DEVICES OF GSM/SMS REMOTE COMMUNICATION

GTS Family

exemys

ISO 9001:2000 Certification

Exemys products are in permanent evolution to satisfy the needs customers' needs. For this reason, specifications and capabilities are subject to change without notice.

Please find updated information at www.exemys.com

Rev. 2.3.0 – Dic 2011

1 Table of Contents

Chapter 1

Introduction

1.1 About this manual

1.1.1 Purpose of this manual

The purpose of this manual is to provide the instructions to quickly and simply install and operate the GTS.

The manual begins with a general description of the product followed by the instructions for the correct installation of the hardware. Configuration and operation of the device are detailed later.

1.1.2 Conventions, terms and abbreviations

Convention	Description
{...}	Indicates a mandatory parameter
[...]	Indicates a parameter that can be used or not according to the case
<...>	Indicates that it is a hexadecimal value

Abbreviation	Description
GSM	Global System for Mobile Communications
SMS	Short Message System
PIN	Personal Identification Number
SIM	Subscriber Identify Module
ASCII	American Standard Code for Information Interchange

General Description of the Product

GTS is a wireless communication device via SMS. It has a serial communications port, analog and digital inputs and digital outputs according to the model.

By means of the GTS, it is possible to send and receive messages through the serial port, to act on the outputs, to know the status of inputs and other functionalities that are covered in this manual.

Models

The current existing models are detailed and the characteristics of each one are explained.

1.1.1 GTS2001

GTS2001 has a serial communications port, 16 digital inputs and 14 digital outputs.

The distribution of input and output terminals is shown below:

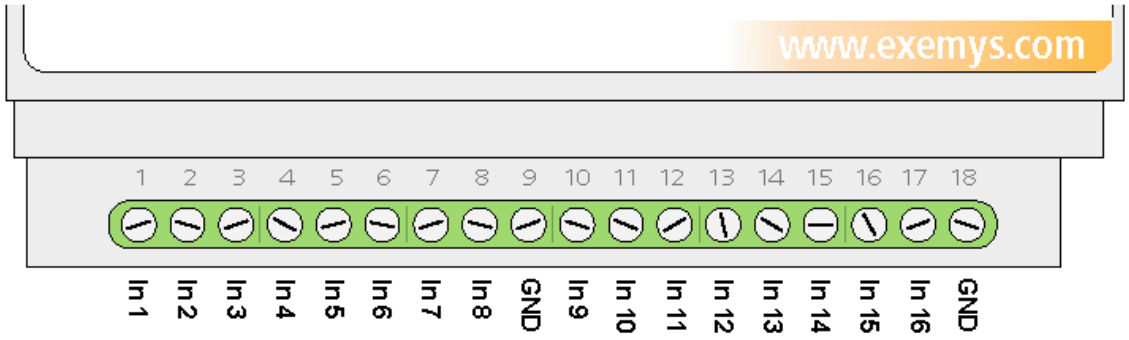


Figure 1 – Terminals 1 to 18

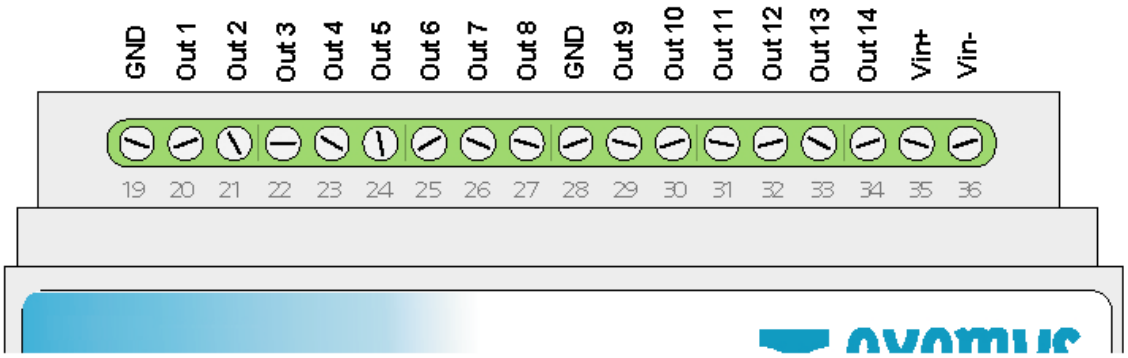


Figure 2 – Terminals 19 to 36

1.1.2 GTS3002

The GTS3002 has a serial communications port, 16 digital inputs, 6 analog inputs of 0 to 10 volts and 6 digital outputs.

The distribution of input and output terminals is shown below:

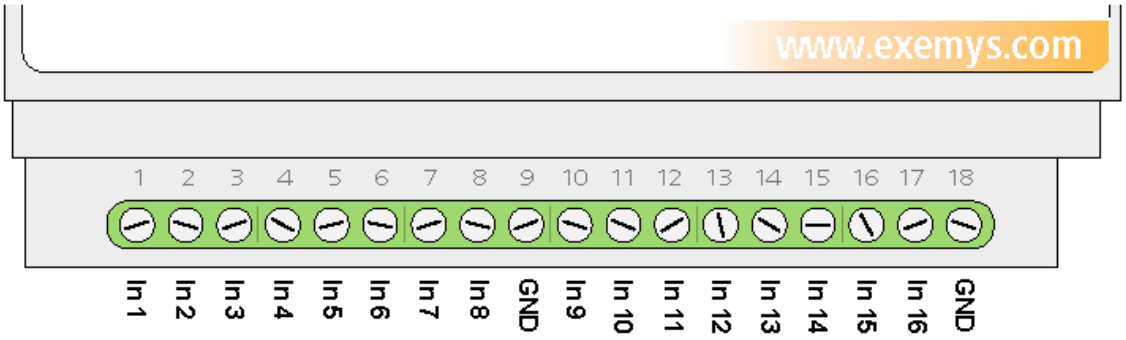


Figure 3 – Terminals 1 to 18

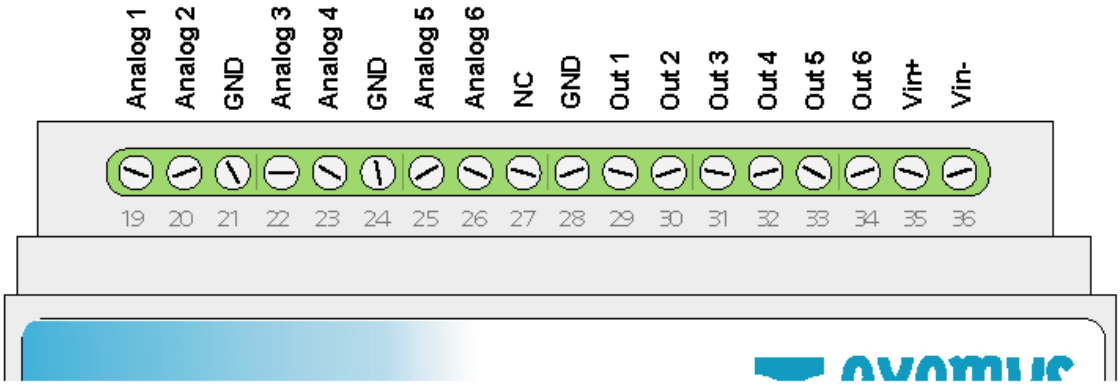


Figure 4 – Terminals 19 to 36

1.1.3 GTS3003

The GTS3003 has a serial communications port, 16 digital inputs, 6 analog inputs of a current of 0 to 20 mA and 6 digital outputs.

The distribution of input and output terminals is shown below:

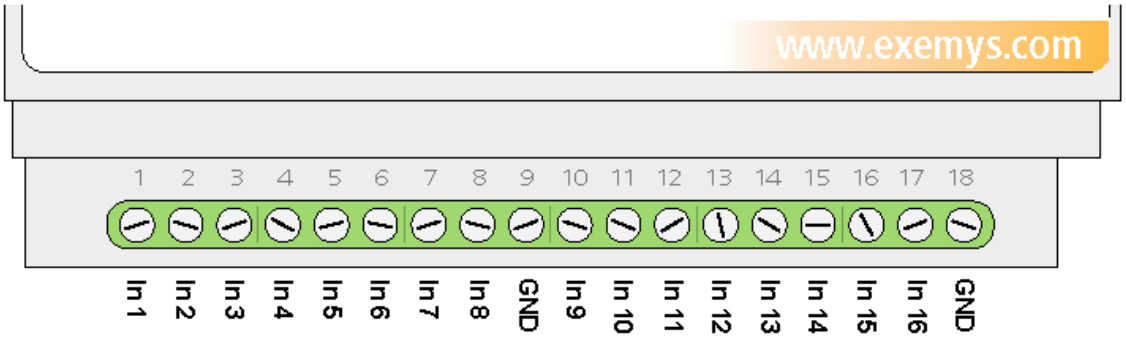


Figure 5 – Terminals 1 to 18

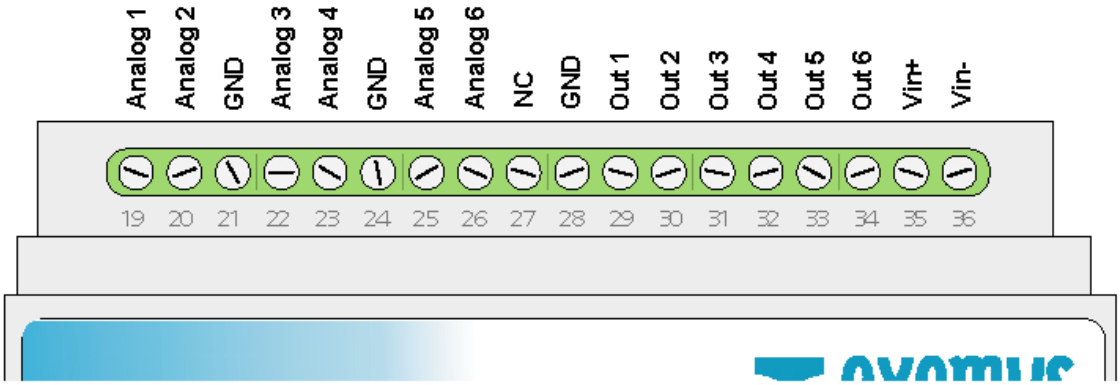


Figure 6 – Terminals 19 to 36

Technical Characteristics

The minimum and maximum possible values in inputs as well as current and voltage outputs, and consumption of GTS are detailed below:

1.1.4 Power Supply

Parameter	Condition	Minimum	Maximum	Units
Input voltage		10	30	Vdc
Consumption idle	GTS to 30 Vdc		40	mA
	GTS to 10 Vdc		100	
Consumption in transmission	GTS to 30 Vdc		300	mA
	GTS to 10 Vdc		800	

1.1.5 Digital inputs

In order to activate digital inputs an external continuous voltage must be applied. This power supply has to share the GND terminal with the GTS power supply. If necessary, the same power supply used to power the GTS can be used.

The input is of a sinking type. It accepts PNP sourcing type sensors or devices.

Parameter	Minimum	Maximum	Units
Activated input	3.5	28	Vdc
Input impedance	2		KΩ

Two examples of how to connect directly from the same power source of the GTS as well as an external power supply where it can be seen that they must share a common terminal are shown.

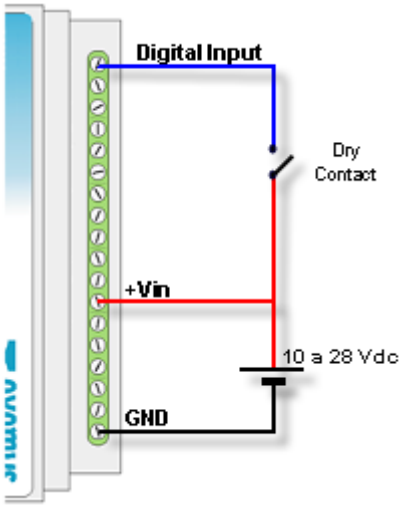


Figure 7 - Digital input with single power supply

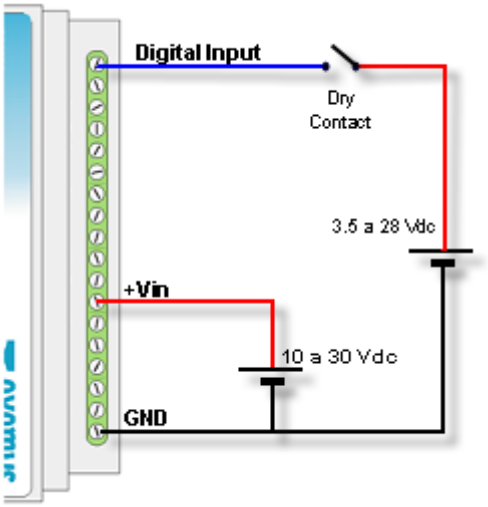


Figure 8 - Digital input with double power supply

1.1.6 Digital Outputs

The digital outputs are open collector type. The connected load must be supplied with and external power supply and they have to share the same GND terminal with the GTS power supply. Use the same power supply to power the device if necessary. The output is NPN sourcing type (Open Collector)

Parameter	Minimum	Maximum	Units
Maximum voltage		45	Vdc
Maximun current		50	mA

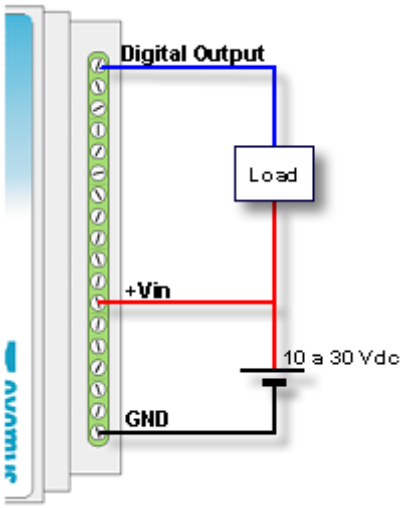


Figure 9 – Digital output with single power supply

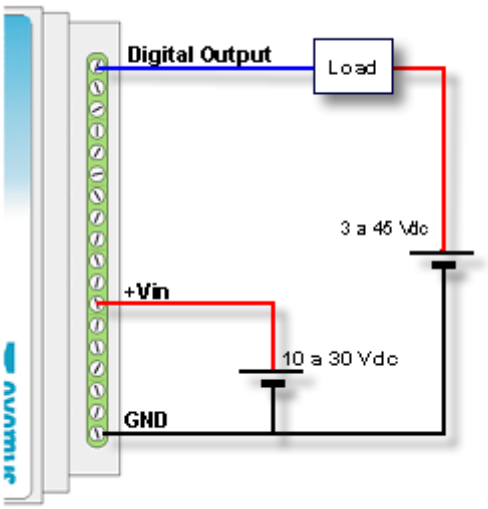


Figure 10 – Digital output with double power supply

1.1.7 Analog Inputs

The analog inputs referenced to the GND terminal of the GTS, so the power supply to power the sensor must share the GND terminal with the GTS.

1.1.7.1 GTS3002

Parameter	Value	Units
Full scale	10.00	Vdc
Precision	0.01	Vdc
Tolerance	±0.2	% of full scale
Input impedance	>10	KΩ

Two examples of how to connect a voltage analog input for a single power supply and for independent power supplies are shown below.

