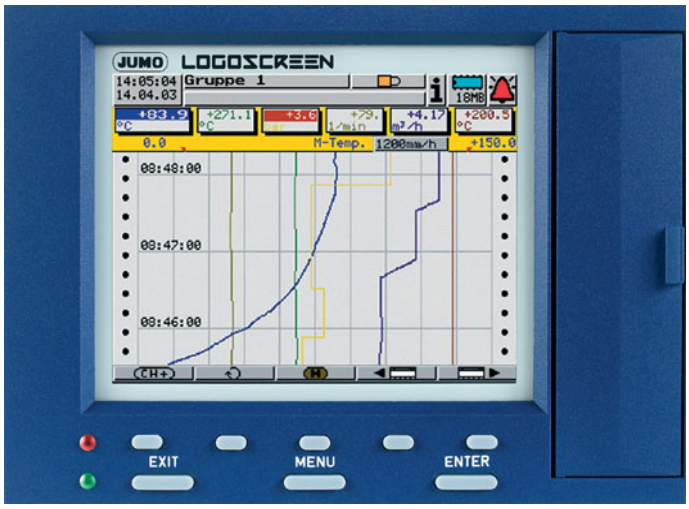


LOGOSCREEN es

Paperless Recorder for secure acquisition of FDA-compliant measurement data

B 70.6560.2.0

Modbus Interface Description

11.07/00416045

Contents

Contents

1.1 Preface

Please read these operating instructions before commissioning the interface. Keep the operating instructions in a place that is accessible to all users at all times.

Please assist us to improve these operating instructions.

Your suggestions will be most welcome.

Phone	in Germany	(0661) 6003-725
	from abroad	(+49) 661 6003-0
Fax	in Germany	(0661) 6003-681
	from abroad	(+49) 661 6003-607

All necessary information for operating the interface is contained in these operating instructions. However, if any problems should still arise during start-up, you are asked not to carry out any unauthorized manipulations. You could endanger your rights under the warranty!

Please contact the nearest subsidiary or the main factory.

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** (electrostatic discharge).

1.2 Typographical conventions

1.2.1 Warning signs

The signs for **Danger** and **Warning** are used in the manual under the following conditions:

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

Warning This symbol is used when there may be **damage to equipment or data** if the instructions are disregarded or not followed accurately!

Warning 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 attention is drawn to a **special remark**.

Reference This sign refers to further information in other handbooks, chapters or sections.

abc[1] **Footnote** Footnotes are notes which refer to certain points in the text. Footnotes consist of two parts:

Markings in the text and the footnote text.

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

1.2.3 Presentation

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

2.1 Applications

The RS232 or RS422/RS485 serial interfaces are available for communication with supervisory systems (e. g. bus system or PC). They can, for example, be used to

- read out measurements from the recorder
- read out device and process data from the recorder (for software purposes, the recorder is a device)
- send texts for batch reporting to the recorder
- define measurements and logic signals

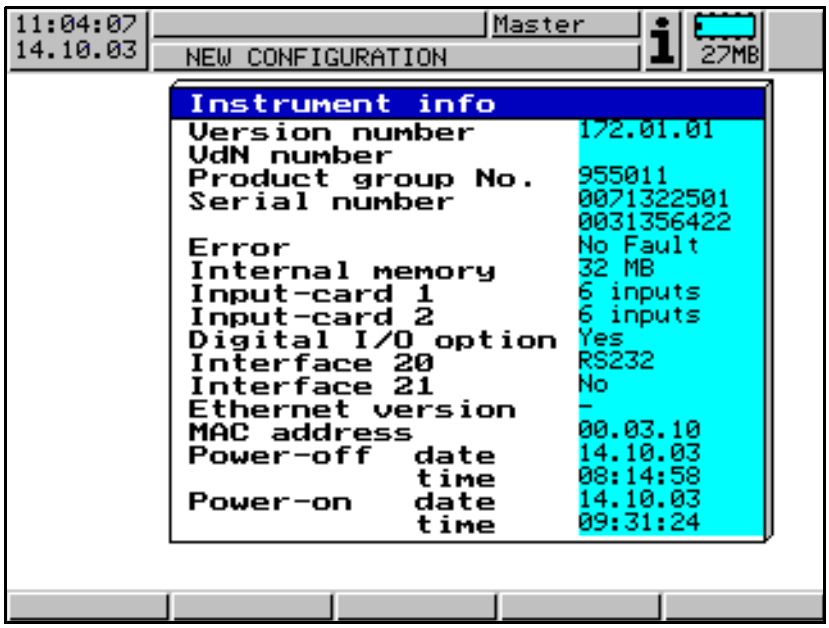
2.2 System requirements

The following items are necessary for operating the serial interface:

- master (e. g. PC)
- connecting cable
- JUMO-PCVUE (SVS2000) evaluation program or others

2.3 Identifying the interface

The paperless recorder is supplied with an integral RS232 interface as standard.
Optionally, it can be supplied with an RS422 or RS485 interface (extra code), but in this case without the RS232 interface.
Which interface is implemented in the recorder can be requested via the menu *Device info* ➔ *Interface*.



