WEST
Control Solutions

DataVU 5 - Interface Manual Modbus

59482/1

Contents

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1.1 Preface

Please read this Interface Description before commissioning the interface for the instrument. Keep the interface description in a place which is accessible to all users at all times.

☞ All the necessary information for operating the interface is contained in this interface description. However, if any difficulties should still arise during start-up, please do not carry out any unauthorized manipulations. You could endanger your rights under the instrument warranty!

Please contact the nearest subsidiary or the head office in such a case.

When returning modules, assemblies or components, the regulations of EN 100 015 “Protection of electrostatically sensitive components” must be observed. Use only the appropriate **ESD** packaging for transport.

Please note that we cannot accept any liability for damage caused by ESD.

ESD = electrostatic discharge

1.2 Typographical conventions

1.2.1 Warning signs

The symbols for **Danger** and **Caution** are used in these operating instructions under the following conditions:

Danger This symbol is used when there may be **danger to personnel** if the instructions are ignored or not followed correctly!

Caution This symbol is used when there may be **damage to equipment or data** if the instructions are ignored or not followed correctly!

Caution This symbol is used where special care is required when handling components liable to damage through electrostatic discharge.

1.2.2 Note signs

Note This symbol is used when your **special attention** is drawn to a remark.

abc[1] **Footnote** Footnotes are remarks that refer to specific points in the text. Footnotes consist of two parts:

A marker in the text, and the footnote text.

The markers in the text are arranged as continuous superscript numbers.

1.2.3 Representation modes

0x0010 **Hexadecimal number** A hexadecimal number is identified by being preceded by an “0x” (here: 16 decimal).

2.1 Areas of application

The serial interface – RS232 or RS485/ (MODbus, Jbus) – is used for communication with supervisory systems, such as a bus system or a PC. It is used to perform various functions, such as:

- to read out measurements from the paperless recorder
- to read out device and process data from the paperless recorder.

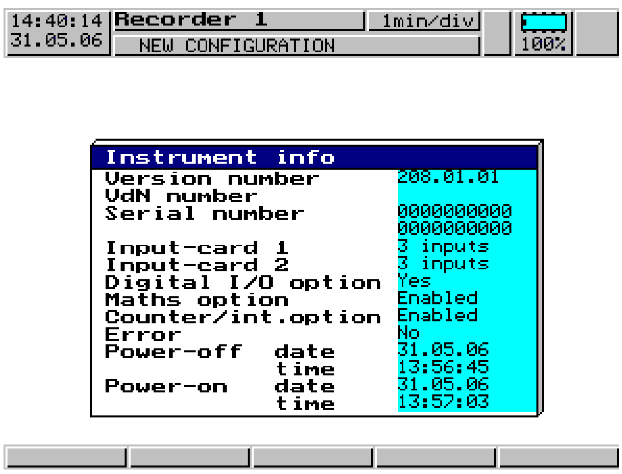
2.2 System requirements

The following items are required for operating the serial interface:

- paperless recorder with a serial interface (option)
- connecting cable, e.g.
  PC interface with TTL/RS232 converter and adapter
  PC interface with USB/RS232 converter and adapter
- setup or evaluation program, e.g.
  setup program
  PC evaluation software PCA3000
  PCA communications software PCC
- PC or notebook

2.3 Identifying the interface

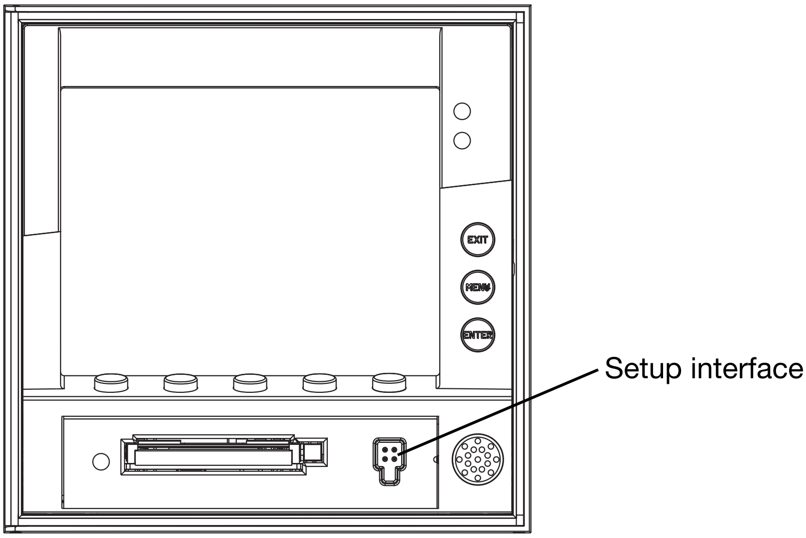
The serial interface RS232 / RS485 (MODbus, Jbus) is available as an option.
To see whether the device already has a serial interface, use the menu *Device info* ➔ *Option Digital I/O* to investigate the configuration.



