COMMUNICATION NODE

TYPE SIP-2

USER GUIDE

Rev. 3 - January 2018

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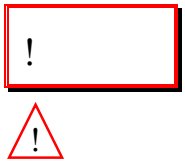
SAFETY SYMBOLS



WARNING OR CAUTION:

This symbol denotes a hazard. Not following the indicated procedure, operation or alike, could mean total or partial breakdown of the equipment or even injury to the personnel handling it.

NOTE:

Information or important aspects to take into account in a procedure, operation or alike.

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1 INTRODUCTION

1.1 GENERAL

The SIP-2 is a communication node designed to operate as a WAN router and a serial to IP encapsulation device. Next, several examples of application are indicated.

The equipment can have one or two serial ports, one or two Fast Ethernet interfaces, and a cellular 2G (GSM/GPRS), 3G (UMTS/HSPA) or 4G (LTE) interface.

The cellular interface admits dual SIM operation. It allows increasing the service availability since it provides access to more than one operator, and the user configures how the equipment will manage the WAN connection and the operator in use.

The equipment can also have two digital inputs, galvanically isolated, which can be managed via SNMP. Upon request, it can also have two digital outputs.

As regards its installation, the SIP-2 can be supplied with a chassis suitable for mounting in DIN rail or wall mounting.

FIGURE 1 Remote access to Ethernet device

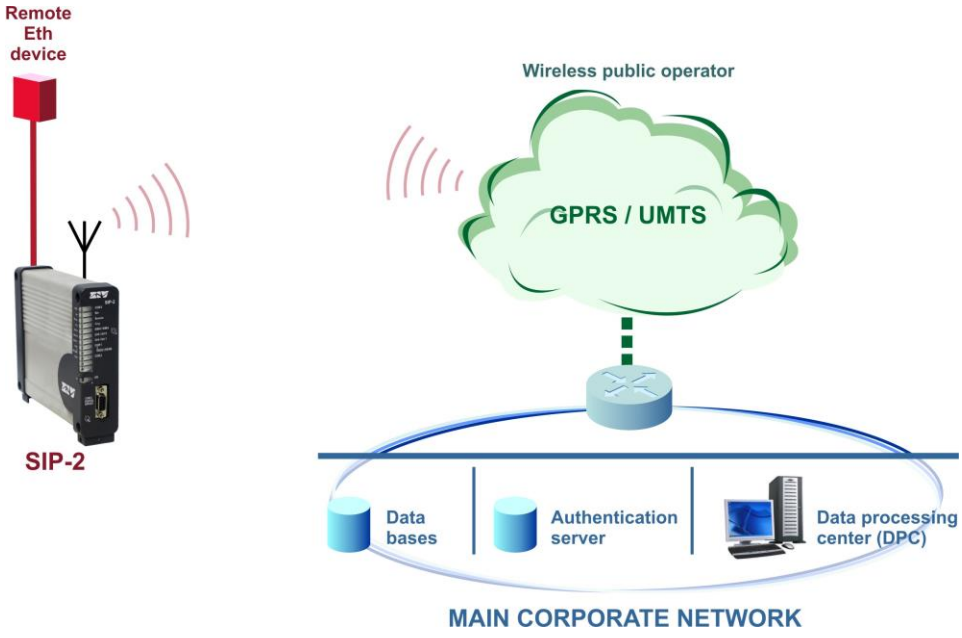


FIGURE 2 Serial to IP encapsulation on wired interface

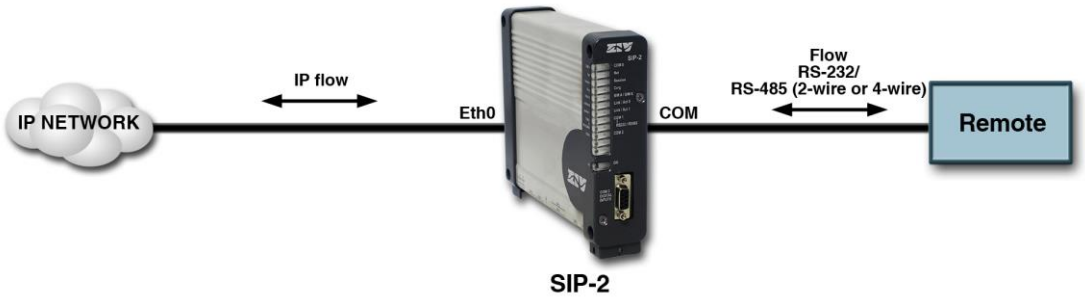


FIGURE 3 Serial to IP encapsulation on GPRS network

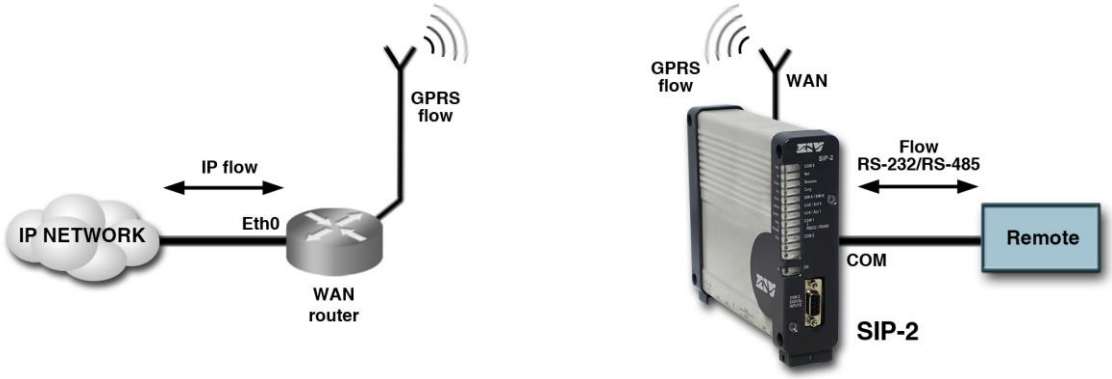


FIGURE 4 Remote connection between two SIP-2s

The SIP-2 can be managed locally and remotely, through a console or through a built-in web server (http/https), SSH and Telnet server.

The SIP-2 also supports the SNMPv1, SNMPv2c and SNMPv3 protocols, as well as other protocols and services such as NAT, DHCP, NTP and TACACS+.

The basic encapsulation function is the creation of a point-to-point connection, equivalent to a direct connection between two serial devices, even when the actual data transfer is done on a TCP/IP network.

The encapsulation function guarantees delivery of the data accepted in one of the serial ports of an end, free of errors, and with unaltered order at the other end of the connection. This function is usually called PAD (Packet Assembler-Disassembler).

The encapsulation function does not depend on the user data content. The equipment admits two processing modes with the PAD function: direct or with packets.

SIP-2 equipment has the necessary procedures to perform an intelligent encapsulation so as to process the data as higher level transmission units for a series of specific protocols of Telemetry and Telecontrol. Thus, the operations on the data are not limited to their mere transmission, but possible errors are identified, or the SIP-2 is capable of identifying different data flows in a unique shared channel and of transferring them towards differentiated destinations (demultiplexing).

Some of the supported protocols are IEC 60870-5-101/102/103, DLMS, GESTEL, DNP3.0, PROCOME, SAP20, MODBUS, Pid1, Twc, etc.

Another additional characteristic for any of the encapsulator operations modes is the SIP-2 capability to offer the basic HAYES modem behaviour towards the client equipment, so that the encapsulator point-to-point connections are made upon demand and with the determined receiver by application or the client equipment. The operation in HAYES mode is enabled separately for each one of the serial ports present in the SIP-2.

1.2 PORT INTERCONNECTION

In addition to the serial ports -which are called ***physical ports***-, the equipment operates with resources that are TCP/UDP connections, which are used to encapsulate data on the TCP/IP networks; these TCP/UDP connections are called ***virtual ports***, as opposed to the tangible ports.

The equipment basic operation is the determination of the port characteristics, both physical as well as virtual, and then establishes the “connections” between them; which in practice sets the ends where the transfer of encapsulated data is done.

On the other hand, if the equipment has an optional WAN interface, there will be an additional virtual port related to the GSM data call, in order to establish a connection between said virtual port and a serial port.

Next, for a better understanding when approaching the SIP-2 configuration by accessing the equipment HTML pages, there is a description of the main operations that should be performed for ***the interconnection between physical ports (COM) and virtual ports (TCP/UDP).*** It is advisable to perform the indicated operations in the order that they appear.

See chapter 5 for more detailed information about the configuration menus and their parameters.

1. Configure the serial port parameters. For this, access the ***Serial*** menu (see section 5.4 for more information).
El ***Serial*** menu has two well differentiated sections: ***Physical*** and ***Logical***.
In the ***Physical*** section, configure the basic operation parameters of the COM ports (speed, data bits, parity and stop bits).
In the ***Logical*** section, configure either the encapsulation protocol or the use of an encapsulation policy (*policy-based* option), and an identifier for it. The policy configuration itself is done from the ***Policy*** submenu from the ***Flow*** menu.

> The identification of the COM port, that is, the name, is done in the ***Physical Ports*** section of the ***Flow*** menu configuration screen.

2. Create and configure the parameters of the TCP/UDP virtual ports. For this, access the ***Flow*** menu configuration screen (see section 5.16 for more detailed information).
The ***Flow*** menu configuration screen has two well differentiated sections. ***Physical Ports*** and ***Virtual Ports***.
Establish a different and unequivocal name for each COM port in the ***Physical Ports*** section.

> All the ports have the name *serial0* configured by default and, therefore, it is essential to assign a specific name to each of them.

On the other hand, if the equipment has a WAN interface, the *Use autocli* box should be OFF, that is, not ticked, in the *Datacall* parameter so that the data call-serial connection (GSM) is effective.

> The operation of the datacall will depend on the services permitted by the operator, especially in 3G and 4G networks.

Define the configuration of the virtual ports in the ***Virtual Ports*** section. For this, take into account the following:
- The **TCP** connections may have two behaviours, active and passive. Active means that the equipment will take the initiative as regards establishing the TCP connection. On the contrary, passive means that the equipment will await for external connection requests. The behaviours are complementary between them.
- The **UDP** connections do not need any prior establishment procedure; it is just assumed that the receiver is configured to accept data in the indicated port. The UDP connections do not offer end-to-end confirmation, or any guarantee as long as the delivery sequence is the original one.
- It is usual to configure ports with values above 1000 since there are pre-established ports for the use of general services in TCP/IP networks; thus, possible collisions are avoided.

> - The virtual ports may also have an assigned encapsulation protocol or policy, although, as a general rule, just one encapsulation protocol or policy is assigned to a sole end of each connection, understanding that it already includes a physical and a virtual port as well. Thus, **it is usual to assign the encapsulation protocol to the physical port and leave the virtual port without a protocol, that is, with the raw protocol option (default option).**

! The inactivity time is the maximum period of time desired to maintain the connection in the case of a lack of data, either in transmission or reception.
This parameter is configured at 0 by default, that is, the activity is not monitored at the data level, which implies that the connection will be permanent regardless of its activity. The parameter units are seconds.

- The active TCP connections have an ***On Demand*** parameter. Said parameter indicates if the establishment should start just because the connection is configured, or just when the equipment has encapsulated data to be transmitted.

! The ***On Demand*** parameter is configured by default to establish the communication start permanently. If the *On Demand* option is activated, the duration of the connection will be established by the inactivity parameter, which limits the connection to the activity periods.

3. Establish the connections between the ports through their identifiers. For this, access the ***Connection*** submenu (see section 5.16.2 for more information) from the ***Flow*** menu.

For an effective connection it is essential to correctly enter the name of the identifiers established in the ***Physical Ports*** and ***Virtual Ports*** sections of the ***Flow*** menu configuration screen. In order to avoid possible errors, it is advisable to use the commands *Ctrl.+C* (copy) and *Ctrl.+V* (paste) instead of the keyboard. Second, for connection to be operative, the *CheckBox* for the *Enable* parameter should be active, that is, ticked.

1.3 VERSION WITH GW 104-101

The SIP-2 version GW 104-101 provides adaptive functionality between telecontrol entities that communicate using the IEC 60870-5-3 protocol, although they use transport protocols adapted to different media, in particular IEC 60870-5-101 on the remote side and IEC 60870-5-104, using TCP/IP, on the control side. That is, the SIP-2 version GW 104-101 allows management of remotes type 101 from a control center type 104 TCP/IP in a transparent way.

The functionality is known as Gateway 104-101 and, in this way, the equipment offers two distinct behaviours: acts as a remote 104 from the point of view of the control center and, in turn, acts as a control center 101 from the point of view of the remote terminal.

This functionality does not modify in any way the information units exchanged at the application level (ASDUs) between the telecontrol remote and control centre, which are established in IEC 60870-5-3. Therefore, despite offering the translation of the transport layer, the user is the one that must establish the operation profile with regard the ASDUs of the equipment.

1.4 TECHNICAL SPECIFICATIONS

1.4.1 Equipment interfaces

- 1 or 2 Fast Ethernet ports (Eth 0 & Eth 1) type 10/100Base-Tx with female RJ-45 connector. The two interfaces can work as a part of a two-port switch or either as two independent Ethernet interfaces.
- 1 wireless WAN interface, 2G (GSM/GPRS), 3G (UMTS/HSPA) or 4G (LTE), with 1 or 2 external SIM card slots.
- 1 asynchronous serial data port (COM 1), with female RJ-45 connector (DCE mode), configurable by software for RS-232 interface or for RS-485 (2-wire or 4-wire) interface.
- Depending on model, female DB9 standard connector (COM 2) for one RS-232 asynchronous serial data port (DCE mode) or 2 digital inputs (and 2 digital outputs, upon request), galvanically isolated, which can be managed via SNMP.
- 1 service console (DCE mode) with female RJ-45 connector (COM 0). Depending on model, female DB9 standard connector for the console. Then, the equipment is not provided with the COM 1 and COM 2 serial ports.

1.4.2 Encapsulation protocols

- IEC 60870-5 101/102/103 (the first two with the variants to support link addresses of 1 or 2 bytes).
- DLMS.
- GESTEL.
- MODBUS.
- DNP 3.0.
- SAP20.
- PROCOME.
- Pid1.
- Twc.

1.4.3 Equipment management

- Local and remote management through a *CLI* console (Command Line Interface*)* or a built-in web server (http/https), SSH and Telnet server.

1.4.4 Additional services

- SNMP agent.
- DHCP server and client.
- NTP server and client.
- TACACS+ client.
- NAT rules.
- 104-101 Gateway.
- IPSec tunnels with DMVPN (Dynamic Multipoint VPN) support.
- IPIP (IP over IP) and GRE tunnels.

1.4.5 Accessories

- Ethernet cables.
- Serial cables.
- Antenna cables.
- Antennas.
- Screws and fixing accessories for wall mount and/or DIN rail installation.

1.4.6 Certifications

- CE.
- Designed for Electrical Substations.
- Designed for industrial applications.

1.4.7 Asynchronous serial data ports (DCE) characteristics

- Data bits: 5, 6, 7 or 8.
- Stop bits: 1 or 2.
- Parity: odd, even or none.
- Speed: 600 bit/s to 115200 bit/s.
- Flow control: none, hardware or software.
- Interface: V.24/V.28 of the ITU-T (EIA RS-232C) or, only for port COM 1, RS-485 (2-wire or 4-wire).

1.4.8 WAN interface characteristics

GSM/GPRS (2G)

- Quad band: 850/900/1800/1900 MHz.
  - Class 4 (2W, 33dBm) for GSM 850/900
  - Class 1 (1W, 30dBm) for GSM1800/1900
- Quad band GPRS class 10.

UMTS/HSPA (3G)

- Quad band GSM/GPRS/EDGE: 850/900/1800/1900 MHz.
  - Class 4 (2 W, 33 dBm) for GSM 850/900
  - Class 1 (1 W, 30 dBm) for GSM 1800/1900
  - Class E2 (0.5 W, 27 dBm) for EDGE 850/900
  - Class E2 (0.4 W, 26 dBm) for EDGE 1800/1900
- Quad band GPRS and EDGE class 33.
- Tri-band UMTS/HSPA: 850/900/2100 MHz.
  - Class 3 (0.25 W, 24dBm) for UMTS
- HSPA+ data up to 7.2 Mbit/s (downlink) and 5.76 Mbit/s (uplink).

LTE (4G)

- LTE: 800/1800/2600 MHz.
  - Class 3 (0.2 W, 23dBm) for LTE
- LTE data up to 100 Mbit/s (downlink) and 50 Mbit/s (uplink).
- UMTS/HSPA+: 900/ 2100 MHz.
  - Class 3 (0.25 W, 24dBm) for UMTS
- HSPA+ data up to 42 Mbit/s (downlink) and 5.76 Mbit/s (uplink).
- GSM/GPRS/EDGE: 850/900/1800/1900 MHz.
  - Class 4 (2 W, 33 dBm) for GSM 850/900
  - Class 1 (1 W, 30 dBm) for GSM 1800/1900
  - Class E2 (0.5 W, 27 dBm) for EDGE 850/900
  - Class E2 (0.4 W, 26 dBm) for EDGE 1800/1900

1.4.9 Mechanical characteristics

- Dimensions: Height: 150 mm (with no cover for wires); Width: 40 mm; Depth: 177 mm.
- Weight: 600 g.
- DIN rail mounting (by means of optional accessory) or wall mount.
- IP protection level: IP 51.
- Material: varnishing (RAL 9006) aluminium 6060 T5 alloy and Fireproof (UL 94 V0) STAREX ABS VH-0800 (RAL 7024) plastic.

1.4.10 Operating conditions

- Power supply: 48 Vdc (19-75 Vdc) isolated, 12 Vdc (10.5-15 Vdc) isolated or Universal (88-300 Vdc, 88-265 Vac).
  In DC supply-voltage operation the equipment is protected against polarity inversion.
- Maximum power consumption at 48 Vdc: 3.5 W.
- Temperature range: -40ºC to +70ºC.
- Relative humidity not greater than 95%, in accordance with IEC 721-3-3 class 3K5 (climatogram 3K5).
- R.F. emissions: in accordance with EN 55022 standard.
- Dielectric strength: in accordance with EN 60255-5 standard.
- Electromagnetic compatibility.
  - Electrostatic discharge immunity test:
    in accordance with EN 61000-4-2 standard.
  - Radiated, radio-frequency, electromagnetic field immunity test:
    in accordance with EN 61000-4-3 standard.
  - Electrical fast transient/burst immunity test:
    in accordance with EN 61000-4-4 standard.
  - Surge immunity test:
    in accordance with EN 61000-4-5 standard.
  - Immunity to conducted disturbances, induced by radio-frequency fields:
    in accordance with EN 61000-4-6 standard.
  - Power frequency magnetic field immunity test:
    in accordance with EN 61000-4-8 standard.
  - Damped oscillatory wave immunity test:
    in accordance with EN 61000-4-18 (EN 61000-4-12) standard.
  - Voltage dips, short interruptions and voltage variations immunity tests:
    in accordance with EN 61000-4-11 standard.

- Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 Hz:
  in accordance with EN 61000-4-16 standard.
- Ripple on d.c. input power port immunity test:
  in accordance with EN 61000-4-17 standard.
- Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests:
  in accordance with EN 61000-4-29 standard.

➢ Mechanical operating conditions.

- Vibration in accordance with EN 60870-2-2 standard.
- Shock in accordance with EN 60870-2-2 standard.

1.5 WARNINGS

1.5.1 Warnings before installing

! **1.** The installation of the SIP-2 in Electrical Substations or Secondary Substations is generically subject to the fulfilment of all the safety measures and prevention of risks established for this type of work by the electricity company that will use these devices and the Safety standards (EN 50110).

2. In order to install and handle the SIP-2 the following points must be complied with:

- Only qualified personnel appointed by the electricity company that owns the installation should carry out the installation and handling of the SIP-2.
- The environment in which it is to operate should be suitable for the SIP-2, fulfilling all the conditions indicated in section 1.4.10.

3. ZIV will not accept responsibility for any injury to persons, installations or third parties, caused by the non-fulfilment of points 1 and 2.

1.5.2 Equipment safety considerations

! **1.** Earth connection must be made before connecting any other power-supply cable.

The earth terminal of the connector is connected to the equipment chassis. Contact occurs in the inside of the chassis. The area outside the chassis is isolated by varnishing.

2. ZIV will not accept responsibility for any injury to persons or third parties, caused by the non-fulfilment of point 1.

! **1.** The terminal contains components sensitive to static electricity, the following must be observed when handling it:

- Personnel appointed to carry out the installation and maintenance of the SIP-2 must be free of static electricity. An anti-static wristband and/or heel connected to earth should be worn.
- The room housing the SIP-2 must be free of elements that can generate static electricity. If the floor of the room is covered with a carpet, make sure that it is anti-static.

2. ZIV will not accept responsibility for any damage to the equipment caused by the non-fulfilment of point 1.

2 MECHANICAL AND ELECTRICAL CHARACTERISTICS

The diverse elements comprising the communication node type SIP-2 are supplied in a box ready for DIN rail mounting (by means of optional accessory) or wall mount.

FIGURE 5 show the general dimensions in mm of the SIP-2.

FIGURE 5 General dimensions in mm of the SIP-2

NOTE: Dimensions are identical for model of 1 Fast Ethernet port

In FIGURE 6 can be seen in detail the position of the fixing holes for wall mounting.

FIGURE 7 shows the position of the slit for the placement of the DIN rail (EN 50022, BS 5584, DIN 46277-3) fixing accessories.

FIGURE 6 Wall-mount detail

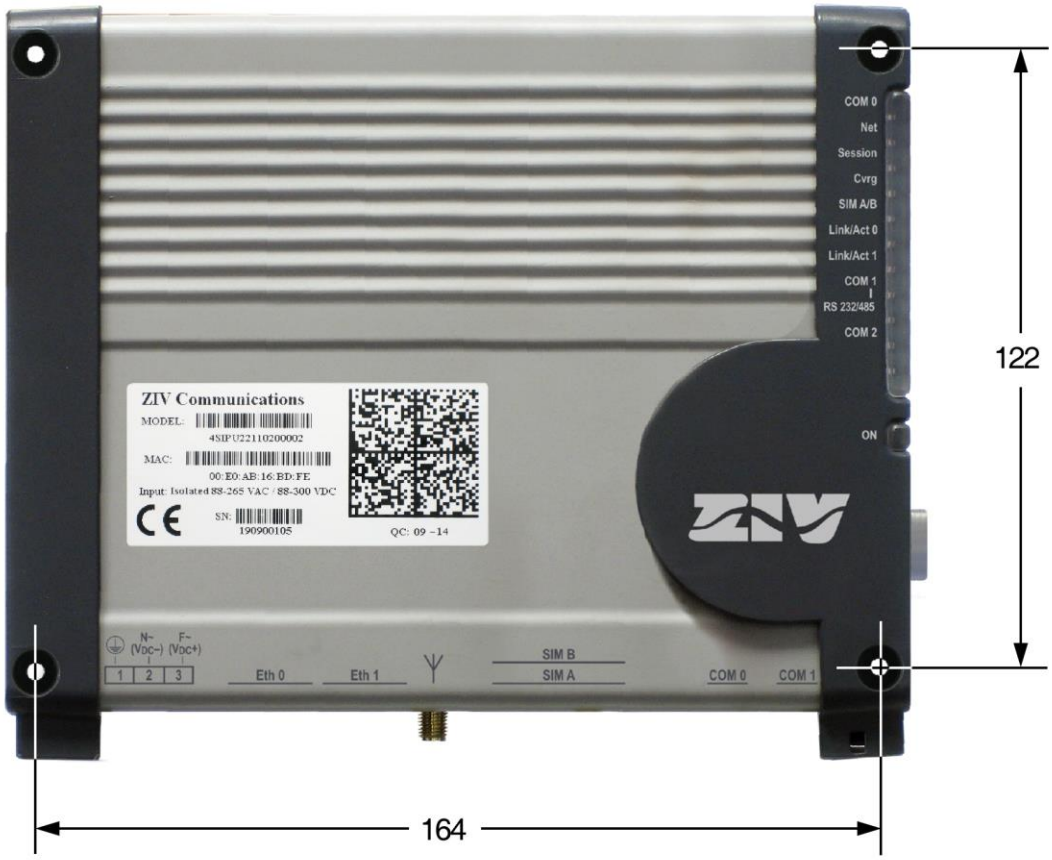


FIGURE 7 Detail of the slit for fixing the DIN rail optional accessory

2.1 POWER SUPPLY

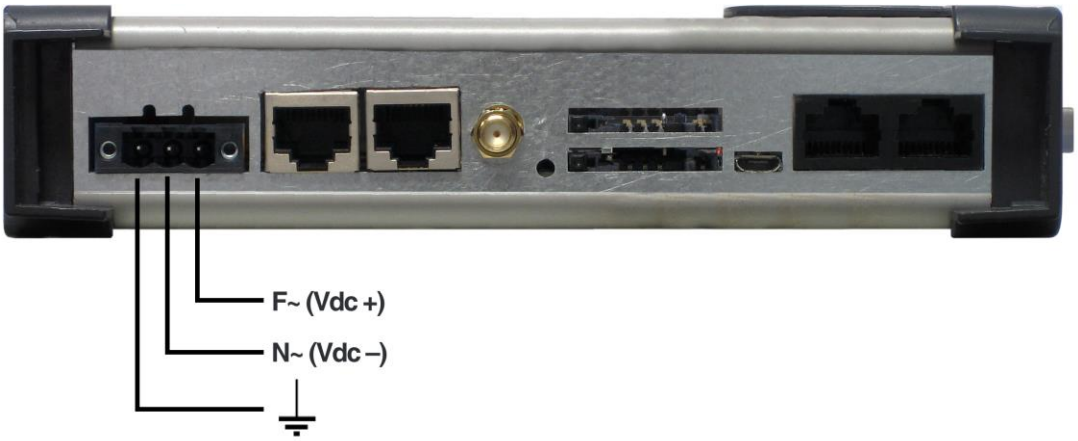
The SIP-2 has three power-supply versions: DC isolated (19-75 Vdc), DC isolated (12 Vdc) and Universal (88-300 Vdc, 88-265 Vac).

The SIP-2 is powered through the connector shown in FIGURE 8.

The female connector supplied with the equipment is suitable for rigid or flexible conductors of up to 2.5 mm^2.

The grounding of the power supply complies with the EF (floating) class, according to IEC 870-2-1 standard.

FIGURE 8 Location of the power-supply connector



⚠ Earth connection must be made before connecting any other power-supply cable.

In DC supply-voltage operation the equipment is protected against polarity inversion.

The earth terminal of the connector is connected to the equipment chassis. Contact occurs in the inside of the chassis. The area outside the chassis is isolated by varnishing.

The ON LED (green) lights permanently when the equipment is powered with an external power-supply voltage.

2.2 FAST ETHERNET PORTS (Eth 0 & Eth 1)

Next to the power-supply connector, there are the two Fast Ethernet connectors. The said connectors correspond to a 10/100Base-Tx interface with RJ-45 connector.

> The two interfaces can work as a part of a two-port switch or either as two independent Ethernet interfaces.

The cable used to connect a 10/100Base-Tx port should be an unshielded twisted 4 pair category five cable (UTP-5) with 8-pin RJ-45 connectors. The cable length should not be more than 100 m.

The UTP-5 cable is made up of eight copper wires that form the four twisted pairs, covered in different coloured insulating material. FIGURE 9 shows the colour of the wires that make up each one of the pairs, according to ANSI/TIA/EIA-568-A standard.

FIGURE 9 Unshielded twisted pair category five cable (UTP-5) with RJ-45 connector according to ANSI/TIA/EIA-568-A standard

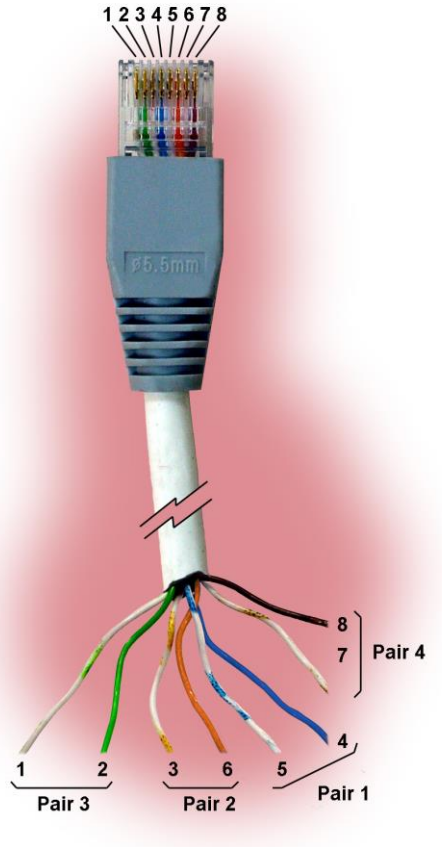
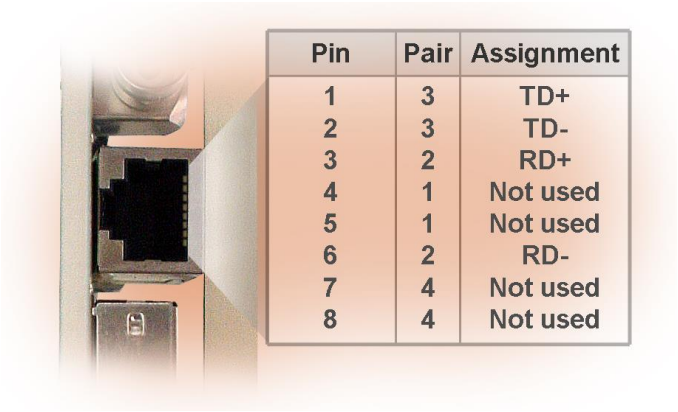


FIGURE 10 shows the use of each one of the pins of the RJ-45 connector, as well as the pair it belongs to according to ANSI/TIA/EIA-568-A standard, in the 10/100Base-Tx LAN interface.

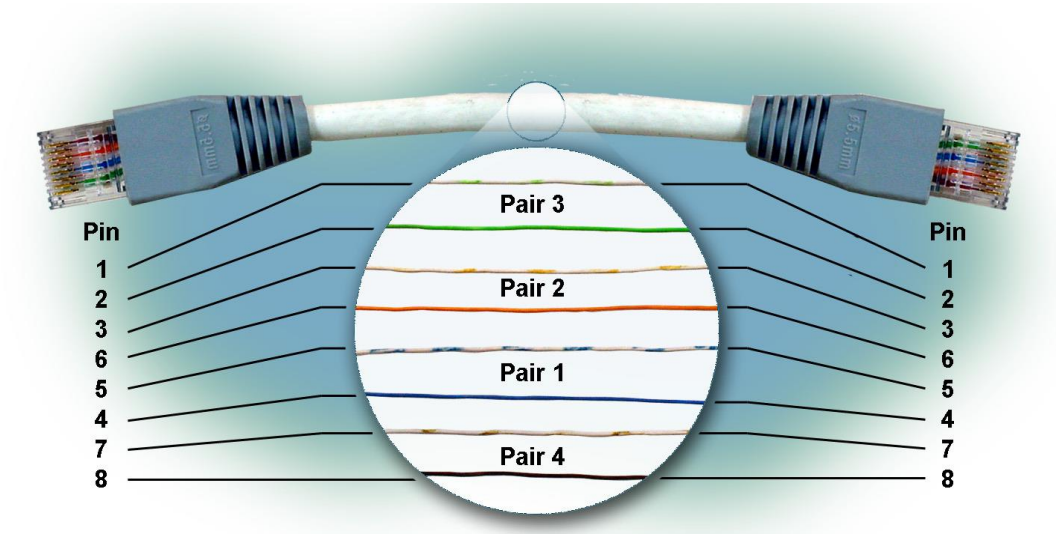
FIGURE 10 Signals of the RJ-45 connector in the 10/100Base-Tx LAN interface



Pin	Pair	Assignment
1	3	TD+
2	3	TD-
3	2	RD+
4	1	Not used
5	1	Not used
6	2	RD-
7	4	Not used
8	4	Not used

Straight-through cables must be used, see FIGURE 11, where the 4 pairs correspond at both ends of the cable.

