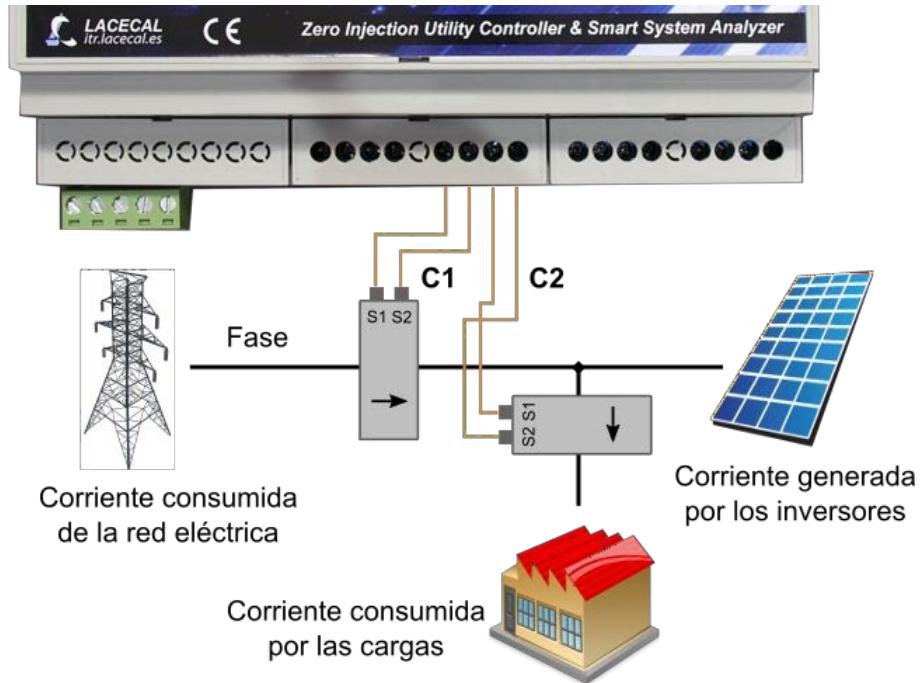
In installations where it is difficult to connect the two current measurements, it is possible to operate by measuring only the mains consumption. Refer to the specific configuration manual of the inverters used for possible incompatibilities or limitations of this configuration.
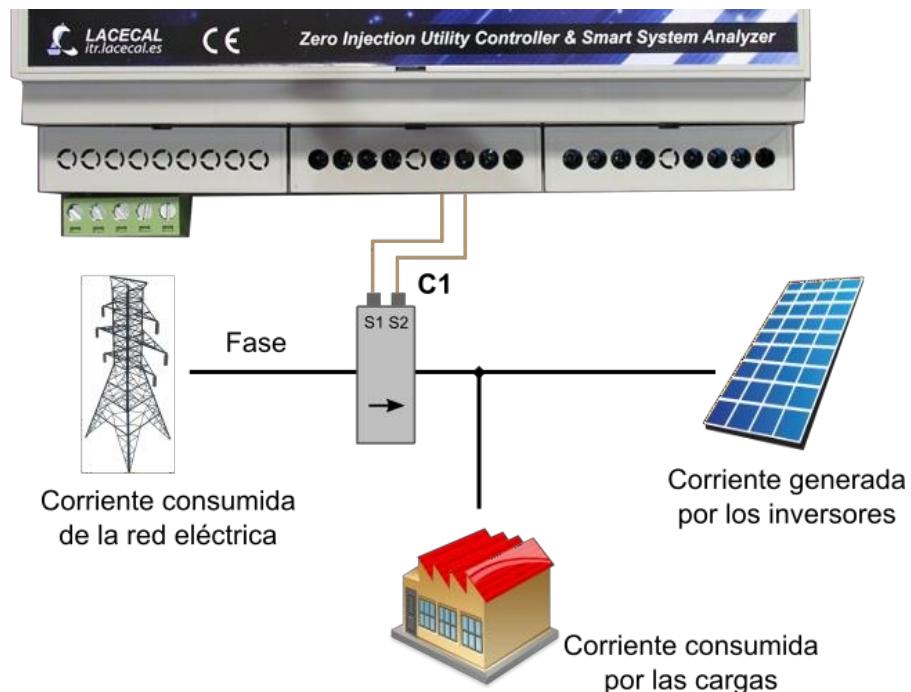
> ⚠️ **In three-phase installations, the same connections previously seen for the R phase will be replicated in the S and T phases.**

The connection of a Circutor MC3 series three-phase transformer is shown below. These transformers, with a 250mA secondary, have the particularity of having a single current return cable common to the three phases.
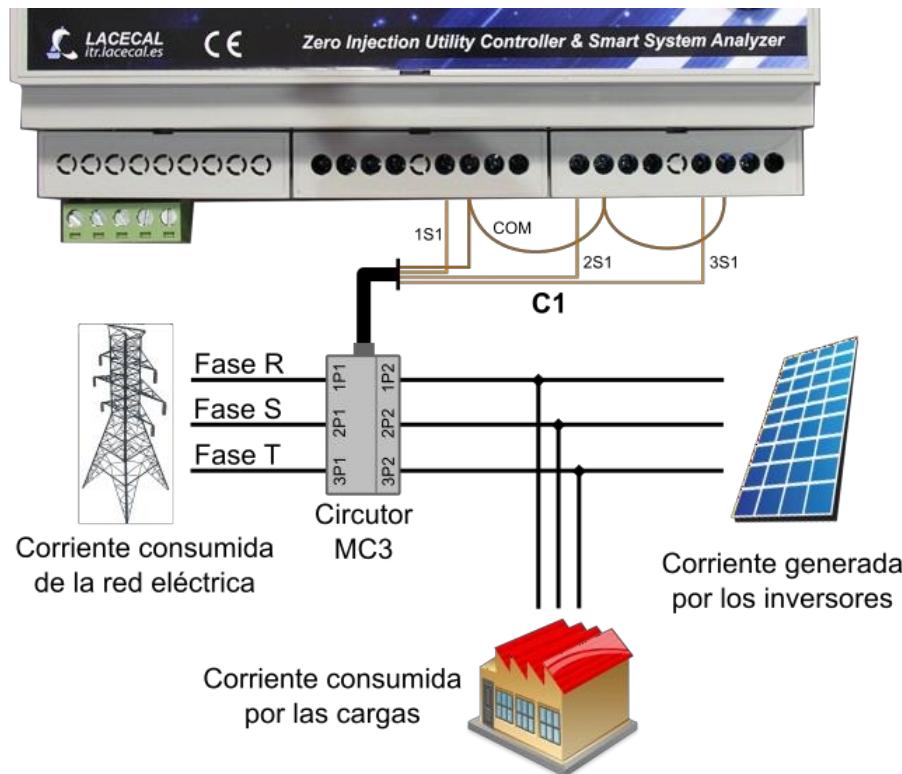
5.3   CONNECTOR A: RS485 / RS422

This connection is used to establish communication with the inverters that require it. Depending on the type of inverter, communication can be via RS422, RS485 or Ethernet.
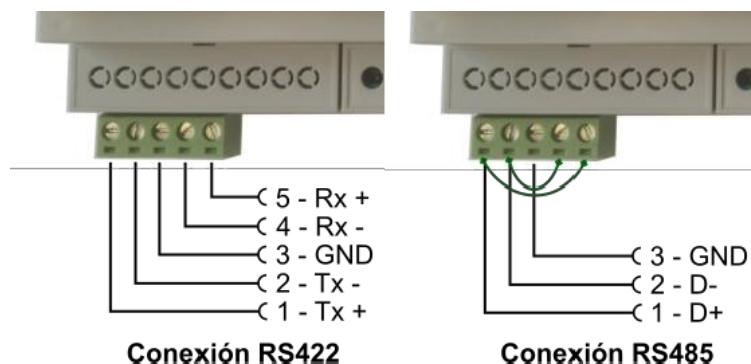
The same connector is used for both types of serial communication. In case the communication is RS485, two external jumpers must be made between pins 1-5 and 2-4 as shown in the diagram above.

The specific configuration manual of the inverters used will provide particular connection details.