2.4 Communications server PCC

With the help of the JUMO PCC communications server, measurement data that have been saved in the memory of the paperless recorder can be read out via the serial interface or Ethernet. The data can then be comfortably evaluated by the JUMO PCA 3000 evaluation software. We recommend using a transmission rate of 38400 baud (baud = bps). The baud rate for the paperless recorder is set by the parameter *Configuration* ➔ *Interface* ➔ *Baud rate*.

The data will now be read out under “timing control”. It is not possible to set up an “online” connection between the PC and the paperless recorder.

2.5 Visualization software JUMO SVS-2000

The JUMO SVS-2000 visualization software can be used to read out data from the paperless recorder in “online” mode.

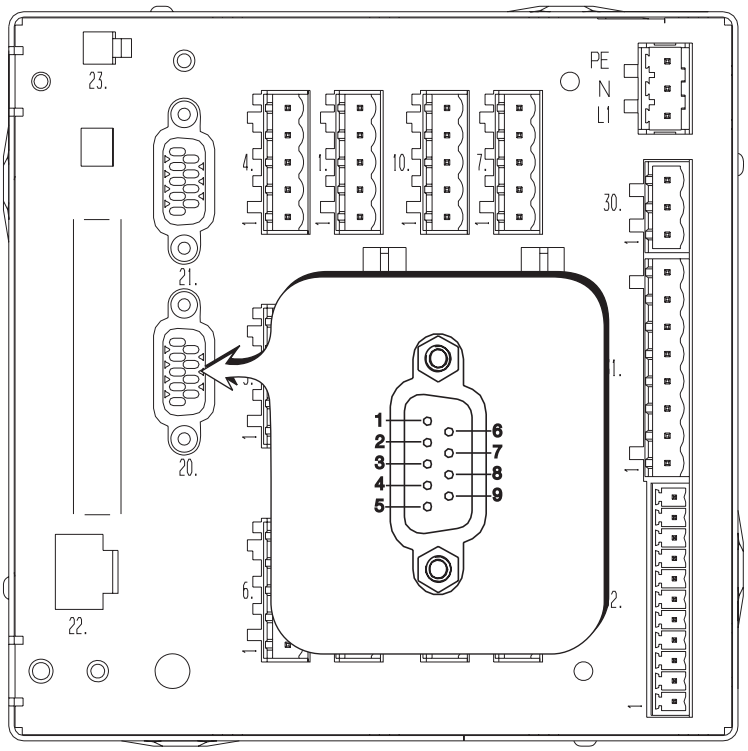
Only one progam at a time can communicate with the device through each interface. So simultaneous communication is only possible by using different interfaces, such as reading out the latest measurement data via the RS 232/422/485, using JUMO SVS 2000, while fetching the saved data from the memory via the Ethernet interface by using JUMO PCC and looking at measurements through the teleservice function of the setup program, via the setup interface on the front panel.

2.6 Setup program

The setup program is used to configure the device. It also provides a teleservice function for reading out diagnosis and batch data.

3.1 Connection diagram

Rear view of the paperless recorder



Connector 20

Interface

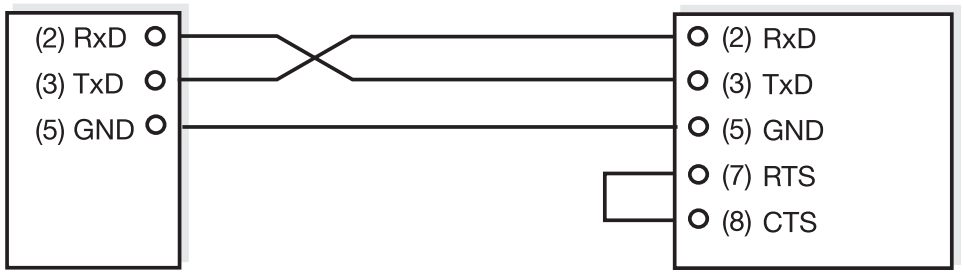
Connection diagram

RS232		RS422		RS485	
1		1		1	
2	RxD	2		2	
3	TxD	3	TxD+	3	TxD+/RxD+
4		4	RxD+	4	
5	GND	5	GND	5	GND
6		6		6	
7		7		7	
8		8	TxD-	8	TxD-/RxD-
9		9	RxD-	9	

☞ When connecting the serial interface, care must be taken not to mix up the connectors 20 and 21. Connector 21 is reserved for the LON interface, which is available as an extra.
Modules of the “JUMO mTRON automation system” series can be connected to the paperless recorder through the LON interface. The connection and operation of the LON interface are described in the Operating Instructions B 70.6560.2.1.

