

User manual

ADA-DIOC40

Isolated digital INPUT & OUTPUT MODBUS module



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1. GENERAL INFORMATION

Thank you for your purchase of **CEL-MAR Company** product. This product has been completely tested and is covered by a two year warranty on parts and operation from date of sale.

If any questions or problems arise during installation or use of this product, please do not hesitate to contact Technical Support at +48 41 362-12-46 or e-mail support@cel-mar.pl.

1.1. WARRANTED INFORMATION

ADA-DIOC40 module is covered by a two year warranty from date of sale. In case of being damaged it will be repair or the damaged component will be replace. The warranty does not cover damage caused from improper use, materials consumption or any unauthorized changes. If the product does not function (is damaged), or not operate in accordance with the instructions, will be repaired or replaced.

All warranty and no warranty repairs must be returned with paid transport and insuring to the **CEL-MAR Company**.

CEL-MAR Company under no circumstances won't be responsible for ensuing damage from improper using the product or as a result of random causes: the lightning discharge, the flood, the fire and the like.

CEL-MAR Company is not be held responsible for damages and loss including: loss of profits, loss of data, pecuniary losses ensuing from using or the impossibility of using this product.

In specific cases **CEL-MAR Company** discontinue all warranties and in particular do not follow the user manual and do not accept terms of warranty by the user.

1.2. GENERAL CONDITIONS FOR SAFE USE

The device should be installed in a safe and stable places (eg, electroinstallation cabinet), the powering cable should be arranged so as not to be exposed to trampling, attaching, or pulling out of the circuit.

Do not put device on the wet surface.

Do not connect devices for nondescript powering sources,

Do not damage or crush powering wires.

Do not make connection with wet hands.

Do not adapt, open or make holes in casings of the device!

Do not immerse device in water or no other liquid.

Do not put the fire opened on device sources: candles, an oil lamps and the like.

Complete disable from the supply network is only after disconnecting the power supply circuit voltage.

Do not carry out the assembly or disassembly of the device if it is enabled. This may result to short circuit and damage the device.

The device can not be used for applications that determine human life and health (eg. Medical).

1.3. CE LABEL



CE symbol on the device CEL-MAR means compatibility with

- Electromagnetic Compatibility Directive **EMC 2014/30/WE**.

- Low Voltage Directive **LVD 2014/35/WE**.

The declaration of conformity is delivered with purchased device.



1.4. ENVIRONMENTAL PRESERVATION

This sign on the device inform about putting expended device with other waste materials. Device should send to the recycling. (In accordance with the act about the Electronic Appliance Expended from day 29 of July 2005)

1.5. SERVICE AND MAINTENANCE

ADA-DIOC40 module does not require the servicing and maintenance.

Technical support is available at number +48 41 362-12-46 in 8.00-16.00, from Monday to Friday or e-mail support@cel-mar.pl.

1.6. PACK CONTENTS

ADA-DIOC40 module, user manual, Line terminators $R_t=120W$ (2 pcs.), CD with ADAConfig software, CE declaration.

2. PRODUCT INFORMATION

2.1. PROPERTIES

- Operating on 2 or 4 wire buses in RS485/RS422 standard,
- Baud rate RS485/RS422 interfaces (bps): 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
- Data format RS485/RS422 interfaces: data bit: 5, 6, 7, 8; parity: None, Odd, Even; number of stop bits: 1, 2,
- Supported protocol: MODBUS-RTU,
- Signalling of power supply by LEDs,
- Status signalling of input and output by LEDs,
- External stable power supply 10 - 30 VDC,
- ~3kV= optoisolation between RS485/422 and input & output circuits,
- 1kV= or 3kV= galvanic isolation between RS485/RS422 interfaces and power supply,
- Connection RS485/RS422 network and power supply via screw terminal block,
- Implemented short circuit protection and over-voltage protection on RS485 / RS422 network,
- Implemented protection against power supply reverse connection,
- Cover compatible with DIN 43880 standard– mounting in typical electro-installation unit,
- Cover adapt to rail mounting according to DIN35 / TS35 standard,
- Cover dimensions (W x D x H) 53mm x 62mm x 90mm,

2.2. DESCRIPTION

ADA-DIOC40 module is the executive element, that extends control systems based on RS485-MODBUS bus with the ability to read status of circuits/devices, connected to digital input, and perform controls using the digital output. ADA-DIOC40 is dedicated to working together with PLC controllers, SCADA type software and devices supports MODBUS-RTU protocol. The module has one isolated digital input (marked on the case as DI+ and DI-), and one isolated digital output (marked on the case as DO+ and DO-). The module can communicate with master devices in communication modes like:

- a/ **Signaling of DI status** - after each change of the input status, the module sends an informing frame about that the master device,
- b/ **Modbus** – the module is working like device Modbus SLAVE type
- c/ **Signaling of DI status and Modbus** - the module is working in two above modes simultaneously - this required connection 4-wire RS485 bus from the module to the master device.

Terminal blocks 10-30VDC V+ and V- are used for power supply connection, and terminal blocks TX+/A, TX-/B, RX+, RX-, GND for RS485 bus connection.

The module has LEDs for signalling:

red LED - DI input status; yellow LED - DO output status; green LED - power supply PWR,

useful for diagnostic purposes. The module is mounting on DIN35 rail, according to DIN EN EN50022 norm.

Module configuration is via RS485/RS422 interface by the use ADAConfig software. There is also possibilities of changing the setting by the use MODBUS protocol.

