



## MV210-202/204

### Input Module

### User guide

MV210-202/204\_3-EN-43057-2.4  
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## Contents

|  |           |
|--|-----------|
| <b>Warning notice system</b> .....           | <b>3</b>  |
| <b>Safety</b> .....                          | <b>4</b>  |
| <b>Introduction</b> .....                    | <b>5</b>  |
| <b>Abbreviations</b> .....                   | <b>6</b>  |
| <b>1 Overview</b> .....                      | <b>7</b>  |
| <b>2 Specifications</b> .....                | <b>8</b>  |
| 2.1 Environmental conditions .....           | 9         |
| 2.2 Isolation of the Device Components.....  | 9         |
| <b>3 Installation</b> .....                  | <b>10</b> |
| <b>4 Connection</b> .....                    | <b>12</b> |
| 4.1 Connection recommendations .....         | 12        |
| 4.2 Connectors .....                         | 12        |
| 4.3 Power supply .....                       | 13        |
| 4.4 Electrical connection .....              | 13        |
| 4.4.1 Contact sensors .....                  | 14        |
| 4.4.2 PNP and NPN transistors.....           | 14        |
| 4.4.3 PNP and NPN encoders .....             | 15        |
| 4.5 Ethernet connection .....                | 15        |
| <b>5 Construction and operation</b> .....    | <b>17</b> |
| 5.1 Operation principle .....                | 17        |
| 5.2 Indication and control .....             | 17        |
| 5.3 Real time clock.....                     | 18        |
| 5.4 Log file .....                           | 18        |
| 5.5 Data exchange modes.....                 | 20        |
| 5.5.1 Modbus TCP communication .....         | 20        |
| 5.5.2 Error codes for Modbus protocol.....   | 26        |
| 5.6 Digital inputs operation modes .....     | 28        |
| 5.6.1 Logic level detection .....            | 29        |
| 5.6.2 Counting of high-frequency pulses..... | 29        |
| 5.6.3 Frequency measurement .....            | 29        |
| 5.6.4 Encoder signal processing .....        | 29        |
| <b>6 Configuration</b> .....                 | <b>30</b> |
| 6.1 Connection to akYtec Tool Pro .....      | 30        |
| 6.2 Configuring Network Settings .....       | 31        |
| 6.3 Module access password.....              | 32        |
| 6.4 Firmware update .....                    | 32        |
| 6.5 Real-time clock setting.....             | 33        |
| 6.6 Restore default settings .....           | 33        |
| 6.7 Counter reset.....                       | 33        |
| <b>7 Maintenance</b> .....                   | <b>34</b> |
| 7.1 General Instructions .....               | 34        |
| 7.2 Battery replacement .....                | 34        |
| <b>8 Transportation and storage</b> .....    | <b>36</b> |
| <b>9 Scope of delivery</b> .....             | <b>37</b> |

**Appendix A Encrypting the log file .....38**

### Warning notice system

Explanation of the symbols and keywords used:

**WARNING**

WARNING indicates a **potentially dangerous situation** that could result in death or serious injuries.

**CAUTION**

CAUTION indicates a **potentially dangerous situation** that could result in minor injuries.

**NOTICE**

NOTICE indicates a **potentially dangerous situation** that could result in damage to property.

**NOTE**

NOTE indicates helpful tips and recommendations, as well as information for efficient and trouble-free operation.

### Safety

Read this manual carefully before installing, operating or servicing the device.

The device has been designed and built solely for the intended use described in this guide, and can only be used accordingly. The technical specifications contained in this guide must be observed.

Any other use is considered improper.

**CAUTION**

This device must not be used for medical devices which receive, control or otherwise affect human life or physical health.

When installing and using this product, all applicable state, federal and local regulations must be observed.

Based on safety considerations and compliance with the data provided in the documents, the repair of the components of the products is carried out exclusively by the manufacturer.

There is a dangerous voltage on the terminal block. Any connections to the device and maintenance operations must be carried out only when the power of the device is turned off.

The device's method of protection against electric shock meets the terms of class II, IEC 61131-2-2012.

The device installation must be performed in particularized equipment cabinet, the inner access to which is allowed only to approved specialists.

**CAUTION**

It is forbidden to use the device in corrosive environments with acids, alkalis, oils, etc. in the atmosphere.

Obey all the necessary rules and instructions when using programmable logic controllers in areas where technical safety requirements apply.

Failure to obey these warnings could result in personal injury or equipment damage.

Akytec company shall not be liable for technical or editorial errors or omissions contained in this document.

### Introduction

This document provides detailed information about the operation principle, design, configuration, installation and maintenance of the digital input modules MV210-202 and MV 210-204, hereinafter referred to as the Device or Module.

Connection, adjustment and maintenance of the device must be carried out only by qualified personnel after reading this operating manual.

Order code: **MV210-202** and **MV210-204**.

### Abbreviations

- **PC** – personal computer.
- **PLC** – programmable logic controller.
- **RTC** – real time clock.
- **USB** – an industry standard that establishes specifications for cables, connectors and protocols for connection, communication and power supply between personal computers and their peripheral devices.
- **UTC** – coordinated universal time.

### 1 Overview

The Module is designed to collect data from the built-in digital inputs and transfer them via the Ethernet network to the PLC, panel controllers, computers or other devices.

The module has 20 digital inputs for connecting sensors or signals of the following types:

- For **MV210-202**: contact sensor, transistor switch of npn type, transistor switch of pnp type.
- For **MV210-204**: dry contact sensor, transistor switch of npn type.

The Module is intended for use in industry and agriculture.



## 2 Specifications

Table 2.1 Specifications

| Characteristic   | Value   |           |                  |                      |                   |
|--|---|-----------|------------------|----------------------|-------------------|
| <b>Power supply</b>  |   |           |                  |                      |                   |
| Power supply   | 24 (10...48) V DC   |           |                  |                      |                   |
| Power consumption  | 5 W   |           |                  |                      |                   |
| Protection against reverse polarity of supply voltage                              | Yes   |           |                  |                      |                   |
| <b>Interfaces</b>  |   |           |                  |                      |                   |
| Data transfer interface  | Dual Port Ethernet 10/100 Mbit  |           |                  |                      |                   |
| Configuration interface  | USB 2.0 (MicroUSB), Ethernet 10/100 Mbit  |           |                  |                      |                   |
| Date transfer protocol   | Modbus TCP  |           |                  |                      |                   |
| Protocol version   | IPv4  |           |                  |                      |                   |
| <b>Digital inputs of MV210-202</b>   |   |           |                  |                      |                   |
| Number of inputs   | 20  |           |                  |                      |                   |
| Signal type  | <ul style="list-style-type: none"> <li>– contact sensor (requires external 24 V power supply)</li> <li>– NPN / PNP transistor</li> </ul>  |           |                  |                      |                   |
| Operation mode   | <ul style="list-style-type: none"> <li>– logical level detection</li> <li>– counting the number of high-frequency pulses (only the first 8 inputs)</li> <li>– frequency measurement (only the first 8 inputs)</li> <li>– encoder signal processing (up to 3 encoders)</li> </ul>  |           |                  |                      |                   |
| Minimum pulse duration perceived by the digital input (DI1–DI8 only)               | 5 $\mu$ s (up to 100 kHz)   |           |                  |                      |                   |
| Minimum duration of a single pulse (for DI9–DI20)                                  | 1 ms (up to 400 Hz)   |           |                  |                      |                   |
| Input current of logical 0   | max. 1.2 mA   |           |                  |                      |                   |
| Input current of logical 1   | min. 5.5 mA   |           |                  |                      |                   |
| Voltage range of logical 0   | 0.0...6.1 V   |           |                  |                      |                   |
| Voltage range of logical 1   | 8.8...30.0 V  |           |                  |                      |                   |
| <b>Digital inputs of MV210-204</b>   |   |           |                  |                      |                   |
| Number of inputs   | 20  |           |                  |                      |                   |
| Signal type  | <ul style="list-style-type: none"> <li>– dry contact sensor</li> <li>– NPN transistor</li> </ul>  |           |                  |                      |                   |
| Operation mode   | <ul style="list-style-type: none"> <li>– logical level detection</li> <li>– pulse count</li> </ul>  |           |                  |                      |                   |
| Minimum duration of a single pulse   | 1 ms  |           |                  |                      |                   |
| Resistance of contacts (switch) and connecting wires connected to a discrete input | max. 100 $\Omega$   |           |                  |                      |                   |
| <b>Flash-memory (log-file)</b>   |   |           |                  |                      |                   |
| Number of write and erase cycles   | up to 100,000   |           |                  |                      |                   |
| Maximum log file size  | 2 KB  |           |                  |                      |                   |
| Maximum number of log files  | 1000  |           |                  |                      |                   |
| Minimum log writing interval   | 10 s  |           |                  |                      |                   |
| <b>Real time clock</b>   |   |           |                  |                      |                   |
| Inaccuracy   | <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center;">at +25 °C</td> <td style="width: 50%; text-align: center;">max. 3 s per day</td> </tr> <tr> <td style="text-align: center;">at –40 °C and +55 °C</td> <td style="text-align: center;">max. 10 s per day</td> </tr> </table> | at +25 °C | max. 3 s per day | at –40 °C and +55 °C | max. 10 s per day |
| at +25 °C  | max. 3 s per day  |           |                  |                      |                   |
| at –40 °C and +55 °C   | max. 10 s per day   |           |                  |                      |                   |
| Battery type   | CR2032  |           |                  |                      |                   |
| Lifetime of one battery  | 6 years   |           |                  |                      |                   |
| <b>General specifications</b>  |   |           |                  |                      |                   |
| Dimensions   | 42 × 124 × 83 mm  |           |                  |                      |                   |

## 2 Specifications

| Characteristic              | Value    |
|-----------------------------|----------|
| IP code                     | IP20     |
| Mean time between failures* | 60,000 h |
| Average service lifetime    | 10 years |
| Weight                      | 0.4 kg   |

\* Except real-time clock battery

### 2.1 Environmental conditions

The Module meets the requirements for immunity to interference in accordance with IEC 61000-6-4:2006. According to the level of emission of radio interference (noise emissions) the Device complies with the standards established for equipment of class A by CISPR 22-97. The Device is designed for operation in the following conditions:

- ambient temperature:  $-40 \dots +55 \text{ }^\circ\text{C}$ ;
- relative humidity: up to 95% (at  $+35 \text{ }^\circ\text{C}$ , non-condensing);
- closed non-hazardous areas, free of corrosive or flammable gases.
- permitted pollution degree 1 according to IEC 61131-2.

