

# M2M IO/RS485 CONCENTRATOR 16DI<sup>®</sup>

## User Manual



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# Document specifications

This document was made by the *WM Systems LLC*. for the **M2M IO/RS485 CONCENTRATOR 16DI<sup>®</sup>** device.

The User Manual contains the description of the product related technical data, configuration.

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# Chapter 1. Introduction

## 1.1 Product Overview

16 channel isolated digital I/O concentrator for industrial automation, smart metering and building automation.

Our data concentrator and digital I/O module is the ideal product for IoT system integrators.

The product is used to read data from multiple front-end I/O field devices over one communication link and make the data available real-time to a back-end management system through another.

This way conventional devices can be attached to a modern control system and through standard

Modbus protocol easily communicate with most SCADA/ HMI systems and PLCs.

The device provides the ability to save Data Logger information to an internal non-volatile memory, allowing real-time data reception of the 16 input channels to be recorded.

The input data (counter registers) can be sent by a connected modem or router through the RS485 output transparently (RTU over IP) or with RTU↔TCP conversion, and the data can be read out by the data center.

Thankful to the Modbus RTU and RS485 data connection there can be connected up to 254 devices into the same network, which is suitable to query max. 4064 endpoints.

Thanks to the Modbus protocol, it can be easily integrated into a Scada environment or for local data collection into a PC- or a PLC environment to display on an HMI.

Our data concentrator has an IP31 protected, flame-proof plastic housing. It has protected and

isolated digital inputs and a surge protected output. In combination with a cellular modem or router, it is suitable for reliable, real-time input monitoring, which all makes the device to one of the most cost-effective products of industrial IoT.

### Features

- Continuous counting of input signals of meter devices (water, gas, electricity, etc.)

- Readout the status of connected inputs
- Accept reed and hall sensor output from meters
- 16 channel isolated digital inputs
- Standard ModBus protocol allows for up to 254 devices
- RS485 output with surge protection
- Static electricity and lightning protection for each input

## **Digital Inputs**

- Input modes: wet contact / dry contact / TTL / open-collector
- Input range: between +4V and +36V
- Input channels also can work as 32-bit counter input (counters stored into Flash memory when power off)
- Input channel number is configurable, can be set up from 1 channel through 16 channels to improve frequency for small count input
- Frequency: 100Hz / 16 channels, 1000Hz / 1 channel
- Counter frequency: 0 - 200Hz / for 16 channels, 1000Hz / for 1 channel
- Counter resolution: 0.1Hz
- Counter length: 32-bit, 4 bytes
- Each of input can be enabled or disabled
- Terminal block for wiring

## **Output**

- RS485 port - isolated by high speed opto-couplers (terminal block)
- Surge protection, to reduce interference by serial port (RS485) communication
- Standard Modbus protocol communication (allows for up to 254 unique devices on one RS485 network)
- Surge-protected RS485 port, which ensure reliability
- Terminal block for wiring

## **Operation**

- Watchdog to monitor operation
- Operation indication by LED signals

## Design and outfit

- IP31 protected, flame proof plastic enclosure /Surface mount
- Operating: from -20°C to +85°C / Storage: from -40°C to +100°C at 10-90% r.h.

## Compatibility

- Industrial RS485 Modem®
- M2M Industrial Router®
- M2M Industrial Router Mbus®
- M2M Industrial Router wMbus®
- M2M PRO4 DCU®
- M2M PRO4 DCU Mbus®
- M2M PRO4 Modem®
- M2M Router PRO4®
- M2M Modbus RS485 IO Gateway®
- Modbus compatible PLC systems, Scada and metering applications