FIGURE 11 Straight-through cable

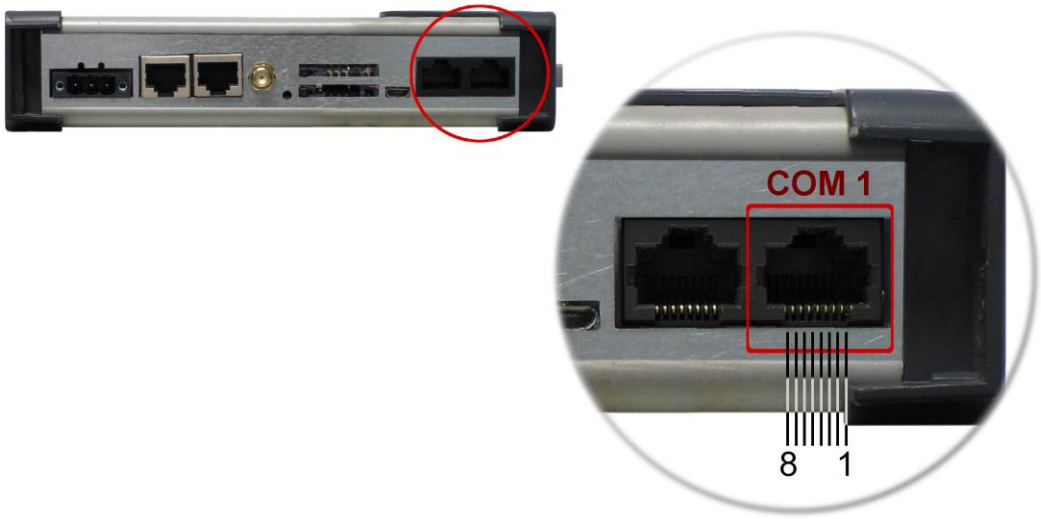


2.3 RS-232/RS-485 PORT (COM 1)

FIGURE 12 shows the arrangement of the RS-232/RS-485 (COM 1) port. This is a female RJ-45 connector (DCE mode).

The electrical characteristics of the connector are configured by software among the ones indicated in the technical characteristic; see section 1.4.7, *Asynchronous serial data ports (DCE) characteristics*.

FIGURE 12 Location of the RS-232/RS-485 (COM 1) port



Pin	RS-232 (RJ-45) signal
1	DSR
2	DCD
3	DTR
4	GND
5	RD (Out)
6	TD (In)
7	CTS
8	RTS

Pin	RS-485 (2-wire) signal	RS-485 (4-wire) signal
1		TX– (In)
2	TX/RX+	RX+ (Out)
7	TX/RX–	RX– (Out)
8		TX+ (In)

2.4 RS-232 PORT (COM 2)

As is shown in FIGURE 13, the equipment can have a second RS-232 asynchronous data port arranged on the front plate. This is a standard DB9 female connector (DCE mode).

The connector has a protective cap.

The electrical characteristics of the connector are configured by software among the ones indicated in the technical characteristic; see section 1.4.7, *Asynchronous serial data ports (DCE) characteristics*.

FIGURE 13 Location of the RS-232 (COM 2) port

Pin	RS-232 (DB9) signal
2	RD (Out)
3	TD (In)
5	GND
7	RTS
8	CTS

2.5 DIGITAL INPUTS

Instead of an additional serial port (COM 2), the equipment can be ordered with two digital inputs, galvanically isolated, which can be managed via SNMP, in the same connector.

As is shown in FIGURE 13, the said inputs are arranged in the standard DB9 female connector on the front plate, identified as DIGITAL INPUTS.

Its use is indicated below.

Pin	Use
2	Input 1 -
3	Input 1 +
7	Input 2 -
8	Input 2 +

Upon request, the equipment can have two digital inputs and two digital outputs. In that case, the use of contacts is the following.

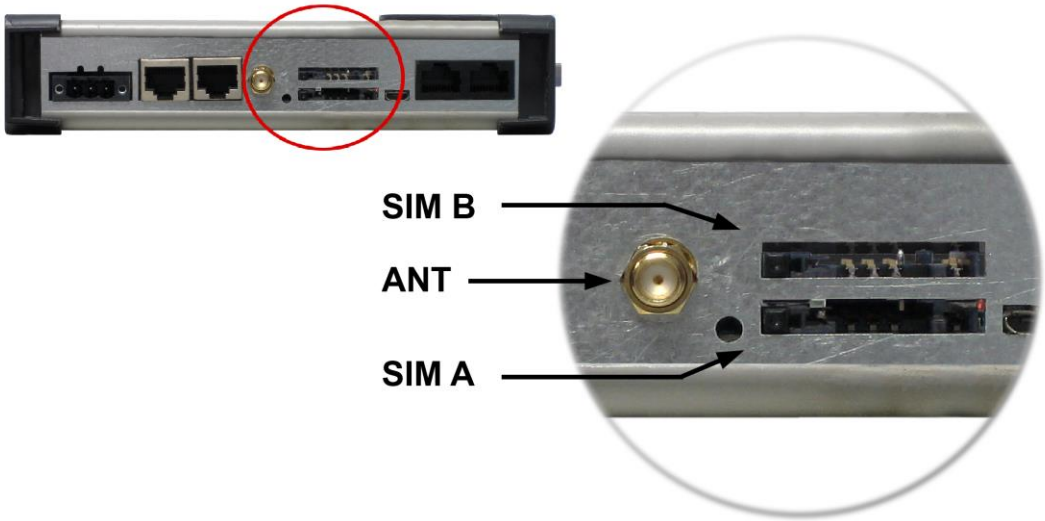
Pin	Use (upon request)
1	Input 1 +
2	Input 1 -
3	Input 2 +
4	Input 2 -
6	Output 1 +
7	Output 1 -
8	Output 2 +
9	Output 2 -

2.6 WAN INTERFACE

When the SIP-2 is fitted with a WAN interface, as can be seen in FIGURE 14, there is a SMA female connector for antenna, as well as two slots for housing SIM cards.

SIM B is the top card and SIM A the bottom card. Both SIMs **CANNOT be** activated simultaneously. In the case of dual SIM operation, one SIM acts as the primary one and the other as the secondary or back-up one.

FIGURE 14 Detail of the SMA connector and of the slots for housing WAN interface SIM cards



The inserting and removing procedure of the SIM cards is indicated in the following. Before inserting a card, it must be suitable arranged in the card holder (see figure).

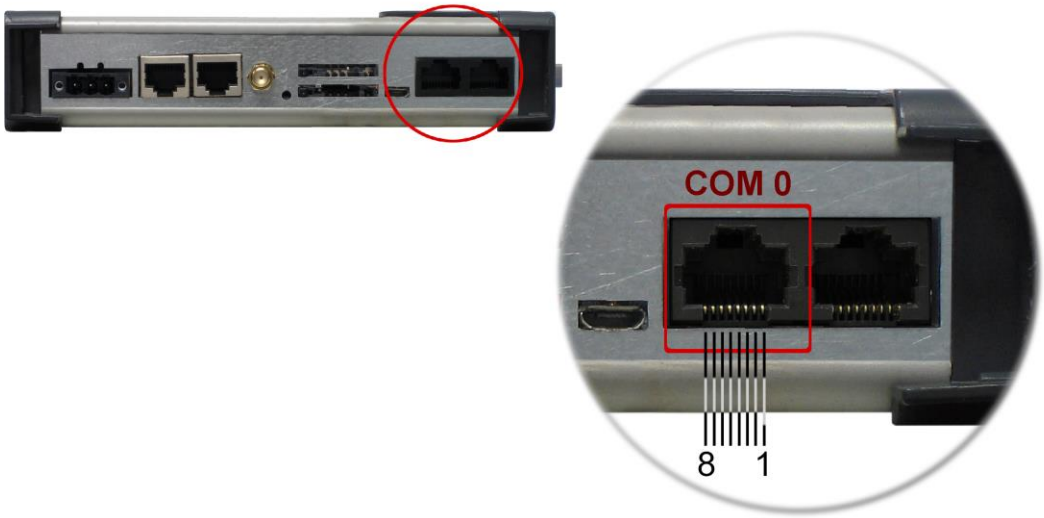
Inserting procedure of the SIM cards (example with SIM B)

Removing procedure of the SIM cards (example with SIM B)

2.7 SERVICE INTERFACE (COM 0)

The SIP-2 also has a service interface, identified as COM 0, for accessing the equipment through a console. This is a female RJ-45 connector, see FIGURE 15.

FIGURE 15 Location of the service connector (COM 0)



Pin	RS-232 (RJ-45)
4	GND
5	RD (Out)
6	TD (In)

	COM 0 SERVICE PORT (DCE mode)
Interface type	ITU-T V.24/V.28 (EIA RS-232)
Connector	RJ-45 female
Data	Asynchronous
Speed	115200 bit/s
Protocol	CLI (system console)

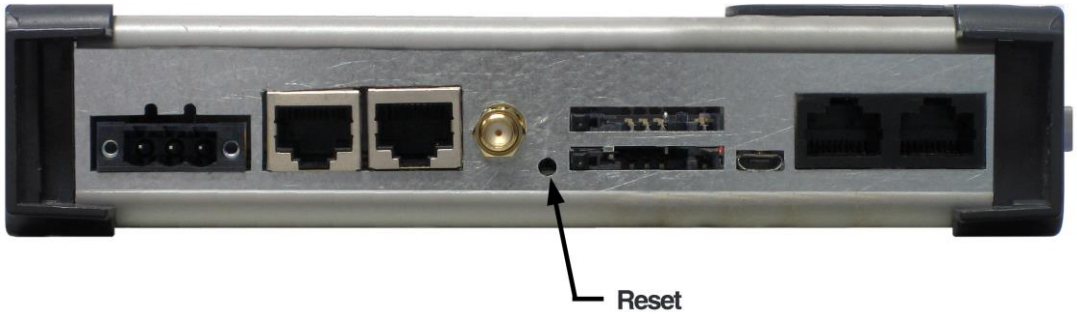
2.8 INITIALIZATION PUSH-BUTTON

FIGURE 16 shows the detail of the push-button that loads the factory configuration in the equipment, that is, deletes any configuration that the user had set and/or stored.

The touch is considered as whished when the push-button is pressed for at least 3 seconds.

Any type of tool with 3 mm diameter must be used.

FIGURE 16 Initialization push-button



3 LED SIGNALLING

The SIP-2 has on the front plate two basic LEDs (COM 0 and ON), and several specific LEDs associated with the different interfaces.

The location and identification of the LEDs can be seen in FIGURE 17.

FIGURE 17 LEDs of the SIP-2

Basic LEDs

ON LED	Green. It is permanently lit when the equipment is powered with an external power-supply voltage.
COM 0 LED (service port)	Three-coloured. It flashes in green when there is emission activity or, in red, when there is reception activity by the COM 0 serial service interface. It flashes in amber when there is simultaneously emission and reception activity.

LED associated with the Fast Ethernet (10/100Base-Tx) ports

Link/Act 0 LED	Two-coloured. It stays on when the Eth 0 link is established correctly, and flashes in the case of emission or reception activity in the interface. It lights up in **green** at 100 Mbit/s and in **amber** at 10 Mbit/s.
Link/Act 1 LED	Two-coloured. It stays on when the Eth 1 link is established correctly, and flashes in the case of emission or reception activity in the interface. It lights up in **green** at 100 Mbit/s and in **amber** at 10 Mbit/s.

LEDs associated with the RS-232/RS-485 port (COM 1)

RS232/RS485 LED	Two-coloured. It stays on, in green, when the COM 1 port is configured with a 2-wire RS-485 interface and, in red, when is configured with a 4-wire RS-485 interface.
COM 1 LED	Three-coloured. It flashes, in green, in the case of data transmission in the COM 1 port or, in red, in the case of data reception in the COM 1 port. It flashes in amber when there is simultaneously data transmission and reception in the COM 1 port.

LED associated with the additional RS-232 port (COM 2)

COM 2 LED	Three-coloured. It flashes, in green, in the case of data transmission in the COM 2 port or, in red, in the case of data reception in the COM 2 port. It flashes in amber when there is simultaneously data transmission and reception in the COM 2 port.

LEDs associated with the WAN interface

Net LED	Green. It stays on when the wireless interface has been registered in the operator network.
Session LED	Amber. It stays on when the operator session has been established for the wireless interface.
Cvrg LED	Three-coloured. It stays on, indicating the coverage level. **Green**: signal coverage is good. **Amber**: signal coverage is average. **Red**: insufficient coverage.
SIM A /B LED	Two-coloured. It stays on, indicating which of the two SIMs is in use. **Green**: SIM A (bottom position) is in use. **Red**: SIM B (top position) is in use.

4 ACCESS TO THE EQUIPMENT

The SIP-2 can be managed locally and remotely, through a console or through a built-in web server (http/https).

If management is carried out through the http server, it is assumed that the user has a basic knowledge of IP addressing and networking devices such as hubs, switches, routers, etc.

All the parameters controlling the equipment operation are described in detail in chapter 5, using the HTML pages as an auxiliary graph example.

4.1 CONSOLE

The equipment provides a user console application called *CLI (*Command Line Interface), accessible through the COM 0 connector (service port), a RJ-45 female connector in DCE mode that operates at 115200 bit/s, with 8-bit characters, without parity and with a stop bit.

Access can also be obtained to the console remotely through a Telnet session.

Appendix B contains all the information required to use the *CLI* user console. The appendix explains the access methods, local and remote, commands available on the console and gives a step-by-step example of how to obtain information on the status and configuration of the equipment.

4.2 HTTP SERVER

The HTTP server included provides access to the HTML pages giving access to all the configuration data.

To execute the HTTPS protocol is necessary the installation of certificates. The procedure for loading the certificates is described in section B.4 of Appendix B, *Data structure in CLI.*

The factory IP address of the equipment is 192.168.0.1, meaning it is possible to access the HTTP server to configure it from the very start.

If the IP address of the SIP-2 equipment (server) is modified, the IP address of the client equipment (computer) must be consequently modified.

If the SIP-2 equipment and the computer are connected directly or through a LAN (they belong to the same network), the IP address of each of them must have the same network number and a different host number, so the subnet mask must be the same for both. The default gateway does not need to be configured.

If the SIP-2 equipment and the management computer belong to different LANs and the connection between them is via WAN, their IP addresses may have a different network number, but both must be connected to some device (default gateway) capable of interconnecting LANs.

Next chapter describes the parameters of the HTML pages, and in FIGURE 18 is shown the tree menu.

For information about the ***Reboot*** and ***Reflash*** commands see sections 5.18 and 5.19, respectively.

The ***Apply***, ***Save*** and ***Reboot*** commands request confirmation of the operation from the user before it is actually executed.

5 CONFIGURATION AND MANAGEMENT

Configuration and management of the SIP-2 is performed through the console and through access to the equipment HTML pages.

All the parameters controlling the equipment operation are described below in detail, using the real HTML pages as an auxiliary graph example.

HTML page tree menu is shown in FIGURE 18.

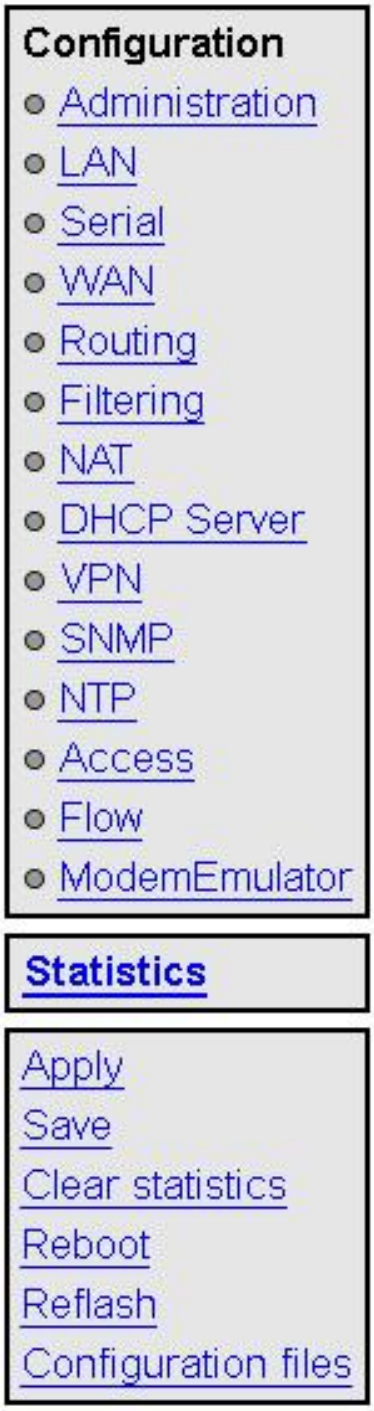
Whenever changes are made, regardless of whether they are made through the console or the HTTP server, the equipment must be informed what is to be done with them. There are two options:
- the first is to execute the ***Apply*** command, which entails the immediate use of the changes made.
- the second is to execute the ***Save*** command, which means that the changes will be operative once the equipment is rebooted.

If accessing through the HTTP server, after making the changes and before executing ***Apply*** or ***Save***, the ***Send*** button must be pushed to allow the equipment to obtain the new desired values.

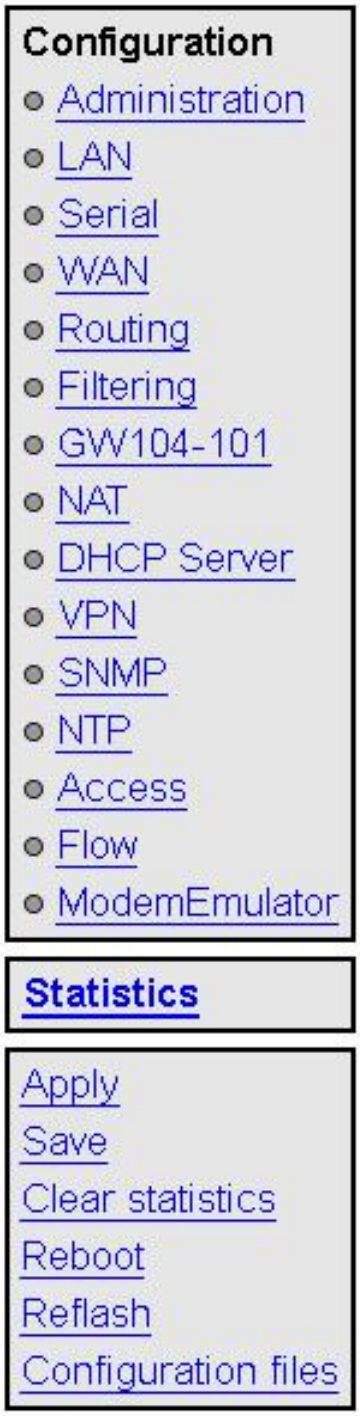
If executing the ***Apply*** command, if the changes are required to be permanent, the ***Save*** command must also be executed.

The only exceptions are changes affecting the SNMP configuration. Changes made to the SNMP agent configuration will **only** be active after **RESETTING** the equipment. The ***Apply*** command is not sufficient, and so the changes must previously be saved using the ***Save*** command before requesting the re-initialisation.

FIGURE 18 HTML page tree menu



Standard version



104-101 Gateway version

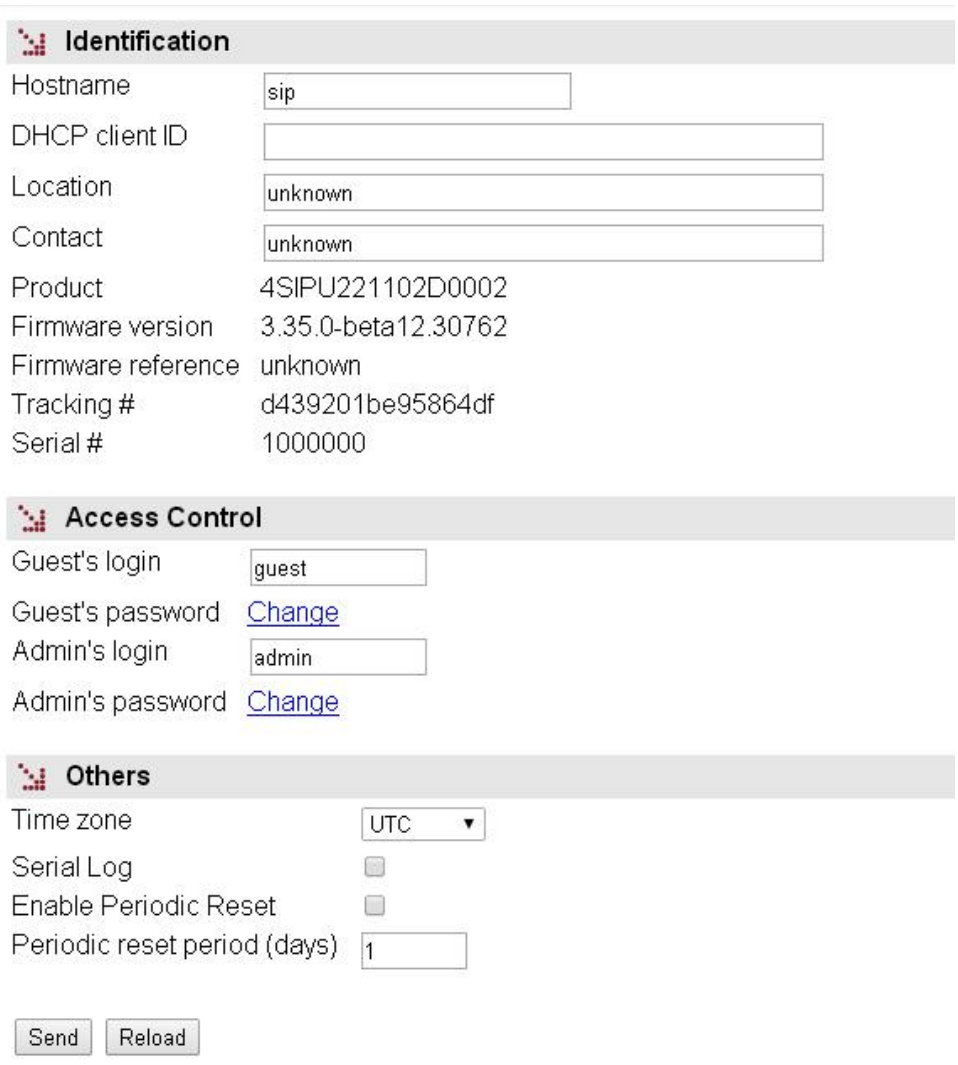
5.1 GENERAL PARAMETERS

The general parameters are grouped on the first page, see FIGURE 19, which is shown when the SIP-2 validates the user identity.

In addition to the configuration parameters, which will be described in the following sections, as shown in the figure, the system provides information about the equipment software, that is to say, version being executed, and equipment hardware, that is to say, serial and tracking number.

> The tree menu is permanently located on all the pages used by the HTTP server.

FIGURE 19 Main HTML page



5.1.1 Equipment identification

The identification zone has three parameters; the equipment name (***hostname***), its location (***location***) and the contact data of the responsible person or company (***contact***). At least one string of text is required, with at least one character.

The ***hostname*** is used automatically as a prompt value on the console.

The ***DHCP client ID*** configures the *Client ID* option of the RFC 2131 in DHCP configuration requests. If this parameter is not configured, the MAC address of the interface on which the request is sent is used as a default value for the *Client ID*.

The identification parameters coincide with those assigned with the same name in the SNMP data.

5.1.2 Access control

Access control allows the user logins and associated passwords to be determined for the two pre-established profiles: guest and admin.

The guest profile can only access query operations. On the contrary, the admin. profile has access to all the system configuration data.

As summarised in TABLE 1, the default values of these parameters are ***guest*** and ***admin*** as the logins, with ***passwd01*** and ***passwd02*** being the respective passwords.

> It should be borne in mind that the system makes a distinction between upper and lower case characters.

TABLE 1 System default access codes

	Login	Password
Guest profile	guest	passwd01
Admin. profile	admin	passwd02

It is highly recommended to change at least the password of the admin. profile when executing the first configuration in each equipment.

It is advisable to store the new password in some type of register as, should the new password be forgotten, it is not possible to access the web server.

5.1.3 Others

This section deals with four parameters. The first of them establishes the hour zone in relation to UTC.

The second parameter, ***Serial log***, indicates whether the log data transmission on the service serial port is activated from the initial start-up time (*Checkbox* control selected) or not.

The third parameter, ***Enable periodic reset***, allows users to indicate whether they want to reboot the equipment automatically every so often. This is established in days through the last parameter, ***Periodic reset period***.

5.2 ADMINISTRATION

The equipment has an integrated http server for management purposes. The server supports the http and the HTTPS protocols, and users can selectively enable their use and the respective port.

FIGURE 20 ***Administration*** menu

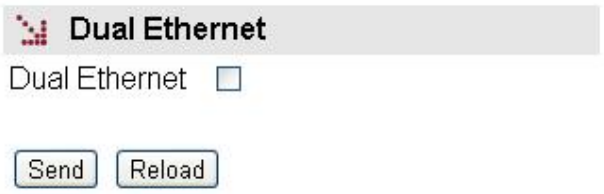
The procedure for the installation of the certificates is described in section B.4 of Appendix B, *Data structure in CLI.*

5.3 LAN CONFIGURATION

The ***LAN*** menu contains the configuration data for the network connection.

The main screen associated with the LAN menu is used to indicate whether the two Ethernet interfaces form **a two-port Ethernet switch (*Dual Ethernet*** box not selected), or if they are **independent interfaces** (***Dual Ethernet*** box selected).

FIGURE 21 ***LAN*** configuration page

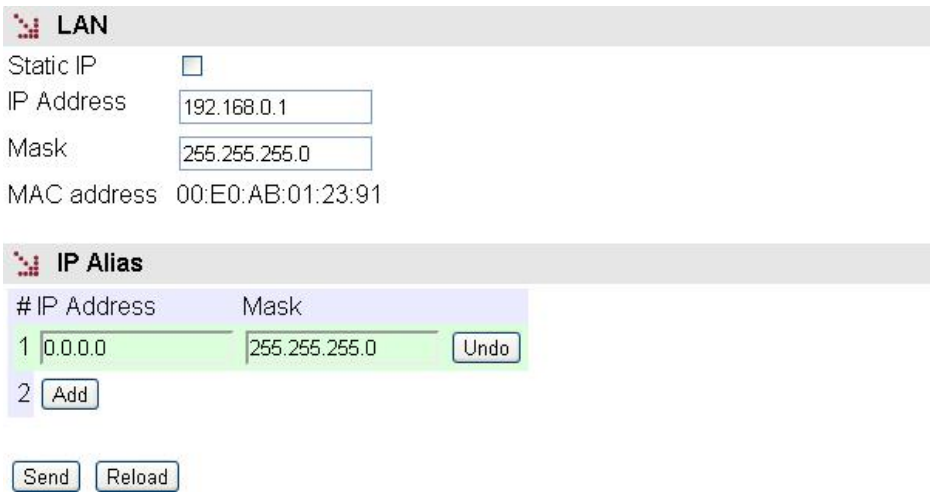


Port configuration is then carried out through the *eth0* and *eth1* submenus.

Configuration data associated with ***eth1*** interface affect the behaviour of the equipment only when the ***Dual Ethernet*** option is selected.

The screen related to each *eth* submenu of the *LAN* menu has two well differentiated sections, which are described below.

FIGURE 22 ***eth*** configuration page



LAN:

The main IP address and its mask may be obtained automatically through the DHCP client, which is called dynamic or NON-static configuration. The user may activate this feature through the *CheckBox* type control with the ***Static IP*** label. When the control is ticked, the equipment uses the data provided by the user.

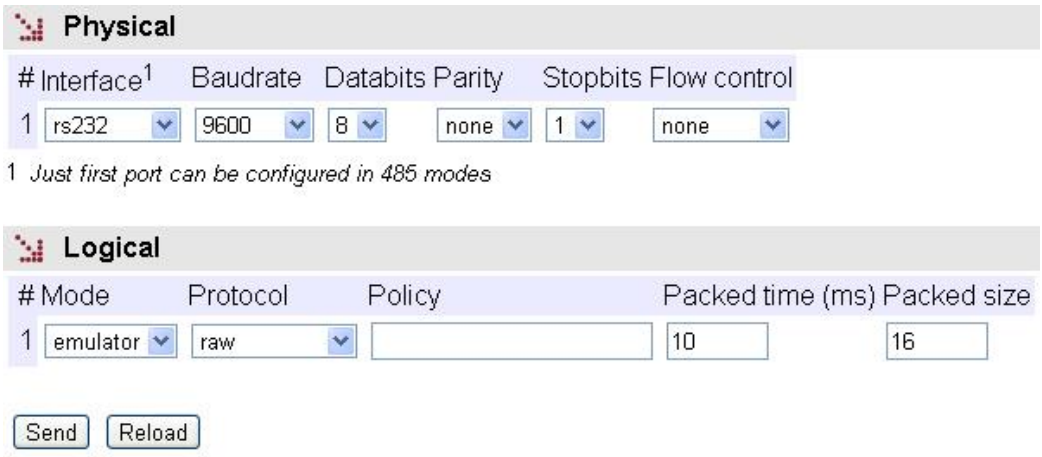
IP Alias:

The equipment is capable of responding to IP addresses different from the main one if they have been previously added through the ***Add*** *CommandButton*.

5.4 SERIAL PORT CONFIGURATION

The ***Serial*** menu provides access to the equipment serial port configuration screen. This port is configurable by software for RS-232 interface or RS-485 (2-wire or 4-wire) interface.

FIGURE 23 ***Serial port (COM)*** configuration page



The screen related to the ***Serial*** menu has two well differentiated sections, which are described below. See section 1.2 for more general information about the port interconnection.

Physical:

- **#.** It establishes the equipment physical port number. Port 1 for port COM1.
- **Interface.** It establishes the type of the interface: RS-232 or RS-485 with 2-wire or 4-wire.

- **Baudrate.** It establishes the serial port speed. The available values are the following: 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 bit/s.
- **Databits.** It establishes the character length. The available values are the following: 5, 6, 7 and 8.
- **Parity.** It establishes the parity. The available values are the following: odd, even or none.
- **Stopbits.** It establishes the number of stop bits. The available values are the following: 1 and 2.
- **Flow control.** It establishes the flow control mechanism. The available values are the following: none, hardware (control signals) and software (Xon and Xoff).

