

ELOTECH
INDUSTRIELELEKTRONIK GMBH

Manual: Data Transfer

Profibus DP, EN 50170



Multizone Temperature Controller

Series: R2000, R2100, R2200

Content:

| | | |
|-------|---|----|
| 1. | Disclaimer of liability | 2 |
| 2. | Interface, general | 2 |
| 2.1 | Line routing, screening and measures to combat interference voltage | 3 |
| 2.2 | Shielding of lines | 4 |
| 2.3 | Connection guide | 5 |
| 2.3.1 | PROFIBUS-Connections: | 5 |
| 2.3.2 | PROFIBUS – Adjustments: | 5 |
| 2.3.3 | PROFIBUS - Diagnostic displays: | 6 |
| 3. | Data Transfer, general | 6 |
| 3.1 | The Communication: | 6 |
| 3.2 | Process reflection | 7 |
| 3.2.1 | From master to slave: | 7 |
| 3.2.2 | From slave to master: | 8 |
| 3.2.3 | Transmission example | 9 |
| 3.3 | Configuration channel | 11 |
| 3.3.1 | Data transmission, general | 11 |
| 3.3.2 | Terms | 11 |
| 3.3.3 | Parameter values | 11 |
| 3.3.4 | Configuring of the parameters via the configuration channel. | 11 |
| 3.3.5 | Parameter list | 13 |
| 3.3.6 | Transmission examples | 15 |
| 3.4 | Process reflection and Configuration channel | 18 |

1. Disclaimer of liability

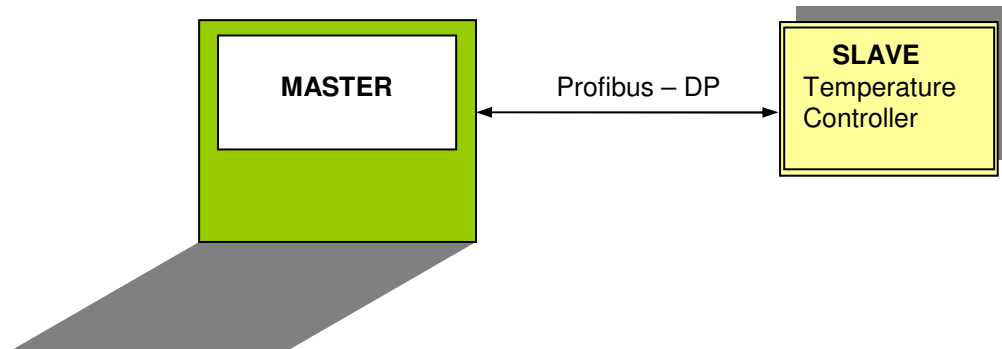
We have checked the contents of the document for conformity with the hardware and software described. Nevertheless, we are unable to preclude the possibility of deviations so that we are unable to assume warranty for full compliance. The information given in the publication is, however, reviewed regularly. 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.

**Note: Only in PROFIBUS-technologie trained personnel following the safety regulations may do the PROFIBUS-connections.
It is essential, that one has well experience in installing a profibus device.**

2. Interface, general

The ELOTECH – multizones temperature controller is equipped with a PROFIBUS DP interface.



The PROFIBUS -interface allows the slave to be monitored and controlled by a PROFIBUS master. The data transfer between the slave and master takes place with the aid of the PROFIBUS-DP-protocol acc. to EN 50170.

The communication is always controlled by the PROFIBUS-DP master. The temperature controller actuates as a slave. Each slave has its own device adress.

If there are transmission or other errors detected by the slave, it doesn` t accept this datas. The old parameter values are still valid.

Please take attention to the manual of the specific temperature controller.

GDS - data file:

Will be delivered with the slave on disk or download: www.elotech.de

FAQ`s:

see www.elotech.de (downloads)

2.1 Line routing, screening and measures to combat interference voltage

This chapter deals with line routing in the case of bus, signal and power supply lines, with the aim of ensuring an EMC-compliant design of your system.

General information on line routing

- Inside and outside of cabinets

In order to achieve EMC-compliant routing of the lines, it is advisable to split the lines into the following line groups and to lay these groups separately.

