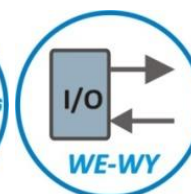
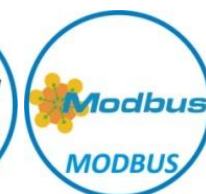


MD150A Manual



Digital process display 0-10V, 4-20mA

Programmable indicator for sensors with current, voltage or potentiometer output



www.wobit.com.pl

P.P.H. WObit E.J.K. s.c.
Dęborzyce 16, 62-045 Pniewy
tel.48 61 22 27 422, fax.48 61 22 27 439
e-mail: wobit@wobit.com.pl
www.wobit.com.pl

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Thank you for selecting our product!

This instruction will help you at correct service and accurate exploitation of described device.

Information included in this instruction were prepared with high attention by our specialists and is description of the product without any responsibilities within the meaning of the commercial law. Based on the information should not be inferred a certain features or suitability for a particular application. This information does not release the user from the obligation of own judgment and verification. P.P.H. WObit E.K.J. Ober S.C. reserves the right to make changes without prior notice.

- Please read instructions below carefully and adhere to its recommendation
- Please pay special attention to the following characters:



CAUTION!

Not adhere to instruction can cause damage or impede the use of hardware or software.

1. Safety and assembly rules

Safety rules

- Prior to first start-up of the device carefully read the manual.
- Prior to first start-up of the device make sure all cables are properly connected.
- Provide appropriate working conditions, in compliance with the device specifications (e.g.: power supply voltage, temperature, maximum current consumption).
- Prior to any modifications of cables connections, disconnect power supply voltage.
- Dismantling of the indicator housing during guarantee agreement period results in its invalidation.

Assembly recommendation

In the environments of unknown levels of interruptions it is recommended to use the following means preventing against possible interruptions of the device operation:

- Ground or zero the metal rails on which instruments are mounted.
- Do not power the device from the same lines as high power devices without appropriate network filters.
- Apply power supply, sensor and signal cables screening while screen grounding should be connected only on one side as close to the device as possible.
- Use communication cables (USB) equipped with filters in the form of ferrite beads.
- Avoid routing control (signal) cables in parallel with or in close vicinity of power and supply cables.
- Avoid close vicinity of devices generating high level of electromagnetic and/or pulse interference (high power loads, loads with phase or group power regulation).

2. Device description

2.1 Intended use and properties

MD150A process display is intended for measurement of voltages **0...10V** or **0...20mA** currents. It can cooperate with various sensors providing analogue voltage or current output signal and convert the measurement into a specific unit. Additional 5V voltage output allows for sensor power supply or connection of potentiometer sensor.

The measurement is realized based on digital converter which can measure the voltage of 1mV resolution which provides 10000 measurement steps for the range of 0-10V. The measurement result is presented on six position display.

Apart from measurement output MD150A has **2 relay outputs** which can be freely configured for switching on/off at specified thresholds. The device is also equipped with universal digital inputs which can be used for external triggering of measurements and for “pausing” of a current measurement.

MD150A process display is operated intuitively. Configuration for operation with a given sensor does not require any calculations and it is based on input of output signal range from the sensor and the range of value displayed on the process display. The process display converts measurement value so it can e.g. after connection of distance sensor with 4-20mA output it indicates the value in mm.


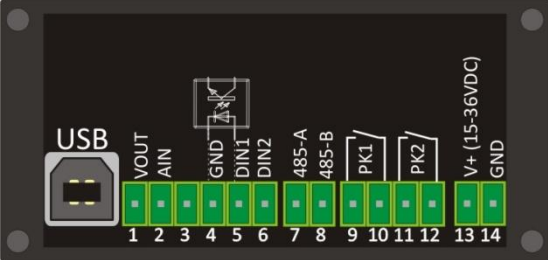
MD150A is equipped with **USB** and **RS485 MODBUS** interfaces. USB interface allows for recording measurement data in PC (e.g. to Excel file) with the use of MD150A-PC software. MODBUS-RTU allows for reading of measurements from several indicators at the same time to PLC controller, HMI panel or its own PC application.

MD150A has full aluminium profile housing compliant with DIN43700 standard which guarantees high mechanical durability and resistance to adverse environmental conditions including electric interference..

