



ELOTECH
INDUSTRIELELEKTRONIK GMBH

The Multizones Temperature Controller:

R2000, R2100, R2200, R2400, R2500:

Serial Interface, Data Transfer Protocoll description: ELOTECH - Standard

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2. Interface, general description

The microprocessor based controllers of the series **R2000, R2100, R2200, R2400** and **R 2500** can be equipped with a serial interface RS-485, RS232-C or TTY(0/20mA).

E.g. the RS485-interface allows up to 32 devices (here called: slaves) to be monitored and controlled on a common bus (multipoint interface) by a higher level computer (here called: master). Each device has different zones (controller zones).

The interface is electrically isolated by the rest of the device circuit.

The data transfer between the slave and master takes place with the aid of a defined protocol.

The communication is always controlled by the master.

The controller operates as a slave with its own address (1...255).

The address has to be programmed in the configuration level of the controller.

If there are transmission or other errors detected by the slave (controller), it doesn't accept this data. The old parameter values are still valid.

All data are transferred in a hexadecimal, ASCII-coded format.

Check criterias:

1. Only ASCII-Codes from 0...9 or A...F ?
Except for start and stop character?
2. Data format (Parity) o.k. ?
3. Check sum o.k. ?

RS-485 interface data:

Number of drivers/receivers:	32
Transmission character:	symmetric
Max. wire length:	1200 m

<p>TAKE ATTENTION TO THE CORRESPONDING OPERATING MANUALS OF THE CONTROLLER !</p>

Disclaimer of liability

We have checked the contents of the document for conformity with the hardware and software described. Nevertheless, we are unable to preclude the possibility of deviations so that we are unable to assume warranty for full compliance. The information given in the publication is, however, reviewed regularly. Necessary amendments are incorporated in the following editions. We would be pleased to receive any improvement proposals which you may have. This document may not be passed on nor duplicated, nor may its contents be used or disclosed unless expressly permitted.

3. Interface Parameters

The following parameters have to be programmed either in the configuration level of the controller (Types R2000, R2100) or have to be set with the help of the function switches (Type R 2200):
See controller manual --> configuration level.

Adr	Unit address	1 255	(ex works: 1)
		The master addresses the slave at this address. Each slave has its own address. RS485: It is possible to adress 32 slaves with different zones.	
For	Data format	7E1	7 data, even, 1 stop bit
		7o1	7 data, odd, 1 stop bit
		7E2	7 data, even, 2 stop bit
		7o2	7 data, odd, 2 stop bit
		7n2	7 data, none, 2 stop bit
		8E1	8 data, even, 1 stop bit
		8o1	8 data, odd, 1 stop bit
		8n1	8 data, none, 1 stop bit
		8n2	8 data, none, 2 stop bit
bAud	Baud rate	OFF; 0,3 ... 9,6 kBaud	(ex works: 9,6)
		The baud rate denotes the transmission rate at which one bit is transmitted.	

Start bit:

At the beginning of the transmission a start bit (log. 0) is transmitted. It's purpose is to inform the receiver of the start of a data word (synchronization of the data exchange).

Data bit:

The start bit is (starting with the least significant bit) followed by 7 or 8 data bit,.

Parity bit:

The next bit is the parity bit. It is calculated from the check sum of all data bit and enables the receiver to recognize transmission errors.

EVEN - Parity: The number of the ones transmitted (including the parity bit) must be even.

ODD - Parity: The number of the ones transmitted (including the parity bit) must be odd.

NONE - Parity: There is no parity-bit calculated and transmitted.

Stop bit:

The transmission of a data word is concluded with 2 stop bit (log. 1). The purpose of this is to provide a minimum space between two immediatly consecutive data words.