Group A: •shielded bus and data lines (e.g. for PROFIBUS-DP, RS232C and printers etc.)
 •shielded analogue lines
 •unshielded lines for DC voltages ≥ 60 V
 •unshielded lines for AC voltage ≥ 25 V
 •coaxial lines for monitors

Group B: •unshielded lines for DC voltages ≥ 60 V and ≥ 400 V
 •unshielded lines for AC voltage ≥ 24 V and ≥ 400 V

Group C: •unshielded lines for DC voltages > 400 V

The table below allows you to read off the conditions for laying the line groups on the basis of the combination of the individual groups.

Line laying instructions as a function of the combination of line groups:

| | Group A | Group B | Group C |
|---------|----------------|----------------|----------------|
| Group A | 1 | 2 | 3 |
| Group B | 2 | 1 | 3 |
| Group C | 3 | 3 | 1 |

- 1) Lines may be laid in common bunches or cable ducts.
- 2) Lines must be laid in separate bunches or cable ducts (without minimum clearance).
- 3) Lines must be laid in separate bunches or cable ducts inside cabinets but on separate cable racks with at least 10 cm clearance outside of cabinets but inside buildings .

2.2 Shielding of lines

Shielding is intended to weaken (attenuate) magnetic, electrical or electromagnetic interference fields.

Interference currents on cable shields are discharged to earth via the shielding bus which is connected conductively to the chassis or housing. A low-impedance connection to the PE wire is particularly important in order to prevent these interference currents themselves becoming an interference source.

Wherever possible, use only lines with braided shield. The coverage density of the shield should exceed 80 %. Avoid lines with foil shield since the foil can be damaged very easily as the result of tensile and compressive stress on attachment. The consequence is a reduction in the shielding effect.

In general, you should always connect the shields of cables at both ends. The only way of achieving good interference suppression in the higher frequency band is by connecting the shields at both ends.

The shield may also be connected at one end only in exceptional cases. However, this then achieves only an attenuation of the lower frequencies. Connecting the shield at one end may be more favourable if

- it is not possible to lay an equipotential bonding line
- analogue signals (a few mV resp. mA) are to be transmitted
- foil shields (static shields) are used.

In the case of data lines for serial couplings, always use metallic or metallised plugs and connectors. Attach the shield of the data line to the plug or connector housing. Do not connect the shield on the connector of the slave (controller).

If there are potential differences between the earthing points, a compensating current may flow via the shield connected at both ends. In this case, you should lay an additional equipotential bonding line.

Please note the following points when shielding:

- Use metal cable clips to secure the shield braiding. The clips must surround the shield over a large area and must have good contact.
- Downstream of the entry point of the line into the cabinet, connect the shield to a shielding bus. Continue the shield as far as the module, but do not connect it again at this point!

2.3 Connection guide

Note: Only in PROFIBUS-technologie trained personnel following the safety regulations may do the PROFIBUS - connections.
It is essential, that one has well experience in installing a profibus device.

You will require the following components to connect the slave:

- Connector for Profibus connection to the slave
- PROFIBUS cable (this cable is generally already installed on site!)
- Diskette with type resp. GSD file
- Project planning tool for the PROFIBUS-Master

It is essential, that you perform the following during connecting in order to ensure that the slave operates correctly:

2.3.1 PROFIBUS-Connections:

Connect the slave with the PROFIBUS. Take care to the terminals.

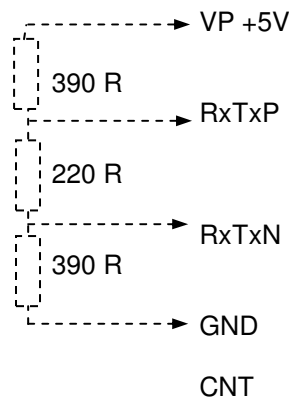
See: connection diagram of the specific controller type.

The terminals VP and GND have to be used to connect the terminating-resistors.

There is no further load allowed.

The terminating resistors have to be connected on the first and the last device of the Profibus-bus.

Terminating-Resistors (Tol. +/-2%):



2.3.2 PROFIBUS – Adjustments:

Adjust the following parameters (slave):

Series R2000, R2100:

| | | |
|-----------------------|------|---|
| Parameter „Adress“: | Adr: | Adjustment of the Profibus-Adress |
| Parameter „Baudrate“: | baud | No adjustment possible. The baudrate will detected and monitored automatically. Display: „ndEt“ = no baudrate detected. |

Series R2200:

| | | |
|-----------------------|------------------|--|
| Parameter „Adress“: | see DOP switches | in front of the instrument |
| Parameter „Baudrate“: | baud | No adjustment possible. The baudrate will detected and monitored automatically. |

2.3.3 PROFIBUS - Diagnostic displays:

Series R2000 and R2100: See the lightened decimal point in the left display of the zones indication display (Zone).

