Digitric P

Controller for industry and process engineering

Operating manual

42/61-28 EN

Rev. 05

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Associated documents

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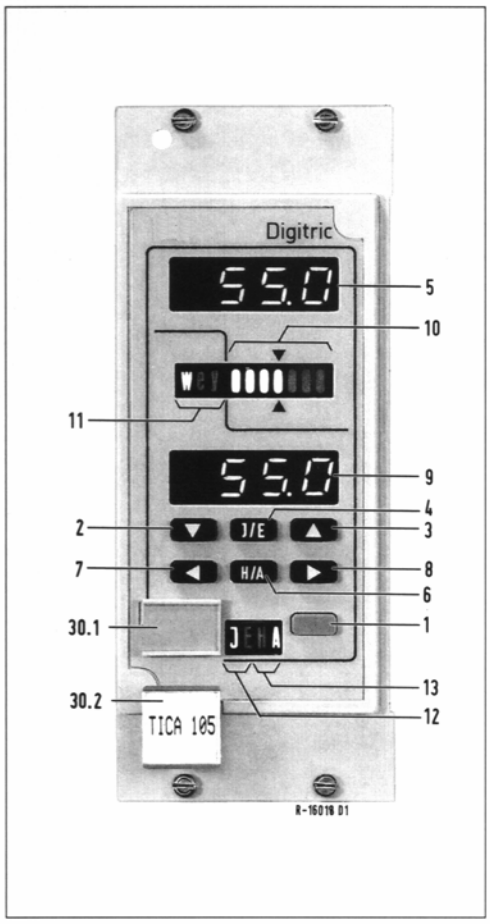
Operating Manual 42/61-27-EN [1) 3)] (Configuration Instruct.)
Operating Manual 42/61-29-EN (Parameter definition, modifications)
Operating Manual 42/61-30-EN (Software S5)
Operating Manual 42/61-31-EN (Serial interface RS-485)
Service Manual [2)] Ordering no. 98061-5-6675209

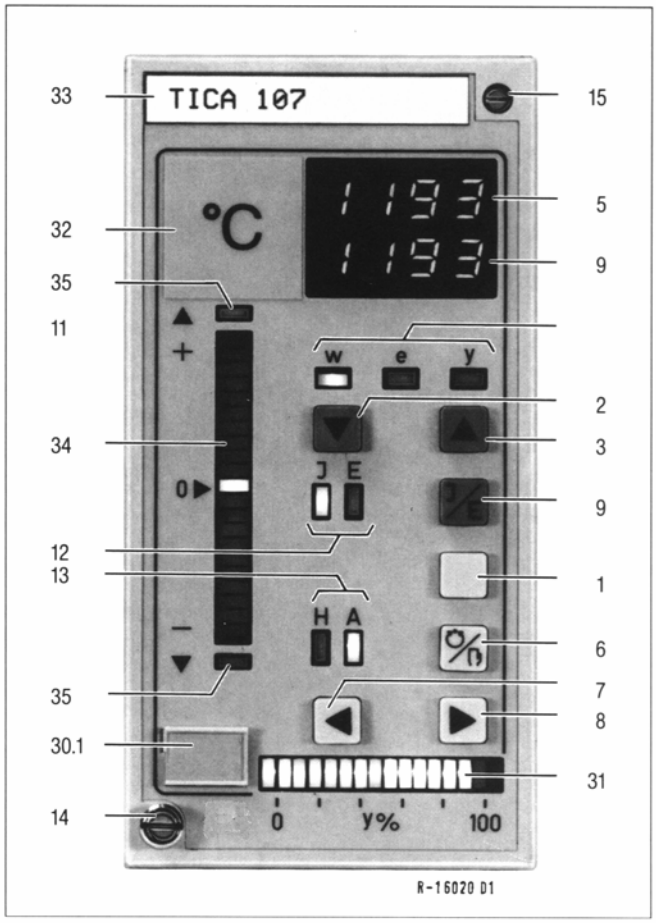
Instrument Manual 90 / 61-600 EN
(contains all documents except the Service Manual)
Ordering no. 61395-0-0200000

Technical Informations
- 30 / 61-290 XA [3)] Self-setting of control parameters
- 30 / 61-292 XA [3)] Adapting the controller to the controlled system

[1)] available only with the Instrument Manual
[2)] German only
[3)] German / English



19″ version
(same view with format 48 mm x 96 mm)



Panel instrument
Format 72 mm x 144 mm

Panel instrument
Format 96 mm x 96 mm

1 Display changeover switch
2 Universal setting key “lower” (designated as ▼ in text)
3 Universal setting key “raise” (designated as ▲ in text)
4 Set point changeover (designated as I/E key in text)
5 Top display line
(controlled variable, variable names, fault message)
6 Manual/automatic changeover
(designated as H/A key in text)
7 Manual setting key “lower” (designated as ◀ in text)
8 Manual setting key “raise” (designated as ▶ in text)
9 Bottom display line (variable values, channel display)
10 Analog display for control deviation, controller output, switching status
11 Display of the main variables to (9)
12 Status display set point internal/external
13 Status display set point manual/automatic
14 Closing screw and slide-in unit
15 Additional closing screw
30.1 Cover for configuration jack/designation plate
30.2 Designation plate (only with 19″ plug-in card)
31 Output display/switching status
32 Adhesive label for specification of the unit of measurement
33 Inscription field

only with format 72 mm x 144 mm:

34 Control deviation display
35 Light emitting diodes for control deviation for more than ± 10 %

Important Instructions for Your Safety. Please read and observe.

Correct and safe operation of the Digitric P controller 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.

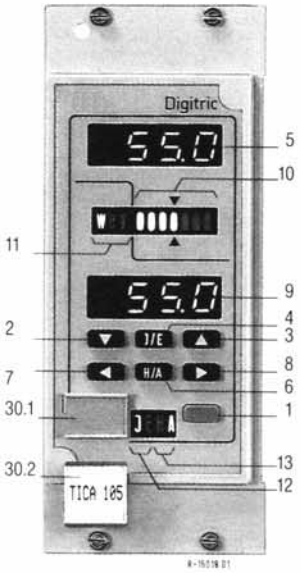
Please take note of
- the contents of this Operating Manual,
- the safety regulations affixed to the controller
- the safety regulations pertaining to the installation and operation of electrical systems.

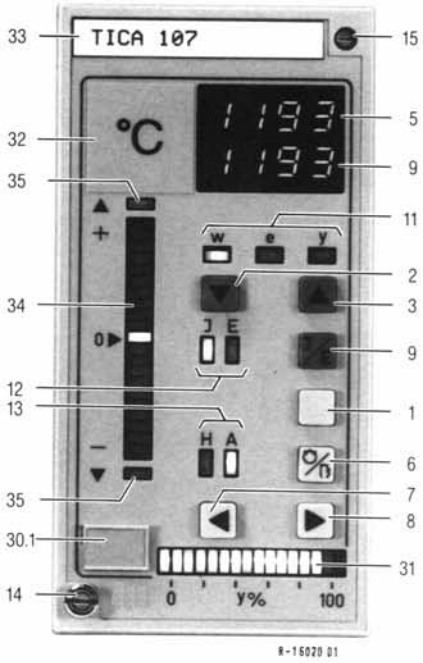
The directives, norms and guidelines mentioned in this Operating Manual are applicable in the Federal Republic of Germany. When using the apparatus in other countries, please observe the national regulations prevailing in the respective country.

This controller Digitric P 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 ABB Service Department will be delighted to give you more information.

Controller
Displays and manual control elements
Abridged version of sections "Commissioning" and "Operation control"





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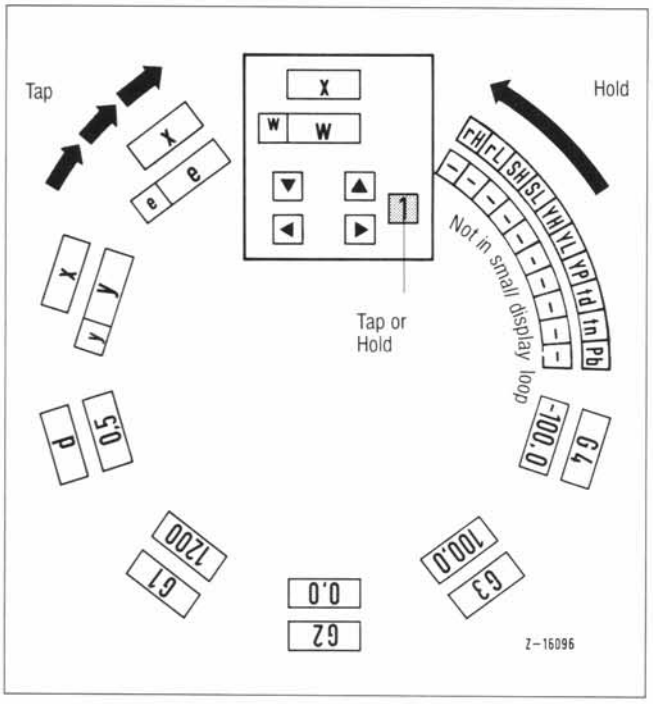
Display and setting possibilities

In the display a number of process variables can be shown and changed with display changeover switch (1).



Small and extended display loop

Setting values

All values, except manipulated variable y, are set with ▲ and ▼ if the name in the top display line (5) and the value of the variable selected in the bottom display line (9) are visible.

Display (5) [1]	Display (9)	Function
Value for x	Channel display	Controlled variable or ratio [1] (Current)
Value for x	Value for w	Controlled variable and set point
Value for x	Value for e	Controlled variable and control deviation
Value for x	Value for y	Controlled variable and output variable
d.	Value	Set point difference ($w_{ext} - w_{int}$)
G1.	Value	Alarm value X max.
G2.	Value	Alarm value X min.
G3.	Value	Alarm value control deviation max.
G4.	Value	Alarm value control deviation min.
r	Value	Secondary variables with ratio
E1	Value	Multicomponents
E2	Value	Reference variable with ratio; multicomponents
E3	Value	Control of output limit Override (YL; YH)
E4	Value	Multicomponents

[1] All displays and setting possibilities are available manifoldly in multichannel instruments.

Operating instructions

Manual operation

After bumpless transfer to "manual" "y" is automatically displayed.

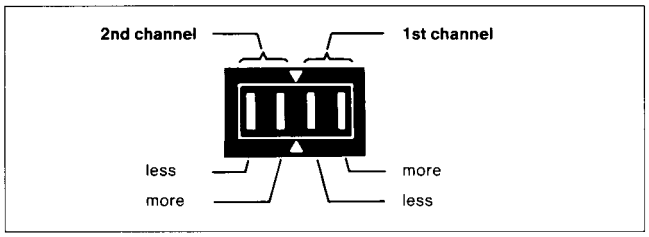
■ y can be adjusted with ◀ or ▶.

Continuous controller

■ – Slow change by tapping keys ◀ or ▶.
  – Quicker change by holding keys ◀ or ▶.
  – Rapid movement to 0 or 100 % by holding keys ◀ or ▶ and H/A additionally.

Step controller

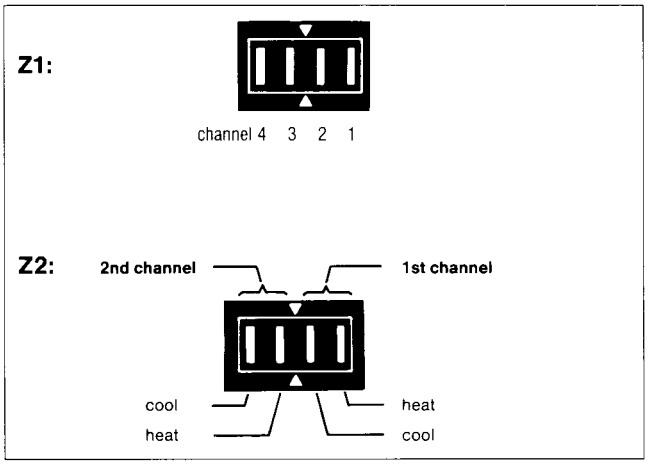
The actuating time depends only on the actuating time of the motor. The switching status of the outputs is displayed.



Switching status display of the step controller

On/off controller

In manual operation the on/off controller generates a pulse train whose average value in time is displayed as y.



Switching status display of the on/off controller

■ – Slow change by tapping keys ◀ or ▶.
  – Quicker change by holding keys ◀ or ▶.
  – Rapid movement to 0 or 100 % by holding keys ◀ or ▶ and H/A additionally.

Multichannel controller

Operation is similar to that of the single-channel controller.

An additional channel display is available in the multichannel instruments.

Channel 4	3	2	1	Control deviations (coarse indicator)
	▬			e > 0
▬		▬		e = 0
▬		▪	▬	e < 0

The channels (control loops) are displayed by means of horizontal luminous symbols. A decimal point appears after the operational channel.

– Select channel display: With display changeover switch (1) and ▲ or after going through the display loop.
– Select operational channel with ▲.

Cascade controller

The I/E key has two possible positions:

I = cascade is open. Slave controller runs with local set point.

E = cascade is closed.

Channel 2 is always the **slave controller,** channel 1 is the **master controller.**

■ The mode selector switch affects only the slave controller.
  – Actuation of H/A key effects changeover to the slave controller and changeover of its operating mode.
  – Changeover to I/E and H/A is bumpless.

Override controller (limit controller)

Channel 2 is always the **master controller,** channel 1 is the **limit controller.**

■ The mode selector switch H/A affects only the master controller.
  – Actuation of H/A key effects changeover to the master controller and changeover of its operating mode.
  – Changeover to H/A ist bumpless.