EXAMPLE 1

Data format: (7E2) :	1 Start bit	7 Data bit	Parity (EVEN)	2 Stop bit
Data word:		111 1100		
Transmission:	0	0011 111	1	1 1

EXAMPLE 2

Data format: (8o1) :	1 Start bit	8 Data bit	Parity (ODD)	1 Stop bit
Data word:		1111 1100		
Transmission:	0	0011 1111	1	1

4. Data Transmission / Protokoll

All data (Hex-Byte) are transmitted in ASCII-format (text characters).

Permitted ASCII characters: 30H ... 39H, 41H ...46H,
0AH, 0DH

All other characters would be ignored.

E.g.: Hex-Byte **2FH** -> "2" in ASCII: 32H
"F" in ASCII: 46H

Two ASCII characters are thus required for each hex byte.

The only exceptions are:

the start character: (0AH = line feed, LF) and

the end character: (0DH = carriage return, CR).

The instruction or parameter transfer is executed in both directions by means of defined data blocks.

4.1 Terms

Start character:	introduces transfer of a data block. All characters in front of the start character are ignored.	(1 ASCII)
Device adress:	designates a specific multi zones device	(2 ASCII)
Zone adress:	designates the specific controller zone	(2 ASCII)
Instruction code:	tells the device (slave) what it must do	(2 ASCII)
Parameter code:	designates each individual parameter that can be called in the device.	(2 ASCII)
Parameter group code:	some parameters are combined to a group (E.g.: the feedback parameters P, I, D and the switching cycle time C). All this parameters can be set and called up with one instruction.	(2 ASCII)
Parameter value:	states the value of a parameter	(6 ASCII)
Responce:	acknowledgement message of the device in response to a master instruction.	(2 ASCII)
Check sum:	the two´s complement of the sum of all the hex bytes of a data block without the start and the end characters. Serves the purpose of recognizing transmission errors.	(2ASCII)
End character:	concludes the transmission of a data block	(1 ASCII)

5. Instruction and Response

The master (computer) can issue the following instructions to the slave (controller):

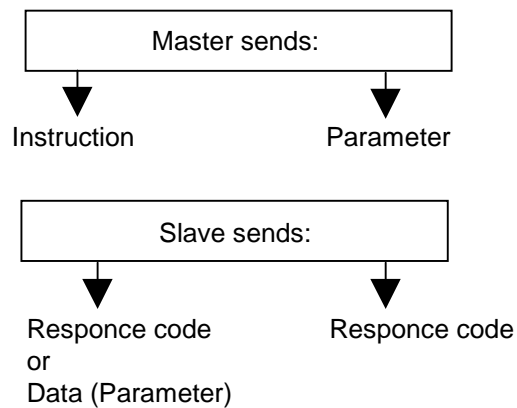
- | | |
|--|-----------------------|
| a. Send parameter: | Instruction code 10 H |
| b. Send parameter group: | Instruction code 15 H |
| d. Accept parameter: | Instruction code 20 H |
| e. Accept parameter and store with powerfail protection: | Instruction code 21 H |
- Take care:
The EAROM / E² ROM permits max. 10.000 write cycles.

Provided, that the slave understood the instruction, it always responds by sending a complete data block.

The typical interval between master instruction and slave response (time-out) is 5...10 msec..

The slave repeats the received instruction code.

5.1 Instruction



5.2 Response (with error code)

- | | |
|------|--|
| 00 H | - acknowledge, no error (Instruction executed) |
| 01 H | - Parity error |
| 02 H | - Check sum error |
| 03 H | - Procedure error |
| 04 H | - Non-compliance with specified range |
| 05 H | - Zone number not allowed / available. |
| 06 H | - The addressed parameter is a read-only parameter |
| FEH | - Error during writing into the powerfail storage |
| FFH | - General error |

6. Parameter Structure

The parameter value comprises three data bytes:
2 data byte (mantissa), 1 data byte (exponent).