Logical:

- **#.** It establishes the equipment physical port number. Port 1 for port COM1.
- **Mode.** It establishes the port operation mode: ***flow*** or ***emulator***. ***Flow***, that is, serial port mode. The ***emulator*** mode implies the activation of the HAYES modem emulator additional characteristic, and it should only be selected to define a *ModemEmulator* behaviour for the port, which is similar to a HAYES modem. In this last case, there are additional options in the *ModemEmulator* menu.
- **Protocol.** It establishes the protocol of the data to be encapsulated; the possible values are the following: **r*aw*** (without processing, it is transparent to the information), ***packed***, (the data will be grouped in packets according to the related parameters, being also transparent as regards the encapsulated information), one of the identifiers of the **telecontrol protocols being hold** (iec101_1, iec101, iec102_1, iec102, pid1, dlms, gestel, sap20, twc, dnp3, procome, iec103, modbusrtu, modbusrtu_cc) or the policy-based mode (***policybased***).
- **Policy.** This field should be configured when the ***policybased*** mode has been established in the *Protocol* parameter. It establishes an identifier, whose policy should be configured in the *Policy* submenu of the *Flow* menu.
- **Packed time (ms).** This field should be configured when the ***packed*** mode has been established in the *Protocol* parameter. It establishes the maximum waiting time after receiving the last character, in ms, before sending a packet with the data received so far. It forces sending the data for inactivity time when not reaching the data established as desired packet size (see following parameter).
- **Packed size.** This field should be configured when the ***packed*** mode has been established in the *Protocol* parameter. It establishes the maximum number of characters to be transmitted in a packet on the network.

5.5 WAN CONFIGURATION

This menu only appears when the SIP-2 equipment has the optional wireless WAN interface.

5.5.1 *cell0* submenu

This submenu is used to configure the wireless interface data. The submenu has four different sections, which are described below.

WAN:

- **Enable Wireless WAN.** This allows the WAN interface of the equipment to be enabled and disabled by selecting ON and OFF, respectively.
  Selecting the **ON** option will make the equipment try a new GPRS/UMTS/HSDPA/LTE session, in accordance with the subscriber data (PIN, APN, Authentication method, user, password). In the case of **dual SIM** functionality, the subscriber data will be those corresponding to the primary SIM.

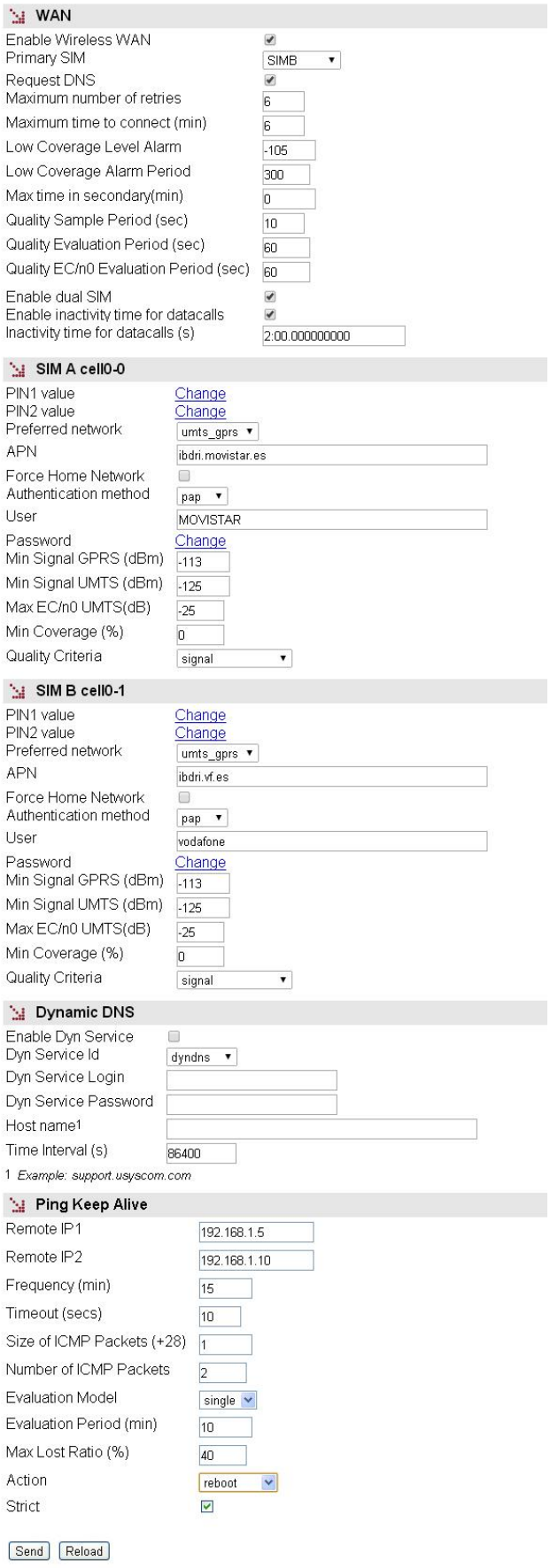
  The **OFF** option disables the WAN interface, and is the default option. Consequently, you should enable this option if you want the GPRS/UMTS/LTE service, after FIRST configuring the necessary parameters for establishing the operator session.

- **Primary SIM**. In the case of **dual SIM** functionality, this permits users to determine which of the two available SIMs will act as the primary one: SIMA or SIMB. In this operating mode the SIM that is not selected is therefore the secondary or back-up SIM. It is also possible to establish an operating mode with alternation of the SIMs (***alternated***) each time the equipment is started up, as well as an operating mode for random selection of the primary SIM each time the equipment is started up (***random***).

- **Request DNS.** Tick this box and the equipment will request the addresses for DNS servers if connected to the GPRS/UMTS/LTE service.

- **Maximum number of retries.** This gives the number of retries (3 to 10) that can be made to try and establish the operator session. If the number of retries is used up, the equipment will be rebooted.
  In the case of **dual SIM** functionality, the number of retries is for each of the SIMs. In this way, once the number of retries with the primary SIM has been used up, the equipment will try to establish connection using the secondary SIM. If it is not possible to connect with the secondary SIM, once the number of retries has been used up, or if the secondary SIM is disabled, the equipment will be rebooted.

FIGURE 24 ***WAN*** interface configuration page



- **Maximum time to connect (minutes)**. This specifies the time in minutes (3 to 20) for the equipment to wait in order to obtain the WAN IP address from the operator. If after that time, a WAN IP has not been obtained, the equipment will be rebooted. In the case of **dual SIM** functionality, it must be taken into account that the **Maximum time to connect** counter starts operation at the same time that the **Maximum number of retries** counter. In this way, the equipment will be rebooted when one of the two counters reaches at zero, that is to say, when it is not possible to connect once the number of retries of both SIMs has been used up (see Maximum number of retries counter) or once the time configured in the Maximum time to connect counter has been used up.

- **Low Coverage Level Alarm**. It specifies the coverage level under which the low coverage level alarm should be activated.

- **Low Coverage Alarm Period**. It specifies the time the coverage level should remain below the level indicated in the previous paragraph before the low coverage alarm is activated.

- **Max time in secondary (minutes)**. This parameter is associated with the **dual SIM** functionality. It allows the time during which the equipment is connected to the secondary SIM to be limited. After that time, the equipment will again try to connect to the primary SIM. The maximum time permitted is 1440 minutes.

- **Quality Sample Period (sec)**. This parameter defines the period of time that the equipment uses for sampling the received signal measure, RSSI when operating on a 2G network or RSCP and EC/n0 when the network is 3G.

- **Quality Evaluation Period (sec)**. The user defines the period of time and thus, indirectly, the number of samples of the received signal measure to determine compliance with minimum quality. The signal value is individualized for each possible operator and network type, see **Min Signal GPRS** and **Min Signal UMTS**. The criteria for determining if the level is correct or not is that all samples of the current evaluation period not meet the minimum set.

- **Quality EC/n0 Evaluation Period (sec)**. This parameter is equivalent to the above, but the measure that is evaluated is EC/n0, which only applies in 3G networks. The threshold value is set for each operator with **Max EC/n0 UMTS** parameter. The criteria for determining if the level is correct or not is that all samples of the current evaluation period exceed the maximum set.

- **Enable dual SIM.** This box must be ticket to determine whether the equipment will use the secondary SIM or not. It enables the options: ***SIMB***, ***alternated*** and ***random.***

- **Enable inactivity time for datacalls.** Selecting this box determines if the equipment will use the following parameter.

- **Inactivity time for datacalls (s).** It establishes the inactivity time in seconds that will imply the voluntary and controlled shutdown of the GSM datacall connection.

SIM A cell-0 y SIM B cell0-1:

- **PIN 1 and PIN 2 values.** These are the safety codes associated with the SIM card. Normally, PIN1 is sufficient to access the general services provided by the operator. Check that the code entered is correct. Entering a wrong code will block the SIM card.

> Once the **PIN 1** and **PIN 2** values are introduced from the **Change** option, execute the **send** command of said option, and then, if you want the values to be applied and saved in the equipment, **DO NOT forget** to execute the **apply** and **save** commands from the main menu tree.

- **Preferred network. Only for the UMTS interface**. This allows the equipment behaviour to be specified in the case of a failure in UMTS/HSDPA coverage. When **UMTS** is selected, the equipment will always try to connect to a UMTS/HSDPA network. This option therefore involves the disconnection of the equipment, due to the lack of UMTS/HSDPA reception. If **UMTS/GPRS** is selected, the equipment will try to connect to a UMTS/HSDPA network, but if there is no UMTS/HSDPA coverage it will connect to a GPRS network. With this option, the equipment will permanently monitor the UMTS/HSDPA network coverage, and as soon as the UMTS network becomes available again, it will switch from a GPRS network to a UMTS/HSDPA network.

- **APN.** This establishes the identity of the operator access point.

- **Force Home Network.** On ticking this box connection with the operator of the local network associated with the SIM card is forced (home network). If this option is selected, the equipment will not connect to any operator other than the one specified.

- **Authentication method.** The authentication method to be used when establishing the PPP session must be selected. The possible values are None, PAP and CHAP.

- **User Name.** User name established by the operator during the authentication process (see preceding point).

- **Password.** Password established by the operator to validate the user name in the preceding point. The password is not shown for security reasons and so when it is changed (**Change** option), it must be entered twice.

  Once the **Password** is introduced from the **Change** option, execute the **send** command of said option, and then, if you want the password to be applied and saved in the equipment, **DO NOT forget** to execute the **apply** and **save** commands from the main menu tree.

- **Min Signal GPRS (dBm).** This parameter allows a minimum coverage level to be specified (in dBm) as a quality parameter for the GPRS (2G) connection. When the coverage level is below this value the equipment will not try to establish the operator session and will remain disconnected. The default values are -113 dBm (0%, no coverage) and -51 dBm (100%, coverage).

  TABLE 2 relates the AT command for coverage measurement (AT+CSQ), the value in dBm of said coverage, and the level of coverage the equipment is receiving, which is shown in the coverage bar on the upper strip of any of the pages on the user interface.

- **Min Signal UMTS (dBm).** This parameter allows a minimum coverage level to be specified (in dBm) as a quality parameter for the UMTS (3G) connection. When the coverage level is below this value the equipment will not try to establish the operator session and will remain disconnected. The default values are -113 dBm (0%, no coverage) and -51 dBm (100%, coverage).

  TABLE 2 relates the AT command for coverage measurement (AT+CSQ), the value in dBm of said coverage, and the level of coverage the equipment is receiving, which is shown in the coverage bar on the upper strip of any of the pages on the user interface.

- **Max EC/n0 UMTS (dB).** This parameter specifies the maximum threshold of the EC/n0 measure to be considered as acceptable.

- **Min Coverage (%).** The system calculates the coverage as a percentage from the received power RSSI to 2G networks, or a combination of the received power (RSCP) and the measured EC/n0, in the case of 3G networks. This parameter sets the minimum threshold required to be evaluated.

- **Quality criteria.** The equipment samples several quality data depending on the network technology in use. This parameter configures what action or combination shall be evaluated in each of the periods. The options are:

    - **Signal:** The system will analyze well RSSI (2G) or RSCP (3G) as the only measure of quality.
    - **Coverage:** The system shall refer the measure Min. Coverage with the corresponding configured value to evaluate the compliance of the required level.
    - **Signal_and_ecn0:** The system will monitor both RSCP and EC/n0 and, for the quality criteria to be satisfied, both measures must meet the corresponding thresholds simultaneously and for the entire evaluation period.
    - **Signal_or_ecn0:** The system will monitor both RSCP and EC/n0 and quality criteria are satisfied if one of the two measures meets the corresponding threshold for the entire evaluation period.
    - **ecn0:** The system will analyze EC/n0 as the only measure of quality. Applicable only operating on 3G networks.

  If the network in use is 2G, the **Signal_and_ecn0**, **Signal_or_ecn0** and **ecn0** criteria are interpreted as **Signal.** This establishes the criteria for 3G networks, and allows the equipment to be operative although the actual network be 2G, temporarily or permanently.

TABLE 2 AT command for coverage measurement (AT+CSQ)

AT+CSQ	Coverage (GPRS)	Coverage (3G)	Received power	Number of bars on screen
0	0%	0%	<-113 dBm	-
1	0%	0%	-111 dBm	-
2	1%	1%	-109 dBm	-
3	1%	3%	-107 dBm	-
4	2%	4%	-105 dBm	-
5	2%	6%	-103 dBm	-
6	3%	7%	-101 dBm	-
7	3%	8%	-99 dBm	-
8	4%	11%	-97 dBm	-
9	5%	14%	-95 dBm	-
10	6%	15%	-93 dBm	1
11	11%	21%	-91 dBm	2
12	17%	29%	-89 dBm	2
13	23%	35%	-87 dBm	3
14	29%	43%	-85 dBm	3
15	35%	49%	-83 dBm	4
16	41%	57%	-81 dBm	5
17	47%	66%	-79 dBm	5
18	53%	74%	-77 dBm	6
19	59%	85%	-75 dBm	6
20	65%	99%	-73 dBm	7
21	71%	100%	-71 dBm	8
22	77%	100%	-69 dBm	8
23	83%	100%	-67 dBm	9
24	90%	100%	-65 dBm	10
25	92%	100%	-63 dBm	10
26	94%	100%	-61 dBm	10
27	96%	100%	-59 dBm	10
28	97%	100%	-57 dBm	10
29	98%	100%	-55 dBm	10
30	99%	100%	-53 dBm	10
31	100%	100%	>-51 dBm	10
>31	0%		Unknown	-

Dynamic DNS:

A dynamic DNS service permits the assigning of a DNS name to equipment with a non-permanent IP address, and the Dynamic DNS client is responsible for updating it when it changes. In this way, from the user standpoint the equipment is always accessible via a DNS name, and so it is not necessary to always know the IP address assigned.

The Dynamic DNS client is entrusted with connecting to the chosen server and updating the IP address.

> To use the Dynamic DNS client, users must first register the DNS name of the equipment with the service provider. The client can only update the IP address.

The parameters are as follows:

- **Enable Dyn Service.** Enables the Dynamic DNS client execution.
- **Dyn Service Id.** Allows you to select one of the dynamic DNS service providers supported.
- **Login y Password.** Establishes the user name (login) and password (password) for accessing the service provider.
- **Host name.** Name of the equipment registered with the service provider, i.e., the name of the equipment used to identify the SIP-2 via DNS.
- **Time interval (seconds).** Time between accesses for the Dynamic DNS client to update the IP address.

Ping Keep Alive:

This is a facility for checking the status of the WAN interface.

- **Remote IP1 and Remote IP2.** This establishes the IP addresses of the equipment with which accessibility will be checked, through the sending of ICMP (ping) packets. If the fields are at 0.0.0.0 this means the "Ping Test" function is disabled. It is sufficient for any one of the remote equipment to respond to consider the accessibility test valid. A field with the value 0.0.0.0 means that the option is not enabled.

- **Frequency (minutes).** This allows the time passing between the sending of ICMP (ping) packets to be specified.

- **Timeout (secs).** This allows the maximum response time to the ICMP (ping) packets sent by the *Ping Keep Alive* function to be specified. It admits a range between **5** and **60**.

- **Size of ICMP packets.** This allows the size of the ICMP packet to be specified. The configuration consists of indicating the extra bytes to be added to the smallest ICMP packet, which is, by default, 28 bytes.

- **Number of ICMP packets.** This allows the number of ICMP packets that are sent in each verification to be specified.

- **Evaluation Model.** This establishes the model for the evaluation of the accessibility test. The options are: **single** and **period**. The **single** model establishes that, if some execution of the test fails, the behaviour of the equipment is the one defined in the **Action** parameter. The **period** model establishes, by means of the two following parameters, a test evaluation period and an admitted failure percentage within it.

- **Evaluation Period (min).** When the Evaluation model parameter is configured as **period,** this establishes a period between **1** and **6000** within which a failure of the accessibility test can be produced. All the responses to the *Ping Keep Alive* packets sent in this period make the universe of samples that will be considered to decide about the execution of *Action* according to the fulfilment of the criteria established by means of the following parameter.

- **Max Lost Ratio (%).** This allows the maximum admitted percentage of failure in the Evaluation period to be specified for the results of the Ping Keep Alive messages.

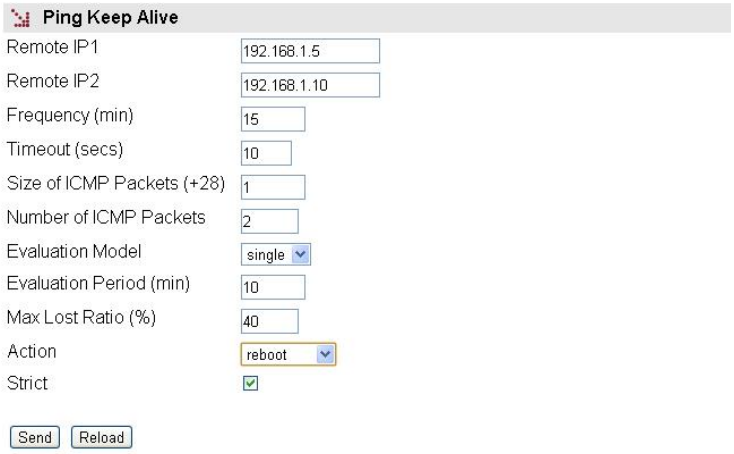
- **Action.** This establishes the desired behaviour of the equipment if the accessibility test is failed. The options are: **None** (no action taken), **Reconnect** (set up a new GPRS/UMTS/LTE session) or **Reboot** (reboot the equipment).

- **Strict.** This option allows users to inhibit the accessibility test in the presence of traffic. If the option is not activated, the test will only be executed when the period of time indicated in **frequency** without traffic has passed. When the option is enabled, the test will be performed regardless of whether traffic is present or not.

  In the figure given as an example in the Ping Keep Alive configuration, connectivity of the IP addresses 192.168.1.5 and 192.168.1.10 is verified every **15** minutes by sending **2** ICMP packets of 29 bytes (28+**1**). In case of failure, the behaviour is *Single* and, in this case, if there is no response to the "Ping Test", the equipment will be rebooted.

> To prevent "Ping Test" failures occurring due to the simultaneous reception of traffic, the equipment will check the activity through the WAN interface for 30 seconds prior to executing the "Ping Test". If the reception of traffic is detected, the "Ping Test" function will not be executed.

FIGURE 25 Example of the Ping Keep Alive configuration



5.5.2 *Tunnel* submenu

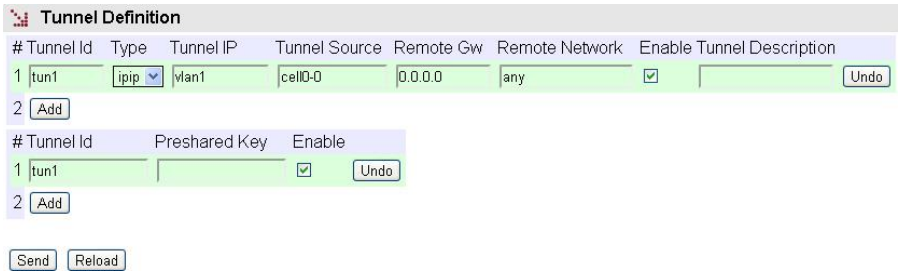
A tunnel can be defined as a virtual connection which emulates an end-to-end connection between two nodes connected through a complex network, which may be public like Internet or private.

To configure a tunnel, it is necessary to define the start and end points of the tunnel and the traffic to be sent through it.

There are two types of unsafe (unencrypted) tunnels: IPIP and GRE. The difference between them is that IPIP tunnels can only encapsulate IPv4unicast traffic, whereas GRE tunnels admit multicast traffic.

To guarantee privacy and safety, the data circulating on the tunnel can be encrypted through the IPSec cipher protocol. It can be configured through the *VPN* menu.

FIGURE 26 ***Tunnel*** submenu of the ***WAN*** menu



The configuration parameters are:

- **Tunnel ID.** This establishes the name of the virtual tunnel-like device.
- **Type.** This establishes the desired tunnel type; GRE or IPIP.
- **Tunnel IP**. This establishes the IP address associated with the virtual tunnel device, whose identity is the value of the **Tunnel ID** parameter. The address must be the host address, but it admits the inclusion of the associated net mask and also its configuration in an indirect form, through the equipment device identifier, in which case the IP address configured in this interface is assigned with a host mask.
- **Tunnel Source**. This establishes the local interface through which the tunnel traffic will be routed. In the case of WAN interfaces, it may be *cell0-0* (identifies SIM A) or *cell0-1* (identifies SIM B). Otherwise, it will be a virtual network identifier from one of the VLANs in the equipment.
- **Remote GW**. This establishes the IP address of the equipment at the other end of the tunnel, that is to say, the terminator.
- **Remote network**. The remote subnetwork connected to the point at the end of the tunnel (Remote GW) whose traffic passes through the tunnel. If *any* is selected, all traffic not accessible locally or based on specific rules will be sent through the tunnel.

- **Enable.** This permits a tunnel to be enabled or disabled, by ticking or not ticking the respective *Enable* box.
- **Tunnel description.** A descriptive field permitting the indication of data about the tunnel, for example, its usefulness.
- **Preshared key.** A key that is exchanged between the equipment at both ends of the tunnel, for the purpose of establishing it. It must be configured in both terminators (Tunnel IP and Remote GW). For it to be effective, the associated *Enable* box must be ticked.

Example:

An example is given below which allows the different parameters referred to above to be identified, with specific values. The GRE tunnel is established between Routers A and B, connected through an IPv4 network; the connection could well be the Internet.

Routers A and B route the traffic between the equipment belonging to Group 1 and Group 2 as if both routers were directly connected to each other, since they both have an IP address in the same segment, 10.1.2.1 and 10.1.2.2 respectively, which are the IP addresses assigned locally to each end of the tunnel; they do this in a transparent manner on the IPv4 network

FIGURE 27 ***Tunnel*** submenu of the ***WAN*** menu

In router A, the configuration would be:

- **Tunnel ID.** Tunnel0.
- **Type.** GRE
- **Tunnel IP**. 10.1.2.1/24 (IP address of the virtual Tunnel0 device).
- **Tunnel Source**. vlan1 (Local interface in which the local address 1.1.1.1/24 is configured).

- **Remote GW**. 2.2.2.2/24 (tunnel terminator address).
- **Remote network**. 10.1.3.0/24 (IP network located at the remote end of the tunnel).

In router B, the configuration would be:

- **Tunnel ID.** Tunnel0.
- **Type.** GRE
- **Tunnel IP**. 10.1.2.2/24 (IP address of the virtual Tunnel0 device).
- **Tunnel Source**. vlan2 (Local interface in which the local address 2.2.2.2/24 is configured).
- **Remote GW**. 1.1.1.1/24 (tunnel terminator address).
- **Remote network**. 10.1.1.0/24 (IP network located at the remote end of the tunnel).

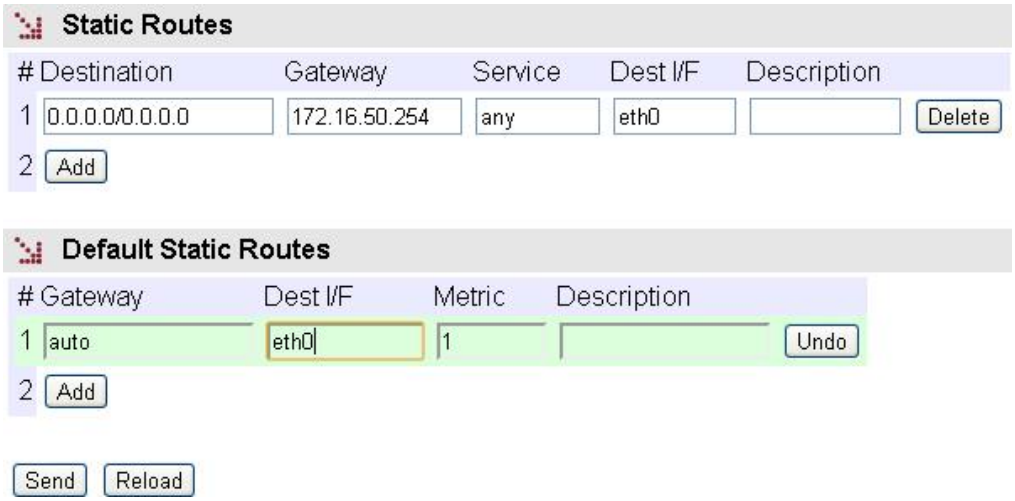
5.6 STATIC ROUTES CONFIGURATION

The ***Statics Routes*** option of the ***Routing*** menu provides access to the configuration screen through which the user can provide the system with the static and permanent data for the routing service.

The screen has two well differentiated sections. Explicit static routes are configured in the *Static Routes* section. The address acting as a route by default in the case that the service has no specific data for reaching a destination is configured in the *Default Static Routes* section.

> If the equipment has the optional wireless interface, the operator will not only provide the IP address of the interface but also establish a default router associated with that interface, which takes precedence over any configuration established by the user.

FIGURE 28 ***Static routes*** configuration page



The parameters for configuring a static route are:

- **Destination.** This allows the IP address to be specified, and the remote or destination network subnet mask. The field requires the values to be entered in the IP address format. Example: 192.168.0.0/255.255.255.0 or 192.168.0.0/24.

- **Gateway.** This allows the IP address of the router to which the traffic destined for the remote network of the previous field must be sent.

- **Service**. This allows an additional filter to be established in the remote IP address for determining the selection of the next jump. The condition is established based on a specific service (tcp/udp/icmp). After the service the port number (1÷65535) must be indicated, separated by two points. The default value is **any**, that is to say, the route applies for all types of traffic (only the IP destination is taken into account). Example: tcp:5000, which means that all the packets with tcp traffic on port 5000 will be sent to the indicated router.

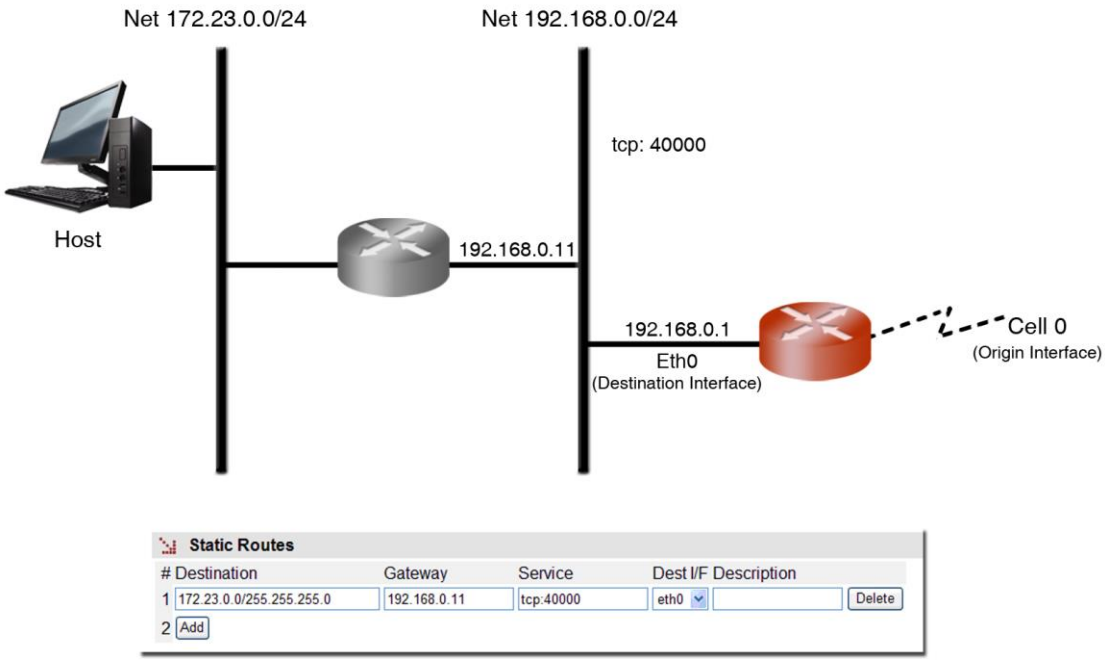
- **Dest I/F (Destination interface)**. This allows the interface through which the routed traffic coinciding with this route will be sent.

- **Description.** This permits a description of up to 15 alphanumerical characters to be specified.

Example:

The figure shows an example of assigning a static route between two different network segments. All the TCP packets of port 40000 can reach the network segment 172.23.0.0/24 through router 192.168.0.11.

FIGURE 29 Example of how a static route is configured



The default parameters for configuring a static route are:

- **Gateway.** This allows the IP address of the next router to be specified for routing traffic whose destination does not coincide with any known route.
- **Dest I/F (Destination interface)**. This permits the specification of the interface through which traffic routed to the router indicated in the previous field will be sent.
- **Metric**. This permits a value to be established originating from among the default different routes that could be created. A higher metric means a lower priority.

  If the wireless interface is operative, this parameter must be different and higher than 1, the value 10 being recommendable as values higher and next to 1 could be reserved to other routes established by the operator.

- **Description.** This permits a description of up to 15 alphanumerical characters to be specified.

5.7 DNS SERVER CONFIGURATION

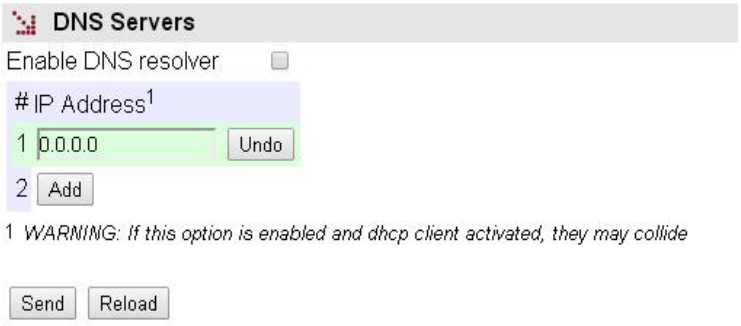
The ***DNS servers*** option of the ***Routing*** menu provides access to the configuration screen through which the user can configure the DNS server addresses manually.

The configuration parameters are:

- **Enable DNS resolver.** Enables the DNS service. The DNS servers can be configured manually when the option is selected.
- **IP Address.** Specifies the IP addresses of DNS servers. For the addresses to be effective, the *Enable DNS resolver* box must be selected.

> ! For proper operation of this service, the DHCP client must NOT be configured.

FIGURE 30 DNS server configuration page



5.8 FILTERING CONFIGURATION

The *Filtering* menu permits firewall functionalities, defining which traffic is allowed and which traffic is rejected and the application of additional conditions to the traffic processed through the routing function.

