Table of Contents

Introduction to the GRD (3G models)

Purpose of this manual

The purpose of this manual is to provide the instructions to quickly and easily install and operate the GRD equipment (3G models)

The installation of the GRD also implies the installation of middleware and eventually any other application depending on the intended use for the system.

Telemetry solutions GPRS with GRD

The GRD has multiple uses. These are the most common uses that will guide you to read this manual.

- **GPRS RTU/Datalogger to Database (WEB server)**
  - Physical inputs/outputs
  - Modbus inputs/outputs (embedded Modbus master)
  - Serial port data (using script programming)
  - Local input/output control (using script programming)
  - *Database to store the registers sent by the GRD*
- **GPRS RTU accessible by Modbus**
  - Physical inputs/outputs
  - Serial port data (using script programming)
  - *Modbus protocol to read input/outputs remotely*
- **Remote Access to serial port**
  - Remote serial port with Redirector (Virtual COM port)
  - Remote serial port in Modbus mode
- **SMS alarms/control**
  - Physical inputs/outputs
  - Modbus inputs/outputs (embedded Modbus master)
  - Serial port data (using script programming)
  - Local input/output control (using script programming)

GPRS RTU/Datalogger to Database (WEB server)

There are hundreds of types of sensors that can be contacted directly to the GRD inputs to measure different types of variables. Depending on the GRD model, sensors could be used to deliver signals in 0-10V, 4-20mA or pulses, or simply connect different devices to their inputs/outputs. The GRD can also be configured as Modbus master and queries can be made to different slaves to expand its inputs/outputs.

The GRD works as a GPRS datalogger, creating records with timestamp with the value of the built-in or external I/Os and sending them to the Middleware (MW)

The MW will forward all the incomming records to an external database (MySQL or MS SQL)

You can also create a WEB site to show the value. Or you can use Exemys Telemetry service to connect your GRD to our MW and web site (www.exemys.com/m2mserver)

The GRD can also be used to do a local control over its inputs/outputs using the script programming feature.

Note: The WEB server and the database engine are not provided by Exemys. You can use Apache HTTP Server and MySQL. Both of them are free tools.
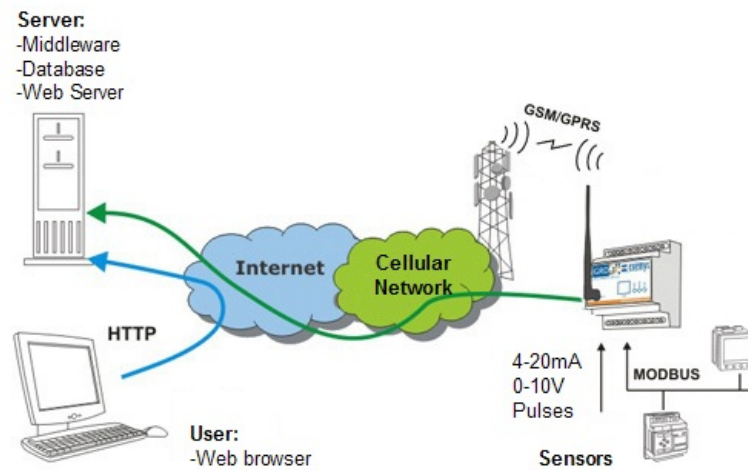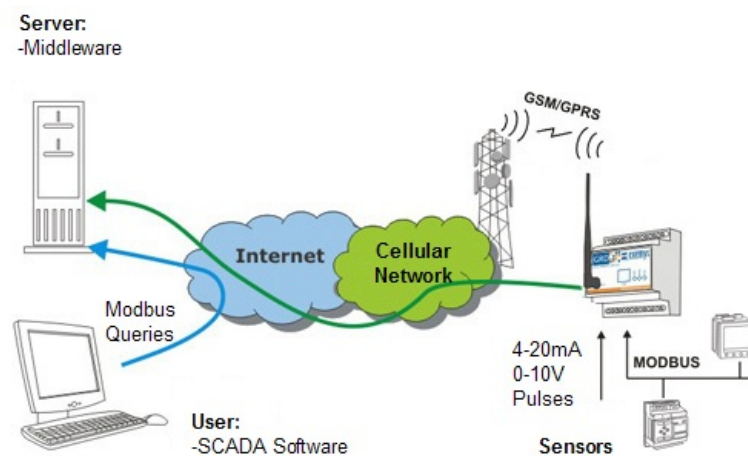
For this type of solution the following procedure must be followed:

- Install the GRD.
- Install the configuration software via USB ("GRD Config"), this application will allow us to configure all the GRD parameters, locally or remotely.
- If you won't connect the GRD to the Exemys Telemetry Server, install and configure the MW on a computer that will work as a server.
- Have a running database engine and configure appropriately in the MW.
- Establish a connection between the GRD and the MW.
- Configure the inputs/outputs in the GRD according to their utilization:
  - Physical inputs/outputs
  - External Modbus inputs/outputs.
    - Configure the GRD serial port.
    - Configure the "Embedded Modbus master" and the queries we want it to make.
- Configure the channels and enable the desired reports and historical records

GPRS RTU accessible by Modbus

GRD I/Os can be read remotely from any Modbus master software (SCADA, OPC server, etc). The Modbus master will read the MW's Internal Modbus slave. It will answer back with the value of all GRD's I/Os. The master can establish the link using Modbus TCP, Modbus RTU or Modbus ASCII over TCP. To optimize the GPRS network use the GRD will update the value of its inputs sending "reports" only when they change.

For this type of solution the procedure below must be followed:

- Install the GRD

- Install the configuration software via USB ("GRD Config"), this application will allow us to configure all GRD parameters locally or remotely.
- Install and configure the MW on a computer that will work as a server.
- Establish a connection between the GRD and the MW.
- Configure the inputs/outputs in the GRD.
- Add the channels and enable the required reports. (In this case it is not necessary to configure Historicals since queries are made on the reports).

Remote serial port

This solution allows you to remotely access the GRD's serial port as if it were physically connected to the serial port of our computer.
You can think of it as an alternative to the telephone modems but with several advantages.

There are two way to do it:

- **Redirector of serial port**
- **Modbus for serial ports**

Remote serial port - Redirector (Virtual COM port)

To access the remote serial port you must install the "Redirector of serial port" software. This software creates a virtual serial port that lets you use an existing software and connect to the remote equipment as if it were connected in a physical serial port of the computer.

Middleware is here only a link between the Redirector of serial port and the GRD serial port.
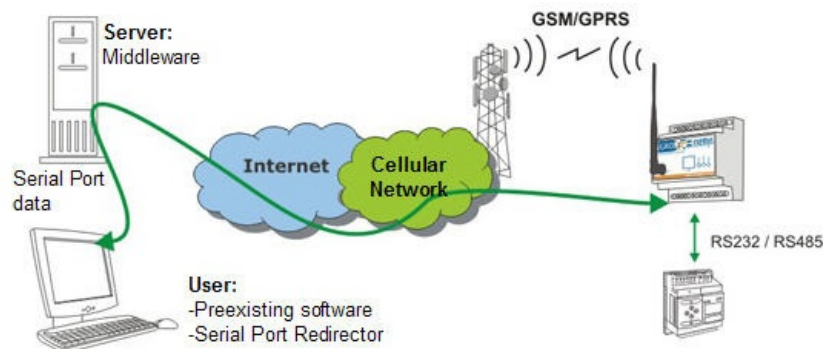
For this type of solution the procedure below must be followed:

- Install the GRD
- Install the configuration software via USB ("GRD Config"), this application will allow us to configure all GRD parameters locally or remotely
- If you won't connect the GRD to the Exemys Telemetry Server, install and configure the MW on a computer that will work as a server.
- Install and configure the "Redirector".
- Establish a connection between the GRD and the MW.
- Configure the serial port of the GRD in remote mode
- If you are using you own MW, configure the operational mode of the serial port in the MW as TRANSPARENT.

Remote Access to serial port – Modbus mode

If the protocol used by the serial port of the remote equipment is Modbus, the MW can be configured in a

special mode that will allow the optimization of the queries.
The Middleware has the capability of sending the Modbus query received to a particular GRD depending on the ID of the Modbus slave of the received query.
This simplifies the communication between the user software and the Modbus slaves since they work as if the were connected to a unique Modbus network.

The master can establish the link using Modbus TCP, Modbus RTU or Modbus ASCII over TCP.
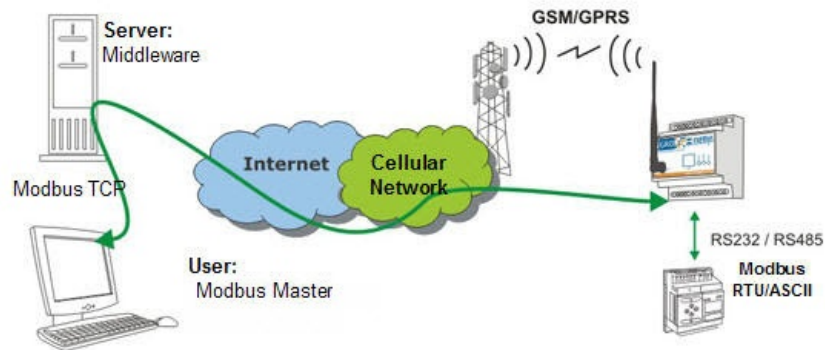
For this type of solution the procedure below must be followed:

- Install the GRD
- Install the configuration software via USB ("GRD Config"), this application will allow us to configure all GRD parameters locally or remotely.
- Install and configure the Middleware in the PC working as a server, GRDs will be connected to this program and information will be sent to them.
- Establish a connection between the GRD and the MW.
- Configure the serial port of the GRD in remote mode.
- Configure the operational mode of the serial port in the MW as Modbus and add the corresponding slaves.

SMS alarms / control

The GRD can send SMS alarms to up to 8 recipients based on the value of its inputs.

You can also send and SMS to the GRD to ask for the value of a particular input/output or to activate an output.

This inputs/outputs can be physical or Modbus signals.

The SMS feature can be used together with GPRS solutions.

Script programming can also be used for customized solutions where the standard criteria to send SMS alarms is not enough.

For this type of solution the procedure below must be followed:

- Install the GRD
- Install the configuration software via USB ("GRD Config"), this application will allow us to configure all GRD parameters locally or remotely.
- Configure the inputs/outputs in the GRD according to their utilization:
  - Physical Inputs/Outputs
  - External Modbus Inputs/Outputs.
    - Configure the GRD serial port.
    - Configure the "Embedded Modbus master" and the desired queries.
- Configure the possible recipients

- Configure the possible conditions to send an SMS alarm and the text that will be sent

2017-06-15

> ⚠️ *For GRD-3G only*

GRD Models – Installation

Selection table

Depending on the application you will be able to choose from the following models:

Model	Serial port	Modbus master	Digital Inputs	Digital Outputs	Analog Inputs	Pulse count	Mobile Data	SMS alarms	Script programming	Power supply
GRD1620-XF-3G	1 x RS232/1 x RS485	Yes	-	-	-	-	2G/2.5G/3G	Yes	Yes	External 10 to 30Vcc
GRD3621-XF-3G	-	Yes	4(1)	4(1)	2 (4)	4 (2)	2G/2.5G/3G	Yes	Yes	External 10 to 30Vcc
GRD3625-XF-3G	1 x RS232/1 x RS485	Yes	6(1)	6(1)	4	6 (2)	2G/2.5G/3G	Yes	Yes	External 10 to 30Vcc
GRD3534-XF-3G	2 x RS232/RS485	Yes	16	8	8	8 (3)	2G/2.5G/3G	Yes	Yes	External 10 to 30Vcc

(1) Digital Inputs/Outputs are configurable and share the same terminals.

(2) Digital inputs can be use as pulse inputs.

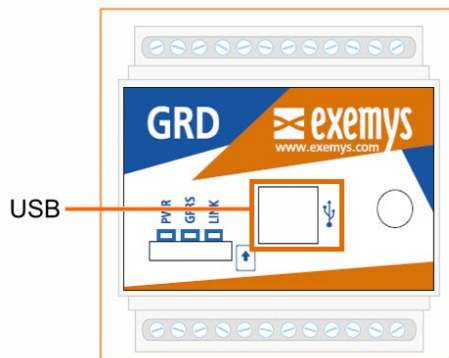(3) Some digital inputs can be use as pulse inputs.

(4) A PT100 temperature sensor can be connected to AI1
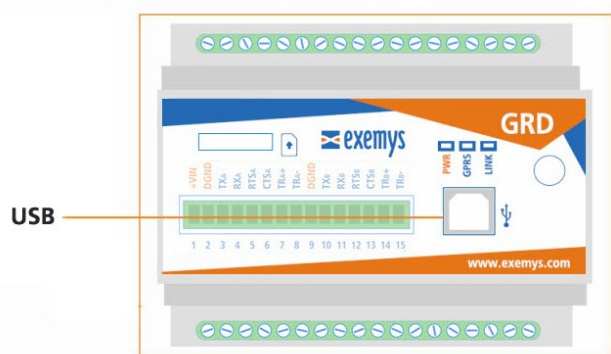
Wiring – USB configuration port

All GRD models have a USB communication port. This port is used to configure the GRD.

For the connection with the PC a type "B" USB standard cable is used.

GRD1620-XF-3G / GRD3621-XF-3G / GRD3625-XF-3G   **GRD3534-XF-3G**

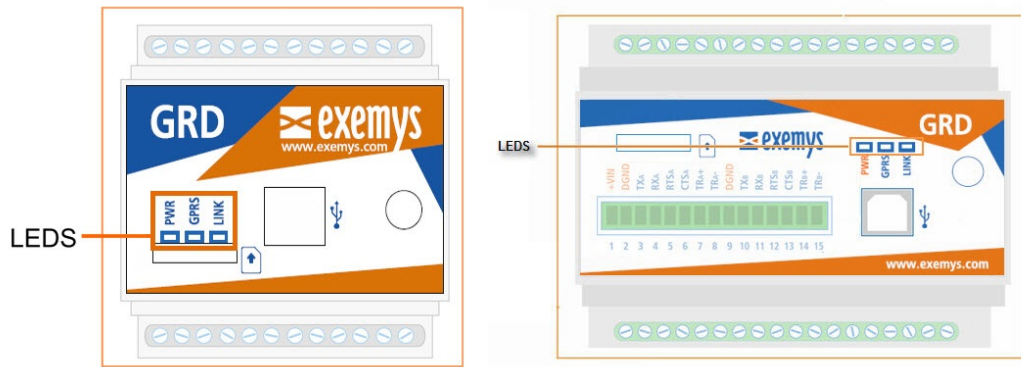### LED Indicators

The GRD has 3 LEDs indicators.

PWR: Power applied to the GRD

GPRS: State of registration of the GRD in the GPRS network (GPRS, EDGE, 3G)

LINK: State of the connection between the GRD and the Middleware

GRD1620-XF-3G / GRD3621-XF-3G / GRD3625-XF-3G   **GRD3534-XF-3G**

We find below the detail of the indication of each LED independently and in combination.

PWR LED	GPRS LED	LINK LED	Description
Fast blinking	-	-	Connecting to the GSM network.
On	-	-	Connected to the GSM network if blinked previously otherwise SIM disabled.
On	Fast blinking		Connecting to GPRS/3G
On		-	Connected to GPRS/3G
On		Fast blinking	Connecting to the MW
On			Connected to the MW
Fast blinking			SIM card missing
On	One blink	-	Sending or receiving a SMS
On		One blink	Sending or receiving data via GPRS/3G
Sequencial blinking from left to right			Power on process
On	Slow blinking	-	Failure in connection to the GPRS/3G retrying in a few seconds
Blinking together with the LINK LED	Alternate blinking with the PWR and LINK LEDs	Linking together with PWR LED	Low signal level
On		Slow blinking	Failure in connection with MW retrying in a few seconds

Installation of the SIM card

Requirements

For the correct operation of the equipment the Micro SIM card must meet the following requirements:

A subscription to GSM and **GPRS/3G** services

It must be **cleared** to be installed in any equipment (some SIM cards can only be installed in the equipment where they were purchased).

Verify the **telephone number** assigned to the SIM Card.

You must know the data to access the **GPRS/3G network** of the telephone operator corresponding to the SIM card (APN, user, password). These data are preloaded in the GRD for Movistar Argentina, Telecom Personal Argentina and Claro Argentina. If you use another operator please contact support@exemys.com.

If the **PIN** (security code) of the SIM Card is activated you must enter it into the GRD when requested.
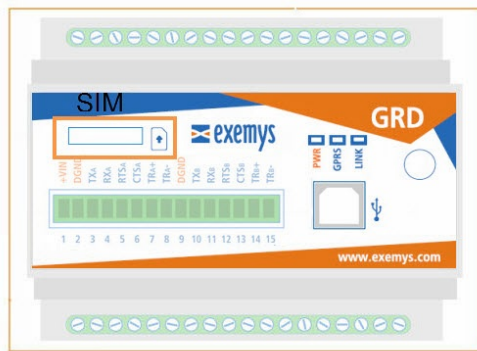
How to place the SIM card in the GRD

Place the SIM inside the GRD as shown in the figure or press it to remove
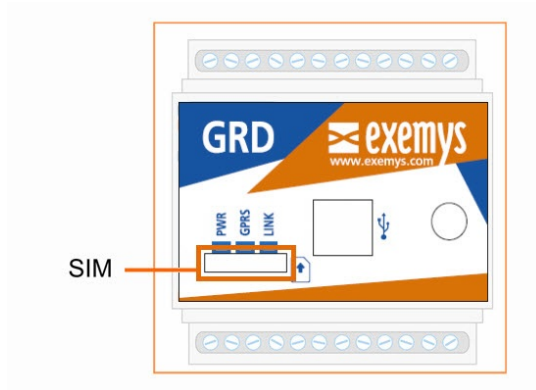
GRD1620-XF-3G / GRD3621-XF-3G / GRD3625-XF-3G

2017-12-21

GRD configuration software – GRDconfig

GRDconfig is the application program used to configure the GRD equipment.

This application was developed with an easy-to-use feature in mind to configure and monitor GRD equipment.

The Configurator is supported on the following platforms: Windows 2003, XP, Vista, 2008, 7, 8 and 10 (32 and 64 bits).

Java Runtime Environment 1.8 or higher must be installed (available free in www.java.com).

Installation

For installation follow these steps:

- Run the installation software (download it from here www.exemys.com/grdconfig)
- A welcome screen will be displayed, then follow the instructions of the Installation program which will request the necessary information to complete the installation. Click on "Next" to continue.
- Destination folder: Select the folder for the installation of the application program.
- Wait for the installation program to copy all necessary files onto the hard disk, and press "Finish" to end the installation process.

Once installed you will see in the Programs menu a folder called Exemys. Inside the folder you will find another folder called *GRDconfig*; this folder contains the *GRDconfig* and *Uninstall* icons.

USB Driver Installation

After intalling GRDconfig all drivers will be automatically installed. In case you still have problems you can manually install the drivers from here:

For GRD-2G

"C:\Program Files\Exemys\GRDconfig\Drivers\USBDriverInstaller.exe"
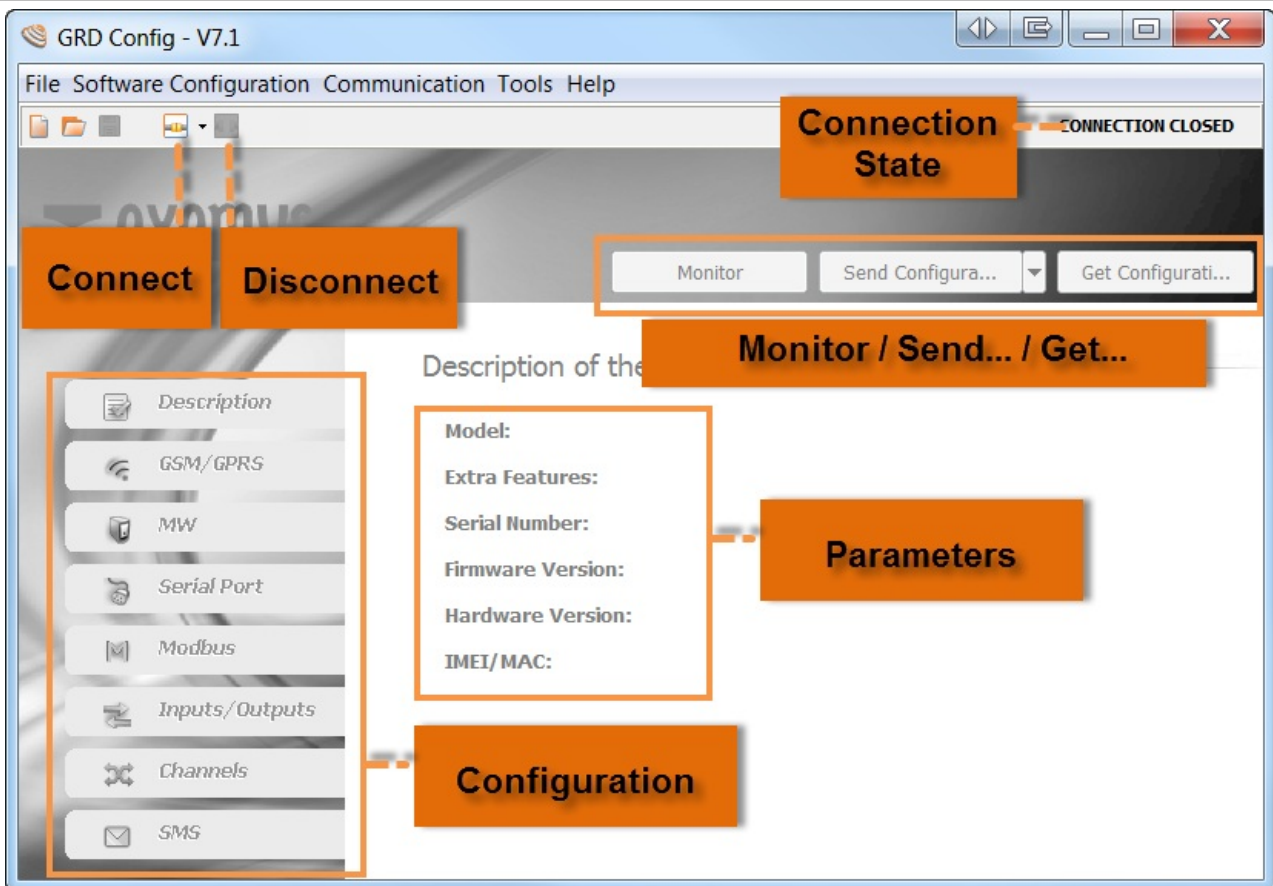
For GRD-3G

"C:\Program Files\Exemys\GRDconfig\DriverFTDI\InstallDriver.exe"

If you don't install the drivers you won't be able to configure the GRD and will get this message:

General description of the Configurator

The following figure shows the main screen of the Configurator.

Configuration of the USB port

Once the software is installed you won't have to configure any parameter of the USB port since this port recognizes automatically the COM in which the GRD is connected.

⚠	*You can only connect up two GRDs to the PC at the same time.*

Establishing the connection with the GRD

To connect to the GRD you must have the PC connected to the GRD using the cable described in "GRD models – Installation".

To establish the connection select the menu option "Communication -> Open Local Connection" or press the ⬚ button.
If you initiate the "GRDconfig" for the first time and if you have any GRD connected, it will request you to disconnect it and connect it back again .
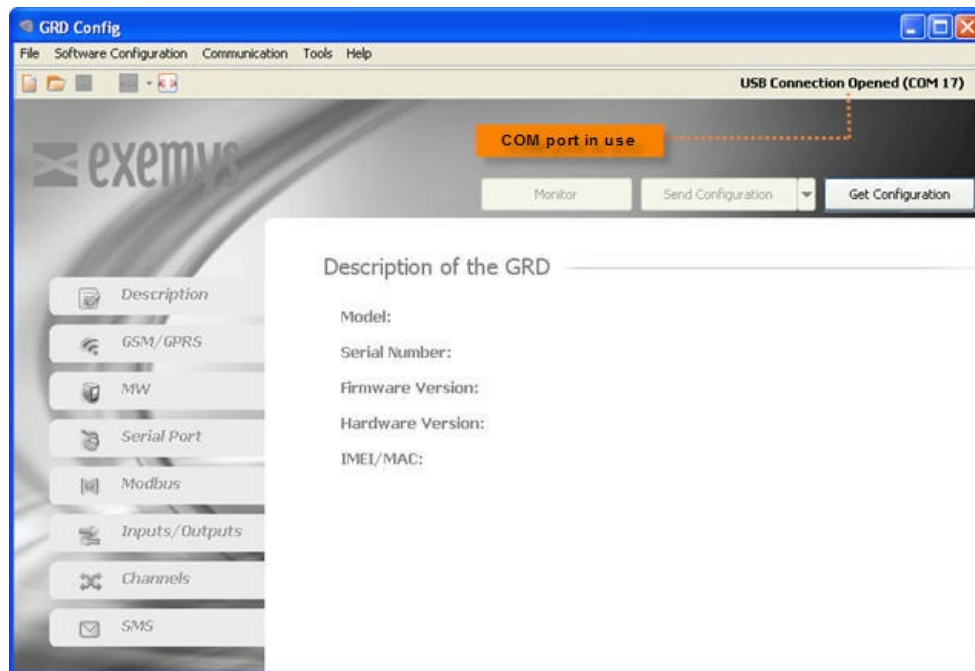

If the communication fails verify that:

- The cable connecting the PC to the GRD is the correct one.
- The GRD is on.

- The driver is installed correctly.

After a few moments you will be able to see that the state of the connection changes to connected and will also indicate the COM port of the connection.

Getting GRD parameters

To obtain the parameters of the equipment you will have to press the "Get Configuration" button and all the GRD parameters will be displayed indicating on the first screen, the model, IMEI, etc.

You will always have to read the GRD parameters to be able to modify the parameters or for monitoring purposes.
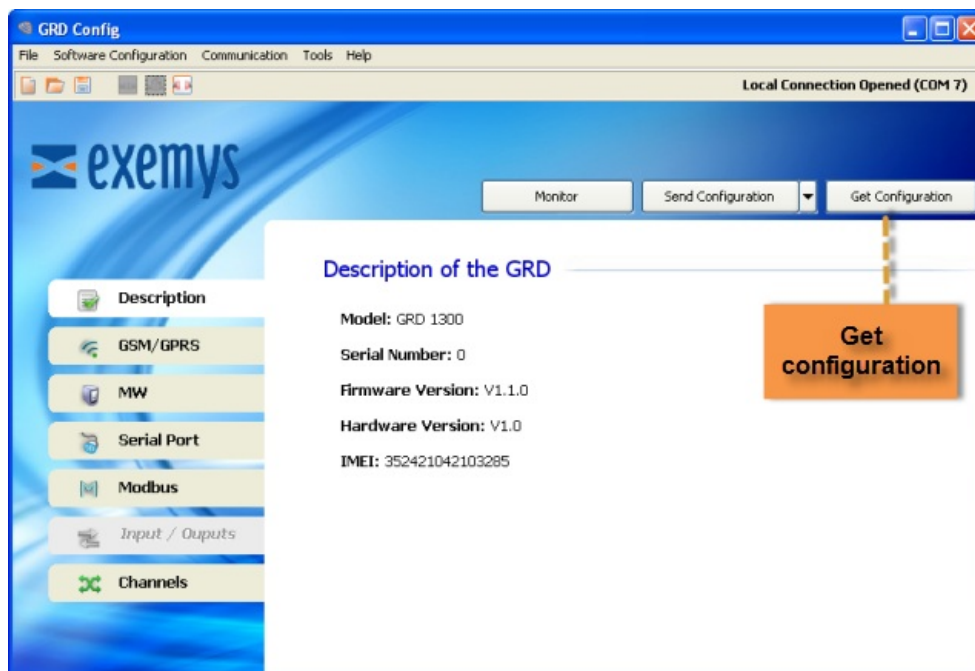
*If the Configurator finds an unknown model it will not enable any of the screens. Download the latest GRDconfig release.*

Sending parameters to the GRD

If you want to send to the GRD any change in the configuration press the "Send Configuration" button, please note that to the right of the button we have a combo that when displayed allows us to send the standard configuration plus the change of GSM band in case of necessity, this is because this parameter is not sent by default.
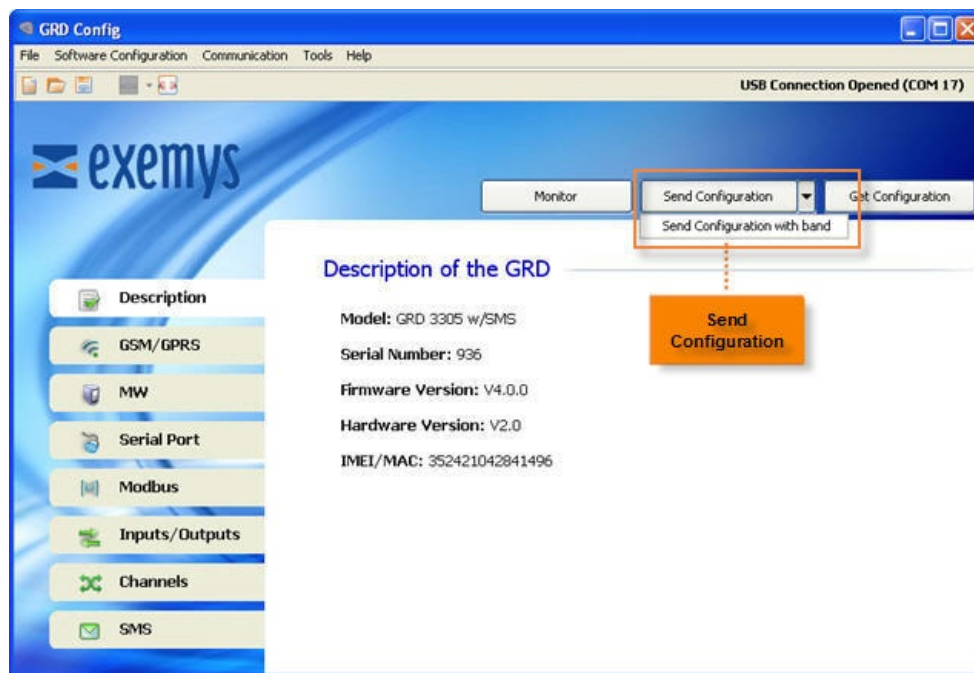

> *It is very important to take into account that the GSM band in which the GRD will operate has to be configured according to the geographical area.*

Monitoring

To access the monitoring area where all the GRD parameters can be seen, you should press the "Monitor" button.
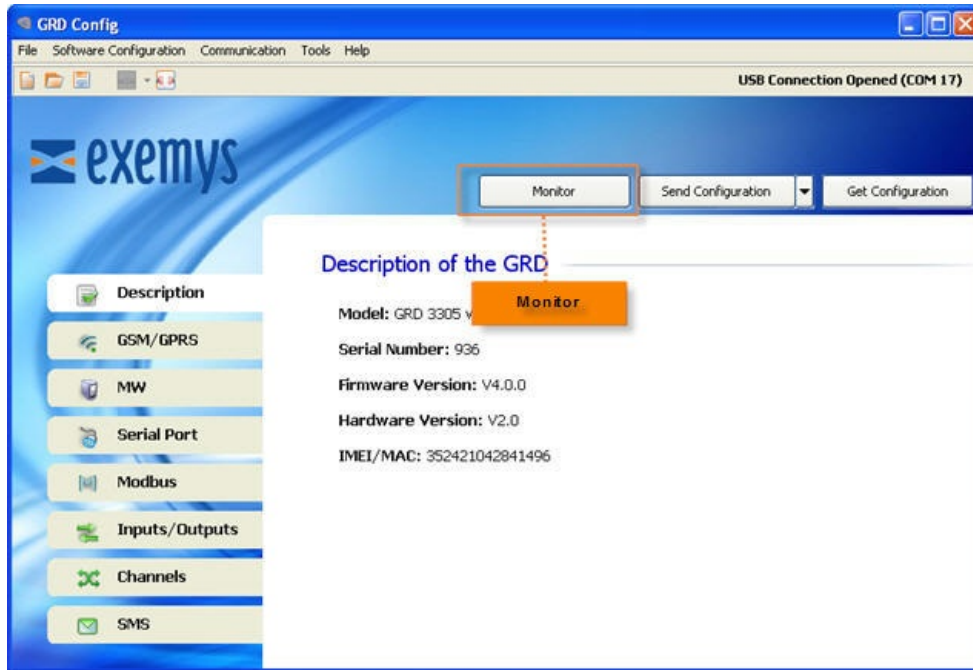
Once we enter monitoring the following screen will be displayed, in which we will be able to see the values of the input/output channels, the time, quantity of accumulated Historicals, the SIM in use and the states of connection of the equipment.
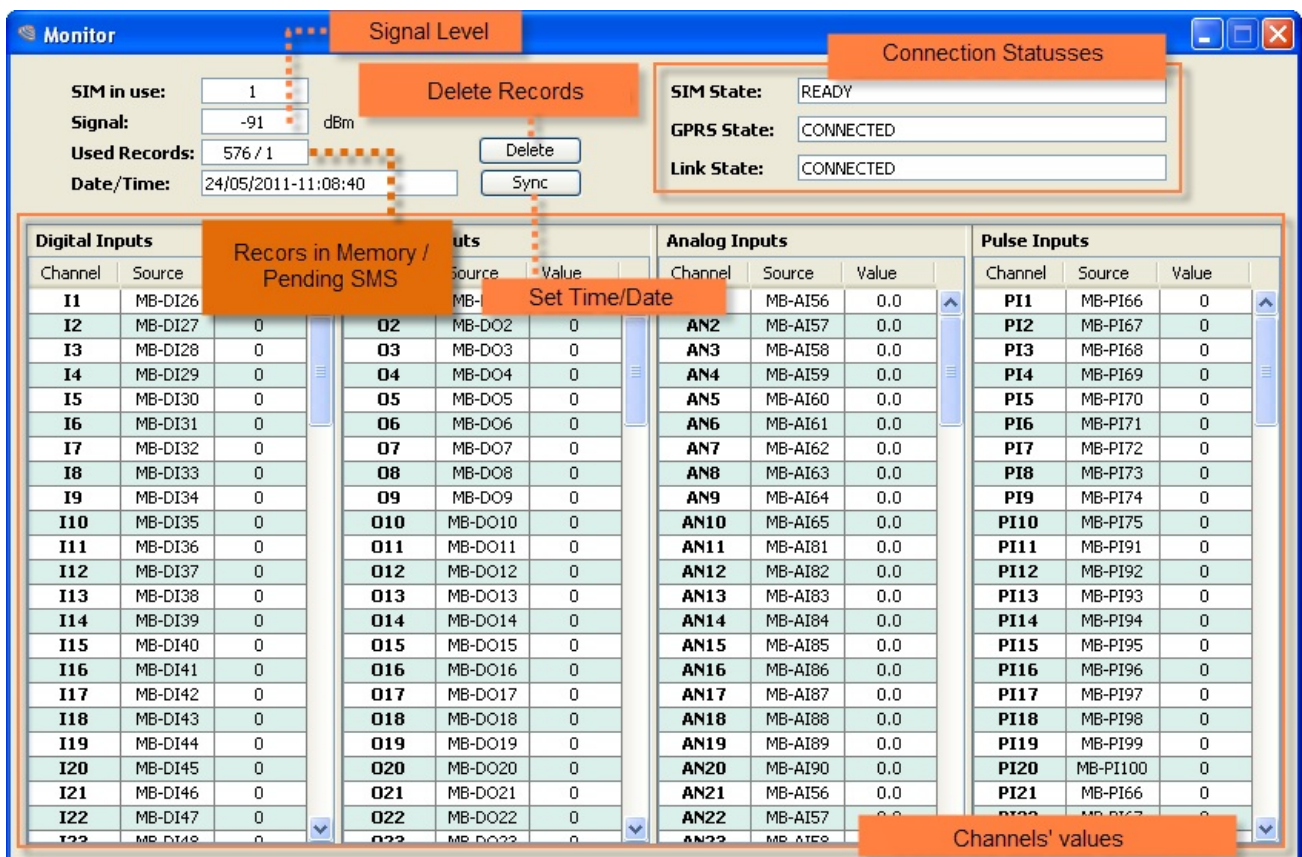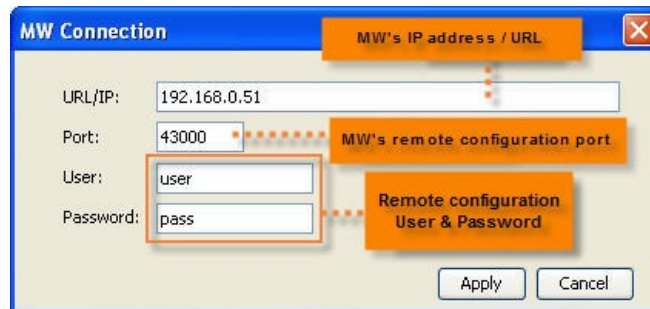

Remote configuration and Monitoring

The configurator together with the MW have the capability to remotely access the configuration and monitoring of the GRDs, which means that they do not have to be connected locally to the PC. You must point out that the connection parameters of the GPRS and MW cannot be modified this way.

