

Manual

WDF1



Measuring amplifier for Flexi Force[®] load cells
Programmable module with 0..10V, OC and RS485
(Modbus) outputs



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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. Designation

Measuring amplifier WDF1 is designed for cooperation with durable piezoresistive force sensors FlexiForce® type. This durable sensors have greater flexibility, superior linearity and accuracy ($\pm 3\%$) and are ultrathin (0,02 mm).

Due to its features FlexiForce® sensors are utilized in many applications to:

- Detect and measure a relative change in force or applied load
- Detect and measure the rate of change in force
- Identify force thresholds and trigger appropriate action
- Detect contact and/or touch

In areas such like tests and load measurement, quality tests, automotive industry and robotics.



WDF1 make linearization of resistive signal through digital processing. Due that is possible to approximately define force influencing on sensor.

WDF1 is equipped with 0..10 V voltage output and with transistor output. It can be configured, to be triggered at selected threshold responding to sensor load.

WDF1 is also equipped with RS485 interface operating in Modbus RTU standard. Due that is possible to communicate several sensors on one bus with master device (e.g. PLC).

Module features:

- Power supply 15..28 VDC
- Current consumption <0,06 A
- Input for sensor 0..1 M Ω
- Linearization and sensor signal filtering
- Measurement with ~20% accuracy
- Voltage output 0..10 V
- Transistor output OC type (Open Collector), possibility of configuration for operation in 3 modes
- RS485 (Modbus) interface
- Cooperation with WDF1-PC software
- Small dimensions

2.2 Connectors description



Picture 2. Connectors description

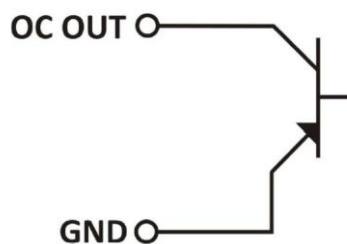
Name	Description
V+	Power Supply +15..28 VDC, 60 mA
GND	Ground of power supply and outputs
Vout	Voltage output 0..10 V
OC OUT	Transistor output max 500 mA
RS485 A	RS485 interface, A signal
RS485 B	RS485 interface, B signal
SENSOR	Sensor input
S1...S6	Modbus address switches
LED 1	Power supply signalization
LED 2	Signalization of triggering of transistor output and Modbus transmission

2.3 Voltage output Vout

On this output is appearing a voltage, which is proportional to measured force value (0..100%). For idle sensor it will be 0,020 V value. For max. loaded sensor it will be 10 V.

2.4 Transistor Output OC

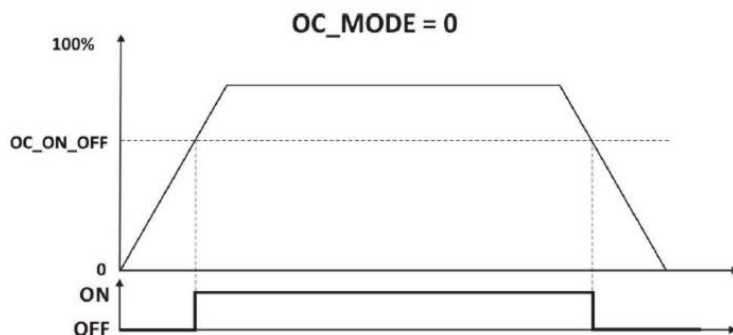
Transistor output OC type allows to trigger small loads (up to 0,5A). Max load can be applied is 28 VDC.



Picture 3. Output OC type (Open Collector)

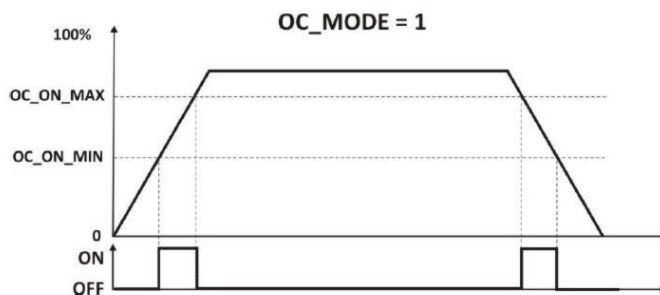
This output can operate in three modes (OC_MODE) configured by RS485 Modbus.

OC_MODE 0 – at this mode transistor output is switch on, when measurement value will be bigger than set value **OC_ON_OFF**.