Examples:	Dec.	Hex.	Mantissa	Exp.	ASCII
Process value (°C):	215	00D7	00D7	00	30 30 44 37 30 30
Setpoint (°C):	230	00E6	00E6	00	30 30 45 36 30 30
Output ratio, "cooling" (%)	-16	FFF0	FFF0	00	46 46 46 30 30 30
Setpoint ramp (°C/min):	2,2	0016	0016	FF	30 30 31 36 46 46
	The parameter value is calculated as follows: Dec.: 2,2 = 22 x 10 ⁻¹ Hex.: = 0016 (mantissa) = FF (exponent)				
Status word (mantissa: low byte)	1	0001	0001	00	30 30 30 31 30 30

Negative mantissas / negative exponents : Built binary two's complement.

7. Check Sum

The checksum is formed by subtracting the hex data of a data block (without start- and end characters) from 00H (two's complement of the sum). Carryovers are disregarded.

Example:

Device address = 01dec.:	01	00 - 01 = FF	(device adress no. 1)
Zone number:	01	FF - 01 = FE	(zone no.: 1)
Instruction code:	10	FE - 10 = EE	(send parameter)
Parameter code:	10	EE - 10 = DE	(process value)

Checksum: DE

Try to program this example first and send it to the device.
Don't forget the start- and stop-bit (but do ignore, when you calculate the check sum).

If this and the unit adress, the baudrate and the data format is o.k.,
the devise with the adress1 sends the process value of zone no.1.

8. Configuration Level, general settings

(valid for the complete unit)

The configuration parameters are allowed to be addressed via each controller zone. They are valid for all zones.

Parameter-discription	Parameter-code	Adjustment-range						
Sensor mix selection	8E H (r/w)	0	all zones prepared for thermocouple (TC)- connection					
		1	Zones 1 - 2 : RTD - connection; other zones: TC					
		2	Zones 1 - 4 : RTD - connection; other zones: TC				End: 4-zones	
		3	Zones 1 - 6 : RTD - connection; other zones: TC				End: 6-zones	
		4	Zones 1 - 8 : RTD - connection; other zones: TC				End: 8-zones	
		5	Zones 1 - 10 : RTD - connection; other zones: TC				End: 10-zones	
		6	Zones 1 - 12 : RTD - connection; other zones: TZ				End: 12-zones	
		7	Zones 1 - 14 : RTD - connection; other zones: TC					
		8	Zones 1 - 16 : RTD - connection					
Alarm 1-Configuration (switches relay A1)	34 H (r/w)	0	alarm OFF, no alarm signalisation					
		1	signal contact, setpoint dependend:	off-on				
		2	limit contact, process value dependend:	off-on				
		3	limit comparator:	off-on-off				
		4	signal contact:	on-off				
		5	limit contact:	on-off				
		6	limit comparator:	on-off-on				
		7	limit comp. with start-up suppression:	off-on-off				
		8	heater current monitoring; limit contact:	off-on				
9	heater current monitoring; limit contact:	on-off						
Relay A1 switching behaviour	3C H (r/w)	0	dir	on:	LED = „1“	Relay A1 "activated"		
				off:	LED = „1“	Relay A1 "not active"		
		1	inv	on:	LED = „1“	Relay A1 "not active"		
				off:	LED = „1“	Relay A1 "activated"		
		Alarm 2-Configuration (switches relay A2) 35 H (r/w) see: alarm 1 - configuration						
		Relay A2 switching behaviour	3D H (r/w)	0	dir	on:	LED = „2“	Relay A2 "activated",
off:	LED = „2“					Relay A2 "not active",		
1	inv			on:	LED = „2“	Relay A2 "not active",		
				off:	LED = „2“	Relay A2 "activated",		
Heater current monitoring:								
Delay time, relay A1	3E H (r/w)	1, 2, 3, 4, 5 0	= 5 steps adjustable no delay time					
Delay time, relay A2	3F H (r/w)	1, 2, 3, 4, 5 0	= 5 steps adjustable no delay time					
Current detection intervall	31 H (r/w)	1 ... 60 sec.						
Min. leakage current value	32 H (r/w)	0 = OFF	or	0,0...99,9 A				
Actual leakage current value	12 H (r)	0,0...99,9 A						

9. Controller zones configuration

(separat adjustments for each controller zone)

After addressing the unit, the corresponding controller zone has to be addressed.

