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		our prior consent.	

**Important Instructions for Your Safety!**  
**Please read and observe!**

Correct and safe operation of the controller Bitric P calls for appropriate transportation and storage, expert installation and commissioning as well as correct operation and meticulous maintenance.

Only those persons conversant with the installation, commissioning, operation and maintenance of similar apparatuses and who possess the necessary qualifications are allowed to work on the apparatus.

Please take note of

- the contents of this Operating Manual,
- the safety regulations affixed to the apparatus,
- the safety regulations pertaining to the installation and operation of electrical systems.

The directives, norms and guidelines mentioned in this Operating Manual are applicable in the Federal Republic of Germany. When using the controller in other countries, please observe the national regulations prevailing in the respective country.

This apparatus has been designed and tested in accordance with DIN VDE 0411 Part 1, "Safety requirements for electronic measuring apparatuses", and has been supplied in a safe condition. In order to retain this condition and to ensure safe operation, the safety instructions in this Operating Manual bearing the headline "Caution" must be observed. Otherwise, persons can be endangered and the apparatus itself as well as other equipment and facilities can be damaged.

If the information in this Operating Manual should prove to be insufficient in any point, the Hartmann & Braun Service Department will be delighted to give you more information.

## Field of application

The digital controller for industry and process engineering Bitric P is used as an on/off controller for regulating temperature and other physical variables in electrical or gas-heated furnaces, machines and apparatus. As a step controller, it is also used for regulating flow, pressure and level. The Bitric P can be used as an alarm signalling unit for three alarms to perform monitoring tasks.

## Instrument identification

Information in the form of a numeral and line code specifying the factory settings is given on the rating plates of the instrument.

The P-number can be decoded with order matrix (see page 28).

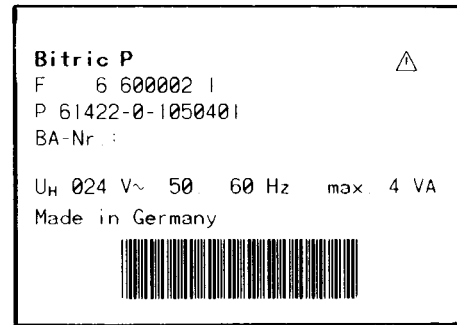


Fig. 1.1 Rating plate

# 1 Installation

## 1.1 Selecting the mounting site

When selecting the mounting site bear in mind the permissible climatic and mechanical stipulations given in the Technical Data (see Appendix).

## 1.2 Mounting the instrument

The instrument is pushed from the front into the panel cutout and is secured there by means of the fasteners which have been supplied.

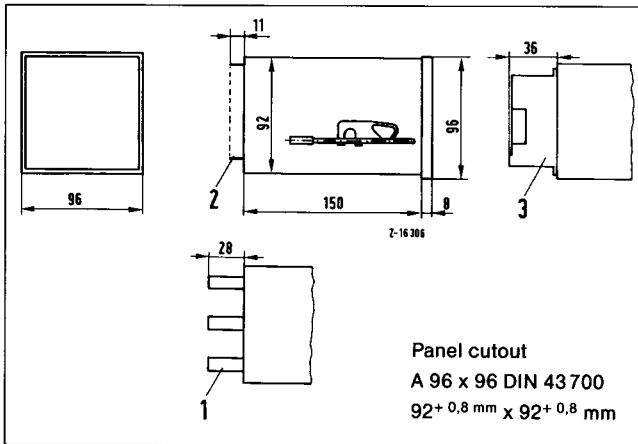


Fig. 1.2 Dimensional drawing (dimensions in mm)

- 1 Bitric P with multi-plug connector
- 2 Bitric P with blade-type connector
- 3 Bitric P with serial interface RS-485 or binary I/O module

## 1.3 Installing the leads

On selecting the material of the leads and on installing them bear in mind the regulations valid in your country for installing power systems with rated voltages up to 1000 V.

To provide protection against electric shocks, connect the protective conductor PE to the protective conductor terminal PE/⊕ before making any other connections. It must be provided even for a power supply of 24 VAC.

Inside the instrument, the reference conductor terminal (L) is connected with ⊕ via an 0.1 μF capacitor.

The contacts with the metallic panel required for immunity to interference are assured via tempered points of the fixing elements during apparatus installation.

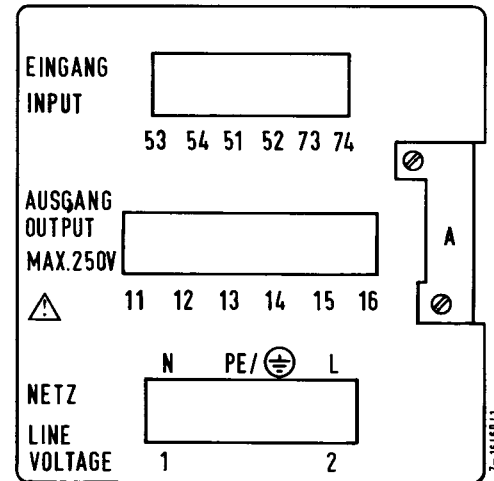


Fig. 1.3 Connection side  
A Slot for serial interface  
or binary input/output module

## Connection

Connection is established via tab connectors A 6.3 x 0.8 or A 2.4 x 0.8 (DIN 46 422) or pins 2.4 x 0.8 (DIN 41 611).

### Important!

All external flexible cables must be strain-relieved so that cable connections on the controller and, if available, on the modules are free of tensile load.

Screw terminals are available optionally as additional components (Catalogue No. 61404-4-0342910; 1 set with 15 pieces).

In a special version the connection side features multi-plugs with terminals, coded in a manner which ensures that the connections are not mixed up.



### Caution

The multi-plug for power supply (mains) may only be connected and disconnected when the unit is dead.

All leads conducting dangerous voltages must be provided with insulated connector assemblies.

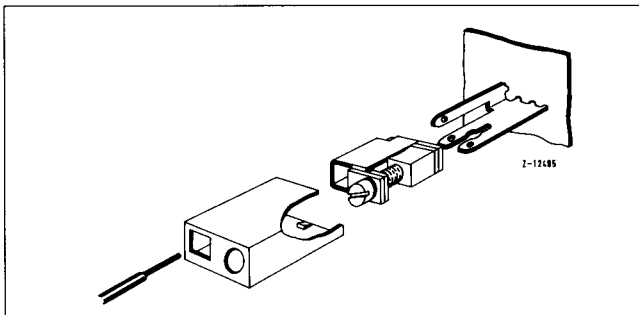


Fig. 1.4 Mounting the screw terminals

## 1.4 Signal inputs

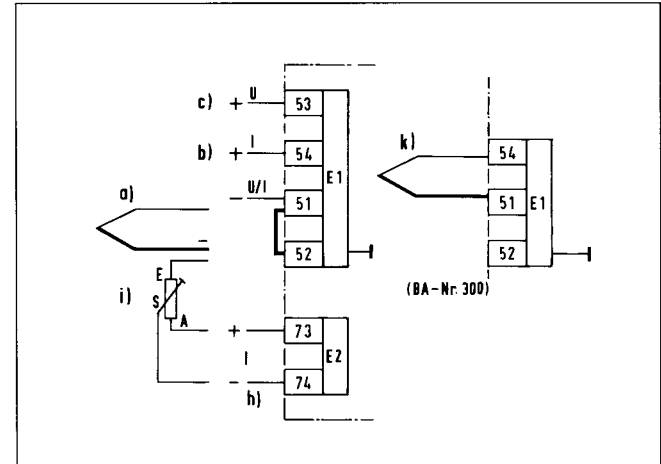
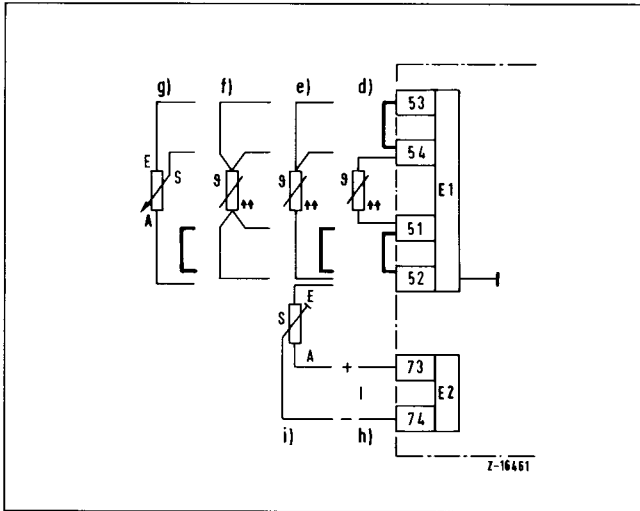