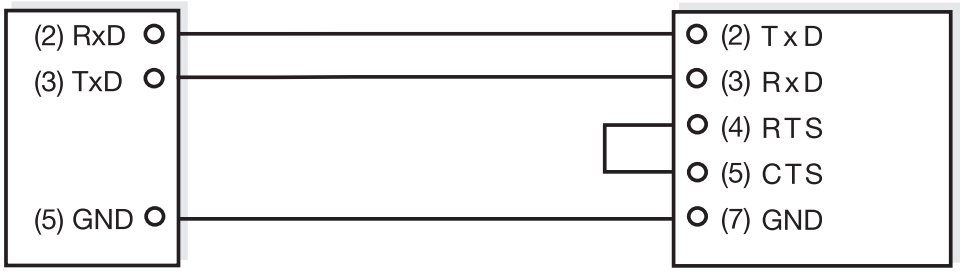
3.2 RS232

The handshake connections (RTS, CTS) are not used with the RS232 interface. The RTS connection from the master (CTS on recorder) is ignored, the answer is sent directly from the recorder. The CTS connection of the master (RTS on the recorder) remains open. If the master evaluates the handshake connections, they have to be bridged in the cable.



Paperless recorder

PC Com-interface
9-pin sub-D connector



Paperless recorder

PC Com-interface
25-pin sub-D connector

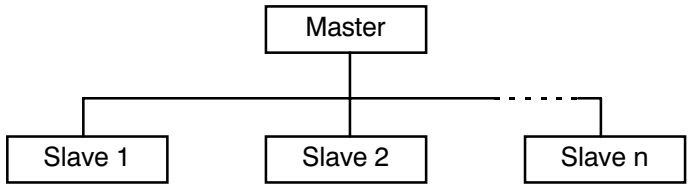
3.3 RS422/RS485

The RS422 and RS485 interfaces are changed over automatically by the paperless recorder, according to the type of connection (2-wire or 4-wire connection).

The use of a screened and twisted connecting cable is recommended.

4.1 Master-slave principle

The communication between a PC (master) and a recorder (slave) 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 address. Up to 255 slaves can be addressed.

The paperless recorder can only operate as a slave, and not as a master.

4.2 Transmission mode (RTU)

The transmission mode used is the RTU mode (Remote Terminal Unit). Data are transmitted in binary form (hexadecimal) with 8 bits, 16 bits for integers and 32 bits for float values.

Data format

The data format describes the arrangement of a byte transmitted. The data format can be as follows:

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

4 Protocol description

4.3 Device address

The device address for the slave can bet set in the range from 1 to 254 (decimal). Device addresses 0 and 255 are reserved.

A maximum of 31 slaves can be addressed via the RS422/RS485 interface.

The address is made in binary form (hexadecimal) in the transfer protocol.

4.4 Timing of the communication

Character transmission time

The start and end of a data block are identified by transmission pauses. The character transmission time (time for the transmission of one character) depends on the baud rate and the data format used.

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

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

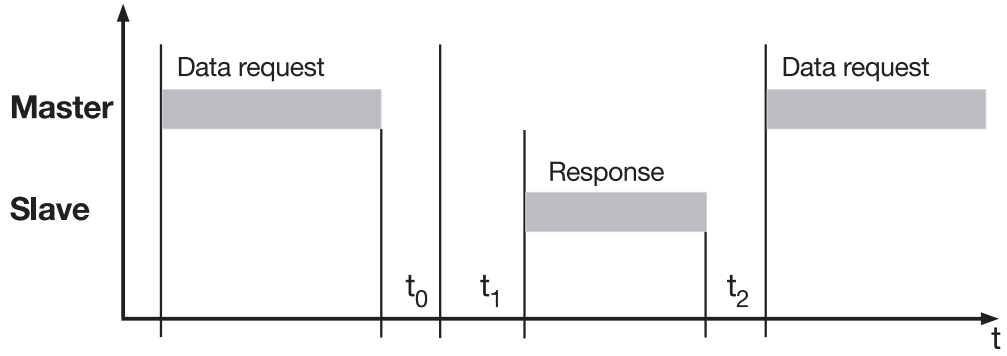
For other data formats this is:

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

Example

Baud rate [baud]	**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

Timing scheme A data request runs according to the following timing scheme:



t_0 Internal waiting time of the recorder before checking the data request (12.5 — 25 msec)

t_1 This time depends on the internal processing.
The maximum processing time is 350 msec

☞ A minimum response time can be set in the recorder, under the menu item *Configuration* ➔ *Interface*. This preset time is the minimum time which will be waited before a response 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) and the recorder answers as soon as the internal processing is completed. A preset time of 0 msec means that the recorder responds with the maximum possible speed.