Parameter-discription	Parameter-code	Adjustment-range	
Zone on / off	8F H (r/w)	0	measuring- or controller zone „off“
		1	measuring- or controller zone „on“
Controller configuration <u>Heat-only- or Cool-only- controller - x2x -</u>	80 H (r/w)	0	2-point-controller „heating-off“
		1	2point-controller „cooling-off“
		2	2point-controller „cooling-off“ with non-linear cooling
		3	Zone works as an indicator, no controller action
Controller configuration <u>Heat-only- and</u> <u>Heating-off-cooling- controller - x3x -</u>	80 H (r/w)	0	2-point-controller „heating-off“
		1	2point-controller „cooling-off“
		2	2point-controller „cooling-off“ with non-linear cooling
		3	3point-controller „heating-off-cooling“
		4	3point-controller „heating-off-cooling“ with non-linear cooling *)
		5	Zone works as an indicator, no controller action
Sensor selection <u>Series R2000</u>	1A H (r/w)	0	Pt 100, -50,0 ... +100,0 °C
		1	Pt 100, -58,0 ... +212,0 °F
		2	Pt 100, -90,0 ... +205,0 °C
		3	Pt 100, -130 ... +401 °F
		4	Pt 100, 0 ... 400 °C
		5	Pt 100, 32 ... 752 °F
		6	Pt 100, 0 ... 800 °C
		7	Pt 100, 32 ... 1472 °C
		or,	if selected as a thermocouple-input zone (depending on parameter code 8E):
		0	T/C Fe-CuNi (L), 0 ... 400 °C
		1	T/C Fe-CuNi (L), 32 ... 752 °F
		2	T/C Fe-CuNi (L), 0 ... 800 °C
		2	T/C Fe-CuNi (L), 32 ... 1472 °F
		3	T/C Fe-CuNi (J), 0 ... 800 °C
3	T/C Fe-CuNi (J), 32 ... 1472 °F		
4	T/C NiCr-Ni (K), 0 ... 1200 °C		
5	T/C NiCr-Ni (K), 32 ... 2192 °F		
6	T/C Pt10Rh-Pt (S), 0 ... 1600 °C		
7	T/C Pt10Rh-Pt (S), 32 ... 2912 °F		
Sensor selection <u>Series R2100, R2200 and R2500</u>	1A H (r/w)	0	Pt 100, 0,0 ... 99,9 °C
		1	Pt 100, 32 ... 212 °F
		2	Pt 100, -100 ... 200 °C
		3	Pt 100, -148 ... 392 °F
		4	Pt 100, 0 ... 400 °C
		5	Pt 100, 32 ... 752 °F
		6	Pt 100, 0 ... 800 °C
		or,	if selected as a thermocouple-input zone (depending on parameter code 8E):
		0	T/C Fe-CuNi (L), 0 ... 400 °C
		1	T/C Fe-CuNi (L), 32 ... 752 °F
		2	T/C Fe-CuNi (L), 0 ... 800 °C
		3	T/C Fe-CuNi (J), 0 ... 800 °C
		4	T/C NiCr-Ni (K), 0 ... 999 °C

If the Sensor selection is changed, the following parameters need to be adjusted new:
Setpoint 1, setpoint 2, process value offset,
lower setpoint limitation, higher setpoint limitation, setpoint-ramp values, alarm values.

Parameter-discription	Parameter-code	Adjustment-range
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Softstart-function:

Softstart	6D H (r/w)	0	Softstart not active
		1	Softstartfunction activated
Softstart output ratio	6A H (r/w)	10 ... 100%	
Softstart setpoint	6B H (r/w)	adjustment range: SP.Lo SP.Hi	
Softstart duration time	6C H (r/w)	0	OFF
		0,1 ... 9,9 min.	