Configuration of parameters for remote access.

We must load in the configurator the MW parameters to which we want to connect in order to have remote access to the connected GRDs, we have to enter in *"Software Configuration -> MW Connection"*

We then have to configure the URL/IP, Port, User and Password


The IP to be loaded is the one the MW is running on, and the port is the one configured to have access to it.
We will now see how to configure these parameters in the MW, entering in *Configuration -> Advanced"* and then in the subsection *"Remote Configuration".*


Remote connection

To connect remotely to a GRD we have to enter in *"Communication -> Open Remote Connection"* or clicking on the 🖼 icon, then a window will be displayed with a list of the GRDs. Those available appear in black and those in grey are not connected to the MW at that moment.
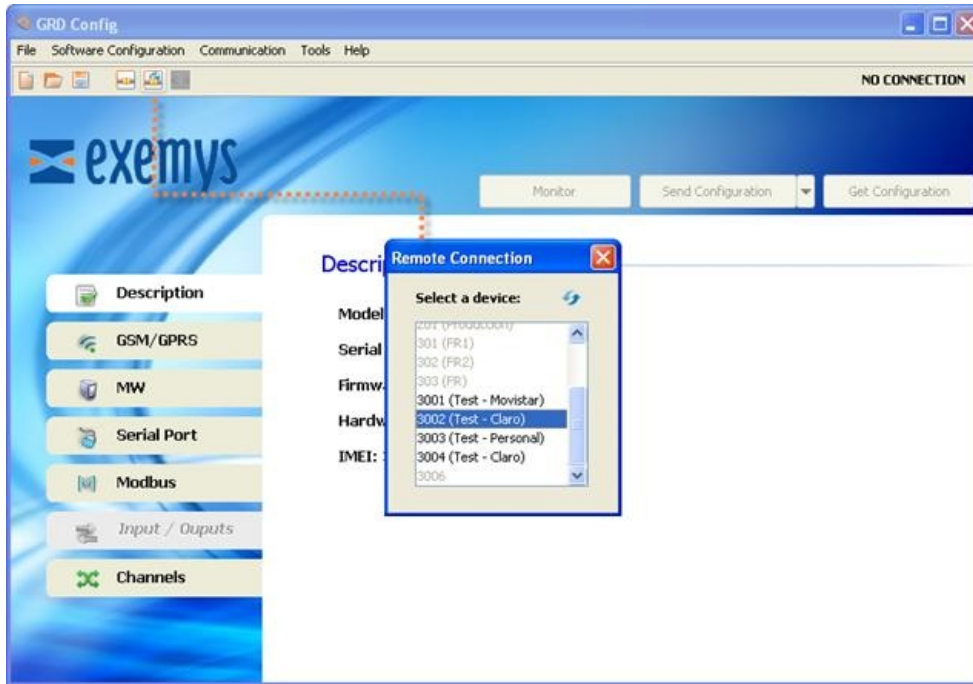
Saving configurations

"GRDconfig" allows us to save the GRDconfiguration so if we have to configure many equipments the same way, we won't have to load again the parameters one by one, the only thing to take into account is that the GRD ID number will have to be changed and avoiding to have a duplicate.

To create and save a configuration we don't need to have a GRD connected, only clicking in *"File -> New" or on the ▯ icon a list of the models will be displayed from which we make the selection.*
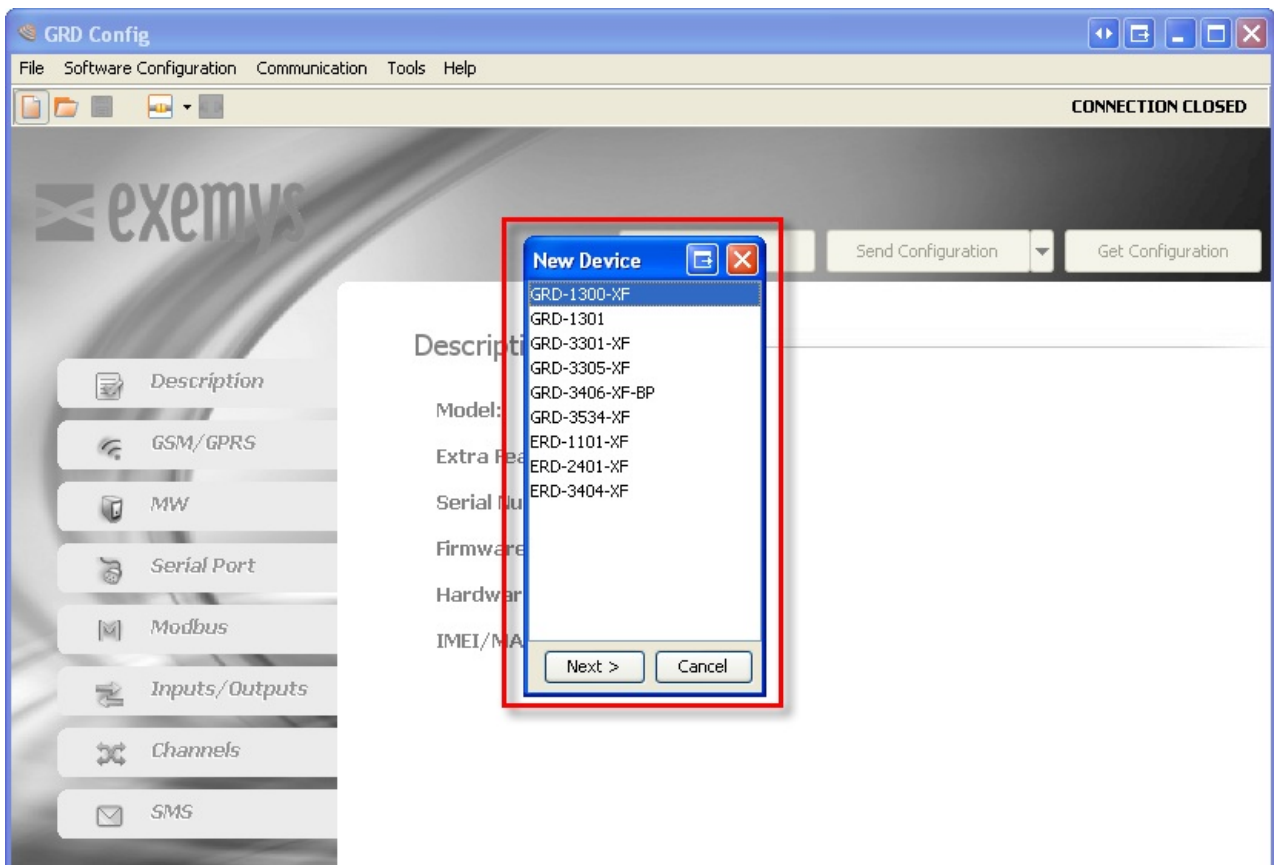
We then configure the parameters with *"File -> Save As"* or with the 🖫 icon to load them later when the GRD is connected.

Once the configuration is saved, we can open it and load to multiple GRDs entering *"File -> Open"* or with the 📁 icon.
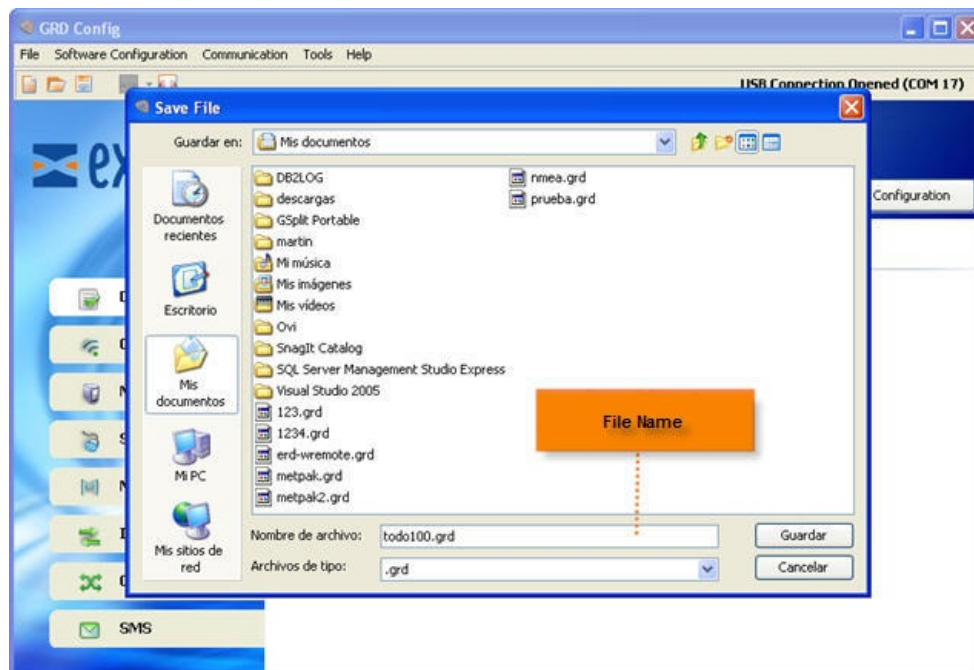
2017-06-06

GSM and GPRS services configuration

GSM Service

Enabling SIM / GSM

We first have to verify that the SIM has been selected and that it is within the corresponding GSM band. This is done in the following tab: GSM/GPRS -> General Configuration.

Configuring the PIN on the SIM card

If you place a SIM card with and activated PIN (security code), it must be configured in the GRD in order to have access.

⚠	Remember that if you enter a wrong PIN three consecutive times, the SIM card will block. To unblock it, you will have to enter the PUK of the SIM card. For more information check with the cell phone operator.

To load the PIN go to the "GSM/GPRS -> General Configuration" tab.

And then load it in the corresponding field.
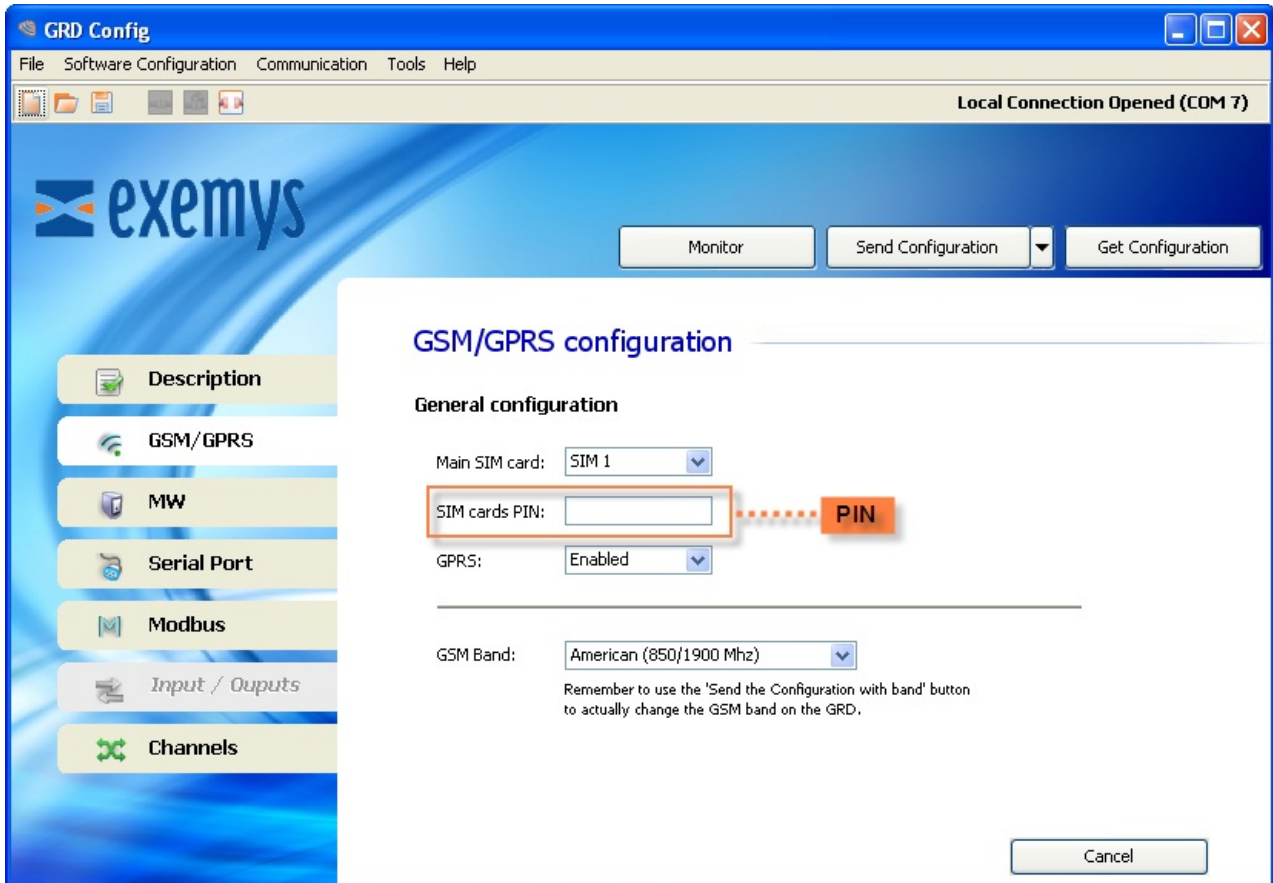
When the new configuration is applied, the GRD will try to unblock the SIM Card with the entered PIN. If this is the correct one, the registration process will be initiated.

To verify if the SIM card that has been placed is blocked or if the configured PIN is correct, check the SIM status in the monitoring option.

GPRS service

Enabling the connection with the GPRS.

The enabled option of the GPRS must be verified in the "GSM/GPRS -> General Configuration" tab.

⚠	GPRS is only used if the GRD needs to be connected to the MW. If you are only planning to send SMS you can disable GPRS.
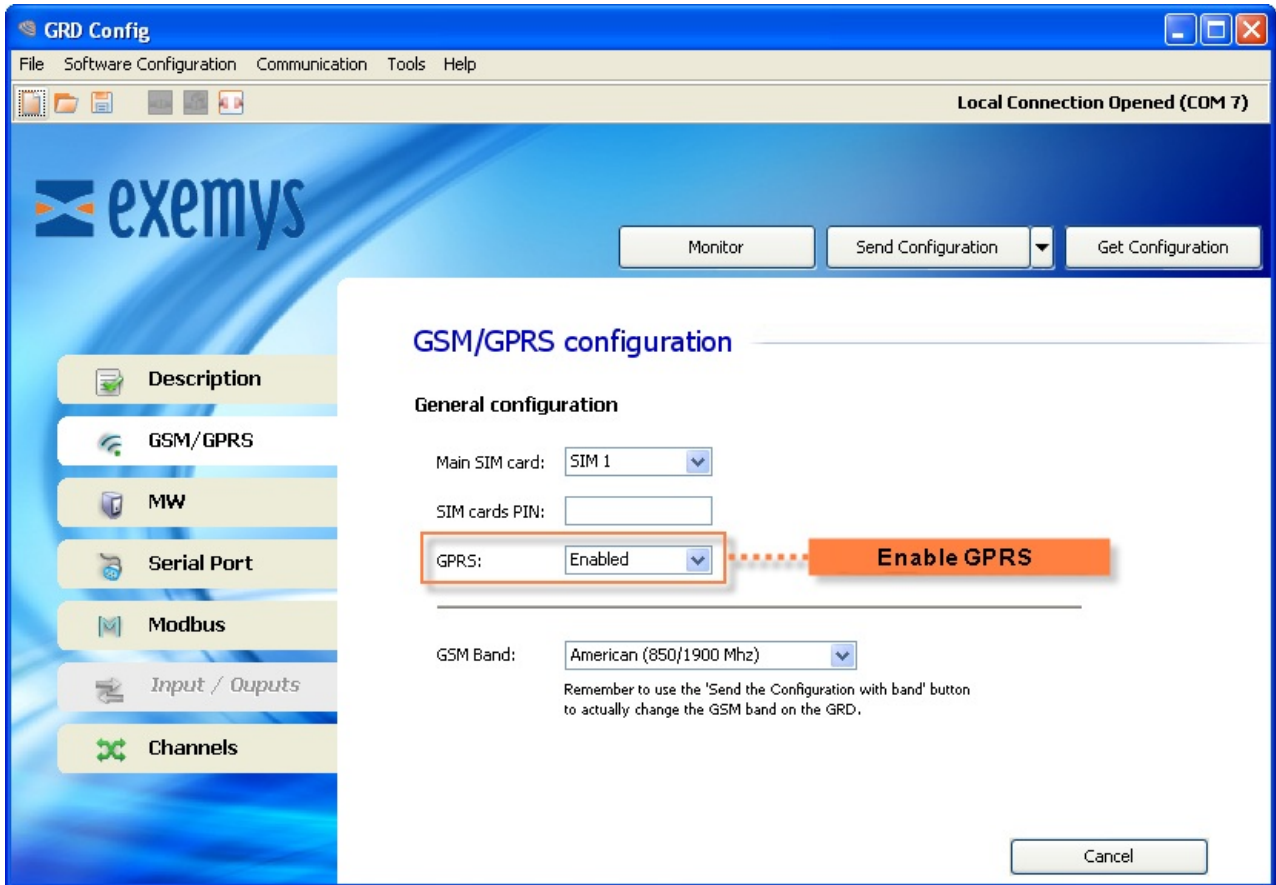
Configuring the cell phone operator

The following step is the correct configuration of the GPRS service. For this, you have to tell the equipment the corresponding operator of the installed SIM card or the APN parameters, user and password. These parameters are found in the "GSM/GPRS -> SIM x" tab (Where x is the SIM number, since it can be dual depending on the model).
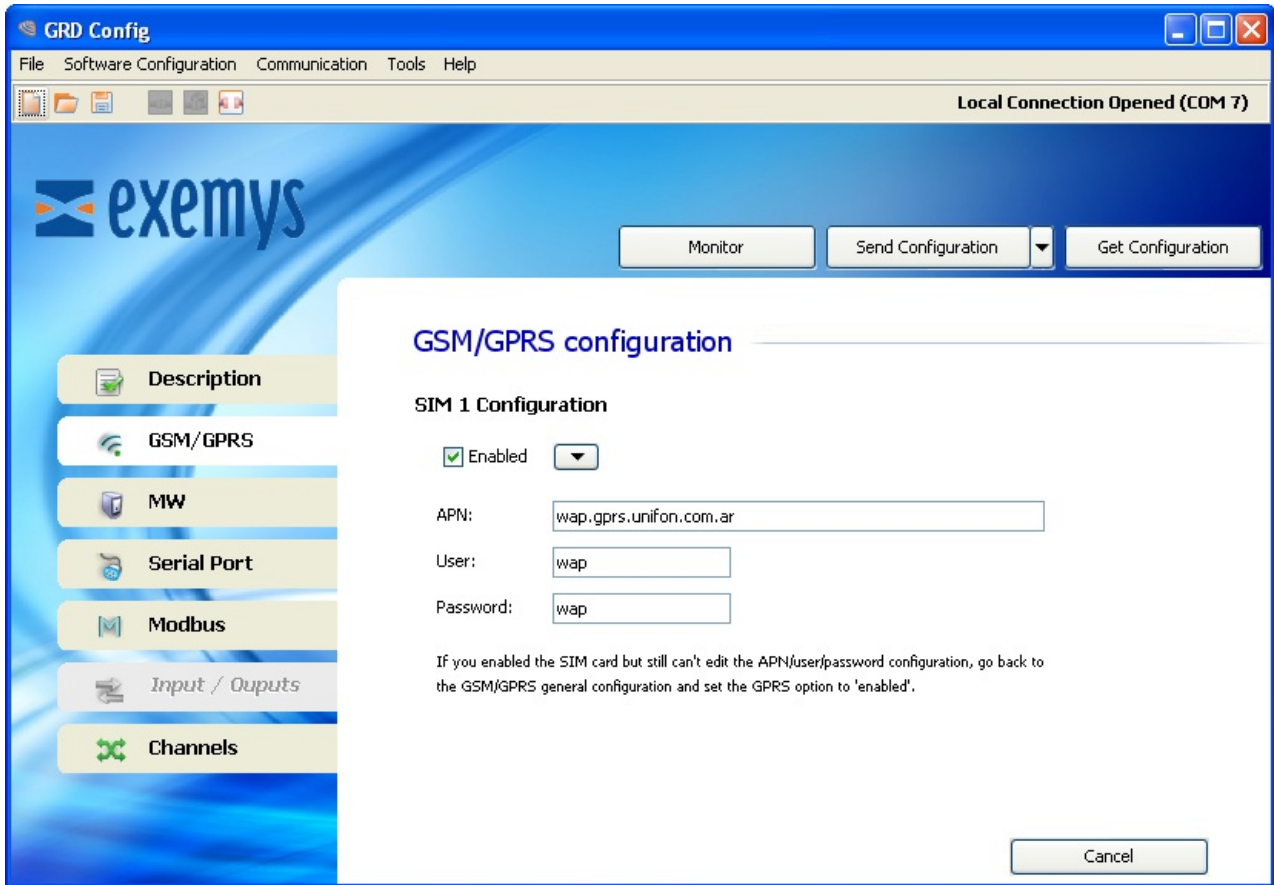
The GPRS parameters can be saved so they won't have to be entered every time the GRD is used with the same cell phone operator. To do this you have to go to "Software Configuration -> Properties".
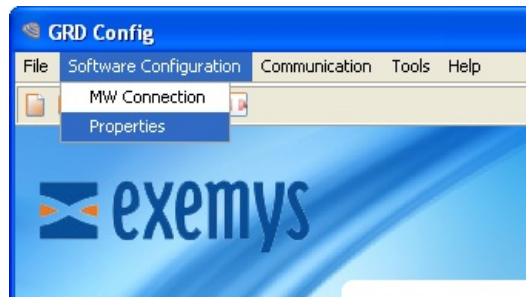
A window will be displayed on which we will be able to enter a name to recognize the configuration, APN, user and password.

2017-06-02

⚠️	*For GRD-3G and cLAN V2+ only*

Serial Port Modes

- "Remote" access using Redirector (Virtual COM port / Transparent)
- "Remote" access in Modbus mode
- Embedded "Modbus Master" (for I/O extension)
- Embedded "Modbus Slave" (to read I/Os from an external Modbus master)
- Data parsing from "Scripts"
- Connection to external "Satellite" modem

Serial Port Configuration

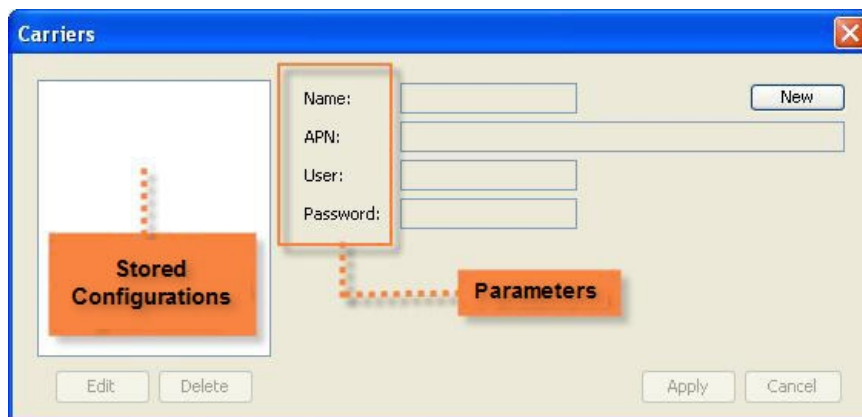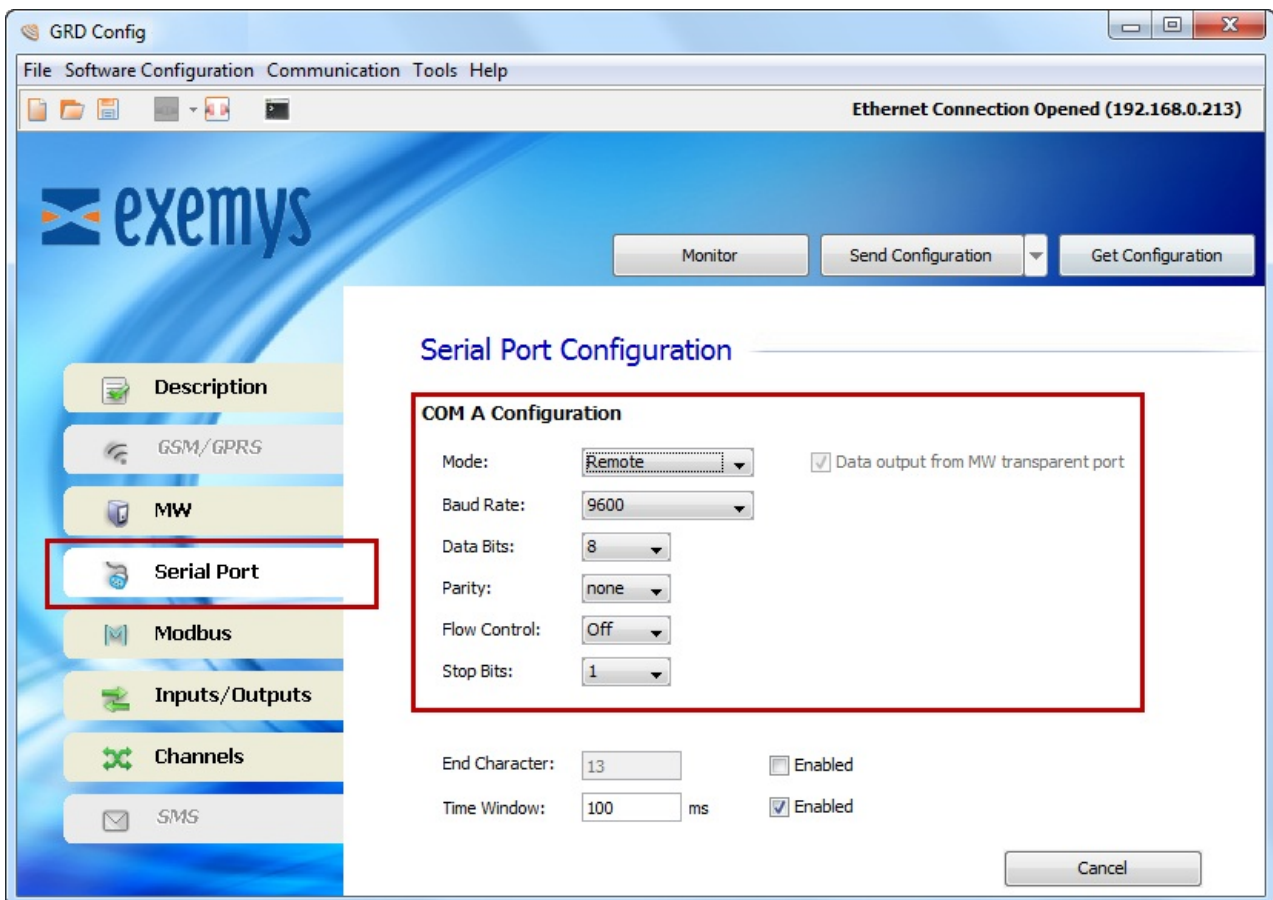In GRD with two serial ports you will be able to configure them individually. **Notice that the two serial ports cannot be configured on the same mode**.

Mode: Depending on how you are planning to use the GRD/cLAN you will choose on of these modes

- *Remote*: To access the GRD's serial port remotely in Modbus or Transparent Mode
- *Modbus Master:* To use the Embedded Modbus master to expand the I/Os
- *Script*: To parse incomming data or send data from the script (only on devices with script programming support)
- *Modbus Slave:* To use the Embedded Modbus slave to read/write the device channels (Physical, Modbus or script)
- *Satellite:* To connect an external satellite modem

Data output from MW transparent port : It allows you to configure which serial port can be reached remotely from the MW. Configuring a serial port will force this option to on.

***Baud Rate*:** Serial Port speed (1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)

***Data bits*:** Can be 7 or 8 bits

***Parity*:** Error checking (none, even, odd)

***Flow control*:** Allows automatic control of communication traffic according to the network availability. It is generally used for massive data transfer to avoid loss of information.

Stop bits: Allows to define the number of stop bits.

Time window and End character

In the "Remote" serial port mode, the device will attempt to group several data before sending the packet through the network; this makes a better use of the bandwidth and reduces communication costs. The implemented criteria for the packet end are the following:

- Time window (0…1000ms): once data are received, the device will wait in silence during this period before sending the packet through the network. These criteria incorporate a delay in the transmission of the communication, so care must be taken depending on the serial communication protocol being used.

- End character (0…255): It is the end character of a serial stream before sending the data.

ℹ	*If the end character criteria is enabled and the time window is disabled, the device will store the received data for an indefinite time until the configured character is received or the 1000 characters are accumulated.*

If both criteria are used, whichever is the earliest will cause data to be sent.

2017-06-16

Physical Inputs/Outputs

Depending on the model, the GRD/cLAN can have or not physical inputs/outputs.
We will now see the types of inputs/outputs that we can have and which parameters we can configure of each one.
It is important to point out that this configuration is applicable only to physical inputs and not to inputs from the Modbus queries.
For the configuration of the parameters you will have to enter the "Inputs / Outputs" menu and then select the type of input / output which are:

- Digital inputs
- Digital outputs
- Analog inputs

Digital inputs
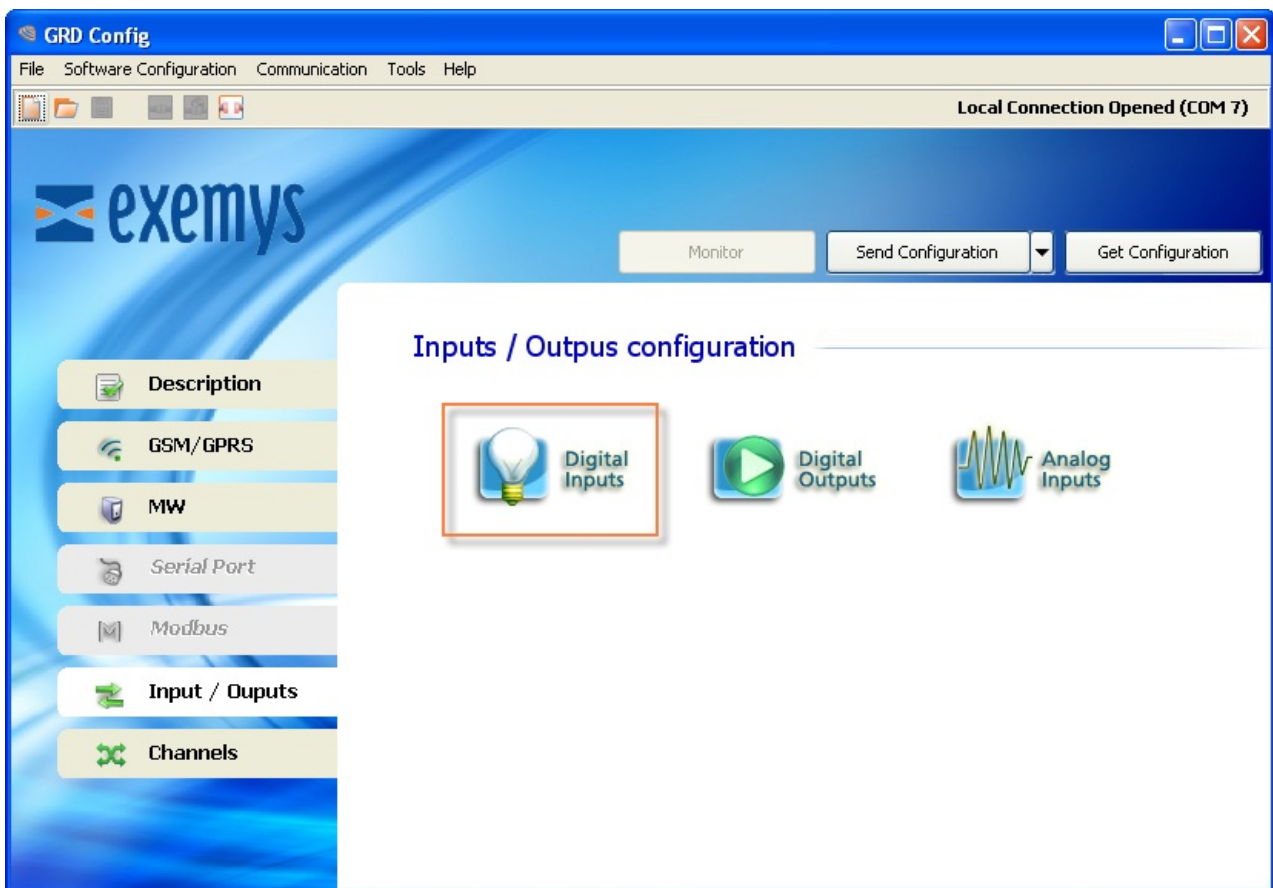
When we enter the configuration of a digital input we will see that we can configure 2 parameters one is the anti-rebound to avoid noise and the counting splitter in case of use as pulse input.
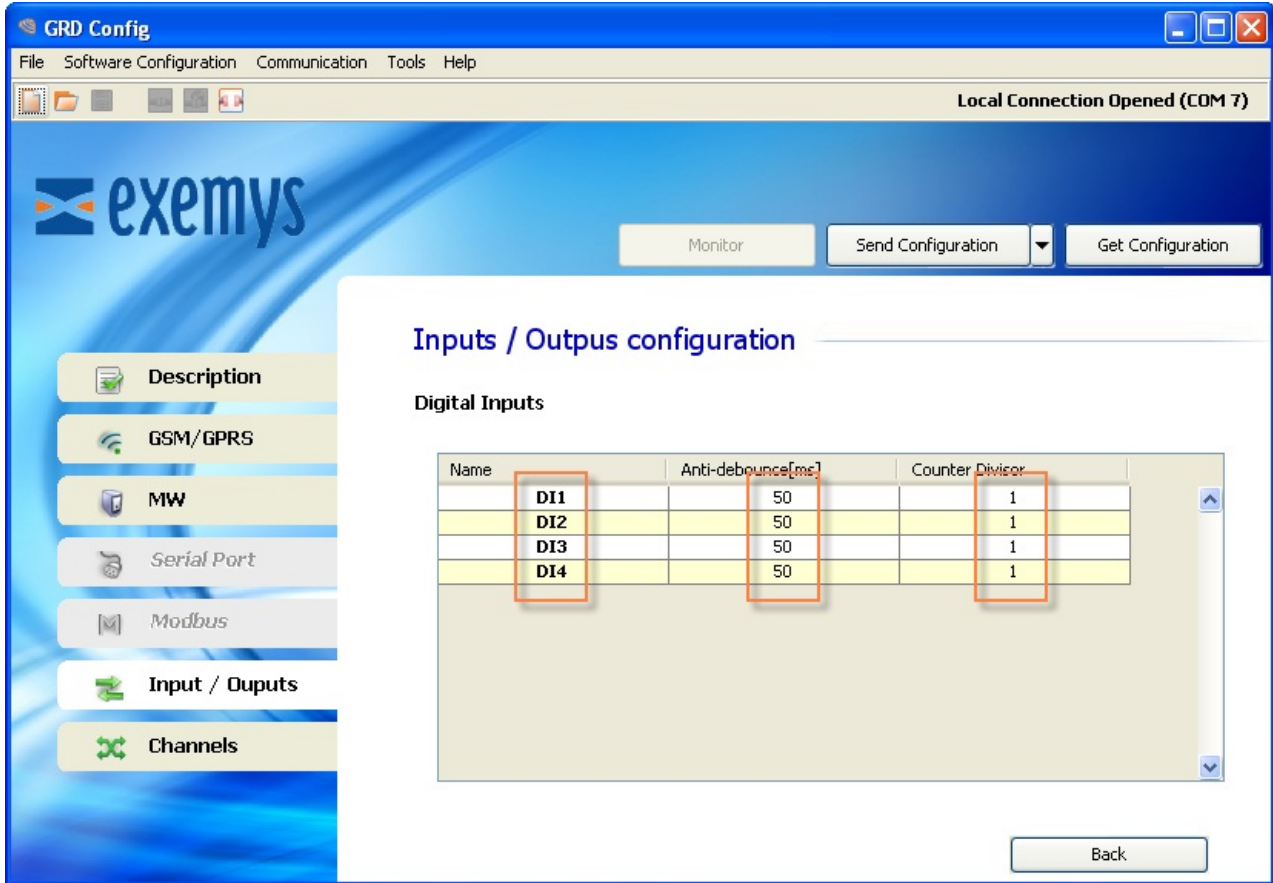
The value of the anti-debounce can be configured between 1 and 250 ms.

The counting divisor can take a value between 1 and 1000.

