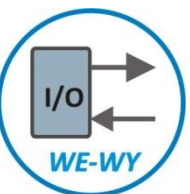
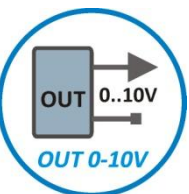
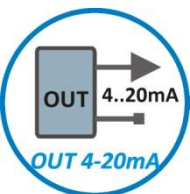


ADT42 User Manual



**4-channel measuring module for force sensors
with 0-10V/4-20mA output, USB and RS485 MODBUS**



www.wobit.com.pl

PPH WOBIT E.K.J OBER. s.c.
62-045 Pniewy, Dęborzyce 16
tel.(061) 22 27 422, fax.(061) 22 27 439
e-mail: wobit@wobit.com.pl
www.wobit.com.pl

Contains

1. Safety and assembly rules	3
1.1. Safety rules	3
1.2. Assembly recommendation.....	3
2. Device description.....	4
2.1 Intended use and properties.....	4
2.2 Features.....	5
2.3 Description of connectors and diodes.....	5
2.4 Power supply.....	6
2.5 Force sensors connection.....	6
2.6 Insulated inputs.....	7
2.7 Transistor outputs	7
2.8 Analog output 0-10V/4-20mA.....	7
3. Transducer configuration.....	8
3.1 Connection by USB	8
3.2 Configuration of strain gauge inputs and measurements.....	8
3.2.1 Example of configuration	9
3.3 Configuration of output and RS485.....	10
3.3.1 Configuration of analog output.....	10
3.3.2 Configuration of transistor outputs.....	11
3.3.3 Configuration of RS485 MODBUS.....	11
4. RS485 MODBUS Communication.....	12
5. Complementary information	14
5.1 Force sensor types.....	14
5.2 Sensor measuring range.....	14
6. Technical parameters	15

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. 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

1.1. 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.
- Usage of described device in special meaning systems (e.g.: medical applications, vehicles, etc.) requires use of additional safety measures against operational errors.
- This device can't be used in open space. It can cause an electric shock and shorten lifetime of the device.
- Exceeding of recommended operational parameters can lead to damage of the device or to fire.
- Dismantling of the indicator housing during guarantee agreement period results in its invalidation.

1.2. 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.
- For power supply of the motor please use twisted pair of cables, if possible 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).

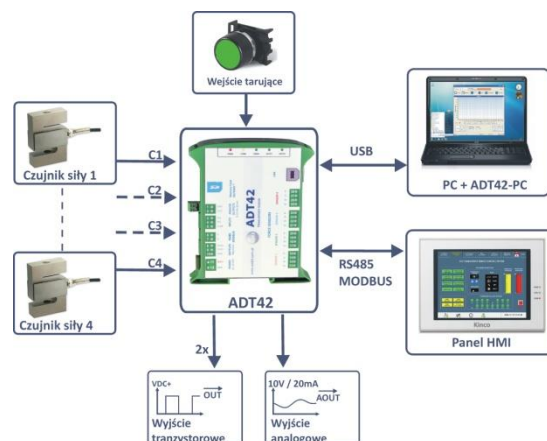
2. Device description

2.1 Intended use and properties

ADT42 is a multipurpose **4-channel** measuring module for load cells. It enables very precise measurement with resolution up to 100.000 of measuring range.

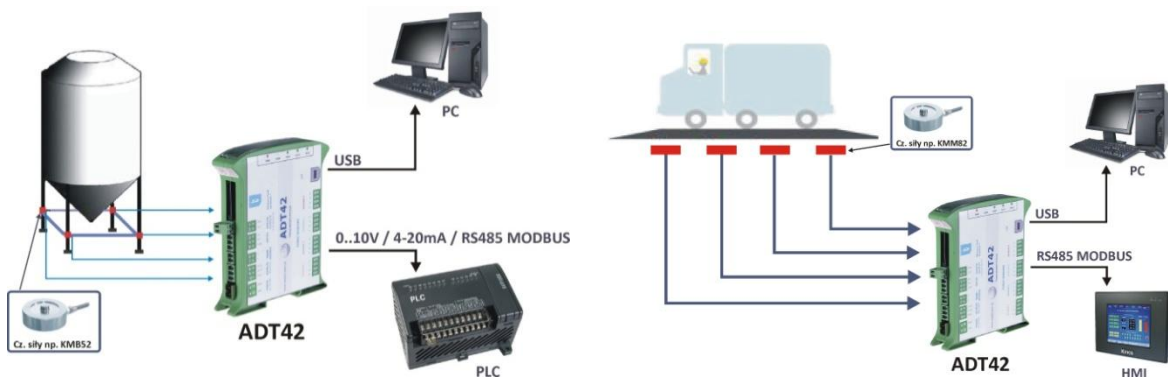
ADT42 has multipurpose usage as well at industry as in laboratory, where averaged or precise force (weight) measurement is necessary. Depends on used sensor there is a possibility of measurement of small masses in range as well small weights (grams) as large loads (tons). Due to possibility of aggregate of measurements from selected channels the module can be used in multi-sensor weight systems.

