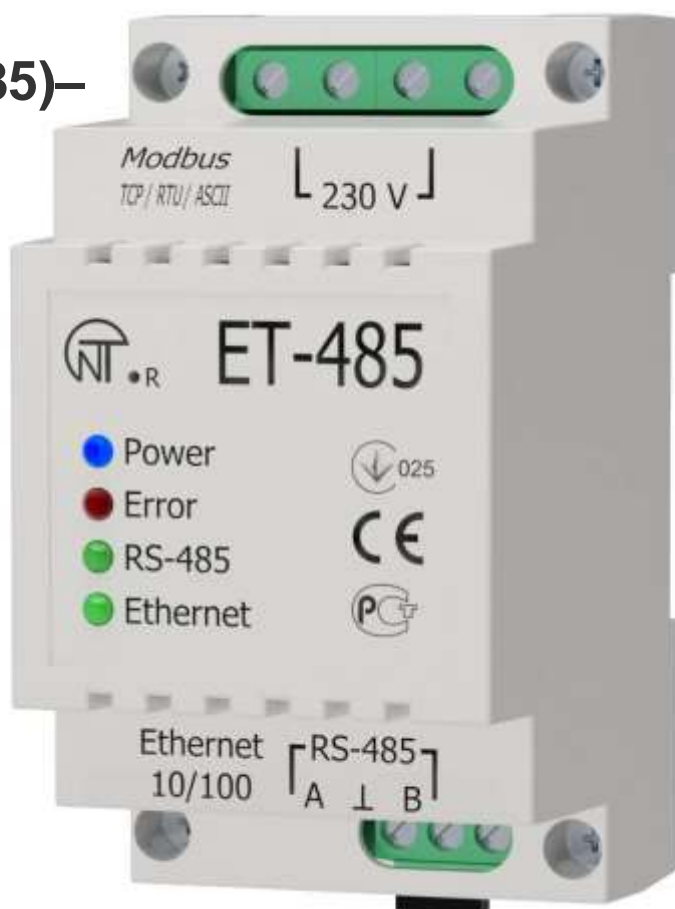


## Protocol converter Modbus RTU/ASCII (RS-485)– Modbus TCP (Ethernet)

**ET- 485**



## OPERATING MANUAL

*Quality control system on the production complies with requirements ISO 9001:2008*

### CAUTIONS

- Carefully study the user manual before using the appliance.
- Place the unit under operating conditions and wait at least 2 hours before connecting it to the electricity mains.
- Do not use abrasives or organic compounds (alcohol, gasoline, solvents, etc.) for cleaning.



**DO NOT OPEN AND REPAIR THE EQUIPMENT YOURSELF.**  
It may contain energized parts.



**DO NOT OPERATE THIS UNIT IN CASE OF ANY MECHANICAL DAMAGE TO THE CASING.**



**DO NOT EXPOSE THIS PRODUCT TO WATER OR OPERATE IN A HIGH HUMIDITY ENVIRONMENT.**

This is a safe in service unit if complying with operating procedures.

~ 2 ~  
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## 1 DESIGNATION

ET-485 is a microprocessor unit.

The unit is designed to provide data exchange between the equipment, connected to Ethernet 10BASE-T and 100BASE-T network, and the equipment, supplied with RS-485 interface and forming Modbus network. The examples of network topology with application of ET-485 are shown in appendix B.

The unit fulfills the functions of a Modbus-server for switching the Modbus-clients to the Ethernet network. The unit provides functions of Modbus-server for connecting Modbus-clients within Ethernet network. In the RS-485 master mode, the unit redirects Modbus-queries from the clients in Ethernet network to the devices in Modbus network and returns the answers from the devices to the clients. In the query redirection to remote server mode, the unit maintains the connection to Modbus TCP server in Ethernet network and in addition directs client queries to this server. In the RS-485 slave mode, the unit in addition accepts RS-485 queries from a Modbus-client within Modbus network.

ET-485 has:

- flexible addressing within the Ethernet network (overloading MAC-address, static and dynamic IP-address);
- different data transfer modes for Modbus network (RTU and ASCII with/without odd-even check, wide range of transmission speeds, selectable delay;
- adjustable redirection of queries;
- security access (IP address filtration and/or access password for condition reading, for setting the unit, for connection to Modbus network, and for recording/reading within Modbus network).

ET-485 meets the following requirements:

Information processing equipment. Safety. Part 1. General requirements (IEC 60950-1:2001).

Technology equipment. Radio disturbance characteristics. Limits and methods of measurement (CISPR 22:2006).

## Terms and abbreviations

- **10Base-T** – Ethernet standard for twisted pair communication with the speed of 10Mbit/s;
- **100Base-T** – Ethernet standard for twisted pair communication with the speed of 100Mbit/s;
- **8P8C/RJ45** – is an unified socket for 10Base-T / 100Base-T network connections;
- **ACC** - Active Connection to the Client, where connecting side acts as a server;
- **Twisted pair** – is a pair of insulated conductors inside the cable, which are twisted together in order to reduce the distortion of the transmitted signal;
- **Indicator** – is a LED element;
- **Client** – is a device, which is addressing the other devices (server) with a request to perform certain functions;
- **Package** – is a block of data to be transmitted between devices;
- **Unit** – is the ET-485 Protocol converter;
- **Server** – is a unit, which performs specific functions at the request of other units;
- **DCRS** - Data Collection Remote Server, to which ET-485 connects in the ACC mode
- **ASCII** – is a table of standard codes for information interchange;
- **Ethernet** – is a standard for packet network communication and transmitting data between units (e.g., PCs);
- **HTTP** – is a protocol for transferring Web-pages and other data over "client-server " technology;
- **Internet** – is a global routing system of units for storing and transferring data;
- **IP (protocol)** – is a routable protocol for transferring data over Ethernet. It is a part of TCP/IP and used for Internet;
- **IP (address)** – is a node address, which is unique within a single network, operating over the IP protocol;
- **IPv4** – is a four byte IP-address;
- **MAC (address)** – is an address, used for device authentication during Ethernet transmissions. It is usually unique although qualified personnel can change it under certain circumstances.
- **MAC-48** – is a six byte MAC-address;
- **Modbus** – is a standard and protocol for packet communication over the "client-server " technology for industrial electronic units;
- **Modbus RTU** – is a communication protocol of the unit for bite wise transfer of the package;
- **Modbus ASCII** – is a communication protocol of the unit for the transfer of package in the form of ASCII-symbols;
- **Modbus TCP** – is a protocol for transferring Modbus packages under the TCP/IP standard;
- **RS-485/EIA-485** – is a network standard for communicating units over the twisted pair;
- **TCP/IP** – is a standard and a set of protocols for transferring data along the networks with delivery verification;
- **WEB** – is a system for accessing documents on the server, used in the Internet.
- **WEB-page** – is a document, file, recourse, which is available on the Web-server;
- **WEB-browser** – is a WEB-server client for accessing the WEB-pages, which is primarily using the HTTP protocol.

## 2. SPECIFICATIONS

### 2.1 MAIN SPECIFICATIONS

Main specifications are resulted in Table 1.

**Table 1** – Main specifications of the unit

Operating supply voltage, VAC	230
Voltage to maintain normal operation, V	
- alternating current	100 – 250
- direct current	140 – 350
Supply frequency, Hz	47 – 63
Data Exchange Interface over the Ethernet network	10BASE-T/100BASE-T (twisted pair)
Supported Ethernet protocols	Modbus TCP, HTTP
Maximum number of connections over the Modbus TCP protocol	11
Integrated servers	Modbus-server, HTTP-server
Data Exchange Interface over the Modbus network	RS-485
Modbus network exchange modes	Driving (Master) / Driven (Slave)
Supported Modbus protocols	Modbus RTU, Modbus ASCII
RS-485 driver maximum output voltage, V	3.3
RS-485 output current of short circuit driver (limiting), mA	250
Integrated terminator resistance, Ohm	300
Recommend number of connected units within the Modbus network*	32, not more
Indication	LED's
Readiness time upon switching the unit to the mains, sec, no more than	1
Utilized current (in case of 220 V), mA, at most	10
Weight, kg, at most	0.200
Dimensions, mm	95 x 52 x 67
Unit purpose	Communication equipment
Nominal operation condition	continuous
Terminal bus specifications	
- cross-section of switched conductors, mm <sup>2</sup>	0.3 – 3
- maximum effort (torque) on screw terminals, Nm	0.4
Level of protection:	
- unit	IP30
- terminal bus	IP20
Protection class against electrical shock	II
Permissible pollution density	II
Overvoltage category	II
Rated insulation voltage, V	450
Rated impulse withstand voltage, kV	2.5
Operating position	arbitrary
Pollutants in the amount, which is not to exceed the maximum permissible concentration	None

\* – when input current of connected device receivers equals 1 mA and equivalent resistance of RS-485 bus terminators equals 60 ohm.

### 2.2 OPERATING CONDITIONS

This unit is designed to operate (or to be stored) under conditions resulted in Table 2.

**Table 2** – Operating and storage conditions

Operating temperature, °C	from minus 35 to +55
Storage temperature, °C	from minus 45 to +70
Atmospheric pressure, kPa	from 84 to 106.7
Relative air humidity (at 25°C), %	from 30 to 80

## 3. STRUCTURE AND FUNCTIONING

### 3.1. STRUCTURE

#### 3.1.1. Design

The unit has a standard plastic case, which can be attached to the DIN-rails with the width of 35 mm. The unit drawing, together with the overall and setting dimensions, is provided in Figure 1.

