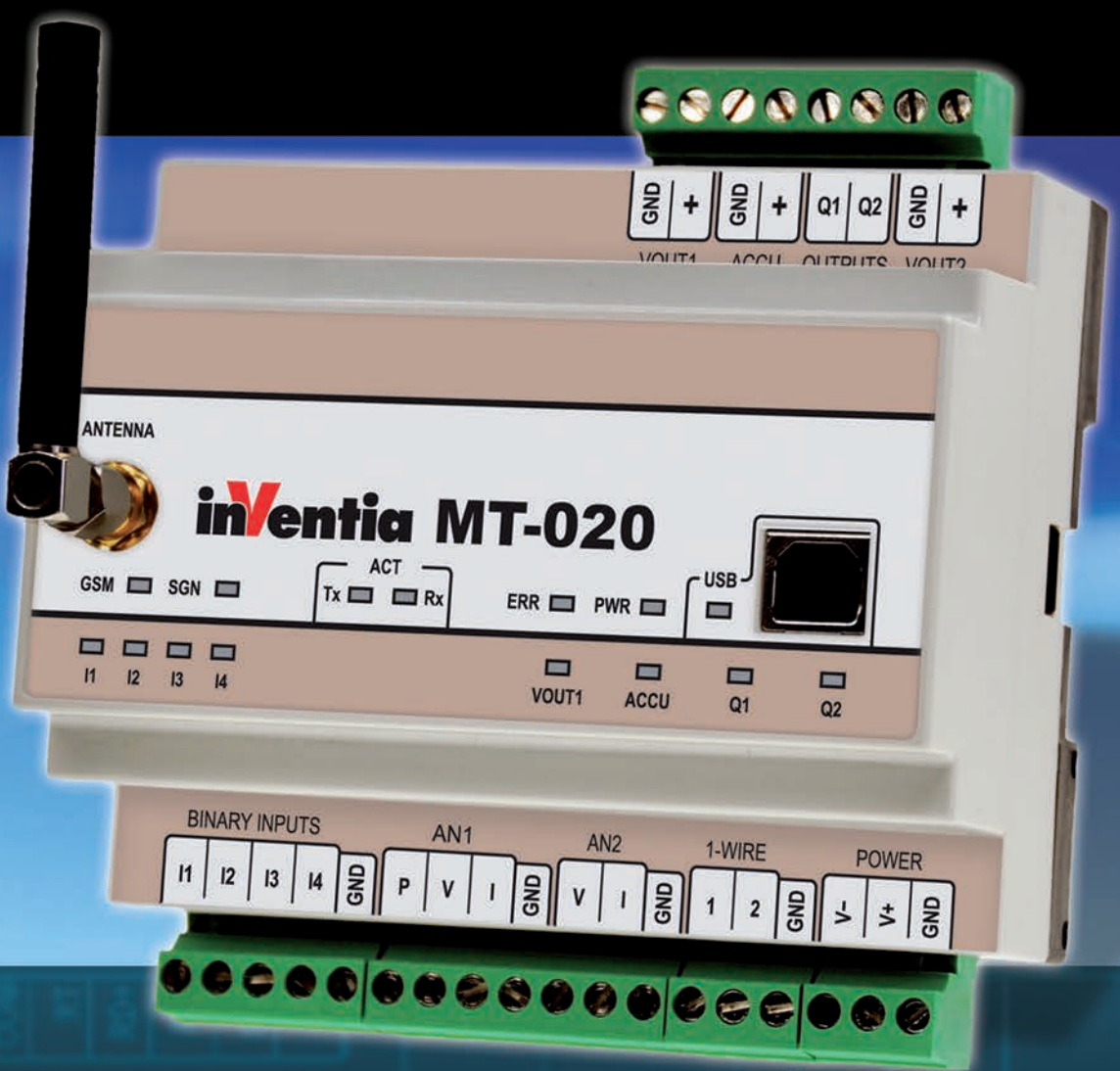
Telemetry Module MT-020

CE

User Manual



telemetria.pl

inVentia

CE

Telemetry Module
MT-020
User Manual

GSM/GPRS Telemetry Module
for monitoring and control

Class 1 Telecommunications Terminal
Equipment for GSM 850/900/1800/1900

MT-020

INVENTIA Sp. z o.o

v1.00

MT-020

Publisher:

INVENTIA Sp. z o.o.
ul. Kulczyńskiego 14
02-777 Warszawa
Tel: +48 22 545-32-00
inventia@inventia.pl
www.inventia.pl

Version:

1.00
Warsaw, June 2014

MTC Compatibility:

1.00

INDEX

1. Module destination

Telemetry module MT-020, thanks to its very attractive price/performance ratio, is well suited for use in remote monitoring systems for small objects. It allows monitoring, diagnosis and control of remote objects via text messages (SMS and e-mail), CLIP calls and using data packet transmission of GPRS network. Configurable text messages with a fixed or variable content (e.g. containing current measurement value) are a convenient way to provide information to the monitoring center or directly to the defined staff phone numbers. Alarm messages can be generated upon binary inputs and binary outputs state change, when measured analog values cross alarm thresholds and from timer and counter flags.
Communication via GPRS enables secure and reliable communication with higher-order applications (SCADA, database) allowing to expand the capabilities of the monitoring system with remote communication with difficult to access or distant sites.
Industrial design , practical I/O resources and easy-to-use software tools as well as the possibility of remote management of module via SMS commands or GPRS are the biggest advantages of MT-020. Direct connection of temperature sensors lowers the cost of system building. 1-Wire inputs can be used for reading typical Dallas pellets for the purpose of identification and authentication. The module can work with humidity sensors, water level sensor, pressure transducers, flow sensors, smoke, gas, motion, shock and noise detectors, etc.
The module can be powered from a DC voltage source (9-30 VDC) and directly from the mains transformer (12-18 Vrms AC). Integrated circuit which controls and charges external battery ensures continuous system operation during power failures.

Basic features of the MT-020 module:

- Compact design
- A rich set of integral I/Os
- Support for the 1-Wire bus
- SMS and e-mail text messaging
- GPRS communication with a computer using provided free of charge MTDataProvider driver
- The possibility of spontaneous sending information (SMS/e-mail/GPRS data frames) in the case of predefined emergency situations
- Configuration via SMS, GPRS and locally via USB
- The possibility of powering from DC (9-30 V) or AC (12-18 Vrms) power source with optional backup battery

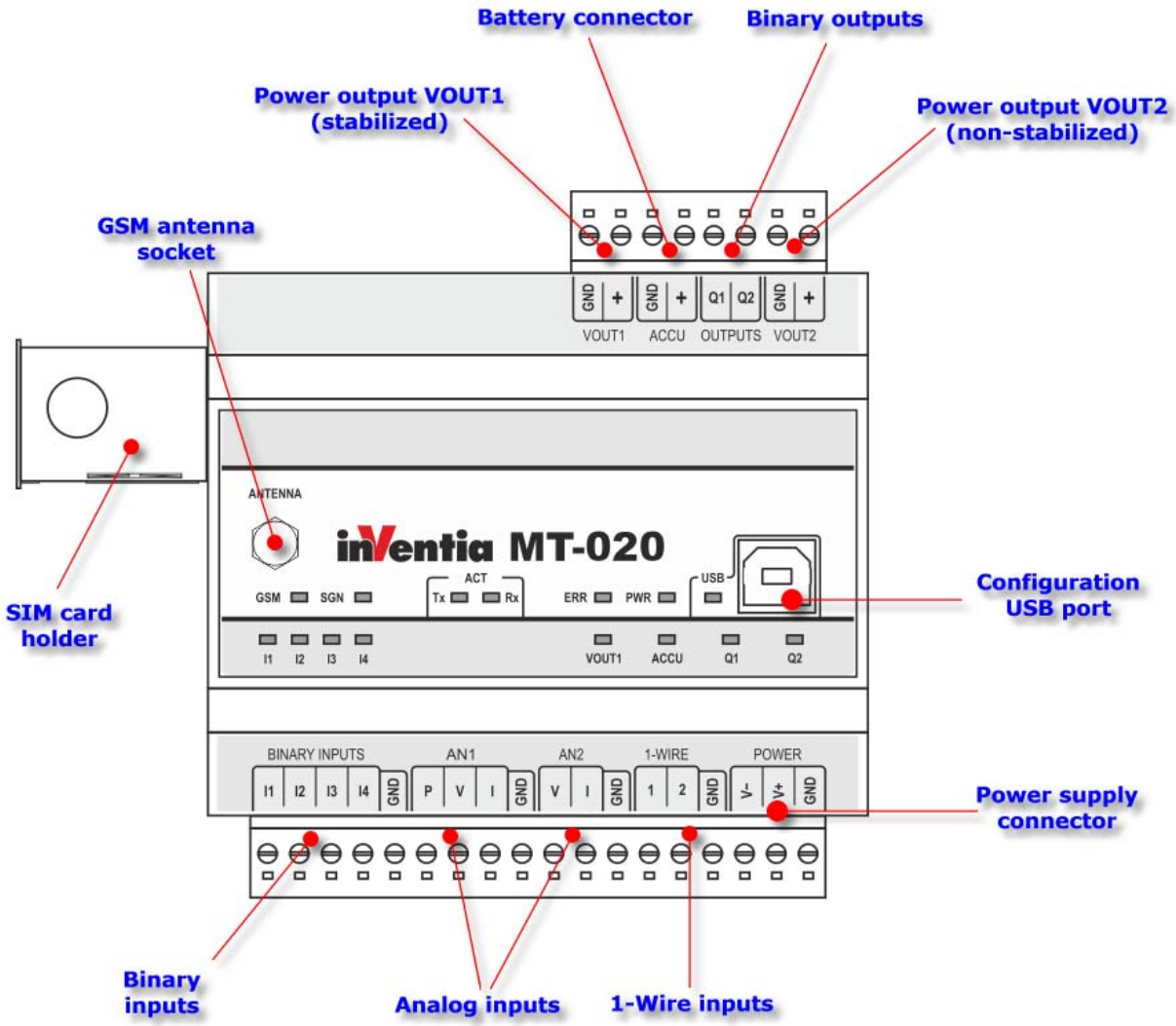
2. GSM requirements

For proper operation of the module a SIM card provided by a GSM operator with SMS/CLIP option enabled is essential. Enabled GPRS communication allows device to send e-mail and GPRS data frames.

A paramount condition for operation is securing the adequate GSM signal level in the place where module antenna is placed. Using the module in places where there is no adequate signal level may cause breaks in transmission and thereby data loss along with generating excessive transmission costs.

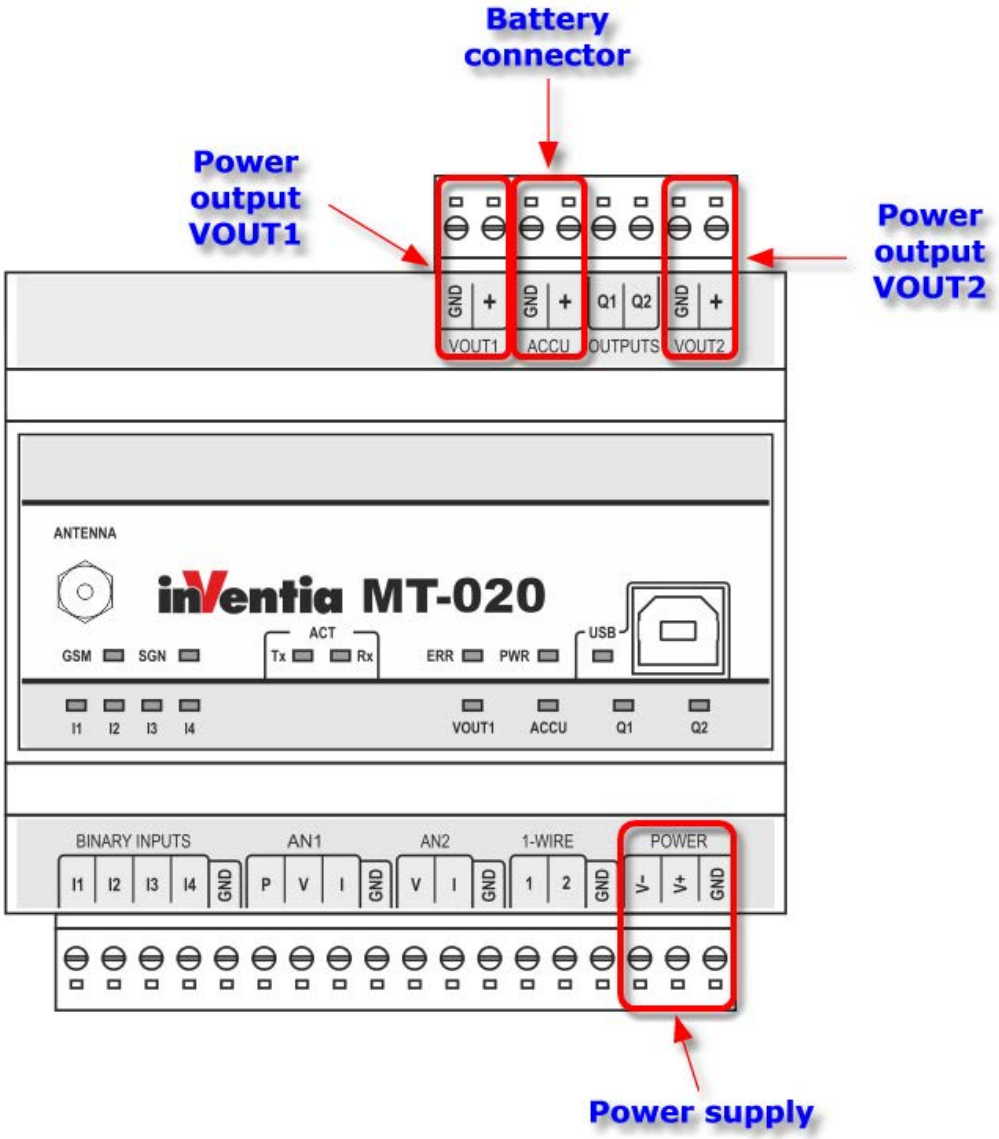
3. Module design

3.1. Module topography



3.2. Power supply and power outputs

MT-020 telemetry module can be powered from **9 - 30VDC** or **12- 18Vrms AC** power supply.



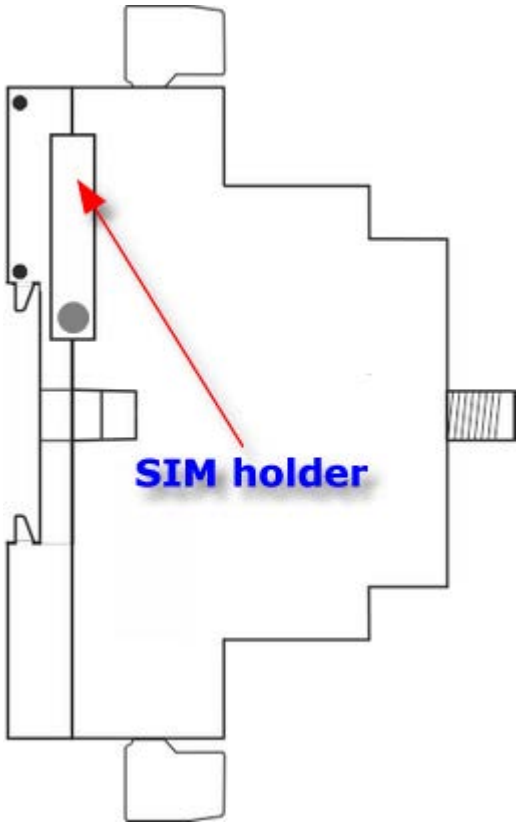
The Module has a backup battery connector allowing to connect SLA (Sealed Lead-Acid) or gel battery. Battery's nominal voltage should be **6V** and its capacity should be at least **1.3Ah**. Build-in battery charger automatically charges battery with configured current (0.4A or 0.8A) until it is fully charged. When main power is lost, the module automatically switches to battery power preserving continuous operation. When powered from the battery the module still provides power to external devices through power output VOUT1.
The Module controls battery voltage, signals when battery is depleted and turns off when battery is depleted to prevent damage.
MT-020 is equipped with two power outputs dedicated for powering external devices connected to MT-020:

- **VOUT1** - stabilized output with configurable voltage (**12VDC** or **20VDC**). It operates when the module is powered from mains power supply or battery.
- **VOUT2** - non-stabilized output with voltage of mains power supply voltage reduced by 1.5VDC . It operates only when the module is powered from battery.

NOTICE!
Exceeding the range of accepted power supply voltage may cause faulty operation or damage to the module!

3.3. SIM card

MT-020 telemetry module is equipped with standard miniature SIM card holder for connecting card to GSM modem.



Proper placement of the SIM card is imperative for module operation. The module accepts only SIM cards operating in 3.3V technology.

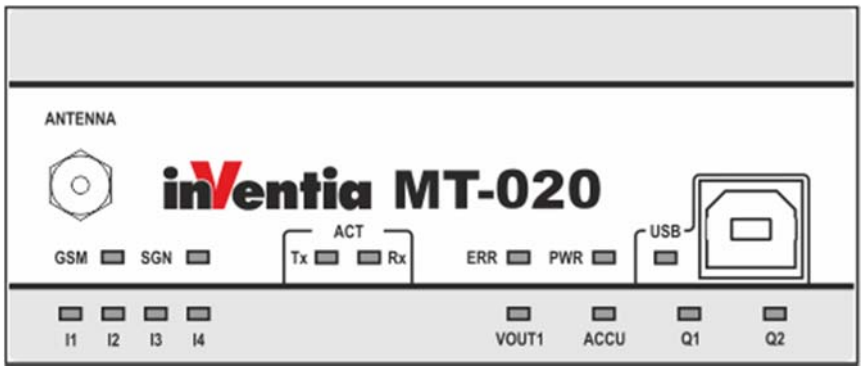
3.4. LED indicators

LED indicators placed on **MT-020** front panel are convenient during module's startup phase.

The LEDs have assigned following significance:

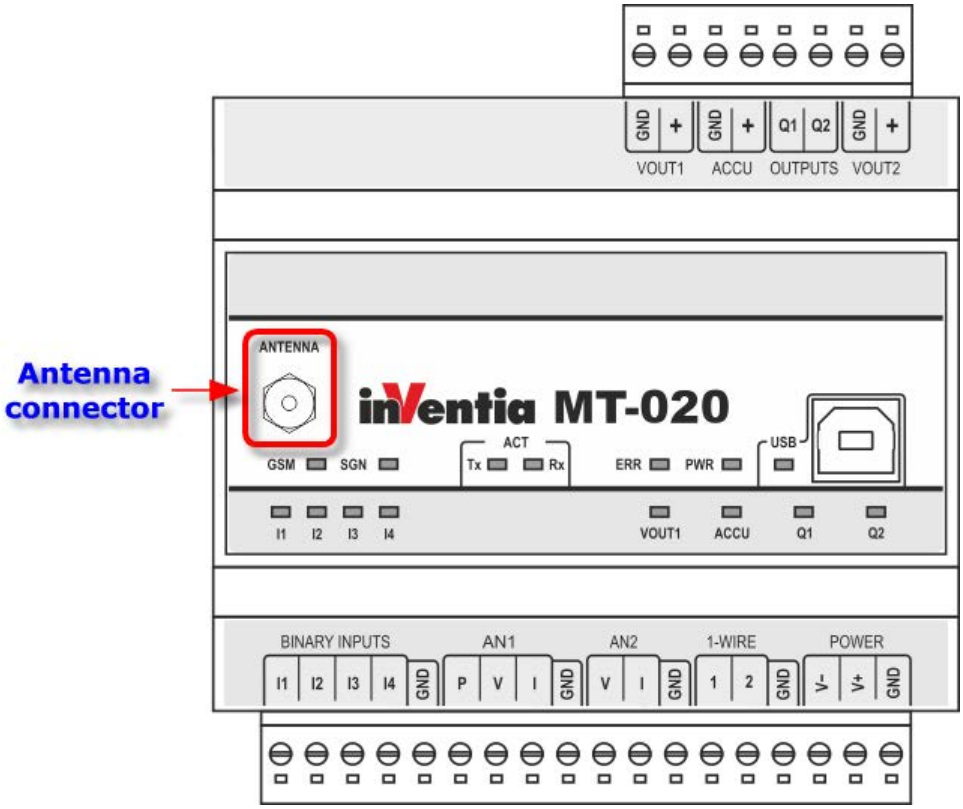
- **GSM** LED indicates GSM modem operating mode;
- **SGN** LED presents GSM signal strength;
- LEDs from **ACT** group (**Tx** and **Rx**) present GSM modem activity;
- **ERR** LED informs about errors encountered by module during its operation;
- **PWR** LED is lit when the module is powered from mains or backup power supply;
- **USB** LED informs about proper USB connection;
- **I1 - I4** LEDs indicate binary inputs logical states;
- **VOUT1** LED is lit when power output VOUT1 is operating;
- **ACCU** LED informs about battery state;
- **Q1 -Q2** LEDs indicate binary outputs states.

Detailed description of LED signaling can be found in LED signaling chapter.



3.5. Antenna

Installation of the antenna is essential for proper operation of MT-020 telemetry module. SMA antenna socket is placed on module's front panel. Attached antenna has to secure appropriate radio signal level enabling login to GSM network.



The type and placement of antenna has significant influence on module's sender/receiver circuits. GSM signal level is reflected by **SGN** led on the module's front panel. Please use a directional antenna if GSM signal level is insufficient.

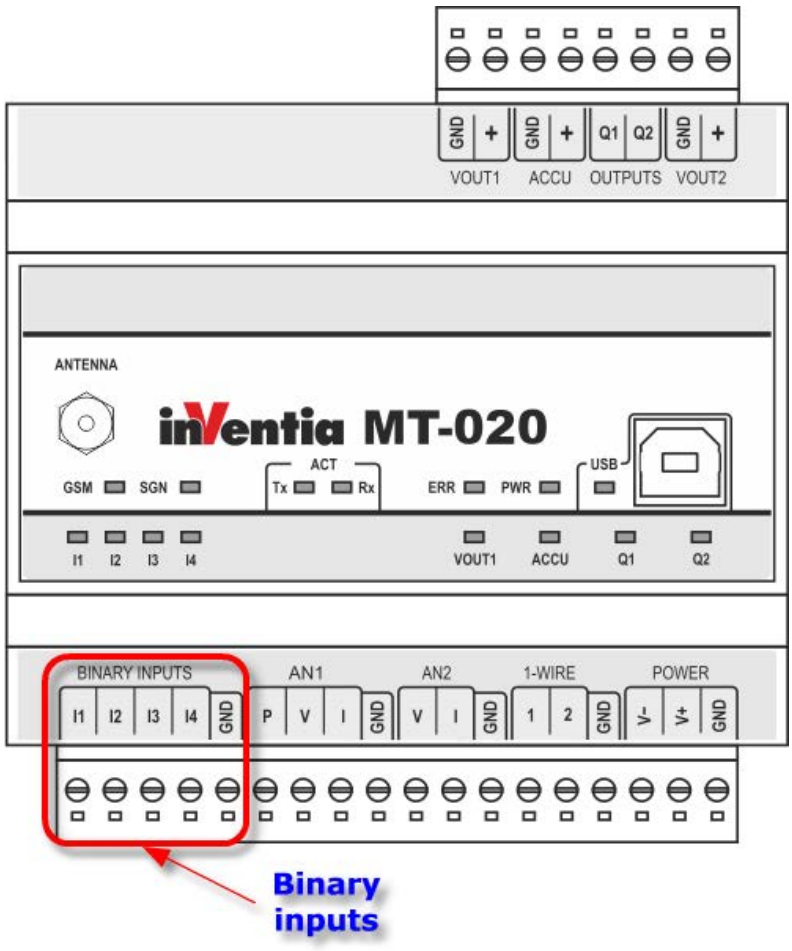
3.6. Resources

MT-020 module's resources:

Resource	Qty	Description
I1 - I4 - binary inputs	4	Optoisolated binary inputs. All of binary inputs can be independently configured to operate as counters (respectively **CNT1 - CNT4**)
Q1 - Q2 - binary outputs	2	Binary outputs (NPN- switch to GND)
AN1, AN2 - analog inputs	2	• PT100 (AN1 only) • NTC 10k (AN2 only) • 0-10V • 0-5V • 4-20mA
1-WIRE1, 1-WIRE2 - 1-Wire inputs	2	allow reading out measurements from temperature sensors supporting 1-Wire bus
USB Port	1	used for communication with **MTManager** software environment for module configuration and event logger readout

3.6.1. Binary inputs

MT-020 module is equipped with 4 optoisolated binary inputs marked as I1 - I4. All binary inputs operate with positive logic and share common ground.