If the option *Digital I/O option* is available (*Yes*), then the instrument already has a serial interface.

3.1 Connection diagram

Front panel of the paperless recorder



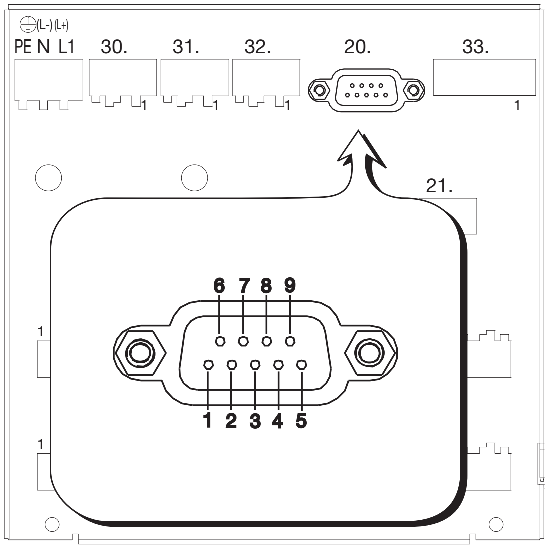
Connection diagram

☞ The connection on the front panel can only be made through the setup interface with the connecting cable for “PC interface with TTL/RS232 converter and adapter”.

If the PC or notebook does not have a serial interface, then the connecting cable “PC interface with USB/RS232 converter and adapter” is also required.

3 Connecting the interface

Rear view of the paperless recorder



Connection diagram

Connector 20	
RS232	**RS485**
1 ○	1 ○
2 ○ RxD	2 ○
3 ○ TxD	3 ○ TxD+/RxD+
4 ○	4 ○
5 ○ GND	5 ○ GND
6 ○	6 ○
7 ○	7 ○
8 ○	8 ○ TxD-/RxD-
9 ○	9 ○

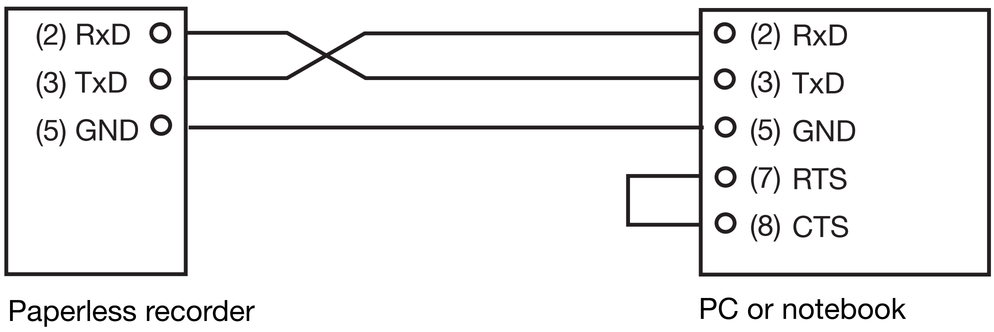
☞ We recommend using a twisted-pair connecting cable with shielding!