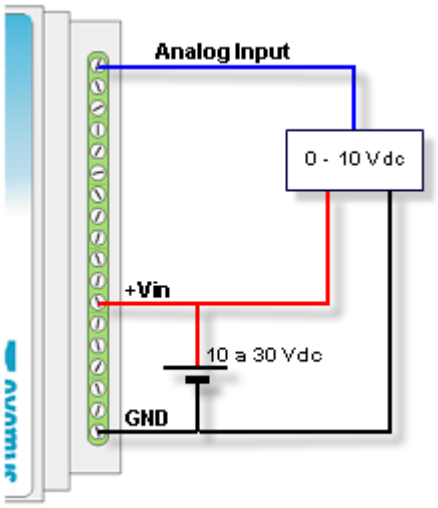


Figure 11 – Analog for a single power supply

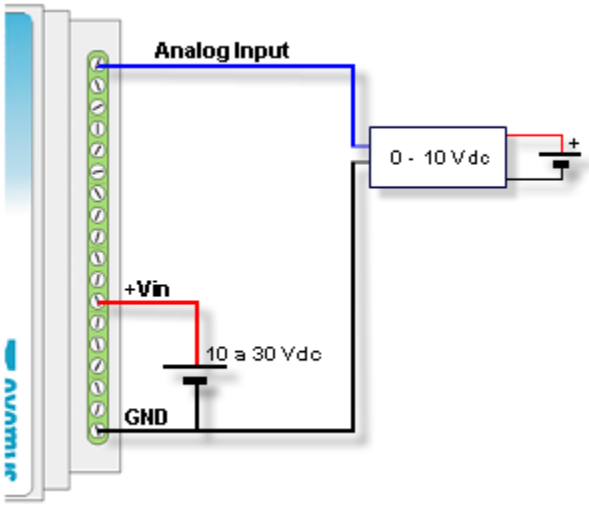


Figure 12 – Analog for a double power supply

1.1.7.2 GTS3003

Parameter	Value	Units
Full scale	20.00	mA
Precision	0.01	mA
Tolerance	±0.4	% of full scale
Shunt resistance	120	Ω

Two examples where you can see the connection of a 4 – 20 mA sensor sharing the power supply with the GTS for passive sensors or for an active sensors with independent power supply are shown below.

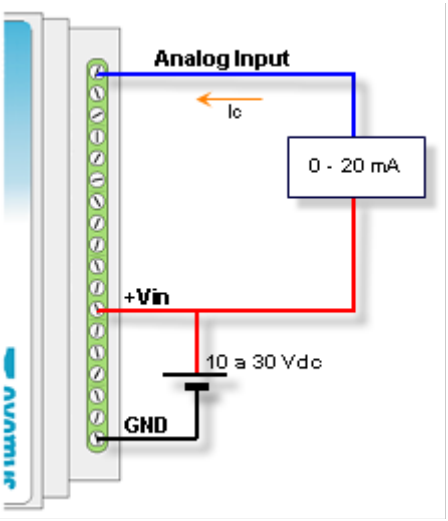


Figure 13 – Analog Input for a passive sensor

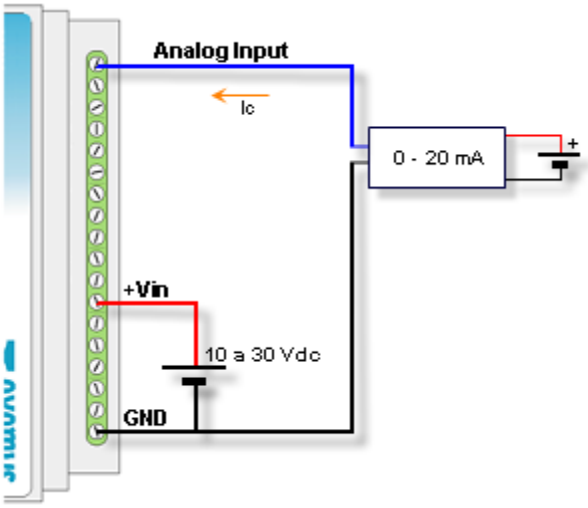


Figure 14 – Analog Input for an active sensor

Chapter 2

2 Installation

Power supply connection

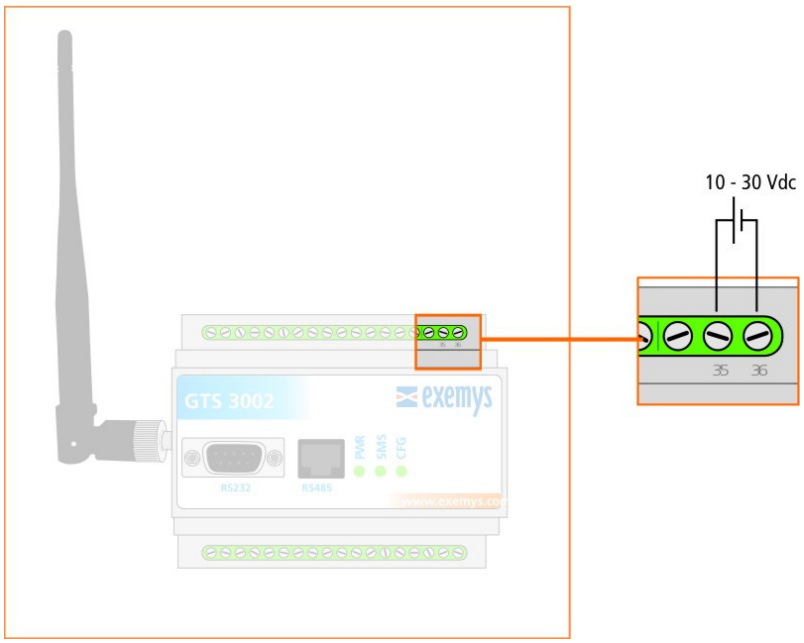


Figure 15 – Power supply terminals

Serial connection

2.1.1 RS232 Connection

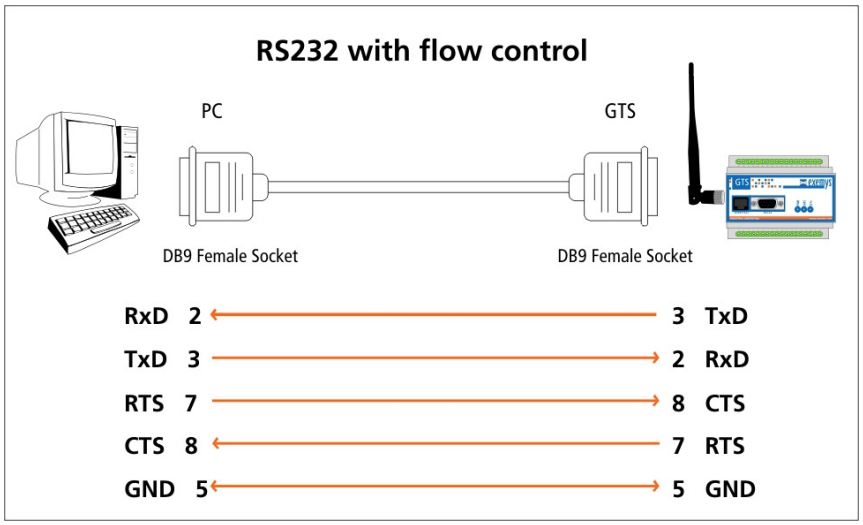


Figure 16 – RS232 cable pinout

2.1.2 RS485 and RS422 Connections

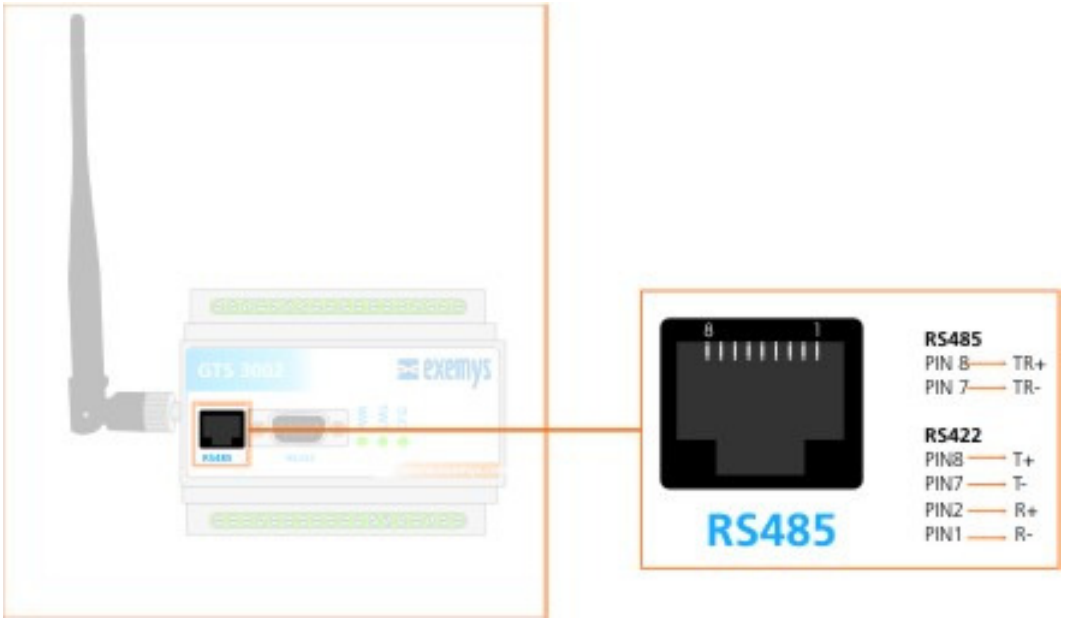


Figure 17 –RS485 and RS422 pinout

Installation of the SIM card

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

- The installed card must have a subscription or contract providing the GSM services
- Verify that the telephone number assigned to the SIM card is known.
- If the PIN (security code) of the SIM card is activated you must know it and enter into the GTS when requested.

Configuring the PIN of the SIM Card

If you place a SIM card with the PIN activated, the GTS will indicate the fault by a fast flashing of the 3 LEDs in a synchronized manner. In this case the PIN must be entered through the GTS Configurator Sotware. For more information see SIM card

If the entered PIN is not correct the device will not allow sending or receiving SMS. In case the PIN is correct the GTS will store the entered code and the will continue with the normal operation.

Important: remember that if you enter 3 times the incorrect PIN number, the SIM card will block. To unblock it you will have to enter the card's PUK. For more information please contact **support@exemys.com**

Once the PIN is entered, you will not need to enter it again unless you change the SIM card.

Important: When you place or remove the SIM card verify that the device is not energized; otherwise the SIM card could be irreversibly damaged.

LED indicators

The GTS has 3 LED indicators: **Power**, **SMS** and **Configuration**

The **Power** LED indicates the device is energized.

The **SMS** LED indicates the device managed to access the SIM, that has an acceptable signal level and that is ready to operate; this LED also indicates with a single flash the reception and sending of an SMS.

The **Configuration** LED indicates when the device is being accessed through the serial port by the GTS Configurator Software for its monitoring and configuration.

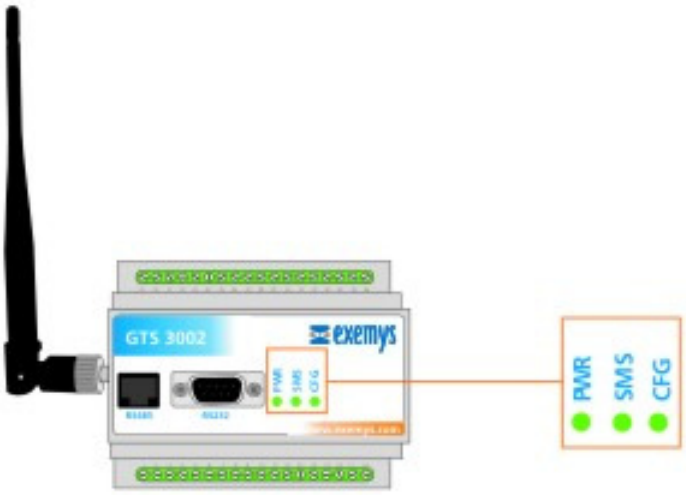


Figure 18 – LED in the front panel

Power LED	SMS LED	Configuration LED	Description
Fast flashing			The GTS is turning on the internal modem
	Constantly on		The GTS is subscribed to the GSM network and is ready to operate
	A single flash		Sending and receiving of SMS
		Turns on ½ second and turns off ½ second	GTS Configurator connected
Fast flashing in a synchronized manner with the other two LEDs	Fast flashing in a synchronized manner with the other two LEDs	Fast flashing in a synchronized manner with the other two LEDs	The GTS could not detect the presence of the SIM card or the corresponding PIN is not configured.
Alternate flashing with the SMS LED	Alternate flashing with the Power and Configuration LEDs	Alternate flashing with the SMS LED	The level of the detected signal is not sufficient for a correct operation. Verify if the antenna is correctly placed.

Chapter 3

3 GTS Configurator Software

Installation and Utilization

The GTS Configurator is the software provided with the product used to configure the GTS.

This application was developed with the easy-to-use philosophy and allows the configuration and monitoring of the GTS device. The GTS Configurator can be installed on the following platforms: Windows 98 SE/ME, Windows 2000/NT4, Windows XP and Windows Vista.

3.1.1 Installation

To install the GTS Configurator follow these steps:

- To begin the installation of the program insert the GTS CD and execute setup.exe.
- A welcome screen will appear in the monitor, follow the installation instruction that will request the necessary information to complete the installation. Click on "Next" to continue.
- Destination folder: Select the folder where the application program will be installed.
- Wait for the installation program to finish copying all the necessary files to your hard disk, and press "Finish" to end the installation process.

Once installed, you will be able to see in its menu, Programs a folder called Exemys, which contains the links to software provided by the company. In this folder you will find another folder called ***GTS Configurator,*** this contains the links ***GTS Configurator*** and ***Uninstall GTS Configurator.***

3.1.2 General Description

The following figure shows the GTS Configurator main screen, with its different sections.

It has a menu, a tool bar which is a quick access to the menu and in the lower part a status bar presenting contextual help, the connection status of the GTS configurator and the selected COM port.