## 1.2 Technical Description

IIoT I/O & RS485 CONCENTRATOR 16 DI ®		
<b>Power</b>	<b>Voltage</b>	• 24V AC/DC power supply
	<b>Current</b>	• Max. 0.6W
<b>Interfaces</b>	<b>Inputs</b>	<ul style="list-style-type: none"> <li>• Input channels: 16 pcs isolated digital inputs (terminal blocks)</li> <li>• Input range: between +4V and +36V</li> <li>• Input signal: wet contact, dry contact, TTL, open-collector</li> <li>• Input channel number is configurable, can be set up from 1 channel through 16 channels to improve frequency for small count input</li> <li>• Counter frequency: 0 - 200Hz / for 16 channels, 1000Hz / for 1 channel</li> <li>• Counter resolution: 0.1Hz</li> <li>• Counter length: 32-bit, 4 bytes</li> <li>• Each of input can be enabled or disabled</li> </ul>
	<b>Output</b>	<ul style="list-style-type: none"> <li>• Output: RS485 port - isolated by high speed opto-couplers (terminal block)</li> <li>• Standard Modbus protocol communication (allows for up to 254 unique devices on one RS485 network)</li> <li>• Surge-protected RS485 port, which ensure reliability</li> </ul>
<b>Indication</b>	<b>LED indication</b>	• Operation indication by LED signals
<b>Device operation</b>	<b>Main features</b>	<ul style="list-style-type: none"> <li>• Continuous counting of input signals of meter devices (water, gas, electricity, etc.)</li> <li>• Accept reed and hall sensor output from meters</li> <li>• Readout the status of connected inputs</li> <li>• Counter values are stored in flash memory</li> <li>• Watchdog to monitor operation</li> </ul>
<b>Protection</b>	<b>Protection</b>	<ul style="list-style-type: none"> <li>• Input protection: against lightning, static electricity</li> <li>• Output protection: against lightning, static electricity</li> <li>• Isolation voltage: 3000V</li> </ul>
<b>Construction</b>	<b>Temperature range</b>	• Operating: from -20°C to +85°C at 10-90% rel. humidity    • Storage: from -40°C to +100°C at 10-90% rel. humidity
	<b>Enclosure</b>	• IP31 protected, flame proof plastic enclosure    • Surface mount
	<b>Dimensions/Weight</b>	• 100 x 69 x 25 mm    • 100gr

## 1.3 Operation

The concentrator can receive and count signals of max. 16 connected devices and stores them into the non-volatile Flash memory (against power outages for saving the register values into the memory).

External devices can read counter registers over Modbus protocol (up to 254 devices, where max. 4064 endpoint can be queried) via the RS485 connection.

The module is writing the data to the RS485 BUS, where an external connected modem or router can receive the data and transmit via cellular network to the data center.

The operation status of the digital module is signed on LED signals.

## 1.4 Port connections

### ▪ 16 Digital Inputs (terminal block)

- Vcc1: 24VDC power source for the DI1-DI8 inputs (in case of voltage input mode)
- DI1-DI8: 8pcs isolated digital inputs
- Vcc2: 24VDC power source for the DI9-DI16 inputs (in case of voltage input mode)
- DI9-DI10 and DI11-DI16: 8pcs isolated digital inputs
- DGND: common ground (GND) for the inputs – for DI1-DI16 (available in DRY (contact) input mode)



Every input has a 32 bit counter for receiving 1000Hz frequency / the channel (0-200Hz for 16 channels) for the signals. The current counter and status of the input line can be read out.

- **RS485 output connection (terminal block)**

- RGND: RS485 grounding
- DATA+: connect the wire A of RS485 cable
- DATA-: connect the wire B of RS485 cable

The RS485 output is capable for register read and write registers to the RS485 BUS. Use an RS485-to-USB adapter for PC connection.

Also can be used for data sending through a connected modem or router.

- **Power (terminal block)**

- For connecting 24V DC power source
  - 24V: for DC power source, connect the positive end
  - GND: grounding, negative end
- For connecting 24V AC power source
  - 24V: for AC power source, connect the hot line
  - GND: grounding, neutral line

- **Reset to default settings**

- INIT: make a short between the INIT and the GND (or use a jumper)

## **1.5 RS485 BUS / Modbus information (factory configuration)**

Address of device: 254

Baudrate: 19 200

Channel: enable all channels

Filtering: 200us for frequency input

## 1.6 LEDs

- **Heart (red LED):** Flashing when the system is working
- **Comm (green LED):** Flashing when serial port (RS485) communication is working