The menu parameters are divided into three quite different blocks, which are:

– Filtering of packets for local services (http, Telnet or ***any***).

– Filtering of packets through the incoming/outgoing service for the GPRS/UMTS/LTE (cell0) interface, if the equipment has the WAN interface.

– Filtering of packets through the incoming/outgoing service for the Ethernet (eth) interface.

FIGURE 31 ***Filtering*** menu configuration page

The configuration parameters in each block are:

- **Origin.** This allows the IP source of the traffic to be specified, i.e., from a specific IP address or any IP address (**any**). The default value is **any.** The specification of a particular IP address requires the values to be entered in the IP address format. Example: Subnet (192.168.50.0/255.255.255.0 or 192.168.50.0/24) or Host (192.168.50.5/255.255.255.255 or 192.168.50.5/32 ó 192.168.50.5). Only present in the sections in which this makes sense.

- **Destination.** This allows the IP source of the traffic to be specified, i.e., to a specific IP address or from any IP address (**any**). The default value is **any.** The specification of a particular IP address requires the values to be entered in the IP address format.
  Example: Subnet (192.168.50.0/255.255.255.0 or 192.168.50.0/24) or Host (192.168.50.5/255.255.255.255 or 192.168.50.5/32 or 192.168.50.5).

- **Service**. This allows any type of traffic to be specified (**any**) or a specific traffic (**tcp/udp/icmp)**. The default value is **any**. If a specific traffic is indicated, the port number can be indicated together with the service, if required (1÷65535) or a range. Example: tcp or tcp:23 or udp:5001-5005.

- **Dir**. This allows the traffic direction to be specified, i.e., whether it is incoming (**in**) or outgoing (**out**).

- **Policy**. This allows the filtering policy to be specified (**accept**, **drop** or **reject**). When the filtering policy is **accept**, only packets complying with the established rule are accepted. When the filtering policy is **drop**, on the other hand, packets complying with the established rule are dropped. The **reject** filtering policy also rules out packets complying with the established rule, but unlike drop, when the packet is ruled out, the appropriate ICMP message is sent to the source address of the packet.

- **Description.** This permits a description of up to 15 alphanumerical characters to be specified.

- **Default Policy**. This allows the behaviour of the equipment filtering to be determined as regards not being included in any specific rule of the respective section.

Example:

A filtering policy is to be established to eliminate traffic present in the ethernet (eth0) interface coming from host 10.0.0.5, whose destination is within the IP range 192.168.0.0/24. The **eth0** block configuration will be that shown in the figure.

FIGURE 32 Example of filtering configuration page

5.9 GW 104-101 CONFIGURATION

This menu only appears when the SIP-2 has the Gateway 104-101 functionality.

The GW 104-101 menu contains the parameters that must be programmed to allow the transparently management of RTUs that do not use the variant IEC 60870-5-104 from a control center that operates with IEC 60870-5-104.

The GW 104-101 menu contains three submenus: IEC 60870-5-104, IEC 60870-5-101 and RTU, which are described below.

5.9.1 IEC 60870-5-104 configuration

This submenu allows the operating parameters of the APCI layer according to the IEC 60870-5-104 standard to be configured, and the parameters used in the format of the ASDUs.

FIGURE 33 *IEC 60870-5-104* submenu of *GW 104-101* menu

The configuration parameters are divided into three blocks, which are described below:

ENABLE:

- **Enable.** This permit the GW 104-101 function to be enabled.

APCI:

In the IEC 60870-5-104 standard the use of the APCI protocol to transport information packets at application level (ASDU) over standard transport layers is detailed. The APCI protocol acts as a client of the TCP transport layer. The standard also indicates the parameters that the user has available to establish its behaviour, apart from establish procedures to be followed by the APCI protocol.

This submenu allows the user to configure all the parameters detailed by the IEC 60870-5-104 standard, except for the *t0* parameter that does not apply to the telecontrol remotes but applies to the control center.

The parameters, their meaning and range of possible values are described below.

- **Parameter *t1*.** The *t1* parameter sets the maximum waiting time for receiving confirmation of a message at APCI level. When the established time is elapsed, the connection will be finished. The possible values are from 1 to 255 seconds with a resolution of 1 second.

- **Parameter *t2*.** The *t2* parameter sets the maximum time that an APCI entity can wait from receiving an APCI message and sending the confirmation message, either through an information message on the contrary direction or by a control message for this purpose.

  The standard establishes that it is imperative that the value of the parameter *t2* be lower than the parameter *t1*. The possible values and resolution are identical to those of *t1* parameter.

- **Parameter *t3*.** The *t3* parameter sets the period of inactivity on an established APCI connection, which involves the transmission of TEST messages to ensure the persistence of the connection. The possible values and resolution are identical to those of *t1* and *t2* parameters.

- **Parameter *k*.** The *k* parameter sets the maximum number of pending confirmation messages that can manage the APCI entity for each established connection. It admits a range from 1 to 32767.

- **Parameter *w*.** The *w* parameter sets the maximum number of messages received by an APCI entity that involves the corresponding confirmation message transmission, either through a user message on the contrary direction or, in the absence of traffic in transmission, by a control message. It admits a range equal to that of *k* parameter.

  The standard recommends that the value of *w* be less or equal to two thirds of the value of *k*, in order to avoid a blocking situation in the absence of traffic in one of the two ways. The system indicates the user this situation when configuring data but does not require compliance with the recommendation.

ASDU profile:

- **Cause of Transmission Size (COT).** It determines the number of bytes to be used in the filed Cause of Transmission of the ASDU. The admitted values are 1 or 2, indicating the number of octets that will constitute the field.
  When the Cause of Transmission is configured with 2 octets, the second octet contains the *Address* (identifier of center 104), which allows the existence of multiple connections 104 (of different centers 104) on the same link 101.

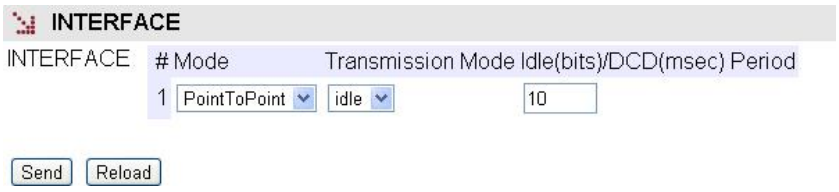
- **Common Address Size.** It establishes the length, in number of octets, of the address field that identifies the remote, admitting as values 1 or 2. This field determines the number of remotes to be manageable by a control center.

- **IOA size.** It establishes the length of the field IOA *(Information Object Address*) in number of octets. The possible values are 1, 2 or 3.

5.9.2 IEC 60870-5-101 configuration

This submenu allows the typology of the telecontrol remote connection to the SIP-2 equipment to be configured, and the mechanism used for display and error recovery on the IEC 60870-5-2 link.

FIGURE 34 *IEC 60870-5-101* submenu of *GW 104-101* menu



The configuration parameters are described below:

- **Mode.** It determines the type of connection between the telecontrol remote and the COM port of the SIP, the only option available being the Point-to-Point connection.

- **Transmission mode.** The parameter admits two possible values: **dcd** and **idle** mode. In the first case, the mechanism for recovering an error condition is via state changes of the **dcd** signal. In the second case, the mechanism is by timed inactivity.

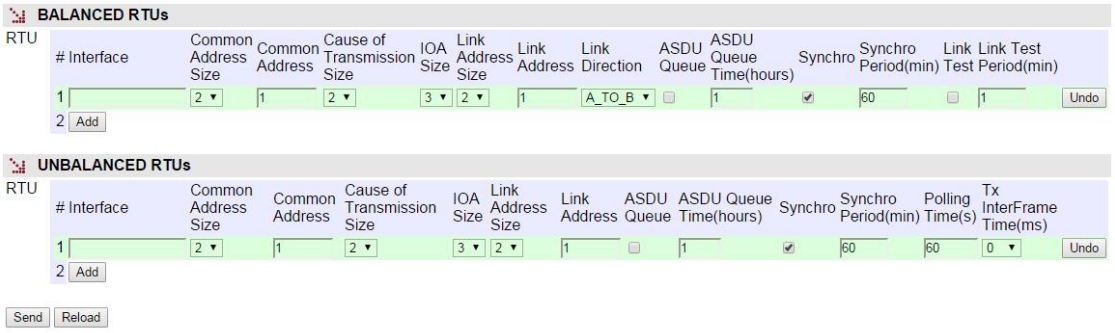
- **Idle (bits)/DCD (msec) Period.** The meaning of this field depends on the chosen transmission mode. **dcd** mode is the minimum idle time to resynchronize signal. It is measured in units of time of 10 ms, and it is limited to a maximum value of 5.

  idle mode is the free-line time (unused) that is necessary for resynchronize after detecting an error. It is measured in bit intervals, the value 0 not being allowed. To deactivate the idle condition the value named “IDLE time” (with a value by default equal to 10) must be configured with a value equal to 0.
  The new value equal to 0 will indicate to the GW104-101 that it must not consider the standard idle times for eliminating messages.

5.9.3 RTU configuration

This submenu allows the identity parameters of the telecontrol remote (CA) to be configured, and the operating parameters of the IEC 60870-5-2 link.

FIGURE 35 *RTU* submenu of *GW 104-101* menu



The configuration parameters are described below:

BALANCED RTUs:

- **#.** It establishes the equipment physical port number. Port 1 for port COM1.
- **Common Address Size.** It establishes the length of the address field that is to be used by the remote in number of octets. The possible values are 1, 2 or 3.
- **Common Address.** It determines the telecontrol remote address.
- **Cause of Transmission Size.** It establishes the length of the CoT field that is to be used by the remote in number of octets. The possible values are 1 or 2.
- **IOA Size.** It establishes the length of the field containing the address of the objects in the remote in number of octects. The possible values are 1, 2 or 3.

- **Link Address Size.** It determines the size of the link address associated with the telecontrol remote. It may not be identical with the length of the Common Address field.

- **Link Address.** It determines the link address associated with the telecontrol remote. It may differ from the Commom Address.

- **Link Direction.** It establishes the behaviour of SIP-2 with respect to IEC 60870-5-2 link. The encoding of the two possible directions is:

    - **A to B.** From station type A to station type B.
    - **B to A.** From station type B to station type A.

  The COM interface of SIP-2 must be configured depending on the behaviour of the telecontrol remote, that is, if the remote acts as station type B_to_A, the SIP-2 must be configured as type A_to_B, and vice versa.

- **ASDU Queue.** It activates the queue of GW 104-101 that stores the received ASDU from the telecontrol remote, and already confirmed to the remote, and that have not yet been transmitted to the control center or, if they have been transmitted, the confirmation from the control center has not yet been received.

- **ASDU Queue Time (hours).** It establishes the persistence time of messages in the queue of the GW 104-101 from the moment there is no connection with a control center. When the configured time is elapsed, the stored messages are deleted. It is useful when the queue is active.

- **Synchro.** It indicates if the GW 104-101 function must synchronize to the telecontrol remote automatically, that is, without intervention of the control center.

- **Synchro Period (Minutes).** It sets in minutes the transmission period of the synchronism messages generated by the GW 104-101 function.

- **Link Test.** The GW 104-101 function can execute the line test included in the IEC 60870-5-2 link procedures in order to determine if the connection with the remote is still operative. This feature is requested by activating this parameter.

- **Link Test Period (min).** This parameter sets the frequency with which the test line (see previous parameter) will take place.

UNBALANCED RTUs:

- **#.** It establishes the equipment physical port number. Port 1 for port COM1.
- **Common Address Size.** It establishes the length of the address field that is to be used by the remote in number of octets. The possible values are 1, 2 or 3
- **Common Address.** It determines the telecontrol remote address.
- **Cause of Transmission Size.** It establishes the length of the CoT field that is to be used by the remote in number of octets. The possible values are 1 or 2.
- **IOA Size.** It establishes the length of the field containing the address of the objects in the remote in number of octects. The possible values are 1, 2 or 3.
- **Link Address Size.** It determines the size of the link address associated with the telecontrol remote.
- **Link Address.** It determines the link address associated with the telecontrol remote.
- **ASDU Queue.** It activates the queue of GW 104-101 that stores the received ASDU from the telecontrol remote, and already confirmed to the remote, and that have not yet been transmitted to the control center or, if they have been transmitted, the confirmation from the control center has not yet been received.
- **ASDU Queue Time (hours).** It establishes the persistence time of messages in the queue of the GW 104-101 from the moment there is no connection with a control center. When the configured time is elapsed, the stored messages are deleted. It is useful when the queue is active.
- **Synchro.** It indicates if the GW 104-101 function must synchronize to the telecontrol remote automatically, that is, without intervention of the control center.
- **Synchro Period (Minutes).** It sets in minutes the transmission period of the synchronism messages generated by the GW 104-101 function.
- **Polling Time(s).** The unbalanced RTUs should be consulted periodically by the GW 104-101 about the availability on data because the 104 Control Center will not do so. This parameter establishes the frequency of queries.
- **Tx InterFrame Time (ms).** It establishes a minimum time between the transmission of messages to the remote.

5.10 NAT CONFIGURATION

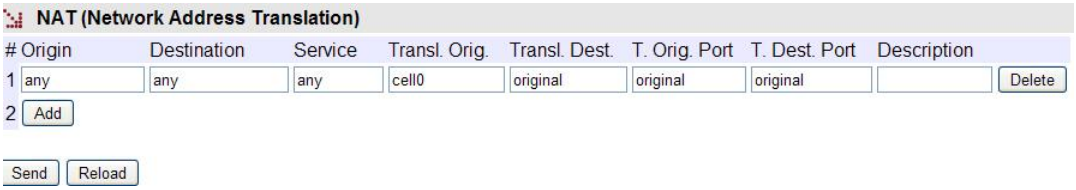
This feature is used when the SIP-2 operates as a router.

NAT is the IP address translation service which allows users to combine the use of private IP address without this preventing them from accessing resources with a public IP address, or preserve the address schema in different interconnected network areas.

The NAT menu defines the rules that allow IP addresses to be selectively translated and change the transmission service ports.

> ! It is important to bear in mind that the NAT service has a **default rule.**
> The correct operation of services based on its operation in analysing data which can be changed by the NAT rules could be altered by the presence of this default rule, since the services have a specific order of execution.
> **If not using NAT, you should eliminate this default rule.**

FIGURE 36 ***NAT*** configuration page



The configuration parameters are:

- **Origin**. This establishes a range of IP addresses. It admits the value **any**, in the case that the **origin** IP address is not relevant.
- **Destination**. This establishes a range of IP addresses. It admits the value **any**, in the case that the IP **destination** address is not relevant.
- **Service**. This establishes conditions related to service, understood as the protocol (**tcp/udp/icmp)** and port (1 to 65535 or a range). It admits the value **any**, in the case that the service is not relevant. Example: tcp or tcp:23 or udp:5001-5005.
- **Transl**. **Origin**. This establishes the IP address that must replace the **origin** IP. An IP address may be specified or the respective interface identifier. In the case of not wanting to change the original address, the value must be **original.**

- **Transl. Dest.** This establishes the IP address that must replace the **destination** IP. An IP address may be specified or the respective interface identifier. In the case of not wanting to change the original address, the value must be **original.**

- **T. Orig. Port.** This establishes the identifier of the port that must replace the **origin** port in the packet. It admits a range configuration. In the case of not wanting to change the original port, the value must be **original.**

- **T. Dest. Port.** This establishes the identifier of the port that must replace the **destination** port in the packet. It admits a range configuration. In the case of not wanting to change the destination port, the value must be **original.**

- **Description.** This permits a description of up to 15 alphanumerical characters.

5.11 DHCP SERVER CONFIGURATION

The SIP-2 has a built-in DHCP server which allows IP addresses to be assigned automatically to the equipment requesting this.

The configuration parameters are:

- **Enable DHCP server.** This allows the DHCP service to be activated. The DHCP server is operative when the option is selected.

- **First IP Addr.** Allows the **first** IP address of the IP addresses pool managed by the DHCP Server to be specified.

- **Last IP Addr.** Allows the **last** IP address of the IP addresses pool managed by the DHCP Server to be specified.

- **Maximum number of leases.** Allows the maximum number of IP addresses simultaneously assigned in use to be specified.

- **Mask.** This establishes the net mask that will communicate with the DHCP clients.

- **Default Gateway.** This establishes the default router address (Default Gateway) that will communicate with the DHCP clients.

- **Lease time.** This allows the time in seconds to be specified for an IP address to be assigned following a request from a DHCP client. After the indicated time, if the DHCP has not requested a renewal, the IP address will be considered available for dealing with new requests.

- **1st DNS server.** This allows the specification of the primary DNS server IP address which the DHCP server will provide to the DHCP client. If left blank (0.0.0.0) no information on DNS servers will be sent to the client.

- **2nd DNS server**. This allows the IP address of a secondary DNS server to be specified to the DHCP client. If left blank (0.0.0.0) this means that no information will be sent to the client in this respect.

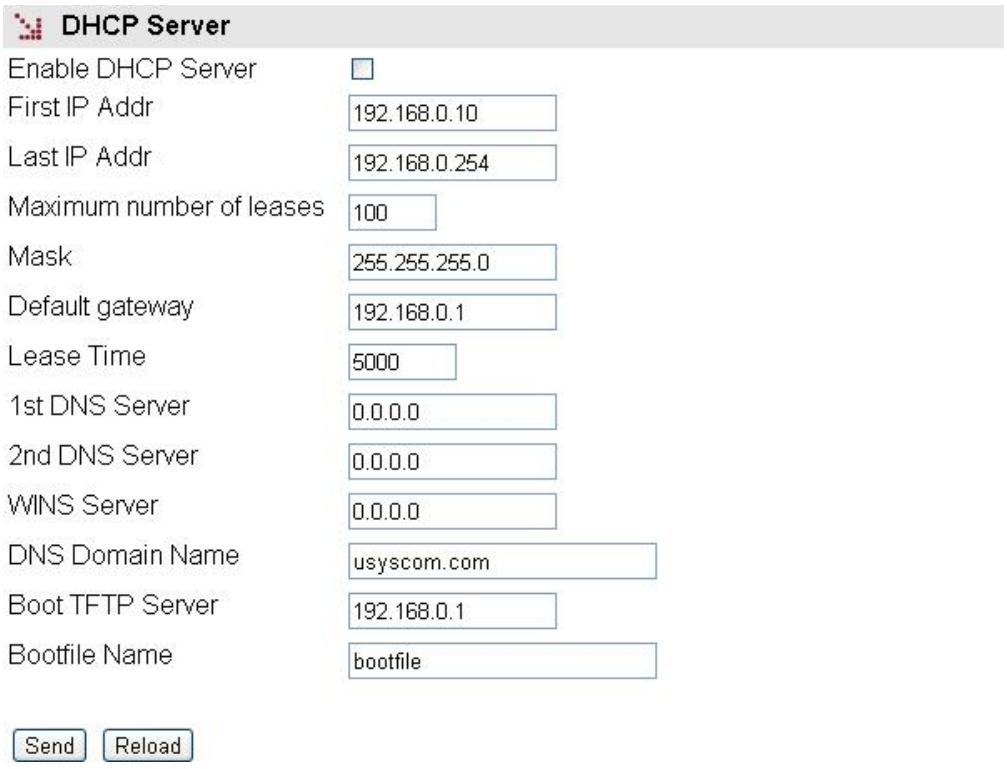
- **WINS server**. This allows the IP address of the WINS server to be established, which will be notified to the DHCP client. WINS is a names resolution system owned by Microsoft for equipment executing the Windows operating system.

- **DNS Domain Name**. This establishes the DNS domain to be used by the client for creating its full DNS name.

- **Boot TFTP Server**. This establishes the IP address of the TFTP server that stores the remote boot file, thereby allowing the client to execute a request to download the file.

- **Bootfile Name**. This establishes the name of the remote boot file which the client will request from the TFTP server configured in the preceding point.

FIGURE 37 ***DHCP server*** configuration page



5.12 VPN CONFIGURATION

This menu only appears when the SIP-2 equipment has the optional wireless WAN interface.

As already mentioned in the ***Tunnel*** submenu of the ***WAN*** menu (section 5.5.2), the tunnels are a method for establishing the opportune end-to-end links between equipment. Unlike the GRE and IPIP tunnels, IPSec tunnels are characterised by being safe; this means the information is transmitted so that its content cannot be accessed by others, which is particularly important if the IP network upon which it is established is not controlled by the user, or is not public.

To create an IPSec tunnel a security association must be established in each terminator: Tunnel IP (origin) and Remote GW (destination).

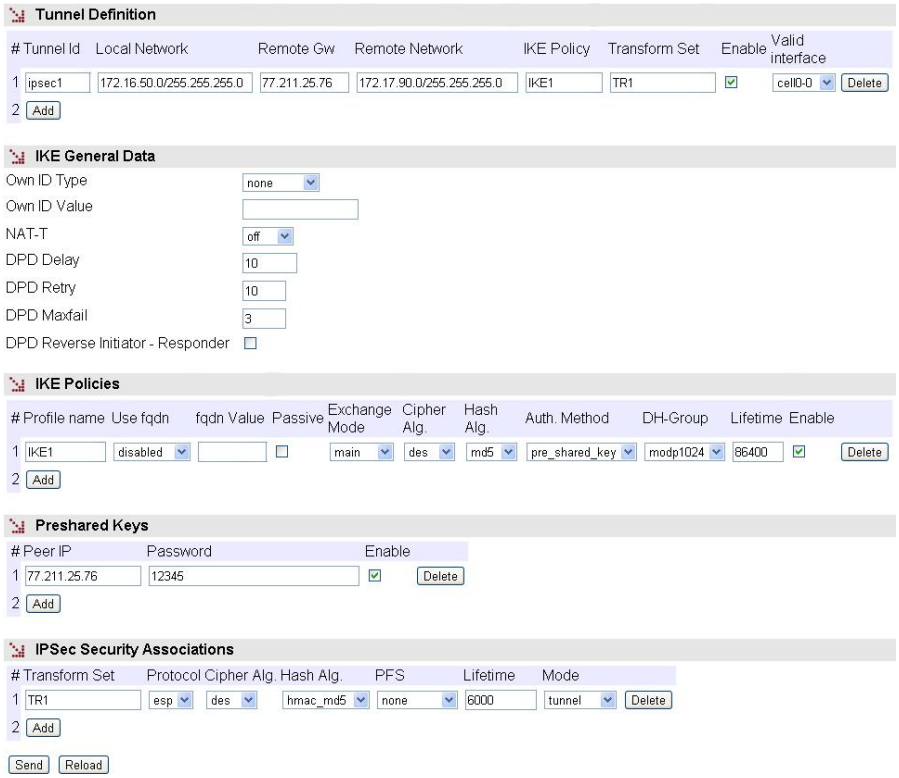
An IPSec connection between two ends requires three steps:

- Establishing an IKE Security association (IKE Policy).
- Establishing an IPSec Security association (IPSec Association).
- Sending protected data through the IPSec connection.

The parameters used in each of these steps are configured as independent blocks, thereby permitting their use in more than one tunnel at the same time and reducing the need to duplicate configuring information.

The DPD (Dead Peer Detection) function is a mechanism for supervising operativity in the IPSec tunnels established.

FIGURE 38 ***VPN*** menu



The sections and their configuration parameters are as follows:

Tunnel Definition:

- **Tunnel ID.** The identifier of the virtual tunnel device to be established.
- **Local Network.** This establishes the range of origin IP addresses that will be transmitted in the tunnel. It provides a filter at the original IP address level. The **any** value is accepted, as well as IP network addresses, through the IP/Mask format.
- **Remote GW.** IP address of the terminator remote equipment in the IPSec tunnel.
- **Remote Network.** The range of IP addresses that can be reached at the remote end of the tunnel. It is equivalent to a static route in the sense that all data coinciding with the specified range will be sent through the tunnel. The special value **any** is also accepted.
- **IKE Policy.** This selects the set of previously-defined parameters that will be used for establishing the *IKE Security association.*

- **Transform Set.** This selects the set of previously-defined parameters that will be used for establishing the *IPSec Security association.*

- **Enable.** This enables the configured tunnel. It allows the user to have configured operative or non-operative tunnels, as wished.

- **Valid Interface.** This indicates the valid device identifier upon which the tunnel can be established. It operates like an additional filter. The value **any** is accepted.

IKE General Data:

- **Own ID Type.** This indicates the type of identification to be used by the equipment. The options are **none**, **address** entailing the use of the IP address, **fqdn**, which involves using a domain (e.g. foo.domain.com), or **user_fqdn**, entailing the use of an e-mail address (e.g. foo@domain.com).

- **Own ID Value.** The own identity value in the case of selecting an option other than **none** in the preceding parameter.

- **NAT-T.** It enables the use of the option **NAT-T**, allowing the IPSec protocol to function correctly when NAT services are crossed. The options are **off**, when the user does not want it to be enabled or it will not be accepted if proposed by the remote end, which is also the default value. **On** means that the option will be used when detecting the presence of NAT services between both ends, and **force** entails its use regardless of whether or not the presence of NAT services is detected.

- **DPD Delay.** This parameter sets the time between Hello messages transmitted for the tunnel supervision function. The valid range of values is 0 to 1200, and the units are seconds. 0 means the supervision is not executed.

- **DPD Retry.** This establishes the waiting time for a response to a Hello message transmitted, in seconds. If no response is received from the remote end within this time, the equipment considers that a supervision failure has occurred.

- **DPD Maxfail.** The value of this parameter is the maximum admitted number of failures to respond to a Hello message. If this maximum number is reached it is considered that the tunnel is not available and an attempt will be made to restore it.

- **DPD Reverse Initiator-Responder.** This option allows the use of the DPD supervision service with tunnels ended by Cisco equipment that execute a non-standard variation.

IKE Policies:

- **Profile name.** This identifies the set of parameters being configured to establish an *IKE Security association*, so that it can be used by one or more configured tunnels.
- **Use fqdn (Full Qualified Domain Name**). This indicates the type of identification to be used by the equipment. The options are **disabled,** entailing the use of the IP address, **fqdn**, which involves using a domain (e.g. foo.domain.com), or **user_fqdn**, entailing the use of an e-mail address (e.g. foo@domain.com).
- **fqdn value.** This parameter determines the domain or e-mail address to be used after selecting one of the two options indicated in the preceding section.
- **Passive.** When this option is executed, the equipment will not take the initiative in establishing the tunnel and wait to receive the request from the remote end.
- **Exchange Mode.** This establishes the mode for exchanging codes. The mode must be the same at both ends for the exchange to be successful. The options are **main**, **aggressive** and **base.**
- **Cipher alg. Cipher alg.** This determines the cipher algorithm to be used for exchanging codes. The available algorithms are **DES**, **3DES** and **AES**.
- **Hash Alg.** This determines the hash algorithm used for authentication during the code exchange. The available options are **MD5** (Message Digest 5) and **SHA1** (Secure Hash Algorithm).
- **Auth. Method.** This establishes the code-generating mechanism. Only the exchange of previously-established codes is available as a method.
- **DH Group.** Selection of the Diffie-Hellman (DH) Modular Exponential (MODP) group for creating codes. Group 1 (768 bits, option **modp768**), group 2 (1024 bits, option **modp1024**) and group 5 (1536 bits, option **modp1536**) are available).
- **Lifetime.** The valid term for the security association in exchanging codes. When the established time is up, a new association is renegotiated. The value establishes the time in seconds.
- **Enable.** This indicates that the group of parameters specified can be used (active option) or that it cannot be used (inactive option).

Preshared Keys:

- **Peer IP.** This establishes the IP address of the remote tunnel equipment (**Remote GW**) for which the password of the next parameter is defined.
- **Password**. The password is stored in this parameter.
- **Enable.** This indicates whether the configured password can be used (active option) or not (inactive option).

IPSec Security Associations:

- **Transform set.** This identifies the set of parameters being configured to establish an *IPSec Security association* so that it can be used by one or more configured tunnels.
- **Protocol.** The protocol establishes which of the two types of encapsulation will be used. **ESP** (Encapsulating Security Payload) provides ciphering and authentication for each packet, and **AH** (Authentication Header) only provides the authentication service.
- **Cipher alg.** This determines the cipher algorithm to be used for encrypting the user data. The available algorithms are **DES**, **3DES** and **AES**.
- **Hash alg.** This determines the hash algorithm used for authentication. The available options are **MD5** (Message Digest 5) and **SHA1** (Secure Hash Algorithm). A third option exists, **non-auth,** which means the authentication is not included.

The authentication and ciphering options can be combined in different modes. If the **AH** protocol is selected, only the hash algorithm choice will be taken into account, and on the contrary if the **ESP** protocol is selected, the encryption is always present with the cipher algorithm selected, and the authentication may be included with either **MD5** or **SHA1,** or it may not be included if the **non-auth** value is selected.

- **PFS (Perfect Forward Secret).** If the option is enabled, this means that each new code renegotiated must be completely separated from the previous one. The remote end must accept the **PFS** option for the establishment to be successful. This option provides additional security but a greater processing load.
- **Lifetime.** The maximum validity time for a security association. When the established time is up, a new association is renegotiated. The value establishes the time in seconds.

- **Mode**. The IPSec provides two operating modes; the first is **tunnel**, which means the original packet is completely encapsulated in an additional IP head, and the second is **transport**, meaning that the original head is used without adding an extra one.

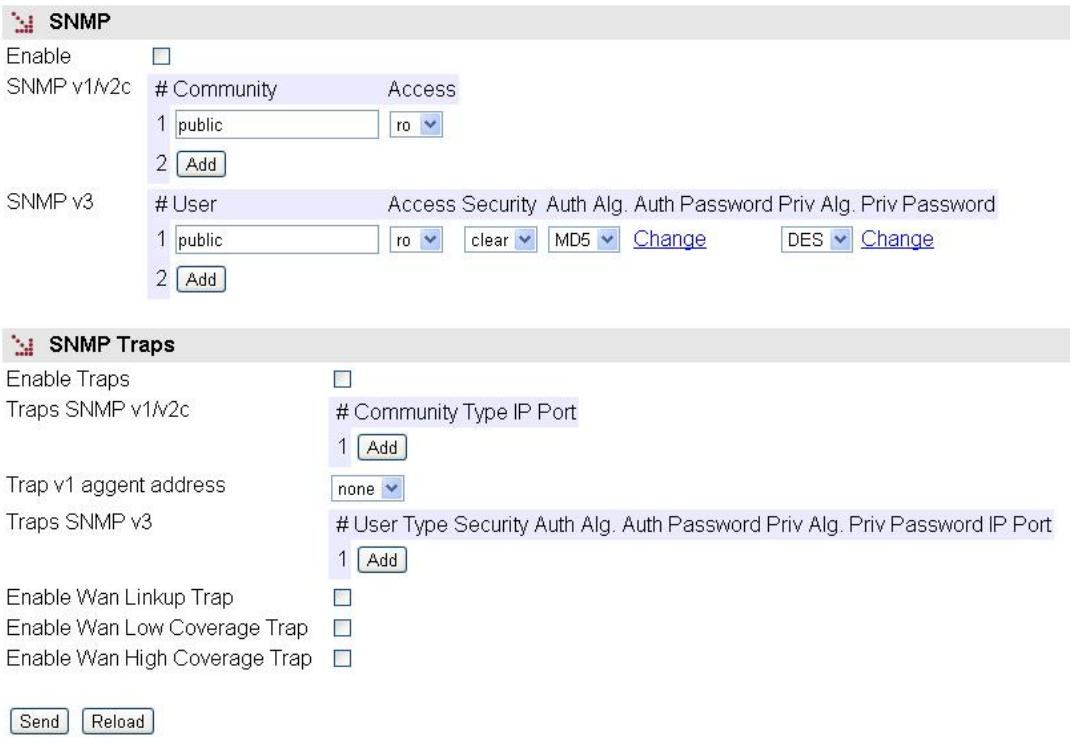
5.13 SNMP CONFIGURATION

The equipment has an SNMP agent with the capacity to generate spontaneous messages to control equipment, based on that protocol.

