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1 Abbreviations and explanations

- **Xn** – is a number of socket. This information are provided for manufacturer's purpose and used in data schemas and connection diagrams.
- **GSM – Global Standart for Mobile Communications.** This interfaces is prepared for remote connections and data bidirectional data transfer over Global Standart Mobile network.
- **GPRS** - a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications (GSM).
- **Ethernet** - a family of computer networking technologies for local area networks (LANs) commercially introduced in 1980. Standardized in IEEE 802.3, Ethernet has largely replaced competing wired LAN technologies. This interfaces is prepared for connection LAN (Local Area Network).
- **IP address** - An **Internet Protocol (IP) address** is a numerical label that is assigned to devices participating in a network that uses the Internet Protocol for communication between its nodes.
- **TCP/IP** – Transmission Control Protocol is for communication between computers, used as a standard for transmitting data over networks and as the basis for standard Internet protocols.
- **MAC address –Media Access Control** address is a unique identifier assigned to most network adapters.
- **UART** – An **Universal Asynchronous Receiver/Transmitter** is a type of "asynchronous receiver/transmitter, a part of computer hardware that translates data between parallel an serial forms. UART are commonly used in conjunction with communication standards such as EIA RS-232, RS-422 or RS-485. Record (UARTx) on top of enclosure also are used as serial interface number.
- **GND** – ground wire contact
- **RS232** – the traditional name for a series of standards for serial binary single-ended data and control signals connecting between a DTE (Data Terminal Equipment) and a DCE (Data Circuit-terminating Equipment). It is commonly used in computer serial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pin out of connectors. RS232 interfaces are prepared for connection of pheripheral devices (example energy meters, controllers, machines and etc.).
- **TD** – contact for transfer data wire of RS232 socket
- **RD** – contact for read data wire of RS232 socket
- **DTR** – contact for Data Transmit Ready wire of RS232 socket
- **RS485** - standard defining the electrical characteristics of drivers and receivers for use in balanced digital multipoint systems. The standard is published by the ANSI Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA). Digital communications networks implementing the EIA-485 standard can be used effectively over long distances and in electrically noisy environments. Multiple receivers may be connected to such a network in a linear, multi-drop configuration. RS485 interfaces are prepared for connection of pheripheral devices (example energy meters, controllers, machines and etc.).
- **A+** – contact for positive wire of RS485 socket
- **B-** – ontact for negative wire of RS485 socket
- **USB – Universal Serial Bus** is an industry standard, that defines the cables, connectors and protocols used for connection, communication and power supply between computer and electronic devices. USB type B socket is prepared for connection to PC(Personal Computer). USB type A socket is prepared for connection to pheripheral devices (example memory stick's and etc.).
- **MBUS+** – contact for M-Bus positive wire
- **MBUS-** – contact fot M-Bus negative wire
- **Socket** – is an endpoint of a bidirectional inter-process communication flow across an Internet Protocol-based computer network, such as the Internet.
- **Status** – device status indicating LED
- **Uoutput** – status of power for external device indicating LED
- **TX/RX** – data transfer/receive indicating LED
- **Central computer** – server or a computer, where data can be sent.

2 Safety instructions

To install and setup device, special technical knowledges are needed. Call to seller or certified professionals to connect and setup device !

Before connecting to power supply, be sure that:

1. Controller is not damaged (no cracks, melted, broken or exposed areas)
2. Controller is used with right and correct thickness cables.
3. Controller and antenna are installed indoor.
4. The controller is intended for supply from a Limited Power Source (LPS) with current rating of overcurrent protective device not greater than 2A
5. The highest transients on the DC secondary circuit of LPS, derived from AC main supply, shall be less than 71V peak.
6. The associated equipments (AE): PC and PSU (LPS) shall comply with the requirements of Standard EN 60950-1.
7. Controller is dry;
8. Ambient temperature and humidity is in normal range;
9. Other types of devices (counters, etc.) are connected correctly by using manufacturer's regulations.
10. The end of stranded conductor shall not be consolidated by soft soldering and must to be terminated
11. Device, PC and other peripheral devices are strictly connected through one double pole breaker (current break less than 5A and space between breaker contacts more than 3mm.) Pole breaker has to be in building's wiring and in reachable place with markings

Don't use:

1. Device under open water (in rain and if water are splashing on controller or connected devices;
2. Device if enclosure, connected cables, or other connected devices are damaged;
3. External Back-Up batteries for powering of controller.



Use device by manufacturer's regulations otherwise you can damage controller or other devices. In that case **manufacturer's warranty could not be obtained.**

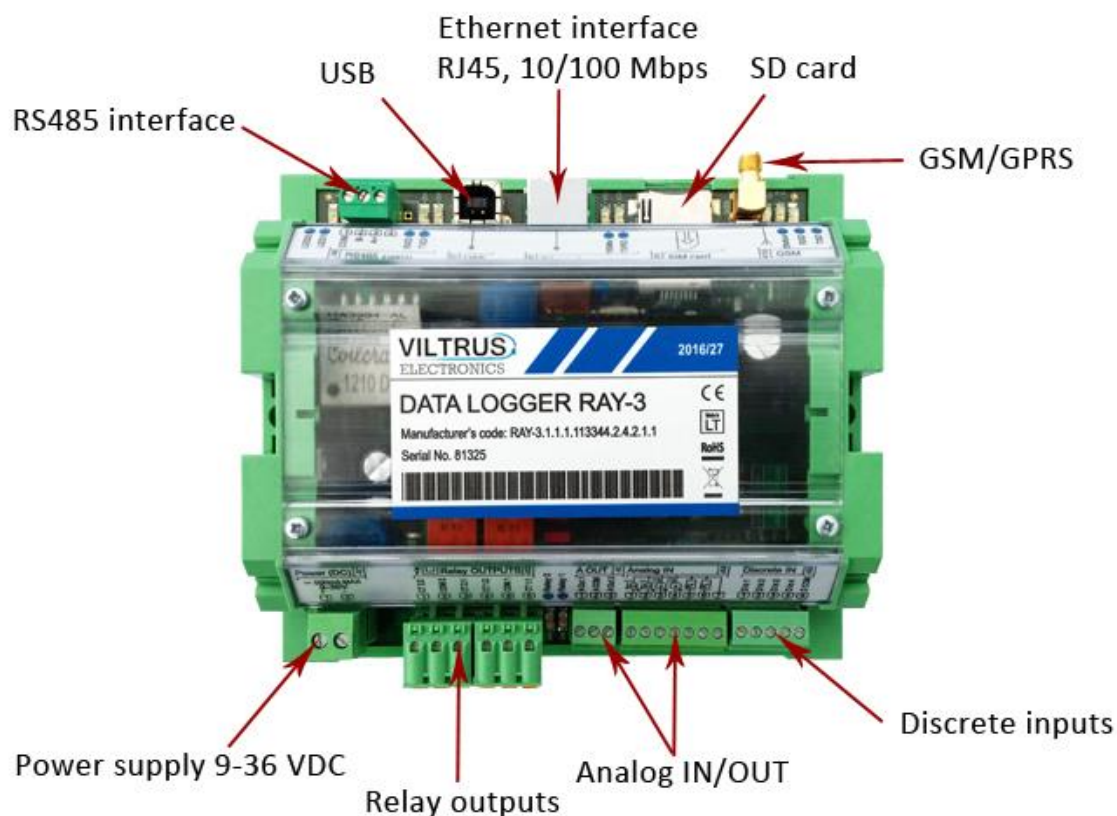


If you suspect that device doesn't operate correctly or has visible violations, please contact manufacturer or your distributor to check or run maintenance.



Manufacturer does not affect and is not responsible for GSM/GPRS/Internet operators' provided network service pricing and costs.

3 Technical Data



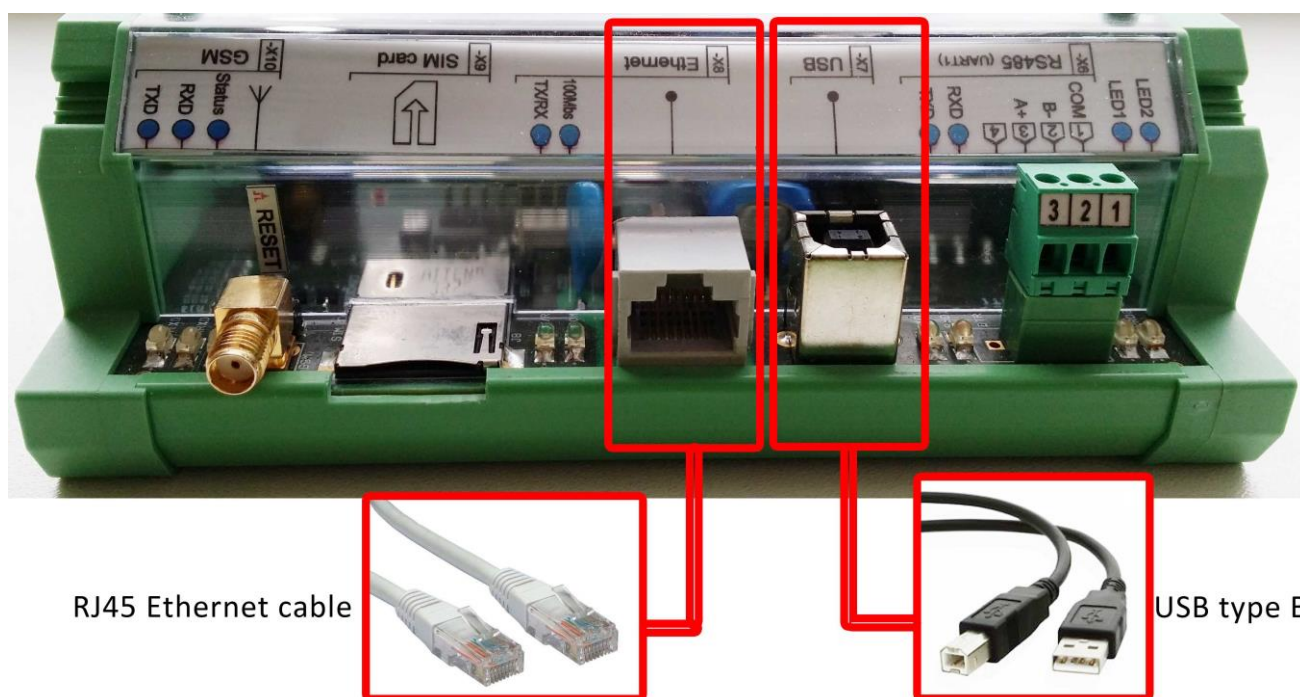
Interfaces	Technical data
RS485	up to 1,2 km, max 32 transivers, speed up to 38,4 Kbits/s
RS232	up to 15 m, speed up to 38,4 Kbits/s
M-Bus	Up to 8 devices
GPRS	4 band 850/900/1800/1900 MHz
Ethernet	RJ45. Twisted pair Ethernet 10/100 Mb, up to 100 m
USB	Type B, version 2.0
Discrete INPUTS	Sink contact
Discrete OUTPUTS	Relay 3A
Analog INPUTS	Current 0/4-20mA, 0-5 mA; Voltage 0-5V, 0-10V; Thermoresistor PT100 or PT1000; error $\pm 0,15\%$
Analog OUTPUTS	Voltage 0-10V, load up to 5mA
Galvanic insulation	
Insulation voltage between power supply and second circuits	1000 V