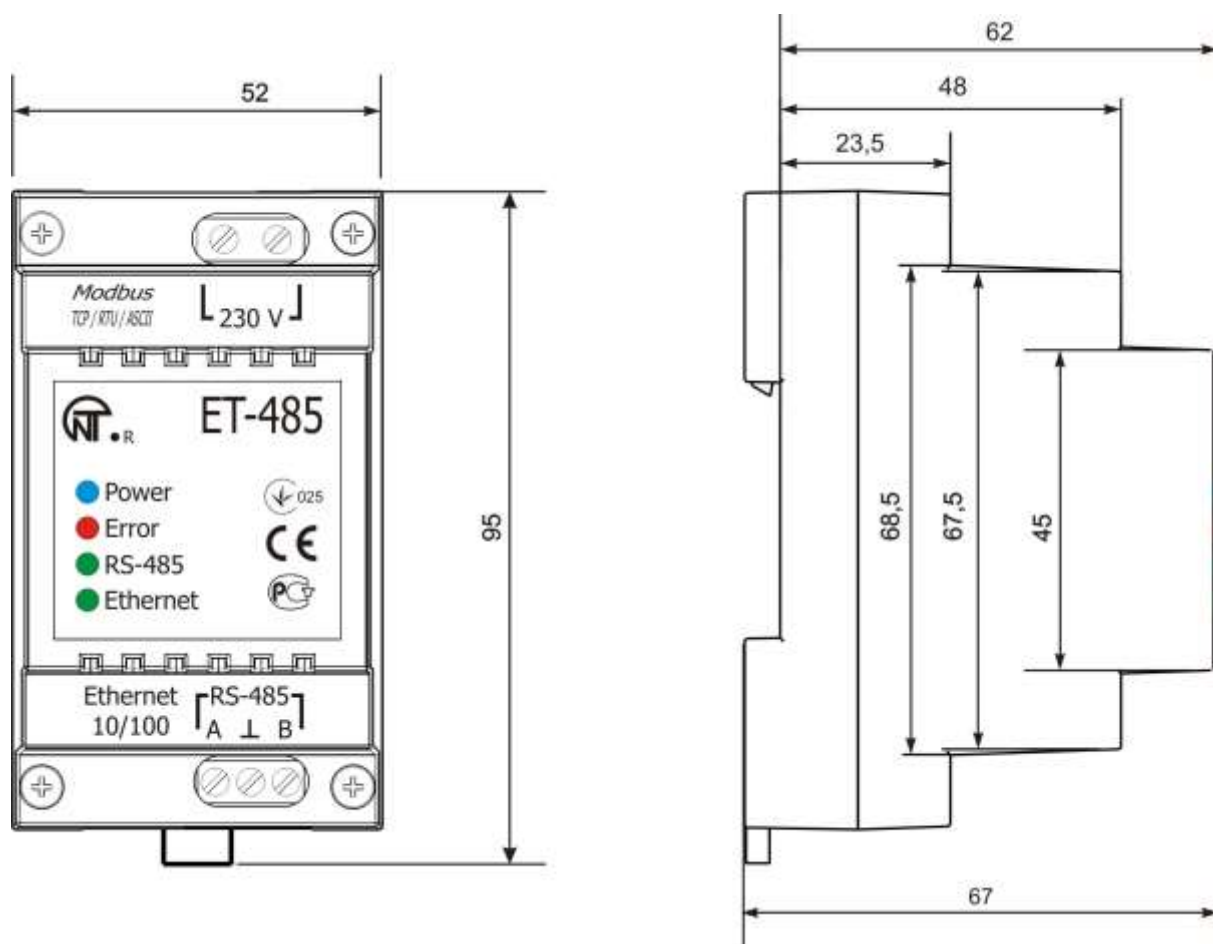


Figure 1 – Overall dimensions of the unit

### 3.1.2. Display and control

The front panel of ET-485 is provided in Figure 2.

- 1 – Reset button "R" (the «R» reset button (is under the body and accessible for pressing through the opening in the body) is designed to restart the unit or factory reset.
- 2 – Power indicator «Power» is activated if supply voltage is available.
- 3 – Error indicator «Error» warns about errors (to include format errors of incoming data packages).
- 4 – Indicator «RS-485» is activated while waiting a reply from the unit in the Modbus network; is flashing while data exchange over the Modbus network.
- 5 – Indicator «Ethernet» is activated when connected to the Ethernet network; is flashing while data exchange over the Ethernet network.

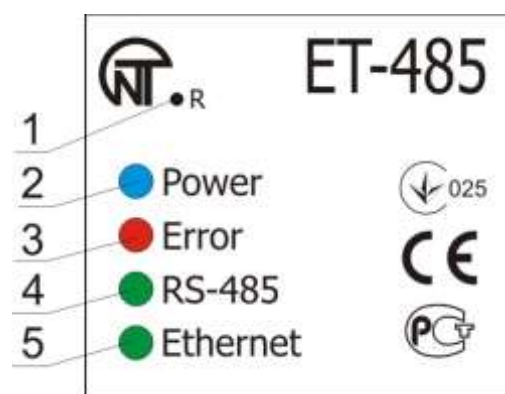


Figure 2 – Front panel of ET-485

### 3.2. FUNCTIONING

Simplified structural diagram of the unit is provided in Figure 3.

32-digit RISC-processor with ARM architecture provides data routing between the Modbus RTU/ASCII (RS-485) network and Ethernet (10base-T/100base-T) network. The operating speed and availability of channels for direct access to the memory allows to process the high-speed data flow. Indicators provide information on the connection status and data transfer over the Modbus and Ethernet networks.

The "Reset" button allows of restart the unit, without switching it off the mains, or do a factory reset:

- to do a factory reset – press and hold down the reset button "R" for 8 seconds; "Error" indicator shall be activated in 2 seconds; the unit shall be restarted and the indicator "RS-485" shall be activated and deactivated after 8 seconds of holding down the button; release the "R" button;

•to reset the unit while saving user configurations – press and hold down the reset button "R"; release the "R" button when "Error" indicator shall become activated.

**Note – When restarting the unit, the clients may need to renew the connections.**

The unit has a memory to save settings. Every unit is provided with a globally unique MAC-address (during the production) and can be connected to local networks with a protected access to Internet.

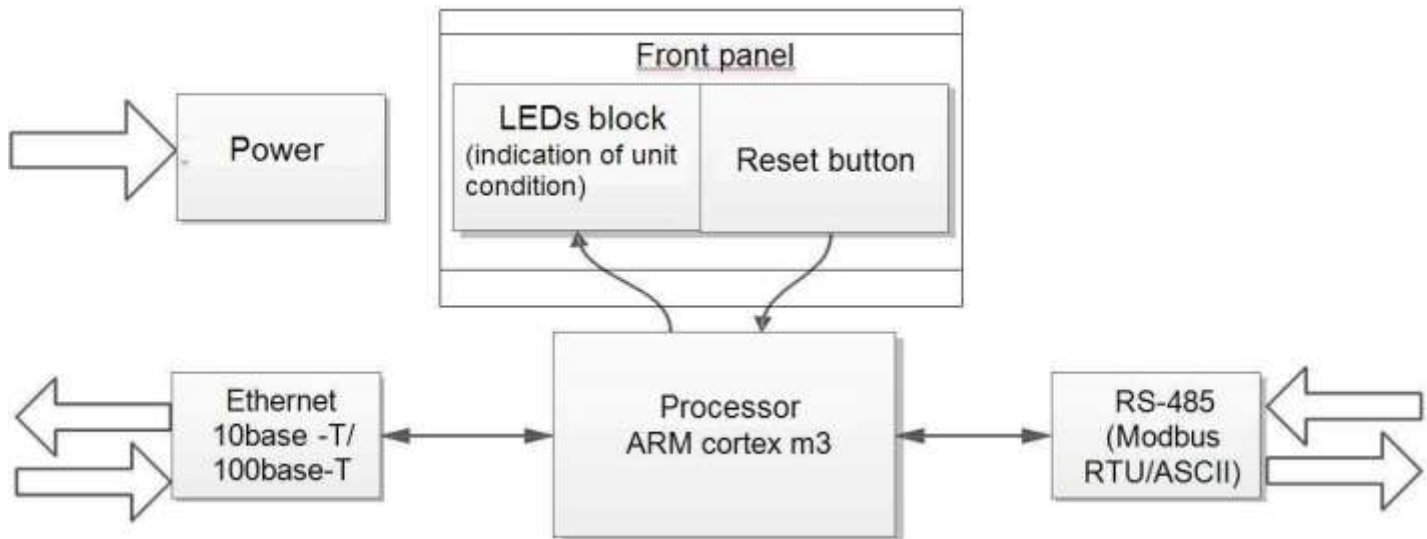


Figure 3 – Structural diagram of the unit

## 4 MAINTENANCE AND SAFETY MEASURES

### 4.1 SAFETY MEASURES



#### 4.1.1 ET-485 IS OPERATING A POTENTIALLY LETHAL VOLTAGE;

**Power off the unit, as well as any other units connected to it, before maintenance, trouble-shooting or installation works.**

4.1.2 The unit is not designed for operation under impact or vibration conditions.

4.1.3 Do not expose the inner electric components of the unit, as well as input contacts of terminal blocks and sockets, to water.

4.1.4 Do not operate the unit in aggressive environment with the presence of acids, alkalies, oils, etc. in the air.

4.1.5 Switching, adjustment and maintenance of the unit should be conducted by the qualified personnel, who is familiar with the provisions of this user manual.

4.1.6 The following regulations should be enforced while operating and maintaining the unit: "Operational regulations of Electrical Installations", and "Safety Regulations for the Operation of Electrical Installations".

### 4.2 MAINTENANCE PROCEDURE FOR ET-485

Suggested maintenance interval – every six month.

The maintenance procedure includes visual inspection to verify the connection of cables to the ET-485 terminals, as well as the absence of fractures and cracks on the case.

All safety regulations provided under section 4.1 should be enforced during the maintenance.

## 5 SWITCHING OF ET-485

The unit is switched according to the diagram, see Fig. 4.

1) Switch the cable connection with Modbus network (twisted pair cable of Cat.1 or higher) to the "RS- 485" socket and Modbus network (or directly to the unit with RS-485 interface).

**Note - Contact "A" is designed for transferring non-inverted signal, while contact "B" is used for the inverted signal.**

2) Switch the cable connection with Ethernet network (supplied) to the "Ethernet" socket and Ethernet network. Any connection peculiarities depending on the type of network are resulted in Appendix A.

3) Switch the power cable connection (copper stranded conductor cable with the cross-section of 0.75 mm<sup>2</sup> and maximum operating voltage of no less than 400V) to "230V" socket, and then connect the cable to the power supply 230V, 50 Hz

## 6 OPERATING ET-485

### 6.1. GENERAL INFORMATION

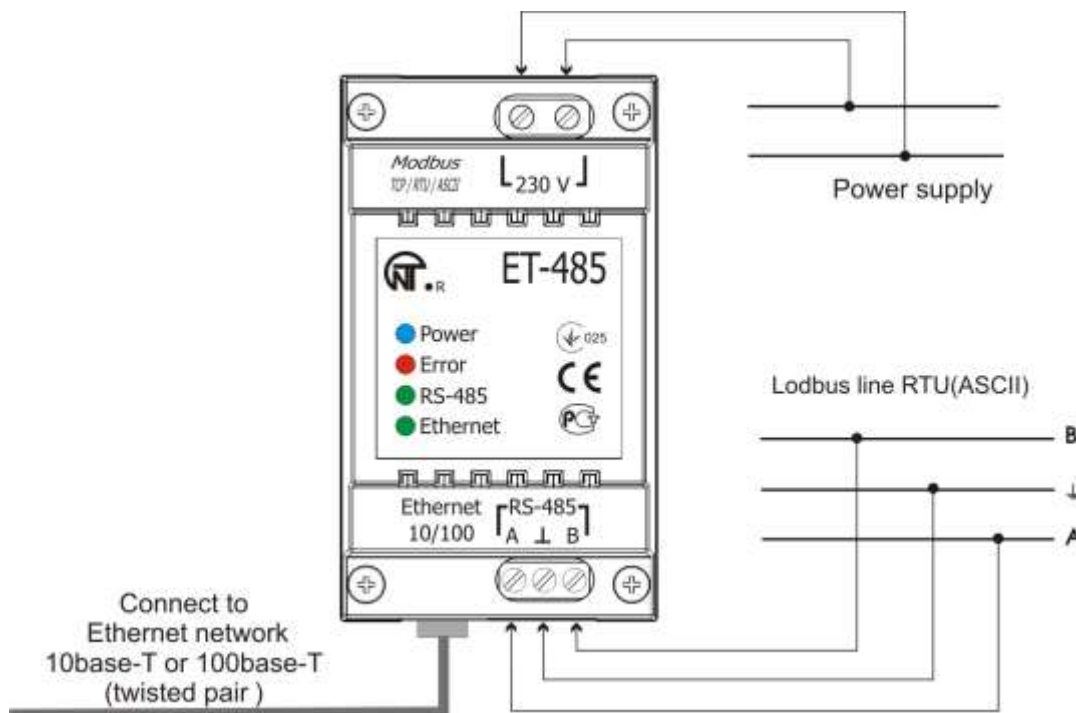
Powering up the unit will activate "Error" and "RS-485" indicators, while the unit shall start initiating transceivers.