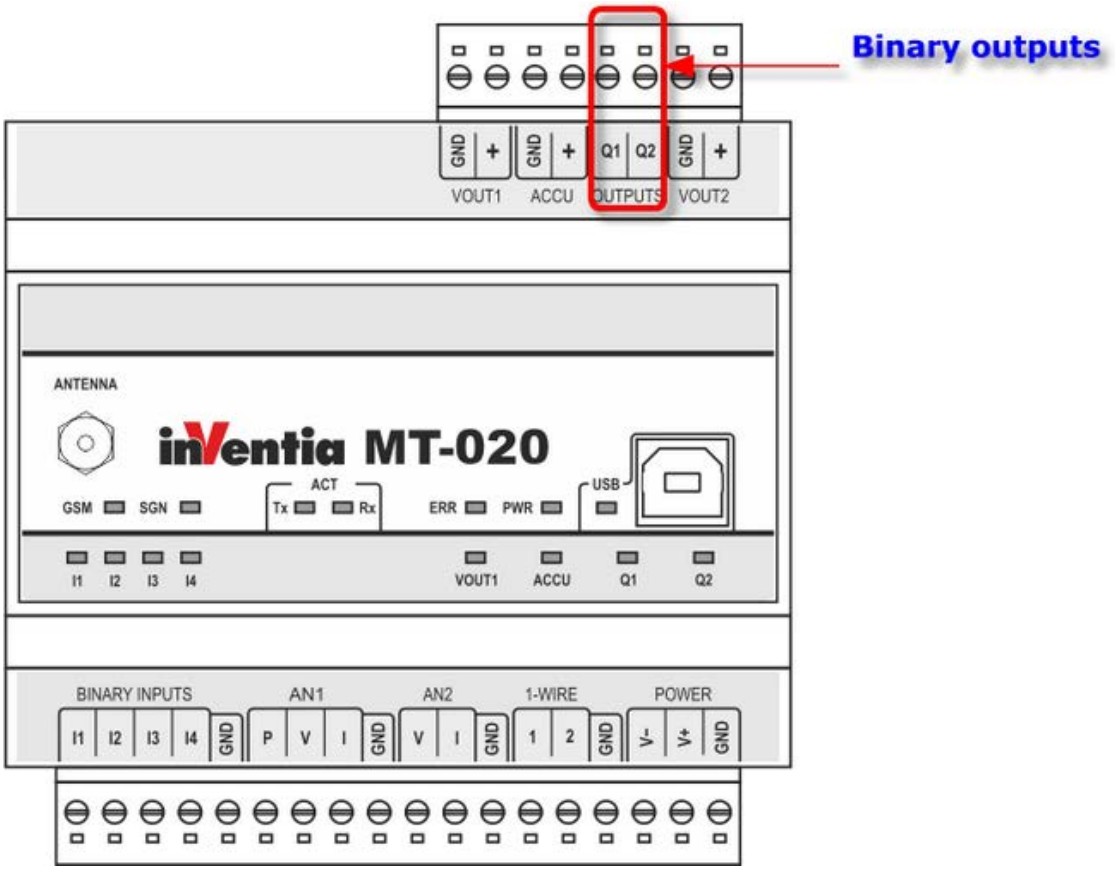
Any of binary inputs can be individually configured to operate as 32-bit counter input allowing to count pulses. The counter can count „up” or „down” to user defined range (from 1 to 2147483647). Counting "up" means that the counter value is increased by 1 for each detected pulse. After reaching the value set as "counter length-1" the counter is reset to "0". Counting "down" diminishes the counter value by 1 for each detected pulse After reaching the value set as "-1*(counter length-1)" the counter is reset to the value of defined maximum. Crossing the value of counter length sets counter flag for respective input.

3.6.2. Binary ouputs

MT-020 module is equipped with 2 binary outputs operating as NPN switch to module ground. Outputs can operate in one of three functional modes:

- monostable with configurable initial state
- bistable with configurable initial state
- toggle with configurable initial state

Outputs can be controlled by writing value to OUT_CTR register in Holding register address space (address 8) and/or by user defined events.



3.6.3. Analog inputs

MT-020 provides two analog inputs marked as AN1 and AN2 which can operate in following modes:

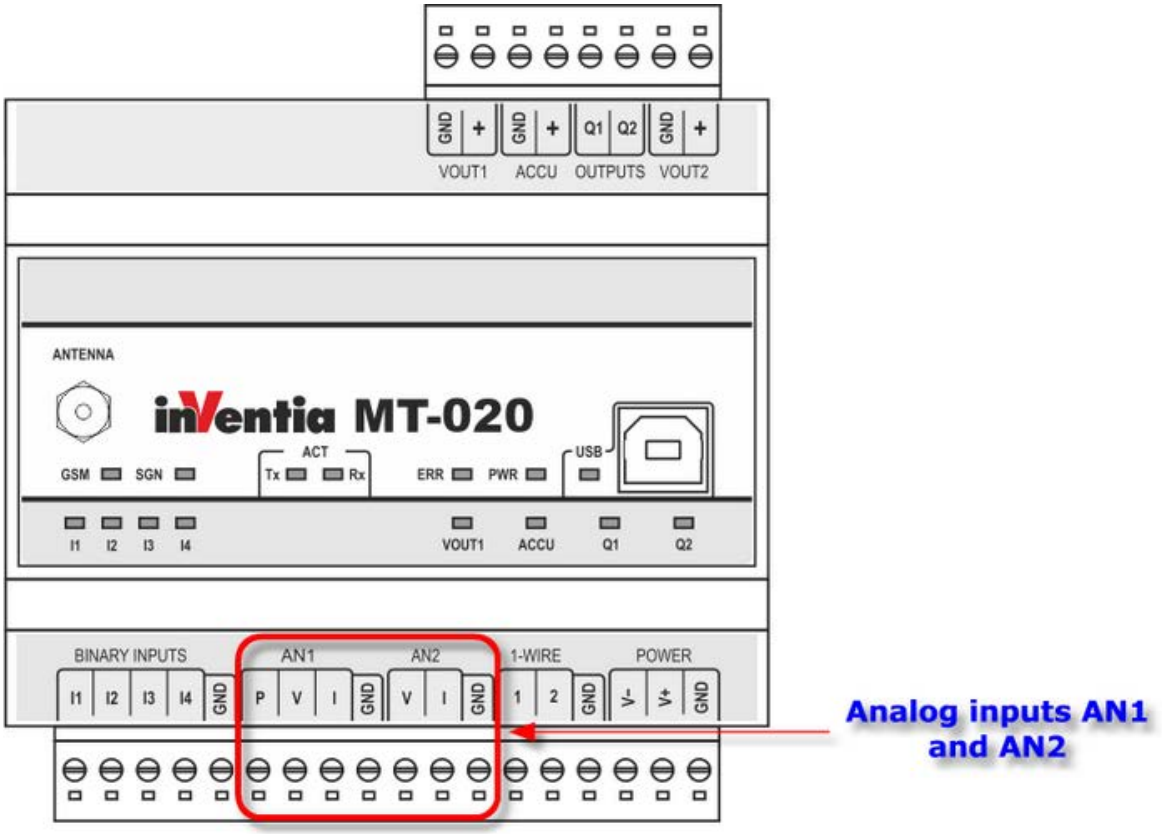
AN1:

- Pt-100 sensor temperature readout

- voltage input - 0-5V or 0-10V
- current input - 4-20mA

AN2:

- NTC sensor temperature readout
- voltage input - 0-5V or 0-10V
- current input - 4-20mA



3.6.4. Real time clock (RTC)

MT-020 Module is equipped with **astronomical time clock (RTC).**

The clock is a base for defining working cycles of module, timers and time stamps for measurement results recorded in registers. Imprecise clock setting results in faulty time stamping and subsequent loss of vital information. For that reason, it is recommended to set the clock to UTC time instead of the local time zone of the module placement.

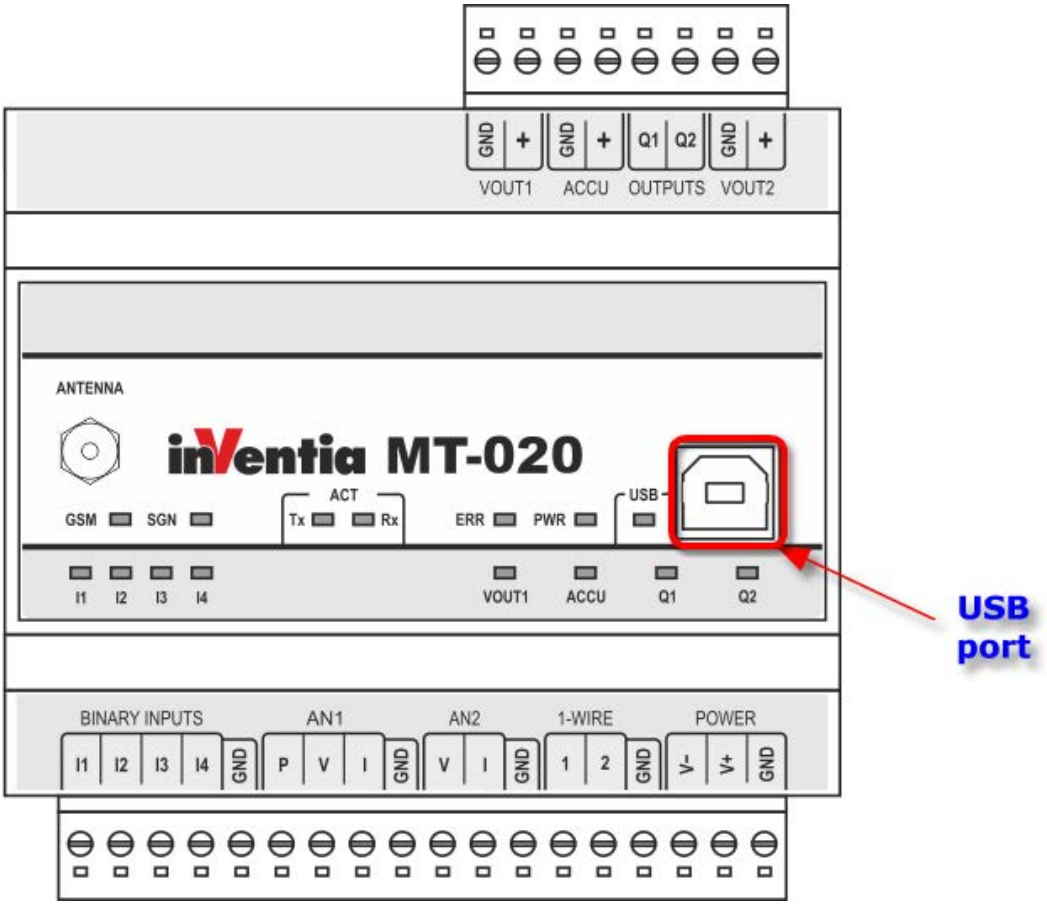
NOTICE!
RTC should be set each time the module has lost power supply (both mains and backup).

Setting the time is described in configuring mode documentation for the MTManager program. There is also a method for setting the RTC remotely using SMS configuration commands described in chapter Starting the module/Remote configuration via SMS.

3.6.5. USB port

MT-020 module is equipped with one USB port.

This port is used for the local configuration of the module and event logger readout. These functionalities are supported by MTManager - provided free of charge environment for managing telemetry system.



3.6.6. Event logger

MT-020 automatically registers events like analog inputs measurement, time interval being counted by timer, GSM logon, making an outgoing call, one of analog values exceeding an alarm thresholds value, module power on and other. Logger can store up to 48000 records. This allows to reconstruct the history of module operations.

Logger records can be read via USB using **Log read** module of **MTManager** software environment.

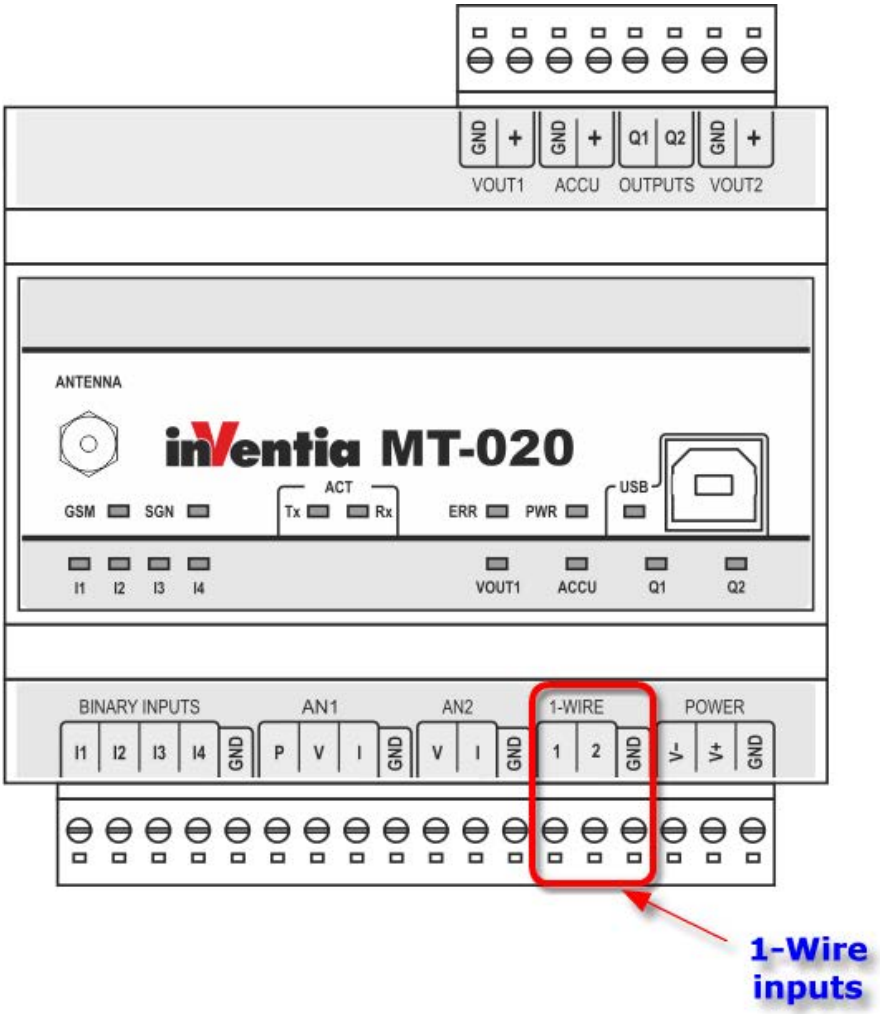
3.6.7. Timers

MT-020 provides four synchronous timers TMR1 - TMR4 that enable cyclical time measuring from 1 min to 1 month with synchronization with module's RTC clock. Timers can be used for triggering various actions like establishing clip calls, setting binary outputs and other.

3.6.8. 1-Wire inputs

MT-020 Telemetry module is equipped with two 1-Wire inputs for connecting sensors using this interface for transmission of measured temperature value.

There is possibility of creating individual 1-Wire solutions to suit special application needs. For more information please contact your local distributor.



4. Starting the module

The sample configuration described below should present configuration methods available for **MT-020**.

There are two methods of making the first configuration of the module:

- local configuration via USB cable using MTManager
- remote configuration using SMS commands

Using one method does not exclude using of the second as they can be used interchangeably.

Regardless of chosen method, following steps should be taken before configuration:

1. Connect GSM antenna,

2. Install SIM card. If you plan to make first configuration of the module via SMS, turn off PIN code request,

NOTICE!
SIM card unlocking procedure is described in the How to disable a SIM PIN number chapter.

3. Connect power to the module ('POWER' terminal block).

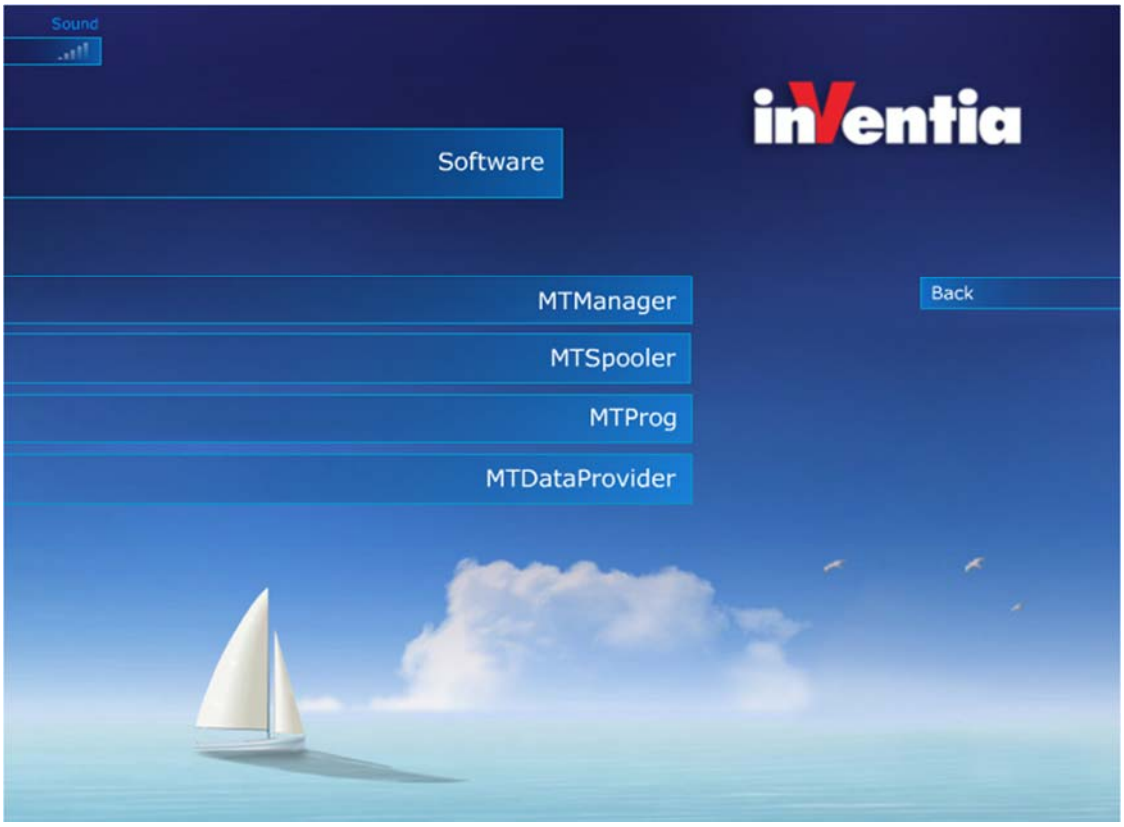
Correct power connection is signaled by PWR LED (green light). After connecting power the module starts process of registration in the GSM network. If you use a SIM card with PIN code request option turned off, the module should log on to the GSM network. Successful GSM network logon is indicated by three blinks of GSM LED and signal strength presented on SGN LEDs.

Her are the steps to create a basic configuration:

- Entering PIN code,
- Adding a phone number to authorized phones list,
- Defining event for binary input I1 occurring on change of its state from 0 to 1 (rising edge),
- Defining message sending rule that sends an SMS reading "ALARM" to a predefined phone number when previously configured event is triggered,
- Setting RTC clock of the device.

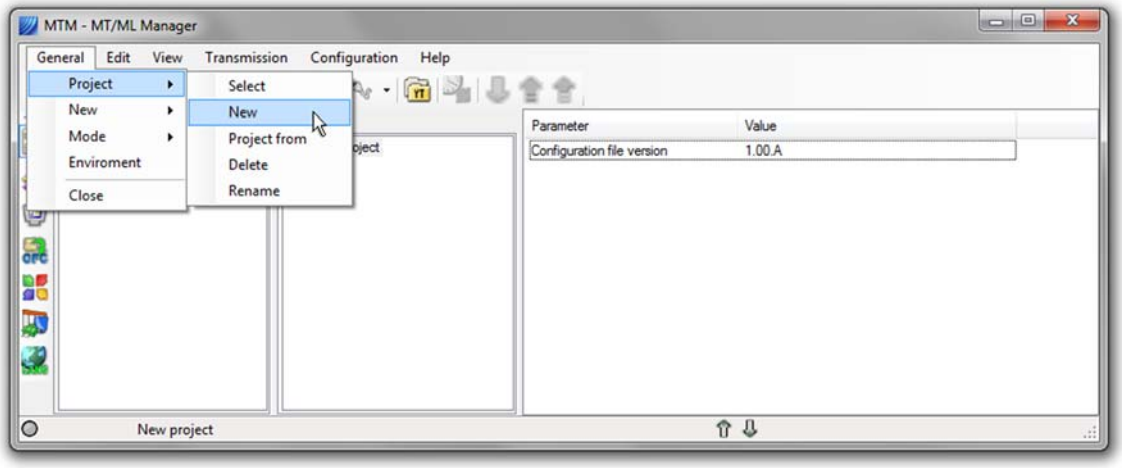
4.1. Configuration using MTManager

Install MTManager on your PC from CD provided with module.

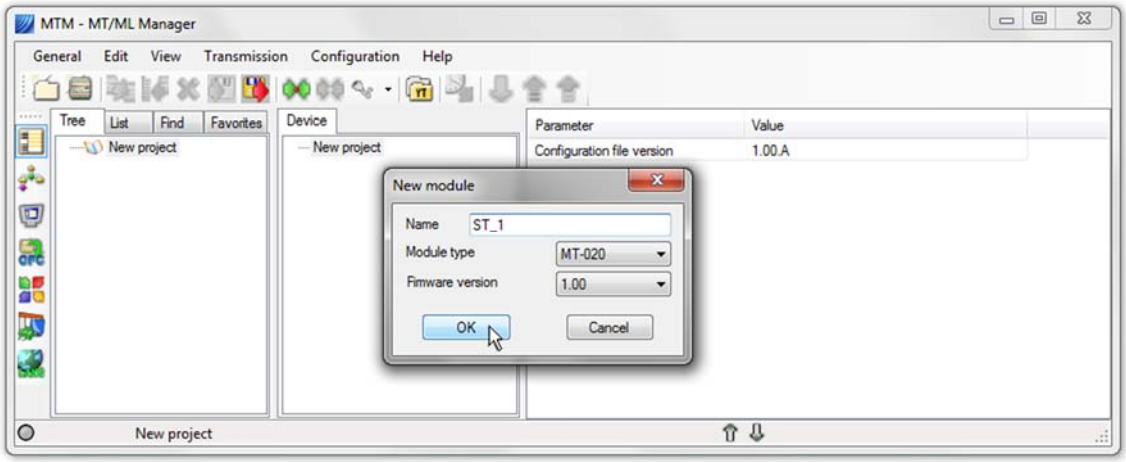


When installed with default setting MTManager creates shortcuts on Desktop and in Start menu.
Start MTManager by double-clicking on shortcut icon:

In newly created MTManager project add new module using main menu option **General->New->Module.**

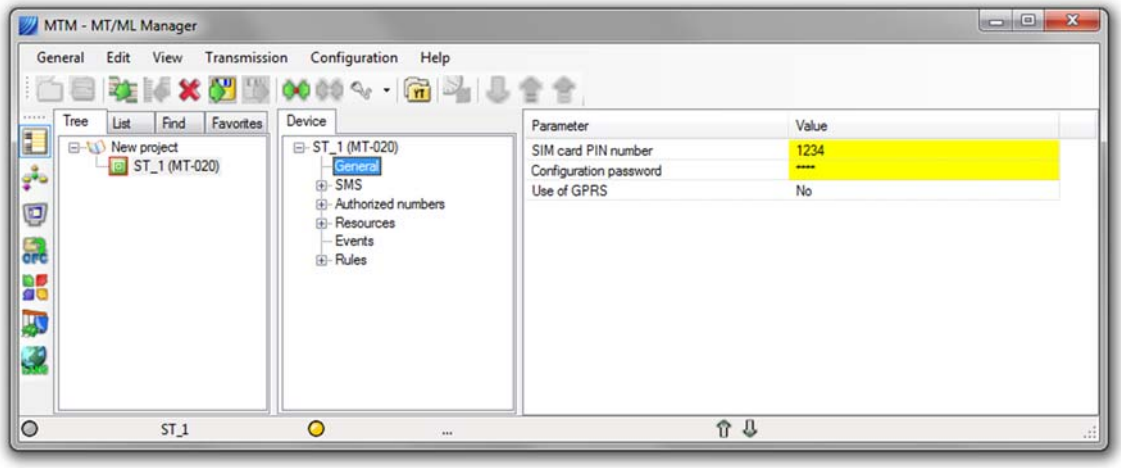


Choose **MT-020** as type, type in module name (e.g. ST_1) and select firmware version (firmware version is marked on the module box).

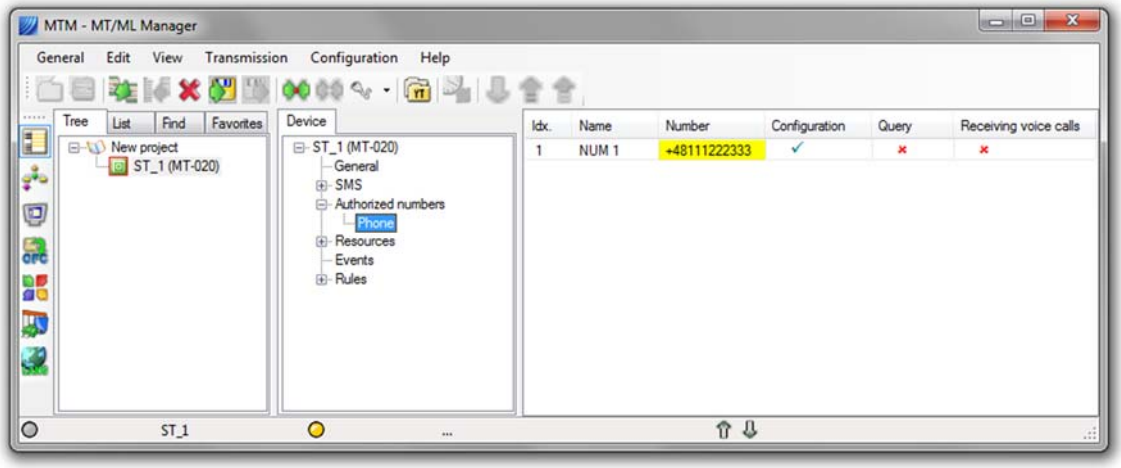


In the next step set parameters essential for establishing GSM connection:

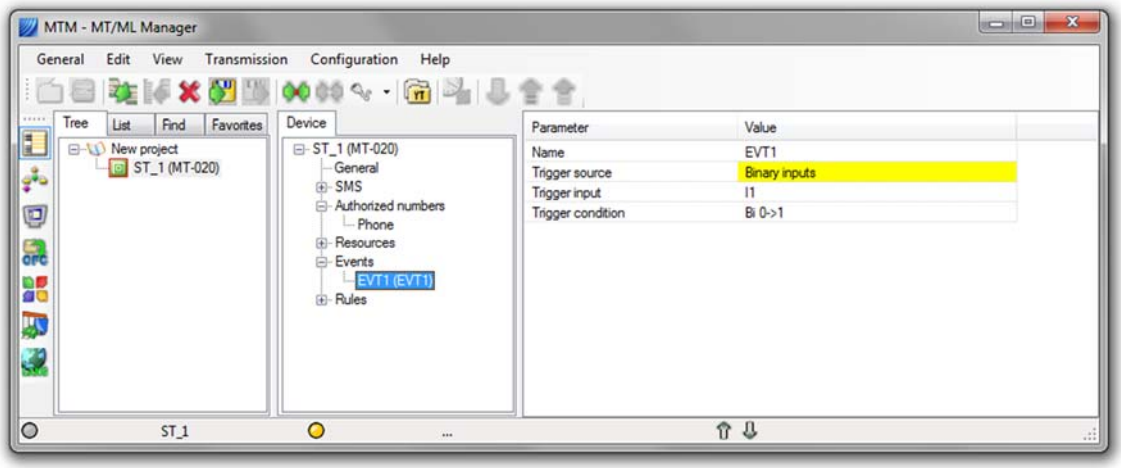
- SIM card PIN number (required if PIN code request is on)
- Configuration password to protect module from unauthorized access.