5.4   CONNECTOR B: LOAD CONTROL OR SAFETY RELAY

This connector has three potential-free outputs for relay control, which can be used to activate or deactivate consumption of the installation. Any one of them can be configured to perform the task of safety relay, disconnecting the photovoltaic generation if energy is injected into the grid.
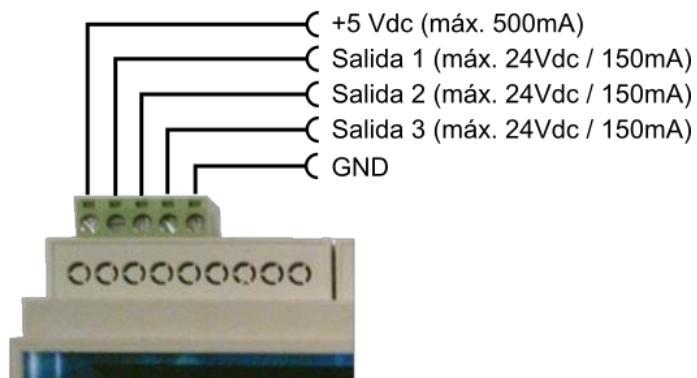
The following diagram shows how to connect the relays using the 5Vdc output built into the connector (the coil of the relays must be 5Vdc and at most 150mA consumption).
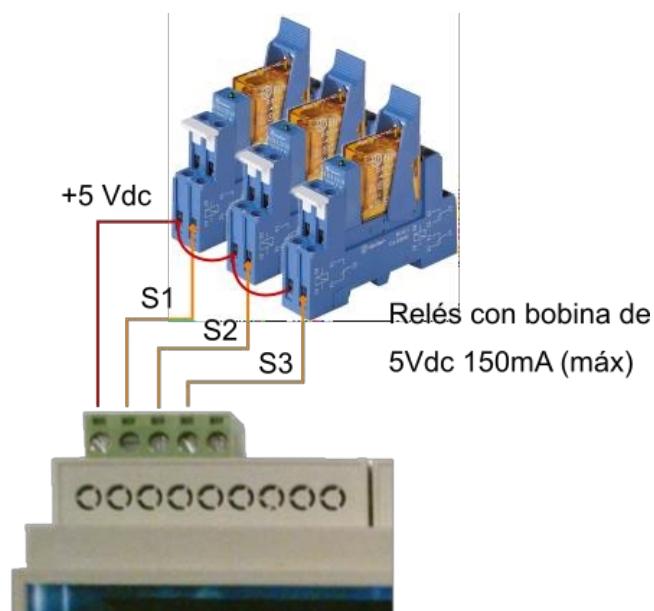
If it is necessary to use higher power contactors to control the loads, whose coil is activated by alternating voltage, the coil of these contactors must be activated by the contact of a relay configured according to the above diagram.

5.5 CONNECTION TO THE INVERTERS

The specific configuration manual for each brand of inverter provides particular connection details. The available communication options with the inverters are:

- RS485 serial communication.
- RS422 serial communication.
- Ethernet local network communication.

6 EQUIPMENT CONFIGURATION

6.1 POWER ON AND STATUS LEDS

Once all connections have been made, voltage can be applied to the ITR 2.0, which will start its start-up sequence. The current status can be obtained by means of the LEDs on the front panel, the meaning of which is shown below.

STATUS LED AND START SEQUENCE

When power is supplied to the equipment, the three LEDs on the front panel (green, yellow and red) will light up permanently.

After a few seconds they will turn off and the 'Status' LED will flash, first rapidly and then at a rate of half a second on and half a second off.

When the system software has finished initialization and the ITR 2.0 is operational, the 'Status' LED is permanently lit. Otherwise the system is not working properly, please contact technical support.

CONTROL' LED

This LED indicates the status of the communication with the

inverters. If no inverters are configured, it remains off.

A short flash indicates that communication with one of the configured inverters has been lost, and each flash indicates a new communication attempt.

In normal state (if inverters are configured and all are accessible via communication) it stays on and turns off briefly each time the ITR 2.0 sends a new setpoint to the inverters.

SERVER' LED

Lights up if the ITR 2.0 has access to the internet and has established a connection to the central data server. The connection status is checked every two minutes or so, so it may take that long for the LED to reflect the current connection status.

6.2   CONFIGURATION WEB SERVER

The initial configuration is done through the WEB server implemented in the equipment. To do this, it is sufficient to directly connect a conventional Ethernet cable between the RJ45 ports of the computer and the ITR 2.0.

The factory programmed IP is **192.168.137.99**, so it is necessary to properly configure the properties of the computer's local area connection:
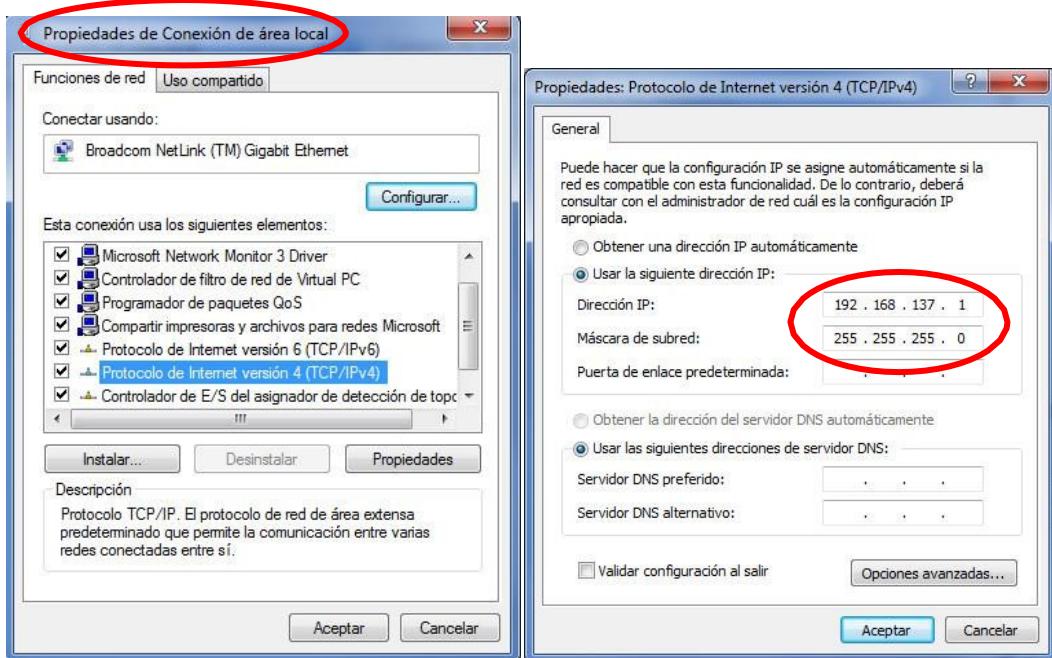
In the TCP/IPv4 protocol, the IP address 192.168.137.1 with subnet m a s k 255.255.255.255.0 will be configured.

Next, access the address http://192.168.137.99 with the browser, entering the main measurement page of the ITR 2.0 WEB server.

In the initial 'Plant status' screen you can see the rms values of all the measurements: voltages, currents and power per phase of the measurements taken.

⚠️	**Check that the measurements match what is expected to detect possible errors in the connection**.
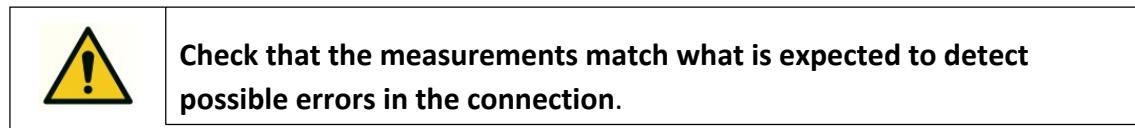
The most common errors are:

- The change of direction of some current due to the exchange of input and output signals in one of the transformers. This can be detected because with the inverters off the active power associated with that current is negative.
- The exchange of some phase current with respect to its voltage. This error is more difficult to detect, since depending on the consumption, all the power readings may be positive. In general, this error will generate power factors far away from those expected in the installation.

The first time you access the 'Configuration' menu you must use the generic user password (**ITR1234**). Only the ITR 2.0 connectivity options can be configured using this password.