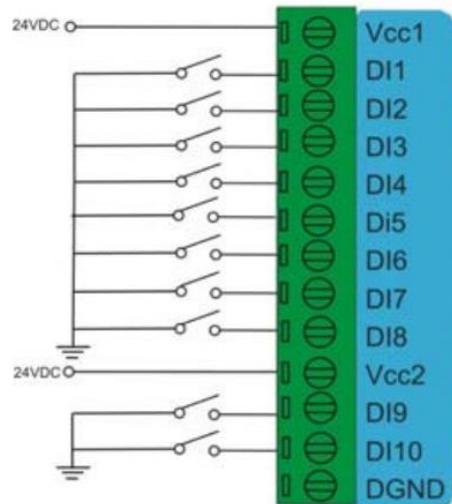
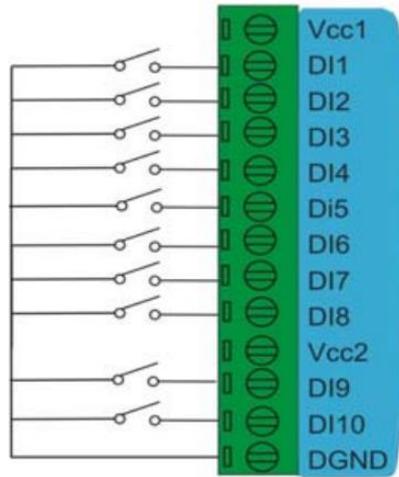


## 1.7 Input modes - wiring

You can choose between different input modes at wiring. The following examples show possible operation modes for the left DI1-DI10 inputs. You can continue wiring of opposite right DI11-DI16 inputs – the same way as it has been described.

### **Dry (contact) inputs:**

1. According to the chapter 1.8 set the internal jumper to DRY mode.
2. Wire the cables to the required inputs and close the cable with the DGND (common grounding).
3. The device will be continuously counting the input changes.



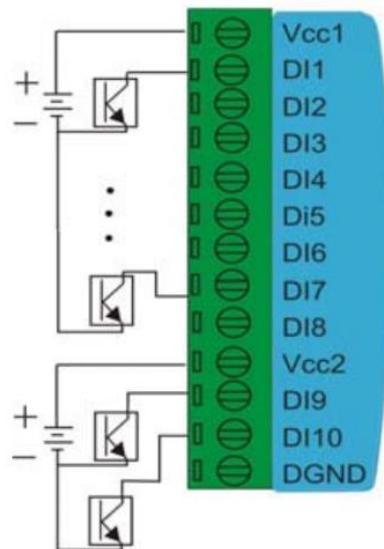
**Wet (voltage) input:**

1. According to the chapter 1.8 set the internal jumper to WET mode.
2. Wire the cables to the required inputs
3. In case of using DI1-DI8 wire 24V DC power to the Vcc1 input.
4. In case of using DI9-DI16 wire 24V DC power to the Vcc2 input.
5. A common ground is necessary to wire for the inputs.
6. The device will be continuously counting the input changes.

**Open collector input:**

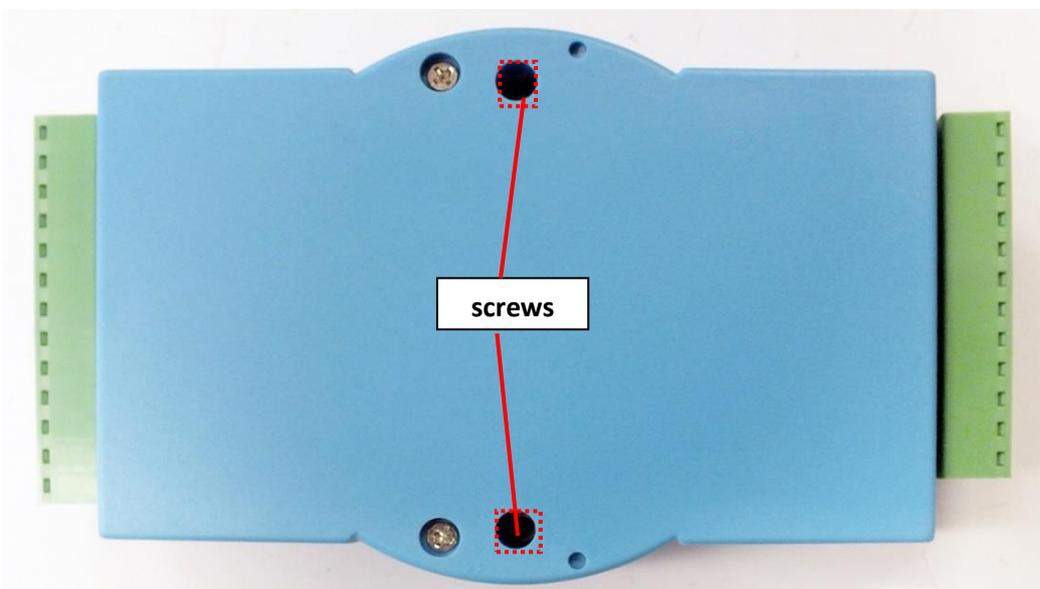
1. Wire the required inputs in the way, that wire 24V DC power to the positive (+) side (in case of DI1-DI8 to the Vcc1 power input / in case of DI9-DI16 to the Vcc2 power input).
2. Connect the input to the negative (-) wire, according to the next figure.

