ELSETA

IOmod 8DI4RO

User manual

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DECLARATION OF CONFORMITY

(in accordance with ISO / IEC Guide 22 and EN Section 45014)
Manufacturer: UAB Elseta
Address of the manufacturer L. Zamenhofo str. 3 LT Vilnius, Lithuania

We claim that:
The device IOMod 8DI4RO

Conforms to the following standards:
EMC:
Radiation EN 55022 (Class A)
1 emitted radiation (30-1000MHz)
Second radiation conductors (0.15-30 MHz)
EN 50082-1 immunity test
1 IEC 801-3: Radio-frequency electromagnetic field 2 IEC 801-2:
Electrostatic discharge.
3 IEC 801-4: Quick periodic electrostatic discharges

Additional information:
"The device complies with the Low Voltage Directive 73/23/EEC and EMC Directive 89/336/EEC. Device assembly complies with the RoHS Directive.

Manufacturer contact:
Equipment quality controller
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SAFETY REQUIREMENTS

These equipment operating notes must be met for your personal safety as well as to avoid damage to the equipment. These notes are marked with a warning triangle symbol and the various degrees of risk of falling within signs. All work related to electronic systems design, installation, commissioning, adjustment and maintenance should be carried out in accordance with the safety requirements.

SYMBOLS USED BY USER MANUAL

Danger - important notice, which may affect the safety of the user or device.

Attention - notice on possible problems that may arise in individual cases.

Information Notice - the information that is useful advice or special places.

Warning of the danger. The work may only be performed by a qualified professional. Equipment installation, commissioning and maintenance may only be performed by a qualified professional authorized to perform commissioning, grounding and labeling devices, systems and circuits. The person must be aware of occupational safety in the workplace, need to understand the equipment components and electrical equipment, have the knowledge and skills to identify a component beneath the voltage.

To maintain the equipment it is necessary always to turn off the power supply before doing installing or dismantling works. It must be kept in mind that even standalone equipment can have a common ground connection. Power supply, cables and interconnect components must always be inspected before connecting.

This product cannot be implemented or resold to install in areas that are marked as high-security such as nuclear power plants, aircraft navigation, military equipment, transport traffic in management. In such areas, equipment failure can result in of nature damage and human injury.

Do not operate the equipment under extreme weather conditions as they may affect the operation of the equipment.

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IOMOD 8DI4RO User Manual Modbus

Introduction

IOMod 8DI4RO is a small-size stand-alone Modbus RTU, IEC 60870-5-103 or IEC-60870-5-101 digital input and relay output controller (protocol depends on firmware). IOmod can be used for industrial applications, where digital signaling is used and robust communication is needed. IOmod is an ideal solution for applications such as data acquisition, control, and process monitoring at remote places. This user manual is written for Modbus protocol firmware version.

Features

- 8 digital inputs;
- Configurable active input signal polarity or input inversion;
- 4 relay outputs;
- Galvanically isolated inputs and outputs;
- Pulsed or latched mode for individual outputs;
- Possible output feedback measurement with inputs;
- Configuration over USB console or MODBUS RTU;
- Values with data and time information;
- Drag and Drop firmware upgrade over USB mass storage;
- Modbus RTU, IEC-60870-5-103, IEC-60870-5-101 communication over RS485;
- Software selectable R_T 120 Ohm termination resistor on RS485 interface;
- LED indication for input/output and data transmission;
- Easy integration with WCC Lite gateway and CloudIndustries.eu platform;

Operational information

IOmod 8DI4RO uses Modbus RTU, IEC 60870-5-103, or IEC 60870-5-101 protocol to communicate with the master device over the RS485 interface. Protocol used by the device can be changed by uploading the corresponding firmware. Default communication settings are:

Baud rate	9600
Data bits	8
Parity	Even
Stop bits	1
Link address	1

IOmod 8DI4RO configuration can be changed over a USB interface with a terminal console like PuTTY or similar.

Status LED

Status LED can be in 2 colors :

Blue - Device connected to USB.

Green - Normal operation.

Rx/Tx LED

The RX/TX LED on the IOMod flashes when data is either being transmitted or received via the RS485 port.

MODBUS operational information

To read output status, send 01 Modbus command (Read Coils) with address of the first register (0) and displacement of 4. Returned value will show all 4 output states (1 - turned On, 0 - turned Off).

The fourth byte in 8DI4RO respond shows the status of outputs (0A = 0000 1010, means that RO2 and RO4 outputs are turned on).

Source	Message	Function	Start	Number	Value	RawData
VINCI		1	0	4		01 01 00 00 00 04 3D C9
RX		1			0A	01 01 01 0A D1 8F

To read input status, send 02 Modbus command (Read Discrete Inputs) with address of first register (0), and displacement of 8. Returned value will show 8 input states.

The fourth byte in 8DI4RO respond shows the status of outputs (10 = 0001 0000, means that fifth input is turned on).

Source	Message	Function	Start	Number	Value	RawData
VINCI		2	0	8		01 02 00 00 00 08 79 CC
RX		2			10	01 02 01 10 A0 44

To read input counter values, send 03 Modbus command (Read Holding Registers) or 04 Modbus command (Read Input Registers) with resolution of first register (0) and size of 24. Returned data will show pulse count (first register) and ON time (2nd and 3rd registers) for each input – pulse count of input #2 will be at register 4th, and so on. ON time will be shown as seconds.

Function 3:

Function 4:

Values can be compared with values in Diagnostics Screen in Putty application (this interface will be discussed later):

```
COM4 - PuTTY                                          —    □    ×

--------- Diagnostics Screen V1.21.0 --------------

Output #1 state: 0
Output #2 state: 1
Output #3 state: 0
Output #4 state: 1

Input #1 state: 0; Pulse count: 2; On time: 10
Input #2 state: 0; Pulse count: 1; On time: 6
Input #3 state: 0; Pulse count: 1; On time: 6
Input #4 state: 0; Pulse count: 11; On time: 33
Input #5 state: 0; Pulse count: 7; On time: 741
Input #6 state: 0; Pulse count: 1; On time: 7
Input #7 state: 0; Pulse count: 1; On time: 7
Input #8 state: 0; Pulse count: 3; On time: 17
```

ON time and pulse count will increase when input pulse is longer than Filter time, which is configured by user in USB terminal menu. Shorter pulses will be ignored in both pulse and ON time registers. From software version 1.10, as capacity of input counter expanded to 32-bits, additional 16 registers depict such wider values in registers 0002300039. That means that function 3 and 4 commands can be sent with length 40 specified. Then 24-39 registers are going to display only pulse count values:

			Job — □ ×
4	24	5	
4	25	1	
4	26	3	Name: Read Input Registers
4	27	0	
4	28	3	
4	29	0	Station: 1 Function: 4
4	30	2	Address: 0 Length: 40
4	31	0	
4	32	2	
4	33	0	
4	34	2	
4	35	0	
4	36	2	
4	37	0	
4	38	5	Save Cancel
4	39	0	

Two registers are allocated for each pulse count value. If value of pulse count becomes more than 65535 then second register comes into use. The values above can be compared with values from diagnostics screen:


```
COM4 - PuTTY                                          —    □    ×

--------- Diagnostics Screen V1.21.0 --------------

Output #1 state: 0
Output #2 state: 0
Output #3 state: 0
Output #4 state: 0

Input #1 state: 0; Pulse count: 65541; On time: 10
Input #2 state: 0; Pulse count: 3; On time: 0
Input #3 state: 0; Pulse count: 3; On time: 0
Input #4 state: 0; Pulse count: 2; On time: 0
Input #5 state: 0; Pulse count: 2; On time: 0
Input #6 state: 0; Pulse count: 2; On time: 0
Input #7 state: 0; Pulse count: 2; On time: 0
Input #8 state: 0; Pulse count: 5; On time: 0
```

These input counter values can be changed by using 06 Modbus command.