Indication	
Indication type	LED's
Indicated parameters	<ul style="list-style-type: none"> • Each discrete input status • Each discrete output status • UART/Ethernet Transfer/Receive • GSM/GPRS modem status, Transfer and Receive
Power supply	
Power supply	9-36 VDC $\overline{\text{---}}$
Power consumption	12W
Construction	
Mounting	DIN rail
Dimensions	147x128x50 mm
Enclosure protection	IP20
Climate conditions	
Operating temperature	From - 25 °C to + 60°C
Storage temperature	From - 40 °C to + 60°C
Relative humidity	From 5 % to 95 % non-condensing
Safety parameters	
Safety requirements	EN 60950-1:2006 EN 60950-1:2006/A1:2010 EN 60950-1:2006/A11:2009 EN 60950-1:2006/A12:2011
Electromagnetic compatibility	EN 55011:2009/A1:2010; EN 55022:2010 EN 61000-4-2:2009; EN 61000-4-3:2006 EN 61000-4-3:2006/A1:2008; EN 61000-4-3:2006/A2:2010 EN 61000-4-4:2012; EN 61000-4-6:2009 EN 61000-4-8:2010; EN 61326-1:2013
Other parameters	
Storage memory	8 MB
Configuration settings storage without power supply	More than 5 years
Real time clock	Yes
Firmware loading	Yes. Through RS232/USB and Ethernet, GSM/GPRS.

4 Setting up connection to the device

In order to configure the controller, user must connect its PC to the device by using any of the following interfaces:

- **USB** port
- **ETHERNET** interface
- Through a **GPRS** connection (only accessible after configuring GPRS APN, user and password inside the controller).



RJ45 Ethernet cable

USB type B

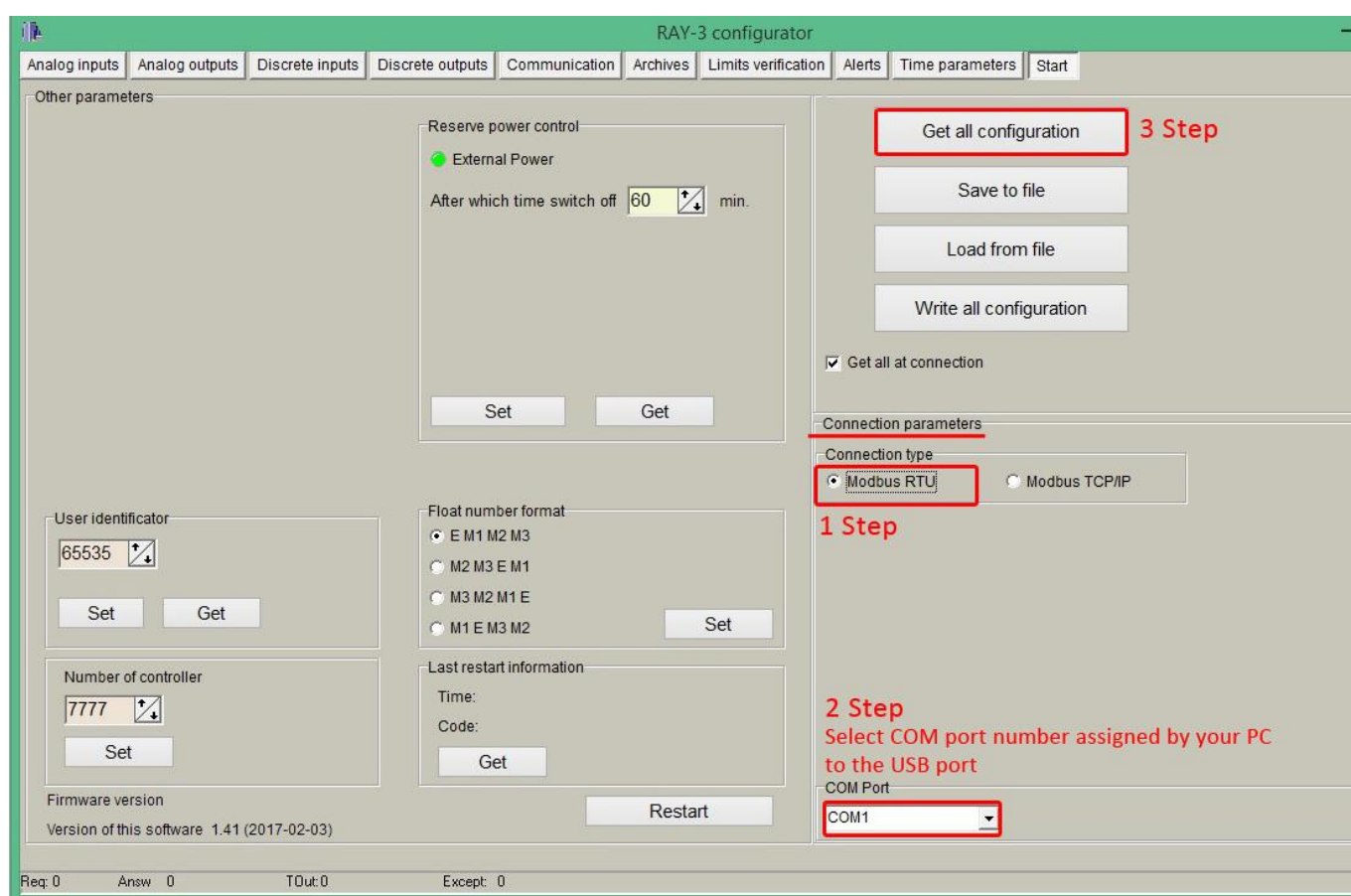
Pic 2. RAY-3 connection interfaces

4.1 Connecting via USB

Connect the RAY-3 data logger to the any computer via USB and open RAY-3 configuration software. If needed, install the USB driver (the USB driver can be found in VILTRUS web page: <http://www.viltrus.com/data-logger-ray-3/>).

Open RAY-3 Configuration software. Set up Connection parameters frame. Steps to be followed:

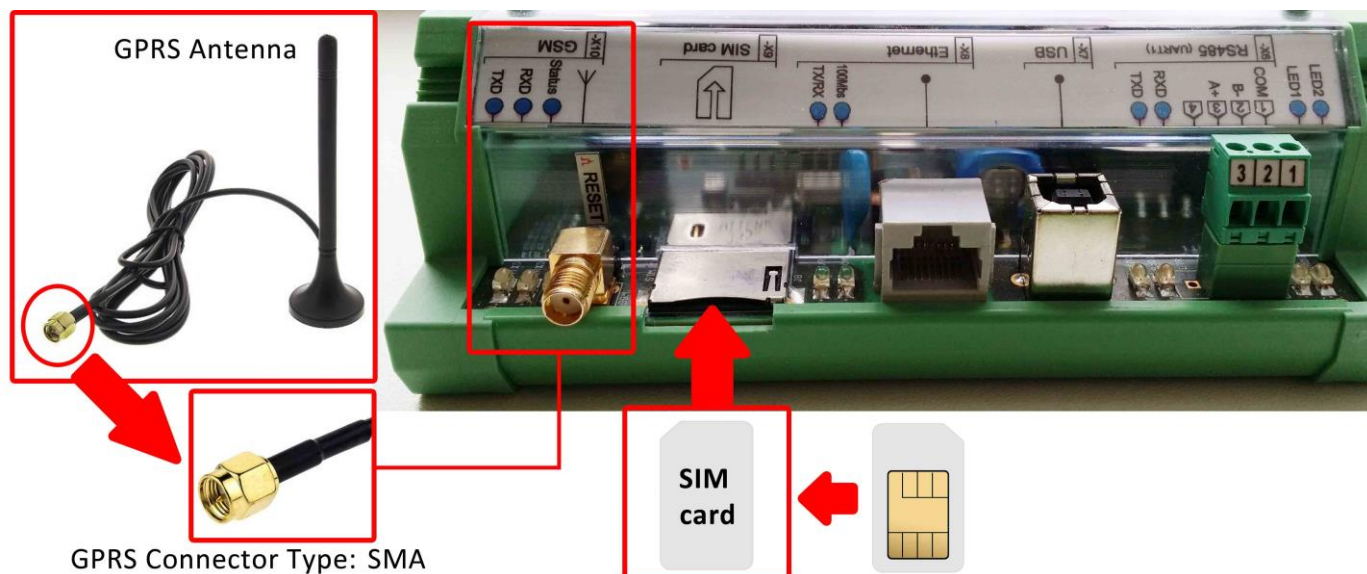
- **1 Step:** Under Connection type select **ModBus RTU** option
- **2 Step:** Select COM port number assigned by your PC to the USB port
- **3 Step:** Click on **Get all** to establish connection with data logger.