3.2 RS232

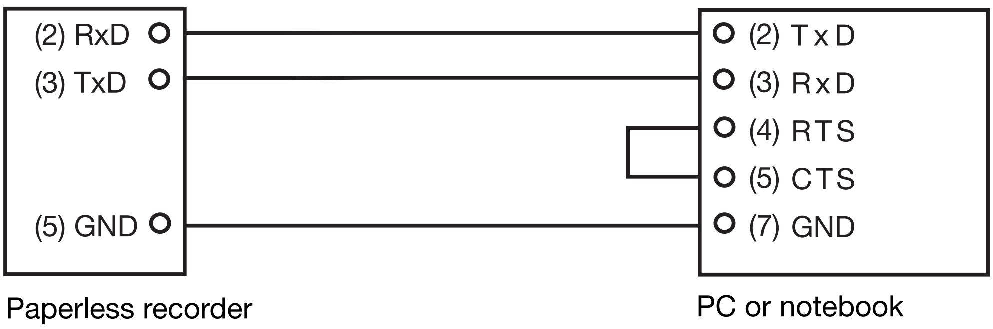
In the case of the RS232 interface, the handshake lines (RTS, CTS) are not used. The RTS line from the master (PC or notebook), which is the CTS line for the paperless recorder, will be ignored. The response is sent back immediately by the recorder. The CTS line of the master (RTS on the recorder) remains open.

If the program that is used evaluates the handshake lines, then they must be bridged in the cable.

PC COM interface with 9-pin Sub-D socket



PC COM interface with 25-pin Sub-D socket



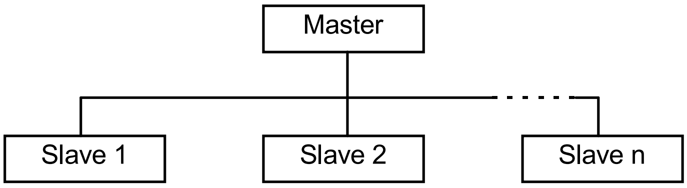
Only the signal lines shown above are to be connected. If this is not observed, then the recorder may switch over to RS485 mode.

3.3 Switching between RS232 and RS485

The changeover between the RS232 and RS485 interfaces is made through the recorder parameter
Configuration level ➔ Interface ➔ Interface type
or, using the setup program
Edit ➔ Configuration level ➔Interface ➔ Interface type

4.1 Master-slave principle

The communication between a master (PC or notebook) and a slave device (paperless recorder), using MODbus/Jbus, takes place according to the master-slave principle, in the form of a data request/instruction – response.



The master controls the data exchange, the slaves only have a response function. They are identified by their device addresses.

☞ The paperless recorder cannot be used as the master, it can only be operated as a slave.

4.2 Transmission mode (RTU)

The transmission mode used is the RTU mode (Remote Terminal Unit). Data are transmitted in binary format (hexadecimal) with 8 bits, as 16-bit integer values, or as 32-bit float values.

Data format The data format describes the structure of a transmitted byte.

Data word	Parity bit	Stop bit	Bit number
8 bits	—	1	9
8 bits	—	2	10
8 bits	even	1	10
8 bits	odd	1	10

☞ The data format that is to be used can be selected, see Chapter 4.8 Configuration of the interface on the back panel, page 18.

4.3 Device address

The device address for the paperless recorder can be set between 1 and 254 (decimal), see Chapter 4.8 Configuration of the interface on the back panel, page 18.

☞ A maximum of 31 paperless recorders can be addressed via the RS485 interface.

Device address 0 is reserved.

If only **one** recorder is connected to the PC or notebook, then it can also be accessed through device address 255 (even if a different address has been configured). The paperless recorder will always respond to instructions for device address 255.

In the transmission protocol, the address is given in binary format (hexadecimal).

4.4 Timing sequence for communication

Character transmission time

The start and end of a data block are marked by transmission pauses. The character transmission time (the time taken to transmit one character) depends on the baud rate and the data format that is used.

For a data format with 8 data bits, no parity bit and one stop bit, this is:

character transmission time [msec] = 1000 * 9 bits / (baud rate)

For the other data formats it is:

character transmission time [msec] = 1000 * 10 bits / (baud rate)

