Specification: communication protocol Modbus <--> RCL324, basis			ELESTA energy control
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Short description

An other document “Specification: communication protocol, Modbus <--> RCL324, datapoints and domains tables” (164300) describes the Modbus datapoint index tables.
This specification defines the format of messages and data, which runs between Modbus and RCL324-controller.
The RCL324-controller is normally defined as slave on Modbus. It can also be defined as Master for simple local data transferring.

Contents

1. Introduction

- In this document hex values will be defined with 0x. For example 0xa (hex) means 10 (dec.)
- The datapoints values (always 4 bytes long) will be defined as float
- The domain values (various length) will be defined separately (normally not float, but character oriented)
- A datapoint means one value. For example: Parameter A001
- A domain means a list of values. For example: time with hour, min, s, etc.
- It is possible to query max. 127 words (254 bytes) per message

2. Communication channel

Devices
- COM2: RS485 or RS232

Setting
- 9600 baud (default setting: other setting are possible on RCL324A)
- 8 data bits
- No parity bit
- 1 stop bit
- RTU mode
- Address setting on RCL324A: 0 to 200 (only COM2)

RTU framing
- The message frame must be separated with a silent interval of at least 3.5 character times.
- The entire message must be transmitted as a continuous stream. If a silent interval of more than 1.5 character times occurs before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message.

Address
0 to 200. 0 means broadcast.

Errors
- By communication error (parity, CRC, etc), no response is returned
- By error in the data => response error

3. Codes and format of messages

Function code	**Name**
0x01	Read multi data, value of the datapoint
0x02	Read multi data, value of the datapoint
0x03	Read multi data, value of the datapoint
0x04	Read multi data, hidden status of the datapoint
0x10	Write multi data
0x15	Write multi data
0x16	Write multi data

Error code	**Name**
0x01	Illegal function
0x02	Illegal data address
0x03	Illegal data value
0x04	Slave not ready
0x06	Slave device busy

Calculation of Modbus index

- The MMI of the datapoints in RCL324A are defined in paper:
  CLIMESTA RCL324A, Technical manual, Parameters
- A list of all datapoints, domains index and domain struture are defined in paper:
  Specification: Communication protocol, Modbus <--> RCL324, Datapoints and domains tables (164300)

Parameter name (MMI)	Level offset	Datapoint ID (only even number)
• Default display parameter	9000	18000-18998
• Parameter D000-D999	0	0000..1998
• Parameter H000-H999	1000	2000..3998
• Parameter A000-A499, P500-P999	2000	4000..6998
• Parameter E000-E999	3000	6000..7998
• Parameter M000-M999	4000	8000..9998
• Various internals parameters	6000	12000..13998

Switch points	Channel	Day
• Switch points channel	0..2	0..6 (monday..sunday)

Datapoints

- Datapoint index: (level offset + parameter number) * 2

Remarks:

- The Modbus protocol allows only 2 bytes words. So datapoints will be defined as 2 words (4 bytes).
- Only complete datapoints can be transferred. So the Modbus index by datapoints must always be even (modulo 2 = 0).
- A list of contiguous data points can queried. Undefined data points will be returned as NaN (0xffc00000).

Datapoint index example: index A110 = (2000 + 110) * 2 = 4220

Domains

- Domain length, domain offset, RCL-com domain start:

	Length [words]	Domain offset	RCL-com dom. start
• Time / date, domain 0xa	4	0xa000	0x0a
• Datalogger header	64	0xa100	0x100
• Texts (Alarms)	17	0xb000	0x50
• Short texts	9	0xb231	0x71
• Texts (Modem)	17	0xb500	0xb0
• Short texts (read only)	9	0xb800	0x201
• Switch points	3	0xc000	0x21
• Datalogger datas	104	0xd000	0x101

Remarks:

- Only complete domain can be transferred. So the Modbus index by domains must always be modulo length = 0.

Domain index example:

Domains	Modbus domain index
• Time / date, domain 0xa	0xa000
• Switch points, channel=2, day=6	0xc000 + (channel * 0x40) + (day * 3) = 0xc092
• Text domain 0x61	0xb000 + ((0x61 – 0x50) * 17) = 0xb121
• Short text domain 0x82	0xb231 + ((0x82 – 0x71) * 9) = 0xb2ca
• Short text domain 0x209/521	0xb800 + ((0x209 – 0x201) * 9) = 0xb848

4. Examples

4.1 Read multi data

4.1.1 Read datapoints

Query

Field name	Example	Remark
Slave address	0x01	
Function code	0x03	
Starting index Hi	0x1f	
Starting index Lo	0x42	Parameter M001 (8002 = 0x1f42)
No. of words Hi	0x00	
No. of words Lo	0x04	2 datapoints => 8 bytes => 4 words
CRC (16 Bits, Lo)	0xe3	
CRC (16 Bits, Hi)	0xc9	

Response OK

Field name	Example	Remark
Slave address	0x01	
Function code	0x03	
Byte count	0x08	2 datapoints => 4 words => 8 bytes
Data	0x42	Parameter M001: MSB
Data	0xca	
Data	0x00	
Data	0x00	Parameter M001: LSB
Data	0x42	Parameter M002: MSB
Data	0xcc	
Data	0x00	
Data	0x00	Parameter M002: LSB
CRC (16 Bits, Lo)	0xae	
CRC (16 Bits, Hi)	0x75	

Response error

Field name	Example	Remark
Slave address	0x01	
Function code	0x83	0x03 + 0x80
Error code	0x02	Illegal data address
CRC (16 Bits, Lo)	0xc0	
CRC (16 Bits, Hi)	0xf1	

