RS 485 connection for WTW monitors/measuring transmitters

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Accuracy when going to press

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1 Hardware

1.1 Overview

The RS 485 interface enables to connect the monitor to an RS 485 field bus. This transmission technique works with differential levels that are not interference-prone and enables the error-free data transmission over distances of up to approx.1 km.

Operating modes

The monitor has two operating modes of the RS 485 interface:

- Prn (Master operation) for the output of measured values to a data terminal such as a printer or PC.
- SL (Slave operation) for bidirectional communication with a master in the bus system. Apart from the master, up to 31 slave devices can be connected to the bus.

RS 232 / RS 485 converter

To connect a data terminal with an RS 232 interface (COM port) such as a printer or PC, a commercial RS 232 / RS 485 converter with the following characteristics is required:

- Galvanic isolation (Data terminal/bus)
- adjustable record or automatic record recognition
- Integrated or switchable closing resistance,
  R = 120 Ohm (100-130 Ohm)

Computer

Any IBM compatible PC with a serial interface (COM port) can be used. The COM port must be set to "9600 bd / 8 bits / no parity".

1.2 Wiring and connections

The instruments are wired with the two-wire technique (2 data wires + shield). Accordingly, the same wires are used for sending and receiving ("half duplex" operation).

Bus cable

All cables with electrical characteristics according to EN 50170, line type A are suitable as an RS 485 bus cable (e.g. all PROFIBUS cables).

Connections

The connections are named A, B (data lines) and GND (shield line). Connect the individual terminals in the instrument with the correspondingly labeled connections on the converter.

Wiring of the BUS (Slave operation)

Apart from the master (e.g. PC or PLC), up to 31 components (WTW monitors or other RS 485 field instruments) can participate in the bus. Example:

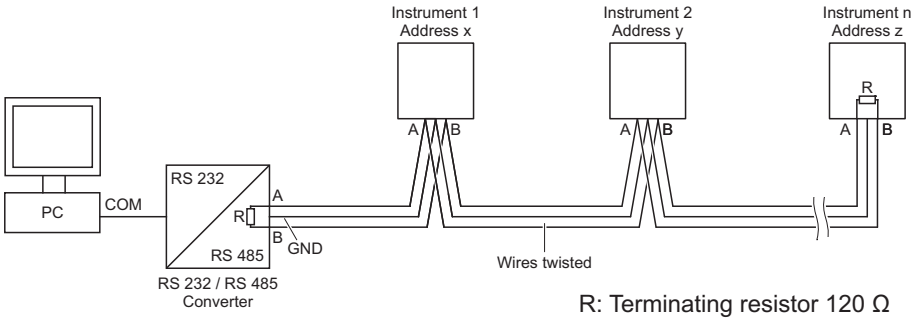


Fig. 1-1 Wiring in the bus system

For trouble-free operation, heed the following points when wiring:

- In principle, connect all components in series. The bus line must not be branched (no branch lines).
- The instruments at both ends of the bus line must have a terminating resistor (see Fig. 1-1). With WTW monitors, the terminating resistor is switched on or off with the instrument software.
- Loop the shield line of the bus cable through every instrument between the ends of the bus line. With WTW monitors, loop the shield line through by connecting the shield wires of both bus cables together on the GND connection.
- Connect the shield superficially with the local potential equalization / grounding system.
- The bus cable must be installed separately at a minimum distance of 20 cm from any other lines carrying a voltage greater than 60 V.

1.3 Checklist for the RS 485 bus system

The following checklist supports you when planning, projecting and installing an RS 485 plant with the RS 485. For smooth operation, you should be able to answer all questions with "Yes".

- Is the [bus system] (bus segment) installed without branch lines?
- Was the correct RS 485 bus cable used (cord type A according to EN 50170)?
- Are the poles of the signal lines A line and B line correctly connected at all bus connections?
- Is it guaranteed that there is no short-circuit between A line, B line and cable shielding?
- Is the shielding installed free of interruptions?
- Are the guidelines for shielding and grounding being observed, and doesn't any unallowed potential equalization current flow via the shielding?
- Is the maximum cable length (per bus segment) observed for the corresponding baud rate?
- Do all devices support the required baud rate?
- Are exactly two terminating resistors switched on at the ends of the [bus system] (bus segment)?
- Are the terminators supplied with voltage so the following applies: $U_{B\ line} - U_{A\ line} > + 500$ mV?
- Do all devices have individual bus addresses?
- After changing the bus address, have the devices been restarted (switched off and on again)?
  Note: The WTW monitor does not have to be restarted.
- Do the addresses projected in the master correspond to the actual addresses?
- After commissioning:
  Do all devices signal error-free behavior?
- Is it guaranteed that the RS 485 master has consistent access to the 16 byte instrument data structure?