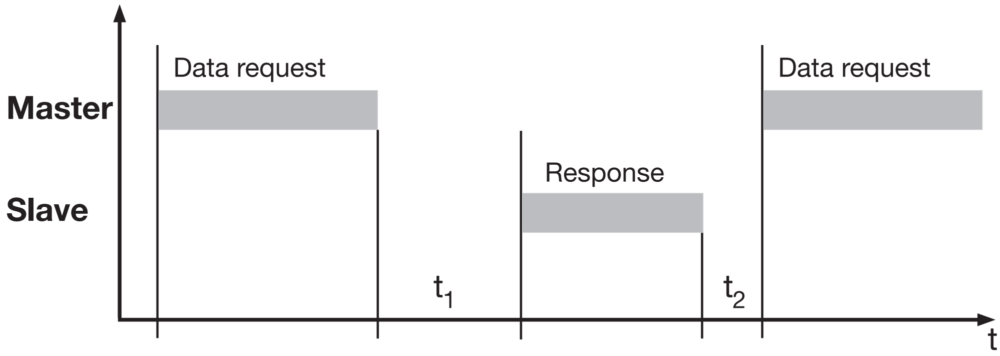
Example

Baud rate [bps]	**Data format** [bit]	**Character transmission time** [msec]
38400	10	0.260
	9	0.234
19200	10	0.521
	9	0.469
9600	10	1.042
	9	0.938

The baud rate is selectable, see Chapter 4.8 Configuration of the interface on the back panel, page 18.

Timing sequence

A data request runs according to the following timing sequence:



t_1 Internal waiting time of the paperless recorder before checking the data request, and the internal processing time.

min.:	12.5 msec
typical:	12.5 — 30 msec
max.	1 sec

☞ A minimum response time can be set in the instrument, under the menu item *Configuration* ➔ *Interface*. This preset time is the minimum waiting time that must elapse before an answer is transmitted (0 — 500 msec). If a smaller value is set, then the response time may be longer than the preset value (because the internal processing time is longer), the recorder will then answer as soon as the internal processing is completed. A preset time of 0 msec means that the recorder answers with the maximum possible speed.

The minimum response time which can be set is required by the RS485 interface in the master, in order to switch over the interface driver from transmit to receive. This parameter is not required for the RS232 interface.

t_2 This is the waiting time which the master has to observe before initiating a new data request.

for RS232	at least 3.5 x the transmission time for one character (this time depends on the baud rate)
for RS485	25 msec

While t_1 and t_2 are running, the master must not present any further data requests, since the paperless recorder will either ignore them or declare them to be invalid.

4.5 Structure of the data blocks

Data structure

All data blocks have the same structure:

Slave address	Function code	Data field	Checksum CRC16
1 byte	1 byte	x byte(s)	2 bytes

Each data block contains four fields:

Slave address the device address of a specific paperless recorder

Function code function selection (read/write a word)

Data field contains the information:
- word address
- word number
- word value

Checksum detection of transmission errors

4.6 Difference between MODbus and Jbus

The MODbus protocol is compatible with the Jbus protocol. The structure of the data blocks is identical.

The difference between MODbus and Jbus is, that the absolute data addresses are shifted by +1 for Jbus.

Absolute address	Jbus address	Modbus address
0	1	0
1	2	1
2	3	2
...	...	...

4.7 Checksum (CRC16)

Calculation method

The checksum (CRC16) is used to recognize transmission errors. If an error is detected during evaluation, the corresponding device will not respond.

```
CRC = 0xFFFF
    CRC = CRC XOR ByteOfMessage
    For (1 to 8)
        CRC = SHR(CRC)
        if (flag shifted right = 1)
        then                        else
        CRC = CRC XOR 0xA001
while (not all ByteOfMessage processed);
```

The low byte of the checksum is transmitted first.

Example 1

Read out the measurement input 2 (present value = 58.272) of recorder 20 (0x14).

Data request to slave 0x14: read two words, starting at address 0x37 (CRC16 = 0x0077)

14	03	0037	0002	7700

Response (CRC = 0x1DFA):

14	03	04	1687	4269	FA1D
			Word 1	Word 2	

Word 1 + Word 2 produce the response 58.272.

Example 2

Request status of the relay outputs.

Instruction: read one word from address 0x31 (CRC16 = 0x00D7)

14	03	0031	0001	D700

Response (CRC = 0x4774):

14	03	02	0001	7447
			Word 1	

Word 1 indicates that only Output 1 is active.

4.8 Configuration of the interface on the back panel

Configuration on the paperless recorder

✱ Select *Configuration* ➔ *Interface* on the paperless recorder.
The parameters for the configuration of the interface will now be available.