2.3. VIEW AND DIMENSIONS OF THE MODULE

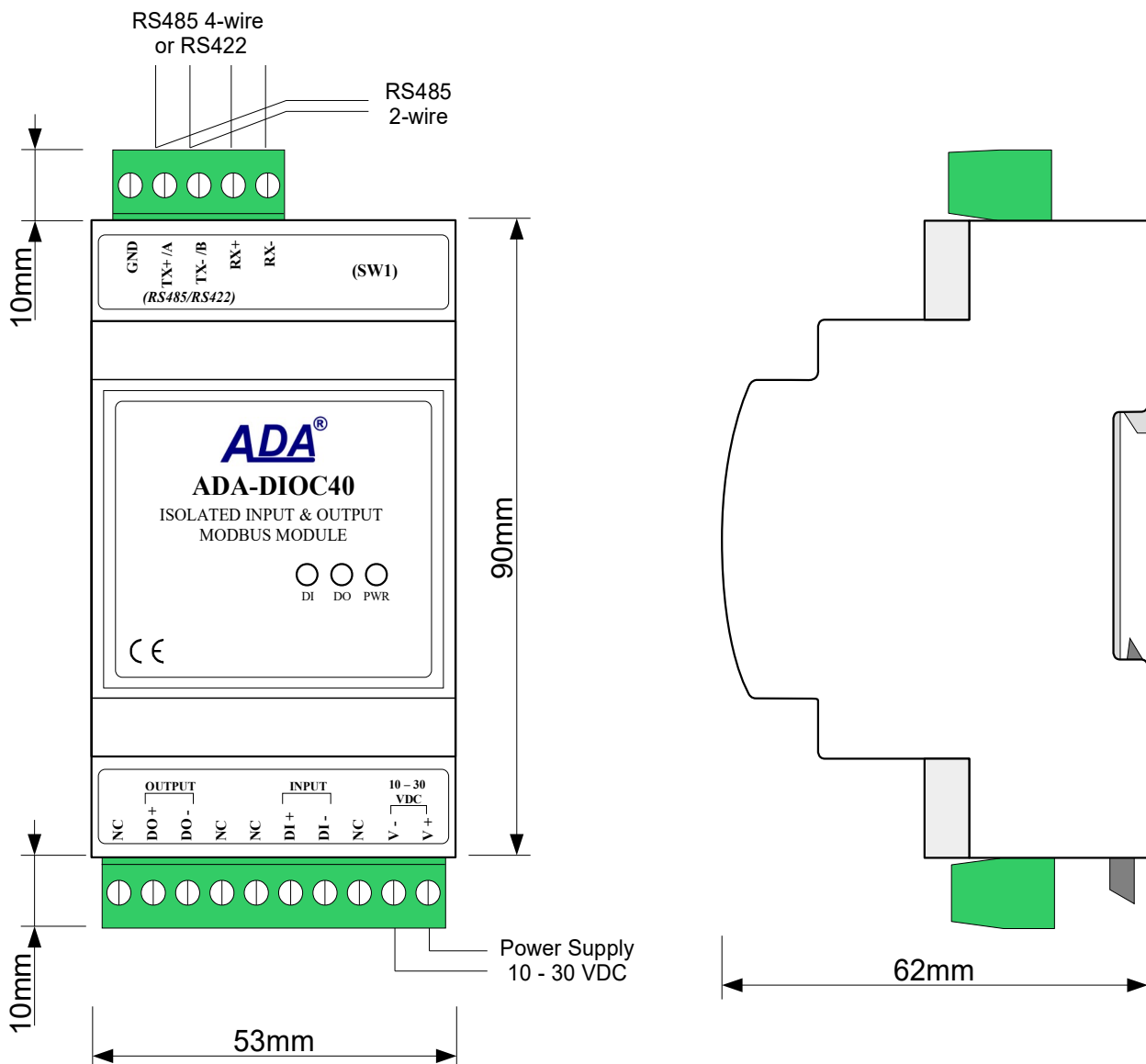


Fig. 1. ADA-DIOC40-1 view

2.4. ISOLATION

ADA-DIOC40 module has 3-way galvanic isolation on the levels 1kV= or 3kV=, depend on version described in section VERSIONS.

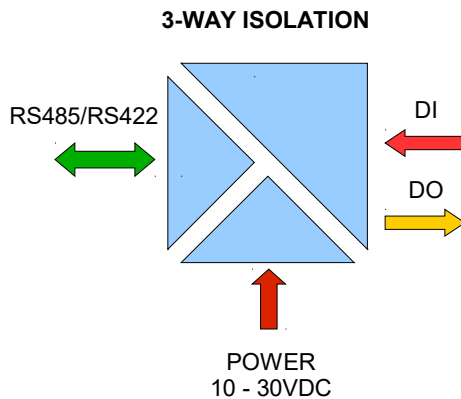


Fig 2. Isolation structure

3. INSTALLATION

This chapter will show how to correctly connect ADA- DIOC40 to RS485 bus and power supply and how connect devices to digital output and input.

In the purpose of minimization of disruptions from environment is being recommended to:

- apply multipair type shielded cables, which shield can be connected to the earthing on one end of the cable,
- arrange signal cables in the distance not shorter than 25 cm from powering cables.
- apply cable of adequate cross-section due to voltage drops for module powering,
- use suppression filters for powering module that are installed within a single object.
- not supply module from power circuit device that generates large impulse interference such as transmitters, contactors.

3.1. ASSEMBLING

The cover of ADA-DIOC40 module is adapted to assembly on TS-35 (DIN35) rail. To install the module, should be mounted on the rail upper part of the cover then press bottom part to hear characteristic „Click” sound.

3.2. COMPUTER CONNECTION

To connect ADA-DIOC40 to RS232 port or USB of PC is needed additional converter e.g. ADA-I1040 RS232 to RS485/RS422 converter or ADA-I9140 USB to RS485/RS422 converter; connected to RS485 port of ADA-DIOC40.

Typical connections of ADA-DIOC40 to PC are shown below.

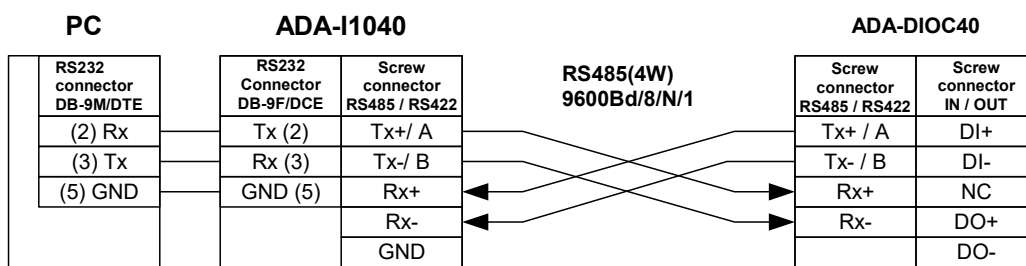


Fig 3. 4-Wires connection of ADA-DIOC40 to PC with the use of ADA-I1040 - RS232 to RS485/RS422 converter

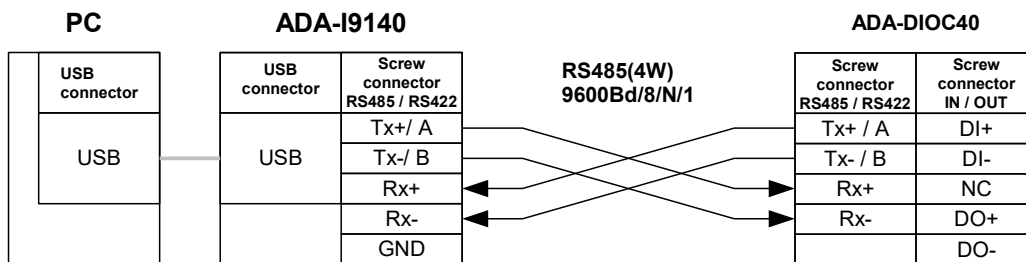


Fig 4a. 4-Wires connection of ADA-DIOC40 to PC with the use of ADA-I9140 USB to RS485/RS422