1	4	5	10101
1	4	6	3
1	4	7	0
1	4	8	0
1	4	9	2

Function 6
Address: 5   Value: 10101

Send command

Source	Message Function	Start	Number	Value	RawData
VINCI	6	5		27 75	01 06 00 05 27 75 43 DC
RX	6	5		27 75	01 06 00 05 27 75 43 DC

To turn single output on or off, send command 05 (Write Single Coil), with output address (0 to 3). To turn output on – send hex value FF00; to turn off – hex value 0000.

Slave	Function	Address	Value	
1	1	0	False	
1	1	1	False	
1	1	2	True	
1	1	3	False	

Function 5

Address: 2   ☑ Value

Send command

Source	Message	Function	Start	Number	Value	RawData
VINCI		5	2		FF 00	01 05 00 02 FF 00 2D FA
RX		5	2		FF 00	01 05 00 02 FF 00 2D FA

To turn multiple outputs on or off, use command 15 (Write Multiple Coils), and send binary coded value for 4 coils at address (0) and length 4.

To invert input states by software configure device over USB terminal. Useable Modbus commands shown in table below.

Supported MODBUS functions

01 (0x01) Read Coil Status
Reads status of relays (Off or On). IOMOD 8DI4RO has 4 relay outputs from address 0 to address 3.

02 (0x02) Read Discrete Inputs
Reads status of digital inputs (Off or On). IOMOD 8DI4RO has 8 digital inputs from address 0 to address 7. These inputs are active-high by default.

03 (0x03) Read Holding Registers
Lets user read counter/timer values dedicated to digital inputs. There are 40 MODBUS registers. Values held in these registers are explained in a table below. There are two types of values - Pulse Counter and On Timer, the latter calculating the time that respective input was held in its active state.

04 (0x04) Read Input Registers
Lets user read counter/timer values dedicated to digital inputs. There are 80 MODBUS registers. Values held in these registers are explained in a table below. There are two types of values - Pulse Counter and On Timer, the latter calculating the time in seconds that respective input was held in its active state. This function is deprecated and mirrors function 0x03 to conform to past versions of IOMOD 16DI.

05 (0x05) Write Single Coil
Sets a single relay output On or Off. Output addresses from 0 to 3 (first output – address 0, last output – address 3).

06 (0x06) Preset Single Register
Sets a single register. Register addresses is identical to "Read Input Registers" addresses.

15 (0x0F) Write Multiple Coils
Sets multiple relay output On or Off. Output addresses from 0 to 3 (first output – address 0, last output – address 3).

Modbus register mapping table

Register	Description	Value range
	Read coil status (01)	
00000-00007	Reading digital outputs RO1-RO4	0-255
	Read discrete inputs (02)	
00000-00007	Reading digital inputs DI1-DI8	0-255

	Read holding register (03), Read input register (04), Preset Single Register (06)	
00000	Pulse count for DI1, Least Significant Word	0-65535
00001-00002	On-time in seconds for DI1, Least Significant Word first*	0-65535
...	...	...
00021	Pulse count for DI8, Least Significant Word	0-65535
00022-00023	On-time in seconds for DI8, Least Significant Word first*	0-65535
00024-00039	Pulse count for DI1-DI8, Least Significant Word first*	0-65535
	Write single coil (05)	
00000-00003	Writing a single relay output	0x0000 / 0xFF00
	Write multiple coils (15)	
00000-00003	Writing multiple relay outputs RO1-RO4	0-255

*It is advised to set most significant word of counter/timer first

Device configuration

Input inversion and polarity selection

Unlike 8DI8DO IOmod 8DI4RO does not have pull-up resistors. If user desires to turn input status on, when that input signal is low, user then inverts inputs logically. All input indication LED's stay the same (are not inverted).

Input / Output grouping

Sometimes two inputs or two outputs must be captured as one DPI input or output. Inputs and outputs can be grouped into the pairs of two. This allows outputs to be controlled by one DPI command (of address of first output in the group). Only two neighbor pins can be grouped into pair, while first pin in pair must be an odd number pin. When grouped, second pin in the pair is not used anymore – all requests for this pin generate an error. For example – RO1.1-2 and RO2.1-2 can be grouped, after that RO2.1-2 is not used; RO2.1-2 and RO3.1-2 cannot be grouped; RO3.1-2 and RO4.12 can be grouped, but RO4.1-2 is not used then, etc.

Fig. 1. picture shows outputs and inputs ungrouped and controlled independently. In this mode, General Interrogation will be composed of 4 output states and 8 input states.
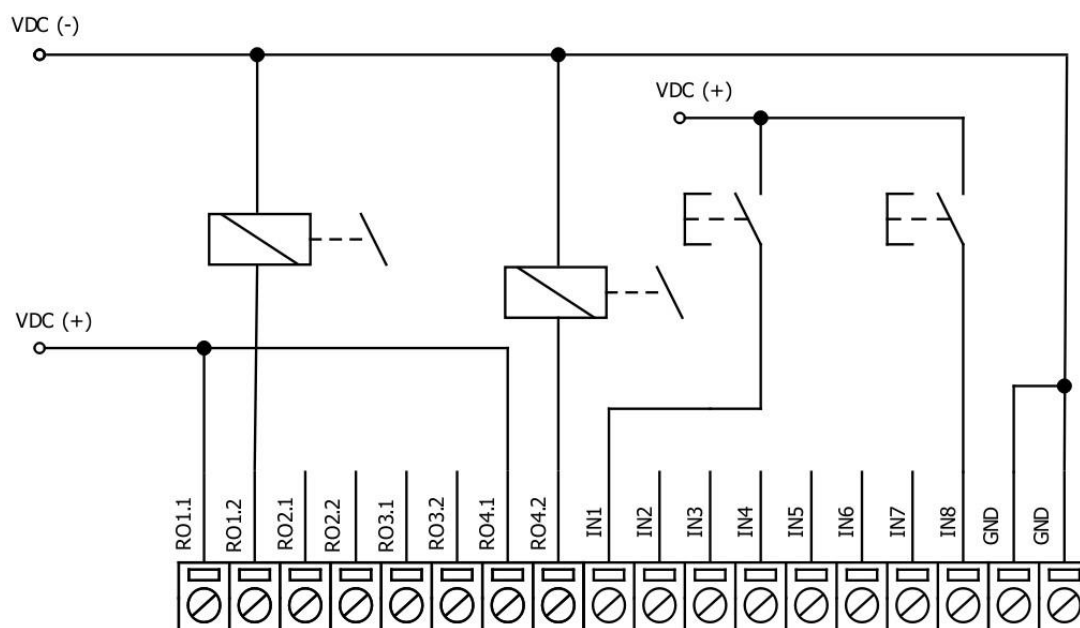

Fig. 1.