Automatik / Manual operation:

Output ratio configuration	8B H (r/w)	0	OFF
		1	Auto
		2	Manual

Setting: OFF
Function not active

Setting: Auto

In event of sensor break the controller automatically maintains the last valid output ratio as the actuating signal.

Under the following circumstances, the output ratio will be 0%:

- if the output ratio at time of the sensor break was 100%.
- if the controller is working along a setpoint-ramp.
- if the control deviation was more than 0,25% of the total range at the time of sensor break.
- if the prop. band (P; xp) = 0.
- if the soft start was active at the time of the sensor break.

A few seconds after the sensor break has been rectified, the controller returns to automatic operation and calculates the required output ratio.

An additional signal can be issued in the event of sensor break, if the alarm contacts are programmed accordingly.

Setting: Man

The controller now operates only as an actuator.

Via parameter 62 H an output ratio can be programmed.

Manual output ratio	62 H (r/w)	0 ... 100%	
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Parameter-discription	Parameter-code	Adjustment-range
ACTUAL TEMPERATURE PROCESS VALUE	10 H (r)	
Process value offset	18 H (r/w)	-99 ... 0 (OFF) ...100 units - 9,9 ... 0 (OFF) ... 10,0 units
Temperature-Setpoint 1	21 H (r/w)	SP.Lo...SP.Hi 0 = OFF
Temperature-Setpoint 2	22 H (r/w)	SP.Lo...SP.Hi Activated, when external contact k1 is closed. 0 = OFF
Rising ramp	2F H (r/w)	0 = rising ramp function: OFF 0,1...99,9 / 100,0 °C/min. or °F/min.
Falling ramp	2F H (r/w)	0 = falling ramp function: OFF 0,1...99,9 / 100,0 °C/min. or °F/min.
Alarm value 1 switching point (switches relay A1)	38 H (r/w)	Temperature monitoring: alarm value adjustment Signal contact, limit comparator, limit contact OFF = -200 or: measuring rang bottom -1 or Heater current monitoring: alarm value adjustment Limit contact 0 =OFF 0,0 ...99,9 Amp.
Alarm value 2 switching point (switches relay A2)	39 H (r/w)	Temperature monitoring: alarm value adjustment Signal contact, limit comparator, limit contact OFF = -200 or: measuring rang bottom -1 or Heater current monitoring: alarm value adjustment Limit contact 0 =OFF 0,0 ...99,9 Amp.
		The range of adjustment is dependant on the sensor, the connected current transformers and the alarm configuration. Both have to be set in the configuration level.
ACTUAL HEATER CURRENT VALUE	11 H (r/	0,0 ...99,9 Amp.