The minimum response time which can be set is required by the RS485 interface in the master to switch over the interface driver from transmitting to receiving. This parameter is not required for the RS422 or RS232 interface, and should be set to 0 msec.

t_2 Waiting time which the master has to keep before starting a new data request.

on RS232	a minimum of 3.5 times the transmission time for 1 character (time depends on the baud rate)
on RS422/RS485	25 msec

The master must not make any data requests within t_0, t_1 and t_2, since, if this is the case, the recorder will either ignore the request or declare it invalid.

4 Protocol description

4.5 Structure of the data blocks

All data blocks have the same structure:

Data 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 device address of a specific slave

Function code function selection (read, write, bit, word)

Data field contains the information:

-bit address (word address)

-bit number (word number)

-bit value (word value)

Checksum recognition of transmission errors

4.6 Distinction Modbus/Jbus

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

Modbus differs from Jbus in the absolute addresses of the data. The addresses of the Modbus are shifted by one compared with those of the Jbus.

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

4.7 Checksum (CRC16)

The checksum (CRC16) serves to recognize transmission errors. If an error is identified during evaluation, the corresponding device does not answer.

Calculation scheme

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

The low byte of the checksum is transmitted first.

Example 1

Read out counter 2 (current count = 12345).

Data request: Read two words, starting at address 0x57 (CRC16 = 0x771E)

14	03	0057	0002	771E

Response: (CRC16 = 0xBB92)

14	03	04	E400	4640	BB92
			Word 1	Word 2	

Word 1 und Word 2 result in the answer 12345.0.

Example 2

Poll status of relay outputs.

Instruction: Read one word of address 0x31 (CRC16 = 0xD700)

14	03	0031	0001	D700

Response (CRC = 0x7447):

14	03	02	0001	7447
			Word 1	

Word 1 means that only output 1 is active.

4 Protocol description

4.8 Configuring the interface

The interface is configured from the keys of the paperless recorder or through the setup program.

Configuration from the keys

The *Configuration* menu must be called up first, and the parameter *Interface* selected. The parameters for configuring the interface are now available.

	Parameter	Value/selection	Description
Protocol	Configuration ➔Interface ➔ Protocol	**MODBUS**, JBUS	Select protocol ⇨ Section 4.6 “Distinction Modbus/ Jbus”
Baud rate	Configuration ➔Interface ➔ Baud rate	**9600 baud**, 19200 baud, 38400 baud	Select baud rate
Data format	Configuration ➔Interface ➔ Data format	**8-1- none**, 8-1- odd, 8-1- even, 8-2- none	Select data format (Data bit-stop bit-parity)
Device address	Configuration ➔Interface ➔ Device address	**1**—254	Select address
Min. response time	Configuration ➔Interface ➔ Min. response time	**0**—500msec	Select minimum response time ⇨ Section 4.4 “Timing of the communication”

The device address must also be observed when communicating via the RS232 interface, even though it is not a bus interface.

Configuration via the setup program

The menu item *Edit* ➔ *Interface (RS232-RS422/485)* is available for configuration using the setup software.

These parameters only apply to communication via the RS232 and RS422/485 interfaces. The parameters for communication via the setup interface are set up in the recorder as follows:

Protocol:	Modbus
Baud rate:	9600 baud
Data format:	8-1-none
Device address:	-
Min. response time:	0 msec

4.9 Password protection

Read and write access via the Modbus can be protected, but this is not compulsory. If access to the device is to be made possible without password protection, then the rights for “Teleservice: read”, “Teleservice: write” and "Write batch texts” must be enabled in the recorder, for the “public” (i.e. default). user. This can be done through the setup program (*Extras* menu).

If access to the device is only to be made available after previous transmission of a password, then the rights for “Teleservice: read”, “Teleservice: write” and “Write batch texts” must be inhibited for the default user. This can also be set up through the setup program (*Extras* menu). As a result, it will subsequently be necessary to write the password of the master or user to the address 0x011F via the serial interface, before access will be permitted. Communication via the interface is then enabled until a period of 10 seconds passes without a Modbus instruction being received.

If an attempt is made to read from or write to the device without having previously transmitted the correct password to the recorder, then the device will respond with Modbus error code 04.