MD150A realizes the following functions:

- Measurement of voltage or current with resolution of 10000 measurement steps (1mV),
- Filtering of signal.
- Conversion of voltage/current to any units.
- Changes of status of relay outputs based on set thresholds.
- Transfer of measurement data to PC (USB) or master device e.g. HMI panel, PLC controller (RS485 MODBUS-RTU)

2.2 Description of interfaces and front panel

	LED1	- indicator of PK1 relay activation	
	LED2	- indicator of PK2 relay activation	
	ESC	- abortion, Reset	
	DOWN	- next menu position/next parameter digit	
	UP	- previous menu position / digit value increase	
	ENTER	- menu entry/confirmation of entered changes	
Panel tylni			
	1	VOUT	12VDC output, max. 200mA
	2	AIN	Analogue input 0-10V / 0 -20mA
	4	GND	Ground
	5	DIN1	Digital input (5-24V) of measurement triggering
	6	DIN2	Digital input (5-24V) of current value withholding
	7	485A	Signal A of RS485 interface
	8	485B	Signal B of RS485 interface
	9,10	PK1	PK1 (NO) relay contacts
	11,12	PK2	PK2 (NO) relay contacts
	13	V+	12-36 VDC power supply, min. 250mA
	14	GND	Power supply ground

2.3 Connections diagram

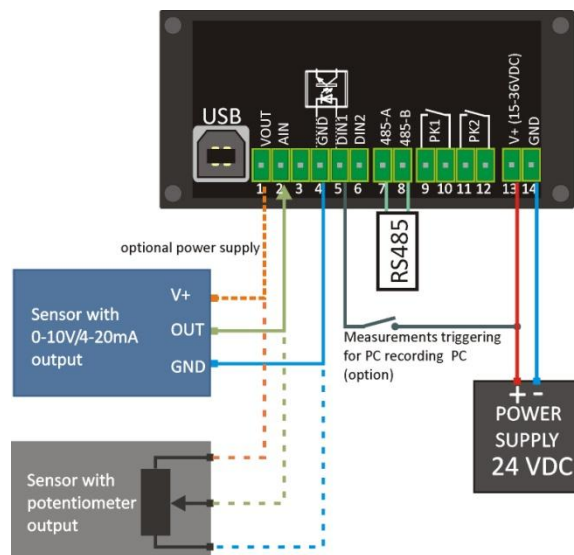













Fig. 1 Example of connections of external signals to MD150A.

3. Menu description

3.1 MENU map














4. 000000 -> Displaying of current measurement value				
 Menu entry ↓	 Min. measurement value display	 Max. measurement value display	 (3 sec.) Reset of min/max measurement value	
1. P1 -> Menu				
 Next/previous parameter	 Parameter selection		 Digit selection  Change value Parameter edition	
1.	P1	PK1 relay threshold	Relays	± 999999
2.	P2	PK2 relay threshold		± 999999
3.	P3H	Relays switching on/off hysteresis		± 999999
4.	MODE	Relays operational mode		0 / 1 / 2
5.	INPUT	Measurement input mode	Measurement	0..10V / 0..20mA
6.	U-LO	Minimum signal from sensor		0...10.0000/0..20.0000
7.	U-HI	Maximum signal from sensor		0...10.0000/0..20.0000
8.	P-LO	Minimum displayed value		± 999999
9.	P-HI	Maximum displayed value		± 999999
10.	FILT	Filtration level		0-99
11.	DP	Number of decimals of the result	0-3	
12.	ADR	MODBUS address	RS485	0-99
13.	BAUD	MODBUS transmission speed		19200 / 38400 57600 / 115200
14.	BEP	Keys audible signal	Other	ON/OFF
15.	LED	Display brightness level		0-9
16.	FAC	Restoring factory default settings		
17.	PAS	Password		X-0000 – non-active
 Menu exit/abortion		 Parameter confirmation/abortion		





- Blinking measurement value preceded by C symbol on the display means the result overflow (the result is not contained within 6 positions of the display). In order to display older part of the result, press .
- Exceeding of measurement range (10V or 20mA) results in blinking of the displayed value

3.2 Example of parameter change

After correct connection of external elements and switching power supply on, MD150T process display is ready for operation with previously used settings, and in case of first operation – with factory settings.

- In order to enter programming mode, press . The display shows **1. PI**, if the password is switched off or **0000**, if it is active. . In such case, in order to enter programming mode (at active password) enter the password and confirm it with the key ;
- With subsequent pressing of  key you switch to next parameters and with pressing of  key you return to previous parameters.
- At the selected parameter you want to change, press ;
- With key  select display digit position you want to change and change its value with key . Confirm the entered value with key ;
- Value of single digit parameters is selected with keys  and ;
- If you want to enter a negative value select the first digit (from the left) then press and hold key  until the symbol “-” is displayed.
- With key  you confirm the introduced change and with key  you abort the change or exit the menu.