The resistance to mechanical influences during operation of the Device is in accordance with IEC 61131-2-2012.

The resistance to climatic influences during the operation of the Device is in accordance with IEC 61131-2-2012.

### 2.2 Isolation of the Device Components

The circuit of galvanic isolated components and the strength of galvanic isolation are shown in [Figure 2.1](#).

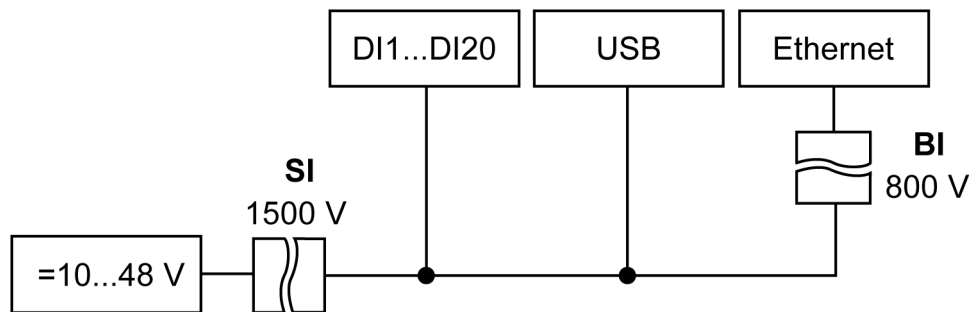


Fig. 2.1 Isolation of the Device Components

Table 2.2 Insulation types

| Type                          | Description   |
|-------------------------------|---|
| Basic insulation (BI)         | The insulation used for active parts of equipment to provide protection against electric shock. The electrical strength of the basic insulation is checked by type tests: by applying a test AC voltage, the value of which is different for different circuits of the Device.  |
| Supplementary insulation (SI) | Independent insulation used in addition to the basic insulation in order to guarantee protection against electric shock in the event of a failure of the main insulation. The electrical strength of the supplementary insulation is checked by type tests: by applying an alternating test AC voltage of various sizes (RMS value) |



#### NOTICE

The value of the insulation strength is indicated for testing under normal climatic conditions, the exposure time is 1 minute according to IEC 61131-2.

### 3 Installation

Module is to install in the electrical cabinet. The design of the cabinet must protect Module from moisture, dirt and foreign objects.

To install Module:

1. Make sure that there is enough free space to connect the wire harness. You need 50 mm above the Module and below it.
2. Fasten the Device to the DIN rail or to a vertical surface using screws (see [Figure 3.1](#)).

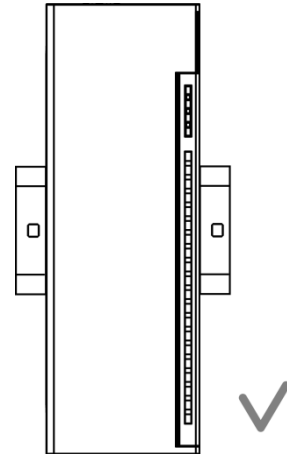


Fig. 3.1 Proper installation

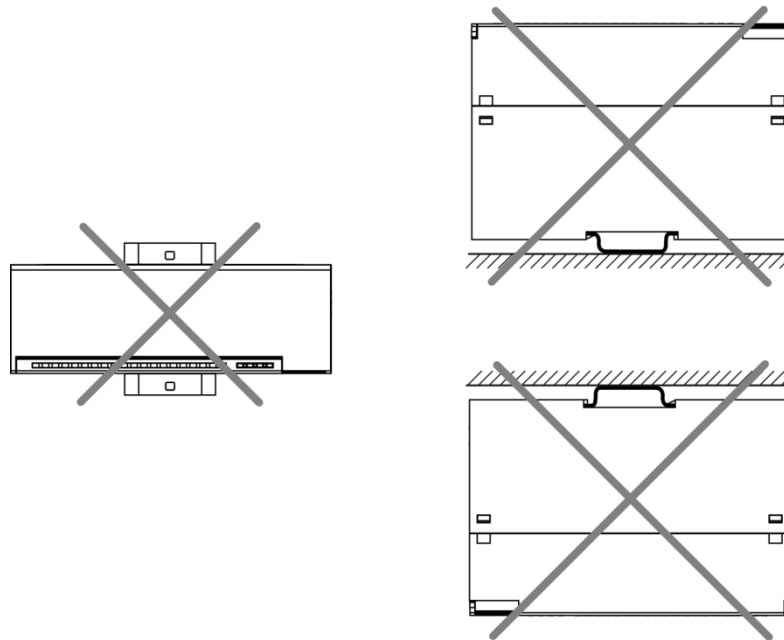


Fig. 3.2 Improper installation



**CAUTION**

Long-term operation of Module with improper installation can lead to damage (see [Figure 3.2](#)).

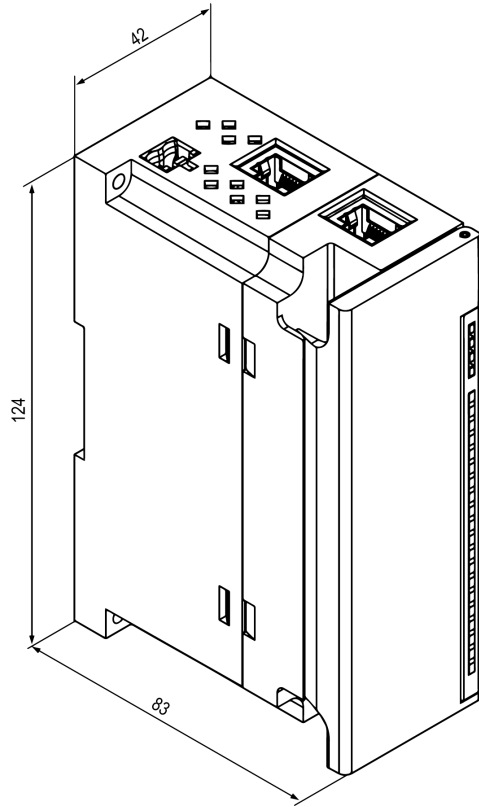


Fig. 3.3 Dimension drawing

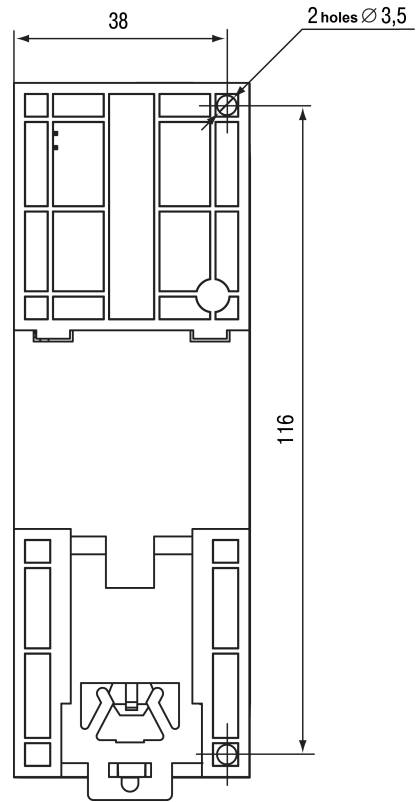


Fig. 3.4 Mounting dimensions

## 4 Connection

### 4 Connection

#### 4.1 Connection recommendations


Mounting of external connections must be carried out by a wire with a cross section of not more than 0.75 mm<sup>2</sup>.


For stranded wires, use end sleeves.


After mounting, put the wires into the cable channel of Module housing and close the cover.

If necessary, remove the terminal blocks of Module, loosen the two screws at the corners of the terminal blocks.

The power wires must be mounted using the supplied return terminal block.

 **CAUTION** Connection and maintenance is performed only when power of Module and devices connected to it is turned off.

 **CAUTION** Do not connect wires of different cross-sections to one terminal.

 **CAUTION** Do not connect more than two wires to one terminal.

#### 4.2 Connectors

The connectors of the interfaces and of the power supply of the Device are shown in Figure 4.1.

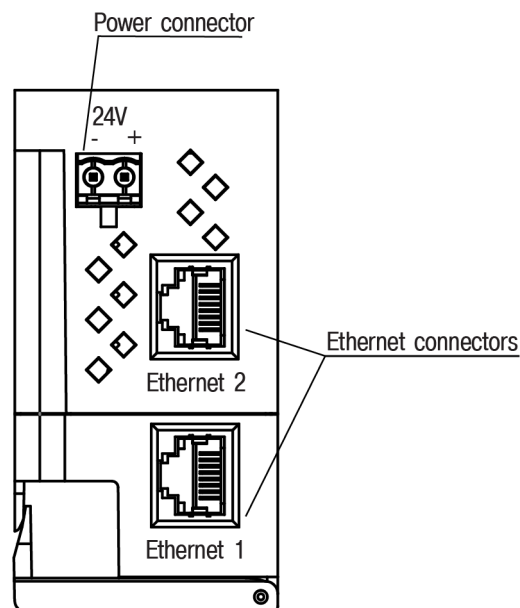


Fig. 4.1 Device's connectors

4.3 Power supply

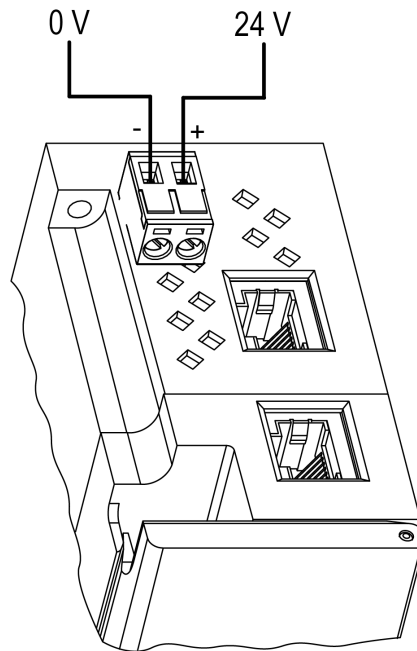


Fig. 4.2 Power supply contacts



**CAUTION**

Using power supplies without potential isolation or with basic isolation of low voltage circuits from AC lines can lead to dangerous voltage in the circuits.