ADT42 has **2 transistor outputs**, and **2 insulated inputs** (one tare input). Built-in operating modes enable the device to be used for dosing without any additional controllers. Measured values can be converted into analogue signal in **0-10V (ADT42-U version)** or **(0)4-20mA standard (ADT42-I version)**. Access to device is also possible through **RS485 bus in MODBUS-RTU protocol**, which allows direct communication one or several modules simultaneously with PLC drivers or HMI panels.



Device configuration can be made also by **USB** connector **ADT42-PC** program. This program except device settings enables preview of current measurement values, saving them to a file and to show data on a graph.



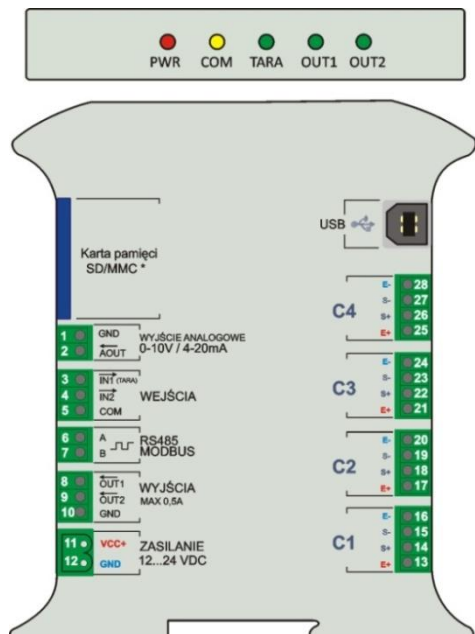


Example of application with ADT42 module (silo weight measurement, weight platform)

2.2 Features

- Signal measurement from four load cells
- Result conversion into force in N or weight in g, kg, T, f
- Read out of each channel separately or aggregate of all channels
- Measurement filtering function
- 0-10V (ADT42-U) / (0)4-20mA (ADT42-I) output with calibration function
- 2 opt insulated inputs (general-purpose and tare)
- 2 transistor outputs with configurable thresholds
- RS485 interface for communication with other devices in MODBUS-RTU protocol
- USB connector for transducer configuration and measurement data acquisition

2.3 Description of connectors and diodes



Picture. 1 Connector and panel description

Nr	Description	
Analog output 0-10V/ 4-20mA		
1	GND	Ground of analog output
2	AOUT	0-10V / 4-20mA output
Opt insulated inputs		
3	IN1	Input 1 (TARA)
4	IN2	Input 2 (M-TARA on/off, record)
5	COM	Ground of opt insulated input
RS485 MODBUS-RTU		
6	A	Signal +
7	B	Signal -
Transistor output		
8	OUT1	Transistor output 1, max. 0,5A
9	OUT2	Transistor output 2, max. 0,5A
10	GND	Ground of outputs
Power supply		
11	VDC+	Power supply 12-24 VDC
12	GND	Ground of power supply
Load cells inputs		
13, 17, 21, 25	E+	Sensor power supply +
14, 18, 22, 26	S+	Sensor signal +
15, 19, 23, 27	S-	Sensor signal -
16, 20, 24, 28	E-	Sensor power supply -