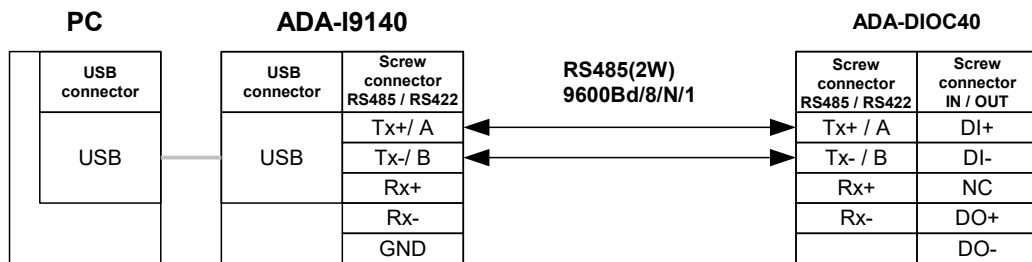


Fig 4b. 2-Wires connection of ADA-DIOC40 to PC with the use of ADA-I9140 USB to RS485/RS422

3.3. CONNECTION TO RS485/RS422 BUS

RS485/RS422 interface in ADA-DIOC40 module is described as: Tx+/A, Tx-/B, Rx+, Rx-. Connections of ADA-DIOC40 to RS485(4W) and RS485(2W) bus are shown bellow.