The agent admits the emitting of messages based on the SNMPv1 [1], SNMPv2c [2] and SNMPv3 protocol, and the selection of the type of message, *trap* and *inform*.

> Changes made to the SNMP agent configuration will **only** be active after **RESETTING** the equipment. The ***Apply*** command is not sufficient, and so the changes must previously be saved using the ***Save*** command before requesting the reboot.

FIGURE 39 ***SNMP*** menu



The configuration parameters are:

- **Enable:** Enables/disables the execution of the SNMP agent. The agent is operative when the option is selected.

- **Community:** Parameter associated with SNMPv1/v2c. Tabulate information that allows several operating profiles to be defined, including the rights of access (Access) associated with each one, read only rights (*ro*) or reading/writing rights (*rw*). The profiles are called *communities*.

- **User:** Parameter associated with SNMPv3. Tabulate information that allows the users, including the privileges and the operating mode associated with each user, to be defined. That is to say, the rights of access (Access), read only rights (*ro*) or reading/writing rights (*rw*), and the way in which the data transference (Security) will be carried out, without encryption (*clear*), authentication (*auth*) or authentication and encryption (*priv*).
  In case of authentication transmission (*auth*), it is necessary to select the type of algorithm (*Auth Alg*.), MD5 or SHA, and establish the authentication password (*Auth Password*). The password establishes the word to be used to generate the authentication information. The authentication word must be known by the receiver in order to be able to verify the authenticity of the identity of the transmitter.

  In case of encrypted transmission (*priv*), in addition to select the type of authentication algorithm (*Auth Alg*.) and authentication password (*Auth Password*), it is necessary to select the cipher algorithm (*Priv Alg*.), DES o AES, and establish the cipher password (*Priv Password).*

  The password is not shown for security reasons and so when it is changed (**Change** option), it must be entered twice.

  Once the **Password** is introduced from the **Change** option, execute the **send** command of said option, and then, if you want the password to be applied and saved in the equipment, **DO NOT forget** to execute the **apply** and **save** commands from the main menu tree.

SNMP Traps:

- **Enable Traps:** Enables/disables the generation and transmission of spontaneous messages by the SNMP agent. The agent will send the traps selected by the user when the different events occurred.

- **Traps SNMPv1/v2c:** Tabulate information allowing several destination equipment for the *traps* to be defined.
  For each of the spontaneous SNMP message addressees, a profile must be provided, which must be included in the spontaneous message, the SNMP protocol version with which it will be coded, the IP address of the addressee and the UDP port to which the messages will be sent. The default value established in the standard is port 162. It can be changed to adapt to the operating data of each addressee.
  The transmission of the messages in a confirmed (*inform*) way is only accepted for the v2c and v3 versions of the protocol.

- **Trap v1 agent address:** This establishes the IP address the agent will communicate as being its own when sending spontaneous messages. This parameter is only used to create the traps when using SNMPv1.

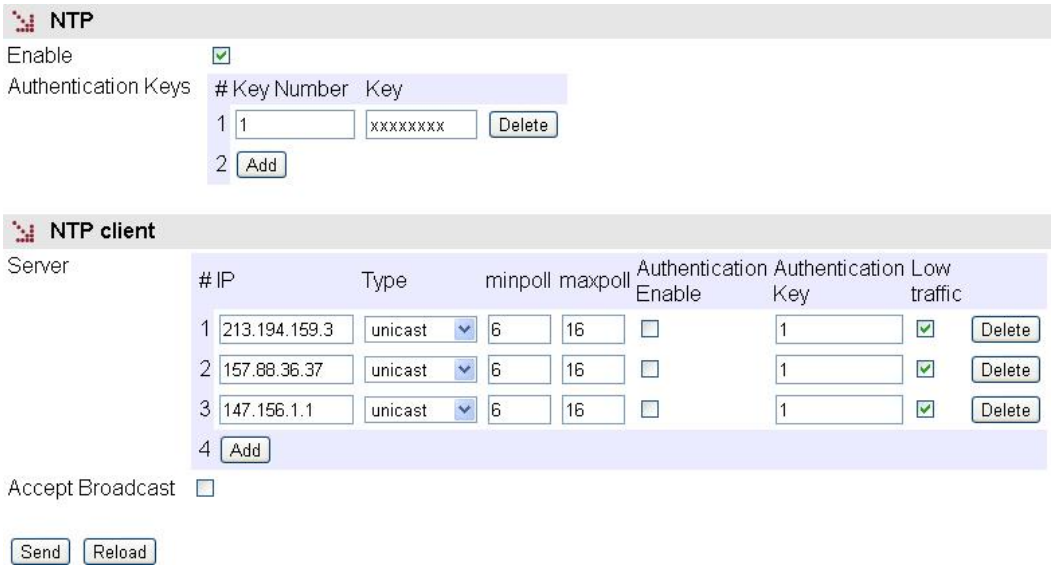
- **Traps SNMPv3:** Tabulate information allowing several destination equipment for the notifications to be defined.
  The receivers are identified by means of their IP address and the UDP port to which the notifications are to be sent. The standard UDP port for the SNMP notifications is the 162, being the value by default.
  The *Type* control is used to establish whether the transmission of the notifications is carried out in an unconfirmed (*trap*) or confirmed (*inform*) way.

- **Enable Digital Input Change Trap:** Enables/disables the transmission of spontaneous messages by the SNMP agent, indicating the status changes of the digital inputs (see section 2.5).

5.14 NTP CONFIGURATION

The equipment has an NTP client, meaning that it can synchronise time-related information by accessing NTP servers. The NTP [3] protocol is a standard that is widely used in TCP/IP-based networks. It admits the use of several NTP servers simultaneously, and the option of using authentication.

FIGURE 40 ***NTP*** menu configuration page



The usage parameters are:

- **Enable:** Enables/disables the execution of the NTP client. The client is operative when the option is selected.

- **Authentication keys:** Tabled information allowing the definition of different authentication codes to be used subsequently in communicating with the different NTP servers.

- **Server:** Tabled data that includes the NTP servers access data. Each row contains data related to one NTP server.

- **Accept broadcast:** This establishes whether the NTP client will accept messages transmitted with broadcast-type NTP messages.

For each of the NTP servers configured, an IP address must be provided, as well as the type of IP message it will use to access the individual server (*unicast*) or collective Server (*manycast*), the minimum time between requests, with the parameter establishing the exponent of the power of 2 in seconds; the maximum time between requests, also as the exponent of the power of 2 in seconds, and a selection option that determines whether authentication should be used, in which case it is necessary to indicate which previously-defined code the client with the server in question will use.

5.15 ACCESS CONFIGURATION

The equipment offer users several means of access: operating console, access via http server (web) and telnet.

Local users predefined in the system are always present but an external resources can be used to validate users for different types of access, for which reason the user database is a centralised and independent resource with respect to the equipment itself. For this purpose the equipment has a TACACS+ client.

TACACS+ (Terminal Access Controller Access Control System) is a remote authentication protocol used to manage access to servers and communication devices; it provides separate authentication, authorisation and registration services.

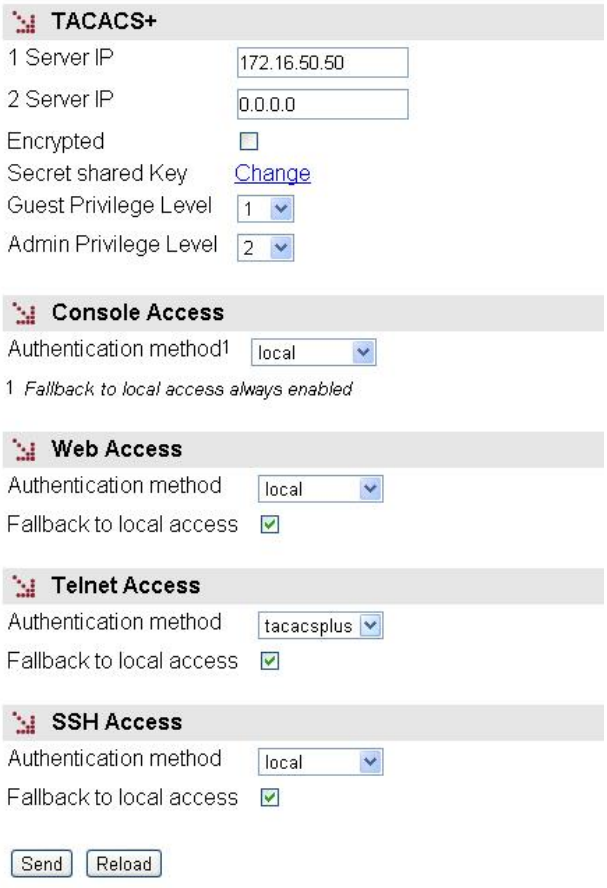
The general configuration parameters are the following:

- **Server IP 1.** This establishes the IP address of the primary TACACS+ server.
- **Server IP 2.** This establishes the IP address of the secondary TACACS+ server.
- **Encrypted.** This permits user to select whether the equipment communication with the TACACS+ servers must be made in the ciphered mode or not.
- **Secret Shared Key.** This establishes the code to be used for ciphering the communication when the **encrypted** option is active.
- **Guest Privilege Level.** This establishes the privilege level (0 to 15) of the guest profile (***guest***). This level must be the same that the one established in the TACACS+ server.
- **Admin Privilege Level.** This establishes the privilege level (0 to 15) of the administrator profile (***admin***). This level must be the same that the one established in the TACACS+ server.

The parameters associated with each access option (**console**, **web access, telnet** and **SSH**) are the following:

- **Authentication method.** This establishes whether the user validation must be made locally or by consulting the configured tacacsplus servers.
- **Fallback to local access.** When this option is enabled, if there is no accessibility to the configured TACACS+ servers, users are permitted to validate themselves with local user names. If the option is disabled, and the TACACS+ servers are not accessible, users will not be granted access. Access through the console has this option permanently enabled, for which reason it is not configurable.

FIGURE 41 ***Access*** menu configuration page



5.16 DATA FLOW CONFIGURATION

The ***Flow*** menu basically permits the virtual ports (TCP/UDP) configuration parameters to be established, as well as to define the connections and/or flows between any of the available interfaces. See section 1.2 for more general information about the port interconnection.

> The **UDP** protocol is a **connectionless protocol**. The data is transmitted as independent blocks (packets).
>
> The **TCP** protocol is a **connection-oriented protocol**; thus, a prior establishment phase is necessary, and with it the data is transmitted as a continuous character flow.

5.16.1 Encapsulation protocols

Each one of the ports should be configured for operation with a specific protocol, either to operate in **transparent mode** (***raw*** and ***packed***), with one of the **telecontrol protocols being hold** or with a **policy** defined by the user.

Some protocols have multiple identifiers, which not only indicate the protocol itself, but also the **size of the link address**, when the standard requires it as a user option.

The protocols without multiple identifiers are the following:

- **pid1, dlms, gestel, sap20, twc, dnp3, procome** and **iec103.**

The protocols with multiple identifiers and values related to them are listed below:

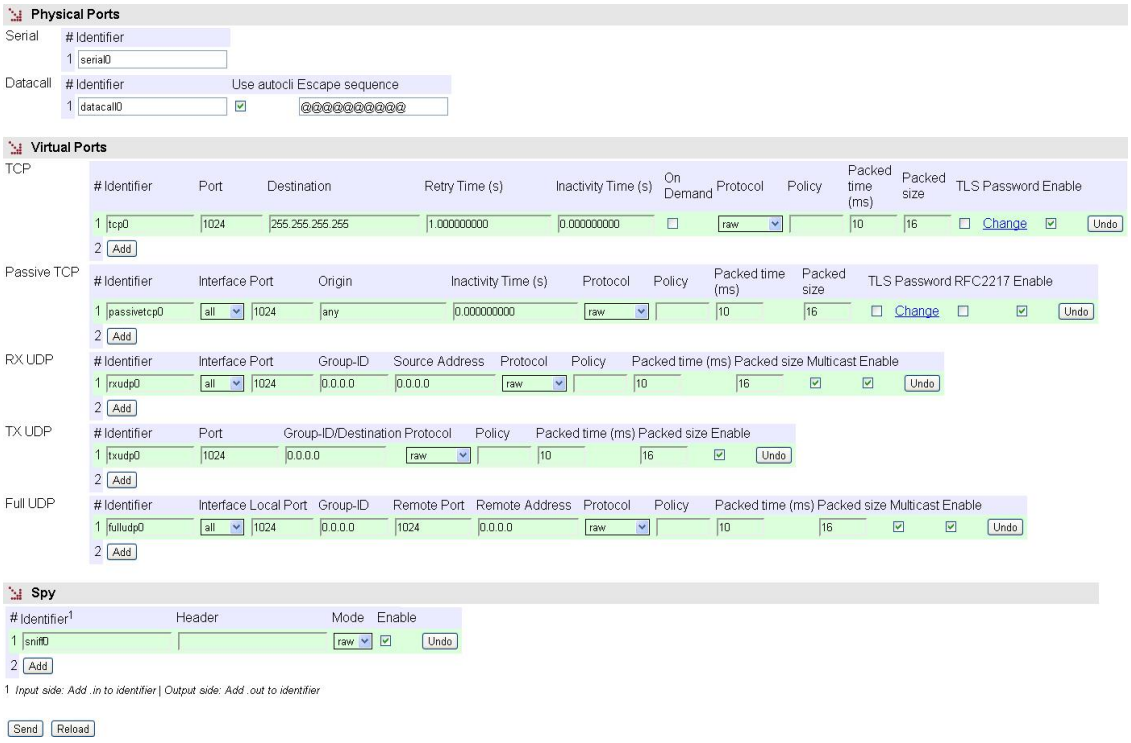
- **iec101_1**. IEC 60870-5 101, with FT1.2 frame and a link address size of **1** byte.
- **iec101**. IEC 60870-5 101, with FT1.2 frame and a link address size of **2** byte.
- **iec102_1**. IEC 60870-5 102, with FT1.2 frame and a link address size of **1** byte.
- **iec102**. IEC 60870-5 102, with FT1.2 frame and a link address size of **2** byte.
- **modbusrtu**. Modbus protocol in RTU mode for operation in the encapsulator connected to the remote equipment.
- **modbusrtu_cc**. Modbus protocol in RTU mode for operation in the encapsulator connected to the controlling equipment (control center).

Although always present in the configuration registers, the following parameters are only useful when the ***packed*** protocol is selected.

- **Packed time (ms).** It establishes the maximum waiting time after receiving the last character, in ms, before sending a packet with the data received so far. It forces sending the data for inactivity time when not reaching the data established as desired packet size (see following parameter).

- **Packed size.** It establishes the maximum number of characters to be transmitted in a packet on the network.

FIGURE 42 ***Flow*** configuration page



The configuration screen related to the ***Flow*** menu has three well differentiated sections, which are described below. The first one, ***Physical Ports***, permits the serial port identification to be established and, if the equipment is configured with the optional WAN interface, to configure a serial-datacall (GSM) connection. The second one, ***Virtual Ports***, permits the configuration of the virtual ports (TCP/UDP) to be defined. The third one, ***Spy***, permits the configuration of a spy port to be defined.

> The operation of the datacall will depend on the services permitted by the operator, especially in 3G and 4G networks.

Physical Ports:

- **Serial #.** It identifies the equipment physical port number. Port 1 for port COM1.
- **Identifier.** It establishes a different and unequivocal name for the serial port configured in the *Serial* menu. The port has the name *serial0* configured by default. The parameters to configure a serial-datacall (GSM) connection appear if the SIP-2 is equipped with the WAN interface.
- **Datacall #.** It is a sequence identifier provided by the equipment itself.
- **Identifier.** It establishes the identifier related to the GSM datacall; *datacall0* is the value by default.
- **Use autocli.** Upon receiving a data call, the equipment connects the call to the **cli** management service if this option is activated (ticked box); thus, it is equivalent to a remote access to the service console. If the option is NOT activated (unchecked box), the data call will be redirected to the physical port configured by the user in the *Connection* block (see section 5.16.2).
- **Escape sequence.** If the data call does not have direct access to the management service, but to a determined port (autocli parameter NOT activated), it is still possible to access the **cli** management service by inserting the escape chain defined in this parameter. If the **cli** management service is accessed through the escape sequence, it is necessary to end the call and establish it again in order to recover the initial data flow.

Virtual Ports:

- **TCP (connections in active mode):**
  #. It is a sequence identifier provided by the equipment itself.
  Identifier. It establishes a different and unequivocal name for each one the active TCP virtual ports. When being added, all the connections have the name *tcp0* configured by default; therefore, it is essential to change said identifier for each one of the new connections.
  Port. It establishes the destination TCP port.
  Destination. It establishes the destination IP address.
  Retry Time (s). If the connection fails, it establishes the waiting time in seconds before retrying the connection.
  Inactivity Time (s). It establishes the inactivity time in seconds that will imply the voluntary and controlled shutdown of the connection. By default, this parameter is set to 0, which means that the connection is permanent regardless of its activity.

On Demand. It indicates if the connection should try to be established permanently (*inactive* parameter), or just when necessary if there is data (*active* parameter).

Protocol. It establishes the protocol of the data to be encapsulated; the possible values are indicated at the beginning of section 5.16.1. Usually the virtual ports operate in *raw* mode; the corresponding physical port is configured with the desired protocol.

Policy. This field should be configured when the ***policybased*** mode has been established in the *Protocol* parameter. It establishes an identifier, whose policy should be configured in the *Policy* submenu of the *Flow* menu.

Packed time (ms). See description at the beginning of section 5.16.1.

Packed size. See description at the beginning of section 5.16.1.

TLS. It establishes if the TCP connection will use ciphered communications through Transport Layer Secure (TLS).

Password. Related to the use of TLS, it establishes the common basic password.

Enable. It establishes if the TCP connection is active or not. The TCP connection is enabled if the box is ticked. By unchecking the box, the TCP connection is disabled, and it will not be retried.

- **Passive TCP (connections in passive mode).**

  #. It is a sequence identifier provided by the equipment itself.

  Identifier. It establishes a different and unequivocal name for each one of the TCP virtual ports (TCP connections), which will be awaiting connection requests from other equipment. When being added, all the connections have the name *passivetcp0* configured by default; therefore, it is essential to change said identifier for each one of the new connections.

  Interface. It establishes the possible interfaces the requests will be accepted on; therefore, it restricts the possible input points of the connection requests. The possible values are the following: all, eth0, or cell0, if the equipment has the WAN interface.

  Port. It establishes the TCP port where the connection requests will be awaited.

  Origin. It establishes the source IP address range from which the connection requests will be accepted. It acts as filter of the authorized source equipment. The address may be a host or network address; therefore, it is necessary to specify the IP network mask.

  Inactivity Time (s). It establishes the inactivity time in seconds that will imply the voluntary and controlled shutdown of the connection. By default, this parameter is set to 0, which means that the connection is permanent regardless of its activity.

Protocol. It establishes the protocol of the data to be encapsulated; the possible values are indicated at the beginning of section 5.16.1. Usually the virtual ports operate in *raw* mode; the corresponding physical port is configured with the desired protocol.

Policy. This field should be configured when the ***policybased*** mode has been established in the *Protocol* parameter. It establishes an identifier, whose policy should be configured in the *Policy* submenu of the *Flow* menu.

Packed time (ms). See description at the beginning of section 5.16.1.

Packed size. See description at the beginning of section 5.16.1.

TLS. It establishes if the TCP connection will use ciphered communications through Transport Layer Secure (TLS).

Password. Related to the use of TLS, it establishes the common basic password.

- **RFC2217.** It establishes if the TCP connection should operate with the serial interface control extensions established in the RFC2217, or not.

  Enable. It establishes if the TCP connection is active or not. The acceptance of TCP connection requests is enabled, if the box is ticked. When unchecking the box, the TCP connection requests will be rejected.

- **RX UDP (UDP ports that will accept data).**

  #. It is a sequence identifier provided by the equipment itself.

  Identifier. It establishes a different and unequivocal name for each one of the UDP virtual ports where the data packets will be accepted. When added, all the ports have the name *rxudp0* configured by default and, therefore, it is essential to assign a specific name to each of them.

  Interface. It establishes the possible interfaces the data will be accepted on; therefore, it restricts the possible input points of the packets. The possible values are the following: all, eth0 or cell0, if the equipment has the WAN interface.

  Port. It establishes the UDP port to be used to receive packets.

  Group-ID. *Multicast* IP address that will accept data in reception, as long as the parameter value is a valid address, and the *multicast* option is active. The *0.0.0.0* default value is not a valid IP address.

  Source Address. It establishes the source IP address range from which the connection requests will be accepted. It acts as filter of the authorized source equipment. The address may be a host or network address; therefore, it is necessary to specify the IP network mask.

Protocol. It establishes the protocol of the data to be encapsulated; the possible values are indicated at the beginning of section 5.16.1. Usually the virtual ports operate in *raw* mode; the corresponding physical port is configured with the desired protocol.

Policy. This field should be configured when the ***policybased*** mode has been established in the *Protocol* parameter. It establishes an identifier, whose policy should be configured in the *Policy* submenu of the *Flow* menu.

Packed time (ms). See description at the beginning of section 5.16.1.

Packed size. See description at the beginning of section 5.16.1.

Multicast. It establishes if the data with the *multicast* address established on Group-ID will be accepted. When the option is not active, the IP address for reception is the equipment own *unicast* IP address.

Enable. It establishes if the RX UDP port is active or not. With the box ticked, the RX UDP port is enabled, and will accept input packets. Unchecking the box, the RX UDP port will not accept data.

- **TX UDP (UDP ports where data will be transmitted).**

  #. It is a sequence identifier provided by the equipment itself.

  Identifier. It establishes a different and unequivocal name for each one of the UDP virtual ports where the data packets will be transmitted. When added, all the ports have the name *txudp0* configured by default and, therefore, it is essential to assign a specific name to each of them.

  Port. It establishes the destination UDP port.

  Group-ID/Destination. *Unicast* or *multicast* IP address to be used for data transmission. The *0.0.0.0* default value is not a valid IP address.

  Protocol. It establishes the protocol of the data to be encapsulated; the possible values are indicated at the beginning of section 5.16.1. Usually the virtual ports operate in *raw* mode; the corresponding physical port is configured with the desired protocol.

  Policy. This field should be configured when the ***policybased*** mode has been established in the *Protocol* parameter. It establishes an identifier, whose policy should be configured in the *Policy* submenu of the *Flow* menu.

  Packed time (ms). See description at the beginning of section 5.16.1.

  Packed size. See description at the beginning of section 5.16.1.

  Enable. It establishes if the TX UDP port is active or not. With the box ticked, the TX UDP virtual port may be used for packet transmission.

- **Full UDP.**

  #. It is a sequence identifier provided by the equipment itself.

  Identifier. It establishes a different and unequivocal name for each one the bidirectional UDP virtual ports. When added, all the ports have the name *fulludp0* configured by default and, therefore, it is essential to assign a specific name to each of them.

  Interface. It establishes the possible interfaces the data will be accepted on; therefore, it restricts the possible input points of the packets. The possible values are the following: *all*, eth0 or cell0, if the equipment has the WAN interface.

  Local Port. It establishes the UDP port to be used to receive packets.

  Group-ID. *Multicast* IP address that will accept data in reception, as long as the parameter value is a valid address, and the *multicast* option is active. The *0.0.0.0* default value is not a valid IP address.

  Remote Port. It establishes the destination UDP port.

  Remote Address. Unicast or multicast IP address to be used for data transmission. The *0.0.0.0* default value is not a valid IP address.

  Protocol. It establishes the protocol of the data to be encapsulated; the possible values are indicated at the beginning of section 5.16.1. Usually the virtual ports operate in *raw* mode; the corresponding physical port is configured with the desired protocol.

  Policy. This field should be configured when the ***policybased*** mode has been established in the *Protocol* parameter. It establishes an identifier, whose policy should be configured in the *Policy* submenu of the *Flow* menu.

  Packed time (ms). See description at the beginning of section 5.16.1.

  Packed size. See description at the beginning of section 5.16.1.

  Multicast. It establishes if the data with the *multicast* address established on Group-ID will be accepted. When the option is not active, the IP address for reception is the equipment own *unicast* IP address.

  Enable. It establishes if the Full UDP port is active or not. With the ticked box, the Full UDP virtual port is enabled, and accepts packets in reception, as well as their transmission.

Spy:

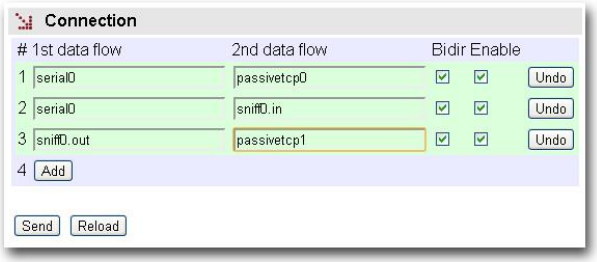
- **#.** It is a sequence identifier provided by the equipment itself.
- **Identifier.** It establishes a different and unequivocal name for each one the spy ports. When added, all the ports have the name sniff0 configured by default and, therefore, it is essential to assign a specific name to each of them.
- **Header.** It establishes the text appearing before each one of the messages provided by this instance in order to facilitate their origin if there are multiple spies.
- **Mode.** It establishes the representation format of the data available in the spy connection. The acceptable values are raw (original data format), or hex (hexadecimal representation).

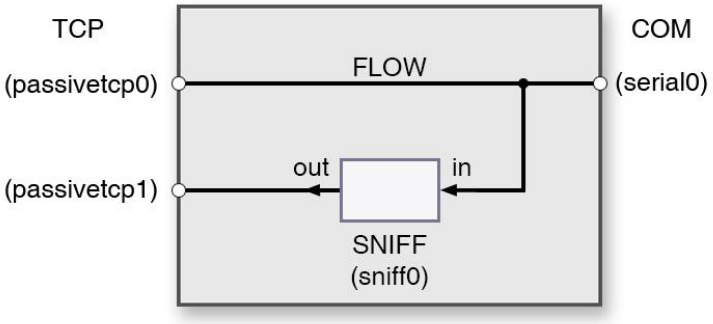
Enable. It establishes if the spy port is active or not. The spy port is enabled if the box is ticked.

Example:

The figure shows an example of a spy port definition to check the connection between a ***serial0*** port and a ***passivetcp0*** port. In addition to defining the spy port (***sniff0***), it will be necessary to define a port (***passivetcp1***) that will provide the information we are spying on.

FIGURE 43 Spy port configuration example



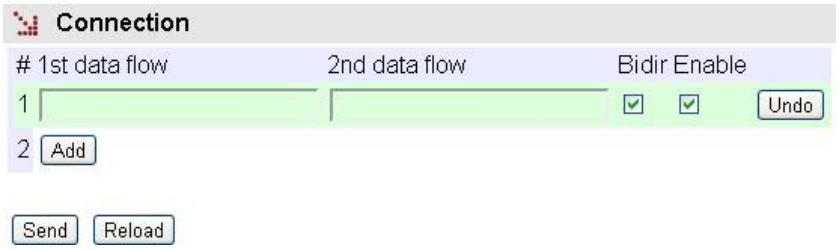


5.16.2 Connection

The ***Connection*** submenu of the ***Flow*** menu permits defining the connections determined by the physical and/or virtual ports, where the user traffic will be exchanged.

See section 1.2 for more general information about the port interconnection.

FIGURE 44 ***Connection*** configuration page of the ***Flow*** menu



The configuration parameters are the following:

- **#.** It is a sequence identifier provided by the equipment itself.
- **1st data flow.** It determines the **first port** included in this connection through its identifier.
- **2nd data flow.** It determines the **second port** included in this connection through its identifier.

> It is essential to introduce the identifier name correctly in the two previous fields, so that it is one of those established in the *Physical ports* and *Virtual ports* sections of the *Flow* menu configuration screen. In order to avoid possible errors, it is advisable to use the commands *Ctrl.+C* (copy) and *Ctrl.+V* (paste) instead of the keyboard.

- **Bidir.** It determines if the connection operates both ways, that is, if it is ***bidirectional***.

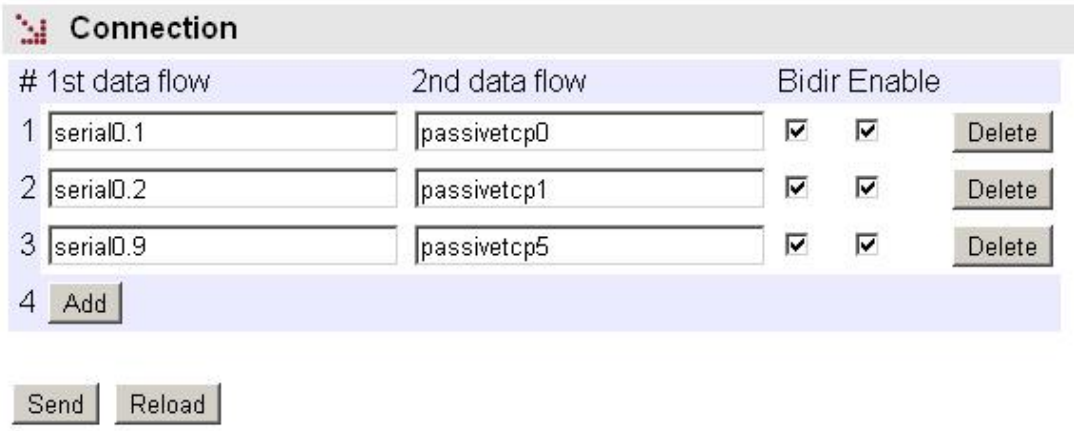
  In the case of ***unidirectional*** connections, the traffic flow is just from the port with the identifier specified on *1st data flow* towards the port with the identifier specified on *2nd data flow*.

- **Enable.** It establishes that the connection is active. The connection, or flow, is enabled if the box is ticked.

As can be seen in FIGURE 45, the identifiers permit a **numeric suffix**, apart from the identifier configured in previous sections, which is interpreted as the protocol message flow whose link address coincides with the established value; that is, for some of the encapsulation protocols, the equipment is capable of extracting specific conversations so that they may be demultiplexed towards differentiated destinations.

The size of the link address is specified when selecting the encapsulation protocol, or when the encapsulation policy is defined (in this last case, only for iec101/102).

FIGURE 45 Example of including a numeric suffix



5.16.3 Policy

The ***Policy*** submenu of the ***Flow*** menu permits the creation of variants of some protocols, which enhances the encapsulator functions (see bibliography [4]).