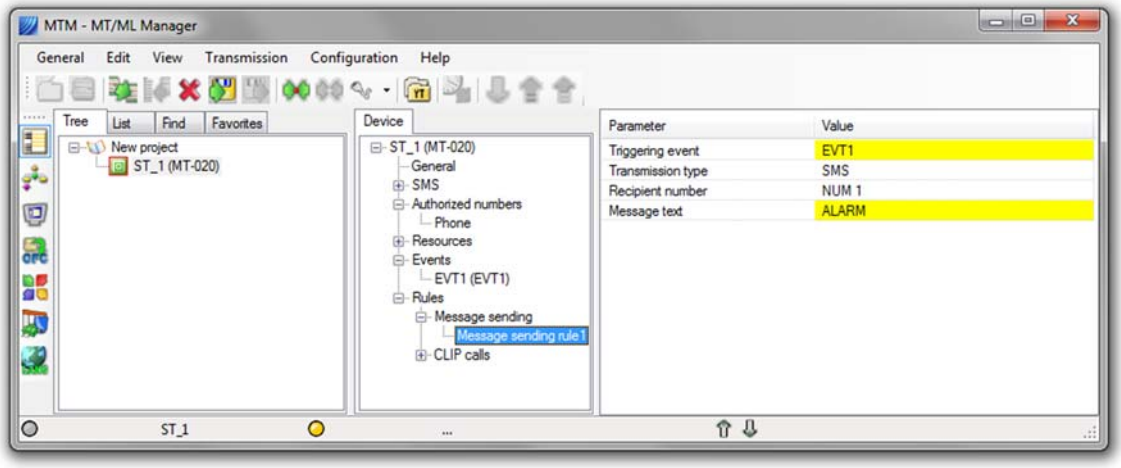
Open Authorized numbers -> Phone and add new telephone number (e.g. +48111222333) to the list. This number will be then used as receiver of SMS message send from device.



Create Event EVT1. In this example event it will be triggered by binary input I1 changing its logical state from 0 to 1.

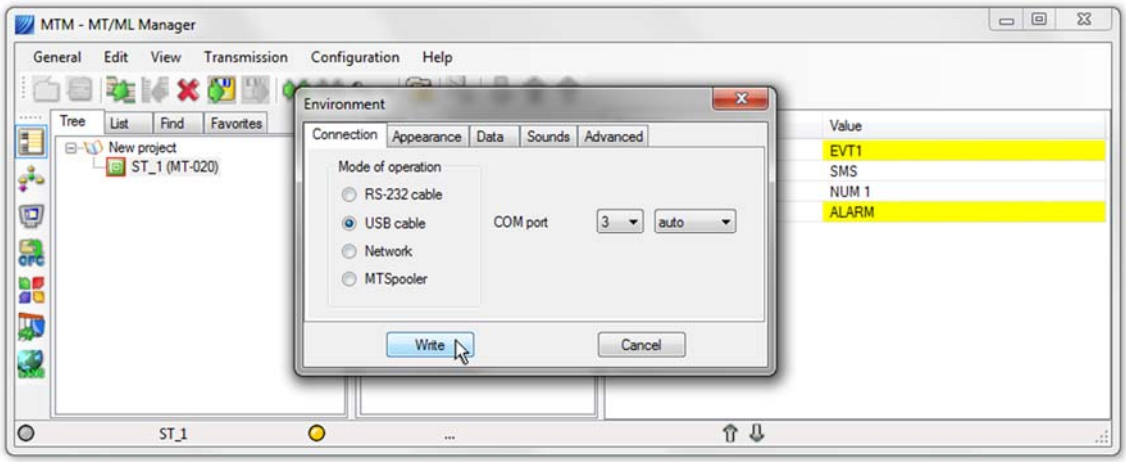


As the last step of configuration set up Message sending rule 1. Choose EVT1 as Triggering event, type *ALARM* in Message text. NUM1 corresponds to telephone number added two steps before.

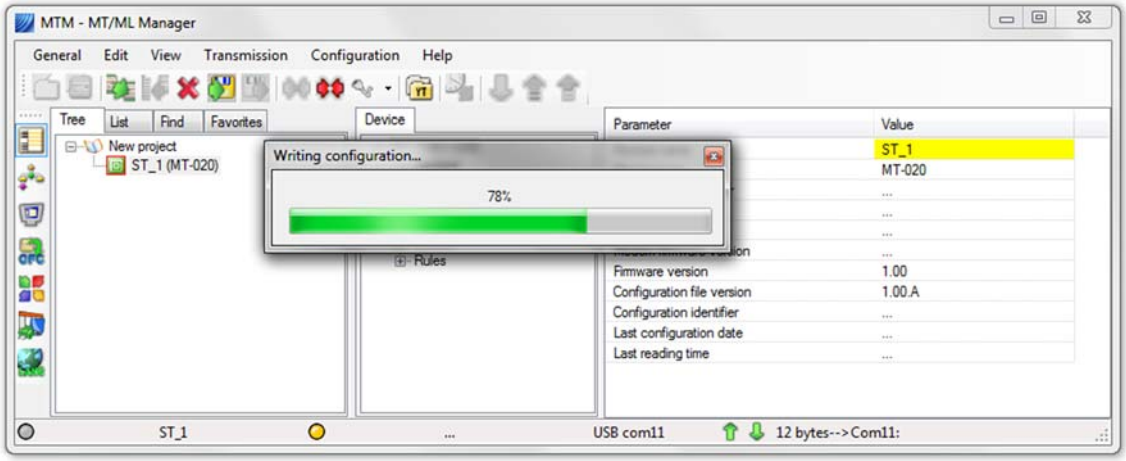


To write prepared configuration into module connect MT-020 with PC using USB cable provided with module. Proper USB connection is signaled by USB LED. Operating system should automatically install driver for MT-020 - it will be seen in Device Manager as additional COM port called **Silicon Labs CP210x USB to UART Bridge (COMX)**, where **X** is COM port number.

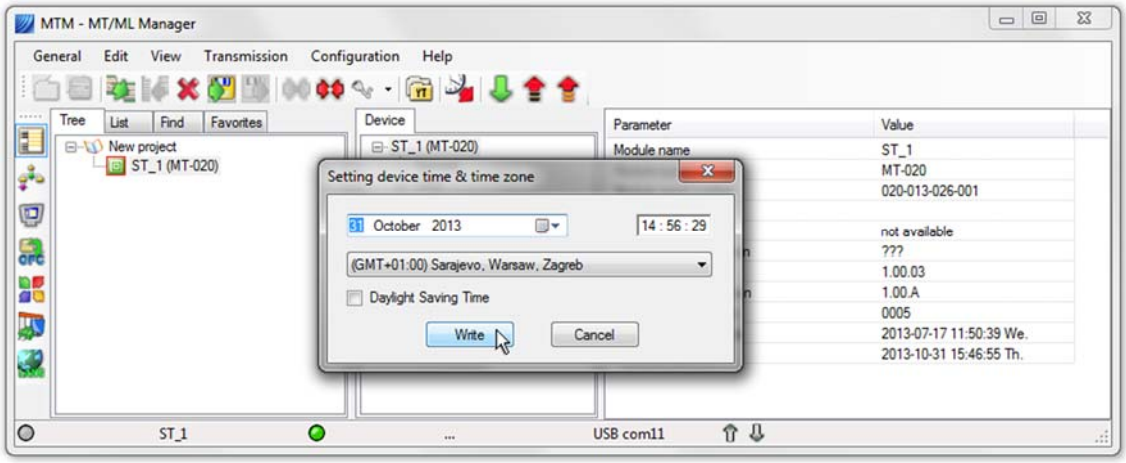
Please open **Environment** in MTManager (Main menu->General->Environment), set correct COM port in **USB cable** option and press **Write** to save setting.



Next press **Connect** button (Transmission->Connect) and **Write** button (Transmission->Write).



At the end synchronize device RTC using **Set time** button (Configuration->Set time).



Now, each time binary input I1 is set to high logical state (voltage between I1 and GND terminal is higher than 9V) the module sends a SMS that reads ALARM to phone number +48111222333

4.2. Remote configuration via SMS

Configuration described in previous chapter can also be written to the module using SMS commands. These commands, their default values and allowed value ranges are described in Module configuration via SMS chapter in Appendices. Below you can find a sample configuration SMS:

&#SPIN="1234"#CONF_PSW="PASS"#SMSN_1="+48111222333"#EVNO=1#EV_TRIG_1=2#EV_FLAG_1=0#EV_EDGE_1=1#TRNO=1#TR_TRIG_1=1#TR_TCH_1=1
#TR_T_1="ALARM"#TR_N_1=1

This SMS sets:

- SIM card PIN number (1234)
- Configuration password (PASS)
- First telephone on Authorized->Phone list (+48111222333)
- Event EVT1 triggered when binary input I1 changes its logical state 0->1
- Message sending rule 1 which will send SMS saying ALARM to previously defined telephone number each time event EVT1 is triggered.

As an answer to this SMS module will send back the same text preceding it with '>' sign.
It is good practice to adjust module's RTC after first configuration. SMS below sets time to last second of 2013:

&PASS#CRTC="2013-12-31 23:59:59"

SMS begins with '&' sign and new password set by previous configuration SMS.

First configuration can be done from any phone number. Any following SMS configuration commands will be accepted only from numbers placed previously on Authorized list. Therefore it is vital to enter at least one phone number to that list during first configuration. Maximum length of SMS configuration command should not exceed 160 signs.

Now each time binary input I1 is set to high logical state (voltage between I1 and GND terminal is higher than 9V) module sends SMS that reads ALARM to phone number +48111222333.

4.3. How to disable a SIM PIN number

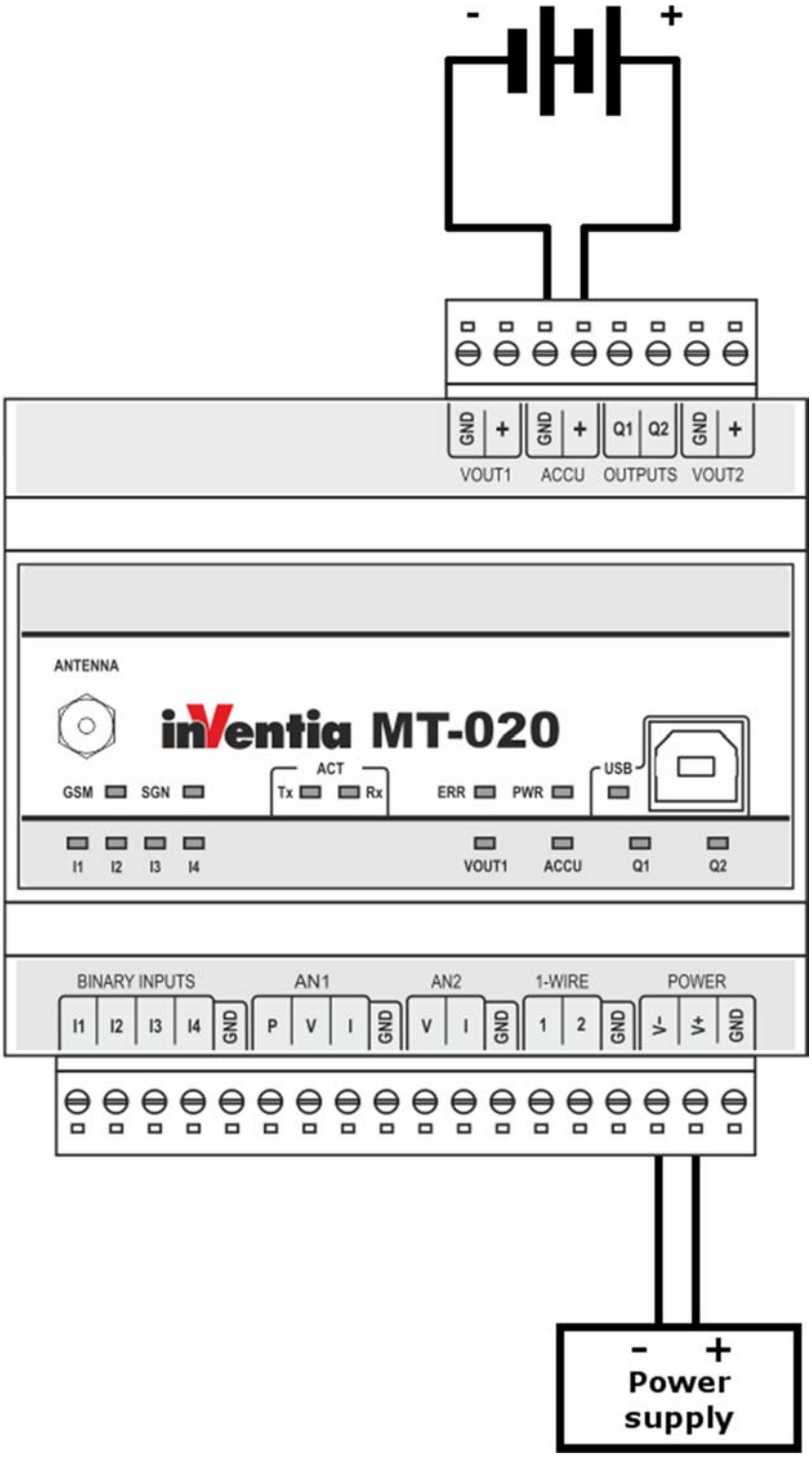
Procedure of disabling PIN code protection on SIM card on example of Nokia 6210:

- Place the SIM card into the appropriate slot on the phone.
- Turn on the phone and enter correct PIN number for your SIM card.
- From menu select Settings->Security Settings->PIN code request.
- Please enter PIN number when you are prompted for it and select off.
- If PIN is disabled appropriate message will appear on phone screen. You can now turn off your phone and remove SIM card.

5. Connections scheme

5.1. Power supply

MT-020 telemetry module can be powered from **9-30 VDC** or **12-18 Vrms AC** power supply. Backup battery should be connected to ACCU terminals. Module supports 6VDC batteries. Maximum recommended battery capacity is 3.0Ah.

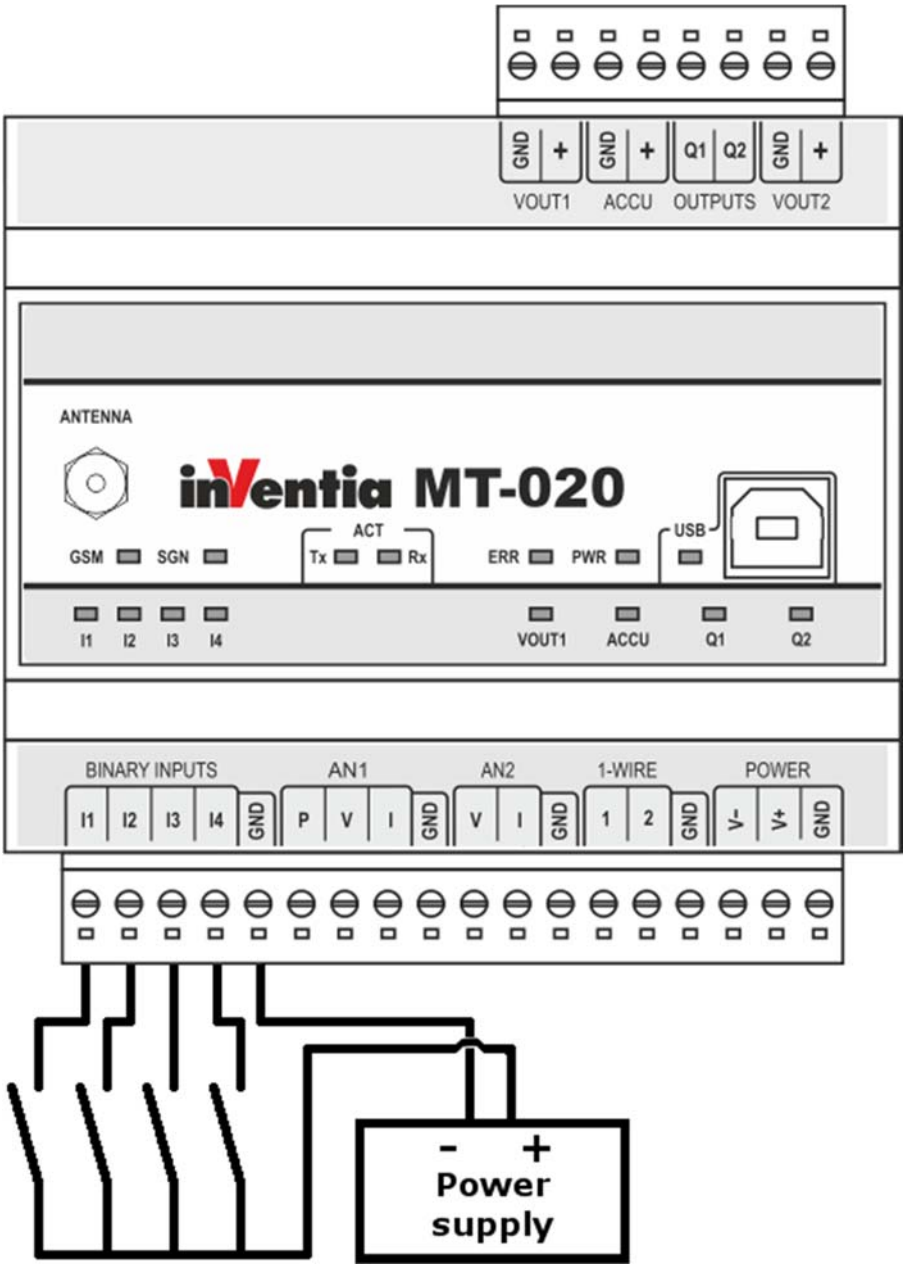


For AC power supply polarization does not matter. GND terminal is used for connecting ground. Please do not connect protective conductor (yellow-green) to this terminal.

NOTICE!
Power supply cables should not be longer than 10m.
Signal cables should not be longer than 30m.
For longer cables it is recommended to use external overvoltage protection.

5.2. Binary inputs

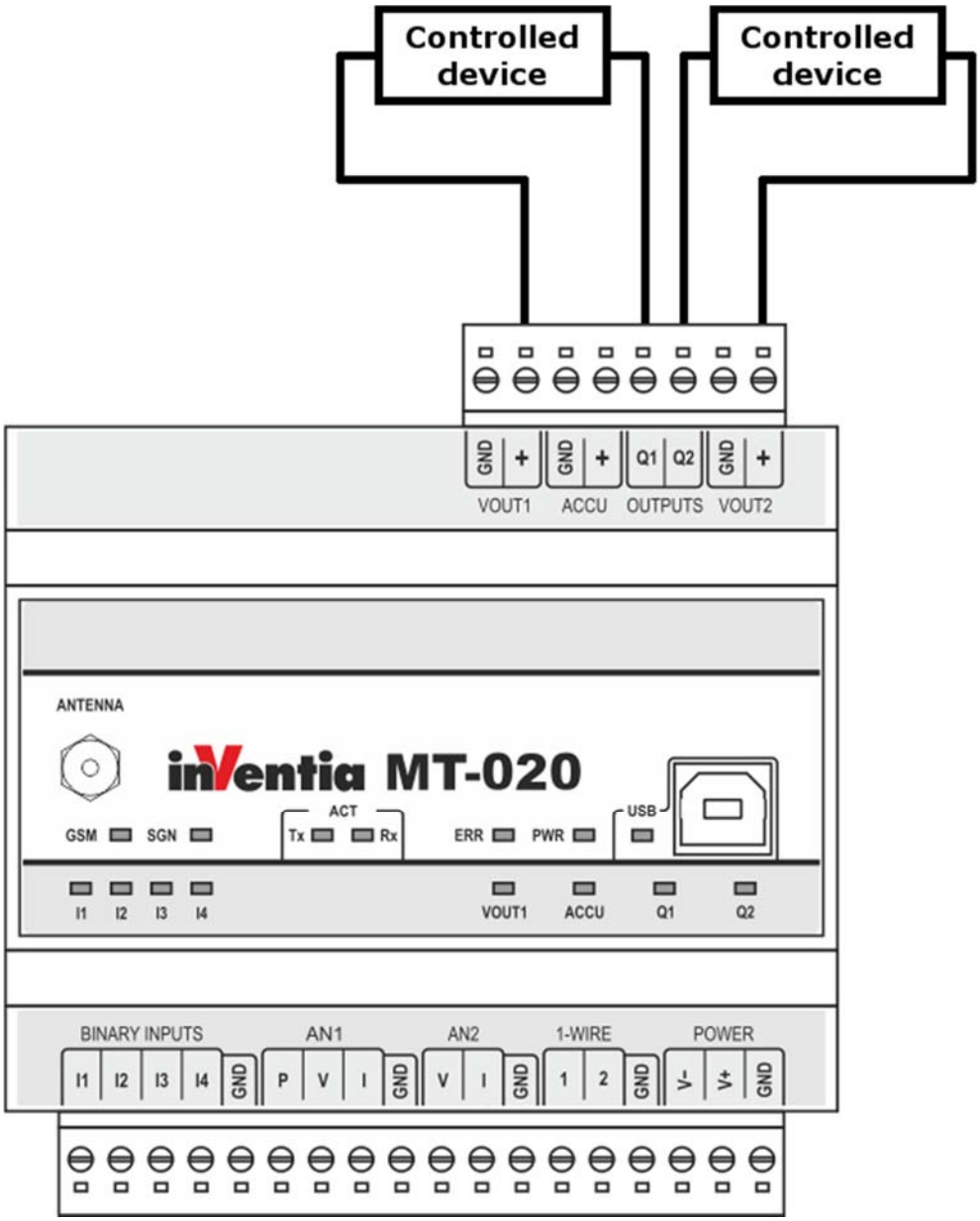
MT-020 module is equipped with 4 optoisolated binary inputs marked as I1 - I4. All binary inputs operate with positive logic and share the same ground.



NOTICE!
Power supply cables should not be longer than 10m.
Signal cables should not be longer than 30m.
For longer cables it is recommended to use external overvoltage protection.

5.3. Binary outputs

MT-020 module is equipped with 2 binary outputs operating as NPN switch to module ground. In high state (logical '1') they are connected to module's ground level (and may be used for closing electrical circuit) while in low state (logical '0') outputs are open and not connected with any other signal (electrical circuit is open).



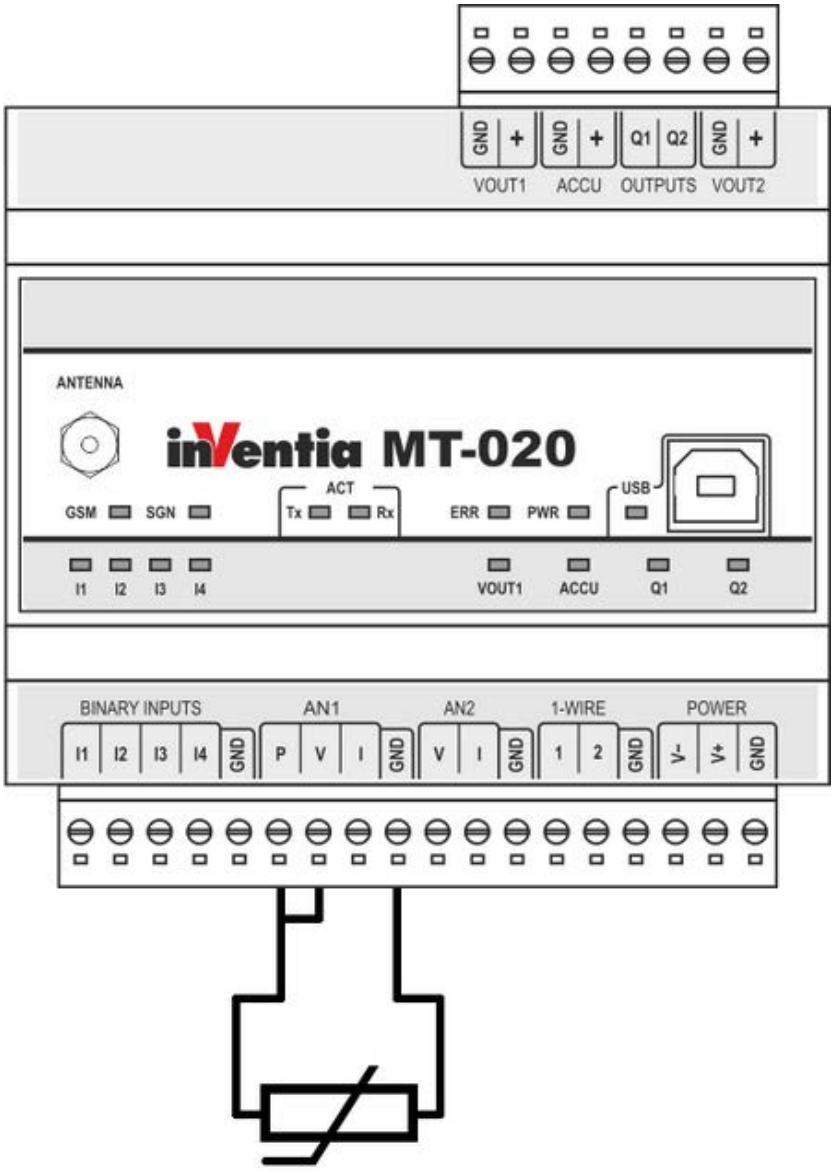
To control external device you can use output terminal and power output **VOUT1** (stabilized voltage, operates on both mains and backup power) or **VOUT2** (non-stabilized DC voltage, operates only when mains power supply is present).