Fig. 1.5 Signal inputs mV, mA, V

- a) mV or thermocouple
- b) Current (mA) } Reference variable with positioner
- c) Voltage (V) } or sequential variable with ratio
- h) Auxiliary variable additionally to x or w, ext. setpoint  
Reference variable with ratio.  
Position feedback signal (current)  
with step controller or positioner
- i) Teletransmitter<sup>1)</sup> for position feedback signal  
with step controller or positioner or external  
setpoint  $w_e$ .
- k) mV or thermocouple with electronic  
separation potential

<sup>1)</sup> if position feedback signal is not used,  
bridge terminals 73-74



**Fig. 1.6** Signal inputs resistance measurement

- d) Two-wire circuit
- e) Three-wire circuit
- f) Four-wire circuit
- g) Teletransmitter as primary detector
- h) Auxiliary variable additionally to  $x$  or  $w$ ; ext. setpoint  
Reference variable with ratio  
Position feedback signal (current) with step controller or positioner
- i) Teletransmitter for position feedback signal <sup>1)</sup> with step controller or positioner or ext. setpoint  $w_e$

<sup>1)</sup> if position feedback signal is not used, bridge terminals 73-74

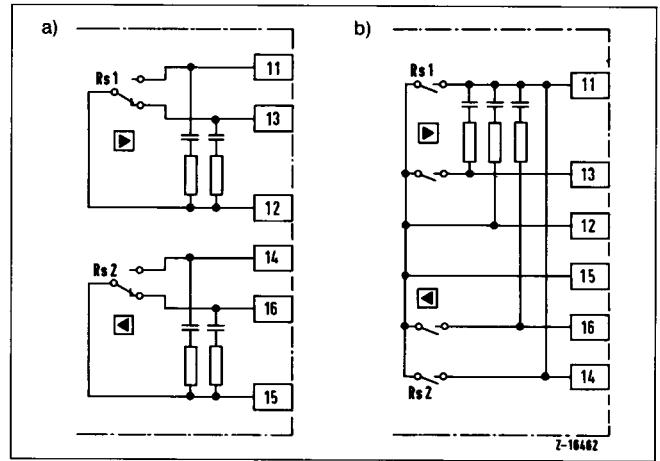
## Ratio

The current source for the reference variable  $w$  is connected directly to input E2 and the sequential  $x$  variable is connected to input E1.

## Line balancing with resistance thermometer

The line resistance can be balanced. The measures to be taken are described in Section 5, "Configuration".

## 1.5 Relay output



**Fig. 1.7** Relay output

- a) with potential-free changeover contact
- b) for direct activation of motor

The contacts of the incorporated relays are wired with a spark quenching element with dimensions sufficient for driving small and medium inductive loads (see Fig. 1.7 a).

In the case of greater inductive loads, an external spark quenching element is recommended for the protection of the contacts.



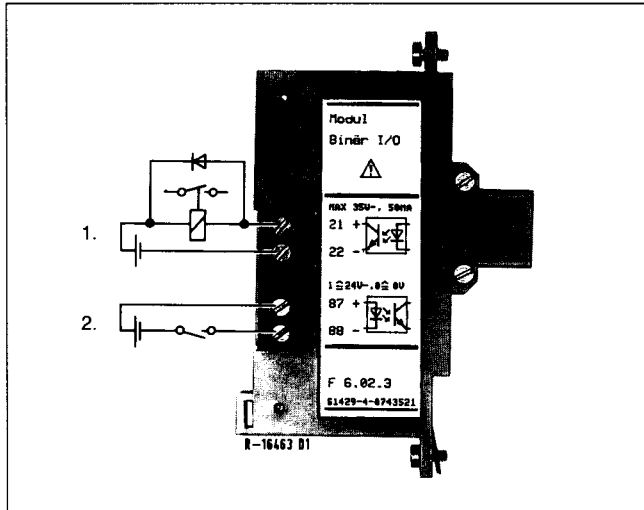
**Caution:**

**The potential difference between the voltages connected in both relays may not exceed 400 V.**

In a special version (Supp. No. 400) a relay output is available for direct activation of the motor. The activation of the contactors is only possible if the latter have a holding current of > 30 mA (see Fig. 1.7 b).

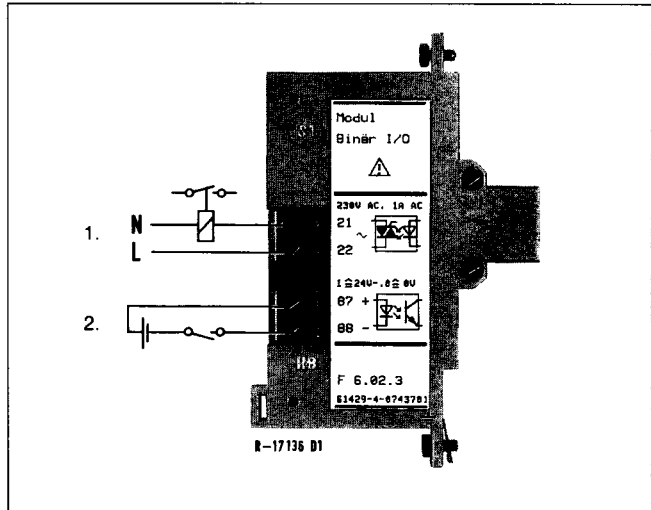
### 1.6 Binary I/O module

Optionally a binary module is available which can also be fitted at a later date (see Fig. 1.8 and 1.9). Module inscription: binary I/O module.



**Fig. 1.8** Binary I/O module with transistor output

- |                      |  |
|----------------------|--|
| 1) Binary output     | Max. load 35 V-; 50 mA                       |
| 2) Binary input      | 0 $\hat{=}$ - 3 ... + 5 V- ( $w_i$ active)   |
| $w_i/w_e$ changeover | 1 $\hat{=}$ + 13 ... + 30 V- ( $w_e$ active) |



**Fig. 1.9** Binary I/O module with Triac output

- |                      |  |
|----------------------|--|
| 1) Binary output     | load 230 V~; 1 A max.                        |
| 2) Binary input      | 0 $\hat{=}$ - 3 ... + 5 V- ( $w_i$ active)   |
| $w_i/w_e$ changeover | 1 $\hat{=}$ + 13 ... + 30 V- ( $w_e$ active) |

## 1.7 Power supply

The connection voltage valid for the instrument is imprinted on the rating plate. See Technical Data for further details (Appendix).

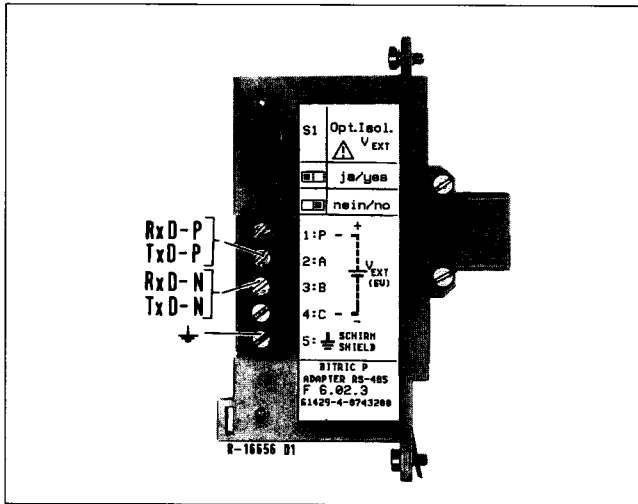
The unit has an internal thermal fuse.



**Caution:**

**It must be possible to switch off the power supply externally at two poles.**

**In order to provide protection against accidental contact with terminals, the Bitric P must be installed appropriately.**



**Fig. 1.10** Connection of serial interface RS-485

## 1.8 Serial interface

A serial interface RS-485 can be supplied as an option or for retrofitting (see Fig. 1.10).

### Bus cable

Foil shield or braided shield, at least three-core cable.

Shield for immunity to interference and radio interference suppression required.

- |                             |  |
|-----------------------------|--|
| Terminal 1 (P)              | possibly: (+) $V_{ext}$ (see Fig. 1.10)  |
| Terminal 2 (A = Rx D/TxD-P) | 2 data cable leads   |
| Terminal 3 (B = Rx D/TxD-N) | (do not interchange)   |
| Terminal 4 (C = DGND)       | reference conductor: 3rd or remaining conductors parallel and possibly (-) $V_{ext}$ |
| Terminal 5 ( $\oplus$ )     | cable shield   |

### Cable shield

- Cable shield must be brought into contact with metallic cabinet with a clip for braiding or sheath wire for controllers near cabinet inlet.
- Cable shield must be connected to each module at 1 cm max. with terminal 5. Shield contact at PC is assured via plug.