Access rights will also be checked for attempts to access the device via the serial interfaces or Ethernet. The following rights are relevant for access via Modbus:

Address	**Contents**	**Right required for:**	
		Read access	**Write access**
0x0000 - 0x0026	Device information	no right required	not possible
0x002F - 0x0031	Logic inputs, alarms, ...	Teleservice: read	not possible
0x0032 - 0x0033	External logic inputs, control flag	Teleservice: read	Teleservice: write
0x0035 - 0x005C	Analog inputs, counter	Teleservice: read	not possible
0x005D - 0x00A4	External analog inputs	Teleservice: read	Teleservice: write
0x00A6 - 0x0113	Texts for batch report	Teleservice: read	Write batch texts
0x0114 - 0x011E	Message text	Teleservice: read	Teleservice: write
0x012B - 0x01F2	Recipe for batch report	Teleservice: read	Write batch texts

If access to these Modbus addresses is to be made available without a log-in (for a PLC, for instance), then the necessary rights must be defined as default (standard) rights in the recorder. This can be done through the JUMO PCS security manager software if a LOGOSCREEN es is being used. For a LOGOSCREEN cf on the other hand, it must be done through the menu *Extras* / *User administration* in the JUMO setup program.

The recorder is supplied ex-factory with the right “Write batch texts” included in the default rights setting, but the rights for “Teleservice: read” and “Teleservice: write” are not included.

If an attempt is made to read from or write to a device without having the corresponding rights, then the device will respond with Modbus error code 04.

Measurements and other device or process data can be read out from the recorder using the functions described below.

Overview of functions

Function number	Function	
0x01/0x02	read n bits	(max. 256 bits)
0x03/0x04	read n words	(max. 127 words)
0x05	write one bit	
0x06	write one word	
0x10	write n words	(max. 127 words)

There are no separate areas for bit and word for the system variables. The bit and word areas overlap and can be read and written both as bit area or as word area.

Address calculation

The word address is calculated as follows:

word address = base address + variables address

The bit address is calculated as follows:

bit address = word address * 16 + bit number

Example: word address for the measurement of analog input 6:

word address = 0x0035 + 0x000A = 0x003F

Example: bit address of the open-collector output:

bit address = (0x002F + 0x0002) · 0x0010 + 0x0005 = 0x0315

5 Functions

5.1 Read n bits

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

Data request

Slave address	Function 0x01 or 0x02	Address first bit	Bit number	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response

Slave address	Function 0x01 or 0x02	Number of bytes read	Bit values	Checksum CRC16
1 byte	1 byte	1 byte	x byte(s)	2 bytes

Example

Read the status of the first 4 logic inputs (process data)
⇨ Section 8.2 “Process data”

Bit address = (base address + process data address) * 16 + bit number
= (0x002F + 0x0000) * 0x10 + 0x08 = 0x02F8

Data request: (CRC16 = 0xBCFB)

0A	01	02F8	0004	BCFB

Response: (CRC16 = 13A8)

0A	01	01	0F	13A8

In every case, at least 8 bits (1 byte) are read, irrespective of the number of bits to be read, since the response is made in bytes.

In the example above this means that the bits 0x02F8—0x02FF are read.

0x02FF	0x02FE	0x02FD	0x02FC	0x02FB	0x02FA	0x02F9	0x02F8

8 bits = 1 byte

For all irrelevant bits (0x02FC—0x02FF) the response is the value 0.

5.2 Read n words

This function reads n words from a defined address.

Data request

Slave address	Function 0x03 or 0x04	Address 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 measurement inputs
⇨ Section 8.2 “Process data”

Word address = base address + process data address
= 0x0035 + 0x0000 = 0x0035

Data request: (CRC16 = 7D03)

14	03	0035	0006	D703

Response: (CRC16 = 5047)

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

5.3 Write one bit

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

Instruction

Slave address	Function 0x05	Bit address	Bit value XX 00	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response

Slave address	Function 0x05	Bit address	Bit value XX 00	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

For the bit value,
the following applies: FF00 = set bit
0000 = erase bit

Example

Set the Modbus flag (bit 0) below the base address 0x002F
⇨ Section 8.2 “Process data”
⇨ Section 9.2 “Modbus flag”

Bit address = (base address + “Modbus flag” address) * 16 + bit number
= (0x002F + 0x0004) * 0x10 + 0x0
= 0x0330

Instruction:

14	05	0330	FF00	CRC16

Response (as instruction):

14	05	0330	FF00	CRC16

5.4 Write one word

For the “write one 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 first four “external logic inputs”
⇨ Section 8.2 “Process data”
⇨ Section 9.1 “External logic inputs”

Word address = base address + “external logic inputs” address
= 0x002F + 0x0003 = 0x0032

Instruction:

14	06	0032	000B	CRC16

Response (as instruction):

14	06	0032	000B	CRC16

5.5 Write n words

Instruction

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

Example

Write “Text 2 for batch report”
(2 words: “ABC” = 0x4142, 0x4300)
⇨ Section 8.2 “Process data”
⇨ Section 9.1 “External logic inputs”