Let's consider a situation shown in Fig. 2. In the picture below first two relay outputs are grouped into pair. Also 3rd and 4th inputs are grouped into pair. Now, General interrogation will be composed of 3 output states (with RO2.1-2 missing), and 7 input states (with IN4 missing). Output and input numbers is represented by "Info number" in protocol.
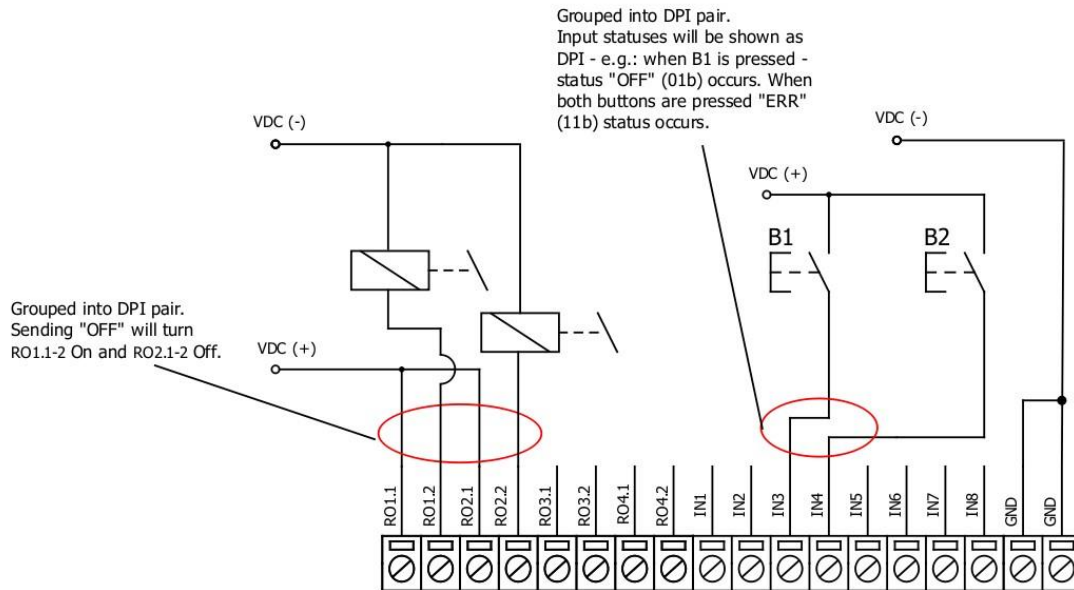

Fig. 2.

Input filter

Input filter is a simple glitch filter with time input. This filter time corresponds to stable time that input must achieve before sending a status change.

Output pulse time

User can configure outputs to be pulse controlled – it means that output will be turned on for configured amount of time. When this time runs out, output is turned off. This is useful when pulse toggle relays are used. Output pulse is independent from output grouping option and can be used on both grouped and ungrouped outputs. When output is grouped, device will allow only one command completion at a time – when output is already turned ON, other "turn ON" requests will be responded with NACK. If user desires latching outputs to be used, output pulse time is set to 0.

In the picture below is depicted an example of pulse output usage. Inputs and outputs are grouped, and output pulse time is set to 1s. When user sends ON command, RO2.1-2 are pulsed for 1s, and relay is set. This will connect NO contact and IN2 will turn on (assuming it is not inverted). When user sends OFF command, RO1.1-2 are pulsed, and relay is reset, turning IN1 on.

Output detection with inputs

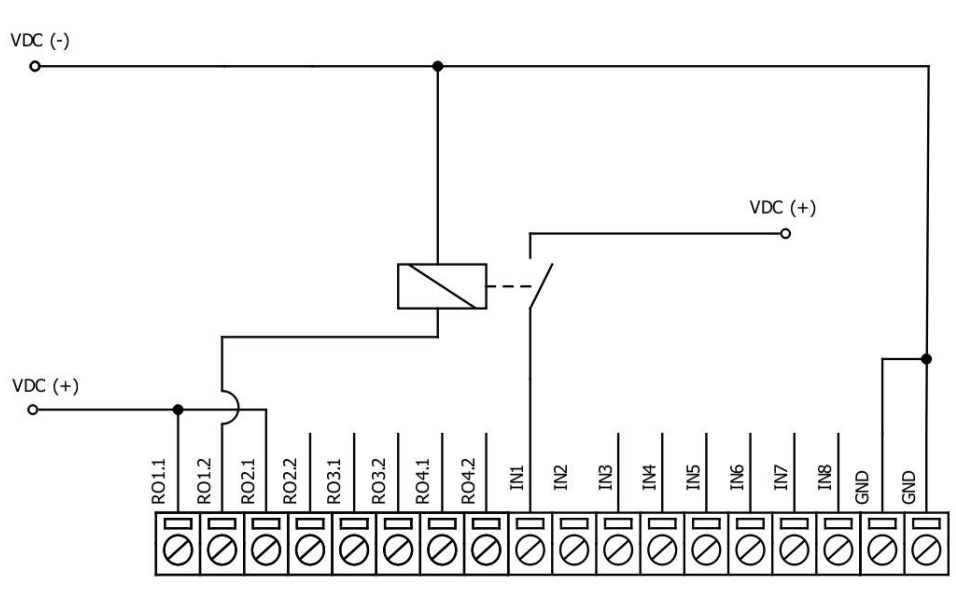Users can detect an output change with inputs.

Fig. 3.

To find out if relays are turned on, user can connect relay outputs to IOMod inputs (maximum allowed voltage must be taken into account). When relays are turned on, device responds with IEC-60870-5-101 protocol message "Remote Operation". If inputs are never turned on or off, device will send "Remote Operation" message after time-out period, with current input statuses. Time-out period is configured by user as a Feedback Time.

Technical information

	System	
1.	Dimensions	101 x 119 x 22.5 mm
2.	Case	IP20, blend PC/ABS self-extinguishing, black
3.	Working environment	Indoors
4.	Operating temperature	from -30°C to +70°C
5.	Humidity	5-95% RH (non-condensing)
6.	Configuration	USB – serial console, MODBUS RTU
7.	Firmware upgrade	USB – mass storage device
	Electrical specifications	
	Inputs	
8.	Nominal input voltage range	12-48VDC
9.	Isolation	8 X 3kV(rms)

10.	Maximum input voltage	60VDC
	Output relay contacts ratings	
11.	Isolation	3kV(rms)
12.	Rated resistive load	5 A (at 250 VAC or at 30 VDC)
13.	Rated inductive (L/R=7ms) load	2 A (at 250 VAC or at 30 VDC)
14.	Maximum switching voltage	277 VAC 125 VDC
15.	Maximum switching current	5 A
	Power	
16.	Power Supply	12-24 VDC / 9-33 VDC (full range)
17.	Current consumption	70 mA

In the Fig. 5. you can see internal structure of 8DI4RO IOmod. An important fact to mention is that as it can be noticed in the scheme below all inputs are isolated. However ground connection is common for all phototransistors.
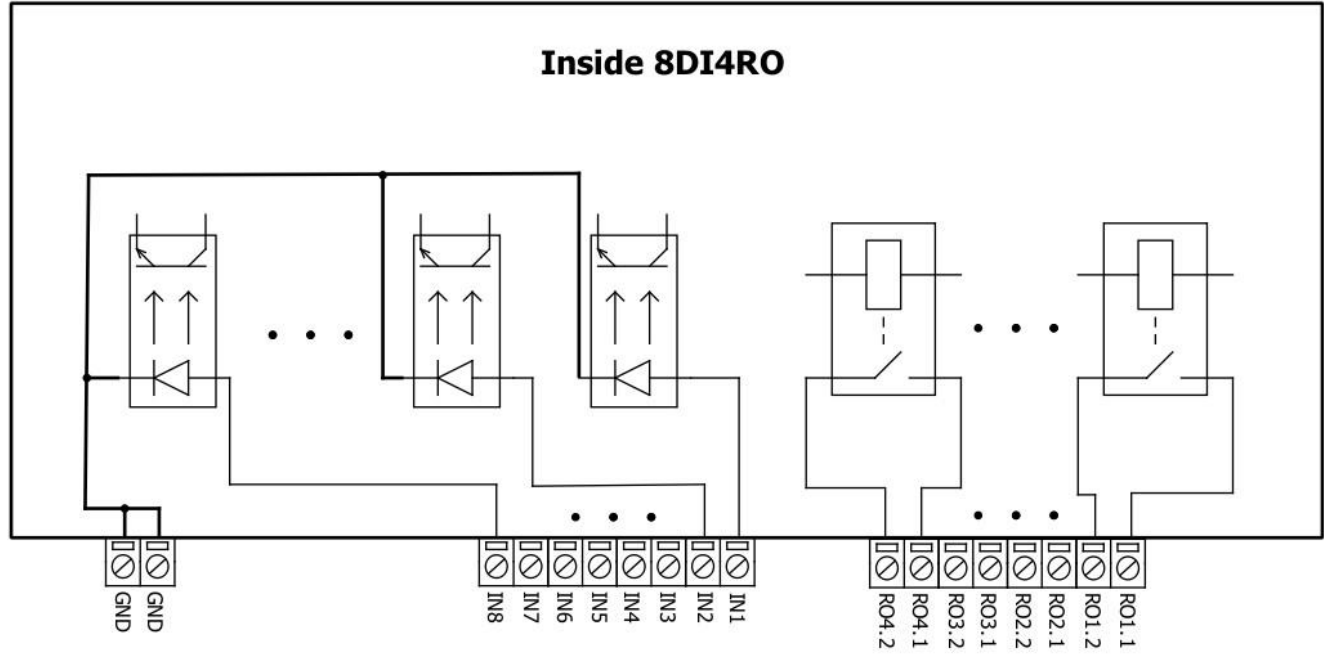

Fig. 4.