In this first login you will be asked to create your installer password, which must always be 8 characters long:

⚠	**Write down the installer password assigned to the ITR 2.0 in a safe place, as you will not be able to retrieve it.** We recommend that you always use the same one in all your equipment.
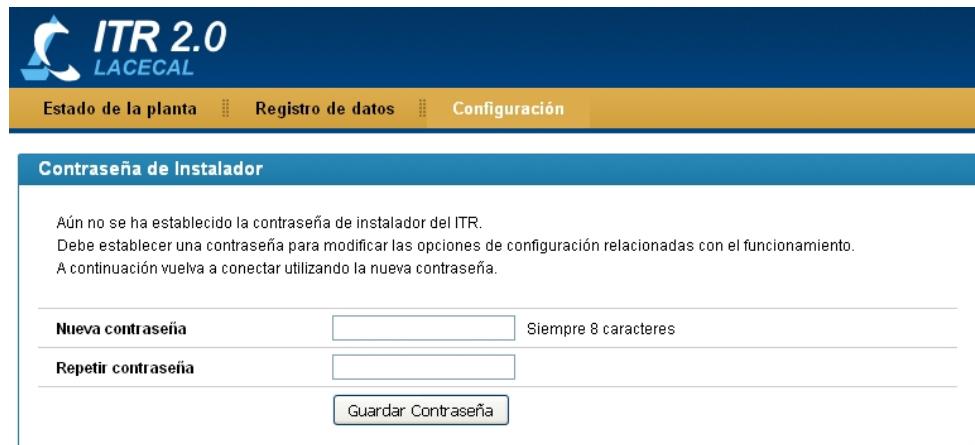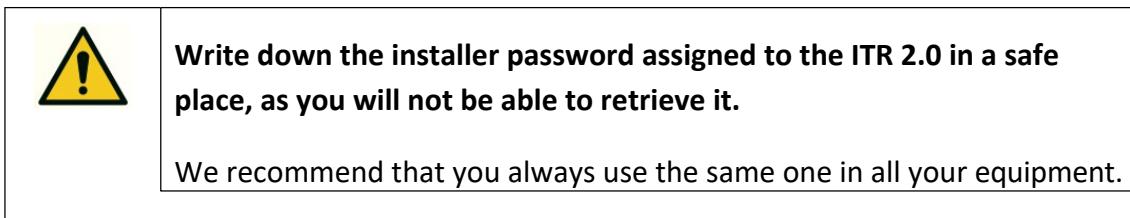
Using your installer password, you can set the configuration and operating data for the plant and inverters. In the various configuration screens you can hover your mouse over the blue information icon to get help for the corresponding option.

6.3   HARDWARE CONFIGURATION

- **Change direction of current C1:** Allows to change by software the direction of all t h e currents associated to the measurement channel C1 in case the physical connection has been made in the opposite direction to the one indicated in the connection section.

- **Change current direction C2:** Same as the previous option but in the measurement channel C2.

- **Current measurements:** Allows you to select which measurement is connected to each of the channels. The available options are:
    o C1 measures the mains current and C2 the consumption.
    o C2 measures the mains current and C1 the consumption.
    o C1 measures the grid current and C2 measures the PV production.
    o C2 measures the grid current and C1 measures the PV production.
    o C1 measures consumption and C2 measures PV production.
    o C2 measures consumption and C1 measures PV production.
    o C1 measures the mains current and consumption is not measured.
    o C2 measures the mains current and consumption is not measured.
    o The mains current is the sum of channels C1 and C2 and the consumption is not measured.

- **Primary current C1:** Indicates the rated current in amperes of t h e transformer primary connected to measurement channel C1.

- **Primary current C2:** Indicates the rated current in amperes of t h e transformer primary connected to measurement channel C2.

- **Rated voltage:** For information only. Indicates the nominal measurement voltage of the equipment (usually 230V).

- **Manufacturer**: Selects the manufacturer and communication mode (in case there are several options for the same manufacturer) of the inverters connected to the ITR 2.0.
  - SMA (SpeedWire)
  - SMA (RS485)
  - Kostal (Ethernet)
  - Fronius Lite
  - Fronius + DataManager
  - Huawei (RS485)
  - Huawei + Smarlogger
  - Ingeteam (RS485)
  - Ingeteam (TCP Gateway)
  - Danfoss
  - REFUsol
- **Time zone**: Allows you to indicate the time zone in which the installation is located, so that the winter and summer time changes will be automatically applied in the data record.
- **Serial number, Hardware version and Software version** are for information only.
- **Change installer password:** allows you to modify the access password with installer permissions programmed in the ITR.

6.4   SAFETY RELAY CONFIGURATION

The safety relay is an element that, in the event of any failure of the control system that could lead to a discharge of energy into the power grid, disconnects the generating plant, preventing the injection of energy.

This menu allows configuring the relay control system that in turn will control the opening of the contactor at the output of the photovoltaic generation.

Two relay control options are available: via one of the outputs of the load control connector located on the top of the ITR or via a remote device controlled by MODBUS TCP protocol.

6.4.1   CONTROL VIA INTEGRATED OUTPUT

By selecting the 'Output Connector' option in the 'Relay Connection Type' box, one of the three potential-free contact outputs available on Load Control Connector B can be used.

Once this option has been selected, the following configuration possibilities will appear:

- **Configuration:** Allows selection of the output to which the relay is connected and the default status of this output in normal operating mode.
- **Operating mode:** Select whether the relay trips according to the lower of the phase powers or according to the total three-phase power.
- **Trip power:** Indicate the power value below which the alarm mode of the relay will be activated.
- **Reaction time:** Indicate how long the power must be kept below the limit indicated in the previous option for the alarm mode to be triggered.
- **Reset power:** Indicate the minimum power that must be consumed from the mains to be able to reactivate the normal operating mode.
- **Minimum reset time:** Indicate the minimum time that the alarm state of the relay must be maintained once it has been activated.

6.4.2   CONTROL BY MODBUS TCP DEVICE

Selecting this option will modify the configuration options available for entering the data associated with the control device.

- **Destination IP address:** Enter the IP address of the relay control device.
- **Port number:** Enter the TCP port number on which the MODBUS server of the control device is located.
- **Write MODBUS address:** Indicate the MODBUS map address associated with the relay control.
- **Value in normal state:** Indicate the value to be written to the above address to place the relay in normal operating mode.
- **Value in alarm state:** Indicate the value to be written to the above address to place the relay in alarm mode.

6.5   INVERTER TABLE

Allows you to define which inverters are connected in the plant, assigning them a name that will be used to identify each of them in the registers.

If the inverters are single-phase in a three-phase installation, it is also possible to indicate in which phase each inverter is connected.

> ⚠️ **Depending on the inverter brand and the communication mode, different configuration options are available**
>
> A specific configuration manual is available for each brand of inverter supported.

6.6   CONTROL CONFIGURATION

- **Power control mode:** In single-phase installations 'Per phase' should always be selected. In three-phase installations, if 'Per phase' is selected, the power of the inverters will be limited so that no energy is dumped into the power grid by any of the phases. If 'Three-phase' is selected, the power of the inverters will be limited so that no energy is dumped into the grid on all three phases.

- **Inverter control:** Selecting 'On' will perform zero feed-in control over the installation. Selecting 'Off' will limit the inverter production to a fixed value between 0% and 100% of its nominal power.

- **Minimum consumption per phase**: Indicates in watts the minimum consumption from the mains desired in each phase. Values slightly higher than zero reduce possible sporadic energy discharges. A suitable starting value would be 0.5% of the installed PV power.

- **Control speed**: Speed of response of the power control.

- **Inverter response**: Inverter response speed to power limitation variations.

6.7   ETHERNET CONNECTION CONFIGURATION

- **Connection type:** offers the different connection options available.
    - **Manually set IP** allows you to assign the IP address and the rest of the network parameters directly.

o **Obtain IP** will **automatically** use the DHCP server of the local network (usually the router connecting to the Internet) to obtain the IP address and the rest of the network parameters.

o **Internet access sharing** will create an access point and the ITR 2.0 will behave as a router, with a fixed IP (192.168.138.1) and a DHCP server that can assign IP addresses to other devices connected on the Ethernet network.