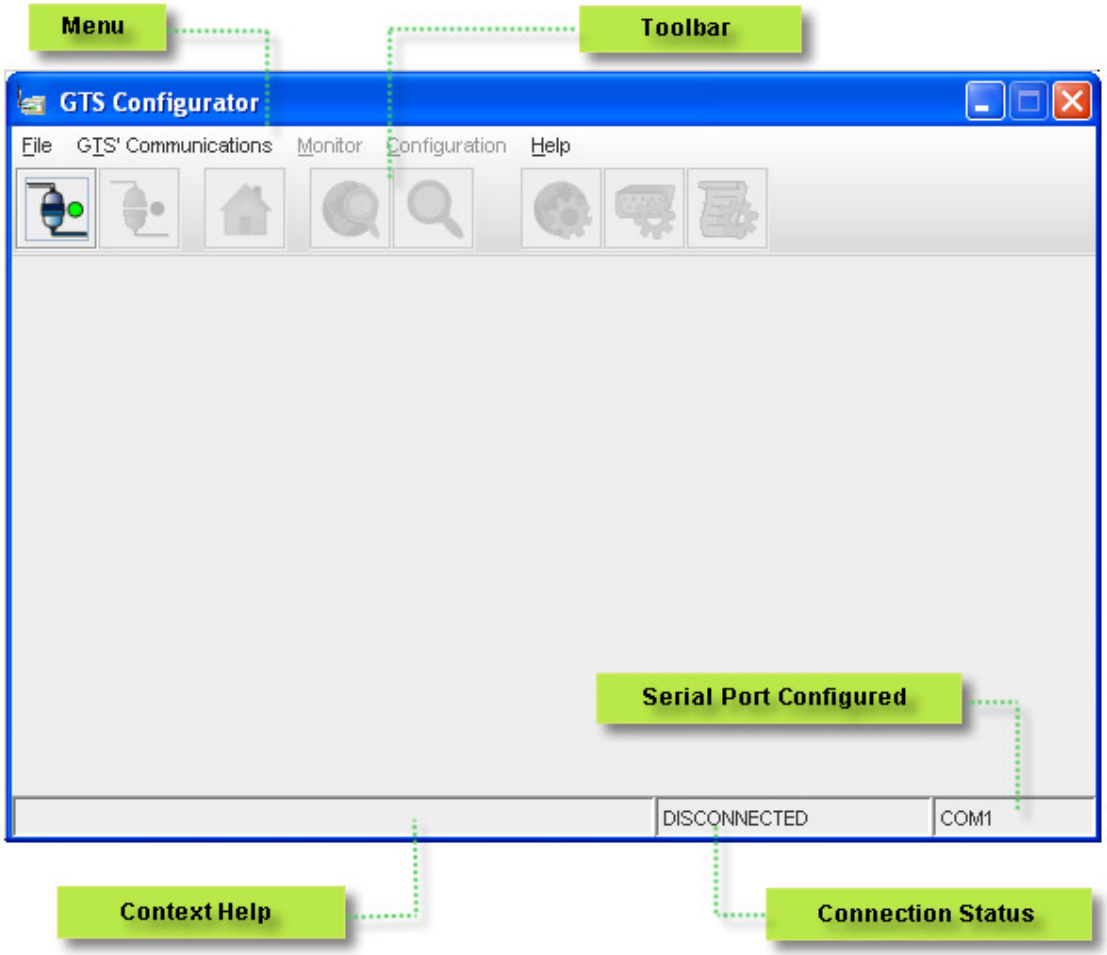


Figure 19 – Main screen of the GTS Configurator

3.1.3 Configuration of the connection with the GTS

Before being able to establish the communication, it is necessary to configure the program so it uses the correct serial port. Select in the menu ***GTS' Communications -> Serial Port***

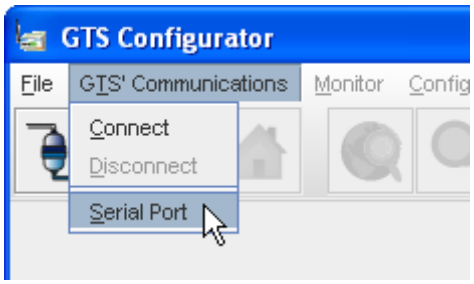


Figure 20 – COM Configuration

And then indicate the serial port where the GTS will be connected.

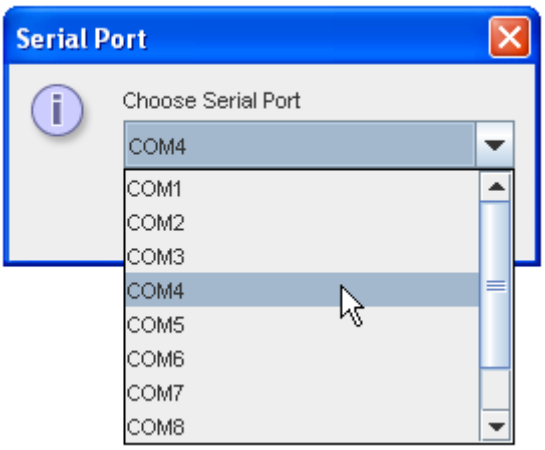


Figure 21 – COM selection

3.1.4 Establishing the Communication with the GTS

To establish communication with the GTS, first connect the serial cable with the RS232 port.

It is necessary for the cable to have the connection for the flow control pins (see Installation – serial connection).

To establish the connection select in the menu the ***GTS communication -> Connect*** option or press the button. When the communication is correctly established, you will be able to observe on the screen information about the device.

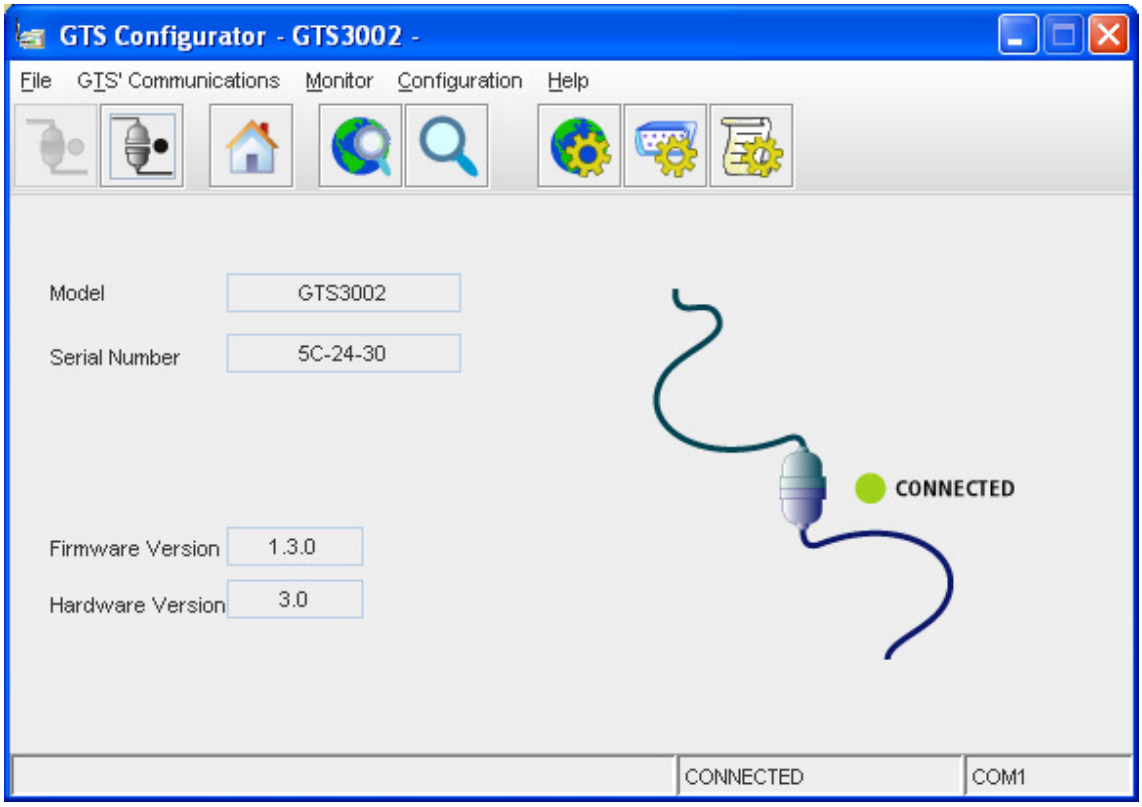


Figure 22 – Main screen

3.1.5 Organization

The GTS Configurator is divided into two main fundamental components, on one side we find the monitoring tools that will let you visualize the GTS operation and status. On the other side we have the configuration tools that permit to select and determine the device operation.

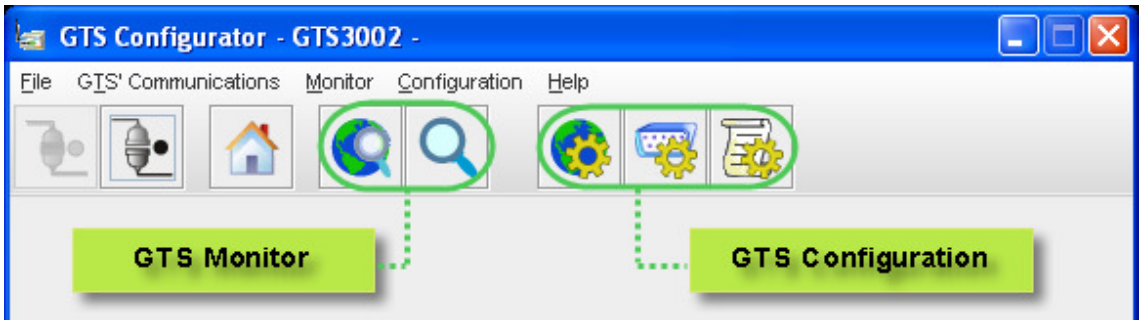


Figure 23 – Organization of the GTS Configurator

If the GTS Configurator finds an unknown model it will not enable the configuration and monitoring buttons. In this case contact soporte@exemys.com to obtain the updated software version.

Monitoring

3.1.6 SMS Monitoring

To enter the SMS Monitoring screen you must access the menu with the following path ***Monitor -> SMS*** or by pressing the SMS monitor button 

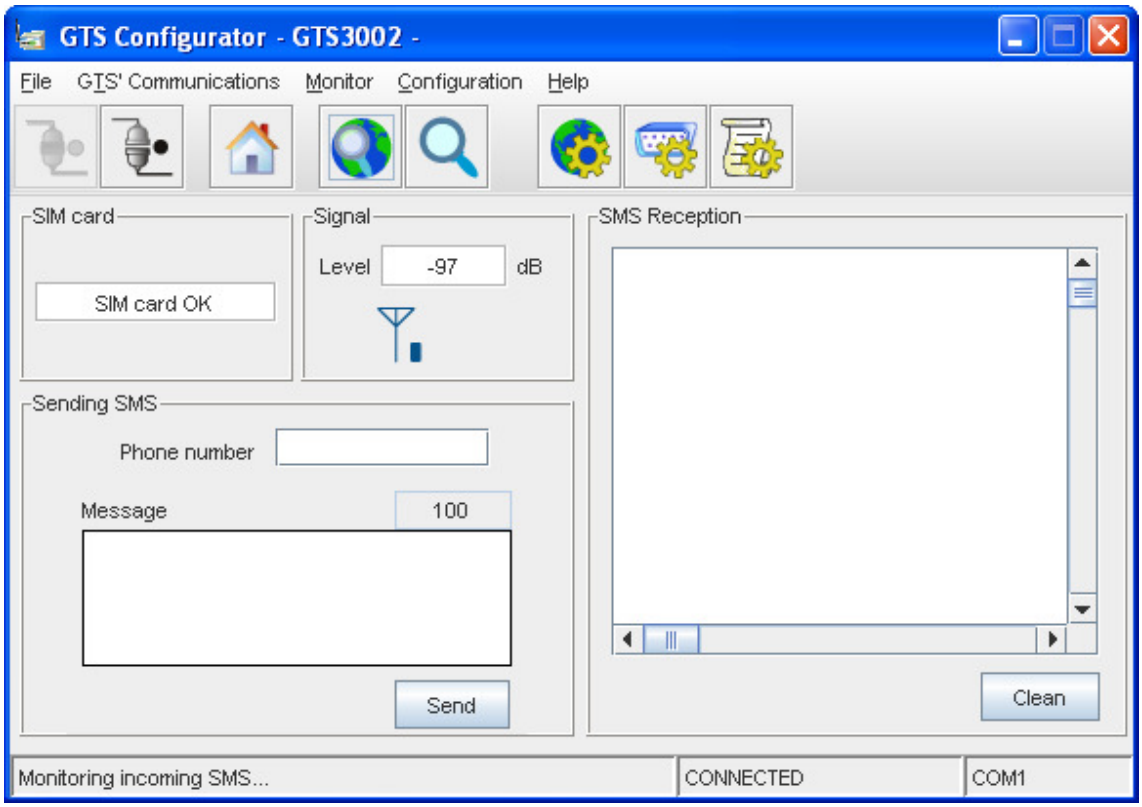


Figure 24 – SMS monitor screen

3.1.6.1 SIM Card

The GTS tell us the status of the SIM card, it can contain four possible states.

- SIM Card OK: The SIM works perfectly
- Inaccessible SIM: The SIM is not correctly placed or it is damaged.
- Enter PIN: The SIM has a PIN number that must be entered. For more information see SIM Card
- Blocked SIM (PUK): The SIM is blocked by PUK, enter the PUK number placing the SIM in the cell phone.

3.1.6.2 Signal

The GTS indicates the quality of the signal at this moment, and it is shown in dB and the device will have to count on a minimum signal to work correctly. The range of values can vary from -113dB (no signal) to -51dB (maximum signal).

3.1.6.3 Sending SMS

It is possible to send messages to any destination and with a maximum length of 100 characters by means of the GTS Configurator. You only have to place the telephone number, the message and then press Send.

3.1.6.4 SMS Reception

In the SMS monitoring screen the GTS reports all received messages and the telephone number of the sender. Please take into account that if switch screens while receiving messages, they will be erased.

3.1.7 Monitoring Inputs and Outputs

To enter the Input and Outputs monitoring screen you have to access the menu of ***Monitor -> Inputs/Outputs*** or press the Monitor IO's button. 

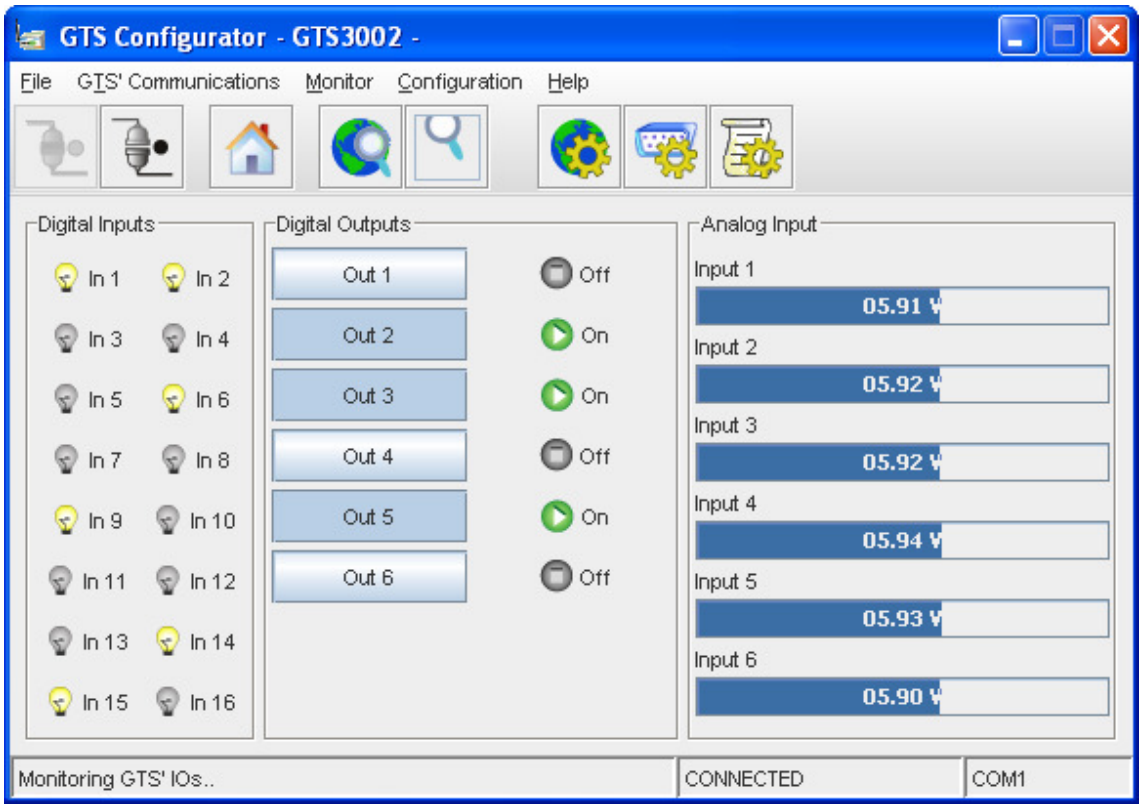


Figure 25 – Inputs and Outputs monitoring screen

3.1.7.1 Digital Inputs

The GTS informs in real time the value of the digital inputs. Take into consideration that the number of inputs can differ according to the GTS model.

3.1.7.2 Digital Outputs

The GTS informs in real time the value of the digital outputs. It's also possible to act on them. Take into consideration that the number of outputs can vary according to the GTS model.

3.1.7.3 Analog inputs

The GTS continuously informs the value of analog inputs. Take into consideration that some models do not have analog inputs and according to the model they can be voltage inputs or current inputs.