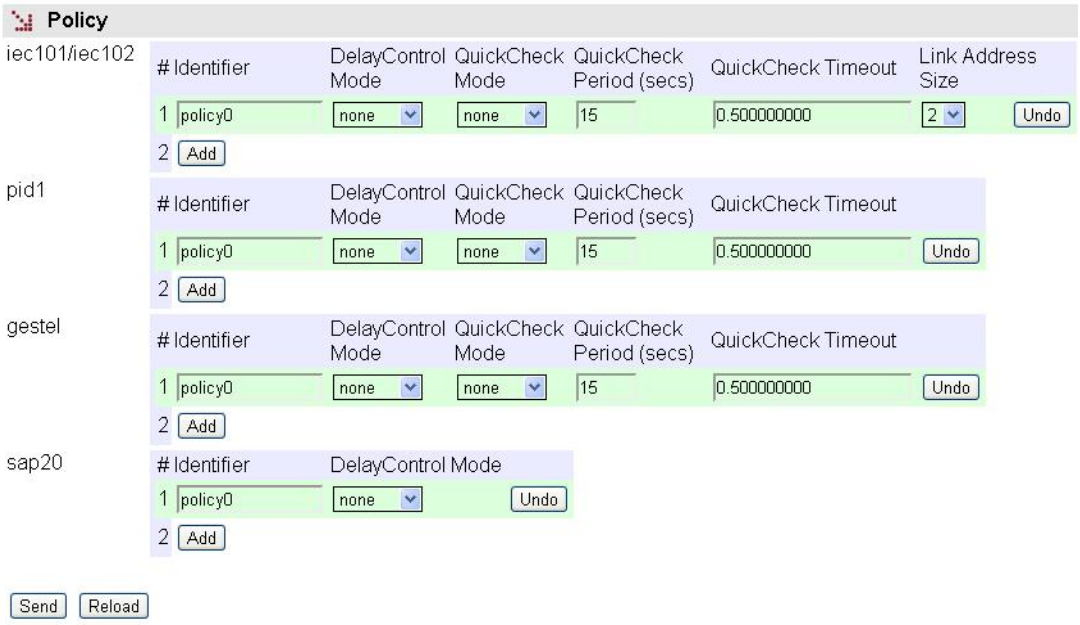
The protocols that admit said variants are the following: iec101/iec102, pid1, gestel and sap20.

The additional functions implemented are designed for the use of the non-balanced mode protocols so as to minimize the traffic between the encapsulation equipment at the same time.

When the remote equipment is in non-balanced mode, it can only send information to the controlling equipment as a response to explicit requests (*polling* mechanism). So, in order to have response time to possible events that occurred and were detected by the remote entities, the control center should transmit cyclic inquiry messages and with a sufficiently high cadence. Therefore, these messages transit the TCP/IP network. The cyclical messages that are part of the *polling* are called **Quick Check (QC)**.

The enhanced functions imply that the cyclic inquiry of the *polling* mechanism will be created and sent by the encapsulation equipment connected directly to the remote equipment. Only when the remote responds to the **QC messages** will the encapsulation equipment from the remote side send them to the encapsulation equipment from the controlling side to be delivered to the control center. Thus, the control center is released of the cyclic inquiry mission and, in turn, the use of the related wideband is avoided.

FIGURE 46 ***Policy*** configuration page of the ***Flow*** menu



The **Quick Check** function is regulated with the following parameters:

- **#.** It is a sequence identifier provided by the equipment itself.
- **Identifier**. It establishes a different and unequivocal name for each one the policies. When added, all the policies have the name *policy0* configured by default and, therefore, it is essential to assign a specific name to each of them.
- **Delay Control Mode**. The ***none*** option means that the Quick Check enhanced time control functions will not be executed. Any other option enables it and, in turn, determines if the equipment is connected to the control center (***system***), or to the remote equipment (***rtu***).
- **Quick Check Mode**. The ***none*** option means that the Quick Check enhanced functions will not be executed. Any other option enables the Quick Check option and, in turn, determines if the equipment is connected to the control center (***system***), or to the remote equipment (***rtu***).

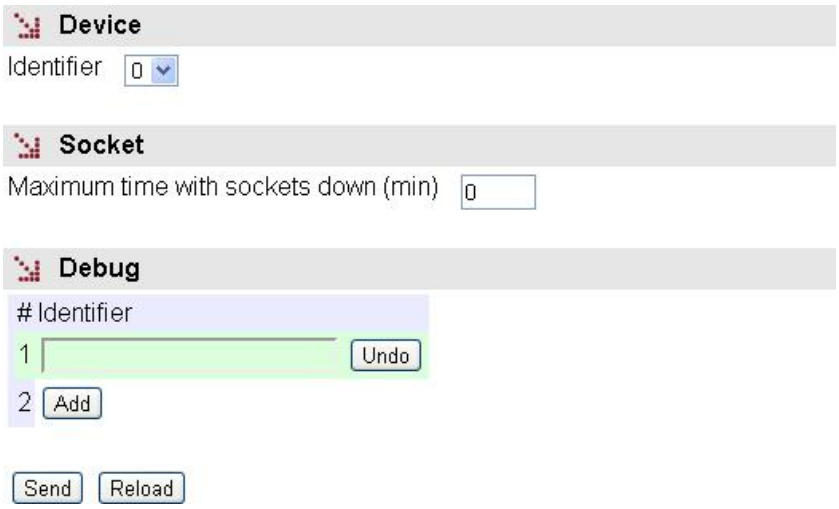
- **Quick Check Period (secs)**. It establishes the period of time for the local generation of the QC messages to the remote equipment.
- **Quick Check Timeout**. It establishes the maximum waiting time for a response from the remote equipment to the transmission of a QC message by the encapsulator.
- **Link Address Size. Only for the iec101/102 policies**. It establishes the size of the link address used in this profile, since these protocols admit two options as regards the size.

5.16.4 Other

The ***Other*** submenu of the ***Flow*** menu permits the activation of some additional facilities, mainly focused towards the obtainment of information to facilitate the resolution of possible configuration errors or events.

The screen related to the ***Other*** submenu has three well differentiated sections, which are described below.

FIGURE 47 ***Other*** configuration page of the ***Flow*** menu



Device:

- **Identifier.** This parameter specifies the identity of the related Control Center when using **Quick Check** policies. It only applies to the equipment working with the system profile, that is, the equipment the Control Center is connected to.

Socket:

- **Maximum time with sockets down (min).** It sets the maximum time acceptable, in minutes, during which there is no connection between the equipment executing **Quick Checks.**

Debug:

- **#.** It is a sequence identifier provided by the equipment itself.
- **Identifier.** It establishes the physical or virtual port identifier desired to generate additional information on the log files.

5.16.5 Transparent

The ***Transparent*** submenu of the ***Flow*** menu allows a transparent connection to be set up.

The configuration parameters are:

- **Passive Port.** Sets the passive TCP port on which the equipment accepts a connection to be relayed to another equipment in a transparent way.
- **Active IP.** Sets the IP address of the destination equipment to which the information of the passive TCP connection will be retransmitted.
- **Active Port.** Sets the TCP port used to set up the TCP connection to the destination equipment.
- **Description.** This permits a description of up to 15 alphanumerical characters to be specified.

5.17 CONFIGURATION OF THE SERIAL PORT AS *ModemEmulator*

The ***ModemEmulator*** menu implies that the equipment is presented as a HAYES modem to the client equipment; thus, the connections are established automatically based on the parameters provided by the client equipment, through the dialling commands.

The HAYES emulation offers the following behaviours according to the received command:

ATDT. It launches a TCP connection whose addressee and port results from the number included in the command itself. The number accepts two interpretations:

- **Direct number,** which corresponds to the IP address and the desired destination port. It is a 17-digit number: 12 correspond to the IP address, and 5 to the destination port. The IP address, as well as the port, should clearly include the digits whose value is null. That is, the destination with the *IP address* **10.89.1.123** and the port **348** would suppose that the command to be sent would be **ATDT 010 089 001 123 00348** (there are intentional blank spaces in the example chain to show the presentation mode, but there should not be included in the actual command).

- To consult the configured **Dialling Table**. The table permits the translation of a clearly arbitrary numbering plan to IP address and ports.

ATD*. The serial port acts as a PPP server, requesting the credentials (user and password) from the client equipment, and providing an IP address to it. The indicated parameters are established in the registers included in the Modem Emulator table.

ATD. It launches a GSM datacall to the destination number included in the command itself.

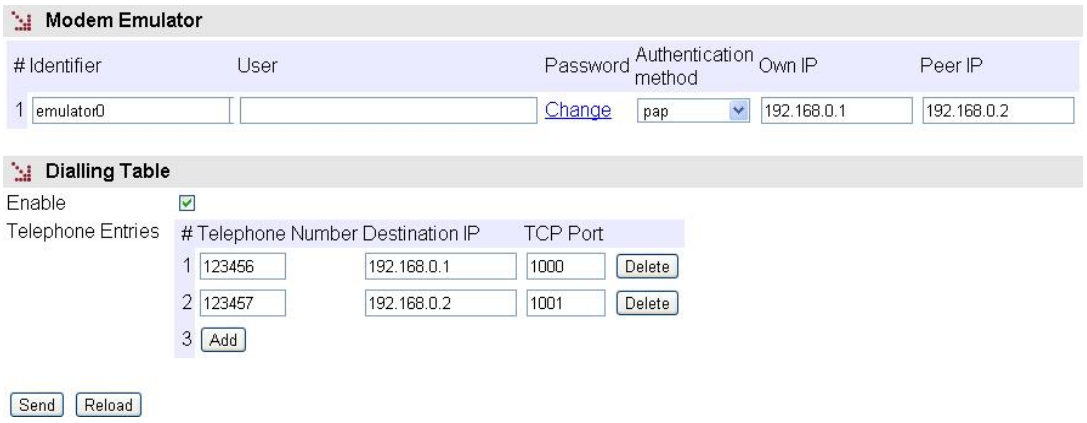
The following are other commands accepted by the device in emulation mode related to the management of calls:

ATA: It accepts a GSM datacall.

ATH: It implies the end of a call in progress.

In addition, as regards the behaviour management as MODEM, the equipment has the S2 register; it admits the configuration of the ECHO (E) parameters, management of the DCD (&C) signal and management of the DTR (&D) signal, and it supports the following standard commands: ***ATA***, ***ATO***, ***ATI***, ***AT&F***, ***AT&W*** and ***AT&V***.

FIGURE 48 ***ModemEmulator*** configuration page



The screen related to the ***ModemEmulator*** menu has two well differentiated sections, which are described below.

Modem Emulator:

- **#.** It is a correspondence identifier with the physical port (serial port) related to the emulation function, to which the configuration register corresponds.
- **Identifier.** It establishes a different and unequivocal name for each one of the configurations. All of them have the name *emulator0* configured by default and, therefore, it is essential to assign a specific name to each of them.
- **User.** It establishes the admissible user when the equipment acts as a PPP server.
- **Password**. It establishes the password related to the PPP user from the previous field.
- **Authentication method**. It establishes the standard protocol used for the exchange of credentials with the external equipment; the values are ***none*** (without authentication), ***pap*** (Password Authentication Protocol) and ***chap*** (Challenge Handshake Authentication Protocol).
- **Own IP**. The IP address related to the equipment serial interface when acting as a PPP server.
- **Peer IP**. The IP address to be provided to the client equipment.

Dialling Table:

- **Enable.** It establishes if the table should be used for the translation of the numbering plan of the calls made with the ATDT command, or not.
- **#.** It is a sequence identifier provided by the equipment itself.
- **Telephone Number.** The number of the numbering plan related to the register.
- **Destination IP.** The destination IP address for the number specified in the previous parameter.
- **TCP Port.** The destination TCP port for the number specified in the telephone number parameter.

5.18 REBOOT

The equipment can be rebooted by executing the ***Reboot*** command, through the console or through the HTML pages. The command is available only for the administrator profile.

5.19 CODE REFLASH

The equipment admits the updating of applicative software by executing the ***Reflash*** command, which is only available in the HTML pages and for the administrator profile.

> The code reflash process does not alter the configuration data, unless this is expressly indicated. Nevertheless, once terminated, it entails a momentary loss of service due to the automatic rebooting of the equipment.

A binary images that is appropriate for the equipment is necessary, which can be selected by pressing the button *Examine*.

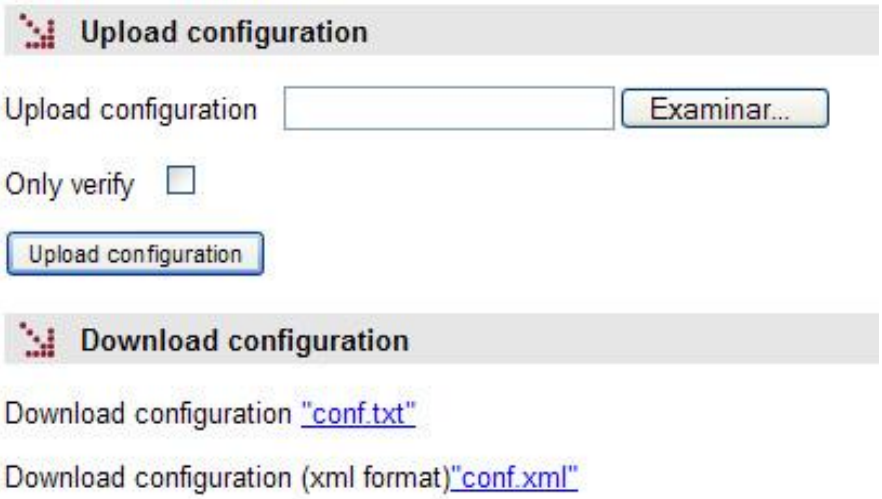
After having selected the image, the update is executed by pressing ***Reflash***. The process usually takes about 5 minutes, during which time the results of the different steps are displayed in the HTML browser window, but depending on the browser, it is possible that only the result at the end of the process is shown.

The ***Only verify*** option allows users to check that the code saved is coincident with the binary image selected without affecting the installed image.

5.20 CONFIGURATION FILE

The equipment configuration can be retrieved (***Download***) or uploaded (***Upload***) by means of a text or XML file.

FIGURE 49 Options for uploading (***Upload***) or downloading (***Download***) the configuration file



5.20.1 Upload (from the computer to the equipment)

The user must select the file containing the configuration to be uploaded by pressing the button *Examine*.

In order to only verify the configuration without upload it, the ***Only verify*** box must be ticked.

Once the equipment has received the file, the system checks the file contents and verifies that the variables are valid and that the values assigned to them comply with the existing syntactic requirements. If errors are detected in the received file, irrespective of whether the ***Only verify*** option is selected or not, the system automatically rejects all the information received and indicates the error situation to the user.

If the received configuration is valid, it is indicated by the system to the user, and it is then possible to continue (*Continue* button). When continue is selected, the configuration is activated and stored.

> When applying the new configuration, the system issues a warning due to the possible loss of equipment access.

If the ***Only verify*** option has been selected, and verification has been successful, it is indicated by the system to the user. If desired, the configuration can be applied by means of the *Apply* and *Save* commands or both.

5.20.2 Download (from the equipment to the computer)

With this option the user obtains a local copy of the operating configuration in .**txt** format or .**xml** format.

The procedure for downloading this file depends on both the http browser and the actions to perform with the received file (for example, where to store it).

6 STATISTICS

The system provides statistics divided into eight blocks, each of them corresponding to a specific functionality.

The first block shows general information related to the equipment, and is displayed automatically when the statistics object is selected.

The remaining statistics are grouped into data belonging to the *ModemEmulator* function, the Ethernet (*LAN)* interface, WAN interface, the *Routing* rules, DHCP server, synchronization client (*NTP*), and port interconnection (*Flow*), each of which can be accessed by selecting the respective tag located under the heading *Statistics*.

Each statistical data table can be updated by pressing the *Reload* button without having to select the respective option again in the tree menu.

The statistics can be **REBOOTED** by the user at will, from the console by executing the ***clear*** command in the prompt, or using the menu option ***Clear Statistics***.

FIGURE 50 Example of statistics related to general data

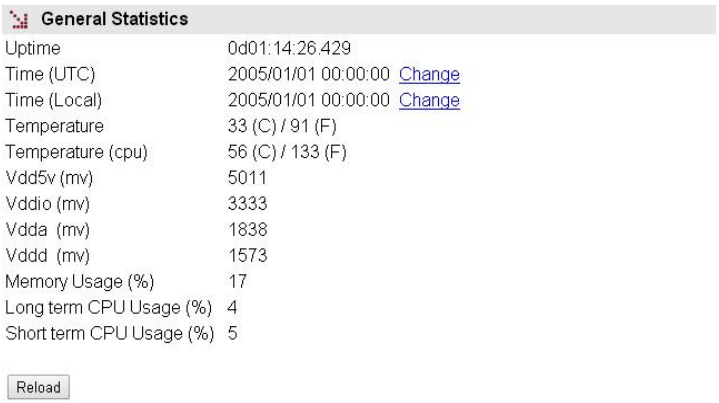


FIGURE 51 Example of statistics related to *ModemEmulator* function

Modem Emulator

#	Num TCP	Num PPP	Num Datacalls	State	In Octets	Out Octets
1	0	0	0		0	0

Reload

FIGURE 52 Example of statistics related to LAN

General Data

#	Status	IP Address	Status Date	TX Bytes	RX Bytes
1	Active	0.0.0.0	Thu Sep 15 14:37:49 UTC 2011	2520784	53776901

Reload

FIGURE 53 Example of statistics related to WAN

General Data

IMEI	351501050661695
IMSI	
CID	8934566511000010938
PIN Status	READY
Active SIM	SIM B
Operator	"vodafone ES"
Roaming	H-PLMN
Network	HSDPA-HSUPA
Local Area Code	69B5
Cell Identifier	0E20BE5
Signal Strength	-
RSCP	-59 dBm
EC/n0	-6.50 dB
Total TX KBytes	0
Total RX KBytes	0
Number of Session failures	6
SIMA Tx Bytes	0
SIMA Rx Bytes	0
SIMB Tx Bytes	700
SIMB Rx Bytes	364

Current Data Session

Status	Active
IP Address	10.10.14.4
Connection Date	Thu Jan 1 06:15:57 UTC 1970
TX Bytes	100
RX Bytes	52
TX Rate (bps)	0
RX Rate (bps)	0

Previous Data Session

Disconnection Date	Thu Jan 1 06:14:51 UTC 1970
Up Time (s)	619
TX Bytes	0
RX Bytes	0

Reload

FIGURE 54 Example of statistics related to Routing

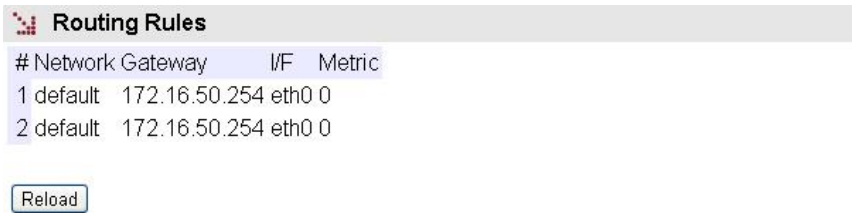


FIGURE 55 Example of statistics related to DHCP Server

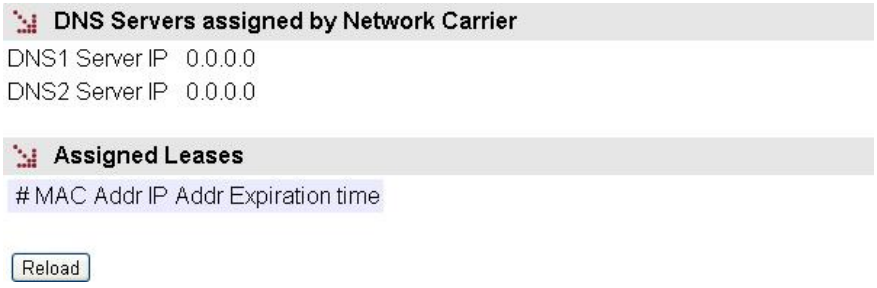


FIGURE 56 Example of statistics related to NTP

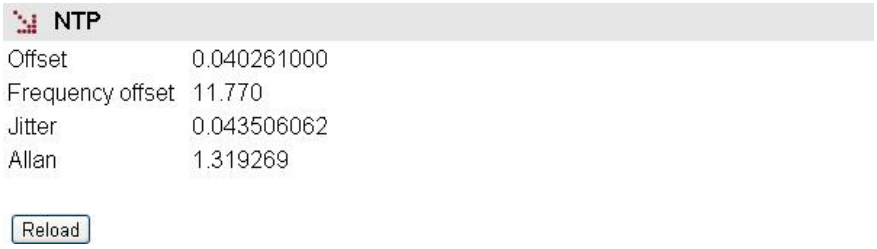
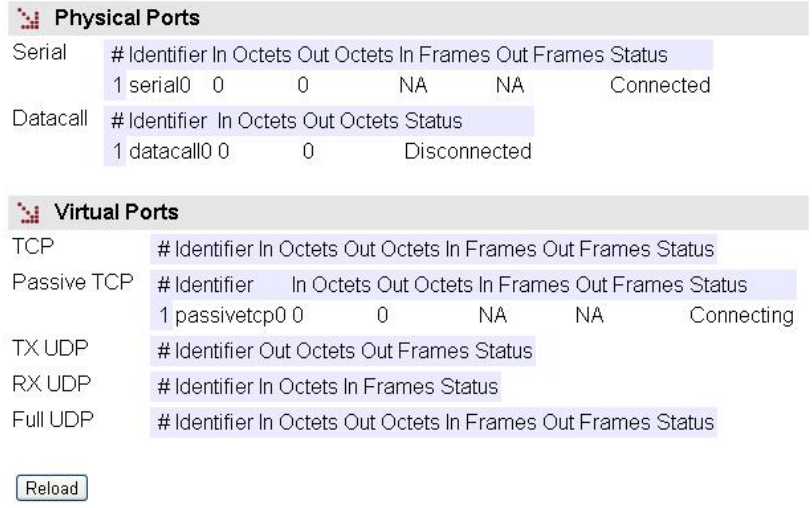


FIGURE 57 Example of statistics related to the port interconnection (*Flow*)



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APPENDIX A

BIBLIOGRAPHY AND ABBREVIATIONS

APPENDIX A

BIBLIOGRAPHY AND ABBREVIATIONS

A.1 BIBLIOGRAPHY

[1] STD 15. IEEE RFC 1157. May 1990. A Simple Network Management Protocol (SNMP).
[2] STD 62. IEEE RFC 3416. December 2002. Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP) (Obsoletes RFC 1905).
[3] IEEE RFC 1305, March 1992. Network Time Protocol (Version 3) Specification, Implementation and Analysis.
[4] Development specification of the terminals used for the creation of a point-multipoint channel via GPRS_Rev.06 (14/4/2008) of IBD reference GPF070302CVG.

A.2 ABBREVIATIONS

ADSL	Asymmetric Digital Subscriber Line
AES	Advanced Encryption Standard
API	Application Programming Interface
APN	Access Point Name
ASDU	Application Service Data Units
BPDU	Bridge Protocol Data Units
DHCP	Dynamic Host Configuration Protocol
DMVPN	Dynamic Multipoint Virtual Private Network
DNS	Domain Name Server
DPD	Dead Peer Detection
DSCP	Differentiated Services Code Point
GPRS	General Packet Radio Service
GRE	Generic Routing Encapsulation
HTTP	HyperText Transfer Protocol
ICMP	Internet Control Message Protocol
IGMP	Internet Group Management Protocol
IKE	Internet Key Exchange
IOA	Information Object Address
IP	Internet Protocol
IP Multicast	Extension of the Internet Protocol for providing support to multidiffusion communications
IPBX	Internet Protocol Private Branch Exchange
IPS	Intrusion Prevention System
IPSec	IP Security

ISDN	Integrated Services Data Network
ISP	Internet Service Provider
ITSP	Internet Telephony Service Provider
LAN	Local Area Network
NAT	Network Address Translation
NHRP	Next Hop Resolution Protocol
NTP	Network Time Protocol
PPP	Point-to-Point Protocol
PPTP	Point-to-Point Tunneling Protocol
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RADIUS	Remote Authentication Dial-In User Server
RAS	Registration, Authentication and Status
RSVP	Reservation Protocol
RTCP	Real Time Control Protocol
RTP	Real Time Protocol
SIM	Subscriber Identity Module
SMTP	Simple Mail Transfer Protocol
STP	Spanning Tree Protocol
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UMTS	Universal Mobile Telecommunications System
URL	Uniform Resource Locator

VLAN	Virtual Local Area Network
VPN	Virtual Private Network
VRID	Virtual Router Identifier
VRRP	Virtual Router Redundancy Protocol
WAN	Wide Area Network
WEP	Wired Equivalent Privacy
WINS	Windows Internet Naming Service
WPA	Wi-Fi Protected Access Client Support

APPENDIX B

DATA STRUCTURE IN *CLI*

APPENDIX B

DATA STRUCTURE IN *CLI*

This appendix contains all the information required to use the CLI user console. It explains the access methods, commands available on the console and gives a step-by-step example of how to obtain information on the status and configuration of the equipment.

Conventions:

The equipment configuration parameters are laid out in a tree directory, in which parameters and related subdirectories are grouped, where:

- A name followed by "***/***" indicates the name of a directory. *E.g.****Main/***
- A name followed by "***[]/***" indicates a parameter with a matrix structure, as it contains several attributes. *E.g.* ***nat[]/***
- A name with nothing after it is a parameter in itself. *E.g.* ***Action***

The system makes a distinction between upper and lower case characters.

To browse through the directories the ***cd* (*change directory*)** command is used.

The data stored in table form, identified by the inclusion in the variable name of the symbol [], have specific commands for adding and removing rows, which are ***add*** and ***remove*** respectively. To query or establish the value of the data in one row, the row identifier must be included between square brackets in the ***get*** or ***set*** command.

Changes made with the ***set*** command are not operative merely because they have been executed. Effective, immediate use of the changes made is achieved by executing the ***Apply*** command. On the contrary, the ***Save*** commands entails storing the changes made permanently, without requiring their immediate use, but applied in the case of an initialisation.

In this way, the changes are implemented as an operating procedure through the ***Apply*** command, and after checking that the behaviour is correct, it is saved using the ***Save*** command. Consequently in the case of obtaining undesirable results, it is always possible to eliminate the ***Save*** command and reboot the equipment to recover the previous status, even in the case that the changed activated lead to the user not being able to obtain access.

Users and their passwords are, by default, the same as in the web interface, that is to say:

	Login	Password
Guest profile	guest	passwd01
Admin. profile	admin	passwd02

B.1 ACCESS METHODS

There are two ways of accessing the equipment through the CLI user console:

- in the local mode, through the COM 0 serial port (service port).
- in the remote mode, through Telnet.

Local mode access

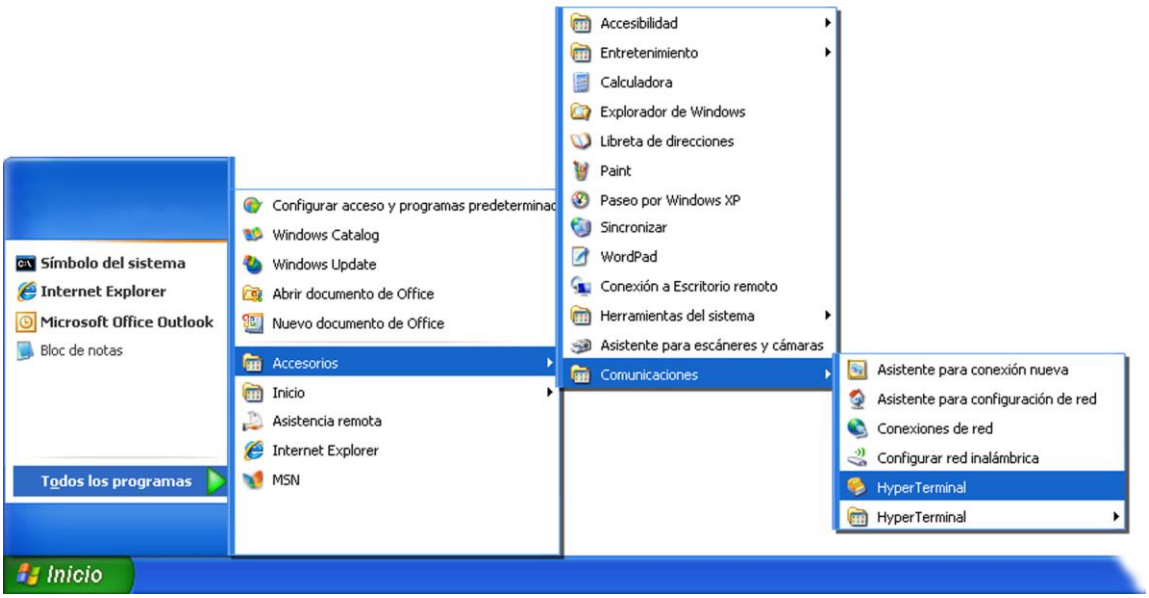
Local mode access is obtained through a cable that connects the serial port of the computer (or alternatively a USB to serial converter) to the COM 0 serial port of the equipment (service port).

Communication between the computer and the equipment is established through a terminal emulation programme, such as Windows® *HyperTerminal*, configuring a serial connection with the following characteristics:

- Speed: 115.200 bps
- Data bits: 8
- Parity: No
- Stop bits: 1
- Flow control: No

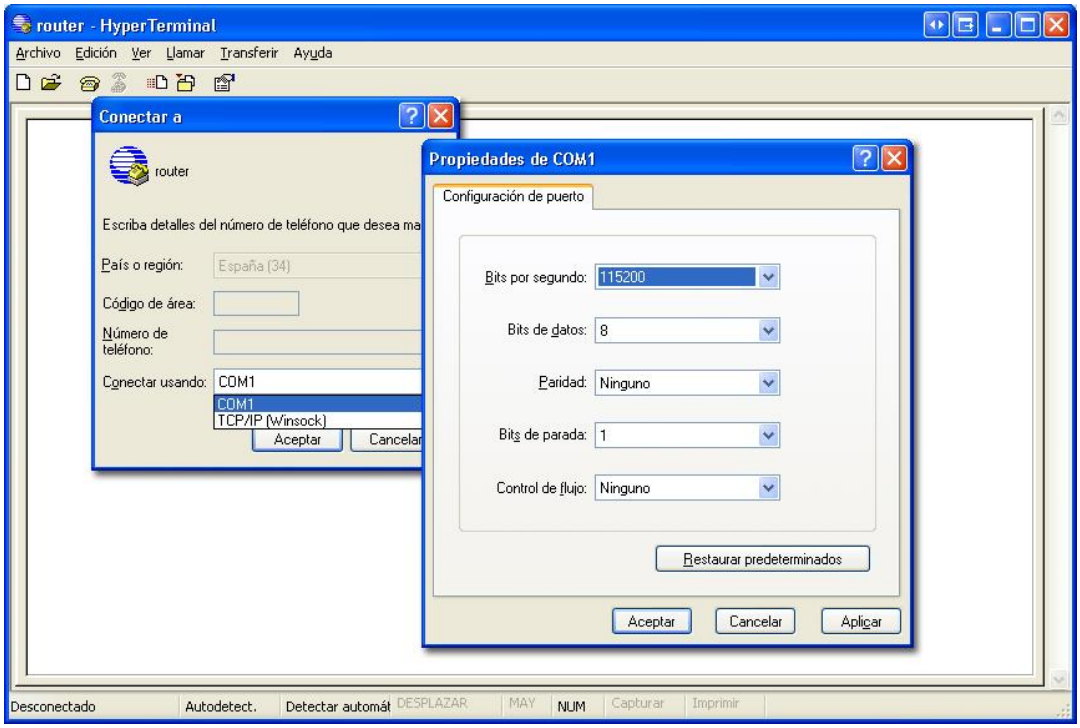
In Windows XP© execute *HyperTerminal* from *Start* → *All Programmes* → *Accessories* → *Communications* → *HyperTerminal* (see FIGURE 58).