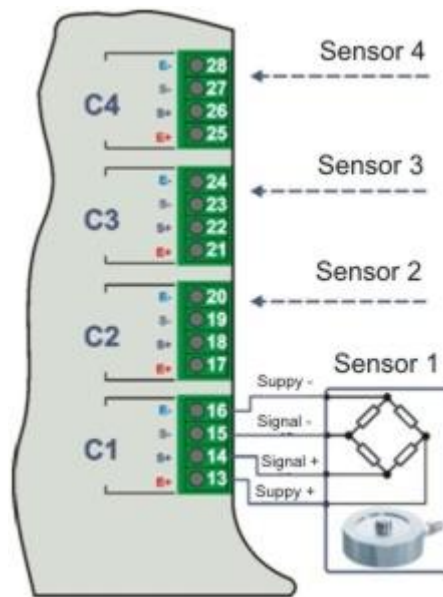
Signaling diode description	
PWR – Module power supply signaling	COM - RS485 / USB communication signaling
TARA - IN1 input state (TARA)	OUT1/2 - ½ output state

2.4 Power supply

ADT42 module can be powered by voltage in range 12 - 24 VDC (max. 36 VDC). Current consumption is max. 150mA (for connected 4 force sensors). While using transistor outputs you should add current consumed on this outputs (max. 0,5A / output).

2.5 Force sensors connection

ADT42 module can cooperate with any force sensor which has bridge with resistance bigger than 150Ω. Sensor(s) should connect according to scheme below.



Picture. 2 Connection of force sensors.



CAUTION!

Sensor wires usually have additional shielded braid, which is connected with metal housing of the sensor. This signal can be connected to supply ground of ADT42, but we don't recommend to do that, while sensor is mounted to metal construction, which can be in different potential.



CAUTION!

Do not short-circuit derivation cables of sensor power supply (E+,E-), and also do not short-circuit E+ output to other derivation, it can cause damage of the device.

Sensor model	K200, K300, K500, KB52, KB82, KMB19, KMB25, KMB31	K701, K801, K1101, K1506	K1401, K1501, K1600	KMM20, KMM30, KMM40, KMM50, KMM60, K1505, EMS70, EMS150, EMS200
Power supply + (V+)	Red	Brown	Red	White
Power supply - (V-)	Black	Yellow	Black	Brown
Signal + (S+)	Green	Green	Brown	Yellow
Signal - (S-)	White	White	Yellow	Green

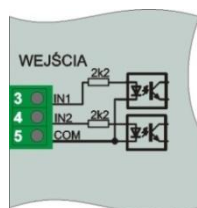
Tab. 1 Wires color description for sensors from WObit's offer. CAUTION it is possible, that colors of signals can change.

2.6 Insulated inputs

ADT42 has two opt insulated inputs. They're activate after giving a voltage 5..24 VDC (minimum 3 V), between input and their common terminal COM by at minimum 10 ms. To keep input inactive, voltage shouldn't exceed 1 V.

Input	Description
IN1	Tare of aggregate value of measurement. It takes as long time as on input IN1 is high state. IN1 = 0 -> tare inactive IN1 = 1 -> tare active
IN2	Switching between value with tare and value without tare. IN2 = 0 -> output signal = aggregate signal after tare IN2 = 1 -> output signal = aggregate signal before tare

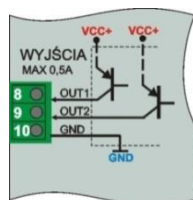
Tab. 2 Functions of opt insulated inputs.



Picture. 3 Opt insulated input

2.7 Transistor outputs

ADT42 has two transistor outputs PNP type, each with load up to 0.5 A. Their thresholds and operations ranges can be freely configured (by ADT42-PC program). For example output can be configured in that way, that it turns on after exceeding set value or when it will be between two values.



Picture. 4 Transistor outputs

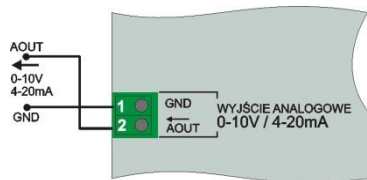


CAUTION!

Circuit is assure by polymer fuse. Exceeding of admissible current on some of outputs will cause turn off of both outputs.

2.8 Analog output 0-10V/4-20mA

Analog output can be configured for converting of measured force (weight) into voltage in range 0 - 10 V (for ADT42-U version) or current 0(4) – 20 mA (for ADT42-I version).



3. Transducer configuration

3.1 Connection by USB

USB connector is used for communication with ADT42-PC program which is used for device configuration and measurement data acquisition. After connecting to PC and starting ADT42-PC program there should appear information about connection with ADT42. Installation of USB port drivers isn't required.