	Parameter	Value/selection	Description
Interface type	➔ Interface type	RS 232, **RS 485**	see Chapter 3.3 Switching between RS232 and RS485, page 11.
Protocol	➔Protocol	**MODbus**, Jbus	see Chapter 4.6 Difference between MODbus and Jbus, page 16.
Baud rate	➔ Baud rate	9600 bps, 19200 bps, **38400 bps**	see Chapter 4.4 Timing sequence for communication, page 14.
Transmission mode (RTU)	➔ Data format	**8-1-none**, 8-1-odd, 8-1-even, 8-2-none	see Chapter 4.2 Transmission mode (RTU), page 13.
Device address	➔ Device address	**1** — 254	see Chapter 4.3 Device address, page 14.
Min. response time	➔ Min. response time	**0** — 500 msec	see Chapter 4.4 Timing sequence for communication, page 14.

Configuration through setup program

Configuration with the aid of the setup software is made through the menu item *Edit* ➔ *Configuration level* ➔ *Interface*.

4.9 Configuration of the interface on the front panel

The transmission parameters for the interface are fixed in the instrument, and cannot be altered.

- baud rate = 9600 bps
- data format = 8 data bits, 1 stop bit, no parity

The interfaces on the front and back panel have identical device addresses.

☞ We recommend using device address 255 for the setup interface on the front panel. The instrument will then always answer, irrespective of the configured device address.

4.10 Password protection for the serial interface

Access to the serial interface can be protected by a password (1 — 9999).

On the paperless recorder:
(*Configuration* ➔ *Device data* ➔ *Code No. (password)* ➔ RS232/RS485
or,
using the setup program:
(*Edit* ➔ *Device data* ➔ *Code numbers* ➔ *Interface*)

If password protection is active (i.e. password is **not** 0), then it is only possible to communicate with the device when the password has been written to MODbus address 0x7007 in the recorder. This prevents the unauthorized reading of data from the paperless recorder.

When password protection is active, only addresses
0x0000 to 0x001E (software version etc.) and
0x7008 (flag to indicate whether password protection is active) can be read, and address
0x7007 (interface password) can be written.

When the correct password has been transmitted, the password protection is instantly removed.

☞ If there is no transmission via the MODbus interface
for 10 seconds, then the protection will be re-activated!

If an incorrect password is sent to the device, then MODbus communication remains blocked. In this case, the device responds with error code 02. A fresh attempt at password entry will only be permitted after 10 seconds, to make it more difficult to try out passwords!

☞ Address 0x7008 can be queried, to see whether the password protection is active:
0 = password protection inactive
1 = password protection active

Function summary

The functions described below can be used to read out measurements and other device and process data from the paperless recorder.

Function number	**Function**	**Restriction**
0x03 or 0x04	read n words	max. 127 words (254 bytes)
0x06	write one word	max. 1 word (2 bytes)
0x10	write n words	max. 127 words (254 bytes)

☞ If the recorder does not respond to one of these functions, or reacts by generating an error code, then please refer to Chapter 7 Error messages, page 29.

No other MODbus functions are implemented in this instrument apart from those explained in this interface description.

5 Functions

5.1 Read n words

This function reads n words, starting from a defined address.

Data request

Slave address	Function 0x03 or 0x04	Address of first word	Word number	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response

Slave address	Function 0x03 or 0x04	Number of bytes read	Word value(s)	Checksum CRC16
1 byte	1 byte	1 byte	x byte(s)	2 bytes

Example

Read the first 3 analog inputs

For the addresses of the analog inputs,
see Chapter 8.2 Process data, page 32.

Data request: (CRC16 = 1A57)

14	03	004D	0006	571A

Response: (CRC16 = 4750)

14	03	0C	1999	4348	4CCC	4348	2666	4396	5047
			Measurement 1 200.1		Measurement 2 200.3		Measurement 3 300.3		

5.2 Write one word

For the “write word” function, the data blocks for instruction and response are identical.

Instruction

Slave address	Function 0x06	Word address	Word value	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response

Slave address	Function 0x06	Word address	Word value	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example

Set the MODbus flag (bit 0 of address 0x0033).

For the address of the MODbus flag, see Chapter 8.2 Process data, page 32.
For the function of the MODbus flag, see Chapter 9.1 MODbus flag, page 37.