On the cLAN2205-XF, GRD3621-XF-3G and GRD3625-XF-3G you must configure wether a IO terminal will work as an input or as an output

Take special care not to apply direct voltage to a terminal configured as an output and in ON state.
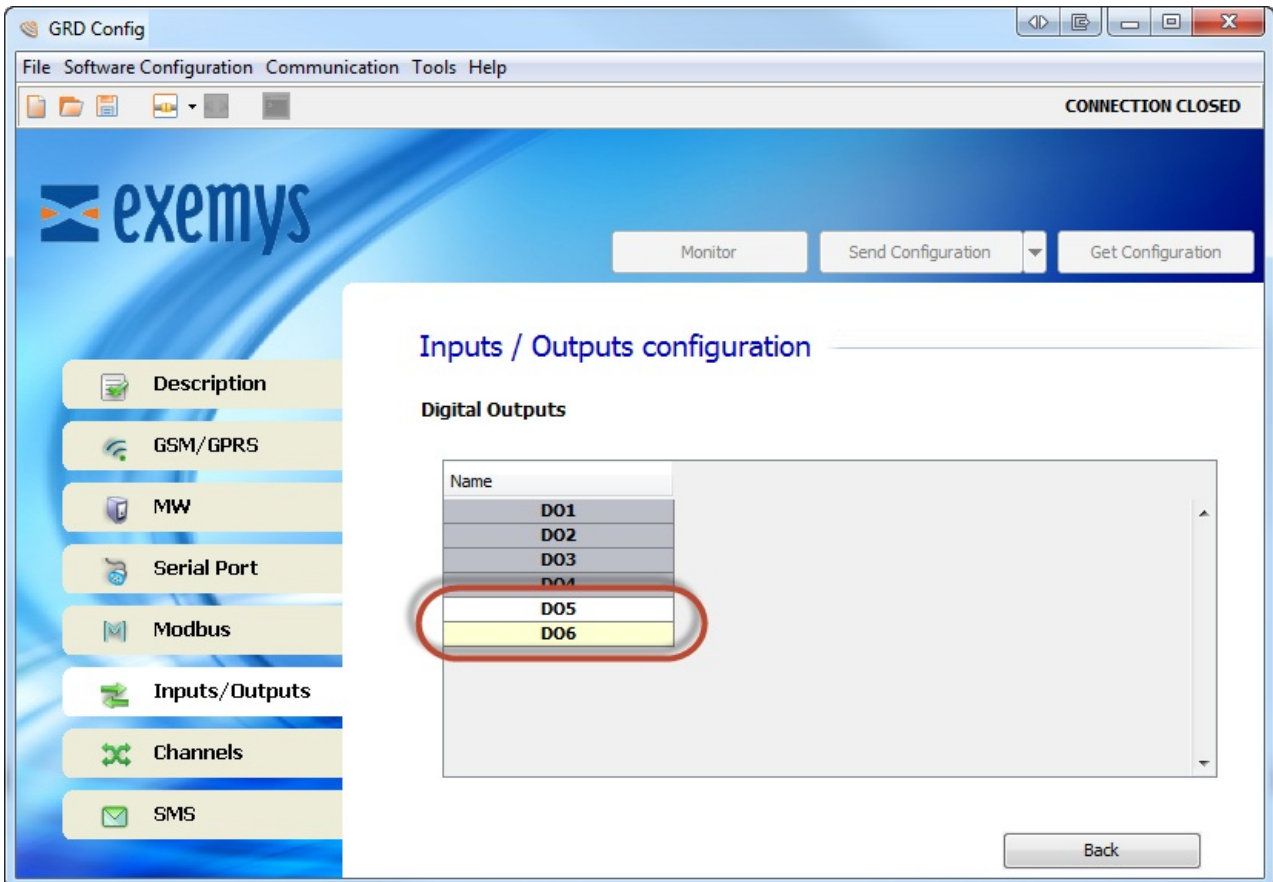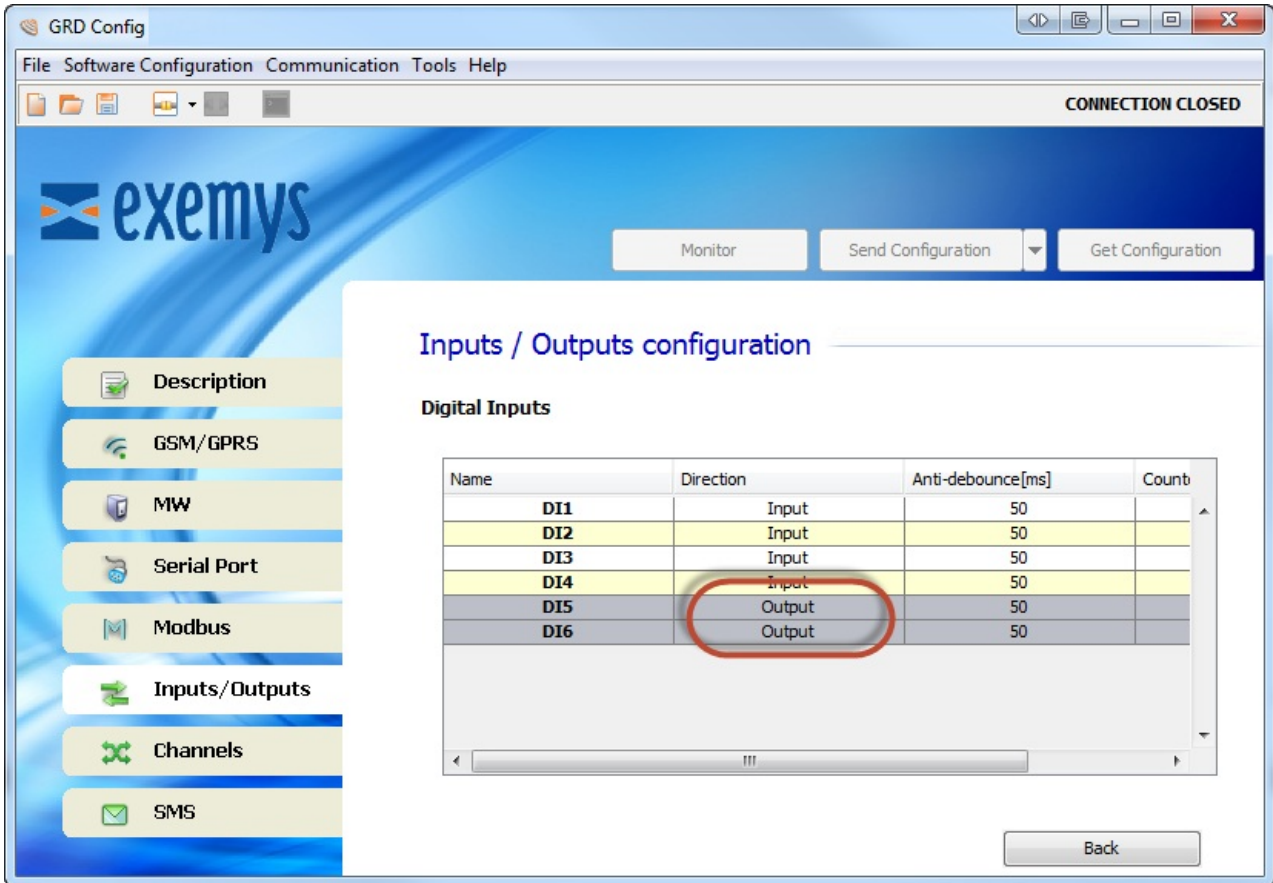
Analog inputs

In the configuration of analog inputs we can select the operational mode depending on the GRD/cLAN model, this refers to whether we are going to measure voltage or current and its resolution.
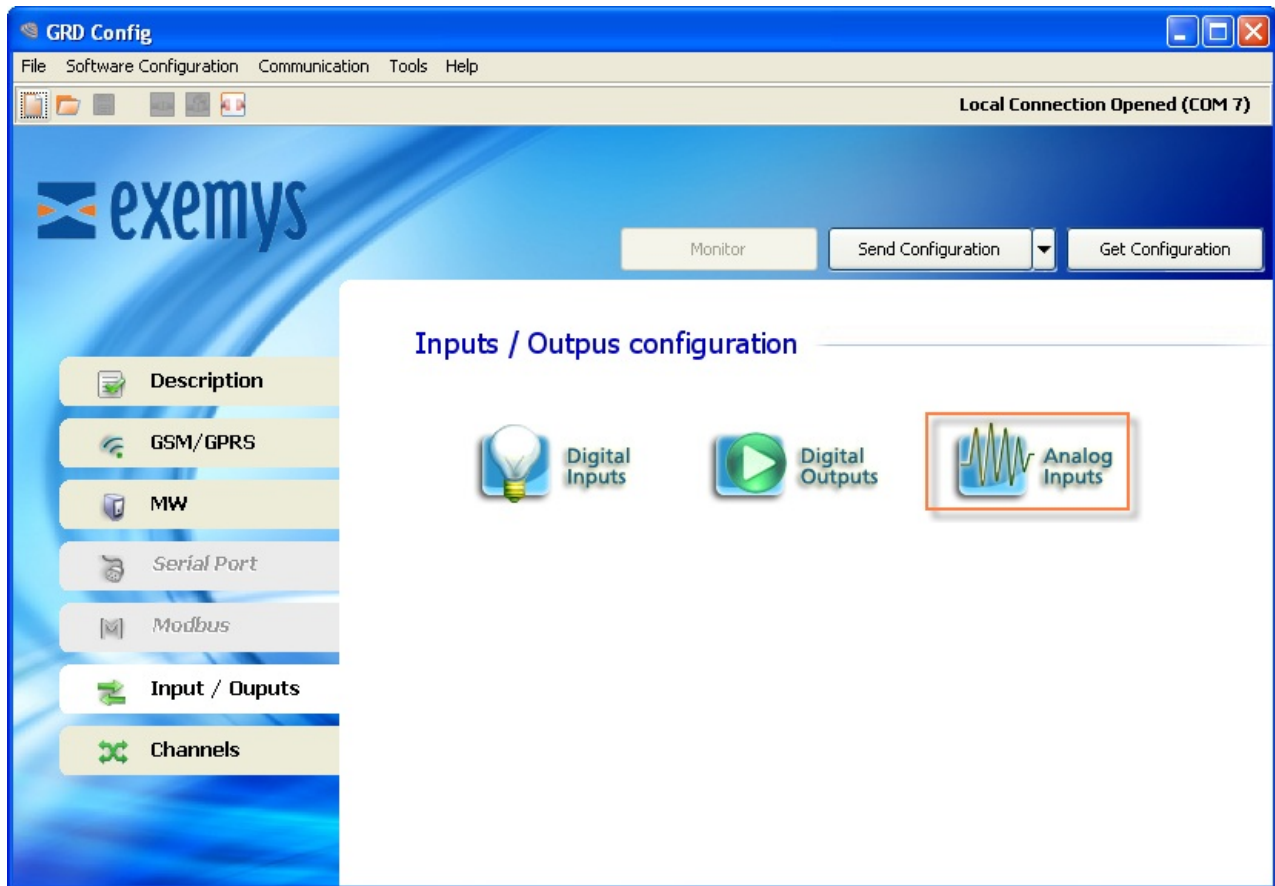
The analog inputs can be configured as follows:
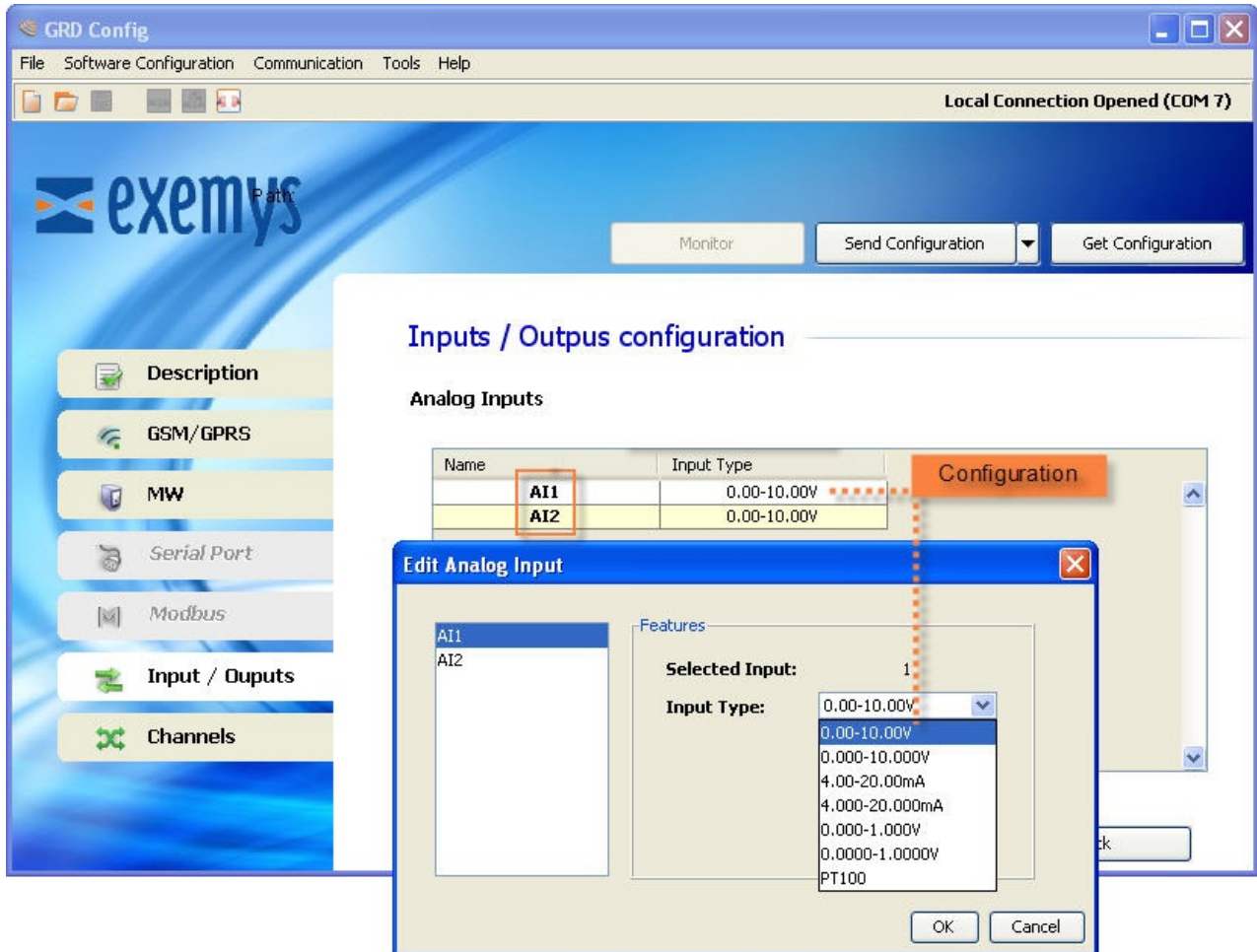
> ⚠️ *To use AI1 in PT100 mode you must also set internal jumpers on the GRD-3301-XF and the GRD-3621-XF-3G*

- **Voltage:**
  - ○ 0 to 1V with 3 decimal digits
  - ○ 0 to 1V with 4 decimal digits
  - ○ 0 to 10V with 2 decimal digits
  - ○ 0 to 10V with 3 decimal digits

- **Current:**
  - • 4 to 20mA with 2 decimal digits
  - • 4 to 20mA with 3 decimal digits

- **Temperature (PT100, GRD-3621-XF-3G only):**
  - ○ -199 to 849 ºC with decimal digit

    2017-12-21

⚠	*For GRD-3G* only

Power supply and inputs / outputs

Below you will find the minimum and maximum admissible values of digital inputs and outputs as well as analog voltage and current inputs, and also GRD consumption and power supply.

Power supply

Parameter	Condition	Minimum	Maximum	Units
Input voltage		10	30	Vdc
Average consumption	GRD at 24 Vdc GRD at 12 Vdc		100 150	mA
Maximum consumption	GRD at 24 Vdc GRD at 12 Vdc		1 1	A

Digital inputs

To activate the digital inputs a continuous voltage must be applied externally. This source of power has to share the GND terminal with the power supply of the equipment. If necessary the same power supply that feeds the GRD can be used. The input is of a Sinking type. It accepts sensor or PNP Sourcing type devices.

GRD3621-XF-3G / GRD3625-XF-3G

Parameter	Minimum	Maximum	Units
Activated input	7	50	Vdc
Input impedance	280		KΩ
Count frequency		45	Hz

GRD3534-XF-3G

Parameter	Minimum	Maximum	Units
Activated input	3.5	25	Vdc
Input impedance	2		KΩ
Count frequency	0	1	Khz

We now show two examples of how to connect an input, directly from the same source feeding the equipment and from an external source where we can clearly see that they must share the common Terminal.
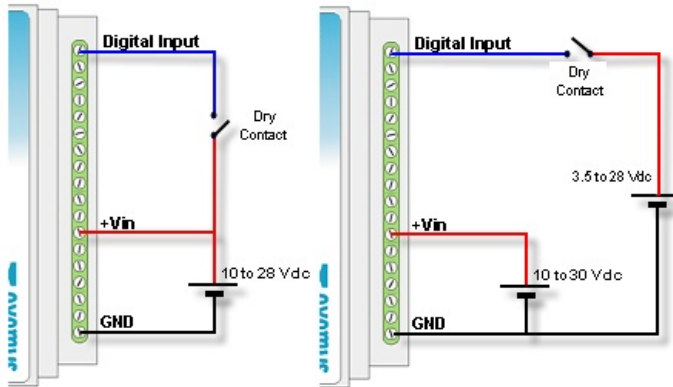
Digital outputs

Digital outputs are of the open collector type. The load to be connected must be fed with an external power supply and they have to share the GND Terminal with the equipment power supply. If necessary, the same power supply used to feed the equipment can be used.

The output type is NPN Sourcing type (Open collector).

GRD3621-XF-3G / GRD3625-XF-3G

Parameter	Maximum	Units
Withstand voltage	50	Vdc
Current	200	mA

GRD3534-XF-3G

Parameter	Maximum	Units
Withstand voltage	45	Vdc
Current	50	mA
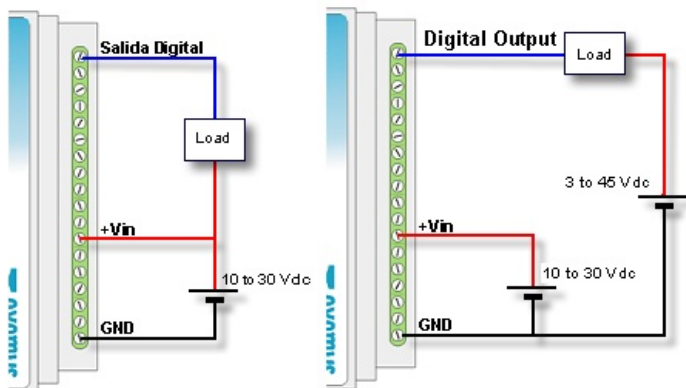
Digital outputs to actuate a Relay

When the digital output is used to actuate a relay coil a protection diode must be added to the connection to avoid damage to the output of the equipment. This must be connected in reverse, that is the anode to the output terminal of the equipment and the cathode to the positive terminal feeding the relay. The relay must be fed using an external power supply, sharing the GND terminal with the power supply of the equipment, or if necessary the same power supply feeding the GRD can be used.

The following graph shows how to connect a relay to a digital output of the equipment.
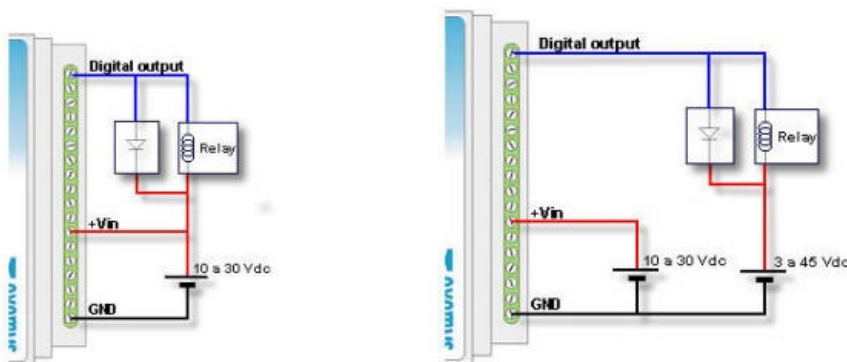
Analog Inputs

Analog inputs refer to the GND Terminal of the equipment, consequently, the power supply used to feed the sensor must share the GND terminal with the equipment.

Voltage inputs (0-10V / 0-1V)

Parameter	Value	Units
Full scale	10 / 1	Vdc
Precision	1 / 0.1	mV
Input impedance	11.4	KΩ

The following two examples show how to connect and analog voltage input for a single power supply or for independent power supplies.
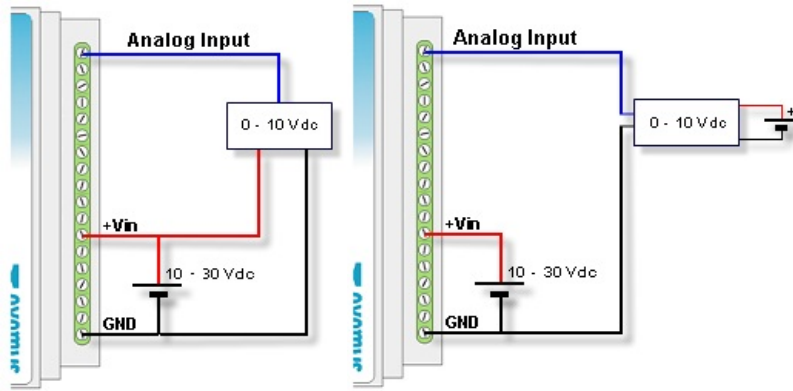
Current inputs (4-20mA)

Parameter	Value	Units
Full scale	20	mA
Precision	10 / 1	uA
Shunt resistance	100	Ω

The following two examples show the connection of a 4 – 20 mA sensor sharing the power supply with the equipment for passive sensors or for active sensors with independent power supply.
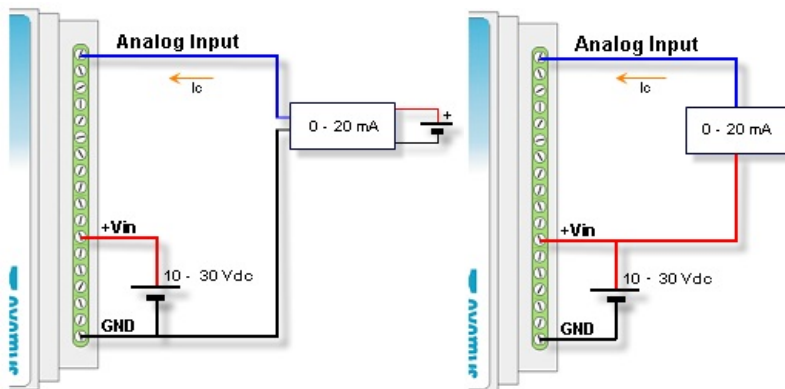
PT100 inputs (GRD-3621-XF-3G only)

Parameter	Value	Units
Full scale	-199 to 849	ºC
Precision	0.1	ºC

In the following diagrams you can see how to connect 2 and 3 wires PT100 sensors.

2017-12-21

⚠️ *For GRD-3G and cLAN V2+ only*

Embedded Modbus master (Input/Output extension)

Depending on the GRD/cLAN model, it can have an internal Modbus master, which will allow you to increase the number of inputs/outputs of the device. We will now see the configuration and utilization.

This master will let you load a maximum of 100 Modbus queries to which will be able to configure certain parameters. Each one of the queries can be mapped as an input/output channel, and be able to configure the generation of Historicals and reports.
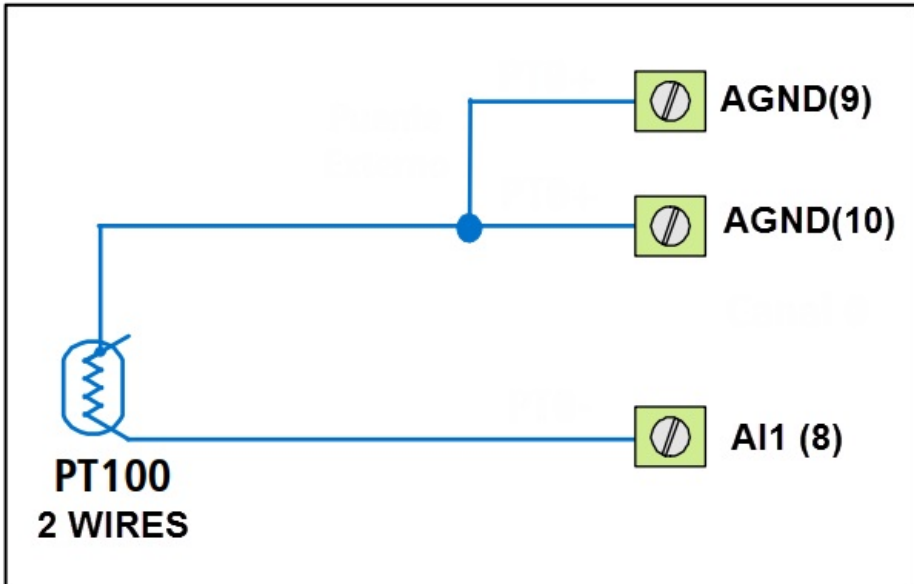
In "GRD Config" you will find a tab called "Modbus" where you can configure the general characteristics of the Modbus master and Queries.

To use the Modbus master set the serial port in "Modbus Master" mode

Configuration of the Modbus master

Configure one serial port in "Modbus Master" mode
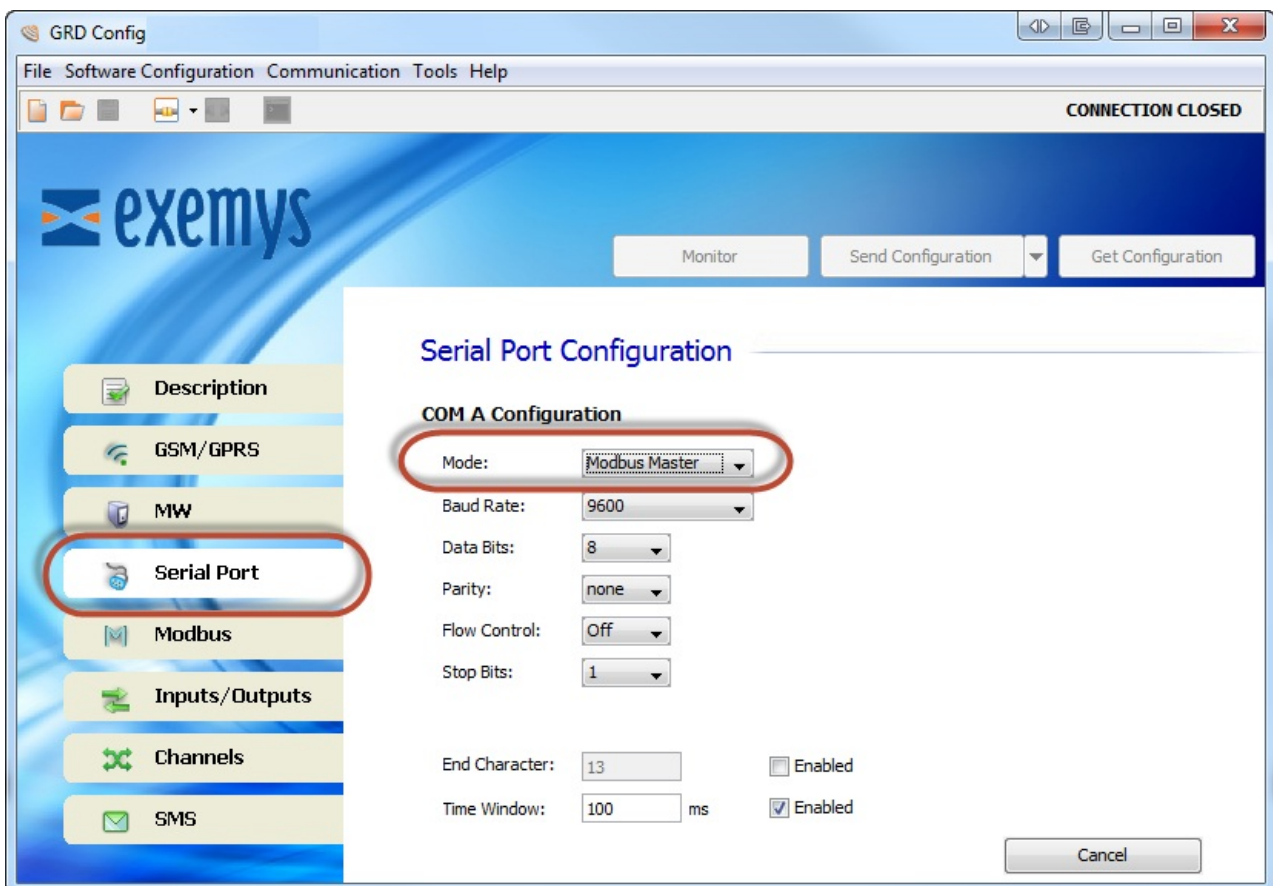
Inside the "Modbus" tab enter the "General Configuration" menu, where you can configure the Modbus master.
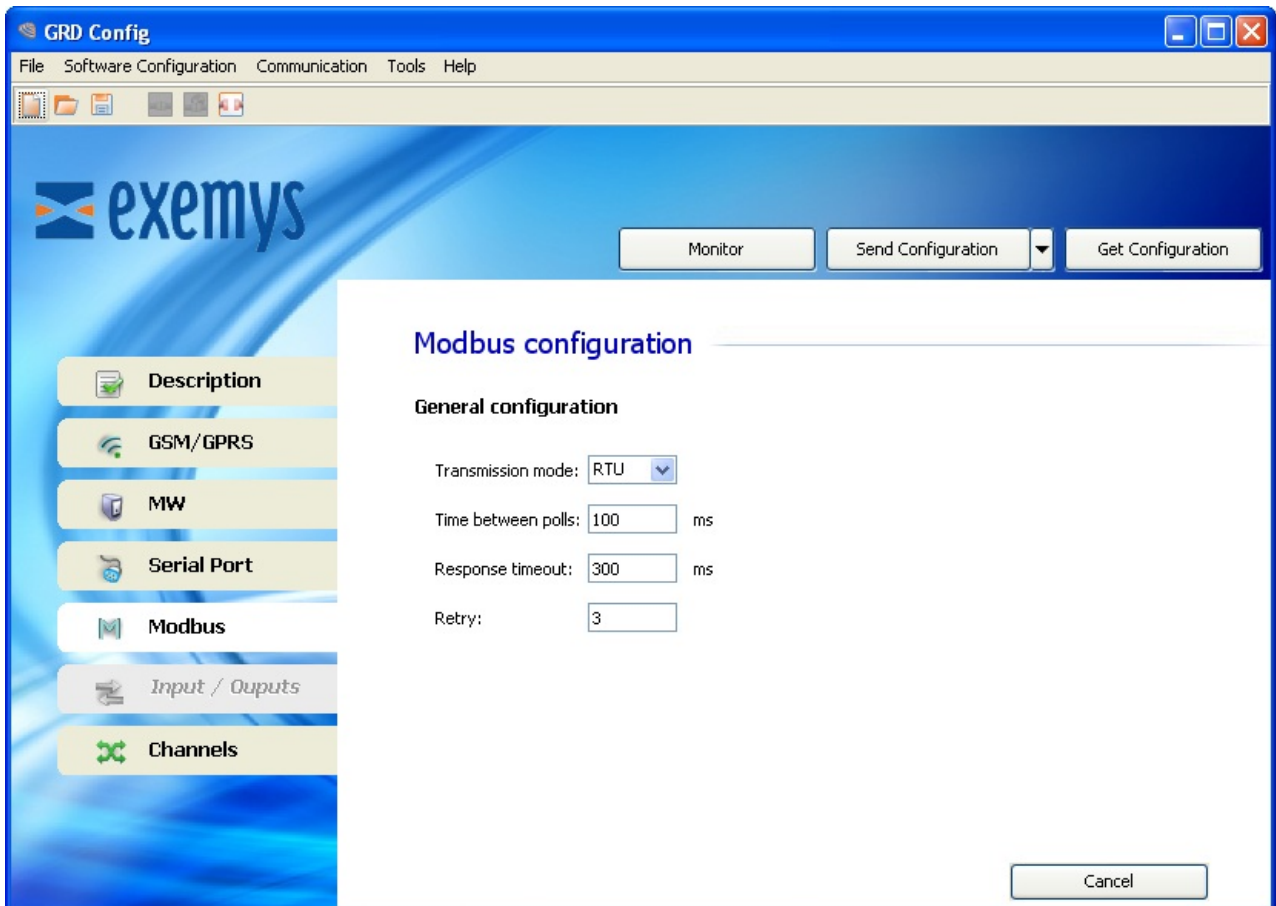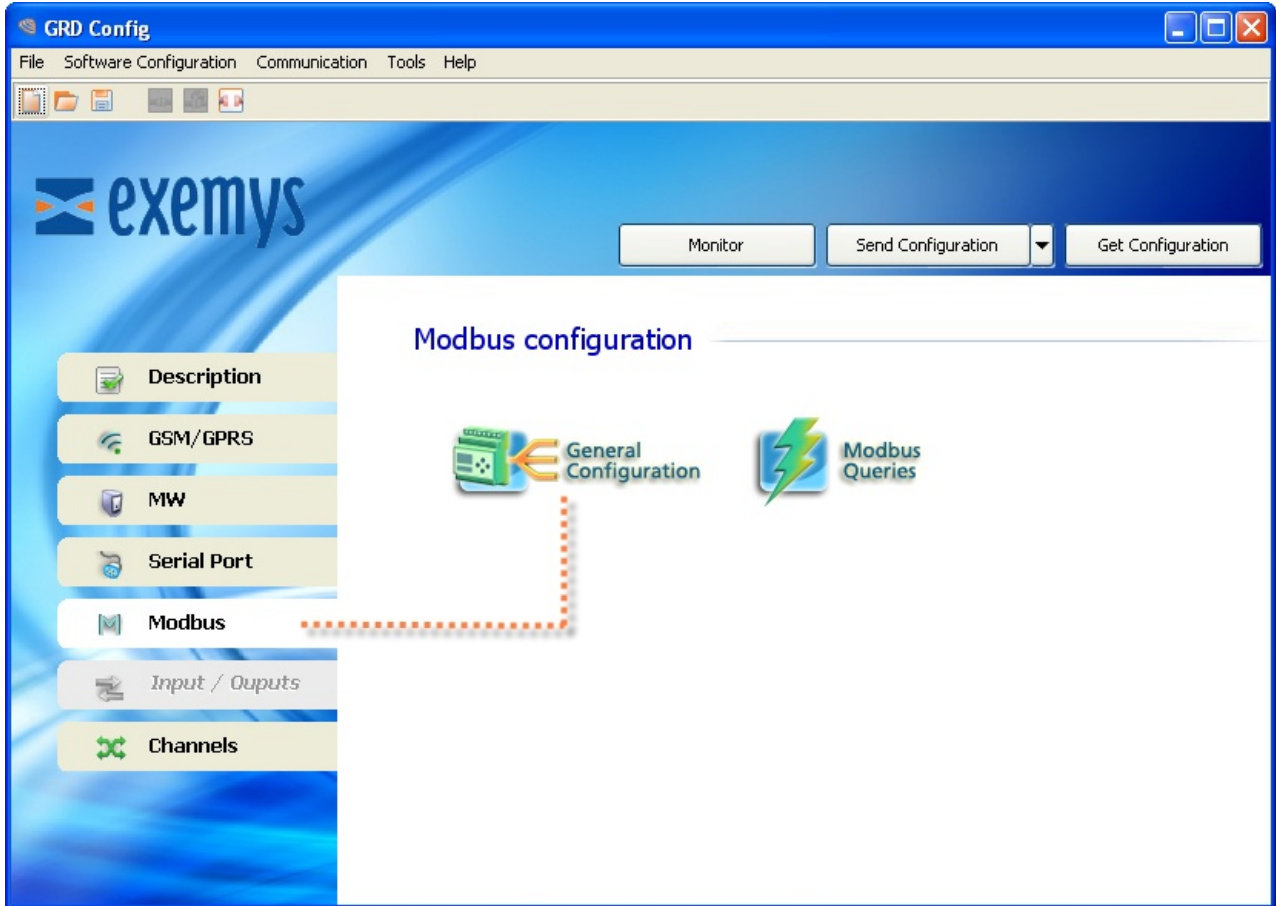
Transmission mode

It refers to the Modbus protocol to be used, being RTU or ASCII.

Time between polls

This is the time the equipment will wait before sending a query after having received the response to another query.

Timeout

This is the time the GRD/cLAN waits for the arrival of a response from the slave.

Retry

The retries are the number of times that the master will send the query if we don't have a valid response, before considering the value of the query as 0, while the quantity of retries is not met, the master will maintain the previous value.