Pic 3. USB connection steps

4.2 Connecting via GPRS

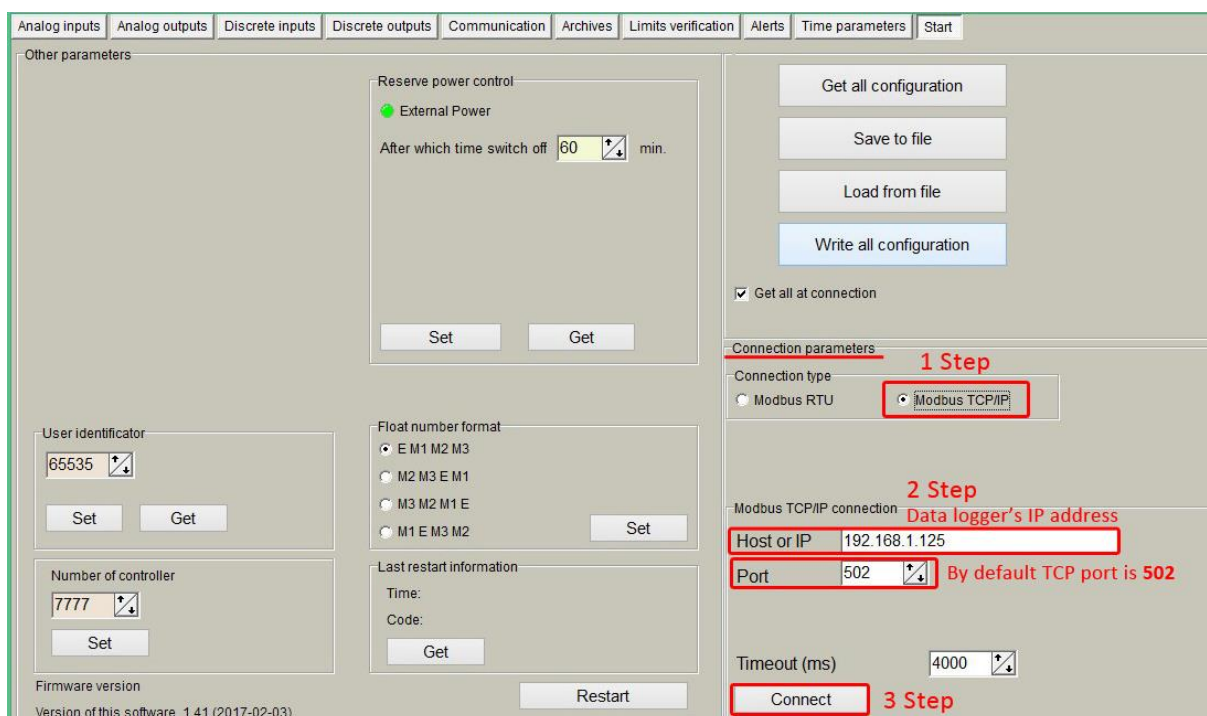
Check GPRS antenna is properly connected to the device. Insert SIM card.



Pic 4. Steps to connect GPRS antenna and insert SIM card

Open RAY-3 Configuration software. Steps to be followed are:

- **1 Step:** In "Connection type" area you need to choose **Modbus TCP/IP**
- **2 Step:** Add data logger **IP address** and **TCP port**. By default controller is set to **502 Port** (this is system standard Modbus TCP/IP port), change it if you need other.
- **3 Step:** Click on **Connect** to establish connection with data logger. If connection fails, check GPRS modem, Communication type, IP address and try to connect again.



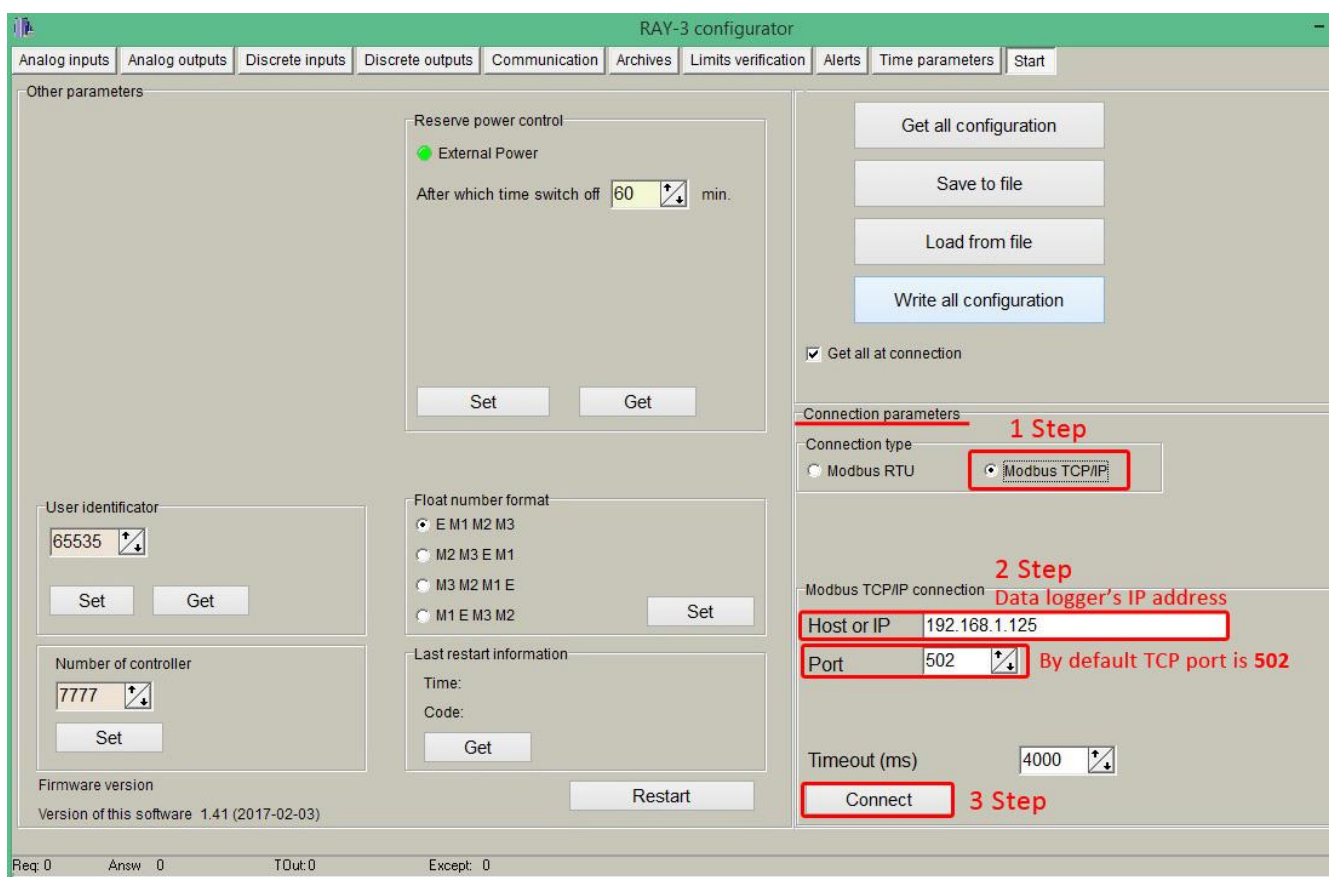
Pic 5. GPRS connection steps

4.3 Connecting via Ethernet

Connect a RJ45 Ethernet cable to the Ethernet port. Open RAY-3 Configuration software.

Steps to be followed:

- **1 Step:** Under Connection type select **ModBus TCP/IP** option
- **2 Step:** Add data logger **IP address** and **TCP port**.
By default Ethernet settings are: IP address **192.168.1.125** (or **192.168.1.126**); TCP port **502**.
- **3 Step** Click on **Connect** to establish connection with data logger. If connection fails, check cables, communication type, IP address and connect again.



Pic 6. Ethernet connection steps

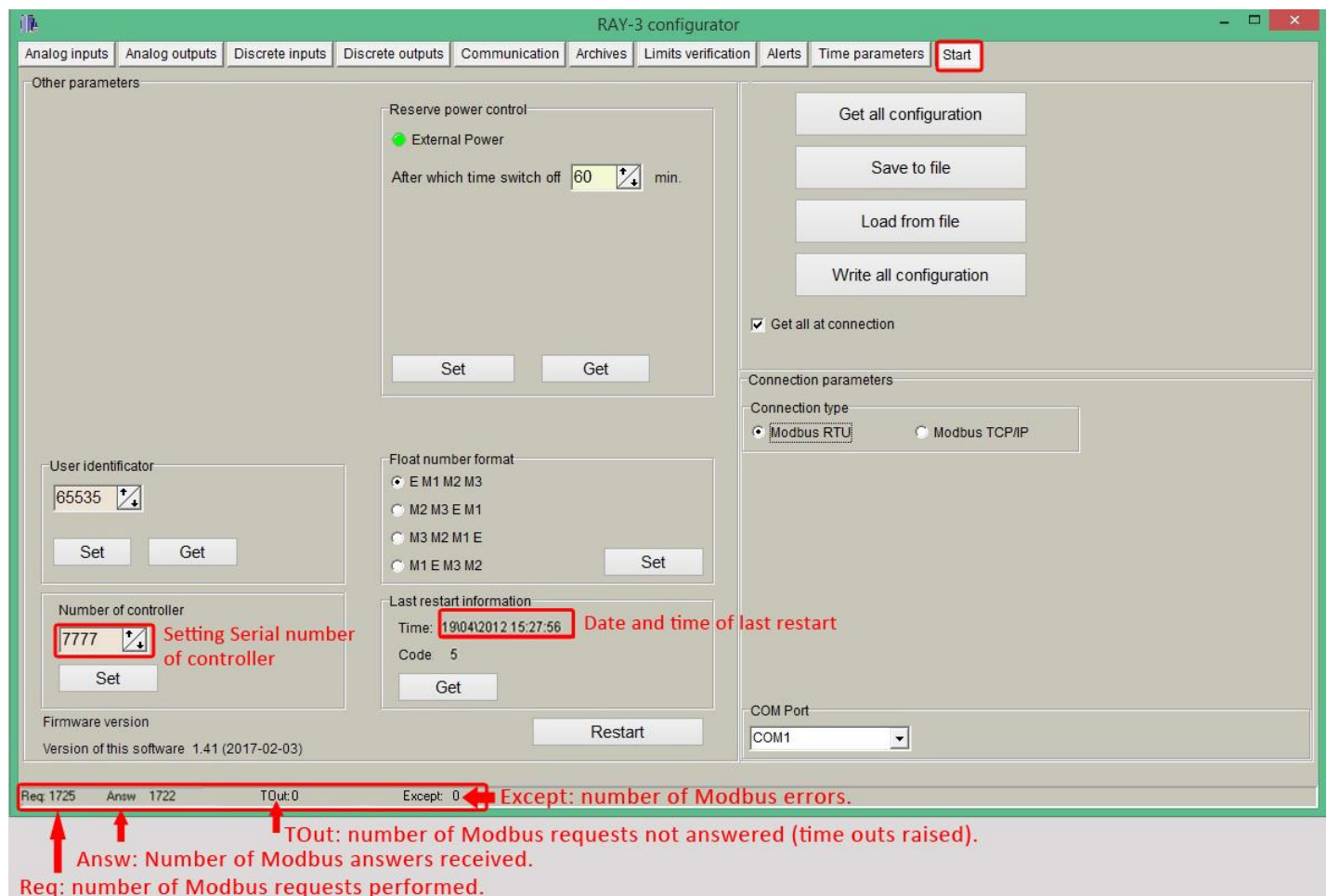
5 RAY-3 General settings and Status indicators

Once user has established communication with RAY-3, basic information such as **User identifier**, **Serial number** (each controller has its own factory serial number), **Last restart**, etc. is shown in the software frame.