### Reference

If the interface cable exceptionally does not feature a reference conductor, correct operation is only assured if potential difference between DGND-connections of all bus subscribers does not exceed  $\pm 7,0$  V.

### Line termination

Standardized bus terminating resistor is not required for Bitric P and inadmissible with respect to performances.



## Electrical isolation

If not all sensors and current outputs of the controller group are ungrounded, module supply has to be effected via an external direct voltage source, electrically isolated and immune to interferences  $V_{\text{ext}} = 6 \text{ V} \pm 5\%$ ,  $I = 20 \text{ mA}$  (peak value  $i = 150 \text{ mA}$ ) at terminals 1 and 4; otherwise measured values can be faulty.

Recommendation: H & B power rectifier TZG6, Catalogue Number 14691-0-1200000. Parallel supply of several modules from a more powerful source is possible.

The **telegram structure** is based on DIN 19 245. Telegrams are described in Interface description 42/61-42-... EN.

## 2 Commissioning



### Caution:

**The unit may only be operated when properly built in.**

**Before switching on make sure that the operating voltage given on the rating plate corresponds to mains voltage.**

**The ground conductor PE must be connected with the terminal marked ⊕ .**

### 2.1 Switching on

Once all the lines have been connected and the mains voltage switched on, Bitric P is immediately ready for operation. The unit is in the manual mode.

The controlled variable x is indicated.

### 2.2 Displays

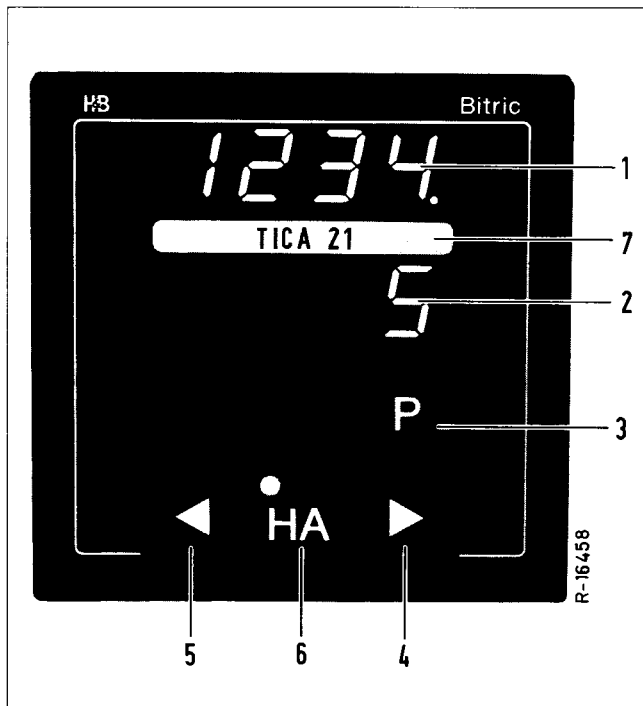
The main display (1) normally shows the controlled variable x.

- With **P** the function display (2) and hence the main display is switched over.

The order of the functions is shown in the Fig. 2.2.

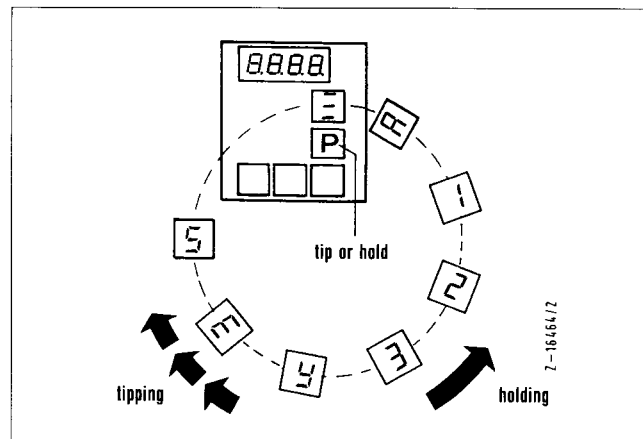
- Tipping the key **P** : Switch over clockwise
- Holding the key **P** : Switch over counterclockwise

The relationship between the function display and the main display is shown in Table 2.1. Functions not available are suppressed.



**Fig. 2.1** Front view of Bitric P

- 1 Main display
- 2 Function display
- 3 Display changeover (designated as **P** in text)
- 4 Adjustment "raise" (designated as **►** in text)
- 5 Adjustment "lower" (designated as **◄** in text)
- 6 Mode selector switch (designated as **HA** in text)
- 7 Inscription plate



**Fig. 2.2** Sequence of the functions

Function display	Main display	Display in:
see Fig. 2.3	Controlled variable	Phys. unit
S	Setpoint	Phys. unit
E	Control deviation	Phys. unit
Y	Output variable	%
3	Alarm value 3	Phys. unit
2	Alarm value 2 <sup>2)</sup>	Phys. unit
1	Alarm value 1 <sup>2)</sup>	Phys. unit
A <sup>1)</sup>	External set point	Phys. unit

**Table 2.1**

<sup>1)</sup> Only present with  $w_r/w_e$  changeover

<sup>2)</sup> In the case of three-position controllers (Z2) and step controllers alarm values cannot be set. Thus they are not displayed.

During the indication of the controlled variable, the switching pulses are depicted in the function display (2) in the case of on/off, three-position and step controller or alarm signal unit.

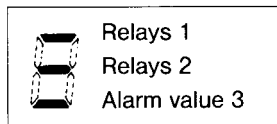


Fig. 2.3 Display of the switching pulses in the function display.

### 2.3 Adjustment of values

■ With ◀ or ▶ the value indicated in each case can be adjusted in so far as it is adjustable.

### 2.4 Input weighting

All inputs can be weighted.

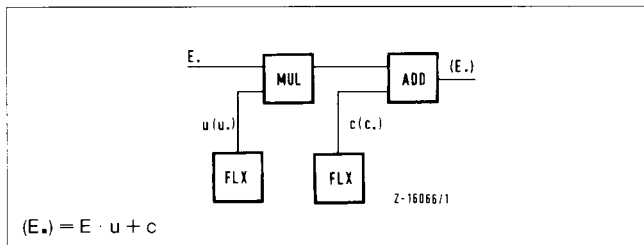


Fig. 2.4 Input weighting

Display and setting of  $u$ - and  $c$ -values takes place at the parameter setting level.

### 2.5 Changeover of mode

■ With **HA** manual or automatic mode can be selected. The LED in the key indicates the **manual mode**.

### 2.6 Adaption of the position indication $y$ with the step controller

With the input weighting values  $c$ . and  $u$ . (in the parameter setting level) the correcting range  $Y_h$  of the servodrive can be set in such a manner that position indication  $y$  indicates 0...100%.

If the position display is not used, bridge terminals 73-74.

The adjustment is carried out as follows:

1. Set the servodrive to the minimum output variable
2. Read start value of the output variable  $y$
3. Set with a negative sign the weighting value  $c$ . in the parameter setting level to the value read
4. Set the servodrive to the maximum output variable
5. Read final value of the output variable  $y$
6. Set  $u$ . in the parameter setting level to the calculated value

$$u. = \frac{10000}{\text{Final value of the output variable}}$$

7. Finally check the position indication  $y$ .

## 2.7 Setting parameter

Parameters are set in accordance with the setting rules given in the documentation on this subject or known by experience or by means of the self-parameter setting function of the unit.

### 2.7.1 Self-parameter setting

Self-parameter setting determines the values for the proportional range  $X_p$ , integral action time  $T_i$ , and derivative action time  $T_d$ . Other parameters e.g. the dead zone must be set previously.

#### Calling the self-parameter setting:

1. Holding of **P** and tipping of **▶** twice slowly.  
Information **tunE** appears.
2. Further switching with **P**, the display **OFF** appears.
3. Changeover of the display with **▶** to **On**.

Self-parameter setting is in operation.

The display switches to the setpoint display.

With a control deviation greater than 5%, the controller immediately begins determination of the parameters. If the control deviation is less than 5%, the setpoint must be changed so as to reach a control deviation of at least 5%.

As a request to change the setpoint, the setpoint flashes until a sufficient control deviation is produced. Five seconds after the setpoint has been last changed determination of parameters starts. Any subsequent change of setpoint would result in abortion of the self-parameter setting.

During the self-parameter setting the LED in the **HA** key flashes. H/A changeover is blocked.