Setpoint changeover

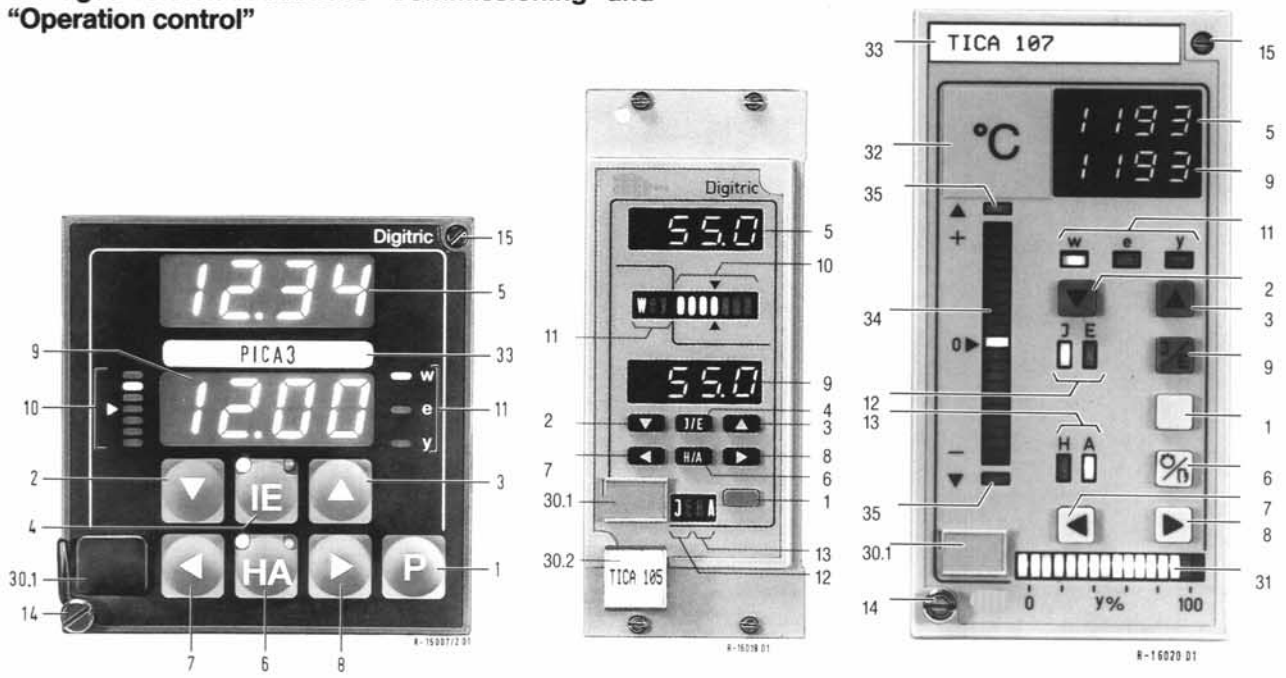
If an input for the external set point is fitted, changeover can be effected between the internal and external set point.

– Changeover **external → internal:** is bumpless.
  The last external set point is the new internal set point.
– Changeover **internal → external:** In the variable "d", the difference between the internal and external set point can be read. If there is a difference while switching over the active set point approaches the external set point with 6 %/s.

■ If the I/E key is activated, "w" is always displayed.
■ In position "I" internal and "w" in the display (11), the set point can be set with keys ▲ or ▼.

Programmer, program controller
Displays and manual control elements

Abridged version of sections "Commissioning" and "Operation control"



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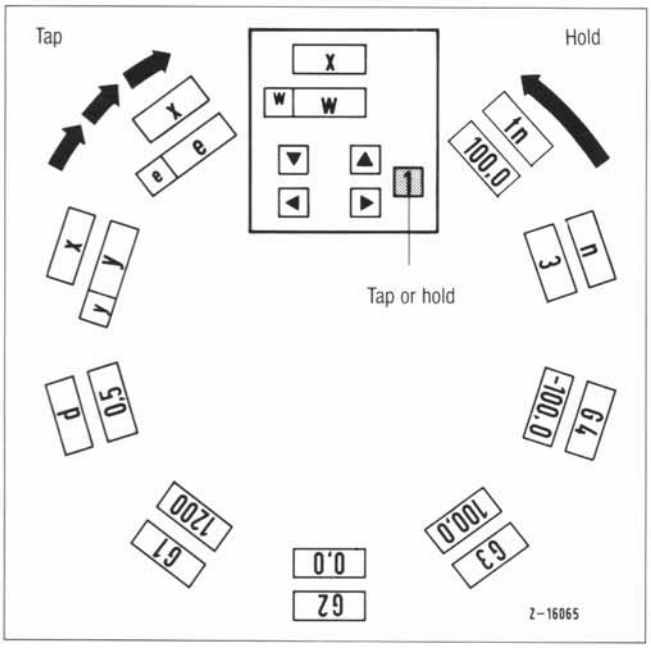
Display and setting possibilities

In the display a number of process variables can be shown and changed with display changeover switch (1).



Small and extended display loop

Programmer

Display (5)	Display (9)	Function
w-program	Channel display	Only with multichannel instruments
w-program	w active	Program set point, active set point
n	1...7	No. of section being currently processed
tn	Value	Time which has elapsed in the section currently running (4)

Program controller

Display (5)	Display (9)	Function
Value for x	Channel display	1st channel = controller 2nd channel = programmer
Value for x	Value for w	Controlled variable and active set point
Value for x	Value for w	Controlled variable and control deviation
Value for x	Value for y	Controlled variable and output variable
d.	Value	Set point difference ($W_{program} - W_{int}$)
G1.	Value	Alarm value X max.
G2.	Value	Alarm value X min.
G3.	Value	Alarm value control deviation max.
G4.	Value	Alarm value control deviation min.
n	1....7	No. of section being currently processed
tn	Value 0...100 %	Time which has elapsed in the section currently running (%)

Operating as a programmer

Operating modes

■ The operating modes are set with H/A key or J/E key.

H Stop. The program run stops. The set point remains constant at the last value reached.

HA Program runs.

Rapid forward at 16 s per section.

J Internal set point is set with ▲ or ▼ on the instrument.

E Program set point.

Manual operation of the programmer

The display "H" ligts up.

– **Reset** ■ Jump to the program start by **simultaneously** pressing ◀ and ▶.

– **Forwards** ■ Skip parts of the program with ▶.
Actuate H/A key additionally to jump to the next checkpoint.

– **Backwards** ■ Repeat program with ◀.
Actuate H/A key additionally to jump to the preceding checkpoint,

– **Start** ■ Switch to "HA" with H/A key.

Channel changeover

An additional channel display is available for multichannel instruments.

Channel 4	3	2	1	Control deviations (coarse indicator)
	–			e > 0
–		–		e = 0
–		.	–	e < 0

The channels (control loops) are displayed by means of horizontal luminous symbols. A decimal point appears after the operational channel.

■ Select channel display: With display changeover switch (1) and ▲ or after going through the display loop.

■ Select operational channel with ▲.

Operating as a programm controller

Manual operation

After bumpless transfer to "manual" "y" is automatically displayed.

■ y can be adjusted with ◀ or ▶.

Continuous controller

■ – Slow change by tapping keys ◀ or ▶.
– Quicker change by holding keys ◀ or ▶.
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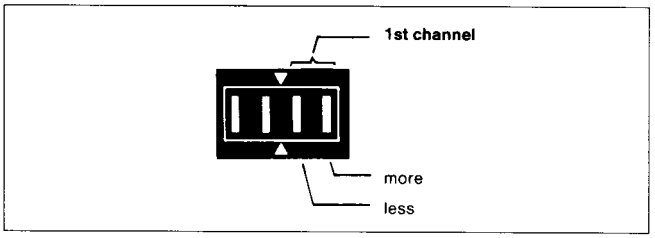
Step controller

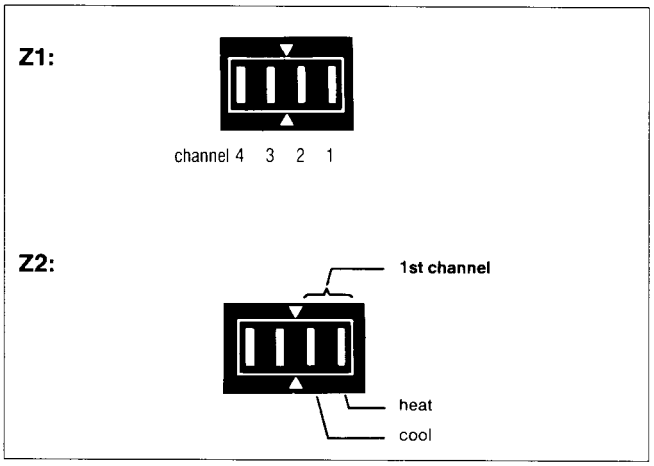
The actuating time only depends on the actuating time of the motor. The switching status of the outputs is displayed.



Switching status display of the step controller

On/off controller

In manual operation the on/off controller generates a pulse train whose average value in time is displayed as y.



Switching status display of the on/off controller

Setpoint changeover

In program controllers the program set point acts as external set point.

– Changeover **E → J:** The last external set point is the new internal set point.
Changeover is bumpless.

– Changeover **J → E:** Having selected the variable "d", the difference between the internal and external set point can be read.
If there is a difference while switching over the active set point approaches the external set point with 6 %/s.

■ If the J/E key is activated "w" is always displayed.

■ In position "J" and "w" in the display (11), the set point can be set with keys ▲ or ▼.

Field of application

The Digitric P controllers are compact controllers for instrumentation of anything from single control loops to the automation of small and medium-sized processes.

They are suitable for simple as well as for complex control activities, chiefly in heating and heat treatment processes.

Apart from temperature control tasks, flow, pressure and mixture ratio control tasks can be performed.

Installation

Identifying the instrument

The rating plate is consulted for identification of the unit. It is to be found on both the case and slide-in unit.

The specifications P 6141... and the additional specification Suppl. No.... describe the hardware and software.

More detailed information can be found in the order matrix for the units, page 26, in table Function versions (page 27 for process interface Digitric P-19" in Data Sheet 61-4.12 EN) and in Data Sheet 61-4.11 EN.

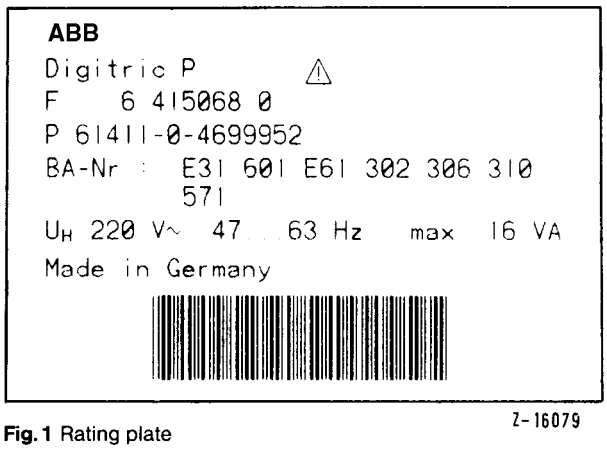


Fig. 1 Rating plate

Digitric P compact controllers featuring a special configuration supplied by Hartmann & Braun have an additional label in the EPROM indicating the number of the configuration.

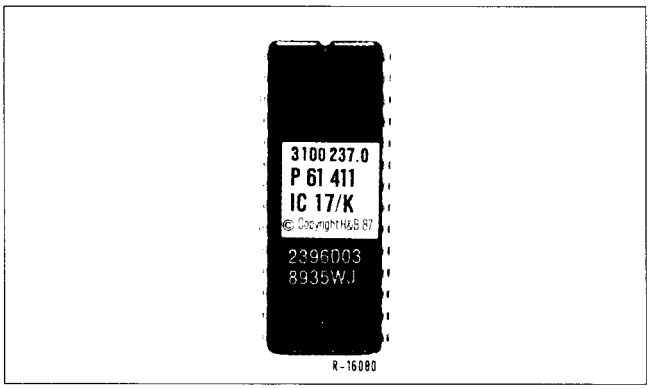


Fig. 2 EPROM with firmware

For verification purposes, the configuration (Suppl. Nos. 400 to 600) which is active in the instrument can be displayed.

The number of a special configuration is saved by Hartmann & Braun in the addresses 84DAH and 84DBH.

A document is also supplied describing the special configuration functions.

Mounting

When selecting the installation location, bear in mind the Technical data (see Appendix) referring to climatic and mechanical capabilities.

Panel instruments

Slide the instrument into the panel cutout from the front and fasten by equally turning the fasteners which have been supplied in the panel cutout.

Fasteners with tapered rivets at the top and bottom (Catalog No. 61404-4-0344060) are available for mounting several units in a slot.

The connections are made using
- tab connectors A 6.3 x 0.8; A 2.4 x 0.8 to DIN 46422 or pins 2.4 x 0.8 to DIN 41611.
- Screw terminals (Catalog No. 61404-4-0342910; each with 15 pcs.) are available optionally.

Units with increased electromagnetic compatibility (EMC)

(Designs 96 mm x 96 mm and 72 mm x 144 mm)

When mounting units featuring increased EMC make sure that the panel has the same potential as the grounding conductor and that a conducting contact exists via the fasteners between the case and panel.

⚠ Caution

Shock protection of the terminals must be guaranteed by appropriate mounting of the Digitric P.

When using blade-type terminals make use of insulated tab connectors.

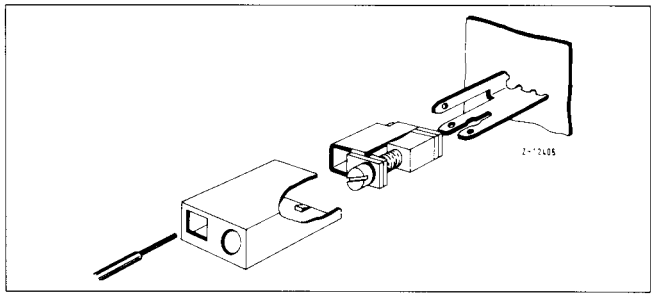


Fig. 3 Fitting the screw terminals

19" plug-in card "Process interface Digitric P19""

If the 19" plug-in card or 19" output extension card featuring supply voltage or relay voltage of 230 V are combined with other 19" plug-in cards, a space of at least 2 T ≈ 10 mm must be left for safety reasons at the left beside the Digitric P modules.

The connecting lines between the 19" plug-in card and the output extension card (OEC) must be installed as a measuring lead. They must not exceed 3 m in length.

Controller connection	A3/ A4	AR1	AR2	AR3	AR4	OEC connection
18a	x	x				22c
18c	x		x			22a
20a	x			x		20c
20c	x				x	20a
24a	x	x	x	x	x	14a
24c	x					14c
26a	x					12a
26c	x	x	x	x	x	12c

Table 1 Wiring between 19" plug-in card and 19" output extension card (OEC)

Installing the lines

When selecting and installing the connecting cables please observe the regulations for electric power installations with nominal operating voltages up to 1000 V, (DIN VDE 0100) or the corresponding local regulations.