4.4 Electrical connection

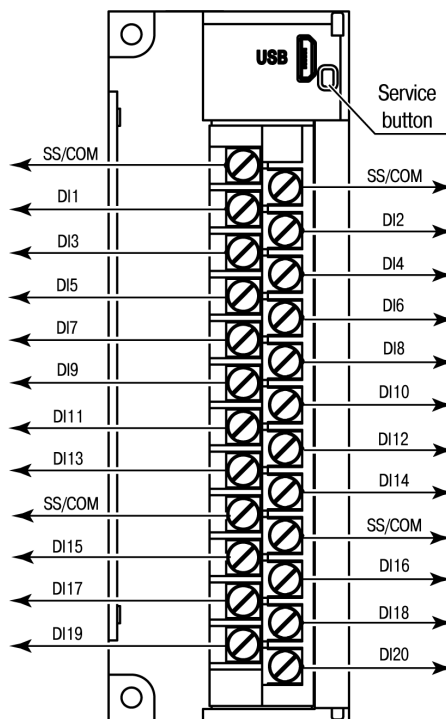


Fig. 4.3 Terminal block layout

## 4 Connection

Table 4.1 Contact function

| Marking             | Description                     |
|---------------------|---------------------------------|
| DI1–DI20            | Inputs DI1–DI20                 |
| COM (for MV210-204) | Common input power supply point |
| SS (for MV210-202)  |                                 |

### 4.4.1 Contact sensors

**NOTICE** The COM/SS circuits are connected inside the device.

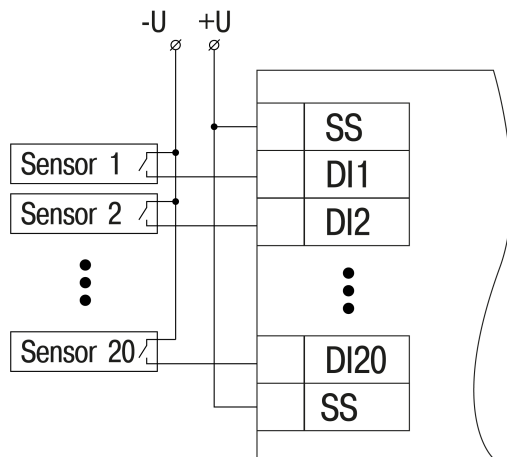


Fig. 4.4 Connection to the inputs DI1–DI20 (MV210-202)

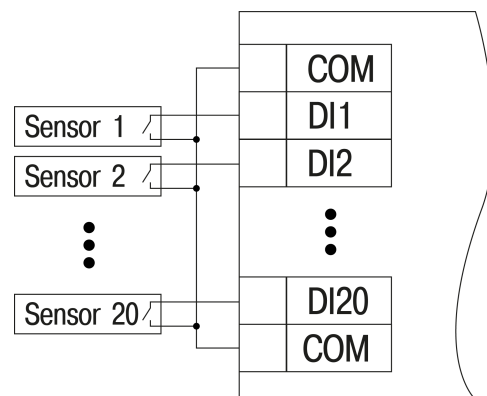


Fig. 4.5 Connection to the inputs DI1–DI20 (MV210-204)

### 4.4.2 PNP and NPN transistors

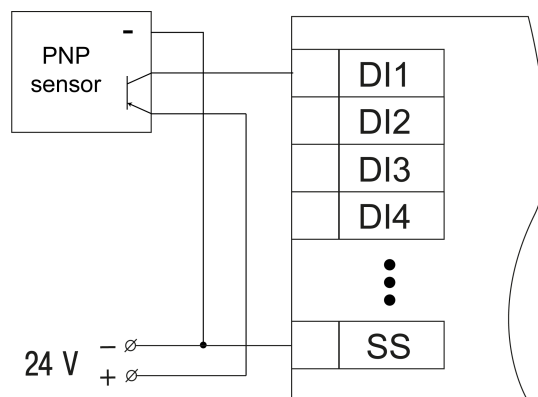


Fig. 4.6 Connection of PNP transistors (only for MV210-202)

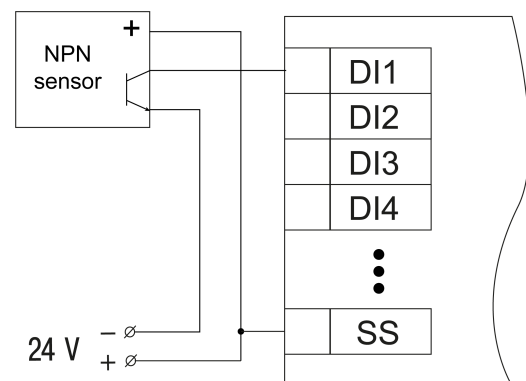


Fig. 4.7 Connection of NPN transistors (only for MV210-202)

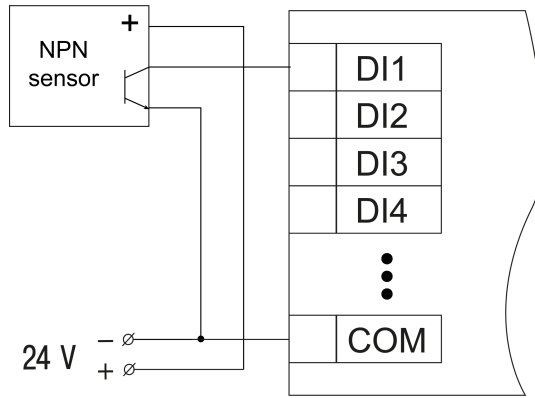


Fig. 4.8 Connection of PNP transistors (only for MV210-204)

#### 4.4.3 PNP and NPN encoders

The figures below show the connection of the encoders to the Module MV210-202.

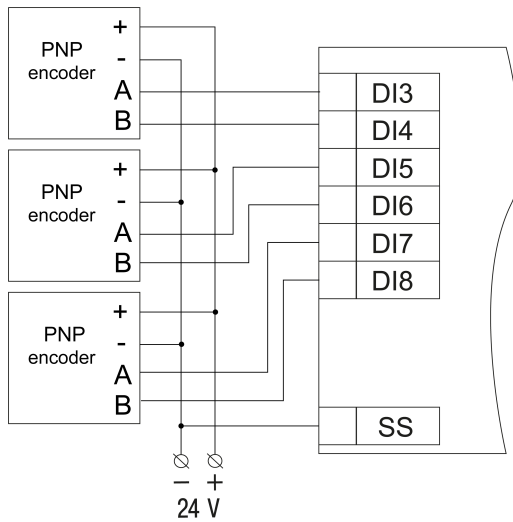


Fig. 4.9 Connection of PNP encoders

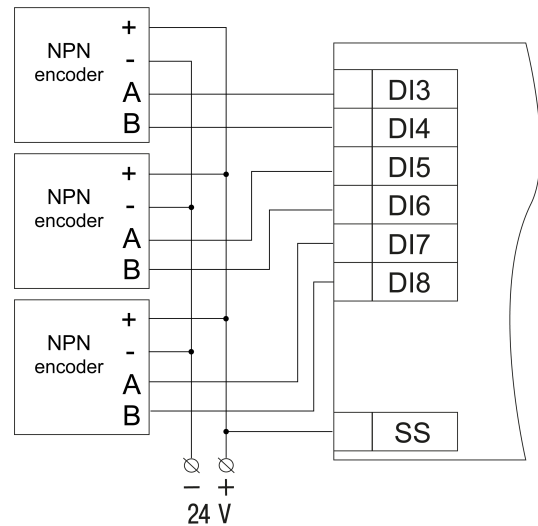


Fig. 4.10 Connection of NPN encoders

#### 4.5 Ethernet connection

To connect modules to an Ethernet network, you can use the following schemes:

- Wye ([Figure 4.11](#)),
- Daisy-chain ([Figure 4.12](#)).



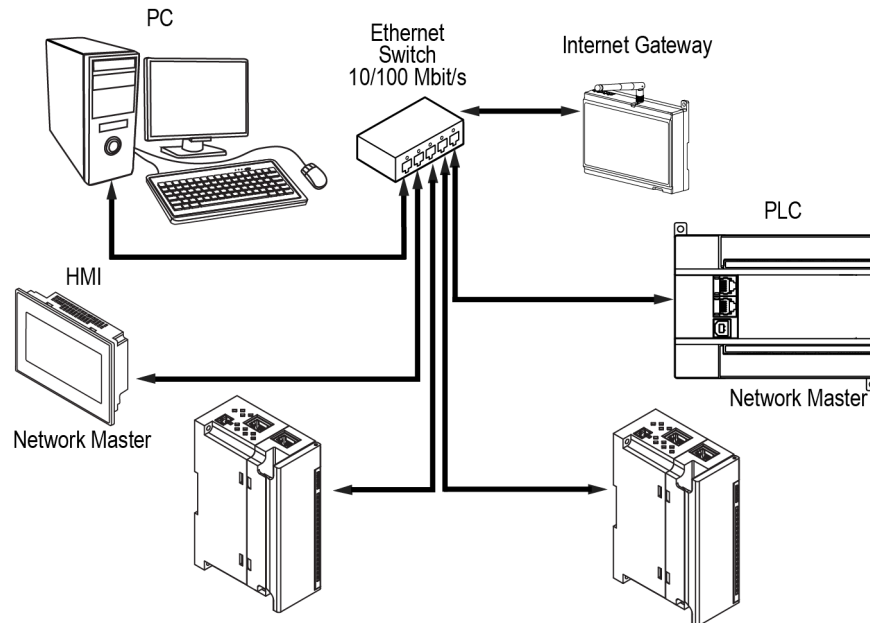


Fig. 4.11 Wye connection

**NOTICE**

1. Maximum length of communication lines: 100 m.
2. Connection is possible to any Ethernet port of the module.
3. The unused Ethernet port must be closed with a blanking plug.