CAUTION

- 1) USB connection should be established always before turning on of driver power supply.
- 2) Connection through USB is susceptible to interferences in supply network and to electromagnetic interferences, which occurs in industry conditions. While occurring problems with communication the module with ADT42-PC program, you should use additional protection elements like:
 - Power line filter before feeder, which supplies the module,
 - Good quality USB cable with length < 1,5 m, equipped with ferrite beads,
 - Opt insulated USB HUBs on PC side.

In some conditions can occur, that communication won't be possible or measurement data acquisition won't be correct.

3.2 Configuration of strain gauge inputs and measurements

After activation of ADT42-PC application you should open Settings  tab, and then to Sensor inputs  tab.



- 1) It allows to define number of active inputs. For example at operations with two force sensors you should choose 1 + 2. Values from selected channel are available as independent measurements and as their aggregate. Results are presented in „Measurements” tab.
- 2) Filtration options allows to decrease or to eliminate fluctuations to achieve the highest measurement stability.
- 3) Parameter settings of force sensors: **bridge constant [mV/V]** and **bridge range [N]**. It allows also zeroing of selected channel.
- 4) It cause zeroing of total measured value. It is equivalent with giving signal on IN1(TARA) input.
- 5) Options of measurement units and displaying

- precision of measurement values (number of decimals).
- 6) Reading and recording of introduced parameters to module, factory settings recall.


Input configuration for force sensors boils down to determine number of used channels (1) and setting of parameters used for force sensors (3).

Parameters setting of connected force sensors

For force sensor should be introduced parameters as below:

Sensor range [N] – rated load of used sensor in N, usually present on sensor's housing.

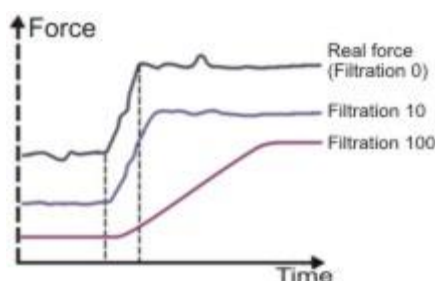
Bridge constant [mV/V] – sensitivity of used sensor in mV/V, usually present on sensor's housing or in its documentation. As a rule it is value from a range 1...2 mV/V.

Additionally for each input channel you can reverse measured signal (change sign from + for -) using option „Reverse the sign” and zeroing channel by pressing „Zero” .

Filtration of measurement

ADT42 has constant averaging filter set in range 0...99 samples and measurement mode „Fast” and „Slow” (2).

Bigger value of filtration increases stability of measurements, but also causes slower response for change of signals from sensor. Additionally setting of „slow” mode decreases measurement frequency 8 times, but it improve its stability.



Picture. 5 Filtration influence on value of measurement.

Units of measurements

Units of measurements (5) determines in which units the module will present measurements (N – Newton's, g- gram, kg – kilogram, T – ton, F- pound). Also values available by MODBUS interface are stored in set units. „Precision” tab set quantity of decimals indicated values in ADT42-PC program and doesn't influence on real accuracy of measurement.

3.2.1 Example of configuration

Example: Two force sensors 1,5mV/V, with measuring range up to 500N.

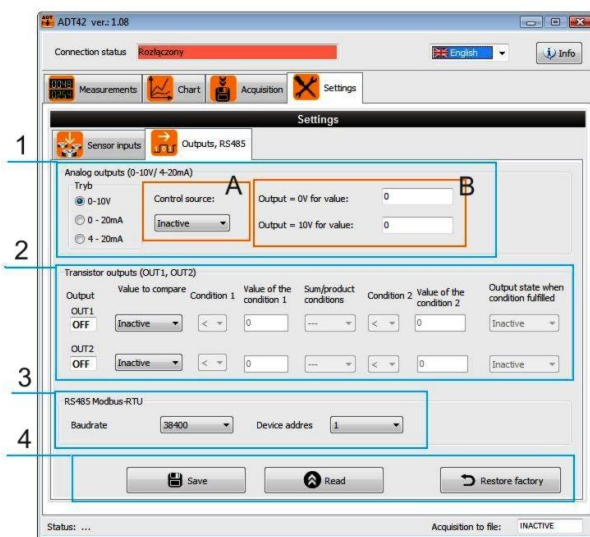
- 1) Setting of active inputs on „1 + 2” (1)

- 2) Introducing value 500 (3) in „Rated capacity” window for sensors 1 and 2
- 3) Introducing value 1,5 (3) in „Rated output” window for sensors 1 and 2
- 4) Zeroing of sensor’s offset – 0 button for each channel independently or 0 for all channel simultaneously(3)
- 5) Saving of settings to device – „Save” button (6)

For multivariant measurements we recommend to set filtration on „Slow” and select filtration level to achieve compromise between measurement stability and response time on change of force. (2). Each value change should be saved by „Save” button (6)

3.3 Configuration of output and RS485

After starting ADT42-PC application go to **Settings**  tab, then to **Outputs, RS485**  tab.