Prolonged pressing of keys  or  results in automatic increase/decrease of a given position/value.

4 Configuration of measurements

4.1 Configuration of 0-10V / 0-20mA input

Depending on the output standard of the applied sensor, you should select an appropriate process display input mode. It is achieved with **5.INPUT**. For sensors with **voltage output** or at measurements of signals from **potentiometer sensors**, set **0-10V** mode. For sensors with **current output** with range 0-20mA (e.g. 4-20mA) set **0-20mA** mode.

4.2 Configuration of measurement units

MD150A process display enables converting the sensor signal into values in measurement units specific for a given sensor. This allows for indication of e.g. measurement value in meter for distance meter, inclination for inclinometer or pressure in bar for pressure sensor.

Four parameters are used for configuration of units:

6. U-LO – minimum value of signal from the sensor (0...10V or 0...20mA)

7. U-HI – maximum value of signal from the sensor (0...10V or 0...20mA)

8. P-LO – minimum measurement value displayed by the process display

9. P-HI – maximum measurement value displayed by the process display

Example 1) For draw wire sensor with 4-20mA output and range 0-10m, in order to display its result in meters you should enter the following parameters: U-LO = 4.00 U-HI = 20.00 P-LO = 0 P-HI = 10.00 , and parameter INPUT -> 0-20mA.

Example 2) For analogue inclinometer with 2.5-5V output and range -20deg - +20deg, in order to display the result in degrees you should enter the following parameters: U-LO = 2.50 U-HI = 5.00 P-LO = -20.0 P-HI = 20.00 , and parameter 5.INPUT -> 0-10V

4.3 Number of decimals of the result/parameters

Parameter **11. DP** specifies the number of decimals of the displayed value. If DP is set to 0, the indicator displays only the total measurement part. For DP = 4 the result includes four decimal places.

Parameter DP also influences the range of values of entered parameters. If DP = 0, then settings P1, P2, P3-H, U-LO, H-HI, P-LO, P-HI can be changed only in total part in the range of -99999 to 999999. If DP=4, the above parameters can be changed in range from -99.9999 to 99.9999

4.4 Filtering of measurements

Parameter **10.FILT** specifies filtration level. The higher the filtration value (max. 99), the more stable indications, however, response to changes of the measured signal is slower. For example, for set filtration equal to 99 and change of input signal from 0V -> 10V, the indicator reaches indicated value 10V after 1 sec. (100Hz/99 ->"1).

5. Configuration of relay output

MD150A indicator has 2 relay outputs PK1 and PK2 which can be switched on/off depending on current measurement value. The following parameters are used for relay outputs configuration:

- 1. P1** - activation (deactivation) threshold of PK1 relay
- 2. P2** - activation (deactivation) threshold of PK2 relay
- 3. P3H** - hysteresis level of activation/deactivation of PK1 and PK2 outputs
- 4. MODE** - output operating mode:

Mode 0 – Absolute with two thresholds. Activation of PK1 and PK2 outputs is realized after reaching of P1 and P2 values, respectively.

Mode 1 – Reverse with two thresholds. Operation is similar to the above mode. Deactivation of PK1 and PK2 outputs is realized after reaching of P1 and P2 values, respectively.