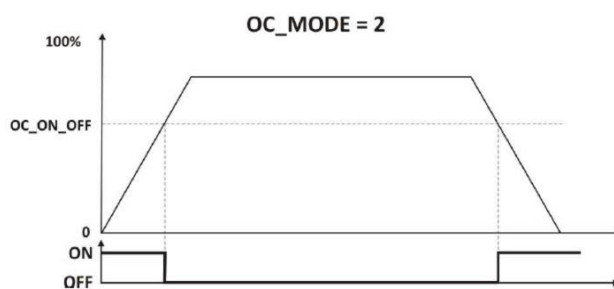
Picture 4. Output operation mode OC_MODE=0

OC_MODE 1 – at this mode transistor output is switch on, when value of measurement will be in range from OC_ON_MIN up to OC_ON_MAX.



Picture 5. Output operation mode OC_MODE =1

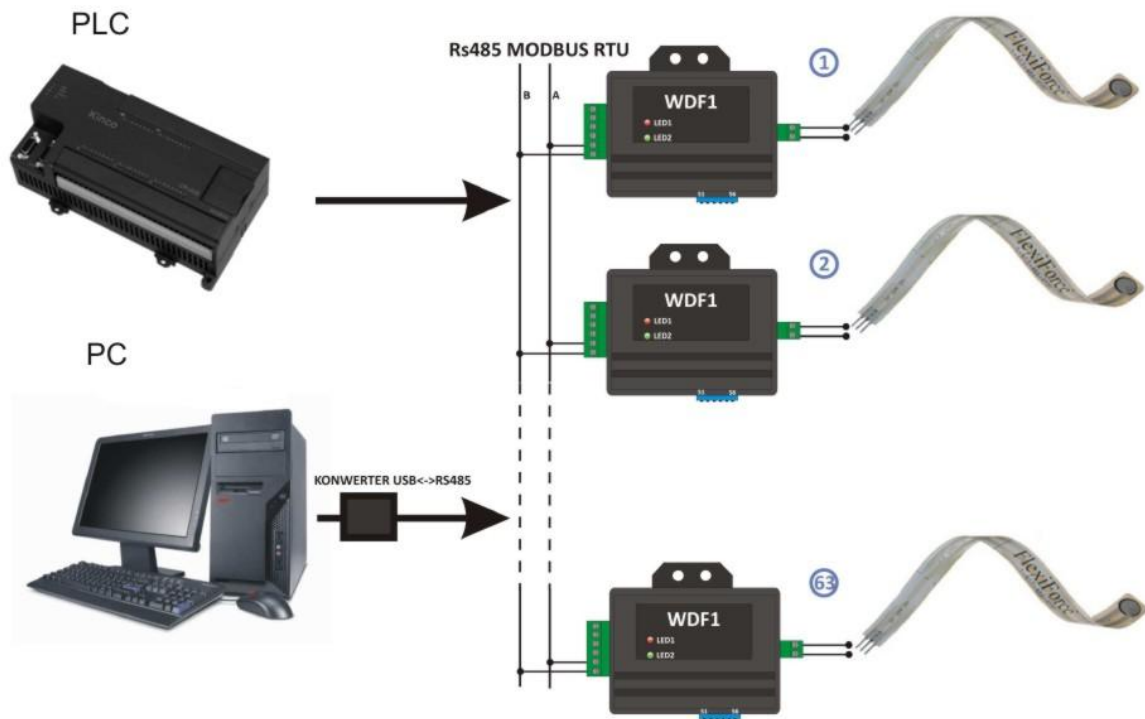
OC_MODE 2 – at this mode transistor output is switch on, when value of measurement will be lower than set value OC_ON_OFF.



Picture 6. Operation mode of OC_MODE=2 output

3. RS485 and communication in Modbus RTU protocol

WDF1 is equipped with RS485 interface, which allows for communication with external devices in Modbus RTU standard such PLC driver. Using this bus you can put in many WDF1 transducers on one line, thereby readout from many sensors at the same time. WDF1 is operating as a slave device.



Picture 7. Communication at Modbus protocol

3.1 Selection of device address

WDF1 can communicate with master device in RS485 bus through Modbus protocol. On one bus can be connected up to 64 devices. Device address is included in range from 50 to 113 and is selected by S1..A6 switches according to pattern below:

$$\text{ADDRESS} = 50 + S1 \cdot 1 + S2 \cdot 2 + S3 \cdot 4 + S4 \cdot 8 + S5 \cdot 16 + S6 \cdot 32$$

where: $S_x = 1$ when switch is set in position "ON"

$S_x = 0$ when switch is set in position "OF"

3.2 Data format

- Modbus RTU protocol
- Bandwidth: 57600 b/s
- Stop Bit: 2
- Parity: No

- Timeout: 750µs (max. interval time between next Bytes in frame)