To connect to the Daisy-chain scheme, you must use both Ethernet ports of Module. If Module fails or the power is turned off, the data will be transferred from port 1 to port 2 without disconnecting.

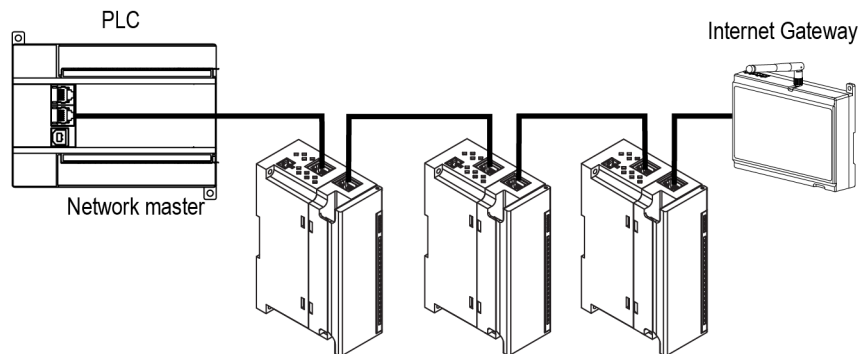


Fig. 4.12 Daisy-chain connection

**NOTICE**

1. The maximum length of the communication line between two adjacent active devices when connected with the "Daisy-Chain" must be not more than 100 m.
2. An adjacent connection scheme is allowed.
3. The unused Ethernet port should be closed with a blanking plug.

### 5 Construction and operation

#### 5.1 Operation principle

The Module receives commands from the Network Master and sends information about the status of digital inputs to it.

As a Network Master you can use:

- PC;
- PLC;
- Operator panel.

#### 5.2 Indication and control

On the front panel there are indication LEDs. The decoding of the LED indications is given in [Table 5.1](#).

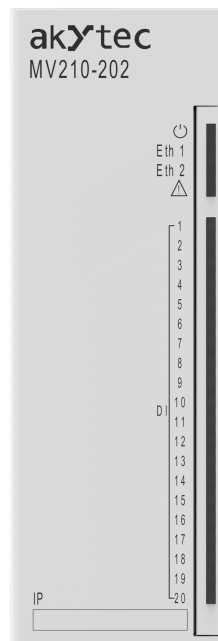


Fig. 5.1 Device faceplate



#### NOTICE

The IP field is located at the bottom of the front panel.

The IP field is intended for applying the IP address of the Module with a thin marker or on a paper sticker.

Table 5.1 Indication

| LED            | LED Status | Function  |
|----------------|------------|---|
| Power  (green) | ON         | Device operating voltage is applied             |
| Eth 1 (green)  | Flashing   | Data transfer via Ethernet port 1               |
| Eth 2 (green)  | Flashing   | Data transfer via Ethernet port 2               |
| Fault  (red)   | OFF        | Normal operation                                |
|                | ON         | Main application and / or configuration failure |

## 5 Construction and operation

| LED                                 | LED Status   | Function  |
|-------------------------------------|--|---|
|                                     | Lights 200 ms once every 3 seconds                     | It is necessary to replace the battery of RTC             |
|                                     | Lights 100 ms twice a second (after a pause of 400 ms) | Module is in a safe state                                 |
|                                     | 900 ms on, 100 ms off                                  | Hardware peripheral failure (Flash, RTC, Ethernet Switch) |
| Input status indicators (red-green) | Green  | Input is closed   |
|                                     | OFF  | Input is open   |

Under the module faceplate there are terminal blocks and a service button (*Figure 4.3*).

The service button performs the following functions:

- Factory settings restore (*Section 6.6*);
- IP-address assignment (*Section 6.2*);
- Firmware update (*Section 6.4*)

### 5.3 Real time clock

The Module has a built-in real time clock (RTC). Its source of power is a battery.

The timing is in seconds, starting with January 1, 2000 at midnight UTC. RTC indication is used for writing entries into the log file.

### 5.4 Log file

The module has built-in encrypted flash memory. The encryption algorithm is Data Encryption Standard (DES) in cipher block chaining (CBC) mode. The key is the string **superkey**. An initialization vector is generated using a hash function. The function argument is the password specified in akYtecToolPro. A checksum is calculated by the CRC32 algorithm and saved in the file end. The checksum is also encrypted.

Log file of Module will be saved as a few files. The log interval, the restriction on the size of one file and their number is set by the user in akYtecToolPro. If the log file is full, then the data is overwritten, starting with the oldest data in the oldest file.

A log file is a collection of records. Entries are separated by line break characters (0x0A0D). Each entry corresponds to one parameter and consists of fields separated by the “;” character (without quotes). Entry format is shown in table.

*Table 5.2 Entry format*

| Parameter                                | Type        | Size                       | Comment  |
|--|-------------|----------------------------|--|
| Time stamp                               | binary data | 4 bytes                    | In seconds from 00:00 01.01.2000 (UTC+0)         |
| Separator                                | string      | 1 byte                     | Character “;” (without quotes)                   |
| Unique identifier of the parameter (UID) | string      | 8 byte                     | As a string of HEX characters with leading zeros |
| Separator                                | string      | 1 byte                     | Character “;” (without quotes)                   |
| Parameter value                          | string      | depending on the parameter | As a string of HEX characters with leading zeros |
| Separator                                | string      | 1 byte                     | Character “;” (without quotes)                   |

## 5 Construction and operation

| Parameter        | Type        | Size    | Comment  |
|------------------|-------------|---------|--|
| Parameter Status | binary data | 1 byte  | parameter status in the log file (0 – the parameter value is correct, 1 – the parameter value is incorrect and its further processing is not recommended). |
| Line break       | binary data | 2 bytes | \n\r (0x0A0D)  |

Example of decrypted entry:

0x52 0x82 0xD1 0x24 **0x3B** 0x30 0x30 0x30 0x30 0x61 0x39 0x30 0x30 **0x3B** 0x30 0x30 0x30 0x30  
0x30 0x30 0x30 0x31 **0x3B** 0x31 **0x0A 0x0D**

where

- 0x52 0x82 0xD1 0x24 – time stamp. To get the date and time in UnixTime format, it is necessary to reverse the byte order and add the offset constant (number of seconds between 00:00:00 01/01/1970 and 00:00:00 01/01/2000): 0x24D18252 (HEX) + 946684800 (DEC) = 1564394971 (DEC, corresponding to July 29, 2019, 10:09:31);
- **0x3B** – separator;
- 0x30 0x30 0x30 0x30 0x30 0x61 0x39 0x30 0x30 – unique identifier of the parameter (00003ba00);
- **0x3B** – separator;
- 0x30 0x30 0x30 0x30 0x30 0x30 0x30 0x31 – parameter value (00000001);
- **0x3B** – separator;
- 0x31 – parameter status (1 – parameter value is correct);
- **0x0A 0x0D** – line break characters.

The time is written to the file from the built-in real time clock. You can also set the time zone, which will be read by external software.

The log file in the Device is written with a interval specified by user. Writing occurs with a certain frequency, calculated in such a way that the resource of Device flash memory is sufficient for a period of at least 10 years of operation.

Log file can be read:

- by akYtecToolPro;
- by user software (using Modbus function 20).

The list of logged parameters is available in the akYtecToolPro software on the **Device Information** tab. The order of writing parameters to the log file corresponds to the order of parameters on the tab.



### NOTE

After updating the firmware, all device settings except the network settings will be reset to the factory settings.

The log file is read using the Modbus function 20 (0x14). This function returns the contents of the registers of the memory file. The function allows using one request to read one or several records from one or several files.

The file read request for each entry indicates:

- link type, 1 byte (should be equal to 6);
- file number, 2 bytes;
- starting address of the register inside the file, 2 bytes;
- number of registers to read, 2 bytes.



### NOTE

The file number in the Modbus request is calculated as 4096 + the file sequence number. Sequential file numbering is from scratch. The Last log file index contains the sequential number of the log file for the last time data were written.

The number of readable registers in the request should be selected so that the length of the response does not exceed the allowable length of the Modbus packet (256 bytes).

The size of the log file is not known in advance, so you should read portions of the data using separate queries. If in response to the request a message is received with error code 0x04 (MODBUS\_SLAVE\_DEVICE\_FAILURE), then you can conclude that the addresses of the registers

## 5 Construction and operation

in the request are outside the file. To read the latest file data, you need to reduce the number of registers in the request.



### CAUTION

When the Module power is turned off, the last entry made at the time of power off may not be saved.

### 5.5 Data exchange modes

The module has the following data exchange modes:

- exchange with the Master via the Modbus TCP protocol (port 502) – up to 4 simultaneous connections with different Network Masters;
- connection and data exchange with a PC using the akYtec Tool Pro.

#### 5.5.1 Modbus TCP communication

Table 5.3 Modbus functions

| Operation | Function              |
|-----------|-----------------------|
| Reading   | 3 (0x03) or 4 (0x04)  |
| Writing   | 6 (0x06) or 16 (0x10) |

The list of Modbus registers is read from the device using the akYtecToolPro program in the “Device Parameters” tab. This list of Modbus registers is presented in the tables below.