After that, both indicators go out within 0.5 second and the unit starts working (Ethernet network connection may take more time depending on the settings of the unit as well as other units connected to the network).



**WARNING! CONTINUOUS ACTIVATION OR FLASHING OF “ERROR” INDICATOR IN THE ABSENCE OF CONNECTIONS TO THE UNIT INDICATES UNIT MALFUNCTION.**

Ethernet network connection pending. The network connection is established, if “**Ethernet**” indicator becomes activated. Flashing of “**Ethernet**” indicator stands for transmitting data over the network.



**Figure 4 – Unit connection diagram**

## 6.2. OPERATING ET-485 OVER THE HTTP PROTOCOL

ET-485 waits for a connection to an Ethernet network using the HTTP protocol on port 80. PC connection can be established using the WEB-browser.

When a client connects to port 80, the unit starts expecting requests for HTML-pages. These requests may contain certain parameters. In case of a valid request, those parameters are processed and the client receives the text of a selected HTML-page. In case of a request without an indication of certain page, the client is returned to the title page. When the page is transferred, the unit deactivates the client and awaits for further connection.

## 6.3. OPERATING ET-485 OVER THE MODBUS TCP PROTOCOL

While operating, the ET-485 waits for a connection to an Ethernet network using the Modbus TCP protocol on port 502. The connection port for Modbus TCP can be changed by the user. PC connection can be established using any software – Modbus TCP of the clients. Client software for OC Windows can be downloaded from the manufacturer's web-site ([http://novatek-electro.com/programmnoe\\_obespechenie.html](http://novatek-electro.com/programmnoe_obespechenie.html)).

When a request for client connection to the Modbus TCP port is received, the unit starts verifying the client's IP-address (if connection filtering over IP is activated). If this address does not correspond with the preset value, the connection is rejected. Otherwise, the unit starts checking the list of available connections. In case of no available connections, the unit (depending on the configuration) can connect a new client instead of the previously connected one (if no activity of the client was registered over a set period of time, or if the connection is maintained longer than prescribed).

When connecting a client to Modbus TCP port, the unit adds it to the internal list of served clients (but not exceeding the number of clients, specified in the technical characteristics).

When connection of the client is established, the unit awaits a Modbus-query from the client. In the RS-485 slave mode, the device also accepts RS-485 queries from the master device of Modbus network.

When the query from the client has been received, the unit analyzes the query and, depending on the requested function code and the current rights of the client, either processes or blocks it. When the query is blocked, ET-485 can generate and transfer the client-specified Modbus exception code (default – code 1) to the client. The rights of the client, depending on the settings, are determined according to its IP address (the Modbus network master IP address is considered to be 127.0.0.1) and input passwords.

If the query is addressed to ET-485, the unit does not redirect the query, processes it and transfers the answer to the client.

In the RS-485 master mode, queries to other devices are redirected to Modbus network and an answer form



Modbus network is awaited – herewith the «RS-485» indicator will start to glow. If the data have been received or the standby time has run out, the «RS-485» indicator will go out.

In the remote server redirection mode, if connection to the client-specified Modbus TCP server in Ethernet network has been established, queries to other devices are also sent to this server and an answer from it is awaited.

**Note – The answer is received from the first answering addressee, therefore there must be no devices with same Modbus addresses (identifiers) in Modbus network and among the addressees, available through the remote server.**

If a query failed to be redirected (e.g. in the RS-485 slave mode, if connection to the remote server was broken), ET-485 can generate and transfer the client-specified Modbus exception code (default – code 10) to the client.

If there is no answer, ET-485 can generate and transfer the client-specified Modbus exception code (default – code 11) to the client.

If the answer to the query has been received, ET-485 transfers it to the client, which sent the query. In case of any format errors, an “Error” indicator shall become activated for 0.5 seconds and no response is provided to the client.

## 6.4 THE OPERATION OF ET-485 IN THE MODE OF ACTIVE CONNECTION TO THE CLIENT

In this mode in addition to providing other connections ET-485 autonomously establishes and further maintains active connection to the client (data collection remote server) with a set host name or IP address.

ET-485 receives Modbus TCP queries from this client and returns responses. The mode allows one user to work with one or more ET-485 units via the Internet without static address assignment to each unit (see annex B).

## 7 SETTING

### 7.1 GENERAL INFORMATION

Configurable parameters are described in section 7.2. All parameters are saved at the power off.

Unit configuration can be done in two ways:

- through WEB-interface, see Section 7.3;
- through Modbus-interface, see Section 7.4;



**WARNING! ANY CHANGES IN UNIT CONFIGURATION MAY RESULT IN BLOCKING OR OBSTRUCTION WHILE TRYING TO REACH THE UNIT OVER THE NETWORK.**  
In this case, all parameters should be factory reset (see Section 3.2).

### 7.2 PARAMETERS OF ET-485

A collection of parameters available via Modbus protocol is provided in Table 3. The inner structure of any collection of parameters is similar to the structure of collection, which is described in table 7 (apart from start-address).

The presentation format of parameters in Modbus registers is detailed in Table 4.

The unit describing parameters are given in Table 5.

The unit current mode parameters are available for reading and recording and specified in Table 6.

All parameters to determine the current condition of the unit (available for read-only) are provided in Table 7.

All parameters available in the configuration mode only are provided in Table 8.

ACC identification state parameters (table 9) are available for ACC and in a parameter mode.

ACC identification control parameters are available only for ACC and are described in table 10.

**Table 3 – Collection of parameters available via Modbus protocol**

Collection	Description	Access	Address
Acting settings	Current unit configuration	In any mode, read-only	200–298, 1200–1241
Saved settings	The collection is saved regardless of power supply and further used as the restart.	In configuration mode only, read-only	300–398, 1300–1341
Factory settings	Fixed collection, which can be activated as shown in sections 7.3 and 7.4	In configuration mode only, read-only	400–498, 1400–1441
Changeable settings	All parameters listed in table 8, which can be modified and incorporated as described in Section 7.4	In configuration mode only, reading and writing	500–598, 1500–1541

**Table 4 – Presentation format of parameters in Modbus registers**

Parameter	Range of values	Description	Number of Registers
Number	0-65535	Integer (16 bits) in a standard range of Modbus register	1
Number	0-4294967295 in two registers, upper part – first	Integer number, which can not exceed the limit for Modbus register (65535)	2



Character string	In every register – ASCII character code or 0 (end of string)	The set of values, each one of which is equal to code 1 of a symbol in ASCII code. If the string is shorter than maximum length, last character is followed by the code 0.	Maximum length of the string for the given parameter
IP-address (IP-mask)	In every register – one byte (0-255)	A set of four byte IPv4 address, from left to right	4
MAC-address	In every register – one byte (0-255)	A set of six byte MAC-48 address, from left to right	6

**Table 5 – The Unit Describing Parameters**

Parameter	Description	Address
Unit type	Code identifying the Modbus unit by the manufacturer (12 – ET-485)	0
Firmware version	Version of firmware of the integrated software of the unit	1

**Table 6 – The Unit Current Mode Parameters**

Parameter	Min – Max	Initial value	Description	Address
Entering password	String of characters	0	When a valid password is input, the corresponding permit is given to the client (see registers 543-580). When an empty string is input, the rights of the client are reset to the level of rights at the moment of connection.	100–119
Control command	0-3, writing in the configuration mode	0	0: no activity 1: «Restart» – unit restart 2: «Save» – save the changed settings on the Modbus 3: «Factory reset» – reset the unit to factory settings	120

**Table 7 – Parameters to determine the current condition of the unit**

Parameter	Description	Address
Mode (more detailed see register 141)	0: User mode 1: Configuration mode	121
Current IP-address	IP-address of the unit in Ethernet network	122–125
Current MAC-address	MAC-address to authenticate the unit in Ethernet network	126–131
Number of Modbus TCP clients	Number of connections provided over the Modbus TCP protocol	132
Modbus TCP clients limit	Total number of Modbus TCP connections (herewith, one connection is always reserved for the main client)	133
Time, min	Number of minutes since the start	134–135
Modbus TCP loading, requests/sec	Number of requests processed in a second	136
Number of Ethernet network congestions	Number of input buffer overflows for Ethernet – from the moment of start-up	137
Number of communication errors	Number of identified errors (connection/communication) after which the work was continued, - since the start	138
Number of programmed resets	Number of resets according to user's setting – during all working time of the unit	139
Number of critical errors	Number of identified errors (failures) resulting in a restart of the unit - during the whole period of operation	140
Access mode flags	<div> <div>Bit 0</div> <div>0: the connected client cannot get the permit for requesting functions of non-recording the devices, connected to ET-485 1: the connected client can get the permit for requesting functions of non-recording the devices, connected to ET-485</div> </div> <div> <div>Bit 1</div> <div>0: the connected client does not have the permit for requesting functions of non-recording the devices, connected to ET-485 1: the connected client has the permit for requesting functions of non-recording the devices, connected to ET-485</div> </div>	141