3.3.1. CONNECTION TO RS485(4W) BUS

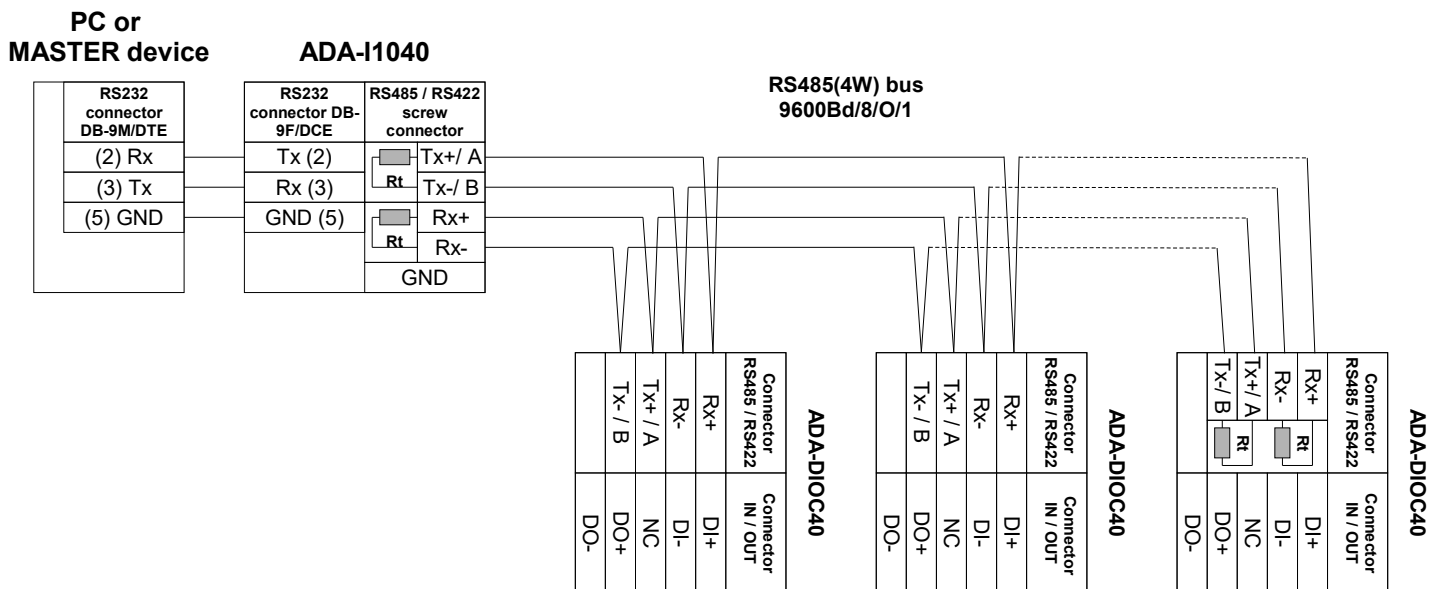


Fig 5. Example connection of ADA-DIOC40 to RS485(4W) 4-wire bus

3.3.2. CONNECTION TO RS485(2W) BUS

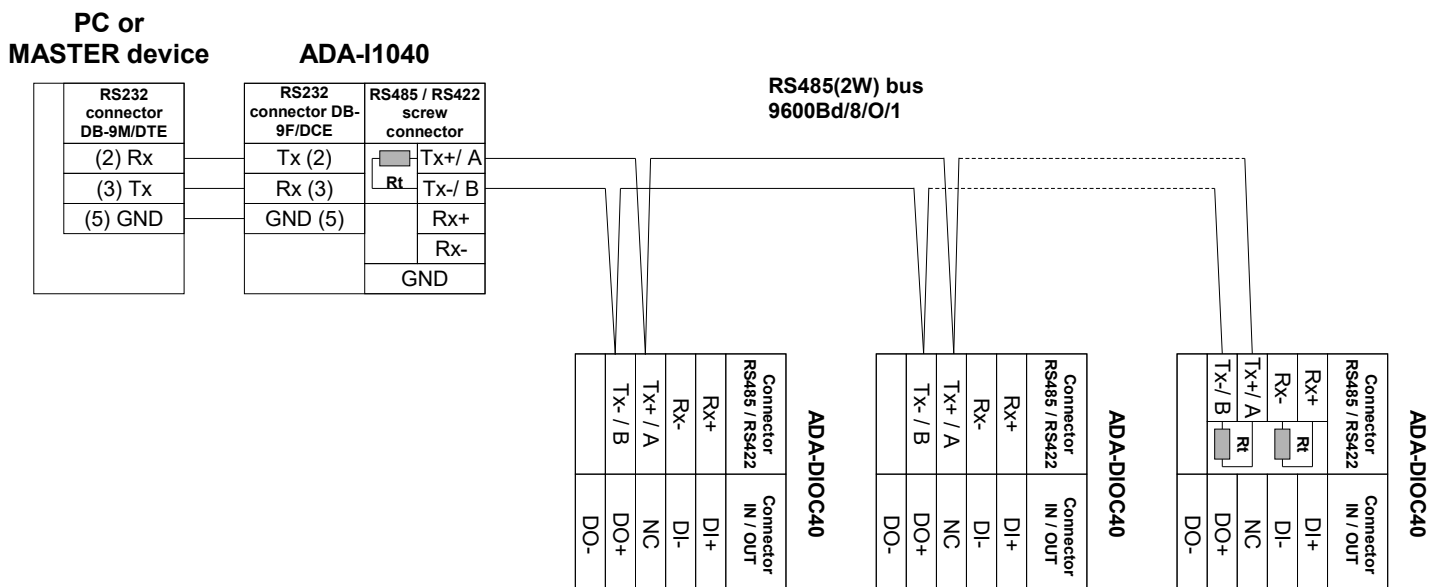


Fig 6. Example connection of ADA-DIOC40 to RS485(2W) 2-wire bus

3.3.3. GND TERMINALS CONNECTION

Connection of GND terminals of RS485/422 interfaces, devices connected to RS485/422 bus, should be done in the case of the potential difference of the signals grounds on interfaces RS485 / RS422, which prevents proper data transmission.

Cannot connect to the GND terminal - cables screens, PE circuit of electrical installation, signals grounds of other devices.

3.3.4. LINE TERMINATION Rt

The application of Line Termination (terminator) $R_t = 120$ ohms will reduce electrical reflection in data line at high baud rate. It is not needed below 9600Bd. Should be used the Line Termination resistor if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd, and if the disturbance in transmission will appear.

Example connection of R_t are shown on Fig. 5 & 6. Two $R_t = 120 \Omega$, 5%, 0,25W are delivered with the module.

3.4. CONNECTION OF CIRCUITS TO DIGITAL INPUT & OUTPUT

Digital Input & Output in ADA-DIOC40 module are available on screw terminal block, described as:

- digital input DI+, DI-,
- digital output DO+, DO-.

The method of connection the circuits to digital input and output of ADA-DIOC40 module is shown below.

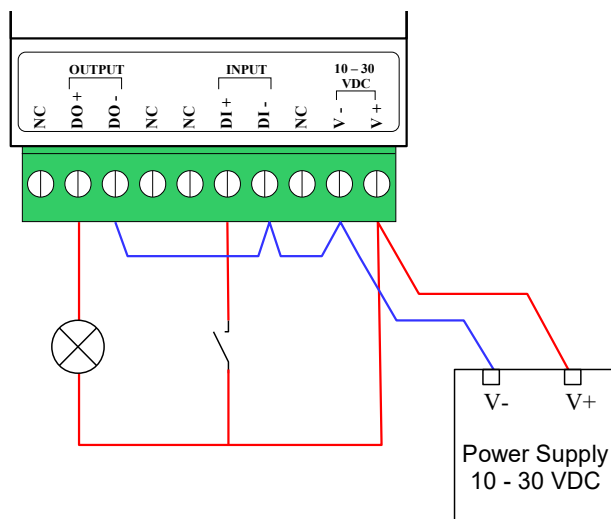


Fig 7. Example connection of circuits to input and output of ADA-DIOC40

3.4.1. CONNECTION OF QS18VP6LPQ PHOTOCELL TO DIGITAL INPUT

In case of monitoring changes of the output status QS18VP6LPQ photocell, connect it to digital input of ADA-DIOC40 module like on the figure below. Additionally, the module has to be configured to communication mode "Signalling DI Status" (see section CONFIGURATION)

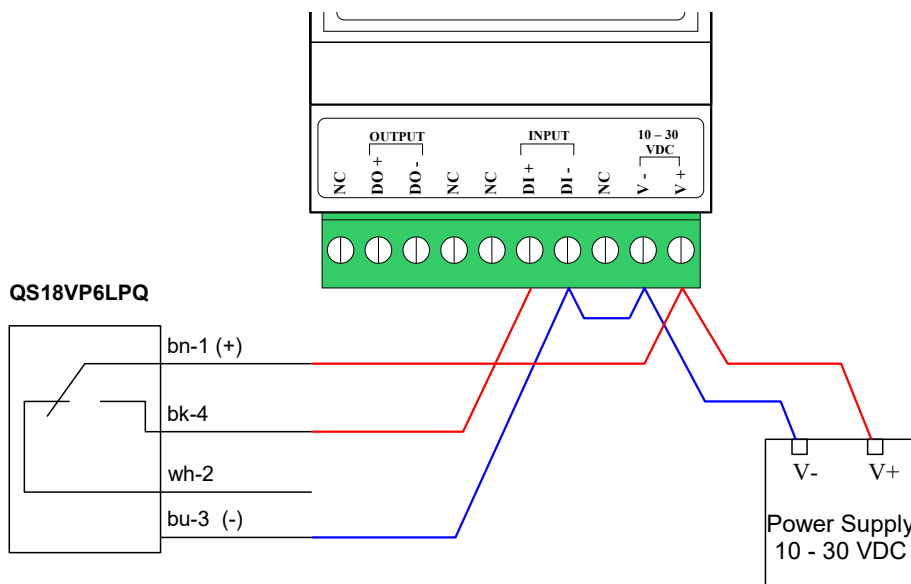


Fig 8. Example connection of QS18VP6LPQ photocell to the input of ADA-DIOC40 module

3.5. POWER SUPPLY CONNECTION

To connect power supply to the module, should have stabilized power supply with output voltage from 10 V= to 30V=, e.g. HDR-15-24. Power cable from DC power supplies to device can not be longer than 3m. Should connect positive (+) end of DC power supplies to V+ device terminal and negative (-) end to V- on terminal block. ADA-DIOC40 has protection against power supply reverse connection. If after power connection the green LED PWR on front panel is not lit, check correctness of power supply connection (polarisation).

4. ACTIVATION

The module can be power on after properly connection according to section above. If after connection power supply on front panel will not light green led PWR, check correctness of power supply connecting (polarization).

4.1. DESCRIPTION OF SIGNALLING LEDES

LED	Description
PWR	Signalling of Power Supply
RUN mode	
DI	Signalling of digital input status Red LED lights – status 0 Red LED not lights – status 1
DO	Signalling of digital output status Yellow LED lights – status 0 Yellow LED not lights – status 1
Configuration	
LED beside SW1	Blinking at frequency 1 Hz - signalling of configuration mode (see the setting of microswitch SW1)
Firmware Update	
LED beside SW1	Blinking - signalling of data transmitting of software to the module

4.2. TROUBLESHOOTING

Problem	Solutions
PWR LED is not light	Check polarization and parameters of connected power supply.
DI LED lights continuously	Check the continuity of the circuit connected to the DI input. Possible input damage.
DO LED not lights, and the output not makes control	Check the continuity of the circuit connected to the DO output. Possible output damage.

