



# RS485-ASCII

Description of the protocol

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**Studio**

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## 2. Description of functions

Communication with the transmitter is on the principle MASTER - SLAVE. Converter minimum response time is 9ms and can be changed up to 72ms increments of 9ms. Communication speed is factory set to 19200 baud and can be programmatically selected in the range from 2400 to 19200 baud. Other transmission parameters are set firmly and 8bits no parity and one stop bit (8/N/1).

Slave addresses can be selected from the range ASCII <A-Z, a-z>. Special char as address is the character @, which is used for a broadcast message. In order to change the address is not working. Practical use of broadcast messages is only when stored measured values in the memory for all transmitters simultaneously, and then the subsequent reading from different addresses, or is used for identification, if there is only one line converter whose address is unknown.

The command is represented by a string of ASCII characters. If during the transmitting of command the time lag is greater than the time of posting four characters at a given baud rate, the receive buffer in the device deleted. The converter can get unintelligible string, which does not respond. To decode the string is always in the converter after the character <CR>.

The command structure is as follows:

<T> <function> <address> <parameters> <CRC> <CR>

The meaning of each character in the string command	
<T>	starting character
<function>	identification of the function
<address>	address of converter (a-z, A-Z)
<parameters>	meaning is given to the description of each function
<CRC>	Checksum (it can be programmatically enabled, in the factory settings is implicitly disabled) calculation example for a string TMA0033 54H+4DH+41H+30H+30H+33H+33H=01A8H=>A8H
<CR>	Character CR value 0DH ( "\r" )

Each command invokes a response called the device. The exception is reset command and the command with the broadcast address @.

Response string has the following syntax:

< > <1> <address> <parameters> <CRC> <CR>

The meaning of each character in the string answers	
< >	introductory character ">" ( is optional ) (Factory settings without this character)
<1>	character is always 1 except of answers relating to the second channel - there is 2
<address>	character transmitter address that responded
<parameters>	meaning is given to the description of each function
<CRC>	Checksum the same meaning as in the command string
<CR>	character CR value 0D <sub>H</sub>

#### Function list

function	meaning	parameters
D	data reading	one ASCII character of range <1,2,3,4,5>
M	reading memory	four ASCII characters representing the 16b address in hex
Z	writing memory	2 x four ASCII characters representing the 16b address in hex and a 16b written value in hex
V	change baud rate	one ASCII character assigning <1..4> => <19200Bd..2400Bd>
A	change address	character a new address of range <A-Z, a-z>
R	reset	ASCII character 1

### 3. Function D

The function D is used to read the input values (data). Transfer of measured values is caused by the requirement of reading. According to the specified parameter data is provided to the output or are stored in the memory of transmitter, or are provided from this memory to the output.

Output data is provided in a fixed format in the form  $\pm XXX.XX$  (engineering unit). The value is always opened by sign, followed by a number. If the number is smaller the output string is added from the left with zeros so that the decimal point is always at the same place. Number of decimal places varies depending on the converter and measured values

The command has follows structure:

TD <address> <parameter> <CR>

Parameter	Meaning	Output data
1	Reading input 1	Value of input 1
2	Reading input 2	Value of input 2
3	Reading memory of input 1	Value from memory input 1
4	Reading memory of input 2	Value from memory input 2
5	Input to memory	String <OK>

Note: Parameter 2 or 4 is valid only for device with second input.

If you use parameter 5 with address @, devices do not respond and writing to memory is carried out of all device on the bus.

After correct command followed this response:

<input number> <address> <data> <CR>

In case of error comes error message ([see error table](#)) or converter does not respond at all.

Example 1: Reading the immediate value of the converter with address Q on input 2

Command	Response
TDQ2 <CR>	2Q +001.25 <CR>

Example 2: Saving the input values to memory and subsequent reading of the transducer with address R, S, T on input 1

Step	Command	Response
1	TD @ 5 <CR>	no response
2	TDR3 <CR>	1R-3 251.12 <CR>
3	TDS3 <CR>	1S-4 000.45 <CR>
4	TDT3 <CR>	1Y +058.29 <CR>

Note: The description is not considered a change on the checksum.

## 4. Function M

The function M is used to read 16-bit value from the EEPROM interface. In this memory are placed information about the setup converter, serial number, calibration date, note and linearization data.

The function has only one parameter, there is the address of read point as 16 bit number of address memory location in hex format.

The command has follows structure:

TM <device address> <16 bit address space read> <CR>

Answer after a properly conducted command is

1 <device address> <16 bit address space read> <16 bit value><CR>.

Function M with 8-bit parameter <10> presents special notation. So defined entry has in the output space a string of 8 characters from a storage location for the note. In response, however, does not represent the address of the output data.

If an error is coming error message ([see error table](#)) or converter does not respond at all.

The opposite of the function "M" is the function "Z", which is designed for writing values into the appropriate places in the EEPROM.

Example 1: Reading a memory address 002A (configuration word) of the converter with address Q.

Command	Response (data depends on settings)
TMQ002A <CR>	1Q002A0002 <CR>

Example 2: Reading the value of the notes of the converter with address D.

Command	Response (data depends on settings)
TMD10 <CR>	1DBoiler1 <CR>

Note: The description is not considered a change on the checksum.

## 5. Function Z

The function Z is used to write 16-bit values to the EEPROM interface. On these memory locations that are specified in the table, there is information about setting up converter, serial number, calibration date, notes and linearization data.