Start frame delimiter	Address	Function	Data	CRC	End frame delimiter
T ₋₁₋₂₋₃₋₄	8 Bits	8 Bits	N x 8 Bits	16 Bits	T ₋₁₋₂₋₃₋₄

T₋₁₋₂₋₃₋₄ - time interval between next frames, min. 1,750ms

3.3. Modbus protocol – implemented functions

Function nr	Description
0x03	Registers readout
0x06	Record of single register
0x60	Device reset

3.3.1. Registers and functions description

Name	Mode	Description
MES_VAL	Readout	Measurement value. Number from range 0..1023 correspond to sensor load from 0 to 100%.
OC_ON_OFF	Record/Readout	Value of triggering threshold or turn off transistor output (for output operation mode OC_MODE: 0 or 2). Number from range 0..1023.
OC_ON_MIN	Record/Readout	Value of turn on transistor output (only for OC_MODE:1 mode) Number from range 0..1023.
OC_ON_MAX	Record/Readout	Value of turn off transistor output (only for OC_MODE:1 mode) Number from range 0..1023.
OC_MODE	Record/Readout	Selection of transistor output operation mode. Number 0,1 or 2.
RESET	Record	Device reset.

3.3.2 Parameters for 0x03 function (registers readout)

Address (hex)	Description	Data format
0x00	Measurement value MES_VAL	Unsigned int (16 Bit)
0x01	Value OC_ON_OFF	Unsigned int (16 Bit)
0x02	Value OC_ON_MIN	Unsigned int (16 Bit)
0x03	Value OC_ON_MAX	Unsigned int (16 Bit)
0x0A	Output operation mode OC_MODE	Unsigned int (16 Bit)

Example of measurement value readout function MES_VAL:

Inquiry		Response	
Device address	0x36	Device address	0x36
Function	0x03	Function	0x03



Initial Hi address	0x00	Quantity of Bytes	0x02
Initial Lo address	0x00	0x00 Hi register	Byte 1
Quantity of Hi registers	0x00	0x00 Lo register	Byte 2
Quantity of Lo registers	0x01	CRC	16 Bit
CRC	16 Bits		

Example of operation mode readout function OC_MODE:

Inquiry		Response	
Device address	0x36	Device address	0x36
Function	0x03	Function	0x03
Initial Hi address	0x00	Quantity of Bytes	0x02
Initial Lo address	0x0A	0x00 (Hi)	Byte 1
Quantity of Hi registers	0x00	0,1 or 2	Byte 2
Quantity of Lo registers	0x01	CRC	16 Bit

3.3.3 Parameters for 0x06 function (record of single register)

Address (hex)	Description	Data format
0x01	Value OC_ON_OFF	Unsigned int (16 Bit)
0x02	Value OC_ON_MIN	Unsigned int (16 Bit)
0x03	Value OC_ON_MAX	Unsigned int (16 Bit)
0x0A	Output operation mode OC_MODE	Unsigned int (16 Bit)

Example of setting OC_ON_OFF parameter function (e.g. on value 270 (HEX **0x010E**))

Inquiry		Response	
Device address	0x36	Device address	0x36
Function	0x06	Function	0x06
Initial Hi address	0x00	Initial Hi address	0x00
Initial Lo address	0x01	Initial Lo address	0x01
Hi value	0x01	Hi value	0x01
Lo value	0x0E	Lo value	0x0E
CRC	16 Bit	CRC	16 Bit

Example of setting OC_MODE operation mode function (e.g. on 2 mode)

Inquiry		Response	
Device address	0x36	Device address	0x36
Function	0x06	Function	0x06
Initial Hi address	0x00	Initial Hi address	0x00
Initial Lo address	0x0A	Initial Lo address	0x0A
Hi value	0x00	Hi value	0x00
Lo value	0x02	Lo value	0x02
CRC	16 Bit	CRC	16 Bit