Connecting the unit

⚠ Caution

In order to assure shock protection, the connection of the protective-conductor terminal ⏚ and an appropriate protective earth must be made before any other connection.

The grounding conductor (PE) is also used to divert HF interferences. Hence provision should be made for it also with a power supply of 24 V (direct or alternating voltage).

The reference conductor connection (⊥) in the unit is connected via a capacitor 1 µF with PE.

If there is interloop flexibility between several Digitric P units, for the purpose of compliance with the permissible common-mode voltage there is potential equalization to be done by connecting the reference conductors.

Signalling circuits

An abridged version of the input and output circuits is given in tables 2 and 3; terminal assignment on the rear of the unit according to the type of construction is given in Fig. 5.

A survey of all inputs and outputs of the different function versions is given in the appendix to this Operating Manual.

Intrinsically safe measuring circuit via safety barriers

Safety barriers for current and voltage (thermocouples) (e.g. H&B type TZI 102-Ex or TZU 102-Ex).

When using such safety barriers, make sure that the relevant national regulations and ordinances pertaining to explosion protection are observed.

Relay output

Relay module for general use

The built-in spark quenching element is generally adequate for small inductive loads.

For bigger inductive loads an external spark quenching combination parallel to the load is recommended in order to protect the contacts.

⚠ Caution

The potential difference of the switched voltages must not exceed 380 V.

Relay module for direct motor activation

The output extension for direct motor activation features increased spark quenching capabilities. Only contactors with a retaining current of > 30 mA can be activated with it.

Power supply

⚠ Caution

It must be possible to switch off the power supply at two poles. The unit does not contain fuses.

Acc. to DIN VDE 0411 the following fuses must be provided externally:

230 VAC:	fuse cartridge T 0.08	250 C
115 VAC:	fuse cartridge T 0.16	250 C
24 V UC:	fuse cartridge T 0.63	250 C

Serial interface RS-485

A shielded two-wire conductor is used as a bus cable. The shield serves to divert HF interferences originating in the bus line **and** enhances the immunity of the bus line to interferences.

To prevent potential differences, connect the reference conductor of the bus subscribers with a sufficiently large potential equalization line.

The structure of the telegrams is described in Operating Manual 42/61-31-. EN (Serial Interface).

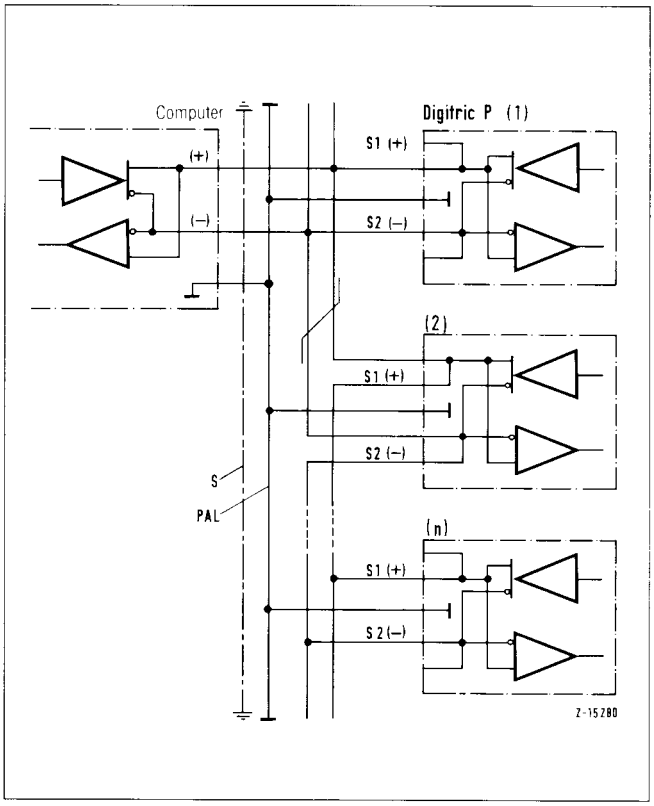
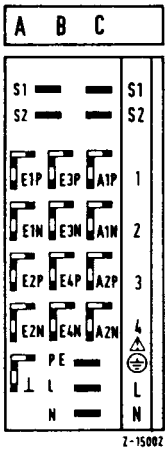
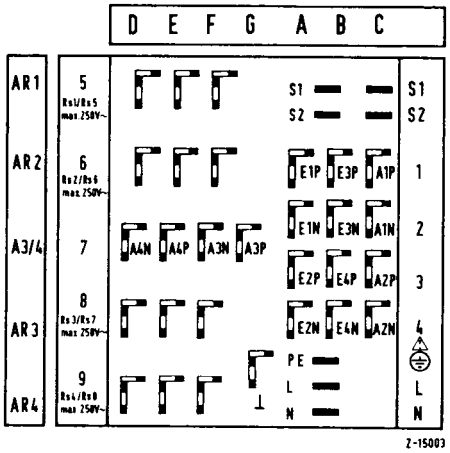


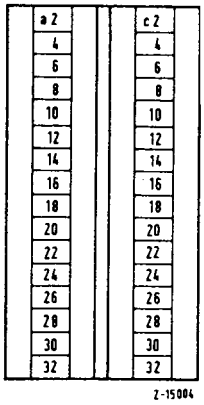
Fig. 4 Connection of the serial interface
PAL Potential equalisation line
S Shield



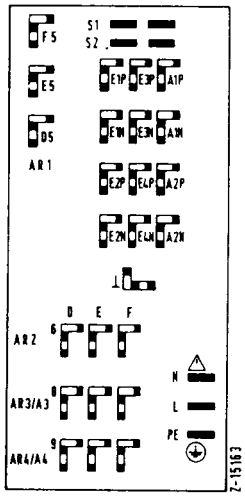
Panel instrument
46 mm × 96 mm



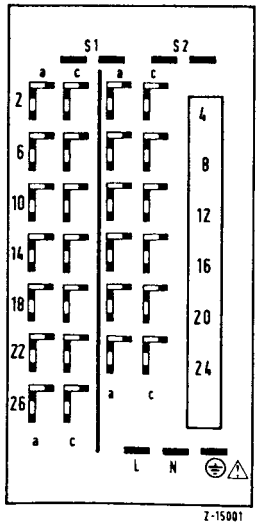
Panel instrument
96 mm × 96 mm



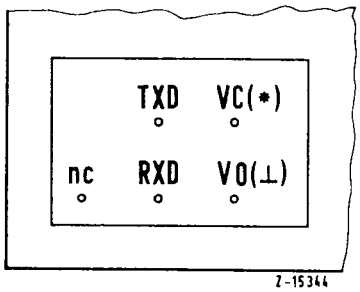
Surface-mounting case IP 54



Panel instrument
72 mm × 144 mm

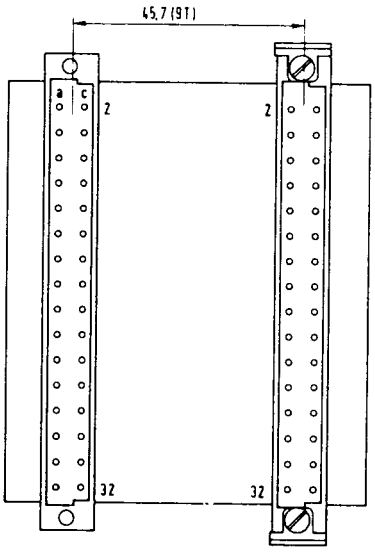


Panel instrument 72 mm × 144 mm
for a plug-in card 19″



Interface connection RS-485
on the front panel

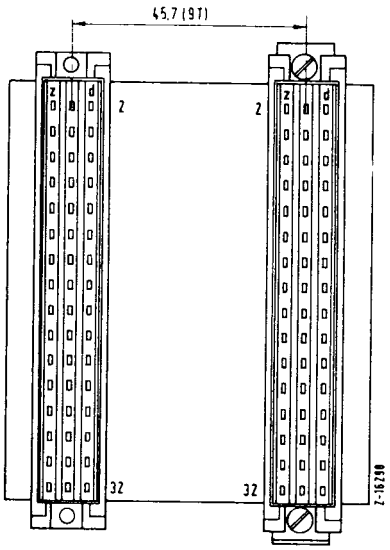
Configuration C



Digitric P
Controller

19″ output
extension

Configuration F



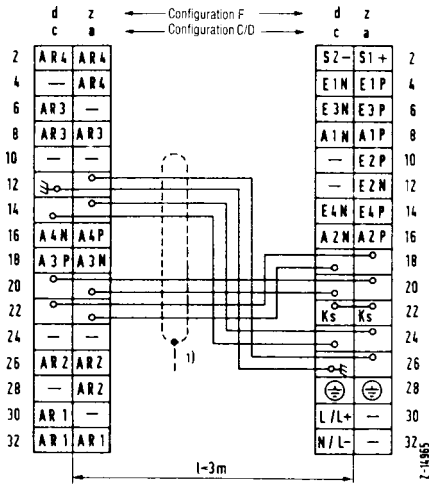
Digitric P
Controller

19″ output
extension

19″ plug-in card with 19″ output extension card

19″ output
extension

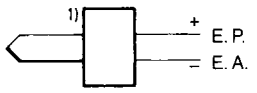
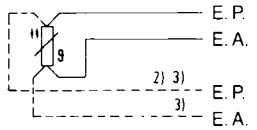
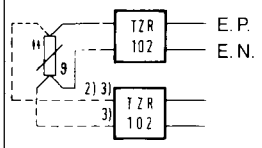
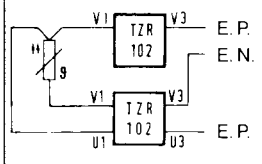
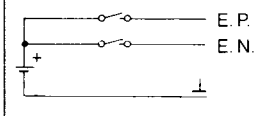
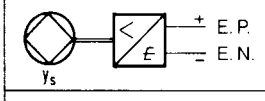
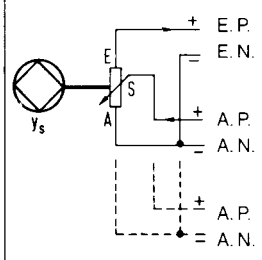
19″ pcb



1) Shielding is required with line length > 0.5 m
or with electromagnetic disturbances

19″ standard connection

Fig. 5 Terminal assignments

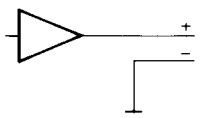
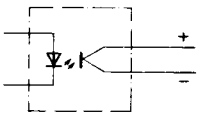
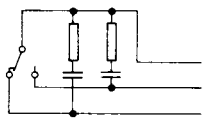
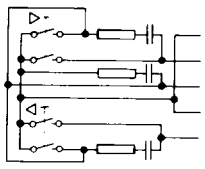
Input circuit	Panel instrument	19″ plug-in card[5)8)]	Remarks
	E1 E2 E3 E4 A1 A2 | A3 A4 | B1 B2 | B3 B4	E1 E2 E3 E4 4a 4c | 10a 12a | 6a 6c | 14a 14c	Input for the thermocouple, mV, V und mA[4)]
	A1 A2 | A3 A4 | B1 B2 | B3 B4 E2 A3 A4 E4 B3 B4	4a 4c | 10a 12a | 6a 6c | 14a 14c E2 10a 12a E4 14a 14c	Input for resistance thermometer[4)] Additional inputs for resistance thermometers in 3- and 4-wire circuit
	A1 A2 | A3 A4 | B1 B2 E2 A3 A4 E4 B3 B4	4a 4c | 6a 6c E2 10a 12a E4 14a 14c	Resistance thermometer with explosion protection barriers TZR[4)] Additional inputs for resistance thermometers in 3- and 4-wire circuit
	A1 A2 | B1 B2 E2 A3 E4 B3	4a 4c | 6a 6c E2 10a E4 14a	Resistance thermometer with explosion protection barrier TZR[4)] in 3-wire circuit
	A1 A2 | A3 A4 | B1 B2 | B3 B4 ⊥	4a 4c | 10a 12a | 6a 6c | 14a 14c	Binary inputs (current sinking) Active Sensor Same connections with passive sensors[5)]
	A3 A4 | B1 B2 | B3 B4	10a 12a | 6a 6c | 14a 14c	Step controller: Position feetback signal Current
	A3 A4 | B1 B2 | B3 B4 A2 C3 C4 | A1[7)] C1 C2 | A3 G7 F7 | A1[7)] C1 C2 | A3 G7 F7 A2 A2P A2N | A1[7)] A1P A1N | A3 D8 E8 | A1[7)] A1P A1N | A3 D8 E8	10a 12a | 6a 6c | 14a 14c A2 16a 16c | A1[7)] 8a 8c | A3 18c 18a | A1[7)] 8a 8c | A3 18c 18a Z-16064/1	Step controller Potentiometer For dimensions 72 mm × 144 m

E1...E4 = Number of the input
A1...B4 = Terminal designation of the panel instrument
2a...32c = Designation of the terminal strip

1) Optionally external reference junction
2) 3-wire circuit
3) 4-wire circuit
4) See 42/61-29-.EN for range setting
5) See 42/61-29-.EN for modification possibility
6) For plugs of type F the terminal designations are changed: (a) becomes (z) and (c) becomes (d) e.g. 4a → 4z 4c → 4d
7) With controllers without relay outputs output A3 should be connected instead of A1.
8) Including process interface Digitric P-19″

Note:
Each unit features a **connection diagram** showing its input and output assignments, the functions (binary or analog) of the inputs and outputs and the ranges.