Series R2200: See the green "BUS-LED"

Function:

Dec.-point or LED are "on": Data exchange:
The device is into the "data-exchange-modus".
The communication is ok..
The data exchange takes place.

Dec.-point or LED "flashing": Wait:
The bus connection has been detected.
The device is waiting to be configured or programmed by the master.

Dec.-point or LED are "off": No connection:
Please check the wiring and the bus connections.
Check if the master works ok..
There is no communication.

3. Data Transfer, general

3.1 The Communication:

The master sends it's data to the slave.
The datad will be overtaken only if the instrument is programmed to "remote"-action.

After this the slave sends an answer to the PROFIBUS DP - master.
This takes place cyclic and will be controlled by the master.
The configuration of the slave takes place with the help of the GSD-file.

The following moduls are available for the slave:

- | | |
|--|---|
| 1. Process reflection: | Module: „x – channel process data“ |
| 2. Configuration channel: | Module: „parameter channel“ |
| 3. Process reflection and Configuration channel: | Module: „x – channel process + parameter“ x= 4, 6, 8, 10, 12 or 16 (zones) |

Example for 8-zones controllers: x = 8 channel modul, also if only 1 or 6 zones are in action.

If the device is an 8-zones controller and if there are only 4 or 6 zones in operation, a 8-channel module has to be used.

3.2 Process reflection

Parameter transfer according to the process reflection modul:

3.2.1 From master to slave: Transfer of Setpoint 1 and Status word 1

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | |
|---|--|--------------------------------|---|--|--------------------------------|-----|
| Zone 1: Setpoint 1 High Byte | Zone 1: Setpoint 1 Low Byte | Zone 1: Control byte | Zone 2: Setpoint 1 High Byte | Zone 2: Setpoint 1 Low Byte | Zone 2: Control byte | ... |

USW.

| | Byte 46 | Byte 47 | Byte 48 |
|-----|--|---|---------------------------------|
| ... | Zone 16: Setpoint 1 High Byte | Zone 16: Setpoint 1 Low Byte | Zone 16: Control byte |

If there are instruments with controller zones lower than 16 (e.g. 8 or 12 zones) the number of the transmitted data bytes is lower too.

Setpoint / process value: The parameter value consists out of 2 data bytes within the process reflection.
First the high- and then the low-byte will be transmitted.
Setpoint and actual process values will be transmitted always with a decimal digit, although the measuring range has no decimal digit.

| Example: | °C | Dec. | Hex. | High-Byte | Low-Byte |
|--|-------|------|------|-----------|----------|
| Measuring range with dec. point: act. value | 23,0 | 230 | 00E6 | 00 | E6 |
| Measuring range with dec. point: setpoint | 170,0 | 1700 | 06A4 | 06 | A4 |
| Measuring range without dec. point: act. value | 23 | 230 | 00E6 | 00 | E6 |
| Measuring range without dec. point: setpoint | 170 | 1700 | 06A4 | 06 | A4 |

Control byte: The parameter consist out of one data byte:

Bit 0: controller zone 0=on, 1=off

Bit 1: self tuning 0=off, 1=on
Changing this bit from „0“ to „1“ will force the controller to do one selftuning action.
Set this bit to „0“, before starting a new selftuning action.

Bit 2: 0

Bit 3: actual setpoint 0=setpoint SP1, 1=setpoint SP2

Bit 4: 1 = delete warning „selftuning error“ into the status byte

Bit 5: 0

Bit 6: 0

Bit 7: 1 = delete warning „system error“ into the status byte

**3.2.2 From slave to master:
Transfer of the process data**

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 |
|-------------------------------------|------------------------------------|---|--|------------------------------------|-------------------------------|
| Status Setpoint High Byte | Status Setpoint Low Byte | Zone 1 Process value High Byte | Zone 1 Process value Low Byte | Zone 1 Controller Status | Zone 1 Alarm Status |

| Byte 7 | Byte 8 | Byte 9 | Byte 10 | |
|---|--|------------------------------------|-------------------------------|-------|
| Zone 2 Process value High Byte | Zone 2 Process value Low Byte | Zone 2 Controller Status | Zone 2 Alarm Status | . . . |

| | Byte 63 | Byte 64 | Byte 65 | Byte 66 |
|-------|--|---|-------------------------------------|--------------------------------|
| . . . | Zone 16 Process value High Byte | Zone 16 Process value Low Byte | Zone 16 Controller Status | Zone 16 Alarm Status |

If there are instruments with controller zones lower than 16 (e.g. 8 or 12 zones) the number of the transmitted data bytes is lower too.