Mounting and installation guide
IOmod 8DI4RO RS485 interface

IOmod 8DI4RO has an integrated 120Ω termination resistor which can be enabled or disabled over USB configuration. It is recommended to use termination at each end of the RS485 cable. See typical connection diagram on Fig. 6.
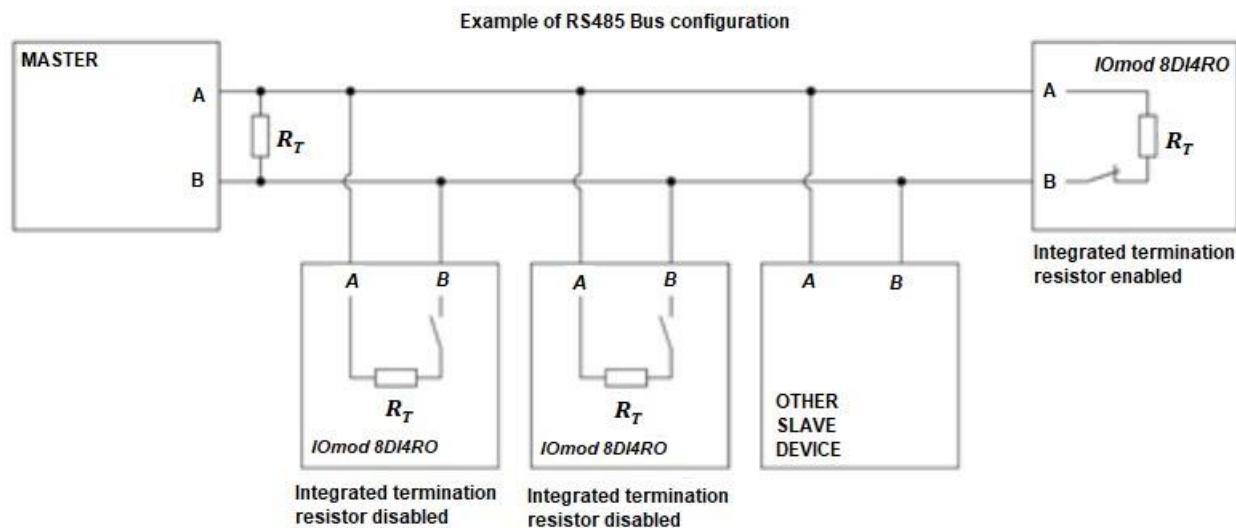

Fig. 5.

IOmod 8DI4RO has 1/8 Unit load receiver which allows to have up to 256 units on line (compared to standard 32 units). To reduce reflections, keep the stubs (cable distance from main RS485 bus line) as short as possible when connecting device.

IOmod 8DI4RO inputs

Typical application of IOmod 8DI4RO inputs is shown on Fig. 2. When default configuration for inputs is applied, user will see inputs connected to +12-24V as "high" or state "1" and input status LED will glow.
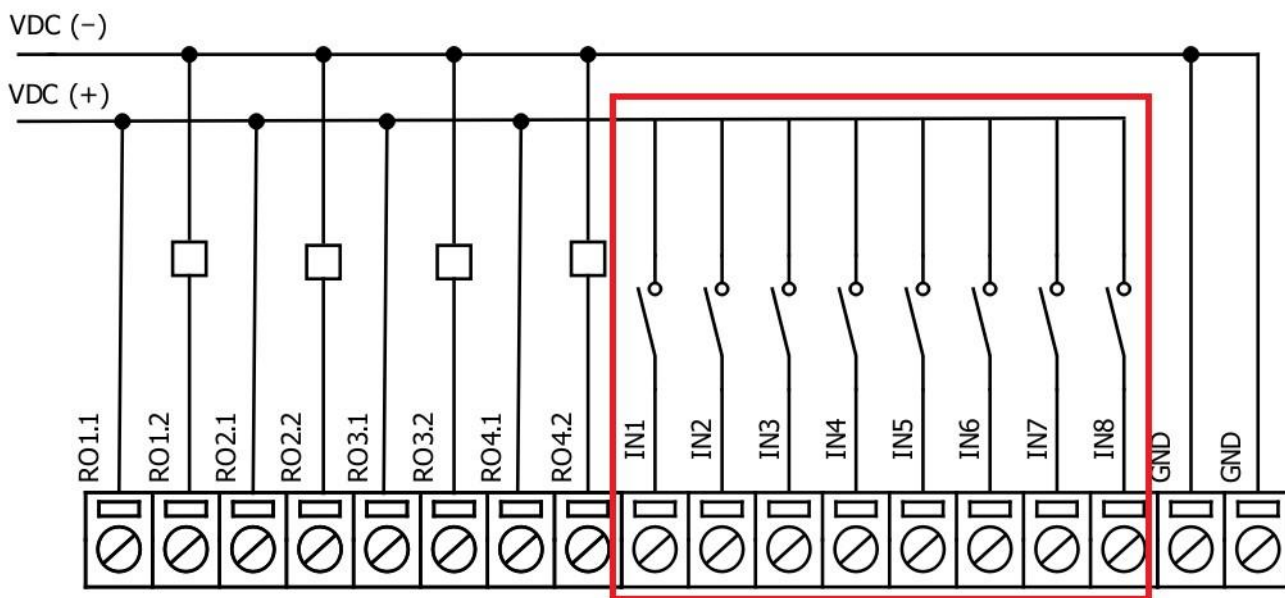

Fig. 6.

User also can configure to enable software input inversion. With this configuration, user will see inputs connected to 0V (see Fig. 3.) as "high" or state "1", input status LED will NOT glow.