Table 5.4 General Registers for Online Modbus Communication

| Name                             | Register | Size/type/description   |
|----------------------------------|----------|---|
| Device name (DEV)                | 0xF000   | Character string up to 32 bytes, Win1251 encoding                   |
| Firmware version (VER)           | 0xF010   | Character string up to 32 bytes, Win1251 encoding                   |
| Platform name                    | 0xF020   | Character string up to 32 bytes, Win1251 encoding                   |
| Platform version                 | 0xF030   | Character string up to 32 bytes, Win1251 encoding                   |
| Hardware version                 | 0xF040   | Character string up to 16 bytes, Win1251 encoding                   |
| Additional character information | 0xF048   | Character string up to 16 bytes, Win1251 encoding                   |
| Time and date                    | 0xF080   | 4 bytes, in seconds since 2000                                      |
| Time zone                        | 0xF082   | 2 bytes, signed short, offset in minutes from Greenwich             |
| Serial number                    | 0xF084   | Character string 32 bytes, encoding Win1251, 17 characters are used |

Table 5.5 ModBus communication registers

| Parameter                  | Value (unit)                     | Register address |        | Access         | Data format |
|----------------------------|----------------------------------|------------------|--------|----------------|-------------|
|                            |                                  | DEC              | HEX    |                |             |
| Time and date (UTC)        | since 2000 (seconds)             | 61568            | 0xF080 | Read only      | UINT 32     |
| New time                   | since 2000 (seconds)             | 61565            | 0xF07D | Read and write | UINT 32     |
| Save new time              | 0 – do not save<br>1 – save      | 61567            | 0xF07F | Read and write | UINT 16     |
| Time zone                  | offset in minutes from Greenwich | 61570            | 0xF082 | Read and write | UINT 16     |
| Time (ms)                  | —                                | 61563            | 0xF07B | Read only      | UINT 32     |
| Current IP address         | —                                | 26               | 0x1A   | Read only      | UINT 32     |
| Current subnet mask        | —                                | 28               | 0x1C   | Read only      | UINT 32     |
| Current gateway IP address | —                                | 30               | 0x1E   | Read only      | UINT 32     |

| Parameter                                   | Value (unit)   | Register address |        | Access         | Data format |
|---|--|------------------|--------|----------------|-------------|
|   |  | DEC              | HEX    |                |             |
| Assign IP address                           | —  | 20               | 0x14   | Read and write | UINT 32     |
| Enter subnet mask                           | —  | 22               | 0x16   | Read and write | UINT 32     |
| Set the gateway IP address                  | —  | 24               | 0x18   | Read and write | UINT 32     |
| DHCP Mode                                   | 0 – absolute prohibition<br>1 – only reading<br>2 – only writing down  | 32               | 0x20   | Read and write | UINT 16     |
| Safe state activation timeout               | 0...60 (seconds)   | 700              | 0x2BC  | Read and write | UINT 8      |
| Device status                               | —  | 61620            | 0xF0B4 | Read only      | UINT 32     |
| MAC-address                                 | —  | 61696            | 0xF100 | Read only      | UINT 48     |
| DNS server 1                                | —  | 12               | 0xC    | Read and write | UINT 32     |
| DNS server 2                                | —  | 14               | 0xE    | Read and write | UINT 32     |
| Battery status (power supply)               | 0...3300 (mV)  | 801              | 0x321  | Read only      | UINT 16     |
| Log interval                                | 10...3600 (s)<br>default settings – 30   | 900              | 0x384  | Read and write | UINT 16     |
| Status of digital inputs DI1-DI20, bit mask | 0...1048575  | 51               | 0x33   | Read only      | UINT 32     |
| Additional mode for input DI1*              | 0 – off<br>1 – pulse count<br>2 – period measurement<br>3 – frequency measurement                                  | 64               | 0x40   | Read and write | UINT 16     |
| Additional mode for input DI2*              | 0 – off<br>1 – pulse count<br>2 – period measurement<br>3 – frequency measurement                                  | 65               | 0x41   | Read and write | UINT 16     |
| Additional mode for input DI3*              | 0 – off<br>1 – pulse count<br>2 – period measurement<br>3 – frequency measurement<br>4 – encoder signal processing | 66               | 0x42   | Read and write | UINT 16     |
| Additional mode for input DI4*              | 0 – off<br>1 – pulse count<br>2 – period measurement<br>3 – frequency measurement<br>4 – encoder signal processing | 67               | 0x43   | Read and write | UINT 16     |
| Additional mode for input DI5*              | 0 – off<br>1 – pulse count<br>2 – period measurement<br>3 – frequency measurement<br>4 – encoder signal processing | 68               | 0x44   | Read and write | UINT 16     |
| Additional mode for input DI6*              | 0 – off<br>1 – pulse count   | 69               | 0x45   | Read and write | UINT 16     |

| Parameter                      | Value (unit)   | Register address |      | Access         | Data format |
|--------------------------------|--|------------------|------|----------------|-------------|
|                                |  | DEC              | HEX  |                |             |
|                                | 2 – period measurement<br>3 – frequency measurement<br>4 – encoder signal processing                               |                  |      |                |             |
| Additional mode for input D17* | 0 – off<br>1 – pulse count<br>2 – period measurement<br>3 – frequency measurement<br>4 – encoder signal processing | 70               | 0x46 | Read and write | UINT 16     |
| Additional mode for input D18* | 0 – off<br>1 – pulse count<br>2 – period measurement<br>3 – frequency measurement<br>4 – encoder signal processing | 71               | 0x47 | Read and write | UINT 16     |
| Debounce filter for input D11  | 0 – off<br>1 – on  | 96               | 0x60 | Read and write | UINT 16     |
| Debounce filter for input D12  | 0 – off<br>1 – on  | 97               | 0x61 | Read and write | UINT 16     |
| Debounce filter for input D13  | 0 – off<br>1 – on  | 98               | 0x62 | Read and write | UINT 16     |
| Debounce filter for input D14  | 0 – off<br>1 – on  | 99               | 0x63 | Read and write | UINT 16     |
| Debounce filter for input D15  | 0 – off<br>1 – on  | 100              | 0x64 | Read and write | UINT 16     |
| Debounce filter for input D16  | 0 – off<br>1 – on  | 101              | 0x65 | Read and write | UINT 16     |
| Debounce filter for input D17  | 0 – off<br>1 – on  | 102              | 0x66 | Read and write | UINT 16     |
| Debounce filter for input D18  | 0 – off<br>1 – on  | 103              | 0x67 | Read and write | UINT 16     |
| Debounce filter for input D19  | 0 – off<br>1 – on  | 104              | 0x68 | Read and write | UINT 16     |
| Debounce filter for input D110 | 0 – off<br>1 – on  | 105              | 0x69 | Read and write | UINT 16     |
| Debounce filter for input D111 | 0 – off<br>1 – on  | 106              | 0x6A | Read and write | UINT 16     |
| Debounce filter for input D112 | 0 – off<br>1 – on  | 107              | 0x6B | Read and write | UINT 16     |
| Debounce filter for input D113 | 0 – off<br>1 – on  | 108              | 0x6C | Read and write | UINT 16     |
| Debounce filter for input D114 | 0 – off<br>1 – on  | 109              | 0x6D | Read and write | UINT 16     |
| Debounce filter for input D115 | 0 – off<br>1 – on  | 110              | 0x6E | Read and write | UINT 16     |
| Debounce filter for input D116 | 0 – off<br>1 – on  | 111              | 0x6F | Read and write | UINT 16     |
| Debounce filter for input D117 | 0 – off<br>1 – on  | 112              | 0x70 | Read and write | UINT 16     |

| Parameter                                | Value (unit)  | Register address |      | Access         | Data format |
|--|---|------------------|------|----------------|-------------|
|  |   | DEC              | HEX  |                |             |
| Debounce filter for input DI18           | 0 – off<br>1 – on   | 113              | 0x71 | Read and write | UINT 16     |
| Debounce filter for input DI19           | 0 – off<br>1 – on   | 114              | 0x72 | Read and write | UINT 16     |
| Debounce filter for input DI20           | 0 – off<br>1 – on   | 115              | 0x73 | Read and write | UINT 16     |
| Frequency measuring period for input DI1 | 0 – 10 ms<br>1 – 100 ms<br>2 – 1 s<br>3 – 10 s  | 128              | 0x80 | Read and write | UINT 16     |
| Frequency measuring period for input DI2 | 0 – 10 ms<br>1 – 100 ms<br>2 – 1 s<br>3 – 10 s  | 129              | 0x81 | Read and write | UINT 16     |
| Frequency measuring period for input DI3 | 0 – 10 ms<br>1 – 100 ms<br>2 – 1 s<br>3 – 10 s  | 130              | 0x82 | Read and write | UINT 16     |
| Frequency measuring period for input DI4 | 0 – 10 ms<br>1 – 100 ms<br>2 – 1 s<br>3 – 10 s  | 131              | 0x83 | Read and write | UINT 16     |
| Frequency measuring period for input DI5 | 0 – 10 ms<br>1 – 100 ms<br>2 – 1 s<br>3 – 10 s  | 132              | 0x84 | Read and write | UINT 16     |
| Frequency measuring period for input DI6 | 0 – 10 ms<br>1 – 100 ms<br>2 – 1 s<br>3 – 10 s  | 133              | 0x85 | Read and write | UINT 16     |
| Frequency measuring period for input DI7 | 0 – 10 ms<br>1 – 100 ms<br>2 – 1 s<br>3 – 10 s  | 134              | 0x86 | Read and write | UINT 16     |
| Frequency measuring period for input DI8 | 0 – 10 ms<br>1 – 100 ms<br>2 – 1 s<br>3 – 10 s  | 135              | 0x87 | Read and write | UINT 16     |
| Value on input DI1 in additional mode*   | 0...4294967295 (pulses) – mode 1<br>10...4294967295 (ms) – mode 2<br>100...4294967295 (Hz) – mode 3<br>0...4294967295 (pulses) – mode 4 | 160              | 0xA0 | Read only      | UINT 32     |
| Value on input DI2 in additional mode*   | 0...4294967295 (pulses) – mode 1<br>10...4294967295 (ms) – mode 2<br>100...4294967295 (Hz) – mode 3<br>0...4294967295 (pulses) – mode 4 | 162              | 0xA2 | Read only      | UINT 32     |