Configuration

3.1.8 Basic Configuration

To enter the basic Configuration screen you must access the menu in ***Configuration -> Basic*** or by pressing the basic configuration button. 

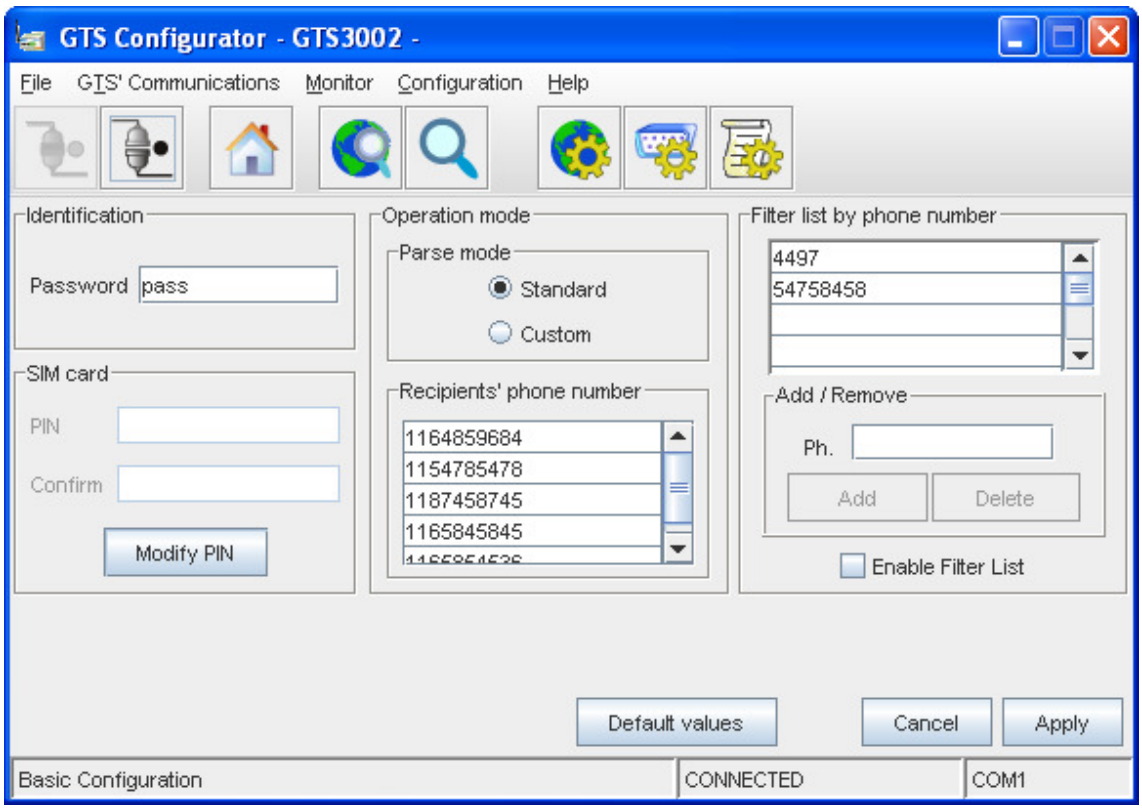


Figure 26 – Basic configuration screen

Every time a change is made in the configuration you must press the "Apply" button to transfer it to the GTS.

The changes are permanently stored when the communication ends with the GTS Configurator. If a power outage takes place before this happens, the changes made will be lost.

3.1.8.1 Identification

It is possible to put a password in the SMS to increase the security level. It is possible to enter text of up to eight characters. If the password is left empty it is considered as disabled.

When the password is enabled it must be included in the SMS at the end of the message.

3.1.8.2 SIM card

If the SIM is protected by a PIN, the same must be informed to the GTS, this is done by pressing the "Modify PIN" button which enables entering the PIN and its confirmation. Once both fields are entered you must press the "Apply" button so changes are applied and the SIM card is enabled.

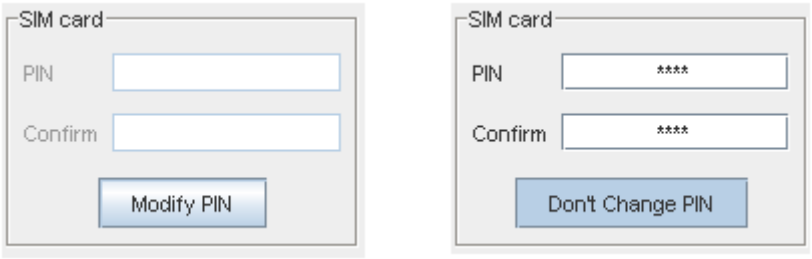


Figure 27 – Entering the PIN

3.1.8.3 Parse mode

There are two modes of parsing the SMS' received by the GTS, which can be Standard or Custom. For more information see chapter 5 – Modes of operation of the GTS.

3.1.8.4 Recipients' phone number

The recipients' phone number are the telephone numbers that will receive all the messages sent by the GTS, either messages of the serial port, change events or alarm reports.

3.1.8.5 Filter List by phone number

The GTS will allow you to define up to 15 telephone numbers that will be accepted, this means that those telephones that send messages and do not belong to this list will be ignored. Only those that are in the list can act on the GTS.

To enable the filter you must mark the "Enable Filter List" check box.

If you do not want to enter the whole telephone number you can only enter the last digits, so GTS only compares against the last digits of the telephone number, for example: if the number 12345 is entered in the filter list, those numbers ending in 12345 will be able to access the GTS. If you want to be less restrictive enter 345 and all those ending with these three numbers will be able to access.

3.1.8.6 Default values

The Default Values button places in the corresponding boxes the values that have been previously loaded. This way we avoid having to enter these three values each time.

To load default values we must enter the menu ***File -> Edit Default Values.***

The following screen lets you place values that will be permanently stored by the GTS Configurator and every time the Default Values button is pressed the indicated values will be automatically inserted.

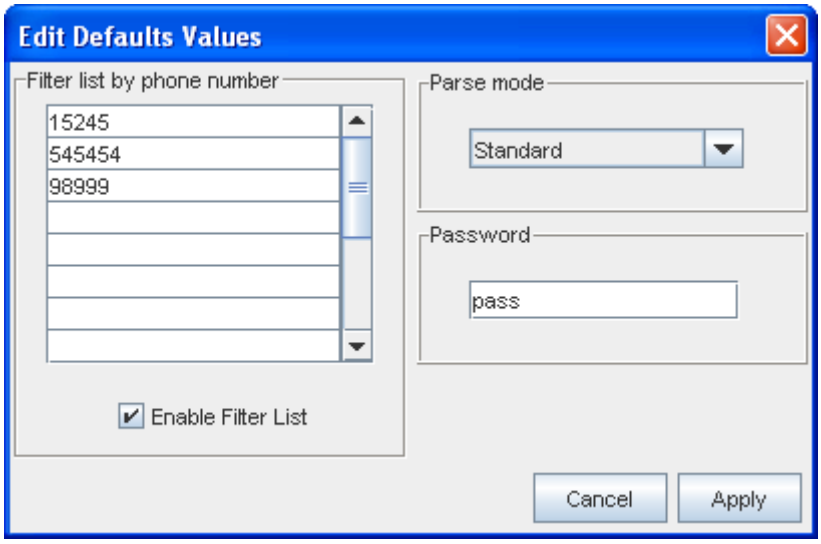


Figure 28 – Default values edit screen

3.1.9 Serial Port Configuration

To enter the serial port configuration screen you must access from the menu to ***Configuration -> Serial Port*** or by pressing the Serial Port Configuration button of the GTS 

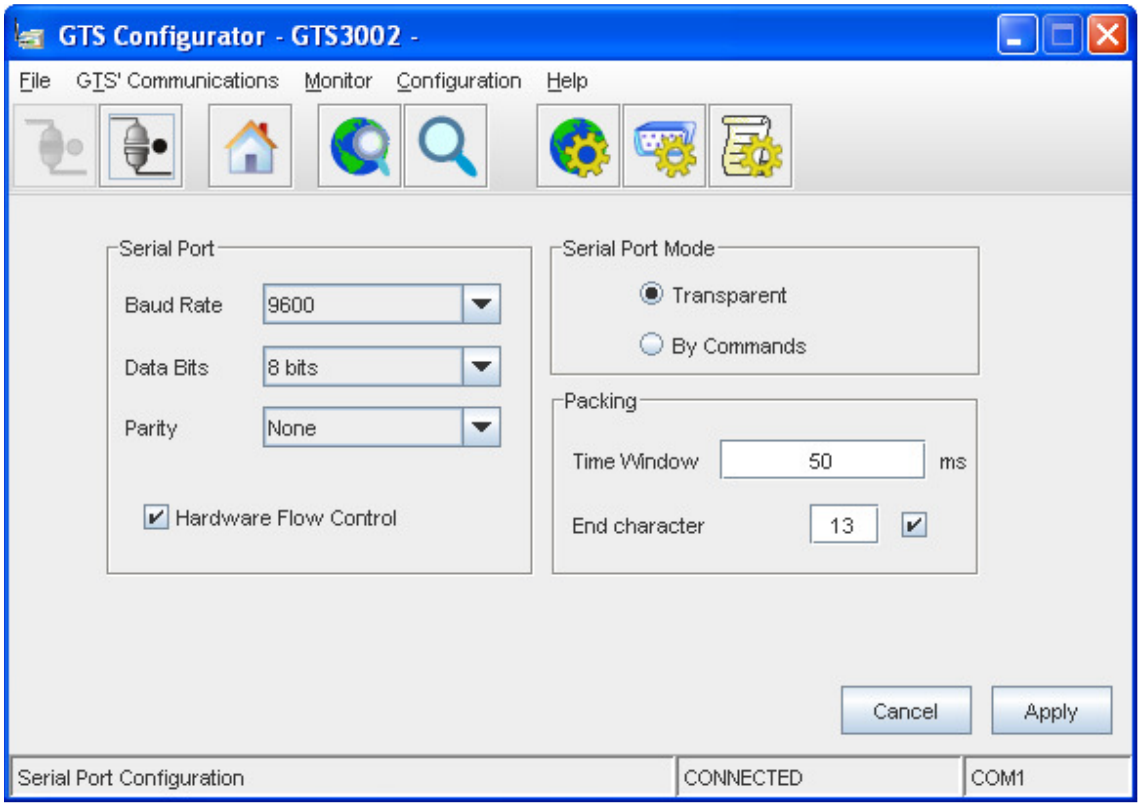


Figure 29 – Serial Port configuration screen

3.1.9.1 Serial Port

The GTS has a serial communications port that has different configurations, among them we find Baud Rate, Data Bits, Parity and flow control.

3.1.9.2 Packing

The GTS will attempt to gather several data before sending a packet through the network; this way it takes maximum advantage of each message and the communication costs are reduced. The criteria implemented for the end of the packet are the following:

- Time window (0…1000ms): once data are received, the GTS will await in silence this time before sending the SMS. To disable this criterion the time window must be configured in 0 ms.
- End character (0…255): Indicates the last character of a serial stream before sending the SMS.

Important: if the end character criterion is enabled and the time window is disabled the GTS will store the received data for an indefinite time until it receives the configured character or until GTS' storage capacity reaches its limit.

If both criteria are used the first condition to be fulfilled will cause the sending of the SMS.

3.1.9.3 Serial Port mode

There are two modes for the Serial Port: Transparent and By Commands, for more information see in chapter 5 – Operational modes of the Serial port -.You must take into account that in the By command mode, the end character and the Window Time make no sense and are disabled.

3.1.10 Configuration of Inputs and Outputs

To enter the Configuration screen for Inputs and Outputs you can access from the menu through ***Configuration -> Inputs/Outputs*** *or* by pressing the IOs' Configuration button. 

In the configuration screen of Input and Outputs you can find two or three tabs corresponding to "Digital inputs", "Digital outputs" and "Analog inputs" as you can see in the following figure.

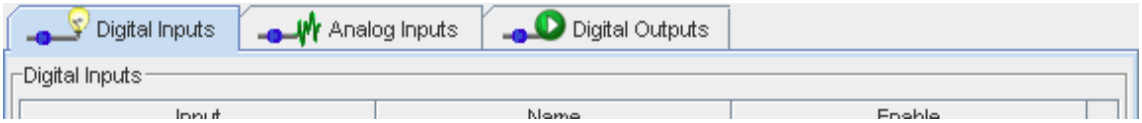


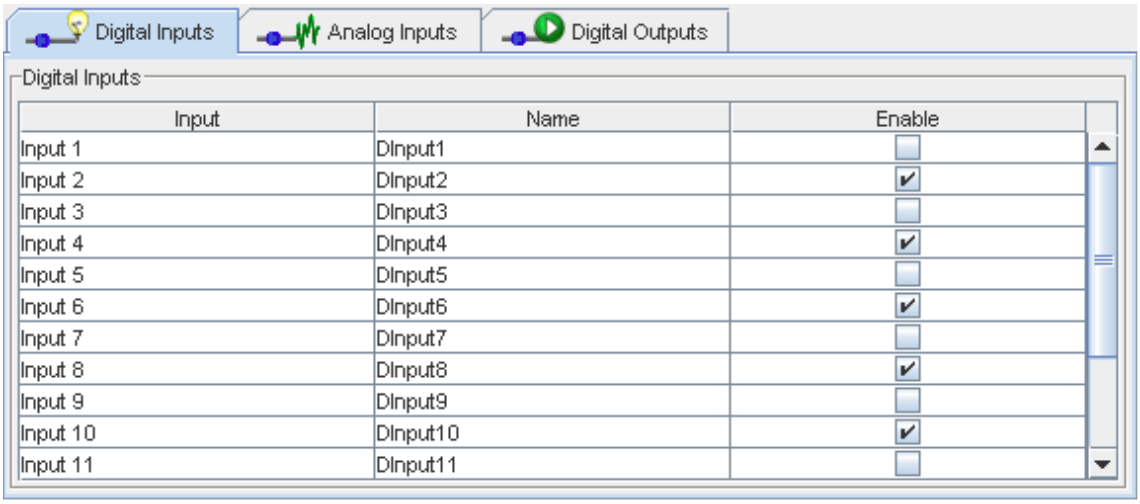
Figure 30 – Configuration tabs of IOs

Take into consideration that not all GTS models have Analog Inputs. In this case, the Analog Inputs tab will not be visualized.

There are two different configurations for Inputs and Outputs. One configuration in Standard Mode and the other one in Custom mode.

3.1.10.1 Configuration of Inputs and Outputs in standard mode

3.1.10.1.1 Digital Inputs



Input	Name	Enable
Input 1	DInput1	☐
Input 2	DInput2	☑
Input 3	DInput3	☐
Input 4	DInput4	☑
Input 5	DInput5	☐
Input 6	DInput6	☑
Input 7	DInput7	☐
Input 8	DInput8	☑
Input 9	DInput9	☐
Input 10	DInput10	☑
Input 11	DInput11	☐

Figure 31 – Configurations of digital inputs in standard mode

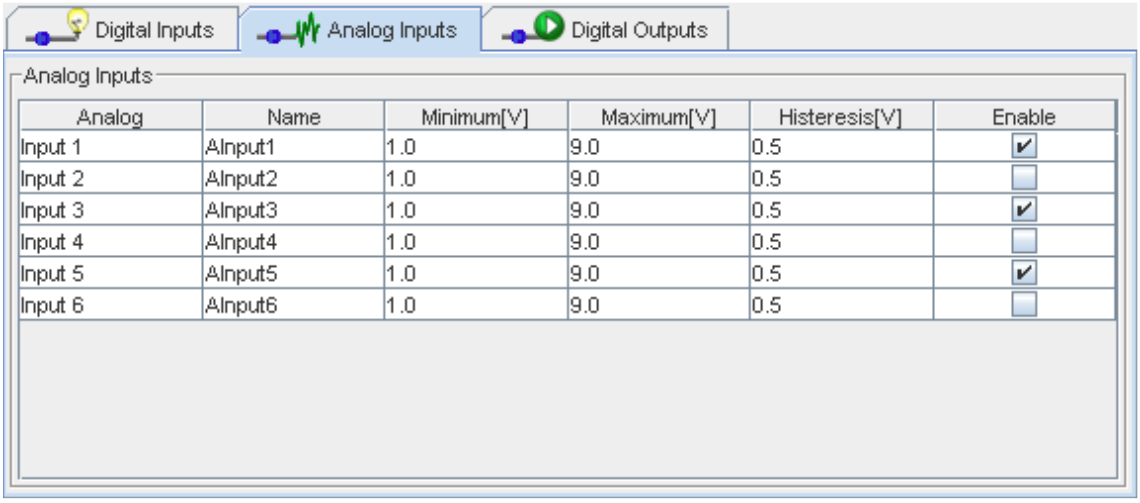
In the table of digital inputs three fields are shown:

Input: Indicates the Input number and is not editable.