Table 2 Connection diagram for the inputs

Output circuit	Panel instruments	19″-plug-in card [1)2)]		Remarks
		Controller	19″-Output extension	
	Format 96mm×96mm Format 48mm 96 mm A1: C1, C2 — A2: C3, C4 — A3: G7, F7 — A4: E7, D7 Format [illegible] A1P, A1N — A2P, A2N — D8, E8 — D9, E9	A1: 8a, 8c — A2: 16a, 16c	A3: 18c, 18a — A4: 16a, 16c	Current and voltage output A2 and/or A4 if configured as transmitter supply
	Format 96mm×96mm Format 48mm 96 mm A1: C1, C2 — A2: C3, C4 — A3: G7, F7 — A4: E7, D7 Format [illegible] A1P, A1N — A2P, A2N — D8, E8 — D9, E9	A1: 8a, 8c — A2: 16a, 16c	A3: 18c, 18a — A4: 16a, 16c	Optoelectronic coupler output
		19″-Output extension		
	AR1: D5, E5, F5 — AR2: D6, E6, F6 — AR3: D8, E8, F8 — AR4: D9, E9, F9	AR1: 30c, 32c, 32a — AR2: 26a, 26c, 28a — AR3: 6c, 8c, 8a — AR4: 2c, 4a, 2a		Relay output Residual current of spark quenching element approx. 15 mA [3)]
	AR1/AR2: D5, E5, F5, D6, E6 — AR3/AR4: D8, E8, F8, D9, E9	AR1/AR2: 30c, 32c, 32a, 26a, 26c — AR3/AR4: 6c, 8c, 8a, 2c, 4a		Relay output for direct motor activation Residual current of spark quenching element approx. 30 mA [3)]
Power supply				
PE — L/L+ — N/L− —	⏚ L/L+ N/L−	28a, 28c 30c 32c		

A1 to A4 = Outputs 1...4
AR1 to Ar4 = Relay outputs 1...4

C1 to F9 = Terminal designation of the panel instruments
a2...c32 = Designation of the terminal strip

Each unit features a **connection diagram** showing its input and output assignments, the functions (binary or analog) of the inputs and outputs and the ranges.

[1)] For plugs of type F the terminal designations are changed:
(a) becomes (z) and (c) becomes (d), e.g. 4a → 4z; 4c → 4d

[2)] Including process interface Digitric P-19″

[3)] **Note:**
See complementary connection diagrams for step controller on pages 33 and 34

Table 3 Connection diagram for the outputs

Commissioning

⚠ Caution

The unit may only be operated when properly installed.

Before switching on the apparatus make sure that the supply voltage, indicated on the rating plate and on the transformer, and the mains voltage are identical.

If the slide-in unit has to be taken out of the case, the power supply of the unit and of the relay contacts have at first to be switched off at all poles.

Make sure that Digitric slide-in units or output extensions with different terminal assignments are never interchanged.

Switching on the unit

Once all the lines have been switched on and the power supply connected the Digitric P controller is immediately ready for operation. It reverts to the status featured by it at the time of delivery or to the operating mode which was valid when it was switched off.

Displays

(see fold-out page at the back of this document)

Numerical displays

The displays are divided into three levels (loops):

Loop "L" = Small display loop for the operator

Loop "E" = Extended display loop for the commissioning

Loop "A" = Large display loop, shows all the variables used in the unit as well as their values for special adjustments and for troubleshooting.

The extended display loop "E" is enabled when the unit is supplied by the manufacturer.

The changeover to the small or the big display loop is given in section „Auxiliary Routines" in appendix.

The main variables **"w"**, **"e"** and **"y"** are shown in the small and in the extended display loop in the **bottom display line** (9) [1].

The controlled variable "x" is visible in the **top display line.**

In all other cases the name appears in the **top display line** and the value of the selected variable in the **bottom display line.**

- 1. Variable changeover with key 1.
  2. Select set point with J/E.
  3. Select output variable with H/A on H (manual).

Multiple channel display and channel changeover

An additional channel display is available for multichannel instruments:

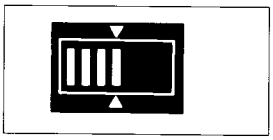
Channel 4	3	2	1	Control deviations (coarse indicator)
▬	▬			e > 0
▬		▬		e = 0
▬		.	▬	e < 0

The channels (control loops) are displayed by means of horizontal luminous symbols. A decimal point appears after the operational channel.

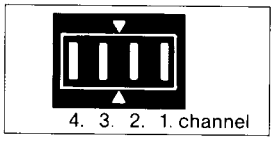
- Select channel display: With display changeover switch (1) and ▲ or after going through the display loop.
- Select operational channel with ▲.

Analog display – switching status display

On delivery from factory the analog display (10) illustrates the following information depending on the closed loop control function:

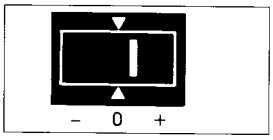


Output variable y in the case of Continuous controllers



Switching status display in the case of Switching controllers

Disposing of an appropriate configuration, it can also be used to show the control deviation.



Control deviation

Exception: panel instrument, format 72 mm x 144 mm
The control deviation is shown on the analog display (34; 35) and the switching status on the analog display (31).

Setting values

- All values apart from the output variable y are adjusted with ▼ and ▲ if the name is visible in the top display line (5) and the value in the bottom display line (9).
- The output variable y is always adjusted with ◄ and ► if control loop is on manual.
- Rapid adjustment to 0 % or 100 % is possible with continuous and on/off controllers by simultaneously activating ◄ or ► and the H/A key.

All displays and setting possibilities are available manifoldly in multichannel instruments.

Display (5)	Display (9)	Function
Value for x	Channel display	Controlled variable or ratio (Current)
Value for x	Value for w	Controlled variable and set point
Value for x	Value for e	Controlled variable and control deviation
Value for x	Value for y	Controlled variable and output variable
d.	Value	Set point difference ($w_{ext} - w_{int}$)
G1.	Value	Alarm value X max.
G2.	Value	Alarm value X min.
G3.	Value	Alarm value control deviation max.
G4.	Value	Alarm value control deviation min.
r	Value	Secondary variables with ratio
E1	Value	Multicomponents
E2	Value	Reference variable with ratio; multicomponents
E3	Value	Control of output limit Override (YL; YH)
E4	Value	Multicomponents

[1] The position numbers in brackets refer to the front panel representations on cover page 3

Operating mode changeover

■ Press key J/E or H/A .

The new mode is active as soon as the respective display stops flashing.

Setting the input circuits: multicomponents and ratio

Weighting the inputs

All inputs can be weighted.

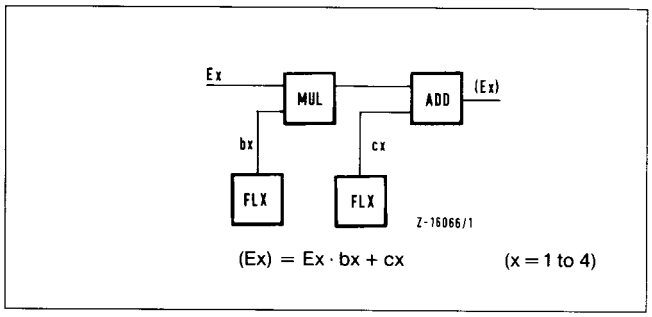


Fig. 6 Input weighting

Input weighting of position feedback signals y_s are different with step controller (see page 14).

The values for bx and cx are displayed and set in the large loop "A" (see "Numerical Displays", page 14 or page 36).

Multicomponents

The main controlled variable E1, set point and alarm values are assigned to the display range user range 1.

Weighting the auxiliary inputs E2 and E4 is determined with b2 and b4 as well as c2 and c4. To these inputs are assigned the physical display ranges "user range" 2 or 4.

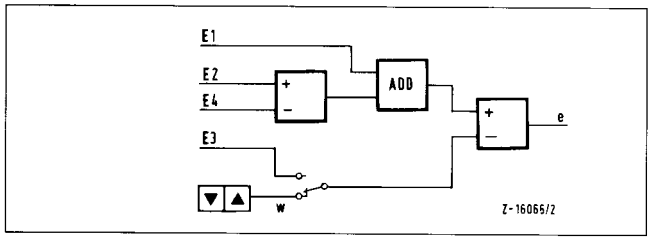


Fig. 7 Input circuit multicomponents

Ratio

In the input circuit, system deviation is calculated as follows:

$$e = (E1 \pm c1) - w \cdot E2$$

For the adjusted state, i.e. e = 0, the following applies:

$$\frac{E1 \pm c1}{E2} - w = 0$$

w = ratio setpoint
e = system deviation x_w
E1 = sequential variable; input e1
(shown in the display by r)
E2 = reference variable; input E2
(shown in the display by E2)
c1 = constant part (normally 0 %) for zero displacement of E1

The instrument has an **electrical** ratio range 0 ... 2. As a rule and under normal operation transmitters should be set for supplying, approximately the same output signal or respecting the electrical ratio range 0 ... 2. In special cases it is possible to extend the electrical ratio range by weighting inputs E1, E2 with b1 and/or b2; see Fig. 2.1.

With a ratio $w_{ext.}$, check whether variable b3 at input E3 is set to 199.9 %.

For combustion control, variable c1 at input E1 is used to set an air excess in the lower load range.

All variables can be set in the **big** display loop "A".

The **physical** ration range eventually required for process control, including the transmitter ratio, can be displayed by setting user range Ur. 3 and setting as ratio setpoint. Therefore it is necessary to determine physical ratios corresponding to the electrical ratios 0 and 1 and to enter them in user range Ur.3, within the numeral volume.

It is possible to set individual physical display ranges for displayed variables r and E2.

r1 = user range Ur.1
E2 = user range Ur.2

All user ranges can be set in auxiliary routine "USr."; see appendix, page 37.

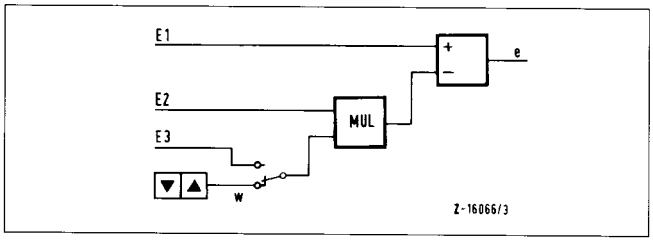


Fig. 8 Input circuit ratio

Characteristics for manual operation

Continuous controller and on/off controller

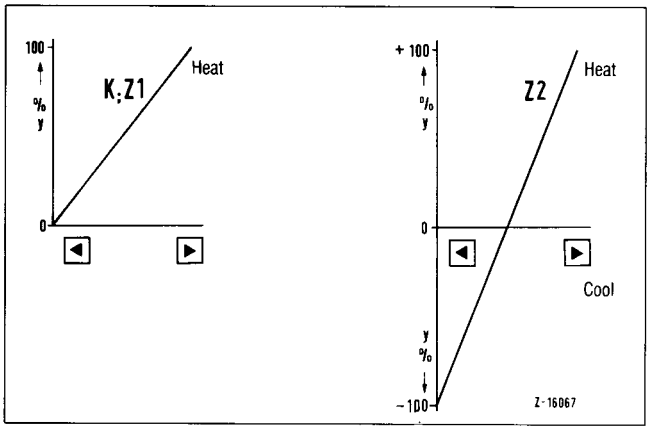


Fig. 9 Characteristics for manual operation

K = Continuous controller
Z1 = On/off controller
Z2 = Heat-/cool-controller

Step controller

The manual characteristic is determined by the wiring.

- On activating key ▶ the positioning signal behind the actuation increases.

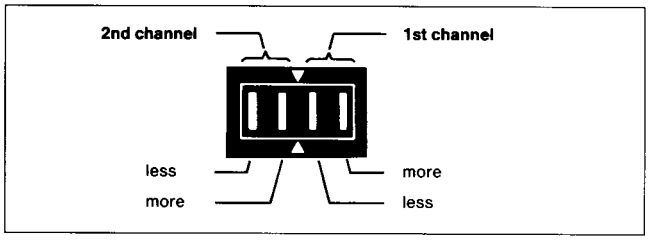
The actuator can only be adjusted when the controller is switched on <H> (manual). The positioning speed solely depends on the run time of the actuator.

Fast positioning is not possible.

- The "dead band" can be set in the display loop "E" with <H>.

Display of the actuating pulses

The LED indicator (10) is configured in such a way that the actuating pulses are displayed by the flashing of the individual segments.



Position feedback signal

The position feedback signal is not included in the control action. In automatic operation it is compared with the set output limits YH and YL.

The position feedback signal is effected with a potentiometer or current signal (see table 2).

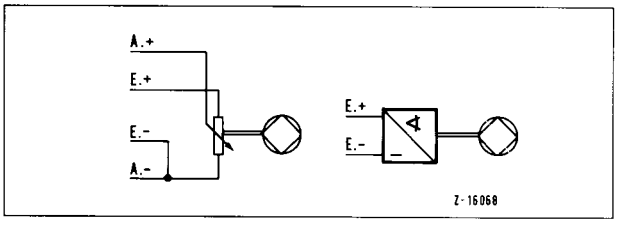


Fig. 10 Position feedback signal

A.+ / A.- Supply from A1 or A3
E.+ / E.- For inputs see annex page 22/23

Weighting position feedback signal inputs ys

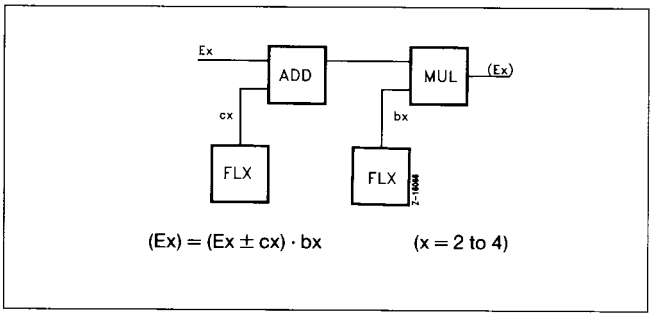


Fig. 11 Input weighting at position feedback signal inputs ys

Model step controller No. BA	Input Ex	Variable		
		cx	bx	(Ex)
451 / 551 453 / 553	E4	c4	b4	y1
452 / 552 456 / 556 457 / 557 458 / 558 462 / 562	E3	c3	b3	y1
454 / 554	E2 E4	c2 c4	b2 b4	y1 y2

Table 4

The alignment for 0 % and 100 % is effected depending on the input with the variables c2, c3 or c4 or with b2, b3 or b4.

Adapting the position indication to the corresponding range

Depending on the input used the balancing for 0 % and 100 % is effected either with the variables c2, c3, c4 or with b2, b3, b4. Refer to the function versions of the step controller, e. g. input E4 = c4, b4.