| Parameter                              | Value (unit)  | Register address |      | Access    | Data format |
|--|---|------------------|------|-----------|-------------|
|  |   | DEC              | HEX  |           |             |
| Value on input DI3 in additional mode* | 0...4294967295 (pulses) – mode 1<br>10...4294967295 (ms) – mode 2<br>100...4294967295 (Hz) – mode 3<br>0...4294967295 (pulses) – mode 4 | 164              | 0xA4 | Read only | UINT 32     |
| Value on input DI4 in additional mode* | 0...4294967295 (pulses) – mode 1<br>10...4294967295 (ms) – mode 2<br>100...4294967295 (Hz) – mode 3<br>0...4294967295 (pulses) – mode 4 | 166              | 0xA6 | Read only | UINT 32     |
| Value on input DI5 in additional mode* | 0...4294967295 (pulses) – mode 1<br>10...4294967295 (ms) – mode 2<br>100...4294967295 (Hz) – mode 3<br>0...4294967295 (pulses) – mode 4 | 168              | 0xA8 | Read only | UINT 32     |
| Value on input DI6 in additional mode* | 0...4294967295 (pulses) – mode 1<br>10...4294967295 (ms) – mode 2<br>100...4294967295 (Hz) – mode 3<br>0...4294967295 (pulses) – mode 4 | 170              | 0xAA | Read only | UINT 32     |
| Value on input DI7 in additional mode* | 0...4294967295 (pulses) – mode 1<br>10...4294967295 (ms) – mode 2<br>100...4294967295 (Hz) – mode 3<br>0...4294967295 (pulses) – mode 4 | 172              | 0xAC | Read only | UINT 32     |
| Value on input DI8 in additional mode* | 0...4294967295 (pulses) – mode 1<br>10...4294967295 (ms) – mode 2<br>100...4294967295 (Hz) – mode 3<br>0...4294967295 (pulses) – mode 4 | 174              | 0xAE | Read only | UINT 32     |
| Value of pulse counter on input DI9    | 0...4294967295 (pulses)   | 176              | 0xB0 | Read only | UINT 32     |
| Value of pulse counter on input DI10   | 0...4294967295 (pulses)   | 178              | 0xB2 | Read only | UINT 32     |
| Value of pulse counter on input DI11   | 0...4294967295 (pulses)   | 180              | 0xB4 | Read only | UINT 32     |
| Value of pulse counter on input DI12   | 0...4294967295 (pulses)   | 182              | 0xB6 | Read only | UINT 32     |
| Value of pulse counter on input DI13   | 0...4294967295 (pulses)   | 184              | 0xB8 | Read only | UINT 32     |

| Parameter                           | Value (unit)                  | Register address |      | Access         | Data format |
|-------------------------------------|-------------------------------|------------------|------|----------------|-------------|
|                                     |                               | DEC              | HEX  |                |             |
| Value of pulse counter on input D14 | 0...4294967295 (pulses)       | 186              | 0xBA | Read only      | UINT 32     |
| Value of pulse counter on input D15 | 0...4294967295 (pulses)       | 188              | 0xBC | Read only      | UINT 32     |
| Value of pulse counter on input D16 | 0...4294967295 (pulses)       | 190              | 0xBE | Read only      | UINT 32     |
| Value of pulse counter on input D17 | 0...4294967295 (pulses)       | 192              | 0xC0 | Read only      | UINT 32     |
| Value of pulse counter on input D18 | 0...4294967295 (pulses)       | 194              | 0xC2 | Read only      | UINT 32     |
| Value of pulse counter on input D19 | 0...4294967295 (pulses)       | 196              | 0xC4 | Read only      | UINT 32     |
| Value of pulse counter on input D20 | 0...4294967295 (pulses)       | 198              | 0xC6 | Read only      | UINT 32     |
| Reset pulse counter on input D11    | 0 – reset<br>1 – do not reset | 224              | 0xE0 | Read and write | UINT 16     |
| Reset pulse counter on input D12    | 0 – reset<br>1 – do not reset | 225              | 0xE1 | Read and write | UINT 16     |
| Reset pulse counter on input D13    | 0 – reset<br>1 – do not reset | 226              | 0xE2 | Read and write | UINT 16     |
| Reset pulse counter on input D14    | 0 – reset<br>1 – do not reset | 227              | 0xE3 | Read and write | UINT 16     |
| Reset pulse counter on input D15    | 0 – reset<br>1 – do not reset | 228              | 0xE4 | Read and write | UINT 16     |
| Reset pulse counter on input D16    | 0 – reset<br>1 – do not reset | 229              | 0xE5 | Read and write | UINT 16     |
| Reset pulse counter on input D17    | 0 – reset<br>1 – do not reset | 230              | 0xE6 | Read and write | UINT 16     |
| Reset pulse counter on input D18    | 0 – reset<br>1 – do not reset | 231              | 0xE7 | Read and write | UINT 16     |
| Reset pulse counter on input D19    | 0 – reset<br>1 – do not reset | 232              | 0xE8 | Read and write | UINT 16     |
| Reset pulse counter on input D110   | 0 – reset<br>1 – do not reset | 233              | 0xE9 | Read and write | UINT 16     |
| Reset pulse counter on input D111   | 0 – reset<br>1 – do not reset | 234              | 0xEA | Read and write | UINT 16     |
| Reset pulse counter on input D112   | 0 – reset<br>1 – do not reset | 235              | 0xEB | Read and write | UINT 16     |
| Reset pulse counter on input D113   | 0 – reset<br>1 – do not reset | 236              | 0xEC | Read and write | UINT 16     |
| Reset pulse counter on input D114   | 0 – reset<br>1 – do not reset | 237              | 0xED | Read and write | UINT 16     |

| Parameter                         | Value (unit)                  | Register address |       | Access         | Data format |
|-----------------------------------|-------------------------------|------------------|-------|----------------|-------------|
|                                   |                               | DEC              | HEX   |                |             |
| Reset pulse counter on input DI15 | 0 – reset<br>1 – do not reset | 238              | 0xEE  | Read and write | UINT 16     |
| Reset pulse counter on input DI16 | 0 – reset<br>1 – do not reset | 239              | 0xEF  | Read and write | UINT 16     |
| Reset pulse counter on input DI17 | 0 – reset<br>1 – do not reset | 240              | 0xF0  | Read and write | UINT 16     |
| Reset pulse counter on input DI18 | 0 – reset<br>1 – do not reset | 241              | 0xF1  | Read and write | UINT 16     |
| Reset pulse counter on input DI19 | 0 – reset<br>1 – do not reset | 242              | 0xF12 | Read and write | UINT 16     |
| Reset pulse counter on input DI20 | 0 – reset<br>1 – do not reset | 243              | 0xF3  | Read and write | UINT 16     |

\* Only for MV210-202

### 5.5.2 Error codes for Modbus protocol

When working on the Modbus protocol, errors may occur. These errors are described in [Table 5.6](#). In case of an error, Module sends a response to the Network Master with an error code.

*Table 5.6 List of possible errors*

| Name                        | Code      | Description  |
|-----------------------------|-----------|--|
| MODBUS_ILLEGAL_FUNCTION     | 01 (0x01) | Illegal function code. The error occurs if Module does not support the Modbus function specified in the request. |
| MODBUS_ILLEGAL_DATA_ADDRESS | 02 (0x02) | Illegal register address. The error occurs if the request contains register addresses that are not in Module.    |
| MODBUS_ILLEGAL_DATA_VALUE   | 03 (0x03) | Illegal data value. The error occurs if the request contains an invalid value for writing to the register        |
| MODBUS_SLAVE_DEVICE_FAILURE | 04 (0x04) | The error occurs if the requested action cannot be completed.  |

During the exchange via the Modbus protocol, Module checks the compliance of the requests with the Modbus specification. Requests that fail verification are ignored by the module. Requests that specify an address that does not match the module address are also ignored.

Next, the function code is checked. If a request is received by the module with a function code not specified in [Table 5.7](#), a MODBUS\_ILLEGAL\_FUNCTION error occurs.

*Table 5.7 List of supported functions*

| Name                            | Code      | Description                                       |
|---------------------------------|-----------|---|
| MODBUS_READ_HOLDING_REGISTERS   | 3 (0x03)  | Reading values from one or more holding registers |
| MODBUS_READ_INPUT_REGISTERS     | 4 (0x04)  | Reading values from one or more input registers   |
| MODBUS_WRITE_SINGLE_REGISTER    | 6 (0x06)  | Writing a value to single register                |
| MODBUS_WRITE_MULTIPLE_REGISTERS | 16 (0x10) | Writing values to multiple registers              |

| Name                     | Code      | Description           |
|--------------------------|-----------|-----------------------|
| MODBUS_READ_FILE_RECORD  | 20 (0x14) | Reading log from file |
| MODBUS_WRITE_FILE_RECORD | 21 (0x15) | Writing log to file   |

Situations leading to errors during operation with registers are described in [Table 5.8](#).

Table 5.8 Errors while working with registers

| Function                        | Error name                  | Possible causes  |
|---------------------------------|-----------------------------|--|
| MODBUS_READ_HOLDING_REGISTERS   | MODBUS_ILLEGAL_DATA_ADDRESS | <ul style="list-style-type: none"> <li>– number of requested registers is greater than the maximum possible number (125);</li> <li>– request for nonexistent parameter</li> </ul>  |
| MODBUS_READ_INPUT_REGISTERS     | MODBUS_ILLEGAL_DATA_ADDRESS | <ul style="list-style-type: none"> <li>– number of requested registers is greater than the maximum possible number (125);</li> <li>– request for nonexistent parameter</li> </ul>  |
| MODBUS_WRITE_SINGLE_REGISTER    | MODBUS_ILLEGAL_DATA_ADDRESS | <ul style="list-style-type: none"> <li>– attempt to write a parameter whose size exceeds 2 bytes;</li> <li>– attempt to write a parameter, access to which is denied;</li> <li>– attempt to write a parameter of this type, which cannot be written to by this function. Supported Types: <ul style="list-style-type: none"> <li>– signed and unsigned integers (max. 2 bytes);</li> <li>– enumerated type;</li> <li>– float16 (currently this type is not used for Module).</li> </ul> </li> <li>– request for nonexistent parameter</li> </ul> |
|                                 | MODBUS_ILLEGAL_DATA_VALUE   | <ul style="list-style-type: none"> <li>– value outside the parameter limits</li> </ul>   |
| MODBUS_WRITE_MULTIPLE_REGISTERS | MODBUS_ILLEGAL_DATA_ADDRESS | <ul style="list-style-type: none"> <li>– writing of a nonexistent parameter;</li> <li>– attempt to write a parameter, access to which is denied;</li> <li>– number of writable registers is greater than the maximum possible number (123)</li> </ul>  |
|                                 | MODBUS_ILLEGAL_DATA_VALUE   | <ul style="list-style-type: none"> <li>– no terminating character (\0) was found in the string parameter;</li> <li>– size of the requested data is less than the size of the first or last parameter in the request;</li> <li>– value outside the parameter limits</li> </ul>  |

Situations leading to errors during operation with the log file are described in [Table 5.9](#).