On completion of the self-parameter setting, the controller switches to automatic mode and controls the controlled variable to the setpoint set.

#### Basic conditions for the self-parameter setting:

- The self-parameter setting should only be started if the controlled variable has been constant for some time (stationary status).
- Heat/off/cool controller:  
A **positive** setpoint jump results in the parameters for heating. A **negative** setpoint jump results in the parameters for cooling.  
Hence a corresponding operating status must be reached before beginning the self-parameter setting.
- Step controller:  
Prior to **positive** setpoint jump a valve flap position (Y) of less than 50% must exist. A **negative** setpoint jump requires a controller output variable of above 50%.

### 2.7.2 Parameter table

- **Switchover** to the parameter setting level **PAr**, self-parameter setting **tunE** and configuration level **----** is effected by means of:

Holding **P** and **▶**.

Switchover takes place on releasing key **▶**.

- **Paging within** the parameter setting level from top to bottom:

Tipping of key **P**

On reaching the bottommost position, the uppermost position is selected again.

By holding **P**, paging from bottom to top is effected.

- **Return to the operating level:**

Holding of **P** and **◀** for more than 4 seconds.

Level	Display	Factory setting	Function display flashes	Description of function
Par				<b>Parameter setting level</b>
	Value	100 %	P	Proportional range
	Value	40 s	n	Integral action time 1 ... 1999 s or 1 ... 199.9 min
	Value	10 s	d	Derivative action time 1 ... 1999 s or 1 ... 199.9 min
	Value	50 %	h	Operating point in the case of controllers without I part 0 ... 100%; with I part 50 ... 100% adjustable, influences the starting behaviour
		1 %		Dead Zone in the case of the step controller 0.1 to 10 %
	Value	Z1, Z2: 5 s Step controller: 0,25 s	t	Minimum switch-on time relay 1 (step controller with both relays) On/off controller: 0,1 to 199.9 s Step controller: 0,03 to 19.00 s
	Value	100 %	H	Upper setpoint limit
	Value	0 %	L	Lower setpoint limit
	Value	Z1, Z2: 100 % Step controller: 102.4 %	O	Upper output limit
	Value	Z1: 0 % Step controller: -2,4 %	U	Lower output limit
	Value	100 %	u	Weighting factor input 1, multiplication $\pm 0 \dots 199.9 \%$
	Value	0	c	Weighting factor input 1, addition $\pm 0 \dots 199.9 \%$ or in physical units
	Value	100 %	P.	Proportional range cooling
	Value	40 s	n.	Integral action time $T_n$ 1 ... 1999 s or 1 ... 199.9 min, cooling
	Value	10 s	d.	Derivative action time $T_d$ 1 ... 1999 s or 1 ... 199.9 min, cooling
	Value	Z2: 5 s	t.	Relay 2 minimum switch-on duration 0,1 to 199.9 s, cooling
	Value	100 %	u.	Weighting factor input 2, multiplication $\pm 0 \dots 199.9 \%$
	Value	0	c.	Weighting factor input 2, addition $\pm 0 \dots 199.9 \%$ or in physical units
	Value		A.	Value of the input 2

**Table 2.2** Parameter table  
(continuation page 14)

Level	Display	Factory setting	Function display flashes	Description of function
<b>tunE</b>	OFF / ON	OFF	off	<b>Self-parameter setting</b>
				OFF: Self-parameter setting is switched off or terminated ON: Self-parameter setting is active Switchover with ► .
<b>ConF</b>	The display shows 'ConF' at the top and '0000' in a 4-digit display below it.			<b>Gate to configuration level:</b> Access by holding ◀ and ▶ for more than 4 s or entering a code digit The display C o n F appears, see Section 5

**Table 2.2** Parameter table (end)

### 3 Operation

#### 3.1 Displays

The main display (1) normally shows the controlled variable  $x$ .

- With **P** the function display (2) and hence the main display is switched over.
- Tipping the key **P** : Switch over clockwise
- Holding the key **P** : Switch over counterclockwise

The relationship between the function display and the main display is shown in Table 3.1.

Functions not available are suppressed.

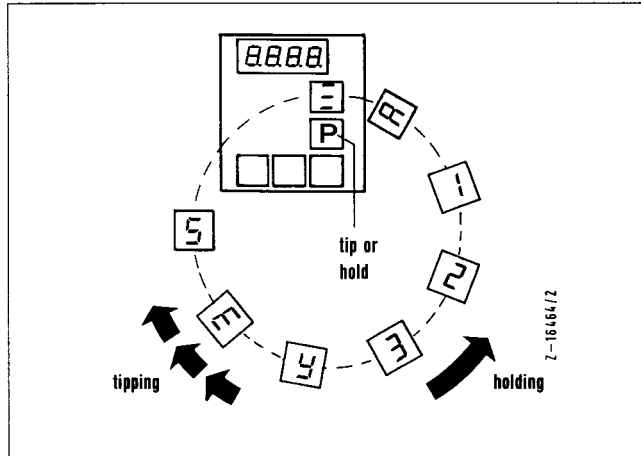


Fig. 3.1 Sequence of the functions

Function display	Main display	Display in:
see Fig. 3.2	Controlled variable	Phys. unit
S	Setpoint	Phys. unit
E	Control deviation	Phys. unit
Y	Output variable	%
3	Alarm value 3	Phys. unit
2	Alarm value 2 <sup>2)</sup>	Phys. unit
1	Alarm value 1 <sup>2)</sup>	Phys. unit
A <sup>1)</sup>	External setpoint	Phys. unit

Table 3.1

During the indication of the controlled variable, the switching pulses are depicted in the function display (2) in the case of on/off, three-position and step controllers.

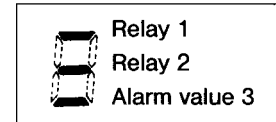


Fig. 3.2 Display of the switching pulses in the function display

<sup>1)</sup> Only present with  $w_i/w_e$  changeover

<sup>2)</sup> In the case of three-position controllers (Z2) and step controllers, these alarm values are not possible. Thus they are not displayed.

## 3.2 Adjustment of values

### Setpoint

- Select setpoint in the function display.
- Adjust setpoint, in so far as adjustable, by using the keys ◀ and ▶ .

### Operating mode changeover

- With **HA** manual or automatic mode can be selected. The LCD in this key indicates the “manual” mode.

### Adjusting the output variable y

- Display output variable by switching over to manual mode (function display y).
- Adjust output variable with ◀ or ▶ .
- **Rapid adjustment** is possible with the on/off controller by holding ◀ or ▶ **and** tipping key **HA** .

With the controller Z2 (heat/off/cool) the y-display is -100...0...+100% (-100...0% cool; 0...+100% heat).

### Alarm values

- Select alarm values 1, 2 or 3 provided their adjustment is enabled.
- Set with ◀ or ▶ .

Alarm values that monitor the measured value or control deviation are indicated in physical units. The right decimal point in the main display flashes.

## 4 Messages from the self-monitoring

### 4.1 General error messages

The following faults are detected in the Bitric P and indicated in the main display (1) for 0.5 s and repeated every 6 s. If several faults occur simultaneously they are shown successively acc. to the order below. With this group of faults the message arrived is not deleted even though the cause no longer exists.

- Acknowledge fault with **P**

The image shows a black LCD display with the text 'Er H' in white. 'Er' is on the left and 'H' is on the right, separated by a space.

- Hardware fault. The running calculation of the checksum EPROM is wrong.

The image shows a black LCD display with the text 'Er t' in white. 'Er' is on the left and 't' is on the right, separated by a space.

- Error in the self-parameter setting (selftune).

The image shows a black LCD display with the text 'Er 5' in white. 'Er' is on the left and '5' is on the right, separated by a space.

- Serial EEPROM defective; writing or reading error.

The image shows a black LCD display with the text 'Er 1' in white. 'Er' is on the left and '1' is on the right, separated by a space.

- Data was brought too quickly in succession to the serial EEPROM. Queue full.



## 4.2 Error messages from the input monitoring

With the following group of faults the message is deleted automatically if the cause disappears.

### Thermocouples and resistance thermometers

A black rectangular LCD display showing the error code "-UF-" in white, seven-segment font. The dashes are on the left and right sides, and "UF" is in the center.

- Lower-range value undershot

A black rectangular LCD display showing the error code "-OF-" in white, seven-segment font. The dashes are on the left and right sides, and "OF" is in the center.

- Upper-range value overshoot

With the following faults the message appears flashing quickly every second for a duration of 0.2 s in the display.

### mA; V; thermocouples; mV

A black rectangular LCD display showing four white dashes "----" in a seven-segment font.