3. Every other inputs should be connected to the common negative (-) wire, according to the next figure.

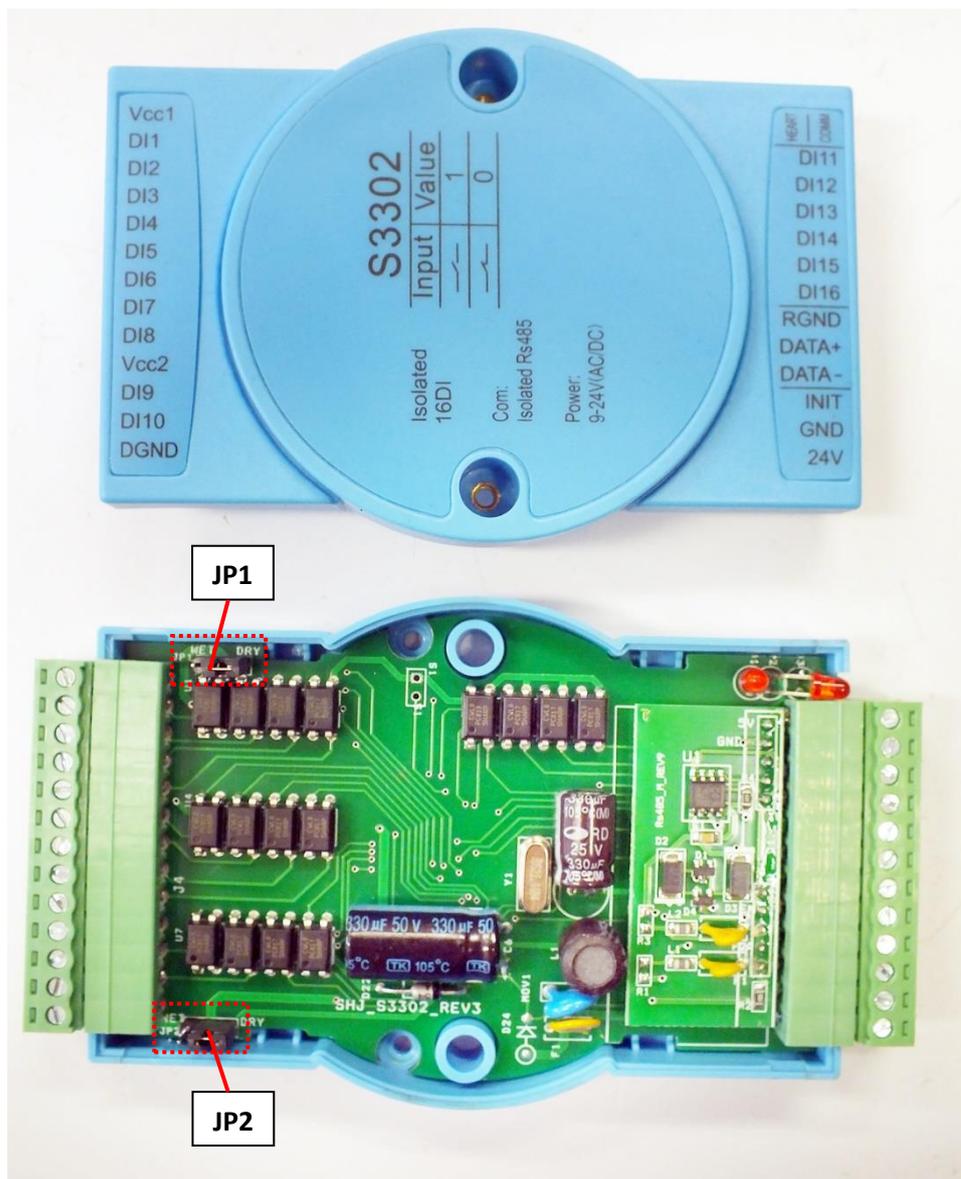


## 1.8 Input modes - jumpering

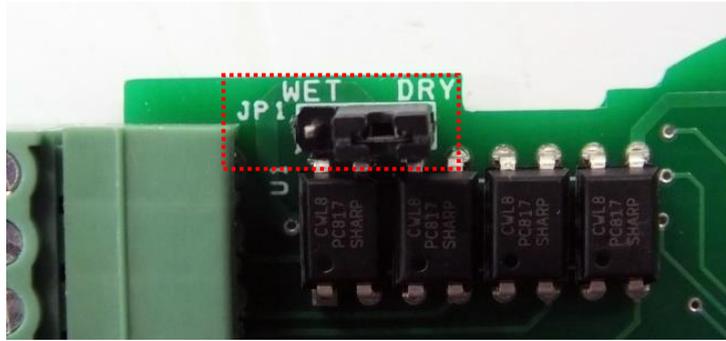
You can choose between different input modes – DRY (contact) or WET (voltage) - during the usage. The operation modes of the inputs can be triggered by internal jumpers – independently for the left DI1-DI8 inputs (by the