2 Prn operation

In Prn operation (master operation) the monitor cyclically and every two to four seconds sends measured values that can be received by a data terminal (e.g. printer or PC).

The main and secondary measured value (temperature) are transmitted.

Sample output: D.O. monitor

```
O2:  1.85 mg/l,TP:  15.6 °C
```

3 SL operation

3.1 Course of the data transmission

The communication procedure is divided into the command section and the response section:

The **command section** contains:

- the address of the Slave
- the command to be executed (message section)
- the CRC check (Cyclic Redundancy Check).

The command to be executed is imported by the Slave and correspondingly evaluated.

The **response section** contains a message concerning the correct BUS transfer and, if necessary, data.

3.2 Data structure

Structure of a message

1 byte	1 byte	n bytes	2 bytes
Slave address Status bits	Length information n+2	ASCII message	CRC16 (CCITT-X.25)

Slave address and status bit

7	6	5	4	3	2	1	0
Always 1	Master/ Slave	Error	Slave address 01 to 31, 00 = broadcast				

Bit 7 "1" always 1

Bit 6 Master/Slave "1" indicates that the message has been sent from the Master to the Slave.
The Slave address addresses the data sink.
"0" indicates that the message is a response from the Slave to the Master. The Slave address then specifies the data source.

Bit 5 Error: during transmission from Master--> Slave always "1"/ for a syntax error, it is set by the Slave bit to 0.

Bit 4,3,2,1,0 Slave address 1 to 31; 00.
The address 00 ("broadcast") addresses all slaves and is admissible for certain commands only.
There is no feedback from the slaves.

Length field

7	6	5	4	3	2	1	0
"0"	Cont.	Length of the message field incl. CRC 16					

Bit 5,4,3,2,1,0 Length of the message or length of the message plus 2 bytes (CRC bytes): Maximum block length, 65 bytes.

Bit 6 Cont.:

- Length of the message field ≤ 1 block -> bit 6 = 0
- Length of the message field > 1 block -> bit 6 = 1.

The continuation bit is set if another block follows. The last data block sets the data bit to "0".

Message field This field contains the commands to the "Slaves" (see table). The CRC immediately follows subsequent to the message (2 bytes).

CRC16 field The CRC is the checksum of all the transmitted bytes. The CRC is transmitted as 2 binary bytes. The higher value bytes are transmitted first followed by the lower value bytes.

The transmitted CRC 16 is constructed so that it always supplements the total CRC to 0000 (hex). A string is only valid if the CRC calculated over the entire received string is = 0000 (hex). Otherwise, the message is ignored.

Algorithm to create a CRC (C program):

```
Unsigned short crc16 (unsigned char *bytes, int byte_anz)
{
    unsigned short crc;
    unsigned char byte;
    unsigned short merker;
    int i;

    crc = 0;
    while(byte_anz--)
    {
        byte = *bytes++;
        for(i = 7; i >= 0; i--, byte <<= 1)
        {
            merker = crc & (1 << 15);
            crc <<= 1;
            if(byte & (1 << 7))
                crc++;
            if(merker)
                crc ^= 0x1021;
        }
    }
    return crc;
}
```