5. CONFIGURATION

5.1. OPERATION MODE

ADA-DIOC40 module can operates in a few modes::

- RUN mode,
- configuration mode,
- factory default
- emergency firmware update mode,

Those modes can be set by use SW1 located by terminal block RS455/RS422. To set the switch section, should remove terminal cover marked as SW1 and make the appropriate settings by the use a small, flat screwdriver.

All available adjusting of the SW1 switch are shown in table below.

Module operation modes

SW1- 1	SW1- 2	Mode
OFF	OFF	Run
ON	OFF	Configuration
OFF	ON	Factory default In this mode, OFF and ON the module power supply, will cause factory default setting
ON	ON	Emergency firmware update

5.2. CONFIGURATION BY USING ADACONFIG

The configuration of ADA-DIOC40 module can be made by the use of *ADAConfig* Software - selling with module.

To make the configuration, connect module to computer (see pt. *COMPUTER CONNECTION*) and power supply. If after powering, on the front panel is not lit green LED PWR, check the power connection (polarity). If the PWR LED lights, set the section of SW1 switch to configuration mode as in table below.

SW1-1	SW1-2
ON	OFF

In the configuration mode yellow LED located by SW1 micro-switch will blink with frequency 1 Hz. Start the ADAConfig Software and make the configuration of transmission parameters for RS485 interface of module and setting of address seen on RS485-MODBUS bus. First, should be set the number of COM port for communication with the module, then readout the configuration from ADA-DIOC40 memory using the button **[Read converter configuration]** and the proper changes of interface setting.

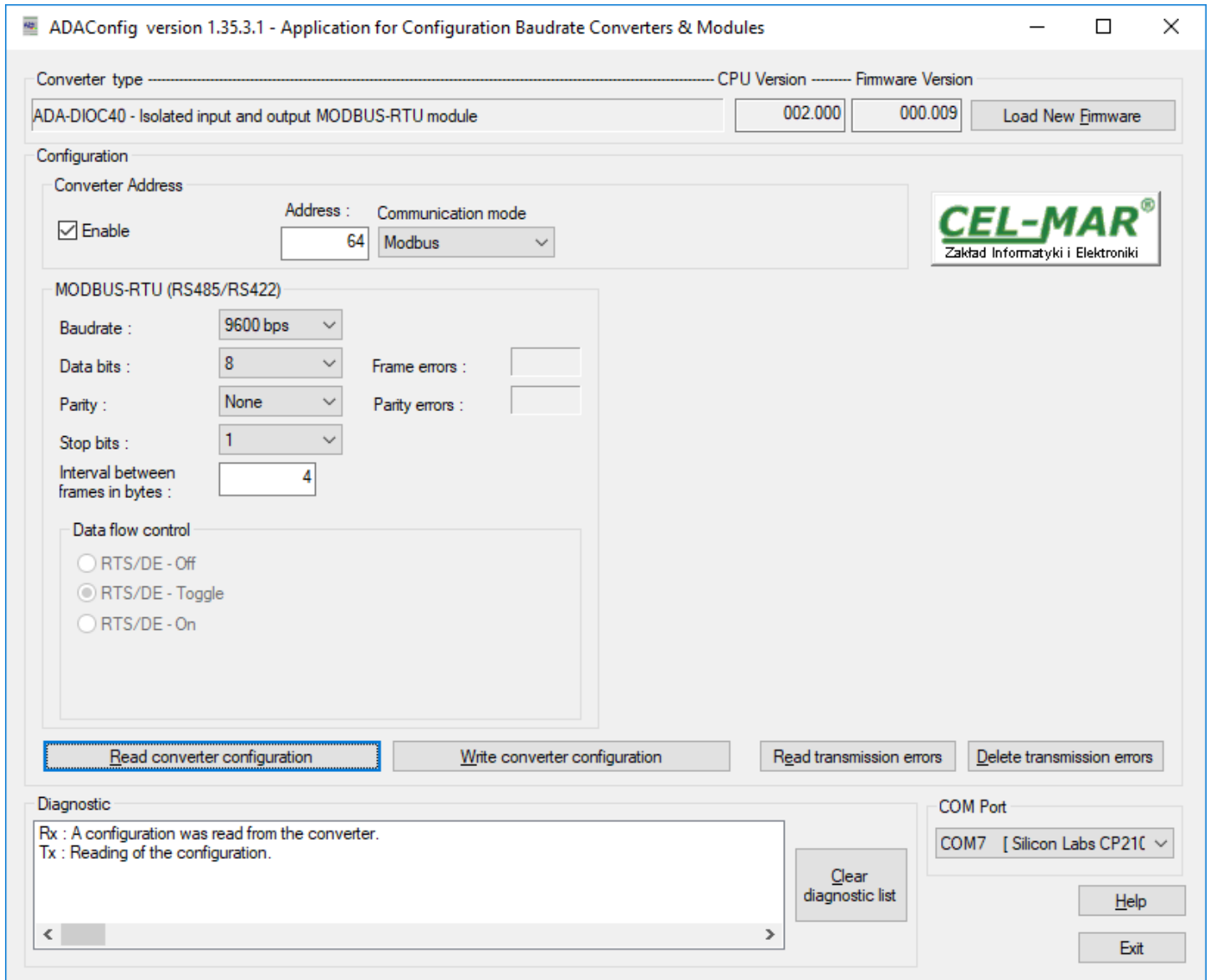


Fig 9. View of ADAConfig software interface

5.2.1. CONFIGURATION OF ADDRESSING MODE

For ADA-DIOC40 module the addressing mode is permanently enabled, therefore should be set a proper module address from range 1 - 247.

5.2.2. CONFIGURATION OF BAUD RATE AND DATA FORMAT

RS485 communication interface of module, can be set as below:

a/ baud rate (kbps): 0.3, 0.6, 1.2, 1.8, 2.4, 4.8, 7.2, 9.6, 14.4, 19.2, 28.8, 38.4, 57.6, 76.8, 115.2, 230.4,

b/ number of data bites:: 5, 6, 7, 8,

c/ control parity: no control, parity control, control of none parity,

d/ number of stop bits: 1, 2,

e/ frame spacing – range from 4 to 255 (silence time as frame's end).