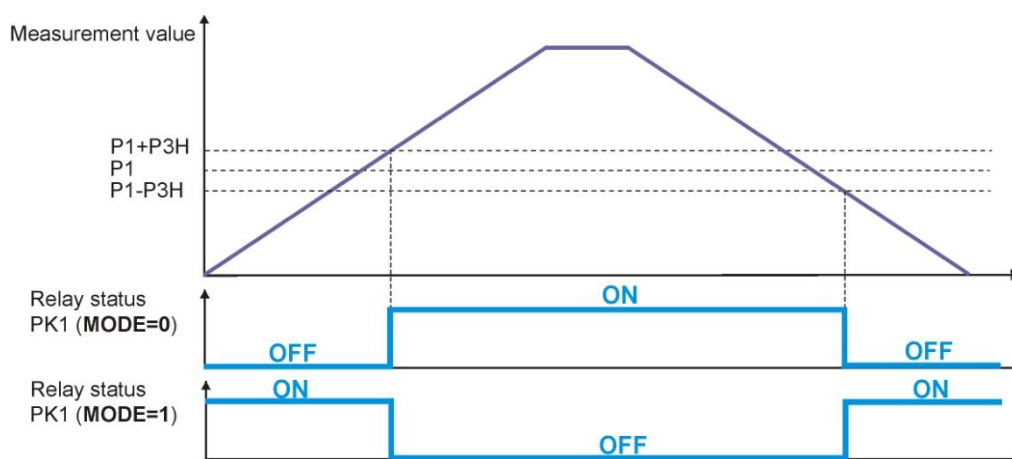


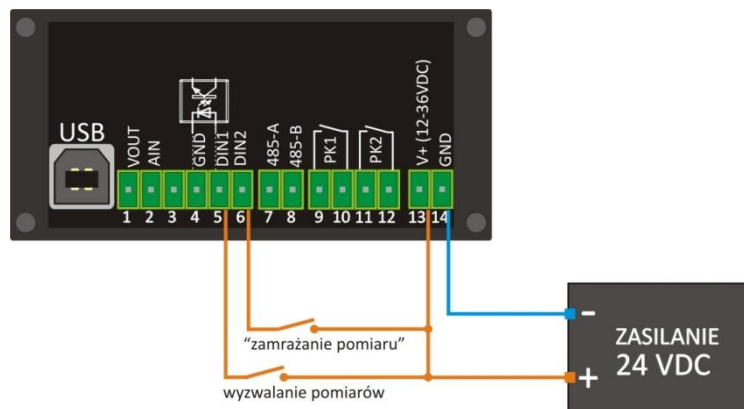
Fig. 2 Example of PK1 relay output activation depending on P1 and P3H setting and operating mode (MODE).

6. Digital input DIN1, DIN2

DIN1 input enables interception of measurements by MD150A-PC software. In order to activate the function, you should check the option “DIN1 triggering” in the software.

Automatic data acquisition is stopped at this moment. The next measurement shall be intercepted by software only at the moment of increasing slope at DIN1 input, i.e. change of the signal status from 0V to +5...+24V.

DIN2 input is used for “freezing” of a current measurement on the MD150A indicator display. The last measured value is displayed (blinks) until DIN2 input reaches high status (+5...+24V).



Picture. 3 Example of DIN1 and DIN2 outputs control.

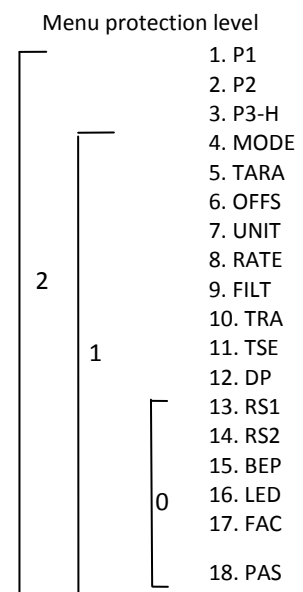
7. Password protection

Access to the process display settings can be password protected (parameter 11. PAS). There are 3 protection levels available. Protection level is set with the first digit, and the last 4 digits are used for password entry.

0-0000	
	4-digit password (0-9999)
	Protection level:
	0-Settings protection above 12. DP parameter
	1-Settings protection above 3. P3-H parameter
	2-Protection of all settings

If the digital processing unit is password protected, then after switching to protected settings the display shows 0000 value – enter previously set password. The password can be deactivated by switching the parameter 18.PAS and setting 0000 value.

(If the password is lost, you can find universal password in chapter 10)



8. USB and RS485 MODBUS interface

8.1 USB interface

USB interface is used for communication of MD150T process display with MD150-PC software (device configuration, recording of measurements) and for updating of internal software. MD150 process display must be powered in order to facilitate communication via USB.



Caution!

USB interface is prone to interference in the power supply grid and to electromagnetic interference occurring in industrial environments. In case of connection problems during communication of the digital processing unit with MD150T-PC software, apply additional protective elements in the form of:

- Powering of MD150T digital processing unit from an independent power supply source,
- Application of network filters upstream of the indicator supply feeder.
- Use of USB cable of length <1,5m equipped with ferrite beads at the cable beginning and its end.
- Use of optically insulated USB hubs at PC side.

In the conditions of severe interference (e.g. high interference of power grid) the communication may not be possible..