- The variables c. and b. are made accessible after call-up of the display loop (see Appendix)
  Setting possibilities are as follows:

1. Press key 1: upwards in the alphabet
   Hold key 1: downwards in the alphabet
   Set c. = 0.0; b. = 100.0
   or c. = -100.0; b = -100.0.
2. First bring the gear system successively into the two final positions. Both positions are illustrated in the digital display as y.
3. c. and b. can now be calculated on the basis of the read out values
   ya = value in the final position 0 %
   ye = value in the final position 100 %

$$c. = -ya \qquad b. = \frac{10\,000}{ye - ya}$$

If no position feedback signal is required, YL should be set to a value smaller than y.

If the position feedback signal input E. is 4....20 mA and no position feedback signal is required, YL should to be set to -30 %.

Adapting the controller to the controlled system

Automatic characteristic

On delivery from factory the controller has a reverse action characteristic. The output signal decreases as the measured value increases (see Appendix, Setting the PID auxiliary routine).

Parameter definition

Parameters are defined in the extended display loop. Having completed parameter definition the small display loop should be adjusted (see Appendix, changing the display loop).

In the three-position controller Z2 the channels 1 (heat) and 3 (cool) or channels 2 and 4 are to be parameterized.

The following parameters affect the control result:

Pb = Proportional range 0...1850 %
The effective proportional range in the step controller is Pb* = pb times (motor actuating time/60 s)

Tn = Integral action time

Td = Derivative action time
With Tn and Td the decimal point position shows the time range (see Appendix, Fig. A8; auxiliary routine PID)
xxxx = seconds
xxx.x = minutes
xx.xx = hours
x.xxx = hours times 1000

A self-parameter definition routine is available to determine these parameters.

If this routine cannot or should not be used apply the adjustment rules which are given in the documentation on this subject [1].

The following additional parameters may be of importance:

H = Dead zone in the case of the step controller

YP = Parameter for improving the start-up behavior or the operating point of controllers without I-action

YL = Minimum correction value in %

YH = Maximum correction value in %,
is effective in the step controller only if provision has been made for a position feedback signal

SL = Minimum set point which can be adjusted

SH = Maximum set point which can be adjusted

Self-parameter definition [2]

In the current firmware the self-parameter definition is inhibited for the following standard configurations:
- All configurations for heating and cooling (Z2)
- Cascade
- Override
- All control functions with the input signal connections multi-components and ratio.

The self-parameter definition can be activated for only one channel at a time.

■ Preparation

Bring the control loop manually close the the envisaged operating point (set point) [1].

■ Call the self-parameter definition

1. Press and hold ◄ **and** ► **and** gently tap the display changeover switch (1).
   "nor" appears in the display (5).
2. Select display **"S.tun"** with ▲ or ▼.
   The selected channel is shown in the display (9) e. g. "Ch.4"
3. Using ▲ or ▼ one can switch to other enabled channels.
4. Activate self-parameter definition using the display changeover switch (1). "d.St.P" appears.
5. For a first self-parameter definition, switch forwards with the display changeover switch (1) within 3 s. "tr.1" (scan time) appears.
6. Using ▲, select a time at which a **significant** change (5...10 %) of the controlled variable is expected after a control jump.
7. Using the display changeover switch (1) switch through other parameters until "dY.1" appears.
   If for instance during subsequent parameter definition runs, switch (1) is not activated after "d.St.P", the program jumps directly to "dY.1".
   The magnitude and polarity of the control jump are shown in the bottom display line (9).
8. Using the H/A key the polarity is changed and the magnitude is changed with ▲ or ▼.

A few seconds after the last key actuation the self-parameter definition starts. On completion, the calculated parameters are entered automatically.

■ Quitting the parameter definition routine (without abortion)

1. Press and hold ◄ **and** ► **and** gently press the display changeover switch (1).
2. Actuate the J/E key (4).
   "nor" is displayed and changeover to the normal mode is effected. The self-parameter definition still active can be recognized by the flashing "H".

Note

Do not change the set point or output variable before completion.

■ Aborting the self-parameter definition

Press the display changeover switch (1) and ▲.

Error messages

Error message "Er.St." shows that the self-parameter setting has been unsuccessfully aborted.

The cause of error can be interrogated in self-parameter routine "S.tun" by activating key J/E (4).

E = Input signal violates InH.1 or InL.1

t. = Time range too long. After less than 113 scan pulses steady-state condition has already been reached.

t = Time range too short. Occurs if after automatic doubling of the scan time no steady-state condition has been reached after 51.2 minutes or 14.4 h or if with fixed scan time no steady-state condition has been reached after the scan time has elapsed.

A = Amplitude of resulting system deviation too small (< 7.5 %)

F = Curve form error of step response. Occurs with inadmissible system characteristic or when readjusting setpoint and/or manipulated variable during parameter setting operation.

J = Wrong conroller characteristic

d = Strongly spreading results of several test runs

■ Acknowledge error message with key (1).

---

[1] For further information see Technical Information 30/61-292 XA

[2] For further information see Technical Information 30/61-290 XA

Alarm values

Four alarm values per channel are configured but only some are routed to outputs (see Appendix, from page 27).

G1n Maximum alarm value for channel n monitoring of X

G2n Minimum alarm value for channel n monitoring of X

G3n Maximum alarm value for channel n monitoring of e

G4n Minimum alarm value for channel n monitoring of e

■ After selection of the alarm values in the top display line (name) and bottom display line (value) the values are modified with ▲ or ▼.

Inhibiting auxiliary routines

If the serial interface is not needed, connection S 1 can be used to inhibit auxiliary routines.

Access to auxiliary routines is inhibited by jumpering connection S1 with reference conductor connection (⊥).

If the serial interface is needed, it is possible to alternatively activate a software barrier; see Operating Manual 42/61-29 EN.

Operating Control

Manual operation, automatic operation

After bumpless transfer to "manual" "y" is automatically displayed.

■ Y can be adjusted with ◀ (7) or ▶ (8).

Continuous controller

– Slow change by **tapping** keys ◀ or ▶.

– Quicker change by **holding** keys ◀ or ▶.

– Rapid movement to 0 or 100 % by **holding** keys ◀ or ▶ **and** tapping H/A key **additionally.**

Step controller

The actuating time only depends on the actuating time of the motor. The switching status of the outputs is shown in the display (10).[1)]

y-is displayed only if a position feedback signal is provided

On/off controller Z1 and Z2

In manual operation the on/off controller generates a pulse train whose average value in time is displayed as y.

The switching status of the outputs is shown in the display (10)[1)].

– **Slow change** by **tapping** keys ◀ or ▶.

– **Quicker change** by **holding** keys ◀ or ▶.

– **Rapid movement to 0 or 100 %** by **holding** keys ◀ or ▶ and **pressing H/A key additionally.**

Multichannel controller

Operation is similar to that of the single-channel controller.

An additional channel display is available in the multichannel instruments.

Cascade controller

The **J/E key** has two possible positions:

J = cascade is open. Slave controller runs with local set point

E = cascade is closed.

Channel 2 is always the **slave controller,**
channel 1 is the **master controller.**
The mode selector switch (H/A key) affects only the slave controller.

– Actuation of **H/A key** effects changeover to the slave controller and changeover of its operating mode.

– Changeover J → E and H → A is bumpless.

Override controller (limit controller)

Channel 2 is always the **master controller,**
channel 1 is the **limit controller.**
The mode selector switch (H/A key) affects only the master controller.

– Actuation of **H/A key** effects changeover to the master controller and changeover of its operating mode.

Changeover to H → A is bumpless.

[1)] All readings shown on the analog display (10) are indicated on the fold-out page at the end of this document.

Setpoint changeover

If an input for the external set point is fitted, changeover can be effected between the internal and external set point with the J/E key.

In program controllers the program set point acts as external set point.

- Changeover **E → J:** The last external set point is the new internal set point. Changeover is bumpless.
- Changeover **J → E:** Having selected the variable "d", the difference between the internal and external set point can be read.
  If there is a difference the active set point approaches the set point at 6 %/s of the external set point.

■ If the J/E key is activated "W" is always displayed.

■ In position "J" and "w" in the display (11), the set point can be set with keys ▼ or ▲.

Programmer and program controller

The programmer and program controller are integrated in the firmware and can be called like all other functions variants. Please consult Operating Manual 42/61-29- EN for more information.

Setting the programs

The programs are divided into 7 sections whose checkpoints can be set in the **extended** display loop (Fig. A9).

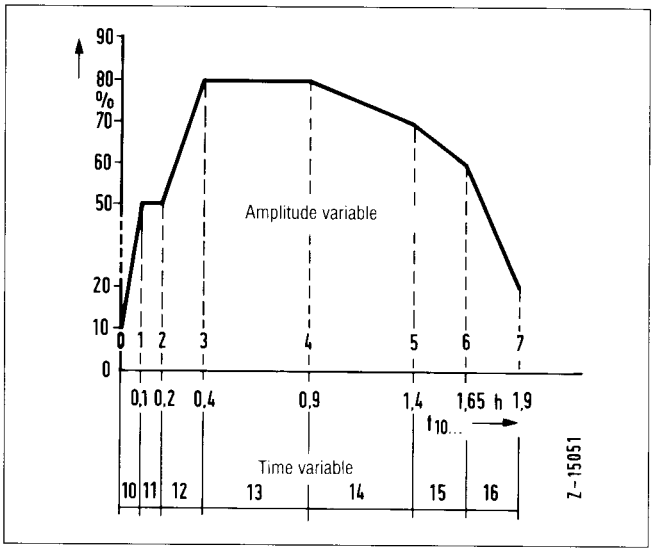


Fig. 12 Example of a program (delivery status)

Check-point no.	Amplitude (set points)		%	Time ranges	
	Variable	Value		Variable	Value
0	00(25)				
1	01(26)			10(35)	
2	02(27)			11(36)	
3	03(28)			12(37)	
4	04(29)			13(38)	
5	05(30)			14(39)	
6	06(31)			15(40)	
7	07(32)			16(41)	

Table 5 Variable names and setting values
For channel 2 variable names in parentheses

The amplitude values are entered as physical variables (user range).

The time range between two checkpoints is set. The position of the decimal point gives the time scale.

■ The decimal point is adjusted by holding the display changeover switch (1) and tapping ▼.

xxx.x 0...199.9 minutes
xx.xx 0...19.99 hours
x.xxx 0...1.999 x 1000 hours
xxxx 0...1999 seconds

Displays in the small loop

(see Figure A9 on the folding page at the end of this Manual)

Programmer

Display (5)	Display (9)	Function
w-program	Channel display	Only for multichannel instruments
w-program	w active	Program set point, active set point
n	1...7	No. of the current section
tn	Value	Time which has elapsed in the current section (4)

w = set point in the user range
n = current section
tn = % of the time which has elapsed in the current section

Program controller

In the **Program controller** these variables are also illustrated in the small display loop of the control channel.

Display (5)	Display (9)	Function
Value for x	Channel display	1st channel = controller 2nd channel = programmer
Value for x	Value for w	Control variable and active set point
Value for x	Value for e	Control variable and control deviation
Value for x	Value for y	Control variable and output variable
d.	Value	Set point difference ($W_{program} - W_{int}$)
G1.	Value	Alarm value x max.
G2.	Value	Alarm value x min.
G3.	Value	Alarm value control deviation max.
G4.	Value	Alarm value control deviation min.
n	1....7	No. of the current section
tn	Value 0...100%	Time which has elapsed in the current section (%)

Operation as a programmer

Operating modes

■ The operating modes are set with H/A key or I/E key.

Stop. The program run stops. The set point remains constant at the last value reached.

Program runs.

Rapid forward at 16 s per section.

Internal set point is set with ▲ or ▼ manually on the instrument.

Program set point.

Manual operation of the programmer

The display "H" lights up.

■ **Reset** Jump to the program start by **simultaneously** pressing **◀ and ▶**.

■ **Forwards** Skip parts of the program with ▶.
Actuate H/A key additionally to jump to the next checkpoint.

■ **Backwards** Repeat a part of the program with ◀.
Actuate H/A key additionally to jump to the preceding checkpoint.

■ **Start** Switch to "HA" with H/A key.

Remote control of the programmer

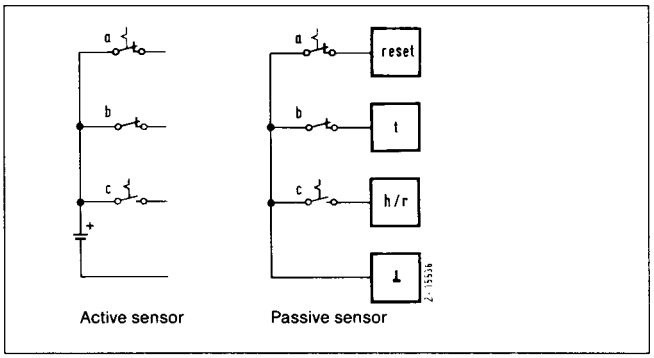


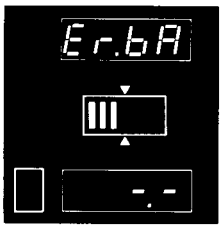
Fig. 13 Remote control of the programmer

a Open contact effects reset and slops program flow.
b Open contact effects rapid forward if the program is not stopped ("H").
c Cyclic changeover between program run and stop by virtue of pulses > 200 ms.

Servicing

Messages from the self-monitoring

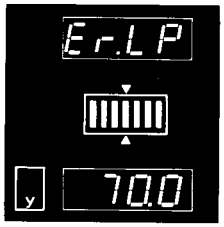
Battery monitoring



In the presence of too little battery voltage the message "Er.bA" is displayed within 4 seconds for 2 s. The unit continues functioning.

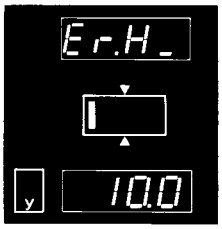
If the battery is not replaced a battery failure is likely before long.

Monitoring the power supply



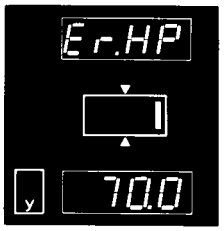
If the unit is being supplied with a voltage below the permissible level, processing is stopped. The message "Er.LP" appears in the display.