Configuration of the Modbus queries

Once the master is configured we can add the desired queries entering the "Modbus Queries" menu and inside "Modbus".
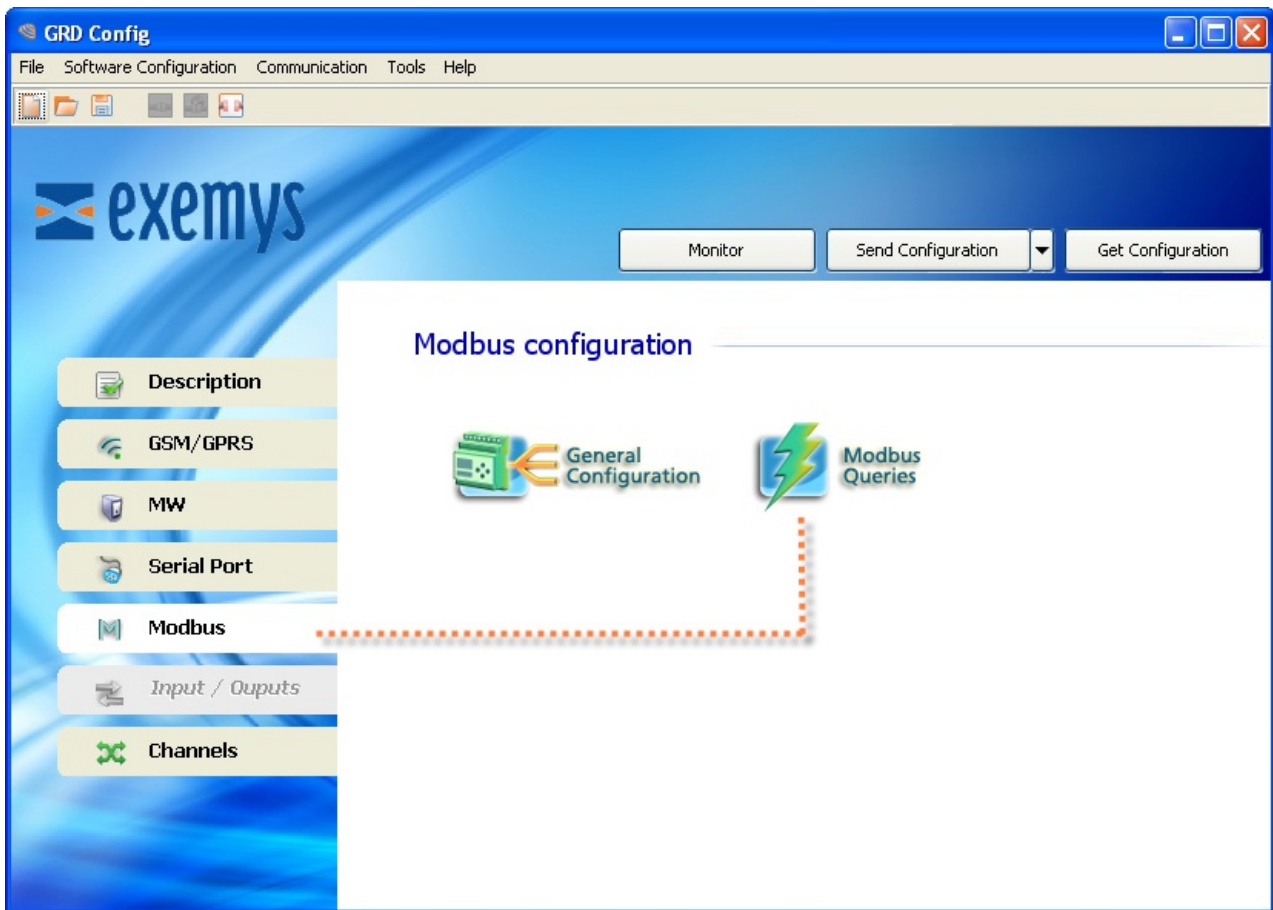
Inside the "Modbus Queries" a list will show us all the added queries and their parameters, which we will be able to modify. To add a query we click on "Add" or "Del" to erase it.
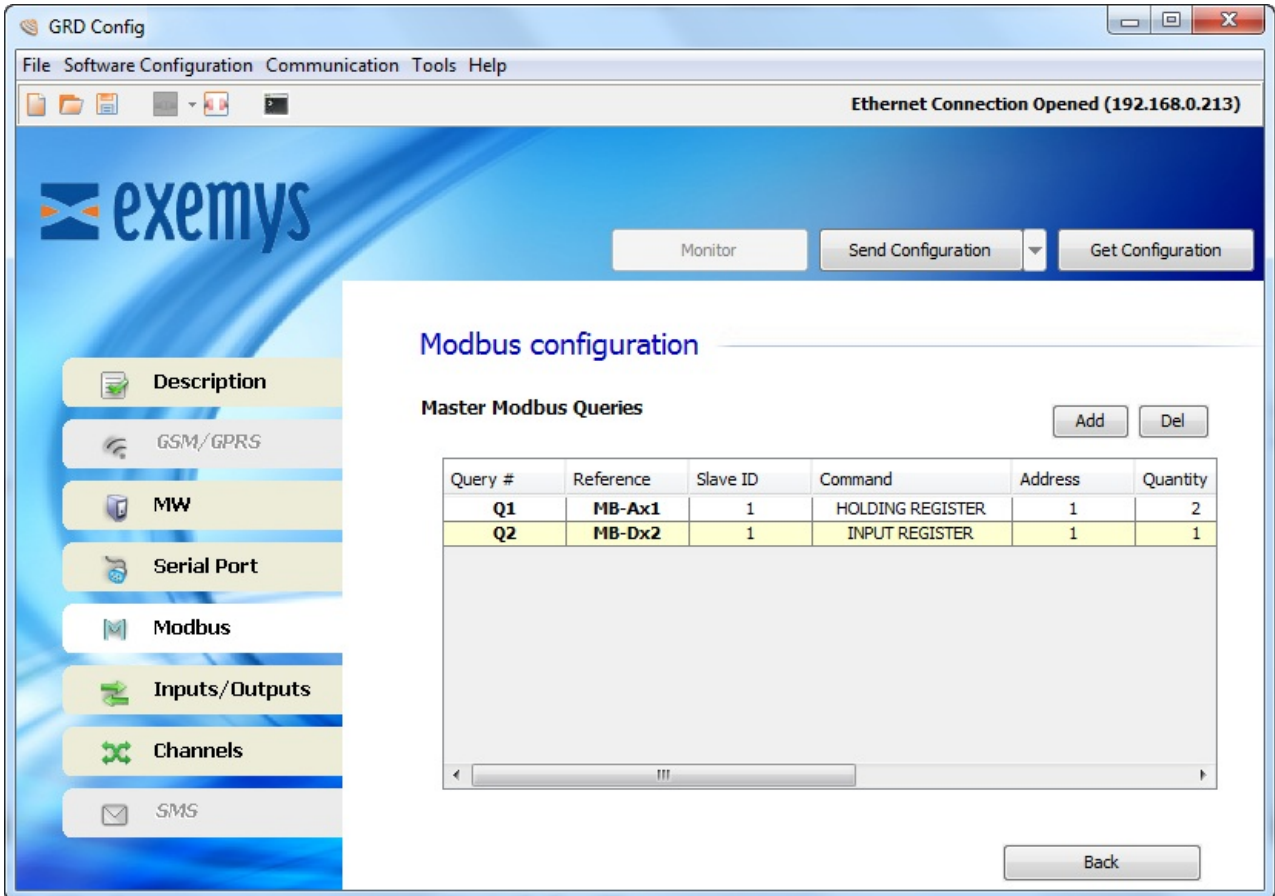
If we click on "Add" a screen will be displayed in which we will be able to configure all the parameters of the query
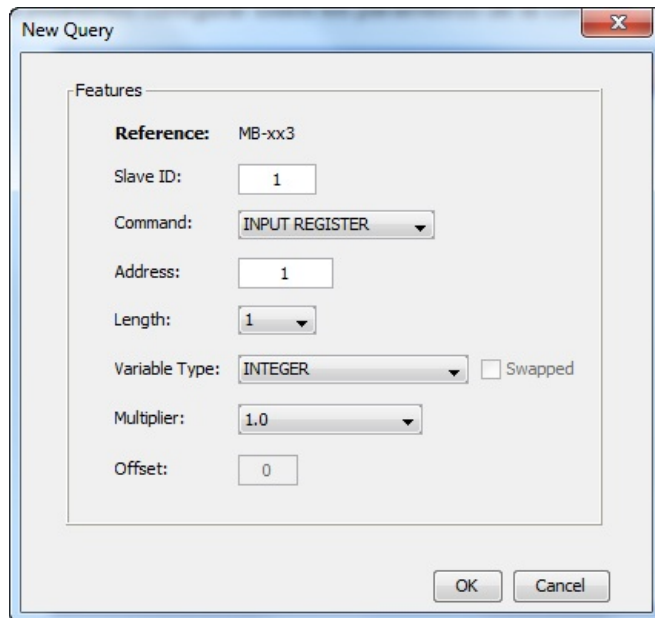
Slave ID

It is the address of the slave we wish to query.

Command

Here we can configure the type of register to be queried:

- **INPUT REGISTER**

- **INPUT STATUS**
- **HOLDING REGISTER**
- **INPUT REGISTER**

Address

In this parameter we load the address of the query, the value can be between 1 – 65536.

Length

With this parameter we will be able to define the number of registers we want to query, this length can be 1 or 2 according to the type of query.

If the query is of the "Input Status" of "Coil Status" type, the length will necessarily be 1, that is, no modification will be allowed.

If the query is of the "Input Register" or "Holding Register" type, the length can be 1 or 2, implying that as a result of the query we will have 16 or 32 bits respectively.

Variable Type

This parameter is very important since it defines how the GRD/cLAN is going to store data received from a query. The types of variable that we will select depend on the type of queried register and its length.

The types are:

- **BIT**
- **BIT WORD**
- **INTEGER**
- **INTEGER SIGNED**
- **INTEGER 32 BIT SIGNED** (Address 40001 will get registers 40002:40001)
- **FLOAT 32 BITS** (Address 40001 will get registers 40002:40001)
- **INTEGER 64 BITS** (Address 40001 will get registers 40004:40001)
- **FLOAT 64 BITS** (Address 40001 will get registers 40004:40001)

Swapped

Registers will be ordered in a diferent way in querys with register length greater than one.

- **INTEGER 32 BIT SIGNED** (Address 40001 will get registers 40001:40002)
- **FLOAT 32 BITS** (Address 40001 will get registers 40001:40002)
- **INTEGER 64 BITS** (Address 40001 will get registers 40001:40004)
- **FLOAT 64 BITS** (Address 40001 will get registers 40001:40004)

Offset

The offset can only be selected when we define the type of variable as "BIT WORD" this means that from a Modbus query that returns 16 bits we can keep the result of 1 bit. The value of this parameter goes from 0 to 15, being 0 the LSB and 15 the MSB.

Types of queries

We will now see the types of queries we can create and according to its parameters to which channel we will be able to add them.

Register type	Length	Data type	Offset	Channel
Input Status	1	BIT	-	I or O

Coil Status	1	BIT	-	I or O
Holding Register	1	BIT WORD	0 to 15	I or O
		INTEGER	-	AN or PI
		INTEGER SIGNED	-	AN or PI
	2	INTEGER 32 BITS SIGNED	-	AN or PI
		FLOAT 32 BITS	-	AN or PI
	4	INTEGER 64 BITS		
		FLOAT 64 BITS	-	AN or PI
Input Register	1	BIT WORD	0 to 15	I or O
		INTEGER	-	AN or PI
		INTEGER SIGNED	-	AN or PI
	2	INTEGER 32 BITS SIGNED	-	AN or PI
		FLOAT 32 BITS	-	AN or PI
	4	INTEGER 64 BITS		
		FLOAT 64 BITS	-	AN or PI

2017-06-12

Channels

Channels are the media through which information about inputs/outputs of the MW equipment are sent or received.
These channels can be linked to physical entry points of the equipment like MODBUS queries according to their compatibility with the channel.
The GRD/cLAN have 4 types of channels::

- Digital inputs channels
- Digital outputs channels
- Analog inputs channels
- Pulse inputs channels

The most common option is to link them in the following manner:

Channel	Input/Output
I1..n	DI1..n
O1..n	DO1..n
AN1..n	AI1..n
PI1..n	DI1..n

Where:

Ix: is a digital input channel.
DIx: is a physical digital input.
Ox: is a digital output channel.
DOx: is a physical digital output.
ANx: is an analog input channel.
AIx: is a physical analog input.
**PIx:** is a pulse input channel

Beyond the most common way to link the channels like the previous example, it can be done in a disordered manner or repeating them. This means that you could create a channel I5 linked with the DI13 input and a channel I6 that is also linked to the DI13 input.

On GRD/cLAN with serial port, I/O channels can be linked to Modbus queries if you use the embedded Modbus master feature. If you do it, the queries will be shown on the "source" combo box (MB-DIx, MB-DOx, MB-AIx or MB-PIx)

On GRD/cLAN with script programming support you can link script variables to any channel. The channel will take variable value to send reports and when creating historical records. You can also change the variable channel remotely if you link it with a digital output channel.

Adding Channels

To add channels in the "Configurator" you must enter the menu "Channels -> Type of desired channel".
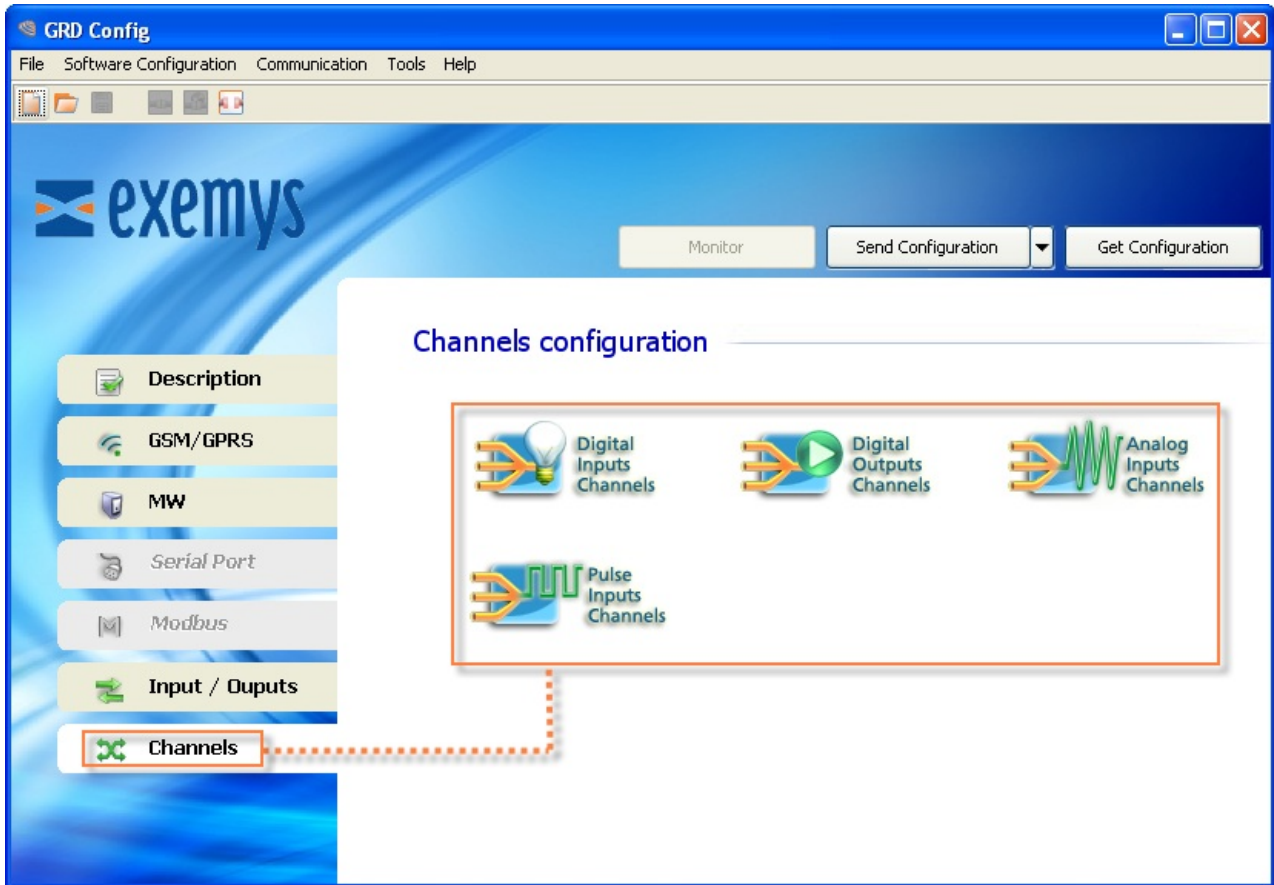
After selecting the desired channel and among any of the 4 you'll have the option to add or remove, it is important to point out that within each channel only inputs and outputs compatible with that channel will appear.

You will now see an example of how to add a digital input channel.
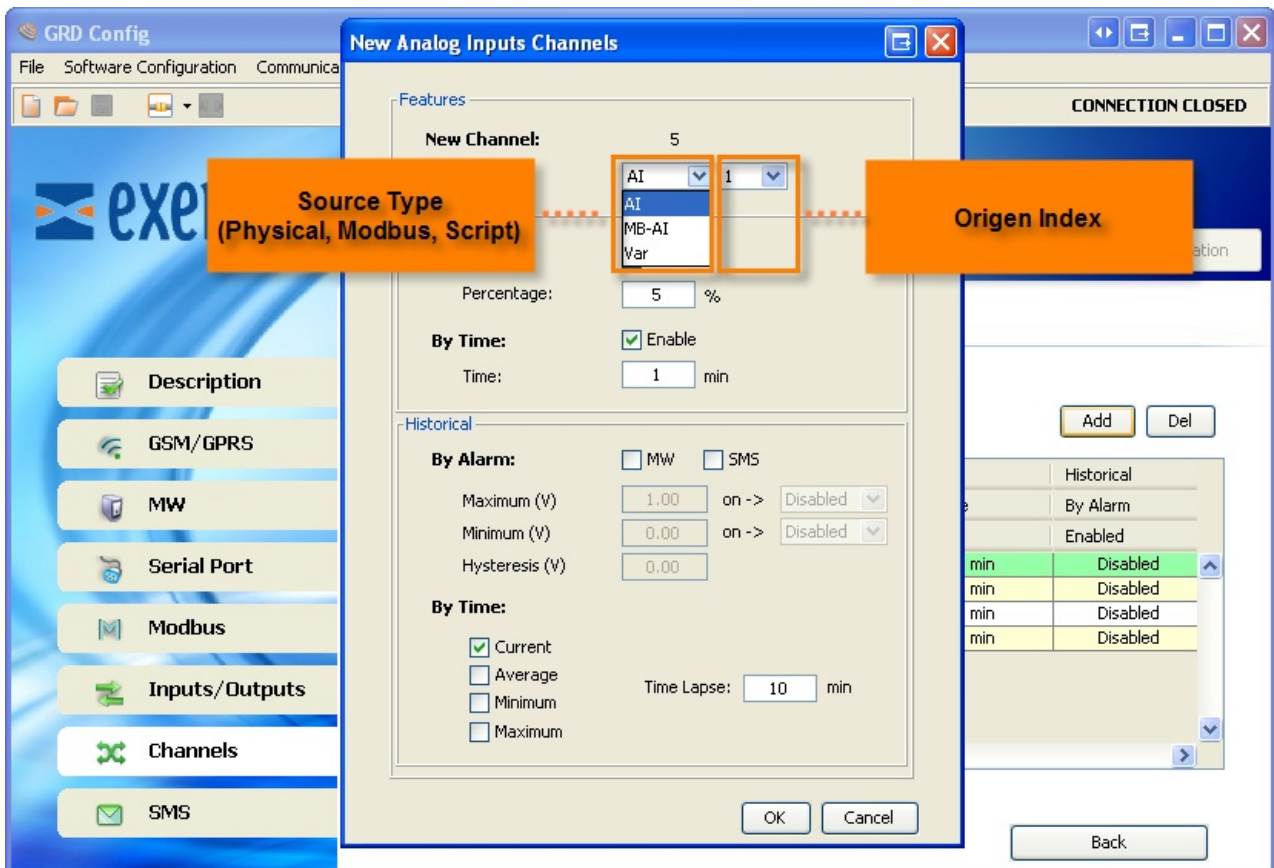
To erase a channel you only have to click on the "Del" button of the channel previously selected.

	The signal level can be configured as analog channel source in GRD-2G with firmware 4.0.0 or higher.
	This feature is available in all GRD-3G

2017-08-18

⚠️	*For GRD-3G and cLAN V2.0+ only*

Reports and Historical records

There are 2 types of information that the GRD/cLAN can send. On one side, we have the reports that contain the real values of inputs and outputs updated according to the criteria configured in the device. We can select the values we want to have updated and under which conditions and only when there is a connection with the MW. On the other hand, and independently, we have the Historicals, which are made of registers of events and time (logs) that are stored in the GRD and are sent to the MW.If there is no connection the registers remain in the equipment until they are recovered.

Historicals and reports are configured on the channels.

Reports

We will now see the types of reports and how to configure them. The reports are configured individually in each channel, to access the report configuration screen go to the Configurator, the "Channels" menu and here select the type of channel and channel number by double clicking on it. A configuration screen will be displayed where you have the available configurations for that channel.

It is important to be aware that when the GRD losses connection with the MW and recovers it or is the first time it is connected, it sends a message with all configured reports.

Digital inputs channels reports:

The following figure shows the configuration screen of the digital inputs reports:
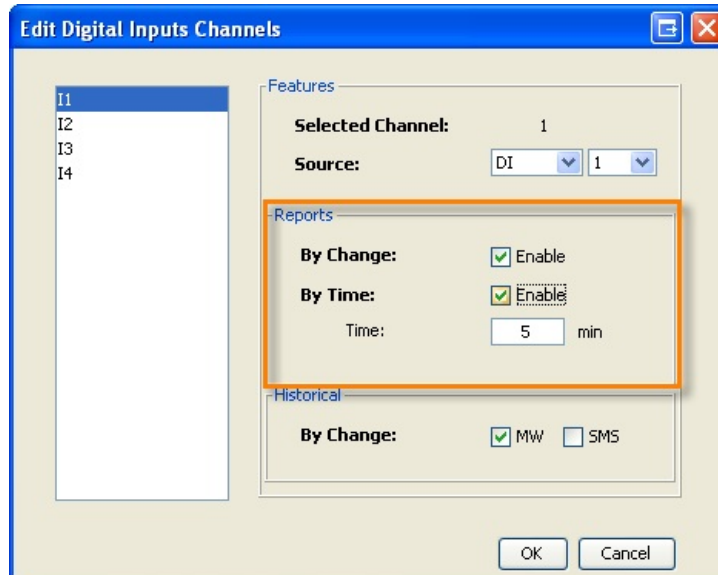
Report by change

If a report by change of a digital input cannel is enabled, a change of value will generate a message that will be sent to the MW. This way, only the events of interest at the moment they occur, are reported, if one of the inputs with a disabled report changes value it will not be reported.
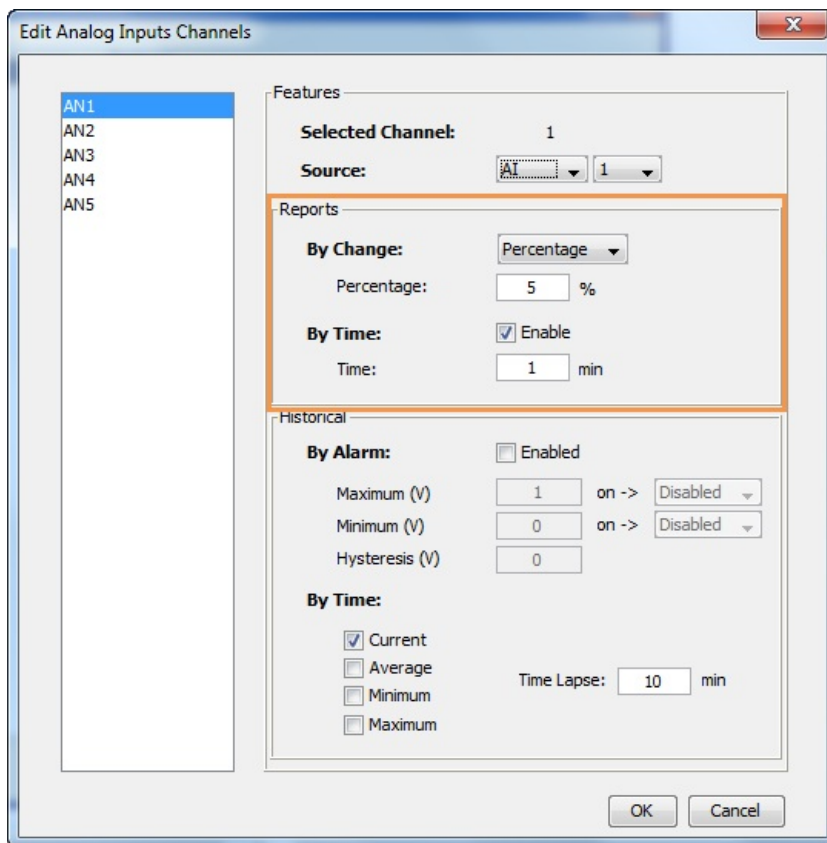
Report by time

It defines the time in minutes which determines how often a report message is generated. Let's suppose that we are interested in updating an input channel every five minutes independently of the changes that occur, the only thing we need to do is to enable the report by time and configure in 5 minutes, this will

force the report message that will update the input value in the MW every 5 minutes.
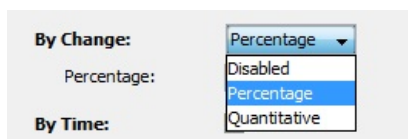
Analog inputs channels reports:

The following screen shows the configuration screen of the analog inputs report. The analog inputs have 2 types of reports, on one side reports by percentage change and the other one temporary report.

Report by change

The report by change is enabled in the channels we want to be updated in the MW every time that the signal changes

The "percentage" report will report if the input changes a percentage from full scale. The full scale value will depend on the input type.

The "quantitative" report will report if the input changes a configured absolute value. .

Report by time

It defines a time in minutes which determines how often a report message is generated.

Digital outputs channels reports:

In this case we only count on a temporary report, the change report is always enabled, this means that when a change occurs in one of the outputs, it will be immediately reported. The purpose of having the change report permanently enabled, is because the report can be used as verification of a remote activation.
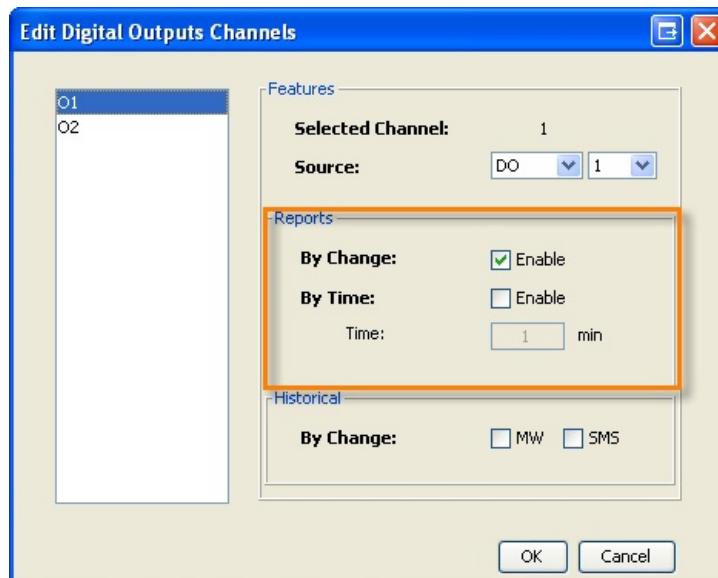
Pulse inputs channels reports:

The pulse channels have 2 types of reports. On one side the reports by performed count and on the other the temporary report.

Report by count

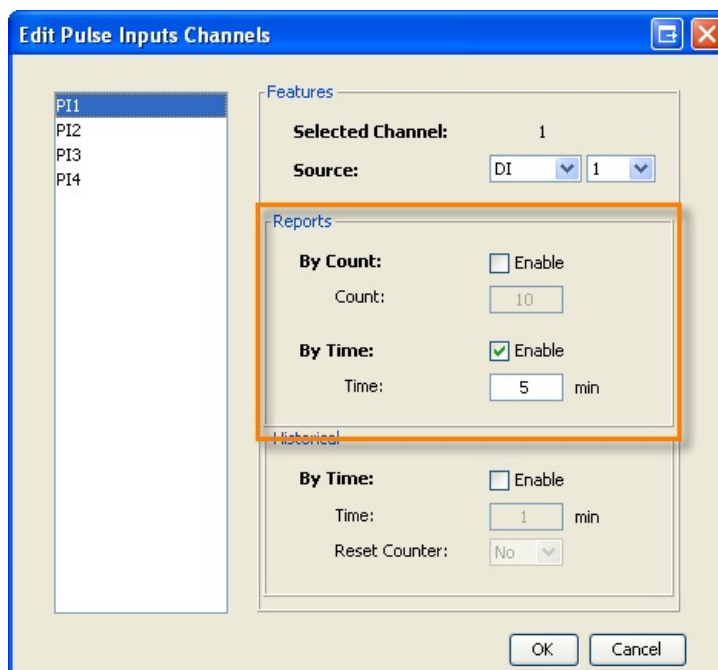In the counts number report the device sends a message to the MW each time the desired input counts a number of pulses from the last report of this channel, by counts or by time.

Report by time

It defines time in minutes which determines how often a report message is generated.

Historical records

Historicals allow the device to store the events as changes in inputs or outputs being either on-line or off-line and then transmit them to the MW for further visualization and analysis. These Historicals will let you know the value and number, of an input or an output that has been modified and the date and time the

event took place.
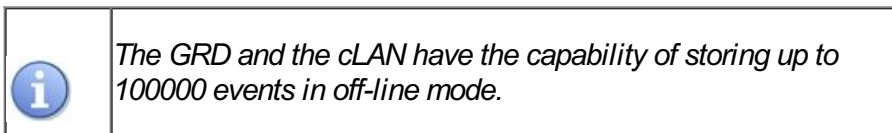
	The GRD and the cLAN have the capability of storing up to 100000 events in off-line mode.

Para acceder a la pantalla de configuración de históricos debe ir en el Configurador al menú "Channels" allí seleccionar el tipo de canal y luego el número de canal haciendo doble clic sobre él de esta manera accederá a una pantalla de configuración donde tendrá las configuraciones disponibles para dicho canal.

Digital input channels historical records

In this case the digital input channels have Historicals by change, this means that a register is generated for every change of this input. The following figure shows the screen to enable these Historicals.
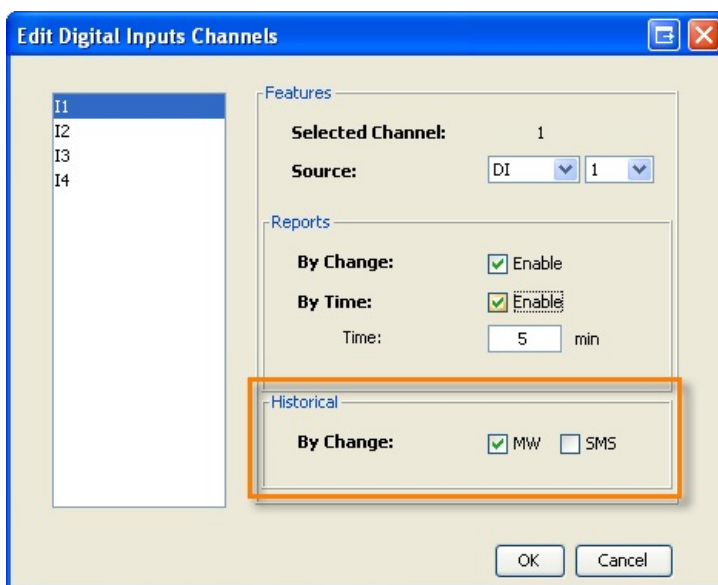
Analog input channels historical records

Just as in digital inputs it is possible to keep a Historical of analog inputs under two clearly defined criteria.

On one side we have an alarm type register of Historicals that allows monitoring the limits of tensions with a determined value of hysteresis.

On the other side, we can create a register of Historicals by time, that is, sample the analog inputs and store its value every specific time, this type of Historical, in turn, is subdivided into 4 since we can store the real value, the minimum value, the maximum value or the average in the configured time period.

Once stored in the device's memory, it is transmitted whenever possible, but is never lost under any circumstance.

By alarm

This criterion defines an operational band through a maximum and minimum. When the analog input exceeds the maximum value a Historical is generated by maximum, when the analog input is lower than the minimum a Historical by minimum is generated and when the analog input passes from a maximum value or from a minimum value to a normal value between both a Historical by normal value is generated. In this manner we can follow the evolution of the input when it fluctuates between the specified limits. In addition to the maximums and minimums a value of hysteresis must be defined to avoid continuous generation of Historicals when the analog signal oscillates above a threshold value. In the following figure we can see how the hysteresis mechanism works for the maximum.
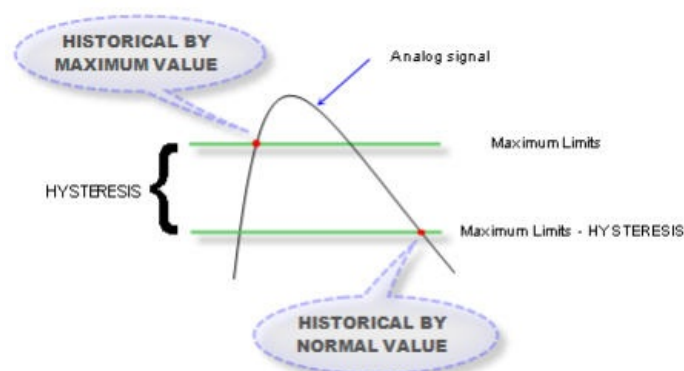
The same happens for minimum values but in an exactly opposite manner.
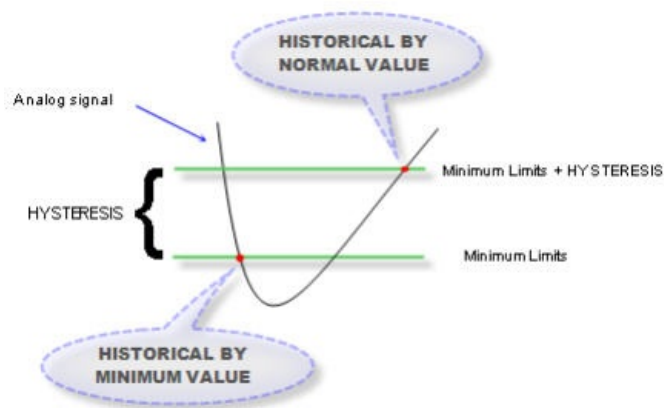
It is not possible to configure a value of hysteresis greater than the difference between the maximum and minimum, and also a maximum smaller than a minimum. We can also associate a digital output channel to the alarm event by maximum and another one of alarm by minimum, this means that when the analog input in the maximum range will activate an output and in the minimum another one.

By time

In this case the Historical by time has 4 sub-types. En este caso el histórico por tiempo tiene 4 subtipos.

- Current Historical by time:

This type of Historical makes a unique capture of the value of the analog channel at the moment the configured time is due and generates the register.

- Maximum Historical by time:

In this case captures are made from the last Historical until the register time is due, when this happens a Historical is generated with the maximum value measured in this period.

- Minimum Historical by time:

This Historical is similar to the maximum but only registers the minimum value in the time period.

- Average Historical by time:

The concept is the same as in the previous ones but in this case it calculates an average of the value of the channel in the time period.

The device is prepared to register by cardinal time, this means that if we configure the time in 60 minutes at 8:38 it will register for the first time at 9:00 hrs, then at 10:00 hrs and so on.

Digital outputs channels historical records

Just as the inputs a Historical by change of the output channels can be made. Take into account that modifying one of the outputs remotely depends on the availability of the communication with the MW at that moment

Pulse input channels historical records

The pulse channels can also generate Historicals in a specific time that can be configured the same way as in the other channels, as it is shown in the following figure. We can also decide if once the Historical is generated, we want the counter reset to 0 or not.