Table 5.9 Errors while working with the log file

| Function                | Error name              | Possible causes   |
|-------------------------|-------------------------|---|
| MODBUS_READ_FILE_RECORD | MODBUS_ILLEGAL_FUNCTION | <ul style="list-style-type: none"> <li>– illegal data size (0x07 &lt;= data length &lt;= 0xF5)</li> </ul> |

| Function                 | Error name                  | Possible causes   |
|--------------------------|-----------------------------|---|
|                          | MODBUS_ILLEGAL_DATA_ADDRESS | <ul style="list-style-type: none"> <li>reference type does not meet specification;</li> <li>could not open the file for reading (it may be missing)</li> </ul>  |
|                          | MODBUS_ILLEGAL_DATA_VALUE   | <ul style="list-style-type: none"> <li>could not move to the desired offset in the file</li> </ul>  |
|                          | MODBUS_SLAVE_DEVICE_FAILURE | <ul style="list-style-type: none"> <li>file deletion error when deleting;</li> <li>request too much data (more than 250 bytes);</li> <li>illegal record number (more than 0x270F);</li> <li>illegal record length (more than 0x7A)</li> </ul> |
| MODBUS_WRITE_FILE_RECORD | MODBUS_ILLEGAL_FUNCTION     | <ul style="list-style-type: none"> <li>illegal data size (0x09 &lt;= data length &lt;= 0xFB)</li> </ul>   |
|                          | MODBUS_ILLEGAL_DATA_ADDRESS | <ul style="list-style-type: none"> <li>reference type does not meet specification;</li> <li>could not open file for writing</li> </ul>  |
|                          | MODBUS_SLAVE_DEVICE_FAILURE | <ul style="list-style-type: none"> <li>requested file is missing;</li> <li>requested file is read-only;</li> <li>failed to write the required number of bytes</li> </ul>  |

### 5.6 Digital inputs operation modes

The inputs of the module operate in the logical level detection mode.

For each input, the counter of incoming pulses is used.



#### NOTE

By default, counters are always on. Counters on inputs with additional modes are enabled only if the additional mode at the input is disabled.

Table 5.10 Pulse counter parameters

| Parameter               | Value                                     |
|-------------------------|---|
| Capacity                | 32 bit                                    |
| Maximum input frequency | 400 Hz                                    |
| Debounce                | On/Off: Configurable in the akYtecToolPro |
| Debounce time           | 25 ms (not configurable)                  |



#### CAUTION

To work with signals with a frequency of more than 40 Hz at a duty cycle of 0.5 or less, do not turn on the debounce, since the useful signal will be received for bounce and skipped.

If the counter is full, the corresponding register is automatically reset. The sequence of actions for forced counter resetting is given in [Section 6.7](#).



#### NOTICE

Counters are non-volatile, their values are saved after a reboot. Counters on inputs with additional modes after reboot are reset.

The state values of the digital inputs are stored as a bitmask and read from the corresponding register.

## 5 Construction and operation

The first 8 inputs of the MV210-202 Module support the following additional modes of operation:

- counting the number of high-frequency pulses (see [Section 5.6.2](#));
- frequency measurement (see [Section 5.6.3](#));
- encoder signal processing (see [Section 5.6.4](#)). Up to 3 encoders can be connected.



### NOTICE

Only one additional operation mode can be switched on at one input.

Select and configure modes:

- in the akYtecToolPro (parameter **Input mode**);
- via Modbus TCP Protocol.

### 5.6.1 Logic level detection

Module inputs perform the logic level detection.

By polling, the Module returns to the Modbus register a bit mask corresponding to the state of the inputs. The logic level detection is performed continuously and does not depend on the activation of the pulse counter mode, frequency measurement, or processing of the encoder signals.

### 5.6.2 Counting of high-frequency pulses

The counting of the number of high-frequency pulses works for the inputs DI1 – DI8.

The maximum frequency of the input signal is 100 kHz with duty ratio of 0.5.

A 32-bit counter is used for each input. The values of the input counter are read from the register corresponding to this input or from the status and log files. The LSB corresponds to one pulse.

If the counter overflows, the value is reset. To force a counter reset, write 0 to input value reset register. The counter will be reset within 10 ms after writing the value 0.

### 5.6.3 Frequency measurement

The first 8 inputs can be set to a frequency measurement mode, in which a square wave signal with a frequency from 0 Hz to 100 kHz is fed to the input.

For this mode, you must set the measurement range:

- from 0 Hz to 100 Hz;
- 100 Hz to 100 kHz.

In the range from 0 to 100 Hz, the period of the input signal is measured in ms.

In the range from 100 Hz to 100 kHz, the frequency is calculated by counting the number of pulses received at the input during the measurement period.

The value of the measurement period is set during configuration using the program akYtecToolPro in the parameter **Measuring period**.

Possible measurement period values: 10 ms, 100 ms, 1 s, 10 s. Default value is 1 s.

A 32-bit register is enabled for each input. Input values are read from the register corresponding to this input or from the status and log files.

### 5.6.4 Encoder signal processing

Up to three dual-channel encoders can be connected to the module (without the Z channel). Connection input numbers: 3-4, 5-6, 7-8.

The maximum frequency of the encoder signals is 100 kHz.

For each input, a 32-bit register is used, in which the accumulated number of pulses is located, taking into account the direction of rotation after reset, recorded by the encoder. If, after reset, the direction of rotation is reversed, the counting starts from the maximum and decreases by the number of accumulated pulses.

Input values are read from the register corresponding to this input or from the log file.

If the counter overflows, the value is reset. To force a counter reset, write 0 to input value reset register. The counter will be reset within 10 ms after writing the value 0.

## 6 Configuration

### 6.1 Connection to akYtec Tool Pro

The Module is configured in the akYtec Tool Pro program.

The Device can be connected to a PC using the following interfaces:

- USB (microUSB),
- Ethernet.

To select an interface:

1. Connect the module to the PC using a USB cable or Ethernet interface.



#### NOTICE

If the module is connected to the USB port, the main module power supply is not required.  
In case of connecting via Ethernet interface it is necessary to supply the main power to the module.

2. Run akYtec Tool Pro.
3. Click the icon **Add devices** on the tool bar.
4. In the drop-down menu "Interface" select:
  - Ethernet (or other network card to which the module is connected): for Ethernet connection;
  - STMicroelectronics Virtual COM Port: for USB connection.

Connection settings

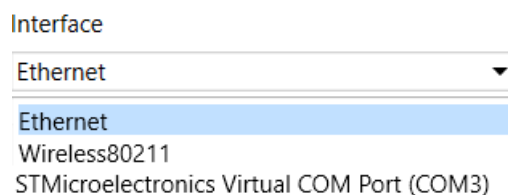


Fig. 6.1 Interface selection menu

The next steps for finding a Device depend on the choice of interface.

To find and add a Device connected to the Ethernet interface to the project:

1. Select "Find device"
2. Enter IP-address of the connected device.
3. Click Find. A Module with the specified IP address is displayed in the window.



#### NOTICE

The default IP address (factory setting) is **192.168.1.99**.

4. Select the Device (place a check mark) and click OK. If the Device is password protected, you must enter the correct password. The Device will be added to the project.

To find and add a device connected via USB interface to the project:

1. In the drop-down menu, select the akYtec Auto Detection Protocol.

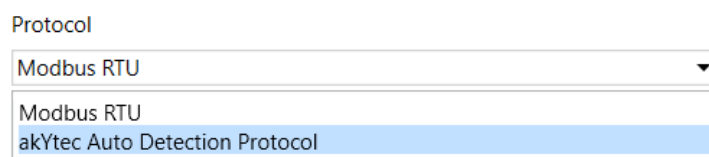


Fig. 6.2 Select Protocol

2. Select **Find device**.



## 6 Configuration

3. Enter the address of the connected device (default is **1**).
4. Click **Find**. The module with the specified address is displayed in the window.
5. Select the device (place a check mark) and click OK. If the device is password protected, you must enter the correct password. The device will be added to the project.

For more information on connecting and working with Devices, see the AkYtec Tool Pro Help. To call help in the program, press **F1**.

### 6.2 Configuring Network Settings

The parameters shown in the table must be set for the Module for Ethernet connection:

Table 6.1 Module's network parameters

| Parameter          | Note   |
|--------------------|--|
| MAC-address        | Set at the factory and is unchanged  |
| IP address         | Can be static or dynamic. The factory setting is <b>192.168.1.99</b> .   |
| Subnet mask        | Specifies the subnet of the IP addresses of other devices visible by the Module. The factory setting is <b>255.255.255.0</b> |
| Gateway IP Address | Specifies the gateway address to access the Internet. The factory setting is <b>192.168.1.1</b>                              |

The IP address can be:

**Static.** This IP address is set using the akYtecToolPro program or the Service button.

To set a static IP address using the akYtecToolPro, proceed as follows:

1. Click on the line **Connection Settings** in the parameter field.
2. Select the **Ethernet settings**.
3. Specify new values for fields **Enter IP Address**, **Enter Subnet Mask** and **Assign gateway IP address**.
4. Set **DHCP Mode** to **Off**.
5. Click on symbol "Save data" in the menu bar.

With help of service button, you can set IP addresses immediately for the group of Modules.

To assign IP address using service button:

1. Connect a module or group of Modules to an Ethernet network.
2. Start the akYtecToolPro program on a PC connected to the same Ethernet network.
3. Click on symbol "IP addresses" in akYtecToolPro program.
4. Enter IP address for the first Module or Module group.
5. Push the service buttons sequentially on the Modules, monitoring the result in the program window. In this case, the information about the Module on which the button was pressed will be displayed in the program window, this Module will be assigned a specified static IP address and other network parameters. The program automatically increments the address by 1.