IOmod 8DI4RO outputs

IOmod 8DI4RO has 4 relay outputs. Maximum 5A per output is allowed. Typical application of outputs is shown on Fig.4.
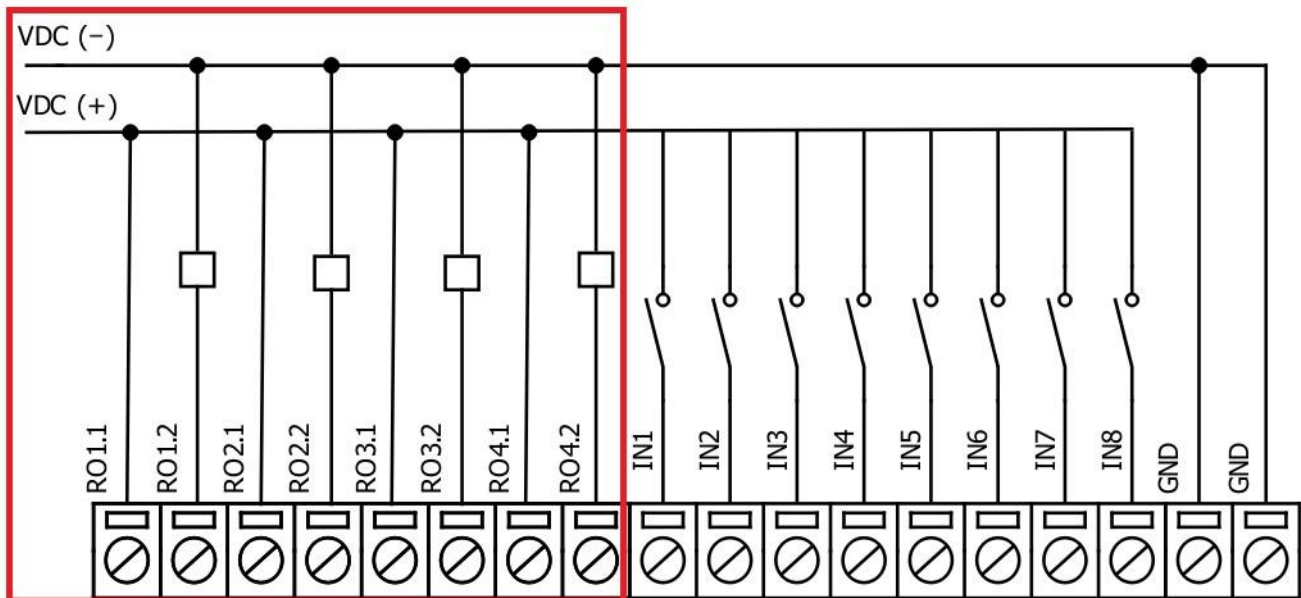
Fig. 7.

Configuration over USB
Driver installation

Device requires USB drivers to work as a Virtual COM port. First-time connection between device and computer could result in "Device driver software was not successfully installed" error (Fig. 5.).
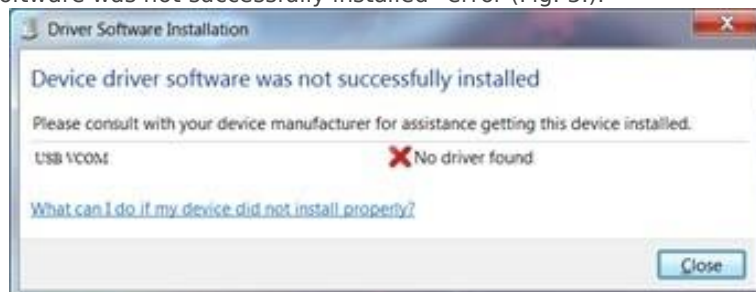

Fig. 8.

Drivers can be installed from Wiki Elseta -> Downloads -> IOMOD Series Downloads-> Firmware and tools -> IOMOD USB drives for Windows;

User then manually installs drivers by selecting downloaded driver folder:
Go to Control Panel -> Hardware and Sound -> Device Manager
Select failed device;
Press "Update driver software"; screen in Fig. 6. should appear:

Fig. 9.

Select "x86" driver for 32-bit machine, or x64 for 64-bit machine. If not sure, select root ("vcom") folder (folder in which x64 and x86 lays inside).
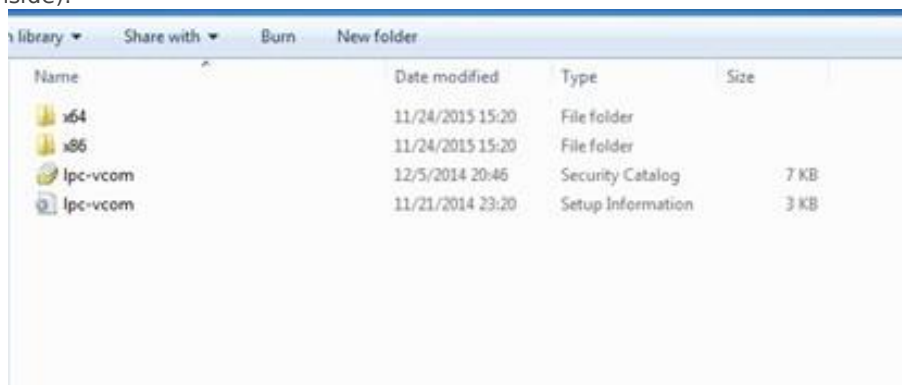

Fig. 10.

IOmod configuration with PuTTY terminal

Configuration of IOmod device is done through CLI (Command Line Interface) on a virtual COM port. Drivers needed for MS Windows to install VCOM will be provided. To open up CLI simply connect to specific V-COM port with terminal software (it is advised to use PuTTY terminal software. If other software is being used, user might need to send <return> symbol after each command). When connected user should immediately see main screen. Accidental close of the terminal window does not stop USB connection, user can connect terminal program again, and press any key on keyboard to show up main menu again.
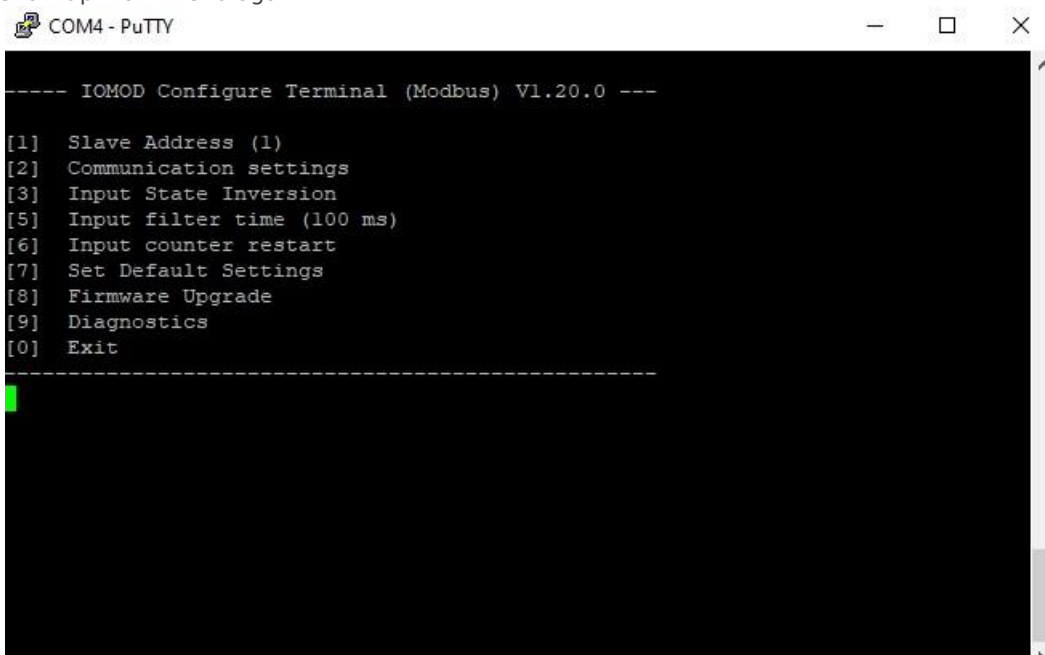
Fig. 11.

Navigation is performed by sending numbers to terminal. User then proceeds by following further on-screen instructions. For example, press [1] to set Slave Device address, press [2] to set Communication settings, press [3] to enable or disable Input State Inversion. When done, press [0] (exit) before disconnecting device physically. Default values is set by pressing [7] on main screen and confirming changes [1]. Communication settings window is shown in Fig. 12.

Fig. 12.