- 1) Setting of analog output. A – selection of signal source, sent on 0-10V/4-20mA output, B – calibration of analog output
- 2) Setting of transistor outputs OUT 1 and OUT2.
- 3) Setting of communication parameters RS485 MODBUS
- 4) Reading and saving set parameters to module and factory settings recall

3.3.1 Configuration of analog output

This options allows to determine:

- Output type: 0-10V, 0-20mA or 4-20mA
- Controlling value (A), which will be transferred to analog output. As controlling value you can select one of 4 channels or aggregate of active channels.
- Calibration of input value (B) in relation to controlling signal.

Depend on module version it will be allowable proper analog output:

- **ADT42-U** – module with voltage output – allowable selection 0-10V
- **ADT42-I** – module with current output – allowable selection 0-10mA or 4-20mA

Example 1: For aggregate value in range of 0-2000 analog output can change in range from 4mA up to 20mA

- 1) Setting of output mode for **4-20mA**

- 2) Selection of **Sum** controlling value
- 3) Setting **Output = 4mA for value: 0**
- 4) Setting **Output = 20mA for value: 2000**
- 5) Save settings by **Save** button

Example 2: For value of channel 1 in range from 0 to 500 analog output should change in range from 10V up to 0V

- 1) Set output mode on **0-10V**
- 2) Selection of **Input 1** controlling value
- 3) Set **Output = 0V for value: 500**
- 4) Set **Output = 10V for value: 0**
- 5) Save settings by **Save** button

3.3.2 Configuration of transistor outputs

By using this option it is possible to configure conditions of activation/ deactivation transistor outputs OUT1 and OUT2.

Example : OUT1 output should be activated when value on 2 input will exceed 500

Wyjście	Wartość do porównania	Warunek 1	Wartość do warunku 1	Suma/iloczyn warunków	Warunek 2	Wartość do warunku 2	Stan wyjścia gdy warunki spełnione
OUT1 OFF	Wejście 2	>	500	---	<	200	Aktywne

Example: OUT1 output should be activated in range of measured aggregate value 100 up to 200.

Wyjście	Wartość do porównania	Warunek 1	Wartość do warunku 1	Suma/iloczyn warunków	Warunek 2	Wartość do warunku 2	Stan wyjścia gdy warunki spełnione
OUT1 OFF	Suma	>	100,00	ORAZ	<	200	Aktywne

3.3.3 Configuration of RS485 MODBUS

This options allows to set MODBUS baudrate in range: 9600, 19200, 38400, 5760, 115200 and set slave address in range 1-247.

4. RS485 MODBUS Communication

RS485 can be used for communication with PLC driver, HMI panel or other device operating in MODBUS-RTU protocol. RS485 port in ADT42 has no galvanic insulation, so you must provide the same ground potential for ADT42 as for master device.

Default transmission parameters:

- Baudrate: **38400bps**, bits: 8, Stop bit: 1, Parity: none
- Address **Modbus: 1**

Baudrate and slave address of ADT42 can be changes by ADT42-PC program.

Used MODBUS functions

Function number (hex)	Description
1 (0x01)	Reading of output state (OUT1, OUT2)
2 (0x02)	Reading of input state (IN1, IN1)
3 (0x03)	Reading of X registers
5 (0x05)	Record of single bit