Sample program

C-program to create a CRC for the "RSID" command (requesting the instrument identification):

```
#include <string.h>

const unsigned char noErrorBit = 1 << 5;
const unsigned char Master = 1 << 6;
const unsigned char setBit = 1 << 7;
const unsigned char followBit = 1 << 6;

main()
{
unsigned char block[65];
unsigned short crc;

/* Instrument address (example=1) */
int busAdr = 1;

    char text[] = "RSID";
int textLen;
textLen = strlen(text);

    /* Enter text from 3rd field */
memcpy(&block[2], text, textLen);

    /* Assign 1st field*/
block[0] = setBit | Master | noErrorBit |
(busAdr & 31);

    /* Assign 2nd field*/
    block[1] = textLen + 2;

/* Set CRC = 0 */
block[textLen + 2] = 0;
block[textLen + 3] = 0;

/* Calculate checksum (inclusive CRC == 0) */
crc = crc16(block, textLen + 4);

/* Enter checksum */
block[textLen + 2] = crc >> 8; // high-Byte
block[textLen + 3] = crc;      // low-Byte

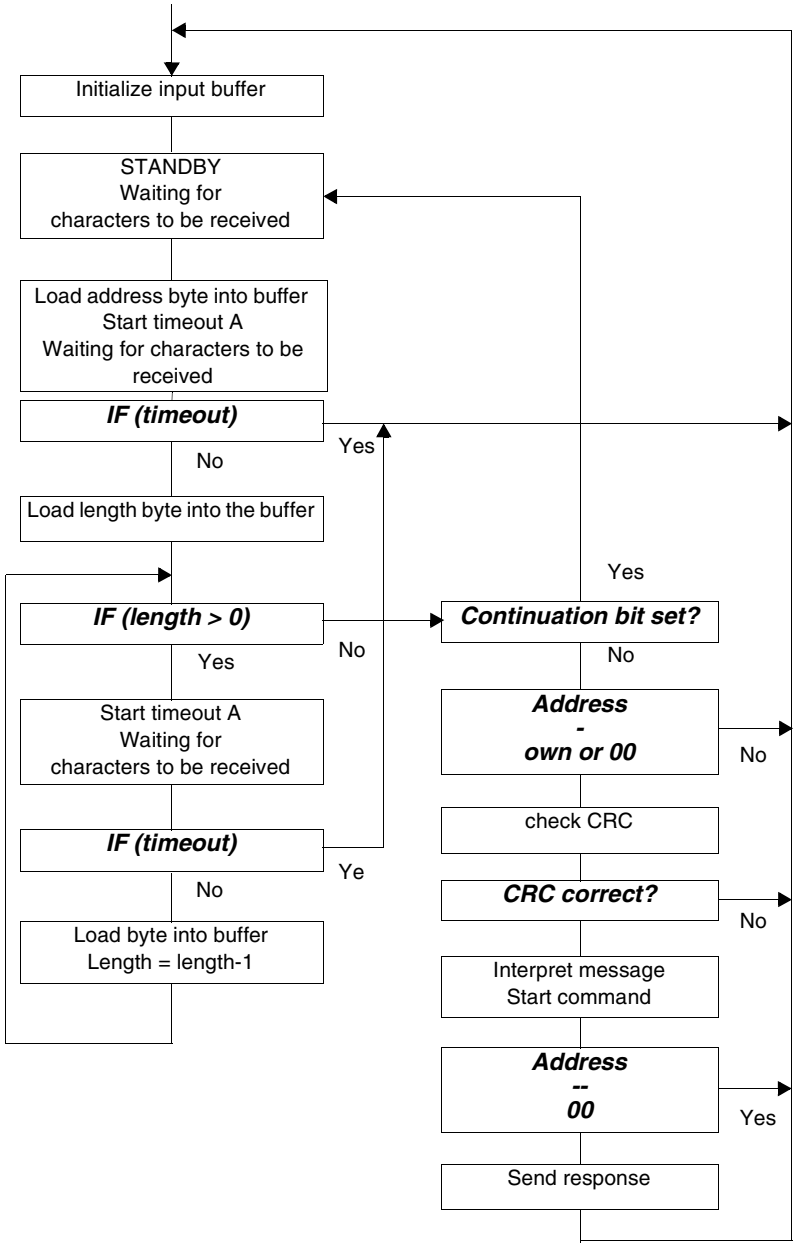
/* Control: checksum is now 0 */
crc = crc16(block, textLen + 4);

/* Send block (with length == textLen + 4) */
/* ... */

return 0;
}
```

3.3 RS485 Slave bus protocol

Flowchart



Error behavior:

Timeout times

A = 3 byte transmission times (approx. 3.1 ms with 9600 bauds)