Main Menu

	Menu Name	Function	Values	Default Values
1.	Slave Address	Modbus Slave address / ID	1-254	1
2.	Communication settings	Enters configuring screen for communication settings.	-	-
2.1	Configure baudrate	Configure number of bits transmitted per second	100 - 256 000	9600
2.2	Data, Stop and Parity bits	Configure length and content of packets	[1] 8+1 [2] 8+2Parity: [1] None [2] Odd [3] Even[4] Mark [5] Space	8+1+N
2.3	RS485 Terminating Resistor	RS485 120 Ohms Terminating Resistor	[1] Enable [2] Disable	Disabled
3.	Input State Inversion	Input state inversion for individual pins. Inverts states of input signals, so that high input voltage is considered to be logical 0 and vice versa.	[1] Inverted [2] Set Normal	Normal
4.	Input filter time	Filter for short input pulses	0 - 256 000 (ms)	100

5.	Input counter restart	Restarts all input counter registers to 0	[1] Confirm [0] Cancel	-
6.	Set Default Settings	Sets Default Settings	[1] Confirm [0] Cancel	-
7.	Firmware Upgrade	Mass Storage Device Firmware Upgrade	[1] Confirm [0] Cancel	-
8.	Diagnostics	Input / Output states [9] USB protocol simulator mode	-	-
0.	Exit	Exit and disconnect	-	-

Protocol simulator

When entered diagnostics screen, user can turn on USB protocol simulator mode by pressing [9]. When protocol simulator is turned on, device will communicate through USB port rather than RS-485 line. Communication on RS-485 line is closed and all IEC-101 commands will be accepted only from USB. To exit this mode user must restart device.

Firmware upgrade over USB

To update device firmware user must enter main configuration menu and enter Firmware upgrade screen by pressing [8] is shown in Fig. 13.

Fig. 17.
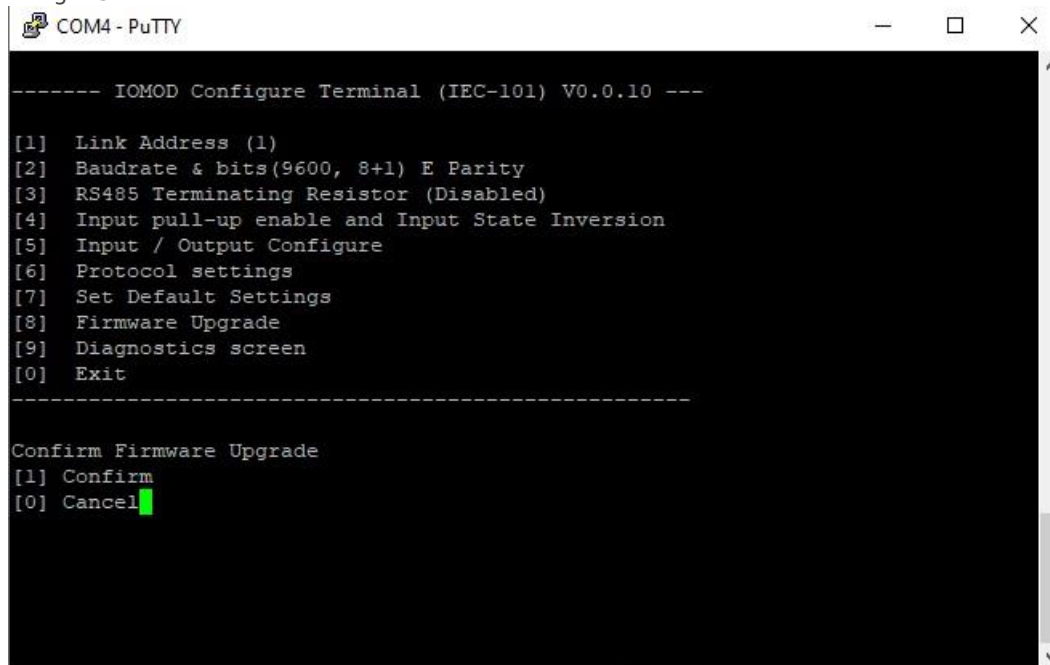
Confirm upgrade by pressing [1];
Device should enter a Firmware Upgrade mode. It means that device switches from USB Console mode into Mass storage device and computer recognize it as USB Storage.

Usually after confirming the upgrade a window with an error message appears (Fig. 14)

Fig. 18.

User then must **delete** existing file "firmware.bin", and simply drag and drop new firmware file.
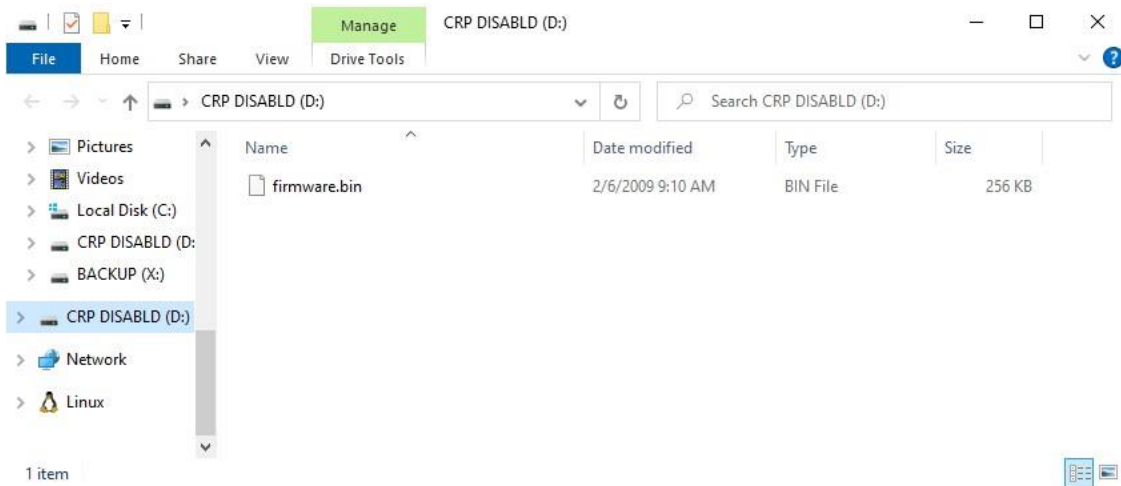
Fig. 19.

Finally, reconnect device and check firmware version. Lastly, you may want to set default settings by pressing [7].

IOMOD 8DI4RO User Manual IEC 60870-5-103

IEC 60870-5-103 working information

Initialization

IOmod uses a standard IEC-60870-5-103 communication scheme. Initiation, control messages and queries are initiated by the master (controlling station), while IOmod device (controlled station) only answers these requests.

Therefore, the first message should be sent by master to start/restart communication (function code 7) (RESET CU or LINK RESET FCB). This message is answered by IOmod with an acknowledgement (ACK) (0). After that master sends RequestStatusOfLink (9) message. The message is answered by slave with Status (11) message. Finally, master sends ResetOfRemoteLink (0) message which has to be answered with ACK (0) message from slave.

The initialization procedure enables master to proceed with sending other messages defined by IEC- 60870-5-103 protocol. Other messages are ignored until a successful initialization has taken place.

Data polling

When initialization is complete, master may poll IOmod device with both Class 1 and Class 2 requests. Class 2 is used when master polls for a cyclic data. Controlled device answers with a message containing Access Demand flag when spontaneous data exists and master then sends request for Class 1. IOmod would then respond with time-tagged message.

On first Class 1 request IOmod device always asks for the Access Demand to send an identification string. However, if there are spontaneous messages to be sent, they will be sent before the identification string.

Output control

To enable or disable relay outputs master (controlling station) sends commands conforming to the IEC-60870-5-103 protocols. The function type of the output commands has to be 128 (80h). Info number represents the number of output pin (1-4 accordingly). Info elements shows DPI information of output state (0 – intermediate, 1 – off, 2 – on and 3 – not used (defines error)). Successful command is accepted with a positive acknowledge.