#### NOTICE

If the IP address assignment with service button does not work, set the **DHCP mode** to **One-off setting with service button** in the akYtecToolPro program (default setting).




| Ethernet settings          |   |
|----------------------------|---|
| Current IP address         | 10.2.20.15  |
| Current subnet mask        | 255.255.0.0   |
| Current gateway IP address | 10.2.1.1  |
| Enter IP address           | 10.2.11.122   |
| Enter subnet mask          | 255.255.0.0   |
| Assign gateway IP address  | 10.2.1.1  |
| DHCP mode                  | One-off setting with service butt  |
|                            | Off   |
|                            | On  |
|                            | One-off setting with service button   |

Fig. 6.3 DHCP mode settings

**Dynamic.** A dynamic IP address is used to work with the cloud service (not available yet) and does not imply working with the Modbus TCP Master. The IP address of the Module is set by the DHCP server of the Ethernet network.



**CAUTION**

Check with the system administration services if there is a DHCP server in the network area to which Module is connected. If using a dynamic IP address, you must enable the DHCP mode.



**NOTICE**

To use the new network settings, you need to restart Module. If the module is connected via USB, it must also be disconnected.

### 6.3 Module access password

To limit access to read and write configuration parameters, a password is used. You can set or change the password when configuring using the akYtec Tool Pro. If the password is lost, the factory settings must be restored (see [Section 6.6](#)). By default, the password is not set.

### 6.4 Firmware update

Firmware can be updated by the following ways:

- by using the USB interface;
- by using Ethernet (recommended).

To update via USB, follow the steps:

1. When the Module is powered on, press and hold the service button. The Module will enter the downloader mode.
2. Update the software with a special utility. The utility is available at [www.akytec.de](http://www.akytec.de).

To update via Ethernet, follow the steps:

1. In the akYtec Tool Pro, click on **Firmware update**.
2. Follow the program's instructions (the firmware file is available on [www.akytec.de](http://www.akytec.de));
3. Restart the Module.

During the update via Ethernet, the integrity of the firmware file and the checksum are checked.



**NOTICE**

A restart of the Module is required to complete the update. If the Module is connected via USB, it must also be disconnected.

### 6.5 Real-time clock setting

The real-time clock (RTC) can be set or read from the Module via Modbus registers and also using the akYtec Tool Pro program (see the program help).

To set a new time via Modbus registers:

1. Write the time value in the appropriate registers.
2. Set the value **1** in the current time update register for at least 1 second.
3. Write the value **0** in the current time update register.

The next writing of the current time can be made after 1 second.

### 6.6 Restore default settings



#### **CAUTION**

After restoring the factory settings, all previously configured settings, except network settings, will be deleted.

To restore the factory settings and reset the installed password:

1. Switch on the power.
2. Press and hold the service button for more than 12 seconds.
3. Switch off and switch on the Device.

After turning on, the Device will work with default settings.

### 6.7 Counter reset

If the input state counter overflows, then the corresponding register is reset automatically. To force the counter to zero, write the value 0 to the counter reset register.

## 7 Maintenance

### 7.1 General Instructions

During the maintenance work on the Device, the safety requirements must be considered. Maintenance of the Device is carried out at least once every 6 months and includes the following procedures:

- checking the Device mounting;
- checking the screw connections;
- removal of dust and dirt from the device terminal block.

### 7.2 Battery replacement

A replaceable CR2032 type battery is used to power the real-time clock.

Replace the battery if at least one of the following events occurs:

- LED Fault blinks (it lights for 200 ms with a 3 second interval).
- The last battery change was 6 years ago.

To replace the battery:

1. Power off the module and all connected devices.
2. Remove the module from the DIN rail.
3. Raise cover 1.
4. Remove two screws 3.
5. Remove the terminal block 2 as shown in *Figure 7.1*.

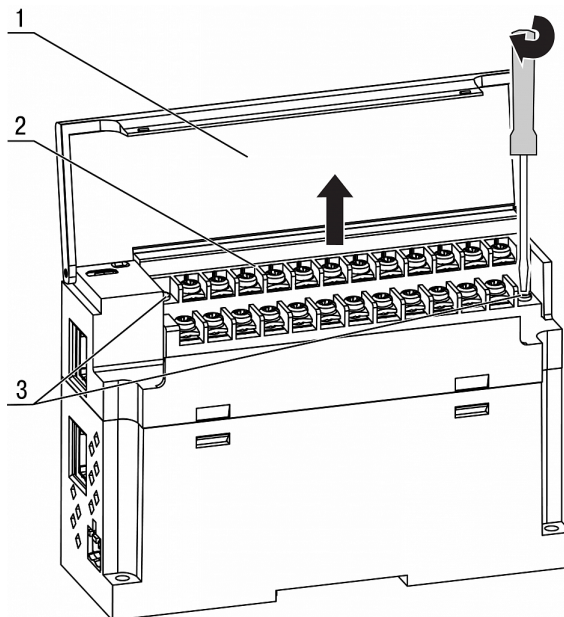


Fig. 7.1 Remove terminal block

6. Alternately remove the hooks from the holes on one side and on the other side and remove the top cover.

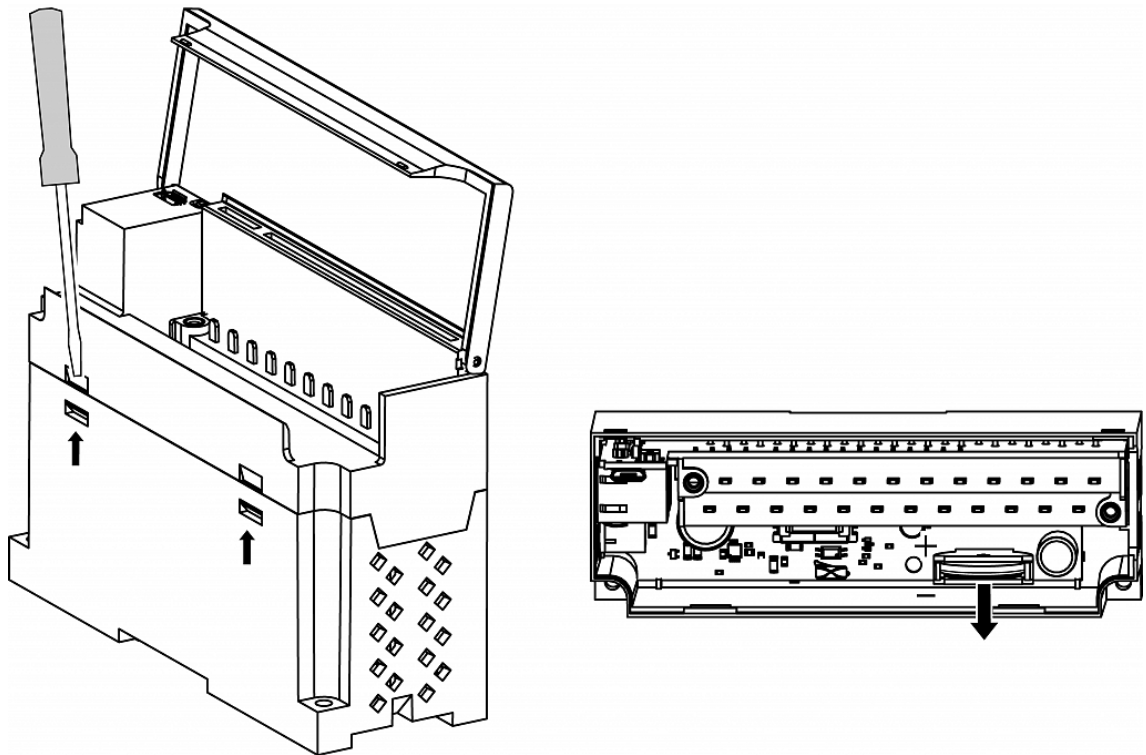


Fig. 7.2 Battery replacement

7. Replace the battery. Recommended time for replacing the battery is not more than 1 minute. If the battery is missing for a longer time, the real-time clock must be set up again.
8. Assembly and installation should be carried out in the reverse order.

**NOTICE**

Do not use a different type of battery. When installing the battery, observe the polarity.

After Module is assembled and turned on, make sure that the system time is correct. If necessary, configure the real-time clock in the akYtecToolPro program.

When loosening the fastening screws, the terminal block rises, so it is recommended to unscrew the screws by turns several turns at a time.

### 8 Transportation and storage

Pack the device in such a way as to protect it reliably against impact for storage and transportation. The original packaging provides optimum protection.

If the device is not taken immediately after delivery into operation, it must be carefully stored at a protected location. The device should not be stored in an atmosphere with chemically active substances.

Permitted storage temperature: – 40...+55 °C



#### **NOTICE**

***The device may have been damaged during transportation.***

***Check the device for transport damage and completeness!***

***Report the transport damage immediately to the shipper and akYtec GmbH!***

## 9 Scope of delivery

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### 9 Scope of delivery

|                                      |   |
|--------------------------------------|---|
| Device                               | 1 |
| Short guide                          | 1 |
| UTP patch cable 5e 150 mm            | 1 |
| Power supply terminal 2EGTK-5-02P-14 | 1 |
| Ethernet blanking plug               | 1 |

**NOTICE**

The manufacturer reserves the right to introduce amendments to the scope of delivery.

### Appendix A Encrypting the log file

When decrypting the log file, a hash function should be used as the initialization vector. The hash function returns 8 bytes (type long long).

An example implementation of a hash function in C:

```
typedef union {
    struct {
        unsigned long lo;
        unsigned long hi;
    };
    long long hilo;
}LONG_LONG;

long long Hash8(const char *str) {    // Based on Rot13
    LONG_LONG temp;
    temp.lo = 0;
    temp.hi = 0;

    for ( ; *str; )
    {
        temp.lo += (unsigned char) (*str);
        temp.lo -= (temp.lo << 13) | (temp.lo >> 19);
        str++;
        if (!str) break;
        temp.hi += (unsigned char) (*str);
        temp.hi -= (temp.hi << 13) | (temp.hi >> 19);
        str++;
    }
    return temp.hilo;
}
```