

# User Manual

## GATEWAY Modbus/TCP

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# 1. General information

This manual describes the SICES s.r.l. "Gateway ModBus/TCP" and the PC program for configuring the device. The abbreviation GMT will be used to indicate this device throughout the document.

The GMT is a simple and compact product used to let devices with serial ports communicate in an Ethernet network. It comes in an aluminium case, and is mounted on the wall with four holes.

It must be connected to a standard Ethernet network that supports TCP/IP protocol. The network interface built into the product can manage a maximum speed of 10 Megabits per second. The device can also be connected to a 100 megabits per second network using a hub or switch that supports both speeds.

The GMT does not support standard DHCP network protocol, in other words the automatic assignment of IP addresses in a network. This protocol is widely used in Windows networks, with a server (called the DHCP server) that performs this function. If the network where the GMT will be installed uses DHCP, disable an IP address on the DHCP server (so that server cannot use it) and assign it to the GMT. Contact the network administrator to perform this operation.

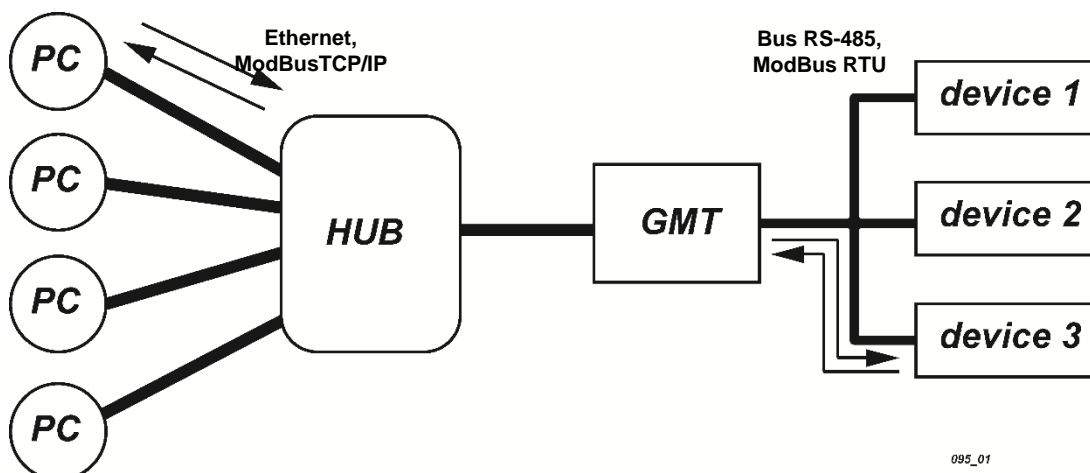
The GMT can also be used in Internet (because Internet supports TCP/IP protocol). In this case however, the GMT must have a static IP address (i.e. a unique IP address for Internet). Static IP addresses must be acquired from the competent authority.

The GMT has a serial port, which can be configured for RS-232 and RS-485 standard. This serial port can be used to connect one or more devices that implement Modbus protocol in RTU mode. These devices must be slaves in serial communication. In other words they must only respond to queries and should never transmit on their own initiative.

Once the GMT has been installed and configured, you can communicate with devices connected to the serial port of any PC in the network, indicating the IP address assigned to the GMT and the address of the device to query. On the PC, you should use the Ethernet version of the ModBus protocol, called Modbus/TCP. The GMT converts Modbus/TCP messages into Modbus/RTU format and sends them to the serial port. On receipt of the response, it converts the same into Modbus/TCP format and transmits the same via Ethernet to the IP address of the PC that sent the query.

The GMT also acts as a network concentrator: in fact, it supports up to four simultaneous connections from the network. This means the devices can be queried "simultaneously" by four different PCs. This would not otherwise be possible, given the master/slave nature of Modbus Protocol, which envisages only one master (sending queries) and many slaves (responding). Of course, as simultaneous connections increase, there will be a drop in performance for a single connection.

The following diagram shows the information flow in a practical example:



In addition, the GMT has four digital inputs and four digital outputs that can be used as you wish. Using a certain ModBus address (255, which is normally not used), the same GMT can be queried via Ethernet (rather than a device connected to the serial port), to acquire the status of inputs and control the outputs.

SICES supplies PC software with the GMT, which is simple and easy to use, for device configuration both via the serial port or Ethernet. This software runs in WINDOWS 98/2000/NT/XP. It does not run in WINDOWS 95 or earlier.

## 1.1 Input voltage

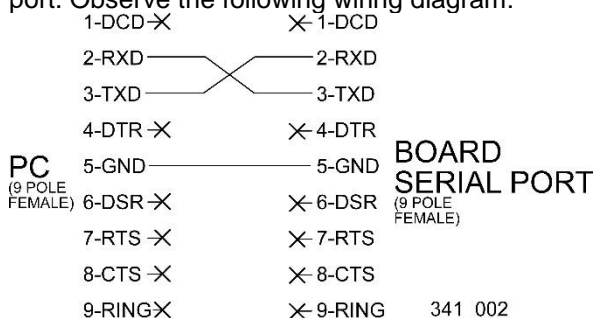
The GMT must be supplied with a voltage from 7.5 to 32 VDC, using connector J8. In fact it is designed to be used with our generator management boards, powered by the genset starter battery. Connector J8 also has a ground terminal.

## 1.2 Ethernet connector

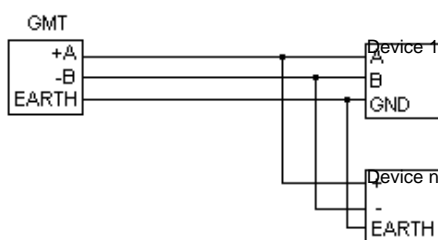
The device has a standard RJ45 8-pole Ethernet connector. There are two lights next to the connector: the green light indicates connection to the Ethernet network, the yellow light indicates data transmission on the network.

## 1.3 Serial port

There is a nine-pin male DB connector with standard RS-232 PC serial port pin configuration. Use a standard crossover cable to connect a device (or PC during configuration) to the serial port. Observe the following wiring diagram:



There is also a three-pole terminal block for connection to a RS-485 standard network. The three poles are named with standard terminology. The poles are marked A/B and +/- for data transmission. To connect one or more devices to this terminal block you will need a 2-pole screened cable. See diagram below.



There is also a toggle switch (SW2) to enable/disable a 120 ohm termination resistance on the RS-485 network.

Use a toggle switch (SW1) to enable the RS-232 connector or the RS-485 terminal block.

This port is normally used to connect one or more serial devices that implement the Modbus (RTU) protocol, as a slave. It can sometimes be used to configure the GMT.

## 1.4 Digital inputs

The board has four optically isolated digital inputs (connector J6). Each digital input has a 1-pole terminal board. To activate an input, connect terminal J6.5 (negative) to the relevant terminal.

## 1.5 Digital outputs with relays

The I/O board has four digital outputs with relays (0.5 Amp max. on contacts). Each digital output has a two-pole terminal block for the closing contact of the relay (connector J2). The relays are controlled by the operator through the PC software configuration.

## 1.6 Dip switches

The board has a bank of two dip switches (SW3), numbered one and two.

Dip switch 1 is used when you want to use the serial port (RS-232 or RS-485) to configure the GMT (if closed down).

Dip switch 2 is not used.

## 1.7 Non-volatile memory

Used to store the GMT configuration. The information stored includes the IP address, TCP port, etc.