Parameter	Description		Address
	Bit 2	0: the connected client cannot get the permit for requesting functions of recording the devices, connected to ET-485 1: the connected client can get the permit for requesting functions of recording the devices, connected to ET-485	
	Bit 3	0: the connected client does not have the permit for requesting functions of recording the devices, connected to ET-485 1: the connected client has the permit for requesting functions of recording the devices, connected to ET-485	
	Bit 4	0: the connected client cannot get the permit for access to ET-485 registers, except for registers of version, password, mode and access flags 1: the connected client cannot get the permit for access to ET-485 registers, besides registers of version, password, mode and access flags	
	Bit 5	0: the connected client does not have the permit for access to ET-485 registers, except for registers of version, password, mode and access flags 1: the connected client has the permit for access to ET-485 registers, except for registers of version, password, mode and access flags	
	Bit 6	0: the connected client does not have the permit for requesting function of recording ET-485 1: the connected client has the permit for requesting function of recording ET-485	
	Bit 7	0: the connected client does not have the permit for setting ET-485 1: the connected client has the permit for setting ET-485 (similar to register 121)	
	Bit 8	0: the client is not the main client 1: the client is the main client	
	Bit 9	1: the client has the right for connection (always read as "1" after connection)	
	Bit 10	0: the client is connected not by ACC 1: the client is connected by ACC	
Maximum of Modbus TCP clients	Maximum observed number of Modbus TCP clients (from the moment of start-up)		142
Maximum of queries, queries/sec	Maximum observed load of Modbus (from the moment of start-up)		143
Frequency of answered queries, queries/sec	Number of processed queries per second, to which the answer is formed without any errors		144
Time before connection to Modbus TCP remote server	0: connection to remote server established 1: connection to remote server is being established 2 – 65534: number of seconds to repeated connection 65535: redirection to remote server is off		145
Time before active connection to the client (or DCRS)	0: ACC is established 1: ACC is being established 2 – 65534: number of seconds to repeated ACC 65535: ACC is off		146

Table 8 – Unit configuration settings

Parameter	Min – Max	Factory setting	Description	Address
<b>Addressing in the Ethernet network</b>				
Static IP-address	IP-address	192.168.0.111	IP-address of the unit in Ethernet network shall be equal to this value if dynamic addressing is disabled or not available.	500–503
Subnet mask	IP-mask	255.255.255.0	Used only with static IP address	504–507
Gateway	IP-address	192.168.0.1	Used only with static IP address or as an IP filter for DHCP server	508–511

Parameter	Min – Max	Factory setting	Description	Address
Enable dynamic addressing via DHCP-server	0–1	0	0: preset IP-address, mask and gateway is used for addressing in Ethernet. 1: DHCP network server is used by the unit to determine IP-address, mask and gateway. The parameters for static addressing are used if server is unavailable	512
Enable IP-address filter of the DHCP server	0–1	0	Used if dynamic addressing is enabled. 0: unit receives addressing data from the first DHCP-server to respond 1: unit receives addressing data only from DHCP-server with IP-address of the gateway	513
Enable manually set MAC-address	0–1	0	0: a unique value is used as MAC address for each unit 1: manually set value is used for MAC-address	514
manually set MAC-address	MAC-address	Unique for every unit	Used if manually set MAC-address is enabled for the authentication of unit in the Ethernet network	515–520
<b>Switching to Ethernet network</b>				
Connection port for Modbus TCP	1–65535	502	Used in case of TCP-connection to the unit via Ethernet to exchange data over Modbus TCP protocol	521
IP-address of the primary client	IP-address	192.168.0.2	IP-address, for which one connection via Modbus TCP is reserved. Address, which is used for unit configuration. In the RS-485 slave mode, one should specify the address 127.0.0.1 for the mail client, connecting by RS-485.	522–525
Enable the IP-connections filter for configuration	0–1	0	0: setting parameters via Modbus-interface or WEB-interface from any address (password protected) 1: setting parameters via Modbus-interface or WEB-interface is only allowed from the IP-address of the main client	526
Enable the IP-connections filter over Modbus TCP	0–1	0	0: Modbus TCP connections are available from any address 1: any Modbus TCP connections are available only from the IP-address of the main client	527
Enable replacement of non-active clients	0–1	1	0: Modbus TCP connection is maintained regardless of the time period between requests from the client 1: if all connections to Modbus TCP are busy, the new client, requesting for a connection, can be connected instead of the client, who provided no requests over the longer then preset period	528
Maximum query timeout, sec	0–9999	90	Used, if replacement of non-active clients is enabled	529
Enable the queue for the last busy Modbus TCP connection	0–1	0	0: Modbus TCP connection is maintained regardless of the connection hold time 1: if all connections to Modbus TCP are busy, the new client, requesting for a connection, can be connected instead of the last connected client, if the hold time is more than a preset time	530
The maximum hold time of the last connection to Modbus TCP, msec	0–600 000	60 000	Used, if the queue is enabled for the last connection to Modbus TCP	531–532
<b>Modbus network</b>				
Own Modbus-identifier of the unit	0–247	111	0: unit forwards all Modbus TCP requests into the Modbus network, unit registers via Modbus TCP are unavailable 1–247: units responds to Modbus TCP requests bearing the given Modbus-identifier without forwarding them to the Modbus network	533
Bit rate in Modbus-network, bit/sec	75 – 1 500 000	9 600	Used in case of data exchange between the units in Modbus-network, the same value for all units in Modbus-network	534–535

Parameter	Min – Max	Factory setting	Description	Address
Enable the odd-even check	0–1	0	Used in case of data exchange between the units in Modbus-network, the same value for all units in Modbus-network 0: unused, byte is completed with 2 stop bits 1: byte is completed with parity bit and 1 stop bit	536
Enable the odd-even check (to verify odds)	0–1	0	Used in case of data exchange between the units in Modbus-network, if odd-even check is enabled. The same value for all units in Modbus-network 0: Parity check 1: Imparity check	537
Response time from Modbus RTU, msec	0–60 000	200	Used in case of data transfer via the Modbus-network in RTU mode. Waiting for a response is terminated if the first byte of the response has not been received within the given time after sending the request. The response is always expected longer then time of silence between frames (time of silence depends on the bit rate and shall be equal to the time required for transmitting 3.5 bytes, or 1.75 msec for bit rate over 19,200 bits/sec).	538
Enable ASCII exchange in Modbus network	0–1	0	Exchange mode in Modbus-network, the same value for all units in Modbus-network 0: RTU exchange mode (format: 1start bit, 8 data bits, 1 parity bit or stop-bit or 1 stop bit – total 11 bits). 1: ASCII exchange mode (format: 1start bit, 7 data bits, 1 parity bit or stop-bit or 1 stop bit – total 10 bits).	539
Response time for subsequent Modbus ASCII character, msec	0–60 000	1000	Used in case of data transfer via the Modbus-network in ASCII mode. Waiting for a response is terminated if the subsequent byte of the response has not been received within the given time, as indicated for the reception of response. Waiting time shall not be less then time required for transmission of a single character (depending on the bit rate).	540
<b>Miscellaneous</b>				
Enable the unit automatic reset	0–1	0	0: periodical reset is off 1: the unit is reset after a preset time interval	541
Unit restart interval, min	5–7200	7200	Used if periodic restart of the unit is enabled	542
Password to enter the setup mode	String of characters	11111	Used to access the setup mode for Modbus TCP. Any string of 5 to 20 characters can be used as a password. It may not contain spaces or special characters listed in quotes below: «; : " < > * + = \   / ? , »	543–562
The preset password for permit to record to devices, connected to ET-485	Symbol string		Used for access to the devices, connected to ET-485, for requesting functions of recording or control, which can change the state of these devices. As a password one may specify a string with length up to 6 symbols. The string must not contain any spaces or special symbols, given below in quotes: “; : " < > * + = \   / ? , ”	563–568
The preset password for permit to read from devices, connected to ET-485	Symbol string		Used for access to the devices, connected to ET-485, for requesting functions of reading, which do not affect the state of these devices. As a password one may specify a string with length up to 6 symbols. The string must not contain any spaces or special symbols, given below in quotes: “; : " < > * + = \   / ? , ”	569–574
The preset password for access to ET-485 registers of state and settings	Symbol string		Used for access to ET-485 registers, except for the registers of version, password, mode and flags. As a password one may specify a string with length up to 6 symbols. The string must not contain any spaces or special symbols, given below in quotes: “; : " < > * + = \   / ? , ”	575–580

Parameter	Min – Max	Factory setting	Description	Address
Enable the automatic reset mode only at downtime	0–1		Used when the automatic reset is on. 0: the unit is reset after a preset time interval from the moment of start-up 1: the unit is reset after a preset time interval from the last query processing	581
Mail client port	0–65535	0	0: not checked 1–65535: port is used with IP address to identify the main connected client. In the RS-485 slave mode, if the main client is connected by RS-485, this parameter is not used.	582
Enable Modbus write protection mode	0–1	0	0: write protection is adjusted by means of other parameters or is off 1: all function queries from all clients are blocked, except Modbus functions 1, 2, 3, 4, 7, 17, 20	583
Enable IP connection filter to record to devices, connected to ET-485	0–1	0	Used for access to the devices, connected to ET-485, for requesting functions of recording or control, which can change the state of these devices. 0: IP filter is not used 1: IP filter is on	584
Enable IP connection filter to read from devices, connected to ET-485	0–1	0	Used for access to the devices, connected to ET-485, for requesting functions of reading, which do not affect the state of these devices. 0: IP filter is not used 1: IP filter is on	585
Enable IP connection filter for access to ET-485 registers of state and settings	0–1	0	Used for access to ET-485 registers, except for the registers of version, password, mode and flags. 0: IP filter is not used 1: IP filter is on	586
Enable RS-485 slave mode	0–1	0	0: Driving mode (Master). RS-485 is used to send queries, received from clients of Modbus TCP. 1: Driven mode (Slave). RS-485 is used to receive queries from additional client, having IP address 127.0.0.1	587
Enable the Modbus TCP remote server query redirection mode	0–1	0	0: queries are not sent to remote server 1: queries are additionally sent to Modbus TCP remote server, which is “integrated” into Modbus network of this ET-485 unit. The answer is accepted from the first answering addressee.	588
IP address of Modbus TCP remote server	IP address	192.168.0.2	Used in the Modbus TCP remote server query redirection mode. IP address of the remote server, wherewith connection is maintained.	589–592
Modbus TCP port of remote server	0–65535	0	Used in the Modbus TCP remote server query redirection mode. Remote server port for Modbus TCP connection.	593
Standby time to repeated connection to Modbus TCP remote server, seconds	0–30 000	20	Used in the Modbus TCP remote server query redirection mode. After connection with the server is lost, the repeated connection will be established after a preset standby time (after unit start-up, the first connection is established in the fixed time interval of 5 seconds)	594
Standby time to answer from Modbus TCP remote server, msec	0–60 000	1000	Used in the Modbus TCP remote server query redirection mode. After the query transfer, if the correct answer failed to be received within this time interval, answer awaiting is stopped.	595
Modbus code of exception, generated at access ban	0–255	1	0: At ban of the access to Modbus registers of the unit or connected devices, the answer is not returned to the client. 1-255: At access ban, this exception code is returned to the client, which sent the query.	596
Modbus code of exception, generated at absence of connection to query addressee	0–255	10	0: If there is no connection to the query addressee (Gateway Path Unavailable), the answer is not returned to the client. 1-255: If there is no connection to the query addressee, this exception code is returned to the client.	597