Hardware monitoring



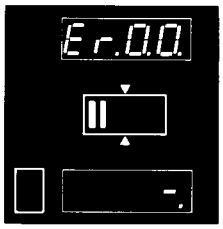
If a serious fault occurs in the digital processing the unit signals "Er.H_. It must be repaired.

Auxiliary processor



Auxiliary processor faults are signalled by the message "Er.HP".

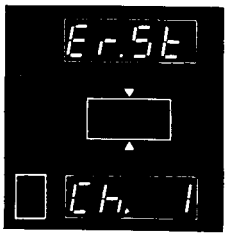
Software monitoring



If the controller detects faulty processing on several occasions it initially attempts to restart the program through a reset. If this is not possible reinitialization is executed, i.e. the configuration last saved in the EPROM is loaded. The controller signals "Er.00" and goes to manual mode.

- This message is acknowledged with key (1).

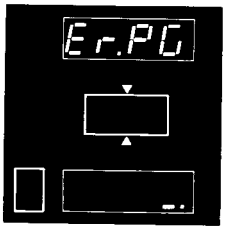
Self-parameter setting



The message "Er.St" shows that the self-parameter setting has been unsuccessfully aborted.

- Acknowledge this message with key (1).

Programmer



With correct configurations the message "Er.PG" appears only after loading and can be eliminated by a reset.

- This message is acknowledged with key (1).

Maintenance

Apart from replacing a used battery, the unit requires no maintenance. Relays are subjected to wear, depending on the switching frequency and load.

⚠ Caution

Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective ground 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.

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 unfavorable conditions for a long time;
- the apparatus has been subjected to adverse transport conditions.

Appendix
Technical Data

(excerpt from Data Sheet 61–4.11 EN)

Input

1...4 plug-in modules for

Thermocouples and mV
Reference junction can be switched off, break monitoring

Resistance thermometers
Two or four-wire circuit

Standard signal
0/4...20 mA or 0/2...10 V

Binary signals
Two per module up to 10 Hz;
0/24 V DC or floating contact

Measuring range and sensor type
Set at the factory by software. Easy to change subsequently

Permissible common-mode voltage
$\leq \pm 5$ V between two signal inputs and against ground

Measurement deviations
0.15 % of the basic measuring range,
0.05 % of the measured value
± 1 digit

Non-linearity
with temperature sensor input 1 °C,
Increased non-linearity with type S below 300 °C
and type B below 900 °C

Resolution
12 bit (4096 LSB)

Input signal connections

Fixed value/cascade	$e = x - w$
Multicomponents	$e = x1 + (x2 \pm x2) - w$
Ratio	$e = x1 - V \cdot x2$

All inputs can be weighted.

Output

Analog
0/4...20 mA to 0...500 Ω
or 0/2...10 V to 10 kΩ

Binary
Optoelectronic coupler electrically isolated for 35 V max., 50 mA.
Two outputs analog and/or binary are located on each plug-in module

Relay output
Max. 4 relays with spark quenching element for activation of contactors, max. 250 V; 0.5 A; $\cos \varphi \geqq 0.7$,
or electric motors max. 250 V; 0.5 A, $\cos \varphi \geqq 0.9$
max. 100 VA

Control functions

Single to four-channel
See Appendix for combinations possible

PID action
Self-parameter definition can be switched off
Proportional range 0...1850 %
Integral action time 1 s to 2000 h
Derivative action time 1 s to 2000 h
Derivative gain 4 or 1
Cycle time approx. 30...50 ms
Inverse action characteristic; direct action characteristic can be configured

On/off controller Z1
1 control switch point
Switching frequency 6/min. at 50 % duty cycle

Three-position controller Z2 (dual on/off controller)
Two control switch points
Dynamic dead zone 0 % (0.1 to 20 % can be set)

Step controller D
For electrical servodrives
Dead zone 1 % (0.1 to 10 % can be set)
Switching hysteresis 1/4 of the dead zone
Position feedback signal current 0/4...20 mA or potentiometer 100...1000 Ω, supplied with 20 mA via analog output

Continuous controller K
Number of channels: 1, 2 or 4 channels
Reverse action characteristics; direct action configurable
Control action 4 x PID; P, PD, PI are configurable

Programmer P
Seven sections, time per section 1 s to 2000 h
Analog signal: 0...199.9 % or in physical units
Switch signal: one binary signal per section can be set
Operating modes:
J: manually adjustable set point
E: Program set point
H: Stop
HA: Program running
Test: test run at 8 s per section

Manual control unit

Digital displays
Top for controlled variable, fault messages;
Bottom for set point, control deviation, output variable, parameter.
Display in % or in physical unit

Analog displays
7 LEDs for control deviation, output variable or switching state display
Format 72 mm x 144 mm:
23 LEDs for control deviation and 16 LEDs for output variable

Keys
▼ or ▲ adjustment of set point and parameter.
◄ or ► raise/lower for manual operation.
Changeover manual/automatic as well as internal/external set point.
Display changeover switch

Alarm value generation

4 alarm values per channel are configured
Alarm value 1 and 2: x – signalling
Alarm value 3 and 4: e (x_w) – signalling
Switching hysteresis 1 %

Output
Binary output depending on the unit complement

Interfaces

1. Rear RS-485 for max. 32 subscribers
   Line length up to 1200 m
2. Front configuration interface
   TTL level. One subscriber

Telegram format
Acc. to DIN V 19 245 (PROFIBUS)

Power supply

220 V AC (187...253 V), 47...63 Hz, approx. 12 VA
115 V AC (93.5...140 V), 47...63 Hz, approx. 12 VA
24 V AC/DC (20...27 V AC, 18...30 V DC), approx. 7 W/12 VA
Separate fuse protection

General and safety data

Climatic capabilities
To DIN 40 040 KWE
Ambient temperature 0...+50 °C
Transportation and storage temperature −25...+65 °C
Relative atmospheric humidity ≦ 75 % annual average, short-term 95 %, occasional and slight condensation permissible

Mechanical capabilities
Acc. to DIN IEC 68 part 2-27,
Impact 30 g/11 ms
Vibration in operation 2 g/5...150 Hz

Electromagnetic compatibility
Tested to IEC 801/DIN VDE 0843
Increased immunity to interference for designs 96 mm x 96 mm and 72 mm x 144 mm: at least standard acc. to NAMUR

Electrical safety
Tested to DIN VDE 0411
Class of protection I
For designs 48 mm x 96 mm, 96 mm x 96 mm, 72 mm x 144 mm

Insulation group I to DIN VDE 0110

Degree of protection
Front IP 50, rear IP 40, connections IP 00,
with design 96 mm x 96 mm, front panel degree of protection IP 54
Screw terminals IP 20, female tab connectors with bush IP 20.
19″ plug-in card. acc. to installation

Controller with safety certification

Digitric P with safety certification according to
* Data Sheet VdTÜV 100/1 water level controller
* DIN 3440 Temperature controller
* Regulations and type testing of the Germanische Lloyd (GL)

are marked (case/rating plate). Additional special conditions apply to them and have to be observed.

Connection, case and mounting

Electrical connections:
Mains or interface connection: tab connectors A 6.3 x 0.8 acc. to DIN 46 244
Other connections: tab connectors A 6.3 x 0.8 or A 2.8 x 0.8 or MTP 2.4 x 0.8
or as accessory: screw terminal up to 1.5 mm^2

Modeö 19″ plug-in card
Plug connector D or F
with blade contact acc. to type of construction C

Weight
0.65...0.9 kg design 96 mm x 96 mm
0.5 kg design 48 mm x 96 mm
1.25 kg design 72 mm x 144 mm
0.3 kg 19″ units, 0.2 kg 19″ output extension

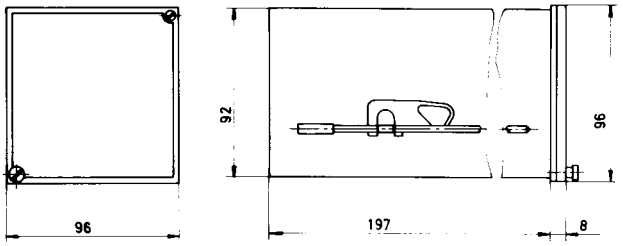
Any installation position

Dimensions
see Dimensional drawing (Fig. A1)

Packing instructions

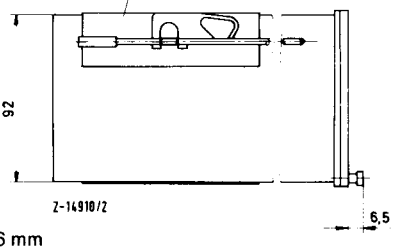
If the original packing is no longer available, the unit must be wrapped in an insulating air foil or corrugated board and packed in a sufficiently large crate lined with shock absorbing material (foamed material or similar) for the transportation. The amount of cushioning must be adapted to the weight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

For overseas shipment the unit must additionally be sealed air-tight in 0.2 mm thick polyethylene together with a dessicant (e. g. silica gel). The quantity of the dessicant 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.

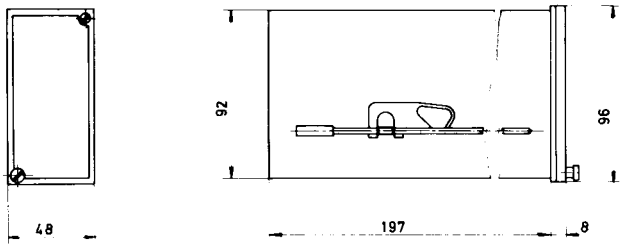


Panel cutout
A 96 x 96 DIN 43 700
$92^{+0.8}$ mm x $92^{+0.8}$ mm

Fastener for horizontal
high-density arrangement of units

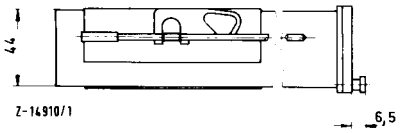


Panel cutout 96 mm x 96 mm

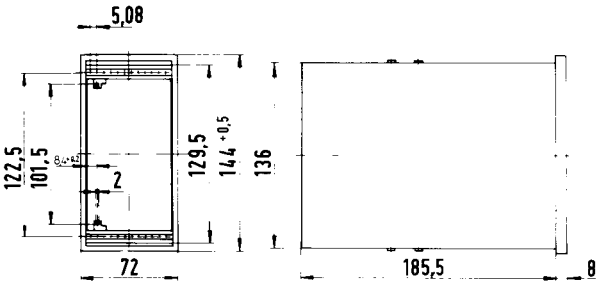


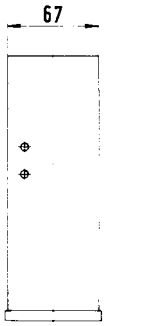
Panel cutout
A 48 x 96 DIN 43 700
$45^{+0.6}$ mm x $92^{+0.8}$ mm

Fastener for horizontal
high-density arrangement of units



Panel cutout 48 mm x 96 mm



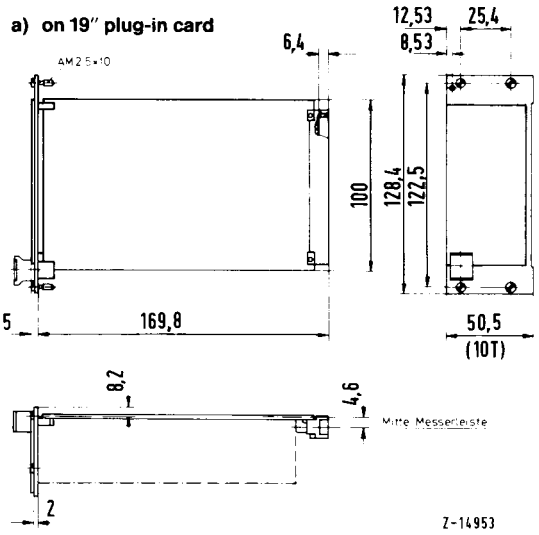


Z-14952

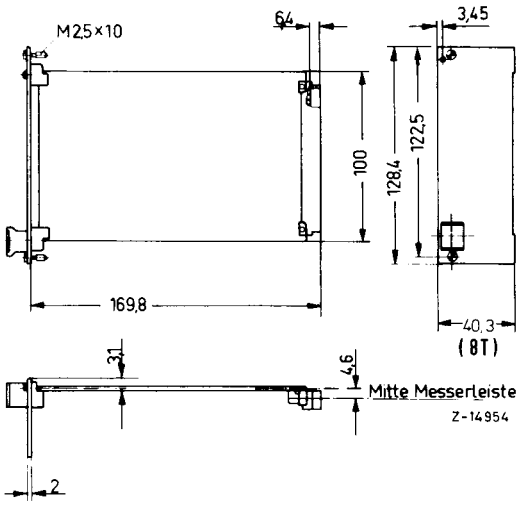
Panel cutout
A 72 x 144 DIN 43 700
$68^{+0.7}$ mm x $138^{+1.0}$ mm

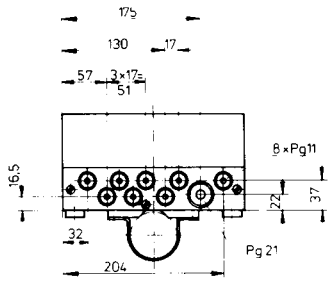
Panel instrument 72 mm x 144 mm
(Cat. No. 61415-0-...)
or panel-mounting case
72 mm x 144 mm for accommodating
at 19" plug-in card

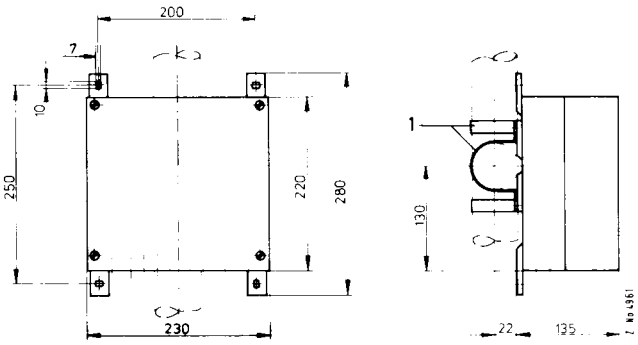
a) on 19" plug-in card



b) on 19" output extension plug-in card







Digitric P in field housing IP 54

Fig. A1 Dimensional drawings (dimensions in mm)