Input messages

When input status changes, IOmod device filters input glitches through filters with a user configurable filter time. When the filter is passed device sends "Spontaneous" message with "Information number" fields displaying input pin addresses and default "Function type" of 160 (A0h). Please note that spontaneous messages are answered with a

fourbyte time structure not containing date info. Controlling station should therefore be able to handle the signals sent before the start of a new day.

Time synchronization

To initiate the time synchronization between devices master must send variable frame, with Function Type = 0 (GLB), Type Identification = 6, Information Number = 0 and Cause of Transmission = 8. Info elements must contain the 7 byte time structure.

As per IEC-60870-5-103 protocol specification time synchronization can be completed for multiple devices using broadcasting messages. It is included in IEC-60870-5-103 firmware since version 1.7.3. To broadcast time synchronization message, link address should be equal to 255.

General interrogation

General Interrogation (GI) is initiated by the master with variable frame, including Function Code = 3 (User data with ACK), Type Identification = 7, Information number = 0 and Cause of Transmission = 9. Slave device then responds with an acknowledgement (ACK). Master gets IOMod data by polling with Class 2 requests. IOmod device responds with a time-tagged message, including DPI states of inputs and outputs (Outputs are sent first). Output and input pin numbers are represented by "Info number" fields in received packets from IOMod. Finally, slave transmits "End of GI" (Cause of Transmission = 10, Type Identification = 8).

Configuration over USB
IOmod configuration with PuTTY terminal

Configuration of IOmod device is done through CLI (Command Line Interface) on a virtual COM port. Drivers needed for MS Windows to install VCOM will be provided. To open up CLI simply connect to specific V-COM port with terminal software (it is advised to use PuTTY terminal software. If other software is being used, user might need to send <return> symbol after each command). When connected user should immediately see main screen. Accidental close of the terminal window doesn't stop USB connection, user can connect terminal program again, and press any key on keyboard to show up main menu again.

IOMOD 8DI4RO User Manual IEC 60870-5-101

IEC 60870-5-101 working information

Initialization

IOmod uses a standard IEC-60870-5-101 communication scheme. Initiation, control messages, and queries are initiated by the master (controlling station), while the IOmod device (controlled station) only answers these requests. Therefore, the first message should be sent by the master to request status of link (function code = 9). This message is answered by IOmod with the status of link (function code = 11) if link is available. Otherwise there is going to be no response. After receiving the status of link the master will send Reset of remote link command (function code = 0) to restart the communication. The IOMod can respond with either acknowledgment (function code = 0, ACK) or Negative Acknowledgment (function code = 1, NACK). If IOMod respond is ACK then the initialization procedure is finished. The described procedure enables the master to proceed with sending other messages defined by the IEC-60870-5-101 protocol.

Data polling

When initialization is complete, the master may request data from the IOmod device with general interrogation. Although according to the protocol specification IOmod will send data on value change. The 8DI4RO IOMod responds with data type 1 (M_SP_NA_1) a single-point information.

Output control

To control device outputs master (controlling station) sends a command conforming to the IEC-60870-5-101 protocols. The IOAs for outputs are 101 (RO1), 102 (RO2), 103 (RO3) and 104 (RO4). By sending the 45-type command (C_SC_NA_1, single point command) with the selected IOA you can either turn ON or OFF outputs. Negative acknowledgement is returned if the sent command is not configured. For example wrong IOA address or Data Type.

Inputs

The IOAs for the inputs are: 9 (DI1), 10 (DI2), 11 (DI3), 12 (DI4), 13 (DI5), 14 (DI6), 15 (DI7) and 16 (DI8).

Time synchronization

To initiate the time synchronization between devices the master must send a Clock Sync command. The command type is C_CS_NA_1 (103) and the Cause of Transmission (COT) has to be 6. The command has to be sent to the correct link address and CASDU, which is the same as the link address by default. If the sent frame is correct the IOMod will respond with a C_CS_NA_1 (103) type command with the COT (cause of transmission) of 0x07 and the p/n bit will be set to 0 (positive confirmation). Also the command will be time-tagged with the **device** time. If the time synchronization feature is disabled or the command is sent to an undefined CASDU the response is the same except the p/n bit will be set to 1 (negative confirmation) and the COT byte will be equal to 0x47.

General interrogation

General Interrogation (GI) is initiated by the master sending the General Interrogation command. The command type is C_IC_NA_1 (100) and the Cause of Transmission (COT) has to be 6. The command has to be sent to the correct link address and CASDU, which is the same as the link address by default. If the sent frame is correct the IOMod will respond with a C_IC_NA_1 (100) type command with the COT (cause of transmission) of 0x07 and the p/n bit will be set to 0 (positive confirmation). Otherwise, it will respond with the same command just that the p/n bit will be set to 1 (negative confirmation) and the COT byte will be equal to 0x47. Then the device will begin to send all of its data. If the GI was successful the IOMOD will also send another 100 type command with the COT (cause of transmission) of 10 (ActTerm) meaning the general interrogation is over.

Configuration over USB
IOmod configuration with PuTTY terminal

Configuration of IOmod device is done through CLI (Command Line Interface) on a virtual COM port. Drivers needed for MS Windows to install VCOM will be provided. To open up CLI simply connect to specific V-COM port with terminal software (it is advised to use PuTTY terminal software. If other software is being used, user might need to send <return> symbol after each command). When connected user should immediately see main screen. Accidental close of the terminal window doesn't stop USB connection, user can connect terminal program again, and press any key on keyboard to show up main menu again.
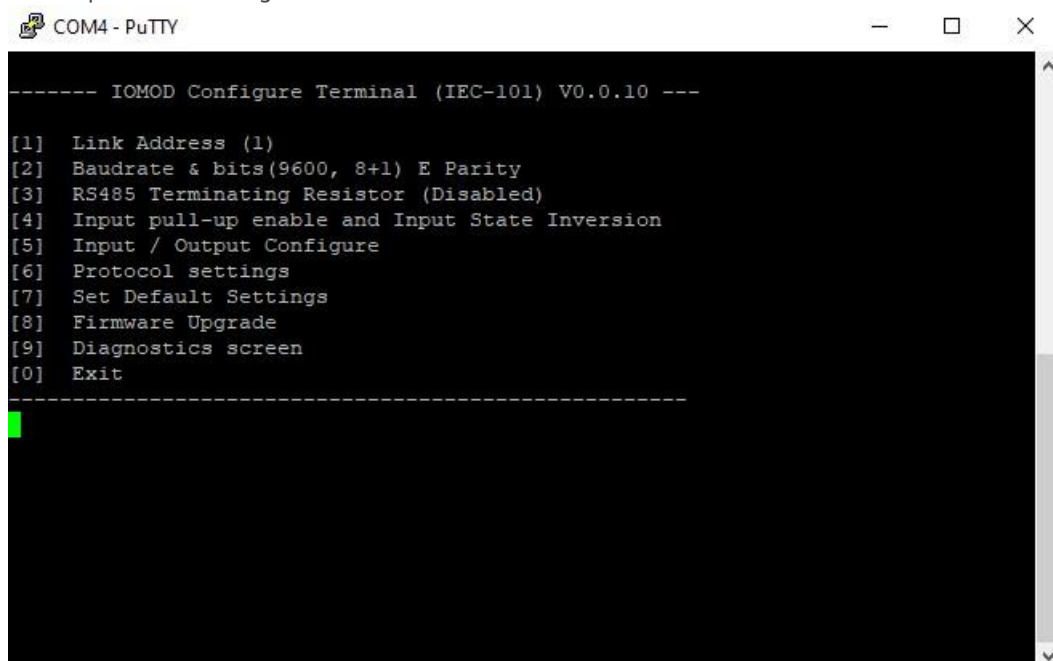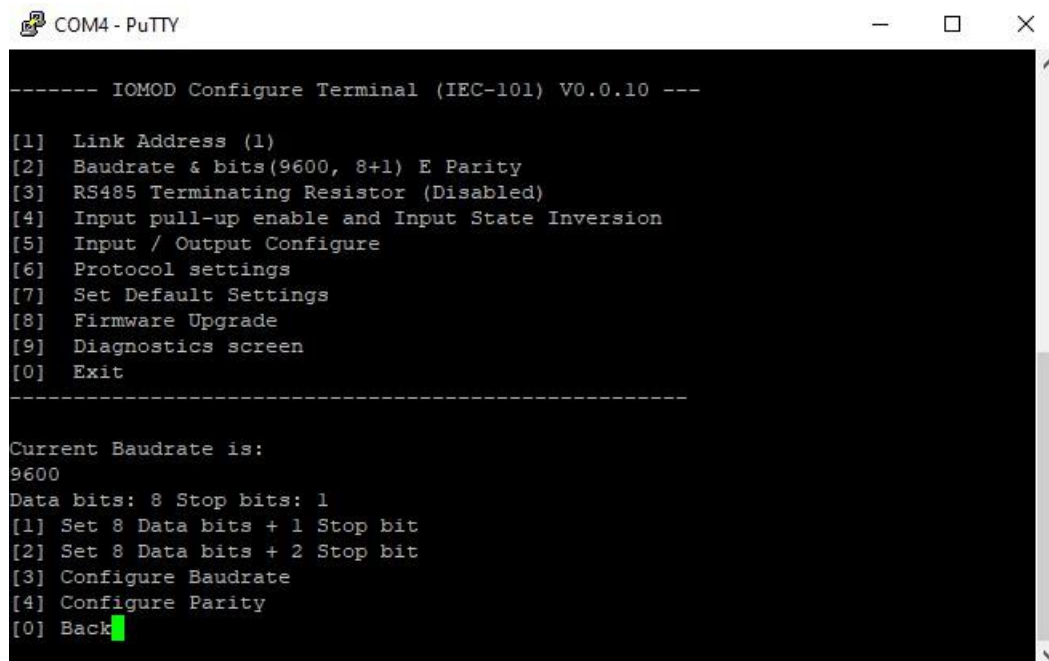