Parameter	Min – Max	Factory setting	Description	Address
Modbus code of exception, generated at absence of answer from query addressee	0–255	11	0: If there is no answer from the query addressee (Gateway Timeout), the answer is not returned to the client. 1-255: If there is no answer from the query addressee, this exception code is returned to the client.	598
<b>ACC settings</b>				
Enable using of DNS server with gateway IP address	0–1	1	Used when DHCP is not available (is off) 0: DNS of gateway is not used 1: DNS of gateway is used to identify client (or DCRS) IP address for active connection, if its address is set as host name	1500
Enable using of DNS server with manually set IP address	0–1	1	Used when DHCP is not available (is off) 0: DNS with manually set IP is not used 1: DNS with manually set IP is used to identify client (or DCRS) IP address for active connection, if its address is set as host name	1501
Manually set IP address of DNS server	IP address	8.8.8.8	Used when manual address of DNS server is enabled in order to identify client (or DCRS) IP address for active connection, if its address is set as host name	1502–1505
Enable active connection to the client	0–1	0	0: active connection to the client is not used 1: Modbus queries are also received from the client (or DCRS) with set address, to which ET-485 establishes and maintains connection. This client receives rights of the second primary ET-485 client	1506
Enable sending of unique MAC address of the unit after active connection to the client	0–1	1	Used in the mode of active connection to the client. 0: automatic sending is not accomplished 1: after active connection to the client the unit once sends 1000–1010 registers contents in the form of Modbus response without client query (response – 1000–1010 registers reading by function 3)	1507
Timeout until repeated active connection to the client, sec	0–30 000	20	Used in the active connection to the client mode. After loss of active connection to the client, repeated connection will be established after present connection timeout (after setting of the unit the first connection is established after the fixed time interval of 5 seconds).	1508
Client port (or DCRS) for active connection	0–65535	20502	Used in the mode of active connection to the client. Client (or DCRS) port, to which ET-485 establishes active connection.	1509
Client (or DCRS) address for active connection	Symbol string	modbus. overvis.com	Used in the mode of active connection to the client. IP address (or host name) of the client or DCRS for active connection	1510–1541

**Table 9** – State of unit identification for ACC

Parameter	Description	Address
Unit type	see register 0	1000
Firmware version	see register 1	1001
Unique MAC address	Globally unique MAC address of the unit, which can be used for identification by the client	1002–1007
ACC state flags	Bit 0 0: error of unique MAC address reading 1: registers 1002–1007 contain globally unique MAC address	1008
	Bit 1 0: activation code on the data collection server is not set 1: activation code on the data collection server is set	
	Bit 2 0: ET-485 does not require new activation code from the data collection server 1: ET-485 requires new activation code from the data collection server	
	Bit 3 0: connection is not activated by the data collection server 1: connection is activated by the data collection server	

**Table 10** – Unit identification control for ACC

Parameter	Min.–Max.	Initial value	Description	Address
Activation code on the data collection server	10 000 000 – 100 000 000 or 0	100 000 000	Code, transferred from data collection server and displayed on the unit setting page through WEB interface (p. 7.3). When user enters the code on the data collection server, the unit and ACC connection become available to this user. 0 – connection is activated 10 000 000 – 99 999 999: activation code 100 000 000: code is not assigned	1009–1010

### 7.3 CONFIGURING ET-485 THROUGH WEB INTERFACE

WEB-browser is used for setting via WEB-interface.

Write the unit IP-address in your browser (factory setting - 192.168.0.111) and proceed to the specified address.

**Note - If the browser is set to use the proxy server, the access to the unit over local network shall be granted only after adding the IP- address into the exceptions list as indicated in the browser documentation.**

This will open home page with tabs for transferring into the other modes.

Select "Settings" to start the configuration of unit Ethernet network.

Password request shall appear before granting access to setup mode (factory setting 11111).

Enter password and press "Enter". If the password is correct, you shall be granted access to the setup mode.

Settings page appears with a list of parameters detailed in Table 8. If the password is incorrect, the password request shall be displayed once again.

Click "Save" after making changes to the settings. This will check all the changed parameters. If no errors is detected, new parameters will be stored in the memory (new parameters will become effective upon the following restart/activation of the unit). In case of any errors detected upon clicking the "Save" button, none of the parameters is saved, while the names of erroneous parameters are highlighted in red.

Click "Factory reset" to restore the default value of parameters.

Click "Restart" to stop all connections and interrupt all receive/transmit operations, with the following restart of the unit. In case of any changes to the parameters, either introduced or stored in the memory, these changes shall be implemented.

**Note - If the addressing parameters in Ethernet network (MAC-address, IP- address, DHCP settings) are modified and saved, the browser may not load the page after the restart of the unit by pressing the "Restart" button. This can happen as the browser continues to reply over the previous address. In this case, the connection should be made anew.**

Clicking the "Exit" button the will close the setup mode and a password request appears once again.

### 7.4 CONFIGURING ET-485 THROUGH MODBUS INTERFACE

Setting via Modbus-interface shall be provided if the unit is connected over the Modbus client, which is supporting the Modbus TCP protocol. The connection is established using its IP-address (factory setting - 192.168.0.111) with the indication of Modbus-identifier (factory setting - 111). In the RS-485 slave mode, he setting can also be performed by the master device in Modbus network.

To set the parameters, one should write the password string into the password input parameter (table 6).

The factory password value is 11111, so to write the factory password into the registers from 0 to 4 one should write the number 49 – the ASCII code of figure one. If the password is specified correctly, the mode parameter (table 7) obtains the value 1 – the setting mode.

In the setting mode, the control command parameter (table 8) as well as the setting parameters (listed in Table 8) are available for recording. After the necessary values settings are recorded into the parameter registers, one should write the value 2 – "Save" command – into the control command parameter. The correctness of the saved parameter values can be checked by comparing the sets of adjustable parameters with the saved parameters. If the sets match each other, the new values of settings are accepted and saved.

To reset the saved parameters to factory values, one should write the value 3 – "Return to Factory" command – into the control command parameter in the setting mode.

In order to make the saved parameter values come into effect, the unit must be restarted. By means of Modbus interface, the restart is performed by writing the value 1 – "Restart" command – into the control command parameter

To exit the setting mode, one should write 0 into the first register of password input parameter. Herewith, all the password input registers and the control command parameter register are cleared (obtain 0 value).

## 8 COMPLETE SET

ET-485 is supplied with:

- ET-485 protocol converter ..... 1 piece
- Operating manual ..... 1 piece.
- Cable for Ethernet connection ..... 1 piece
- Shipping box ..... 1 piece



## 9 SERVICE LIFE AND WARRANTY

9.1 Service life – is 10 years. Contact manufacturer upon the expiry of the service life.

9.2 Guaranteed storage life – is 3 years.

9.3 Warranty period – is 36 months from the date of sale.

The manufacturer shall provide a free repair of the unit within the warranty period if all the provisions of user manual were complied with by the consumer.

The unit shall not be subject to warranty service in the following cases:

- end of warranty period; mechanical damage;
- traces of moisture or foreign objects inside the unit; traces of tampering;
- damage by electric shock at a voltage, which is higher than maximum permissible voltage, as indicated in the user manual.

9.4 Warranty service shall be provided at a place of purchase.

9.5 The manufacturer's warranty does not apply to compensation for direct or indirect damages, loss or injury associated with transporting the unit to the place of purchase or to the manufacturer.

9.6 Post-warranty service is provided by the manufacturer.

**Users are earnestly requested to indicate the reason for the return in case of a return of the unit or transferring unit for warranty or post-warranty service in a special field (Data on claims).**

## 10 TRANSPORTATION AND STORAGE


ET- 485 in the shipping box should be stored indoors at a temperature of -50 to +60 °C and relative humidity of no more than 80% with no vapors available in the air, capable of producing harmful effect on the shipping box and unit materials.

When transporting ET- 485, the user should provide some protection against mechanical damage

## 11 ACCEPTANCE CERTIFICATE

ET- 485 is manufactured and accepted in accordance with the applicable technical documentation and considered fit for use.

## SWITCHING TO ETHERNET

 **WARNING! Switching the unit to Ethernet network requires mutual coordination of settings on the connected devices. Connecting the misconfigured unit to the network may affect the communication level of other units on the network. As a rule, all connections to a network of more than 2 units are carried out by the qualified personnel (network administrator) only.**

### 1. IP-ADDRESSING

When units are communicating over Ethernet network using TCP/IP protocol, every unit is using a set of IP-addressing settings to identify the sender and receiver of the data. The unit memory contains a personal and unique, within a single subnet, IP-address (four bytes are written as four integers, separated by dots, in the range of 0-255), subnet mask, which is the same for all units within the subnet (written similar to IP-address), and IP-address of the gateway, which is used to communicate with other networks. Proper communication between units of a subnet is possible under several conditions:

- 1) All units of a subnet have similar mask. Most of small LANs are using 255.255.255.0 mask.
- 2) Mask starts with a group of bits set to 1, followed by a group of bits turned to 0.
- 3) All bits set to 1 in the mask are similar for all the IP-addresses of units in subnet and indicate the subnet address. 192.168 is most frequently used address in LANs for the mask 255.255.255.0. The third byte may be used as a subnet number in a complex LAN. In smaller LANs, the third byte is usually equal to 0.
- 4) A set of bits in IP-address of the unit, which is set to 0 in the mask, is unique to each unit within the same subnet.
- 5) In most cases, the unit like router, which is already communicating with other networks, is switched to the network. This unit often gets the following address 192.168.0.1, 192.168.0.100, or 192.168.0.101. In this case, other units in the network shall have this IP-address of the unit as the gateway address. This address is not necessary for communication between units in a subnet, and is only used to connect units of one subnet to units of other networks.

Factory addressing settings for ET-485 Interface Converter are listed in Table A.1.

**Table A.1 – Factory settings for ET-485 addressing**

Parameter	Value
IP-address	192.168.0.111
Subnet mask	255.255.255.0
Gateway	192.168.0.1

In order to communicate with ET-485, which is set to factory settings, the client unit (or any other units on the same subnet) should have 255.255.255.0 as a mask and address starting with 192.168.0. The fourth byte of the address can take any value in the range from 1 to 255, except for 111. If the connection between ET-485 and a client unit is not provided directly but via a network with a number of units, the mentioned address can not be equal to any of the addresses of other units on the subnet. If network has several units with the mask and the first three bytes of the IP-address, which are different from those specified in Table A.1, or the ET-485 factory IP-address is already taken, the configurable unit should be temporarily removed from the network to avoid addressing conflicts and establish a communication between this unit and ET-485 directly. This will allow to configure the unit and ET-485 for direct communication or switching ET-485 to the network.