Status indicators

Several status indicators are shown in the RAY-3 configuration software in order to inform user about current performance of Modbus communication:

- **Req:** number of Modbus requests performed.
- **Answ:** Number of Modbus answers received.
- **TOut:** number of Modbus requests not answered (time outs raised).
- **Except:** number of Modbus errors.



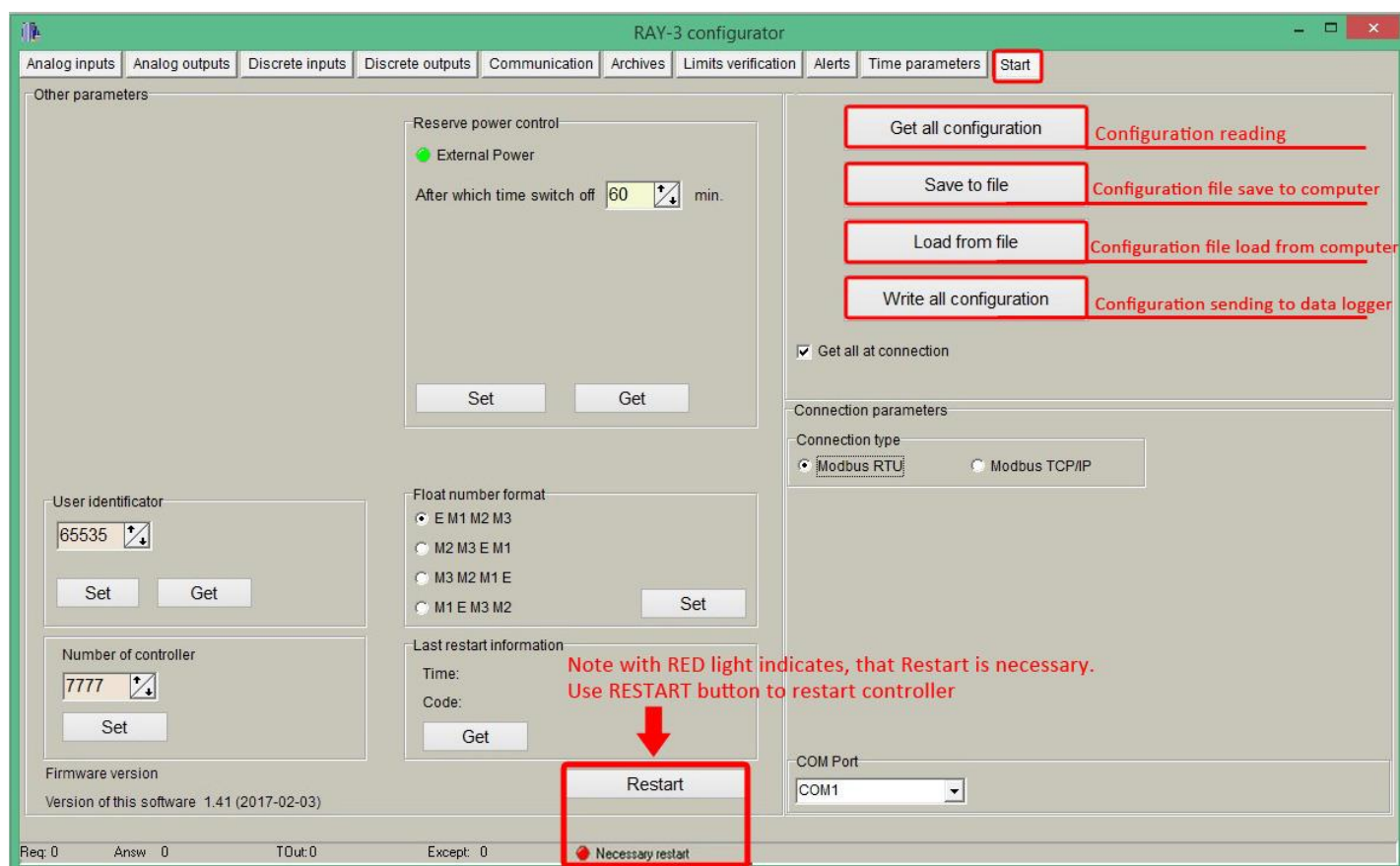
Pic 7. General settings and Status indicators

5.1 Configuration files

This feature enables user to save and load configuration files so that programming a number of data loggers with the same configuration becomes an easy process. Steps:

- **1 Step.** Set up all the configuration parameters making use of RAY-3 Configuration software.
- **2 Step.** Then, under **Start** tab, click on **Save to file** button. A dialog will be shown requesting user to select folder destination.
- **3 Step.** Once the file has been stored, connect a new data logger to the PC and then click on **Load from file** and select the file previously stored.
- **4 Step.** Then, click on **Write all configuration** button to load such configuration into the new controller.
- **5 Step.** A restart will be needed so that data logger can start using the loaded configuration. Data logger can be restarted by turning off/on power supply or pressing button **Restart**.

P.S. Repeat from step 3 with all the controllers that need the same configuration.

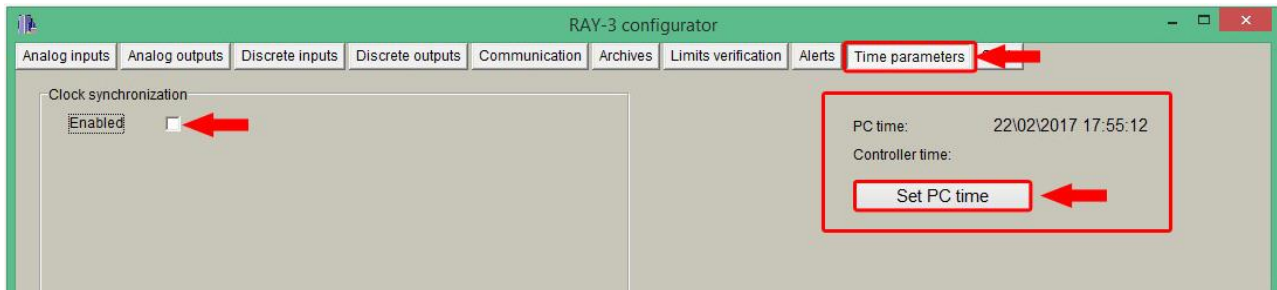


Pic 8. Configuration files management

6 Time parameters tab

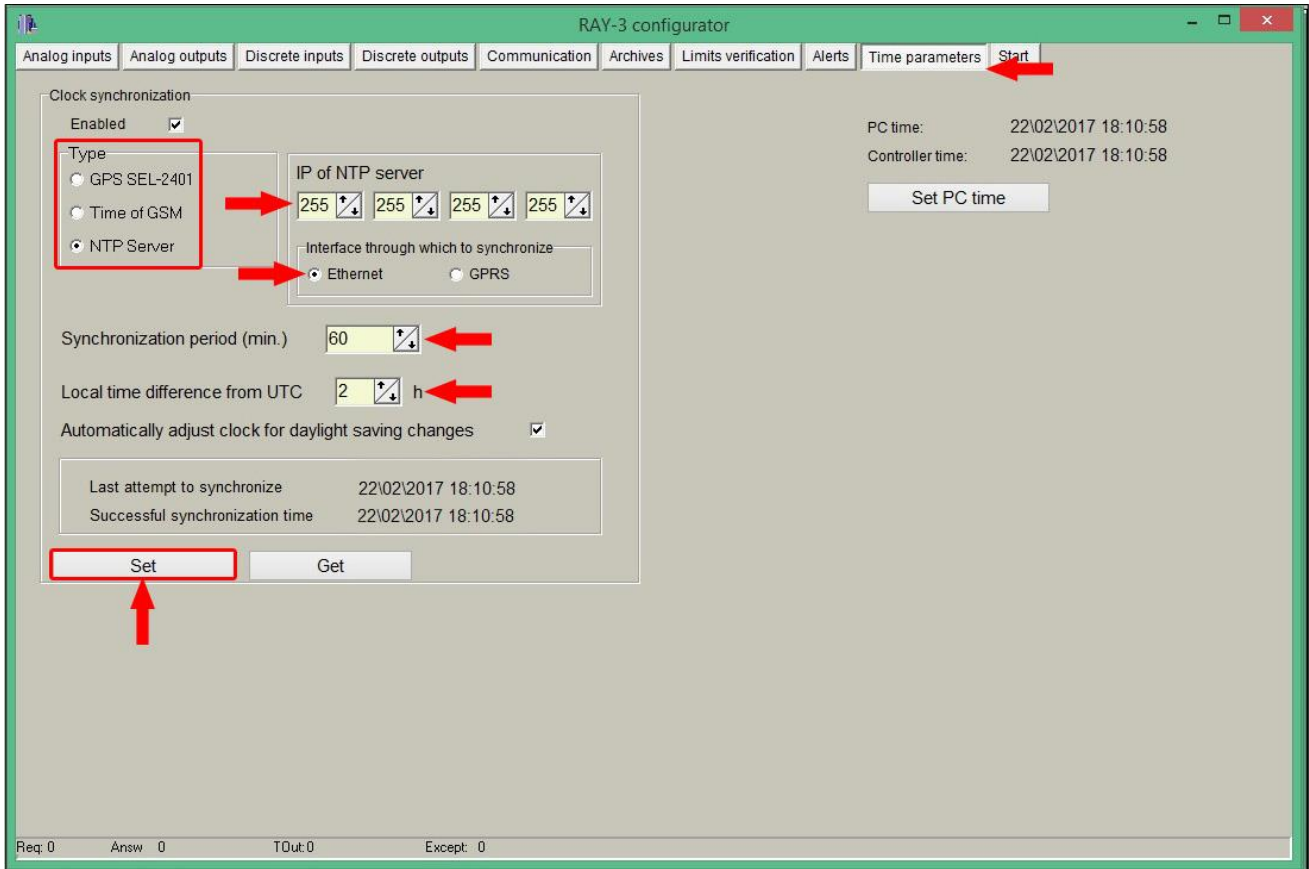
Time parameters tab enables users to set up time synchronization between RAY-3 Real Time Clock (RTC) and external time references. Several parameters can be configured under this tab:

- **Set PC time** - it synchronizes internal RTC with PC time.