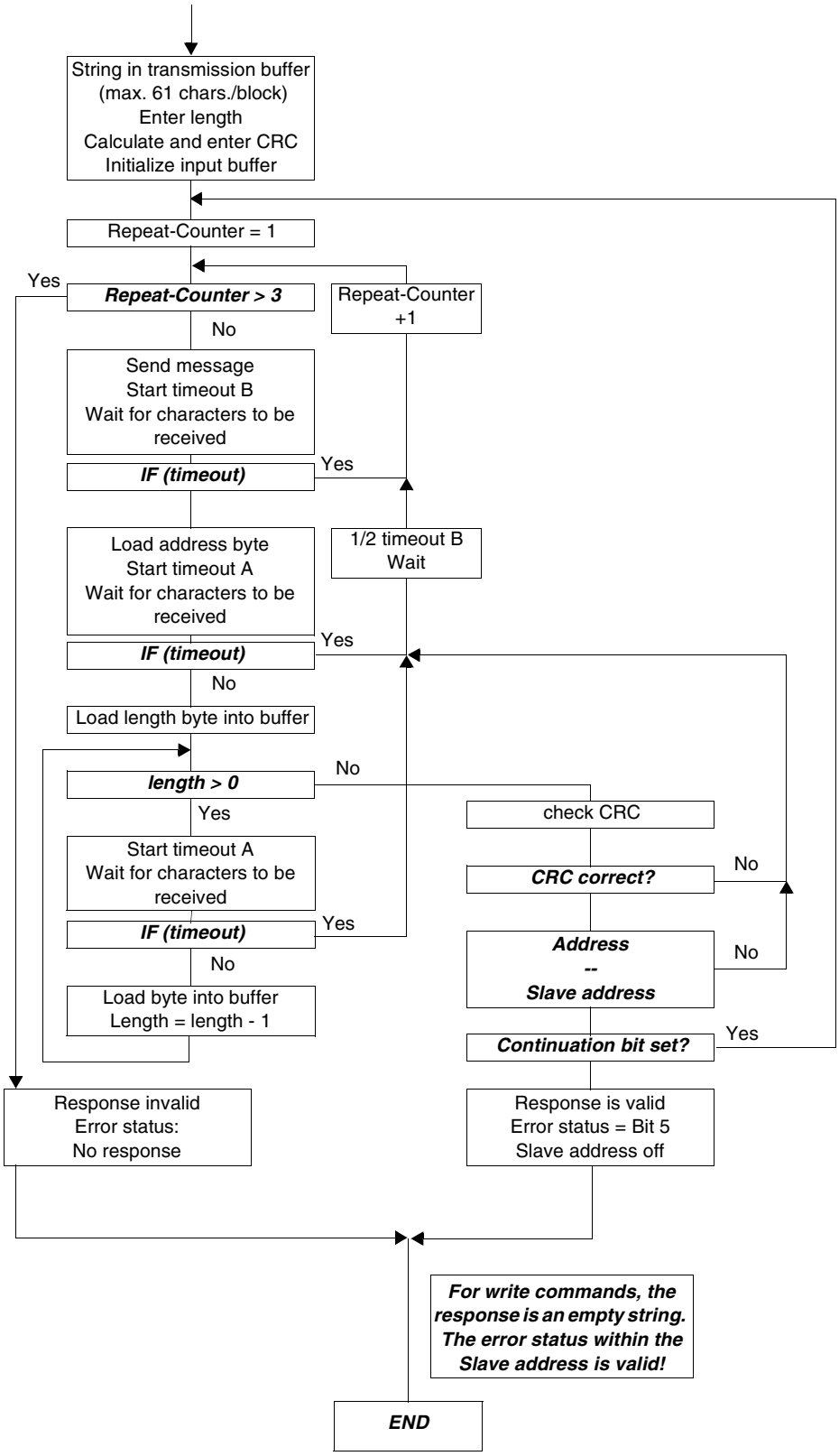
Error conditions in the Slave

- Timeout expired (approx. 3 byte transmission times)
- CRC error
- Unknown target address (not addressed)
- Framing (UART error)

Reaction to errors

Send no response, cancel receive string, return to standby mode.

3.4 RS485 Master bus protocol



Timeout times:

- A = 3 byte transmission times (approx. 3.1 ms with 9600 bauds)
- B= approx. 1s

3.5 Parameterization

The parameterization of the interface is done on the parameterization level of the P IF menu. Details on the parameterization level and operation are given in the operating manual of the monitor.

Setting table of the P IF menu:

Setting	Selection/Values	Explanation
P IF	• Prn • SL	Operating mode: • Prn Master operation • SL Slave operation (delivery condition)
P IF Baud	• 1200 • 2400 • 4800 • 9600	Baud rate Delivery condition = 9600 Baud In the SL operating mode, the baud rate is permanently set to 9600.
P IF	• 7En • 7Odd • 8no	Number of data bits and parity: • 7en 7 data bits / parity even • 7Odd 7 data bits / parity odd • 8no 8 data bits / no parity (delivery condition or permanently set with the selected operating mode SL)
P IF Ident (only in the SL operating mode)	01 ... 31	Component address Delivery condition = 01
P IF (only in the SL operating mode)	• notr • tr	Terminating resistor: • notr Terminating resistor off (delivery condition) • tr Terminating resistor on Note: For more detailed information on the terminating resistor, see section 1.2.