# 2. PC Configuration Program

Together with the GMT (Gateway Modbus/Tcp), SICES s.r.l. provides a PC software to supervise and configure the device via both Ethernet and the serial port. This software is named "ModBus Data Gateway Configuration Tool" (the executable file is named MDGConfig.exe).

## 2.1 Program Installation

The program is sold individually or together with SicesSupervisor supervision software. In the first case, run the "Setup.exe" file on the installation CD to install the program. In the second case, select "MDGConfig.exe" during SicesSupervisor installation.

## 2.2 Program Execution

The program can be executed in two ways: by double-clicking on the "MDGConfig.exe" file, or by selecting "ModBus Data Gateway Configuration Tool" from the start menu.

### 2.2.1 If Installed Individually

The "MDGConfig.exe" is in the "C:\Programs\Sices\Modbus Data Gateway Configuration Tool" folder; from the start menu, follow the "Programs → Sices → Modbus Data Gateway Configuration Tool" path.

### 2.2.2 If Installed with SicesSupervisor

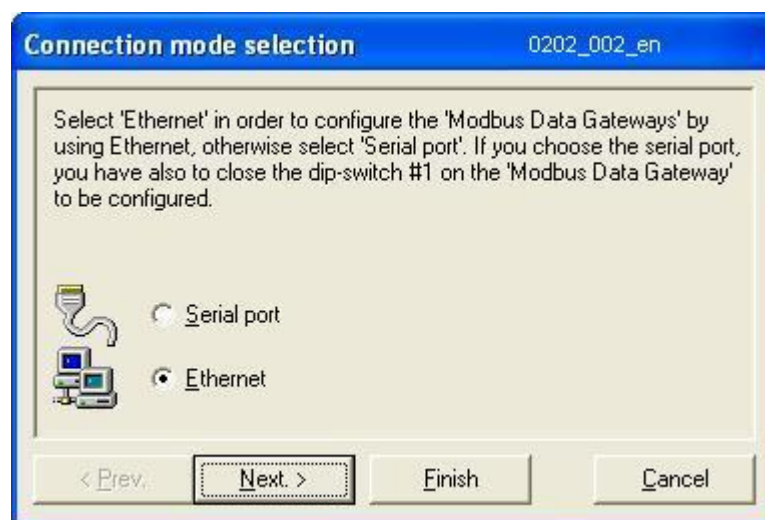
The "MDGConfig.exe" is in the "C:\Programs\Sices\SicesSupervisor" folder; from the start menu, follow the "Programs → Sices → SicesSupervisor" path.

## 2.3 Program Description

When launched, the program asks for language selection:



Once the desired language is selected, click on “OK” to confirm. The program will display the following window:



Choose whether the program should configure the device via Ethernet or via the serial port. It is recommended to configure the device for the first time with the serial port. **Use the serial port if the current GMT IP address is not recognized and the Ethernet network being used does not support the UDP protocol.**

## 2.3.1 Serial Port

To use the serial port, close the GMT dip switch 1 (SW3 bank). Open it again at the end of configuration, otherwise the Ethernet connection will not work.

Select "Serial port" and click on "Finish".

The program will display the following window:



It will then be possible to select the serial port to be used and to set the configuration parameters (baud rate, parity, etc.) for the selected port by clicking on "Configure".

By default, the GMT is configured for 9600 baud, no parity, 1 start bit and 1 stop bit.

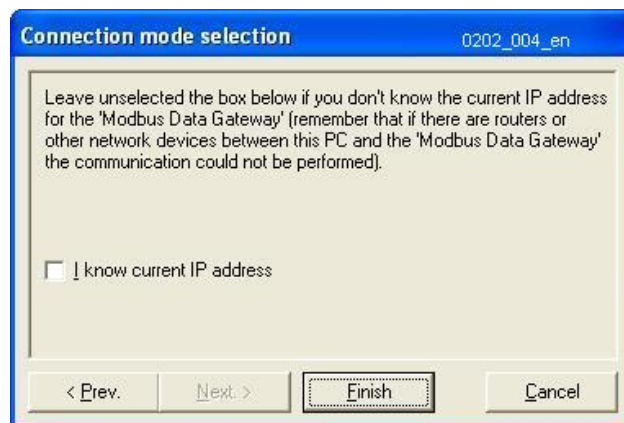
Once finished, click on "OK" (further details in section 2.3.3).

## 2.3.2 Ethernet

To use the Ethernet network for configuration, open the GMT dip switch 1 (SW3 bank).

Select "**Ethernet**" and click on "**Next**".

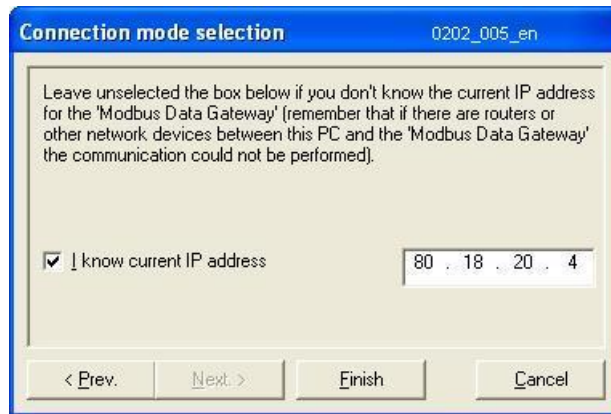
The program will display the following window:



If the current GMT IP address is unknown, leave the "I know current IP address" option unselected. In this case, the program will search for all the GMT connected online, by means of the UDP protocol. When the search is complete, select the desired GMT identified by its serial number. If the network does not support UDP protocol, it is not possible to select the previous option.



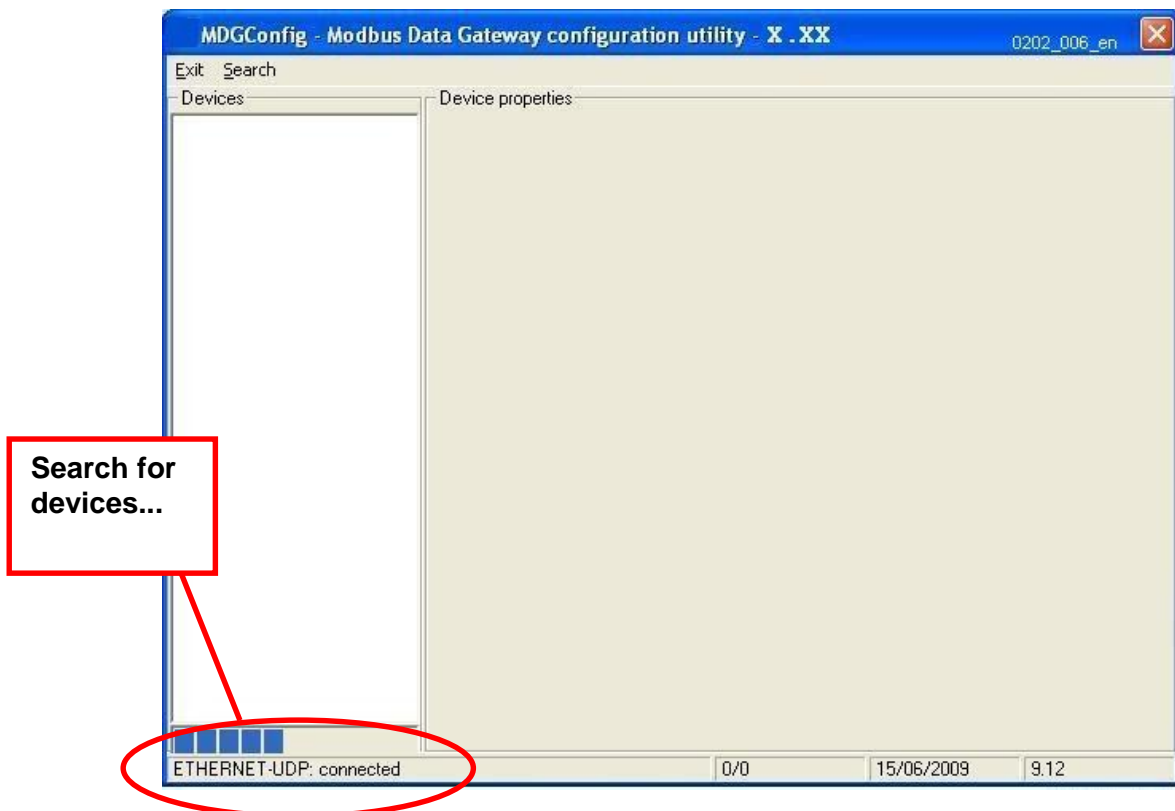
If the IP address is known, select the previous option and type this address in the relevant field (displayed when selecting the option):