FIGURE 58 Location of *HyperTerminal* in Windows XP©



On opening HyperTerminal a text box appears, requesting the necessary information to establish the connection (see FIGURE 59).

FIGURE 59 Connection configuration through the serial port with *HyperTerminal*



Run the *Call* option of the *Call* menu (or press, under the main menu options, the icon of the phone hanged).

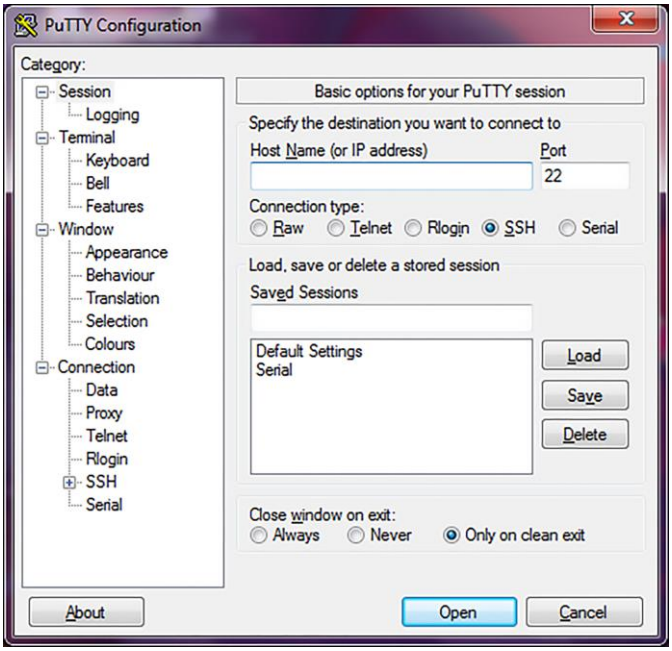
After the appearance of the starting frames, press the return key. When at the prompt is displayed the ***sip login*** text, enter the user name and press return. When at the prompt is displayed the ***sip password*** text, enter the password and press return (the user name and password are the same as in the web interface).

Remember that no text will appear in the *HyperTerminal* window when entering the password.

As operating systems like Microsoft Windows 7© no longer include the *HyperTerminal* program, the *Putty* program, free and executable, is also considered.

The *Putty* program is accessible on the www.putty.org web. Simply select the *Putty* that suits the operating system in use (usually the first, called **putty.exe**), copy it in the computer and run it.

FIGURE 60 *Putty* home window



In the ***Serial*** menu (last of all) the serial port is configured.

> ! Telnet access is carried out by configuring the port 23.
>
> SSH access is carried out by configuring the port 22.

If an USB converter is used, first, consult the COM number in the *Device administrator* (Control panel).

FIGURE 61 *Device administrator* window

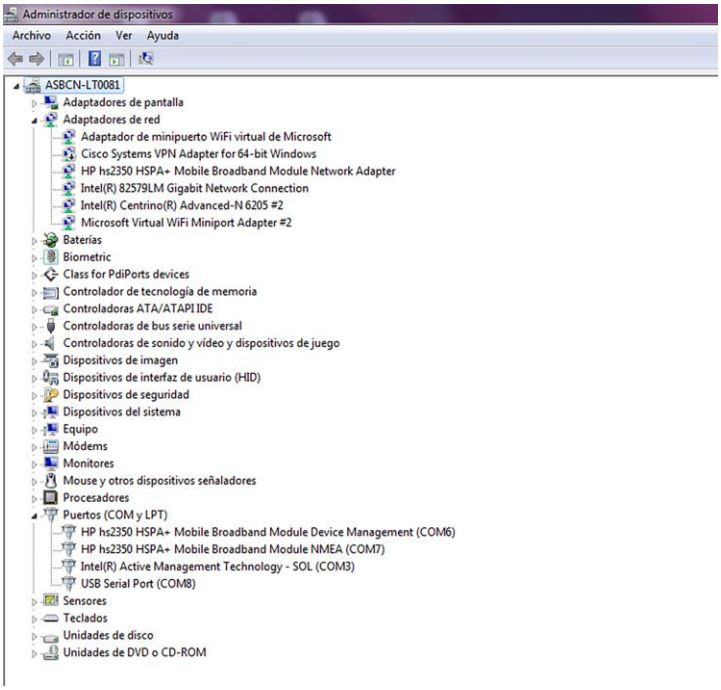
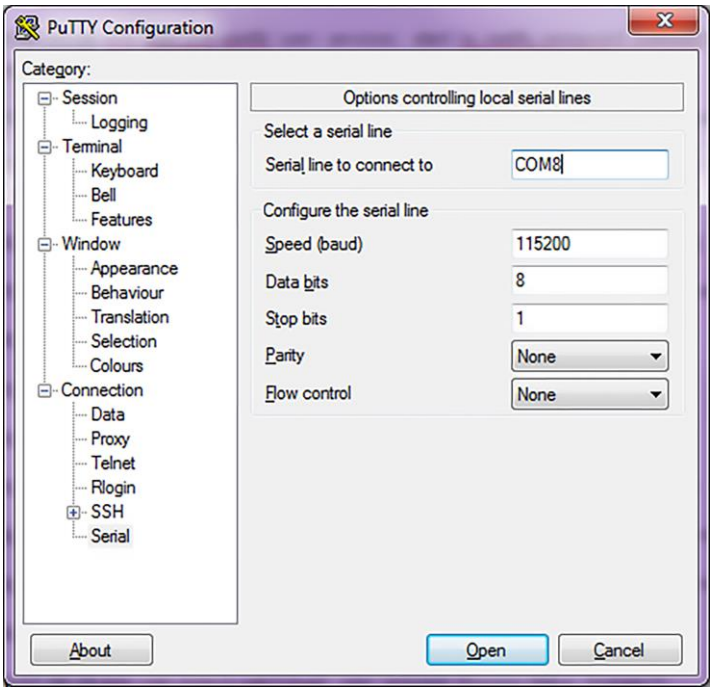


FIGURE 62 Connection configuration through the serial port with *Putty*



Pressing the *Open* button, and return if necessary, a window is shown in which the ***sip login:*** prompt will appear, ready for the user to enter the *login* and *password* for starting the session (the user name and password are the same as in the web interface).

Remember that no text will appear in the *Putty* window when entering the password.

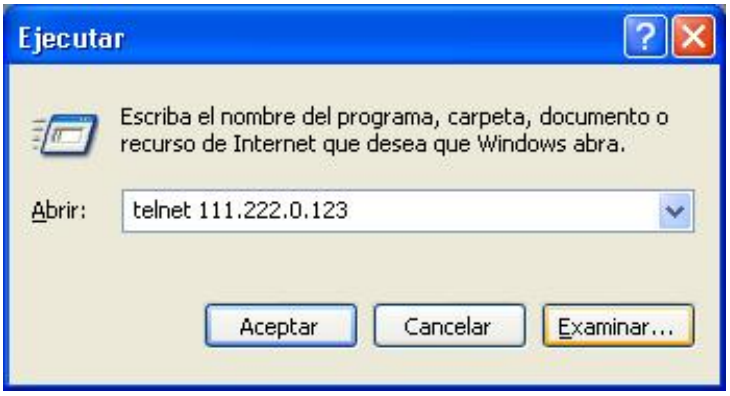
Remote mode access

Remote mode access is obtained with the *Telnet* command and equipment IP address.

! To use this access mode the equipment must have its IP address configured and be connected to the management computer network.

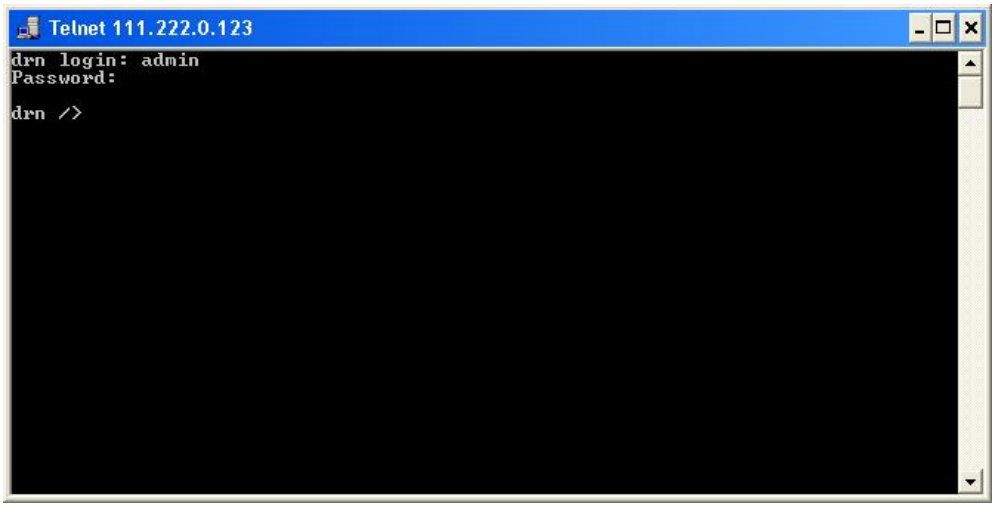
Telnet can be executed in Windows XP© from the Start button: *Start* → *Execute*, and in the text box, enter: telnet + space + Equipment_IP_address (111.222.0.123 in the example), and then press *Accept* (see FIGURE 63).

FIGURE 63 *Execute.. Telnet* text window to establish connection with the equipment



On pressing the Accept button a System symbol window will appear with the Telnet programme connected to the equipment (see FIGURE 64).

FIGURE 64 *Telnet* window



HyperTerminal can be used as the *Telnet* graphic interface. To do this, when configuring the connection select ***TCP/IP (Winsock)*** in the *Connect using* drop down menu.

Telnet can also be run from the *Putty* program. Simply, type the IP address of the equipment in the main window, and press *Open*.

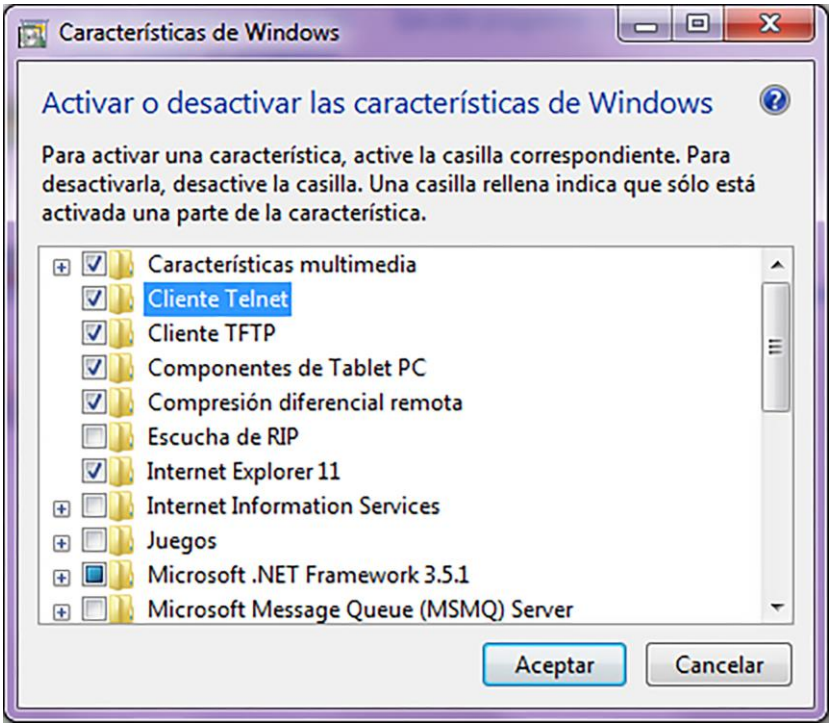
Whatever the method chosen to establish connection with the equipment, the ***sip login:*** prompt will appear, ready for the user to enter the *login* and *password* for starting the session (the user name and password are the same as in the web interface).

In operating systems like Microsoft Windows 7©, the Telnet client is disabled by default.

To enable it, from the Start button: *Start* → *Control panel* → *All Programmes*, in *Programs and characteristics*, select *Activate or deactivate the Windows characteristics.*

Then, in the window of *Characteristics of Windows*, select *Telnet client*, see FIGURE 65. By pressing *Accept*, the Telnet client of Windows may be used.

FIGURE 65 Window of characteristics of Windows



B.2 USER CONSOLE COMMANDS

After starting the session with a valid login and password, the prompt will change to ***equipment />*** waiting for the user to enter a command.

The commands are instructions sent to the equipment to request or change a value or to "browse" through the tree in which the equipment parameters are organised.

The following table shows a full list of available commands with a brief description of each one and their availability depending on the type of user starting the session, highlighting the most useful ones:

TABLE 3 Full list of CLI user console commands

Command	Description	User	
		admin	guest
add	Adds a new item to a matrix-type parameter	✓	✗
apply	Applies the new configuration	✓	✗
cd	Changes the directory in the parameters tree	✓	✓
clear	Deletes the statistics	✓	✗
date	Shows the date stored in the equipment	✓	✗
download	Generates a configuration commands file	✓	✓
Exit	Interrupts the connection with the equipment	✓	✓
get	Shows the parameter values	✓	✓
help	Shows the list of available commands	✓	✓
Log / **Log all**	Shows the list of events	✓	✓
ls	Shows the lists of available parameters in the current directory	✓	✓
ping	Sends a ping to the indicated host	✓	✓
quit	Interrupts the connection with the equipment		
reboot	Reboots the equipment	✓	✗
reload	Loads a previously-saved configuration	✓	✗
remove	Eliminates an item from a matrix-type parameter	✓	✗
restore	Loads a default configuration	✓	✗
Save	Saves all the changes made during the session	✓	✗
Set	Modifies the value of a parameter	✓	✗
stats	Shows the equipment status	✓	✓
telnet	Open a telnet session without interrupting the connection with the equipment	✓	✓

Depending on the function of each command, they can be classified into different groups:

TABLE 4 Classification of commands based on their functions

Configuration	Control	Diagnostic
add	cd	clear
apply	exit	date
download	quit	help
get	reboot	log
remove	reload	ls
restore	telnet	ping
save		stats
set		

Information in the log

The events that are generated at the system level and sent to the log include an identification level.

The system supports 8 different levels, separated into two blocks. The first set corresponds to unwanted situations, and the second block on information without affecting the functionality.

In the first block, the values are **emerg**, **alert**, **crit**, **err** and **warning**, which represents a decreasing level of severity in terms of the detected situation.

In the information block, the values are **notice**, **info** and **debug**, without having any connotation whatsoever for impact.

Configuration commands

add Adds a new item to the matrix of a matrix-type parameter.

Syntax: drn /> **add** *name*

Arguments:

name Parameter to which a new item is to be added.

Observations: To add a new item to a matrix-type parameter, it is necessary to be in the directory in which it is located or enter the relative route.
The new item created has the next order number with respect to the last one. For instance, if *nat[1]* and *nat[2]* already existed, on executing the command add nat the item ***nat[3]*** is created.

Examples:
drn /> **add nat**
drn /wan> **add tunnel/tunnel**
drn /admin> **add ../nat**

apply This applies the configuration changes in the equipment, but without saving them.

Syntax: drn /> **apply**

Arguments: -

Observations: This command can be used irrespective of the directory where the user is.
This command DOES NOT save the changes made.

Example: drn /> **apply**

download This show the necessary commands for configuring equipment with the same parameters as the current one.

Syntax: drn /> **download**

Arguments: -

Observations: This command can be used irrespective of the directory where the user is.
The list of commands shown starts with the command *restore*, which applies the factory configuration, followed by the commands required to obtain the current configuration.
It is a good idea to copy and save this list of commands in a .txt file, so it can be used in other equipment with the same characteristics.

To apply the saved configuration in different equipment, it must be of the same model and version, and above all, have the same firmware version installed, since the factory configuration used to generate the commands list may be different in each one.

Example: drn /> **downdload**

get This show the current values of one or several equipment configuration parameters.

Syntax: drn /> **get** [name]

Arguments: -

name (optional) name of the parameter to be shown.

Observations: The command *get* with no argument shows the values of all the configuration parameters in the current directory and its subdirectories. If the argument is the name of a directory it shows the values of the parameters in that directory. If the argument is the name of a configuration

parameter it shows the value of that parameter.
To show the complete configuration of the equipment, this command must be executed with no arguments, from the root directory.
If an argument is used, it must be in the current directory or the relative route must be entered.

Examples:
drn /> **get**
drn /> **get main**
drn /main> **get hostname**
drn /> **get main/hostname**
drn /admin> **get ../main/hostname**

remove This eliminates an item from the matrix of a matrix-type parameter.

Syntax: drn /> **remove** *name[nº]*

Arguments:

name Parameter from which the item is to be removed.

nº (Optional) Order number of the parameter item

Observations: To remove an item from the matrix of a matrix-type parameter, it is necessary to be in the respective directory or enter the relative route.
If the order number of the item to be removed is indicated, that item will be removed. If the number is not indicated, the last one will be removed.
When removing an item that is not the last one, the other remaining items will be automatically renumbered.

Examples:
drn /> **remove nat[2]**
drn /> **remove nat**
drn /admin> **remove ../nat**

restore This applies the factory configuration.

Syntax: drn /> **restore**

Arguments: -

Observations: This command can be used irrespective of the directory where the user is.

Example: drn /> **restore**

save This saves the changes made in configuring the equipment in its permanent memory. However, these changes will not take effect until the equipment is rebooted.

Syntax: drn /> **save**

Arguments: -

Observations: This command can be used irrespective of the directory where the user is.

Example: drn /> **save**

set This changes the value stored in the configuration parameters or in the attributes of an item in a matrix-type parameter.

Syntax: drn /> **set** [name][[nº][/name2]]

Arguments: -

name	name of the parameter to be changed.
nº	item number of a matrix-type parameter
name2	name of an attribute in a matrix-type parameter

Observations: When this command is executed the system waits for the new value to be entered.

The parameter to be changed must be in the current directory or its relative route must be entered.

In the case of wanting to change the value of any attribute in the item of a matrix-type parameter, the argument must include the parameter name, the item number and the attribute number.

Special attention should be paid when entering the arguments of this command, as if no argument is indicated the system will request the new value of each of the parameters in the active directory and its subdirectories, one by one. Consequently, if the *set* command is executed without an argument in the root directory, the system will request a new value for all the equipment configuration parameters.

If the *set* command is applied to a matrix-type parameter without indicating the attribute to be modified, the system will request a new value for each attribute of the indicated item. If the item number is omitted, the new values entered for each attribute will be applied to the last item in the matrix.

Examples:

drn /main> **set hostname**
drn /> **set main/hostname**
drn /admin> **set ../main/hostname**
drn /> **set nat[2]/origin**

Control commands

cd Changes the active directory.

Syntax: drn /> **cd** *name*

Arguments:

name Name of the destination directory.

Observations: The destination directory must be in the current directory or its relative route must be entered.
To activate the directory on the level immediately above it, two dots must be entered: ***cd ..***
When the director is changed the prompt shows the equipment identification letters and the name of the active directory. Example: ***drn /main>***.

Examples: drn /> **cd main**
drn /main> **cd ../admin**

exit This closes the connection between the computer and the equipment, and therefore the CLI programme session.

Syntax: drn /> **exit**

Arguments: -

Observations: -

Example: drn /> **exit**

quit This closes the connection between the computer and the equipment, and therefore the CLI programme session.

Syntax: drn /> **quit**

Arguments: -

Observations: -

Example: drn /> **quit**

reboot This reboots the equipment without having to turn it off and on again, for instance, in order to apply the saved configuration changes.

Syntax: drn /> **reboot**

Arguments: -

Observations: -.

Example: drn /> **reboot**

reload Reloads the saved configuration in the equipment.

Syntax: drn /> **reload**

Arguments: -

Observations: This command may be useful if it is required to reload the configuration saved in the equipment after the time it was saved.

Example: drn /> **reload**

telnet Open a telnet session, keeping the connection established between the computer and the equipment open.

Syntax: drn /> **telnet** *Host[Port]*

Arguments:

Host Name of the destination host to which open a Telnet session.

Port *(optional)* Number of the destination port where to open a Telnet session.

Observations: To restart the session, it is necessary to re-enter the login and password.
The 3 letters identifying the equipment can be used as the host name.

Example: drn /> **telnet drn**
drn /> **telnet 172.16.50.38 23**

Status and Diagnostic Commands

clear Deletes the statistics.

Syntax: drn /> **clear**

Arguments: -

Observations: -

Example: drn /> **clear**

date Shows the date and time recorded in the equipment.

Syntax: drn /> **date**

Arguments: -

Observations: -

Example: drn /> **date**

help Displays a list of all the available commands and a brief description of their functions.

Syntax: drn /> **help**

Arguments: -

Observations: -

Example: drn /> **help**

Log / **Log all** They show the list of events taking place in the equipment. This command is useful for monitoring the equipment and detecting potential errors during operation.

Syntax: drn /> **log** [*all*]

Arguments:

- Without arguments, this command shows the events recorded in the equipment's non-volatile memory.

all (Optional) Shows all the events taking place in the equipment in real time until the user presses a key.

Observations: All the events taking place in the equipment are stored in a memory buffer with sufficient capacity for 100 records and if an important event occurs (starting of sessions, changes in configuration, etc.) this is recorded in the equipment non-volatile memory which also has capacity for 100 records.
Both the buffer and non-volatile memory are of the circular type, i.e., once the memory is full, the oldest event is removed every time a new event occurs.

Operationally two logs are created, which is permanent (**log** command) and having temporal and global (**log all** command).

You can filter at will the temporary log, using the text as a filter after the command. This operation works with any text in the filter, not only with the category (see section ***Information in the log***), so it is possible to filter traces of individual processes or selected events.

Example:
drn /> **log**
drn /> **log all**
drn /> **log crit**
drn /> **log debug**

ls Shows a list from the active directory. This command is useful for verifying whether the configuration parameter to be consulted/changed is in the active directory.

Syntax: drn /> **ls**

Arguments: -

Observations: -

Example: drn /> **ls**

ping This sends ICPM ECHO_REQUEST packets to a specific host.

Syntax: drn /> **ping** *host*

Arguments:

host Host name or destination IP address.

Observations: When this command is executed the equipment starts to send pings to the indicated host until the user presses the ***Ctrl.***+***C*** keys.

Example: drn /> **ping 172.16.50.38**
drn /> **ping emr**

stats This shows the equipment status parameters. These parameters are derived from the use made of the equipment, for instance, Use of the memory of CPU, temperature, bytes transmitted, etc.

Syntax: drn /> **stats** [*parameter*]

Arguments:

parameter (Optional) Name of the parameter whose status is to be consulted.

Observations: Like the configuration parameters, these are classified by categories, in the form of a directories tree. The normal use of this command is without arguments and from the root directory; it shows all the equipment status parameters.

To show a parameter for a specific status or those of a specific directory, the names of each one must be known.

Examples:

drn /> **stats**
drn /> **stats main**
drn main/> **stats temperature**
drn main/> **stats ../lan/eth0/txbytes**

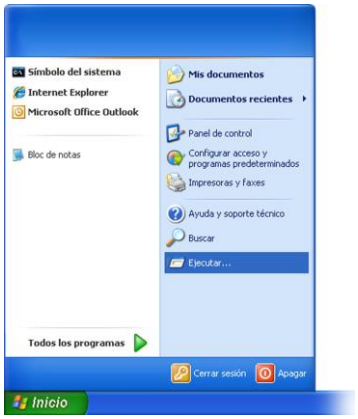
B.3 OBTAINING INFORMATION ABOUT THE STATUS AND CONFIGURATION OF A EQUIPMENT

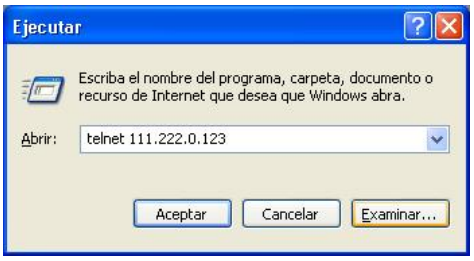
To obtain information about the status and configuration of equipment, proceed as follows::

1- Connection with the equipment

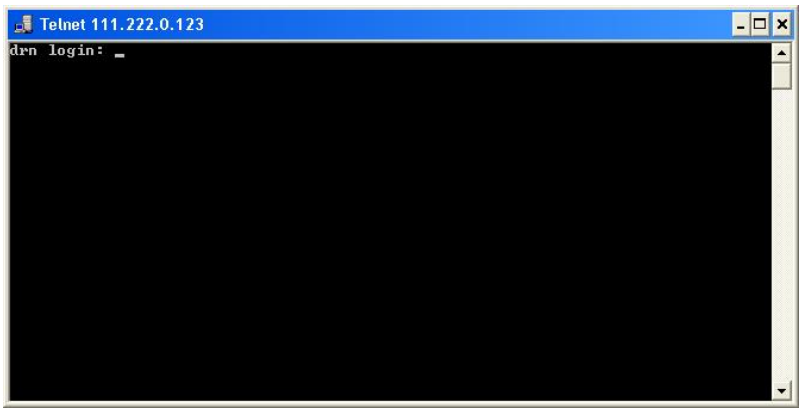
As explained in chapter **B.1**, the equipment connection differs slightly depending on the chosen method. In this example, it is assumed that the equipment is a ***DRA-2***, connected to a network and with an IP address configured, which in the case of this example will be 111.222.0.123. In addition the computer used to make the connection is also connected to that network and the O.S. used is *Windows XP©*.

To establish the connection through ***Telnet***, click on the *Windows XP©* ***Start*** button and once the menu has appeared, click on the command ***Execute***. In the window that appears, enter "***telnet 111.222.0.123***" (without inverted commas) and then press ***Accept.***





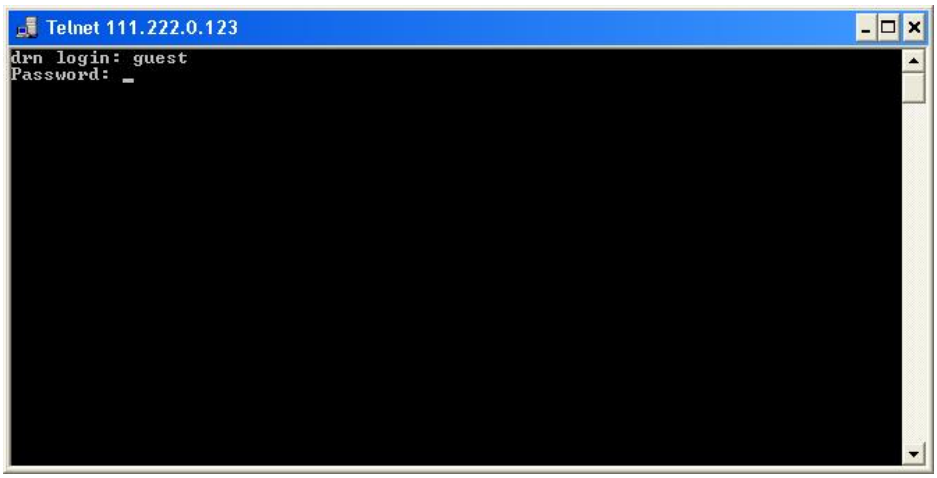
If everything is functioning normally, a window will pop up with a system symbol, which is the interface for the connection.



2- User identification

On establishing connection with the equipment, the prompt ***drn login:*** indicates that the system is waiting for a user name to connect with the ***drn*** equipment.

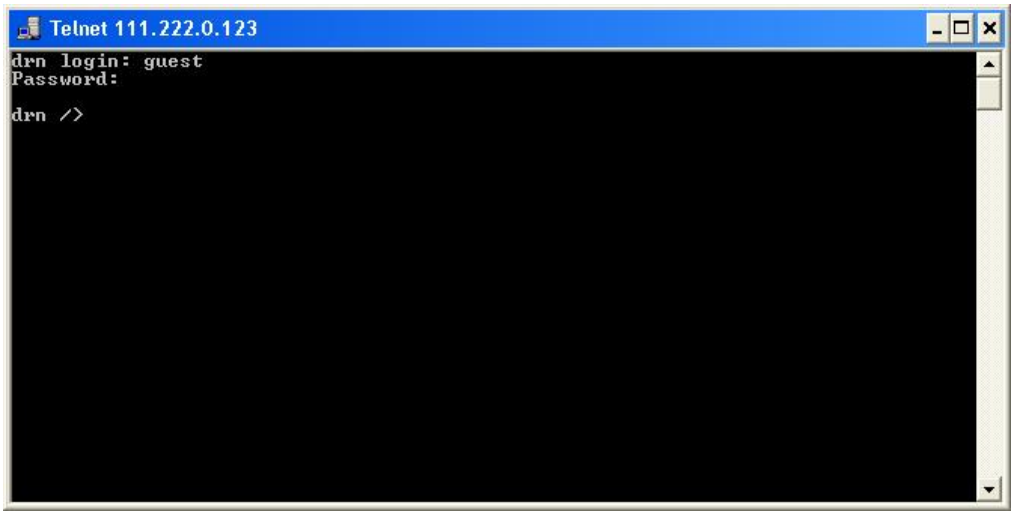
Given that we only want information, it makes no difference which login is entered (***admin*** or ***guest***). Enter ***guest*** and then press ***enter.***



Now the system is waiting for us to enter the respective password. Enter ***passwd01*** which is the one associated with the *guest* user and press ***enter***.

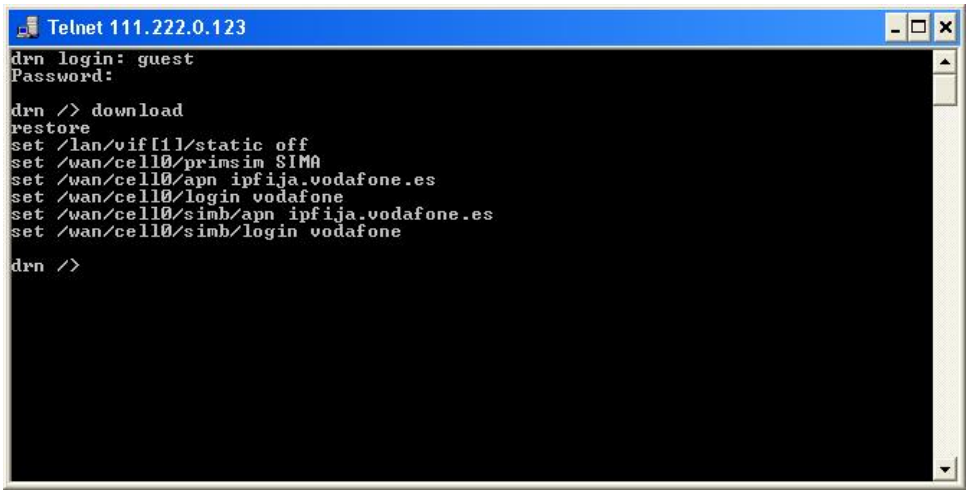
> Remember that no text will appear in the *Telnet* window when entering the password.

If the login and password entered are correct, the prompt ***drn />*** will appear, indicating that the equipment is waiting for a command to be entered.