upper JP1 jumper) or at the right DI9-DI16 inputs (by the lower JP2 jumper).



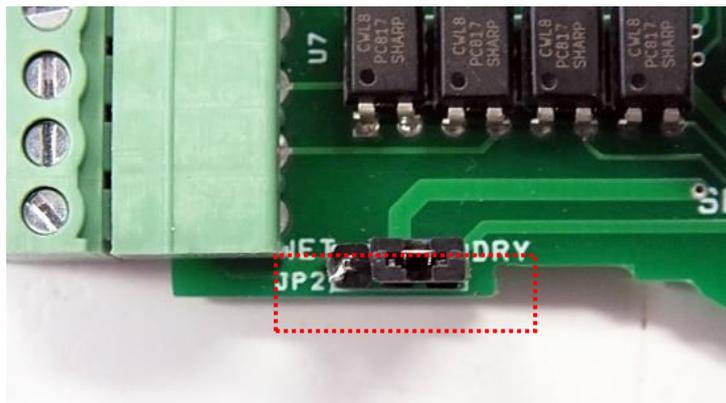
1. To put the jumpers to their right position, first you have to turn off the device to see the bottom side of the blue enclosure.
2. Then unscrew the 2 fixation screws of the casing and turn back the casing. Then remove the blue top cover.
3. Find the JP1 jumper (for DI1-DI8 input modes) or JP2 jumper (for DI9-DI16).