- Common mode range ( $\pm 3$  V) overshoot or undershot (terminal 51 to terminal 52).
- Reference junction defective

### Resistance thermometer; teletransmitter

A black rectangular LCD display showing four white dashes "----" in a seven-segment font. Below the dashes, the number "2-18485" is printed in a small font.

- Terminal 53 open
- Resistance between terminal 53 and 52  $> 2.6$  k $\Omega$

## 5 Configuration

**Entry** into the configuration level via parameter setting level (see Section 2.6.2).

Entrance to the configuration level

- Access can be gained by holding **◀** and **▶** for more than 4 s or **0000** by entering code figure.

- Adjust decimal point with **MA** and **◀** or **▶**
- The display **Con F** appears
- Switchover of function display with key **P**
- Changeover of the functions with key **▶**
- Changing the values (addresses) with **◀** and **▶**.

**Return to the operating level:**

- Holding **P** and **◀** for more than 4 seconds.

The monitoring and test levels are situated beneath the configuration level. They are only used for servicing and testing and are described in a special service manual.

Function display flashing	Display	Factory setting <sup>1)</sup>	Description of function
1	H r H A L r L A	X	Alarm value 1, max. quiescent current Alarm value 1, max. operating current Alarm value 1, max. quiescent current Alarm value 1, max. operating current
1.	P E b	(G.)	Alarm value 1 of controlled variable Alarm value 1 of control deviation Alarm value 1 of control deviation modulus
2	H r H A L r L A	(Z1)  (G2)	Alarm value 2, max. quiescent current Alarm value 2, max. operating current Alarm value 2, min. quiescent current Alarm value 2, min. operating current
2.	P E b	(G2) (Z1)	Alarm value 2 of controlled variable Alarm value 2 of control deviation Alarm value 2 of control deviation modulus
3	I A I F I d	X  (Z1)	Alarm value 1 adjustable Alarm value 1 not adjustable Alarm value 1 not displayed, out of function
3.	2 A 2 F 2 d	X	Alarm value 2 adjustable Alarm value 2 not adjustable Alarm value 2 not displayed, out of function Signalling of operating mode

**Table 5.1** (continuation on page 19 ff)

<sup>1)</sup> See end of table for footnotes

Function display flashing	Display	Factory setting <sup>1)</sup>	Description of function
	I 1 I 2 U 1 U 2 U 3 U 4 L 1 J 1 L 2 J 2  b S d E 1 E 2 E 3 E 4		<b>mA; V; mV</b> Input 1: 0...20 mA linear Input 1: 4...20 mA linear Input 1: 0...1 V linear Input 1: 0,2...1 V linear Input 1: 0...10 V linear Input 1: 2...10 V linear Input 1: thermocouple type L 0... 400 °C Input 1: thermocouple type J 0... 400 °C Input 1: thermocouple type L 0...1000 °C Input 1: thermocouple type J 0...1200 °C Input 1: thermocouple type K 0...1400 °C Input 1: thermocouple type B 0...1800 °C Input 1: thermocouple type S 0...1800 °C Input 1: thermocouple type D 0...2000 °C Input 1: 0... 20 mV linear Input 1: 0... 50 mV linear Input 1: 0... 100 mV linear Input 1: 0...1000 mV linear
4 <sup>1)</sup>	P 2 1 P 2 2 P 2 3 P 2 4 P 3 1 P 3 2 P 3 3 P 3 4 P 4 1 P 4 2 P 4 3 P 4 4 F 1 F 2 d 1		<b>Resistance thermometer; teletransmitter</b> Input 1: Pt 100 2-wire circuit, -100,0...+100,0 °C Input 1: Pt 100 2-wire circuit, 0,0...+350,0 °C Input 1: Pt 100 2-wire circuit, 100,0...+450,0 °C Input 1: Pt 100 2-wire circuit, -200 ...+800 °C Input 1: Pt 100 3-wire circuit, -100,0...+100,0 °C Input 1: Pt 100 3-wire circuit, 0,0...+350,0 °C Input 1: Pt 100 3-wire circuit, 100,0...+450,0 °C Input 1: Pt 100 3-wire circuit, -200 ...+800 °C Input 1: Pt 100 4-wire circuit, -100,0...+100,0 °C Input 1: Pt 100 4-wire circuit, 0,0...+350,0 °C Input 1: Pt 100 4-wire circuit, 100,0...+450,0 °C Input 1: Pt 100 4-wire circuit, -200 ...+800 °C Input 1: teletransmitter 0...1500 Ω Input 1: teletransmitter 0... 150 Ω Factory use only
4.	brh brL		Input 1: reaction in case of sensor break like $x > w$ Input 2: reaction in case of sensor break like $x < w$

**Table 5.1** (continuation)

<sup>1)</sup> See end of table for footnotes

Function display flashing	Display	Factory setting <sup>1)</sup>	Description of function
5	Value	0,0 or range start	User-Range, display for input 1 = 0 %  Adjustment of the decimal point with <b>HA</b> and <b>◀</b> or <b>▶</b>
5.	Value	100,0 or span	User-Range, display for input 1 = 100,0 % On the range selection, range start and range end are set automatically. Changes already made can be cancelled by Holding <b>◀</b> for more than 4 s and tipping <b>▶</b> .
6 <sup>1)</sup>	I 1 I 2 I 1 u I 2 u F 1 F 2		Input 2: 0 ... 20 mA linear Input 2: 4 ... 20 mA linear Input 2: 0 ... 20 mA linear display in the user range input 1 Input 2: 4 ... 20 mA linear display in the user range input 1 Teletransmitter 0 ... 1500 Ω, e.g. for position feedback signal Teletransmitter 0 ... 150 Ω, e.g. for position feedback signal
6.	1 2 3 4 5 6	X	$w_{int}: x = c + u \cdot E1; X_w = x - w; display x$ <b>Additive setpoint feedforward:</b> $x = c + u \cdot E1; X_w = x + c + u \cdot E2 - w; display x$ <b>Auxiliary variable:</b> $x = c + u \cdot E1 + c + u \cdot E2; X_w = x - w; display x$ <b>Ratio display E1 / E2:</b> $X_w = c + u \cdot E1 - c + w (c + u \cdot E2)$ <b>w<sub>i</sub> / w<sub>e</sub> - changeover with binary input:</b> $x = c + u \cdot E1; X_w = x - (w_i \text{ or } w_e);$ <b>w<sub>ext</sub>:</b> $x = c + u \cdot E1; X_w = x - w_e$
7	P I d P I P d P	X	Control action PID (not positioner) Control action PI Control action PD (not with step controller and positioner) Control action P (not with step controller and positioner)
7.	I Z I Z r d r S P		Alarm signalling unit with 1 alarm value Alarm signalling unit with 2 alarm values On/Off controller Z1 with or without alarm value On/Off controller with 2 control switch points Z2 Step controller Positioner
8	1 2	X	Time range for Tn and Td 1 ... 1999 seconds Time range for Tn and Td 0.1 ... 199.9 minutes
8.	1 2	X	Time range for Tn2 and Td2: 1 ... 1999 seconds (cool) Time range for Tn2 and Td2: 0.1 ... 199.9 minutes (cool)

Table 5.1 (continuation)

<sup>1)</sup> See end of table for footnotes

Function display flashing	Display	Factory setting <sup>1)</sup>	Description of function
9	i d		Reverse-action controller characteristic, direct-action manual characteristic
	i i		Reverse-action controller characteristic, reverse-action manual characteristic
	d d		Direct-action controller characteristic, direct-action manual characteristic
	d i		Direct-action controller characteristic, reverse-action manual characteristic
9.	AH	X	Automatic and manual modes
	AHt		Automatic and manual modes, X tracking with manual mode (not with ratio)
	A		Only automatic mode
	H		Only manual mode
A	I n t	X	Internal reference junction
	0		External reference junction 0 °C
	2 0		External reference junction 20 °C
	5 0		External reference junction 50 °C
	6 0		External reference junction 60 °C
b.	n B		Operation mode in case of power supply restoration: as prior to power failure
	n H		Operation mode in case of power supply restoration: hand
C	3 0		Baud rate 300
	6 0		Baud rate 600
	1 2 0		Baud rate 1200
	2 4 0		Baud rate 2400
	4 8 0		Baud rate 4800
	9 6 0	X	Baud rate 9600
	1 9 2		Baud rate 19200
C.	X X	77	Controller address 01 to FFH, freely selectable, global address = 80 H
			Controller address FD reserved to configuration interface
F	Value		Line balancing to a known line resistance (see end of table)
F.	Value		Line balancing to test resistor (see end of table)
h.	0.1		X <sub>Sd</sub> 0.1 % with all alarm values
	0.3		X <sub>Sd</sub> 0.3 % with all alarm values
	1.0	X	X <sub>Sd</sub> 1.0 % with all alarm values
o	3 Hr	X	Alarm value 3; max. quiescent current
	3 HA		Alarm value 3; max. operating current
	3 Lr		Alarm value 3; min. quiescent current
	3 LA		Alarm value 3; min. operating current