Plan of ADT42 registers

Address	Name	Type of variable	Mode(Modbus function)	Description
Values stored in registers INT type (integral number)				
0 (*1)	SUM_INT	INT	R (0x03)	Aggregate value of measurement
2 (*3)	SUM_MIN_INT	INT	R (0x03)	Recorded minimal value
2 (*3)	SUM_MAX_INT	INT	R (0x03)	Recorded maximal value
3 (*4)	CANALO_INT	INT	R (0x03)	Value of 1 channel
4 (*5)	CANAL1_INT	INT	R (0x03)	Value of 2 channel
5 (*6)	CANAL2_INT	INT	R (0x03)	Value of 3 channel
6 (*7)	CANAL3_INT	INT	R (0x03)	Value of 4 channel
7 (*8)	ANALOG_INT	INT	R (0x03)	Value of analog output (x1000)
Values stored in registers REAL type (floating point number)				
8 -9 (*9-10)	SUM_REAL	REAL	R (0x03)	Aggregate value of measurement
10 -11 (*11-12)	SUM_MIN_REAL	REAL	R (0x03)	Recorded minimal value
12 -13 (*13-14)	SUM_MAX_REAL	REAL	R (0x03)	Recorded maximal value
14 -15 (*15-16)	CANALO_REAL	REAL	R (0x03)	Value of 1 channel
16 -17 (*17-18)	CANAL1_REAL	REAL	R (0x03)	Value of 2 channel
18 -19 (*19-20)	CANAL2_REAL	REAL	R (0x03)	Value of 3 channel
20 -21 (*21-22)	CANAL3_REAL	REAL	R (0x03)	Value of 4 channel
22 -23 (*23-24)	ANALOG_REAL	REAL	R (0x03)	Value of analog output
1 – bit values				
4000 (*4001)	MIN_MAX_RESET	BIT	W (0x05)	Zeroing of min/max. value
4001 (*4002)	TARA	BIT	W (0x05)	Tare of aggregate value
4002 (*4003)	ZERO_CANAL1	BIT	W (0x05)	Zeroing of 1 channel
4003 (*4004)	ZERO_CANAL2	BIT	W (0x05)	Zeroing of 2 channel
4004 (*4005)	ZERO_CANAL3	BIT	W (0x05)	Zeroing of 3 channel
4005 (*4006)	ZERO_CANAL4	BIT	W (0x05)	Zeroing of 4 channel
4006 (*4007)	ZERO_ALL	BIT	W (0x05)	Zeroing of 1..4 channels
5000 (*5001)	INPUTS	BIT	R(0x02)	Reading of inputs state bit 0 – IN1 bit 1 – IN2
6000 (*6001)	OUTPUTS	BIT	R(0x01)	Reading/ output setting



6000 (*6002)	OUT1		W(0x05)	bit 0 – OUT1
6001 (*6003)	OUT2			bit 1 – OUT2

* for addresses beginning from 1 (offset of address +1)

R – register reading, W - record

CAUTION: 4-byte number **REAL type** is contained in two registers. The first registry contains younger part of the number, the second - its older part. In order to read **REAL** number value correctly, read two registers (X, X+1), and then conduct appropriate conversion.

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

Register_X HI <-> Byte1

Register_X LO <-> Byte0

Register_X+1 HI <-> Byte3

Register_X+1 LO <-> Byte2

Number_32_bit = **Byte3**<<24 + **Byte2**<<16 + **Byte1**<<8 + **Byte0**, or **Number_32_bit** = Register_2 + Register_3<<16

Example of MODBUS communication table

Reading of measurements from SUM_IREAL register (Function: 03, Register address: 0)

Request (MODBUS MASTER -> ADT42)		Response (ADT42-> MODBUS MASTER)	
Device address	0x01	Device address	0x01
Function	0x03	Function	0x03
Hi registry address	0x00	Number of bytes	0x04
Lo registry address	0x00	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	0xC4	Register 0x03 Lo	REAL (Byte 2)
CRC Lo	0x0B	CRC Hi	8 bit
		CRC Lo	8 bit

Tare – bit setting of TARA register (Function: 05, Register address: 4001)






Request (MODBUS MASTER -> ADT42)		Response (ADT42) -> MODBUS MASTER)	
Device address	0x01	Device address	0x01
Function	0x05	Function	0x05
Hi registry address	0x0F	Hi register address	0x0F
Lo registry address	0xA1	Lo register address	0xA1
Register 0x00 Hi	0xFF	Register 0x00 Hi	0xFF
Register 0x00 Lo	0x00	Register 0x00 Lo	0x00
CRC	16 bit	CRC	16 bit



5. Complementary information

5.1 Force sensor types

WObit company has a broad offer of force sensors in range from single Newton's up to hundreds of kilo Newton's. Depends on assembly and way of measuring force (tension, compression) are available sensors with different shapes (table below).