4. Do the jumpering on JP1 jumper and / or JP2 jumper, according to the needs.



***WET (voltage input mode) / DRY (contact input mode) jumper (JP1): for DI1-DI8 inputs***



***WET (voltage input mode) / DRY (contact input mode) jumper (JP2): for DI9-DI16 inputs***

5. Assemble the casing and use the backside screws to fix back the enclosure top cover.

## **1.9 Installation steps**

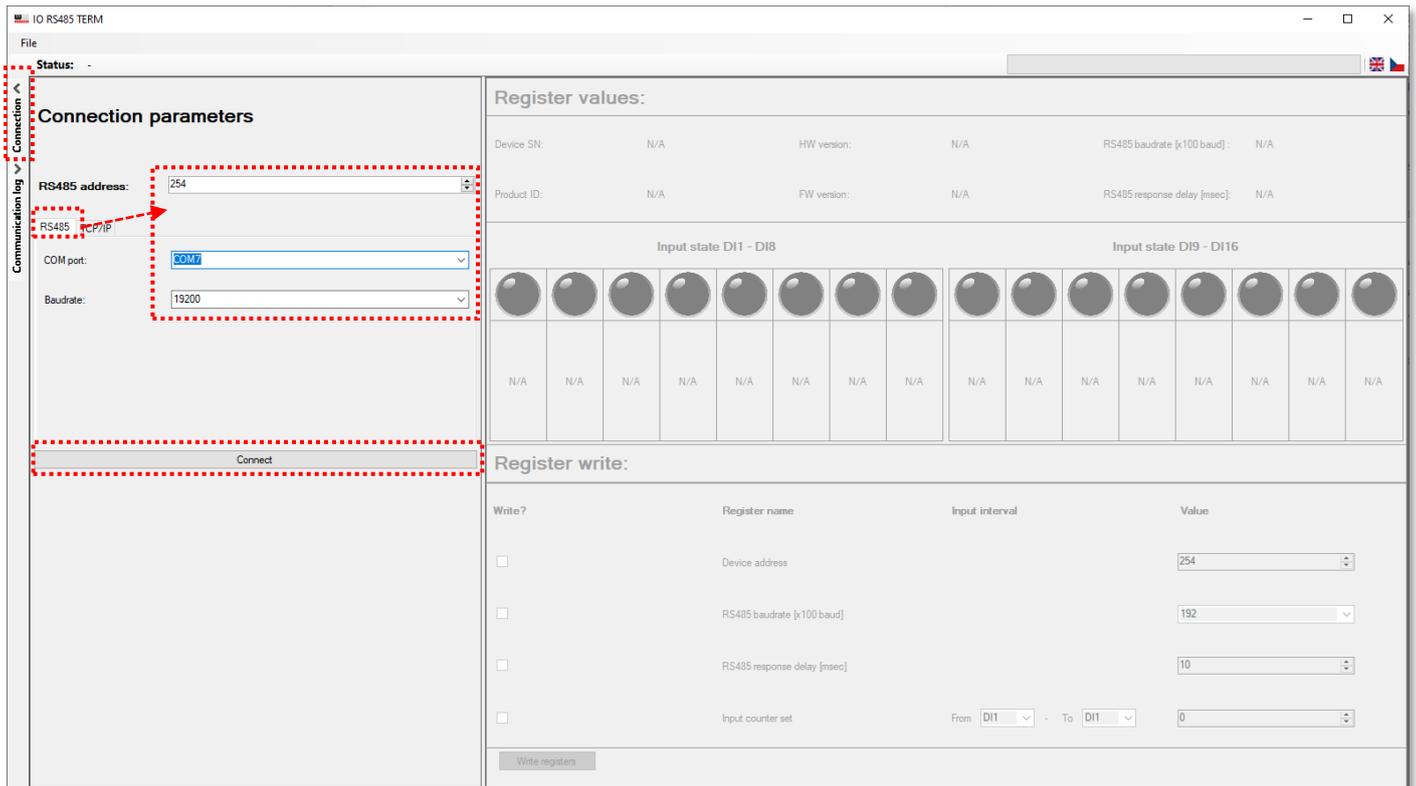
1. Install the module on the site. Mount and fix the concentrator enclosure by surface mount.
2. Disassemble the device according to the Chapter 1.8 and do the jumper settings.
3. Release the terminal block screws at the input side.
4. Wire the required inputs DI1..DI16 by blanked wires according the needs – see the Chapter 1.7 and the wiring description of Chapter 1.4

5. Fasten the input wire screws by a screwdriver on the terminal block.
6. Don't forget to wire the common grounding (DGND – in case of contact mode / other grounding in case of other input mode).
7. Fasten the wire screws by a screwdriver on the terminal block.
8. Connect the RS485 output to the external Modbus devices or modem / router (wired or cellular) by following wiring description of Chapter 1.4
9. Connect the 24V power source to the 24V and GND pins (according to the wiring pinout of Chapter 1.4).
10. The **red HEART LED** will sign the presence power source on the device, while it will start its operation.
11. You can configure the device by the **IO/RS485 TERM** (configuration software) or by another Modbus compatible software.

## 1.9 Configuration

1. Connect the **M2M IO/RS485 CONCENTRATOR** device serial port to your computer serial or USB interface and power up the concentrator module.
2. After connecting the inputs, turn on the concentrator devices by adding the 24V power to the device.
3. The **IO/RS485 TERM**<sup>®</sup> configuration tool can be downloaded from our website or by using the following link:  
[https://www.m2mserver.com/m2m-downloads/IO\\_RS485\\_TERM\\_v1\\_1.zip](https://www.m2mserver.com/m2m-downloads/IO_RS485_TERM_v1_1.zip)
4. Extract the file to a directory on a Windows<sup>®</sup> operation system computer and execute the software by the executable **IO\_RS485\_TERM.exe** file.