> ⚠️ **Do not use this type of connection if you connect the equipment to an existing Ethernet network with its own router.**

The main utility of this type of connection is to allow inverters with Ethernet connection to send data to their own servers using the WIFI or 3G connection of the ITR 2.0. The network configuration to be programmed in the inverters would be as follows:

- **IP**: 192.168.138.xxx (With xxx between 2 and 254)
- **Netmask**: 255.255.255.0
- Gateway: 192.168.138.1
- **DNS**: 192.168.138.1

Ethernet

Tipo de conexión	Establecer IP de forma manual
IP	192.168.137.99
Máscara	255.255.255.0
Gateway	192.168.137.1
DNS	192.168.137.1
Conexión a internet	Sí

Actualizar

- **IP:** in case of manual configuration, IP address assigned to the ITR 2.0.
- **Mask:** in case of manual configuration, mask of the network to which the ITR is connected.
- **Gateway:** in case of manual configuration, IP address of the local network equipment that performs the gateway function to the Internet (usually the local network router).
- **DNS:** in case of manual configuration, IP address of the network name resolution server (usually the local network router). If you do not know it you can configure one of the google public name servers: 8.8.8.8.8 or 8.8.4.4.4

> ⚠️ **In case of manual configuration consult the administrator of the local network to which you are connecting to** provide you with the appropriate values for IP address, netmask, gateway and DNS server.

• **Internet connection**: indicates whether the local Ethernet network to which the ITR 2.0 is connected has Internet access. If 'Yes' is selected, this connection will be used for communication with the central data server.

> ⚠️ **You must select 'No' if the local network does not have internet access to allow connection to the data server via WIFI or 3G networks.**

> ⚠️ **Changes to the network will be applied immediately when you click on the 'Update' button.**
>
> If you are accessing the ITR 2.0 via the Ethernet connection the communication will be lost, and you will have to physically connect the equipment to the new network.

6.8   WIFI CONNECTION CONFIGURATION

If a USB WIFI device is connected to the ITR 2.0, this menu allows you to connect to one of the available networks and configure its properties.

A list of available networks will appear and you can connect to the desired one by clicking on the antenna icon on the right. Connection is only possible to networks with security enabled, otherwise the connection icon does not appear. When you click on connect, the following window will appear, allowing you to configure the connection options.

Wi-Fi	
Red	LACECAL_ID
Contraseña	
Seguridad	WPA
DHCP	Sí
IP	
Máscara	
Gateway	
DNS	
Conexión a internet	Sí
	Conectar Volver

- **Password:** enter the password of the WFI network to which you are connecting.
- **DHCP:** select 'Yes' so that the access point to which you are connecting will configure the rest of the network parameters automatically. This is the usual option when connecting to WIFI networks. If 'No' is selected, the IP, Mask, Gateway and DNS parameters will be configured with the same criteria as indicated in the manual Ethernet configuration.
- **Internet connection**: indicates whether the WIFI network to which the ITR 2.0 is connected has internet access. If 'Yes' is selected, this connection will be used for communication with the central data server.

⚠	**You must select 'No' if the WIFI network does not have internet access to allow the connection to the data server to be made via the 3G network.**

You can also configure the connection to a WIFI network that is currently unavailable, and the ITR 2.0 will connect to it when it is in range. To do this, click on the 'Create connection' button on the initial screen, and in addition to the data indicated above, the network name and security type must be entered.

6.9   3G MOBILE NETWORK CONFIGURATION

You can use a 3G USB modem connected directly to the ITR 2.0 to access the Internet. The modem will be configured automatically, in this screen you can check if the modem has been detected and the connection status.

| ⚠️ | **The ITR 2.0 is only compatible with HUAWEI HiLink series models, such as the E303.** |

6.10   BACKUP COPY

This option allows you to perform three different tasks.

In the first section you can download the current configuration of the ITR and also the historical measurement records month by month. These historical files can be later uploaded to the WEB application, in case the ITR 2.0 does not have internet access, in order to visualize the operation from anywhere.

The second section allows you to restore a previously downloaded configuration file.

Finally, the third section restores the default configuration, deleting all historical data records and configurations made. The IP will also change to the default value: 192.168.137.99.

6.11   TICKET WEB PLATFORM.

If you have an internet connection, the ITR 2.0 will automatically send the recorded data to our servers. In order to access the visualization of this data and the remote management of the installation in the WEB platform, it is necessary to have a user account and register the ITR 2.0 in this account.

To do this we will use this option in the ITR 2.0 configuration menu and we must also access the WEB application at http://itr.lacecal.es.

In the connection page of the WEB application select the option 'Register user', where the steps to follow will appear:

Copy the code identified as 'WEB platform ID' and paste it in the 'WEB platform ticket' option of the ITR 2.0:

Then click on Generate Ticket, and ITR 2.0 will generate the necessary code to register on the WEB platform.

Again in the WEB platform, enter the data provided by the ITR 2.0 and click on the 'Register' button.

If you already have a user account on the WEB platform, you can add ITR 2.0 to your account by simply logging in with your username and password.

If you do not have an account, or you want to create a new one to manage this installation, you can do so by clicking on the toggle icon, highlighted in red.

7   PLANT CONDITION

In the 'Plant Status' menu we have access to three screens that allow us to visualize the current status of the installation.

7.1   EFFECTIVE VALUES

This screen shows the current values measured in each phase for voltage, current, active, reactive, apparent and apparent power and power factor. By checking the 'Automatic update' option, the values will be refreshed periodically for a few minutes.

Valores eficaces				Actualización automática
RED	Total	Fase R	Fase S	Fase T
Tensión:	--	235,8 V	234,7 V	235,1 V
Intensidad:	--	35,0 A	46,5 A	32,8 A
Potencia Activa:	13,764 kW	2,845 kW	7,086 kW	3,833 kW
Potencia Reactiva:	1,955 kVAr	-1,406 kVAr	1,087 kVAr	2,273 kVAr
Potencia Aparente:	13,902 kVA	8,241 kVA	10,911 kVA	7,707 kVA
Factor de Potencia:	0,990	0,345	0,649	0,497
FOTOVOLTAICA	Total	Fase R	Fase S	Fase T
Tensión:	--	235,8 V	234,7 V	235,1 V
Intensidad:	--	36,2 A	36,1 A	36,0 A
Potencia Activa:	25,450 kW	8,514 kW	8,473 kW	8,463 kW
Potencia Reactiva:	0,572 kVAr	0,582 kVAr	-0,050 kVAr	0,040 kVAr
Potencia Aparente:	25,457 kVA	8,534 kVA	8,473 kVA	8,463 kVA
Factor de Potencia:	1,000	0,998	1,000	1,000
CONSUMO	Total	Fase R	Fase S	Fase T
Tensión:	--	235,8 V	234,7 V	235,1 V
Intensidad:	--	57,1 A	74,4 A	59,2 A
Potencia Activa:	39,215 kW	11,359 kW	15,559 kW	12,296 kW
Potencia Reactiva:	2,526 kVAr	-0,824 kVAr	1,037 kVAr	2,313 kVAr
Potencia Aparente:	39,296 kVA	13,457 kVA	17,475 kVA	13,907 kVA
Factor de Potencia:	0,998	0,844	0,890	0,884