5.2.3. CONFIGURATION DATA FLOW CONTROL

In the section **Data flow control** for RS485/RS422 interface, can be set – **not available at present**:

- signal DE – Off - RS485/RS422 interface operates only in receiving data mode,

- signal DE – Toggle - RS485 interface operates in receiving & transmitting data mode for RS485 bus 2-wires and 4-wires,

- signal DE – On - RS485/RS422 interface operates in RS422 mode,

5.2.4. CONFIGURATION OF MODULE COMMUNICATION MODE, IN THE RUN MODE

In the RUN mode the module can communicate with other devices in communication modes as:

- a/**Signalling of DI status** - after each change of the input status, the module sends an informing frame about that the master device,
- b/**Modbus** – the module is working like device Modbus SLAVE type
- c/**Signalling of DI status and Modbus** - the module is working in two above modes simultaneously - this required connection 4-wire RS485 bus from the module to the master device.

This mode is selected in *Comunnication mode* field, more information in point *COMMUNICATION MODES*.

After configuration the setting should be saved to the module memory by using button **[Write converter configuration]**.

Returning to operate in RUN mode is made by setting SW1 switch (the yellow LED stops lighting) as below.

SW1-1	SW1-2
OFF	OFF

5.3. FIRMWARE UPDATE

Set the SW1 microswitch to configuration mode as in table below

SW1-1	SW1-2
ON	OFF

In the configuration mode the yellow LED will blink with frequency 1Hz. Press a button **[Load New Firmware]** to change the software delivered by manufacturer. The Select File window will open (fig. below) and select the *.bin file then click **[Open]** - software will be load to *ADAConfig* buffer storage and will be checked. If the *ADAConfig* not detects errors in loaded file, change module software. Process of updating is visualized by *ADAConfig* in use Progress Window and after proper changing confirmed by correct message.

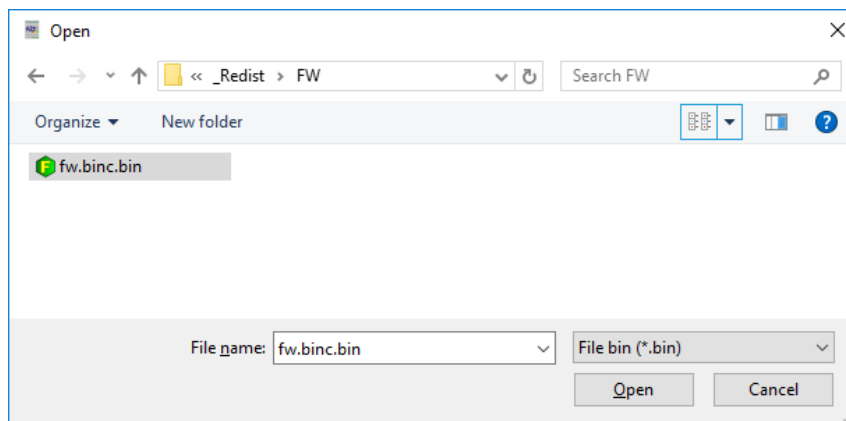


Fig 10. Selection of firmware file

During loading software the yellow LED located beside SW1 microswitch will blink, showing data flow to the module. If the software was loaded correctly yellow LED will be blink again with frequency 1 Hz.

After successful loading, set microswitch SW1 to RUN mode as shown in the table below.

SW1-1	SW1-2
OFF	OFF

Yellow LED will be OFF.

5.4. EMERGENCY FIRMWARE UPDATE

In case of the unsuccessful update of the module firmware, try again according to description in point FIRMWARE UPDATE. If the update is still incorrect use emergency firmware update. Set SW1 microswitch mode as in the table below.

SW1-1	SW1-2
ON	ON

After microswitch setting, should be restarted ADA-DIOC40, by turning OFF and then ON the power supply. The yellow LED will light continuously and the module will be in Emergency Firmware Update mode. Now follow the description in the above point.

After successful firmware update, set microswitch SW1 to the RUN mode as shown in the table below.

SW1-1	SW1-2
OFF	OFF

Yellow LED will be OFF.

5.5. FACTORY DEFAULT

In case of faulty functioning of ADA-DIOC40, like:

- no communication in the configuration mode,
 - transmission errors on RS485/422 bus,
- can be restored the factory default setting of the module internal registers.

Factory default

Parameter	RS485/RS422 interface
Module addressing - Enable	ON
Module addressing - Address	64
Baud rate	9600bps
Data bits	8
Parity	Non
Stop bits	1
Interval between frames in bytes	4
Data flow control	DE-TOG - toggle
Configuration in RUN mode	Modbus

Set the SW1 microswitch mode as in the table below.

SW1-1	SW1-2
OFF	ON

Disconnect the power and after while connect again the power. After that, will be loaded the factory default setting to the module internal registers.

Returning to operate in RUN mode is made by setting SW1 switch (the yellow LED stops lighting) as below.

SW1-1	SW1-2
OFF	OFF

5.6. DIAGNOSTICS DATA TRANSMISSION

To readout diagnostics set the SW1 microswitch to configuration mode (see pt OPERATION MODE).

Correctness of transmission proceed on RS485 interface, can be checked by readout of the errors list by ADAConfig Software from the module memory. Frames error counter will be increased, in case of: improper speed set compared to real speed of data transmission. Parity error counter will be count the errors which can arise in case of misrepresent bytes in transmitted sign.

This counter will not work in case of disable control parity.

For checking this counters press the button **[Read transmission errors]**, and to delete (zeroing of counters in the memory of the module) press **[Delete transmission errors]**.

In case of parity errors or frame errors check ADA-DIOC40 module's configuration and correctness connection of RS485 bus to RS485/422 port of the module.

When diagnostic is finish, set the SW1 microswitch to RUN mode (see pt. OPERATION MODE).

6. COMMUNICATION MODES

The module can operates in one of three communication modes:

- a/**Signalling of DI status** - after each change of the input status, the module sends an informing frame about that the master device,
- b/**Modbus** – the module is working like device Modbus SLAVE type
- c/**Signalling of DI status and Modbus** - the module is working in two above modes simultaneously - this required connection 4-wire RS485 bus from the module to the master device.

6.1. SIGNALLING MODE OF CHANGE DIGITAL INPUT STATUS

In this mode **Signalling of DI status** – the module sends after each change of the input status, informing frame about that the master device. Types of send frames ware described below.