3.3.4 Parameters for 0x60 function (device reset)

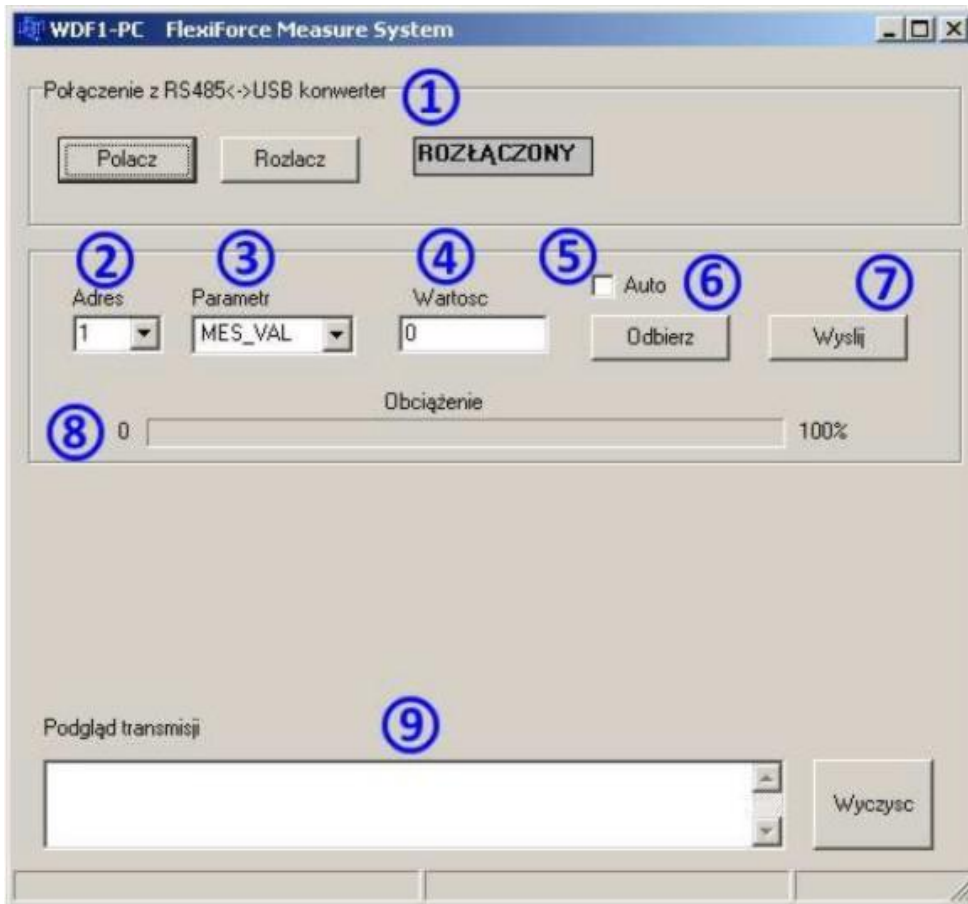
Inquiry		Response	
Device address	0x36	Device address	0x36
Function	0x60	Function	0x60
Initial Hi address	0x00	Initial Hi address	0x00
Initial Lo address	0xFF	Initial Lo address	0xFF
Hi value	0x00	Hi value	0x00
Lo value	0x00	Lo value	0x00
CRC	16 Bit	CRC	16 Bit

4. Cooperation with WDF1-PC program

WDF1-PC program is designed for cooperation with WDF1 measuring module and allows for its complete configuration and for readout of measured force. Program communicate with module by USB-RS485 converter (AD-USB-RS485).

On. Picture 8 is shown program window, below is presented its description:

- 1) Connection/ disconnection with USB-RS485 converter
- 2) Selection of WDF1 module
- 3) Selection of parameter for record/ readout
- 4) Readied out/ recorded value
- 5) Function of automatic measurement readout (only for MES_VAL parameter)
- 6) Receiving of setting from device
- 7) Recording of setting to device memory
- 8) Sensor load indicator
- 9) Window with MODBUS RTU transmission preview



Picture 8. WDF1-PC program window

5. Technical data

5.1 Electrical parameters

Parameter	Description
Voltage supply	14..28 VDC, 60 mA
Measurement range of sensor resistance	4kΩ...10MΩ
Resolution of measurement	0,1% of measurement range
Frequency of measurement	250 inch/sec
Non-linearity error	~20%
Transistor output OC (Open Collector)	Max load 500 mV, Max switching voltage 28 VDC
Voltage output	0..10V, resolution 10 mV, load 20mA
Digital output	RS485 Modbus RTU Baudrate: 57600 b/s Stop Bit: 2 Parity: None

5.2 Mechanical parameters

Parameter	Description
Protection degree	IP52
Dimensions (height x depth x width)	50x68x28 mm
Weight	~60 g
Mounting	2x Ø4mm hole

6. Safety and mounting rules

- Use of described devices in special meaning system (e.g. medical systems, in vehicles etc.) requires use of additional protection against operation errors.
- Devices must be correctly mounted in panel. Not adhere to safety rules can cause electric shock.
- Do not connect external devices during operation of the device.
- Do not disassemble or make any modifications to the device on your own. Please contact with WObit technical department if needed. Non authorized modifications can cause fire or electric shock. It also cause device invalidation.
- Described device can't be exploited in open air. It could cause electric shock and decrease device lifetime.
- Exceeding of recommended operation parameters can cause damage of the device or fire.
- For cleaning of the device it is not allowed to use substances containing water or oils.