5. Then the next screen appears.



6. The following window will appear. At left side you can choose the **RS485 address**.

7. Fill the **Login password: *wm\_io\_rs485***

8. Select the **COM port** and choose the proper interface number and the required **Baudrate** (the 19 200 baud speed rate is the default), but later but it can be also configured between 1 200 and 115 200 baud.

Push to the **Connect** button for connecting to the device,

(In case of local serial connection, a remote TCP/IP connection can be also used, by setting the **IP address** and **port number** at **TCP/IP** tab).

9. At the bottom of the screen, you will find the device identifiers, as **Device SN** (serial number), **Product ID** (device type), **HW version**, **FW version**, **RS485 baudrate** and **RS485 response time**.

Register values:														
Device SN:	030530136027	HW version:	3	RS485 baudrate [x100 baud] :	1152									
Product ID:	3302	FW version:	1.0.5.0	RS485 response delay [msec]:	10									
Input state DI1 - DI8				Input state DI9 - DI16										
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

10. The **Input states** can be seen for inputs DI1-DI16. The counter values of inputs are continuously read out, which are appearing and refreshing by every second.

11. Modify or change the **Device address** (by default it is 254) and setup the **RS485 Baudrate** (which uses the 19 200 baud speed rate by default but it can be also configured between 1 200 and 115 200 baud).

**Important!** After changing the **RS485 baudrate**, sometimes you should reset the input counters. This can be done by enabling the **Input counter set** and choose the **Input interval** column's **FROM** input value to DI1 and for the **TO** choose the value DI16. For **Value** entry fill **0**. Push to the **Write registers** button.

12. The **Response delay** field means the delay interval after sending the response to the device, which will wait the declared time interval (in msec) until sending a response.

13. At the **Register write** part, the listed registers can be configured as well. You can also configure more registers in one step. You should just check the required fields by their checkbox and adding values, than push to the **Write registers** button. The write to the device is processing (check the upper progress indicator). At the end of the write the device will be notify by the **Write successful** or **Write failed** message.

14. For writing the input registers, enable the **Input counter set** and choose the **Input interval** column's **FROM** input value (DI1-DI16) and the **TO** (DI9-DI16). Add the **Value** entry also. Push to the **Write registers** button.

The required value will be written to the device. At the end of the write the device will be notify by the **Write successful** or **Write failed** message.

**Register write:** Write successfully finished!

Write?	Register name	Input interval	Value
<input type="checkbox"/>	Device address		254
<input type="checkbox"/>	RS485 baudrate [x100 baud]		192
<input type="checkbox"/>	RS485 response delay [msec]		10
<input checked="" type="checkbox"/>	Input counter set	From DI1 - To DI16	0

Write registers

If value "0" is written to an input register, then the input counter will be reseted.

15. At the left edge of the screen, you will found the **Communication log** part where the logged last 100 entries and values, activities are presented and recorded.

16. Further messages are logged into a log file – which can be found in the same directory, where you've started the configuration software.

## 1.10 Modbus register list

Address	Bytes	Values			Description	Property
		Min	Max	Default		
0-3	4	1	4294967295	-	Serial number,unique of product	R
4-5	2	100	65535	-	Firmware version number	R
6	1	1	254	254	Device address	R/W
7	2	3302	3302	3302	Product model	R
8	1	1	255	-	Hardware version	R