When input status was changed from 0 to 1, the module will send the frame to control system in the form of a string of bytes [HEX]

40 64 02 01 00 9A AF

where:

0x40 – module address

0x64 – signalling function of change input status

0x02 – number of data bytes

0x01 – data1: current input status

0x00 – data2: previous input status

0x9A – checksum CRC16 -Low

0xAF – checksum CRC16 -Hi

When input status was changed from 1 to 0, the module will send the frame to control system in the form of a string of bytes [HEX]

40 64 02 00 01 5A FF

where:

0x40 – module address

0x64 – signalling function of change input status

0x02 – number of data bytes
 0x00 – data1: current input status
 0x01 – data2: previous input status
 0x5A – checksum CRC16 -Low
 0xFF – checksum CRC16 -Hi

Checksum CRC16 is countered from first byte (0x40) to last data bytes data2 (together with this byte).
 Generating polynomial CRC16 (MODBUS) = 0xA001

6.2. MODBUS-RTU COMMUNICATION MODE

6.2.1. TABLE OF MODBUS ADDRESSES

6.2.1.1. BINARY OUTPUT STATUS FUNCTION 0x01 [0X-REFERENCES]

The module has 1 binary output, OC type marked as DO.

Register address	Modbus address	Description	Attr.	Function
00001	0	Output status	R/W	01/05

6.2.1.2. BINARY INPUT STATUS FUNCTION 0x02 [1X-REFERENCES]

The module has 1 binary input, marked as DI.

Register address	Modbus address	Description	Attr.	Function
10001	0	Input status	R	02

6.2.1.3. HOLDING REGISTERS READ BY FUNCTION 03 [4X – REFERENCES]

Register address	Modbus address	Description	Attr.	Function
40001	0	Output status	R/W	03/06
40002	1	Input status	R	03
40003	2	Input status change counter from 0 to 1 MSB	R/W	03/06
40004	3	Input status change counter from 0 to 1 LSB	R/W	03/06
40005	4	Input status change counter from 1 to 0 MSB	R/W	03/06
40006	5	Input status change counter from 1 to 0 LSB	R/W	03/06
40007	7	Empty	R/W	03/06

6.2.2. CONSTRUCTING FRAME OF MODBUS PROTOCOL

Device address	Function	Data	CRC-16Lo	CRC-16Hi
----------------	----------	------	----------	----------

6.2.3. MODBUS PROTOCOL FUNCTIONS

Function code	Description	Supported
01 (0x01)	Readout of binary output status	YES
02 (0x02)	Readout of binary input status	YES
03 (0x03)	Readout of holding registers	YES
05 (0x05)	Change of single output status	YES
06 (0x06)	Change of single register value HR	YES

6.2.3.1. FUNCTION 0x01 - READOUT OF BINARY OUTPUT STATUS

Function 0x01 is used to readout status (ON / OFF) of the binary output.
 The status of each binary output is presented one bit:

- 0** – means that binary output is in OFF status OFF – disable
- 1** – means that binary output is in ON status – enable

Register of the binary output status is 16-bits

Query

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x01
02	Output address Hi	1 Byte	0x00
03	Output address Lo	1 Byte	0x00
04	Output number Hi	1 Byte	0x00
05	Output number Lo	1 Byte	0x01
06	CRC-Lo	1 Byte	---
07	CRC-Hi	1 Byte	---

Example. Readout of the output status 1 (address x00001 to x00001)
01-01-00-00-01-CRCLo-CRCHi

Response

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x01
02	Data bytes number	1 Byte	0x01
03	Dane-1	1 Byte	0x01
04	CRC-Lo	1 Byte	---
05	CRC-Hi	1 Byte	---

Example. Readout of the output status 1 (address x00001 to x0001) output status ON.
01-01-01-01-CRCLo-CRCHi

In the response, the status of output 1 is presented as byte with value 0x01, is equal 0000 0001 binary.

Response - in case of error

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x81
02	Error code	1 Byte	0x01 - unknown function 0x02 - unknown data address 0x03 - unknown data value 0x04 - unknown error occurred while processing the query
03	CRC-Lo	1 Byte	---
04	CRC-Hi	1 Byte	---

6.2.3.2. FUNCTION 0X02 - READOUT OF BINARY INPUT STATUS

Function 0x02 is used to readout status (ON / OFF) of binary input.
The status of each binary input is presented one bit:

- 0** – means that binary input is in OFF status OFF – disable
- 1** – means that binary input is in ON status – enable

Register of the binary input status is 16-bits

Query

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x02
02	Input address Hi	1 Byte	0x00
03	Input address Lo	1 Byte	0x00
04	Input number Hi	1 Byte	0x00
05	Input number Lo	1 Byte	0x01

Byte no.	Description	Size	Value
06	CRC-Lo	1 Byte	---
07	CRC-Hi	1 Byte	---

Example. Readout of the input status 1 (address x10001 to x10001)
01-02-00-00-00-01-CRCLo-CRCHi

Response

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x02
02	Data bytes number	1 Byte	0x01 [depend on query]
03	Data-1	1 Byte	0x01
04	CRC-Lo	1 Byte	---
05	CRC-Hi	1 Byte	---

Example. Readout of the input status 1 (address x10001 to x10001) input status ON.
01-02-01-01-CRCLo-CRCHi

In the response, status of input 1, is presented as byte with value 0x01, it is equal 0000 0001 binary.

Response - in case of error

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x82
02	Error code	1 Byte	0x01 - unknown function 0x02 - unknown data address 0x03 - unknown data value 0x04 - unknown error occurred while processing the query
03	CRC-Lo	1 Byte	---
04	CRC-Hi	1 Byte	---

6.2.3.3. FUNCTION 0X03 – READOUT OF HOLDING REGISTERS

Function 0x03 is used to readout of 16 bits holding register.

Query

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x03
02	Register address Hi	1 Byte	0x00
03	Register address Lo	1 Byte	0x00
04	Register number Hi	1 Byte	0x00
05	Register number Lo	1 Byte	0x02
06	CRC-Lo	1 Byte	---
07	CRC-Hi	1 Byte	---

Example. Readout of output and input status (address 40001 to 40002)
01-03-00-00-00-02-CRCLo-CRCHi

Response

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x03
02	Data bytes number	1 Byte	0x04 [depend on query (4)]
03	Data1-Hi	1 Byte	0x00
04	Data1-Lo	1 Byte	0x01

Byte no.	Description	Size	Value
05	Data2-Hi	1 Byte	0x00
06	Data2-Lo	1 Byte	0x01
07	CRC-Lo	1 Byte	---
08	CRC-Hi	1 Byte	---

Example. Readout of output and input status (address 40001 to 40002)
01-03-04-00-01-00-01-CRCLo-CRChi

In the response, status of output 1 and input 1, are presented as 4-bytes with values: 00-01-00-01

Response - in case of error

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x83
02	Error code	1 Byte	0x01 - unknown function 0x02 - unknown data address 0x03 - unknown data value 0x04 - unknown error occurred while processing the query
03	CRC-Lo	1 Byte	
04	CRC-Hi	1 Byte	