Pic 9. Time Parameters tab. Set PC time

Clock synchronization: It must be enabled if synchronization between RAY-3 and any Network Time Protocol (NTP) server is requested. This option is particularly accurate since, every given period (**Synchronization period** parameter), device connects to an NTP server to get current UTC time. Also automatic summertime is adjusted.



Pic 10. Time Parameters tab. NTP server configuration

7 "Limits verification" tab

This tab enables users to set up limits verification raising events for issuing alerts when condition is met. To create the list, follow the next steps:

1. Choose **Count of limits** in order to start creating the number of positions desired;
2. Choose **Type of limit** (this must to be done first) among the following options:
 - **Over H:** event will be generated when the value is above the high limit.
 - **Under L:** event will be generated when the value is below the low limit.
 - **Over H & Under L:** event will be generated when the value is out of the range between high and low limit.
 - **Under H & Over L:** event will be generated when the value is within the range between high and low limit.
 - **Equal L:** event will be generated when the value is equal to the low limit.
3. Enter **register number** you want to control or choose from Main fields list (To create and/or edit list of limit's values use file limits.csv, that is in program's folder);
4. Enter data format, corresponding to data format of used register;
5. Choose limits;
6. Delay time (in seconds), if you want to filter accidental or short time events;
7. Finally, add a **code of event** (value must to be from 0 to 99 and will be used for alerts SMS sending)

RAY-3 configurator

Count of limits: 4 **1 Step**

Pos No	Parameter	Register	Format	Type of limit	Low limit (L)	High limit (H)	Delay	Code of event
1	Doors closed (on Din1)	4200	unsigned char	Equal L	0		10	2
2	Doors closed (on Din1)	4248	unsigned char	Equal L	1		10	1
3	(Ain1) temperature	0	Float	Over H & Under L	0	40,000	120	3
4				None	0	40,000		

None
Over H
Under L
Over H & Under L
Under H & Over L
Equal L

List is in limit.csv file

Register address and Format can be taken from List of register

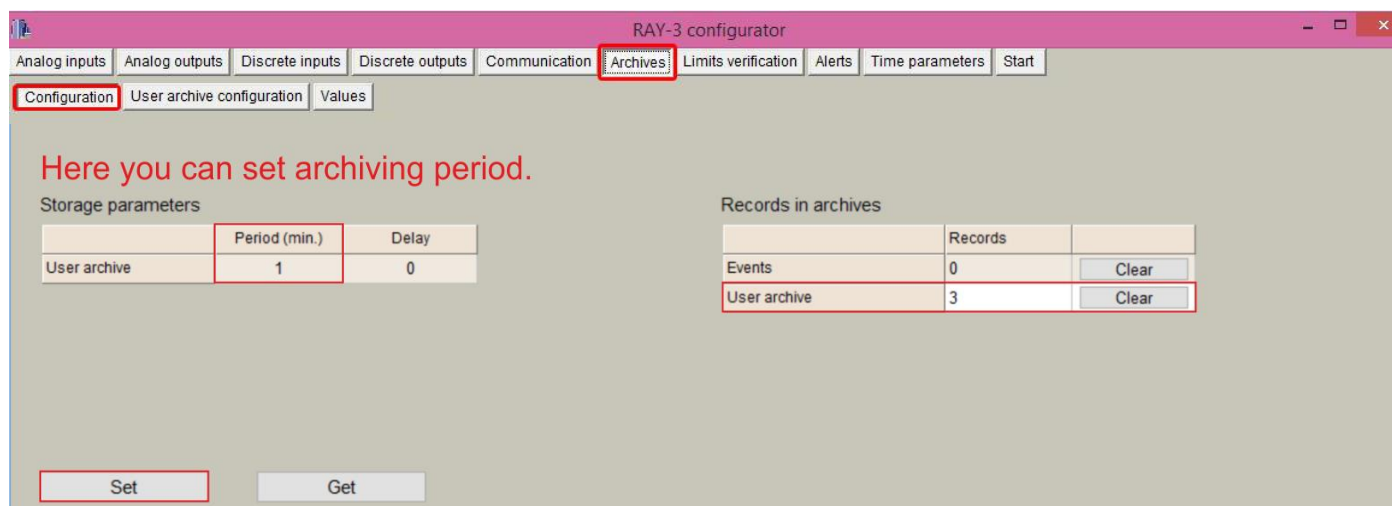
2 Step. Choose "Type of limit"

Pic 11. Limits verification tab

8 "Archives" tab

The RAY-3 has an internal 8MB flash memory. In case, the device is used as data logger, the following steps must be:

- Go to **Archives> Configuration**
- In **Storage parameters** frame, configure the **Period**: It defines storage interval. Internal memory is organized in different blocks depending on the devices nature which are connected to the RAY-3.



Pic 12. Archives tab. Storage frequency configuration

In case user needs to customize storage blocks, signals acquisition must be configured accordingly. Memory block used will be defined as "User Archive" (see next step).

- Go to **Archives>User Archive Configuration**
- Under this tab, user can configure datalogging following his own requirements. In the next pages, a configuration example is given by setting the following parameters:
 - ✓ "Count of parameters": number of registers to be stored.
 - ✓ "Register": Specific register to be stored.

NOTE: Timestamp is registered automatically.

9 "Communication" tab

9.1 Communication > Ethernet

Ethernet interface parameters can be configured within this tab:

- "MAC number": Media Access Control address
- "IP address"
- "Gateway IP"
- "Mask"

NOTE: After configuration is completed, click on **"SET"** button in order to save changes.

RAY-3 configurator

Analogue inputs Analogue outputs Discrete inputs Discrete outputs **Communication** Archives Limits verification Alerts Time parameters Start

Ethernet GPRS/GSM Serial interface Modbus devices Data transfer Routing Compressor

MAC number 00004C014CEB Set unique MAC

IP address 192 168 1 125

Gateways IP 192 168 1 1

Mask 255 255 255 0

Modbus TCP/IP server

Socket live time 2000 sec.

Set Get

Ping data

Enabled ☐

Send to address 255 255 255 255

Time interval(sec.) 60

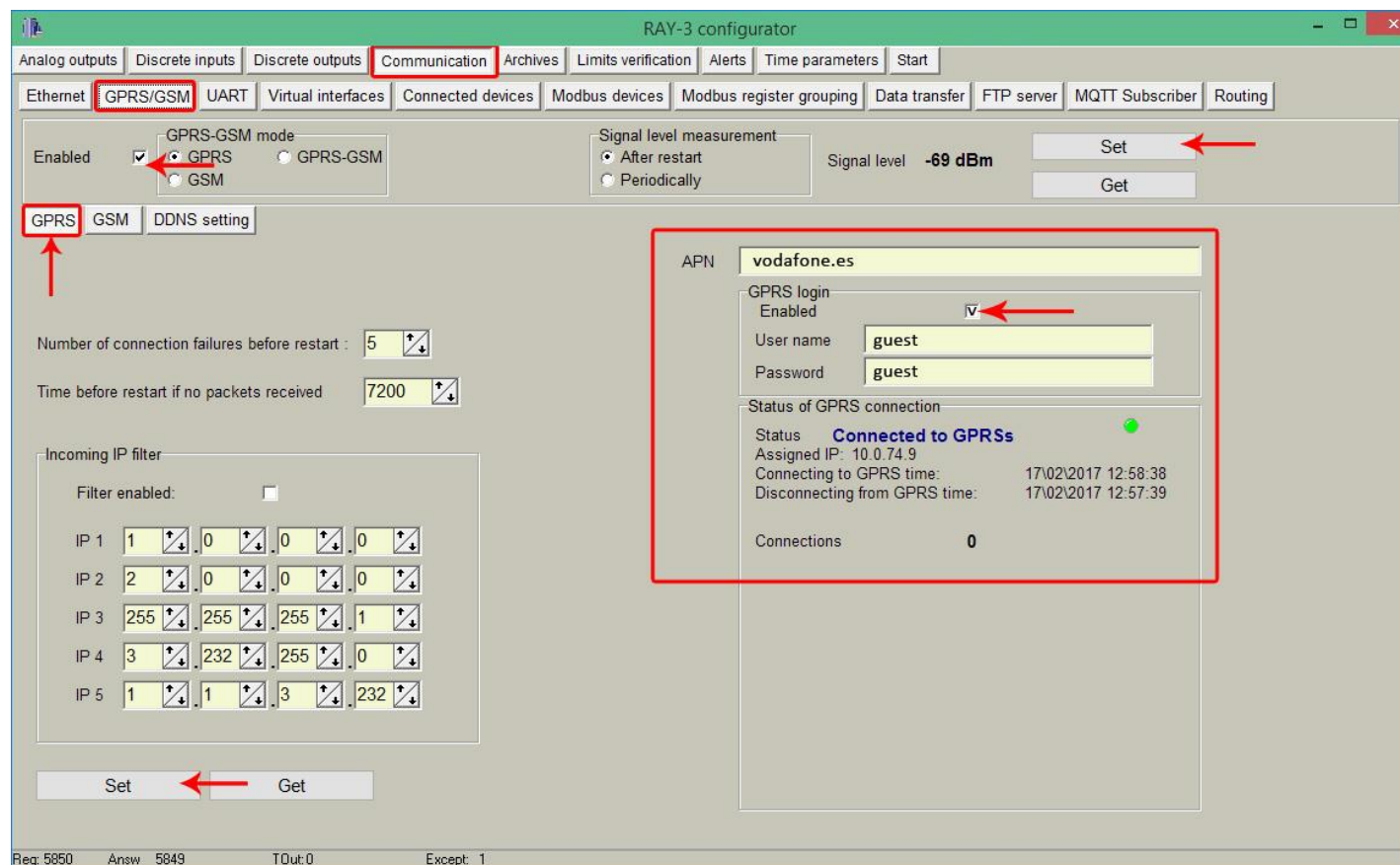
Set Get

Time before restart if no packets received 600

Pic 13. "Ethernet" configuration tab

9.2 Communication > GPRS

RAY-3 can be configured through a GPRS link. In order to do so, user must enable GPRS connection as shown below. Then, click on **“SET”** button in order to save changes.



Pic 14. GPRS Tab. Enabling communication

Within this tab, different services can be configured or checked.