NOTICE!
Power supply cables should not be longer than 10m.
Signal cables should not be longer than 30m. For longer cables it is recommended to use external overvoltage protection.

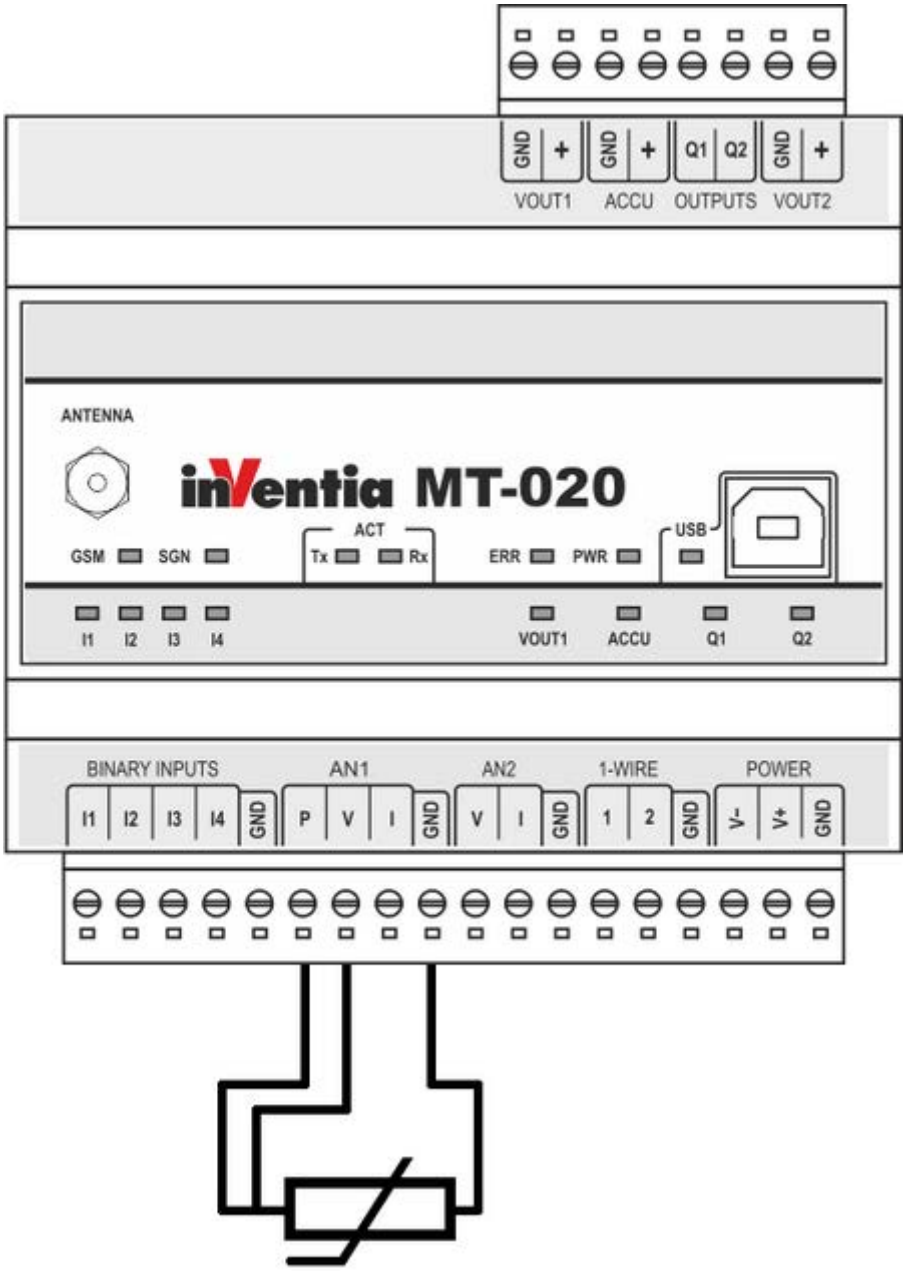
5.4. Analog inputs

Analog inputs **AN1** and **AN2** can be used for measuring temperature using Pt-100 and NTC sensors or collecting measurements via current (4-20mA) or voltage (0-5V/0-10V) signal according to user-defined configuration. Connection schematics are presented below:

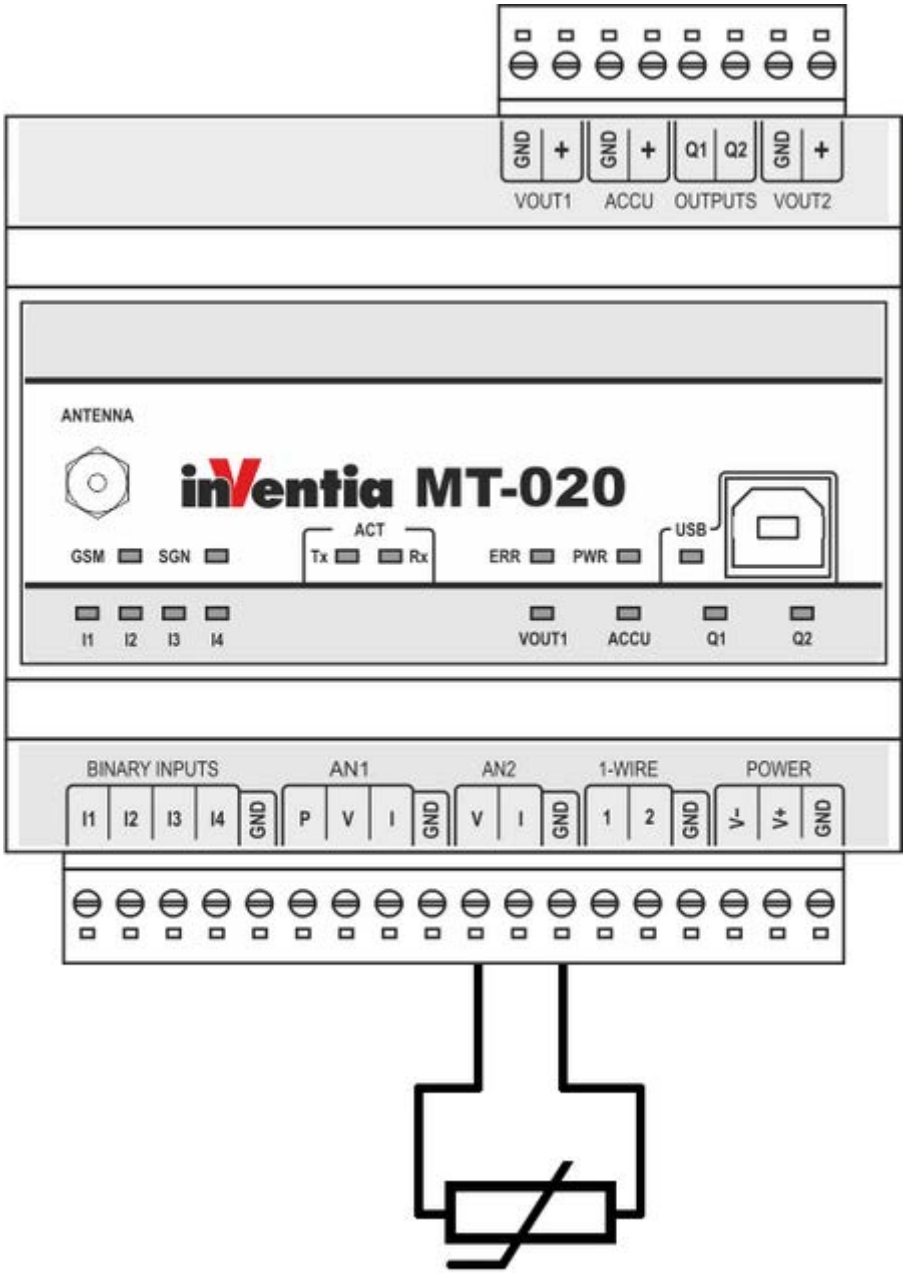
Connecting 2-wire Pt-100 sensor (AN1 only)



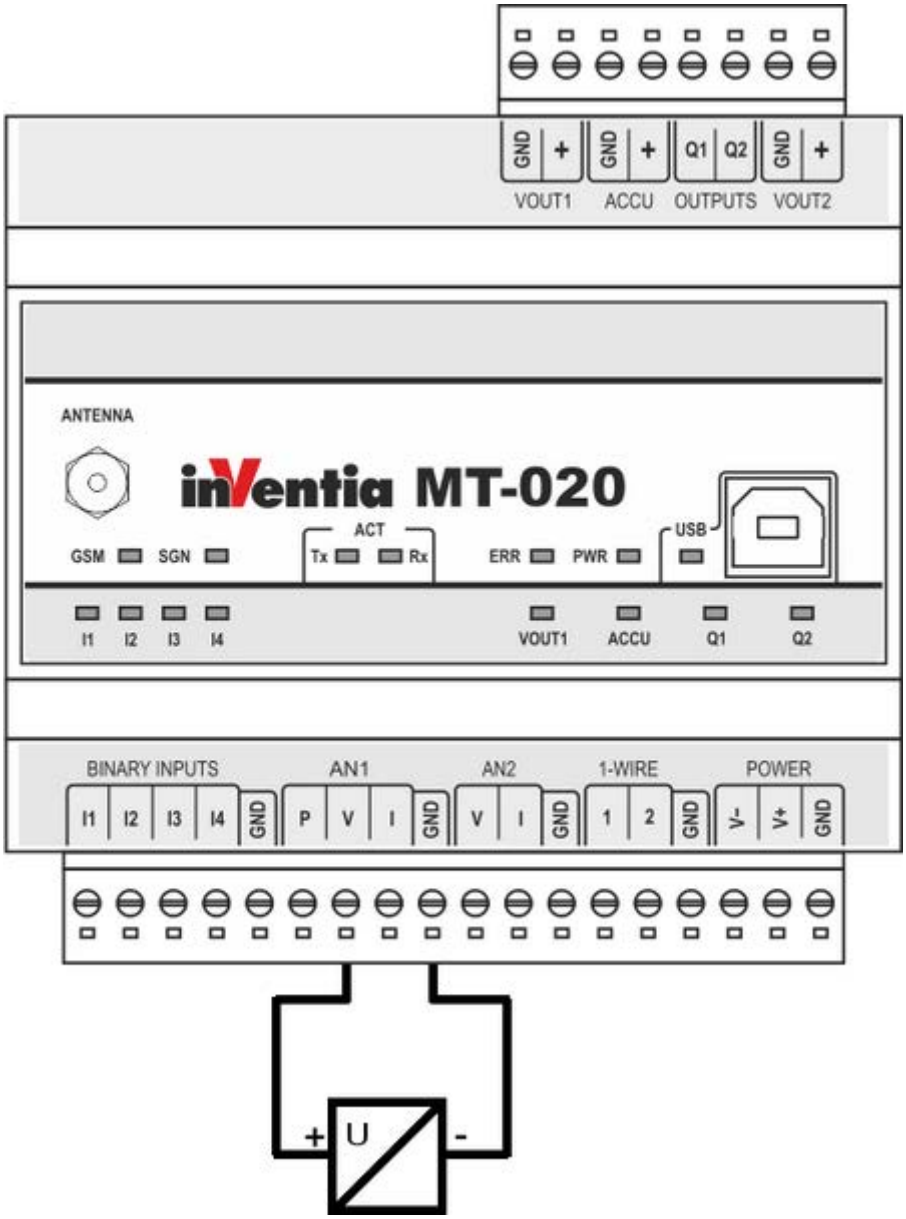
Connecting 3-wire Pt-100 sensor (AN1 only)



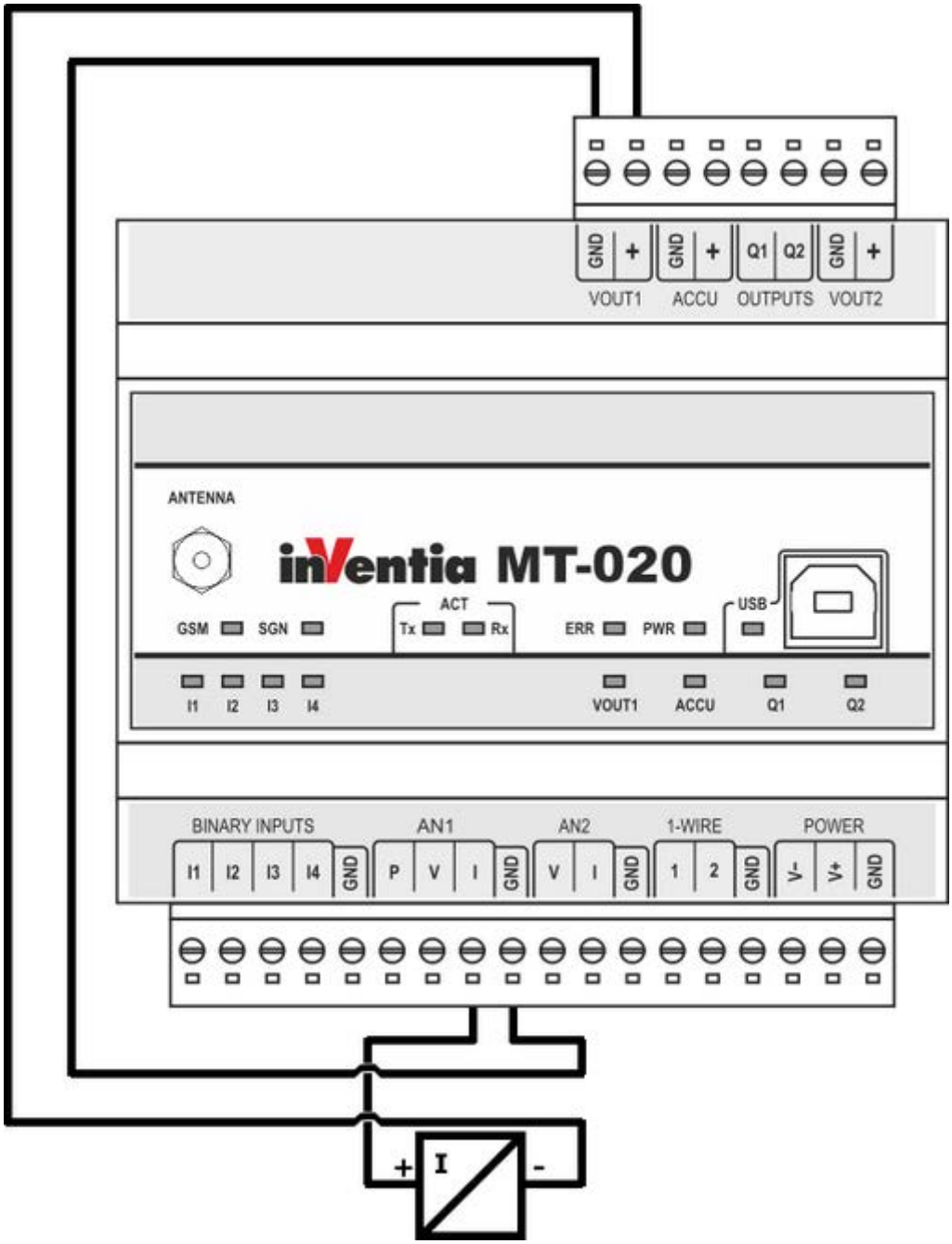
Connecting NTC sensor (AN2 only)



Connecting voltage sensor

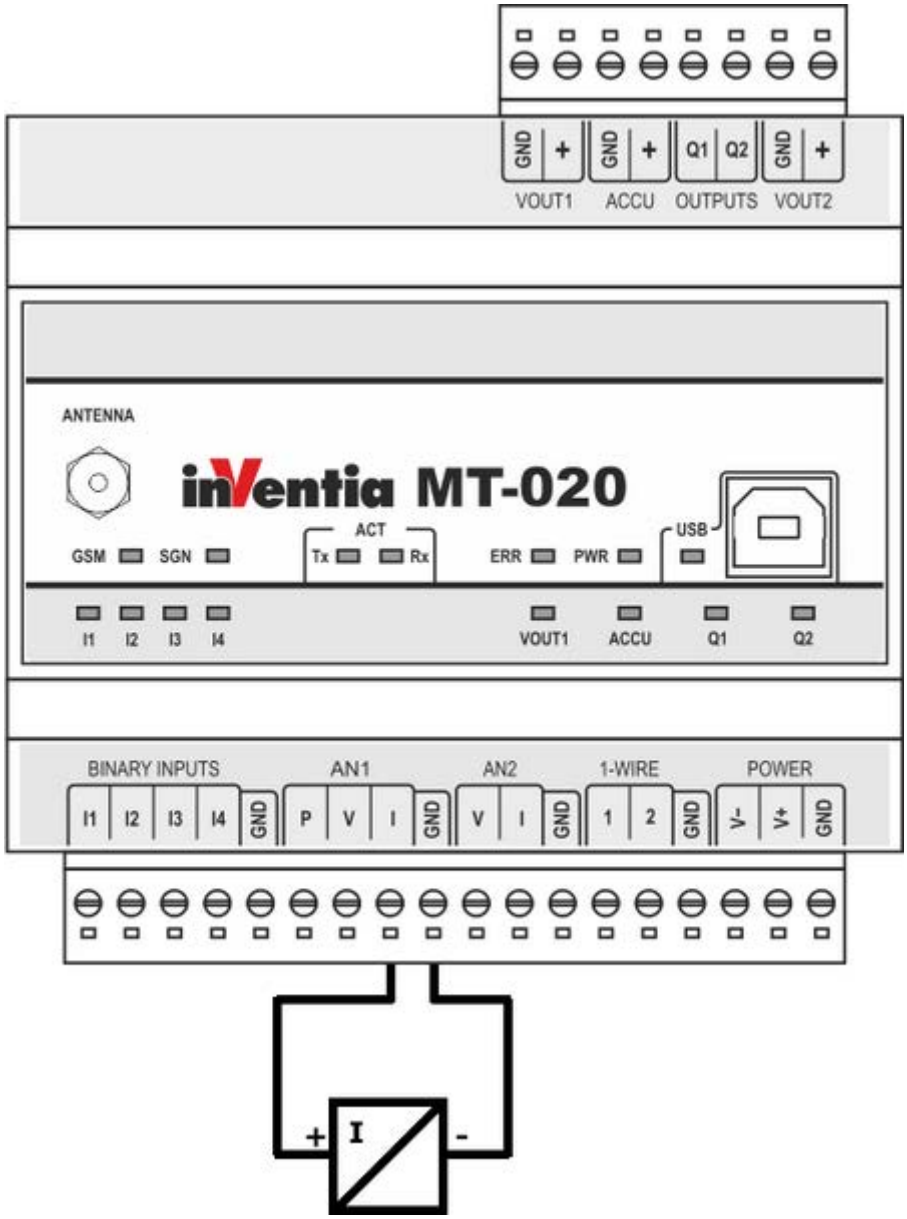


Connecting passive current sensor



For powering analog sensor user can use power output **VOUT1** (stabilized voltage, operates on both mains and backup power) or **VOUT2** (non-stabilized DC voltage, operates only when mains power supply is present) or external DC power supply (please ensure that module has the same GND level as external power supply).

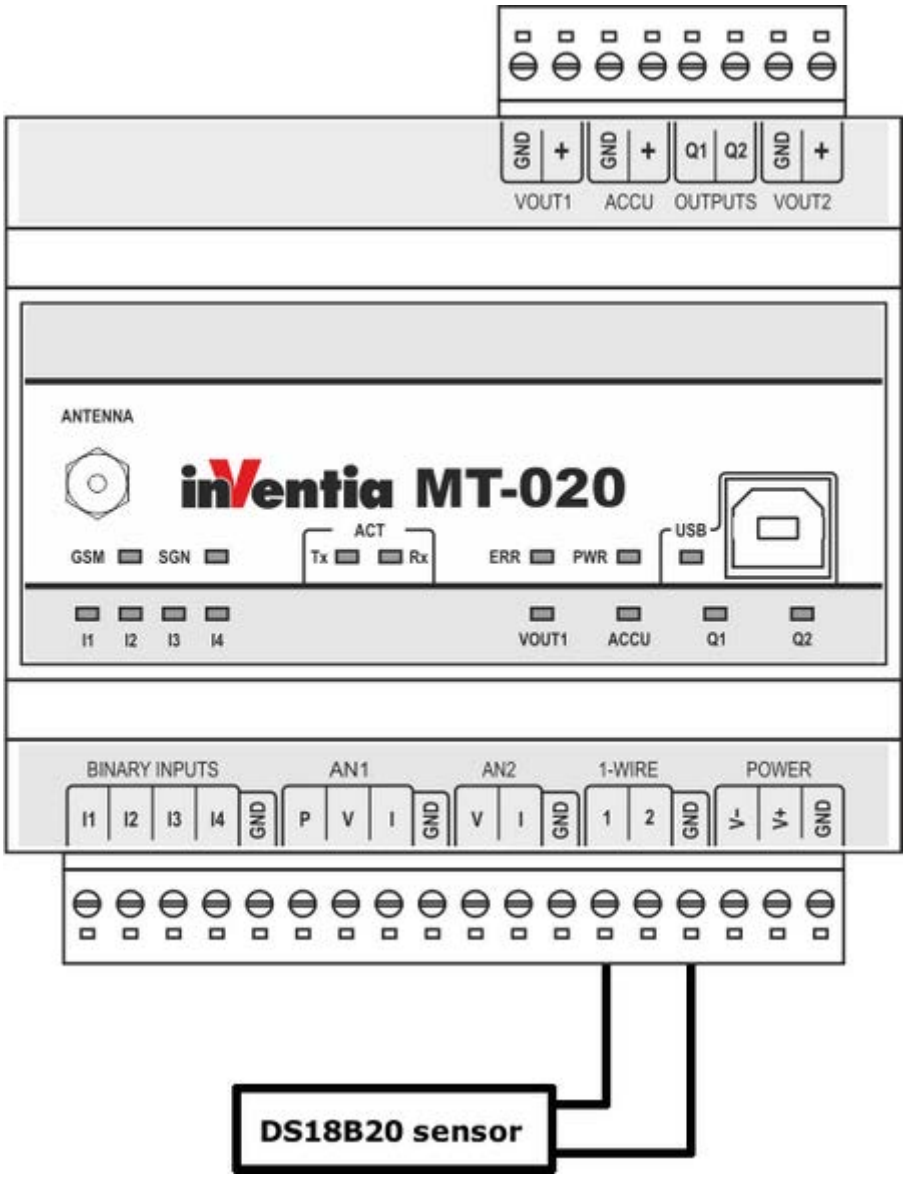
Connecting active current sensor



NOTICE!
Power supply cables should not be longer than 10m.
Signal cables should not be longer than 30m.
For longer cables it is recommended to use external overvoltage protection.

5.5. 1-Wire inputs

Telemetry module **MT-020** is equipped with two 1-Wire inputs for connecting sensors using this interface for transmission of measured temperature value.



NOTICE!
Power supply cables should not be longer than 10m.
Signal cables should not be longer than 30m.
For longer cables it is recommended to use external overvoltage protection.

6. Configuration

The configuration of **MT-020** module as configuration of other MT modules is carried out using the MTManager - program suit delivered free of charge to users of our telemetry solutions.

It is also possible to configure device using SMS commands defined in Module configuration via SMS chapter located in Appendices.

NOTICE!
Availability of different functions and parameters depends on module firmware version and the settings of parameters they may be dependent on.

6.1. Parameter groups

For clarity and ease of use, the operating parameters of MT-020 module are divided into logically or functionally connected groups in the following order:

- Header group - contains unmodifiable parameters describing the module, its firmware and configuration
- General group - contains basic parameters defining module operating mode
- SMS group - contains parameters responsible for handling SMS communication
- GPRS group - contains parameters used for establishing and handling GPRS communication
- Authorized numbers group - contains lists of phone numbers and IP addresses of other devices authorized for communication with configured module
- Resources group - defines hardware and software resources related to reading and processing measurement data.
- Events group - contains list of defined events (e.g. binary input state change), used to trigger module actions (e.g.: sending SMS, e-mail, data or CLIP call)
- Rules group - contains lists of transmission tasks to be carried out upon occurrence of activating criteria

6.1.1. Header

Header group contains basic information describing the module, along with configuration version ID and version of configuration file used by MTManager. Information displayed is for verification purposes only and thus not available for user configuration.

6.1.1.1. Module name

Function	-	Displays name assigned to module during configuration
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	*New module*
Comments	-	N/A

6.1.1.2. Module type

Function	-	Displays module type
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	*MT-020*
Comments	-	N/A

6.1.1.3. Module serial number

Function	-	Displays serial number of configured module
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	N/A
Comments	-	This field displays module's serial number assigned during manufacturing. This number is static and serves as a unique identifier of the unit.

6.1.1.4. IMEI number

Function	-	Displays GSM modem IMEI number
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	N/A
Comments	-	N/A

6.1.1.5. SIM card number

Function	-	Displays SIM card serial number
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	N/A
Comments	-	N/A

6.1.1.6. Modem firmware version

Function	-	Displays GSM modem firmware version
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	N/A
Comments	-	N/A

6.1.1.7. Firmware version

Function	-	Displays current module firmware version
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	*1.00*
Comments	-	N/A

6.1.1.8. Configuration file version

Function	-	Displays version of configuration file identifier used by MTManager for presenting configuration
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	N/A
Comments	-	Presented value depends on module firmware version and MTManager release version.