7.2   INSTANTANEOUS VALUES

This screen allows you to view the waveforms of the voltages, currents and power of each of the phases. It also shows the harmonic analysis up to harmonic number 15.
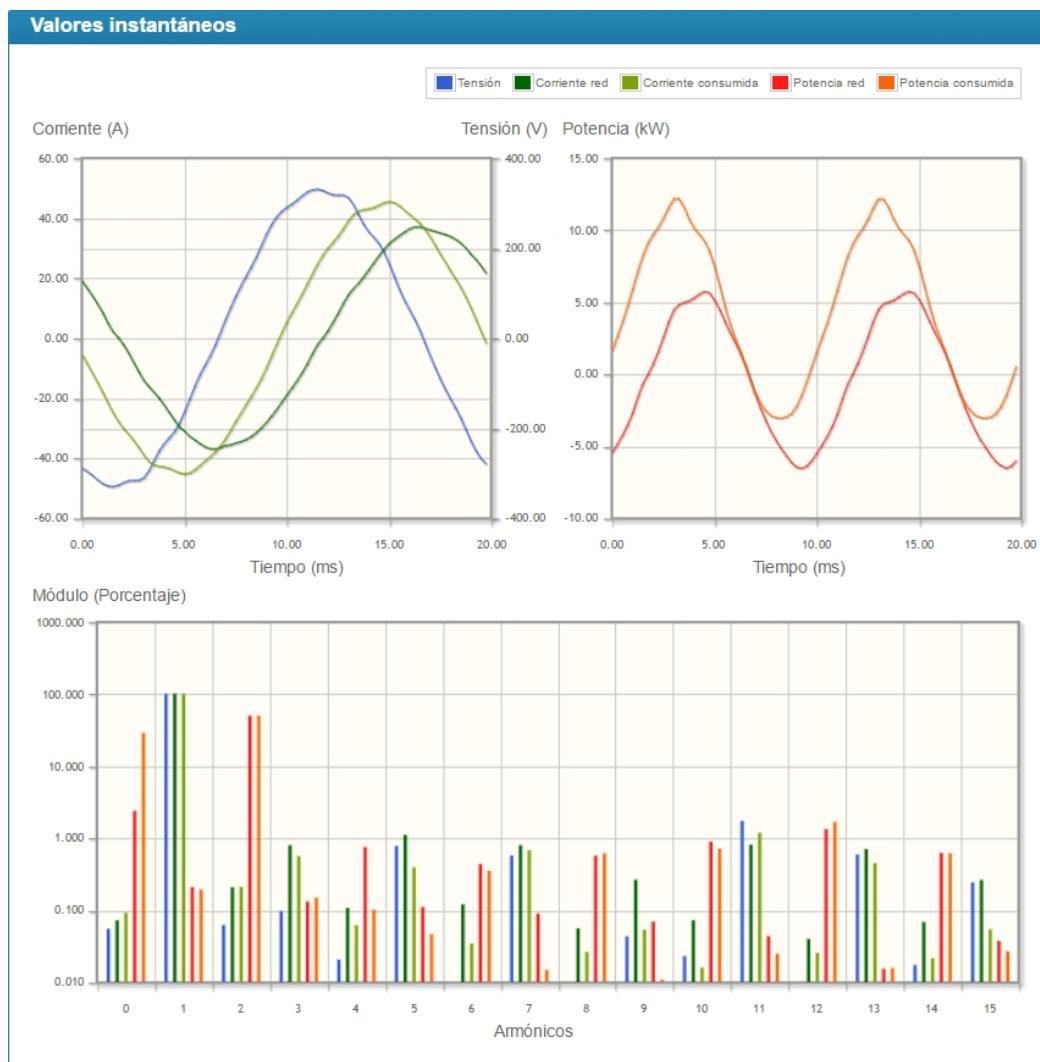
7.3   CONTROLLED DEVICES

In this screen you can check the status of each inverter connected to the ITR 2.0: current power, percentage of power regulation being applied and status of communication with the inverter.

In addition, in 'Other Devices' the status of the controlled loads will be displayed.

Estado de los Inversores

Nombre	Modelo	Fase	Pot. actual (W)	Límite (%)	Estado
Inversor 1	Primo 8,2-1	Fase R	0	100	FALLO

Estado de Otros Dispositivos

Modelo	Nombre	Estado
Conector de Salidas ITR	Salida 1	Desconectado (16.4 min)
Conector de Salidas ITR	Salida 2	●
Conector de Salidas ITR	Salida 3	●
Controlador de Carga ITR.vLD	*** Nuevo controlador ***	Salida 1: 100% Salida 2: 0% OK Salida 3: 0%

8   DATA LOGGING

The 'Data Logging' option provides a history of the data collected from the installation, both consumption and total PV production and from each of the inverters.

Menú

Monitorización planta

Producción inversores

Opciones

Fecha
22/01/2015

Comparar fases
No comparar

Fase
RST ◉   R ○ S ○ T ○

Unidades
Potencia ◉   Energía ○

Actualizar

8.1   PLANT MONITORING

It graphically displays the evolution of total consumption and photovoltaic production on a specific date. Total data can be displayed by three-phase or by phase.
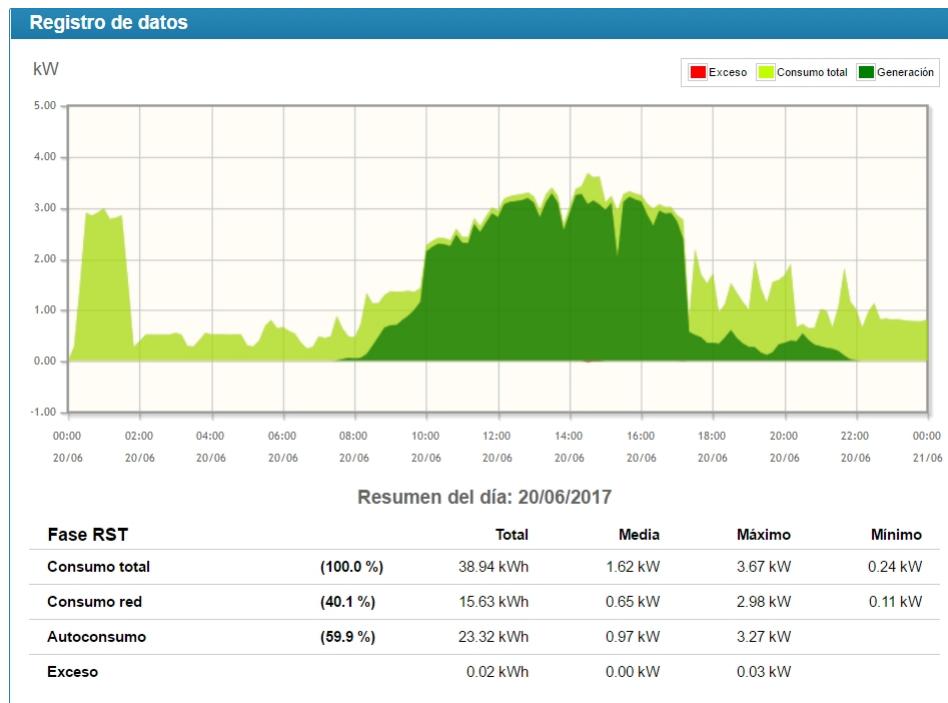
8.2 INVERTER PRODUCTION

The power and energy profile generated on a given date can be displayed for each inverter in the plant.
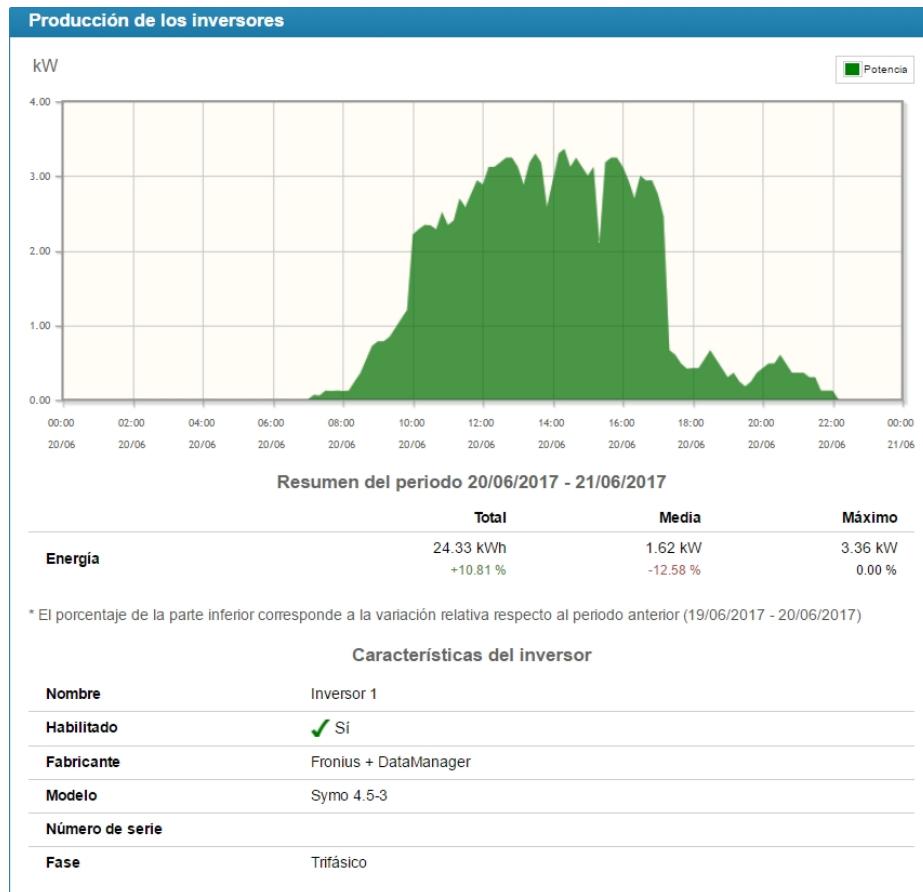
9   CONFIGURATION PUSHBUTTON

If you have changed the default IP address of the ITR and do not remember the current values, it is possible to regain access to the integrated configuration WEB using the 'Config' button. Depending on the date of manufacture, this button may be on the front cover or on a microswitch accessible through the hole near the B connector.