**Table 5.1** (continuation)

<sup>1)</sup> See end of table for footnotes

Function display flashing	Display	Factory setting <sup>1)</sup>	Description of function
o.	3 P	G2; Z. Step controller	Alarm value 3 of controlled variable
	3 E		Alarm value 3 of control deviation
	3 b		Alarm value 3 of control deviation modulus
O.	3 A		Alarm value 3 adjustable
	3 F		Alarm value 3 not adjustable
	3 d		Alarm value 3 not displayed, out of operation

**Table 5.1** (end)

<sup>1)</sup> Factory settings:

X:	Standard setting
no specification:	Dependent on order
(G2):	In the case of alarm signalling unit with 2 alarm values
(Z1):	In the case of on/off controller with alarm value

<sup>2)</sup> At the selection of the measuring range (function display 4 or 6) only those ranges which are prepared via hardware jumpers and by entry in the EEPROM are displayed.

## Line balancing with resistance thermometers

The line resistance can be balanced within the range of  
 0.00...30.00 Ω for the two-wire circuit  
 -19.99...+30.00 Ω for the three-wire circuit  
 (only necessary for unsymmetrical lines):

■ Call function display F or F. at the configuration level ConF.

### a. Line balancing to a known line resistance

1. **P** Call function display F  
Any resistance value e.g. 3.80 Ω appears in the main display.
2. Set the known line resistance value with ◀ or ▶ .

3. Using ◀ or ▶ , set the temperature specification to the known value of the test resistor.

4. Press **P** and ◀ simultaneously for more than 4 s =  
Return to the operation level

**or**

1. Short circuit the measuring leads at the resistance thermometer.

2. Press HA key for more than 3 s.  
Balancing is made automatically.

3. Cancel short circuit of the measuring leads at the resistance thermometer.

4. Press **P** and ◀ simultaneously for more than 4 s =  
Return to the operation level.

### b. Line balancing with test resistor

1. Connect test resistor in the place of resistance thermometer.

2. Call **function display F.** with **P**  
**A temperature specification in °C** appears in the main display.

3. Using ◀ or ▶ , set the temperature specification to the known value of the test resistor.

4. Press **P** and ◀ simultaneously for more than 4 s =  
Return to the operation level.

## 6 Maintenance

The unit requires no maintenance.

Relays are subjected to wear, depending on the switching frequency and load.



### Caution

**Any interruption of the protective connector inside the unit or of the protective conductor outside the unit or disconnection of the protective-conductor terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.**

**When the apparatus is connected to its supply, terminals may be live, and the opening of covers or removal of parts except those to which access can be gained by hand is likely to expose live parts. The apparatus shall be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair. Any adjustment, maintenance and repair of the opened apparatus under voltage shall be avoided as far as possible and, if inevitable, shall be carried out by a person who is aware of the hazard involved.**

**Capacitors inside the apparatus may still be charged even if the apparatus has been disconnected from all voltage sources.**



### Caution

**No high voltage test may be carried out without thorough knowledge.**

### Faults and unusual stress

Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.

It must be assumed that the protection has been impaired when

- the apparatus has visible signs of damage,
- the apparatus no longer functions,
- the apparatus has been stored in unfavourable conditions for a long time,
- the apparatus has been subject to adverse transport conditions.





## Common data

### Measuring deviation

$\pm 0.2\%$  of basic measuring range;  $\pm 0.1\%$  of measured value;  
 $\pm 1$  digit

### Measuring range resolution

$\leq 0.025\%$  ( $\geq 4000$  digits)

### Nonlinearity (sensor)

$\leq 0.1\%$ ; considerable deviations with type S below  $300^\circ\text{C}$   
and with type B below  $900^\circ\text{C}$

### Admissible common-mode voltage

$\leq \pm 3\text{ V}$  between two measuring inputs and symmetrical  
mass

## Output

### Relay

1 or 2 relays with changeover contact (floating)

Spark quenching integrated

Max. 250 V (eff)

Max. 1 A with  $\cos \varphi \approx 1$

Max. 0.5 A with  $\cos \varphi \geq 0.7$

(not suitable for direct motor control with step controller)

Optional for step controller

2 relays with 2 floating NO contacts each, internal wiring for  
direct motor control (Suppl. No. 400)

Silver-cadmium-oxide contacts for min. 100 V

Max. 250 V (eff)

Max. 0.5 A with  $\cos \varphi \geq 0.9$ ; max. 100 VA

Spark quenching amplified

### Binary

1 transistor output or 1 Triac output for alarm signalling, see  
binary I/O module

### Analogue

0(4) ... 20 mA,  $R_A \leq 500\ \Omega$

## Control function

### On/off controller Z1

1 switching value, optionally 1 additional alarm value

Application: on/off control with/without alarm value or  
high/low/off control

### On/off controller Z2

2 switching points

Application: heating/off/cooling control

### Step controller D

for controlling with electrical actuator

### Positioner

Positioner for placing an electrical standardized signal into a  
proportional position via an electrical actuator

### Alarm signalling unit

with 1 or 2 alarm values

## Common data

### Self-parameter setting

Determine requested parameters in closed loop-control out  
of a setpoint step-change

Proportional area  $X_p$ : 0 ... 1850 %

Reset time  $T_n$ : 1 s ... 199.9 min in 2 ranges

Derivative action time  $T_d$ : 1 s ... 199.9 min in 2 ranges

Derivative action amplification  $V_D$ : 4

## On/off controllers Z1 and Z2

### Switching frequency

0.04 ... 3 ... 75/min for 50% duty cycle

### Control action

P, PI, PD, PID with integral action limitation

### Switching action Z1

Relay de-energized when  $x > w$ ,  
reversible characteristic

### Switching action Z2

1st relay (heating): de-energized when  $x > w$   
2nd relay (cooling): de-energized when  $x < w$

### Dead zone on Z2

0.5%

## Step controller/positioner

### Control action

PI or PID

### Dead zone

1%, adjustable 0.1 ... 10%

### Differential hysteresis:

1/4 of dead zone

### Switching action:

both relays de-energized when  $x_w = 0$

### Position feedback

Teletransmitter 0 ... 1500  $\Omega$  (0 ... 150  $\Omega$  configurable)

Used range  $\geq 50\%$

Optionally 0(4) ... 20 mA (state Suppl. No. 337)

## Control station

### 1 digital display

for  $x$ ,  $w$ ,  $y$ , control deviation  $x_w$ , alarm values,  
4-digits max. reading  $-1999 \dots +7999$

1 display for variable name

7-segment display, LED, red, height 13 mm

### 4 keys

H/A

Manual/automatic

◀ and ▶

More/less, for setting displayed variables

P

Display changeover and access to  
parameter level

## Alarm signalling

Depending on the respective function, monitoring of controlled variable  $x$ , control deviation  $x_w$  or modulus  $x_w$ . Switching action max. or min., NC or NO contact operation, configurable. Setting ranges  $\pm 0 \dots 100\%$  or physical units according to user range.

### Alarm signalling unit

1 or 2 relays

Switching action

1 min. and 1 max.

2 min. or 2 max. configurable

Normally NC contact signalling

(de-energized relay is equal to alarm value infringement)

NO contact configurable

### On/off controller Z1

1 relay

$x_w$  max., NC contact signalling

Optionally:

$x$  max. or  $x_w$  modulus signalling

### Binary I/O module (option)

Can be retrofitted as accessory at the rear of the unit, instead of the serial interface. Applicable for on/off controller, step controller and continuous controllers.

#### Binary input

For setpoint transfer  $w_i$  -  $w_e$

Circuitry to DIN 19240 for active sources:

0 = -3 ... +5 V DC

1 = 13 ... 30 V DC

#### Binary output

As additional alarm signalling (NC contact)

for  $x_w$  max.,  $x$  max. or  $|x_w|$  modulus

1 transistor output with opto-electronic coupler, electrically isolated, floating

max. 35 V DC, max. 50 mA

1 = conducting transistor

0 = inhibited transistor (high impedance)

Leakage current  $\leq 10 \mu\text{A}$  for 30 V,

voltage drop  $\leq 1,8$  V for 10 mA

Optionally:

1 Triac output with opto-electronic coupler, electrically isolated, floating

Switching voltage range 20 ... 250 V AC

Rated-load voltage 230 V AC  $\cos \varphi = 0.7$  without additional circuit

Load current max. 1 A at 25 °C, linear reduction to 0.5 A at 50 °C, integrated fuse protection: integrated fuse F 1.0

### Serial interface (option)

Can be retrofitted as accessory at the rear of the unit instead of the binary I/O module.