Parameter-discription	Parameter-code	Adjustment-range
<u>PID – parameters (controller behavior):</u>		
Valid output ratio	60 H (r)	-100...100 %
Output ratio limit „heating“	64 H (r/w)	0...100 %
Xp, prop.-band (P) „heating“	40 H (r/w)	0 = „on – off“ behavior, no feedback 0,1...100,0 %
Tv, rate (D) „heating“	41 H (r/w)	0 = OFF; 1...200 secs
Tn, reset (I) „heating“	42 H (r/w)	0 = OFF; 1...1000 secs
Cycle time „heating“	43 H (r/w)	0,5...240,0 secs
Control sensivity output „heating“	47 H (r/w)	Only if: Prop.band = OFF (On-off action, without feedback) 0,0 = OFF; 0,1 ... 80,0 °C/°F 0,00 = OFF; 0,01 ... 8,00 °C/° F (only measuring ranges with dec.point)
Switch-point difference „heating – cooling“	46 H (r/w)	0,0 = OFF; 0,1 ... 80,0 °C/°F 0,00 = OFF; 0,01 ... 8,00°C/°F (only measuring ranges with dec.point)
Output ratio limit „cooling“	69 H (r/w)	0...100 %
Xp, prop.-band (P) „cooling“	50 H (r/w)	0 = „on – off“ behavior, no feedback 0,1...100,0 %
Tv, rate (D) „cooling“	51 H (r/w)	0 = OFF; 1...200 secs
Tn, reset (I) „cooling“	52 H (r/w)	0 = OFF; 1...1000 secs
Cycle time „cooling“	53 H (r/w)	0,5...240,0 secs
Control sensivity output „cooling“	57 H (r/w)	Only if: Prop.band = OFF (On-off action, without feedback) 0,0 = OFF; 0,1 ... 80,0 °C/°F 0,00 = OFF; 0,01 ... 8,00 °C/° F (only measuring ranges with dec.point)
Xp, prop.-band (P) 3point-stepping controller	40 H (r/w)	0 = „on – off“ behavior, no feedback 0,1...200,0 %
Ts, motor setting time (D) 3point-stepping controller	41 H (r/w)	5 ... 800 secs.
Tn, reset time (I) 3point-stepping controller	42 H (r/w)	0,5 ... 80,0 min.
Control sensivity 3point-stepping controller	47 H (r/w)	0,0 = OFF; 0,1 ... 80,0 °C/°F 0,00 = OFF; 0,01 ... 8,00 °C/° F (only measuring ranges with dec.point)
Dead band, neutral zone 3point-stepping controller	46 H (r/w)	0,0 = OFF; 0,1 ... 80,0 °C/°F 0,00 = OFF; 0,01 ... 8,00 °C/° F (only measuring ranges with dec.point)
Self tuning (autotune)	88 H (r/w)	0 self tuning out of action 1 self tuning on request (one time)

Parameter-discription	Parameter-code	Adjustment-range
Parameter group "process"	0AH	

With this (single) instruction the following, actual parameters can be read out by the master using only one data transmission.

Process value	10 H (r)
Setpoint, actual	20 H (r)
Output ratio, actual	60 H (r)
Status word 1	70 H (r)

10. Status Word 1, Parameter code 70H

For each zone is status word 1 (read only) available. It has 8 bit. Reports alarm states ascertained by the controller.

Mantisse, low byte:

7 6 5 4 3 2 1 0 :

bit

bit 0 = 1 -> System error

bit 1 = 1 -> Sensor error

bit 2 = x -> no function

bit 3 = 1 -> reset-control. A reset was triggered during operation.

The device automatically resets bit 3 = 0 if the status word 1 has been read once by the master.

bit 4 = x -> no function

bit 5 = 1 -> Alarm 1 „on“

bit 6 = 1 -> Alarm 2 „on“

bit 7 = 1 -> Setpoint ramp in operation

11. Data Block Structure

11.1 Master sends „Instruction“, Instruction code: 10H, 15H

```
Start ----> 0A ----> xx xx ----> xx xx ----> xx xx ----> xx xx ----> xx xx ----> 0D ----> End
           Lf      Device-  Zone-  Instruction-  Param.-  Check-
           address  address  code      code      sum
           CR
```

11.2 Master sends "Parameter", Instruction code: 20H, 21H

```
Start ----> 0A ----> xx xx ----> xx xx ----> xx xx ----> xx xx ---->
           Lf      Device-  Zone-  Instruction-  Param.-
           address  address  code      code
           ----> xx xx xx xx  xx xx ----> xx xx ----> 0D ----> End
           Mantissa  Exp.    Check-  CR
           Parameter  sum
```

11.3 Slave sends „Response“ to master:

```
Start ----> 0A ----> xx xx ----> xx xx ----> xx xx ----> xx xx ----> xx xx ----> 0D ----> End
           Lf      Device-  Zone-  Response-  Response  Check-
           address  address  code    code      sum
           Instruction-  Error-
           code         code
```