9.1   ACCESS VIA ETHERNET NETWORK

It is possible to make the ITR 2.0 recover the default IP address of the Ethernet connection by performing the following steps:

1. Press the button for more than 5 seconds. When released the 'Status' led will start flashing.
2. Press the button again for a little more than 1 second (less than 5). The 'Server' led will light up.
3. Again, press the button for 1 second. The 'Control' LED will turn on and the 'Server' LED will turn off.
4. Finally, press the button for 5s and release. The LEDs will flash rapidly for a few moments and then return to normal mode.

Thus, using the browser and following the steps described in section 6.7, we can access the internal configuration on IP 192.168.137.99.

This IP address change is temporary. Repeating the above sequence of steps with the push button, or restarting the ITR 2.0 will restore the configured IP address.

To make a permanent change in the IP configuration, access the Ethernet menu and enter the new desired values.

9.2   WIFI ACCESS

If the ITR 2.0 has a USB WIFI stick connected, it is possible to create an access point and connect wirelessly to the configuration WEB. To do this, the following steps must be followed:

1. Press the button for more than 5 seconds. When released the 'Status' led will start flashing.
2. Press the button again for a little more than 1 second (less than 5). The 'Server' led will light up.
3. Finally, press the button for 5s and release. The LEDs will flash rapidly for a few moments and then return to normal mode.

Once this sequence is done, the ITR 2.0 will create a WIFI access point called 'ITR-Serial-No.' (For example: **ITR-131001**).

We will search for that WIFI network with a computer or mobile device, and connect using the password 'CFG@ITR-SerialNo.' (For example: **CFG@ITR-131001**).

Once the connection has been made, using the browser, we can access the internal configuration using the IP address **192.168.139.1**

Again, this configuration is temporary, and will be lost by performing the same sequence of keystrokes or restarting the computer.

10   LOAD MANAGEMENT

The ITR 2.0 can manage the energy consumed in the installation in two different ways:

- Turning on and off certain loads of the installation by means of the relays connected to the load control connector: ON/OFF or all/nothing load control.
- Modulating the power consumed by a resistive load by means of the external device ITR.vLD: control of adjustable loads. In this way the power consumed will be adapted to the existing solar production, thus obtaining the maximum performance of the photovoltaic plant.

10.1   ALL/NOTHING LOAD CONTROL

Up to three independent loads can be switched on and off using the outputs of the
load control connector.
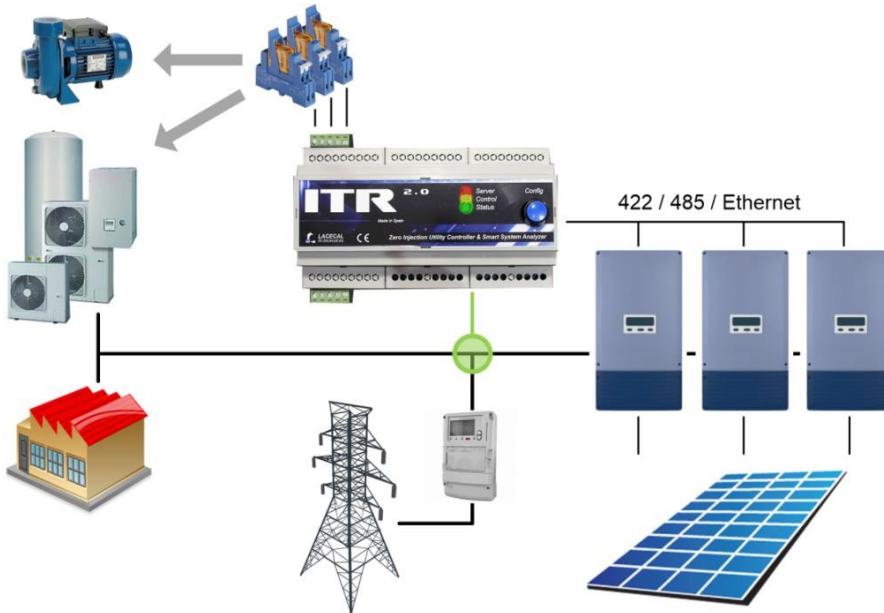
The active outputs can be selected and programmed in the load control configuration
menu.

10.1.1   AVAILABLE LOADS

The list of loads will show all the available outputs for load control, and the data
associated with each output can be edited using the pencil icon on the right.

The data that can be configured in each output are:

- **Assigned name:** allows you to assign a name to this output to more easily identify the load connected to it.

- **Enable load control:** allows you to activate or deactivate all the schedules assigned to a load without having to delete them.

- **State to connect the load:** determines whether to activate the load the output of the ITR 2.0 should be switched on or off. This would allow the use of relays with normally open or normally closed contacts depending on the need.

10.1.2 LOAD SCHEDULING

In this list you can add all the desired load connection and disconnection conditions. Each schedule also includes a time restriction in which it is valid (time interval and days of the week). It is also possible to define periods in which the load is always on or off regardless of any other condition.

The 'Always on' or 'Always off' type schedules have priority over the rest.

For the rest of the programs, the order of priority for connection is the one shown in the list. The order can be changed by pressing the up and down arrows to the right of each program. For disconnection, the order will be the reverse of the order in the list.

You can add a new program using the '**+**' icon, delete a program using the trash can icon and edit an existing program using the pencil icon.

The programming of the switch-on and switch-off conditions is carried out intuitively by means of the following option box, in which you simply follow the indications:

The load connection condition can be set according to the excess energy available in the inverters, or according to the energy consumed from the power grid.

Depending on whether the load is single-phase or three-phase and the type of control desired, it can also be established whether the conditions apply to the power of one of the phases or of the total three-phase.

In addition, the conditions are applied on a time average of the selected power to avoid the influence of momentary variations in consumption.

To avoid too fast connections and disconnections, a condition is also included that establishes a minimum time that the load must remain in each of the states before it can change.

10.2 CONTROL OF ADJUSTABLE LOADS

Using the external ITR.vLD device, the power consumed by a resistive load can be modulated so that the consumption of the system is adapted as closely as possible to the available production at any given time. Typical resistive loads are DHW heaters. The configuration and control of the load is done from the ITR 2.0. The two devices communicate via the Ethernet network (both must be connected to the same local network).

In the system configuration you can set the control response speed and the maximum desired power variation in the load in watts per second.

By means of load control, it would also be possible to perform zero injection regulation without having control over the inverters' production or with renewable energy sources that cannot be limited, such as a windmill.
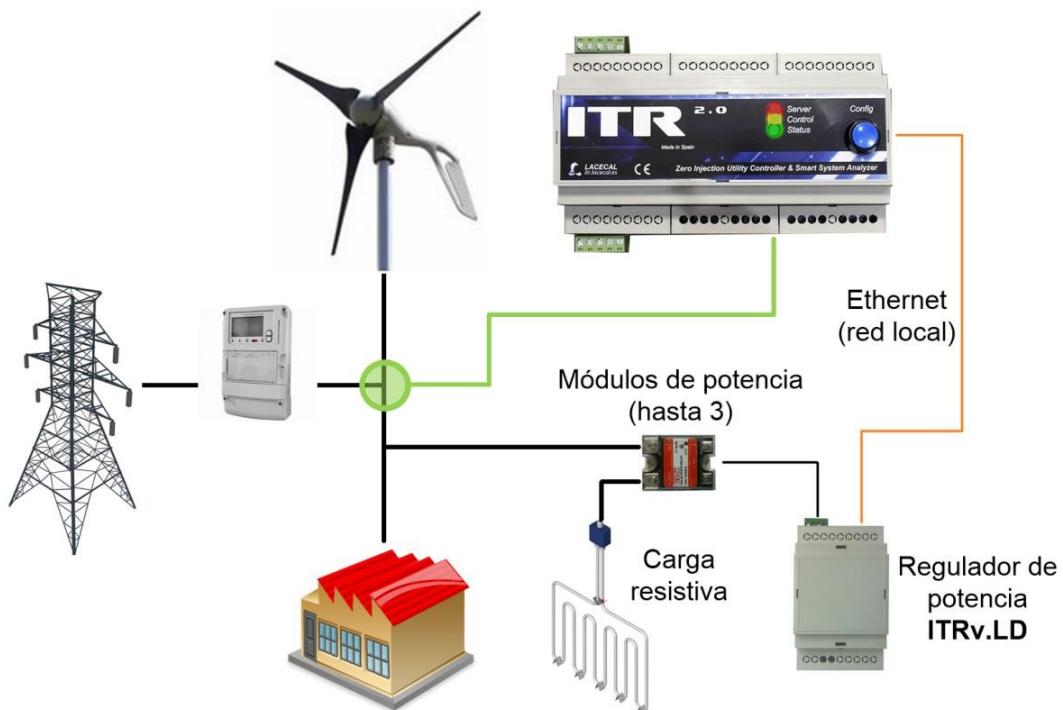
This would require ensuring that there is always enough power in the loads to dissipate any excess production.