Click on "Finish" (further details in section 2.3.3).

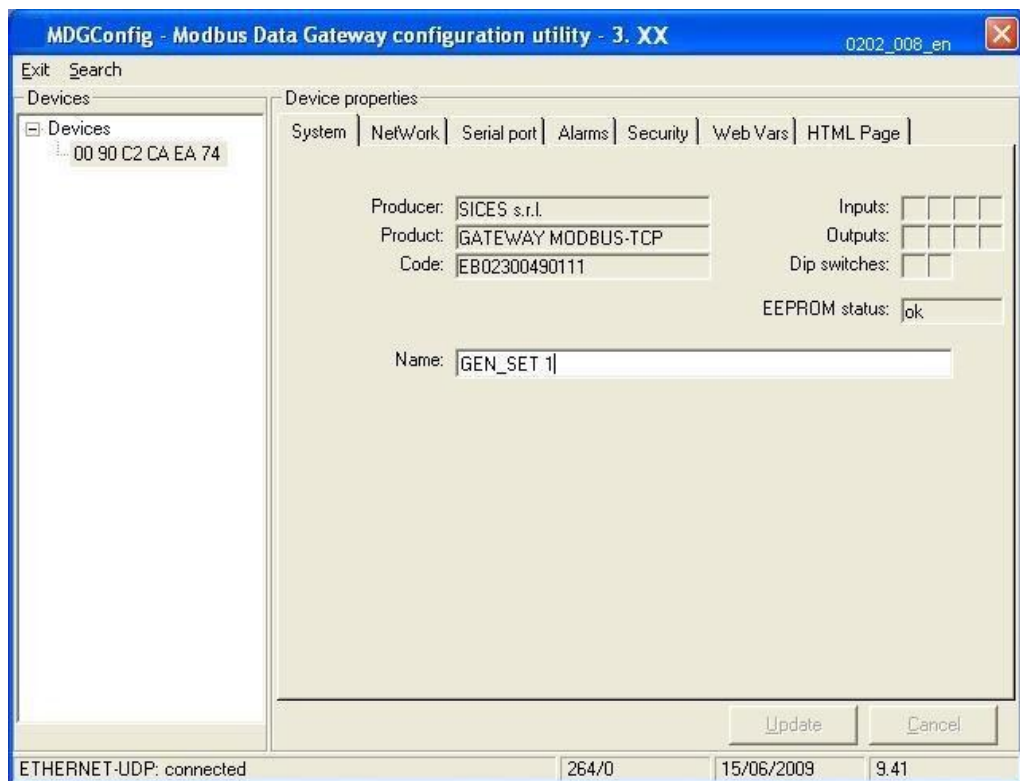
### 2.3.3 GMT Search

The program will now try to contact the GMT(S) online. The following window will be displayed during the search:



Once finished, the detected GMT list will be displayed in the left hand side of the window above (if no GMT is detected, an error message will be displayed). Each GMT is displayed with its network interface MAC address, which is unique. Click on one of them to start the configuration.

## 2.4 Configuration Window



From here, it is possible to configure all the GMTs connected to the Ethernet network or to the PC serial port.

The menu bar is at the top of the window. It only has two items:

- **Exit:** To close the program
- **Search:** To search for GMTs, as described in the previous section.

The status bar is at the bottom of the window. It displays information about the application status, but no controls can be performed from here (there are some exceptions). The displayed information (from left to right) is:

The used communication device (Ethernet or serial port) and the communication status.

A counter for the ModBus/TCP messages sent in the Correct/Wrong format. This counter will be reset by double-clicking on it.

The current system date and time.

On the left hand side, there is a list of all the GMTs detected (listed according to their network interface MAC address).

On the right hand side of the window, once a GMT is selected, all the configuration tools are displayed.

There are five steps for the configuration, respectively in the "System", "Network", "Serial port", "Alarms" and "Security" tabs (the "Alarms" tab might not be displayed if not supported by the GMT). The first step is shown in the previous figure. This step is for configuring the name for the GMT. In addition, the information acquired by the GMT are displayed:

Three fields that identify the manufacturer, the product, and the software release installed.

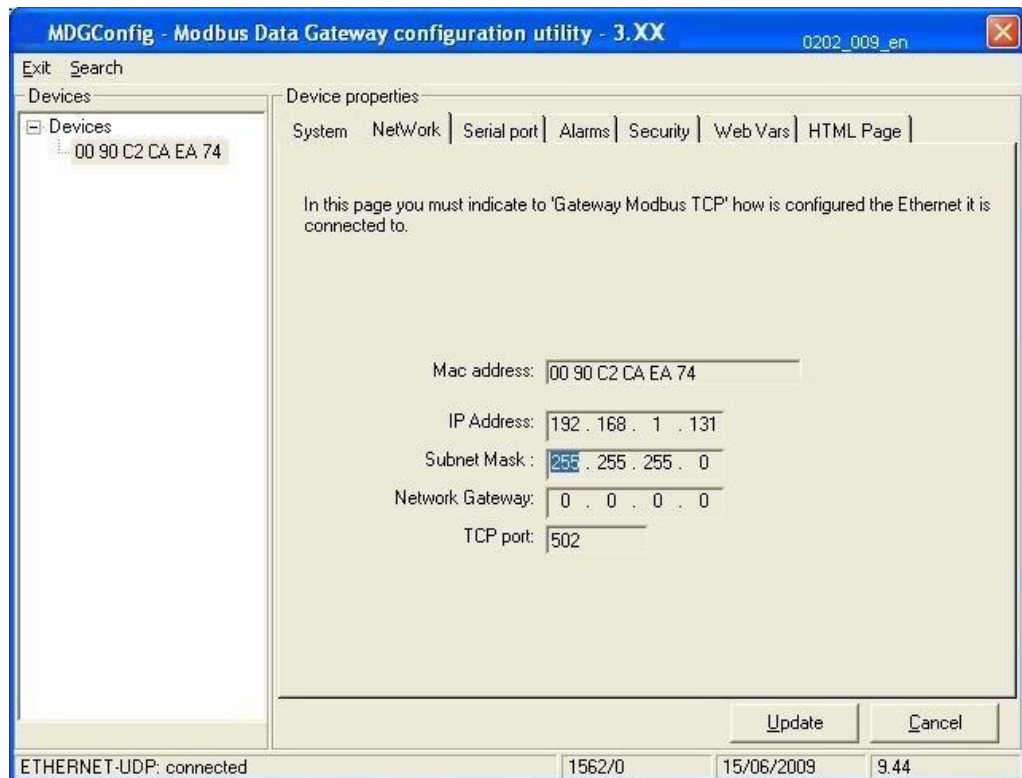
The input status (the boxes are red if the relevant inputs are active).