11.4 Slave sends „Parameter“ or „Parameter group“ to master (Data transfer)

```
Start ----> 0A ----> xx xx ----> xx xx ----> xx xx ---->
           Lf      Device-  Zone-  Response-
           address  address  code
           Instruction-code
           ----> xx xx ----> xx xx xx xx  xx xx ---->
           Param.-  Mantissa  Exp.
           code 1   Parameter value 1
           ----> xx xx ----> xx xx xx xx  xx xx ----> xx xx ----> 0D ----> End
           Param.-  Mantissa  Exp.    Check-  CR
           code n   Parameter value n  sum
```

xx : 1 ASCII

12. Typical Transmission Examples

12.1 Transmission example, Instruction code 10 H

The device No.(address) 5 (zone address:01) is called to send a parameter (process value, 10 H) to the master.

Master to device (slave):	Dec.	Hex		ASCII (Hex)
Start character				0A
Device address:	5	05	-->	30 35
Zone address:		01	-->	30 31
Instruction: Send parameter		10	-->	31 30
Parameter code (process value):		10	-->	31 30
Check sum:		DA	-->	44 41
End character:				0D

Transmission to controller: 0A 30 35 30 31 31 30 31 30 44 41 0D

Device (slave) to master:	Dec.	Hex		ASCII
Start character				0A
Device address:	5	05	-->	30 35
Zone address:		01	-->	30 31
Send parameter (repeats instruction):		10	-->	31 30
Parameter code (process value):		10	-->	31 30
Parameter value:	225	00E1.00	-->	30 30 45 31 30 30
Check sum:		F9	-->	46 39
End character:				0D

Transmission to master: 0A 30 35 30 31 31 30 31 30 30 30 45 31 30 30 46 39 0D

12.2 Transmission example, Instruction code 15 H

The device No.12 (zone address:01) should send the parameter group 0AH to the master.

Master to device (slave):	Dec.	Hex		ASCII (Hex)
Start character				0A
Device address:	12	0C	-->	30 43
Zone address:		01	-->	30 31
Instruction: Send parameter group		15	-->	31 35
Parameter group code (0AH):		0A	-->	30 41
Check sum:		D4	-->	44 34
End character:				0D

Transmission to device: 0A 30 43 30 31 31 35 30 41 44 34 0D

Device to master:	Dec.	Hex		ASCII
Start character				0A
Device address:	12	0C	-->	30 43
Zone address:		01	-->	30 31
Send parameter group (repeats instruction):		15	-->	31 35
1. Parameter code, process value:		10	-->	31 30
Parameter value	248	00F8.00	-->	30 30 46 38 30 30
2. Parameter code, actual setpoint:		20	-->	32 30
Parameter value	250	00FA.00	-->	30 30 46 41 30 30
3. Parameter code, actual output ratio:		60	-->	36 30
Parameter value	42	002A.00	-->	30 30 32 41 30 30
4. Parameter code, Status word 1:		70		37 30
Parameter value	00	0000.00	-->	30 30 30 30 30 30
Check sum:		C2	-->	43 32
End character:				0D

Transmission to master:

0A 30 43 30 31 31 35 31 30 30 30 46 38 30 30 32 30 30 30 46 41 30 30
36 30 30 30 32 41 30 30 37 30 30 30 30 30 30 30 43 32 0D

12.3 Transmission example, Instruction code 20 H

The device No.27 (zone address: 01) gets the instruction:

"Take over the parameter 1 P (xp-heating, Parameter code: 40H) into the RAM.

Master to device (slave):	Dec.	Hex		ASCII
Start character:				0A
Device address:	27	1B	-->	31 42
Zone address:		01	-->	30 31
Instruction code:		20	-->	32 30
Parameter code (xp-heating):		40	-->	34 30
Parameter value:	5	0005.00	-->	30 30 30 35 30 30
Check sum:		7F		37 41
End character:				0D

Transmission to device: 0A 31 42 30 31 32 30 34 30 30 30 30 35 30 30 37 41 0D

Device to master:	Dec.	Hex		ASCII
Start character				0A
Device address:	27	1B	-->	31 42
Zone address:		01	-->	30 31
Instruction code (repeats instruction):		20	-->	32 30
Response* (acknowledged) :		00	-->	30 30
Check sum:		C4	-->	43 34
End character:				0D

Transmission to master: 0A 31 42 30 31 32 30 30 30 43 34 0D

- * If the device has understood the instruction issued by the master, it acknowledges with the response 00 H (acknowledge).