4.1.2 Read domains

Query

Field name	Example	Remark
Slave address	0x01	
Function code	0x03	
Starting index Hi	0xc0	
Starting index Lo	0x8f	Switch points channel 2, saturday (0xc08f)
No. of words Hi	0x00	
No. of words Lo	0x06	2 domains => 12 bytes => 6 words
CRC (16 Bits, Lo)	0xc8	
CRC (16 Bits, Hi)	0x23	

Response OK

Field name	Example	Remark
Slave address	0x01	
Function code	0x03	
Byte count	0x0c	2 domains => 6 words => 12 bytes
Data	0x18	Switch points channel 2, saturday, byte index 0
Data	0xd8	
Data	0xff	
Data	0xff	
Data	0xff	
Data	0xff	Switch points channel 2, saturday, byte index 5
Data	0x18	Switch points channel 2, sunday, byte index 0
Data	0xd8	
Data	0xff	
Data	0xff	
Data	0xff	
Data	0xff	Switch points channel 2, sunday, byte index 5
CRC (16 Bits, Lo)	0x23	
CRC (16 Bits, Hi)	0xa0	

Response error

Field name	Example	Remark
Slave address	0x01	
Function code	0x83	0x03 + 0x80
Error code	0x02	Illegal data address
CRC (16 Bits, Lo)	0xc0	
CRC (16 Bits, Hi)	0xf1	

4.2 Write multi data

4.2.1 Write datapoints

Query

Field name	Example	Remark
Slave address	0x01	
Function code	0x10	
Starting index Hi	0x1f	
Starting index Lo	0x42	Parameter M001 (8002 = 0x1f42)
No. of words Hi	0x00	
No. of words Lo	0x04	2 datapoints => 8 bytes => 4 words
Byte count	0x08	2 datapoints => 8 bytes
Data	0x42	Parameter M001: MSB
Data	0xca	
Data	0x00	
Data	0x00	Parameter M001: LSB
Data	0x42	Parameter M002: MSB
Data	0xcc	
Data	0x00	
Data	0x00	Parameter M002: LSB
CRC (16 Bits, Lo)	0x5f	
CRC (16 Bits, Hi)	0xbf	

Response OK

Field name	Example	Remark
Slave address	0x01	
Function code	0x10	
Starting index Hi	0x1f	
Starting index Lo	0x42	Parameter M001 (8002 = 0x1f42)
No. of words Hi	0x00	
No. of words Lo	0x04	2 datapoint => 8 bytes => 4 words
CRC (16 Bits, Lo)	0x66	
CRC (16 Bits, Hi)	0x0a	

Response error

Field name	Example	Remark
Slave address	0x01	
Function code	0x90	0x10 + 0x80
Error code	0x03	Illegal data value
CRC (16 Bits, Lo)	0x0c	
CRC (16 Bits, Hi)	0x01	

4.2.2 Write domain

Query

Field name	Example	Remark
Slave address	0x01	
Function code	0x10	
Starting index Hi	0xc0	
Starting index Lo	0x8f	Switch points channel 2, saturday (0xc08f)
No. of points Hi	0x00	
No. of points Lo	0x06	2 domains => 12 bytes = 6 words
Byte count	0x0c	12 bytes
Data	0x18	Switch points channel 2, saturday, byte index 0
Data	0xd8	
Data	0xff	
Data	0xff	
Data	0xff	
Data	0xff	Switch points channel 2, saturday, byte index 5
Data	0x18	Switch points channel 2, sunday, byte index 0
Data	0xd8	
Data	0xff	
Data	0xff	
Data	0xff	
Data	0xff	Switch points channel 2, sunday, byte index 5
CRC (16 Bits, Lo)	0xce	
CRC (16 Bits, Hi)	0x6f	

Response OK

Field name	Example	Remark
Slave address	0x01	
Function code	0x10	
Starting index Hi	0xc0	
Starting index Lo	0x8f	Switch points channel 2, saturday (0xc08f)
No. of points Hi	0x00	
No. of points Lo	0x06	2 domains => 12 bytes = 6 words
CRC (16 Bits, Hi)	0x4d	
CRC (16 Bits, Lo)	0xe0	

Response error

Field name	Example	Remark
Slave address	0x01	
Function code	0x90	0x10 + 0x80
Error code	0x03	Illegal data value
CRC (16 Bits, Lo)	0x0c	
CRC (16 Bits, Hi)	0x01	

5. Timing

1) Typical response time: < 100 ms pro access
2) Maximal response time: < 1000 ms pro access

6. CRC checking

CRC generation function

```
UINT crc(UCHAR *pt, UCHAR len)
// pt: Pointer on message
// len: message lenght (> 0)
{
        UCHAR i;
        UINT  crc;

        crc = 0xffff;
        do
        {
                crc ^= ((UCHAR) *pt++);
                i = 8;
                do
                {
                        if (crc & 0x0001)
                        {
                                crc >>= 1;
                                crc ^= 0xa001;
                        }
                        else
                                crc >>= 1;
                } while (--i);
        } while (--len);
        return (crc);
}
```

7. Version history

Version	Change (description)	changed	
		Date	Visa
0.90	Basis edition (Beta status)	09.07.2002	Pa
0.91	Change max message length, new domains	10.09.2002	Pa
0.92	Text domain = 33 Char	02.05.2003	Pa
0.93	Short text domain = 17 char, NaN datapoint	21.12.2003	Pa
1.00	Official edition for software V3.00	16.01.2006	Pa
1.01	Official edition for software V4.00	11.07.2007	smn
1.02	UART setting 1 stop bit (only docu was wrong)	09.07.2008	Pa