6.1.1.9. Configuration identifier

Function	-	Displays ID of module current configuration
Data type	-	Hexadecimal
Range	-	N/A, read-only parameter
Default value	-	N/A
Comments	-	Value of this parameter is incremented by one after each successful configuration write.

6.1.1.10. Last configuration date

Function	-	Displays date and time of last configuration date
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	N/A
Comments	-	Value of this parameter automatically updates after each successful configuration write.

6.1.1.11. Last reading time

Function	-	Displays RTC date and time of last configuration reading
Data type	-	Text
Range	-	N/A, read-only parameter
Default value	-	N/A
Comments	-	Value of this parameter automatically updates after each configuration reading.

6.1.2. General

General group consists of parameters vital for module operation regardless of employed resources and functionality as it used to enter data necessary for successful login to GSM network and configuration of module password protection. Inserting invalid parameter values may render impossible to establish stable GSM connection.

6.1.2.1. SIM card PIN number

Function	-	Defines PIN access code for SIM module delivered by GSM operator. For SIM modules not protected by PIN code value of this parameter is not significant.
Data type	-	Number
Range	-	Number, 4 to 8 digits
Default value	-	N/A
Comments	-	N/A

ATTENTION!
Caution is vital when setting the PIN code value . Entering faulty PIN code may render module's start-up impossible and lock the SIM card.

Procedure in case of blocked module as the result of the wrong PIN value

6.1.2.2. Configuration password

Function	-	Defines the password protecting access to configuration of the module. The password will be required for both local and remote access, thus protecting against unauthorized configuration alterations. The password does not protect against reading current configuration or the module status
Data type	-	Text
Range	-	Letters and digits, max. 32 characters
Default value	-	N/A
Comments	-	Since the only way of unlocking the module is resetting it to factory settings, it is vital that the password is stored in a safe way and available when needed.

6.1.2.3. Use of GPRS

Function	-	Enables GPRS usage required for e-mail and data sending.
Data type	-	Selection list
Range	-	*No* GPRS is disabled. *Yes* GPRS is enabled.
Default value	-	*No*
Comments	-	When GPRS is enabled new group of parameters called GPRS is visible.

6.1.3. SMS

SMS group contains parameters related to sending and receiving SMS text messages by **MT-020** module.

6.1.3.1. Daily SMS limit

Function	-	Defines max number of SMS, the module may send during one day. The parameter protects against uncontrolled sending of SMS messages and consequent expenses running high.
Data type	-	Number
Range	-	*0 - 65535*
Default value	-	*0*
Comments	-	When this parameter is set to *0* limit is lifted.

ATTENTION!
Reaching set by the parameter limit results with unconditional stop of SMS sending. One has to bear in mind that until 00:00 o'clock no messages will be sent even in alarm situations!

Unsent due to limitation SMS messages are queued (the queue holds 16 messages) and will be sent when it is possible (after 00:00). If the number of queued messages is higher than the limit set by user, there is a risk of immediate consuming of the next day limit.

6.1.3.2. Roaming for SMS

Function	-	Decides whether the module may send SMS when it is logged to foreign GSM network.
Data type	-	Selection list
Range	-	*No* No SMS are sent when modules is in roaming *Answer* The module can only respond to queries from authorized numbers

Yes
All SMS messages are sent regardless of the GSM roaming status

Default value - *Answer*

Comments - In order to be able to send SMS in roaming it must be enabled on the SIM card by GSM provider.

6.1.3.3. Number of SMS sending retries

Function - Defines max number of retries of failed SMS transmission

Data type - Number

Range - *0 - 255*

Default value - *10*

Comments - After reaching defined value of retries the SMS is deleted from sending queue.

6.1.3.4. Answer for blank SMS

Function - Defines the text of reply for empty SMS to the sender.

Data type - Text

Range - Letters, digits and special signs, max. 160 characters

Default value - **M0*

Comments - In the message text may be used symbolic names, macros and commands following syntax rules defined in Appendices in the Syntax of read and write commands in SMS chapter.

6.1.3.5. SMS limit exceed information

Function - Turns on/off sending alert that SMS limit was exceeded.

Data type - Selection list

Range - *On*
module will send SMS limit alert to defined phone number of info recipient
Off
SMS limit alert sending is disabled

Default value - *Off*

Comments - This information is sent only **once a day**. This message does not increment sent messages counter.

6.1.3.6. Phone number of info recipient

Function - Selects the SMS limit alert recipient

Data type - Selection list

Range - Friendly names of recipients associated with phone numbers in Phone list

Default value	-	*NUM 1* - first number from the list
Comments	-	The recipient must be previously defined in Authorized numbers -> Phone list. Parameter is visible only when SMS limit exceed information parameter is set to *On*.

6.1.3.7. SMS limit exceed information text

Function	-	Contains the text of the SMS message sent upon reaching Daily SMS limit.
Data type	-	Text
Range	-	Letters, digits and special signs, max. 160 characters
Default value	-	N/A
Comments	-	In message text symbolic names, macros and commands may be used following syntax rules defined in Appendices in the Syntax of read and write commands in SMS chapter. Parameter is visible only when SMS limit exceed information parameter is set to *On*.

6.1.3.8. Formats

Formats group contains parameters allowing user to define formats of date and time presented in SMS messages.

6.1.3.8.1. Date format

Function	-	Defines date format used by #date predefined symbolic name and by *ld* and *ud* macro prefixes
Data type	-	Text
Range	-	Letters, digits and special signs, max. 31 characters
Default value	-	*YYYY-DD-MM*
Comments	-	In the text user can put any sign combination but predefined with special meaning listed below: *YYYY* - if placed in this format text automatically changed for year in four digit notation (e.g. 2011), *YY* - if placed in this format text automatically changed for year in two digit notation (e.g. 11), *MM* - if placed in this format text automatically changed for month (e.g. 01 for January), *DD* - if placed in this format text automatically changed for day of month (e.g. 31). Example: Parameter is set to: *Date of measurement: YYYY-MM-DD* Macro result is (providing today is 31st of January 2011): *Date of measurement: 2011-01-31*

6.1.3.8.2. Time format

Function	-	Defines time format used by *#time* predefined symbolic name and by *lt* and *ut* macro prefixes
Data type	-	Text
Range	-	Letters, digits and special signs, max. 31 characters
Default value	-	*HH:MN:SS*
Comments	-	In the text user can put any sign combination but predefined with special meaning listed below: *HH* - if placed in this format text automatically changed for current hour in 24h format (e.g. 01), *MN* - if placed in this format text automatically changed for current minutes (e.g. 01), *SS* - if placed in this format text automatically changed for current seconds (e.g. 59). Example: Parameter is set to: *Time of measurement: HH:MN:SS* Macro result is (providing that time is 01:01:59): *Time of measurement: 01:01:59*

6.1.3.8.3. General format 1

Function	-	Defines date format used by *#RTC* predefined symbolic name and by *T1* macro prefix
Data type	-	Text
Range	-	Letters, digits and special signs, max. 31 characters
Default value	-	*YYYY/MM/DD, HH:MN:SS*
Comments	-	In the text user can use symbols as available for Date format and Time format parameters.

6.1.3.8.4. General format 2

Function	-	Defines date format used by *T2* macro prefix
Data type	-	Text
Range	-	Letters, digits and special signs, max. 31 characters
Default value	-	*YYYY/MM/DD, HH:MN:SS*
Comments	-	In the text user can use symbols as available for Date format and Time format parameters.

6.1.3.9. Symbolic names

Symbolic names group contains names assigned by the user referring to the internal and input registers. There can be defined up to 16 symbolic names.
In order to use a symbolic name in SMS put it name preceded by '#' sign in SMS text send from mobile phone or defined in *Rules/SMS sending* or as a component of user-defined macros. Using symbolic names makes composing SMS text much more convenient and user friendly.

6.1.3.9.1. Number of symbolic names

Function	-	Defines number of user-defined symbolic names
Data type	-	Number
Range	-	*1 - 16*
Default value	-	*1*
Comments	-	N/A

6.1.3.9.2. Symbolic name table

Idx.	-	Index number
Symbolic name	-	Friendly name facilitating identification of module resource. Letters, numerals and special characters - max. 50 characters. Default value is *IREG0*.
Address space	-	*Binary Inputs* Binary inputs (address 1XXX), read only *Binary Outputs* Binary outputs (address 0XXX), read/write *Input Registers* Input registers (address 3XXX) also known as analog inputs address space, read only *Holding Registers* Holding registers (address 4XXX) also known as internal registers and analog outputs address space, read/write
Register / bit address	-	Address of bit or register to which symbolic name is assigned. *0 - 65535* Default value is *0*.

6.1.3.10. Macros

Macros group contains up to 16 user-defined macros. Macro may contain ASCII signs, symbolic names, SMS commands and other macros .
In order to use a macro in put it name preceded by '*' sign in SMS text send from mobile phone or defined in *Rules/SMS sending* or in other macro.
Using macros makes composing complex SMS texts and queries much more convenient and user friendly.

6.1.3.10.1. Number of macros

Function	-	Defines number of user-defined macros
Data type	-	Number
Range	-	*1 - 16*
Default value	-	*1*
Comments	-	N/A

6.1.3.10.2. Macro table

Idx.	-	Index number
Macro name	-	Friendly name facilitating identification of macro. Letters, numerals and special characters - max. 20 characters. Default value is *M0*.
Macro content	-	Text to which macro is decoded. May use other macros with lower index, symbolic names and SMS commands as described in SMS commands syntax chapter in Appendices. Letters, numbers, special characters - max. 160 characters Default value is *#date #time*.

6.1.4. GPRS

GPRS group contains parameters related to GPRS transmission.
This group and all parameters it includes are visible only when Use of GPRS parameter is set to *Yes*.

6.1.4.1. APN name

Function	-	Defines APN name selected for GPRS transmission
Data type	-	Text
Range	-	Letters, numbers, special characters - max. 63 characters
Default value	-	N/A
Comments	-	APN name is required for GPRS logon Parameter is visible only when Use of GPRS parameter is set to *Yes*.

6.1.4.2. APN user name

Function	-	Defines APN user name
Data type	-	Text
Range	-	Letters, numbers, special characters - max. 31 characters
Default value	-	N/A
Comments	-	Optional parameter used only if required by GSM network operator Parameter is visible only when Use of GPRS parameter is set to *Yes*.

6.1.4.3. APN password

Function	-	Defines password for APN user account
Data type	-	Text
Range	-	Letters, numbers, special characters - max. 31 characters
Default value	-	N/A

Comments	-	Optional parameter used only if required by GSM network operator Parameter is visible only when Use of GPRS parameter is set to *Yes*.

6.1.4.4. Module IP

Function	-	Allows user to define IP number for newly created module definition and displays IP number read from the module configuration that was assigned to the module during last login to GPRS network
Data type	-	IP address
Range	-	*0.0.0.0 - 255.255.255.255*
Default value	-	*0.0.0.0*
Comments	-	If after reading the configuration or setting device time this parameter value is different from *0.0.0.0*, it means that the module is logged into GPRS network with this particular IP address assigned to it. Parameter is visible only when Use of GPRS parameter is set to *Yes*.

6.1.4.5. GPRS login retry interval [s]

Function	-	Defines in seconds interval between retries of GPRS logon attempts after GPRS login failure.
Data type	-	Number
Range	-	*10 - 3600 [s]*
Default value	-	*10 [s]*
Comments	-	Parameter is visible only when Use of GPRS parameter is set to *Yes*.

6.1.4.6. GPRS testing address (ping)

Function	-	Sets IP address which is used to test GPRS network connection in case it is lost
Data type	-	IP address
Range	-	*0.0.0.0 - 255.255.255.255*
Default value	-	*0.0.0.0*
Comments	-	This parameter sets recipient address for ping data frames testing GPRS transmission channel. Leaving recipient address at *0.0.0.0* turns off GPRS testing functionality which is not advised. Parameter is visible only when Use of GPRS parameter is set to *Yes*.

6.1.4.7. Idle time [s]

Function	-	Defines in seconds interval for sending data frame (ping) testing GPRS network in case it is lost
Data type	-	Number
Range	-	*0 - 21600 [s] (6h)*
Default value	-	*0 [s]*
Comments	-	In case of inactivity longer than the value defined in this parameter the module sends a control frame in order to check whether transmission is still possible. The frame is sent to the address specified by GPRS testing IP address parameter, if it is different than *0.0.0.0*. Lack of reply to sent ping frame after defined timeout and number of retries is considered as GPRS connection loss and resets modem. Parameter is visible only when Use of GPRS parameter is set to *Yes*.

6.1.4.8. GPRS roaming

Function	-	Decides whether the module may send data and e-mails over GPRS when it is logged to foreign GSM network.
Data type	-	Selection list
Range	-	*Off* Roaming is disabled - communication in foreign networks is not possible *On* Roaming is enabled - communication in foreign networks is possible
Default value	-	*Off*
Comments	-	In order to be able to send data and e-mails in roaming it must be enabled on the SIM card by GSM provider.

6.1.5. Authorized numbers

Authorized numbers group comprises lists of phone numbers the module is going to communicate with.

6.1.5.1. Number of phone numbers

Function	-	Defines the length of phone numbers list authorized to exchange SMS messages.
Data type	-	Number
Range	-	*1 - 32*
Default value	-	*1*
Comments	-	The value of this parameter may vary as the result of adding/deleting when using the context menu operating directly on Phone number. The module will communicate only with units with the phone number present on the list.

Read more in Syntax for reading and writing data in SMS mode chapter of Appendices.

6.1.5.2. Number of IP addresses

Function	-	Defines the length of the IP addresses list
Data type	-	Number
Range	-	*0 - 32*
Default value	-	*0*
Comments	-	The value of this parameter may vary as the result of adding/deleting when using the context menu operating directly on IP list. Parameter is visible only when Use of GPRS parameter is set to *Yes*.

6.1.5.3. Update phone numbers from SIM card

Function	-	Enables synchronization of Phone list with phone book saved on SIM card
Data type	-	Selection list
Range	-	*Yes* Synchronization is on *No* Synchronization is off
Default value	-	*No*
Comments	-	Synchronization is done after every reboot of the module, after inserting the SIM card or when configuration is written to the module. The module browses SIM card phone book and when it finds entries of the same name as defined in the Authorized numbers\Phone it overrides the numbers from configuration with the numbers from the SIM card. Those numbers are remembered until module restart.

6.1.5.4. Phone number from SIM card always authorized

Function	-	Enables receiving voice calls authorization for all phone numbers stored in SIM card phone book.
Data type	-	Selection list
Range	-	*Yes* Authorization is on *No* Authorization is off
Default value	-	*No*
Comments	-	If set to *Yes*, all mobile phones stored on SIM card are treated as if they were placed on Authorized numbers\Phone list with tick next to *Receiving voice calls* option.

The name assigned to him on the SIM card cannot be empty. Phone book entries with empty name won't be analysed.

6.1.5.5. Phone

Idx. - Index number

Name - Friendly name facilitating identification of the module while defining Rules. Max. length 16 characters

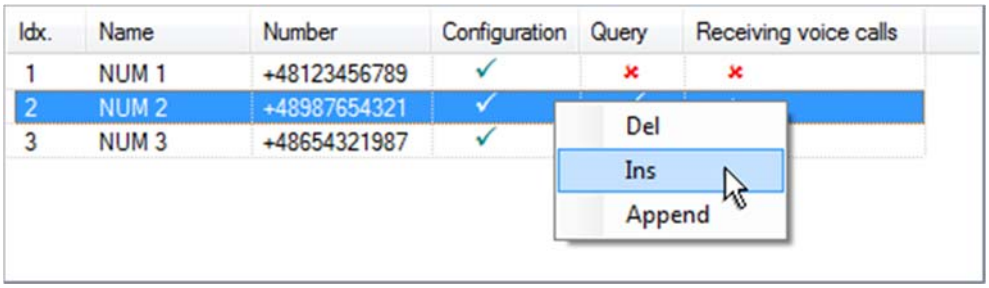
Number - Phone number assigned to list index. Max. 14 characters

Configuration - Depending on configuration settings incoming configuration SMS will be processed or ignored.
Default value: ✓ (allowed)

Query - The module receives and analyzes SMS query messages depending on selected setting. When Query is not allowed, all SMS query messages from that phone number will be ignored
Default value: × (not allowed)

Receiving voice calls - The module receives calls and can use these signals for trigger event depending on selected setting. When Receiving is not allowed, all calls from that phone number will be ignored
Default value: × (not allowed)

Entries on phone list may be easily added and deleted by using context menu activated by right mouse button click on any position of the list in parameters window.



6.1.5.6. IP

Idx. - Index number

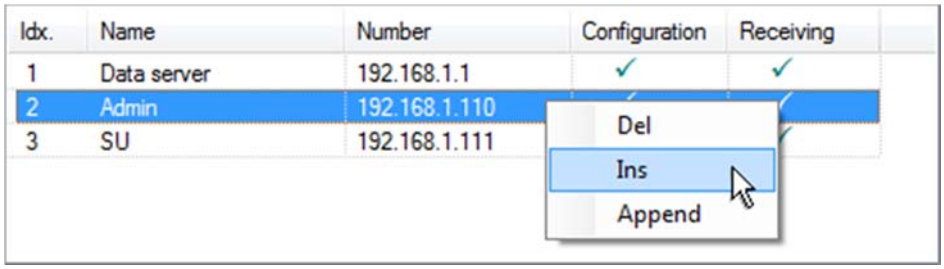
Name - Friendly name facilitating identification of the receiver while defining Rules. Maximum length is 16 characters.

Address - IP address assigned to name

Configuration - Value of this parameter determines whether remote configuration data arriving from selected IP will be ignored or accepted.
Default value: ✓ (allowed)

Receiving - Value of this parameter determines whether data arriving from selected IP will be accepted or ignored.
Default value: ✓ (allowed)

Entries on IP list may be easily added and deleted by using context menu activated by right mouse button click on any position of the list in parameters window.



List is visible only when Use of GPRS parameter is set to *Yes*.

6.1.6. Resources

Resources group contains user defined hardware configuration. Particular sub-groups contain fields allowing fast and intuitive preparation of the module to perform measurements and evaluations of external parameters (binary states, counters, temperature and air humidity) as well as internal (timers, flags).

6.1.6.1. Terminals

Terminals group gathers all inputs and outputs. Depending on type of accepted input, they are binary and analogue. Final functionality of each input depends on settings and configuration parameters connected.

6.1.6.1.1. Binary inputs

Module **MT-020** has four identical binary inputs. Inputs can operate in one of two functional modes:

- binary input
- counter input

Each mode has a set of specific configuration parameters.
In counter mode module provides two 32-bit registers for each binary input - **CNT_Ix** which holds number of counted pulses and **CNT_ENG_Ix** which holds number pulses multiplied by scaling factor. In addition **CNT_ENG_Ix** counters can be reset on event thus allowing to calculated flow.

6.1.6.1.1.1. Name

Function	-	Defines input user friendly name
Data type	-	Text
Range	-	Letters and numerals, max. 16 characters
Default value	-	Respectively *I1*, *I2*, *I3*, *I4*
Comments	-	Assigning friendly names facilitates discrimination of inputs destination and required settings.

6.1.6.1.1.2. Input type

Function	-	Defines binary input operating mode.
Data type	-	Selection list
Range	-	*Binary input* Terminal operates as binary input *Counter input* Terminal operates as counter input
Default value	-	*Binary input*
Comments	-	According to selected mode MTManager displays additional configuration parameters for each input

6.1.6.1.1.3. Filtering constant [s]

Function	-	Defines (in seconds) value of minimum duration of altered state on input in order to consider state to be stable.
Data type	-	Number
Range	-	*0 - 163.83* [s]
Default value	-	*0.10* [s]
Comments	-	Setting value appropriate to contact characteristics eliminates disturbance caused by contact bounce thus preventing multiple registration of what is in reality one pulse.

6.1.6.1.1.4. Counting direction

Function	-	Defines counter counting direction.
Data type	-	Selection list
Range	-	*Up* A pulse on input increases value of counter register *Down* A pulse on input decreases value of counter register
Default value	-	*Up*
Comments	-	According to selected mode MTManager displays additional configuration parameters for each input Parameter is visible only when Input type parameter for this binary input is set to *Counter input*.

6.1.6.1.1.5. Counting range (31bits)

Function	-	Defines maximum value counted by **CNT_Ix** counter.
Data type	-	Number
Range	-	*0 - 2147483648*
Default value	-	*0*
Comments	-	After reaching its range counter sets its flag (*I1_CNT* to *I4_CNT*) for one program cycle and automatically starts counting from *0*. Parameter is visible only when Input type parameter for this binary input is set to *Counter input*.

6.1.6.1.1.6. Triggering slope

Function - Defines binary input slope triggering counter function
Data type - Selection list
Range - *0->1*
Counter value changes upon signal change from logical 0 to logical 1
1->0
Counter value changes upon signal change from logical 1 to logical 0
0->1|1->0
Counter value changes upon signal change from logical 0 to logical 1
Default value - *0->1*
Comments - Parameter is visible only when Input type parameter for this binary input is set to *Counter input*.

6.1.6.1.1.7. Scaling factor

Function - Defines pulse weight which is then used as multiplier for **CNT_ENG_Ix** counters
Data type - Number
Range - *0.01 - 100.00*
Default value - *1.00*
Comments - Parameter is visible only when Input type parameter for this binary input is set to *Counter input*.

6.1.6.1.1.8. Cyclic resetting

Function - Defines whether **CNT_ENG_Ix** should be cyclically reset or not
Data type - Selection list
Range - *No*
Counter value is reset only when counter **CNT_Ix** reaches its range and resets itself
Yes
Counter value is reset when counter **CNT_Ix** reaches its range and resets itself or when resetting event is triggered.
Default value - *No*
Comments - Parameter is visible only when Input type parameter for this binary input is set to *Counter input*.

6.1.6.1.1.9. Resetting event

Function - Selects one of previously defined events which will reset **CNT_Ix** counter
Data type - Selection list
Range - *None* or names of events from the Events table

Default value	-	*None*
Comments	-	Parameter is visible only when Cyclic resetting parameter for this binary input is set to *Yes*.

6.1.6.1.2. Binary outputs

MT-020 module is equipped with 2 binary outputs operating as NPN switch to module ground. Outputs can operate in one of three functional modes:

- monostable with configurable initial state
- bistable with configurable initial state
- toggle with configurable initial state

Each mode has a set of specific configuration parameters.

6.1.6.1.2.1. Name

Function	-	Defines output user friendly name
Data type	-	Text
Range	-	Letters and numerals, max. 16 characters
Default value	-	Respectively *Q1*, *Q2*
Comments	-	Assigning friendly names facilitates discrimination of outputs destination and required settings.

6.1.6.1.2.2. Initial state

Function	-	Defines binary output state after module restart or power on.
Data type	-	Selection list
Range	-	*Off* Binary output default state is off (logical *0* - output circuit is open) *On* Binary output default state is on (logical *1*- output circuit is closed to module GND)
Default value	-	*Binary input*
Comments	-	N/A

6.1.6.1.2.3. Output mode

Function	-	Defines binary output state after module restart or power on.
Data type	-	Selection list
Range	-	*Monostable* Binary output state is changed to opposite from default state defined by Initial state parameter for time given by Pulse duration parameter. There is one event for triggering change of binary output.

Bistable
Binary output state changes are stable in time. There are separate events for triggering On and Off binary output states.

Toggle
Binary output state is changed to opposite from current state. Change is stable in time. There is one event for triggering output change.

Default value - *Monostable*

Comments - Output state can be changed not only by events but also by writing desired state to controlling bit of output. According to selected mode MTManager displays additional configuration parameters for each output

6.1.6.1.2.4. Pulse duration [s]

Function - Defines (in seconds) time after which binary output operating in monostable mode will go back to its initial state.

Data type - Number

Range - *0.1 - 86400.0 [s]*

Default value - *0.1 [s]*

Comments - If
Parameter is visible only when Output mode parameter for this binary input is set to *Monostable*.

6.1.6.1.2.5. On event

Function - Selects one of previously defined events which will turn output on

Data type - Selection list

Range - *None* or names of events from the Events table

Default value - *None*

Comments - Parameter is visible only when Output mode parameter for this binary input is set to *Bistable* or when Output mode parameter for this binary input is set to *Monostable* and Initial state parameter set to *Off*.

6.1.6.1.2.6. Off event

Function - Selects one of previously defined events which will turn output off

Data type - Selection list

Range - *None* or names of events from the Events table

Default value - *None*

Comments - Parameter is visible only when Output mode parameter for this binary input is set to *Bistable* or when Output mode parameter for this binary input is set to *Monostable* and Initial state parameter set to *On*.

6.1.6.1.2.7. Toggle event

Function	-	Selects one of previously defined events which will change output state to opposite
Data type	-	Selection list
Range	-	*None* or names of events from the Events table
Default value	-	*None*
Comments	-	Parameter is visible only when Output mode parameter for this binary input is set to *Toggle*.

6.1.6.1.2.8. Filtering constant [s]

Function	-	Defines (in seconds) length of minimum delay between events in Toggle mode.
Data type	-	Number
Range	-	*0.1 - 86400.0 [s]*
Default value	-	*0.1 [s]*
Comments	-	Events that happen before time defined by this parameter elapses are ignored. Parameter is visible only when Output mode parameter for this binary input is set to *Toggle*.

6.1.6.1.3. Analog inputs

MT-020 provides two analog inputs marked as AN1 and AN2 which can operate in following modes:

AN1:

- Pt-100 sensor temperature readout
- voltage input - 0-5V or 0-10V
- current input - 4-20mA

AN2:

- NTC sensor temperature readout
- voltage input - 0-5V or 0-10V
- current input - 4-20mA

Each analog inputs and each mode provides a set of specific configuration parameters.