6.2.3.4. FUNCTION 0X05 – CHANGE OF SINGLE OUTPUT STATUS

Function 0x05 is used to change of single output status

Query

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x05
02	Input address Hi	1 Byte	0x00
03	Input address Lo	1 Byte	0x00
04	Command Hi	1 Byte	0x00 0xFF
05	Command Lo	1 Byte	0x00 0x00
06	CRC-Lo	1 Byte	---
07	CRC-Hi	1 Byte	---

Example. Disabling the output with the address 0x00
01-05-00-00-00-00-CRCLo-CRChi

Example. Enabling the output with the address 0x00
01-05-00-00-FF-00-CRCLo-CRChi

Response

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x05
02	Output address Hi	1 Byte	0x00
03	Output address Lo	1 Byte	0x00
04	Command Hi	1 Byte	0x00 0xFF
05	Command Lo	1 Byte	0x00 0x00
06	CRC-Lo	1 Byte	---
07	CRC-Hi	1 Byte	---

Example. Confirmation of disabling the output with the address 0
01-05-00-00-00-00-CRCLo-CRChi

Example. Confirmation of enabling the output with the address 0
01-05-00-00-FF-00-CRCLo-CRCHi

Response - in case of error

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x85
02	Error code	1 Byte	0x01 - unknown function 0x02 - unknown data address 0x03 - unknown data value 0x04 - unknown error occurred while processing the query
03	CRC-Lo	1 Byte	
04	CRC-Hi	1 Byte	

6.2.3.5. FUNCTION 0X06 – CHANGE OF SINGLE HOLDING REGISTER VALUE

Function 0x06 is used to change of single register value.

Query

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x06
02	Register address Hi	1 Byte	0x00
03	Register address Lo	1 Byte	0x02
04	Register value Hi	1 Byte	0x00
05	Register value Lo	1 Byte	0x01
06	CRC-Lo	1 Byte	---
07	CRC-Hi	1 Byte	---

Example. Writing the value 0x01 to the register with the address 0x02 (40003).
01-05-00-02-00-01-CRCLo-CRCHi

Response

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x06
02	Register address Hi	1 Byte	0x00
03	Register address Lo	1 Byte	0x02
04	Register value Hi	1 Byte	0x00
05	Register value Lo	1 Byte	0x01
06	CRC-Lo	1 Byte	---
07	CRC-Hi	1 Byte	---

Example. Confirmation of saving 0x01 value to register of 0x02 (40003) address.
01-05-00-02-00-01-CRCLo-CRCHi

Response - in case of error

Byte no.	Description	Size	Value
00	Module address	1 Byte	0x01 [1 to 247]
01	Function code	1 Byte	0x85
02	Error code	1 Byte	0x01 – unknown function 0x02 – unknown data address 0x03 – unknown data value 0x04 – unknown error occurred while processing the query
03	CRC-Lo	1 Byte	
04	CRC-Hi	1 Byte	

6.2.4. CRC CHECKSUM

Checksum CRC-16-MODBUS frames, is calculated for all frame bytes.

6.3. COMMUNICATION MODE OF SIGNALLING OF CHANGE DIGITAL INPUT STATUS AND MODBUS

In this mode **Signalling of DI status and Modbus** – the module is working in two above modes simultaneously - this required connection 4-wire RS485 bus from the module to the master device.

7. VERSIONS

Version:	ADA-DIOC40 - <input type="text"/> - <input type="text"/>
Standard	1
3-way galvanic isolation:	
1kVDC	23
3kVDC	33

Order example:
Product Symbol: **ADA-DIOC40-1-23**
1 – standard version,
23 – 1kV=, 3-way galvanic isolation,

8. SPECIFICATION

TECHNICAL DATA	
Transition Parameters	
Interface	RS485/RS422
Connector	Screw terminal, wire max. Ø 2,5mm ²
Line length	Up to 1200 m
Max. number of connected device	Up to 32
Baud rates (bps)	300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
Data formats	Data bits 5, 6, 7, 8, Parity: None, Parity, Odd, Number of stop bits: 1, 2,
Transmission line	Twisted cable 1-pair or 2-pair, UTP Nx2x0,5 (24AWG), shield inside large interferences STP Nx2x0,5(24AWG).
Transmission type	Asynchronism full duplex, half duplex.
Standards	EIA-485, CCITT V.11
Optical signalisation	<ul style="list-style-type: none"> • PWR – green LED power supply, • DI - red LED input status, • DO - yellow LED output status,
Communication protocol	MODBUS-RTU
Digital Input Parameters	
Number of inputs	1
Input voltage range	0 – 30V DC
Low status „0”	0 – 5,5V DC
High status „1”	6,5 – 30V DC
Input resistance	3kΩ
Optical isolation	3kV DC
Input type	Isolated transoptor
Digital Output Parameters	
Number of output	1
Max. current and voltage	20mA DC / 30V DC
Optical isolation	3kV DC
Output type	OC – Open Collector (PNP)
Electrical Parameters	
Power requirements	10 - 24 – 30 V DC
Power Cable	Recommended length of power cable – up to 3m.
Power	<2W

Protection from reverse power polarization	YES
Galvanic Isolation	1kVDC or 3kVDC between power circuit and RS-485/RS-422 – depend on version.
Optoisolation	~3kV – between input&output circuits and module electronics
Electromagnetic compatibility	Resistance to disruptions according to the standard PN-EN 55024. Emission of disruptions according to the standard PN-EN 55022.
Safety requiring	According to the PN-EN60950 norm.
Environment	Commercial and light industrial.
Environmental Parameters	
Operating temperature	-25 ÷ +23 ÷ +50°C
Humidity	5 ÷ 95% - non-condensing
Storage temperature	-40 ÷ +70 °C
Casing	
Dimensions	53 x 90 x 62 mm
Material	ABS/PC (self-extinguishing)
Degree of casing protection	IP40
Degree of terminal protection	IP20
Weight	0,20 kg
According to standard	DIN EN50022, DIN EN43880
Location during work	Free
Mounting method	On the rail compliant with DIN35 / TS35 standard.

Dear Customer,

Thank you for purchasing **CEL-MAR Company** products.

We hope that this user manual helped connect and start up the **ADA-DIOC40 module**. We also wish to inform you that we are a manufacturer of the widest selections of data communications products in the world such as: data transmission converters with interface RS232, RS485, RS422, USB, Current Loop, Fibre-Optic Converters and Ethernet or Wi-Fi.

Please contact us to tell how you like our products and how we can satisfy you present and future expectation.

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