9	2	12	1152	192	RS485 baudrate [x100 baud]:	R/W	
					<b>Value Baudrate</b>		
					12		1200
					24		2400
					48		4800
					96		9600
					192*		19200
					384		38400
					576		57600
1152	115200						
10-99	-	-	-	-	Reserved	-	
100	2	0	65535	0	Status for DI1...DI16 input channel 0 =contact active,1 =contact inactive. Bit0 correspond to channel 1, Bit1 correspond to channel 2, etc.	R	
101	2	0	65535	0	DI1 counter input, high word	R/W	
102	2	0	65535	0	DI1 counter input, low word, value of counter = (101) * 65536 + (102)	R/W	
103	2	0	65535	0	DI2 counter input, high word	R/W	
104	2	0	65535	0	DI2 counter input, low word, value of counter = (103) * 65536 + (104)	R/W	
105	2	0	65535	0	DI3 counter input, high word	R/W	
106	2	0	65535	0	DI3 counter input, low word, value of counter = (105) * 65536 + (106)	R/W	
107	2	0	65535	0	DI4 counter input, high word	R/W	
108	2	0	65535	0	DI4 counter input, low word, value of counter = (107) * 65536 + (108)	R/W	
109	2	0	65535	0	DI5 counter input, high word	R/W	
110	2	0	65535	0	DI5 counter input, low word, value of counter = (109) * 65536 + (110)	R/W	
111	2	0	65535	0	DI6 counter input, high word	R/W	
112	2	0	65535	0	DI6 counter input, low word, value of counter = (111) * 65536 + (112)	R/W	
113	2	0	65535	0	DI7 counter input, high word	R/W	
114	2	0	65535	0	DI7 counter input, low word, value of counter = (113) * 65536 + (114)	R/W	
115	2	0	65535	0	DI8 counter input, high word	R/W	
116	2	0	65535	0	DI8 counter input, low word, value of counter = (115) * 65536 + (116)	R/W	
117	2	0	65535	0	DI9 counter input, high word	R/W	
118	2	0	65535	0	DI9 counter input, low word, value of counter = (117) * 65536 + (118)	R/W	
119	2	0	65535	0	DI10 counter input, high word	R/W	
120	2	0	65535	0	DI10 counter input, low word, value of counter = (119) * 65536 + (120)	R/W	
121	2	0	65535	0	DI11 counter input, high word	R/W	
122	2	0	65535	0	DI11 counter input, low word, value of counter = (121) * 65536 + (122)	R/W	
123	2	0	65535	0	DI12 counter input, high word	R/W	
124	2	0	65535	0	DI12 counter input, low word, value of counter = (123) * 65536 + (124)	R/W	
125	2	0	65535	0	DI13 counter input, high word	R/W	
126	2	0	65535	0	DI13 counter input, low word, value of counter = (125) * 65536 + (126)	R/W	

127	2	0	65535	0	DI14 counter input, high word	R/W
128	2	0	65535	0	DI14 counter input, low word, value of counter = (127) * 65536 + (128)	R/W
129	2	0	65535	0	DI15 counter input, high word	R/W
130	2	0	65535	0	DI15 counter input, low word, value of counter = (129) * 65536 + (130)	R/W
131	2	0	65535	0	DI16 counter input, high word	R/W
132	2	0	65535	0	DI16 counter input, low word, value of counter = (131) * 65536 + (132)	R/W
133	1	1	100	10	*Respond delay for serial communication. Units in msec. Default is 10ms	R/W
134	1	1	255	200	*Filter time for counter input. Unit in 10µs. Default is 200µs	R/W
135	1	0	255	0	*Disable/enable input. Value by using bitmask. Values: 0 =disable and 1 =enable. Bit0 correspond to input1, Bit1 correspond to input 2 and so on. E.g. „1000001” (only DI1 and DI8 are enabled).	R/W
136	1	0	255	0	*Disable/enable input. Value by using bitmask. Values: 0 =disable and 1 =enable. Bit0 correspond to input9, Bit1 correspond to input 10 and so on. E.g. „0100001” (only DI10 and DI16 are enabled).	R/W
137	1	0	1	0	*Input status selection. 0 =ON/OFF 1 =OFF/ON Default value is ON/OFF (0)	R/W

*\*The registers signed by asterix (\*) cannot be configured by the IO/RS485 TERM configuration software.*

### **Important notes**

The registers can be read out with the standard 0x03 Modbus command and write with the 0x06 command.

The usage of Modbus standard, regarding the Function code 06 you can found more information on the next link. This is relevant if you don't want to use the **IO/RS485 TERM®** configuration software with the device.

[https://www.modbustools.com/modbus\\_poll.html#](https://www.modbustools.com/modbus_poll.html#)

## Chapter 2. Support

### 2.1 Support

If you have a technical questions, you can ask us on the following contact options.

Email: [iotsupport@m2mserver.com](mailto:iotsupport@m2mserver.com)

Phone: +36 20 333-1111

Support: <https://www.m2mserver.com/en/support/>

### 2.2 Product Support

The documents and information related on the product are available here on the product website:

<https://m2mserver.com/en/product/iiot-io-data-concentrator-16di/>

## Chapter 3. Legal notice

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