Delete Historicals

In the need of erasing Historical registers, this can be done by means of the "GRD Config" in the monitor window with the "Delete" button located next to the indicator of stored Historicals.
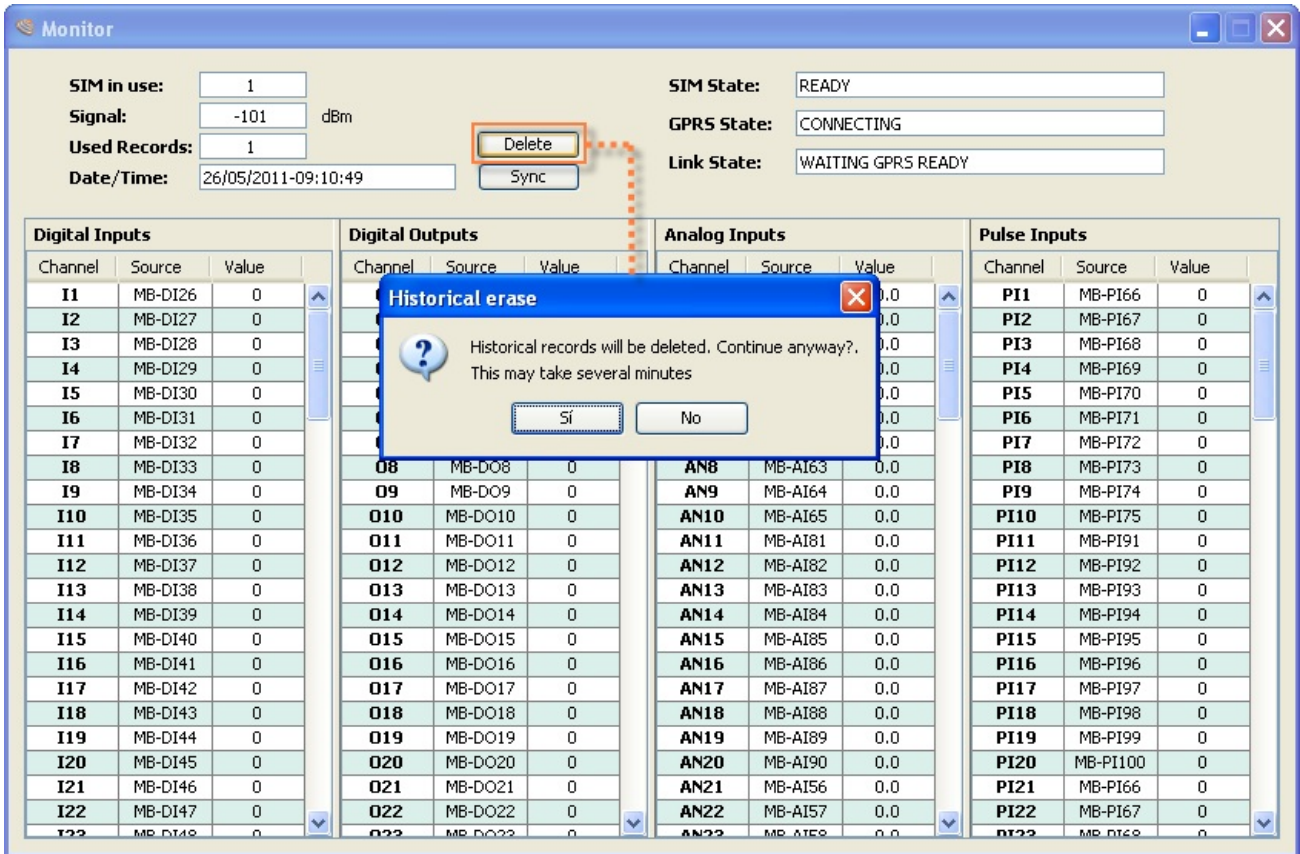
This operation can take a considerable time.

Configuring time

The time can be updated on the monitoring screen by clicking on the "Sync" button. The time is synchronized with the PC time to which is connected.
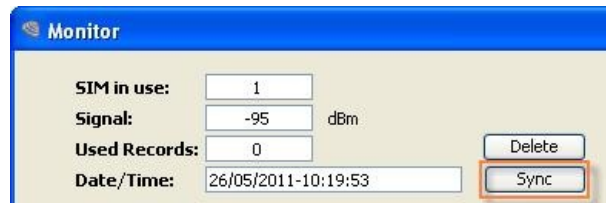
⚠	*It is important to disable the Windows option "**Automatic time change according to daylight savings time**". In case of being in a region with no daylight savings time change the time zone and in an area with daylight savings time change the time zone to a region with it and disable it, then return to your time zone.*

2017-06-16

> ⚠️ *If you connect the GRD/cLAN to the* **Exemys Telemetry Server** *you don't need to read this section*

Intermediary Software - Middleware

Middleware (also called MW-XF or simply MW) is software that together with the GRD/cLAN constitutes a complete tool for the collection of remote data. The MW is basically a server with multiple connections that allows the collection of data from all existing /cLAN in the field and dumps the information in different formats to be accessed in different ways.

The MW can be installed on any of these platforms: Windows 2003, XP, Vista (32 bits), 2008, 7, 8 and 10 (32 and 64 bits). **32 bits** Java Runtime Environment 1.8 or higher must be installed (available for free in www.java.com).

Installation

To install follow the next steps:

- Download the latest MW version from here www.exemys.com/mw and run the installation file
- A welcome screen will appear, follow the instructions of the installation program which will request the necessary information to complete the installation. Click on "Next" to continue.
- Destination folder: Select the folder where you want the application program to be installed.
- Wait for the installation program to finish copying all the necessary files on your hard disk, and press "Finish" to complete the installation process.

Once the program is installed you will see in the Programs menu a folder called Exemys. Inside this folder you will find another one called *MW-XF*; this one contains the *MW-XF Administrator icon*.
If the *32 bit Java Runtime Enviroment* 1.8 or higher is not installed you will have problems in the installation. If this happens, uninstall the MW, install the *Java Runtime Environment* and install again the MW.

> ⚠️ *In Windows you should have the option "**Automatic change of time according to daylight savings time**" disabled, in case of being in a region without daylight savings time, change the time zone to one zone that has it and disable it, then retake the time zone.*

In case of any other inconvenience during installation contact us at support@exemys.com

Operation

It is important to point out that the MW Works is a Windows service. This means that is a program that works even if no user is logged in and it does not have a graphical interface. To configure you must use the **MW-XF Administrator** program, installed together with the MW (or the **MW-XF remote Administrator** to do it from another computer).

We now show an internal diagram of the MW-XF. We will be explaining its different parts as we advance in this manual.
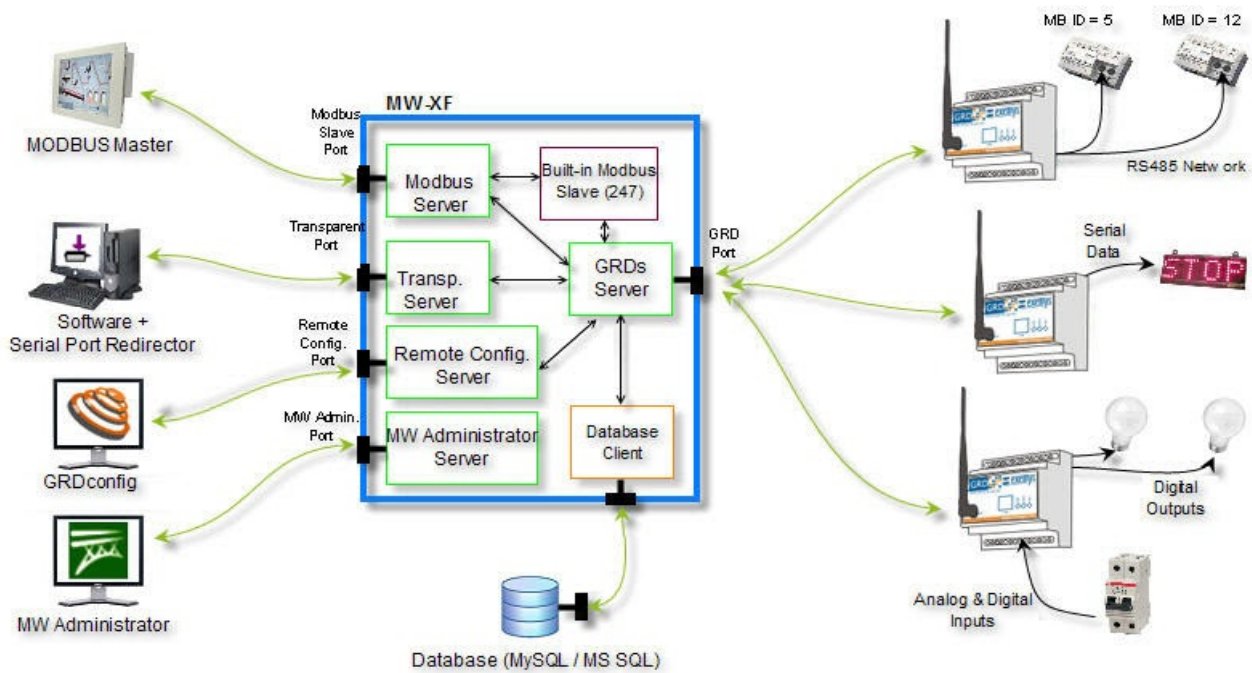
Configuration

To configure the Middleware start the **MW-XF Administrator** program.
The following screen will be displayed.

The Administrator main screen is divided into three parts:

- The configuration menu
- The control buttons
- TCP/IP ports of servers that include the MW

In this section we will make a general comment about the use of TCP/P Ports. In the corresponding chapter we will discuss it in detail.

- GRD Server (GRD/cLAN port): Server port to which GRD/cLAN will be connected.
- Transparent Serial Port (TR port): Server port to which the **Serial Port Redirector** will be connected
- Modbus Server (MB Port):Server port/s to which the Modbus masters (SCADA) will be connected

There are three more ports that generally are not modified but they are worth mentioning here:

- MW Administration: Port used by the MW Administrator to connect with the MW service.
- Internal database: Port of internal use between the MW and the internal database that is used to save the configuration.
- Remote configuration server, this port is used by the **GRD Config** to connect to the MW and remotely configure the GRDs.

Starting the MW

To do this we only have to press the "Start" ● button located in the MW main screen.

Once this is done, the MW is ready to receive the GRD/cLAN connections, Redirectors of serial port and Modbus Masters, and connect to the database (in case it is enabled and configured).

The **Start** ⊙ and **Stop** ⊙ buttons do not stop the MW service, they only act on the MW servers.

If when you press the start button it does not remain pressed as shown in the following figure, it may be that some of the TCP/IP ports used by the MW might be busy by some other service of your computer. Please contact support@exemys.com to get assistance on how to solve this problem.

MW-XF Remote Administrator

If you need to configure the remote from a remote computer you can install the Remote administrator. You can download if from here: www.exemys.com/mwadmin

After opening it you will be asked for the IP address/URL where the MW ir running. You must also enter the MW's remote configuration user and password.
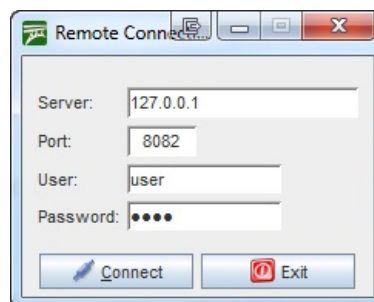
This user and password can be modified on the MW's adminitrador Start menu, Administrador Authentication option

2017-06-15

| | 1) If you connect the GRD/cLAN to the **Exemys Telemetry Server** you don't need to read this section.

2) If you use the GRD/cLAN in **Remote Serial Port** mode you don't need to read this section. |
|---|---|

Database

The MW has the capability of connecting with a MySQL or SQL database. In doing so, it creates a schema and a database with the designated name in its respective configuration that in turn is made up of 3 tables where information is exchanged with the MW. Through these tables, you can get information on the status of the device inputs and outputs, you can also read historical values and you can also actuate on the outputs.

You have to bear in mind that there are 2 types of information that the device can send. On one side, the reports containing real values of inputs and outputs that are updated according to the criterion configured in the device, from which we can choose what we want to have updated and under which conditions, the values are updated only when there is a connection with the MW. On the other side, we keep historicals, consisting of records of events or by time (logs) that are stored in the device and sent to the MW. In case of not having a connection the records remain in the equipment until the recovery of the connection.

When loading the parameters of the connection with the database and the MW is started, the schema and tables are created automatically.
A detail of the tables with their different fields are detailed and in a separate appendix some queries are shown regarding the access to them.

Reports table

The reports table stores the latest values sent by the device, as well as its status. When a new GRD/cLAN is created, this is automatically added to the reports table and from then on the status is available through this means, it only remains to make the appropriate queries to know the desired parameters. There is an entry in the table for each GRD/cLAN and the table being updated with the reports from that device. The date field in first instance takes the NULL value until the arrival of a consistent report.

Table name: "reports"

Field	Description	Condition	Possible values
grd_id	GRD/cLAN ID number	-	1 to 4000
state	Shows the link state	Connected	1
		Disconnected	0
i1 to i200	Status of digital inputs channels	On	1
		Off	0
o1 to o200	Status of digital outputs channels	On	1
		Off	0

		0-1v with 3 decimals	0 to 1000
an1 to an200	Value of analog inputs channels		
		0-10v with 2 decimals	0 to 1000
		0-1v with 4 decimals	0 to 10000
		0-10v with 3 decimals	0 to 10000
		4-20mA with 2 decimals	400 to 2000
		4-20mA with 3 decimals	4000 to 20000
		Signed Modbus	-32768 to 32767
		Unsigned Modbus	0 to 65535
		Script Variable	-2147483648 to 2147483647
		PT100 (-200 °C a 850 °C)	-2000 to 8500
p1 to p200	Values of the pulse inputs channles	Physical inputs	0 to 1000000000
		Modbus or script variable	-2147483648 to 2147483647
date	Date of last report	-	Ex.: 2008-12-30 17:44:50

Historicals table

The Historicals table stores history reported by all the devices. There are different types of Historicals, for example, by digital inputs, by digital outputs, by analog inputs and within these it could be by time or by change.

For more detail on Historical types that can be reported, please refer to the device manual which shows details of each one and how to configure them.

The table containing the information has the following format.

Name of the Table: "historical"

Field	Description	Condition	Possible values
historical_id	Record ID number	-	-
grd_id	GRD/cLAN ID number	-	1 to 4000
register_type	Channel type	Digital inputs channel (Ix)	8
		Digital outputs channel (Ox)	9
		Analog inputs channel (ANx)	11
		Pulse inputs channel (PIx)	12

timestamp	Record date and time	-		Ex.: 2008-12-30 17:44:50
address	Channel address	All channel type		1 to 100
value	Channel value	Digital inputs channel (Ix)		0 or 1
		Digital outputs channel (Ox)		0 or 1
		0-1V analog inputs channel with 3 decimals		0 to 1000
		0-10V analog inputs channel with 2 decimals		0 to 1000
		0-1V analog inputs channel with 4 decimals		0 to 10000
		0-10V analog inputs channel with 3 decimals		0 to 10000
		4-20mA analog inputs channel with 2 decimals		400 to 2000
		4-20mA analog inputs channel with 3 decimals		4000 to 20000
		Pulse inputs channel (PIx)		0 to 999999999
		MODBUS signed ANx/PIx channel		-32768 to 32767
		MODBUS unsigned ANx/PIx channel		0 to 65535
		MODBUS 32 bits Integer ANx/PIx channel		-2147483648 to 2147483647
		MODBUS 32 bits Float ANx/PIx channel		-2147483648 to 2147483647
		MODBUS 64 bits Integer ANx/PIx channel		-2147483648 to 2147483647
		MODBUS 64 bits Float ANx/PIx channel		-2147483648 to 2147483647
		Script variable ANx/PIx channel		-2147483648 to 2147483647
		PT100 (-200 °C a 850 °C) analog inputs channel		-2000 to 8500
historical_type	Historical record type	Digital inputs channel		NULL
		Digital outputs channels		NULL
		"By Time" analog inputs channel record	Current	1
			Period Minimum	5
			Period Maximum	6
			Period Average	7
		"By alarm" analog inputs channel record	Minimum level	2
			Normal level	3
			Maximum level	4
		"By Time" pulse inputs channel record. Current		1

Commands Table (For MW 4.4.2 or superior)

The commands table is used to remotely on the GRD/cLAN. By writing parameters on the database it is possible to:

1) Turn ON/OFF digital output channels (Ox)

2) Turn ON/OFF digital input channels (Ix) (GRD-3G or cLAN V2.0 or superior only)

3) Set the value to analog inputs channels (ANx) (GRD-3G or cLAN V2.0 or superior only)

4) Set the value to pulse inputs channels (PIx) (GRD-3G or cLAN V2.0 or superior only)

5) Force the GRD/cLAN to send a report (Ix, Ox, ANx or PIx) (GRD-3G or cLAN V2.0 or superior only)

The channel value can be set remotely only on channels linked to sources that can be written (physical outpus, script variables, Modbus holding registers, Modbus coil status, pulse channels linked to physical inputs)

The MW is continuously checking if any command has been written, if this is the case, it removes it from the database and takes action. If the entered data have errors, the parameters will be eliminated without taking any action.

Name of the table: "commands"

Field	Description	Valid values
command_id	Command ID value (this value can be null)	Any unused integer value
function	Command type to execute	0 - Modify channel value (Ix, Ox, ANx or PIx)
		1 - Force channel report
grd_id	GRD/cLAN ID number	1 to 4000
register_type	Channel type	8 - Digital inputs channel (Ix)
		9 - Digital outputs channel (Ox)
		11 - Analog inputs channel (ANx)
		12 - Pulse inputs channel (PIx)
output_number	Channel address to modify/report (the name output_numbr is used for backwards compatibility)	1 to 100
state	Value to set (ignored in reports)	Digitals: 0 or 1
		Analogs/Pulses: Depending on the source linked to this channel.
date	Current date (it can be ignored)	Ex: 2008-12-30 17:44:50

Commands Table (For MW 4.4.1 or previous)

The commands table is used to actuate on digital outputs of the GRD/cLAN. By writing parameters on the database it is possible to enable or disable any of the equipment outputs.

The MW is continuously checking if any command has been written, if this is the case, it removes it from the database and takes action. If the entered data have errors, the parameters will be eliminated without taking any action.

Name of the table: "commands"

Field	Description	Valid values
command_id	Command number	
grd_id	GRD/cLAN ID number	1 to 4000
output_number	Output number that wants to be modified	1 to 100
state	Status to be taken	0 (Off)
		1 (On)
date	Current date (it can be ignored)	Ex: 2008-12-30 17:44:50

Database configuration

To access the database screen the MW must be stopped by pressing the Stop button on the main screen, we then go to Configuration -> Database.
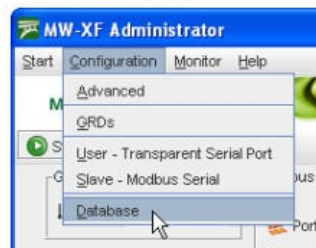
The Database screen displays the database where Historicals, reports are stored and it accepts possible changes in the digital outputs.

From here we can modify the configuration of the base, the IP address, the port, name and type of database (MySQL and SQL) containing the information and also configure the user and password so the MW can have access to the database.

⚠	*The (MySQL o SQL) database must be created and the user configured for the MW must have read and write privileges enabled in the database.*

Database monitoring

To determine the status of the database we can access the monitoring screen in Monitoring -> Database.

Database monitoring indicates the functioning of database tables and are presented in the following screen.
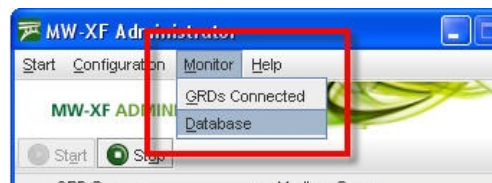
The IP address, the port and the name of the database must coincide with the data entered in the original configuration, then we find the three tables that make the database for the MW. If everything is working correctly, the three tables should indicate "Ready", if this is not the case verify the IP address, the connection port, the user name and password; verify that the MySQL base is working and that the users have read and write privileges to access the database.

2017-06-02

> ⚠ *If you connect the GRD/cLAN to the **Exemys Telemetry Server** you don't need to read this section*

Internal Modbus slave of the MW

The MW has an internal Modbus slave that contains the values of inputs and outputs, the values read from this slave are those corresponding to the GRD/cLAN reports and not to the Historicals, these are not accessible via Modbus. In order to visualize the current GRD/cLAN values the desired reports in the equipment must be enabled. Access to the internal slave is through queries to slave number 247.

Queries to external slaves are made the same way as to the internal slave. Its map contains the values of 8 analog inputs, 8 digital inputs, 8 digital outputs, 2 pulse inputs and the state of all GRD/cLAN from ID 1 to 4000, this means that if the GRD/cLAN has more inputs/outputs we won't be able to query them through this method. It is also possible to act on the digital outputs modifying their state at any instance. Queries can be made, for example, from a SCADA.

The TCP port to accept the incomming queries must be configure on the MW's main screen. You can also chose here to use Modbus TCP, Modbus RTU over TCP or Modbus ASCII over TCP.
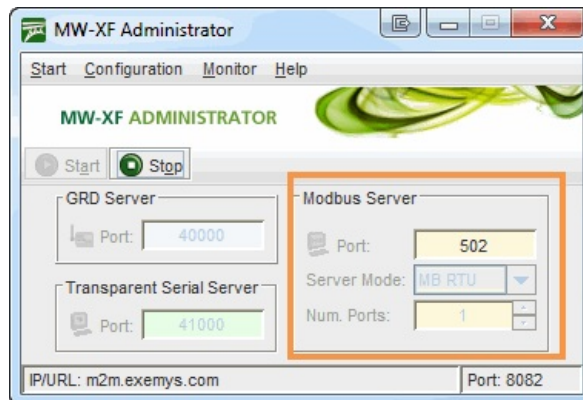
Internal map

The information of each GRD can be visualized in different forms according to the type of parameter you want to see. Each GRD has a specific location in the Modbus map, this location is determined through the ID number.

Input Register

In the input register we find the digital and analog inputs, as well as the value of digital outputs. Each GRD has a total of 16 register that contain the following information.

Record number	Information
Record 1 to 8	Analog 1 to 8
Record 9	Digital inputs

Record 10	Digital outputs
Records 11 to 14	Pulse inputs 1 to 2
Record 15	Reserved
Record 16	State

The calculation to determine the address of a record for a particular device is the following:

Records X = 30000 + (GRD_ID – 1) * 16 + Record number (1 to 16)

As an example, let's suppose that we want to read the analog input 3 of the GRD with the ID = 87. Analog input 3 corresponds to record 3, then.

Record 3 (GRD 87) = 30000 + (87 - 1) * 16 + 3

To be able to see the desired value we have to access record 31379.

Digital inputs and outputs are grouped in a single record that contain in its bits the corresponding values, knowing that input 1 of the device corresponds to bit 0 of the record and input 16 corresponds to bit 15 of the record we can determine each one. The outputs are located in the records the same way.

To know the state of the connection we can read record 16 in bit 0, if this bit is 1 indicates that equipment is connected, while 0 indicates that the equipment is disconnected.

Pulse inputs are located in records 11 to 14, each one of the inputs takes 2 records to be able to cover the range 0 to 1000000000, the lower record represents the higher part of the number and the upper record represents the lower part of the pulse count.

Holding Register

All Input registers values are copied to holding registers. Use the same calculation to get the right address for every channel.

Input Status

In the input status we can read the state of digital inputs of all GRD/cLAN. Each devices occupies 16 positions and the calculation to read the value of one of the inputs is the following.

Input X = 10000 + (GRD_ID – 1) * 16 + Input number (1 to 16)

For example, if we want to know the value of input 8 of the GRD with and ID =6 the calculation is the following.

Input 8 (GRD 6) = 10000 + (6 - 1) * 16 + 8

It is equivalent to address Modbus 10088.

Coil Status

In the coil status records we visualize the digital outputs of the equipment. To determine the address of the outputs for each GRD/cLAN we calculate:

Output X = (GRD_ID – 1) * 16 + Output number (1 to 16)

For example, if we want to access output 4 of the GRD with an ID = 45 the calculation is the following:

Output 4 (GRD 45) = (45 – 1) * 16 + 4 = 708

It is equivalent to address Modbus 708 of the coil status.

If we write on these records the state of the outputs are modified, this means that we can modify the state of the outputs of a device from the Internal Modbus slave.

2017-11-23

Connection between GRDs and Middleware

Configuration of the GRD-MW connection

Communication with Middleware uses a TCP/GPRS connection. To be able to establish the connection it is necessary to:

- Place the antenna correctly and ensure GPRS coverage.
- Place the SIM card, and, if necessary configure PIN.
- Configure correctly the cell phone operator for the establishment of the GPRS connection.
- Configure correctly the connection from the GRD to the MW
- Configure the GRD ID and password.
- Have a MW server running (read the "Intermediary Software - Middleware" section)

Configuring the MW connection

All TCP connections need a Server which awaits a connection request in a pre-established port and a client that, at the right time, will establish the connection to such server. GRD equipment work as TCP clients, so we must have a Server (MW) to wait for the connection request. We now explain how to configure the GRD to establish communication with Exemys Middleware. We enter the MW menu and configure the following parameters:

⚠	*If connect the GRD to* ***Exemys Telemetry Server*** *the GRD ID, GRD Password, IP/URL and Port will be provided by Exemys.*

Enabling the connection with MW

When this option is enabled, we tell the GRD to establish connection with the specified configuration. If

this option is disabled the GRD will not establish connections.

IP/URL

The IP address or URL of the server where the MW running must be entered here. The GRD can resolve URLs using DNS.

Port

The server port must be entered in this field.

Configuring the ID and password

The GRD must be connected to a MW, this is why it is absolutely necessary to place an ID number to identify the GRD at the moment of connection and with a password if necessary.

ID

If the GRD must establish a connection with the Middleware (MW), it has to be identified in order for the MW allows to remain connected. The GRD ID is part of this identification. If the MW has not configured such an ID as valid, it will close the connection with the GRD, this is a number from 1 to 4000 and it must be unique.

Password

The GRD equipment has a password for authentication with the MW, therefore, at the moment of connection the GRD password is verified against the MW password, if there is a coincidence, the connection is accepted. Additionally, GRD equipment can be configured and monitored through SMS messages. In the case of the configuration, it can be protected with a password. So when the SMS is sent, it must include the password to be able to make modifications. The password should have a maximum length of 8 characters.

Advanced:

Inactivity time

This is the time the GRD takes to decide that the connection with the MW has been closed.

Watchdog Timer

This parameter defines how long will wait the GRD to reboot if it can't establish a connection to the MW.

⚠	Available since firmware 4.0.0

Configuration of the connection in the MW

⚠	*If connect the GRD to* **Exemys Telemetry Server** *you don't* need to read this section
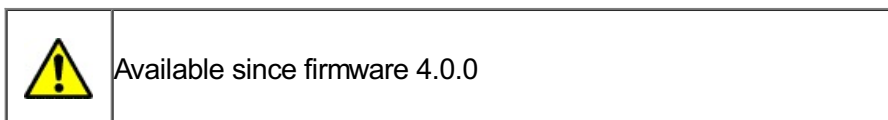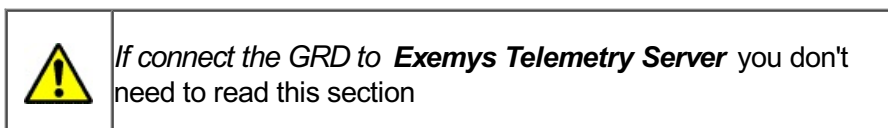
The port in the MW must have the same configuration as the one in the GRD, that is the TCP port through which the *"GRD server"* connections are received. This port must be ready to receive connections, which means that it should not be blocked by any type of firewall or router.
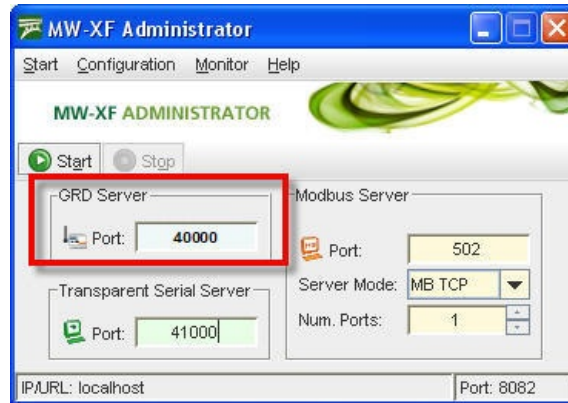
Adding a new GRD to the MW

We first create a GRD with the same ID as the one loaded previously in the equipment, this is done from "Configuration -> GRDs" click on "New GRD".

The password must be entered if there is one previously loaded in the equipment, otherwise, it should be kept blank.

The "Telephone" and "Description" parameters are optional, these help the user with the identification of the GRD beyond the ID.

As to the "Serial port mode" we select as an example "Not Configured", this refers to the mode of operation of the GRD serial port, in this case it will not be used.

The 2 operational modes will be detailed later, as at the moment we just want to establish the connection between the GRD and the MW.
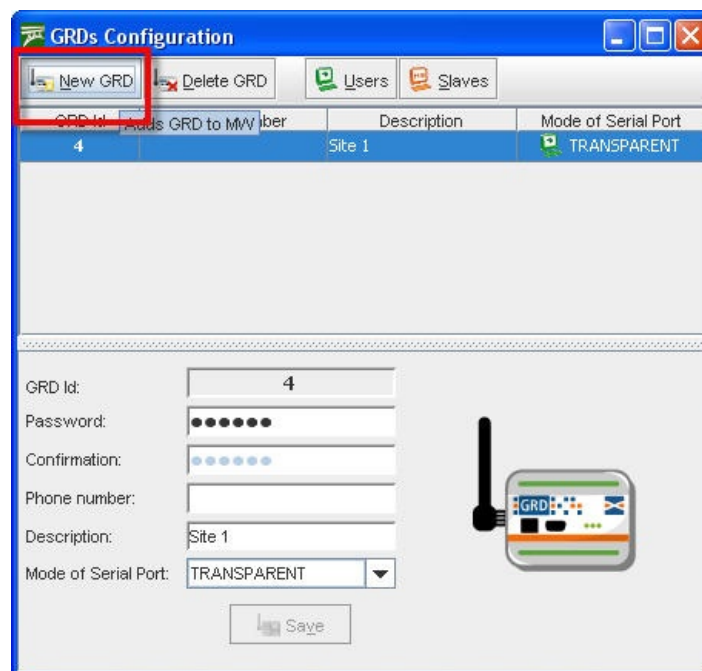
| | With this, the GRD is added so the connection can be established. We end the basic configuration in the MW. |

Monitoring the GRD-MW connection

Monitoring the connection in the GRD

To verify whether the entered configuration into the GRD is the correct one we have the possibility of monitoring the status of the connections and the signal.

To access the monitoring screen of the configurator click on the "Monitor" button. Then, the following screen will be displayed:

SIM State:	READY
GPRS State:	CONNECTED
Link State:	CONNECTED

From here, the following parameters related to the connection are of interest: "Signal, SIM State, GPRS State and Link State".

Signal level

It indicates the signal level in dBm, the minimum value is -113 dBm, data transmission is impossible at this value.

SIM State

- *Disabled:* The SIM (Chip) is disabled from the GRD configuration.

- *Attaching:* It is being registered in the GSM network.

- *Selected but not resent:* In models with SIM detection it indicates that the SIM is not placed.

- *Pin Required:* This message appears when a SIM card requires a PIN.

- *PIN Error:* This message shows that the PIN entered is incorrect.

> ⚠️ If a PIN is entered incorrectly 3 consecutive times, the SIM card will block. To unblock it, you would need to enter its PUK. For more information contact your cell phone operator.

- *SIM Blocked:* The SIM card is blocked, to be able to enable it you must enter its PUK. This operation is not possible using a GRD, and you will need a cell phone or another device to release the card.

> ⚠️ If the PUK is entered erroneously too many times (the number of times depends on the telephone operator) you should change the SIM card. For additional information please contact you cell phone operator.

- *Low Signal:* The signal level is insufficient.

- *Ready:* It is registered in the network.

GPRS State

The following are the possible states of the GPRS connection.

- *Disabled:* The GPRS connection is disabled in the GRD configuration.

- *Waiting SIM Ready:* The GPRS connection is disabled but is waiting for the equipment to register a

GSM.

- *Connecting:* Is in the process of connection.

- *Connected:* Successful connection to GPRS.

- *Error:* Error in the connection to GPRS, it will retry in 30 seconds.

Link State
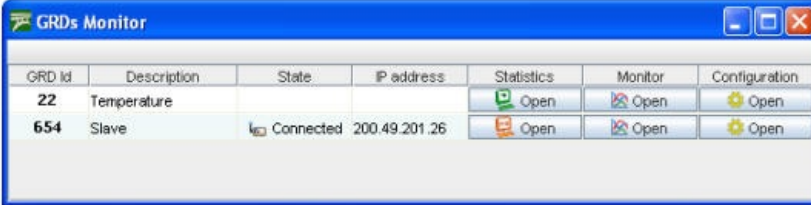
The TCP connection state can also be monitored. Remember that to be able to establish such a connection, you must count first on a GPRS service.
Once the GPRS connection is established, the possible TCP connection states are:

- *Disabled:* The TCP connection has net been enabled. In this state the Link LED is off.

- *Waiting GPRS Ready:* The connection to the MW (TCP) is enabled but is waiting for the equipment to connect to the GPRS to initiate it.

- *Connecting:* The GRD is attempting to establish a connection to the indicated IP address and port. If the GRD is not able to establish the TCP connection, the length of time in this state might be an indication of a failure. If it remains in this state for a few seconds (less than 10), it might be trying a connection to a closed port. If it maintains the state during a minute or more it might be attempting to connect to a port and/or IP behind a firewall and is being filtered.

- *Connection Failed, Host Unreachable and Connection Refused:* The 3 states imply that the connection to the MW was not possible, but individually, they indicate the reason why they occurred. In general, each one has a specific motive although it depends on the TCP connection on the server side for the indication to be correct, even so, any of the these 3 errors indicate a problem in the TCP connection.

  - *Connection Failed:* This error appears when a connection to the configured IP is not possible.
  - *Host Unreachable:* This happens when a connection to the IP is possible the port is open, through the router or firewall, but there is nothing connected to that port.
  - *Connection Refused:* In this case the connection cannot be established because the configured port is closed, this could happen because a router or firewall are blocking it.

- *Host Closed Connection:* This is an event that happens when the server closes the connection. This could be because the MW service has stopped, the server turned off, the connection to Internet dropped or any motive by which the server loses connectivity.

- *Logging in :* The TCP connection has been established, and the GRD is going through the authentication process.

- *Connected:* The TCP connection has been established, at this time the GRD registers in the MW, if the ID and password are valid, the connection is maintained.

- *DNS Failure :* The GRD can't convert the URL into an IP address. Check if the IP address is OK.

- *Error:* The event occurs if the connection was not completed after a certain time and no other type of failure was reported.

Monitoring the connection in the MW

GRDs connected to the MW can be monitored, this can be done by accessing "Monitor -> GRDs Connected" , a list will be displayed showing all GRDs added to the MW ordered by ID, and showing if it is connected and if it is so it will show its IP.

Statistics

Statistics are made based on the quantity of information received and transmitted. The information given by these statistics differ according to how the GRD type was defined.
To have access to statistics of each GRD the button located in the statistics column must be pressed. When the GRD shows the serial port mode as "NOT CONFIGURED", we will not be able to access the statistics.

Modbus statistics

The Modbus statistics screen is shown below:
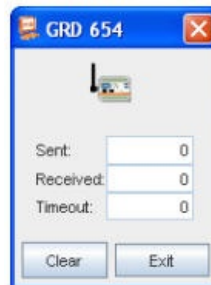
When the GRD is connected the windows is displayed as enabled, on the contrary if the GRD is disconnected the Windows is shown in grey as disabled.
The window shows the number of packets sent to the GRD and received from it, those queries sent that are unanswered are part of the Timeout count.
The erase button resets the counters to zero.

Transparent mode statistics

The transparent mode statistics screen is shown below.

When the GRD is connected and a user is connected to the MW pointing to that GRD, the screen will be shown as enabled.
In the statistics of the TR mode we can find the name of the user and the IP to which he is connecting, as well as the number of bytes transmitted to the serial port of the GRD and bytes received from the serial port of the GRD.
The erase button resets again the counters to zero.

2017-06-06

> ⚠️ *If you connect the GRD/cLAN to the **Exemys Telemetry Server** you don't need to read this section*

Remote serial port - Redirector / Transparent serial port

We will see now how to configure the MW to operate with the serial port in a transparent mode.

- Let's assume the following example:

User: *John*
Password: *exemys*

You want to communicate to the flow meter connected to the GRD/cLAN with ID 268 located in a water well.