Status setpoint: Indicates, if a range error has been detected, when writing the setpoint:

| | | |
|---------|--------------|---|
| Bit 0: | 0 = Zone 1: | setpoint value ok. |
| | 1 = | setpoint value not ok. (out of range ?) |
| Bit 1: | 0 = Zone 2: | setpoint value ok. |
| | 1 = | setpoint value not ok. (out of range ?) |
| Bit 2: | 0 = Zone 3: | setpoint value ok. |
| | 1 = | setpoint value not ok. (out of range ?) |
| Bit 15: | 0 = Zone 16: | setpoint value ok. |
| | 1 = | setpoint value not ok. (out of range ?) |

Alarm Status:

| | |
|-----------|--------------------|
| Bit 0 | 1 = alarm 1 active |
| Bit 1 | 1 = alarm 2 active |
| Bit 2...: | 0 (no function) |

Controller Status: The parameter consist out of one data byte:

| | | |
|--------|-----------------------------------|-------------------------------------|
| Bit 0: | controller zone | 0=on, 1=off |
| Bit 1: | self tuning | 0=off, 1=on |
| Bit 2: | remote action | 0=on, 1=off, operation via keyboard |
| Bit 3: | actual setpoint | 0=setpoint SP1, 1=setpoint SP2 |
| Bit 4: | 1 = selftuning error | |
| Bit 5: | 1 = setpoint ramp function active | |
| Bit 6: | 1 = sensor error | |
| Bit 7: | 1 = system error | |

3.2.3 Transmission example
From master to slave: transfer of setpoint 1 and control byte

Byte 1 + 2: Zone 1 The setpoint 50,0°C should be send to the slave.
 Setpoint: 500 decimal = 0x01F4 hexadecimal as a 16 bit integer-value

Byte 3: Zone 1 The slave should be switched „on“ (Bit 0 = 1).

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | |
|---|--|--|---|--|--|-----|
| Zone 1: Setpoint 1 High Byte 0x01 | Zone 1: Setpoint 1 Low Byte 0xF4 | Zone 1: Control Byte 0x01 | Zone 2: Setpoint 1 High Byte 0x.. | Zone 2: Setpoint 1 Low Byte 0x.. | Zone 2: Control Byte 0x.. | ... |

| | Byte 46 | Byte 47 | Byte 48 |
|-----|--|---|---|
| ... | Zone 16: Setpoint 1 High Byte 0x.. | Zone 16: Setpoint 1 Low Byte 0x.. | Zone 16: Control Byte 0x.. |

If there are instruments with controller zones lower than 16 (e.g. 8 or 12 zones) the number of the transmitted data bytes is lower too.

**Answer from slave to master:
Transmission of the process reflection**

The slave sends the following parameter-values:

Byte 1 + 2: status instruction setpoint transmission: the last instruction was ok.

Byte 3 + 4: Zone 1 Act. process temp. value:55,0°C 550dec.=0x0226hex.dec., 16 bit integer-value

Byte 5: Zone 1 Controller status: controller = on

Byte 6: Zone 1 Alarm status: alarm = no alarm

Byte 7 + 8: Zone 2 Act. process temp. value:56,0°C 560dec.=0x0230hex.dec., 16 bit integer-value

Byte 9: Zone 2 Controller status: controller = on

Byte 10: Zone 2 Alarm status: alarm = no alarm

.
. .
. .
. .