Instruction: (CRC16 = C0BA)

14	06	0033	0001	BAC0

Response (as instruction):

14	06	0033	0001	BAC0

5.3 Write n words

Instruction

Slave address	Funct-ion 0x10	Address of first word	Word number	Byte number	Word value(s)	Check-sum CRC16
1 byte	1 byte	2 bytes	2 bytes	1 byte	x byte(s)	2 bytes

Response

Slave address	Function 0x10	Address of first word	Word number	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example

Write the word “Test” (ASCII coding: 0x54 0x65 0x73 0x74 0x00) to the address 0x0080... and so on, so that this text is entered in the event list.

Instruction: (CRC16 = BFC8)

14	10	0080	0003	06	54 65 73 74 00 00	C8BF

Response: (CRC16 = 03F3)

14	10	0033	0001	F303

6.1 Transmission format

Integer values

When using MODbus, integer values are transmitted in the following format: first the HIGH byte, then the LOW byte.

Example

Request the integer value from address 0x0000, when this address contains the value “20” (ASCII coding: 0x3230).

Request: 14030000000186CF (CRC16 = CF86)
Response: 140302**3230**A0F3 (CRC16 = xF3A0)

Float values

When using MODbus, float values are processed in the IEEE 754 standard format (32-bit), but with the difference that bytes 1 and 2 are swapped with bytes 3 and 4.

Single float format (32-bit) according to standard IEEE 754

SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
Byte 1	Byte 2	Byte 3	Byte 4

S = sign bit
E = exponent (complement to base 2)
M = 23-bit normalized mantissa

MODbus float format

MODbus address x		MODbus address x+1	
MMMMMMMM	MMMMMMMM	SEEEEEEE	EMMMMMMM
Byte 3	Byte 4	Byte 1	Byte 2

Example

Request the float value from address 0x0066, when this address contains the value “550.0” (0x44098000 in IEEE 754 format).

Request: 140300350002D6C0 (CRC16 = C0D6)
Response: 140304**80004409**6434 (CRC16 = 3464)

After the transmission from the device, the bytes of the float value must be swapped accordingly.

Many compilers (e. g. Microsoft Visual C++) store the float values in the following order:

Float value

Address x	Address x+1	Address x+2	Address x+3
MMMMMMMM	MMMMMMMM	EMMMMMMM	SEEEEEEE
Byte 4	Byte 3	Byte 2	Byte 1

Please check how float values are stored in your application. If necessary, the bytes will have to be swapped accordingly in your interface program, after they have been fetched from the paperless recorder.

Double values

When using MODbus, double values are also processed in the IEEE-754 standard format (32 bits). Unlike float values, no bytes are swapped for double values.

Double float format (32-bit) according to standard IEEE 754

SEEEEEEE	EEEEMMMM	MMMMMMMM	MMMMMMMM
Byte 1	Byte 2	Byte 3	Byte 4

MMMMMMMM	MMMMMMMM	MMMMMMMM	MMMMMMMM
Byte 5	Byte 6	Byte 7	Byte 8

S = sign bit
E = exponent (complement to base 2)
M = 52-bit normalized mantissa

MODbus double format

MODbus address x		MODbus address x+1	
SEEEEEEE	EEEEMMMM	MMMMMMMM	MMMMMMMM
Byte 1	Byte 2	Byte 3	Byte 4

MODbus address x+2		MODbus address x+3	
MMMMMMMM	MMMMMMMM	MMMMMMMM	MMMMMMMM
Byte 5	Byte 6	Byte 7	Byte 8

Example

Request the double value from address 0x0035, when this address contains the value “1234567.89” (0x4132D687E3D70A3D in IEEE 754 format).

Request: 140300660004A6D3 (CRC16 = D3A6)
Response: 140308**4132D687E3D70A3D**E1C1 (CRC16 = C1E1)

Please check how double values are stored in your application. If necessary, the bytes will have to be swapped accordingly in your program, after they have been fetched from the paperless recorder.

Character strings (texts)

Character strings are transmitted in ASCII format.

☞ A “\0” (ASCII code 0x00) must always be transmitted as the last character, to mark the end of the string. Any following characters are meaningless.

If a string of characters is transmitted to the recorder without the terminating “/0”, then the instrument will overwrite the last character with “/0” of its own accord!

Since text transmission is made as words (16-bit), if there is an odd number of characters (incl. "\0"), an additional 0x00 will be added on.

The maximum lengths given in the address tables (see Address tables, page 31 onwards) for character strings include the terminating “/0”, i.e. the text for “char 11” can have a maximum length of 10 characters.