### 2. CONFIGURING THE CLIENT UNIT

The unit addressing is set according to documents and software it uses.

Below is an example of configuring the personal computer (PC) on Windows XP or Windows 7 to communicate directly with the ET-485 on factory settings.

Open the list of OS network connections to configure the network address in Windows. To do this, follow the steps below (mind the OS version):

#### •For Windows XP:

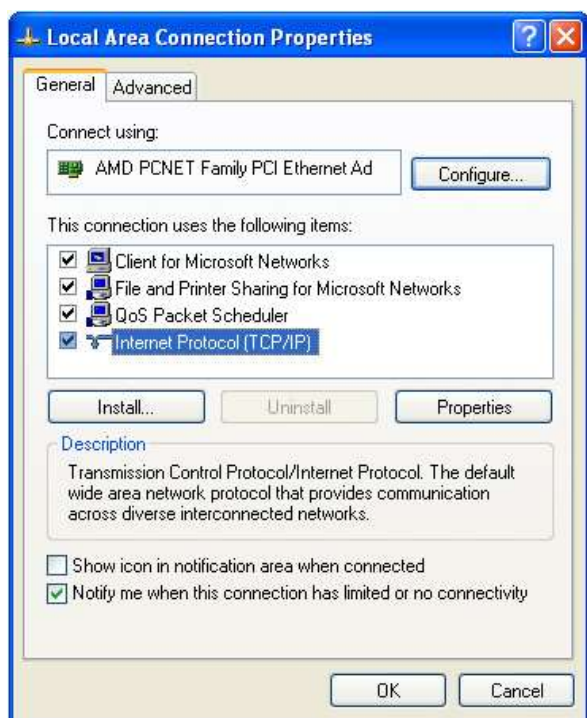
- 1) Log in as administrator.
- 2) Select Start-Control Panel.
- 3) If control panel items are divided into categories, select "Network and Internet Connections".
- 4) Go to "Network Connections".

#### •For Windows 7:

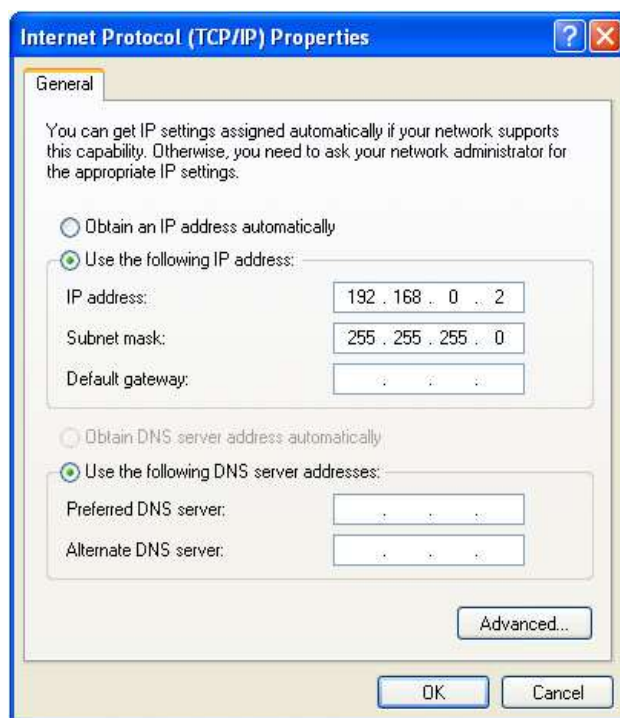
- 1) Log in as administrator.
- 2) Select Start-Control Panel.
- 3) If control panel items are divided into categories, select "Network and Internet".
- 4) Go to "Control Center Network and Sharing Center".
- 5) In the task bar (on the left), select "Change adapter settings".

Next, perform the following steps:

- 1) In the Connections window, select the desired connection via an adapter with the addressing that you want to change. Many computers have only one adapter and one connection, which will be displayed in this window. If the window shows several connections, select the connection you want, using the adapter name in the information on connection or contact your system administrator.
- 2) Click the icon of the connection with the right button, and select "Properties" in the drop-down menu. The Properties window opens (see Fig. A.1).
- 3) Select "Internet Protocol (TCP/IP)" from the list of connection components in the next window. Make sure that the component is enabled (flagged in the list). Click "Properties". The TCP/IP properties window opens (see Fig. A.2).
- 4) Select "Use the following IP- address".
- 5) Specify the address in the "IP- address" field within the range from 192.168.0.1 to 192.168.0.255 (except for 192.168.0.111, which is used by ET-485).
- 6) Specify "255.255.255.0" in the "Subnet Mask" field.
- 7) The fields "Default Gateway", "Preferred DNS-server", and "Alternative DNS- server" should be left blank.
- 8) Press "OK" to close the Protocol Settings window.
- 9) Press "OK" to close the Connections Settings window.
- 10) If prompted by the OS to restart the PC after closing the windows, answer yes.



**Figure A.1** – Connection properties window in Windows OS



**Figure A.2** – TCP/IP properties window in Windows OS

### 3. SWITCHING TO INTERNET



**WARNING!** The user is strongly recommended to connect the unit to Internet under the supervision of the LAN system administrator and/or representative of Internet service provider.

Use the following guidelines to connect the unit to Internet:

- acquire a dedicated line with a static IP-address from your Internet Service Provider (hereinafter referred to as – ISP; for connection with dynamic IP address it is necessary to use active connection to the client, see annex B);
- several connection options are possible if your ISP binds the connection to MAC-address, and the given Internet connection was already used by personal computers or other units:
  - a) connect the unit directly to the PC (see Section 5.2.1) to learn the MAC-address of the unit (see Section 7). Inform the ISP on the change of MAC-address to the MAC-address of the unit;
  - b) determine the MAC-address for Internet connection from the unit settings, which was previously using this connection, or acquire it from your ISP. Connect the unit directly to the PC and change the parameters "Enable manual MAC-address" and "Manually set MAC-address" to have the manual MAC-address enabled and values of the unit correspond to MAC- address with an Internet connection binded;
- direct connection of the unit to the ISP cable is not recommended; in case of a router connection, the ISP cable is connected to the "Uplink" socket on the router (It is usually marked with color and has no numbers. The

marking depends on the router manufacturer, see the router documentation). The straight-through (supplied) Ethernet cable is used for connecting unit to the router. Set the router for Internet connection as per ISP recommendations using the router documentation. The router settings should also provide for the redirection of requests, which are coming to static IP-address provided by the ISP, to the unit IP-address (factory setting - 192.168.0.111);

- verify if the Internet connection is protected by standard means (see below);

when referring the unit via Internet, use IP-address provided by your ISP

#### 4. PROTECTION OF CONNECTION

- ET-485 has basic protection media against unauthorized access via Ethernet network;

•IP address filter for setting can be enabled to provide to a single main client the permit to access the HTTP and Modbus interfaces of the unit. The main client can be the master device in Modbus network (RS-485) or a client in Ethernet network with a set IP. herewith, the access to Modbus network might not be restricted.

•IP address filters for Modbus TCP can be enabled to provide to a single client the permit to access to Modbus network (RS-485) via Modbus protocol and ET-485;

•IP address filters for recording and/or reading can be enabled to provide to a single client the permit to request via Modbus protocol such function codes, which are not reading functions;

•unit settings can be changed remotely only after password input (not less than 5 symbols). The unit blocks the attempts to guess the correct value by multiple input of incorrect passwords;

•access passwords can be established to restrict recording and/or reading via Modbus and to read the ET-485 unit state and settings;

•at password input the access is provided only to the given client via the given protocol. If a client does not send any queries for a long time, the access is closed.

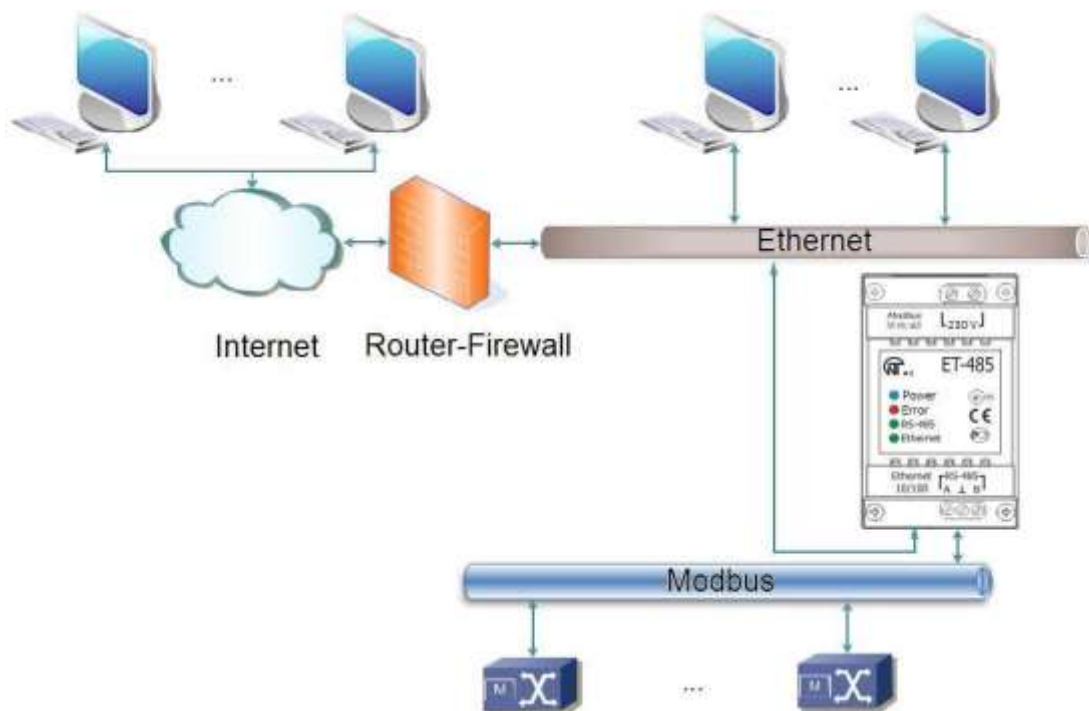
**Note - If the password is input correctly, the access is opened in unsecured connection. The users are strongly recommended to enable the "IP-connections filter for configuration" option of ET- 485 in case of network configuration (especially for networks without other types of protection).**

•The unit protection system is not designed to counter malicious network attacks (especially those, which are not trying to get access to the unit but to block it instead);

•In case of complex and large networks (especially when providing access to the ET-485 via Internet), the users are recommended to separate the unit from unprotected networks with standard protective equipment (router, configured to filter the transmissions, Firewall, etc.).