Byte63 + 64: Zone 16 Act. process temp. value

Byte 65: Zone 16 Controller status

Byte 66: Zone 16 Alarm status

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 |
|---|--|---|--|--|---------------------------------------|
| Status Setpoint High Byte 0x00 | Status Setpoint Low Byte 0x00 | Zone 1 Process Value High Byte 0x02 | Zone 1 Process Value Low Byte 0x26 | Zone 1 Controller Status 0x01 | Zone 1 Alarm Status 0x00 |

| Byte 7 | Byte 8 | Byte 9 | Byte 10 | |
|---|--|--|---------------------------------------|-------|
| Zone 2 Process Value High Byte 0x02 | Zone 2 Process Value Low Byte 0x3A | Zone 2 Controller Status 0x01 | Zone 2 Alarm Status 0x02 | . . . |

| | Byte 63 | Byte 64 | Byte 65 | Byte 66 |
|-------|--|---|---|--|
| . . . | Zone 16 Process Value High Byte 0x.. | Zone 16 Process Value Low Byte 0x.. | Zone 16 Controller Status 0x.. | Zone 16 Alarm Status 0x.. |

If there are instruments with controller zones lower than 16 (e.g. 8 or 12 zones) the number of the transmitted data bytes is lower too.

3.3 Configuration channel

With the help of the configuration channel each parameter can be addressed individually.

The sequence of the described bytes is valid for „question“ and „answer“.

3.3.1 Data transmission, general

The PROFIBUS – master is allowed to monitor and control all parameters of the slave.

The transfer of instructions and parameter values takes place with the aid defined data blocks.

3.3.2 Terms

| | | | |
|------------------|-------|--|-----------|
| Instruction-code | [BC]: | "tells" the device/slave, what to do | (1 byte) |
| Parameter-code | [PC]: | designates each individual parameter of the device | (1 byte) |
| Parameter-value | [PW]: | shows the value of a parameter | (3 bytes) |

3.3.3 Parameter values

| | | |
|------------------|-------|--|
| Instruction-code | [BC]: | 0x10, 0x20, 0x21 |
| Parameter-code | [PC]: | 0x00...0xFF |
| Parameter-value | [PW]: | 16 bit integer, mantissa PWH and PWL and exponent PWE base 10 |

| | |
|---------------------------|-------|
| Parameter-value High-Byte | [PWH] |
| Parameter-value Low- Byte | [PWL] |
| Parameter-exponent | [PWE] |

3.3.4 Configuring of the parameters via the configuration channel.

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 | Byte 8 |
|--|---|--|------------------------|---|---|--|--|
| Current number 0x00 ... 0xFF | Number of Zone max. 16 0x01...0xFF | Instruction code BC 0x10, 0x20 or 0x21 | Always: 0x00 | Parameter-code PC 0x00 ... 0xFF | Parameter-value PWH High-Byte | Parameter-value PWL Low-Byte | Exponent PWE 0x00 ... 0xFF |

Byte 1

Current Number: The master should preset a current number before every new task.. This number will be repeated from the slave with every answer. So it is possible to find out, which instruction and which answer belong together.

Byte 2: Number of controller zone of the addressed instrument (slave).
All parameters, which are necessary to configure the instrument, will be transmitted and addressed via zone no. 1.

Byte 3

Instruction code, BC: 0x10 : Read parameter
0x20 : Write parameter
0x21 : Write parameter and store with powerfail protection
Take care: The EAROM or EEPROM of the slave permits max. 1.000.000 write cycles.

Byte 4: always 0x00

Byte 5

Parameter code, PC: Enquiry:
Addresses the parameter which should be configured.
Answer:
If the read-proceeding to the slave was ok., then, in the answer of the slave, byte 5 shows the parameter-code PC.
If the write-proceeding to the slave was ok., then, in the answer of the slave, byte 5 shows the value 00H (acknowledge).
If the communication was not ok., the following error-warnings are shown in byte 5:
03 H - Procedure error (instruction code not valid)
04 H - Non-compliance with specified range (value to low or too high)
05 H - Byte 2 ≠ 0
06 H - The addressed parameter is a read-only parameter
07 H - Writing of data not possible. Slave status is not „remote“.
08 H - Parameter-code not valid
09 H - It is not possible, to execute the instruction
(e.g., the autotuning can't be started)
FEH - Error during writing into the powerfail storage
FFH - General error

**Bytes 6, 7 und 8
Parameter value:**

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

Byte 6: Parameter value **PWH**
Byte 7: Parameter value **PWL**
Byte 8: Parameter value **PWE**

| Examples: | Dec. | Hex. | Mantissa | Dec. point |
|---------------------------|------|------|----------|------------|
| Process value (°C): | 215 | 00D7 | 00D7 | 00 |
| Setpoint (°C): | 230 | 00E6 | 00E6 | 00 |
| Output ratio, cooling (%) | -16 | FFF0 | FFF0 | 00 |
| Setpoint ramp (°C/min): | 2,2 | 0016 | 0016 | 01 |

The parameter value is calculated as follows: Dec.: 2,2 = 22 + 1 dec.point
Hex.: = 0016 (mantissa)
= 01 (1 dec. point)

Negative mantissa / negative Exponent: Built binary two's complement.