The output status (the boxes are red if the relevant outputs are active). Double-click on an output box to change its status.

The status of the two dip switches of the SW3 bank.

The status of the board non-volatile memory.

Click on the "Network" tab to display the following window:

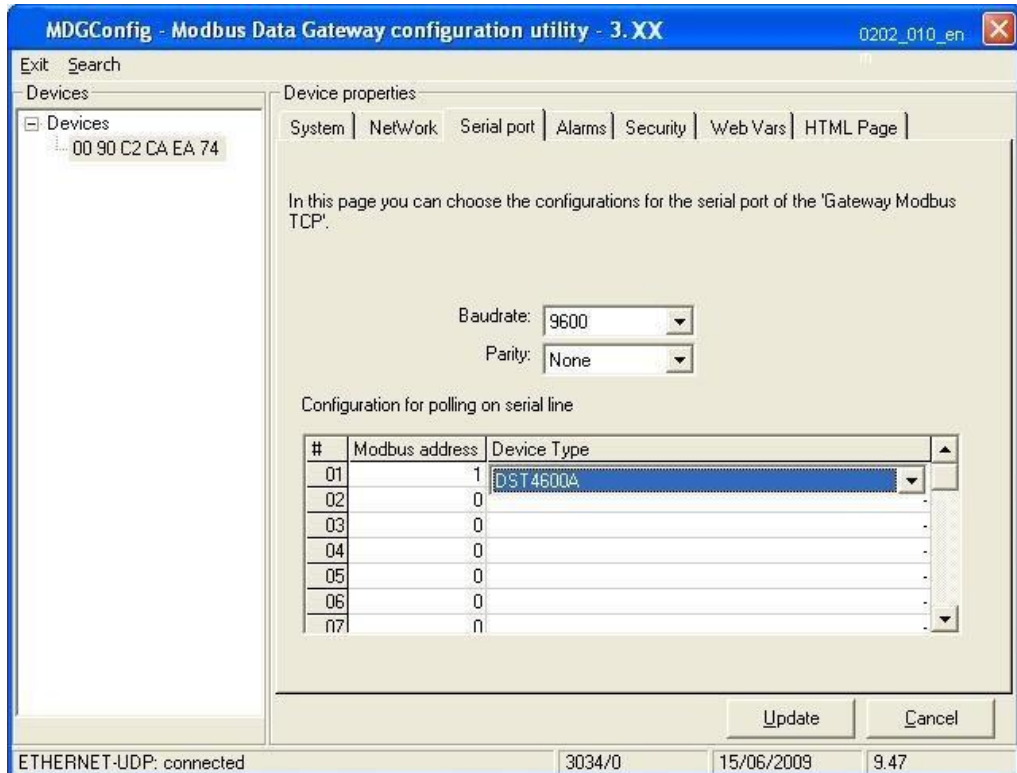


This tab is for configuring the GMT Ethernet. An IP address is assigned to the GMT, the "subnet mask" for its network and the TCP port to be used are configured. For the first two pieces of information, contact the network administrator (see chapter 1 for notes on the DHCP protocol). The TCP port should always be set at 502, if possible.

It is also possible to set the network gateway IP address (router, or other) for those cases when the GMT and the PC it should work with are in two separate networks (ask the network administrator).

At the top of the tab, the network interface MAC address is displayed.

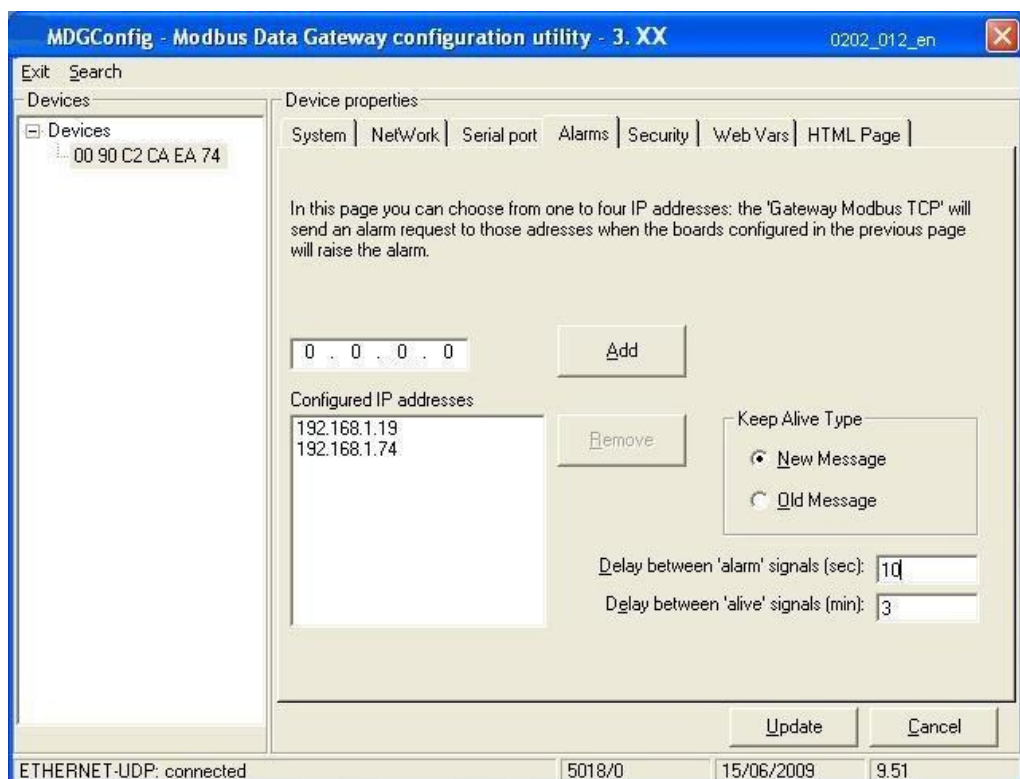
Click on the "Serial port" tab to display the following window:



This tab is for configuring the GMT serial port. Communication speed and parity type are configured here.

If Sices boards are used to control the gen-sets, a list (by type and serial address) of devices can be created: this list will be periodically checked by the GMT if the Ethernet connection is not active, in order to detect possible faults and notify them on the Ethernet. Up to 16 devices can be configured.