With and without electrical isolation (switchable)

RS-485 without electrical isolation

Up to 10 bus subscribers with internal power supply

RS-485 without electrical isolation

Max. 32 bus subscribers, external power supply 6 V DC  $\pm 5\%$  required (average  $I = 20$  mA, short-term peak value  $i = 150$  mA).

The use of one TZG 6 for instance is sufficient for 11 bus subscribers.

Bus length

Max. 1200 m, without termination resistor

RS-232C

Optionally separate interface adapter available as accessory (cable with transformer)

Telegram format

to DIN 19245 (PROFIBUS)

## Power supply

### Alternating voltage

230 V (187...253 V), 47...63 Hz;

115 V ( 98...126 V), 47...63 Hz

24 V ( 20... 27 V), 47...63 Hz;

Power consumption 4.5 VA

### Mains buffering

$\geq 20$  ms,  $U_{nom} = +10\%$ ,  $-15\%$

### Fuses

The controller is equipped with an integrated temperature fuse. No additional fuses required.

## General technical and safety data

### Climatic capabilities

#### Climatic category KWE

to DIN 40 040

#### Ambient temperature

0...+50 °C

#### Transportation and storage temperature

-25...+65 °C

#### Relative humidity

$\leq 75\%$  in annual average,

temporarily 95 %;

occasional and slight condensation

### Mechanical stress

#### Tested to DIN IEC 68 Part 2-27 and 68-2-6

Shock 30 g/18 ms;

Vibration 2g/0.15 mm/5... 150 Hz

## Electromagnetic compatibility

### Emission (radio interference suppression)

Limit value class B is fulfilled for general approval to German Federal Postal Service order 1046/84.

### Immunity to interference

to IEC 801 DIN VDE 0843; Industrial standard to NAMUR

## Electrical safety

Tested to DIN VDE 0411/10.73, class of protection 1

Clearance and creepage distance to DIN VDE 0411 and 0110/1.89

Overvoltage category: III

Degree of contamination: 2

Degree of protection to DIN 40050

Front IP 64

Rear IP 40

Blade-type terminal IP 00

Plug-on screw terminals IP 20

Coded multi-plug IP 20

## Manufacturer's certificate for radio interference suppression

The unit described in this Operating Manual has been radio-interference suppressed in accordance with the provisions of the orders stipulated in the official German gazette 163/1984:

- AmtsblVfg 1046/1984 for units according to DIN VDE 0871

The German Federal Post Office has been notified that the unit has been introduced to the market and been granted the right to inspect the series for conformance to the provisions.

## Safety-certified controllers

### Temperature controller

to DIN 3440 (07.1984). With TÜV expertise.

The apparatus may be used as a temperature controller together with appropriate sensors for water, oil, air and flue gas for setpoint value settings from  $-200^{\circ}\text{C}$  to  $2000^{\circ}\text{C}$  and ambient temperatures up to  $50^{\circ}\text{C}$ . Only temperature sensors complying with DIN 3440 may be connected.

Model State Suppl. No. 750  
Documentation VdTÜV Instructions on Temperature  
H & B Documentation No. 48/61-11 DIN

### Water-level controller

to VdTÜV Instructions 100/1 (03.1986).  
With TÜV Identification.

The apparatus may be used as continuous controller for water level in high-pressure steam boilers in stationary boiler installations.

The controller may only be connected to sensors or transmitters sending standardized signals and tested to VdTÜV Instructions on Water-level 100/1.

Model State Suppl. No. 751  
Documentation VdTÜV Instructions on Water-level  
H & B Documentation No. 48/61-12 TÜV

## Germanischer Lloyd

Controller to rules and type test.

On this basis of this certificate, Bitric P ist suited for unconditional application within the Rules of Germanischer Lloyd. The apparatus may thus be used without restrictions on sea-going and inland waterway vessels as well as offshore structures classed with GL.

Model State Suppl. No. 752  
Documentation  certificate 65260 HH 4/93  
H & B Documentation No. 48/61-13 GL

### Connection, case and mounting

#### Dimensions

see dimensional drawing (Fig. 1.2)

#### Electrical connections

Tab connections A  $6.3 \times 0.8$  or A  $2.8 \times 0.8$  to DIN 46 244 or pole  $2.4 \times 0.8$ , plug-in screw terminals available as accessory (for solid or stranded wire up to  $1.5 \text{ mm}^2$ )

Tab connector A  $6.3 \times 0.8$  DIN 46 244 for mains connection

Optionally:

coded multi-plug with screw terminals

#### Colour of front panel

Black, optionally pebble grey RAL 7032

Front frame black (state Suppl. No.)