3.3.5 Parameter list

| Parameter | Mnemonics | Parameter-Code | R2000 | R2100 | R2200 |
|---|-----------|----------------|-------|-------|-------|
| Actual process values: | | | | | |
| Act. temperature value | | 0x10 | RO | RO | RO |
| Act. heater current value | cur | 0x11 | RO | RO | RO |
| | c. | | RO | RO | RO |
| Temperature offset value | OFSt | 0x18 | RW | RW | RW |
| Sensor configuration | SEn | 0x1a | RW | RW | RW |
| Measuring range, dec. point | r. dP | 0x1d | RO | RO | RO |
| Linear input; decimal points | r. dP | 0x1d | RW | RW | RW |
| Linear input; bottom end value | r. Lo | 0x1e | RW | RW | RW |
| Linear input; top end value | r. Hi | 0x1f | RW | RW | RW |
| Setpoints: | | | | | |
| Actual setpoint | SP, act. | 0x20 | RO | RO | RO |
| Setpoint 1 | SP1 | 0x21 | RW | RW | RW |
| Setpoint 2 | SP2 | 0x22 | RW | RW | RW |
| Setpoint limitation, low range | SP.Lo | 0x2b | RW | RW | RW |
| Setpoint limitation, high range | SP.Hi | 0x2c | RW | RW | RW |
| Setpoint ramp, rising | SP ↑ | 0x2f | RW | RW | RW |
| Setpoint range, falling | SP ↓ | 0x2d | RW | RW | RW |
| Alarms: | | | | | |
| Heater current, detect. interval | Cu.CY | 0x31 | RW | RW | RW |
| Min. leakage current value | Cu.SP | 0x32 | RW | RW | RW |
| Alarm 1, Configuration | Co.A1 | 0x34 | RW | RW | RW |
| Alarm 2, Configuration | Co.A2 | 0x35 | RW | RW | RW |
| Alarm value 1 | A1 | 0x38 | RW | RW | RW |
| Alarm value 2 | A2 | 0x39 | RW | RW | RW |
| Switching behaviour A1 | rE.A1 | 0x3c | RW | RW | RW |
| Switching behaviour A2 | rE.A2 | 0x3d | RW | RW | RW |
| Delay time A1 | dL.A1 | 0x3e | RW | RW | RW |
| Delay time A2 | dL.A2 | 0x3f | RW | RW | RW |
| PID parameters „heating“: | | | | | |
| Proportional range (P) | 1 P | 0x40 | RW | RW | RW |
| Rate time (D) | 1 d | 0x41 | RW | RW | RW |
| Reset time (I) | 1 I | 0x42 | RW | RW | RW |
| Cycle time | 1 C | 0x43 | RW | RW | RW |
| Control sensitivity | 1 Sd | 0x47 | RW | RW | RW |
| Dead band / switch-point difference (only for 3-point-contr.) | SH | 0x46 | RW | RW | RW |
| PID parameters „cooling“: | | | | | |
| Proportional range (P) | 2 P | 0x50 | RW | RW | RW |
| Rate time (D) | 2 d | 0x51 | RW | RW | RW |
| Reset time (I) | 2 I | 0x52 | RW | RW | RW |
| Cycle time | 2 C | 0x53 | RW | RW | RW |
| Control sensitivity | 2 Sd | 0x57 | RW | RW | RW |