4 Interface commands

4.1 D.O. monitor

4.1.1 Query for measured values and calibration data

Syntax	Meaning	Reply (example) / structure
RV	Querying all measured values	`01:O2:20.2 mg/l,TP:17.8 °C,0.3 d°C\r` 1. Component address 2. "O2" = D.O. 3. Measured D.O. value with unit 4. "TP" = Temperature 5. Measured temperature value with unit 6. Adjustment difference from temperature adjustment
RVOXIBIN	Query measured D.O. value in binary code (4 bytes)	D.O. value * 100
RVTPBIN	Query measured temperature value in binary code (4 bytes)	TP value * 10
RVCAL	Query calibration data	`01:CAL:0.89\r` 1. Component address 2. "CAL" = Calibration data 3. Relative sensor slope

\r = line break

4.1.2 Status queries

Syntax	Meaning	Reply (example) / structure
RSID	Query instrument identification	`01:ID:Oxi 4000-RT-RS,SNR:12345678\r` 1. Component address 2. "ID" = Identification 3. Instrument type and options 4. "SNR" = Series number 5. Series number of the instrument
RSFE	Query of whether there are any error messages	`01:ERR:0\r` 1. Component address 2. "ERR" = Error 3. Number of errors (0 = no error)
RSFEF	Query of errors according to priority	`01:ERRP:3,1,7,10\r` 1. Component address 2. "ERRP" = Errors according to priority 3. Number of errors (0 = no error) 4. List of errors with error numbers Meaning of error numbers: 1 System error 2 Calibration error 3 D.O. measuring range exceeded 4 REC1 output range exceeded 5 REC2 output range exceeded 6 Temperature measuring range exceeded 7 D.O. upper limit value exceeded 8 D.O. lower limit value undercut 9 Temperature upper limit value exceeded 10 Temperature lower limit value undercut 11 SensLeck (sensor dependent) 12 SensReg (sensor dependent)
RSMWG	Query of sensor type	`01:MWG:(sensor type)\r` 1. Component address 2. "MWG" = Sensor type 3. Type of the connected sensor

Syntax	Meaning	Reply (example) / structure
RSREL	Query of relay statuses	`01:RST:10\r` 1. Component address 2. "RST" = Relay statuses 3. Status of relay 1 and 2 0 = passive 1 = active In the above example: 10 -> Relay 1 active, relay 2 passive
RSSW	Query of software version	`01:SV:1.00\r` 1. Component address 2. "SV" = Software version 3. Software version of the instrument

RSGW	Query of settings of limiting value signals	`01:OG/UG:2\r`
		`01:UL O2:1, 10.00 mg/l, 0.15 mg/l, 10 s\r`
		`01:LL TP:2, 20.0 °C, 2 °C, 2 s\r`
		1st line:
		1. Component address
		2. "OG/UG" = Limiting value signal settings
		3. Number of relays configured as limiting value signals
		
		2nd and 3rd line:
		If any relays are configured as limiting value signals, the settings are output here:
		1. Component address
		2. Limit value type:
		– "UL" = Upper limit value
		– "LL" = Lower limit value
		3. Measured parameter
		– "O2" = D.O.
		– "TP" = Temperature
		4. Relay number
		5. Limiting value with unit
		6. Hysteresis with unit
		7. Switching delay in seconds

Syntax	Meaning	Reply (example) / structure

RSRP	Query of the parameters of the proportional controller	`01:PI/PF:2\r`
		`01:UL PI:1, 19.9 mg/l, 0.1 mg/l, 10 s\r`
		`01:LL PF:2, 0.1 mg/l, 0.1 mg/l, 70 /min\r`
		1st line:
		1. Component address
		2. "PI/PF" = Proportional controller settings
		3. Number of relays configured as proportional controllers
		2nd and 3rd line:
		If any relays are configured as proportional controllers, the settings are output here:
		1. Component address
		2. Limit value type:
		– "UL" = Upper limit value
		– "LL" = Lower limit value
		3. Controller type:
		– "PI" = Pulse width modulation
		– "PF" = Frequency modulation
		4. Relay number
		5. Limiting value with unit
		6. Proportional range of the unit
		7. Cycle duration in s or max. switching frequency in 1/min

RSPASS	Query of password	`01:PASS:225\r` 1. Component address 2. "PASS" = Password 3. Adjusted password
RSSAL	Query of the entered salinity equivalent for salinity correction	`01:SABGL:2.3 SAL\r` 1. Component address 2. "SABGL" = Salinity adjustment 3. Entered salinity equivalent with unit
RSTABGL	Query of the adjustment difference from the temperature adjustment	`01:TABGL:-0.5°C\r` 1. Component address 2. "TABGL" = Temperature adjustment 3. Adjustment difference