GRD ID: *268*
Password: *well*

MW data: (These parameters are configured in the MW connection)

TR port: *41000*

We must have first the MW connected and the GRD/cLAN added as we saw in "Connection between GRDs and Middleware".
In the MW we enter into "Configuration -> GRDs" and here we edit the equipment configuration in "Serial port mode" -> "TRANSPARENT".
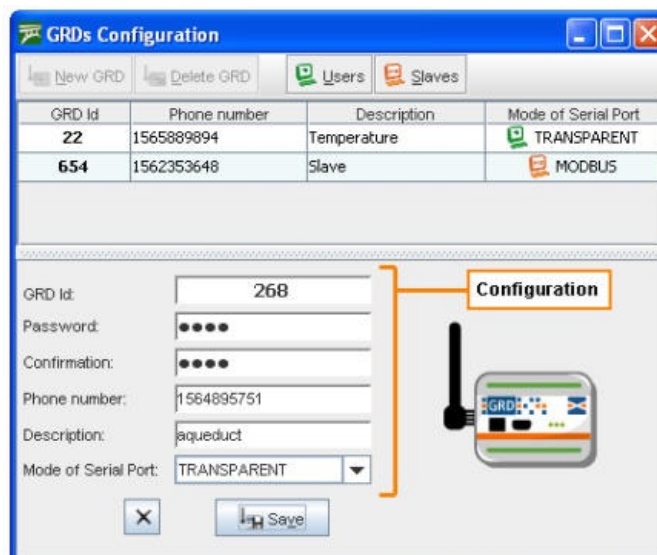
The Telephone and Description options are optional and not necessary. When we finish loading all necessary data we press the "Save" button to add the GRD/cLAN to the list.
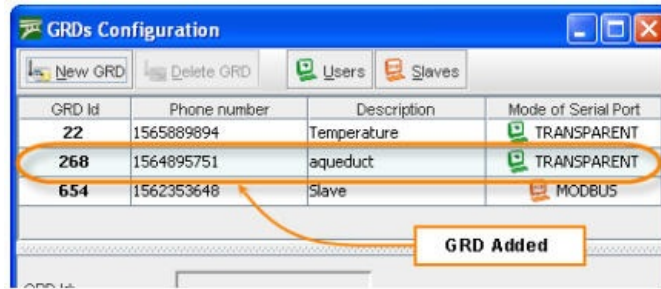
Then a user must be added who will have access to these GRD/cLAN. To access the User and permits screen for transparent mode go to "Configuration -> Users – Serial Transparent".
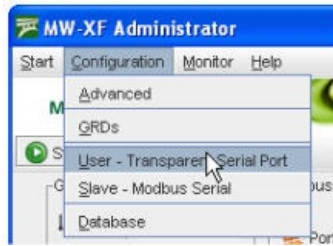
The Users and transparent permits screen allows us to add or delete users and assign permits to the users for the GRD/cLAN you consider convenient. The GRD/cLAN that can be assigned are those with transparent operating mode.
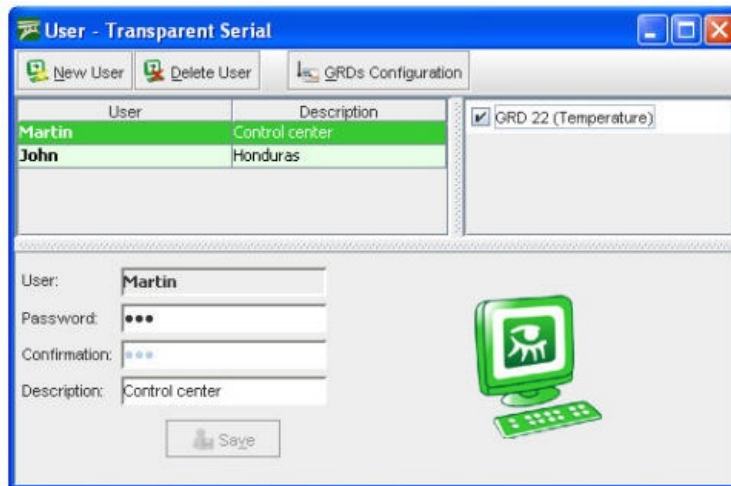
The configured user name and password are used for authentication of the port redirector. When a redirector connects to the MW it must indicate the user name and password.

2017-06-16

Remote serial port with Redirector (Virtual COM port)

Principles of Operation

This Redirector allows transparent communication with equipment located in remote places, simulating a serial COM port.

Exemys recommends to use Serial/IP COM port rediector from Tactical Software. To download a 30 day free trial license or to buy a license please contact us at sales@exemys.com

Use the following items:

- **GRD/cLAN**: converts a RS-232/485/422 Communication to TCP/IP (over GPRS on the GRD)
- **Middleware**: provides connectivity with GRD equipment, allows the establishment of access policies and provides tools for monitoring of equipment.
- **Serial Port Redirector**: simulates a virtual serial port that we will be able to use to communicate with the remote equipment as if we were connected locally. It also provides the necessary interface to configure the connection with the MW, select the remote equipment with which we want to communicate and also monitor the status of the connection.

In this manner, a serial communication could be replaced by the following scheme:
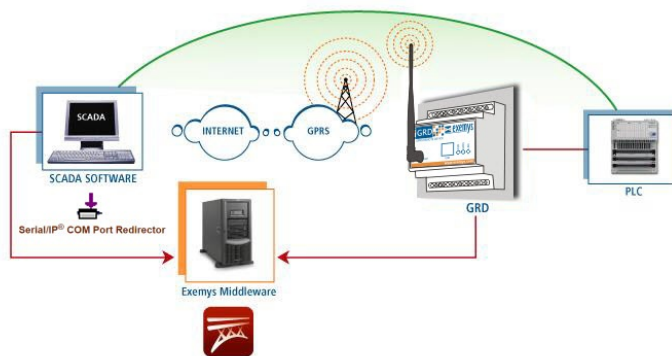
Configuration

To open the Configuration Windows click with the right button on the icon and select "Configure". The first time you enter, the screen to be displayed will be the following:
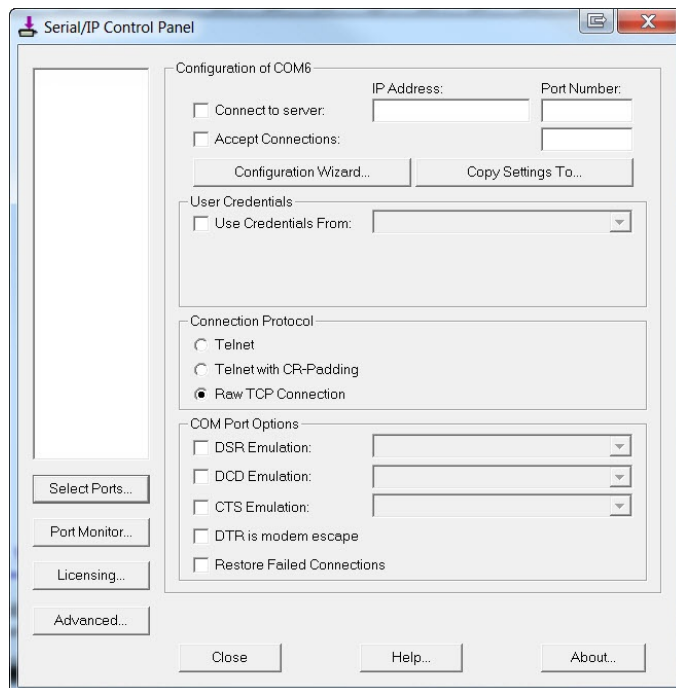
Select the virtual port

In the configuration screen, press the "Select Ports... " button. A screen will be displayed with a list of all virtual COMs from which you will be able to choose from. The Redirector discards from this list the reserved ports. Select the desired virtual port and press "OK".
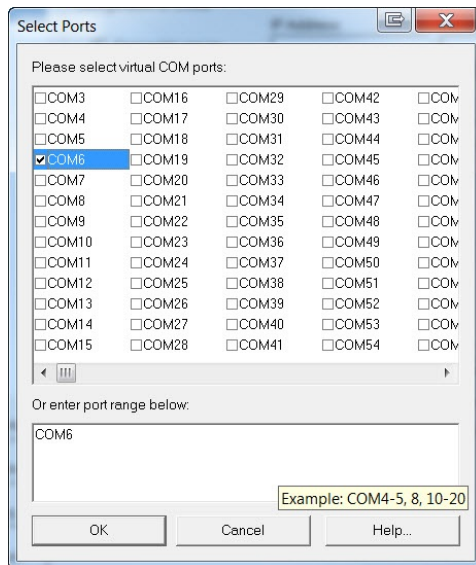
Once the port to be used is selected, the configuration screen will let you configure the rest of the configuration parameters.

Configuration of the connection with the MW

> ⚠️ *If you connect the GRD/cLAN to the* **Exemys Telemetry Server** *the* IP address, port number, user and password will be provided by Exemys
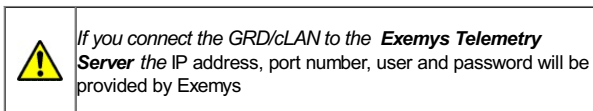
IP address

It is the IP address of the Server where the transparent MW is running. If a URL is entered instead of an IP address the Redirector will attempt to resolve it.

An existing established connection will not be affected by the changes, they will be applied the next time the virtual port is open.
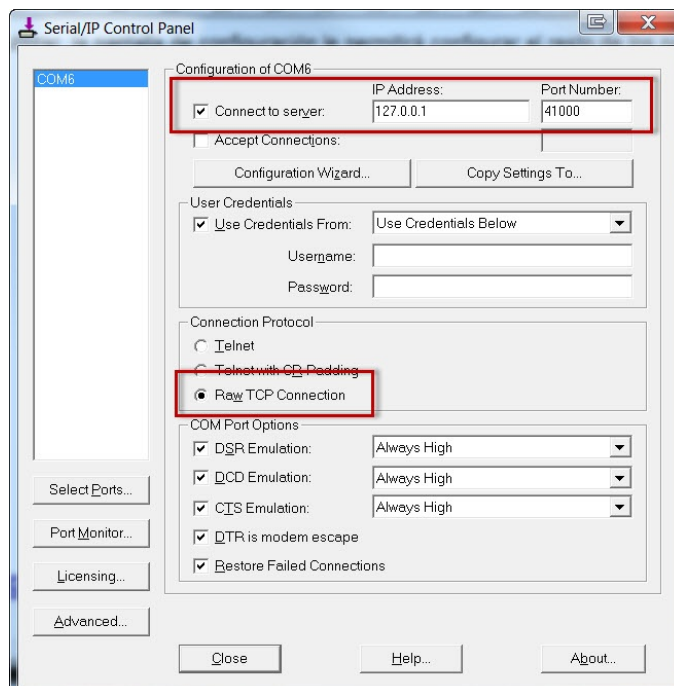
Port

It is the port of the remote server where the transparent MW is running the Transparent Serial server service. The default port is 41000.
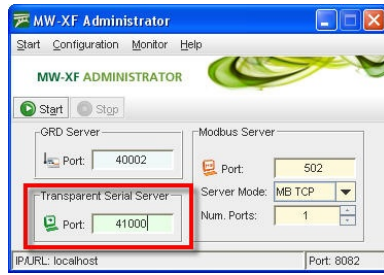
If an established connection already exists it will not be affected by the changes, these will apply the next time the virtual port is opened.

Username and password

To connect with the GRD/cLAN, you must have a user name and password so the MW can allow to access them. The parameters must be the same ones that were configured in the MW in "Transparent" mode.

In the "Username" box type the User followed by a comma an the device's ID number.
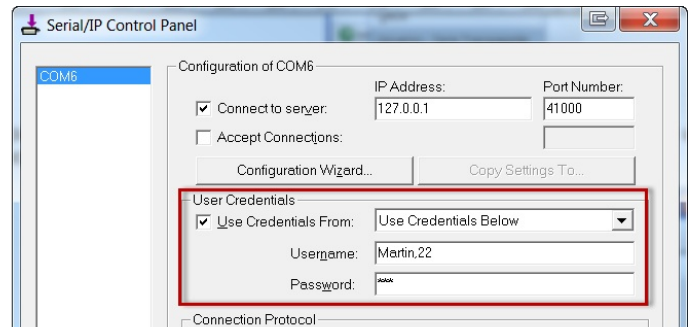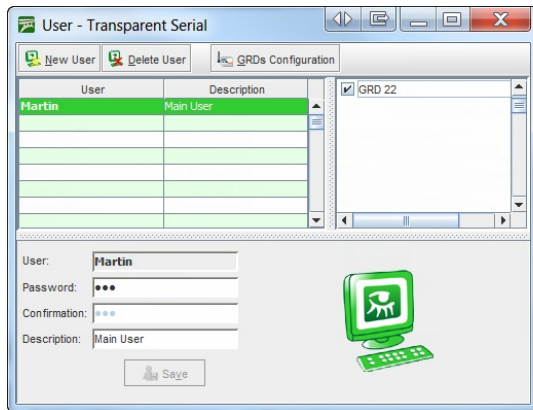
Testing the connection with the MW

Once the configuration is completed you can test it pressing the "Configuration Wizard..." button and then the "Start" button. You should see something like this is the configuration is OK.
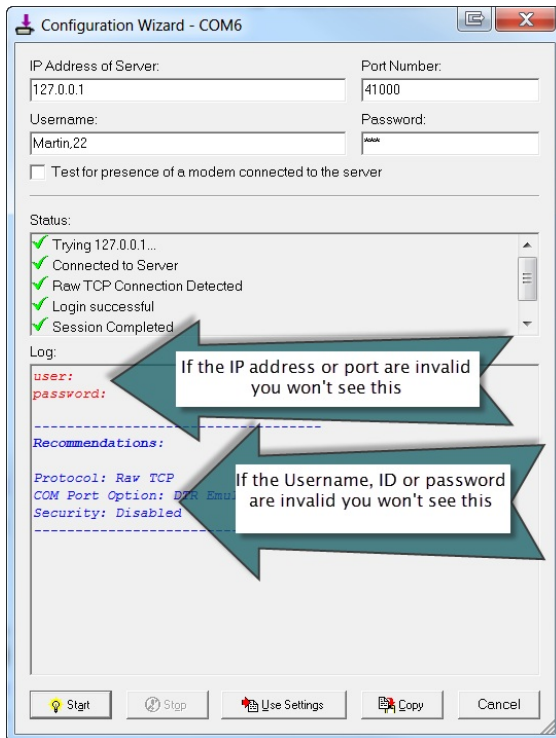
GRD/cLAN serial port configuration

To access the GRD/cLAN serial port remotely configure it in "Remote" mode
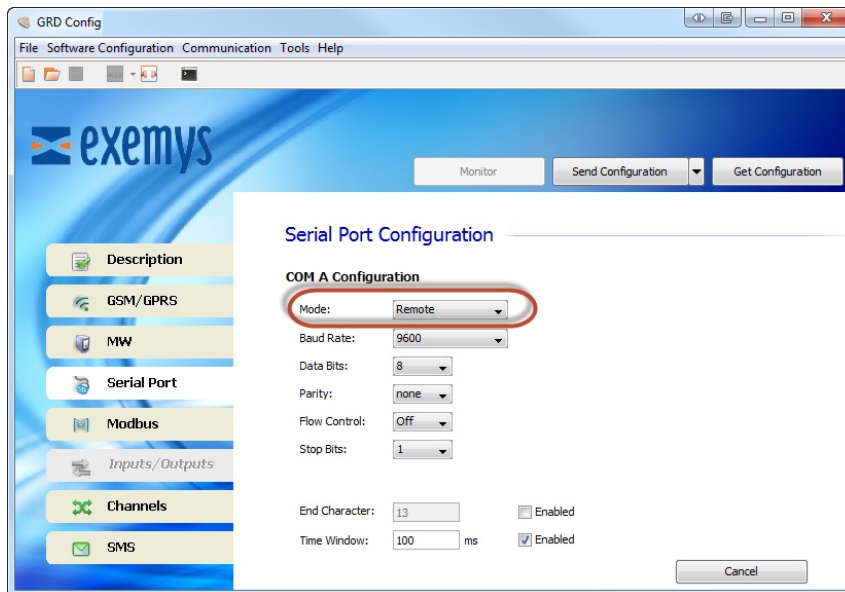
Activity and data monitor

With the right button click on the icon, select "Port Monitor ".

With this screen you are able to follow in real time, the status of the connection of the Redirector.
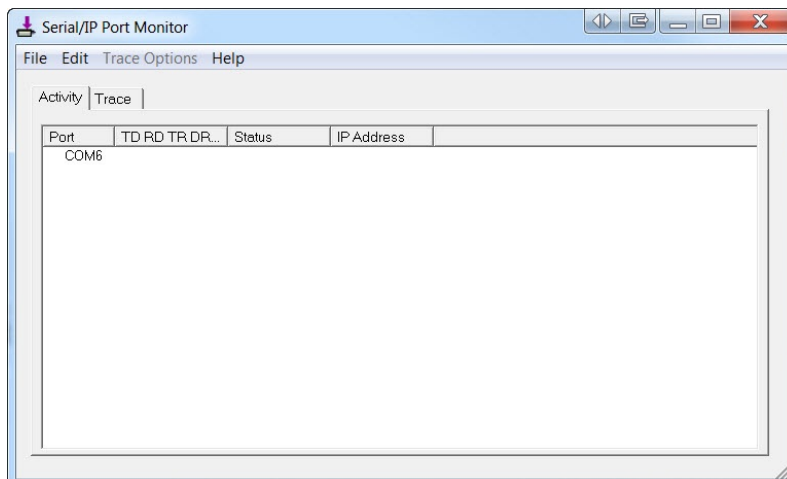
Read the Serial/IP user's manual for more details.

Multiple COM ports and Serial/IP licencing

The Serial/IP redirector requieres a license to work. You can use it for free for 30 days to test it.

The one port license won't limit how many COM ports you can configure, but you will be able only to open one COM port at a time.

If the software you are using doesn't allow you to create multiple COM ports, you can configure Serial/IP to create a list of devices on a single COM port without having to edit the cLAN/GRD ID number. Please read the section "Configuration Presets" in the Serial/IP user's manual for more details. If you need help to configure this feature contact us at support@exemys.com

2017-06-16

> ⚠️ *If you connect the GRD/cLAN to the **Exemys Telemetry Server** you don't need to read this section*

Remote Access to serial port in Modbus mode - MW configuration

We will now see how to configure in the MW the GRDs that we use to multiplex Modbus. In this mode of operation the MW will receive the "Modbus TCP" queries sent to the port/s of the "Modbus Server" which will resend to the GRD with the slave being queried.

The TCP port to accept the incomming queries must be configure on the MW's main screen. You can also chose here to use Modbus TCP, Modbus RTU over TCP or Modbus ASCII over TCP.
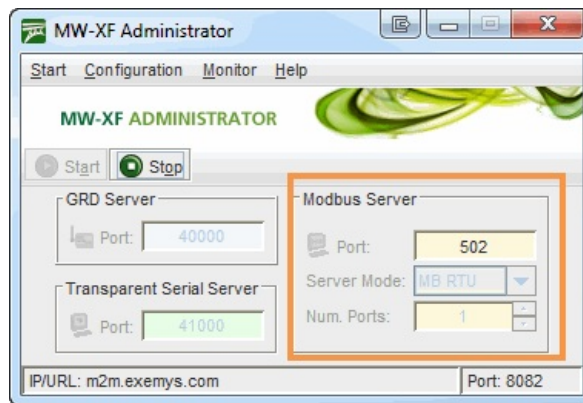
> ℹ️ *Slave number 247 is reserved for use by the "MW internal slave".*

We must first have the MW connected and the GRD added as indicated in "Connection between the GRD and MW".

- Let's look at the following example:

We have 2 Modbus (RTU) devices connected in port 485 of the GRD with GRD ID = 10 without a password.

Device 1: ID Modbus 43 (query from port 502)
Device 2: ID Modbus 66 (query from port 503)

We also have 1 Modbus (ASCII) device in port 232 of the GRD with GRD ID = 13 without password.

Device 1: ID Modbus 87 (query from port 504)

MW data: (These parameters are configured in the MW connection).

MB Port: 502
Number of ports: 3
In the MW we enter in "Configuration -> GRDs" and we edit the "Serial port mode" placing it in "Modbus".
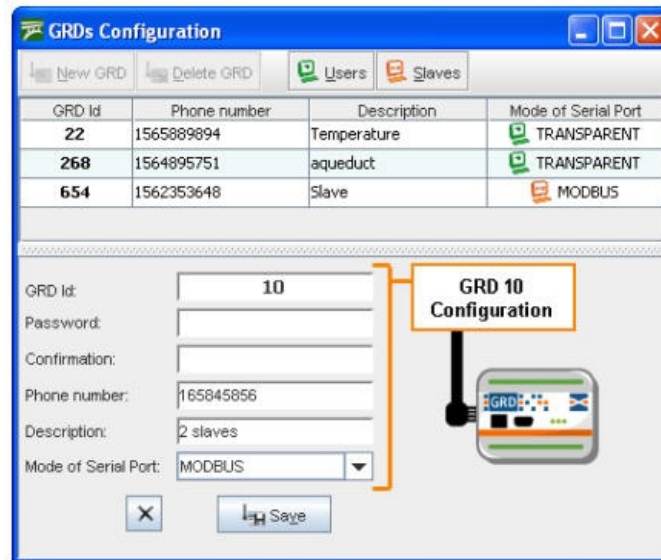
When you press the save button it is stored in the list of valid GRDs. The mode must be MB for it to work in this manner. The following figure shows the addition of the other GRD and in the upper part the GRD added previously.
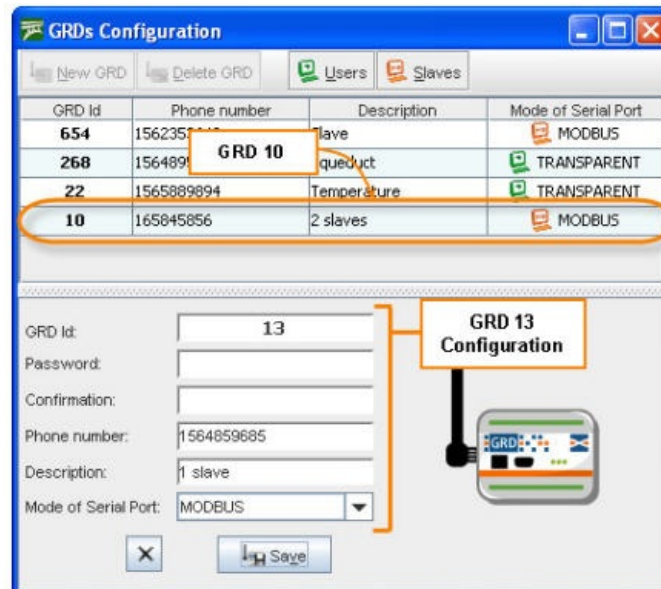

Once both GRDs are incorporated to the list we can assign them the corresponding slaves to each one and also indicate what type of Modb us protocol will be used.

Slaves

To be able to add the slaves to each GRD we have to enter the Administration screen of GRDs MB and slaves, we place the cursor on the GRD in the upper part and press the +Slaves button; a window will open as the one shown in the figure below where you enter the number of the slave connected to the GRD in its serial port and the port number of the MB server from where the query will be made to that slave.
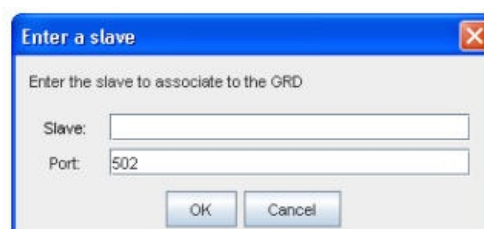
Once the corresponding slaves and its port are entered, the Modbus protocol to be used must be selected, which could be RTU or ASCII.
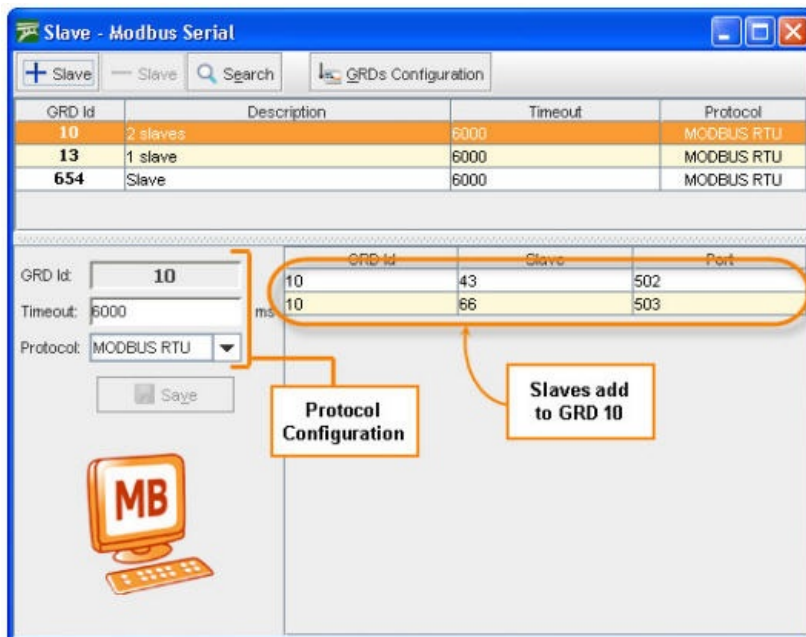
As it can be seen in the previous figure the GRD 10 has 2 Modbus slaves. We also determine the communications protocol, that in this case is RTU, the Timeout of the communication and then we press the save button to store the changes. The purpose of Timeout is to prevent the system from waiting for a response for an undetermined time, this time is expressed in milliseconds, therefore, when a query is sent, this is the maximum waiting time for a response, once this time is up the systems discards all the responses from that GRD until a new query occurs.

> ⚠️ *Verify that the Modbus master timeout is greater than the timeout configured for the GRD to avoid losing responses to the queries.*

In the same manner, the slaves are added for the following GRD, but in contrast to the previous one, this one has an ASCII communication protocol.
The communication protocol is determined by the devices connected to the GRD, this means that, the required communication protocol will depend on the device to be connected.
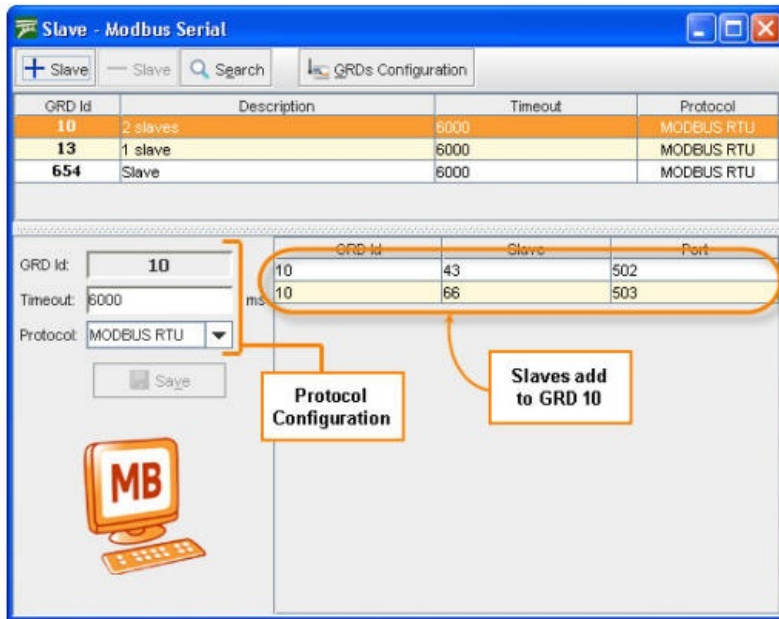
In this manner, the two GRDs are configured from the MW side and working according to what was established in the beginning.

Serial Port Configuration

To access the GRD's serial port remotely you must configure it in "Remote" mode.
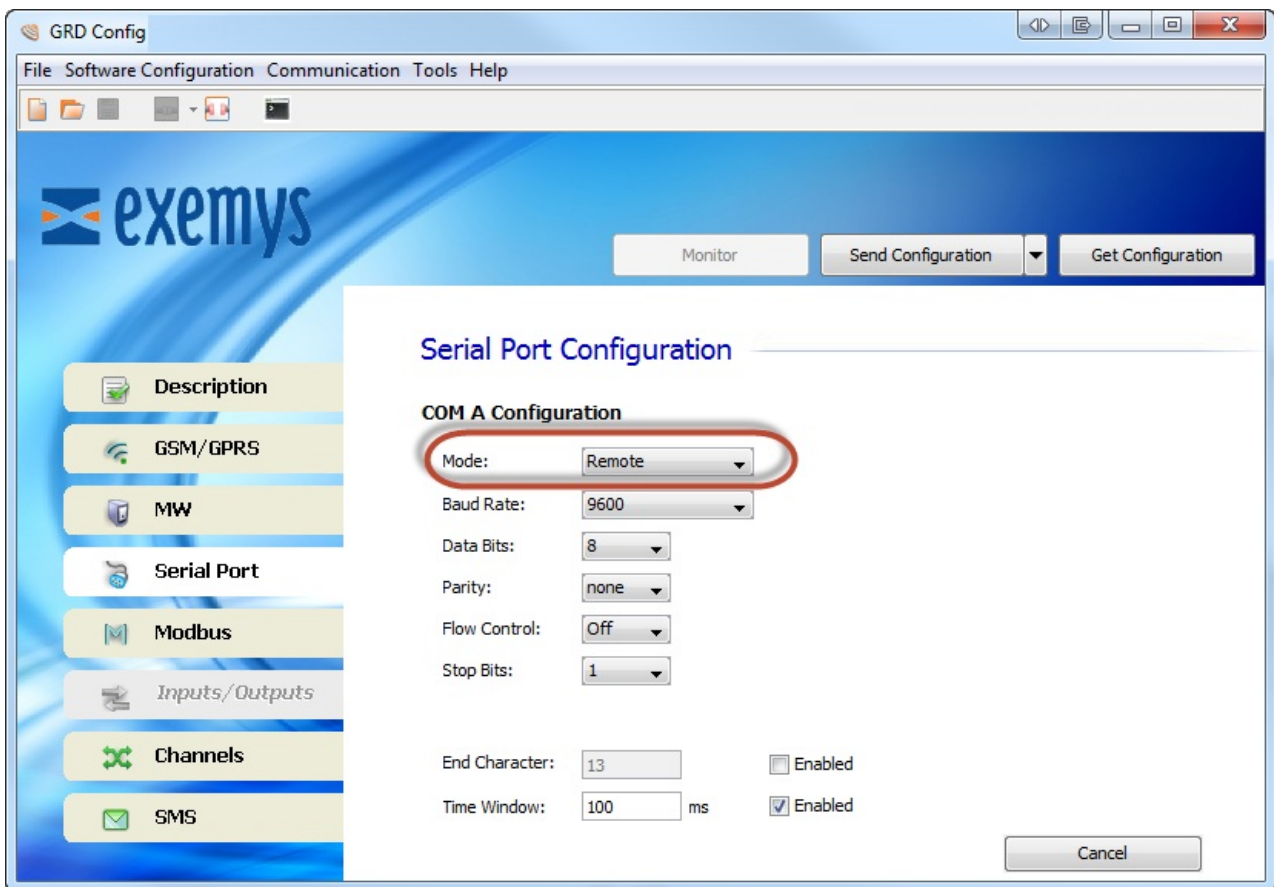
⚠️	*For GRD-3G only*

SMS - Monitoring and Configuration

The status and configuration of GRD equipment can be verified using SMS. It is also possible to modify the configuration with the same system.

The SMS commands supported by the GRDs are detailed below. Every time that the equipment recognizes the command as valid it will respond with another message to the telephone number that sent it. When a configuration command is sent it will respond either that it was applied successfully or that an error occurred.

ℹ️	Before starting you must know the password allowing the modification of the configuration of the equipment. The factory configuration disables the password, then this field will be left empty unless it is enabled.

All commands are not case sensitive.

ℹ️	In all messages the separation between words must be exactly one space.

Verification of the status of the equipment

Status of GSM/GPRS/LINK

Command	Description
STATE o ?	Returns the status of GRDs communications

Note: This command does not require a password.

Returns the current configuration

Command	Description
LIST	Returns the basic equipment configuration, the model and serial number.

Example of a response:

MODEL: GRD3625-XF /SN: 124 /ID: 5 /GPRS: apn/user/password /TCP: m2m.exemys.com:42000

Note: This command does not require a password.

Signal level

Command	Description
SIGNAL	SIgnal level

The signal level can vary between -113 dbm and -51 dbm

Note: This command does not require a password.

Versions and IMEI

Command	Description
VERSION	Returns the versions of Hardware, Software and IMEI

Example of a response:

FIRMWARE: 1.0 HARDWARE: 1.0 IMEI 123456789123456

Note: This command does not require a password.

GRD configuration

Modify ID

With this command you can modify the ID number used by the GRD to connect to the MW.

Command	Description	Possible values
ID *number* *[password]*	Changes the GRD ID number	[1… 4000]

If the ID change is successful the GRD will respond "ID OK"..

Modify GPRS parameters

Using this command you can configure the apn, user and password of the GPRS. This command will also enable GPRS if it was disabled

Command	Description
GPRS apn user password *[password]*	Configures the GPRS service

If the configuration was successful the GRD will respond "GPRS OK".

Command	Description
GPRSOFF *[password]*	Disable GPRS service

If the configuration was successful the GRD will respond "GPRSOFF OK".

Modify the MW configuration

With this command you can change the URL or IP address and the connection port to the MW.

Command	Description
CON *URLorIP port [password]*	Configures the URL or IP and the connection port to the MW

Where:

Parametro	Description	Value
URLorIP	URL or IP where the MW is located	xxx.xxx.xxx.xxx
port	TCP port in which the MW expects the GRD connections	[1…65535]

Example: CON 200.89.185.59 1026 password

If the configuration was successful the GRD will respond "CON OK".

Disconnecting the GRD

Command	Description
DISC *[password]*	This command disconnects the GRD from the MW preventing a reconnection until the connection is reconfigured.

Modifying the password

Command	Description
PASSW *newpasswordo [password]*	Modifies the password used by the GRDs for SMS and the connection to the MW

The password can have a maximum of 8 characters and is not case sensitive.

Configuring a new password if you did not have any:

PASSW *newpassword*

Configuring a new password if you already have one:

PASSW *newpassword previouspassword*

Erasing the password:

To leave the equipment without a password you must send a message leaving 2 spaces between the command and the previous password.
PASSW previous*password*

Rebooting the GRD

Command	Description
RESET *[password]*	Reboots the GRD

Reading Inputs and Outputs

It's possible to read the value of the channels by SMS

Digital Inputs:

Command	Description
GETI *[I channel]* *	Reads channel I. (Read note*)
GETI *[first I channel]…[last I channel]*	Read several I channels
GETI	Reads all I channels (Max. 50 channels in on SMS).

Digital Outputs:

Command	Description
GETO *[O channel]* *	Reads channel O. (Read note*)
GETO *[first O channel]…[last O channel]*	Read several O channels
GETO	Reads all O channels (Max. 50 channels in on SMS).

Analog Inputs:

Command	Description
GETAN *[AN channel]* *	Reads channel *AN*. (Read note*)
GETAN *[first AN channel] …[last AN channel]*	Read several *AN* channels
GETAN	Reads all *AN* channels (Max. 15 channels in on SMS).

Pulse Inputs:

Command	Description
GETPI *[PI channel]* *	Reads channel *PI*.

GETPI *[first PI channel]…[last PI channel]*	Read several *PI* channels
GETPI	Reads all *PI* channels (Max. 15 channels in on SMS).

If you receive three point (...) ending the SMS, it means that more information will be sent on another SMS.

*Note: If you configured an SMS alarm for this channel you will receive the full text you configured. The text will change depending on the state of the I/O. Please read SMS alarms section for further information.

Setting outputs and pulses

You can set an output or pulse channel by sending an SMS to the GRD.

	This commands can only be sent from the phone numbers added to the GRD "Phone book". Please read SMS alarms section for further information.

Command	Description
SETO *[O channel] [state]*	The O channel will be set to "state"

State can be "ON" or "OFF"

Command	Description
SETAN *[AN channel] [value]*	The AN channel will be set to "value"

Only applies to analog channels mapped to script variables or Modbus queries

Command	Description
SETPI *[P channel] [value]*	The P channel will be set to "value"

The value can be between 0 and 1.000.000.000

Script control

Command	Description
STARTSCRIPT *[password]*	Script interpreter will set to 'run' mode

Command	Description

STOPSCRIPT *[password]*	Script interpreter will set to 'stop' mode

2017-06-12

SMS alarms

GRDs w/SMS can send SMS alarms to the configured recipients when and analog inputs goes out of range or a digital input changes.

You will find the tab "SMS" enabled on the GRD Config software when working with these GRDs.
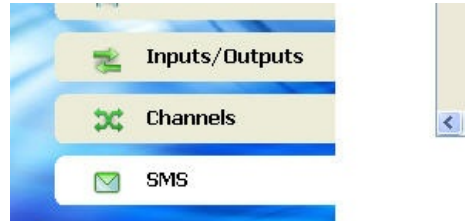
Enabling SMS alarms

You need to enable which channel will send and SMS alarms. Once you do it this channel will be listed on the SMS configuration.