Word address = base address + “Text 2 for batch report” address
= 0x00A6 + 0x000B = 0x00B1

Instruction:

14	10	00B1	0002	04	4142	4300	CRC16

Response:

14	10	00B1	0002	CRC16

6.1 Transmission format

Integer values

Integer values are transmitted over the Modbus in the following format: first the high byte, then the low byte.

e. g.: Polling the int-value of address 0x0000 if the value 12 (0x000C) is written below this address.
Request: 010300000001840A (CRC16 = 0x840A)
Response: 010302**0019**798E (CRC16 = 798E)

Float values

Float values are handled on the Modbus with the IEEE-754 standard format (32 bits), but with the difference that bytes 1 and 2 are swapped with bytes 3 and 4.

Single-float format (32bits) 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 - 23bit normalized mantissa

Modbus-float format

Modbus address x		Modbus address x+1	
MMMMMMMM	MMMMMMMM	SEEEEEEE	EMMMMMMM
byte 3	byte 4	byte 1	byte 2

z. B.: Polling the float value of address 0x0035 if the value 550.0 (0x44098000 in IEEE-754 format) is written below this address.
Request: 010300350002D405 (CRC16 = D405)
Response: 010304**80004409**20F5 (CRC16 = 20F5)

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

Many compilers (e. g. Microsoft C++, Turbo C++, Turbo Pascal, Keil C51) record 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 find out how float values are saved in your application. If required, the bytes have to be swapped accordingly in the interface program, after acquiring them from the paperless recorder.

6 Data flow

Texts

Texts are transmitted in the ASCII format.

The last sign transmitted must always be a “\0” (ASCII code 0x00) as a stop marker.

Since texts are also transmitted word by word (16 bits), an additional 0x00 is transmitted when there is an uneven number of characters (including “\0”).

e. g.: Polling text of address 0x0002 if the character string
“LS es ” (ASCII-Code: 0x4C,
0x53, 0x20, 0x65, 0x73, 0x20, 0x20, 0x20, 0x00) is below
this address.
Request: 0103000200052409 (CRC = 2409)
Response: 01030A**4C5320657320202000 00**B97E (CRC16 = B97E)

7.1 Error handling

Error codes

If the data request by the master was received by the paperless recorder (without transmission error), but could not be processed, the recorder responds with an error code.
Five error codes are available:

1 invalid function

2 invalid parameter address

3 data value outside permissible range of values

4 slave not ready, or no access rights (password)

8 write access denied for parameter

If a bit or word number is read by the master which is larger than the maximum permitted one, the recorder also sends the error code 2.

Response on error

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

The function code is linked by OR with 0x80, i. e. the MSB (most significant bit) is set to 1.

Example

Data request: (CRC16 = 1C0B)

01	09	0000	0001	1C0B

Response: (CRC16 = 8650)

01	89	01	8650

Special cases

The slave does not respond to the following errors:

- the baud rate and/or data format for master and recorder do not match
- the device address of the recorder does not correspond to the one in the protocol (in this case, the data request by the master has to be sent again after a time-out of 2 sec has elapsed).
- the checksum (CRC16) is not correct
- the instruction by the master is incomplete or over-defined
- the number of words or bits to be read is zero

7 Error messages

7.2 Error messages for invalid values

For measurements the convention is that the error number is represented in the value itself, i. e. the error number is entered instead of the measurement number.

Error number	Error
200000.0	underrange
200001.0	overrange
200003.0	other invalid value

Example

Data request: (CRC16 = D405)

01	03	0035	0002	D405

Response: (CRC16 = 9CC2)

01	03	04	5000	4843	9CC2

The measurement (0x48435000 = 200000.0) supplied by analog input 1 indicates an underrange condition.

All process values (variables) together with their addresses, the data type and the access mode are described below.

References are as follows:

R/O	read access only
W/O	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 string stop character “\0”
Bit x	bit No. x
float	float value (4 bytes)

The process values are divided into logical areas.

The absolute Modbus address is given by the base address of the appropriate area and the address offset.

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

8.1 Device data

Base address: 0x0000

Address	Access	Data type	Signal designation
0x0000	R/O	int	Device group (12)
0x0001	R/O	int	Device type (0)
0x0002	R/O	char 9	Device name (“LS es”)
0x0007	R/O	char 11	Software version
0x000D	R/O	char 13	VdN number
0x0014	R/O	char 10	Serial number
0x0019	R/O	char 15	Date/time of last alteration of configuration
0x0021	R/O	char 15	Date/time of last alteration of parameters