Fig. 11.

Navigation is performed by sending numbers to terminal. User then proceeds by following further on-screen instructions. For example, to set Baud rate, press [2] to enter baud rate screen, press [3] to enable or disable Terminating Resistor. When done, press [0] (exit) before disconnecting device. Default values is set by pressing [7] on main screen and confirming changes [1]. Baud rate window is shown in Fig. 8.

Fig. 12.

A lot of options can be changed after entering Input / Output configure screen (Fig. 9.). These include filter time, output pulse time, input and output configuration, output detection with inputs screens.

Fig. 13.

Input (Fig. 10.) and output grouping screen show the connection between neighbor pins. Vertical bars show that input or outputs are not grouped.

Fig. 14.

A connection between a grouped pair of inputs or outputs is depicted by a slash and a backslash that connects beneath the pair (Fig. 11.).
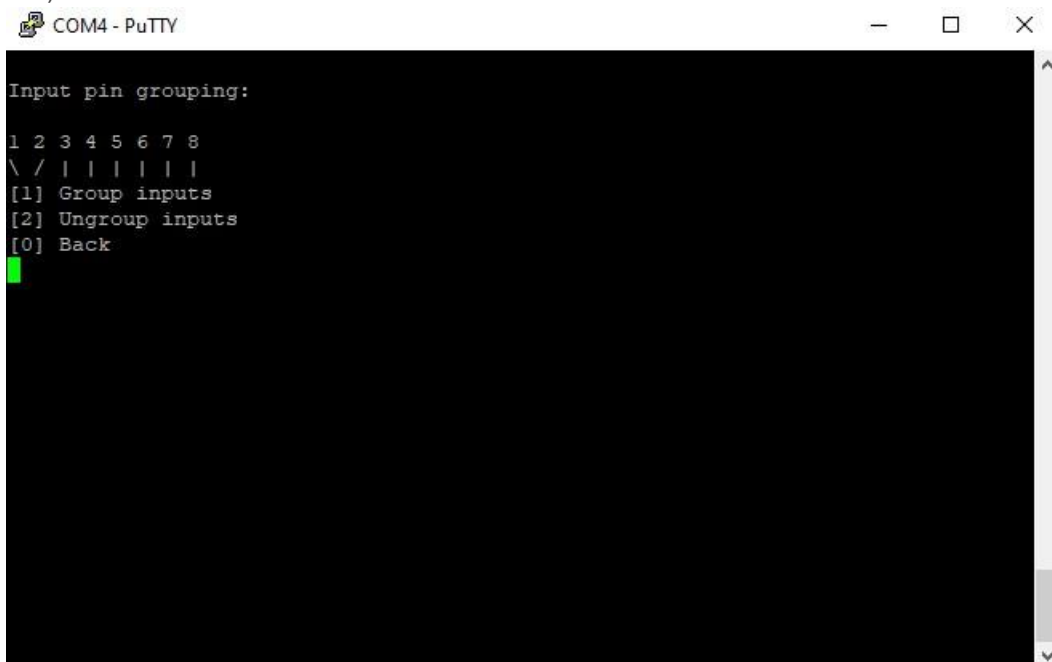

Fig. 15.

Changes in the device and firmware version are shown in a Diagnostics Screen. Such diagnostics screen for IOmod 8DI4RO is shown in Fig. 12.

Fig. 16.

Main Menu

	Menu name	Function	Values	Default values
1.	Link Address	Setts Link address	1-255	1
2.	Baudrate & bits(9600, 8+1) E Parity	Enters configuring screen for communication settings	8+1 or 8+2 (Data + Stop), None, Odd, Even, Mark, Space (Parity)	9600, 8+1, Parity -Even
3.	RS485 Terminating Resistor	RS485 120 Ohms Terminating Resistor	1 – 2 (Enable/Disable)	Disabled
4.	Input pull-up enable and Input State Inversion	Enables input pull-up resistor. Inputs then activated by low signal; Input inversion (Inverts input states in protocol logic)	1 – 2 (Enable/Disable)	Both disabled
5.	Input / Output configure	Enters screen for configuring (see 6.1 – 6.5 rows below)	-	-
5.1	Input grouping;	Groups or ungroups inputs	8 inputs ungrouped / 4 pairs grouped	All inputs ungrouped by default

5.2	Output grouping;	Groups or ungroups outputs	8 outputs ungrouped / 4 pairs grouped	All outputs ungrouped by default
5.3	Input filter time;	Input glitch filter – minimum stable time to detect input	1 – 60000 milliseconds	100
5.4	Output pulse time and select timeout;	Sets short and long pulse time and selects timeout for individual outputs.	0 – 60000 milliseconds (0 if not used)	0
6.	Protocol settings;	Sets the time mode for info objects, IOA size and enables or disables the use of command qualifier for output pulses.	-	-
6.1	Toggle 24/56 bit time	Changes toggle bit time either to 24 or to 56	24/56	56
6.2	Change IOA size	Changes IOA size	1-3	1
6.3	Toggle use of command qualifier	Enables or disables toggle use of command qualifier	Disabled/Enabled	Enabled
7.	Set default settings;	Sets Default Settings	(1 to confirm, 0 to cancel)	-
8.	Firmware update;	Mass Storage Device Firmware Upgrade	(1 to confirm, 0 to cancel)	-
9.	Diagnostics screen;	Input / Output states	-	-
0.	Exit;	Exit and disconnect	-	-

Protocol simulator

When entered diagnostics screen, user can turn on USB protocol simulator mode by pressing [9]. When protocol simulator is turned on, device will communicate through USB port rather than RS-485 line. Communication on RS-485 line is closed and all IEC-101 commands will be accepted only from USB. To exit this mode user must restart device.

Information of the equipment manufacturer

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