3- Obtaining the equipment configuration

The equipment configuration is obtained through the command ***download***. On pressing ***enter*** after this command, the full equipment configuration will be displayed.

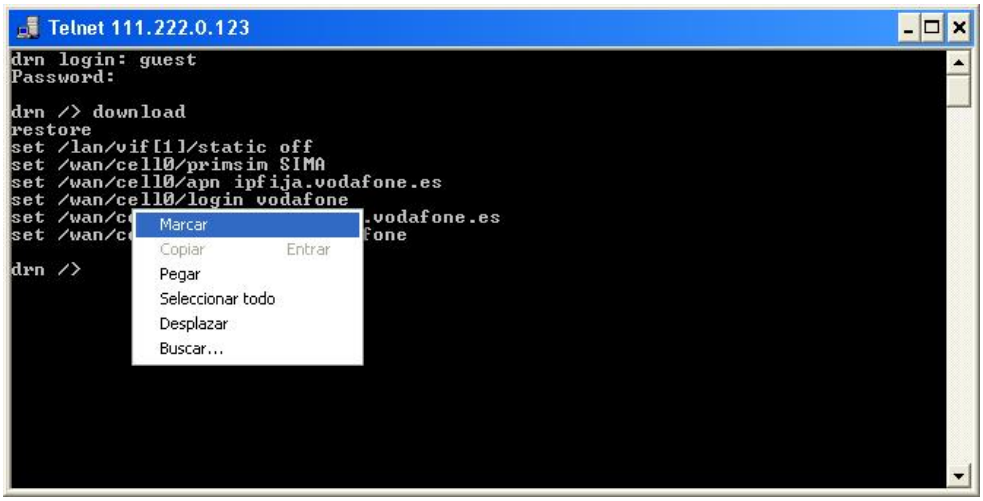


If the information extends beyond the edges of the window, the system will only show the information at the start and it will be necessary to press ***enter*** once or several times for all the information to be shown. You will know whether the system has finished showing all the information when the equipment prompt reappears: ***drn />***.

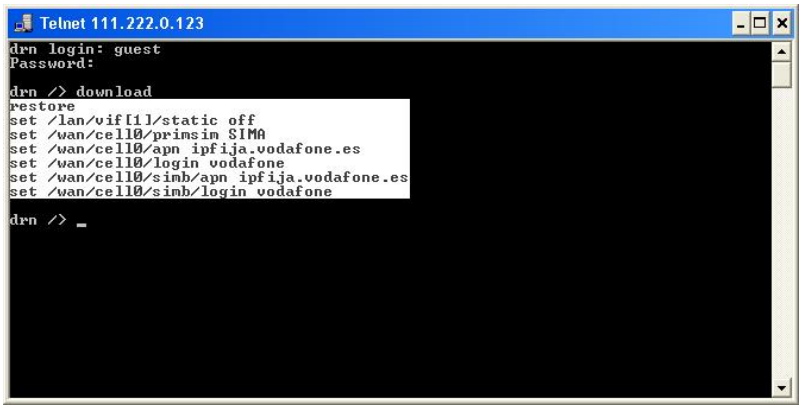
> It is important to save the information in a .txt file using the *download* command so that it can be used whenever necessary.

4- Method for copy text

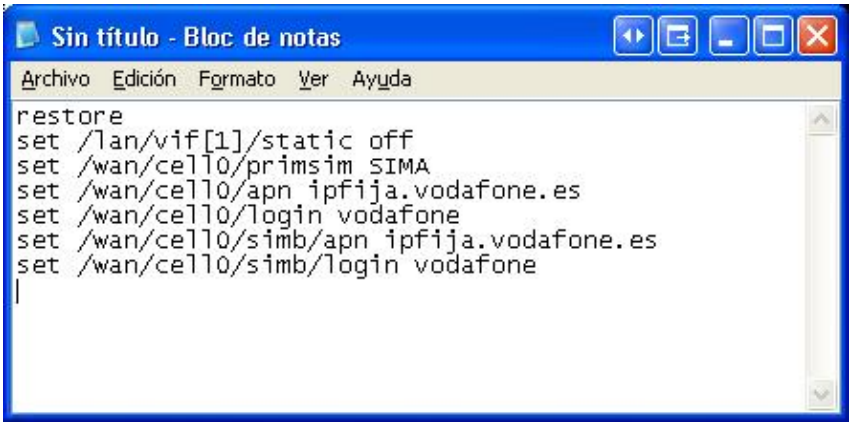
To copy the text from the Windows XP© command window, right-click with the mouse and select ***Mark*** in the menu that appears.



Then place the cursor at the start of the text to be copied, left-click with the mouse and drag the cursor, maintaining the button pressed, until all the text has been selected. After releasing the left button, press the ***enter*** key. That way, you will have copied the selected text into the Windows clipboard.

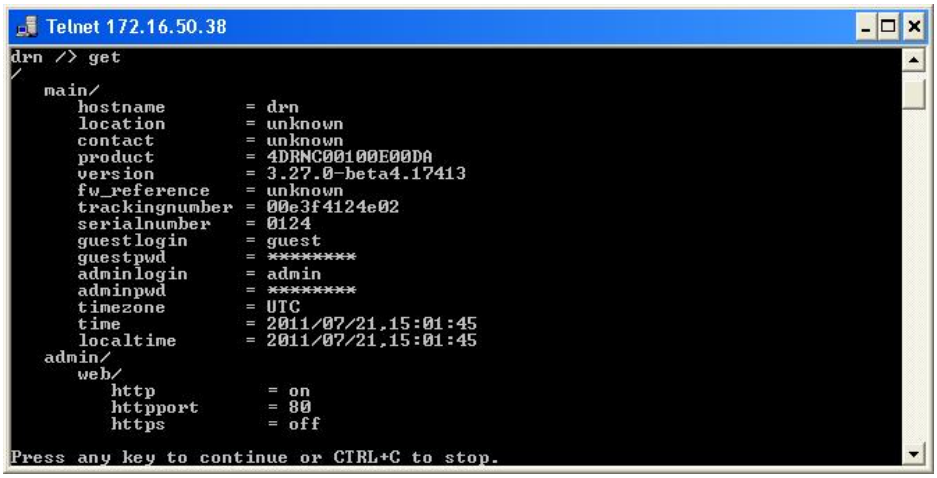


Now open Windows *Notepad* and paste the text (***Ctrl.*** + ***V***) in a *.txt* file and save it.



5- Obtaining the equipment status

The ***get*** command shows the full status of the equipment. Since the information shown is very lengthy, every time a window is filled, it will wait for the user to press a key to continue displaying the information.



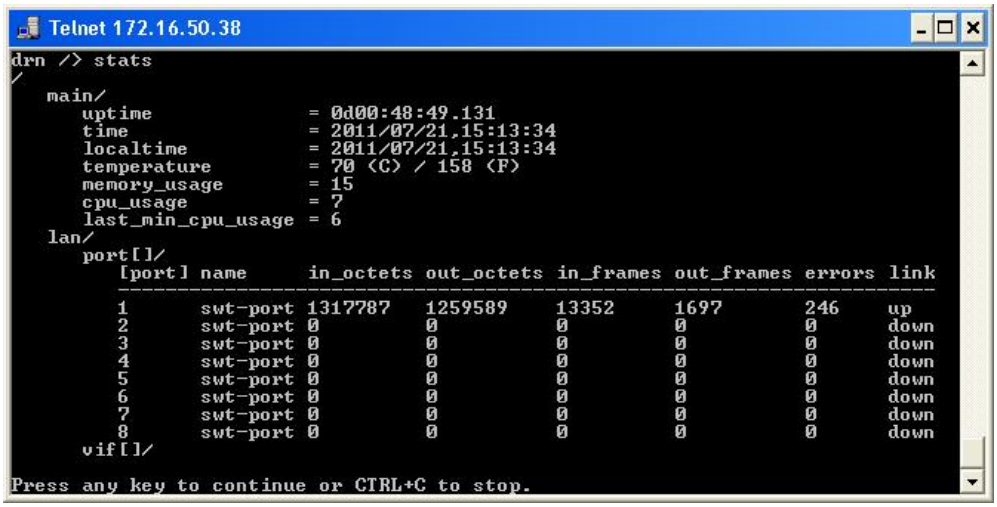
You will know whether the system has finished showing all the information when the equipment prompt reappears: ***drn />***.

As with the *download* command, it is useful to save the information in a *.txt* file using the method described in point 4.

See list of example in point 9.

6- Obtaining the equipment statistics

The equipment statistics list is shown through the command ***stats***.

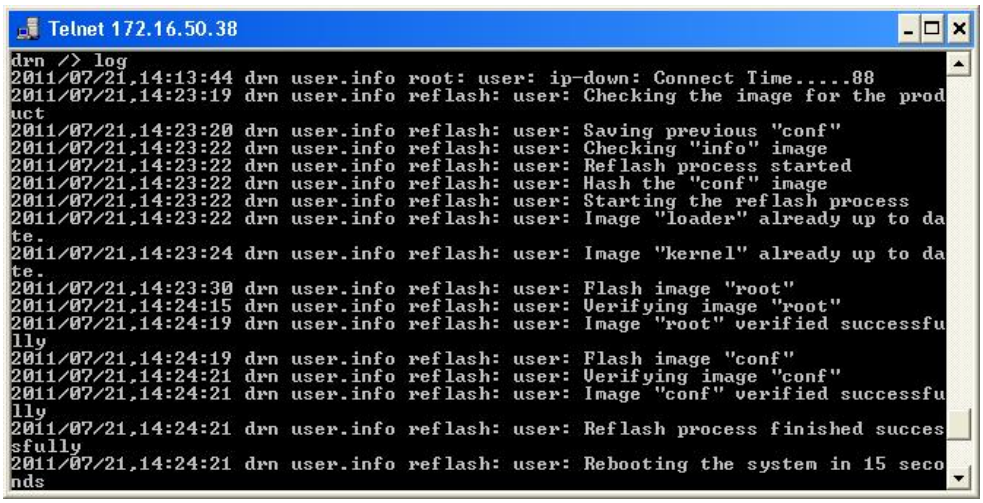


Like the previous commands, if the information to be displayed exceeds the edges of the window, it will stop and wait for the user to press a key to continue.

Remember to save the information in a ***.txt* file**, as indicated in point 4.

7- Obtaining events recorded in the equipment

The ***log*** command allows you to consult the events taking place in the equipment which have been recorded in the non-volatile memory due to their importance.



Remember to save the information in a ***.txt* file**, as indicated in point 4.

8- Obtaining events taking place in the equipment in real time

The ***log all*** command allows users to consult the events taking place in the equipment in real time.

The list of events will continuously be updated until the user presses the ***enter*** key.

Remember to save the information in a *.txt* file, as indicated in point 4.

9- Example of a list showing the status of an equipment (*DRA-2*) obtained with the get command and saved in a .txt file

```
drn login: guest
Password:

drn /> get
/
   main/
      hostname       = drn
      location       = unknown
      contact        = unknown
      product        = 4DRNC00100E00DA
      version        = 3.27.0-beta4.17413
      fw_reference   = unknown
      trackingnumber = 00e3f4124e02
      serialnumber   = 0124
      guestlogin     = guest
      guestpwd       = ********
      adminlogin     = admin
      adminpwd       = ********
      timezone       = UTC
      time           = 2011/07/21,15:36:44
      localtime      = 2011/07/21,15:36:44
   admin/
      web/
         http          = on
         httpport      = 80
         https         = off
         httpsport     = 443
         cert          = empty
         privatekey    = empty
         privatekeypwd = ********
      cli/
         log = off
      reset/
         enable = off
         period = 1
   lan/
      port[]/
         [port] name     enable vlan_function mode vid vid_acl
         -------------------------------------------------------
         1      swt-port on     edge          auto 1   auto
         2      swt-port on     edge          auto 1   auto
         3      swt-port on     edge          auto 1   auto
         4      swt-port on     edge          auto 1   auto
         5      swt-port on     edge          auto 1   auto
         6      swt-port on     edge          auto 1   auto
         7      swt-port on     edge          auto 1   auto
         8      swt-port on     edge          auto 1   auto
      vif[]/
         [vif] static vid ip          mask          description
         ------------------------------------------------------------
         1     off    1   192.168.0.1 255.255.255.0 vlan_name
   stp/
      enable        = off
      version       = rstp
      priority      = 32768
      max_age       = 20.000000000
      hello_time    = 2.000000000
      forward_delay = 15.000000000
      tx_hold_count = 6
      port[]/
         [port] priority cost   edge ptp
         --------------------------------
         1      128      200000 auto auto
         2      128      200000 auto auto
         3      128      200000 auto auto
         4      128      200000 auto auto
         5      128      200000 auto auto
         6      128      200000 auto auto
         7      128      200000 auto auto
         8      128      200000 auto auto
   wan/
      cell0/
         enable              = off
         primsim             = SIMB
         dns_req             = on
         maxretries          = 6
         maxtoconnect        = 6
         alarm_lowcov_level  = -105
```

```
         alarm_lowcov_period = 300
         maxinsec            = 0
         dualsimenable       = off
         pin1                = ********
         pin2                = ********
         apn                 = ipfija.vodafone.es
         force_home          = off
         auth                = pap
         login               = vodafone
         passwd              = ********
         minrxpower          = -113
         defroute            = on
         simb/
            pin1       = ********
            pin2       = ********
            apn        = ac.vodafone.es
            force_home = off
            auth       = pap
            login      = vodafone
            passwd     = ********
            minrxpower = -113
            defroute   = on
         dyn/
            enable   = off
            service  = dyndns
            host     =
            login    =
            passwd   =
            interval = 86400
         pingkeep/
            remoteip  = 0.0.0.0
            remoteip2 = 0.0.0.0
            freq      = 5
            bytes     = 1
            count     = 2
            action    = none
            strict    = on
      tunnel/
         tunnel[]/
            [tunnel] iface description type ip    source remote_gw
remote_net
 enable
            ------------------------------------------------------------------
---
-------
            1        tun1              gre  vlan1 vlan1  172.16.50.43 any
 on
   qos/
      qos2/
         weightfair_enable = on
         priority[]/
            [priority] queue
            -----------------
            0          medium
            1          medium
            2          medium
            3          medium
            4          medium
            5          medium
            6          medium
            7          medium
         dscp[]/
            [dscp] queue
            -------------
            0      medium
            8      medium
            16     medium
            24     medium
            32     medium
            40     medium
            48     medium
            56     medium
         port[]/
            [port] priority use_ieee8021p use_dscp
            ------------------------------------
            1      0        on            off
            2      0        on            off
            3      0        on            off
            4      0        on            off
            5      0        on            off
            6      0        on            off
            7      0        on            off
            8      0        on            off
      qos3/
         classify/
            def_priority = medium
   routing/
```

```
      static/
         st_rules[]/
            [st_rules] dest                    gateway       service if
descr
            ------------------------------------------------------------
---
            1          128.127.0.0/255.255.0.0 172.16.50.254 any     vlan1

      rip/
         enable            = on
         advertised_policy = permit
   filter/
      local/
         policy = accept
      cell0/
         policy = accept
      vlan/
         policy = accept
   dhcps/
      profiles[]/
         [profiles] name    lease dns1    dns2    wins    domain      tftp
  bootfile
         ------------------------------------------------------------------
---
----------
         1          profile 5000  0.0.0.0 0.0.0.0 0.0.0.0 usyscom.com
192.168.0.
1 bootfile
      servers[]/
         [servers] enable interface firstip      lastip        max_leases
mask
        gateway     profile
         ------------------------------------------------------------------
---
---------------------------
         1         off              192.168.0.10 192.168.0.254 100
255.25
5.255.0 192.168.0.1 profile
   vrrp/
      enable        = off
      advert_int    = 1
      if            = vlan1
      vid           = 1
      priority      = 100
      vip           = 192.168.0.1
      vmask         = 255.255.255.0
      preempt       = on
      preempt_delay = 0
      auth_method   = none
      auth_passwd   = passwd02
      pingkeep/
         remoteip = 0.0.0.0
         gateway  = 0.0.0.0
         freq     = 5
         action   = none
   vpn/
      traffic/
         rules[]/
            [rules] tunnel_id local_net                 remote_gw
remote_net
               iskamp saname enable valid_in
            ------------------------------------------------------------
---
---------------------------------------------
            1       ipsec1    172.16.50.0/255.255.255.0 77.211.25.76
172.17.90.0
/255.255.255.0 IKE1   TR1    on     cell0-0
      ike/
         ownidtype      = none
         ownidvalue     =
         nat_t          = off
         dpd_delay      = 10
         dpd_retry      = 10
         dpd_maxfail    = 3
         dpd_invcookies = off
         policy[]/
            [policy] name use_fqdn fqdn_value passive exchange cipher_alg
hash_a
lg auth_method    dh_group lifetime descr enable
            ------------------------------------------------------------
---
-------------------------------------------------
            1        IKE1 disabled            off     main     des        md5
   pre_shared_key modp1024 86400    IKE1  on
      pshkeys/
```

```
         peer_keys[]/
            [peer_keys] peer_ip      key   enable
            ------------------------------------
            1           77.211.25.76 12345 on
      ipsec/
         sa[]/
            [sa] tunnel_id protocol cipher_alg hash_alg pfs  lifetime mode
            ------------------------------------------------------------
            1    TR1       esp      des        hmac_md5 none 6000     tunnel
   ntp/
      enable = off
      authkeys[]/
         [authkeys] keynumber key
         ----------------------------
         1          1         xxxxxxxx
      client/
         broadcastenable = off
         server[]/
            [server] ip          type    minpoll maxpoll authenable authkey
lowt
raffic
            ------------------------------------------------------------------
---
------
            1        192.168.0.1 unicast 5       10      off        1
off

   snmp/
      enable              = off
      trapenable          = off
      trap_v1_aggent_addr = none
      community[]/
         [community] name   access
         -------------------------
         1           public ro
      traps/
         cell_linkup  = off
         cell_covlow  = off
         cell_covhigh = off
   access/
      tacacsplus/
         server1_ip = 0.0.0.0
         server2_ip = 0.0.0.0
         encrypted  = on
         shared_key = ********
      console/
         method = local
      web/
         method = local
         local  = on
      telnet/
         method = local
         local  = on
   security/
      port[]/
         [port] type max_addresses max_action
         ------------------------------------
         1      none 10            replace
         2      none 10            replace
         3      none 10            replace
         4      none 10            replace
         5      none 10            replace
         6      none 10            replace
         7      none 10            replace
         8      none 10            replace

drn />
```

B.4 CERTIFICATE INSTALLATION FOR HTTPS MANAGEMENT

The server integrated in the equipment supports the http and the HTTPS protocols, in the last case being necessary the installation of certificates.

The procedure for loading the certificates for HTTPS management, ***once the certificate, the private key and the password of the last one have been got***, is the following:

1- Access the configuration section of the web interface, through the COM 0 port (service port)
("**cd /admin/web**")

2- Load in "**cert**" a valid **certificate** with the command "**upload cert raw**".
The procedure for loading the certificate is the following. ***Copy*** in the clipboard ***the certificate***. Then, ***execute the indicated upload command*** and, when it is in wait period, ***paste the data from the clipboard***. Wait approximately 30s. When the time is elapsed, the data are shown.

3- Load in "**privatekey**" a valid **private key** with the command "**upload privatekey raw**".
The procedure is the same that the one indicated previously for the certificate.

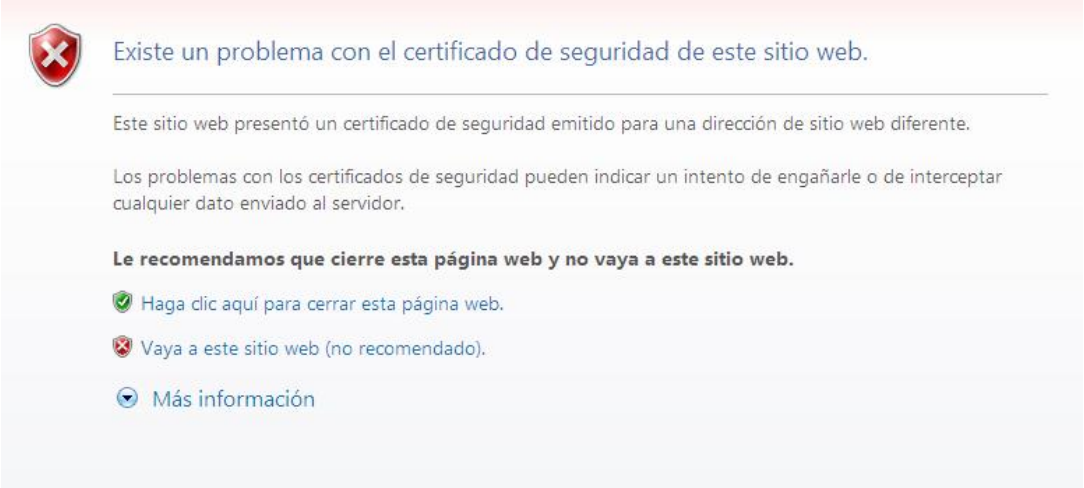
4- Introduce the **password of the private key** in "**privatekeypwd**" with the command "**set privatekeypwd**".
Confirmation of the password is required twice as much.

5- In the equipment, activate the access by means of HTTPS
("**set https on**")

6- Apply the changes
("**apply**")

7- Save the new data (optional)
("**save**")

8- **Load** the equipment configuration web page in the browser (Microsoft Internet Explorer, Mozilla Firefox, etc. Google Chrome is not supported) [(1)]typing "**https://**" instead of http://".
The following message appears:



Although the certificate operates correctly, this message is a warning indicating that the certificate has not been validated by a trusted authority.
Select "**Go to this web site (not recommended)**".
Then, the equipment access control requires the user login and password).

In the equipment with https operation, the ***certificate,*** the ***private key*** and the ***password of the last*** are part of the data obtained by means of the "**download**" command. Therefore, it is possible to add this information to the configuration pattern.

(1) The operation is a success with Microsoft Internet Explorer and Mozilla Firefox. Google Chrome doesn't accept the certificates authorized by you.

Example of download command in the equipment with https operation:

```
emr2 /> download
restore
set /main/hostname emr2
set /main/timezone Madrid
set /admin/web/https on
set       /admin/web/cert       "-----BEGIN       CERTIFICATE-----
\nMIICWzCCAcQCCQCcL+NbBdYynDANBgkqhkiG9w0BAQUFADByMQswCQYDVQQGEwJF\
nUzESMBAGA1UECBMJQmFyY2Vsb25hMRIwEAYDVQQHEwlCYXJjZWxvbmExDDAKBgNV\n
BAoTA1pJVjEOMAwGA1UEAxMFSm9zZXAxHTAbBgkqhkiG9w0BCQEWDmouc2FsYXRA\ne
ml2LmVzMB4XDTEzMDMyNzE1NTAzOVoXDTE0MDMyNzE1NTAzOVowcjELMAkGA1UE\nBh
MCRVMxEjAQBgNVBAgTCUJhcmNlbG9uYTESMBAGA1UEBxMJQmFyY2Vsb25hMQww\nCgY
DVQQKEwNaSVYxDjAMBgNVBAMTBUpvc2VwMR0wGwYJKoZIhvcNAQkBFg5qLnNh\nbGF0
QHppdi5lczCBnzANBgkqhkiG9w0BAQEFAAOBjQAwgYkCgYEAt49IfdfD/xVO\nGsqL2
17s6aumdFWr9NYoJw68LbrHY0VZ9OGwen+alXAjBcl2lqLZjf1lOh250aWE\neZLH31
lD5bxS9c+w8YrwXoWEnYOxUQpK49YGvH7DnqLAyI5ptyQbdyMoTkMcxBOZ\njNoToVi
oGiZ9GRBg6nKCDC4+PxN3/90CAwEAATANBgkqhkiG9w0BAQUFAAOBgQAT\n7QtOOJT6
lLcGciF4R5aooiRoZEiTJQBFm6PoTZ21apGGhF1Bz0FPn3LRxC1Mb6PI\nkNatYteCq
5FJNjGunF8hDIQVc1x7O2ju2vmGOiyVfSz1eqiy+Tx0dMYsgpBeY3K+\n8fb+J1jmLP
NzPhgMlzPK6VGNA70/QhfCG9l5xK1oWQ==\n-----END CERTIFICATE-----"
set   /admin/web/privatekey   "-----BEGIN   RSA   PRIVATE   KEY-----
\nMIICWwIBAAKBgQC3j0h918P/FU4ayovbXuzpq6z0Vav01ignDrwtusdjRVn04bB6\
nf5qVcCMFyXaWotmN/WU6HbnRpYR5ksffWUPlvFL1z7DxivBehYSdg7FRCkrj1ga8\n
fsOeosDIjmm3JBt3IyhOQxzEE5mM2hOhWKgaJn0ZEGDqcoIMLj4/E3f/3QIDAQAB\nA
oGAOvDzYhVKhjodHlUzm3lbsZzAklKAKNorgn8kxbpYE/RM8mkV9f/Lb3jWhiEu\nxy
f7m7BmNMcex8bSRwduzrUnK66DW8jP3b2tsxJHLYU9UpN1XKDNBHGvgJ7Gis+S\nApu
oZFYmh34uBl6SJkUdihCs4jM1ocQBQMHQ7mXe7Sk1sgECQQDgpSDx45vm8Yk+\nGoX4
UzcRIDoU47P3uHnnPTYUQMMqDta3K4bzualwcNOpU8bFtQbWfxjkThHthQBN\nrUeER
Ej9AkEA0S4ernXQGVJGm7b6JhJXFKkILVYo5vP0C3jx7ByRIMt4lkll4l7Q\ntzNepK
jlcmimzLWuHJAiyTBtvzfVcnU4YQJAaXOaX3HkwSgosIpq0QLfGp7yJNQu\nqt5h+vZ
O6FTuSFPm3tOD4G0K6MlN0nKNIEm2CAJpgOJU8BY66jupEqGrUQJAW7Wp\ns/lpJEDj
Pg/p+lkeHqvBLwdQZXldbM442rjnlAZBNzq01ZuWTEvUWcLG3fMt9iBN\nVq6G4cg+x
ZA4H7du4QJALq/zgc4N+Ft50Hkj+ay1XSt5nxH8U2Zk1u7ZWZZhOTcw\nezG/TDLBWk
ROF2n9VX6TYGesnZ2Ve/+DiMPhK7ZVQA==\n-----END RSA PRIVATE KEY------"
set /admin/web/privatekeypwd testhttps
set /lan/vif[1]/static off
set /wan/cell0/primsim SIMA
set /wan/cell0/apn gnftsg.com
set /wan/cell0/login pruebas_ziv1
set /wan/cell0/passwd pruebas_ziv1
set /snmp/enable on
set /access/tacacsplus/server1_ip 10.132.2.148
set /access/tacacsplus/server2_ip 10.132.2.168
set /access/tacacsplus/shared_key Sm4rt3Sy13
set /access/tacacsplus/admin_lvl 15
set /access/web/method tacacsplus
```

If there are no available certificate, private password and password of the last, it is possible to create them. For example, following the instructions in http://www.akadia.com/services/ssh_test_certificate.html, but in this case it is necessary a Linux equipment to execute the instructions.

An example of certificate, as well as private key, is shown in the following.

Pay attention that both the header and bottom lines are part of the certificate.

Example of a valid **certificate**:

```
-----BEGIN CERTIFICATE-----
MIICWzCCAcQCCQCcL+NbBdYynDANBgkqhkiG9w0BAQUFADByMQswCQYDVQQGEwJF
UzESMBAGA1UECBMJQmFyY2Vsb25hMRIwEAYDVQQHEwlCYXJjZWxvbmExDDAKBgNV
BAoTA1pJVjEOMAwGA1UEAxMFSm9zZXAxHTAbBgkqhkiG9w0BCQEWDmouc2FsYXRA
eml2LmVzMB4XDTEzMDMyNzE1NTAzOVoXDTE0MDMyNzE1NTAzOVowcjELMAkGA1UE
BhMCRVMxEjAQBgNVBAgTCUJhcmNlbG9uYTESMBAGA1UEBxMJQmFyY2Vsb25hMQww
CgYDVQQKEwNaSVYxDjAMBgNVBAMTBUpvc2VwMR0wGwYJKoZIhvcNAQkBFg5qLnNh
bGF0QHppdi5lczCBnzANBgkqhkiG9w0BAQEFAAOBjQAwgYkCgYEAt49IfdfD/xVO
GsqL217s6aumdFWr9NYoJw68LbrHY0VZ9OGwen+alXAjBcl2lqLZjf1lOh250aWE
eZLH31lD5bxS9c+w8YrwXoWEnYOxUQpK49YGvH7DnqLAyI5ptyQbdyMoTkMcxBOZ
jNoToVioGiZ9GRBg6nKCDC4+PxN3/90CAwEAATANBgkqhkiG9w0BAQUFAAOBgQAT
7QtOOJT6lLcGciF4R5aooiRoZEiTJQBFm6PoTZ21apGGhF1Bz0FPn3LRxC1Mb6PI
kNatYteCq5FJNjGunF8hDIQVc1x7O2ju2vmGOiyVfSz1eqiy+Tx0dMYsgpBeY3K+
8fb+J1jmLPNzPhgMlzPK6VGNA70/QhfCG9l5xK1oWQ==
-----END CERTIFICATE-----
```

Example of a valid **private key**:

```
-----BEGIN RSA PRIVATE KEY-----
MIICWwIBAAKBgQC3j0h918P/FU4ayovbXuzpq6Z0Vav01ignDrwtusdjRVn04bB6
f5qVcCMFyXaWotmN/WU6HbnRpYR5ksffWUPlvFL1z7DxivBehYSdg7FRCkrj1ga8
fsOeosDIjmm3JBt3IyhOQxzEE5mM2hOhWKgaJn0ZEGDqcoIMLj4/E3f/3QIDAQAB
AoGAOvDzYhVKhjodHlUzm3lbsZzAklKAKNorgn8kxbpYE/RM8mkV9f/Lb3jWhiEu
xyf7m7BmNMcex8bSRwduzrUnK66DW8jP3b2tsxJHLYU9UpN1XKDNBHGvgJ7Gis+S
ApuoZFYmh34uBl6SJkUdihCs4jM1ocQBQMHQ7mXe7Sk1sgECQQDgpSDx45vm8Yk+
GoX4UzcRIDoU47P3uHnnPTYUQMMqDta3K4bzualwcNOpU8bFtQbWfxjkThHthQBN
rUeEREj9AkEA0S4ernXQGVJGm7b6JhJXFKkILVYo5vP0C3jx7ByRIMt4lkll4l7Q
tzNepKjlcmimzLWuHJAiyTBtvzfVcnU4YQJAaXOaX3HkwSgosIpq0QLfGp7yJNQu
qt5h+vZ06FTuSFPm3t0D4G0K6MlN0nKNIEm2CAJpgOJU8BY66jupEqGrUQJAW7Wp
s/lpJEDjPg/p+lkeHqvBLwdQZXldbM442rjnlAZBNzq01ZuWTEvUWcLG3fMt9iBN
Vq6G4cg+xZA4H7du4QJALq/zgc4N+Ft50Hkj+ay1XSt5nxH8U2Zk1u7ZWZZhOTcw
ezG/TDLBWkROF2n9VX6TYGesnZ2Ve/+DiMPhK7ZVQA==
-----END RSA PRIVATE KEY-----
```