In the event of transmission or other errors, the device responds here with the appropriate error code.

12.4 Transmission example, Instruction code 21 H

The device No.2 (zone address: 01) gets the instruction:

"Take over the parameter SP1 (Setpoint 1, Parameter code: 21H) and store powerfail.

Master to device (slave):	Dec.	Hex		ASCII
Start character				0A
Device address:	2	02	-->	30 32
Zone address:		01	-->	30 31
Instruction code:		21	-->	32 31
Parameter code (Setpoint 1):		21	-->	32 31
Parameter value:	235	00EB.00	-->	30 30 45 42 30 30
Check sum:		D0	-->	44 30
End character:				0D

Transmission to device: 0A 30 32 30 31 32 31 32 31 30 30 45 42 30 30 44 30 0D

Device to master:	Dec.	Hex		ASCII
Start character				0A
Device address:	2	02	-->	30 32
Zone address:		01	-->	30 31
Instruction (repeats instruction) :		21	-->	32 31
Response * (acknowledged):		00	-->	30 30
Check sum:		DC	-->	44 43
End character:				0D

Transmission to master: 0A 30 32 30 31 32 31 30 30 44 43 0D

* If the device has understood the instruction issued by the master, it acknowledges with the response 00 H (acknowledge).

In the event of transmission or other errors, the device responds here with the appropriate error code.

13. Analogue inputs

The R2000, R2100 and R2200 series have as an option 2 additional analogue inputs 0...10 Vdc to indicate

2 additional temperature- or other physical values (e.g. pressure, rpm, ...).

The actual values of this 2 inputs are able to be addressed as follows:

4-, 6- or 8-zones controller:	zone address input d1: 09	parameter code (process value): 10 (read only)
	zone address input d2: 10	parameter code (process value): 10 (read only)
10-zones controller:	zone address input d1: 11	parameter code (process value): 10 (read only)
	zone address input d2: 12	parameter code (process value): 10 (read only)

14. Typical Error Messages

Procedure error; error message: 03 H

The device (slave or controller) reports „procedure error“ if unknown instruction or parameter codes or parameter group codes are stated.

Other error messages as follows:

1. The master wishes to edit an illegal alarm value.
Remedy: initially allow the alarm by means of the alarm configuration.
2. The slave (controller) is operating in the automatic mode (controller mode).
The master wishes to edit the manual response ratio (62H).
First switch over to mode „HAnd“.
3. The slave can't store the parameter „manual output ratio“ powerfail.
4. The slave (controller) is configured as a 2-point (heating-off) controller:
The master requests the „cooling“ parameters.

Parameter is a read only parameter; error message: 06 H

The slave (controller) reports „parameter is only read parameter“ if a read parameter is to be edited via the master.

E. g.:

1. The master wishes to specify the response output ratio, although the slave is in the automatic mode (parameter 62H).
2. The master wishes to send status word 1 (parameter 70H) to the slave.
3. The master wishes to edit the actual value.
4. The master wishes to edit the current setpoint (parameter 20H). Edit SP1 or SP2.
5. 3-point-step controller configuration:
The master wishes to send a manual output ratio value when the slave is in „HAnd“-mode.

Non - compliance with specified range; error message: 04H :

The slave reports „non-compliance with specified range“ in the following instances:

1. Alarm configuration: Signal contact
The master wishes to edit +1100 (max. allowed: +999).
2. Configured measuring and controlling range: 0 ... 400°C.
The master wishes to edit 430°C.

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