| Parameter | Mnemonics | Parameter-Code | R2000 | R2100 | R2200 |
|---|-----------|--|-------|-------|-------|
| Output ratio: | | | | | |
| Actual output ratio | Y | 0x60 | RO | RO | RO |
| Manual output ratio | HAnd | 0x62 | RW | RW | RW |
| Output ratio limit (heating) | 1LY | 0x64 | RW | RW | RW |
| Output ratio limit (cooling) | 2LY | 0x69 | RW | RW | RW |
| Softstart output ratio | So. Y | 0x6a | RW | RW | RW |
| Softstart setpoint | So.Sp | 0x6b | RW | RW | RW |
| Softstart duration time | So.ti | 0x6c | RW | RW | RW |
| Softstart function on/off | So.St | 0x6d | RW | RW | RW |
| Status words: | | | | | |
| Controller status / status byte | | 0x78 | RW | RW | RW |
| Controller configuration: | | | | | |
| Control action: heat-only heating-off-cooling | ConF | 0x80 | RW | RW | RW |
| Adjustment lock | LOC | 0x85 | RW | RW | - |
| Configuration of key "F1" | Co.F1 | 0x86 | RW | RW | - |
| Self tuning | OPt | 0x88 0 = off 1 = on | RW | RW | RW |
| Zone offset | Zo.OF | 0x89 | RW | RW | RW |
| Manual output ratio: configuration | Hand | 0x8b 0 = control action 1 = auto 2 = manual operation | RW | RW | RW |
| Unit of measuring zone | Unit | 0x8d | RW | RW | - |
| Sensor configuration | P tc | 0x8e | RW | RW | RW |
| Controller zone off/on | ZonE | 0x8f 0 = off 1 = on | RW | RW | RW |

3.3.6 Transmission examples

3.3.6.1 Configuration channel, Instruction code: 10 H

The slave is asked, to send the parameter „Process value, 10 H“of zone no.1 to the master.
The process value is 225 °C. 225 (Decimal) = 0xE1 (Hex)

| Master to slave: | Dec. | Hex |
|---------------------------------|-------------|------------|
| Current number: | 1 | 0x01 |
| Zone no.: | 1 | 0x01 |
| Send parameter: | 16 | 0x10 |
| Always: | 0 | 0x00 |
| Parameter code (process value): | 16 | 0x10 |
| Parameter value (High-Byte): | 0 | 0x00 |
| Parameter value (Low -Byte): | 0 | 0x00 |
| Exponent: | 0 | 0x00 |

Transmission to slave: 0x01, 0x01 0x10, 0x00, 0x10, 0x00, 0x00, 0x00

| Slave to master: | Dec. | Hex |
|---------------------------------|-------------|------------|
| Current number of instruction: | 1 | 0x01 |
| Zone no.: | 1 | 0x01 |
| Send parameter: | 16 | 0x10 |
| Always: | 0 | 0x00 |
| Parameter code (process value): | 16 *) | 0x10 |
| Parameter value (High-Byte): | 0 | 0x00 |
| Parameter value (Low -Byte): | 225 | 0xE1 |
| Exponent: 10° | 0 | 0x00 |

Transmission to master: 0x01, 0x01 0x10, 0x00, 0x10, 0x00, 0xE1, 0x00

*) Repetition of the parameter code (PC = 16), because the read-process was ok.

3.3.6.2 Configuration channel, Instruction code: 20 H

The slave gets the instruction:

"Overtake parameter „prop.-band heating“ (parameter code: 40H, parameter value: 5,0 %) of zone no. 2 and store into the RAM".

| Master to slave: | Dec. | Hex |
|------------------------------|-------------|------------|
| Current number: | 2 | 0x02 |
| Zone no.: | 2 | 0x02 |
| Instruction code: | 32 | 0x20 |
| Always: | 0 | 0x00 |
| Parameter code: | 64 | 0x40 |
| Parameter value (High-Byte): | 0 | 0x00 |
| Parameter value (Low -Byte): | 50 | 0x32 |
| Dec.-point | 1 | 0x01 |

Transmission to slave: 0x02, 0x02, 0x20, 0x00, 0x40, 0x00, 0x32, 0x01

| Slave to master: | Dec. | Hex |
|---|-------------|------------|
| Current number of instruction: | 2 | 0x02 |
| Zone no.: | 2 | 0x02 |
| Instruction code: | 32 | 0x20 |
| Always: | 0 | 0x00 |
| Parameter code (Prop-band, heating): 0 *) | 0 | 0x00 |
| Parameter value (High-Byte): | 0 | 0x00 |
| Parameter value (Low -Byte): | 0 | 0x00 |
| Dec.-point | 0 | 0x00 |

Transmission to master: 0x02, 0x02, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00

- *) If the slave has understood the instruction of the master, it answers always with the parameter code (PC) = 00, because the writing-process was ok..
If there are transmission or other errors the slave answers with the corresponding error code.