Order matrix

(Summary from Data Sheet 61–4.10 EN)

Catalog number

Design 96 mm x 96 mm	6 1 4 1 1 - 0 -
Design 48 mm x 96 mm	6 1 4 1 1 - 0 -
Design 72 mm x 144 mm	6 1 4 1 5 - 0 -
Design	6 1 4 1 6 - 0 -

Power supply

	96 mm x 96 mm	48 mm x 96 mm	72 mm x 144 mm	19″
220 V AC	**4**	**1**	**1**	**7**
115 V AC	**5**	**2**	**2**	**8**
24 V UC	**6**	**3**	**3**	**9**

Input 1 (E1)

–3...+23 mV	**1**
–3...+60 mV	**2**
–150.0...+200.0 °C Pt 100	**3**
+100.0...+450.0 °C Pt 100	**4**
–200.0...+800.0 °C Pt 100	**5**
Current 0/4...20 mA	**6**
Voltage 0/2...10 V	**7**
2 binary inputs	**8**
not occupied	**9**

Input 2 (E2)

Input 1: Pt 100, 4-wire circuit (indicate Suppl. no. F25)	**0**
otherwise classification figure (1 to 8) as input 1	**x**
not occupied	**9**

Input 3 (E3)

Classification figure (1 to 8) as input 1	**x**
not occupied	**9**

Input 4 (E4)

Input 3: Pt 100, 4-wire circuit (indicate Suppl. no. H25)	**0**
otherwise classification figure (1 to 8) as input 1	**x**
not occupied	**9**

Outputs A1 and A2

2 current outputs 0/4...20 mA	**2**
2 binary outputs	**4**
1 current output and 1 binary output	**5**
not occupied	**9**

Output extension

Design	96 mm x 96 mm	48 mm x 96 mm	72 mm x 144 mm	19″
without	**0**	**0**	**0**	**0**
Outputs A3 and A4				
2 current outputs 0/4...20	**7**	–	**7**	**7**
2 binary outputs	**8**	–	**8**	**8**
1 current output and 1 binary output	**9**	–	**9**	**9**
Relay outputs				
AR1 1 relay output	**1**	–	**1**	**1**
AR1 / AR2 2 relay outputs	**2**	–	**2**	**2**
AR1 / AR4 4 relay outputs	**3**	–	**3**	**3**
AR1 / AR2 2 relay outputs for direct motor control	**4**	–	**4**	**4**
AR1 / AR2 + AR3 / AR4 4 relay outputs for double direct motor control	**5**	–	**5**	**5**
AR1 / AR2 + AR3 / AR4 4 relay outputs for direct motor control and 2 alarm signals	**6**	–	**6**	**6**

Catalog no. 6 1 4 1 _ - 0 - _

The catalog number is completed by the Suppl. number for the type of controller (see table function versions, types of controller/ types of programmer), the measuring range(s) and eventually the output signal range.

Execution of inputs

Suppl. No.

All thermocouple / mV-inputs same H14
Preferred measuring ranges see table ..... .11
External reference junction see table ..... .18

Measuring circuit rupture monitoring, reaction inverse x < w .15
Measuring circuit rupture monitoring not effective ..... .16

Digital display range set ..... .51

for input 1 ..... E
for input 2 ..... F
for input 3 ..... G
for input 4 ..... H

Type L (Fe-CuNi) DIN 43 710
0...400 °C (22.16 mV) L30
0...900 °C (53.14 mV) L36
Type J (Fe-CuNi) DIN IEC 584
0... 400 °C (21.846 mV) J30
0...1000 °C (57.942 mV) J30
Type K (NiCr-Ni) DIN IEC 584
0...500 °C (20.64 mV) K32
0...1400 °C (55.816 mV) K40
Type S (Pt10RH-Pt) DIN IEC 584
0...1800 °C (19.036 mV) S42
Type B (Pt13RH-Pt) DIN IEC 584
0...1800 °C (13.585 mV) B42
Type D (W3RE-W25RE) DIN IEC 584
0...2000 °C (35.751 mV) D45
Current, voltage
4...20 mA 601
2...10 V 500
mV, linear
0...20 mV 531
0...50 mV 571

External reference junction
0 °C V00
50 °C V50
60 °C V60
All mA / V inputs similar H34
Preferred measuring range see table ..... .31
Digital display range set ..... .51

Input 1 ..... E
Input 2 ..... F
Input 3 ..... G
Input 4 ..... H

with one channel instruments
3-wire circuit F26
4-wire circuit F28

with two channel instruments
1st channel
3-wire circuit F26
4-wire circuit F28
2nd channel
3-wire circuit F26
4-wire circuit F28

Resistance thermometer connection
via Ex barrier approx. 230 Ω ..... .27

Digital display range set ..... .51

Input 1 ..... E
Input 2 ..... F
Input 3 ..... G
Input 4 ..... H

Binary input E 1P + E 1N inverse (for passive sensor) E41
Binary input E 2P + E 2N inverse (for passive sensor) F41
Binary input E 3P + E 3N inverse (for passive sensor) G41
Binary input E 4P + E 4N inverse (for passive sensor) H41

Execution of outputs

Suppl. No.

Analog output 4...20 mA (instead of 0...20 mA) ..... .61
All analog outputs 4...20 mA H64
Characteristic raising ..... .65

Output 1 ..... E
Output 2 ..... F
Output 3 ..... G
Output 4 ..... H

All characteristics raising H66
Analog output 0...10 V ..... .62
Analog output 2...10 V ..... .63

Output 1 ..... E
Output 2 ..... F
Output 3 ..... G
Output 4 ..... H

with transmitter supply on output A2 ..... F71
with transmitter supply on output A4 ..... H71

Particularities

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Temperature controller to DIN 3440 301
With screw terminal
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Terminal set 30 pces 303
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Inscription on front panel
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2nd line 307
Increased electromagnetic compatibility; 2a) 310
Front panel colour black, frame pebble grey RAL 7032 315
Inscription on front panel
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Character height 4.5 mm 316
Character height 2.5 mm 317
Bottom; for scale factor
one-line, character height 8 mm 319
Different time base ≦ ± 0.5 ‰ 331
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up to 20 lines 682
up to 50 lines 683
up to 100 lines 684
as from 101 lines 685
Special configuration from position 686
from an earlier job 687
customer-specific configuration 688
With certificate from the Germanische Lloyd 731
Hardware equipment different from standard function 761
Operating Manual
German Z2D
English Z2E
French Z2F
Spanish Z2S

For not mentionned Suppl. Nos. see Data Sheet 61-4.11 EN, part 1 and 2.

[1] Surface-mounting case IP 54
[2] Process interface, 19" plug-in card

Function versions

Legend of function designations used

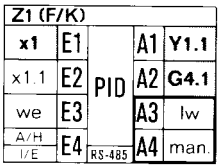
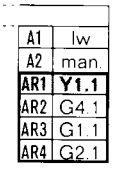
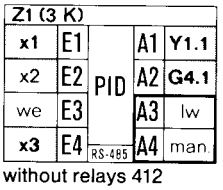
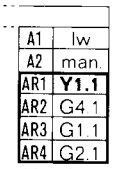
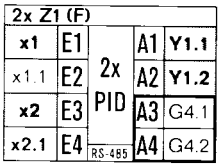
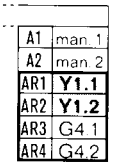
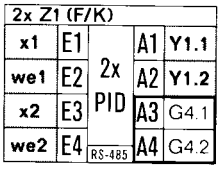
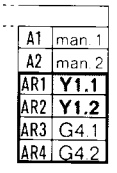
Inputs

E1...4	Analog or binary inputs general
x1...4	Analog input for controlled and controlled auxiliary variables, process interface
x1.1, 2.1	Additional input for resistance thermometer, three and four-wire circuit
we	Analog input for external reference variable, 0(4)...20 mA, we1 = 1st channel, we2 = 2nd channel
ys	Analog input for position feedback signal 0(4)...20 mA
H/A; I/E; c/o	Binary input for changeover H/A; I/E; c/o resp.
	Binary input for internal/external changeover of reference variables we and w, cyclic
	Binary input for cascade changeover, c = closed, o = open, cyclic
t; reset; h/r	Binary input for programmer
D01...04	Binary input process interface

Outputs

A1...4	Analog or binary outputs, general
AR1...4	Relay outputs, general
Y1...4	Controller outputs, on/off controller or continuous controller or programmer; 1st to 4th channel
Y1.x, 2.x	Controller outputs, on/off controller, channel x
Yx (+), (–)	Controller outputs, step action controller, channel x
G1.x...4.x	Alarm signal outputs, channel x G1.1 = 1st switch point G2.1 = 2nd switch point, etc.
Ik	Constant current output 20 mA for supply of resistance position indicator
Iw	Analog output 0(4)...20 mA or 0(2)...10 V of the active set point w, we
P1.1...4.1	Binary outputs, relay outputs of programmer
man. (= Hand), stop	Binary or relay output for feedback signal of "manual" mode, or stop resp.
MB1...4	Binary outputs, process interface
RS1...4	Relay outputs, process interface

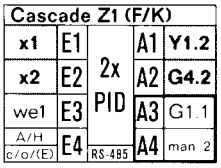
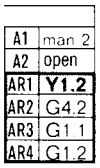
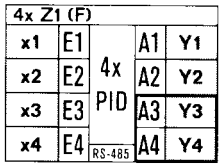
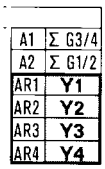
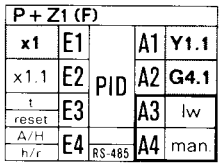
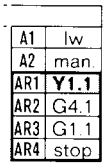
On/off controller Z1, 1 control output

Suppl. No.	Channel No.	Description	Function block [1]
411 511	1	**Fixed value** Internal or external set point e = x1 – w W = wi or we	 without relays 411  with relays 511
412 512	1	**Multicomponents** Internal or external set point e = x1 – w + x2 – x3 w = wi or we	 without relays 412  with relays 512
414 514	2	**Fixed value** Internal set point e1 = x1 – w1; e2 = x2 – w2 Channel 1: Outputs Y1.1 and G4.1 Channel 2: Outputs Y1.2 and G4.2	 without relays 414  with relays 514
415 515	2	**Fixed value** Internal or external set point e1 = x1 – w1; e2 = x2 – w2 w = wi or we Channel 1: Outputs Y1.1 and G4.1 Channel 2: Outputs Y1.2 and G4.2	 without relays 415  with relays 515

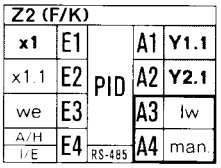
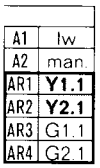
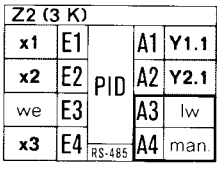
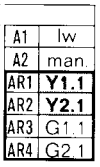
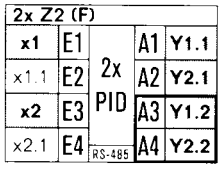
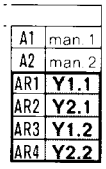
[1] See tables 1.2 and 1.3 for terminal designations

minimum number of components located on the output extension (not possible for format 48 mm x 96 mm)

On/off controller Z1, 1 control output (continuation)

Suppl. No.	Channel No.	Description	Function block [1]
416 516	2	**Cascade** Interconnected Master controller e1 = x1 – w; w = w1 or we1 Slave controller e2 = x2 – w; w = w2 or y1	 without relays 415  with relays 516
421 521	4	**Fixed value** Internal set point ei = xi – wi Channel 1: Output Y1.1 Channel 2: Output Y2.1 Channel 3: Output Y3.1 Collective message e: ΣG1 Collective message x: ΣG2	 without relays 421  with relays 521
422 522	2	**Programmer** e = x1 – w w = wi or program	 without relays 422  with relays 522

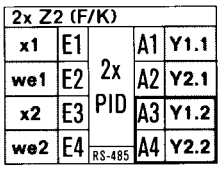
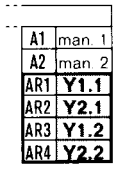
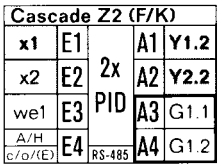
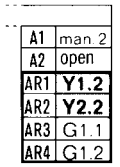
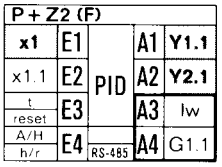
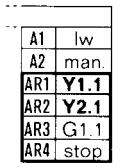
On/off controller Z2, 2 control outputs

Suppl. No.	Channel No.	Description	Function block [1]
431 531	1	**Fixed value** Internal or external set point e = x1 – w w = w1 or we Output Y1.1 heat Output Y2.1 cool	 without relays 431  with relays 531
432 532	1	**Multicomponents** e = x1 + (x2 – x3) – w x1, x2 and x3 can be weighted w = wi or we	 without relays 432  with relays 532
434 534	2	**Fixed value** Internal set point e1 = x1 – w1 e2 = x2 – w2 Y1.1 heat 1st channel Y2.1 cool 1st channel Y1.1 heat 2nd channel Y2.1 cool 2nd channel	 without relays 434  with relays 534

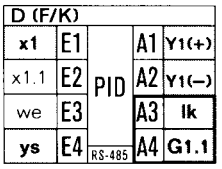
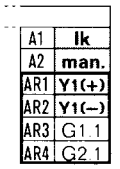
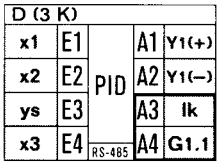
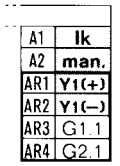
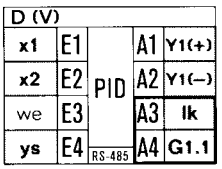
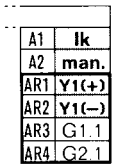
[1] See tables 1.2 and 1.3 for terminal designations

minimum number of components located on the output extension (not possible for format 48 mm x 96 mm)

On/off controller Z2, 2 control outputs (continuation)