6.1.6.1.3.1. Name

Function	-	Defines analog input user friendly name
Data type	-	Text
Range	-	Letters and numerals, max. 16 characters
Default value	-	Respectively *AN1*, *AN2*
Comments	-	Assigning friendly names facilitates discrimination of analog input destination and required settings.

6.1.6.1.3.2. Input type

Function - Selects analog input operating mode
Data type - Selection list
Range - *Voltage input*
Analog input measures signal in 0-10 V or 0-5 V range depending on Signal range parameter setting
Current input
Analog input measures signal in 4-20 mA range
Pt100
Analog input measures temperature using Pt100 sensor (available only for AN1)
NTC
Analog input measures temperature using NTC sensor (available only for AN2)
Default value - *Voltage input*
Comments - N/A

6.1.6.1.3.3. Filtering constant [s]

Function - Defines (in seconds) measurement averaging time
Data type - Number
Range - *0*, *0.05*, *0.1*, *0.25*, *0.5*, *1*, *2*, *4*, *8*, *16*, *32*, *64* [s]
Default value - *0* [s]
Comments - N/A

6.1.6.1.3.4. Signal range

Function - Selects range for voltage measurement
Data type - Selection list
Range - *0 - 5V*
Analog input measures signal in 0-10 V or 0-5 V range depending on Signal range parameter setting
0 - 10V
Analog input measures signal in 4-20 mA range
Default value - *Voltage input*
Comments - Parameter is visible only when Input type parameter for this analog input is set to *Voltage input*.

6.1.6.1.3.5. Low reference - internal units

Function - Defines internal units low reference used for rescaling of input signal to engineering units
Data type - Number
Range - *0 - 500* [x10 mV]
Range valid when Input type parameter is set to *Voltage input* and Signal range parameter is set to *0 - 5V*.

0 - 1000 [x10 mV]
Range valid when Input type parameter is set to *Voltage input* and Signal range parameter is set to *0 - 10V*.
0 - 2000 [x10^-1 mA]
Range valid when Input type parameter is set to *Current input*.

Default value - *0* [x10 mV]
Value valid when Input type parameter is set to *Voltage input.*
2000 [x10^-1 mA]
Value valid when Input type parameter is set to *Current input*.

Comments - Parameter is visible only when Input type parameter for this analog input is set to *Voltage input* or *Current input*.

6.1.6.1.3.6. High reference - internal units

Function - Defines internal units high reference used for rescaling of input signal to engineering units

Data type - Number

Range - *0 - 500* [x10 mV]
Range valid when Input type parameter is set to *Voltage input* and Signal range parameter is set to *0 - 5V*.
0 - 1000 [x10 mV]
Range valid when Input type parameter is set to *Voltage input* and Signal range parameter is set to *0 - 10V*.
0 - 2000 [x10^-1 mA]
Range valid when Input type parameter is set to *Current input*.

Default value - *500* [x10 mV]
Value valid when Input type parameter is set to *Voltage input* and Signal range parameter is set to *0 - 5V*.
1000 [x10 mV]
Value valid when Input type parameter is set to *Voltage input* and Signal range parameter is set to *0 - 10V*.
2000 [x10^-1 mA]
Value valid when Input type parameter is set to *Current input*.

Comments - Parameter is visible only when Input type parameter for this analog input is set to *Voltage input* or *Current input*.

6.1.6.1.3.7. Low reference - engineering units

Function - Defines engineering units low reference used for rescaling of input signal to engineering units

Data type - Number

Range - *-32767 - 32767*

Default value	-	*0*
Comments	-	Parameter is visible only when Input type parameter for this analog input is set to *Voltage input* or *Current input*.

6.1.6.1.3.8. High reference - engineering units

Function	-	Defines engineering units high reference used for rescaling of input signal to engineering units
Data type	-	Number
Range	-	*-32767 - 32767*
Default value	-	*0*
Comments	-	Parameter is visible only when Input type parameter for this analog input is set to *Voltage input* or *Current input*.

6.1.6.1.3.9. Alarm HiHi - engineering units

Function	-	Defines in engineering units **HiHi** alarm level
Data type	-	Number
Range	-	*-32767 - 32767*
Default value	-	*32767*
Comments	-	When measured analog value exceeds defined alarm level HiHi alarm flag is set to 1. Flag is reset when value drops below defined alarm level decreased by Alarm hysteresis parameter value.

6.1.6.1.3.10. Alarm Hi - engineering units

Function	-	Defines in engineering units **Hi** alarm level
Data type	-	Number
Range	-	*-32767 - 32767*
Default value	-	*32767*
Comments	-	When measured analog value exceeds defined alarm level Hi alarm flag is set to 1. Flag is reset when value drops below defined alarm level decreased by Alarm hysteresis parameter value.

6.1.6.1.3.11. Alarm Lo - engineering units

Function	-	Defines in engineering units **Lo** alarm level
Data type	-	Number
Range	-	*-32767 - 32767*
Default value	-	*32767*
Comments	-	When measured analog value drops below defined alarm level Lo alarm flag is set to 1. Flag is reset when value rises above defined alarm level increased by Alarm hysteresis parameter value.

6.1.6.1.3.12. Alarm LoLo - engineering units

Function	-	Defines in engineering units **LoLo** alarm level
Data type	-	Number
Range	-	*-32767 - 32767*
Default value	-	*32767*
Comments	-	When measured analog value drops below defined alarm level LoLo alarm flag is set to 1. Flag is reset when value rises above defined alarm level increased by Alarm hysteresis parameter value.

6.1.6.1.3.13. Alarm hysteresis - engineering units

Function	-	Defines in engineering units alarm hysteresis value
Data type	-	Number
Range	-	*0 - 32767*
Default value	-	*100*
Comments	-	Setting hysteresis higher than signal fluctuations and noise prevents excessive activations of alarm flags.

6.1.6.1.3.14. Deadband - engineering units

Function	-	Defines in engineering units minimal change of analog input value that will cause setting **Db** flag to 1 for one cycle.
Data type	-	Number
Range	-	*0 - 32767*
Default value	-	*100*
Comments	-	Deadband flags are designed for continuous monitoring of analog input value change.

6.1.6.1.4. 1-Wire inputs

MT-020 Telemetry module is equipped with two 1-Wire inputs for connecting sensors using this interface for transmission of measured temperature value.

6.1.6.1.4.1. Name

Function	-	Defines input user friendly name
Data type	-	Text
Range	-	Letters and numerals, max. 16 characters
Default value	-	Respectively *1-WIRE1*, *1-WIRE2*
Comments	-	Assigning friendly names facilitates discrimination of inputs destination and required settings.

6.1.6.1.4.2. Input type

Function	-	Selects 1-Wire input operating mode
Data type	-	Selection list
Range	-	*Inactive* 1-Wire input is turned off *Temperature measurement* 1-Wire input measures temperature using **DS18B20** based sensor
Default value	-	*Inactive*
Comments	-	N/A

6.1.6.1.4.3. Alarm HiHi

Function	-	Defines in Celsius degrees **HiHi** alarm level
Data type	-	Number
Range	-	*-25 - 125* [°C]
Default value	-	*125* [°C]
Comments	-	When measured temperature value exceeds defined alarm level HiHi alarm flag is set to 1. Flag is reset when value drops below defined alarm level decreased by Alarm hysteresis parameter value.

6.1.6.1.4.4. Alarm Hi

Function	-	Defines in Celsius degrees **Hi** alarm level
Data type	-	Number
Range	-	*-25 - 125* [°C]
Default value	-	*125* [°C]
Comments	-	When measured temperature value exceeds defined alarm level Hi alarm flag is set to 1. Flag is reset when value drops below defined alarm level decreased by Alarm hysteresis parameter value.

6.1.6.1.4.5. Alarm Lo

Function	-	Defines in Celsius degrees **Lo** alarm level
Data type	-	Number
Range	-	*-25 - 125* [°C]
Default value	-	*-25* [°C]
Comments	-	When measured analog value drops below defined alarm level Lo alarm flag is set to 1. Flag is reset when value rises above defined alarm level increased by Alarm hysteresis parameter value.

6.1.6.1.4.6. Alarm LoLo

Function	-	Defines in Celsius degrees **LoLo** alarm level
Data type	-	Number
Range	-	*-25 - 125* [°C]
Default value	-	*-25* [°C]
Comments	-	When measured analog value drops below defined alarm level LoLo alarm flag is set to 1. Flag is reset when value rises above defined alarm level increased by Alarm hysteresis parameter value.

6.1.6.1.4.7. Alarm hysteresis

Function	-	Defines in Celsius degrees alarm hysteresis value
Data type	-	Number
Range	-	*0 - 50* [°C]
Default value	-	*2* [°C]
Comments	-	Setting hysteresis higher than signal fluctuations and noise prevents excessive activations of alarm flags.

6.1.6.1.4.8. Deadband

Function	-	Defines in Celsius degrees minimal change of temperature value that will cause setting **Db** flag to 1 for one cycle.
Data type	-	Number
Range	-	*0 - 32767*
Default value	-	*100*
Comments	-	Deadband flags are designed for continuous monitoring of temperature value change.

6.1.6.2. Synchronous timers

Synchronous timers measure cyclically defined time intervals. They are synchronized with module real time clock (RTC).

6.1.6.2.1. Active

Function	-	Turns timer on and off
Data type	-	Selection list
Range	-	*Yes* Timer is turned on *No* Timer is turned off
Default value	-	*No*
Comments	-	N/A

6.1.6.2.2. Start [HH:MM]

Function	-	Defines timer synchronization point with RTC
Data type	-	Time
Range	-	*00:00 - 23:59*
Default value	-	*00:00*
Comments	-	At time defined by this parameter module will always generate a pulse on timer flag.

6.1.6.2.3. Period

Function	-	Defines time intervals measured by timer
Data type	-	Selection list
Range	-	*1 min., 2 min., 3min., 5 min., 10 min., 15 min., 30 min., 1 hour, 2 hours, 3 hours, 4 hours, 6 hours, 8 hours, 12 hours, 24 hours*
Default value	-	*12 hours*
Comments	-	N/A

6.1.6.2.4. Days of week

Function	-	Defines days of week when timer is active
Data type	-	Multiple choice field
Range	-	*Mo., Tu., We., Th., Fr., Sa., Su.*
Default value	-	*Mo., Tu., We., Th., Fr., Sa., Su.* (all days of week selected)
Comments	-	The timer activity is depending on logical sum of days of week and days of month. Selecting all week days will make the timer active all of the time. If no days of week are selected the activity of the timer will depend only on days of month selection.

6.1.6.2.5. Days of month

Function	-	Defines days of month when timer is active
Data type	-	Multiple choice field
Range	-	*1*, *2*, *… 30*, *31*, *Last*
Default value	-	*No day selected* (none of month days is selected)
Comments	-	The timer activity is depending on logical sum of days of week and days of month. Selecting all month days will make the timer active all of the time. If no days of month are selected the activity of the timer will depend only on days of week selection.

6.1.6.3. State logging

State logging group contains parameters defining messages (which may include the current states of inputs and outputs) periodically saved into device event logger. This feature allows to record measured values with given time period.

6.1.6.3.1. Start [HH:MM]

Function	-	Defines logging timer synchronization point with RTC
Data type	-	Time
Range	-	*00:00 - 23:59*
Default value	-	*00:00*
Comments	-	At time defined by this parameter module will always save message specified by Logged information to event logger.

6.1.6.3.2. Period

Function	-	Defines time interval of saving message specified by Logged information to event logger.
Data type	-	Selection list
Range	-	*10 min., 20 min., 30 min., 45 min., 1 hour, 2 hours, 3 hours, 4 hours, 6 hours, 8 hours, 12 hours, 24 hours*
Default value	-	*6 hours*
Comments	-	N/A

6.1.6.3.3. Logged information

Function	-	Defines the text of message periodically saved in event logger
Data type	-	Text
Range	-	Letters, digits and special signs, max. 160 characters
Default value	-	N/A
Comments	-	In the message text may be used symbolic names, macros and commands following syntax rules defined in Appendices in the Syntax of read and write commands in SMS chapter.

6.1.6.4. Power supply

Power supply group contains parameters providing tools for control over power outputs, backup power and battery charging subsystem.

6.1.6.4.1. Power output voltage

Function	-	Allows to set up voltage on stabilized output **VOUT1**
Data type	-	Selection list
Range	-	*Low (12V)* Output voltage is 12VDC *High (20V)* Output voltage is 20VDC
Default value	-	*Binary input*
Comments	-	N/A

6.1.6.4.2. Backup battery

Function	-	Turns on and off backup power supply and battery charging subsystem
Data type	-	Selection list
Range	-	*No* At power loss the module switches off. Battery charger is inactive. *Yes* At power loss the module switches over to external battery. Battery charger circuit is active.
Default value	-	*No*
Comments	-	Module supports 6VDC batteries. Maximum recommended battery capacity is 3.0Ah.

6.1.6.4.3. Battery charging current

Function	-	Defines value of backup battery charging current
Data type	-	Selection list
Range	-	*Low (0.4A)* Battery will be charged with 0.4A. *High (0.8A)* Battery will be charged with 0.8A.
Default value	-	*Low (0.4A)*
Comments	-	Parameter is visible only when Backup battery parameter is set to *Yes*.

6.1.7. Events

Events group defines events (e.g. change of binary input states, incoming calls) which are then used to send SMS or e-mail messages, CLIP calls, data frames or to control relay outputs.

6.1.7.1. Number of events

Function	-	Defines the number of events
Data type	-	Number
Range	-	*0 - 32*
Default value	-	*0*
Comments	-	N/A

6.1.7.2. EVT1 - EVT32

6.1.7.2.1. Name

Function	-	Defines event user friendly name
Data type	-	Text

Range - Letters and numerals, max. 15 characters
Default value - Respectively *EVT1* - *EVT32*
Comments - Assigning friendly names facilitates discrimination of events destination and required settings.

6.1.7.2.2. Trigger source

Function - Defines resource triggering event
Data type - Selection list
Range - *None*
Event is inactive
Binary inputs
Event is triggered by one of the binary inputs (I1 - I4)
Analog inputs
Event is triggered by one of the analog inputs (AN1 - AN2)

1-WIRE inputs
Event is triggered by one of the 1-Wire inputs (1-WIRE1 - 1-WIRE2)
Clocks
Event is triggered by one of the timers (TMR1 - TMR4)
Flags
Event is triggered by one of the system flags
Counters
Event is triggered by one of the counters
Connections
Event is triggered by incoming phone call
Binary outputs
Event is triggered by one of the binary outputs (Q1 - Q2)
Default value - *None*
Comments - According to selected setting MTManager displays additional configuration parameters for each event

6.1.7.2.3. Trigger input

Function - Defines input triggering event
Data type - Selection list
Range - *I1 - I4*
Parameter is visible only when Trigger source parameter for this event is set to *Binary inputs*
AN1 - AN2
Parameter is visible only when Trigger source parameter for this event is set to *Analog inputs*
1-WIRE1 - 1-WIRE2
Parameter is visible only when Trigger source parameter for this event is set to *1-WIRE inputs*

Q1 - Q2
Parameter is visible only when Trigger source parameter for this event is set to *Binary outputs*

Default value - *I1*
When Trigger source parameter for this event is set to *Binary inputs*
AN1
When Trigger source parameter for this event is set to *Analog inputs*
1-WIRE1
When Trigger source parameter for this event is set to *1-WIRE inputs*
Q1
When Trigger source parameter for this event is set to *Binary outputs*

Comments - Parameter is visible only when Trigger source parameter for this event is set to *Binary inputs* or *Analog inputs* or *1-WIRE inputs* or *Binary outputs.*

6.1.7.2.4. Trigger condition

Function - Defines change of binary input or output state triggering event

Data type - Selection list

Range - *0->1*
Event is triggered by rising edge. Parameter is visible only when Trigger source parameter for this event is set to *Binary inputs* or *Binary outputs.*
1->0
Event is triggered by falling edge. Parameter is visible only when Trigger source parameter for this event is set to *Binary inputs* or *Binary outputs.*
0->1|1->0
Event is triggered on state change. Parameter is visible only when Trigger source parameter for this event is set to *Binary inputs* or *Binary outputs.*
HiHi alarm - activation
Event is triggered on HiHi alarm activation. Parameter is visible only when Trigger source parameter for this event is set to *Analog inputs* or *1-WIRE inputs.*
Hi alarm - activation
Event is triggered on Hi alarm activation. Parameter is visible only when Trigger source parameter for this event is set to *Analog inputs* or *1-WIRE inputs.*
Lo alarm - activation
Event is triggered on Lo alarm activation. Parameter is visible only when Trigger source parameter for this event is set to *Analog inputs* or *1-WIRE inputs.*
LoLo alarm - activation
Event is triggered on LoLo alarm activation. Parameter is visible only when Trigger source parameter for this event is set to *Analog inputs* or *1-WIRE inputs.*

HiHi alarm - deactivation
Event is triggered on HiHi alarm activation. Parameter is visible only when Trigger source parameter for this event is set to *Analog inputs* or *1-WIRE inputs.*

Hi alarm - deactivation
Event is triggered on Hi alarm deactivation. Parameter is visible only when Trigger source parameter for this event is set to *Analog inputs* or *1-WIRE inputs.*

Lo alarm - deactivation
Event is triggered on Lo alarm deactivation. Parameter is visible only when Trigger source parameter for this event is set to *Analog inputs* or *1-WIRE inputs.*

LoLo alarm - deactivation
Event is triggered on LoLo alarm deactivation. Parameter is visible only when Trigger source parameter for this event is set to *Analog inputs* or *1-WIRE inputs.*

Default value - *0->1*
When Trigger source parameter for this event is set to *Binary inputs* or *Binary outputs.*

HiHi alarm - activation
When Trigger source parameter for this event is set to *Analog inputs* or *1-WIRE inputs.*

Comments - Parameter is visible only when Trigger source parameter for this event is set to *Binary inputs* or *Analog inputs* or *1-WIRE inputs* or *Binary outputs.*

6.1.7.2.5. Triggering clock

Function - Specifies timer which will triggering event
Data type - Selection list
Range - *TMR1 - TMR4*
Default value - *TMR1*
Comments - Parameter is visible only when Trigger source parameter for this event is set to *Clocks.*

6.1.7.2.6. Triggering flag

Function - Specifies flag which will triggering event
Data type - Selection list
Range - *Module power-on reset*
Event will be triggered after powering module
Default value - *Module power-on reset*
Comments - Parameter is visible only when Trigger source parameter for this event is set to *Flags.*

6.1.7.2.7. Triggering counter

Function	-	Specifies counter which will triggering event when counter reaches its range
Data type	-	Selection list
Range	-	*I1 - I4*
Default value	-	*I1*
Comments	-	Event will be triggered when selected input is configured as counter input. Parameter is visible only when Trigger source parameter for this event is set to *Counters.*

6.1.7.2.8. Connection from any authorized number

Function	-	Selects whether event should be triggered by incoming call from any authorized number or only specific one.
Data type	-	Selection list
Range	-	*Yes* Event will be triggered after receiving incoming call from any number from Phone list with enabled permission for receiving voice calls. *No* Event will be triggered after receiving incoming call from number specified by Connection from number parameter.
Default value	-	*Yes*
Comments	-	Parameter is visible only when Trigger source parameter for this event is set to *Connections.*

6.1.7.2.9. Connection from number

Function	-	Selects the phone number incoming call from which will trigger event
Data type	-	Selection list
Range	-	Friendly names of recipients associated with phone numbers in Phone list
Default value	-	*NUM 1* - first number from the list
Comments	-	The recipient must be previously defined in Authorized numbers -> Phone. Parameter is visible only when Connection from any authorized number parameter is set to *No*.

6.1.8. Rules

Rules group contains lists of transmission tasks performed by device when criteria defined in rules are met. Tasks are divided into three groups:

- Message sending rules (SMS and e-mail messages)
- CLIP calls rules
- Data sending rules

In every case, the criteria are defined by using same resources and conditions of application of the rule.

6.1.8.1. Message sending

List of message sending rules can hold up to 32 entries defining SMS and e-mail sending conditions.

6.1.8.1.1. Number of message sending rules

Function	-	Defines the number of message (SMS or e-mail) sending rules
Data type	-	Number
Range	-	*1 - 32*
Default value	-	*1*
Comments	-	Diminishing the number of rules does not delete settings until the configuration is written to the module.

6.1.8.1.2. SMTP server settings

Function	-	Specifies whether module should use one of preconfigured SMTP setting or allow user to define own server settings
Data type	-	Selection list
Range	-	*User defined* SMTP configuration parameters are visible for user *telemetria.pl* SMTP configuration parameters are not visible for user. Parameters are preconfigured for SMTP server available in APN telemetria.pl
Default value	-	*User defined*
Comments	-	Proper SMTP server configuration is required for e-mail sending. Parameter is visible only when General->Use of GPRS parameter is set to *Yes.*

6.1.8.1.3. Sender e-mail address

Function	-	Allows user to enter sender e-mail address, e.g. john.smith@comapny.com
Data type	-	Text
Range	-	Letters, numerals and special signs, max. 31 characters
Default value	-	N/A
Comments	-	This address is used to send e-mails. Parameter is visible only when General->Use of GPRS parameter is set to *Yes* and SMTP server settings parameter is set to *User defined*.

6.1.8.1.4. SMTP server name

Function	-	Allows user to enter SMTP server name used for e-mail sending, e.g. smtp.comapny.com
Data type	-	Text
Range	-	Letters, numerals and special signs, max. 31 characters
Default value	-	N/A
Comments	-	Parameter is visible only when General->Use of GPRS parameter is set to *Yes* and SMTP server settings parameter is set to *User defined*.

6.1.8.1.5. SMTP server port

Function	-	Defines port number which is used for communication with SMTP server
Data type	-	Number
Range	-	*1 - 65535*
Default value	-	*25*
Comments	-	Parameter is visible only when General->Use of GPRS parameter is set to *Yes* and SMTP server settings parameter is set to *User defined*.

6.1.8.1.6. SMTP authentication

Function	-	Specifies whether module should use SMTP authentication
Data type	-	Selection list
Range	-	*No* SMTP authentication is disabled *Yes (PLAIN)* Module will use PLAIN SMTP authentication method *Yes (LOGIN)* Module will use LOGIN SMTP authentication method
Default value	-	*No*
Comments	-	If this parameter is set to two new parameters appear: SMTP user name and SMTP password which are used to provide data necessary for authentication. Parameter is visible only when General->Use of GPRS parameter is set to *Yes* and SMTP server settings parameter is set to *User defined*.

6.1.8.1.7. SMTP user name

Function	-	Allows user to enter user name used during authentication on SMTP server, e.g. john.smith@company.com
Data type	-	Text
Range	-	Letters, numerals and special signs, max. 31 characters
Default value	-	N/A
Comments	-	Parameter is visible only when SMTP authentication parameter is set to *Yes (PLAIN)* or *Yes (LOGIN)*.

6.1.8.1.8. SMTP password

Function - Allows user to enter password used during authentication on SMTP server, e.g. j0h2ny$m1th

Data type - Text

Range - Letters, numerals and special signs, max. 31 characters

Default value - N/A

Comments - Parameter is visible only when SMTP authentication parameter is set to *Yes (PLAIN)* or *Yes (LOGIN)*.

6.1.8.1.9. Message sending rule 1 - 32

6.1.8.1.9.1. Triggering event

Function - Selects one of the previously defined events that will trigger messages sending

Data type - Selection list

Range - *None* and names of events defined in Events list

Default value - *None*

Comments - N/A

6.1.8.1.9.2. Transmission type

Function - Selects method of text message delivery

Data type - Selection list

Range - *SMS*
message is delivered as SMS

E-mail
message is delivered as e-mail. Option is visible only when General->Use of GPRS parameter is set to *Yes*

E-mail or SMS
message is delivered as e-mail and if it is not possible (e.g. GPRS is not available) - as SMS. Option is visible only when General->Use of GPRS parameter is set to *Yes*

Default value - *SMS*

Comments - Parameter is visible only when Triggering event parameter is set to value other than *None*.

6.1.8.1.9.3. Recipient number

Function - Selects the SMS message recipient

Data type - Selection list

Range - Friendly names of recipients associated with phone numbers in Phone list

Default value - *NUM 1* - first number from the list

Comments	-	The recipient must be previously defined in Authorized numbers -> Phone list. Parameter is visible only when Transmission type parameter is set to *SMS* or *E-mail or SMS*.

6.1.8.1.9.4. Receiver e-mail address

Function	-	Allows user to enter receiver e-mail address, e.g. jane.brown@other_comapny.com
Data type	-	Text
Range	-	Letters, numerals and special signs, max. 31 characters
Default value	-	N/A
Comments	-	Parameter is visible only when Transmission type parameter is set to *E-mail* or *E-mail or SMS*.

6.1.8.1.9.5. E-mail title

Function	-	Allows user to enter e-mail title
Data type	-	Text
Range	-	Letters, numerals and special signs, max. 31 characters
Default value	-	N/A
Comments	-	Parameter is visible only when Transmission type parameter is set to *E-mail* or *E-mail or SMS*.

6.1.8.1.9.6. Message text

Function	-	Allows user to enter message (e-mail or SMS) text
Data type	-	Text
Range	-	Letters, numerals and special signs, max. 160 characters
Default value	-	N/A
Comments	-	In message text symbolic names, macros and commands may be used following syntax rules defined in Appendices in the Syntax of read and write commands in SMS chapter. Parameter is visible only when Triggering event parameter is set to value other than *None*.

6.1.8.2. CLIP calls

CLIP calls are calls established from module to specified numbers. Call is disconnected after answering it by receiver or after time specified by CLIP call duration parameter.

6.1.8.2.1. Number of CLIP calls rules

Function	-	Defines the number of CLIP call sending rules
Data type	-	Number
Range	-	*1 - 16*
Default value	-	*1*

Comments	-	Diminishing the number of rules does not delete settings until the configuration is written to the module.