The function has two parameters. The first is the address where data entry will be made and a 16 bit number expressed in hexadecimal format. The second parameter is the intrinsic value of written data, which is also 16 bit number expressed in hexadecimal notation.

The command has follows structure:

TZ <device address> <16 bit address space entry> <16 bit value written data> <CR>

Answer correctly after making changes to the memory address looks like this

1 <device address> <16 bit address space entry> <16 bit value written> <CR>

You can see that the answer is the same as if we had made a proofreading by function "M" on this place.

Function "Z" with an 8-bit parameter <10> presents the specific notation, which is then followed by a 1-8 character string of note. So defined, the command is used to write the note that is represented by the following string. If done correctly the answer is OK. If the string is longer than 8 characters, the transmitter does not understand the command, not any response and resets the input buffer.

Example 1: Write value to memory location 0x0002 0x002a (configuration word) to the interface with the address Q.

Command	Response (data depends on settings)
TZQ002A0002 <CR>	1Q002A0002 <CR>

Example 2: Writing string note "Boiler1" into the address converter D.

Command	Response (data depends on settings)
TZD10Boiler1<CR>	1DOK <CR>

Note: The description is not considered a change on the checksum.

## 6. Function V

The function V is used to change communication (baud) rate converter.

Function parameter is a single character representing the new communication speed. Assignment is determined by the table.

Character	Baud rate
1	19200 Bd
2	9600 Bd
3	4800 Bd
4	2400 Bd

The command has follows structure:

TV <device address> <new baud rate> <CR>.

When properly made baud rate change, the response is

1<device address>OK <CR>

If an error is coming error message ([see error table](#)) or converter does not respond at all.

After the command, the unit continues to work on the original baud rate.

Communication on the new baud rate is started after reset either power supply off for about 3 seconds, or by resetting the help function R.

**To put the device with address D for speed 2400 Bd can then look like this:**

From the factory comes device with a baud rate 19200 Bd. Communication therefore start at this speed. Enter the command to change the speed

TDV4 <CR> to baud rate 2400Bd.

After correct execution converter responds to the initial baud rate

1D0K <CR>

Now perform the reset command

TDR1 <CR>

Answers already do not go and converter from this time accepts commands on speed 2400 Bd

Note: The description is not considered on the state checksum.

## 7. Function A

A function is useful for changing the device address.

Parameter function has only one character and that character is a new address. This address can be selected only from English alphabet sequences of characters and the range <A-Z> or <a-z>. Small and large letter is always different address.

The command has follows structure:

TA <old address> <new address> <CR>

Answer a properly made, the address is

1 <new address> OK <CR>

If an error is coming error message ([see error table](#)) or converter does not respond at all.

### **Integration process to the system unit**

If not given the order otherwise leaves the factory converter with address "A". Connect the transmitter at the bus and by sending the first command

TAAD <CR>

change its address on "D".

Answer transmitter to correctly executed command is

1DOK <CR>

Note: In the description are not considered other possible parameters such as switching checksum and baud rate change.



## 8. Function R

R function is used to call reset.

The function is useful in connected with the command to change the baud rate, the change becomes effective after a reset, either by turning the power off for about 3 seconds or calling function R.

The command has follows structure:

```
TR <address> 1 <CR>
```

After properly performed command converter does not respond. If an error is coming error message ([see error table](#)).

Note: The description is not considered a change on the checksum.

## 9. Error table

The error message has follows structure:

1<address>AnR<error number><CRC><CR>

Error number	Meaning	Example for address „b“
1	syntax error	1bAnR1<CRC><CR>
2	hardware error	1bAnR2<CRC><CR>
3	input short circuited	1bAnR3<CRC><CR>
4	input open	1bAnR4<CRC><CR>
5	input value is below the range	1bAnR5<CRC><CR>
6	input value is above the range	1bAnR6<CRC><CR>
8	no value on memory	1bAnR8<CRC><CR>

## 10. EEPROM map

To write values and addresses of the memory is used for 16-bit value written in hexadecimal.

description of meaning of addresses in the address		
memory	value	availability
0000 <sub>H</sub> to 0029 <sub>H</sub>	linearization data	read/write
002A <sub>H</sub>	configuration word ( <a href="#">see table 1</a> )	
002B <sub>H</sub>	correction of input 1 *)	
002C <sub>H</sub>	correction of input 2 *)	
002D <sub>H</sub>	MSB month of calibration LSB year of calibration	
0033 <sub>H</sub>	MSB number of type LSB number of SW	only read
0034 <sub>H</sub> a 0035 <sub>H</sub>	32b serial number	

\*) The correction value input is 16-bit hexadecimal number in supplemental form.

We can express both positive and negative shift of a given number of digits.

Shift of +1 digit number is expressed as 0x0001,

shift by -1 digit number then 0xFFFF

## 11. Table 1 - Meaning of bits in the configuration word

Bit	meaning	description
16 (MSB)	unmeaning	0
15	response time	the bits presents binary number n response time=(n+1)*9ms
14		
13		
12	unmeaning	0
11		
10		
9		
8		
7	response to the overflow	0 - error message 1 – value about 6% out of range
6	additional character ">"	0 – OFF 1 - ON
5	filter	0 - filter OFF 1 - filter ON
4	CRC	0 – CRC OFF 1 – CRC ON
3	unmeaning	0
2	compensation	0 - 3W or cold junction compensation 1 - 2W or without cold junction compensation
1 (LSB)	resolution of the input	0 - 15 bits 1 - 14 bits