Click on the "Alarms" tab to display the following window:

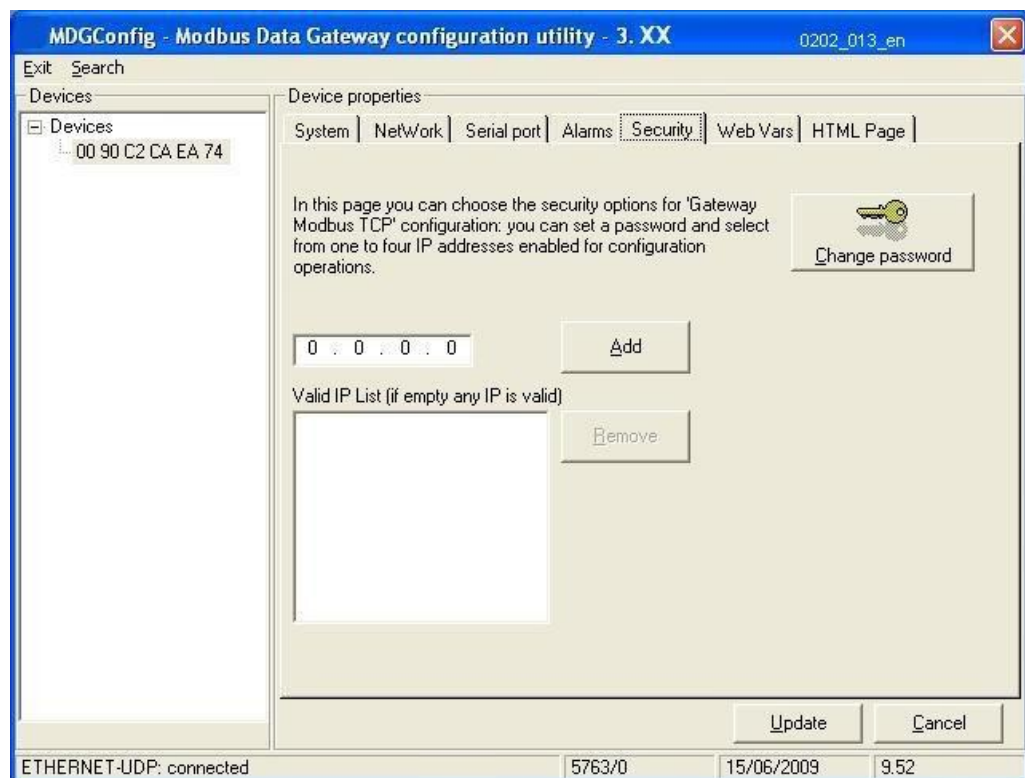


This tab is for configuring the IP addresses where to send messages for possible alarms detected on SICES boards connected to the GMT serial port. If the list "Configured IP addresses" is left empty, the alarm messages will be sent in 'broadcast' mode (that is to all the PCs connected on the network) by means of the UDP network protocol. If the network does not support this protocol (or the 'broadcast' mode), up to four IP addresses can be added to the above-mentioned list: the alarm messages will be sent only to these IP addresses. To add an IP address, type it in the field above the list, then click on "Add". To remove an IP address from the list, click on it from the list and then click on "Remove".

When one of the SICES boards connected to the serial port is in an alarm status, the GMT sends one or more network messages at regular intervals. The box "Delay between alarm signals" allows setting a delay (in seconds) between these two messages.

By setting a value different from 0 in the box "Delay between 'alive' signals", the GMT will send a Keep Alive network message at regular intervals. The aim of this message is to inform those PCs that are connected that the GMT is working correctly. This message also includes a status indicator for the serial communication with the SICES boards, so that the PC can detect faults also between the GMT and the boards. These messages are sent to the same IP address than for the alarms (or in 'broadcast' mode if no IP address is set).

Click on the "Security" tab to display the following window:



This tab is for configuring the GMT security options. It is possible to set a password, which will be required when connecting for Ethernet configurations. In addition, it is possible to create a list of up to four IP addresses for Ethernet connection. If no address is set, the Ethernet connection is available from any IP address. If the network uses the DHCP, this function cannot be used, since not all the networked PC addresses are known or are unmodified.

Once all the steps have been performed, even if only one option has been changed, the "Update" button will be enabled. The configuration will be sent to the GMT by clicking on it (NB: if the program is closed, another GMT is selected, or a new search is launched without first clicking on "Update", the configurations made will be lost). By clicking on "Cancel", it will be possible to read the current configuration from the GMT (this is an automatic operation performed when clicking on a GMT on the left hand side of the window).

### 3. ModBus protocol

The Modbus communication protocol is used in RTU mode. The equivalent ModBus/TCP protocol is used for Ethernet. The indications in this chapter apply to both versions of the protocol.

#### 3.1 ModBus commands implemented.

The GMT recognizes the following standard ModBus commands:

COMMAND	DESCRIPTION
03	Read Holding Register
04	Read Input Register
06	Preset Single Holding Register
16	Preset Multiple Holding Register
17	Report Slave ID
22	Mask Write Holding Register
23	Read and Write Holding Register
43	Read device ID

#### 3.2 Data Transfer Formats

The GMT doesn't implement the ModBus command that allow the transfer of information Boolean. as a matter of fact that there are MODBUS sub-assemblies (e.g. JBUS) intended for that specific purpose. By using only the mentioned commands to transfer all the information, the GMT is compatible with these MODBUS derived protocols.

The above facts do not mean that the GMT do not use bit information. In fact the latter information is compacted in a (16 bits) MODBUS register that is to be interpreted bit by bit. In the specific device documents a table showing the information associated with each bit is provided, together with the corresponding bit value.

Numerical information could be absolute or  $\pm$  values (the most part are absolute values). The  $\pm$  variables are transmitted by using the "complement to two" approach. With such an approach a negative value is transmitted by inverting all the bits of the relevant absolute value and summing 1. As a result, the negative values are identified by numbers having the most significant bit equal to 1. All the numerical pieces of GMT information are displayed with the relevant physical measurement units. In some instances the physical unit values are acquired and sometimes displayed by the devices with a somewhat higher accuracy by including the decimals. The decimals are also transmitted via MODBUS.

The tables shown in the specific device documents report for each register the availability of decimal values, together with the related number of bits. A zero decimal bits register has no decimal content. The decimal bits are positioned as the less significant bits. E.g. an eight decimal bits register has the decimal bits in the 8 less significant positions. To obtain the value of the register from the relevant binary information, the register must be divided by two raised to the number of decimal bits.

It should be noted that the above considerations (parameter sign and decimal part of the register) could be all applied to a single information. In the following part of this paragraph are described in detail the codes used in this document to describe the information transferred through the MODBUS protocol.

##### 3.2.1 BOOL\_XX

This code identifies a bit data information string. The information might be contained in one or more contiguous registers. The "XX" field identifies the number of registers used to the purpose of recording the information. In the specific device paragraphs, a table is included providing the description of what is associated with each bit of the relevant MODBUS registers.

### 3.2.2 US\_XX

This code identifies unsigned numerical information associated with a max of 16 bits. Some few bits could represent the decimal part of the numerical information. The “XX” field indicates the number of decimal bits. This type of information uses always a single register.

The minimal register value, in this format, is zero.

The max value is 65535  $((2^{16})-1)$  divided by two raised to the number of decimal bits.

N° of decimal bits	Formula	Maximum value
0	$65535 / (2^0)$	65535
4	$65535 / (2^4)$	4095,9375
8	$65535 / (2^8)$	255,99609375
12	$65535 / (2^{12})$	15,999755859375

Few examples follow:

- 1) **US\_00** (no decimals)  
While reading 11405 (0x2C8D) from the MODBUS register, to find the actual value it is needed to:
  - a) divide by two rose to the number of digital bits  $\rightarrow 11405 / (2^0) = 11405$ .  
I.e. the register number 11405 represents actually the value 11405.
- 2) **US\_08** (eight decimal bits).  
While reading 11405 (0x2C8D) from the MODBUS register, to find the actual value it is needed to:
  - a) divide by two raised to the number of digital bits  $\rightarrow 11405 / (2^8) = 44,55078125$ .  
I.e. the number 11405 represents the value 44,55078125.

### 3.2.3 UL\_XX

This code identifies unsigned information using up to 32 bits. Some few bits might represent the decimal part of the information. The field “XX” indicates the number of decimal bits. The information uses always two registers.

The minimum information value in this format is zero.