GPRS connection parameters:

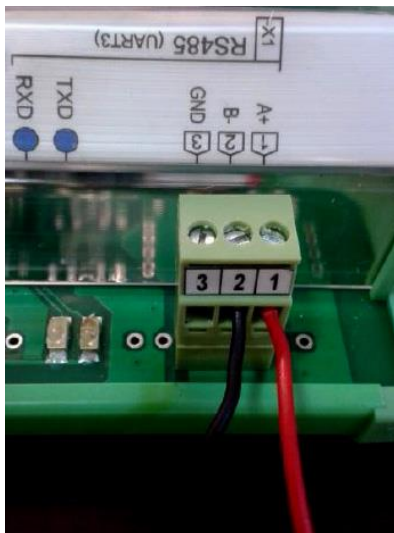
- **APN:** access point name provided by Internet Service Provider (ISP).

If needed by ISP, credentials can also be configured here:

- **Username:** provided by ISP.
- **Password:** provided by ISP.

NOTE: After configuration is completed, click on **“SET”** button in order to save changes.

10 Modbus connection configuration



Connecting Modbus meter/device to the RAY-3

Step 1: Click on **Communication tab** - > **UART** and set the **Bode Rate, Parity, Data Bits, Stop Bits**. This information must be the same as indicated on the Modbus meter / device that is being connected to the RAY-3 data logger. After entering the parameters, press „**SET**“.

Discrete inputs				Communication	Archives	Limits verification	Alerts	Time parameters	Start		
Ethernet				UART	Virtual interfaces	Connected devices	Modbus devices	Modbus register grouping	Data transfer	FTP server	MQTT Subscriber
		UART 1	UART 2	UART 3							
Bode		<input type="radio"/> 300 <input type="radio"/> 600 <input type="radio"/> 1200 <input type="radio"/> 2400 <input type="radio"/> 4800 <input type="radio"/> 9600 <input checked="" type="radio"/> 19200 <input type="radio"/> 38400 <input type="radio"/> 57600	<input type="radio"/> 300 <input type="radio"/> 600 <input type="radio"/> 1200 <input type="radio"/> 2400 <input type="radio"/> 4800 <input type="radio"/> 9600 <input checked="" type="radio"/> 19200 <input type="radio"/> 38400 <input type="radio"/> 57600	<input type="radio"/> 300 <input type="radio"/> 600 <input type="radio"/> 1200 <input checked="" type="radio"/> 2400 <input type="radio"/> 4800 <input type="radio"/> 9600 <input type="radio"/> 19200 <input type="radio"/> 38400 <input type="radio"/> 57600	<p>You have to set UART (Bode, Parity, Data bits, Stop bits) to which it is connected your Modbus meters. UART settings should be the same as the meters.</p>						
Parity		<input checked="" type="radio"/> Even <input type="radio"/> Odd <input type="radio"/> Mark <input type="radio"/> Space <input type="radio"/> None	<input checked="" type="radio"/> Even <input type="radio"/> Odd <input type="radio"/> Mark <input type="radio"/> Space <input type="radio"/> None	<input checked="" type="radio"/> Even <input type="radio"/> Odd <input type="radio"/> Mark <input type="radio"/> Space <input type="radio"/> None							
Data bits		<input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input checked="" type="radio"/> 8	<input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input checked="" type="radio"/> 8	<input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input checked="" type="radio"/> 8							
Stop bits		<input checked="" type="radio"/> 1 <input type="radio"/> 2	<input checked="" type="radio"/> 1 <input type="radio"/> 2	<input checked="" type="radio"/> 1 <input type="radio"/> 2							
Packetization		<input checked="" type="radio"/> Time <input type="radio"/> Symbol <input type="radio"/> Length	<input checked="" type="radio"/> Time <input type="radio"/> Symbol <input type="radio"/> Length	<input type="radio"/> Time <input type="radio"/> Symbol <input type="radio"/> Length							
Packet time (msec.)		10	10	100							
Packet symbol(Hex)		01	01	00							
Packet byte count		1	100	1							
Mode		<input type="radio"/> Full duplex <input checked="" type="radio"/> Half duplex	<input type="radio"/> Full duplex <input checked="" type="radio"/> Half duplex	<input type="radio"/> Full duplex <input checked="" type="radio"/> Half duplex							
Destination of DTR		<input type="radio"/> Always OFF <input type="radio"/> Always ON <input checked="" type="radio"/> OFF when send <input type="radio"/> ON when send	<input type="radio"/> Always OFF <input type="radio"/> Always ON <input checked="" type="radio"/> OFF when send <input type="radio"/> ON when send	<input type="radio"/> Always OFF <input type="radio"/> Always ON <input checked="" type="radio"/> OFF when send <input type="radio"/> ON when send							

After all the settings you need to press the "Set".

Set Get

Req: 983 Answ: 982 TOut: 0 Except: 1

Step 2: Click on *Communication tab* - > *Virtual Interfaces* and set the UART. (Click „SET“).

COM Client			
	COM 1	COM 2	COM 3
Enabled	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UART	UART 3	UART 1	UART 1
Stack depth	1	1	1
Timeout (msec.)	2500	1000	1000
Number of repeats	1	1	1
<div>Set</div> <div>Get</div>			

Modbus RTU Client			
	1	2	
Enabled	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
UART	UART 1	UART 1	
Stack depth	1	1	
Timeout (msec.)	2500	1000	
Number of repeats	1	1	
Delay before next req.(msec.)	100	100	
<div>Set</div> <div>Get</div>			

Step 3: Click on *Communication tab* - > *Modbus devices* -> *Configuring Modbus devices* -> *Modbus RTU client*. Define the reading time (sec) by your requirements. Then set the amount of requests, press „Enter“. Also set the Address, Function, Register, and Coils as indicated in the picture above and press „SET“.

You have to define the reading time (sec.), what is right for you.

You have to enter the number in the field, how many you need, and press "Enter".

The number of registers which are read from the starting registry. In this case 65002

You have to enter a starting address of modbus register number in the field, which you want to read.

You have to choose, what function the meter will be reading.

You have to enter modbus address, which you want to read from your meter.

Configuring Modbus devices							
Current values							
Modbus RTU Client							
	1						
Enabled	<input checked="" type="checkbox"/>						
Modbus RTU Client	Modbus RTU Client 1						
Read period (sec.)	5						
Amount of requests	1						
	Address	Function	Register/Coil	Amount of registers/Coils	MX reg. index	Priority	Error priority
1	88	3	65002	2	0	1	0
<div>Set</div> <div>Get</div>							

Req: 1059 Answ: 1058 TOut: 0 Except: 1

Step 4: Click on **Communication tab -> Modbus devices -> Current values**. In this tab you see if the Modbus meter / device is read. The value is being showed in hex formate. Also there is indication of RAY-3 Register adress, where the received modbus value is.

Discrete inputs | Communication | Archives | Limits verification | Alerts | Time parameters | Start

Ethernet | UART | Virtual interfaces | Connected devices | Modbus devices | Modbus register grouping | Data transfer | FTP server | MQTT Subscriber

Configuring Modbus devices | **Current values**

Here you can check if the meter is read. The value is showing hex format.

Pos	Register	Amount	Value
1	52000	2	0000 3039

52000 is an internal Data Logger register address, into which is attached the received value from the meter.

Step 5: Click on **Communication tab -> Data transfer -> Common parameters**. In this tab are described meter values, formats, headers and dimensions, which will be archived and sent to the FTP. Only archived values can be sent to FTP.

Discrete inputs | Communication | Archives | Limits verification | Alerts | Time parameters | Start

Ethernet | UART | Virtual interfaces | Connected devices | Modbus devices | Modbus register grouping | Data transfer | FTP server | MQTT Subscriber

Common parameters | Modbus TCP/IP | FTP | MQTT

Amount of groups of registers: 8

Set user archive ☒

	Parameter	Register/Coil	Amount of parameters or string length	Format	Header	Dimension
1		100070		1 unsigned long (32b)	Identification Nr.	
2		100050		1 Float (32b)	Volume(m3)	
3		100072		1 unsigned long (32b)	On Time(hours)	
4		100052		1 Float (32b)	Time Point(time & date)	
5		100074		1 unsigned long (32b)	Time Point(date)	
6		100076		1 unsigned long (32b)	Fabrication No	
7		100054		1 Float (32b)	Volume(m3)	
8		52000		1 unsigned long (32b)		

Here are described the meter values formats, headers and dimensions, which will be archived and sent to the FTP. Only archived values can be send to the FTP server.

You can load from CSV file your description or save this and use in other devices.

Set Get Load from CSV Save to CSV

Req: 1725 Answ: 1722 TOut: 0 Except: 3

*Step 6: Click on **Archives** -> **Values** -> **User archive**. In this tab you see modbus values and those values can be saved in the computer.*

Pos No	Volume(m3)	On Time(hours)	Time Point(time & date)	Time Point(date)	Fabrication No	Volume(m3)	
1	0.1350	75444	1.4864132E9	943920000	8014388	0.1350	946693740
2							

Here you can check what values are archived and save them in your computer.

< | >

Get Save archive Clear archive

*Step 7: Click on **Archives** -> **Configuration**. In this tab you can set the archiving period.*

Here you can set archiving period.

Storage parameters

	Period (min.)	Delay
User archive	1	0

Records in archives

	Records	
Events	0	Clear
User archive	3	Clear

Set Get

Step 8: Communication -> Data Transfer -> FTP. In this tab you can set the FTP port, transmission channel, FTP server address / name. Then click „**SET**“.

Discrete inputs | **Communication** | Archives | Limits verification | Alerts | Time parameters | Start

Ethernet | UART | Virtual interfaces | Connected devices | Modbus devices | Modbus register grouping | Data transfer | **FTP server** | MQTT Subscriber

Common parameters | Modbus TCP/IP | **FTP** | MQTT

You have set your FTP port and transmission channel.

	FTP server 1	FTP server 2	FTP server 3	FTP server 4
Enabled	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FTP port	2021	21	21	21
Transfer period (min.)	60	0	10	10
Repeat transfer if failure (min.)	2	0	256	120
Max number of last records to be sent	10	10	10	10
Transmission channel	<input checked="" type="radio"/> Ethernet <input type="radio"/> GPRS	<input checked="" type="radio"/> Ethernet <input type="radio"/> GPRS	<input checked="" type="radio"/> Ethernet <input type="radio"/> GPRS	<input checked="" type="radio"/> Ethernet <input type="radio"/> GPRS

Name template of the file to be sent
RAY3_YYYY_MM_DD_HH_NN.csv

FTP server	URL and directory
1	82.135.139.27
2	
3	
4	

Here you have set FTP server address or name.