\r = line break

4.2 pH monitor

4.2.1 Query for measured values and calibration data

Syntax	Meaning	Reply (example) / structure
RV	Querying all measured values	`01:pH:7.21 pH,TP:17.8 °C,0.3 d°C\r` 1. Component address 2. "pH" = pH value, or "mV" = mV value 3. Measured value with unit (with the mV value, also the adjustment difference from the ORP adjustment dmV) 4. "TP" = Temperature 5. Measured temperature value with unit 6. Adjustment difference from temperature adjustment
RVPHBIN	Query measured pH value in binary code (4 bytes)	pH value * 100
RVTPBIN	Query measured temperature value in binary code (4 bytes)	TP value * 10
RVCAL	Query calibration data	`01:CAL:-59.2 mV/pH,0 mV\r` 1. Component address 2. "CAL" = Calibration data 3. Slope of the combination electrode with unit 4. Asymmetry of the combination electrode with unit

\r = line break

4.2.2 Status queries

Syntax	Meaning	Reply (example) / structure
RSID	Query instrument identification	`01:ID:pH 5000-RT-RS,SNR:12345678\r` 1. Component address 2. "ID" = Identification 3. Instrument type and options 4. "SNR" = Series number 5. Series number of the instrument
RSFE	Query of whether there are any error messages	`01:ERR:0\r` 1. Component address 2. "ERR" = Error 3. Number of errors (0 = no error)
RSFEF	Query of errors according to priority	`01:ERRP:3,1,7,10\r` 1. Component address 2. "ERRP" = Errors according to priority 3. Number of errors (0 = no error) 4. List of errors with error numbers Meaning of error numbers: 1 System error 2 Calibration error 3 pH or mV measuring range exceeded 4 REC1 output range exceeded 5 REC2 output range exceeded 6 Temperature measuring range exceeded 7 Upper limit value of pH or mV exceeded 8 Lower limit value of pH or mV undercut 9 Temperature upper limit value exceeded 10 Temperature lower limit value undercut 11 SensCheck (sensor dependent)
RSMWG	Query of sensor type	`01:MWG:(sensor type)\r` 1. Component address 2. "MWG" = Sensor type 3. Type of the connected sensor

Syntax	Meaning	Reply (example) / structure
RSREL	Query of relay statuses	`01:RST:10\r` 1. Component address 2. "RST" = Relay statuses 3. Status of relay 1 and 2 0 = passive 1 = active In the above example: 10 -> Relay 1 active, relay 2 passive
RSV	Query of software version	`01:SV:1.00\r` 1. Component address 2. "SV" = Software version 3. Software version of the instrument

RSGW	Query of settings of limiting value signals	`01:OG/UG:2\r`
		`01:UL pH:1, 11.00 pH, 0.10 pH, 10 s\r`
		`01:LL TP:2, 20.0 °C, 2 °C, 2 s\r`
		<u>1st line:</u>
		1. Component address
		2. "OG/UG" = Limiting value signal settings
		3. Number of relays configured as limiting value signals
		
		<u>2nd and 3rd line:</u>
		If any relays are configured as limiting value signals, the settings are output here:
		1. Component address
		2. Limit value type:
		– "UL" = Upper limit value
		– "LL" = Lower limit value
		3. Measured parameter
		– "pH" = pH value
		– "TP" = Temperature
		4. Relay number
		5. Limiting value with unit
		6. Hysteresis with unit
		7. Switching delay in seconds

Syntax	Meaning	Reply (example) / structure

RSRP	Query of the parameters of the proportional controller	`01:PI/PF:2\r`
		`01:UL PI:1, 13.90 pH, 0.10 pH, 10 s\r`
		`01:LL PF:2, 0.10 pH, 0.10 pH, 70 /min\r`
		1st line:
		1. Component address
		2. "PI/PF" = Proportional controller settings
		3. Number of relays configured as proportional controllers
		2nd and 3rd line:
		If any relays are configured as proportional controllers, the settings are output here:
		1. Component address
		2. Limit value type:
		– "UL" = Upper limit value
		– "LL" = Lower limit value
		3. Controller type:
		– "PI" = Pulse width modulation
		– "PF" = Frequency modulation
		4. Relay number
		5. Limiting value with unit
		6. Proportional range of the unit
		7. Cycle duration in s or max. switching frequency in 1/min

RSPASS	Query of password	`01:PASS:225\r` 1. Component address 2. "PASS" = Password 3. Adjusted password
RSTABGL	Query of the adjustment difference from the temperature adjustment	`01:TABGL:-0.5°C\r` 1. Component address 2. "TABGL" = Temperature adjustment 3. Adjustment difference