The max information value is 4294967295  $((2^{32})-1)$  divided by two raised to the number of digital bits.

N° of decimal bits	Formula	Max value
0	$4294967295 / (2^0)$	4294967295
8	$4294967295 / (2^8)$	16777215,99609375
16	$4294967295 / (2^{16})$	65535,9999847412109375
24	$4294967295 / (2^{24})$	255,999999940395355224609375

Some few examples follow:

- 1) **UL\_00** (no decimal bits).  
While reading 34464 in the lower index register and 1 in the upper index register, to find the actual value it is needed to:
  - a) Multiply the upper register by  $(2^{16})$   $\rightarrow 1*65536 = 65536$
  - b) Sum the lower register  $\rightarrow 65536+34464 = 100000$
  - c) Divide by two raised to the number of digital bits  $\rightarrow 100000 / (2^0) = 100000$
 Therefore the couple of registers: 34464 (lower) and 1 (upper) represent the value 100000.
- 2) **UL\_08** (eight decimal bits).  
While reading 34464 in the lower index register and 1 in the upper index register, to find the actual value it is needed to:
  - a) Multiply the upper register by  $(2^{16})$   $\rightarrow 1*65536 = 65536$
  - b) Sum the lower register  $\rightarrow 65536+34464 = 100000$
  - c) Divide by two raised to the number of decimal bits  $\rightarrow 100000 / (2^8) = 390,625$
 Therefore the couple of registers 34464 (lower) e 1 (upper) represent the value 390,625.

### 3.2.4 DOT\_02

This code indicates numeric information without a sign expressed in 32 bits, representing the points style of the IP addresses. The information always occupies two registers. DOT\_02 could be the IP address, which is transferred using the holding registers 40127-40128. The IP address is assumed to be 192.168.1.2 for example. It will be transferred as follows:

Register	Value (HEX)	Low part	High part
40127	0x0102	(0x02) 2	(0x01) 1
40128	0xC0A8	(0xA8) 168	(0xC0) 192

### 3.2.5 STR\_XX

This code identifies an ASCII type string of information. The information might be located in one or more contiguous registers. The XX field indicates the number of registers. The strings are transferred via MODBUS by recording two characters per register and using a number of consecutive registers. As an example the string might represent the GMT name (that will be therefore identified by using the STR\_20 code). The GMT name consists therefore of max 40 characters (20 registers by 2 characters). The string terminator or ASCII 00 must also be included. As an example the name "NUOVO IMPIANTO" will be transferred as:

Register	HEX Value	Lower Section	Upper Section
40105	0x554E	0x4E ("N")	0x55 ("U")
40106	0x564F	0x4F ("O")	0x56 ("V")
40107	0x204F	0x4F ("O")	0x20 (" ")
40108	0x4D49	0x49 ("I")	0x4D ("M")
40109	0x4950	0x50 ("P")	0x49 ("I")
40110	0x4E41	0x41 ("A")	0x4E ("N")
40111	0x4F54	0x54 ("T")	0x4F ("O")
40112	0x0000	0x00 (terminator)	0x00 (terminator)
40113	0x0000	0x00 (terminator)	0x00 (terminator)
40114	0x0000	0x00 (terminator)	0x00 (terminator)
40115	0x0000	0x00 (terminator)	0x00 (terminator)
40116	0x0000	0x00 (terminator)	0x00 (terminator)
40117	0x0000	0x00 (terminator)	0x00 (terminator)
40118	0x0000	0x00 (terminator)	0x00 (terminator)
40119	0x0000	0x00 (terminator)	0x00 (terminator)
40120	0x0000	0x00 (terminator)	0x00 (terminator)
40121	0x0000	0x00 (terminator)	0x00 (terminator)
40122	0x0000	0x00 (terminator)	0x00 (terminator)
40123	0x0000	0x00 (terminator)	0x00 (terminator)
40124	0x0000	0x00 (terminator)	0x00 (terminator)

### 3.2.6 SHEX\_XX

This code identifies a string of HEX of information. The information might occupy one or more contiguous registers. The XX field indicates the number of registers. The hex strings are transmitted via MODBUS by recording four hexadecimal digits per register and using a number of consecutive registers. An example of a string can be the MAC of the network that is transferred by using the 30103-30105 input registers (identified with the SHEX\_03 code). The MAC consists therefore of 12 hex digits (# 3 registers by 4 digits each). As an example the MAC serial number "00008EF94CT" is transferred as follows:

Register	HEX value
30103	0x94C7
30104	0x08EF
30115	0x0000

### 3.2.7 Registers assignment

Some registers are reserved to specific functions to be assigned later on. Some others have limited applicability, due to the device configuration, or limited accessibility (write or read only). Limitations are identified with the # symbol in the following tables, at the fourth column. A detailed description is provided in the register description paragraph.



## 3.3 Summary of registers

### 3.3.1 Input Registers

Register	Format	QUANTITY	M.U.
30001	BOOL_01	Digital input state	-
30002	BOOL_01	Dip switch state	-
30003	SHEX_03	Network interface MAC address	-

### 3.3.2 Holding Registers

Register	Format	QUANTITY	M.U.
40001	BOOL_01	Digital output state	-
40002	US_00	# Controls	-
40101	STR_04	# Password	-
40105	STR_20	Name associated with GMT	-
40125	DOT_02	Network sub-net mask	-
40127	DOT_02	IP address associated with GMT	-
40129	US_00	TCP port to use	-
40130	DOT_02	1st IP address from which a connection is accepted	-
40132	DOT_02	2nd IP address from which a connection is accepted	-
40134	DOT_02	3rd IP address from which a connection is accepted	-
40136	DOT_02	4th IP address from which a connection is accepted	-
40138	UL_00	Serial port baud rate	Baud
40140	US_00	Serial port parity type	-
40141	US_00	1st serial address for automatic scanning	-
40142	US_00	2nd serial address for automatic scanning	-
40143	US_00	3rd serial address for automatic scanning	-
40144	US_00	4th serial address for automatic scanning	-
40145	US_00	5th serial address for automatic scanning	-
40146	US_00	6th serial address for automatic scanning	-
40147	US_00	7th serial address for automatic scanning	-
40148	US_00	8th serial address for automatic scanning	-
40149	US_00	9th serial address for automatic scanning	-
40150	US_00	10th serial address for automatic scanning	-
40151	US_00	11th serial address for automatic scanning	-
40152	US_00	12th serial address for automatic scanning	-
40153	US_00	13th serial address for automatic scanning	-
40154	US_00	14th serial address for automatic scanning	-
40155	US_00	15th serial address for automatic scanning	-
40156	US_00	16th serial address for automatic scanning	-
40157	US_00	1st type of device for automatic scanning	-
40158	US_00	2nd type of device for automatic scanning	-
40159	US_00	3rd type of device for automatic scanning	-
40160	US_00	4th type of device for automatic scanning	-
40161	US_00	5th type of device for automatic scanning	-
40162	US_00	6th type of device for automatic scanning	-
40163	US_00	7th type of device for automatic scanning	-
40164	US_00	8th type of device for automatic scanning	-
40165	US_00	9th type of device for automatic scanning	-
40166	US_00	10th type of device for automatic scanning	-
40167	US_00	11th type of device for automatic scanning	-