Name: Name assigned to the corresponding input. Is the name that will be visualized when a change in the input is reported.

Enable: Allows enabling the input that we want to use to avoid false triggers.

3.1.10.1.2 Analog Inputs



Analog	Name	Minimum[V]	Maximum[V]	Histeresis[V]	Enable
Input 1	AInput1	1.0	9.0	0.5	☑
Input 2	AInput2	1.0	9.0	0.5	☐
Input 3	AInput3	1.0	9.0	0.5	☑
Input 4	AInput4	1.0	9.0	0.5	☐
Input 5	AInput5	1.0	9.0	0.5	☑
Input 6	AInput6	1.0	9.0	0.5	☐

Figure 32 – Configuration of analog inputs in standard mode

Six fields are shown in the table of Analog Inputs:

Analog: Indicates the number of analog input and is not editable.

Name: Name assigned to the corresponding input. Is the name that will be visualized when a change in the input is reported.

Minimum: Lower threshold limit for the trigger of the minimum message.

Maximum: Upper threshold limit for the trigger of the maximum message.

Hysteresis: Margin to avoid false triggers. For more information see Appendix D – Operation of Hysteresis -

Enable: Allows enabling the input that we want to use to avoid false triggers.

3.1.10.1.3 Digital Outputs

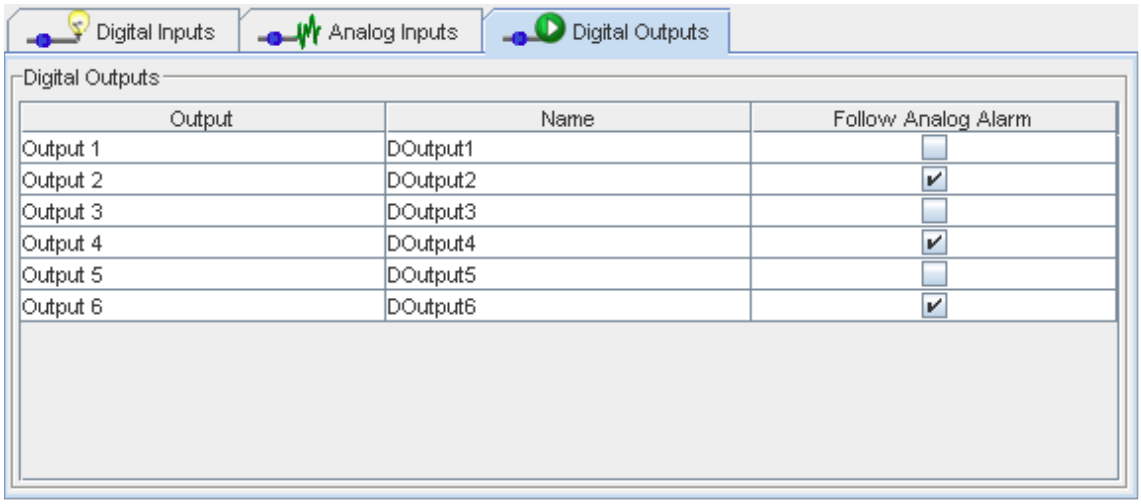


Figure 33 – Configuration of the digital outputs in standard mode

Three fields are shown in the table of digital outputs:

Outputs: Indicates the number of the output and is not editable.

Name: Name assigned to the corresponding output. Is the name to which reference can be made to control the status of such output.

Follow analog alarm: Allows activation of the output so it can follow the status of analog inputs of another GTS. For more information see chapter 6 – Practical Applications -.

3.1.10.2 Configuration of Inputs and Outputs in custom Mode

3.1.10.2.1 Digital Inputs

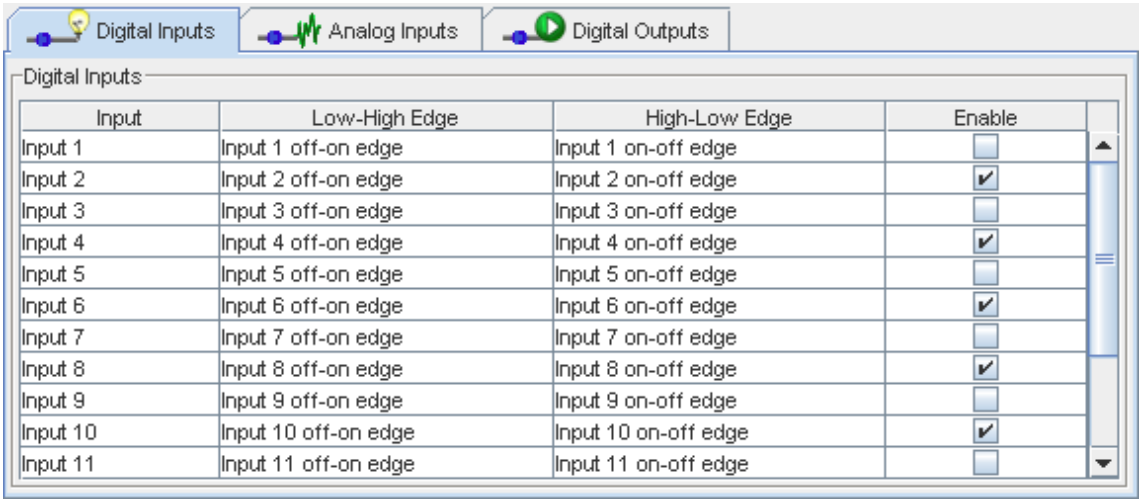


Figure 34 – Configuration of digital inputs in custom mode

Four fields are shown in the table of digital inputs:

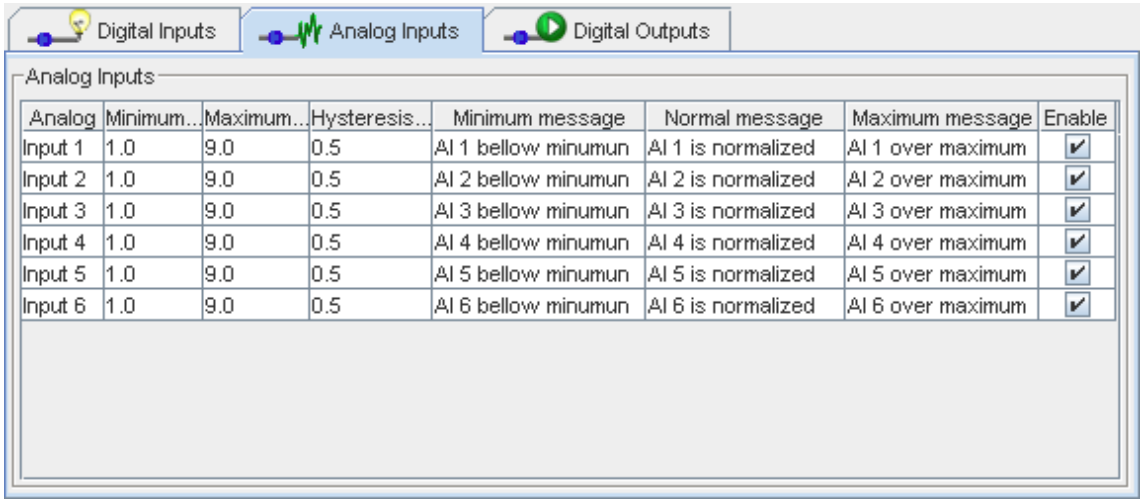
Input: Indicates the number of the input and is not editable.

Low-High Edge: Text that will be sent when input is activated.

High-Low Edge: Text that will be sent when input is deactivated.

Enable: Allows enabling the input that we want to use to avoid false triggers.

3.1.10.2.2 Analog inputs



Analog	Minimum...	Maximum...	Hysteresis...	Minimum message	Normal message	Maximum message	Enable
Input 1	1.0	9.0	0.5	AI 1 bellow minumun	AI 1 is normalized	AI 1 over maximum	✔
Input 2	1.0	9.0	0.5	AI 2 bellow minumun	AI 2 is normalized	AI 2 over maximum	✔
Input 3	1.0	9.0	0.5	AI 3 bellow minumun	AI 3 is normalized	AI 3 over maximum	✔
Input 4	1.0	9.0	0.5	AI 4 bellow minumun	AI 4 is normalized	AI 4 over maximum	✔
Input 5	1.0	9.0	0.5	AI 5 bellow minumun	AI 5 is normalized	AI 5 over maximum	✔
Input 6	1.0	9.0	0.5	AI 6 bellow minumun	AI 6 is normalized	AI 6 over maximum	✔

Figure 35 – Configuration of analog inputs in custom mode

Eight fields are shown in the table of Analog Inputs:

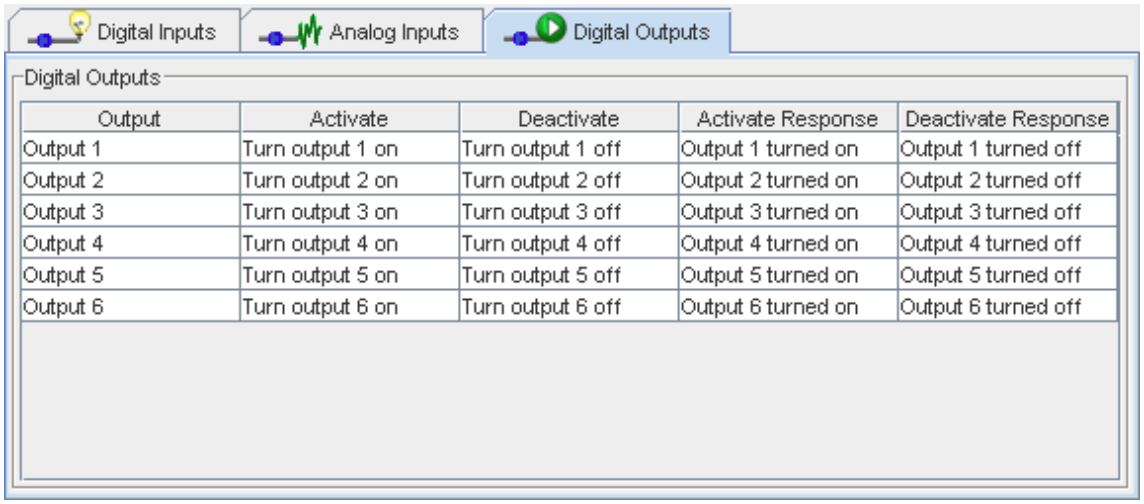
Analog: Indicates the number of the analog input and is not modifiable.
Minimum: Lower threshold limit for the triggering of the minimum message.
Maximum: Upper threshold limit for the triggering of the maximum message.
Hysteresis: margin to avoid false triggers.
Minimum message: Message that will be sent when the analog input changes from a normal state to minimum state.

Normal message: Message that will be sent when the analog input changes from a state of minimum or maximum to a normal state.

Maximum message: Message that will be sent when the analog input changes from a normal state to a maximum state.

Enable: Allows enabling the input that we want to use to avoid false triggers.

3.1.10.2.3 Digital Outputs



Output	Activate	Deactivate	Activate Response	Deactivate Response
Output 1	Turn output 1 on	Turn output 1 off	Output 1 turned on	Output 1 turned off
Output 2	Turn output 2 on	Turn output 2 off	Output 2 turned on	Output 2 turned off
Output 3	Turn output 3 on	Turn output 3 off	Output 3 turned on	Output 3 turned off
Output 4	Turn output 4 on	Turn output 4 off	Output 4 turned on	Output 4 turned off
Output 5	Turn output 5 on	Turn output 5 off	Output 5 turned on	Output 5 turned off
Output 6	Turn output 6 on	Turn output 6 off	Output 6 turned on	Output 6 turned off

Figure 36 – Configuration of digital outputs in custom mode
Three fields are shown in the table of digital outputs:
Output: Indicates the number of digital outputs and is not editable.
Activate: Message configured to activate the corresponding output.
Deactivate: Message configured to deactivate the corresponding output.
Activate Response: Message returned once the activation action is executed.
Deactivate Response: Message returned once the deactivation action is executed.

Chapter 4

4 Configuration, Monitoring and Control by SMS

All special messages that the GTS can receive are shown in this chapter, through them it is possible to know the configuration, modify it, and also know the status of the inputs and outputs or act on them.

Take into consideration that between every parameter being sent there must be only one space. The messages send a confirmation that have been received and also if an error occurred in the format.

Some of the messages only work in the standard operation mode and not in the custom mode, this is indicated in each one.

4.1 Configuration Messages

BY means of SMS, it is possible to configure some of the characteristics of the GTS. In the current chapter the messages and the required format for each one of the configuration messages is described.

4.1.1 `CSERIAL` – Serial port configuration

Configures the parameters of the serial port. It works in both modes.

CSERIAL {Baudrate} {Data bits} {Parity} {Flow Control} [Pass]

Parameter	Description	Values
Baud rate	Speed of serial communication:	1200, 2400, 4800, 9600, 19200, 57600, 115200
Data bits **Parity**	Number of data bits Parity error detection	7, 8 E (Even), O (Odd), N (No parity)
Flow control	Enables or not the data flow control	E (Enable), D (Disable)
Pass	Password (optional)	Configured password

Ex.:

→ **CSERIAL** 9600 8 N E pass
← Port configured

4.1.2 `ADDRECIP` – Adds an SMS recipient

Adds a phone number where the SMS' will be sent. It works in both modes.

ADDRECIP {phone number} [Pass]

Parameters	Description	Values
Phone number	Phone number that will be	From 0 to 15 numeric characters

	added	
Pass	Password (optional)	Configured password

Ex.:

→ **ADDRECIP** 1165845968 pass
← Recipient added

4.1.3 `DELRECIP` – Deletes an SMS recipient

Deletes a phone number where the SMS' will be sent. It works in both modes.

DELRECIP {phone number} [Pass]

Parameters	Description	Values
Phone number	Phone number that will be deleted	From 0 to 15 numeric characters
Pass	Password (optional)	Configured password

Ex.:

→ **DELRECIP** 1165845968 pass
← Recipient deleted

4.1.4 `CPASS` – Password configuration

Configures the password that will be required for some messages. It works in both modes.

CPASS {New password} [Pass]

Parameters	Description	Values
New password	New password to be entered	From 0 to 8 numeric characters
Pass	Password (optional)	Configured password

Ex.:

→ **CPASS** newpass pass
← Password configured

If you want to erase the password you have leave two spaces between CPASS and the configured password.

4.1.5 `ADDSENDER` – Adds a phone number to the "Filter List By Phone Number"

Adds another phone number to the list of authorized telephone numbers. Remember that only 15 numbers are allowed. It works in both modes.