#### Weight

Approx. 1 kg

#### Mounting

Note mechanical stress and climatic capabilities

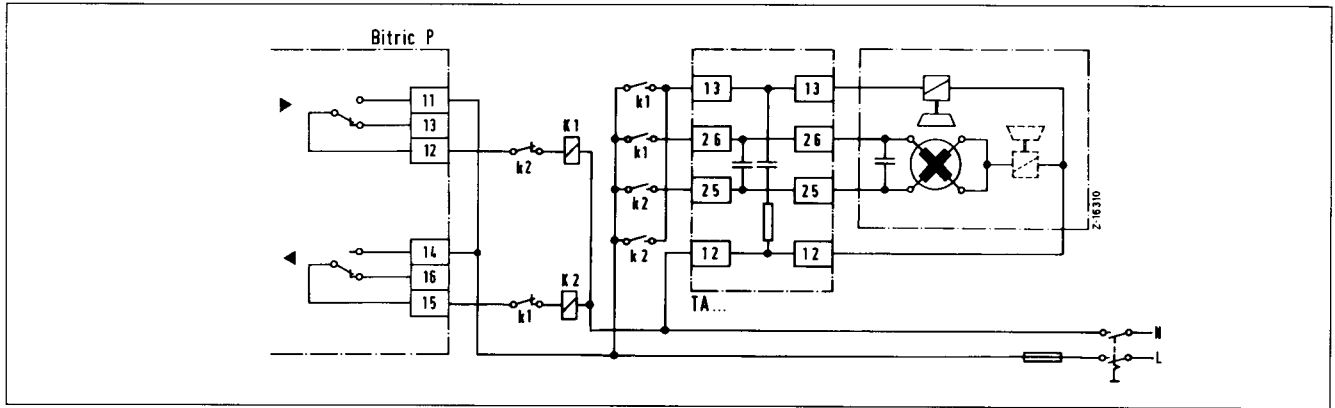
#### Mounting position

Arbitrary, independent of function

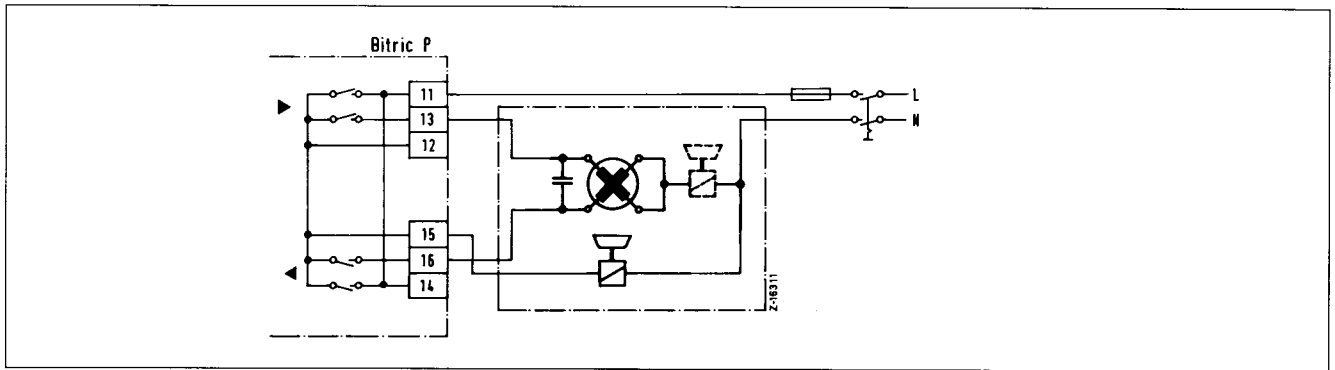
## Ordering matrix

Industrial controller Bitric P	Alarm signalling unit	6 1 4 2 1 - 0 -	
	On/off controller Z	6 1 4 2 2 - 0 -	
	Step controller D	6 1 4 2 3 - 0 -	
	Positioner	6 1 4 2 3 - 0 -	
	Continuous controller	6 1 4 2 4 - 0 -	
<b>Power supply</b>			
230 V ~	1		
115 V ~	2		
24 V ~	3		
<b>Measuring ranges (input Ei)</b>			
0 ... 20 mA	1	0	0
4 ... 20 mA	2		
0 ... 50 mA	3		
0 ... 100 mA	4		
0 ... 1 V	5		
0 ... 10 V	6		
Ratio 2 x 0 ... 20 mA	7		
Ratio 2 x 4 ... 20 mA	8		
<b>Control function</b>			
0 ... 400 °C type L	1	0	0
0 ... 400 °C type J	2		
0 ... 900 °C type L	3		
0 ... 1200 °C type J	4		
0 ... 1400 °C type K	5		
0 ... 1800 °C type B	6		
0 ... 1800 °C type S	7		
0 ... 2000 °C type D	8		
<b>Connections</b>			
-100 ... +100 °C Pt 100, 2-wire circuit)	1		
0 ... +350 °C Pt 100, 2-wire circuit)	2		
100 ... +450 °C Pt 100, 2-wire circuit)	3		
-200 ... +800 °C Pt 100, 2-wire circuit)	4		
Teletransmitter 0 ... 1500 Ω	5		
Teletransmitter 0 ... 150 Ω	6		
<b>Control function</b>			
<b>Alarm signalling unit</b> 1 max. alarm signal	10		
1 min. and 1 max. alarm signal	20		
<b>On/off controller Z1</b> 1 output (for on/off control)	30		
1 output and 1 x <sub>w</sub> max. alarm signal (for on/off control with additional alarm signal or high/low/off control)	40		
<b>On/off controller Z2</b> 2 outputs (for heating/off/cooling control)	50		
<b>Step controller D</b> 2 relays with converters (for closed-loop control with motor-operated actuators)	60		
<b>Positioner</b> 2 relays with converters	90		
<b>Connections</b>			
Blade-type terminal	1		
Multi-plug with screw terminals	2		
Catalogue No.			6 1 4 2 - 0 -

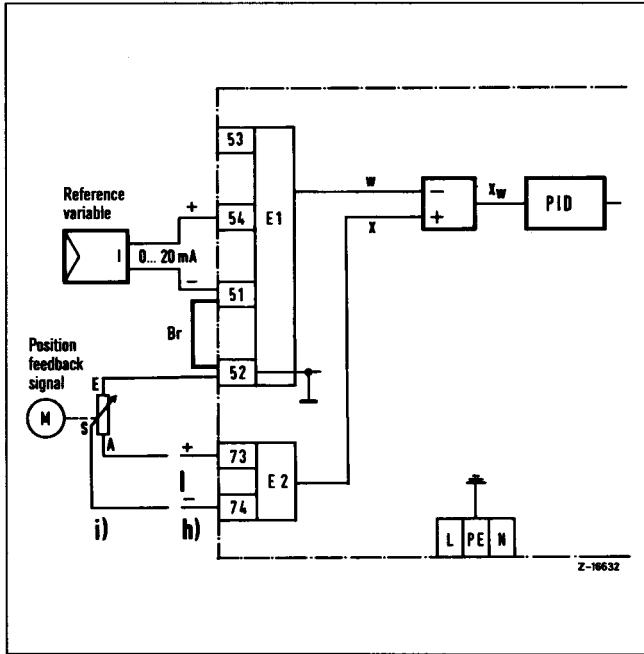
## Examples of connections



**Fig. A1** Output step controller or positioner



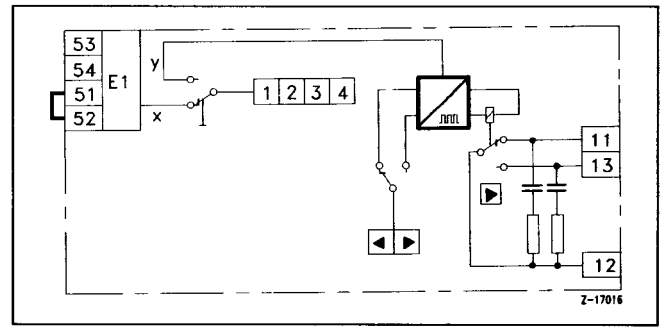
**Fig. A2** Output step controller or positioner, design acc. to Suppl. No. 400



**Fig. A3** Input positioner  
(output see Fig. A1 or A2)

## Examples for application

### On/Off Controller



**Fig. A4** Manual station on/off control output

Operation in accordance with function  
"Manual operation on/off controller"

The following configuration is required:  
Set function indication 7. to 2r and  
function indication 9. to H.



## Manual station step control output

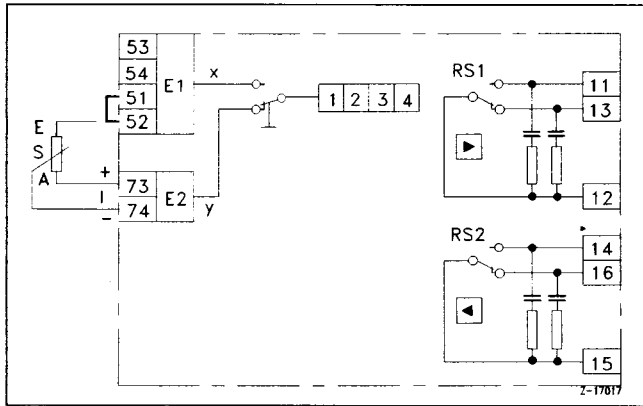


Fig. A5 Manual station step control output

Operation in accordance with function  
"Manual operation on/off controller"

The following configuration is required:  
Set function indication 7. to 2r and  
function indication 9. to H.

## Packing instructions

If the original packing is no longer available, the unit must be wrapped in an insulating air foil or corrugated board and packed in a sufficiently large crate lined with shock absorbing material (foamed material or similar) for the transportation. The thickness of cushioning must be adapted to the weight of the unit and to the mode of transport. The crate must be labeled "Fragile".

For overseas shipment the unit must additionally be sealed airtight in 0.2 mm thick polyethylene together with a desiccant (e.g. silica gel). The quantity of the desiccant must correspond to the packing volume and the probable duration of transportation (at least 3 months). Furthermore, for this type of shipment the crate should be lined with a double layer of kraft paper.

## Spare parts

Spare parts are given in the following Spare Parts List. When ordering spare parts please quote the designation and the Catalogue No. of the spare part. Always state the Serial No. inscribed on the rating plate as well as the Order No.

The designations in the Spare Parts List, the confirmation of order, the delivery note and the invoice may differ from the function-related names given to these parts in this Operating Manual.

The Catalogue No. is the sole criterion.

<b>Object</b>	<b>Catalogue No.</b>
Indicator module	61404-4-0801763
Cover foil, printed, grey	61404-4-0801764
black	61404-4-0801765
Interface cover	61404-4-0801766
Inscription sheet	61405-4-0801767
Connection circuit board	
with terminals	61404-4-0801768
with blade-type connectors	61404-4-0801769
Cover plate printed,	
for terminals	61404-4-0801770
for blade-type connectors	61404-4-0801771
Holder	61404-4-0801772
Case cover	61404-4-0801773
Coding pins	61404-4-0801774
Mains circuit board 230 V AC, 1 relay	61404-4-0801776
230 V AC, 2 relays	61404-4-0801777
230 V AC, 2 relays for direct motor activation	61404-4-0801778

<b>Object</b>	<b>Catalogue No.</b>
Mains circuit board 115 V AC, 1 relay	61404-4-0801779
115 V AC, 2 relays	61404-4-0801780
115 V AC, 2 relays for direct motor activation	61404-4-0801781
Mains circuit board 24 V AC, 1 relay	61404-4-0801782
24 V AC, 2 relays	61404-4-0801783
24 V AC, 2 relays for direct motor activation	61404-4-0801784
Screw terminals	61005-4-0877414
Female tab connectors (15 connectors)	60604-4-0801243
Plug-on screw terminals (15 terminals)	61404-4-0342910
Serial interface RS-485	61429-4-0743200
Binary I/O module	
with transistor output 24 V DC/50 mA	61429-4-0743521
with Triac output 230 V AC, 1 A AC	61429-4-0743701

Subject to technical changes.

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