3.3.6.3 Configuration channel, Instruction code: 21 H

The slave gets the instruction:

"Overtake parameter setpoint 1 / SP1 = 200 °C (parameter code: 21H) of zone no. 1 and store powerfailsafe into the EEPROM".

| Master to slave: | Dec. | Hex |
|------------------------------|-------------|------------|
| Current number: | 3 | 0x03 |
| Zone no.: | 1 | 0x01 |
| Instruction code: | 33 | 0x21 |
| Always: | 0 | 0x00 |
| Parameter code (SP1): | 33 | 0x21 |
| Parameter value (High-Byte): | 0 | 0x00 |
| Parameter value (Low -Byte): | 200 | 0xC8 |
| Exponent: 10 ⁰ | 0 | 0x00 |

Transmission to slave: 0x03, 0x01, 0x21, 0x00, 0x21, 0x00, 0xC8, 0x00

| Slave to master: | Dec. | Hex |
|--------------------------------|-------------|------------|
| Current number of instruction: | 3 | 0x03 |
| Zone no.: | 1 | 0x01 |
| Instruction code: | 33 | 0x21 |
| Always: | 0 | 0x00 |
| Parameter code: | 0 *) | 0x00 |
| Parameter value (High-Byte): | 0 | 0x00 |
| Parameter value (Low -Byte): | 0 | 0x00 |
| Exponent: 10 ⁰ | 0 | 0x00 |

Transmission to master: 0x03, 0x01, 0x21, 0x00, 0x00, 0x00, 0x00, 0x00

- *) If the slave has understood the instruction of the master, it answers always with the parameter code (PC) = 00, because the writing-process was ok..
If there are transmission or other errors the slave answers with the corresponding error code.

3.4 Process reflection and Configuration channel

It is possible, to transmit process reflection and configuration channel simultaneously
 In this case the bytes of the configuration channel have to be fit together with the process reflection.

Master to slave:

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | |
|---|--|--------------------------------|---|--|--------------------------------|-----|
| Zone 1: Setpoint 1 High Byte | Zone 1: Setpoint 1 Low Byte | Zone 1: Control Byte | Zone 2: Setpoint 1 High Byte | Zone 2: Setpoint 1 Low Byte | Zone 2: Control Byte | ... |

| | Byte 46 | Byte 47 | Byte 48 |
|-----|--|---|---------------------------------|
| ... | Zone 16: Setpoint 1 High Byte | Zone 16: Setpoint 1 Low Byte | Zone 16: Control Byte |

| Byte 49 | Byte 50 | Byte 51 | Byte 52 | Byte 53 | Byte 54 | Byte 55 | Byte 56 |
|-----------------------|------------------------|--|--------------------|------------------------------------|---|--|-------------------------------------|
| Current Number | Controller Zone | Instruction Code BC | immer: 0x00 | Parameter Code PC | Parameter Value PWH High Byte | Parameter Value PWL Low Byte | Dec. Point PWK |

If there are instruments with controller zones lower than 16 (e.g. 8 or 12 zones) the number of the transmitted data bytes is lower too.

Slave to Master:

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 |
|-------------------------------------|------------------------------------|---|--|------------------------------------|-------------------------------|
| Status Setpoint High Byte | Status Setpoint Low Byte | Zone 1 Process Value High Byte | Zone 1 Process Value Low Byte | Zone 1 Controller Status | Zone 1 Alarm Status |

| Byte 7 | Byte 8 | Byte 9 | Byte 10 |
|---|--|------------------------------------|-------------------------------|
| Zone 2 Process Value High Byte | Zone 2 Process Value Low Byte | Zone 2 Controller Status | Zone 2 Alarm Status |

| Byte 11 | Byte 12 | Byte 13 | Byte 14 | |
|---|--|------------------------------------|-------------------------------|-------|
| Zone 3 Process Value High Byte | Zone 3 Process Value Low Byte | Zone 3 Controller Status | Zone 3 Alarm Status | . . . |

| | Byte 63 | Byte 64 | Byte 65 | Byte 66 |
|-------|--|---|-------------------------------------|--------------------------------|
| . . . | Zone 16 Process Value High Byte | Zone 16 Process Value Low Byte | Zone 16 Controller Status | Zone 16 Alarm Status |

| Byte 67 | Byte 68 | Byte 69 | Byte 70 | Byte 71 | Byte 72 | Byte 73 | Byte 74 |
|-----------------------|------------------------|-----------------------------------|--------------------|-----------------------------|--|---|------------------------------|
| Current Number | Controller Zone | Instruction Code BC | immer: 0x00 | Parameter Code PC | Parameter Value PWH High Byte | Parameter Value PWL Low Byte | Dec. Point PWK |

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