The ITRv.LD device can control up to three resistive loads independently. In three-phase systems, the control regulates the loads to automatically balance the consumption of the installation.

Once the ITRv.LD device is connected on the same Ethernet network as the ITR 2.0 you can use the 'Search Drivers' button in the 'List of Available Loads' to search for and add all devices.

The first icon is used to define the network configuration of the charge controller.

⚠	**A fixed IP address must be assigned to the Load Controller.** Consult your local network administrator if in doubt to avoid conflicts with other devices.

Using the editing pencil we can configure each of the three outputs of the controller, indicating the power of the connected load, the network phase and the type of control, between: 'Always connected', 'Always disconnected' and 'Controlled'.

The first two options are useful during installation to check that the loads are connected and disconnected correctly regardless of the operating status of the plant.

Time restrictions can also be added to each of the outputs using the editing pencil. In this way, you can define time intervals for certain days of the week in which the load is regulated at a constant percentage from 0% (off) to 100% (on).

The following graph corresponds to the operation of a real plant incorporating the charge controller. It can be seen how the consumption of the installation adapts to the photovoltaic production, and the consumption of the variable resistor automatically compensates other variations of the internal consumptions.
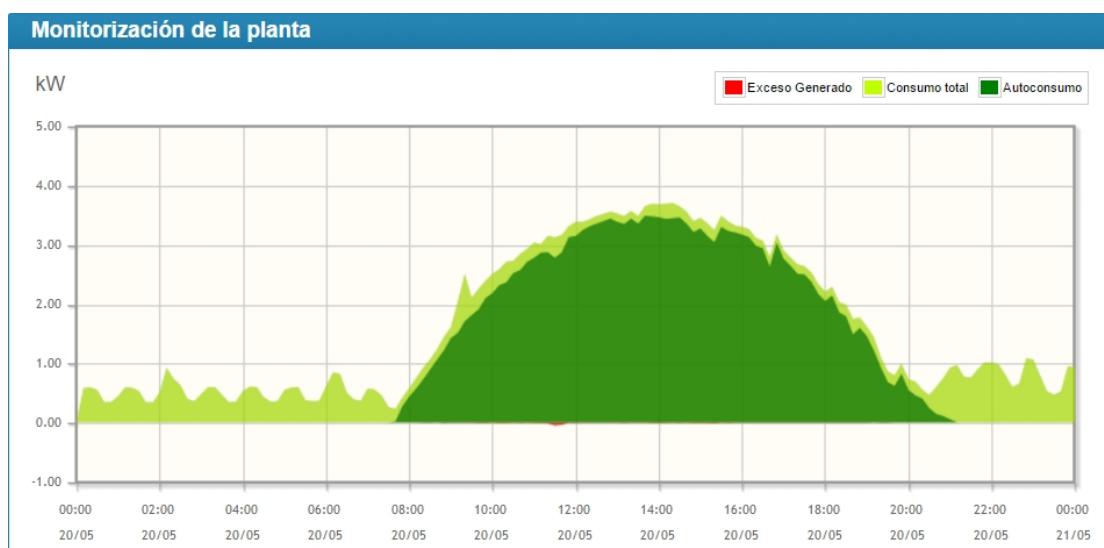
11 MODBUS TCP SERVER

The ITR 2.0 incorporates a MODBUS server on TCP port 502.

This server provides access to all the historical data stored in the equipment: energy consumed from the grid in each phase, both active and reactive, consumption of the loads of the installation and photovoltaic production.

It is also possible to obtain the instantaneous values measured by the ITR 2.0 of voltages, currents, active and reactive powers.

The following sections show the MODBUS address map of the server.

11.1 HISTORICAL RECORD

Home	Final	Size	R/W	Functions	Name	Type	Units	Description	Values
0x1000	0x1002	3	RW	3 6 16	Date	bcd12		Date and time in BCD of the record to be retrieved. yy yy mm dd hh mm	
0x1003	0x1003	1	R	3	State	uint16		0: accessing record 1: registration available 2: record not found	0 - 2
0x1004	0x1006	3	R	3	F_Reg	bcd12		Date and time in BCD of the 10-minute interval read. yy yy mm dd hh mm	
0x1007	0x1008	2	R	3	redR+	float32	kWh	Power consumed from the grid in phase R	> 0
0x1009	0x100A	2	R	3	redR-	float32	kWh	Energy exported to the grid in phase R	> 0
0x100B	0x100C	2	R	3	redS+	float32	kWh	Energy consumed from the grid in phase S	> 0
0x100D	0x100E	2	R	3	redS-	float32	kWh	Energy exported to the grid in phase S	> 0
0x100F	0x1010	2	R	3	redT+	float32	kWh	Energy consumed from the grid in phase T	> 0
0x1011	0x1012	2	R	3	redT-	float32	kWh	Energy exported to the grid in phase T	> 0
0x1013	0x1014	2	R	3	redRST+ network	float32	kWh	Energy consumed from the grid in phases R+S+T	> 0
0x1015	0x1016	2	R	3	redRST-	float32	kWh	Energy exported to the grid in the R+S+T phases	> 0
0x1017	0x1018	2	R	3	redQ1	float32	kVarh	Reactive energy consumed from the grid in quadrant Q1	> 0
0x1019	0x101A	2	R	3	redQ2	float32	kVarh	Reactive energy consumed from the grid in quadrant Q2	> 0
0x101B	0x101C	2	R	3	redQ3	float32	kVarh	Reactive energy consumed from the grid in quadrant Q3	> 0
0x101D	0x101E	2	R	3	redQ4	float32	kVarh	Reactive energy consumed from the grid in quadrant Q4	> 0

Home	Final	Size	R/W	Functions	Name	Type	Units	Description	Values
0x101F	0x1020	2	R	3	conR	float32	kWh	Total consumption of the installation in phase R	> 0
0x1021	0x1022	2	R	3	conS	float32	kWh	Total consumption of the plant in phase S	> 0
0x1023	0x1024	2	R	3	conT	float32	kWh	Total consumption of the plant in phase T	> 0
0x1025	0x1026	2	R	3	conRST	float32	kWh	Total consumption of the installation in phases R+S+T	> 0
0x1027	0x1028	2	R	3	invRST	float32	kWh	Total energy produced by the inverters (Read from the inverters)	> 0

11.1.1 EXAMPLE

Request for 10-minute historical record starting on 12/18/2015 at 20:00 MODBUS

PDU: 0x10 0x10 0x00 0x00 0x00 0x03 0x06 0x20 0x15 0x12 0x18 0x18 0x20 0x00 0x00

- The reading of the values associated with the data register (registers 0x1003 to 0x1028) must be performed on the same TCP connection as the request.
- The reading can be done at any time after the request, but the value of register 0x1003 must be taken into account to know if the rest of the data is valid or not.