\r = line break

4.3 Conductivity monitor

4.3.1 Query for measured values and calibration data

Syntax	Meaning	Reply (example) / structure
RV	Querying all measured values	`01:LF: 1266 uS/cm,TP:21.7 °C,0.1 d°C\r` 1. Component address 2. "LF" = conductivity, or "SAL" = salinity 3. Measured conductivity value with unit 4. "TP" = Temperature 5. Measured temperature value with unit 6. Adjustment difference from temperature adjustment
RVPHBIN	Query measured conductivity value in binary code (4 bytes)	Cond value * 100 SAL * 10
RVTPBIN	Query measured temperature value in binary code (4 bytes)	TP value * 10
RVCAL	Query cell constant	`01:CAL:0.917 1/cm\r` 1. Component address 2. "CAL" = Calibration data 3. Adjusted cell constant with unit

\r = line break

4.3.2 Status queries

Syntax	Meaning	Reply (example) / structure
RSID	Query instrument identification	`01:ID:LF 6000-RT-RS,SNR:12345678\r` 1. Component address 2. "ID" = Identification 3. Instrument type and options 4. "SNR" = Series number 5. Series number of the instrument
RSFE	Query of whether there are any error messages	`01:ERR:0\r` 1. Component address 2. "ERR" = Error 3. Number of errors (0 = no error)
RSFEF	Query of errors according to priority	`01:ERRP:3,1,7,10\r` 1. Component address 2. "ERRP" = Errors according to priority 3. Number of errors (0 = no error) 4. List of errors with error numbers Meaning of error numbers: 1 System error 2 Calibration error 3 Cond or SAL measuring range exceeded 4 REC1 output range exceeded 5 REC2 output range exceeded 6 Temperature measuring range exceeded 7 Cond or SAL upper limit value exceeded 8 Cond or SAL lower limit value undercut 9 Temperature upper limit value exceeded 10 Temperature lower limit value undercut
RSMWG	Query of sensor type	`01:MWG:(sensor type)\r` 1. Component address 2. "MWG" = Sensor type 3. Type of the connected sensor

Syntax	Meaning	Reply (example) / structure
RSREL	Query of relay statuses	`01:RST:10\r` 1. Component address 2. "RST" = Relay statuses 3. Status of relay 1 and 2 0 = passive 1 = active In the above example: 10 -> Relay 1 active, relay 2 passive
RSV	Query of software version	`01:SV:1.00\r` 1. Component address 2. "SV" = Software version 3. Software version of the instrument

RSGW	Query of settings of limiting value signals	`01:OG/UG:2\r`
		`01:UL LF:1, 53 mS/cm, 7 mS/cm, 10 s\r`
		`01:LL TP:2, 20.0 °C, 2 °C, 2 s\r`
		1st line:
		1. Component address
		2. "OG/UG" = Limiting value signal settings
		3. Number of relays configured as limiting value signals
		
		2nd and 3rd line:
		If any relays are configured as limiting value signals, the settings are output here:
		1. Component address
		2. Limit value type:
		– "UL" = Upper limit value
		– "LL" = Lower limit value
		3. Measured parameter
		– "LF" = Conductivity
		– "TP" = Temperature
		4. Relay number
		5. Limiting value with unit
		6. Hysteresis with unit
		7. Switching delay in seconds

Syntax	Meaning	Reply (example) / structure

RSRP	Query of the parameters of the proportional controller	`01:PI/PF:2\r`
		`01:UL PI:1, 199.9 mS/cm, 0.9 mS/cm, 10 s\r`
		`01:LL PF:2, 0.9 mS/cm, 0.9 mS/cm, 70 /min\r`
		1st line:
		1. Component address
		2. "PI/PF" = Proportional controller settings
		3. Number of relays configured as proportional controllers
		2nd and 3rd line:
		If any relays are configured as proportional controllers, the settings are output here:
		1. Component address
		2. Limit value type:
		– "UL" = Upper limit value
		– "LL" = Lower limit value
		3. Controller type:
		– "PI" = Pulse width modulation
		– "PF" = Frequency modulation
		4. Relay number
		5. Limiting value with unit
		6. Proportional range of the unit
		7. Cycle duration in s or max. switching frequency in 1/min

RSPASS	Query of password	`01:PASS:225\r` 1. Component address 2. "PASS" = Password 3. Adjusted password
RSTABGL	Query for the adjustment difference of the temperature adjustment	`01:TABGL:-0.5°C\r` 1. Component address 2. "TABGL" = Temperature adjustment 3. Adjustment difference