ADDSENDER {Telephone number} [Pass]

Parameters	Description	Values
Telephone number	Telephone number to be added to the list	From 1 to 10 numeric characters
Pass	Password (optional)	Configured password

Ex.:

→ **ADDSENDER** 25485 pass
← Sender Added

4.1.6 DELSENDER – Deletes a phone number to the "Filter List By Phone Number"

Deletes a number from the telephone list. If Filter List by Phone number is enabled, GTS will prevent from erasing the phone number of the telephone that is performing this configuration. It works in both modes.

DELSENDER {Telephone number} [Pass]

Parameters	Description	Values
Telephone number	Telephone number that will be deleted	From 1 to 10 numeric characters
Pass	Password (optional)	Configured password

Ex.:

→ **DELSENDER** 25485 pass
← Sender deleted

4.1.7 ENSENDER – Enables/Disables "Filter List By Phone Number"

Enables/Disables "Filter List By Phone Number". The list is only enabled if whoever requests the action is on the list. It works in both modes.

ENSENDER {Status of the list} [Pass]

Parameters	Description	Values
Status of the list	Indicates if one wants to enable or disable the list	ON, OFF
Pass	Password (optional)	Places password

Ex.:

→ **ENSENDER** ON pass
← Senders list enabled

Monitoring Messages

By means of the SMS it is possible to know the GTS' configuration, and the status of the inputs.

4.1.8 LISTALL – Requests the configuration

Requests the current configuration values. It doesn't contain parameters. It works in both modes.

Ex.

→ **LISTALL**
← SERIAL 9600,8,N,E MODE: STD

4.1.9 LISTRECIP – Requests the recipients list

Requests the current recipients list. It doesn't contain parameters. It works in both modes.

Ex.

→ **LISTRECIP**
← Recipients list: 112053521, 15248454548,1254454542

4.1.10 SIGNAL – Requests the value of the signal

Requests the value of the signal in the GTS at that instant. It works in both modes.

Ex.:

→ **SIGNAL**
← Signal: -96 dB

4.1.11 `LISTSENDER` – Requests the list of authorized telephones

Requests the list of authorized telephones that can access the GTS, the character in parenthesis indicates whether it is enabled (E) or disabled (D). It works in both modes.

Ex.:

→ **LISTSENDER**
← Senders(E): 54854,1548548548,1236

4.1.12 `DINPUTS` – Requests the value of digital inputs

Requests the value of digital inputs at that instant, this message can originate as a response one or two messages depending on the number of inputs that the model is using. It works in both modes.

Ex.:

→ **DINPUTS**
← IN1=ON IN2=ON IN3=OFF IN4=ON (Continues until it sends all the inputs)

4.1.13 `DOUTPUTS` – Requests the value of the digital outputs

Requests the value of the digital outputs at that instant, this message can originate as a response one or two messages depending on the number of outputs the model is using. It works in both modes.

Ex.:

→ **DOUTPUTS**
← OUT1=OFF OUT2=ON OUT3=OFF OUT4=OFF (Continues until it sends all the outputs)

4.1.14 `AINPUTS` – Requests the value of analog inputs

Requests the value of analog inputs at that instant, this message can originate as a response one or two messages depending on the number of analog inputs of the model being used. It works in both modes.

Ex.:

→ **AINPUTS**
← AIN1=5.90v AIN2=6.02v AIN3=0.23v (Continues until is sends all the inputs)

4.1.15 `VERSION` – Requests the hardware and firmware versions of the device

Through this command it is possible to know the hardware and firmware versions of your device.

Ex.:

→ **VERSION**
← GTS3002 - HARDWARE: V3.0 FIRMWARE: V1.1.0

Control Messages

By means of SMS it is possible to act on the GTS

4.1.16 `SERIAL` – Sends messages through the serial port

When you want to send data through the serial port you use this command that precedes the message that we will send. It only works in Standard mode.

SERIAL {Message} [Pass]

Parameter	Description	Values
Message	Message we want to send through the serial port	From 1 to 120 characters

Pass	Password (optional)	Configured password

Ex.:

→ **SERIAL** *This is a test message* pass

The word "pass" will not go out the serial port if we have the password configured with this text, that is, as a result we will have in the output of the serial port:

This is a test message

If we want to send through the serial port data not having ASCII representation, for example an ENTER (0x0D) at the end of the message, we must send the decimal code of the character between <>. For more information see Appendix C – Table of characters and the decimal equivalents -.

Ex.:

→ **SERIAL** *This is a test message<13>* pass

4.1.17 `DOUTPUT` – Modifies the status of outputs

Changes the status of any of the outputs, it is possible to turn them on or off individually. It only works in Standard mode.

DOUTPUT {Name (Number)} {Status} [Pass]

Parameter	Description	Values
Name	Name assigned in the GTS Configurator	From 1 to 10 characters
Number	Output number	From 1 to n (Number of outputs for the model)
Status	Status in which we want to place the output	ON or 1 to turn on OFF or 0 to turn off
Pass	Password (optional)	Configured password

It is possible to act on the output by placing only the name or number, if both are placed it acts by the output number. For more information see in chapter 3 – Standard Digital Outputs.-

Ex1.:

→ **DOUTPUT** Motor(3) ON
← DOUTPUT 3 ON

Ex2.:

→ **DOUTPUT** Motor 1
← DOUTPUT Motor 1

Ex3.:

→ **DOUTPUT** (3) OFF
← DOUTPUT 3 OFF

If you give the same name to multiple outputs and you act by name, all outputs will perform the action.

4.1.18 `PULSE` – Generates a pulse at the output

Generates a pulse of a determined duration in the message. The generated pulses are first turning on and then turning off, if the output is on, it will turn off once the duration of the pulse has ended. It only works in Standard mode.

PULSE {Name(Number)} {Time} [Pass]

Parameter	Description	Values
Name	Name assigned in the GTS Configurator	From 1 to 10 characters
Number	Output number	From 1 to n (Number of output for its model)
Time	Duration of the pulse in seconds	From 1 to 60 seconds
Pass	Password (optional)	Configured password

It is possible to act on the output placing only the name or the number, if both are placed it will act by the output number. For more information see chapter 3 –Digital Outputs In Standard Mode-

Ex1.

→ **PULSE** Reset(4) 10 pass
← Pulse in output 4 of 10 seconds

Ex2.

→ **PULSE** Reset 10 pass
← Pulse in output Reset of 10 seconds

Ex3.

→ **PULSE** 4 10 pass
← Pulse in output 4 of 10 seconds

If you place the same name to multiple outputs, and it acts by name; all outputs will perform the action.

Report Messages

These messages are generated asynchronically by the GTS to report certain events and will be sent to the configured receipt phone numbers.

4.1.19 `SERIAL` – Sends messages entering by the serial port

When data enter through the serial port and a packet is formed according to the packing criteria, it is sent to the configured receipt phone numbers. This message is only sent in Standard mode.

SERIAL {Message}

Ex.:

← **SERIAL** Test message from the serial port

You should take into account that those characters entering the serial port that are not ASCII will be transformed to its equivalent representation in decimals with the <> format.

4.1.20 `AINPUT` – Reports the status of analog alarms

When any of the analog inputs enters in an alarm status or leaves the status a message is generated informing about the situation. Maximum, minimum limits, hysteresis and name are configured by the GTS Configurator, for more information see in chapter 3 –Analog Inputs in stander mode-. This message is only sent in Standard mode.

AINPUT {Name(Number)} {Status}

Parameter	Description	Values
Name	Name assigned in the GTS Configurator	From 0 to 10 characters
Number	Input number	From 1 to n (Number of inputs for its mod el)
Status	Alarm status	MAXIMUM ALARM

		MINIMUM ALARM ALARM NORMALIZED

Ex.:

← **AINPUT** Tank(2) MAXIMUM ALARM

4.1.21 `DINPUT` – Reports the change of digital inputs

When any of the digital inputs modifies its status a change report is generated automatically that will be sent to the configured recipient phone numbers. Each one of the inputs can be enabled independently, for more details see in chapter 3 –Digital Inputs in standards mode-. This message is only sent in Standard mode.

DINPUT {Name(Number)} {Status}

Parameter	Description	Values
Name	Name assigned in the GTS Configurator	From 0 to 10 characters
Number	Input number	From 1 to n (Number of inputs for its model)
Status	Input status	ON, OFF

Ex.:

← **INPUT** Sensor(5) ON

Customized Messages

Those messages that are only sent in Standard mode have their equivalent in custom mode. Here is the detail of how the messages operate in this mode.

4.1.22 Messages to or from the Serial Port

To send messages to the serial port in Standard mode you use the SERIAL command, in custom mode this does not work. Simply, the work methodology is that all messages arriving at the GTS will be sent to the serial port, except those messages that are reserved or that correspond to the activation or deactivation of outputs.

Similarly, if you send a message through the serial port, it automatically becomes an SMS and is sent to the configured receipt phone list. In this case, SERIAL will not be the prefix of the message text, therefore the message is sent as it is to its destination.

Remember that if characters not corresponding to the ASCII standard are received or want to be sent through the serial port, these are represented by their decimal equivalent between <>.

If you are working with the serial port in By Commands mode, the operation is similar except that the port has a specific format stream. For more information see chapter 5 – Operational modes of the serial port-.

4.1.23 Handling of digital outputs

First, the messages to "activate" and "deactivate" the outputs must be configured by the GTS Configurator.

For this you must access the configuration of customized outputs and place the desired message to perform the action.

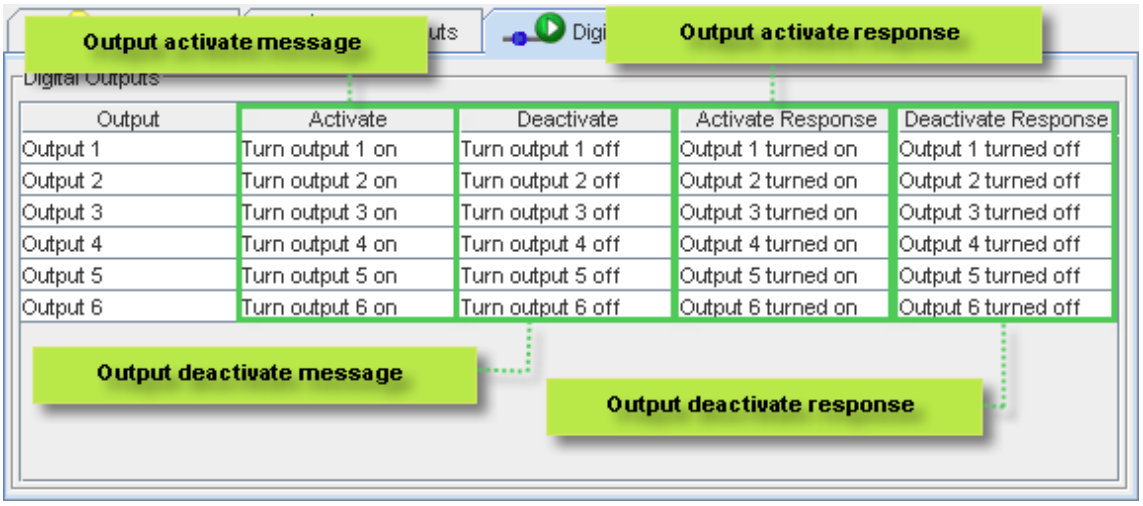


Figure 37 – Configuration of output activation and deactivation messages

Once the messages are configured you only need to send the entered text to perform the desired action.

Ex.:

If we want to activate output 4 we send:

→ Turn output 4 on
← Output 4 turned on

It is possible to repeat the same message to perform simultaneously multiple actions to activate and also deactivate outputs.

Take into consideration that if you place reserved names to turn on outputs like for example: DINPUTS, DOUTPUTS the name of the used function will have no effect. Avoid using reserved words in customized messages.

4.1.24 Report of Digital Inputs

When the status of one of the digital inputs is modified, an SMS is generated automatically informing about the event. In the case of a customized messages we can define the text that will be sent when the event occurs, either when the input produces a transition from 0 to 1 or vice versa.

The message is determined by means of the GTS Configurator in the configuration screen of Digital Inputs in custom mode.

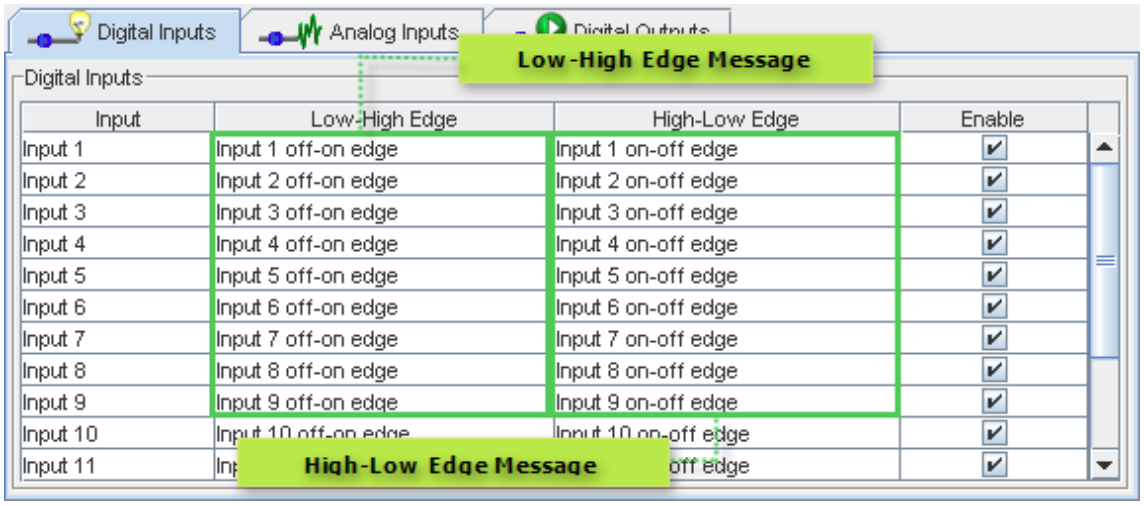


Figure 38 – Configuration of messages of events of digital inputs

Ex.:

Event: Transition from 0 to 1 of input 3
← Input 3 off-on edge

4.1.25 Report of analog inputs

When the analog inputs change value and status is changed according to the configured maximum and minimum, a message is generated automatically reporting the change. The generated message can be configured by means of the GTS Configurator in the configuration of Analog Inputs in custom mode.

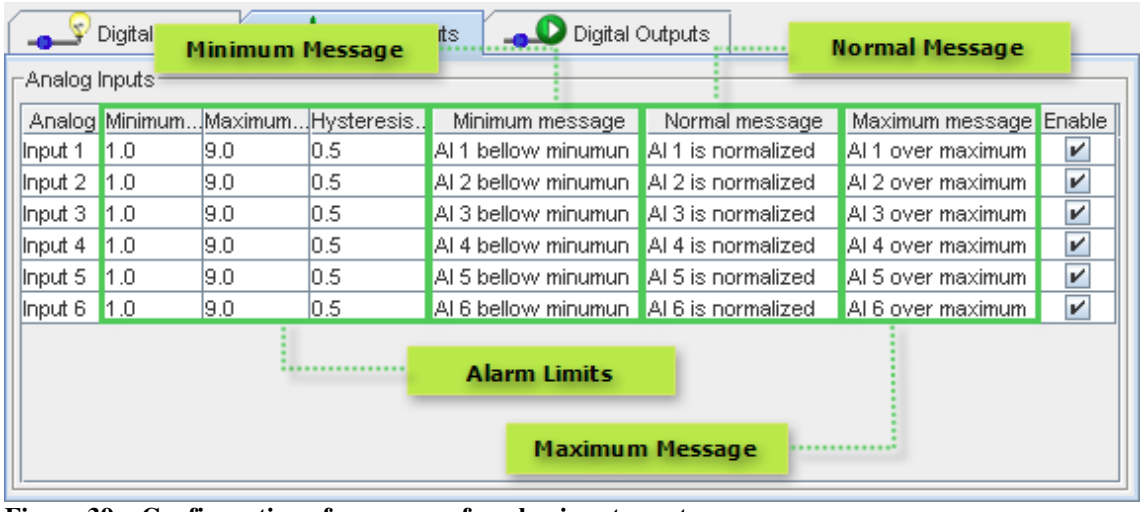


Figure 39 – Configuration of messages of analog input events

If for example we have an upper limit above 9.0V and the input exceeds that threshold the corresponding message is triggered automatically and sent to the configured recipients.