8 Address tables

8.2 Process data

Base address: 0x002F

Address	Access	Data type	Signal designation
0x0000	R/O	int	Group alarms and position of the logic inputs
	R/O	bit0	Alarm group 1 0 = no alarm 1 = at least 1 limit infringed in group
	R/O	bit1	Alarm group 2
	R/O	bit2	Alarm group 3
	R/O	bit3	Alarm group 4
	R/O	bit4	Alarm group 5
	R/O	bit5	Alarm group 6
	R/O	bit6-7	not assigned
	R/O	bit8	Logic input 1 0 = open / 1 = closed
	R/O	bit9	Logic input 2
	R/O	bit10	Logic input 3
	R/O	bit11	Logic input 4
	R/O	bit12	Logic input 5
	R/O	bit13	Logic input 6
	R/O	bit14	Logic input 7
	R/O	bit15	not assigned
0x0001	R/O	int	Logic signals
	R/O	bit0	CompactFlash card is in the slot (0 = no, 1 = yes)
	R/O	bit1	CF card has been stolen (0 = no, 1 = was removed while no user was logged in)
	R/O	bit2	Memory alarm: insufficient free internal memory available. Data must be fetched on a CF card!
	R/O	bit3	Memory alarm: insufficient free internal memory available. Data must be fetched via the serial interface!

Address	Access	Data type	Signal designation
	R/O	bit4	Memory alarm: insufficient free memory available on the CompactFlash card!
	R/O	bit5	Login status: 0 = no user logged in, 1 = a user is logged in
	R/O	bit6	not assigned
	R/O	bit7	not assigned
	R/O	bit8	Combination alarm 0 = no alarm 1 = at least 1 limit infringed in the device
	R/O	bit9	not assigned
	R/O	bit10	Fault condition 0 = no fault / 1 = fault
	R/O	bit11-15	not assigned
0x0002	R/O	int	Logic outputs
	R/O	bit0	Relay output 1 0 = not active / 1 = active
	R/O	bit1	Relay output 2
	R/O	bit2	Relay output 3
	R/O	bit3	Relay output 4
	R/O	bit4	Relay output 5
	R/O	bit5	Open-collector output 0 = not active / 1 = active
	R/O	bit6-15	not assigned
0x0003	R/W	int	External logic inputs (either from ext. I/O modules or via Modbus)
	R/W	bit0	External logic input 1 0 = open / 1 = closed
	R/W	bit1	External logic input 2
	R/W	bit2	External logic input 3
	R/W	bit3	External logic input 4
	R/W	bit4	External logic input 5
	R/W	bit5	External logic input 6
	R/W	bit6-15	not assigned

Address	Access	Data type	Signal designation
0x0004	R/W	int	Flag for operating various device functions
	R/W	bit0	Modbus flag (control flag) 0 = false / 1 = true
	R/W	bit1-15	not assigned

Base address: 0x0035

Address	Access	Data type	Signal designation
0x0000	R/O	float	Measurement input 1 (analog input 1)
0x0002	R/O	float	Measurement input 2 (analog input 2)
0x0004	R/O	float	Measurement input 3 (analog input 3)
0x0006	R/O	float	Measurement input 4 (analog input 4)
0x0008	R/O	float	Measurement input 5 (analog input 5)
0x000A	R/O	float	Measurement input 6 (analog input 6)
0x000C	R/O	float	Measurement input 7 (analog input 7)
0x000E	R/O	float	Measurement input 8 (analog input 8)
0x0010	R/O	float	Measurement input 9 (analog input 9)
0x0012	R/O	float	Meas. input 10 (analog input 10)
0x0014	R/O	float	Meas. input 11 (analog input 11)
0x0016	R/O	float	Meas. input 12 (analog input 12)
0x0018	R/O	float	not assigned
0x001A	R/O	float	not assigned
0x001C	R/O	float	not assigned
0x001E	R/O	float	not assigned
0x0020	R/O	float	Counter value 1
0x0022	R/O	float	Counter value 2
0x0024	R/O	float	External counter value 1 (from ext. I/O modules)
0x0026	R/O	float	Externer counter value 2 (from ext. I/O modules)
0x0028	R/W	float	External analog input 1 (from ext. I/O modules or via Modbus)
0x002A	R/W	float	External analog input 2