\r = line break

4.4 Chlorine monitor

4.4.1 Query for measured values and calibration data

Syntax	Meaning	Reply (example) / structure
RV	Querying all measured values	`01:Cl:5.8 mg/l,TP:17.8 °C,0.3 d°C\r` 1. Component address 2. "Cl" = Measured chlorine value or "mV" = mV value 3. Measured chlorine value with unit (the addition, "0 dmV" to the mV value is irrelevant) 4. "TP" = Temperature 5. Measured temperature value with unit 6. Adjustment difference from temperature adjustment
RVPHBIN	Query measured pH value in binary code (4 bytes)	Measured chlorine value * 100
RVTPBIN	Query measured temperature value in binary code (4 bytes)	TP value * 10
RVCAL	Query calibration data	`01:CAL:-113.5 mV,6.7 pH\r` 1. Component address 2. "CAL" = Calibration data 3. Relative sensor slope in mV per mg/L 4. Manually entered pH value at the time of calibration (only with chlorine sensors with pH dependent measured value)

\r = line break

4.4.2 Status queries

Syntax	Meaning	Reply (example) / structure
RSID	Query instrument identification	`01:ID:CL 7010-RT-RS,SNR:12345678\r` 1. Component address 2. "ID" = Identification 3. Instrument type and options 4. "SNR" = Series number 5. Series number of the instrument
RSFE	Query of whether there are any error messages	`01:ERR:0\r` 1. Component address 2. "ERR" = Error 3. Number of errors (0 = no error)
RSFEF	Query of errors according to priority	`01:ERRP:3,1,7,10\r` 1. Component address 2. "ERRP" = Errors according to priority 3. Number of errors (0 = no error) 4. List of errors with error numbers Meaning of error numbers: 1 System error 2 Calibration error 3 Chlorine or mV measuring range exceeded 4 REC1 output range exceeded 5 REC2 output range exceeded 6 Temperature measuring range exceeded 7 Upper limit value of chlorine or mV exceeded 8 Lower limit value of chlorine or mV undercut 9 Temperature upper limit value exceeded 10 Temperature lower limit value undercut 11 SensCheck (sensor dependent)
RSMWG	Query of sensor type	`01:MWG:(sensor type)\r` 1. Component address 2. "MWG" = Sensor type 3. Type of the connected sensor

Syntax	Meaning	Reply (example) / structure
RSREL	Query of relay statuses	`01:RST:10\r` 1. Component address 2. "RST" = Relay statuses 3. Status of relay 1 and 2 0 = passive 1 = active In the above example: 10 -> Relay 1 active, relay 2 passive
RSV	Query of software version	`01:SV:1.00\r` 1. Component address 2. "SV" = Software version 3. Software version of the instrument

RSGW	Query of settings of limiting value signals	`01:OG/UG:2\r`
		`01:UL Cl:1, 10.00 mg/l, 0.15 mg/l, 10 s\r`
		`01:LL TP:2, 20.0 °C, 2 °C, 2 s\r`
		1st line:
		1. Component address
		2. "OG/UG" = Limiting value signal settings
		3. Number of relays configured as limiting value signals
		
		2nd and 3rd line:
		If any relays are configured as limiting value signals, the settings are output here:
		1. Component address
		2. Limit value type:
		– "UL" = Upper limit value
		– "LL" = Lower limit value
		3. Measured parameter
		– "Cl" = Chlorine
		– "TP" = Temperature
		4. Relay number
		5. Limiting value with unit
		6. Hysteresis with unit
		7. Switching delay in seconds

Syntax	Meaning	Reply (example) / structure

RSRP	Query of the parameters of the proportional controller	`01:PI/PF:2\r`
		`01:UL PI:1, 19.9 mg/l, 0.1 mg/l, 10 s\r`
		`01:LL PF:2, 0.1 mg/l, 0.1 mg/l, 70 /min\r`
		1st line:
		1. Component address
		2. "PI/PF" = Proportional controller settings
		3. Number of relays configured as proportional controllers
		2nd and 3rd line:
		If any relays are configured as proportional controllers, the settings are output here:
		1. Component address
		2. Limit value type:
		– "UL" = Upper limit value
		– "LL" = Lower limit value
		3. Controller type:
		– "PI" = Pulse width modulation
		– "PF" = Frequency modulation
		4. Relay number
		5. Limiting value with unit
		6. Proportional range of the unit
		7. Cycle duration in s or max. switching frequency in 1/min

RSPASS	Query of password	`01:PASS:225\r` 1. Component address 2. "PASS" = Password 3. Adjusted password
RSTABGL	Query of the adjustment difference from the temperature adjustment	`01:TABGL:-0.5°C\r` 1. Component address 2. "TABGL" = Temperature adjustment 3. Adjustment difference

\r = line break

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