## APPENDIX B (recommended) EXAMPLES OF NETWORKS TOPOLOGY

### 1.ACCESS TO RS-485 NETWORK FROM ETHERNET NETWORK



**Figure B.1** – Access to RS-485 network (Modbus RTU/ASCII) via Ethernet (Modbus TCP) network

ET-485 is used in the RS-485 master mode, receiving queries from clients in Ethernet or Internet network. The queries are sent to Modbus network. Redirection to remote server is not used.

### 2. MODBUS NETWORK EXTENSION

Two ET-485 units are used, connected as shown in Figure B.2.

ET-485 “a” is connected in the slave mode to RS-485 Modbus “A” network (with a master device). ET-485 “b” is connected in the master mode with a static IP address to Modbus “B” network (with slave devices). Both units are connected into one Ethernet network or connected by means of routers via Internet so that unit “a” can be connected to unit “b”.

Unit “a” is set for query redirection to the remote server with Modbus TCP address and port, which unit “b” has. All Modbus devices, including both ET-485 units and devices in both Modbus networks, must have different Modbus addresses (identifiers.) The queries, sent by the master device in “A” network, are redirected by unit “a” to unit “b”. Unit “b” sends them to the devices in “B” network.

**Note – One should avoid cyclic redirection of queries. If the unit, whereto the queries are redirected, is set to such redirection that the query will be transferred to its initial sender, the queries will be transferred nonstop, which will cause slowdown and then shutdown of query processing by these units.**

If some other devices, besides the master device and ET-485 unit “a”, are connected in “A” network, the exception code generation must be disabled in the settings of ET-485 units, if there is no answer and no connection. Otherwise, while the master device is sending queries to other slave devices in “A” network, ET-485 unit “a” can generate or transfer an exception code, received from unit “b”, simultaneously with transferring a correct answer from another device, which will result in network collision.

### 3. INCREASE OF THE NUMBER OF SIMULTANEOUSLY CONNECTED DEVICES

The diagram in Figure B.2 allows connecting the number of devices, specified in the technical characteristics, giving the opportunity to double the number of devices, available to the master device.

### 4. MATCHING OF MODBUS NETWORKS

The diagram in Figure B.2 also allows connecting two Modbus networks with different characteristics: Modbus RTU network and ASCII network, networks with different exchange rates etc. herewith, each ET-485 unit is set for the corresponding characteristics of its Modbus network, and sufficient delays for passing and processing of queries and answers are chosen for both units.



## 5. CONNECTION OF SEVERAL MASTER DEVICES VIA RS-485

The diagram in Figure B.2 is not limited to two networks. As it is shown in Figure B.3, a few ET-485 units with similar redirection settings can be independently connected to unit "b", each one allowing to connect Modbus TCP clients and one master client via RS-485. Herewith, Modbus networks, whereto these units are connected (e.g. "A1" and "A2"), are invisible to each other. Therefore the devices in these networks can have same Modbus addresses (identifiers). I.e. an address in "A1" network can also be used in "A2" network, but cannot be repeated in "A1" network or "B" network.

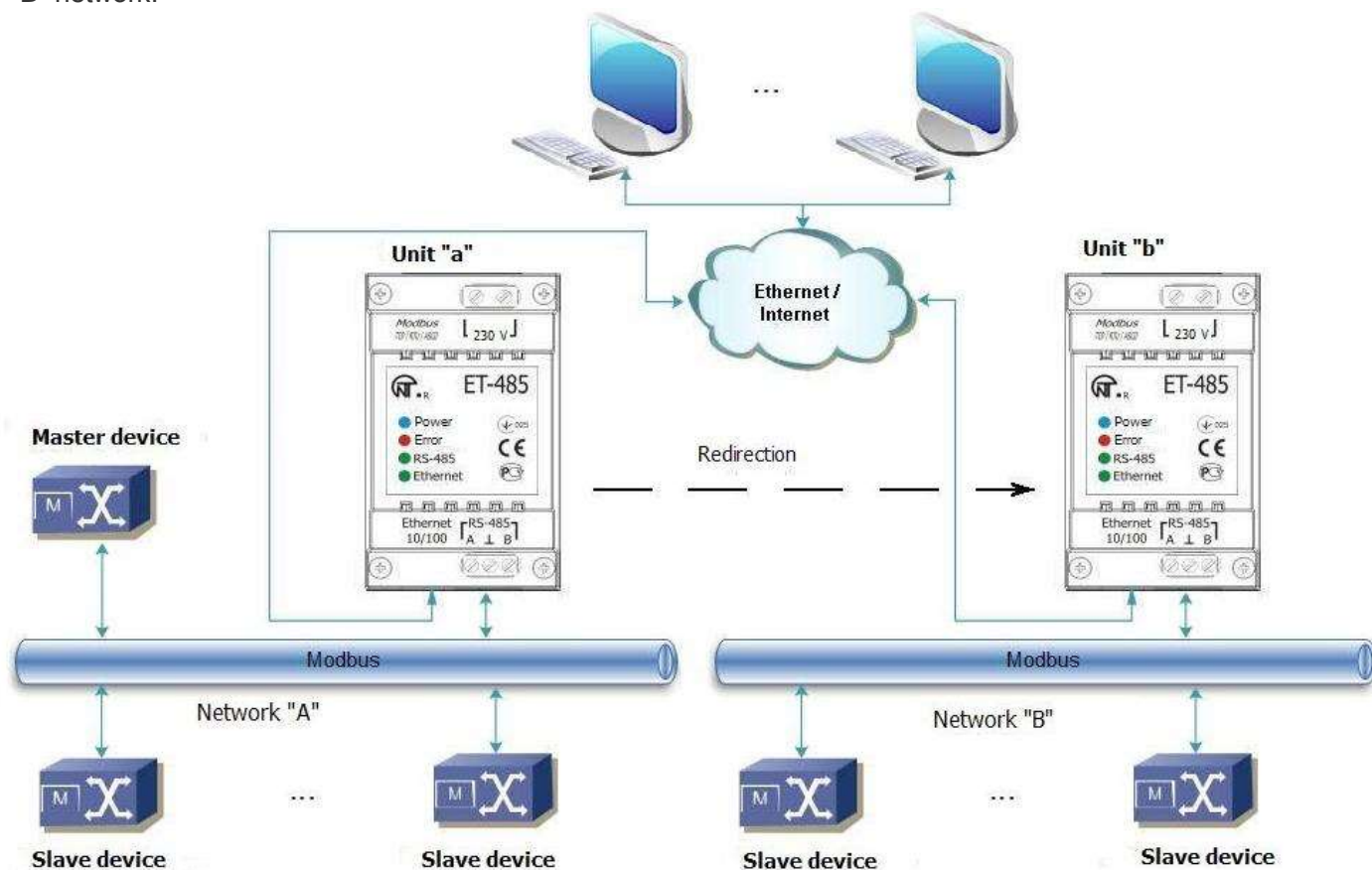


Figure B.2 – Extension of RS-485 network

## 6. EXTENSION OF THE NUMBER OF CONNECTED CLIENTS

Several ET-485 units are used.

Each unit can work both in master or in slave mode via RS-485, and at the same time be set for redirection of queries to other ET-485 unit. The order of redirection can be different: the more redirections a query goes through, the longer is the answer delay and the more Modbus devices can be available for the client.

At consecutive "chain" redirection, as shown in Figure B.4, every new ET-485 unit is set for redirection to the last added ET-485 unit in the chain (in the settings of which, in its turn, a new unit can be specified as the main client). It allows increasing the number of RS-485-connected devices and simultaneously connected Modbus TCP clients by 10 for every additional ET-485 unit.

Each of the devices can work in the slave mode via RS-485, allowing the master device from Modbus network to address the chain section, whereto the given ET-485 unit readdresses the queries.

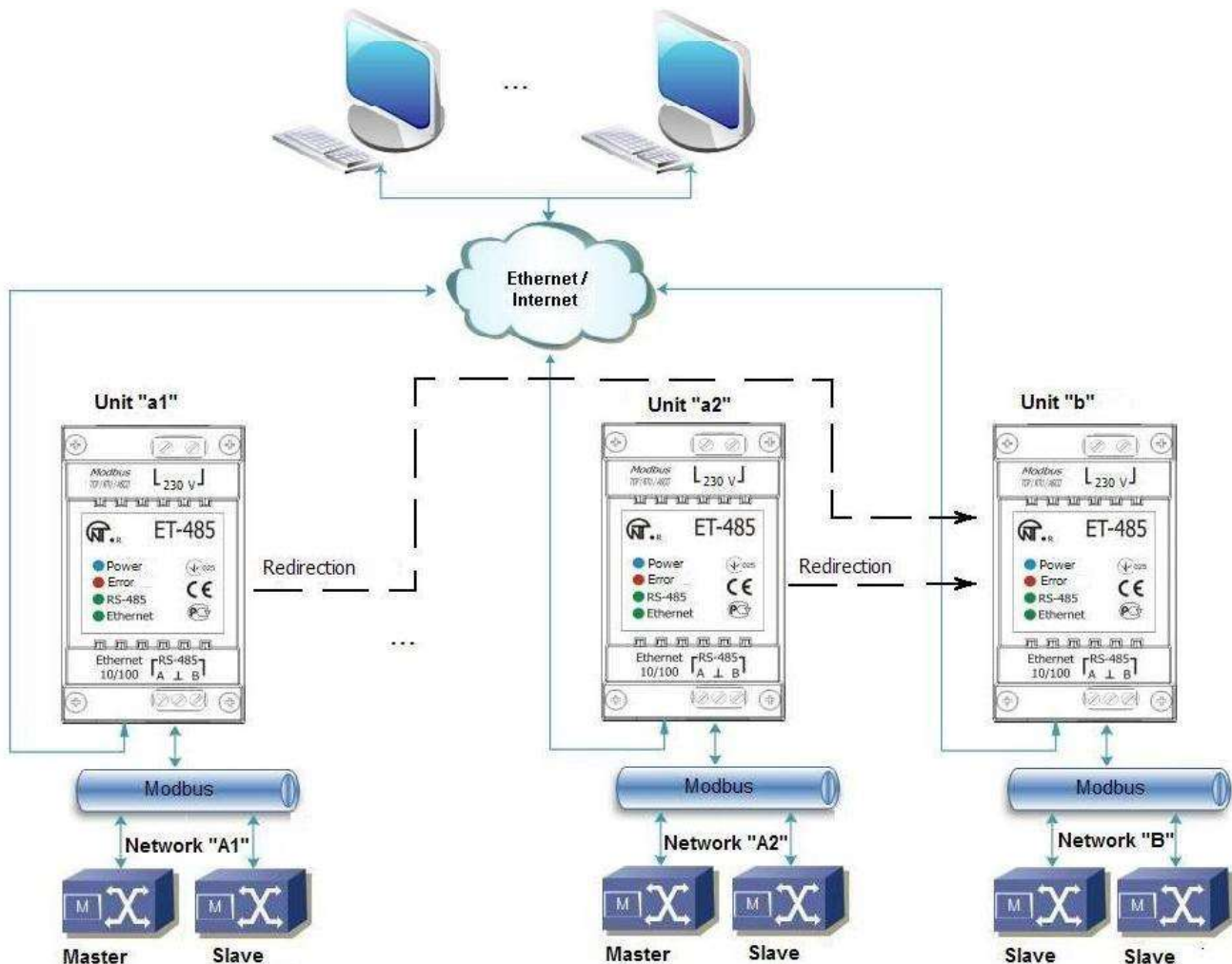
The client's addressing the last unit in the chain via RS-485 or Ethernet causes sending of a query in turn through each of ET-485 units to each Modbus network. Therefore all Modbus addresses (identifiers) must be different in all Modbus networks. Addressing the interim units in the chain accelerates query processing by means of limitation of available devices.