On digital inputs channels you must enable the SMS by change option
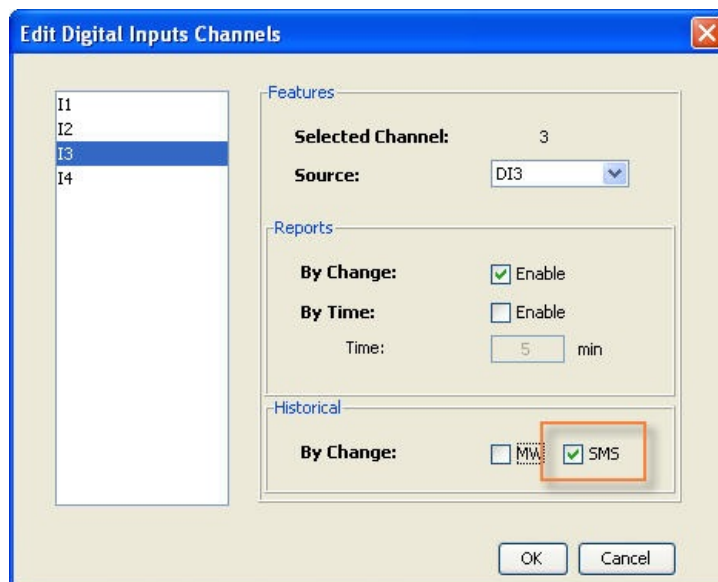
On digital outputs channels you must enable the SMS by change option
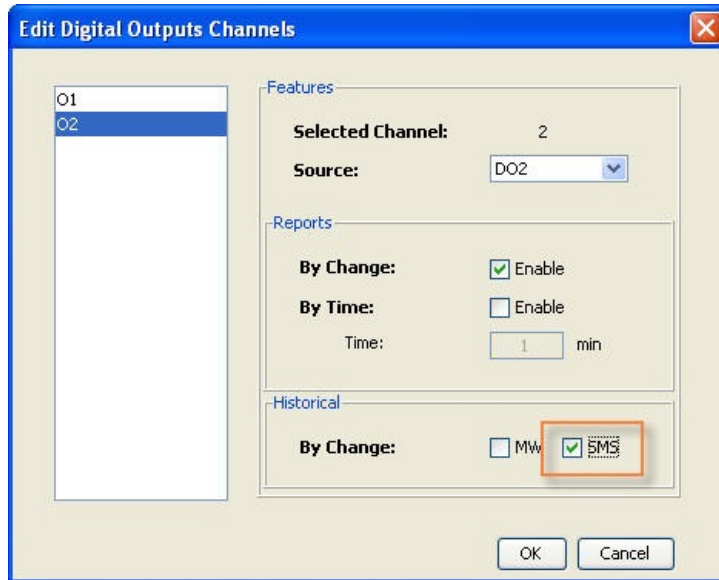
On analog inputs channels you must enable the SMS by alarm option
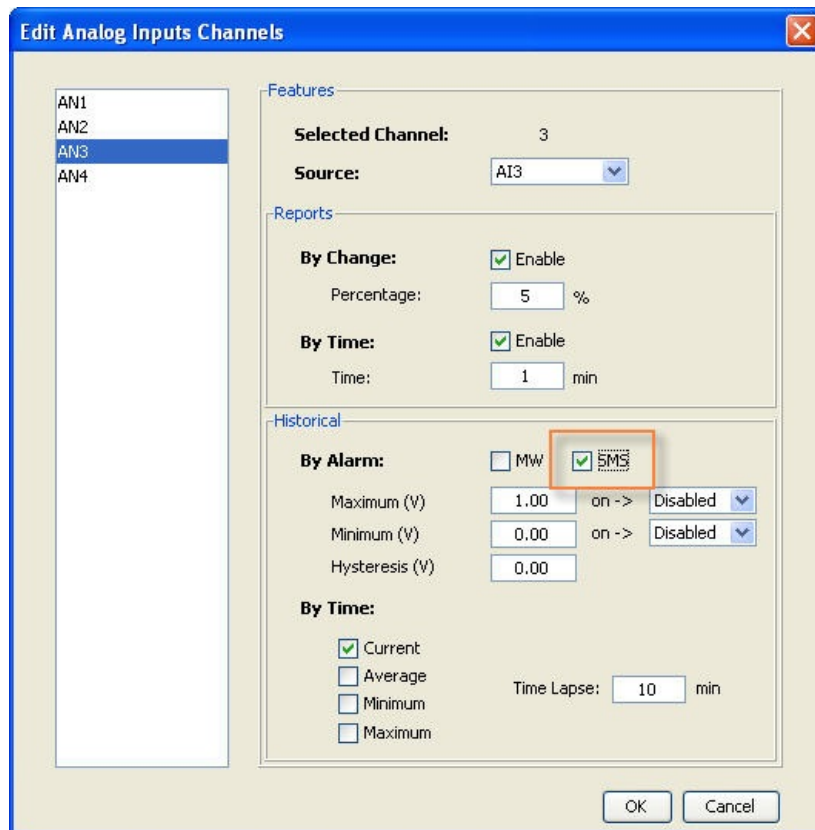
	Limits should be configured later depending on the SMS scaling

Phone Book

To access it go to the SMS tab and then to press the "Phone Book" icon.
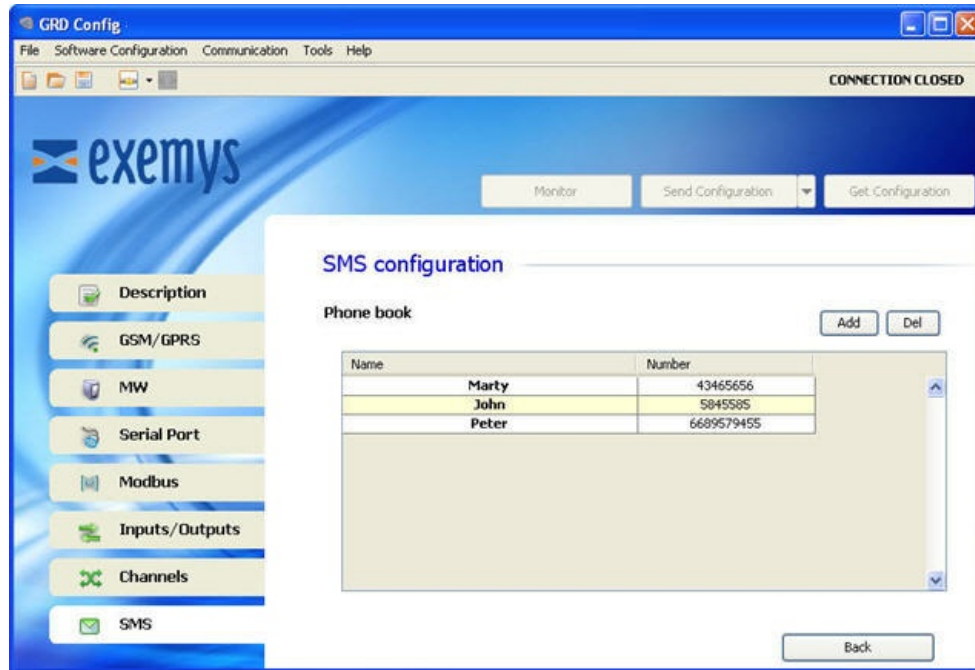
To create a new entry press the "Add" button. This window will be displayed.
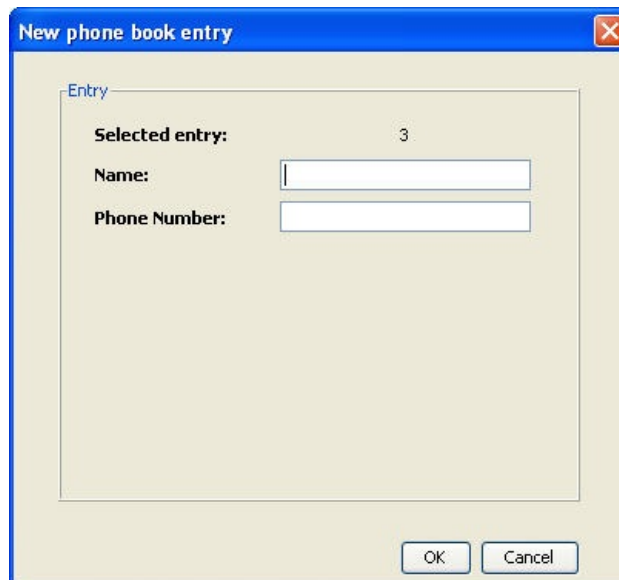
The "Name" is only used as a reference.

SMS selection

After enabling the channels that will send SMS you can configured the text and scaling of each one. Goto to the SMS tab and press the "Message Configuration" icon,

The press the "Add / Remove" button.
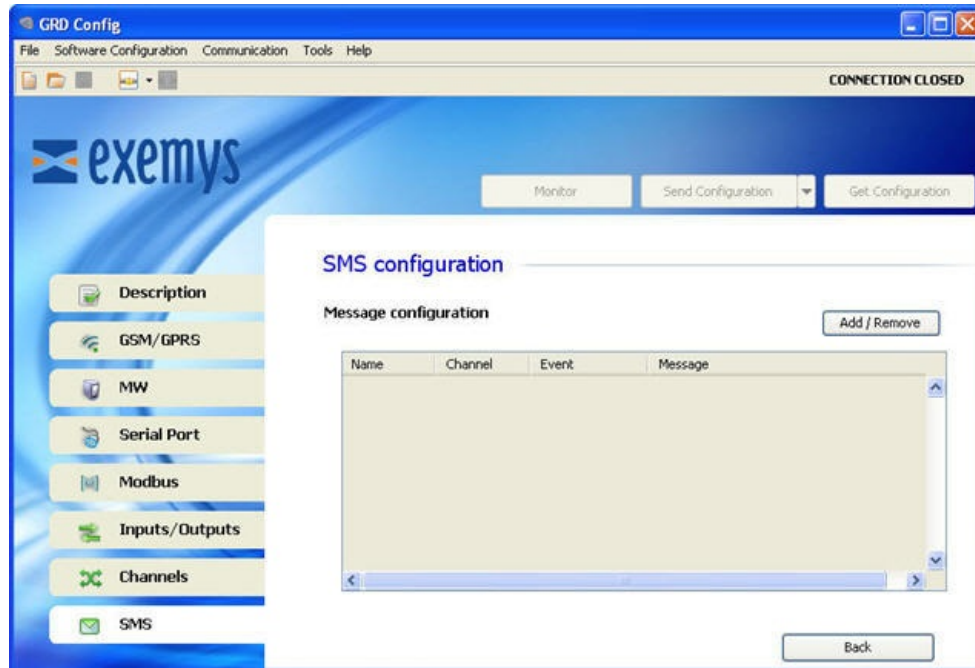
The enable the SMSs alarm you will use.
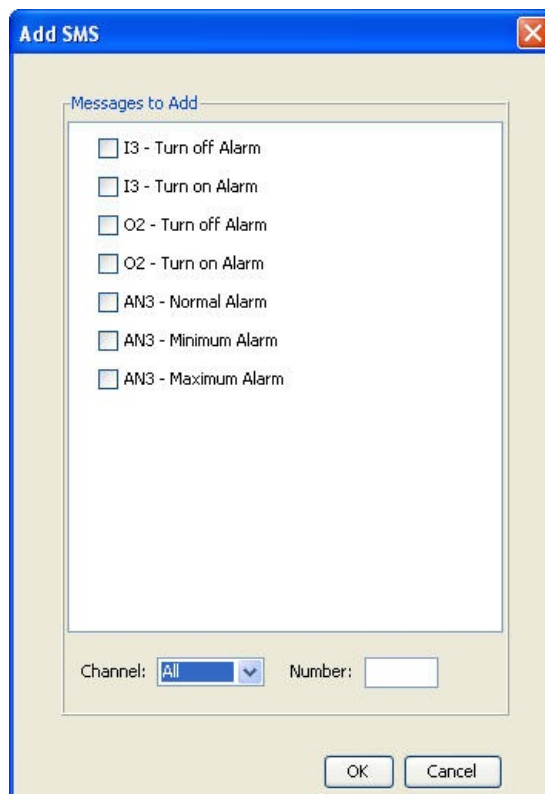
You can enable single events per channel. As an example, you can send an SMS only when input 3 goes on but not when it goes off.

(i)	You can add up to 50 SMSs.

After selecting the messages you will see the default Message. Where &t is the timestamp, &i the channel number and &v the value.
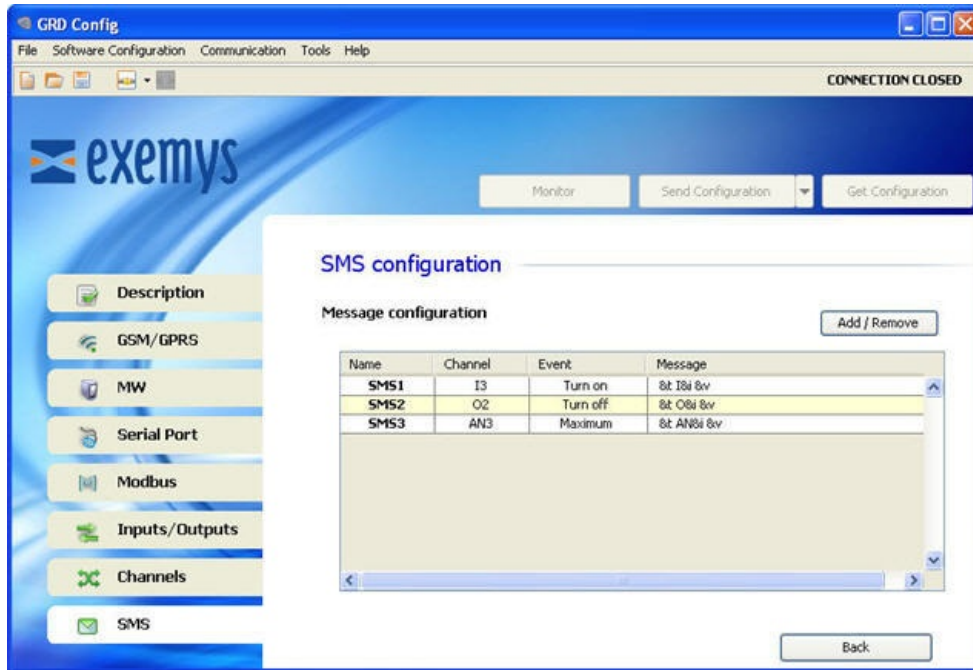
To modify the you must double click the corresponding line.

Editing the SMS text
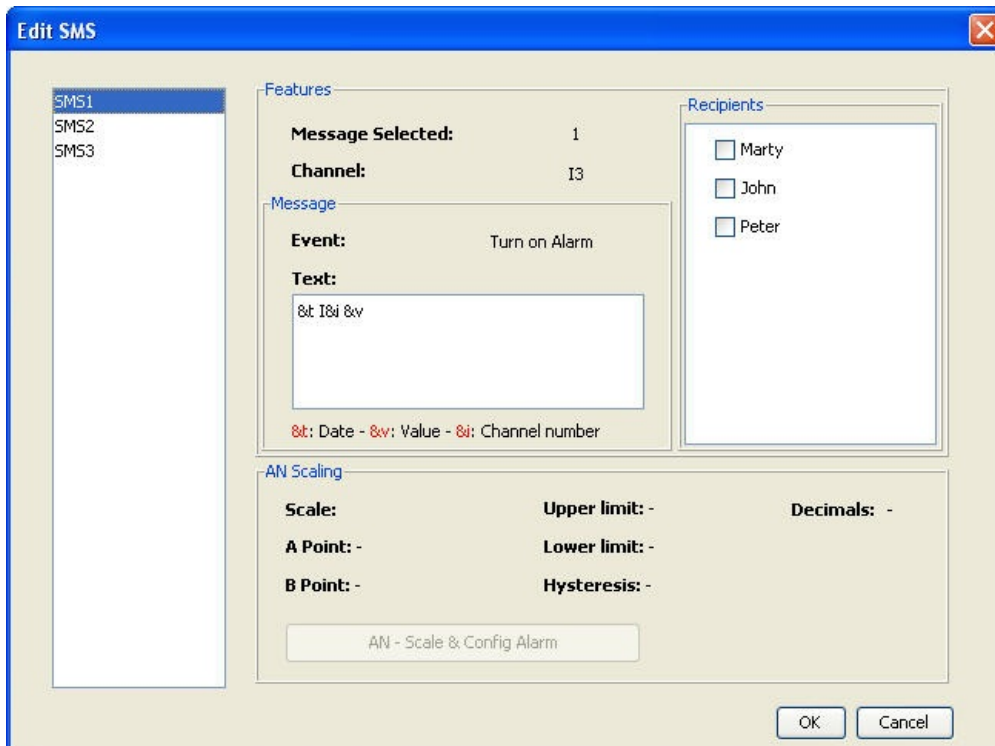
You can select here which recipient will receive this particular SMS.

The maximum text length is 60 characters. Using &t, &v and &i you can add the date, value and channel number to the SMS text.

If the SMS is related to an analog input the "AN scaling" section will be enabled.
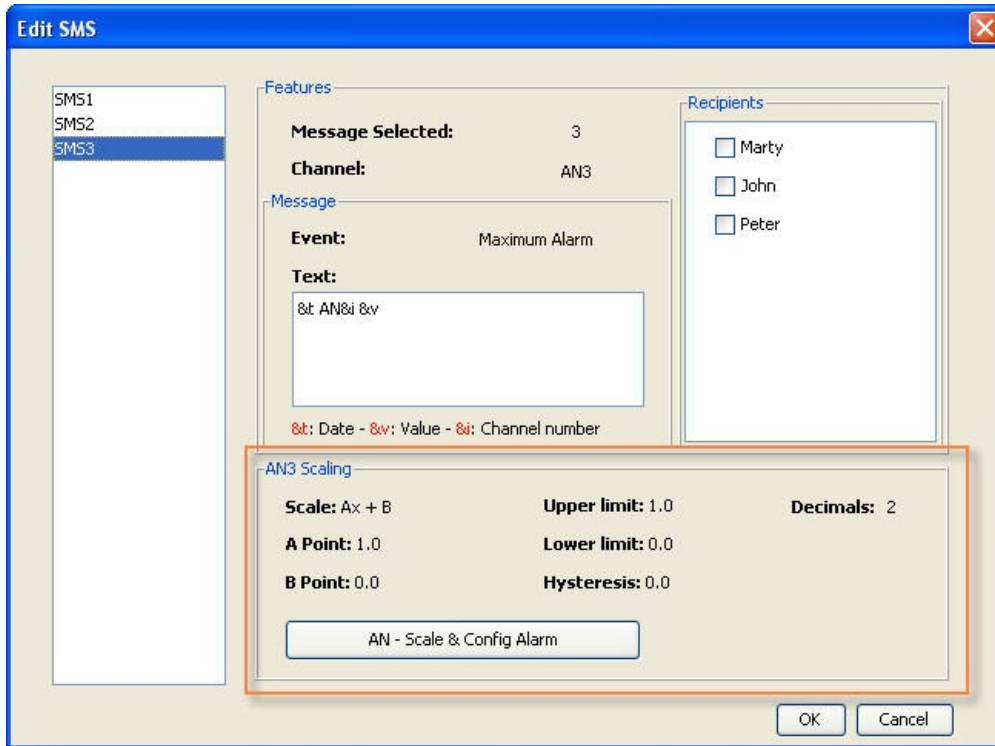
This scaling will only be applied to the SMS of that analog channel.
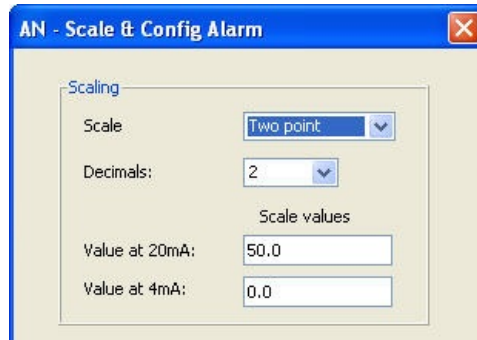
Analog input scaling

If you press the "AN - Scale & Config Alarm" button this window will be shown
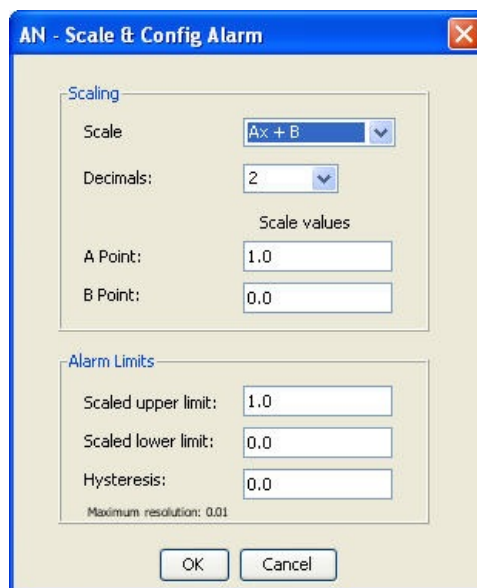
On the top part (Scaling) you can select which scale type will be applied fo this input, how many decimal digits will be used and the A & B scaling values.

You can choose between linear scaling (A x + B) or "Two points" scaling. If the analog channels is related to a physical input you will usually use "Two Points" scaling.
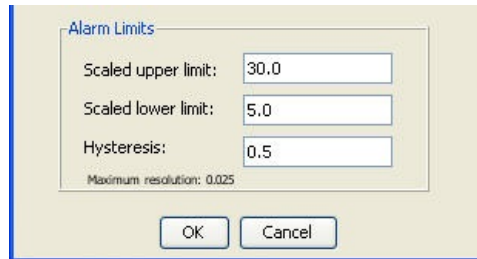
On the botton part (Alarm Limits) you can re define the "Historical By Alarm" limits but using the scaled values.

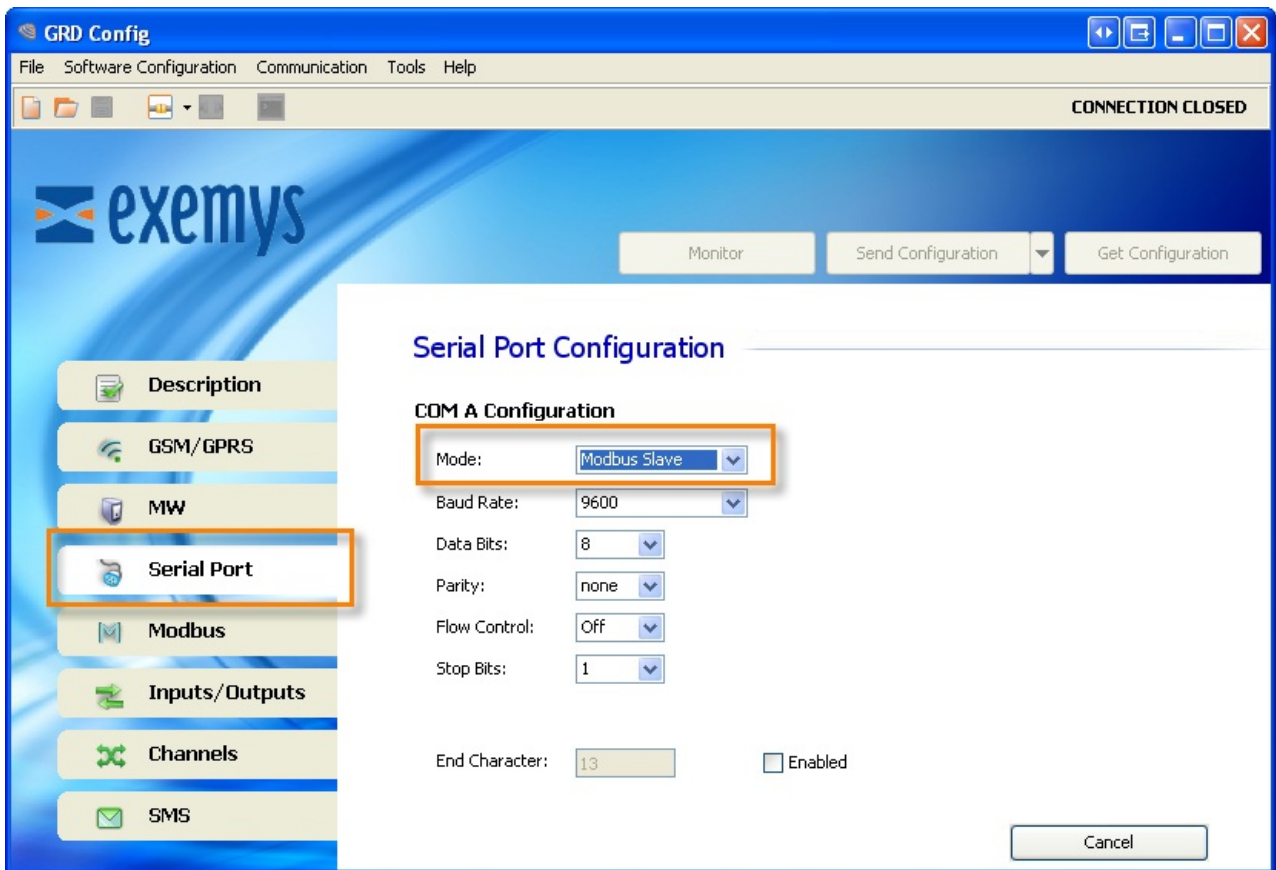|	
ℹ️	Editing the scaling will affect all the SMS related to the same analog channel.

2017-06-19
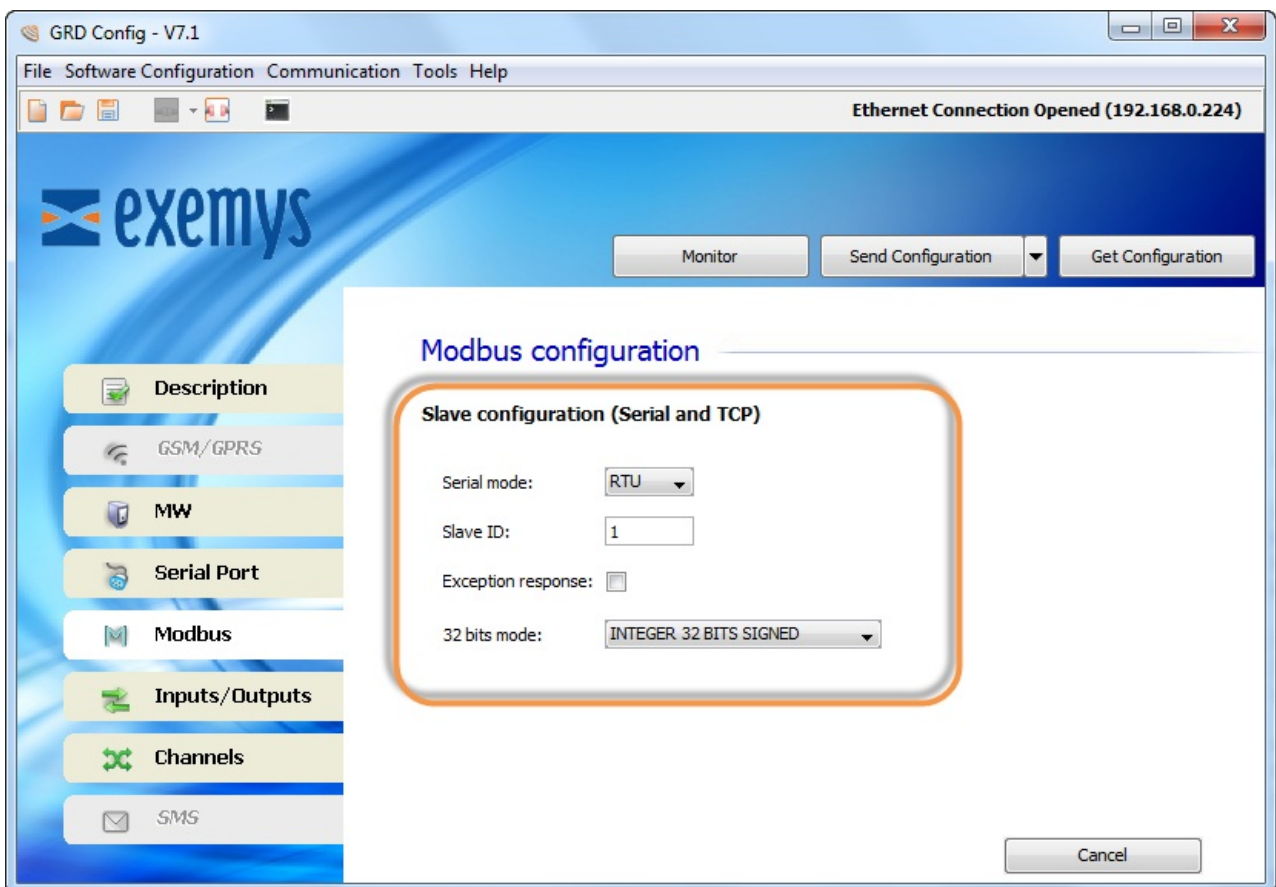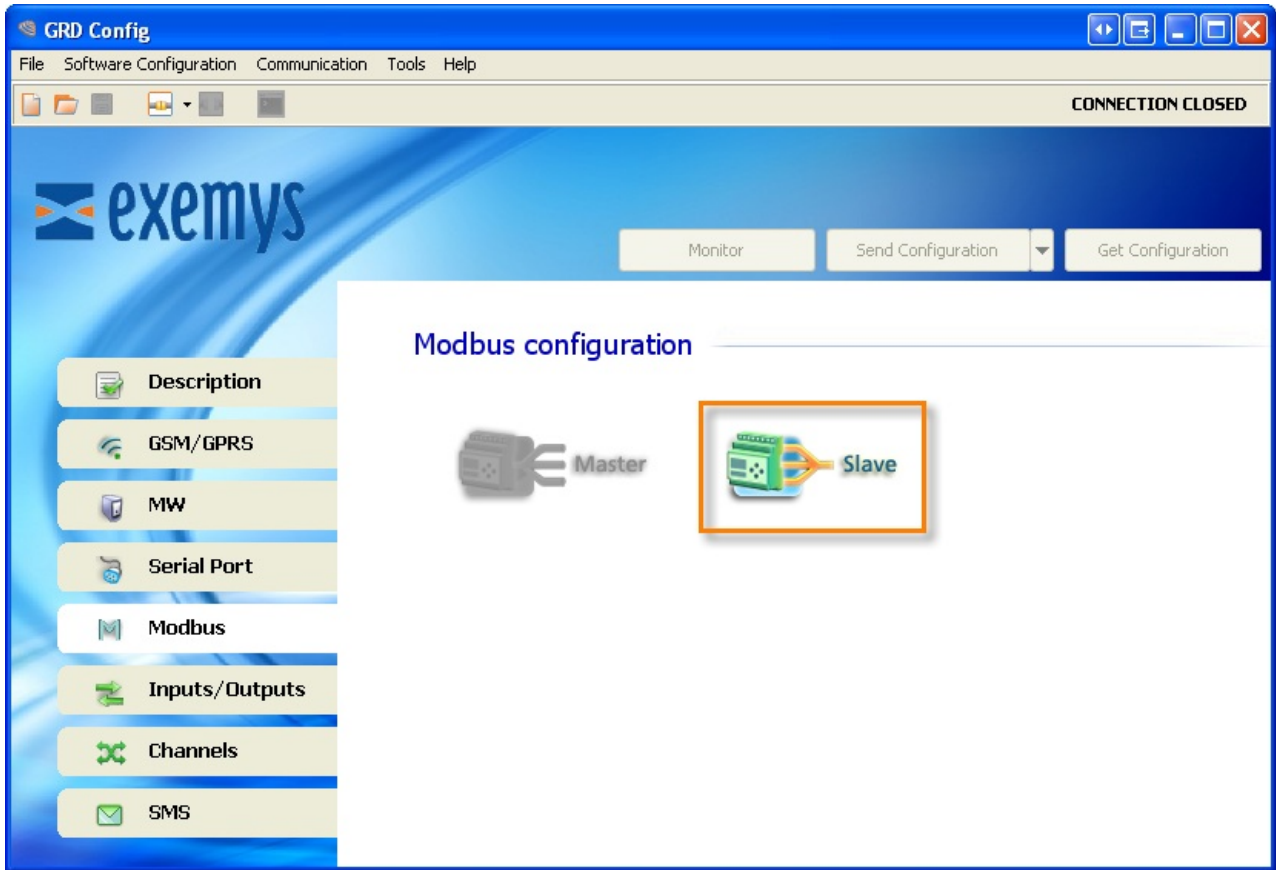
⚠	*For GRD-3G only*

GRD Modbus Slave

GRD's serial port can be configured in Modbus slave mode. This mode will allow you to read and write all GRD channels (physical, Modbus or script)

To use the Modbus slave configure one serial port in "Modbus Slave" mode

Modbus slave configuration

Go to the "Modbus" tab and select "Modbus Slave"

Serial mode

It refers to the Modbus protocol to be used, being RTU or ASCII.

Slave ID

The GRD will answer when it receives a Modbus query to this Modbus slave ID

Exceptions

If enabled the GRD will answer with an exception to a query sent with an invalid command, address range or value.

32 bits mode

AN an P channels are mapped in 32 bit registers. Here you can configure if the most significant word is mapped in the first or the second register

Channels mapping

This is how GRD channels are mapped

Start Address	End Address	GRD Channel	Format
10001	10100	I1 a I100	Bit
00001	00100	O1 a O100	Bit
40001	40200	AN1 a AN100	16 Bits integer
40201	40400	PI1 a PI100	32 Bits integer

Example. On a GRD3305-XF with the default configuration the physical I/Os are mapped like this

| Start Address	End Address	GRD Channel
10001	10004	I1 to I4
00001	00002	O1 to O12
40001	40008	AN1 to AN4
40201	40208	PI1 to PI4

2017-06-07

Script Programming

Description

The GRD/cLAN with script programming support allows you to run user written scripts on the device, making it more powerful and flexible.

The GRD/cLAN will continue working normally while the script is running.

Script Features

- **Math** operations
- **Logic** operations
- **Timing** functions
- Physical and Modbus channels readings
- Digital outputs control
- **SMS** sending and receiving (GRD only)
- **Serial port** data parsing
- Sending and receiving data using external **Satellite** modem
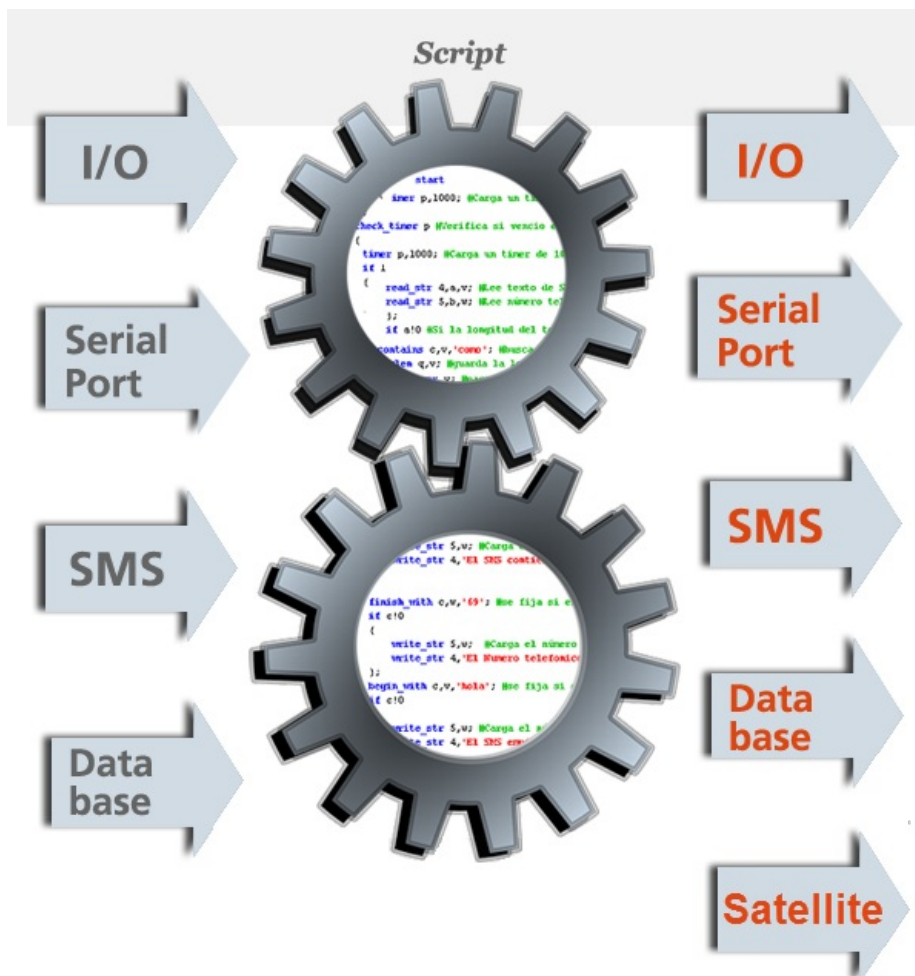
2017-06-14

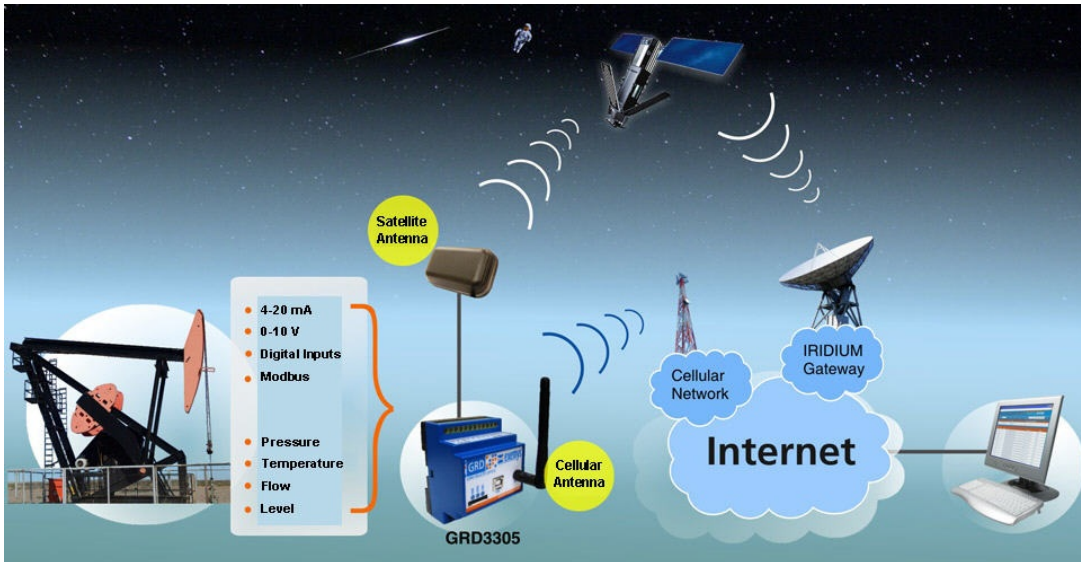# Satellite modem support

Introduction

If you connect an SBD Iridium modem (EDGE or ITAS) to the GRD serial port, you can send historical records to the Middleware using the Iridium satellite network.