Username of FTP server

FTP server	User name
1	user1
2	
3	
4	

Password of FTP server

FTP server	Password
1	user1
2	
3	
4	

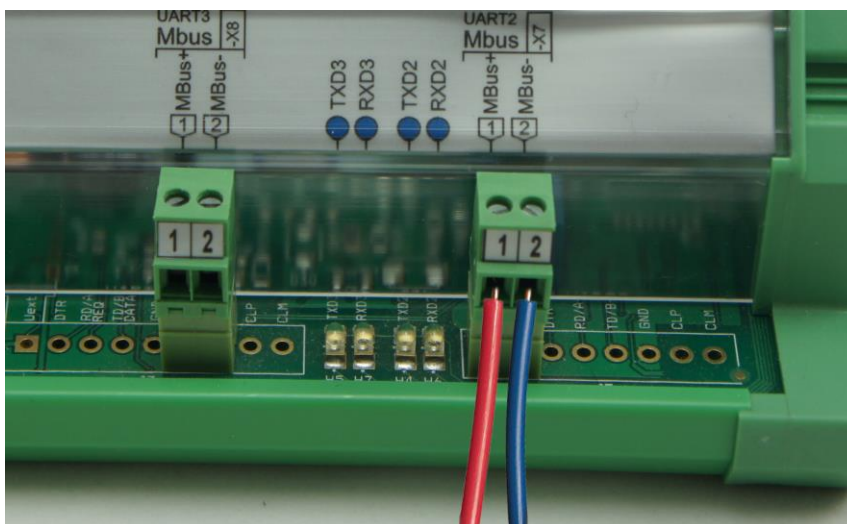
FTP server	Status	Successful/attempt/last record transfer times
1	Not active	01/01/1998 00:00:00 01/01/1998 00:00:00 01/01/1998 00:00:00
2	Not active	01/01/1998 00:00:00 01/01/1998 00:00:00 01/01/1998 00:00:00
3	Not active	01/01/1998 00:00:00 01/01/1998 00:00:00 01/01/1998 00:00:00
4	Not active	01/01/1998 00:00:00 01/01/1998 00:00:00 01/01/1998 00:00:00

Set **Get**

Req: 1663 Answ: 1662 TOut: 0 Except: 1

11 M-Bus connection configuration

Connecting the M-Bus meter/device to the RAY-3 M-Bus interface.



Connecting Modbus meter/device to the RAY-3

Step 1: Click on **Communication** tab - > **UART** and set the Bode Rate, Parity, Data Bits, Stop Bits. This information must be the same as indicated on the M-Bus meter / device that is being connected to the RAY-3 data logger. After entering the parameters, press „**SET**“.

Valuable note: If you are not sure which UART to configure, check the which UART is M-Bus interface on the device.

Discrete inputs				Communication	Archives	Limits verification	Alerts	Time parameters	Start		
Ethernet				UART	Virtual interfaces	Connected devices	Modbus devices	Modbus register grouping	Data transfer	FTP server	MQTT Subscriber
		UART 1	UART 2	UART 3	<p>You have to set UART (Bode, Parity, Data bits, Stop bits) to which it is connected your Mbus meters. UART settings should be the same as the meters.</p>						
Bode	<input type="radio"/> 300 <input type="radio"/> 600 <input type="radio"/> 1200 <input type="radio"/> 2400 <input type="radio"/> 4800 <input type="radio"/> 9600 <input checked="" type="radio"/> 19200 <input type="radio"/> 38400 <input type="radio"/> 57600	<input type="radio"/> 300 <input type="radio"/> 600 <input type="radio"/> 1200 <input type="radio"/> 2400 <input type="radio"/> 4800 <input type="radio"/> 9600 <input checked="" type="radio"/> 19200 <input type="radio"/> 38400 <input type="radio"/> 57600	<input type="radio"/> 300 <input type="radio"/> 600 <input type="radio"/> 1200 <input type="radio"/> 2400 <input type="radio"/> 4800 <input type="radio"/> 9600 <input checked="" type="radio"/> 19200 <input type="radio"/> 38400 <input type="radio"/> 57600								
Parity	<input checked="" type="radio"/> Even <input type="radio"/> Odd <input type="radio"/> Mark <input type="radio"/> Space <input type="radio"/> None	<input checked="" type="radio"/> Even <input type="radio"/> Odd <input type="radio"/> Mark <input type="radio"/> Space <input type="radio"/> None	<input checked="" type="radio"/> Even <input type="radio"/> Odd <input type="radio"/> Mark <input type="radio"/> Space <input type="radio"/> None								
Data bits	<input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input checked="" type="radio"/> 8	<input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input checked="" type="radio"/> 8	<input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input checked="" type="radio"/> 8								
Stop bits	<input checked="" type="radio"/> 1 <input type="radio"/> 2	<input checked="" type="radio"/> 1 <input type="radio"/> 2	<input checked="" type="radio"/> 1 <input type="radio"/> 2								
Packetization	<input checked="" type="radio"/> Time <input type="radio"/> Symbol <input type="radio"/> Length	<input checked="" type="radio"/> Time <input type="radio"/> Symbol <input type="radio"/> Length	<input checked="" type="radio"/> Time <input type="radio"/> Symbol <input type="radio"/> Length								
Packet time (msec.)	10	10	100								
Packet symbol(Hex)	01	01	00								
Packet byte count	1	100	1								
Mode	<input type="radio"/> Full duplex <input checked="" type="radio"/> Half duplex	<input type="radio"/> Full duplex <input checked="" type="radio"/> Half duplex	<input type="radio"/> Full duplex <input checked="" type="radio"/> Half duplex								
Destination of DTR	<input type="radio"/> Always OFF <input type="radio"/> Always ON <input checked="" type="radio"/> OFF when send <input type="radio"/> ON when send	<input type="radio"/> Always OFF <input type="radio"/> Always ON <input checked="" type="radio"/> OFF when send <input type="radio"/> ON when send	<input type="radio"/> Always OFF <input type="radio"/> Always ON <input checked="" type="radio"/> OFF when send <input type="radio"/> ON when send								

After all the settings you need to press the "Set".

Set

Get

Step 2: Click on **Communication tab** -> **Virtual interfaces**. Set the UART and press „**SET**“.

	COM 1	COM 2	COM 3
Enabled	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UART	UART 3	UART 1	UART 1
Stack depth	1	1	1
Timeout (msec.)	2500	1000	1000
Number of repeats	1	1	1

Set Get

Step 3: Click on **Communication tab** -> **Connected devices** -> **M-Bus devices** -> **Configuration** and configure the following parameters:

- **"Enabled"**: Select which M-Bus interface will be active.
- **"COM Client"**: Select COM Client previously configured.
- **"Amount of meters"**: Configure the number of M-Bus devices to be read.
- **"Read Period"**: Set the read period in minutes.

After configuration is completed, click on **"SET"** button in order to save changes. Also, perform a hardware reset.

	1	2
Enabled	<input checked="" type="checkbox"/>	<input type="checkbox"/>
COM Client	1	1
Amount of meters	1	1
Read period	10	1
Period dimension	<input checked="" type="radio"/> sec. <input type="radio"/> min. <input type="radio"/> h	<input checked="" type="radio"/> sec. <input type="radio"/> min. <input type="radio"/> h

Set Get

Meters search

Search begins

☐ From the least significant digit in the address

☒ From the most significant digit in the address

Search devices in 1st line

	1	2
Status	Active	
Rastė kiekis	1	

Load from CSV Save to CSV

Req: 988 Answ: 987 TOut: 0 Except: 1

"M-Bus devices" tab. Communication configuration

Once RAY-3 has been reset, go to **Communication tab** -> **Connected devices** -> **M-Bus devices** -> **Configuration** and click on "**Search devices in 1st line**" button.

Step 4: After the search is done, click on „**Include newly found**“, then „**Delete missing**“ and finally „**Finish and send**“.

Pos	Address
1	0801438865329906

Pos No	Address	Data position
1	0000000000000000	1

1 step
Include newly found

2 step
Delete missing

3 step
Finish and send
Finish without sending
Cancel

Step 5: After a few seconds, a list including all the M-Bus devices connected to the network will be shown. Moreover, a list of its main parameters will be also identified automatically. Click „**Read Available parameters**“.

Discrete inputs | Communication | Archives | Limits verification | Alerts | Time parameters | Start

Ethernet | UART | Virtual interfaces | Connected devices | Modbus devices | Modbus register grouping | Data transfer | FTP server | MQTT Subscriber

M-Bus devices

Configuration | Current values

	1	2
Enabled	<input checked="" type="checkbox"/>	<input type="checkbox"/>
COM Client	1	1
Amount of meters	1	1
Read period	10	1
Period dimension	<input type="radio"/> sec. <input type="radio"/> min. <input type="radio"/> h	<input type="radio"/> sec. <input type="radio"/> min. <input type="radio"/> h

Set Get

First group

In succession

	Type	Address	Data position	Device number	Manufacturer	Medium
1	Unknown	0801438865329906	2	08014388	LSE	Hot W

View/Edit list of parameters
Read available parameters
Read current data

"M-Bus devices" tab. Self-discovery

Step 6: On the left you see all available parameters from the meter. On the right, you can select those parameters, that you need from the meter.

Type Unknown Device number 08014388

Here are parameters which give the meter.

You have to select your required parameters and fill the fields of "index".

Parameters in device						Selected parameters									
Pos No	Parameter	Storage number	Tariff	SubUnit	Type of parameter	Pos No	Parameter	Storage number	Tariff	SubUnit	Type of parameter	Double float index	Double long index	Float index	Long index
1	Identification Nr.	1	1	1	Instantaneous	1	Identification Nr.	1	1	1	Instantaneous				1
2	Manufacturer, Medium,	1	1	1	Instantaneous	2	Volume(m3)	1	1	1	Instantaneous			1	
3	Volume(m3)	1	1	1	Instantaneous	3	On Time(hours)	1	1	1	Instantaneous				2
4	On Time(hours)	1	1	1	Instantaneous	4	Time Point(time & date)	1	1	1	Instantaneous			2	
5	Time Point(time & date)	1	1	1	Instantaneous	5	Time Point(date)	1	1	1	Value during				3
6	Time Point(date)	1	1	1	Value during	6	Fabrication No	1	1	1	Instantaneous				4
7	Fabrication No	1	1	1	Instantaneous	7	Model / Version	1	1	1	Instantaneous				
8	Model / Version	1	1	1	Instantaneous	8	Parameter set	1	1	1	Instantaneous				
9	Parameter set identification	1	1	1	Instantaneous	9	Metrology (firmware)	1	1	1	Instantaneous				
10	Metrology (firmware) version	1	1	1	Instantaneous	10	Volume(m3)	2	1	1	Instantaneous			3	
11	Volume(m3)	2	1	1	Instantaneous	11	Time Point(date)	2	1	1	Instantaneous				
12	Time Point(date)	2	1	1	Instantaneous										

You can delete unnecessary line, push on it the right mouse button.