Register	Format		QUANTITY	M.U.
40168	US_00		12th type of device for automatic scanning	-
40169	US_00		13th type of device for automatic scanning	-
40170	US_00		14th type of device for automatic scanning	-
40171	US_00		15th type of device for automatic scanning	-
40172	US_00		16th type of device for automatic scanning	-
40173	US_00		Non-volatile memory state	-
40174	DOT_02		Network gateway IP address (router or other)	-
40176	DOT_02		1st IP address for alarm transmission	-
40178	DOT_02		2nd IP address for alarm transmission	-
40180	DOT_02		3rd IP address for alarm transmission	-
40182	DOT_02		4th IP address for alarm transmission	-
40184	US_00		Delay between two network alarm messages	Sec
40185	US_00		Delay between two "live" network messages	Min
40201	STR_04	#	Login Password	-
40301	DOT_02	#	IP address (for fault reporting)	-
40303	US_00	#	1st serial address of device in alarm state	-
40304	US_00	#	2nd serial address of device in alarm state	-
40305	US_00	#	3rd serial address of device in alarm state	-
40306	US_00	#	4th serial address of device in alarm state	-
40307	US_00	#	5th serial address of device in alarm state	-
40308	US_00	#	6th serial address of device in alarm state	-
40309	US_00	#	7th serial address of device in alarm state	-
40310	US_00	#	8th serial address of device in alarm state	-
40311	US_00	#	9th serial address of device in alarm state	-
40312	US_00	#	10th serial address of device in alarm state	-
40313	US_00	#	11th serial address of device in alarm state	-
40314	US_00	#	12th serial address of device in alarm state	-
40315	US_00	#	13th serial address of device in alarm state	-
40316	US_00	#	14th serial address of device in alarm state	-
40317	US_00	#	15th serial address of device in alarm state	-
40318	US_00	#	16th serial address of device in alarm state	-
40319	US_00	#	1st device off-line serial address	-
40320	US_00	#	2nd device off-line serial address	-
40321	US_00	#	3rd device off-line serial address	-
40322	US_00	#	4th device off-line serial address	-
40323	US_00	#	5th device off-line serial address	-
40324	US_00	#	6th device off-line serial address	-
40325	US_00	#	7th device off-line serial address	-
40326	US_00	#	8th device off-line serial address	-
40327	US_00	#	9th device off-line serial address	-
40328	US_00	#	10th device off-line serial address	-
40329	US_00	#	11th device off-line serial address	-
40330	US_00	#	12th device off-line serial address	-
40331	US_00	#	13th device off-line serial address	-
40332	US_00	#	14th device off-line serial address	-
40333	US_00	#	15th device off-line serial address	-
40334	US_00	#	16th device off-line serial address	-

## 3.4 Detailed description of input registers

### 3.4.1 Register 30001

Contains the status of board digital inputs.

Bit	Description	Value
0	Input 1	1 = active, 0 = inactive
1	Input 2	1 = active, 0 = inactive
2	Input 3	1 = active, 0 = inactive
3	Input 4	1 = active, 0 = inactive
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

### 3.4.2 Register 30002

Contains the status of the board dip switches.

Bit	Description	Value
0	Dip switch 1	1 = closed, 2 = open
1	Dip switch 2	1 = closed, 2 = open
2		
3		
4		
5		
6		
7		
8	Dip switch 1 on startup	1 = closed, 2 = open
9	Dip switch 2 on startup	1 = closed, 2 = open
10		
11		
12		
13		
14		
15		

### 3.4.3 Register 30003-005

Network interface MAC address on GMT. The MAC address is a unique 6-byte number for all global network interfaces.

## 3.5 Detailed description of holding registers

### 3.5.1 Register 40001

Contains the status of the board digital outputs.

Bit	Description	Value
0	Output 1	1 = active, 0 = inactive
1	Output 2	1 = active, 0 = inactive
2	Output 3	1 = active, 0 = inactive
3	Output 4	1 = active, 0 = inactive
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

### 3.5.2 Register 40002

The value of this register is not significant. The write operation will end the configuration process via an Ethernet network. It is a write-only register

### 3.5.3 Registers 40101-104

Write-only registers. To set password protection for configuration via Ethernet.

### 3.5.4 Registers 40105-124

For configuring the name to be associated with the GMT. This name may be used to identify separate GMTs if more than one is connected to the same network.

### 3.5.5 Registers 40125-126

Used to configure the sub-net mask of the network in which the GMT is installed. The subnet-mask is a 4-byte numeric value (e.g. 255.255.255.0).

### 3.5.6 Registers 40127-128

Used to configure the GMT IP address. The IP address is a 4-byte numeric value (e.g. 192.168.1.1).

### 3.5.7 Register 40129

For configuring the TCP port to use. The TCP port is a 16-bit numerical value. Always use value 502 if possible.

### 3.5.8 Registers 40130-131, 40132-133, 40134-135, 40136-137

Used to configure the IP addresses enabled for Ethernet connection. If the IP address is 0.0.0.0 the address has not been set. If none of the four addresses has been set, an Ethernet connection will be accepted from any IP address.

### 3.5.9 Registers 40138-139

Used to configure the serial port communication speed. It is directly expressed in baud (set 9600 for a baud rate of 9600).

### 3.5.10 Register 40140

Used to configure the type of parity to use for the serial port. The following values can be used:

- 0: no parity
- 1: odd parity
- 2: even parity

### 3.5.11 Registers 40141-156

Used to configure the addresses of devices connected to the serial port which must be automatically controlled by the GMT in order to detect anomalies and report the same via Ethernet (only valid for Sices boards). The address may be 1..247, disabled if set to 0.

### 3.5.12 Registers 40157-172

Used to configure the type of devices connected to the serial port which must be automatically controlled by the GMT in order to detect anomalies and report the same via Ethernet (only valid for Sices boards). The following values can be used:

- 0: disabled
- 1: DST4600A
- 2: DST4601, DST4400, GDC

### 3.5.13 Register 40173

Indicates the status of board's non-volatile memory. The following values can be used:

- 0: errors
- 1: no error
- 2: default configuration values

### 3.5.14 Registers 40174-175

Used to configure the IP address associated with the network gateway (router or other) if the GMT and PC you are connecting are on two different Ethernet networks.

### 3.5.15 Registers 40176-177, 40178-179, 40180-181, 40182-183

Used to configure the IP address to which alarm and "live" messages will be sent. If the IP address is 0.0.0.0 the address has not been set. If none of the four addresses is set, the alarm and "live" messages will be broadcast with UDP.

### 3.5.16 Register 40184

Used to configure the delay (in seconds) with which alarms are sent over the network.

### 3.5.17 Register 40185

Used to configure the delay (in minutes) with which messages are sent "live" over the network.

### 3.5.18 Registers 40201-204

Write-only registers. Used to provide a password (login) when you start a configuration operation via Ethernet and the GMT is protected.

### 3.5.19 Registers 40301-302

Read-only registers: indicate the IP address of the GMT. Used for automatic anomaly reporting in a network on devices connected to the serial port.

### 3.5.20 Registers 40303-318

Read-only registers: contain the addresses of devices in a state of alarm connected to the serial port. Used for automatic anomaly reporting in a network on devices connected to the serial port. Value 0 means the device is not in a state of alarm.

### 3.5.21 Registers 40319-334

Registers are read-only: they contain the addresses of the off-line devices connected to the serial port (do not respond to GMT queries). A value of 0 means the device is online.