Beam		To measure tension force. Range of measured force 0..350 N. Example of models: K200, K300
S-beam		To measure large tension force. Range of measured force 0..75 kN. Example of models: K1401, K1501, K1505, K1506, K1600
Round		To measure large and small tension force. Range of measured force 0..100 kN. Example of models: KB52, KB82, KMB19, KMB25, KMB31, KMM30, KMM50, KMM60,
Round with shaft		To measure large and small tension and compression force. Range of measured force 0..50 kN. Example of models: KMM20, KMM40
Cylindrical		To measure large tension and compression force. Range of measured force 0..200 kN. Example of models: K1101

5.2 Sensor measuring range

Rated load for sensor it is a size of force, which specifies top value of measuring range (given value for sensor as **bridge range -TRA** in N).

Applied load is the biggest force, which have unambiguous connection between force and output signal (signal value is changing linear in relation to force). It can count max. **M150%** of sensor range (bridge).

Cut-off load is the biggest force, which can take each sensor without it damage. It can count max. **200%** of sensor range.

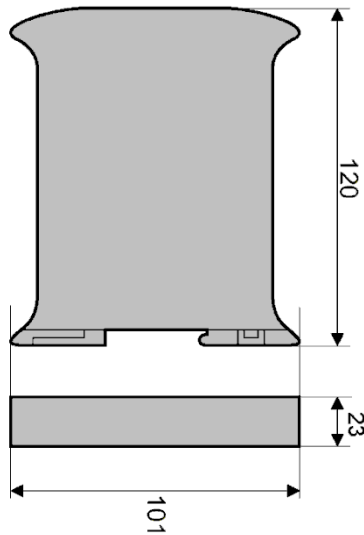
Destroying load means force applied to sensor Shaft, which exceeding can cause to mechanical damage of the sensor.

Destroying load	>200% F	Measuring range
Cut-off load	+200% F	
Applied load	+150% F	
Rated load	+100% F	
Zero load	0 [N]	
Rated load	-100% F	
Applied load	-150% F	
Cut-off load	-200% F	
Destroying load	<200% F	

Constant of e.g. KMM60 sensor is $1,5\text{mV/V} \pm 2\%$. Error of the sensor is specified by following values: tolerance of linearity 0,2% of measuring range, zero tolerance 2% of measuring range, hysteresis 0,2% of range and creep measured in time of 30 minutes 0,1%. Temperature factor of zero point

and constant is 0,1% of range/10°C. Bridge resistance on input has 380om ±10% and output resistance has 350om ±5%.

6. Technical parameters



Mechanical parameters	
Housing dimensions:	120 x 101 x 23 mm
Weight:	100 g
Operating temperature range:	5..50°C
Protection class:	IP20,
Mounting	Handle on DIN rail

Electrical parameters	
Power supply	12...24 VDC , 150 mA + OUT1, OUT2 outputs current
Force sensor inputs	Sensor power supply: 5 V (also 10V sensors) Max. differential voltage: ±39mV, Resolution: 0,001% FS (for typical bridge with sensitivity 2mV/V) Temperature error: 0,0025%/C° Measurement frequency (filtration mode: slow/fast) <ul style="list-style-type: none"> ▪ 1 active channel: 10 Hz / 80 Hz ▪ 2 active channel: 1,2 Hz / 10 Hz ▪ 3 active channel: 0,8 Hz / 6,5 Hz ▪ 4 active channel: 0,6 Hz / 5 Hz Time of initial annealing: about 10 min
Digital inputs IN1, IN2	Opt insulated, Low state: 0 V (max. 1 V), high state: +24 V (5...24 V) Min. pulse length >10 ms,
Transistor inputs OUT1, OUT1	Transistor OC , PNP type Max. ampacity: 0,5 A Low state: OUT = 0 V High state: OUT = VDC (voltage supply of the module)
Analog output 0-10 V (ADT42-U version)	0-10 V mode : V min = 0,015 V, V max = 10V, max. load 20 mA Resolution : ±3 mV, Accuracy 10 mV (0,1% FS)
Analog output 0/4-20 mA (ADT42-I version)	(0)4-20 mA mode : I min = 0,1 mA, I max = 24 mA Resolution: ±13µA, Accuracy 0,05 mA (0,25% FS)
Communication	RS485 MODBUS-RTU , (by default: 38400bps, 8:n:1, address: 1) USB : 1.1, 2.0