In every new ET-485 unit, which is added into the chain, the answer awaiting delay from the remote server must be chosen long enough for the query to go from the last ET-485 unit to the first one in the chain and for the reverse answer from it.

## 7. ACTIVE CONNECTION TO THE CLIENT (DATA COLLECTION SERVER)

This mode is used when connection to ET-485 with specifying an IP address is difficult or impossible (ET-485 address is assigned by means of DHCP, ET-485 is connected to the Internet without static IP address etc.). The mode allows establishing one ET-485 connection to one client, which has a static IP address and a registered host name (herewith, each client can be simultaneously connected to many ET-485 units).

ET-485 units are connected according to one of the above mentioned diagrams.



**Figure B.3** – Connection of two independent Modbus networks to the third network

Those units, to which an access should be provided without specifying their IP addresses, are set for active connection to the Internet. In the course of operation in ACC mode, ET-485 automatically maintains connection to the client. If automatic sending of unique MAC address is enabled, after connection ET-485 shall transfer MAC address as Modbus response (herewith, query is not sent by the client). Then ET-485 awaits queries from clients as well as from other Modbus TCP clients. Since ACC mode is based on Modbus TCP with some changes (ET-485 connects the client and then functions as Modbus server), the client should maintain ACC mode. For example, Overvis system (Internet address "overvis.com") can be used to access ET-485.

Overvis is the system for monitoring and remote control of the production processes. Overvis allows data reading of units, including ET-485 and devices connected to them via RS-485, carrying periodic readouts within 24 hours, automatic saving data in the base, convenient data overlooking, receiving alert messages about incidents via SMS or E-Mail.

Overvis system maintains ACC mode, used in ET-485, acting as a data collection server of many simultaneously connected units and providing access to the data of units, connected in ACC mode, only by the permission of ET-485 owner. Factory settings of ET-485 are ready for connection to Overvis, herewith, ACC mode is off and should be remotely activated by the user.

According to setting instructions for ET-485 through WEB interface (p. 7.3) for connection of a new unit to the Overvis system in ACC mode it is necessary to:

- set ET-485 for access to the Internet and enable ACC mode;
- disable write protection mode, if necessary to enable other protection modes (filters, passwords);

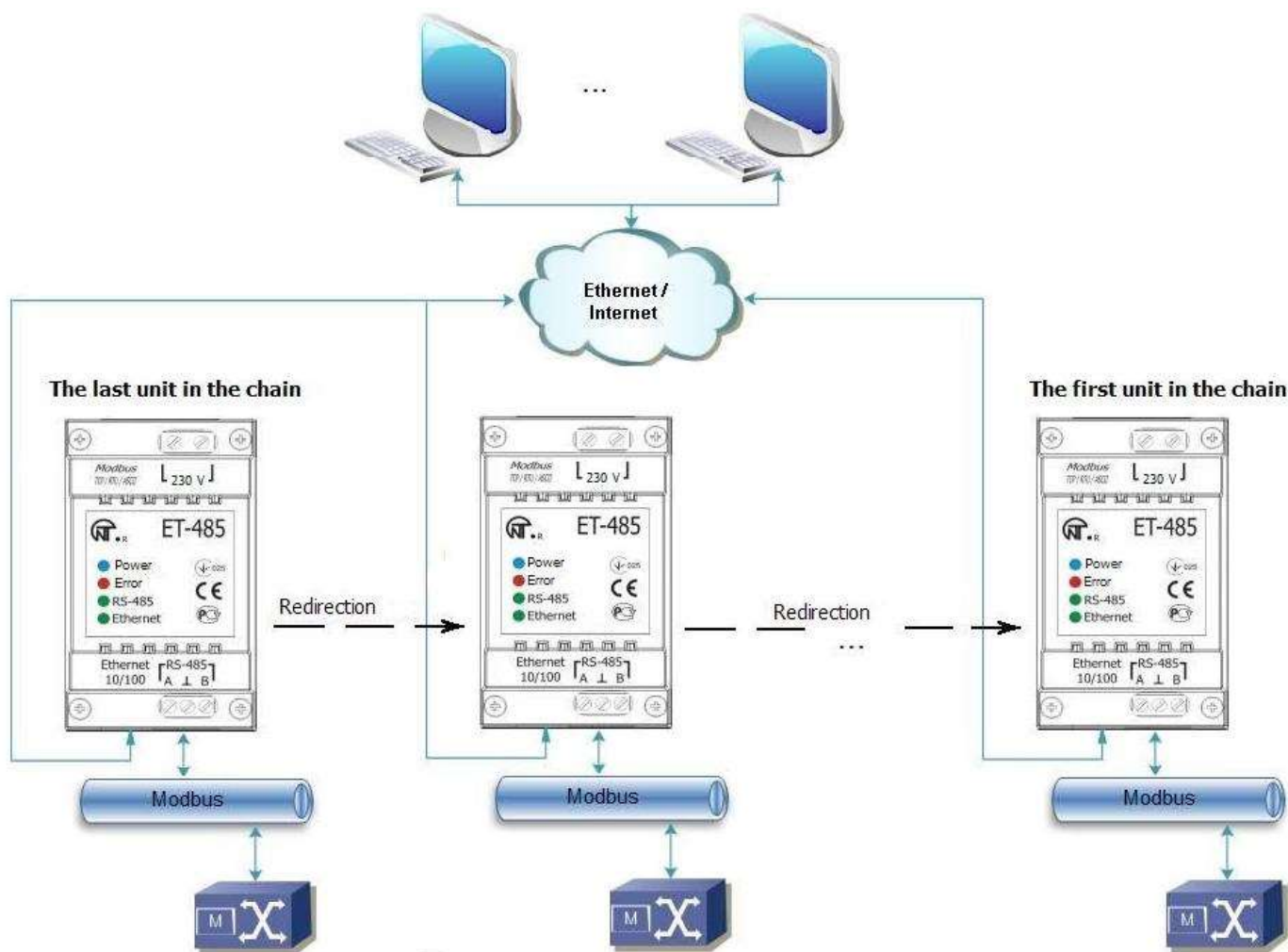
**Note - the Overvis system, while connecting ET-485 unit to it in ACC mode, makes a record in ET-485 of the activation data in appropriate ACC identification control registers. Therefore, while connecting ACC to the Overvis system, Modbus write protection mode in ET-485 unit should be off. Other protection modes (filters, passwords) do not affect ACC and can be used with it.**

- check on the parameter page that ACC is connected and activation code is received.

**Note - if on the parameter page it is pointed for new unit, connected to Overvis through ACC, that connection is activated, for reasons of safety it is necessary to press the button "Reset activation" at the bottom of the page, in order to delete unit from Overvis. This ensures that new unit will be used only by the users who have right to do it.**



- connect to ET-485 with activation code, using instruction from the site of Overvis system.



**Figure B.4** – Consecutive readdressing

For connection to other clients in ACC mode use the following recommendations:

- the client should have a static IP address or a registered host name;
- the client should open a familiar port which is not used by other applications (factory setting ET-485 – 20502, other port can be used) in order to receive ACC from ET-485 units;
- the client can be simultaneously connected with several ET-485 units, whose IP addresses and ports can be used for identification during connection only for a limited time. Therefore, identification should be performed another way, for example, according to one of the following ways:

- a)unique MAC address is used for identification. The client saves MAC address of each connected unit, and when the unit is required it either acts according to the program, set for each MAC address, or requires the user to give MAC address which should worked with, etc.;
- b)client uses unique MAC address of the unit for its identification. In order to provide the access for the user, the unique activation code is given to each unit (herewith, Modbus write protection mode should be disabled). The user is offered once to enter the activation code of the necessary unit. The code is available for reading while ET-485 is being set through WEB interface. After the user enters a code, an appropriate unit is added to the list of user's units. This way provides extra safety in the multiuser system;

- as ACC protocol is based on Modbus TCP, the client should use Modbus address of ET-485 unit, in order to perform identification. Modbus address of ET-485 can be identified, for example, in the following ways:

- a)client holds set Modbus address of ET-485 for each MAC address of the unit;
- b)client checks some range of MAC addresses, for example, 111-121. If type and version of ET-485 firmware cannot be read at any address, the client closes connection;
- c)the option of automatic sending of MAC address to the ACC client is used (factory setting - enabled, can be disabled for interoperation). The client receives Modbus response with MAC address of the unit after its connection, herewith, Modbus address is also contained in this response. This way speeds up and simplifies address identification, and is recommended to use with Overvis system;

•After the unit identification, the client transfers activation code 0 to the unit, which means activation and readiness for operation (herewith, Modbus write protection mode should be disabled).

### APPENDIX C (recommended)

#### Symbol codes according to ASCII

Code*	Symbol	Code*	Symbol	Code*	Symbol
32	(пробел)	64	@	96	`
33	!	65	A	97	A
34	“	66	B	98	B
35	#	67	C	99	C
36	\$	68	D	100	D
37	%	69	E	101	E
38	&	70	F	102	f
39	‘	71	G	103	g
40	(	72	H	104	h
41	)	73	I	105	i
42	*	74	J	106	j
43	+	75	K	107	k
44	,	76	L	108	l
45	-	77	M	109	m
46	.	78	N	110	n
47	/	79	O	111	o
48	0	80	P	112	p
49	1	81	Q	113	q
50	2	82	R	114	r
51	3	83	S	115	s
52	4	84	T	116	t
53	5	85	U	117	u
54	6	86	V	118	v
55	7	87	W	119	w
56	8	88	X	120	x
57	9	89	Y	121	y
58	:	90	Z	122	z
59	;	91	[	123	{
60	<	92	\	124	
61	=	93	]	125	}
62	>	94	^	126	~
63	?	95	_		

\* – codes are given in decimal numbering system