Example

Request the text from address 0x000E, when this address contains the character string “**LS500cf**”
(ASCII code: **0x4C**, **0x35**, **0x30**, **0x30**, **0x63**, **0x66**, 0x20, 0x00).

Request: 1403000E0005E6CF (CRC = CFE6)
Response: 14030A**4C533530306366**2000AA91D6 (CRC16= D691)

☞ Instead of “AA” in front of the CRC sum, there could be any value – since it comes after the “/0”, it will be ignored.

7.1 Error handling

No response from the recorder

The slave will not respond if one of the following errors occurs:

- The baud rate and/or data format for the master (PC or notebook) does not match the slave (paperless recorder).
- the device address for the recorder does not match the address contained in the protocol
- the checksum (CRC16) is not correct
- the MODbus function is not supported by the device
- the instruction from the master is incomplete or over-defined
- the number of words to be read is zero
- communication is active on the setup interface.

In these cases, when the timeout of 2 seconds has expired, the data will have to be retransmitted.

Error codes

If the data request from the master is received by the paperless recorder without any transmission error, but cannot be processed, then the recorder will answer with an error code.

The following error codes may appear:

02 invalid address or
too many words to be read or written, or
access to interface protected by password

03 value is outside the permitted range

08 write-protected value

Response in the event of an error

Slave address	Function XX OR 80h	Error code	Checksum CRC16
1 byte	1 byte	1 byte	2 bytes

The function code is ORed with 0x80, which means that the MSB (most significant bit) is set to 1.

Example

Data request: (CRC16 = 792C)

14	03	1234	0001	C279

Response: (CRC16 = 35D1)

14	83	02	D135

7 Error messages

7.2 Error messages for invalid values

For measurements, the error number is shown in the value itself, i.e. the error number is inserted instead of the measurement.

Error code for float values	Error code for double values	Error
-200000.0	-80000000000000000.0	underrange
200000.0	80000000000000000.0	overrange
200003.0	80000000000000003.0	otherwise invalid value

Example

Data request: (CRC16 = D956)

14	03	004D	0002	56D9

Response: (CRC16 = 03D8)

14	03	04	5000	4843	D803

The measurement 0x48435000 (= 200000.0), provided by analog input 1, shows that an overrange has appeared.

All process values (variables) together with their addresses, data types and access modes are described below.

References are as follows:

R	read access only
W	write access only
R/W	read and write access
char	ASCII character (8 bits)
byte	byte (8 bits)
int	integer (16 bits)
char xx	character string of length xx; xx = length, including the string termination character “\0”
Bit x	bit No. x
float	float value (4 bytes)
double	double value (8 bytes)

The process values are divided into logical groups.

In the following address tables, bit 0 is always the least significant bit.

8.1 Device data

Address	Access	Data type	Signal designation
0x0000	R	char 11	Software version
0x0006	R	char 13	VdN number
0x000E	R	char 9	Device name (“LS500cf”)
0x0013	R	char 21	Serial No.

8.2 Process data

Address	Access	Data type	Signal designation
0x002F	R	int	status of the binary inputs
	R	Bit0-7	free
	R	Bit8	binary input 1 0 = open / 1 = closed
	R	Bit9	binary input 2
	R	Bit10	binary input 3
	R	Bit11	binary input 4
	R	Bit12-15	free
0x0030	R	int	additional binary signals
	R	Bit0	memory alarm for internal memory for read-out via CF card 0 = no alarm 1 = memory nearly full
	R	Bit1	memory alarm for internal memory for read-out via serial interface 0 = no alarm 1 = memory nearly full
	R	Bit2-7	free
	R	Bit8	combination alarm 0 = no alarm 1 = at least 1 limit infringed in the device
	R	Bit9	memory alarm, CF card 0 = no alarm 1 = CF card nearly full
	R	Bit10	fault 0 = no fault 1 = fault
	R	Bit11	Low combination alarm 0 = no Low alarm 1 = at least 1 Low alarm present
	R	Bit12	High combination alarm 0 = no High alarm 1 = at least 1 High alarm present
	R	Bit13	counter/integrator combination alarm 0 = no alarm 1 = at least 1 counter/integrator limit infringement
	R	Bit14	CF card 0 = no CF card in slot 1 = CF card is plugged in
	R	Bit15	free
0x0031	R	int	status of relay outputs and logic channels
	R	Bit0	relay output 1 0 = inactive 1 = active