11.2 INSTANTANEOUS VALUES

Home	Final	Size	R/W	Functions	Name	Type	Units	Description	Values
0x2000	0x2001	2	R	3	Pred_RST	float32	W	P(RST) Power consumed	---
0x2002	0x2003	2	R	3	Pgen_RST	float32	W	P(RST) Generated	---
0x2004	0x2005	2	R	3	Pcon_RST	float32	W	P(RST) Consumption loads	---
0x2006	0x2007	2	R	3	Pred_R	float32	W	P(R) Consumed from mains	---
0x2008	0x2009	2	R	3	Pgen_R	float32	W	P(R) Generated	---
0x200A	0x200B	2	R	3	Pcon_R	float32	W	P(R) Consumption loads	---
0x200C	0x200D	2	R	3	Pred_S	float32	W	P(S) Consumed from mains	---
0x200E	0x200F	2	R	3	Pgen_S	float32	W	P(S) Generated	---
0x2010	0x2011	2	R	3	Pcon_S	float32	W	P(S) Consumption loads	---
0x2012	0x2013	2	R	3	Pred_T	float32	W	P(T) Consumed from mains	---
0x2014	0x2015	2	R	3	Pgen_T	float32	W	P(T) Generated	---
0x2016	0x2017	2	R	3	Pcon_T	float32	W	P(T) Consumption loads	---
0x2018	0x2019	2	R	3	Qred_RST	float32	Var	Q(RST) Power consumed	L (>0)
0x201A	0x201B	2	R	3	Qgen_RST	float32	Var	Q(RST) Generated	L (>0)
0x201C	0x201D	2	R	3	Qcon_RST	float32	Var	Q(RST) Load consumption	L (>0)
0x201E	0x201F	2	R	3	Qred_R	float32	Var	Q(R) Consumed from mains	L (>0)
0x2020	0x2021	2	R	3	Qgen_R	float32	Var	Q(R) Generated	L (>0)
0x2022	0x2023	2	R	3	Qcon_R	float32	Var	Q(R) Load consumption	L (>0)
0x2024	0x2025	2	R	3	Qred_S	float32	Var	Q(S) Consumed from mains	L (>0)
0x2026	0x2027	2	R	3	Qgen_S	float32	Var	Q(S) Generated	L (>0)
0x2028	0x2029	2	R	3	Qcon_S	float32	Var	Q(S) Consumption loads	L (>0)
0x202A	0x202B	2	R	3	Qred_T	float32	Var	Q(T) Consumed from mains	L (>0)
0x202C	0x202D	2	R	3	Qgen_T	float32	Var	Q(T) Generated	L (>0)
0x202E	0x202F	2	R	3	Qcon_T	float32	Var	Q(T) Load consumption	L (>0)
0x2030	0x2031	2	R	3	Ired_R	float32	A	I(R) RMS network current	> 0
0x2032	0x2033	2	R	3	Igen_R	float32	A	I(R) Effective generating current	> 0
0x2034	0x2035	2	R	3	Icon_R	float32	A	I(R) RMS current consumption	> 0
0x2036	0x2037	2	R	3	Ired_S	float32	A	I(S) RMS grid current	> 0
0x2038	0x2039	2	R	3	Igen_S	float32	A	I(S) Effective generating current	> 0
0x203A	0x203B	2	R	3	Icon_S	float32	A	I(S) RMS current consumption	> 0
0x203C	0x203D	2	R	3	Ired_T	float32	A	I(T) RMS network current	> 0
0x203E	0x203F	2	R	3	Igen_T	float32	A	I(T) RMS generation current	> 0
0x2040	0x2041	2	R	3	Icon_T	float32	A	I(T) RMS current consumption	> 0

Home	Final	Size	R/W	Functions	Name	Type	Units	Description	Values
0x2042	0x2043	2	R	3	V_R	float32	V	V(R) RMS voltage phase R	> 0
0x2044	0x2045	2	R	3	V_S	float32	V	V(S) RMS voltage phase S	> 0
0x2046	0x2047	2	R	3	V_T	float32	V	V(T) RMS voltage phase T	> 0
0x2048	0x2049	2	R	3	Pexc_R	float32	W	P(R) Excess available	>= 0
0x204A	0x204B	2	R	3	Pexc_S	float32	W	P(S) Excess available	>= 0
0x204C	0x204D	2	R	3	Pexc_T	float32	W	P(T) Excess available	>= 0
0x204E	0x204F	2	R	3	Pexc_RST	float32	W	P(RST) Excess available	>= 0
0x2050	0x2051	2	R	3	Regul_R	float32	%	(R) Regulatory Percentage	0-100
0x2052	0x2053	2	R	3	Regul_S	float32	%	(S) Percentage of Regulation	0-100
0x2054	0x2055	2	R	3	Regul_T	float32	%	(T) Regulatory Percentage	0-100
0x2056	0x2057	2	R	3	Regul_RST	float32	%	(RST) Percentage of Regulation	0-100
0x2058	0x2059	2	R	3	Pload_R	float32	W	P(R) Variable desired load	>= 0
0x205A	0x205B	2	R	3	Pload _S	float32	W	P(S) Variable desired load	>= 0
0x205C	0x205D	2	R	3	Pload _T	float32	W	P(T) Variable desired load	>= 0
0x205E	0x205F	2	R	3	Pload _RST	float32	W	P(RST) Variable desired load	>= 0
0x2060	0x2060	1	R	3	Out_state	uint16	---	Status of digital outputs	

12   WARRANTIES

In case of any doubt about the operation or malfunction of the equipment, please c o n t a c t   your DISTRIBUTOR:

Amara-e
Technical Department
C/ Trespaderne 29, 1st floor
28042 Madrid
+34 917 23 16 00
tecnicos.solar@amara.es
https://www.amara-e.com

The manufacturer, LACECAL:

It guarantees its products against all manufacturing defects for a period of two years from the delivery of the equipment.

It will repair any manufacturing defective product returned during the warranty period. If repair is not possible, it will replace the product, always requiring the return of the defective product.

No return will be accepted and no equipment will be repaired unless accompanied by a report indicating the defect observed or the reasons for the return.

The warranty will be void if the equipment has been "misused" or if the instructions in this manual have not been followed in all aspects: storage, installation and maintenance. Misuse" is defined as any situation of use, maintenance or storage contrary to the national electrotechnical code or exceeding the limits indicated in the technical and environmental characteristics section of this manual. Likewise, the warranty will be void if it is proven that the equipment has been previously opened or manipulated by personnel outside Amara-e or LACECAL.

LACECAL declines all responsibility for possible damage to the equipment or other parts of the installations in which it is located and will not cover possible penalties resulting from a failure not covered by the warranty. This warranty does not apply to faults occurring in the following cases:

- Due to power surges and/or electrical disturbances in the supply.
- By water, if the product does not have the appropriate IP rating.
- Lack of ventilation and/or excessive temperatures.
- Incorrect installation and/or lack of maintenance.
- If the purchaser repairs or modifies the material without the manufacturer's authorization.

13   TECHNICAL SPECIFICATIONS

Feeding	Model direct measurement 230 Vac (85V ... 264V) 50 ... 60 Hz 8 VA (14 VA max)	External medium voltage model: 5 Vdc 2 A
Voltage measurement	Model direct measurement 3 x 230 V (phase-neutral) 50 ... 60 Hz 0.03 VA	Medium voltage model 3 x 63.5 V (phase-neutral) 50 ... 60 Hz 0.01 VA
Current measurement	.../0.250 A (0.04 VA) .../1 A (0,02 VA) .../5 TO (0.5 VA)	
Accuracy	1 %	
Communications	Ethernet RS422 / RS485 WIFI / 3G / Bluetooth via USB devices standard not included.	
User interface	WEB server integrated in the equipment. Access via Ethernet or WIFI.	
Data logging	Local storage of all operating data on SD included.	
Internet connection	Ethernet / WIFI / 3G Required for sending data to the web portal and receiving automatic firmware updates.	
Mechanical Characteristics	DIN modules (159x90x58 mm) ABS UL94V-0 310 gr DIN rail mounting 46277 (EN 50022)	
Temperature range of work	-25°C ... +70°C	
Temperature range of storage	-40°C ... +85°C	
Maximum relative humidity non-condensing	95%	
Maximum altitude	2000m	
Degree of protection	IP20	

Regulations	
Compatibility electromagnetic	UNE-EN 61000-6-4-4:2007 UNE-EN 61000-6-2:2006
Electrical safety	UNE-EN 61010-1:2011

EC DECLARATION OF CONFORMITY

Manufacturer: Asociación LACECAL

Address: Escuela de Ingenierías Industriales
             Paseo del Cauce 59
             47011 Valladolid

We declare under our responsibility that the product

Self-consumption manager and Zero injection ITR 2.0

models

ITR 2.0 / 0.25A
ITR 2.0 / 5A
ITR 2.0 PV-D / 0.25A
ITR 2.0 PV-D / 5A

is in compliance with European Directives:

2014/30/EU: Electromagnetic Compatibility 2014/35/EU:
Low Voltage
2011/65/EU: Rohs

in accordance with the standards:

61000-6-2:2006
61000-6-4:2007/A1:2011
61010-1:2011

provided that it is installed, maintained and used in accordance with the instructions in its user manual and applicable installation standards.

Year of CE marking:

2015

In Valladolid, on June 1, 2017.

José Antonio Domínguez Vázquez
Director of LACECAL