6.1.8.2.2. CLIP call duration [s]

Function	-	Defines in seconds maximum CLIP call duration
Data type	-	Number
Range	-	*5 - 60* [s]
Default value	-	*10* [s]
Comments	-	Call is automatically ended after time specified by this parameter or when call is answered.

6.1.8.2.3. CLIP call rule 1 - 16

6.1.8.2.3.1. Triggering event

Function	-	Selects one of the previously defined events that will trigger CLIP call
Data type	-	Selection list
Range	-	*None* and names of events defined in Events list
Default value	-	*None*
Comments	-	N/A

6.1.8.2.3.2. Recipient number

Function	-	Selects the CLIP call recipient
Data type	-	Selection list
Range	-	Friendly names of recipients associated with phone numbers in Phone list
Default value	-	*NUM 1* - first number from the list
Comments	-	The recipient must be previously defined in Authorized numbers -> Phone. Parameter is visible only when Triggering event parameter is set to value other than *None*.

6.1.8.3. Data sending

Data sending rules requires GPRS/3G connectivity - Data sending group is visible only when General->Use of GPRS parameter is set to *Yes*. It can hold up to 16 entries defining data transmission conditions.
Each data transmission rule transmits registers which addresses are underlined in memory map. Data can be received using MTDataProvider - provided free of charge with modules OPC/CSV/ODBC server.

6.1.8.3.1. Number of data sending rules

Function	-	Defines the number of data sending rules
Data type	-	Number
Range	-	*1 - 16*
Default value	-	*1*
Comments	-	Diminishing the number of rules does not delete settings until the configuration is written to the module. Parameter is visible only when General->Use of GPRS parameter is set to *Yes*.

6.1.8.3.2. Message sending rule 1 - 32

6.1.8.3.2.1. Triggering event

Function	-	Selects one of the previously defined events that will trigger data sending
Data type	-	Selection list
Range	-	*None* and names of events defined in Events list
Default value	-	*None*
Comments	-	Parameter is visible only when General->Use of GPRS parameter is set to *Yes*.

6.1.8.3.2.2. IP address

Function	-	Selects the data recipient IP address
Data type	-	Selection list
Range	-	Friendly names of recipients associated with phone numbers in IP list
Default value	-	*IP 1* - first number from the list
Comments	-	The recipient must be previously defined in Authorized numbers -> IP list. Parameter is visible only when Triggering event parameter is set to value other than *None*.

6.2. Configuration writing

After required modifications and parameter settings, the configuration is stored on the configuring PC hard disk only. In order to write it to the module memory, it has to be transmitted to the module. For local configuration, it is enough to secure a connection via RS232 cable. Detailed description of local configuration is to be found in the MTM user manual.

Remote configuration can be realized via SMS commands. It is necessary to enter the phone number on an authorized list, except for the first configuration of the module. Detailed description of remote configuration is to be found in the chapter Module configuration via SMS.

6.3. Verification of configuration

Despite high reliability of both local and remote module configuration, verification of configuration is important. It is relevant if the module behavior does not comply in accordance with the performed configuration. For verification, please read the configuration from the module and check parameters settings.

Reading of module configuration is described in details in MTM user manual and chapter Module configuration via SMS.

7. Technical data

7.1. General

Dimensions (height x width x length)	105x86x58 mm
Weight	300 g
Mounting method	DIN Rail 35mm
Operating temperature	-20 - 55ºC
Protection class	IP40

7.2. GSM modem

MT-020 2G version

Modem type	Cinterion TC63i
GSM	Quad Band (850/900/1800/1900)
Frequency range (GSM 850)	Transmitter: from 824 to 849 MHz
	Receiver: from 869 to 894 MHz
Frequency range (EGSM 900)	Transmitter: from 880 to 915 MHz
	Receiver: from 925 to 960 MHz
Frequency range (DCS 1800)	Transmitter: from 1710 to 1785 MHz
	Receiver: from 1805 to 1880 MHz
Frequency range (PCS 1900)	Transmitter: from 1850 to 1910 MHz
	Receiver: from 1930 to 1990 MHz
Transmitter peak power (GSM850 / EGSM900 MHz)	33 dBm (2W) – class 4 station
Transmitter peak power (DCS1800 / PCS1900 MHz)	30 dBm (1W) – class 1 station
Modulation	0.3 GMSK
Channel spacing	200 kHz
Antenna	50 Ω

MT-020 3G version

Modem type	uBlox LISA-U200-02S
GSM	Quad Band GPRS/EDGE (850/900/1800/1900)
UMTS	Six Band 3.75G WCDMA/HSDPA/HSUPA (800/850/900/1700/1900/2100)
Frequency range (GSM 850)	Transmitter: from 824 to 849 MHz
	Receiver: from 869 to 894 MHz
Frequency range (EGSM 900)	Transmitter: from 880 to 915 MHz
	Receiver: from 925 to 960 MHz
Frequency range (DCS 1800)	Transmitter: from 1710 to 1785 MHz
	Receiver: from 1805 to 1880 MHz
Frequency range (PCS 1900)	Transmitter: from 1850 to 1910 MHz
	Receiver: from 1930 to 1990 MHz
Frequency range (UMTS 800 - band VI)	Transmitter: from 830 to 840 MHz
	Receiver: from 875 to 885 MHz
Frequency range (UMTS 850 - band V)	Transmitter: from 824 to 849 MHz
	Receiver: from 869 to 894 MHz
Frequency range (UMTS 900 - band VIII)	Transmitter: from 880 to 915 MHz
	Receiver: from 925 to 960 MHz
Frequency range (UMTS 1700 - band IV)	Transmitter: from 1710 to 1755 MHz
	Receiver: from 2110 to 2155 MHz
Frequency range (UMTS 1900 - band II)	Transmitter: from 1850 to 1910 MHz
	Receiver: from 1930 to 1990 MHz
Frequency range (UMTS 2100 - band I)	Transmitter: from 1920 to 1980 MHz
	Receiver: from 2110 to 2170 MHz
Transmitter peak power (GSM850 / EGSM900 MHz)	33 dBm (2W) – class 4 station
Transmitter peak power (DCS1800 / PCS1900 MHz)	30 dBm (1W) – class 1 station
Transmitter peak power (UMTS800 / UMTS850 / UMTS900 / UMTS1700 / UMTS1900 / UMTS2100 MHz)	24 dBm – class 3 station
Antenna	50 Ω

7.3. Power supply and power outputs

Accepted voltage range	9 - 30 VDC
	12 - 19 Vrms
Current for 12 VDC	Idle 0.05 A
	Max 1.00 A
Current for 24 VDC	Idle 0.03 A
	Max 0.70 A

NOTICE!
Due to high momentary current consumption the power supply must be capable of delivering >= 1A of current.
Inappropriate power supply may result in faulty operation or cause damage to MT-020 module!

Battery charger

Battery nominal voltage	6 VDC
Battery type	lead-acid/gel
Maximum charging current (advised battery capacity*)	0.4 A(1.3 Ah)
	0.8 A(3.0 Ah)

*typical value. Please check specification of your battery before setting up.

Power output VOUT1 (stabilized)

Output voltage	12 VDC or 20 VDC (configurable)
Maximum load current	150 mA for 20 V

Power output VOUT2 (non-stabilized)

Output voltage	Power supply voltage -2 VDC
Maximum load current	50 mA

7.4. Binary inputs I1 - I4

Signal voltage range	0 - 30 VDC
Input resistance	12.7 kΩ
Input ON (1) voltage	> 9 V
Input OFF (0) voltage	< 3 V
Minimum pulse duration	10 ms

7.5. Binary outputs Q1 - Q2

Output type	NPN switch to ground
Advised mean current for single output	50 mA
Maximum current for single output	250 mA
Output resistance in in OFF state	max. 3 Ω
Maximum load current for outputs powered from VOUT1	150 mA

7.6. Analog inputs AN1, AN2

Analog/Pt100 input AN1 - temperature measurement

Sensor type	PT100, 2- or 3-wire
Wires resistance compensation	yes (applies only to 3-wire sensor)
Measurement range	-40 - 200 °C
Accuracy	±1 °C

Analog/NTC input AN2 - temperature measurement

Sensor type	NTC 10k
Measurement range	-25 - 55°C
Accuracy	±1°C (depending on used sensor)

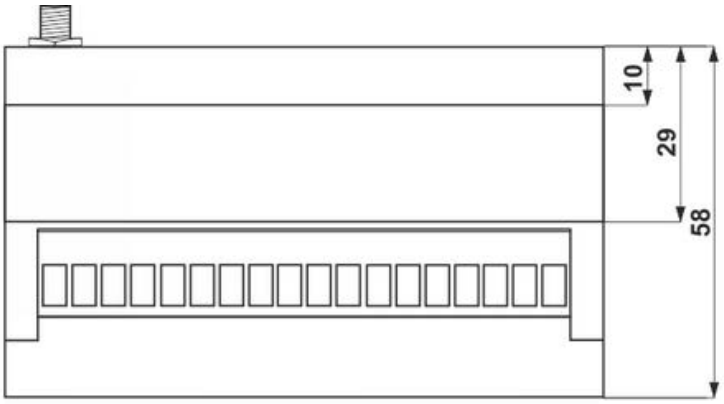
Analog inputs AN1, AN2 - voltage measurement

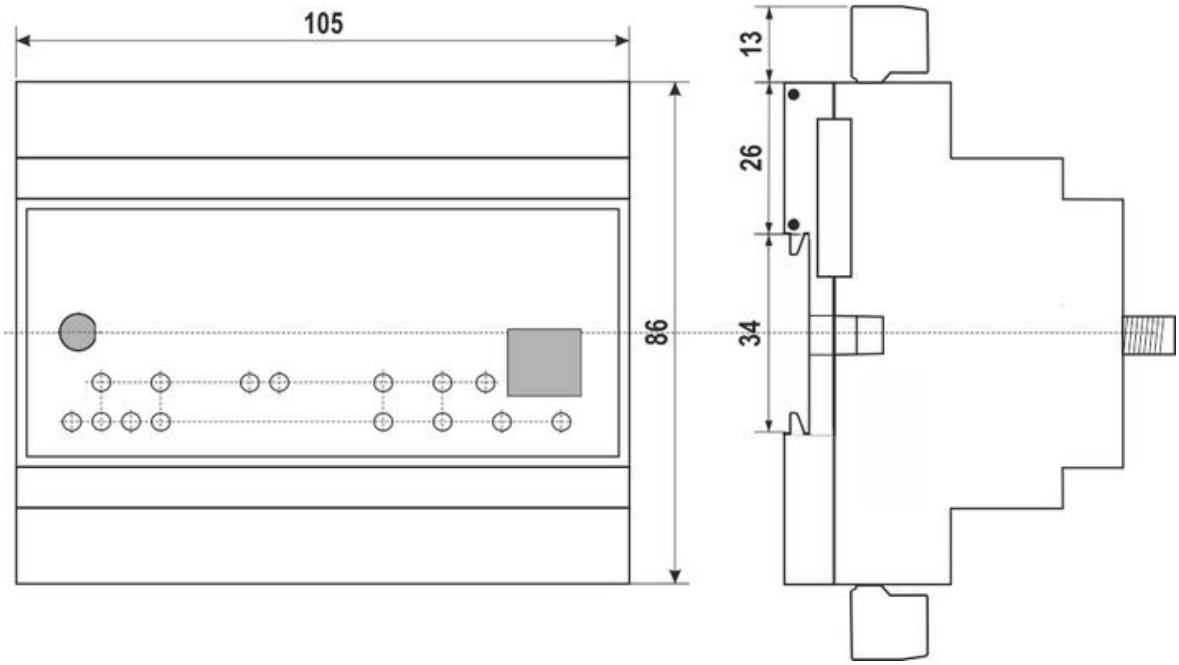
Measurement range	0 - 5 V/0 - 10 V
Maximum input voltage	18 V
Input dynamic impedance	150kΩ typ.
Accuracy	±1.5% max.
Nonlinearity	±1% max.

Analog inputs AN1, AN2 - current measurement

Measurement range	4 - 20 mA
Maximum input current	50 mA max.
Input dynamic impedance	100 Ω typ.
Voltage drop at 20mA	2 V max.
Accuracy	±1.5% max.
Nonlinearity	±1% max.

7.7. Drawings and dimensions



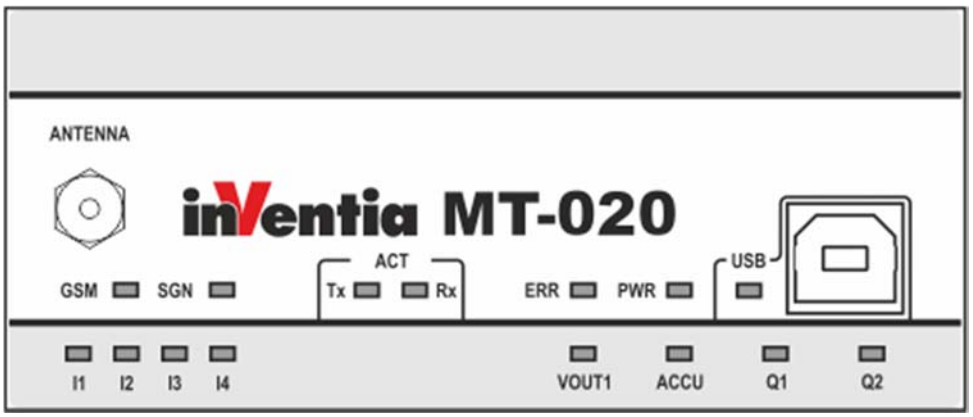


NOTICE!
All dimensions in millimeters!

8. Problem solving

8.1. LED signaling

LED indicators placed on **MT-020** panel are a great diagnostic tool.



In table below are described all states signaled by LED diodes.

LED	Signaling	Description
PWR	on	Module powered V+ and GND terminals
USB	on	USB connected - module powered from USB
I1 - I4	on	Input activated
	off	Input deactivated
Q1 - Q2	on	Output activated
	off	Output deactivated
GSM	blinking quickly	Module initialization
	1 short blink	Modem initialization
	2 short blinks	GSM network searching
	3 short blinks	Module logged in GSM network
	4 short blinks	Module logged in GSM network in roaming
	1 long and 3 short blinks	Module logged in GPRS network
	1 long and 4 short blinks	Module logged in GPRS network in roaming
SGN	1-4 blinks	GSM signal strength
ACT Tx	on	Sending SMS, e-mail or data frame
	blinking	Outgoing call

LED	Signaling	Description
ACT Rx	on	Receiving SMS, e-mail or data frame
	blinking	Incoming call
ERR	blinking quickly	Updating module firmware
	1 blink	Unsuccessful SMS sending attempt
	2 blinks	No SIM card or SIM card improperly inserted
	3 blinks	Wrong PIN
	4 blinks	Wrong PIN.No more PIN entering attempts or PUK needed.
	5 blinks	Unsuccessful GSM log in attempt

8.2. Unblocking SIM card

Three failed attempts of entering incorrect PIN code locks the SIM card and requires entering the PUK code. The fact that SIM card is locked is indicated by the ERR LED. An attempt to unlock the module may be performed only when PUK code is known.
To unlock SIM card you should:

- turn the power supply off,
- remove SIM card from the module,
- insert SIM into mobile phone,
- start the phone and enter proper PUK code and correct PIN code,
- if not done before:
  - start the module,
  - insert appropriate PIN into configuration and write it into module,
  - power the module off,
- remove the SIM from the phone and place it in the module,
- start the module

9. Safety information

9.1. Working environment

When deploying telemetry modules one has to observe and comply to local legislation and regulations. Using the telemetry module in places where it can cause radio noise or other disturbances is strictly prohibited.

9.2. Electronic equipment

Thou most of modern electrical equipment is well RF (Radio Frequency) shielded there is no certainty that radio waves emitted by the telemetry module antenna may have negative influence on its function.

9.2.1. Heart pacemakers

It is recommended that the distance between the antenna of telemetry module and the Heart Pacemaker is greater than 20 cm.
This distance is recommended by manufacturers of Pacemakers and in full harmony with results of studies conducted independently by Wireless Technology Research.

9.2.2. Hearing aids

In rare cases the signal emitted by the telemetry module antenna may disturb hearing aids functions. Should that occur, one has to study detailed operating instructions and recommendations for that particular product.

9.2.3. Other medical equipment

Any radio device including the telemetry module may disturb the work of electronic medical equipment.
When there is a need of installing telemetry module in vicinity of medical equipment one has to contact the manufacturer of this equipment in order to make sure that the equipment is adequately protected against interference of radio frequency waves (RF).

9.2.4. RF Marked equipment

The restriction against installing telemetry modules in areas marked as radio frequency (RF) prohibition zones must be unconditionally observed.

9.3. Explosive environment

Installation of telemetry modules in the environment where explosion hazard is present is not permitted. Usually, but not always, these places are marked with warning signs. Where there is no marking do not install telemetry modules at liquid or gas fuels stores, inflammable materials stores, nor places contaminated with metal or wheat dust.

10. Appendices

10.1. Register of changes

Current version - **v1.00**

1.00.06 - 2014-05-15

- fixed handling of GPRS_ERR flag handling preventing module from logging into GPRS after error during previous GPRS logging attempt, now GPRS sessions are established correctly in roaming as well
- fixed bug causing improper SMS handling when module logged to foreign network (roaming) after restart
- fixed ping handling for 3G modems

1.00.04 - 2014-02-18

- added support for LISA-U200 2G/3G modem
- minor fixes and improvements

---

v1.00.03

- First official version

10.2. Module configuration via SMS

MT-020 can be configured locally using **MTManager** (software tool for telemetry modules management) and remotely via SMS commands. However, you should note that the first SMS message with configuration commands is processed without sender authorization verification - number of sender does not have to figure on Authorized numbers->Phone list (this allows to make first configuration via SMS). Therefore it is strongly recommended to add at least one phone number to this list in first SMS command with allowed configuration changing. Otherwise remote configuration will be disabled.
For system demanding high security configuration can be additionally protected by password (parameter General->Configuration password). It will be needed for both local and remote configuration of the module.

Format of SMS configuration commands:

&password#parameter=value#parameter=value#parameter...

where:
password - password protecting module given by General->Configuration password parameter (if module is not password protected this parameter should be omitted - SMS should begin only with '&')
parameter - predefined configuration parameter mnemonic
value - parameter value. It may be number or text depending on parameter type. Text values should be put in quotes, e.g. "+48123456789" or "Anna". If equals sign and **value** are omitted module will treat command as an inquiry.

If parameters in sent SMS command were given values than module will make attempt to write them into configuration. Result of this action will be send in response SMS.

If SMS was send with correct syntax and values within allowed range or SMS was an inquiry (no values) than response is built from list of parameters with corresponding values.

>#parameter=value#parameter=value#parameter...

If there was at least one wrong parameter name, the module will not change any configuration parameter and will send following response:

>#parameter?#parameter?...

If there was at least one wrong parameter value (not within accepted range or wrong value type) module will not change any configuration parameter and will send following response:

>#parameter=Err#parameter=Err...

The following tables list all available configuration parameter mnemonics, their allowed parameter value range and default value. Please note that some of the parameters and parameter values are depending on other parameter values, e.g. number entered on sixth position on Authorized numbers->Phone list is active only if Authorized numbers->Number of phone numbers parameter is set to six or more.

Parameters in bold accept only text values.

General group:

Parameter	MTManager description	Default value	Range	Definition
MOD_NAME	Module name	New module	max. 31 characters	
SPIN	SIM card PIN number	empty	from 4 to 8 characters or empty	
CONF_PSW	Configuration password	empty	max. 32 characters	
CRTC	RTC time	2000-01-01 00:00:01	YYYY-MM-DD HH:MN:SS	
GPRS_EN	Use of GPRS	1	1 2	No Yes

SMS group:

*** - index from 1 to 16**

Parameter	MTManager description	Default value	Range	Definition
MAXS	Daily SMS limit	0	0 - 65535	
RSMS	Roaming for SMS	2	1 2 3	No Answer All
SREP	Number of SMS sending retries	10	0 - 255	
SPAT	Answer for blank SMS	*M0	max. 160 characters	
SLII	SMS limit exceed information text	1	1 2	Off On
SLIN	Phone number of info recipient	1	1 - 32	Parameter value is index from Authorized phone numbers list
SLIT	SMS limit exceed information	empty	max. 160 characters	
SFOD	Date format	YYYY-DD-MM	max. 31 characters	
SFOT	Time format	HH:MN:SS	max. 31 characters	
SFOO1	General format 1	YYYY/MM/DD, HH:MN:SS	max. 31 characters	
SFOO2	General format 2	YY/DD/MM, HH:MN:SS	max. 31 characters	
SREB	Number of symbolic names	1	0 - 16	
SREA_*	Symbolic name	IREG0	max. 50 characters	
SRES_*	Space	2	1 2 3 4	HR IR HB IB
SREN_*	Register/bit number	0	0 - 65535	
SMAS	Number of macros	1	0 - 16	
SMAN_*	Macro name	M0	max. 20 characters	
SMAC_*	Macro content	#lt.ir0 #ld.ir0	max. 160 characters	

GPRS group:

Parameter	MTManager description	Default value	Range	Definition
APN_NAME	APN name	empty	max. 63 characters	
APN_USR	APN user name	empty	max. 31 characters	
APN_PSW	APN password	empty	max. 31 characters	
GLBR	GPRS login retry interval [s]	10	10 - 3600	
TEIP	GPRS testing address (ping)	0.0.0.0	0.0.0.0 - 255.255.255.255	
GPRS_IDLE	Idle time [s]	600	0 - 21600	
GREP	Number of GPRS transmission retries	3	0 -10	
GTOU	Transmission timeout [s]	9	6 - 60	
GROM	GPRS roaming	1	1 2	Off On

Authorized numbers group:

*** - index from 1 to 32**
† - index from 1 to 16

Parameter	MTManager description	Default value	Range	Definition
LPHN	Number of phone numbers	1	1 - 32	
LIPN	Number of IP addresses	1	1 - 16	
SPBS	Update phone numbers from SIM card	1	1 2	No Yes
SALS	Phone number from SIM card always authorized	1	1 2	No Yes
SMST_*	Name	NUM *	max. 16 characters	
SMSN_*	Number	+48	max. 14 characters	
SCFG	Configuration	FFFFFFFF	from 00000000 to FFFFFFFF	Bits defining configuration access authorization. Bit=1 - authorization granted. Representation - see reference 1.
SINQ	Query	00000000	from 00000000 to FFFFFFFF	Bits defining data polling authorization. Bit=1 - authorization granted. Representation - see reference 1.
SMS_AUT	Receiving voice calls	00000000	from 00000000 to FFFFFFFF	Bits defining receiving calls authorization. Bit=1 - authorization granted. Representation - see reference 1.
GTXT_†	Name	IP †	max. 16 characters	
GIPN_†	Address	0.0.0.0	0.0.0.0 - 255.255.255.255	
GCFG	Configuration	FFFF	from 0000 to FFFF	Bits defining GPRS configuration authorization. Bit=1 - authorization granted. Representation - see reference 1.
GREC	Receiving	FFFF	from 0000 to FFFF	Bits defining GPRS polling and control authorization. Bit=1 - authorization granted. Representation - see reference 1.

Terminals group:

Parameter	MTManager description	Default value	Range	Definition
Binary inputs I1 - I4 (counter inputs) * -index from 1 to 4				
IN_NAME_*	Name	I*	max. 16 characters	
IN_MODE_*	Input type	1	1 3	Binary input Counter input
IN_DIR_*	Counting direction	1	1 2	Up Down
IN_RANGE_*	Counting range (32bits)	0	0 - 2147483647	
IN_EDGE_*	Triggering slope	1	1 2 3	Bi 0->1 Bi 1->0 Bi 0->1|1->0
IN_ESCALE_*	Scaling factor	1.00	0.01 - 100.00	
IN_ERST_*	Cyclic resetting	1	1 2	No Yes
IN_EREV_*	Resetting event	0 - 32	0 1-32	None Event index (see Event group)
IN_FLR_*	Filtering constant [s]	10	10 - 16383	unit is value/100 [s]
Binary outputs Q1 - Q2 * - index from 1 to 2				
OUT_NAME_*	Name	Q*	max. 16 characters	
OUT_MODE_*	Initial state	1	1 2	Off On
OUT_IMP_*	Output mode	1	1 2 3	Monostable Bistable Toggle
OUT_IMPLEN_*	Pulse duration [s]	1	1 - 3600	unit is value/10 [s]
OUT_ONEVT_*	On event (monostable and bistable mode) Off event (monostable mode, when initial state is 1) Toggle event (toggle mode)	0	0 1 - 32	None Event index (see Event group)
OUT_OFFEVT_*	Off event (bistable mode only)	0	0 1 - 32	None Event index (see Event group)
OUT_IMPLEN_*	Filtering constant [s]	0.1	0.1 - 86400.0	
Analog inputs AN1, AN2 * - index from 1 to 2				
AN_NAME_*	Name	AN*	max. 16 characters	
AN_MODE_*	Input type	1	1 2 3	Voltage input Current input PT100 (AN1) or NTC (AN2)
AN_FLR_*	Filtering constant [s]	0	0 1 2 3 4 5 6 7 8 9 10 11	0 0.05 0.1 0.25 0.5 1 2 4 8 16 32 64
AN_RANGE_*	Signal range	1	0 1	0 - 5V 0 - 10V
AN_LREF_*	Low reference - internal units {0 - 5V}	0	0 - 500	
	Low reference - internal units {0 - 10V}	0	0 - 1000	
	Low reference - internal units	0	0 - 2000	

Parameter	MTManager description	Default value	Range	Definition
AN_HREF_*	High reference - internal units {0 - 5V}	1000	0 - 500	
	High reference - internal units {0 - 10V}	1000	0 - 1000	
	High reference - internal units	1000	0 - 2000	
AN_LENG_*	Low reference - engineering units	0	-32757 - 32767	
AN_HENG_*	High reference - engineering units	1000	-32757 - 32767	
AN_ALM_HH_*	Alarm HiHi - engineering units	32767	-32757 - 32767	
AN_ALM_HI_*	Alarm Hi - engineering units	32767	-32757 - 32767	
AN_ALM_LO_*	Alarm Lo - engineering units	-32767	-32757 - 32767	
AN_ALM_LL_*	Alarm LoLo - engineering units	-32767	-32757 - 32767	
AN_ALM_HIST_*	Alarm hysteresis - engineering units	100	0 - 65535	
AN_DBD_*	Deadband - engineering units	100	0 - 65535	
1-Wire inputs (1, 2) * - index from 1 to 2				
OW_NAME_*	Name	1-WIRE*	max. 16 characters	
OW_ACT_*	Input mode	1	1 2	Inactive Temperature measurement
OW_ALM_HH_*	Alarm HiHi	125	-25 - 125	
OW_ALM_HI_*	Alarm Hi	125	-25 - 125	
OW_ALM_LO_*	Alarm Lo	-25	-25 - 125	
OW_ALM_LL_*	Alarm LoLo	-25	-25 - 125	
OW_ALM_HIST_*	Alarm hysteresis	2	0 - 50	
OW_DBD_*	Deadband	2	0 - 50	

Synchronous timers TMR1 - TMR4 group:

*** - index from 1 to 4**

Parameter	MTManager description	Default value	Range	Definition
TMR_ON_*	Active	2	1 2	Yes No
TMR_START_*	Start [HH:MM]	00:00	00:00 - 23:59	
TMR_PERIOD_*	Period	14	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	1 min. 2 min. 3 min. 5 min. 10 min. 15 min. 30 min. 1 hour 2 hours 3 hours 4 hours 6 hours 8 hours 12 hours 24 hours
TMR_DOFW_*	Days of week	7F	from 00 to 7F	Days of week when timer is active. 1 - Monday 2 - Tuesday 4 - Wednesday 8 - Thursday 10 - Friday 20 - Saturday

Parameter	MTManager description	Default value	Range	Definition
				40 - Sunday e.g. Wednesday, Thursday and Friday is 1C.
TMR_DOFM_*	Days of month	00000000	from 00000000 to FFFFFFFF	Days of month when timer is active. Bit=1 - day is selected. Representation - see reference 2.