Address	Access	Data type	Signal designation
	R	Bit1	relay output 2
	R	Bit2	relay output 3
	R	Bit3-7	free
	R	Bit8	logic channel 1 0 = false 1 = true
	R	Bit9	logic channel 2
	R	Bit10	logic channel 3
	R	Bit11	logic channel 4
	R	Bit12	logic channel 5
	R	Bit13	logic channel 6
	R	Bit14-15	free
0x0032	R	int	counter/integrator alarms
	R	Bit0-7	free
	R	Bit8	alarm, counter/integrator channel 1 0 = no alarm 1 = limit infringed
	R	Bit9	alarm, counter/integrator channel 2
	R	Bit10	alarm, counter/integrator channel 3
	R	Bit11	alarm, counter/integrator channel 4
	R	Bit12	alarm, counter/integrator channel 5
	R	Bit13	alarm, counter/integrator channel 6
	R	Bit14-15	free
0x0033	R/W	int	flag for control of various device functions
	R/W	Bit0	MODbus flag 0 = false 1 = true
	R/W	Bit1-15	free
0x0034	R	int	alarms for analog channels
	R	Bit0	Low alarm, channel 1 0 = no alarm 1 = underrange
	R	Bit1	Low alarm, channel 2
	R	Bit2	Low alarm, channel 3
	R	Bit3	Low alarm, channel 4
	R	Bit4	Low alarm, channel 5
	R	Bit5	Low alarm, channel 6
	R	Bit6-7	free
	R	Bit8	High alarm, channel 1 0 = no alarm 1 = overrange
	R	Bit9	High alarm, channel 2
	R	Bit10	High alarm, channel 3
	R	Bit11	High alarm, channel 4
	R	Bit12	High alarm, channel 5
	R	Bit13	High alarm, channel 6
	R	Bit14-15	free

Address	Access	Data type	Signal designation
0x0035	R	float	analog channel 1
0x0037	R	float	analog channel 2
0x0039	R	float	analog channel 3
0x003B	R	float	analog channel 4
0x003D	R	float	analog channel 5
0x003F	R	float	analog channel 6
0x0041	R	float	counter/integrator channel 1 [1]
0x0043	R	float	counter/integrator channel 2 [1]
0x0045	R	float	counter/integrator channel 3 [1]
0x0047	R	float	counter/integrator channel 4 [1]
0x0049	R	float	counter/integrator channel 5 [1]
0x004B	R	float	counter/integrator channel 6 [1]
0x004D	R	float	analog input 1
0x004F	R	float	analog input 2
0x0051	R	float	analog input 3
0x0053	R	float	analog input 4
0x0055	R	float	analog input 5
0x0057	R	float	analog input 6
0x0059	R	float	math channel 1
0x005B	R	float	math channel 2
0x005D	R	float	math channel 3
0x005F	R	float	math channel 4
0x0061	R	float	math channel 5
0x0063	R	float	math channel 6

[1] The values in the recorder are double values (8 bytes).
Since only float values (4 bytes) can be read for this address, only a limited resolution is possible (limitation of count range).
The values can be read in double format at address 0x0066.

Address	Access	Data type	Signal designation
0x0066	R	double	counter/integrator channel 1
0x006A	R	double	counter/integrator channel 2
0x006E	R	double	counter/integrator channel 3
0x0072	R	double	counter/integrator channel 4
0x0076	R	double	counter/integrator channel 5
0x007A	R	double	counter/integrator channel 6

Address	Access	Data type	Signal designation
0x0080	R/W	char 21	message text (for the entry in the event list)

Address	Access	Data type	Signal designation
0x7007	W	short integer	password for communication
0x7008	R	short integer	info flag, whether or not communication is prevented by password: 0 = measurement data can be read 1 = password entry required

9.1 MODbus flag

The MODbus flag can be used just like other binary signals (e.g. binary inputs or alarms) to operate various functions in the paperless recorder. In order to be able to make use of the MODbus flag, the entry “MODbus flag” must be selected in the configuration of the paperless recorder.

One conceivable application for the MODbus flag would be, for example, the activation of event mode through the serial interface.

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