The satellite modem can be used as a backup link to GPRS or as the main method to send data.

The satellite modem is controlled using the script programming feature. Please the read the script programmer user's manual to know more about it.

The information sent will be finally received by the Middleware.

Communication

The records sent using the satellite modem are forwarded by the Iridium gateway to an IP address and port defined when hiring the SBD service.

The Middleware can received data from the Iridium gateway on the "GRD server" port (40000). It will use the modem IMEI (Mobile System Equipment Identity) to link the received data to a GRD ID.

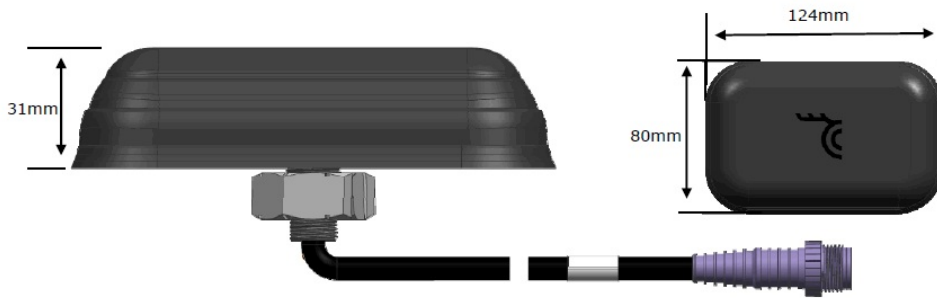Middleware version must be 4.4.0 or higher.
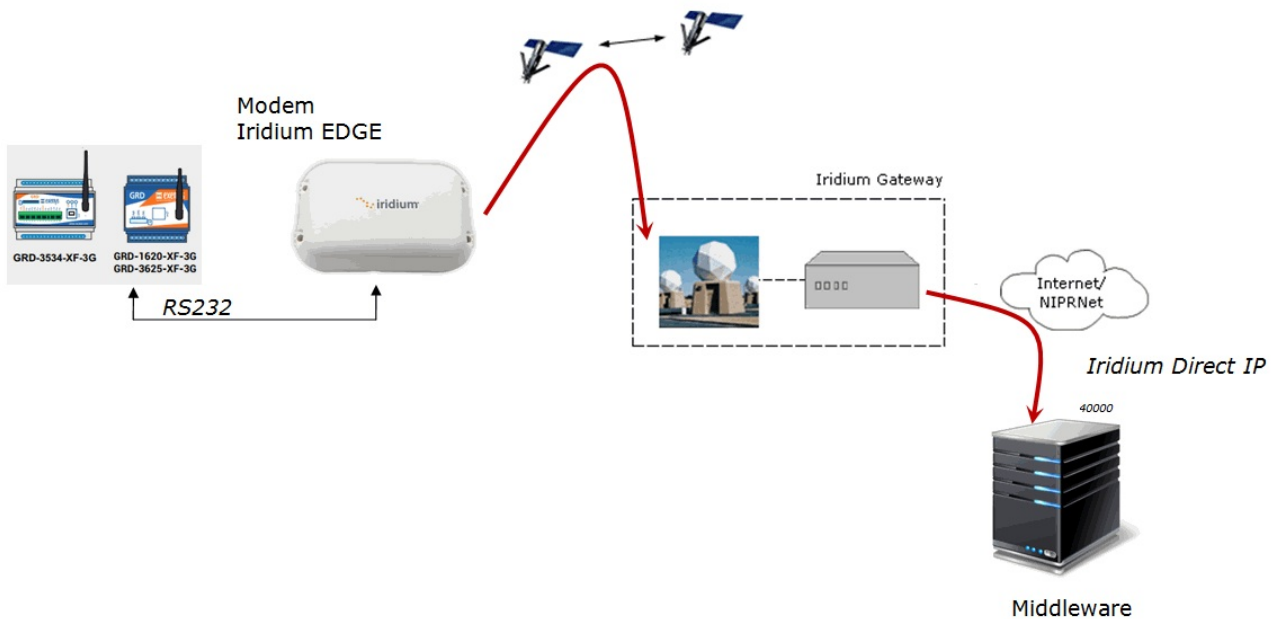
Satellite modem and service

The Iridium EDGE/ITAS modem uses the SBD service to send data. You must hire this service from an authorized dealer.

The EDGE modem has a unique ordering code (**IR EDGE1601**)

The recommend EDGE/ITAS models are **HIRD-SX-0129x-30** or **HIRD-SX-0129x-01** in second place.
Both models can also be named **ITAS 832SP**

When hiring the service you must ask to link it to the modem's IMEI and to send the data to the IP address and port (40000) where you are running the Middleware. This method to send IP data is called *DirectIP* by Iridium.
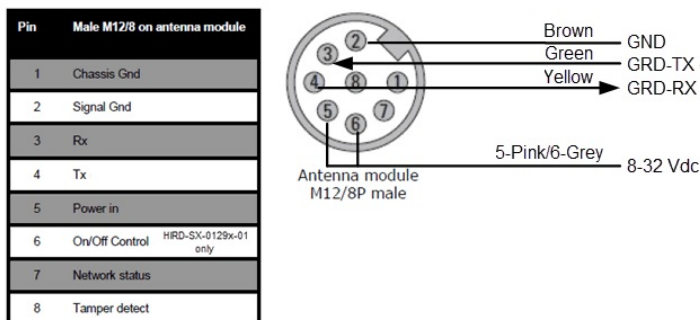
You can find the IMEI on a label on the modem's bottom

Wiring the modem

The modem is connected to the GRD using an RS232 cable.

| Pin	Male M12/8 on antenna module
1	Chassis Gnd
2	Signal Gnd
3	Rx
4	Tx
5	Power in
6	On/Off Control HIRD-SX-0129x-01 only
7	Network status
8	Tamper detect

It is recommended to share the same power supply between the GRD and the modem.

Pin 6 needs only to be connected on ITAS **HIRD-SX-0129x-01**
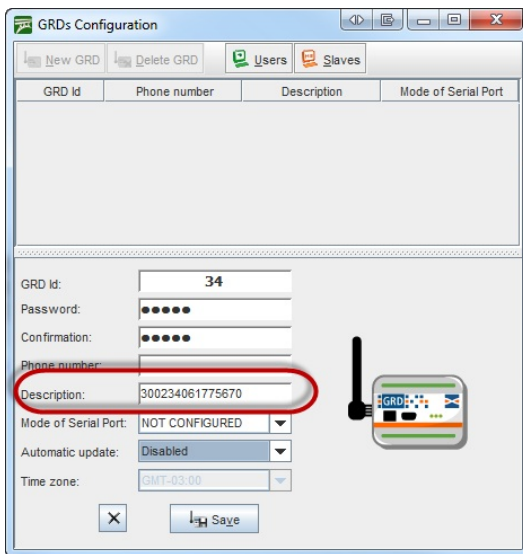
Configuration

GRD Config

Use the "GRD Config" software to configure the serial port as shown on the following picture.
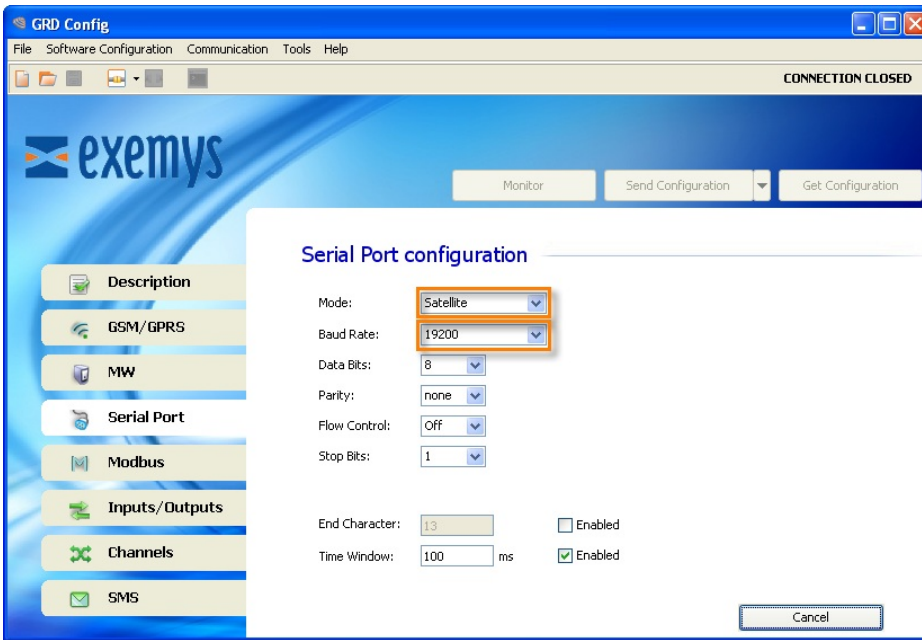
Middleware

The Middleware version must 4.4.0 or higher to receive satellite data on the "GRD server" port.

You only need to configure the modem's IMEI in the "Description" field as shown here:

Creating historical records

Historical records to be sent by the satellite modem can be configured on every channel as usual.

To optimize when to create historical records you can also use the script programming feature.

2017-11-23

GRD1620-XF-3G

Hardware features

- SIMs: 1
- USB: 1 (For configuration)
- 2G,2.5G and 3G(GPRS, EDGE, UMTS) - Automatic switch between American and European Bands
- Serial ports: 2 (one RS232, one RS485)
- Power supply requirements: 10 to 30 Vdc

Data Acquisition

- Physical inputs/outputs
- Modbus inputs/outputs (embedded Modbus master)
- Embedded Modbus slave
- Other protocols using script programming (Version 2)
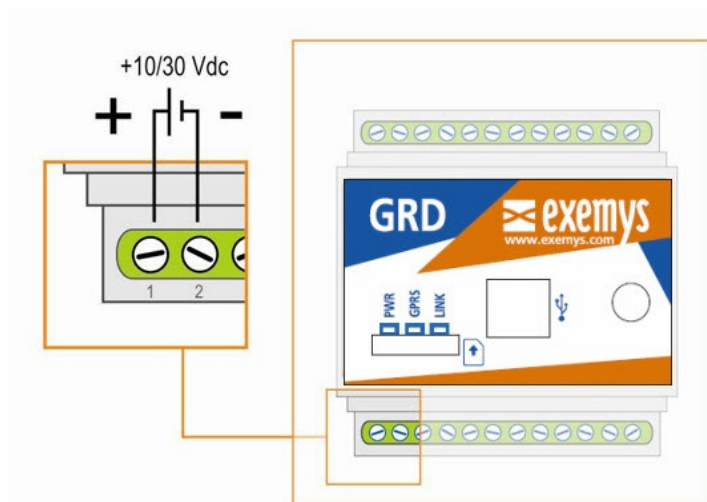
Operating modes:

- Monitoring by WEB page / Database(GPRS datalogger)
- Monitoring from SCADA
- Remote access to serial port
- SMS alarms/control
- Local control using script programming (timing, logic, math, I/O control)

Server link :

- GSM / GPRS (2G/2.5G/3G)
- Satellite (with external satellite modem)
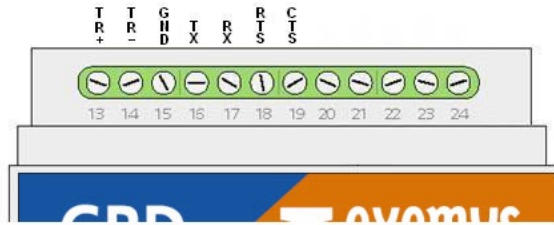
Wiring

Wiring – Power supply
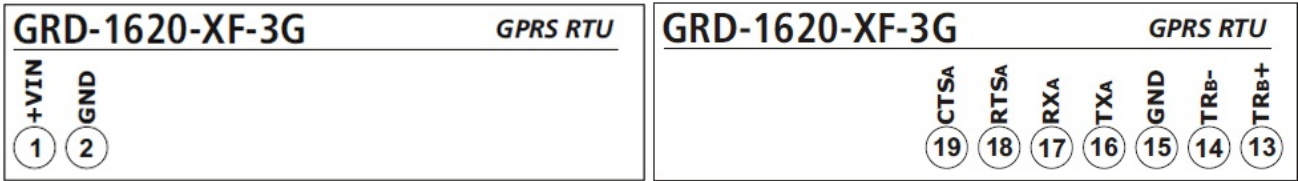

Wiring – RS232 port – RS485 port

The **RS232** port is of the 5-wire DTE type (TX, RX, RTS, CTS, GND) and has a terminal board for its connections.

The **RS485** port is of the 2-wire type (TR+ and TR-) and has a terminal board for its connections.

There's no need to configure whether you are going to use the port RS232 or RS485. Just connect the wires to the corresponding terminals.

Wiring – Terminal Blocks

2017-06-09

GRD3621-XF-3G

Hardware features

- SIMs: 1
- USB: 1 (For configuration)
- 2G,2.5G and 3G(GPRS, EDGE, UMTS) - Automatic switch between American and European Bands
- Digital Inputs/Outputs: 4 Configurable
  - As inputs: voltage activated (They can count pulses of up to 45 Hz)
  - As outputs: open collector type
- Analog Inputs:
  - 1 configurable as 0-1V / 0-10V / 4-20mA / PT100 (Software + Hardware configurable)
  - 1 configurable as 0-1V / 0-10V / 4-20mA (Software)
- Power supply requirements: 10 to 30 Vdc

Data Acquisition
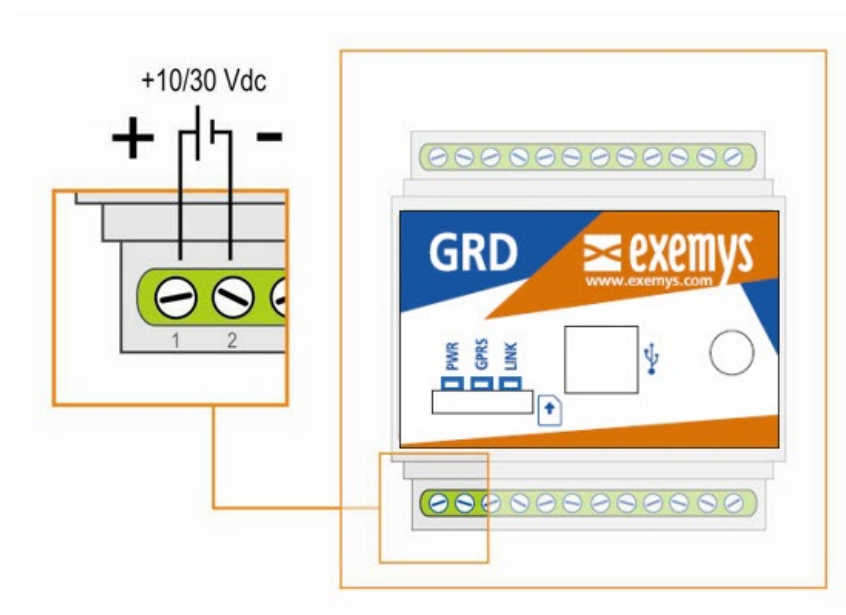
- Physical inputs/outputs

Operating modes:

- Monitoring by WEB page / Database(GPRS datalogger)
- Monitoring from SCADA
- SMS alarms/control
- Local control using script programming (timing, logic, math, I/O control)

Server link :

- GSM / GPRS (2G/2.5G/3G)

Wiring

Wiring – Power supply

Wiring – Terminal Blocks

Wiring - Internal jumpers for AI1

AI1 input can be configured to measure current, voltage or temperature using a PT100 sensor

It must be configured on the configuration software and with two internal jumpers.

To measure current or voltage set both jumpers to the *VI* position. To connect a PT100 sensor set them at the *PT* position.

Disassemble the GRD carefully to reach the jumpers.

2017-12-21

GRD3625-XF-3G

Hardware features

- SIMs: 1
- USB: 1 (For configuration)
- 2G,2.5G and 3G(GPRS, EDGE, UMTS) - Automatic switch between American and European Bands
- Serial ports: 2 (one RS232, one RS485)
- Digital Inputs/Outputs: 6 Configurable
  - As inputs: voltage activated (They can count pulses of up to 45 Hz)
  - As outputs: open collector type
- Analog Inputs: 4 configurable as 0-1V / 0-10V / 4-20mA
- Power supply requirements: 10 to 30 Vdc

Data Acquisition

- Physical inputs/outputs
- Modbus inputs/outputs (embedded Modbus master)
- Embedded Modbus slave
- Other protocols using script programming (Version 2)
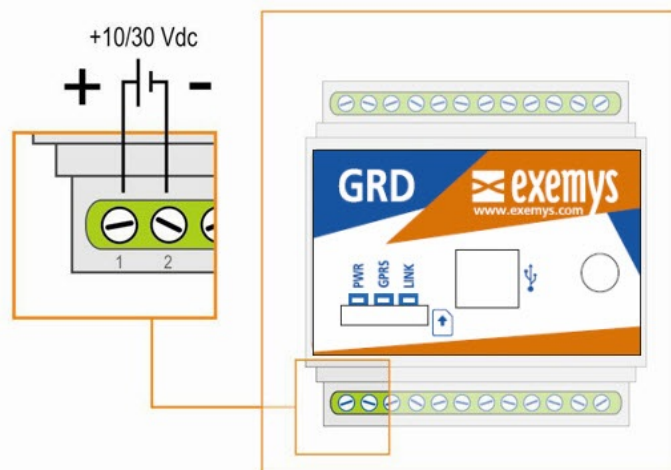
Operating modes:

- Monitoring by WEB page / Database(GPRS datalogger)
- Monitoring from SCADA
- Remote access to serial port
- SMS alarms/control
- Local control using script programming (timing, logic, math, I/O control)

Server link :

- GSM / GPRS (2G/2.5G/3G)
- Satellite (with external satellite modem)

Wiring

Wiring – Power supply

Wiring – RS232 port – RS485 port

The **RS232** port is of the 5-wire DTE type (TX, RX, RTS, CTS, GND) and has a terminal board for its connections.

The **RS485** port is of the 2-wire type (TR+ and TR-) and has a terminal board for its connections.

There's no need to configure whether you are going to use the port RS232 or RS485. Just connect the wires to the corresponding terminals.

Wiring – Terminal Blocks

2018-08-18

GRD3534-XF-3G

Hardware features

- SIMs: 1
- USB: 1 (For configuration)
- 2G,2.5G and 3G(GPRS, EDGE, UMTS) - Automatic switch between American and European Bands
- Serial ports: 2 (Both are RS232 and RS485)
- Digital Inputs : 16 voltage activated (8 of them can count pulses of up to 1 Khz)
- Analog Inputs: 8 configurable as 0-1V / 0-10V / 4-20mA
- Digital Outputs: 8 open collector type
- Power supply requirements: 10 to 30 Vdc

Data Acquisition

- Physical inputs/outputs
- Modbus inputs/outputs (embedded Modbus master)
- Embedded Modbus slave
- Other protocols using script programming (Version 2)
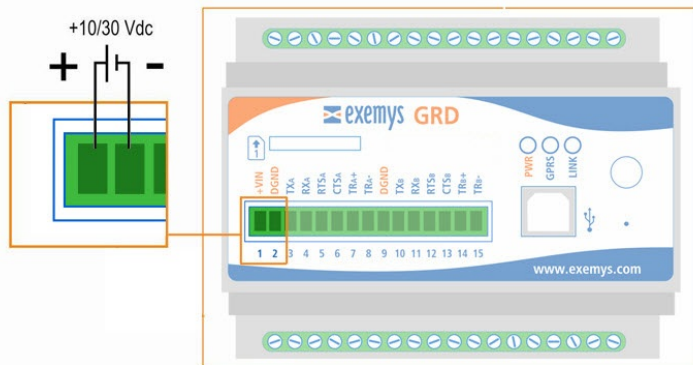
Operating modes:

- Monitoring by WEB page / Database(GPRS datalogger)
- Monitoring from SCADA
- Remote access to serial port
- SMS alarms/control
- Local control using script programming (timing, logic, math, I/O control)

Server link :

- GSM / GPRS (2G/2.5G/3G)
- Satellite (with external satellite modem)
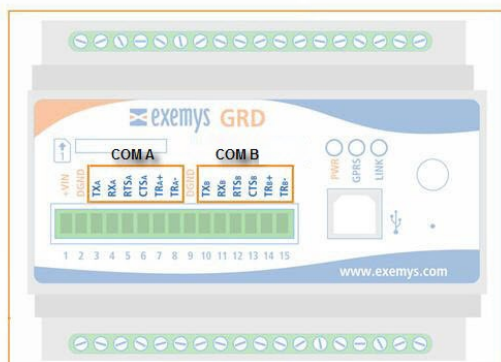
Wiring

Wiring – Power supply

Wiring – RS232 port – RS485 port

The **RS232** ports are of the 5-wire DTE type (TX, RX, RTS, CTS, GND) and has a terminal board for its connections.

The **RS485** ports are of the 2-wire type (TR+ and TR-) and has a terminal board for its connections.

There's no need to configure whether you are going to use the port RS232 or RS485. Just connect the wires to the corresponding terminals.

Wiring – Terminal Blocks

2017-11-23

Signal, SMS, GPRS and MW link Troubleshooting

- **The GRD does not respond to SMS messages.**
  - **If "GRD Config" shows a very low signal level "Ex: -113dB" or SIM status shows "LOW SIGNAL").**
    - The GRD has no signal. Verify:
      - That the antenna is correctly connected.
      - That the GRD is within the coverage area of your cell phone operator.

  - **The SIM card status indicates failure.**
    - The GRD is not accepting the SIM.
      - If "GRD Config" shows "PIN Required": the SIM card has the PIN activated (security code), configure the PIN.
      - If "GRD Config" shows "Blocked card (PUK)": the SIM card is blocked by PUK.

  - **If there is no indication of error.**
    - Verify that the SIM card placed in the GRD has credit.
    - Verify that the SIM card has a subscription or account that allows to send SMS messages.
    - Corroborate that the phone number you are sending the message to, coincides with the one on the SIM Card of the GRD.
    - Be sure that the message sent is one of the supported ones by the GRD. If the message begins with a word the GRD cannot interpret, it will not answer. The same thing happens if the message begins with a space.

- **The GPRS connection cannot be established**
  - Verify the status with "GRD Config" or send a SMS message requesting the connection status ('*state' command*)
  - If the status**shows "ERROR".** Verify that the configured Operator (GPRS APN/user/password) corresponds to the one on the SIM Card. (You can verify this value sending the SMS message *'list'*).
  - If the status shows **"CONNECTING"** for a long time, it simply means there are delays in the network. Wait until the GRD establishes the connection.

- **The MW connection cannot be established**.
  - The status shows **"WAITING FOR GPRS CONNECTION",** the GPRSservice is not available (or is not correctly configured). It won't be able to establish a TCP connection until a GPRS connection is available..
  - The status shows **"DISABLED"** (the Link LED is off): there is no configured connection or the GRD is waiting for the next try.
  - The status shows **"Connecting…"** (The Link LED blinks rapidly).
    - If the LED blinks rapidly during several seconds (a minute or more) verify:
      - That the equipment to which you are trying to connect is not behind a firewall which is filtering the connection. Please read the "Windows Firewall" section
      - You might not have configured the MW's public IP address and/or forgot to open the TCP port in you router. Please read the "Port forwarding" section
      - That the quality of the GPRS service is acceptable. For example: attempt to access a page with a web browser of any cell phone having the service available and verify that it can be done without problems.
    - If the LED blinks rapidly a few seconds (2 or 3) and then blinks slowly verify:

- That the IP address and port to which the GRD is attempting to connect are the correct ones.
- That there is no reason why the server is rejecting the connection request (ex. That is requesting identification or authentication).

- **A connection is established and then it closes**
    - Verify that there is no reason why the server is rejecting the connection request (ex. That is requesting identification or authentication).

- **The connection is established but the communication fails**
    - If the Link LED remains constantly on and it does not blink, is indicating that there is no data reception or transmission. If the Link LED blinks sporadically, it is indicating that data are being sent and/or received. In any case verify:
        - That the established TCP connection was made to the correct IP and port (through SMS with the '*state*' command).

For more information on troubleshooting problems please contact support@exemys.com

2015-08-06

Windows Firewall configuration

The Windows "Firewall" feature is created to protect the computer from hacker atacks. The Middleware receives incomming TCP/IP connection from the GRD/cLAN and the firewall can block them.

The easiest way to avoid firewall issues is to disable it. But this can be considered unsafe. So we suggest adding the MW as an exception to allow in coming TCP connections from the GRD/cLAN the MW to reach it.

Windows XP

- Go to Control Panel -> Windows Firewall -> Exceptions -> Add Ports

Windows 7

- Go to Control Panel
- In the search box, type firewall, and then click Windows Firewall.
- In the left pane, click Advanced settings
- In the Windows Firewall with Advanced Security dialog box, in the left pane, click Inbound Rules, and then, in the right pane, click New Rule
- Create a new rule to allow inbound connections to TCP port 40000.
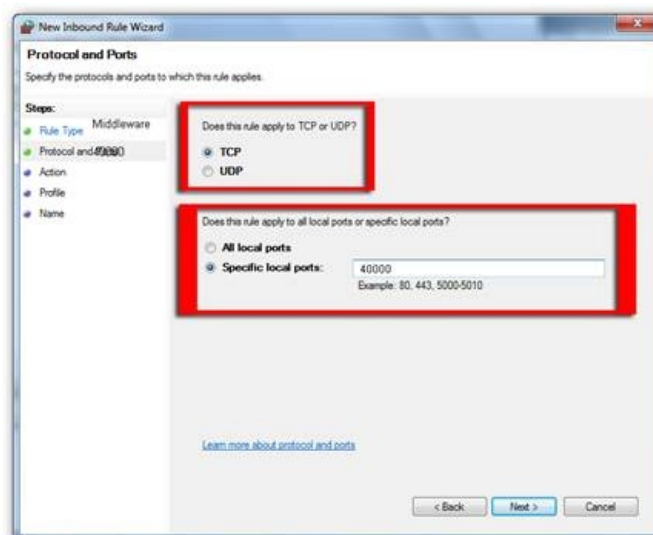
*2017-06-02*

Port Forwarding

When to consider doing it

The GRD/cLAN performs outgoing TCP connections (client) to reach the MW. You might need open a TCP port on your router (port forwding) to allow the GRD/cLAN to reach the MW.

A) With GRD. The computer where you are running the MW doesn't have a public IP address, but it's connected to the internet using a router .
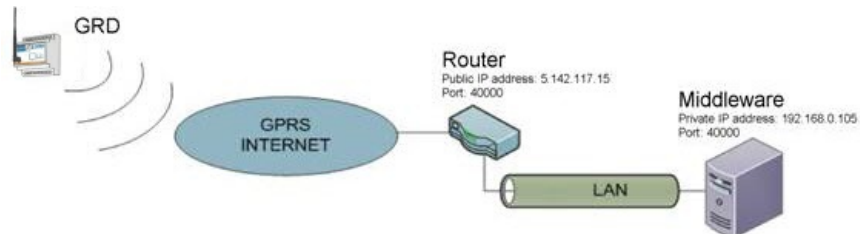
B) With cLAN. If the device is using the Internet to reach then MW, and the computer where you are running the MW doesn't have a public IP address, but it's connected to the internet using a router .
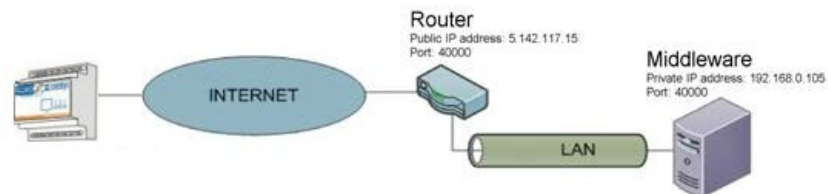
Getting the public IP address

Most routers will show you their public IP address in theirs web site "status" page. If you can't find it there you can go to any of these web sites using a browser on any computer connected to that network. They will show you your network's public IP address.

http://whatismyipaddress.com/

http://ipaddress.com/

http://www.ip-adress.com/

http://www.myipaddress.com/

http://www.whatsmyip.org/

Getting the MW's private IP address

This procedure may vary a little depending on your Windows version.

In **Windows XP**, follow these steps:

- Open the Control Panel from the Start menu
- Open the Network Connections icon
- Open the icon representing your PC's network connection
- When you have more than one icon, just pick the main one
- In the Status dialog box, click on the Support tab
- The Connection Status area lists the IP address.

In **Windows 7**, follow these steps:

- Open the Network and Sharing Center window
- On the right side of the window, choose the link Local Area Connection. A dialog box appears, listing some brief information about the network connection.
- Click the Details button
- You find the PC's IP address listed as IPv4 IP Address in the Network Connection Details dialog box

In **any windows version** you can type "ipconfig" on the command prompt and get your computer's IP address

- Open the command prompt. The command prompt is usually located within the Accessories folder
- At the "Command Prompt" screen type ipconfig then press Enter
- The IP address should appear along with other LAN details in the readout

| ⚠️ | We suggest using a fixed ip address (Not assigned by DHCP) because you will have to type this IP address on the router configuration |

Configuring Port forwarding

According to the router's manufacturer, port forwarding can also be called "virtual server", "port openning" or "NAT".

We'll give you an example here, but if it's not a good guide to configure your router please check your router's manual.

Gaining access to the router

To configure the router you will it's IP address, user name and password.

The router's IP address is the default gateway IP address.

You can find it while determining the private IP address.

If you don't have the user name and password of your router try the default ones that you'll find on the router's user manual.

Open a browser window and type your router's IP address. You'll be prompted to enter the user name and password

Openning the port

Once you are logged into the router's web server you can open the port used by the GRD to access the MW. The default port is TCP 40000.
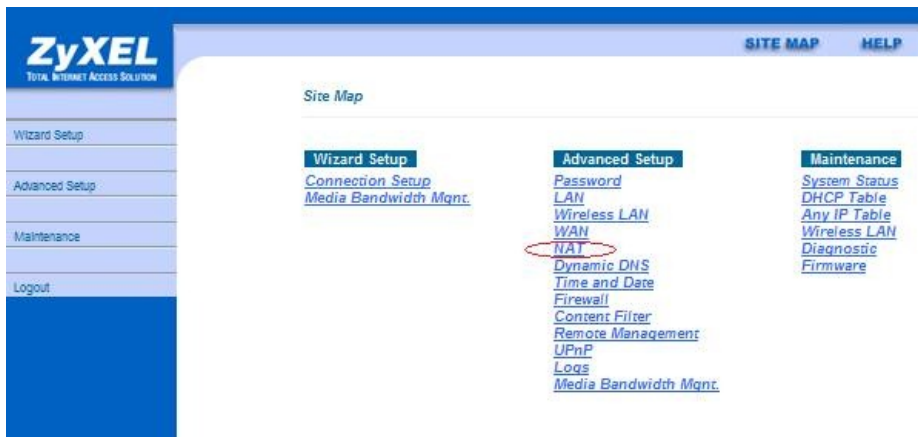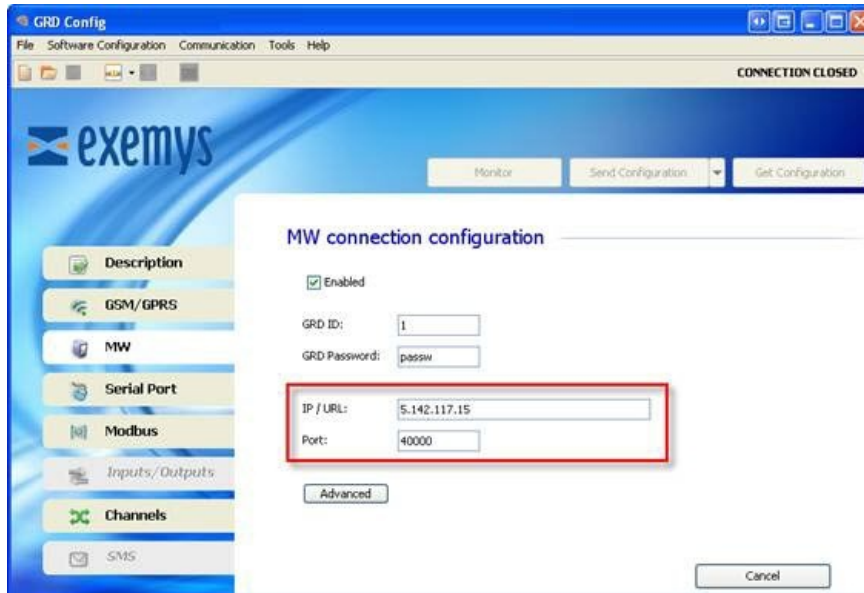

You'll have to configure to open port TCP 40000 to the MW's private IP address.

	Start Port No.	End Port No.	IP Address
1	All ports	All ports	0.0.0.0
2	40000	40000	192.168.0.105
3			
4			
5			

Configuring the GRD/cLAN

Once the MW is ready, configure the public IP address in the cLAN/GRD configuration

Dynamic public IP address and Dynamic DNS services (DDNS)

The MW's IP public address should be a fixed IP address in order to allow the GRD/cLAN to maintain the link with the MW.

If you don't have a public fixed IP address you can still use the GRD/cLAN and the MW in your network, but you must notice that the GRD/cLAN will loose the link to the MW as soon as the public IP changes.

You can configure the GRD to access a new IP address by SMS as described in the GRD's user manual in section "SMS alarms and configuration / SMS - Monitoring and Configuration"
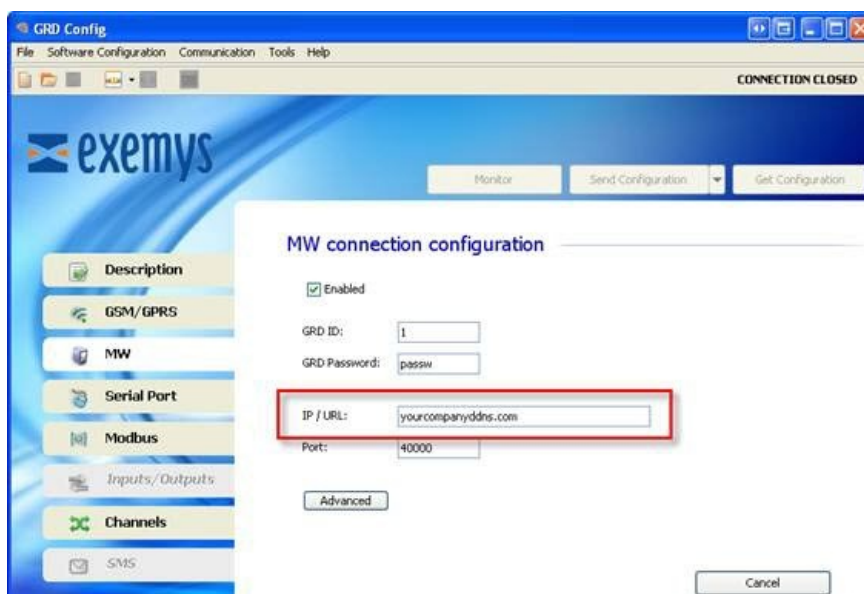
To have a permanent solution to this issue you can use any Dynamic DNS provider (DDNS). Here's a list with some of them:

www.Dyndns.com
www.No-ip.com
www.zoneedit.com/dynamicDNS.html

Once you link your public IP address with a URL using one of these DDNS providers, the GRD/cLAN will re establish the link to the MW in a few minutes every time the public IP address changes. You must then configure the URL instead of the public IP address on the GRD/cLAN.

2015-08-06