"index" fields must be numbered sequentially like here.

Select all Save As Close

Step 7: Set the name to the M-Bus meter:

Type Unknown Device number 08014388

Parameters in device						Selected parameters									
Pos No	Parameter	Storage number	Tariff	SubUnit	Type of parameter	Pos No	Parameter	Storage number	Tariff	SubUnit	Type of parameter	Double float index	Double long index	Float index	Long index
1	Identification Nr.	1	1	1	Instantaneous	1	Identification Nr.	1	1	1	Instantaneous				1
2	Manufacturer, Medium,	1	1	1	Instantaneous	2	Volume(m3)	1	1	1	Instantaneous			1	
3	Volume(m3)	1	1	1	Instantaneous	3	On Time(hours)	1	1	1	Instantaneous				2
4	On Time(hours)	1	1	1	Instantaneous	4	Time Point(time & date)	1	1	1	Instantaneous			2	
5	Time Point(time & date)	1	1	1	Instantaneous	5	Time Point(date)	1	1	1	Value during				3
6	Time Point(date)	1	1	1	Value during	6	Fabrication No	1	1	1	Instantaneous				4
7	Fabrication No	1	1	1	Instantaneous	7	Volume(m3)	2	1	1	Instantaneous			3	

New type of Mbus device

Name LSE

OK Cancel

You can write the meter's initials or anything what you need.

Select all Save As Close

Discrete inputs | Communication | Archives | Limits verification | Alerts | Time parameters | Start

Ethernet | UART | Virtual interfaces | Connected devices | Modbus devices | Modbus register grouping | Data transfer | FTP server | MQTT Subscriber

M-Bus devices

Configuration | Current values

	1	2
Enabled	<input checked="" type="checkbox"/>	<input type="checkbox"/>
COM Client	1	1
Amount of meters	1	1
Read period	10	1
Period dimension	<input type="radio"/> sec. <input type="radio"/> min. <input type="radio"/> h	<input type="radio"/> sec. <input type="radio"/> min. <input type="radio"/> h

Set Get

First group

In succession

	Type	Address	Data position	Device number	Manufacturer	Medium
1	Unknown	0801438865329906	2	08014388	LSE	Hot Water

You have to choose the meter's description, which you created before.

Step 7: In order to check if data are being received from M-Bus devices, go to **“Current values”** tab, here you can see the values of the meters.

Discrete inputs | Communication | Archives | Limits verification | Alerts | Time parameters | Start

Ethernet | UART | Virtual interfaces | Connected devices | Modbus devices | Modbus register grouping | Data transfer | FTP server | MQTT Subscriber

M-Bus devices

Configuration | Current values

Device/Parameter	Last read time	Storage number	Tariff	SubUnit	Type of parameter	Double float	Double long	Float	Long
2 - LSE (08014388)	01/01/2000 03:28:43								
Identification Nr.		1	1	1	Instantaneous				8014388
Volume(m3)		1	1	1	Instantaneous			0.135	
On Time(hours)		1	1	1	Instantaneous				75371
Time Point(time & date)		1	1	1	Instantaneous			1486149120.0	
Time Point(date)		1	1	1	Value during				943920000
Fabrication No		1	1	1	Instantaneous				8014388
Volume(m3)		2	1	1	Instantaneous			0.135	

Here you can see the values of the counters where reading has been configured before.

All of the values that you see here, you can move to the archiving.

All values to archive

If you don't see this button, probably you need update configuration software.

Req: 1239 Answ: 1238 TOut: 0 Except: 1

“M-Bus devices” tab. Current values

Once the registers are identified, on the "**Communication -> Data Transfer -> Common parameters**" tab, write all the registers as shown in the next figure and click on the "**Set user archive**" checkbox in order to replicate the structure in the internal datalogging archive. To send data to the FTP server, you need to archive values.

Discrete inputs | Communication | Archives | Limits verification | Alerts | Time parameters | Start

Ethernet | UART | Virtual interfaces | Connected devices | Modbus devices | Modbus register grouping | Data transfer | FTP server | MQTT Subscriber

Common parameters | Modbus TCP/IP | FTP | MQTT

Amount of groups of registers: 7

Set user archive ☒

	Parameter	Register/Coil	Amount of parameters or string length	Format	Header	Dimension
1		100070	1	unsigned long (32b)	Identification Nr.	
2		100050	1	Float (32b)	Volume(m3)	
3		100072	1	unsigned long (32b)	On Time(hours)	
4		100052	1	Float (32b)	Time Point(time & date)	
5		100074	1	unsigned long (32b)	Time Point(date)	
6		100076	1	unsigned long (32b)	Fabrication No	
7		100054	1	Float (32b)	Volume(m3)	

Here are described the meter values formats, headers and dimensions, which will be archived and sent to the FTP.

Only archived values can be send to the FTP server.

You can load from CSV file your description or save this and use in other devices.

Set Get Load from CSV Save to CSV

Req: 904 Answ: 903 TOut: 0 Except: 1

The RAY-3 has an internal 8MB flash memory. In case, the device is used as data logger, the following steps must be:

- Go to **Archives -> Configuration tab**
- In **Storage parameters** frame, configure the **Period**: It defines storage interval. Internal memory is organized in different blocks depending on the devices nature which are connected to the RAY-3.

Then click on "**SET**" button in order to save changes.

RAY-3 configurator

Analog inputs | Analog outputs | Discrete inputs | Discrete outputs | Communication | Archives | Limits verification | Alerts | Time parameters | Start

Configuration | User archive configuration | Values

Here you can set archiving period.

Storage parameters

	Period (min.)	Delay
User archive	1	0

Records in archives

	Records	
Events	0	Clear
User archive	3	Clear

Set Get

"Archives" tab. Storage frequency configuration

In order to check current data logged in the internal memory, go to **Archives -> Values -> User archive tab**. Here you can check, what values are archived and save them in your computer.

The screenshot shows the 'Archives' tab in the RAY-3 software. The 'User archive' sub-tab is selected, displaying a table of archived data. The table has the following columns: Pos No, Time, Identification Nr., Volume(m3), On Time(hours), Time Point(time & date), Time Point(date), and Fabrication. The data is as follows:

Pos No	Time	Identification Nr.	Volume(m3)	On Time(hours)	Time Point(time & date)	Time Point(date)	Fabrication
1	06/02/2017 14:31:00	8014388	0.1350	75441	1.4864037E9	943920000	8014
2	06/02/2017 14:30:00	8014388	0.1350	75441	1.4864036E9	943920000	8014
3	06/02/2017 14:29:00	8014388	0.1350	75441	1.4864036E9	943920000	8014
4	06/02/2017 14:28:00	8014388	0.1350	75441	1.4864036E9	943920000	8014

Below the table, there are buttons for 'Get', 'Save archive', and 'Clear archive'. The status bar at the bottom shows 'Req: 1204', 'Answ: 1203', 'TOut: 0', and 'Except: 1'.

Here you can check what values are archived and save them in your computer.

"Archives" tab. User archive current values

Configure **FTP client**: Go to **Communication -> Data Transfer -> FTP**. In this tab you can set the FTP port, transmission channel, FTP server address / name. You have set your FTP port and transmission channel.

Configure the following parameters: **"FTP server"**: Up to 4 different FTP connections to remote FTP servers can be configured.

- **"Enabled"**: Select it to enable an FTP connection
- **"FTP Port"**: By default, 21 but can be changed.
- **"Transfer period"**: It defines interval between CSV file sending tasks.
- **"Max number of last records to be sent"**: It defines maximum number of previous data stored and not sent due to communication error. These data will be sent in a CSV file when communication is restored.
- **"Transmission channel"**: It can be Ethernet or GPRS

"URL and directory of FTP servers": It defines the complete FTP server URL where CSV file will be hosted.

Username and password of FTP server: to be configured in case credentials are requested by FTP server.

In order to save changes click on **"SET"** button.

Discrete inputs | Communication | Archives | Limits verification | Alerts | Time parameters | Start

Ethernet | UART | Virtual interfaces | Connected devices | Modbus devices | Modbus register grouping | Data transfer | FTP server | MQTT Subscriber

Common parameters | Modbus TCP/IP | FTP | MQTT

You have set your FTP port and transmission channel.

	FTP server 1	FTP server 2	FTP server 3	FTP server 4
Enabled	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FTP port	2021	21	21	21
Transfer period (min.)	60	0	10	10
Repeat transfer if failure (min.)	2	0	256	120
Max number of last records to be sent	10	10	10	10
Transmission channel	<input checked="" type="radio"/> Ethernet <input type="radio"/> GPRS	<input checked="" type="radio"/> Ethernet <input type="radio"/> GPRS	<input checked="" type="radio"/> Ethernet <input type="radio"/> GPRS	<input checked="" type="radio"/> Ethernet <input type="radio"/> GPRS

Name template of the file to be sent
RAY3_YYYY_MM_DD_HH_NN.csv

FTP server	URL and directory
1	82.135.139.27
2	
3	
4	

Here you have set FTP server address or name.

FTP server	User name	FTP server	Status	Successful/attempt/last record transfer times
1	user1	1	Not active	01/01/1998 00:00:00 01/01/1998 00:00:00 01/01/1998 00:00:00
2		2	Not active	01/01/1998 00:00:00 01/01/1998 00:00:00 01/01/1998 00:00:00
3		3	Not active	01/01/1998 00:00:00 01/01/1998 00:00:00 01/01/1998 00:00:00
4		4	Not active	01/01/1998 00:00:00 01/01/1998 00:00:00 01/01/1998 00:00:00

FTP server	Password
1	user1
2	
3	
4	

Set **Get**

Req: 1663 Answ: 1662 TOut: 0 Except: 1

Communication -> "Data transfer" tab. FTP client configuration