Ex.:

Event: Analog input 4 changes from 8.9V to 9.1V
← AI4 over maximum

Special attention must be paid to the configured value of hysteresis to avoid the system to send SMS continuously when the input is oscillating in the change threshold. For more information see Appendix D – Hysteresis operation.

Chapter 5

5 Operational modes

GTS operational modes

The GTS has two operational modes: standard mode and custom mode.

5.1.1 Standard mode

Under this operational mode the GTS allows the reporting of changes in the inputs, acting on the outputs and also receives and sends SMS to or from the serial port respectively.

The special feature of this mode is that the messages received or sent have a Standard format which cannot be modified and you are restricted to. This has the advantage that the messages can be interpreted by other GTS.

The Standard messages are detailed in chapter 4 – Configuration, Monitoring and Control by SMS – where the format of each of the Standard commands is shown. To better understand about this mode see chapter 6 – Practical Application – where useful layouts are shown where this operational mode is applied.

5.1.2 Custom mode

In this mode, the GTS allows reporting of changes in the input, acting on the outputs as well as sending and receiving messages to or from the serial port respectively. The special feature of the custom mode is that the sent messages can have any format. This means that for example, to activate one or more outputs it is possible to define the message we want and when the message is received the outputs will be activated, the same happens to turn them off.

In the case of digital inputs, it is possible to define the message to be sent when any of the inputs goes on or off.

In analog inputs, it is possible to configure a message being sent when the input exceeds a maximum, returns to the normal status or goes bellow the configured minimum.

Operational modes of the Serial Port

The serial communication port has two operational modes that provide different options depending on the application to be resolved: Transparent mode and By Commands mode.

5.1.3 Transparent mode

In the Transparent mode the serial communications port behaves like a tunnel that simply receives data through the port and generates an SMS that will be sent to the only to the configured recipients list. Or receives an SMS from any source number and sends it through the serial port. The main advantage of this mode is that everything arriving to the serial port becomes automatically an SMS, but with the disadvantage is that the message entering through the serial port can only be sent to the phones previously configured.

Remember that if the GTS is configured en standard mode the word SERIAL will be appended to the messages received on the serial port. Also remember that will have to start your SMS' with the word SERIAL when you wont to send messages to the serial port.

In the Transparent mode of the serial port only ASCII characters are sent, those characters without valid ASCII representation are sent between <>.

5.1.4 By commands mode

In this mode, the serial port must receive a data stream with a defined command to send a message.

Among other things, this mode can be used to send a message to any destination and not only to the configured recipients list. When a message is received it is also possible to know the source number of the message and the time stamp when the message was sent. For more details see Appendix B – Format of the stream in By commands mode -.

Chapter 6

6 Practical Applications

Here we list some practical applications that can show you how and where to use the GTS.

Simple home automation

This is a very basic configuration in which the GTS report events to a cellular phone when the digital inputs or analog alarms change, or receive data from the serial port. It's also possible to send orders to modify the status of the outputs or messages to the serial port from a cell phone.

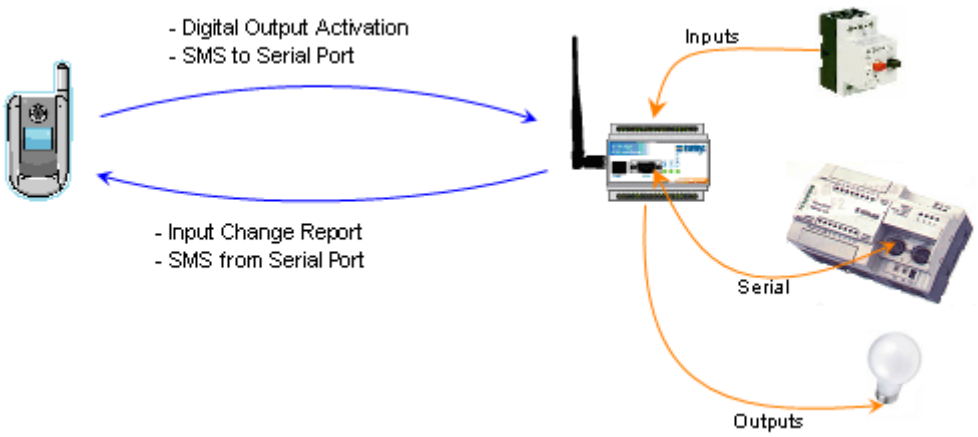


Figure 40 – Simple home automation layout

In this case the GTS can be configured in custom mode and the messages corresponding to the output activation and the input events can be defined, the serial port can be configured in Transparent.

Centralized control

This is a layout where there is a data concentrator connected to an intelligent device that receives the remote GTS' messages.

The remote GTS' report the changes to a single GTS concentrator, this one must be configured in custom mode and the serial port in By Commands mode. This way it is possible to send orders to any of the remote GTSs and know the GTS number sending the report. The remote GTS' can be configured in custom mode and the serial port in Transparent mode configuring the recipient's phone of each one with the number of the GTS concentrator.

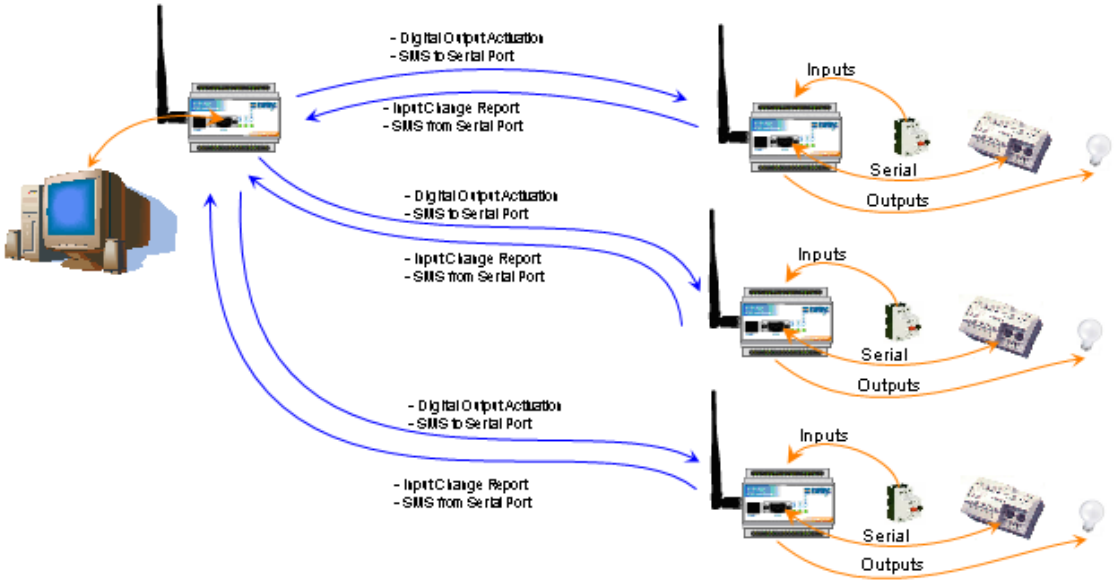


Figure 41 – Centralized control layout

Inputs/Outputs+Serial Tunnel

This configuration works as a tunnel between the GTS'. Serial port data entering through one end goes out on the other end and vice versa. The inputs of a GTS are reflected in the other's outputs. It can choose to reflect the status of the analog inputs or the status of the digital inputs. The main configuration to perform a tunnel is that both devices must be configured in Standard mode and each one must have configured the other one's number.

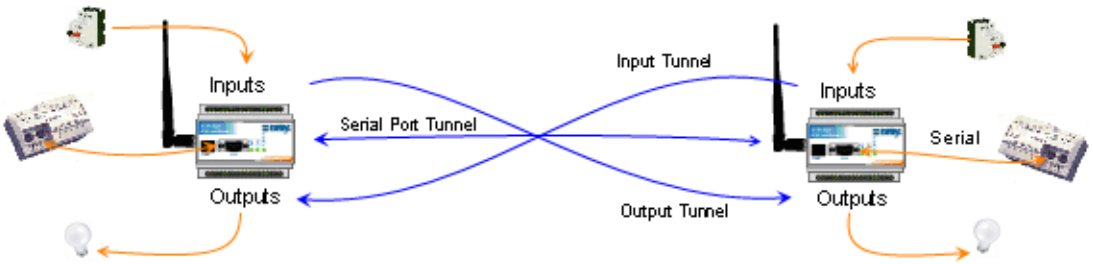


Figure 42 – Tunnel layout

Appendix A

A Troubleshooting quick guide

1. I cannot connect with the GTS Configurator

1.1. I press the connect button and it gives me an error instantaneously

1.1.1. Verify that the selected serial port exists.

1.1.2. Verify that the port is not being used by another application.

1.1.3. If you use USB adapters to the serial port be sure that it is correctly connected and configured.

1.2. I press the connect button and attempts to connect but it cannot do it

1.2.1. Verify that the connection cable of the serial port to the GTS is a complete cable as the one indicated in the installation section.

1.2.2. Verify that the selected port is the adequate one.

2. The GTS does not respond to SMS messages

2.1. If the GTS Configurator shows the antenna crossed out (LEDs flicker slowly and in alternate manner).

2.1.1. The GTS has no signal. Verify:

2.1.1.1. That the antenna is correctly connected.

2.1.1.2. That you are within your cell phone operator coverage area.

2.2. The status of the SIM card indicates fault (LEDs flicker fast and in a synchronized manner).

2.2.1. The GTS cannot access the SIM.

2.2.1.1. If the GTS Configurator indicates "SIM Inaccessible". Verify that the GTS has a SIM card in place.

2.2.1.2. If the GTS Configurator indicates "Enter PIN": the SIM card has the PIN Security code) activated, configure the correct PIN in the GTS (See Configuring the PIN of the SIM card).

2.2.1.3. If the GTS Configurator indicates "SIM blocked (PUK)": the SIM card is blocked by PUK.

2.3. No evidence of error.

2.3.1. Verify if the SIM card placed in the GTS has credit.

2.3.2. Verify if the SIM card has a subscription or account that lets you send SMS messages.

2.3.3. Corroborate that the destination telephone number coincides with the number of the SIM card of the GTS.

2.3.4. Ensure that the sent message is one supported by the GTS. If the message begins with a word that the GTS cannot interpret it will not respond.

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

Appendix B

B Stream format in By Commands mode

All characters are in ASCII format, except those indicated between <>.

STX <0x02> Command SYN <0x16> Data ETX <0x03>

STX: Indicates the beginning of the transmission of the stream and is hexadecimal 2.
Command: It is a number formed by two characters and can go from 00 to 99.
SYN: This is a parameter separator and is a 16 hexadecimal.
Data: These are data corresponding to each command, it can contain multiple parameters.

ETX: Indicates the end of the transmission of the stream and is hexadecimal 3.

Available command:

Command '12' – Send and receive SMS

Send:

Destination number SYN <0x16> Message

Destination number: The telephone number to whom you want to send the message
SYN: separator 16 hexadecimal
Message: Message to be sent with a maximum of 120 characters

Receive:

Source number SYN <0x16> Time Stamp SYN <0x16> Message

Source number: The telephone number that generated the message
SYN: separator 16 hexadecimal
Time Stamp: Number that represents the seconds since 1970
Message: Message received

Ex. Send:

<0x02> 12 <0x16> 1152454545 <0x16> Test message <0x03>

Ex. Receive:

<0x02> 12 <0x16> 1152454545 <0x16> 1524866981 <0x16> Message <0x03>

Appendix C

C Character table and decimal equivalent

0	NULL	64	@	128	€	192	À
1	SOH	65	A	129	□	193	Á
2	STX	66	B	130	‘	194	Â
3	ETX	67	C	131	ƒ	195	Ã
4	EOT	68	D	132	„	196	Ä
5	ENQ	69	E	133	…	197	Å
6	ACK	70	F	134	†	198	Æ
7	BEL	71	G	135	‡	199	Ç
8	BS	72	H	136	ˆ	200	È
9	TAB	73	I	137	‰	201	É
10	LF	74	J	138	Š	202	Ê
11	VT	75	K	139	‹	203	Ë
12	FF	76	L	140	Œ	204	Ì
13	CR	77	M	141	□	205	Í
14	SO	78	N	142	Ž	206	Î
15	SI	79	O	143	□	207	Ï
16	DEL	80	P	144	□	208	Ð
17	DC1	81	Q	145	‘	209	Ñ
18	DC2	82	R	146	’	210	Ò
19	DC3	83	S	147	“	211	Ó
20	DC4	84	T	148	”	212	Ô
21	NAK	85	U	149	•	213	Õ
22	SYN	86	V	150	–	214	Ö
23	ETB	87	W	151	—	215	×
24	CAN	88	X	152	˜	216	Ø
25	EM	89	Y	153	™	217	Ù
26	SUB	90	Z	154	š	218	Ú
27	ESC	91	[	155	›	219	Û
28	FS	92	\	156	œ	220	Ü
29	GS	93	]	157	□	221	Ý
30	RS	94	^	158	ž	222	Þ
31	US	95	_	159	Ÿ	223	ß
32	(space)	96	`	160		224	à
33	!	97	a	161	¡	225	á
34	“	98	b	162	¢	226	â
35	#	99	c	163	£	227	ã
36	$	100	d	164	¤	228	ä
37	%	101	e	165	¥	229	å
38	&	102	f	166	¦	230	æ
39	‘	103	g	167	§	231	ç
40	(	104	h	168	¨	232	è
41	)	105	i	169	©	233	é
42	*	106	j	170	ª	234	ê
43	+	107	k	171	«	235	ë
44	,	108	l	172	¬	236	ì
45	-	109	m	173		237	í
46	.	110	n	174	®	238	î
47	/	111	o	175	¯	239	ï
48	0	112	p	176	°	240	ð
49	1	113	q	177	±	241	ñ
50	2	114	r	178	²	242	ò
51	3	115	s	179	³	243	ó
52	4	116	t	180	´	244	ô
53	5	117	u	181	µ	245	õ
54	6	118	v	182	¶	246	ö
55	7	119	w	183	·	247	÷
56	8	120	x	184	¸	248	ø
57	9	121	y	185	¹	249	ù
58	:	122	z	186	º	250	ú
59	;	123	{	187	»	251	û
60	<	124	|	188	¼	252	ü
61	=	125	}	189	½	253	ý
62	>	126	~	190	¾	254	þ
63	?	127	□	191	¿	255	ÿ

Appendix D

D Hysteresis operation

The hysteresis of an analog inputs defines a band in which the previous alarm status is retained before changing the current alarm status.

To understand its use, the following change curves of an analog input is shown.