State logging group:

Parameter	MTManager description	Default value	Range	Definition
STWS	Start [HH:MM]	00:00	00:00 - 23:59	
STWP	Period	9	1 2 3 4 5 6 7 8 9 10 11 12	10 min. 20 min. 30 min. 45 min. 1 h 2 h 3 h 4 h 6 h 8 h 12 h 24 h
STWI	Logged information	N/A	max. 160 characters	

Power supply group:

Parameter	MTManager description	Default value	Range	Definition
EPVT	Power output voltage	1	1 2	Low (12V) High (20V)
EPAP	Backup battery	1	1 2	No Yes
EPAC	Battery charging current	1	1 2	Low (0.4A) High (0.8A)

Events group:

† - index from 1 to 16

Parameter	MTManager description	Default value	Range	Definition
EVNO	Number of events	0	0 - 32	
EV_TRIG_†	Trigger source	1	1 2 3 4 5 6 7 8 9	None Binary inputs Analog inputs Inputs 1-wire Clocks Flags Counters Connections Binary outputs
Binary inputs I1 - I4				
EV_FLAG_†	Trigger input	0	0 1 2 3	I1 I2 I3 I4
EV_EDGE_†	Trigger condition	1	1 2 3	Bi 0->1 Bi 1->0 Bi 0->1|1->0

Parameter	MTManager description	Default value	Range	Definition
Analog input AN1, AN2				
EV_FLAG_†	Trigger input	63	63 71	AN1 AN2
EV_EDGE_†	Trigger condition	1	1 2 3 4 5 6 7 8	Alarm HiHi - activation Alarm Hi - activation Alarm Lo - activation Alarm LoLo - activation Alarm HiHi - deactivation Alarm Hi - deactivation Alarm Lo - deactivation Alarm LoLo - deactivation
1-Wire inputs (1, 2)				
EV_FLAG_†	Trigger input	79	79 87	1-Wire1 1-Wire2
EV_EDGE_†	Trigger condition	1	1 2 3 4 5 6 7 8	Alarm HiHi - activation Alarm Hi - activation Alarm Lo - activation Alarm LoLo - activation Alarm HiHi - deactivation Alarm Hi - deactivation Alarm Lo - deactivation Alarm LoLo - deactivation
Clocks				
EV_FLAG_†	Triggering clock	32	32 33 34 35	TMR1 TMR2 TMR3 TMR4
Flags				
EV_FLAG_†	Triggering flag	48	48	Module power on reset
Counters				
EV_FLAG_†	Triggering counter	16	16 17 18 19	I1 I2 I3 I4
Connections				
EV_FLAG_†	Connection from any authorized	1	1 2	Yes No
EV_NUM_†	Dial-in from number	1	1 - 32	Parameter value is index from Authorized phone numbers list
Binary outputs Q1 - Q2				
EV_FLAG_†	Trigger output	8	8 9	Q1 Q2
EV_EDGE_†	Trigger condition	1	1 2 3	0->1 1->0 0<->1

Rules group:

*** - index from 1 to 16**
† - index from 1 to 32

Parameter	MTManager description	Default value	Range	Definition
Message sending				
TRNO	Number of message sending rules	1	1 - 32	
TR_SMF	Sender e-mail address	empty	max. 63 characters	
TR_SMA	SMTP server name	empty	max. 63 characters	
TR_SMP	SMTP server port	25	1 - 65535	
TR_SML	SMTP authentication	1	1 2 3	No Yes (PLAIN) Yes (LOGIN)
TR_AU	SMTP user name	empty	max. 31 characters	
TR_AP	SMTP password	empty	max. 31 characters	
TR_TRIG_†	Triggering event	0	0 1 - 32	None Parameter value is index from Event list
TR_TCH_†	Transmission channel	1	1 2 3	SMS E-mail E-mail or SMS
TR_N_†	SMS recipient number	1	1 - 32	Parameter value is index from Authorized phone numbers list
TR_A_†	E-mail receiver address	empty	max. 48 characters	
TR_S_†	E-mail title	empty	max. 31 characters	
TR_T_†	Message text	empty	max. 160 characters	
CLIP calls				
CRNO	Number of CLIP calls rules	1	1 - 16	
CR_TRIG_*	Triggering event	0	0 1 - 32	None Parameter value is index from Event list
CR_N_*	Recipient number	1	1 - 32	Parameter value is index from Authorized phone numbers list
Data sending				
DRNO	Number of data sending rules	1	1 - 16	
DR_TRIG_*	Triggering event	0	0 1 - 32	None Parameter value is index from Event list
DR_IPN_*	IP address	1	1 - 16	Parameter value is index from Authorized IP addresses list

References:

1. Information about configuration authorization, query authorization and receiving calls authorization is stored in one 32-bit digit, in which each single bit corresponds to position on Phone list according to table below:

Bit position	31 (MSB)	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Position on Phone list	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9
Bit position	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0 (LSB)
Position on Phone list	24	23	22	21	20	19	18	17	32	31	30	29	28	27	26	25

For example to enable authorization for eighth and ninth phone on the list you need to set parameter to 80010000 (10000000 00000001 00000000 00000000 in binary notation).

2. Information about days of month is stored in one 32-bit digit, in which each single bit corresponds to one day of month according to table below:

Bit position	31 (MSB)	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Day of month	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9
Bit position	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0 (LSB)
Day of month	24	23	22	21	20	19	18	17	All	31	30	29	28	27	26	25

For example to enable timer for first and last day of month (30th and 31st) you need to set parameter to 1000060 (00000001 00000000 00000000 01100000 in binary notation).

Examples:

- Setting new value of SIM card PIN number (0101) and new Configuration password (ADMIN):

  &#SPIN="0101"#SMSP="ADMIN"

  Module response:

  >#SPIN="0101"#SMSP="ADMIN"

  Attention!!! All changes to SIM card PIN number and Configuration password parameters are taking effect after module restart.

- Reading telephone number stored on second position on Authorized numbers->Phone list:

  &ADMIN#SMSN_2

  Module response:

  >#SMSN_2="+48111222333"

  Number on this position is *+48 111 222 333*.

- Setting new phone number (*+48 123 456 789*) on second position on Authorized numbers->Phone list:

  &ADMIN#SMSN_2="+48123456789"

  Module response:

  >#SMSN_2="+48123456789"

- Setting new phone number on sixth position on Authorized numbers->Phone list. Name parameter is *Mark* and Number parameter is *+48 987 654 321*:

  &ADMIN#LPHN=6#SMST_6="Mark"#SMSN_6="+48987654321"

  Module response:

  >#LPHN=6#SMST_6="Mark"#SMSN_6="+48987654321"

- Setting HiHi alarm threshold of 1-Wire 2 input to *115*:

  &ADMIN#OW_ACT_2=2#OW_ALM_HH_2=115

  Module response:

  >#OW_ACT_2=2#OW_ALM_HH_2=115

- Setting new event on seventh position on event list. Event is triggered by activation of LoLo alarm on analog input AN2:

  &ADMIN#EVNO=7#EV_TRIG_7=3#EV_FLAG_7=71#EV_EDGE_7=4

  Module response:

  >#EVNO=7#EV_TRIG_7=3#EV_FLAG_7=71#EV_EDGE_7=4

- Setting module RTC clock to *2014-12-31 23:59:59*:

  &ADMIN#CRTC="2014-12-31 23:59:59"

  Module response:

  >#CRTC="2014-06-17 08:27:40"

10.3. Syntax of reading and writing data in text messages

Description of SMS command

Internal application of a module is able to receive, process and send short text messages (SMS). There is a set of command which can be put in SMS and e-mail message, allowing the user to read from and write (SMS only) to internal registers placed in module memory.

Characters with special meaning:

Character	Description
#	starts a command ATTENTION! putting two hash signs one after another will prevent module from processing command following it. However after sending one of hash signs will be deleted - this allows to control resources of one module from another, e.g. set binary output Q1 to '1' (##HB128=1)
*	starts a macro
>	used as first character in SMS text inhibits parsing of SMS
$	used as first character in SMS text inhibits answering to this SMS

After reception of SMS message, internal application tries to parse SMS text and execute command enclosed in it. Parsing process generates new message text, which is send back to user (if module is allowed to, either by configuration or by presence/absence of '$' sign).

Commands are formatted as follows:

#[prefix.]symbol[=value]

where:

prefix defines data representation and register count

symbol defines register address and register space being accessed

value defines data to be written to register (s)

Prefix is optional; when not present, data is interpreted according to preset defaults.

Basic read command:

#HR0

When module receives and parses the SMS message containing this command, command string will be replaced with value of register 0 read from holding registers space, noted in decimal format, and this value will be put in SMS sent back to user. Answer to this command will be:

>10

where 10 is value read from holding register 0.

If received SMS contains any other characters than correctly formatted commands, these characters will be copied unaltered to message being sent back. This allows user to freely compose text of return message and include register values together with some informational text. For example, if user sends containing:

Voice call was #IR12 seconds long

then module will answer with:

>Voice call was 15 seconds long

where 15 is a value read from input register 12.

It should be noted that answer from module begins with '>' sign - it means that this SMS was generated by module. If module receives SMS beginning with '>', such message will be ignored (not parsed). This prevents endless "looping" of messages in case they are being exchanged between modules

Writing to register is archived by expanding basic command with '=' sign and value that should be written:

#HR20=2

User should be aware that writing is allowed only to holding register space.

When module receives SMS with write command, it executes the command and sends back value written. For example, sending to module SMS with text:

#HR1=1234

causes module to write value 1234 to holding register 10 and send back SMS with text:

>1234

Both read and write commands can be expanded by adding a prefix, which defines data format (notation). Prefix should be placed between '#' mark (command start) and register symbol, and should contain one (or more) characters ended with a dot. For example, to read an input register 4 in hexadecimal format, one should use a command:

#H.IR4

and module answer will be:

>1FC8

Prefixes can also be used with write commands.

Command can operate on more than one register. Register count can be included in prefix, after character denoting data format (which is then mandatory). For example, command:

#D2.HR2=123456

causes write 123456 to two registers, HR2 and HR3 (32-bit variable).

Full list of available prefixes is enclosed below.

User can define in MTManager own symbolic names in module config and assign them to registers. Then, such names can be used instead of register symbols. It allows user to define "friendly" names for registers and to erase access to bit values. For example, if user has defined symbolic name "output" and assigned it to bit 321 of internal registers space (which is equal to bit of HR20 register), then sending a command:

#output=1

causes module to write 1 to bit 1 of HR20 register. There are several predefined (internal) symbolic names.

Apart from symbolic names, user can define macros. A macro is defined as a name and a text assigned to this name. Parsing of received message begins with macro expansion. Parser looks for words beginning with '*' sign and replaces such names with assigned strings. Once macro expansions ends, new message text is being interpreted

and commands executed. It allows user to place both commands and symbolic names in macro text. Furthermore, macros can contain another macro names ("nested" macros), but only those defined higher in macro list. For example, if configuration contains following macros (in order shown):

No.	Macro name	Macro text
1	counter	*mtime: input 0 counter: #D2.HR0
2	mtime	#date #time
3	state	*mtime: inputs - #B8.IB64, #IR19 SMS sent

then macro *mtime used in macro number 3 (*state) will be correctly expanded and SMS text:

***state**

after macro expansion (before executing commands) will be changed to:

#date #time: inputs - #B8.IB64, #IR19 SMS sent

but expansion of macro 1 will not contain text assigned to macro name *mtime, therefore text being executed after macro 1 was used will look like:

***mtime: input 0 counter: #D2.HR0**

which in turn causes module to send back SMS containing:

>*mtime: input 0 counter: 123

Register spaces

Module firmware distinguishes two register spaces: input registers and holding registers. Access to register space can be made by calls to 16-bit registers or by calls to individual bits.

Symbol	Description
HR{0-45}	Holding registers space. Read/write access. 16-bit registers.
IR{0-375}	Input registers space. Read only. 16 bit registers.
HB{0-18}	Bit access to holding registers space. One can access individual bits (or groups of bits). Read/Write. Bit mapping is as follows: bits 0-15 correspond to holding register 0, bits 16-31 - to holding register 1 and so on.
IB{0-303}	Bit access to input registers space. One can access individual bits (or groups of bits). Read only. Bit mapping is as follows: bits - correspond to input register 0, bits 16-31 - to input register 1 and so on.

Register symbols can be preceded by prefixes, which can define amount of data being processed and data format.

Available prefixes:

Register space HR, IR (16-bit registers)

Prefix	Description
B[1-4]	Binary format, 16 characters (bits) default, bits from most to least significant. Prefix can contain register count (1-4) being processed (register symbol defines lowest register) - in resulting string, rightmost character corresponds to bit with lowest number.
D[1-4]	Decimal format, 1-5 characters, unsigned. Prefix can contain register count (1-4) being processed (register symbol defines lowest register) - number returned is decimal notation of n*16 bit value where most significant bit is placed in register with lowest address (big endian).
H[1-4]	Hexadecimal format, 4 characters. Prefix can contain register count (1-4) being processed - returned string contains n*4-character groups, leftmost group corresponds to register with lowest address (big endian).
LT	Local time fetched from three consecutive registers Rn:Rn+1:Rn+2, where n corresponds to register symbol used. Time format according to "Time format" string in configuration.
UT	UTC time fetched from three consecutive registers R*n:Rn+1:Rn+2*, where *n* corresponds to register symbol used. Time format according to „Time format" string in configuration.
LD	Local date fetched from three consecutive registers R*n:Rn+1:Rn+2*, where *n* corresponds to register symbol used. Date format according to „Date format" string in configuration.
UD	UTC date fetched from three consecutive registers R*n:Rn+1:Rn+2*, where *n* corresponds to register symbol used. Date format according to „Date format" string in configuration.
T{1-2}	UTC timestamp fetched from three consecutive registers R*n:Rn+1:Rn+2*, where *n* corresponds to register symbol used. Timestamp format according to „General format 1" or „General format 2" strings in configuration.
S	Decimal format, 1…5 characters (with '-' sign when needed), signed. Access to single register treated as 16-bit signed value.
F[1-3]	Converts decimal value to floating point number. Number next to prefix defines number of digits after dot.

Bit access to register spaces - HB, IB

Prefix	Description
B[1-64]	Binary format. Amount of bits being displayed provided in prefix. Bits are presented in order from least to most significant (opposite to binary representation of whole register).
D[1-64]	Decimal format. Value presented is calculated from amount of bits provided in prefix, with bit with lowest address being least significant (*little endian*)
H[1-64]	Hexadecimal format. Value presented is calculated from amount of bits provided in prefix, with bit with lowest address being least significant (*little endian*)

Predefined symbolic names

Name	Description
TIME	Returns local time read from RTC registers – the same as **#LT.IR0** command
DATE	Returns local date read from RTC registers – the same as **#LD.IR0** command
RTC	Returns UTC time and date read from RTC registers – the same as **#T1.IR0** command
NAME	Returns module name
SERIAL	Returns module serial number
IPADDR	Returns module current IP address
CR	Starts new line

Examples:

Read input registers 20:

#IR20

Write value 1 to holding register 0:

#HR0=1

Binary representation of input register 4 (readout):

#B.IR4

Read flag (bit) 4:

#B.IB4

Write hexadecimal value **01AC** to holding register 0:

#H.HR0=01AC

Read 8 bits starting from bit 16 from Holding registers address space and present it as bit value:

#B8.IB16

Read 6 bits starting from bit 64 from Holding registers address space and present it as decimal value:

#D6.IB64

Write 1 to bit 128 from Holding registers address space:

#HB128=1

Read local time from register 0 from Input registers address space:

#LT.IR0

Read date from register 0 from Input registers address space

#UD.IR0

Read local time and date from register 0 from Input registers address space:

#T1.IR0

Read signed value from register 18 from Input registers address space

#S.IR18

Read module name and serial number in two lines

#NAME#CR#SERIAL

10.4. Memory map

10.4.1. Analog inputs address space

Analog inputs address space (read only 04H) - zeroed at reset

Address Dec	Bit address	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Description
0	0	Month								Year								RTC
1	16	Hour								Day of month								
2	32	Seconds								Minutes								
3	48	Event source								Number of event in a second								
4	64	I1	I2	I3	I4					Q1	Q2	--	--	--	--	--	--	Digital I/Os
5	80	Modem OK	GSM SEARCH	GSM OK	GSM ERROR	PIN OK		UMTS		SMS ERROR	NO SIM	PIN ERROR	PIN CNT		GSM ROAMING	GPRS OK	GPRS ERROR	GSM status
6	96	GSM signal																GSM signal [0 - 31 more is better]
7	112																	Number of SMS messages sent since power on
8	128																	Number of SMS messages sent today
9	144																	Number of SMS messages which could not been sent
10	160	Lower 16-bits																Module on timer [s]
11	176	Higher 16-bits																
12	192	Time zone															Sign	Time zone [quarters]
13	208																	Analog input AN1 - internal units
14	224																	Analog input AN2 - internal units
15	240																	Analog input AN1 - engineering units (signed)
16	256																	Analog input AN2 - engineering units (signed)

Address Dec	Bit address	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Description
17	**272**	1-WIRE1 OK	1-WIRE1 SHORT	1-WIRE1 No dev.	1-WIRE1 CRC					1-WIRE2 OK	1-WIRE2 SHORT	1-WIRE2 No dev.	1-WIRE2 CRC					1-WIRE status
18	**288**	1-WIRE1																Temperature - 1-WIRE1 (signed)
19	**304**	1-WIRE2																Temperature - 1-WIRE2 (signed)
20	**320**	LAC																GSM LAC (Location Area Code) code
21	**336**	CID																GSM CID (Cell ID)
22	**352**																	Power voltage [mV]
23	**368**																	Battery voltage
24	384	I1 CNT	I2 CNT	I3 CNT	I4 CNT													Pulse counters flags
25	400	TMR1	TMR2	TMR3	TMR4													Timer flags
26	416	RESET	CALL AUTHORIZED															General flags: * RESET - set to '1' after reset * CALL AUTHORIZED - set to '1' on incoming authorized call
27	432	AN1 HiHi	AN1 Hi	AN1 Lo	AN1 LoLo					AN2 HiHi	AN2 Hi	AN2 Lo	AN2 LoLo					Analog inputs alarm flags
28	448	1-WIRE1 HiHi	1-WIRE1 Hi	1-WIRE1 Lo	1-WIRE1 LoLo					1-WIRE2 HiHi	1-WIRE2 Hi	1-WIRE2 Lo	1-WIRE2 LoLo					1-WIRE inputs alarm flags
29	464	CALL1	CALL2	CALL3	CALL4	CALL5	CALL6	CALL7	CALL8	CALL9	CALL10	CALL11	CALL12	CALL13	CALL14	CALL15	CALL16	Incoming calls flags

Address Dec	Bit address	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Description
30	480	CALL17	CALL18	CALL19	CALL20	CALL21	CALL22	CALL23	CALL24	CALL25	CALL26	CALL27	CALL28	CALL29	CALL30	CALL31	CALL32	
31	496	EVT1	EVT2	EVT3	EVT4	EVT5	EVT6	EVT7	EVT8	EVT9	EVT10	EVT11	EVT12	EVT13	EVT14	EVT15	EVT16	Event flags
32	512	EVT17	EVT18	EVT19	EVT20	EVT21	EVT22	EVT23	EVT24	EVT25	EVT26	EVT27	EVT28	EVT29	EVT30	EVT31	EVT32	
33	528	CPU RST	PWR RST	SYS RST	WATCHDOG													Module restart code
34	544	Lower 16-bits																IP address
35	560	Higher 16-bits																
36	576	Reserved																Reserved
37	592	Reserved																Reserved
38	608	Reserved																Reserved
39	624	Reserved																Reserved
40	640																	Number of failed GPRS logins (zeroed on reset)
41	656																	Number of successful GPRS logins (zeroed on reset)
42	672	Reserved																Reserved
43	688																	Number of sent e-mails (zeroed on reset)
44	704																	Number of e-mail sending errors (zeroed on reset)
45	720																	Number of e-mail sending retries (zeroed on reset)
46	736	Reserved																Reserved
47	752																	VOUT1 output voltage [mV]
48	768																	Cellular modem supply voltage [mV]
49	784	Reserved																Reserved

Registers with underlined addresses are sent within data frames triggered by data sending rules.

"**GSM status**" register flags description

Flag	Description
Modem OK	Successful modem initialization
GSM SEARCH	GSM network searching
GSM OK	Module registered in GSM network
GSM ERROR	Unsuccessful GSM registration attempt
PIN OK	PIN code accepted by SIM card
UMTS	Modem currently using 3G network
SMS ERROR	Unsuccessful SMS sending attempt. Zeroed after successful SMS sending
NO SIM	No SIM card, or SIM card inserted improperly
PIN ERROR	Wrong PIN
PIN CNT	Wrong PIN. Two attempts made. No more attempts will be made.
GSM ROAMING	Module logged into foreign network
GPRS OK	Module logged into GPRS
GPRS ERROR	Error during logging into GPRS. Zeroed after successful GPRS logon on disabling GPRS communication.

"1-WIRE status" register flags description

Flag	Description
Wire 1 OK	Successful communication with device on 1-WIRE1
Wire 1 SHORT	1-WIRE1 short
Wire 1 No dev.	No device connected to 1-WIRE1
Wire 1 CRC	CRC error on 1-WIRE1
Wire 2 OK	Successful communication with device on 1-WIRE2
Wire 2 SHORT	1-WIRE2 short
Wire 2 No dev.	No device connected to 1-WIRE2
Wire 2 CRC	CRC error on 1-WIRE2

"**Module restart code flags**" register flags description

Flag	Description
CPU RST	Module reset by CPU. May be set with other flags.
PWR RST	Module reset after connecting power
SYS RST	Module reset by system, e.g. after firmware update
WATCHDOG	Module reset by watchdog

10.4.2. Holding registers address space

Internal registers address space (read 03H/write 06H or 10) - Not zeroed at reset

Address Dec (Hex)	Bit address	Symbol	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Description
0 (0x00)	**0**	CNT_I1	(Low 16 bits)																32 bit counter - input I1
1 (0x01)	**16**		(High 16 bits)																
2 (0x02)	**32**	CNT_I2	(Low 16 bits)																32 bit counter - input I2
3 (0x03)	**48**		(High 16 bits)																
4 (0x04)	**64**	CNT_I3	(Low 16 bits)																32 bit counter - input I3
5 (0x05)	**80**		(High 16 bits)																
6 (0x06)	**96**	CNT_I4	(Low 16 bits)																32 bit counter - input I4
7 (0x07)	**112**		(High 16 bits)																
8 (0x08)	**128**	OUT_CTRL	Q1	Q2															bits controlling outputs
9 (0x09)	**144**	CNT_I1_ENG	(Low 16 bits)																32 bit counter - input I1 engineering units
10 (0x0A)	**160**		(High 16 bits)																
11 (0x0B)	**176**	CNT_I2_ENG	(Low 16 bits)																32 bit counter - input I2 engineering units
12 (0x0C)	**192**		(High 16 bits)																
13 (0x0D)	**208**	CNT_I3_ENG	(Low 16 bits)																32 bit counter - input I3 engineering units
14 (0x0E)	**224**		(High 16 bits)																
15 (0x0F)	**240**	CNT_I4_ENG	(Low 16 bits)																32 bit counter - input I4 engineering units
16 (0x10)	**256**		(High 16 bits)																
17 (0x11)	272	SPEC_FUN_C																	special function code
18 (0x12)	288	SPEC_FUN_P																	special function parameter

Registers with underlined addresses are sent within GPRS data frames triggered by data sending rules.