0x002C	R/W	float	External analog input 3
0x002E	R/W	float	External analog input 4
0x0030	R/W	float	External analog input 5
0x0032	R/W	float	External analog input 6
0x0034	R/W	float	External analog input 7
0x0036	R/W	float	External analog input 8
0x0038	R/W	float	External analog input 9
0x003A	R/W	float	External analog input 10
0x003C	R/W	float	External analog input 11
0x003E	R/W	float	External analog input 12
0x0040	R/W	float	External analog input 13
0x0042	R/W	float	External analog input 14
0x0044	R/W	float	External analog input 15
0x0046	R/W	float	External analog input 16
0x0048	R/W	float	External analog input 17
0x004A	R/W	float	External analog input 18
0x004C	R/W	float	External analog input 19
0x004E	R/W	float	External analog input 20
0x0050	R/W	float	External analog input 21
0x0052	R/W	float	External analog input 22
0x0054	R/W	float	External analog input 23
0x0056	R/W	float	External analog input 24
0x0058	R/W	float	External analog input 25
0x005A	R/W	float	External analog input 26
0x005C	R/W	float	External analog input 27
0x005E	R/W	float	External analog input 28
0x0060	R/W	float	External analog input 29
0x0062	R/W	float	External analog input 30
0x0064	R/W	float	External analog input 31
0x0066	R/W	float	External analog input 32
0x0068	R/W	float	External analog input 33
0x006A	R/W	float	External analog input 34

0x006C	R/W	float	External analog input 35
0x006E	R/W	float	External analog input 36

Base address: 0x00A6

Address	Access	Data type	Signal designation
0x0000	R/W	char 21	Text 1 for batch reports
0x000B	R/W	char 21	Text 2 for batch reports
0x0016	R/W	char 21	Text 3 for batch reports
0x0021	R/W	char 21	Text 4 for batch reports
0x002C	R/W	char 21	Text 5 for batch reports
0x0037	R/W	char 21	Text 6 for batch reports
0x0042	R/W	char 21	Text 7 for batch reports
0x004D	R/W	char 21	Text 8 for batch reports
0x0058	R/W	char 21	Text 9 for batch reports
0x0063	R/W	char 21	Text 10 for batch reports

Base address: 0x0114

Address	Access	Data type	Signal designation
0x0000	R/W	char 21	Message text (for the entry in the event list)

Base address: 0x011F

Address	Access	Data type	Signal designation
0x0000	W/O	char 11	Only LOGOSCREEN cf: Password
0x0006	R/O	12 byte	(*) Reserved

Base address: 0x012B

Address	Access	Data type	Signal designation
0x0000	R/W	char 400	Recipe for batch reports

External logic inputs (R/W), external counters (R/O) and external analog inputs (R/W) can be programmed via the serial interface or connected to the paperless recorder in the form of modules of the JUMO mTRON automation system.

For additional information, please refer to Chapter 9 “Special process data”, or to the Operating Instructions 70.6560.2.1 (LON interface).

8 Address tables

The following chapter describes the special process data in detail:

- external logic inputs,
- Modbus flag,
- external analog inputs and
- texts for batch reports.

The addresses of these process data can be taken from Section 8.2 “Process data”.

9.1 External logic inputs

The external logic inputs are only available as operating inputs via the serial interface when no external mTRON modules are used.

If the logic inputs are operated via the serial interface, although external modules are connected and active, then the data will only be accepted briefly by the paperless recorder and will be overwritten by the external module shortly afterwards.

Like other logic signals (e. g. logic inputs or alarms), the external logic inputs can be used to operate different recorder functions. For this purpose, it is necessary to select “External input 1 — 6" as the corresponding operating signal in the configuration.

9.2 Modbus flag

The Modbus flag, like other logic signals (e. g. logic inputs or alarms) can be used to operate different recorder functions. In order to be able to use the Modbus flag, the entry “Modbus flag” has to be selected when configuring the recorder.

A conceivable application for using the Modbus flag is the activation of batch reports via the serial interface, for example.

9.3 External analog inputs

The external analog inputs are only available for transmitting measurements to the recorder via the serial interface when no external mTRON modules or PROFIBUS interfaces are used.

If the external analog inputs are operated via the serial interface although external modules are connected and active, then the data will only be accepted briefly by the recorder and will be overwritten by the external module shortly afterwards.

The external analog inputs can be used like normal measurement inputs of the recorder. For this purpose, it is necessary to select “External input 1 — 36” as corresponding operating signal in the configuration.

9 Special process data

9.4 Texts for batch reports

For batch reporting, there are several options for entering texts which can be stored as labels for the batch measurements. One possibility is the transmission of the texts using the serial interface.

The texts can be sent to the paperless recorder via the base address 0x00A6 (offset 0x0000, 0x000B, 0x0016, 0x0021). If less than the maximum possible number of characters is sent per text, then the recorder automatically fills the text with empty spaces and writes 0x00 in the last position.

9.5 Recipe text for batch reports

Each batch report includes 400 bytes for a freely-selectable text that can be downloaded to the recorder via one of the interfaces. This text forms part of the batch report and will be generated together with the report. It cannot be displayed on the recorder, only on the PC, in the PCA 3000 evaluation program.

This text could, for example, be used to save the recipe for a batch.

9.6 Message text for the entry in the event list

If a text is written to the Modbus address for the message text, then it will be entered into the event list in the recorder. So customers can use this feature to generate their own message texts.

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