8.2 RS485 (MODBUS-RTU) Interface

MD150T digital processing unit is equipped with RS485 interface. It can be used for communication with PLC controller, HMI panel or other device supporting MODBUS-RTU protocol. Default transmission parameters:

- Baud rate: **38400bps**, Bits: 8, Stop Bits: 1, parity: none
- Address **Modbus: 1**

Modbus address and baud rate of MD150T can be set with the following parameters:

12. ADR - velocity settings MODBUS (9600, 19200, 38400, 57600, 115200)

13. BAUD - address settings MODBUS (1...99)

8.2.1 Descriptions of MODBUS protocol

Implemented functions MODBUS

Function no (hex)	Description
1 (0x01)	Input status readout (relays)
3 (0x03)	Readout of X registers
5 (0x05)	Record of single bit

Type of variables used

Variable name	Description	Size (Bytes)	Number of occupied registers
WORD	Complete number with a sign	2	1
REAL	Floating point number	4	2

Map of MD150A register addressing

Address	Name	Type of variable	Mode (Modbus function)	Description
0 (*1)	MESVAL_AIN	WORD	R (0x03)	Reading of measured voltage value 0-10V (in mV) or current 0-20mA (w uA).
2-3 (*3-4)	MESVAL_REAL	REAL	R (0x03)	Indicator displayed measurement value reading
4 (*5)	MAXVAL_AIN	WORD	R (0x03)	Maximum recorded value reading 0-10V (in mV) or current 0-20mA (in uA).
6-7 (*7-8)	MESVAL_REAL	REAL	R (0x03)	Maximum recorded value reading

* for devices with address starting with 1 value(offset address +1)

R – reading register, W - record

TIP: 4-Byte number of type REAL is contained in two registries. The first registry contains younger part of the number, the second - its older part. In order to read REAL number value correctly, read registries of number 2 and 3 and then conduct appropriate conversion.

Conversion of 2 registries (4 Byte) into 32 Bit number REAL

Registry_2 HI <-> Byte1

Registry_2 LO <-> Byte0

Registry_3 HI <-> Byte3

Registry_3 LO <-> Byte2

Number_32_bit = Byte3<<24 + Byte2<<16 + Byte1<<8 + Byte0

Or number_32_bit = Registry_2 + Registry_3<<16

Example of MODBUS communication table

Example table of MESVAL_AIN registry reading (voltage value (in mV) / current value (uA))

Request (MODBUS MASTER -> MD150A)		Response (MD150A -> MODBUS MASTER)	
Device address	0x01	Device address	0x01
Function	0x03	Function	0x03
Hi registry address	0x00	Number of Bytes	0x02
Lo registry address	0x00	Register 0x00 Hi	INT (Byte 1)
Number of Hi registries	0x00	Register 0x00 Lo	INT (Byte 0)
Number of Lo registries	0x01	CRC Hi	8 bit
CRC Hi	0x84	CRC Lo	8 bit
CRC Lo	0x0A		

Example table of MESVAL_REAL registry reading (indicator displayed value)

Request (MODBUS MASTER -> MD150A)		Response (MD150A -> MODBUS MASTER)	
Device address	0x01	Device address	0x01
Function	0x03	Function	0x03
Hi registry address	0x00	Number of Bytes	0x04
Lo registry address	0x02	Register 0x02 Hi	REAL (Byte 1)
Number of Hi registries	0x00	Register 0x02 Lo	REAL (Byte 0)
Number of Lo registries	0x02	Register 0x03 Hi	REAL (Byte 3)
CRC Hi	0x65	Register 0x03 Lo	REAL (Byte 2)
CRC Lo	0xCB	CRC Hi	8 bit
		CRC Lo	8 bit

9. Technical parameters

Description	Parameter
Power supply	15 ... 36 VDC, recommended 24 VDC, min. 250mA
Sensor supply output	12 VDC, max. 200mA
Analogue input	Resolution <10000 measurement steps (0-10V: ±1mV, 0-20mA: ±4uA) Input resistance 30KΩ Non-linearity error: 0,05% FSR Temperature error: 0,03% FSR/1°C Max. measurement frequency: 100Hz
Digital inputs DIN1, DIN2	Low status 0V (max. 2V), high status +24V (5...24V)
Relay outputs PK1, PK2	2 x 1A/125VAC, 2A/30VDC
Communication	RS485 MODBUS-RTU, default parameters 38400, 8:n:1, USB: 1.1, 2.0
Operating temperature range	0..50° C
Initial heating time	20 min.
Display	6 digits, height 13.5 mm
Housing	Height : 45 Width: 92 mm Length : 81 mm
Weight	200g
Leak tightness degree	IP40, from panel head - IP65
Universal password	3145

FSR – full scale range