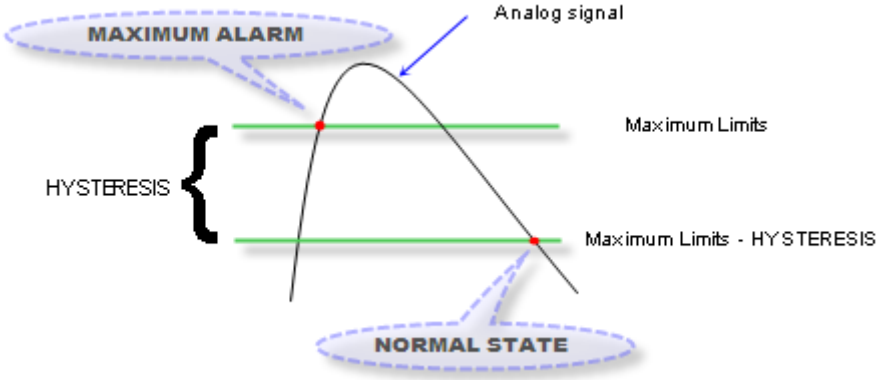


Figure 43 – Hysteresis in the maximum limit

As an example we will assume that the maximum limit is 9.0V and the hysteresis is 0.5V. In the previous figure you can see the "MAXIMUM ALARM" message is sent when the analog signal exceeds the maximum value, in this case when the input exceeds the 9.0V, the "NORMAL STATUS" is sent when the analog signal is below the maximum limit minus the hysteresis. In this case it would be when it goes below the 8.5V.

Having a value of hysteresis prevents from sending repeated messages every time that passes through this limit is the analog signal is varying arround of maximum limit.

The value of hysteresis must adapt to your needs, a very small value of hysteresis can produce repeated alarms by maximum and normal status, on the contrary a very large value can produce a loss of events of a not so significant magnitude.

For the lower limit case the following figure shows the behavior, in which you can clearly visualize that hysteresis is applied when the analog signal goes from its lower limit to a normal value.

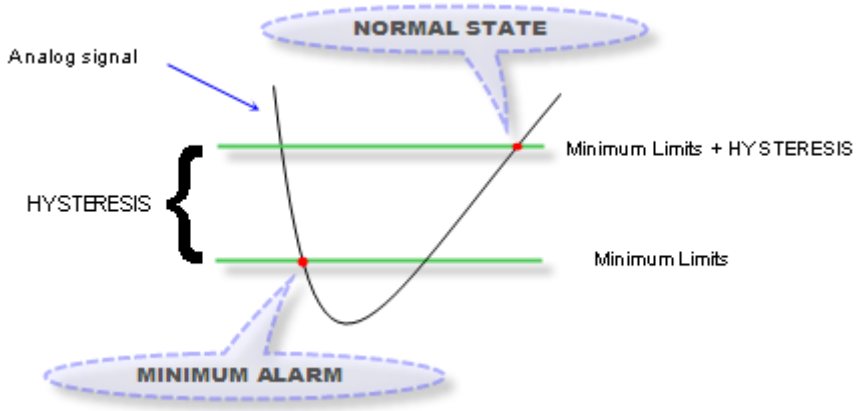


Figure 44 – Hysteresis in the lower limit

You must take into account that hysteresis must be less than the maximum minus the minimum; this means that the value of hysteresis should not exceed the opposing configured limits.

Hysteresis < (Maximum limit – Minimum limit)

Appendix E

E Factory default values

Parameter	Description	Value
Basic configuration		
Password	Password for the reception of SMS	*empty*
Mode	Parse mode	Standard
Receipt telephones	Telephone to which events are reported	*empty*
List filter	Filter list by telephone number	*empty*
Filter activation	Activates the filter list by telephone number	Deactivated
Serial port configuration		
Baud rate	Speed of communication	9600
Data bits	Number of bits of each datum sent or received	8
Parity	Error checking	None
Flow control	Control of reception buffer	Activated
Serial port mode	Determined the behavior of the serial port	Transparent
Window time	Time criterion for packing	50
End character	End character criterion for packing	10 (disabled)
Digital inputs (Standard)		
Name	Input name	DinputN
Activation	Input activation	Deactivated
Digital outputs (Standard)		
Name	Output name	DoutputN
Follow analog	Activation to follow the analog input	Deactivated
Analog inputs (Standard) (*)		
Name	Input name	AinputN
Minimum	Minimum value for trigger	1.0
Maximum	Maximum value for trigger	9.0
Hysteresis	Trigger hysteresis	0.5
Enable	Input enabling	disabled
Digital inputs (Custom)		
Off-on edge	Text in the event of off-on edge	Input N off-on edge
On-Off edge	Text in the event of on-off edge	Input N on-off edge
Enable	Input enabling	disabled
Digital outputs (Custom)		
Activate	Text to activate an output	Turn on N output
Deactivate	Text to deactivate an output	Turn off N output
Response to activation	Response text to activation of an output	Output N turned on
Response to deactivation	Response text to deactivation of an output	Output N turned off
Analog inputs (Custom) (*)		

Minimum	Minimum value for trigger	1.0
Maximum	Maximum value for trigger	9.0
Hysteresis	Trigger hysteresis	0.5
Minimum message	Message when it enters below the minimum	AI N below minimum
Normal message	Message when it enters in normal value	AI N is normalized
Maximum message	Message when it enters above the maximum value	AI N over minimum
Enable	Input enabling	Disabled

(*) Only for models GTS3002 and GTS3003

Appendix F

F Power Supply and Inputs/Outputs connections

The minimum and maximum admissible values in inputs as well as current and voltage outputs, and consumption of GTS are detailed below:

Power Supply

Parameter	Condition	Minimum	Maximum	Units
Input voltage		10	30	Vdc
Consumption idle	GTS at 24 Vdc GTS at 12 Vdc		25 40	mA
Consumption in transmission	GTS at 24 Vdc GTS at 12 Vdc		1 1	A

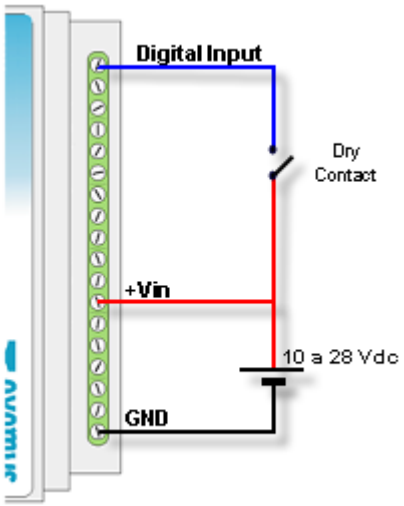
Digital inputs

In order to activate digital inputs an external continuous voltage must be applied. This power supply has to share the GND terminal with the GTS power supply. If necessary, the same power supply used to power the GTS can be used.

The input is sinking type. It accepts PNP sourcing type sensors or devices.

Parameter	Minimum	Maximum	Units
Activated input	3.5	28	Vdc
Input impedance	2		KΩ

Two examples of how to connect directly from the same power source of the GTS as well as an external power supply where it can be seen that they must share a common terminal are shown.



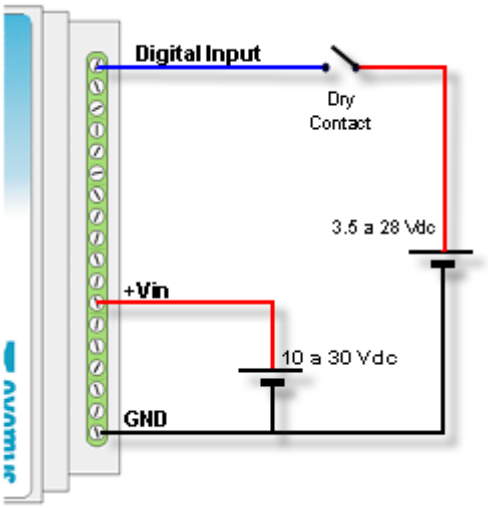


Figure 37 - Digital input with single power supply **Figure 38 - Digital input with double power supply**

Digital Outputs

The digital outputs are open collector type. The load to be connected must be supplied with and external power supply and they have to share the same GND terminal with the GTS power supply. If necessary, the same power supply to power the equipment can be used. The output is of the NPN sourcing type.

Parameter	Minimum	Maximum	Units
Supported voltage		45	Vdc
Current		50	mA

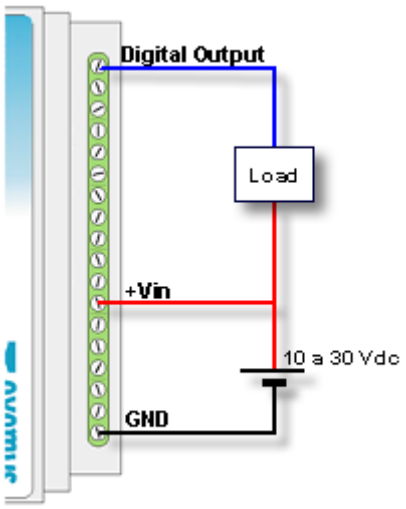


Figure 39 – Digital output with single power supply

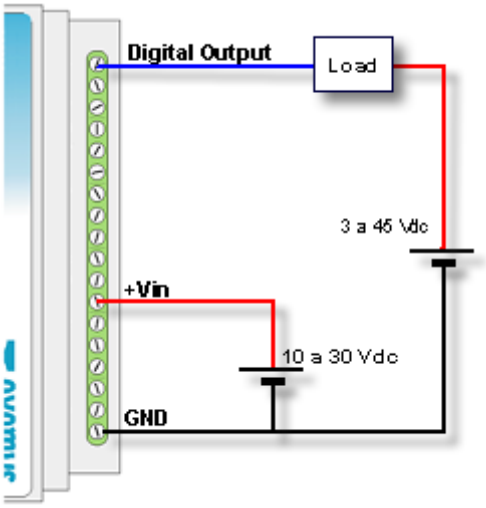


Figure 40 – Digital output with double power supply

Digital output to drive a Relay

When used one digital output is used to a relay is necessary add in the connection a protection diode to avoid damage in the equipment. The diode must be connected in reverse (the anode to the output terminal of the equipment and the cathode to the positive terminal that feeds the relay).
The relay must be feed using a external power supply, sharing the GND terminal to the power supply of the equipment, or if necessary you can use the same source which feeds the GTS.

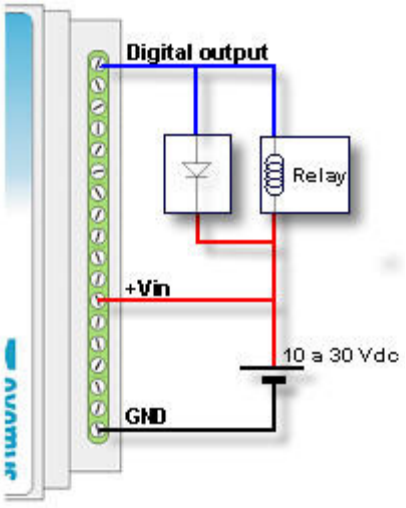


Figure 41 - Output with relay (single power suply)

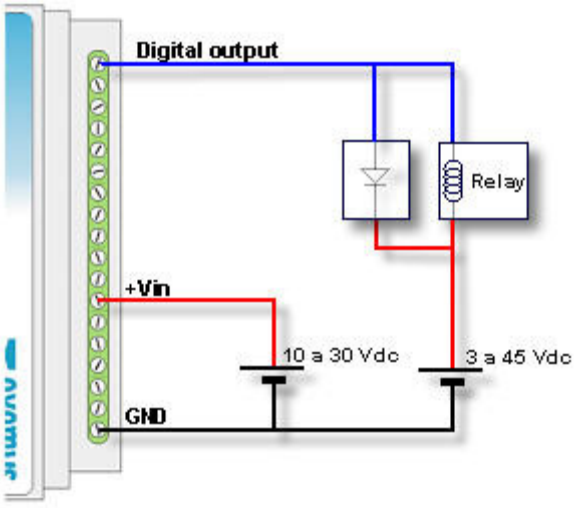


Figure 42 - Output whit relay (double power suplly)

Analog Inputs

The analog inputs are referred to the GND terminal of the GTS, so the power supply to feed the sensor must share the GND terminal with the GTS.

GTS3002

Parameter	Value	Units
Bottom of scale	10.00	Vdc
Precision	0.01	Vdc
Tolerance	±0.2	full scale %
Input impedance	13.3	KΩ

Two examples of how to connect an analog input of voltage for a single power supply and for independent power supplies are shown below.

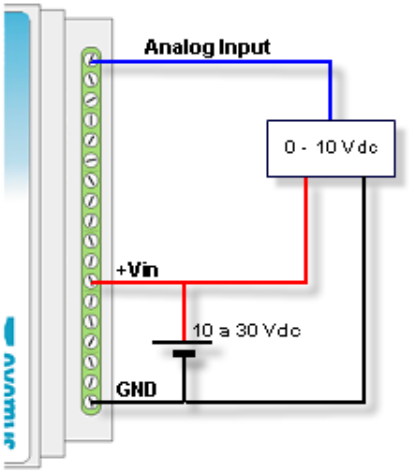


Figure 43 – Analog for a single power supply

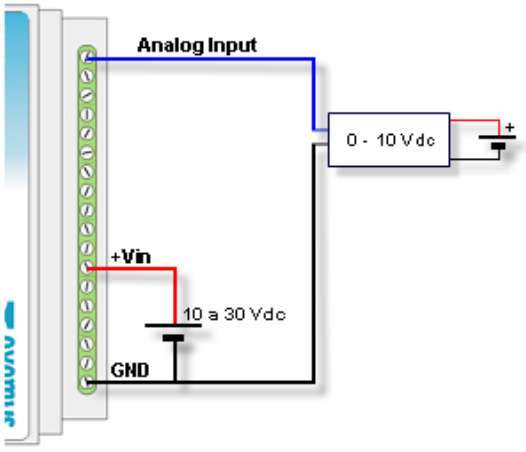


Figure 44 – Analog for a double power supply

GTS3003

Parameter	Value	Units
Bottom of scale	20.00	mA
Precision	0.01	mA
Tolerance	±0.4	full scale %
R of shunt	124	Ω

Two examples where you can see the connection of a 4 – 20 ma sensor sharing the power supply with the GTS for passive sensors or for active sensors with independent power supply are shown below.

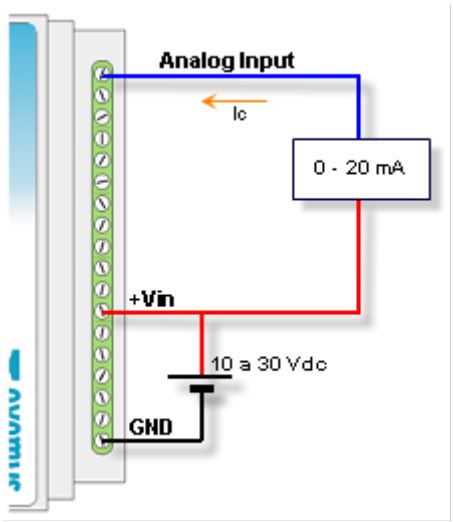


Figure 45 – Analog for a passive sensor

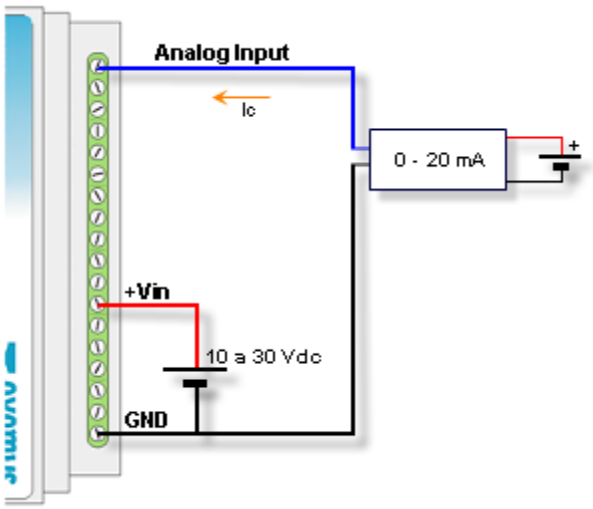


Figure 46 – Analog for an active sensor