## 4. Reporting faults via Ethernet

When used with Sices generator management boards, a list of devices can be configured (by type and serial address) that the GMT will periodically check when it has no active Ethernet connection, to detect any anomalies and report them via Ethernet. You can configure up to 16 devices. When an anomaly is detected, a message is sent every five seconds using UDP protocol to all the IP addresses configured (or broadcast if no IP has been configured). The message consists of the following:

- Eleven standard protocol header characters
- A character "R" (Ring)
- 6 bytes for the GMT MAC address (sender)
- 6 bytes for the MAC address of the receiver (broadcast, all 0xff)
- two characters as a transaction index
- two characters with the length in bytes of the following
- a standard "Preset Holding Register" message containing registers 40301 .. 40318, with the Modbus/TCP protocol. These registers contain the IP address of the GMT and the addresses of all the devices in a state of alarm.

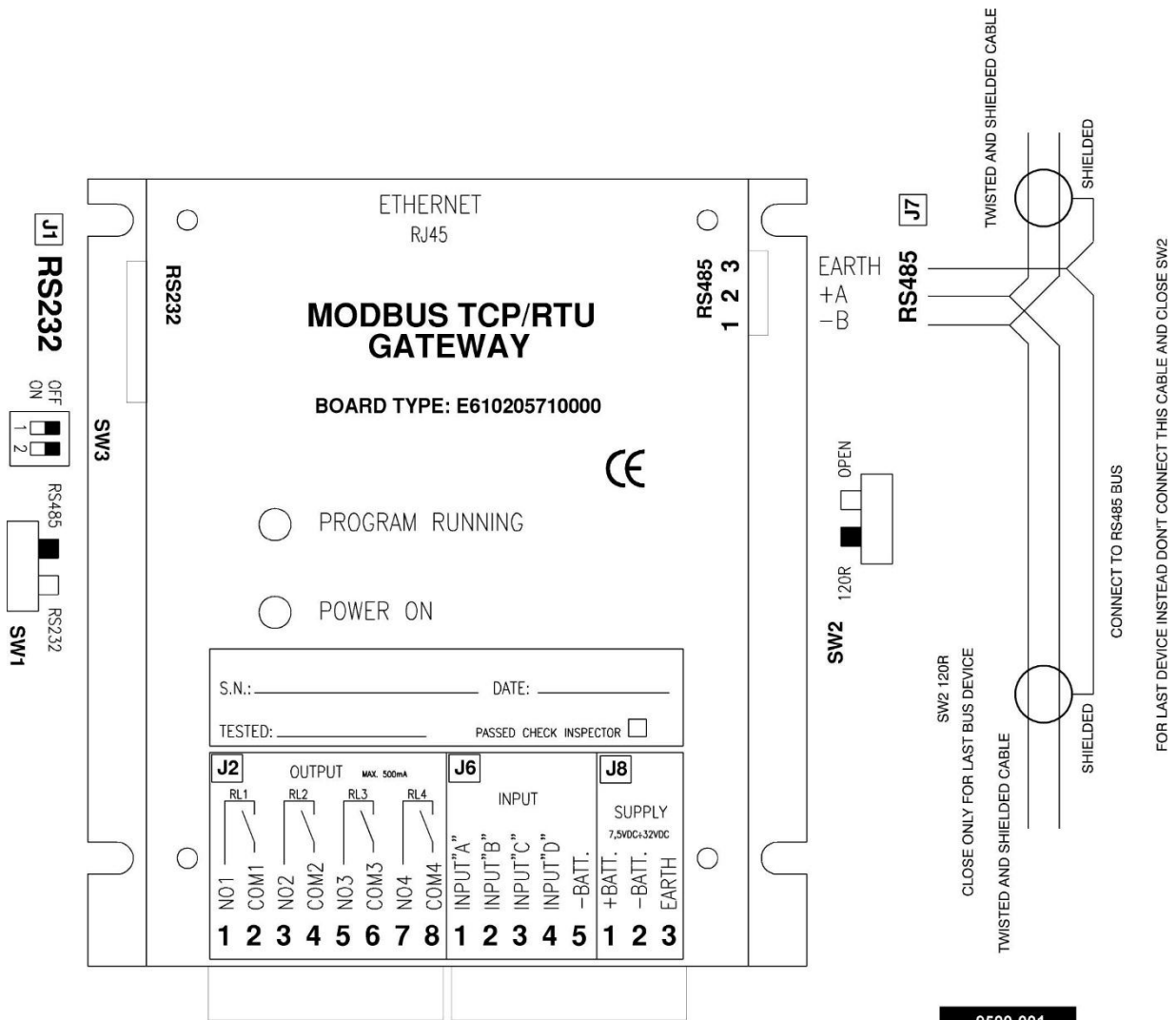
## 5. "Live" reporting via Ethernet

When properly configured, the GMT can periodically send a message via the network using UDP protocol to all the IP addresses configured (or broadcast if no IP address has been configured). This message reports the normal GMT performance (the absence of this message should trigger alarms on the controller PC). The message consists of the following:

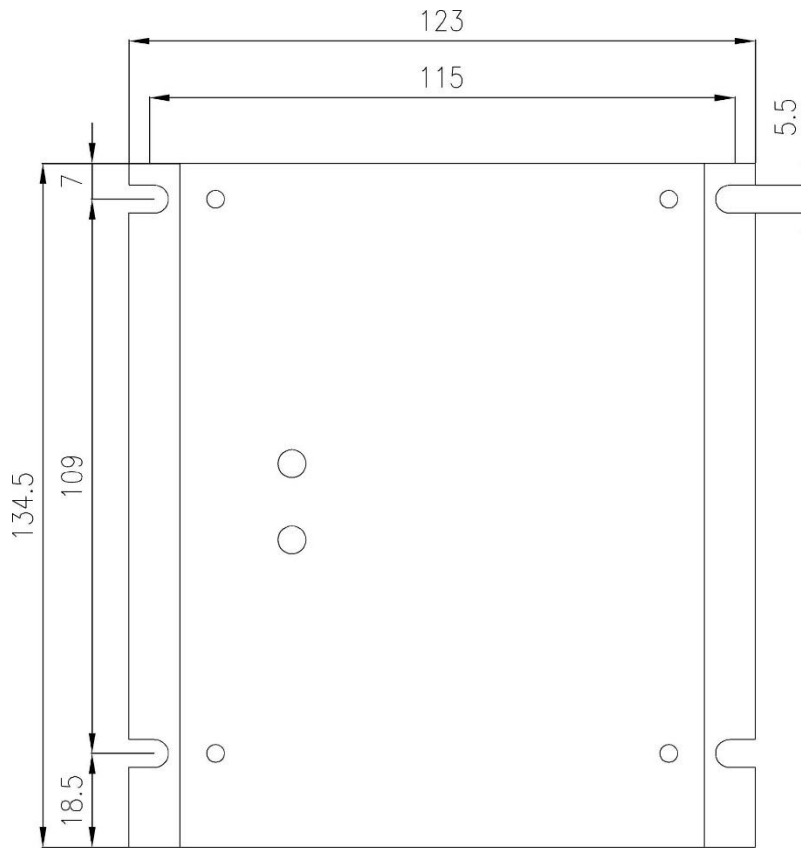
- Eleven standard protocol header characters
- An "L" (Live) character
- 6 bytes for the GMT MAC address (sender)
- 6 bytes for the MAC address of the receiver (broadcast, all 0xff)
- two characters as a transaction index
- two characters with the length in bytes of the following
- a standard "Preset Holding Register" message containing registers 40301 .. 40335, with Modbus/TCP protocol. These registers contain the IP address of the GMT and the addresses of all the devices in a state of alarm and all OFF-LINE devices.

## 6. Description of the hardware

### 6.1 View from above



## 6.2 Dimensions and drilling template for assembly



9500-002



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