Suppl. No.	Channel No.	Description	Function block [1]
435 535	2	**Fixed value** internal or external set point e1 = x1 – w1 e2 = x2 – w2 w1 = wi1 or we1 w2 = wi2 or we2 Output Y1.1, Y2.1, 1st channel Output Y1.2, Y2.2, 2nd channel Heat Y1.1, Y1.2 Cool Y2.1, Y2.2	 without relays 435  with relays 535
436 536	2	**Cascade interconnected** 1 Master controller e1 = x1 – w1 1 Slave controller (2nd channel) e2 = x2 – w2 Output Y1.2 heat Output Y2.2 cool Output G1.1 1st channel Output G1.2 2nd channel we1 = we 1st channel w1 = wil or we1 w2 = wi2 or y1	 without relays 436  with relays 536
442 542	2	**Program controller** **Programmer with** **on/off controller Z2** **Fixed value** Output Y1.1 heat Output Y2.2 cool e = x1 – w w = wi or program	 without relays 442  with relays 542

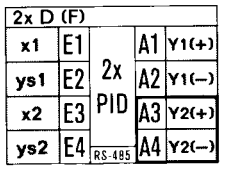
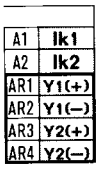
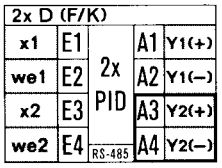
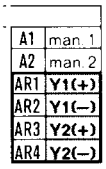
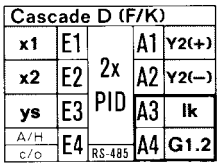
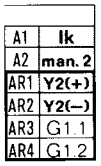
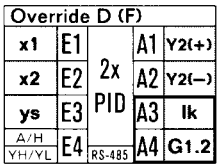
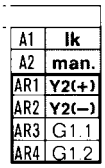
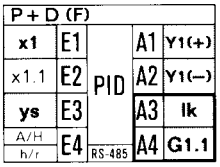
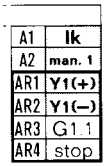
Step controller

Suppl. No.	Channel No.	Description	Function block [1]
451 551	1	**Fixed value** Internal or external set point e = x1 – w w = wi or we	 without relays 451  with relays 551
452 552	1	**Multicomponents** Internal or external set point e = x1 + (x2 – x3) – w x1, x2 and x3 can be weighted w = wi	 without relays 452  with relays 552
453 553	1	**Ratio** Internal or external ratio set point e = x1 – V · x2 x1 and x2 can be weighted V = Vi or Ve (we)	 without relays 453  with relays 553

[1] See tables 1.2 and 1.3 for terminal designations

minimum number of components located on the output extension (not possible for format 48 mm x 96 mm)

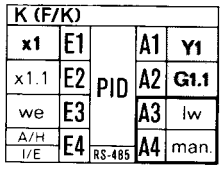
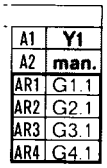
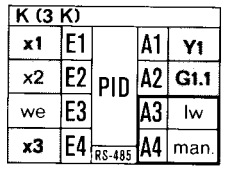
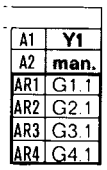
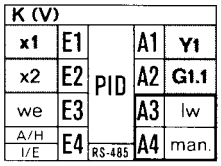
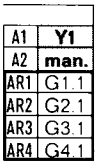
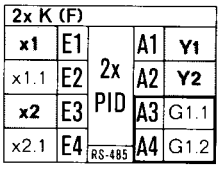
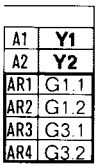
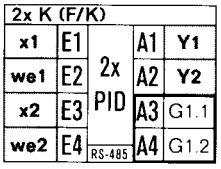
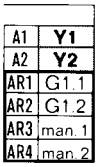
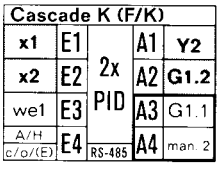
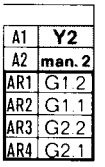
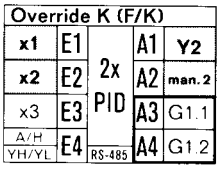
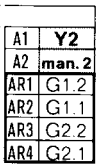
Step controller (continuation)

Suppl. No.	Channel No.	Description	Function block [1]
454 554	2	**Fixed value** internal set point e1 = x1 – w1 e2 = x2 – w2	 without relays 454  with relays 554
455 555	2	**Fixed value** Internal or external set point e1 = x1 – w1 e2 = x2 – w2	 without relays 455  with relays 555
456 556	2	**Cascade** interconnected 1 master controller 1 slave controller (2nd channel) Output G1.1 1st channel Output G1.2 2nd channel e1 = x1 – w1 e2 = x2 – w2 w2 = wi2 or y1	 without relays 456  with relays 556
457 457 458 558	2	**Override** **Min. or max. selection** interconnected Master controller = controller 2 (2nd channel) Override controller = controller 1 Output G1.2 controller 2 Output G1.1 controller 1 e1 = x1 – w1 e2 = x2 – w2	 without relays 457, 458  with relays 557, 558
462 562	2	**Program controller** **Programmer with step controller D** Controller = 1st channel Programmer = 2nd channel e = x1 – w w = $w_{progr.}$ or w1	 without relays 462  with relays 562

[1] See tables 1.2 and 1.3 for terminal designations

▒ minimum number of components ☐ located on the output extension (not possible for format 48 mm x 96 mm)

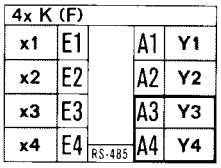
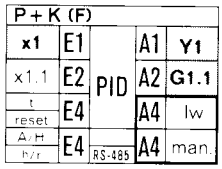
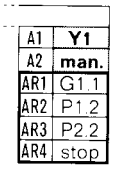
Continuous controller

Suppl. No.	Channel No.	Description	Function block [1]
471 571	1	**Fixed value** internal or external set point e = x1 – we w = wi or we	 without relays 471  with relays 571
472 572	1	**Multicomponents** internal or external set point e = x1 + (x2 – x3) – w x1, x2 and x3 can be weighted w = wi or we	 without relays 472  with relays 572
473 573	1	**Ratio** Internal or external ratio set point Fixed value or fixed value/cascade Xe = x1 – V · x2 x1 and x2 can be weighted V = Vi or Ve (we)	 without relays 473  with relays 573
474 574	2	**Fixed value** Internal set point e1 = x1 – w1 e2 = x2 – w2	 without relays 474  with relays 574
475 575	2	**Fixed value/cascade** Internal or external set point e1 = x1 – w1 e2 = x2 – w2 w1 = wi1 or we1 w2 = wi2 or we2	 without relays 475  with relays 575
476 576	2	**Fixed value/cascade** interconnected 1 master controller 1 slave controller (2nd channel) Output G1.1, G2,1 1st channel Output G1.2, G2.2 2nd channel e1 = x1 – w1 e2 = x2 – w2 w1 = wi1 or we1 w2 = wi2 or y1	 without relays 476  with relays 576
477 478 577 578	2	**Override** **Min. or max. selection** interconnected Master controller = controller 2 (2nd channel) Override controller = controller 1 Output G1.1, G2,1 1st channel Output G1.2, G2.2 2nd channel e1 = x1 – w1 e2 = x2 – w2	 without relays 477, 478  with relays 577, 578

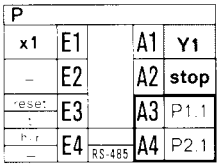
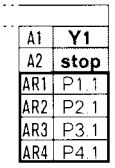
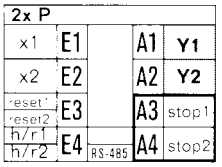
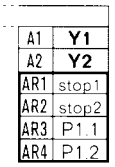
[1] See tables 1.2 and 1.3 for terminal designations

☐ minimum number of components ☐ located on the output extension (not possible for format 48 mm x 96 mm)

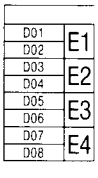
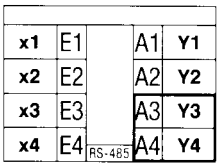
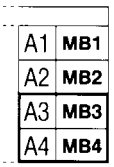
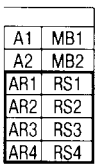
Continuous controller (continuation)

Suppl. No.	Channel No.	Description	Function block [1]
481	4	**Fixed value** e1 = x1 - w1 e2 = x2 - w2 e3 = x3 - w3 e4 = x4 - w4	 without relays 491
482 582	2	**Program controller** **Programmer** **with continuous controller K** Controller = 1st channel Programmer = 2nd channel e = x1 - w w = wi or program	 without relays 482  with relays 582

Programmer

Suppl. No.	Channel No.	Description	Function block [1]
491 591	1	**Programmer** y1 = w	 without relays 491  with relays 591
482 592	2	**Programmer** y1 = w1 (1st channel) y2 = w2 (2nd channel)	 without relays 492  with relays 592

Process interface Digitric P-19″

Suppl. No.	Channel No.	Description	Function block [1]
485 585	1	Digital transducer for binary and analog process signals for serial communication	  without relays 485  485  with relays 585

minimum number of components located on the output extension (not possible for format 48 mm x 96 mm)

1 See tables 1.2 and 1.3 for terminal designations

Connection diagrams of the step controller

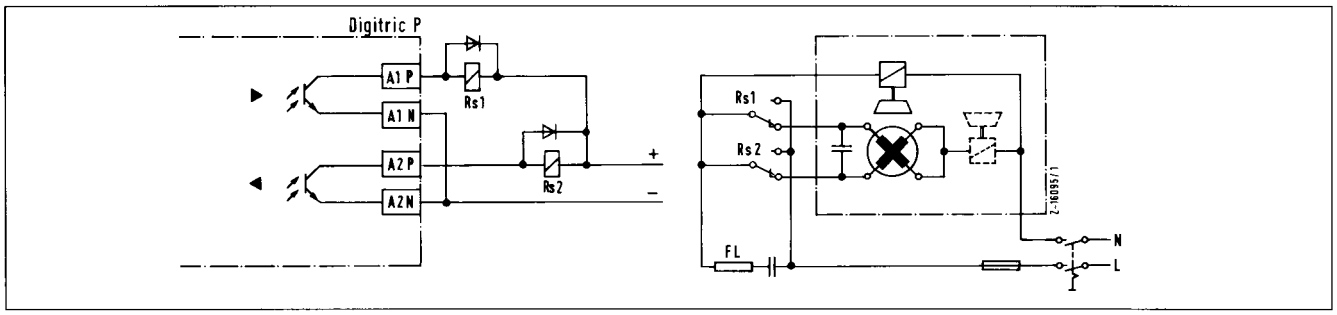


Fig. A2 Step controller with transistor output

Connection of a positioning motor via relay, e. g. RHM 1003 (including diodes)
Catalog No. 86 237 - 0 - 230 4040
FL = Spark quenching element

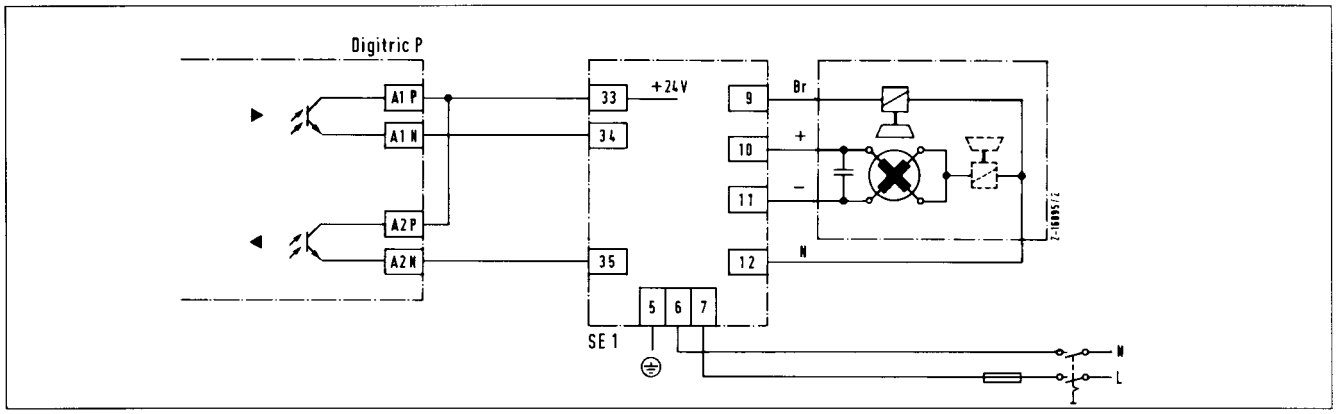


Fig. A3 Step controller with transistor output; connection of a positioning motor via SE1

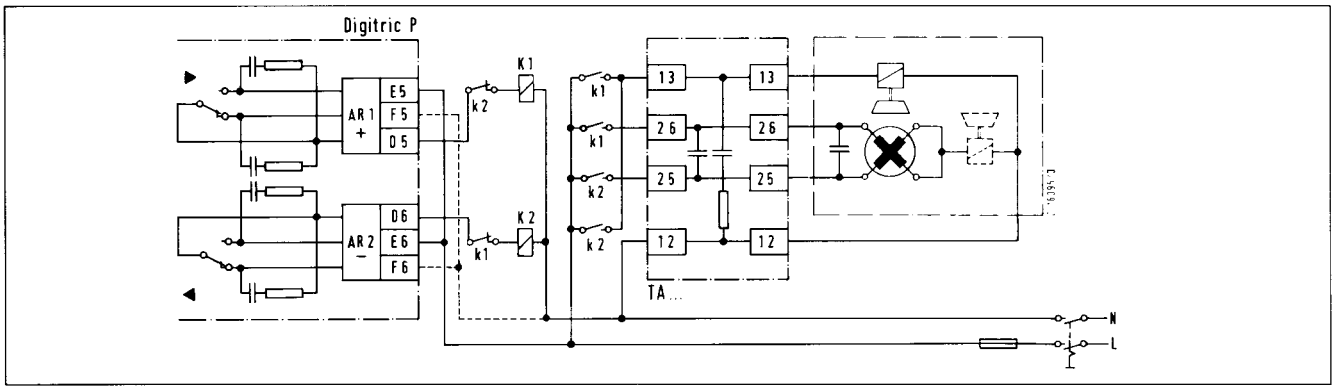


Fig. A4 Step controller with relay output

Interconnection with S&F servodrive RH... - ... (apart from RH 2-60 C and RH 4-60 C)
and capacitor connection unit with T-A via intermediate magnetic contactors

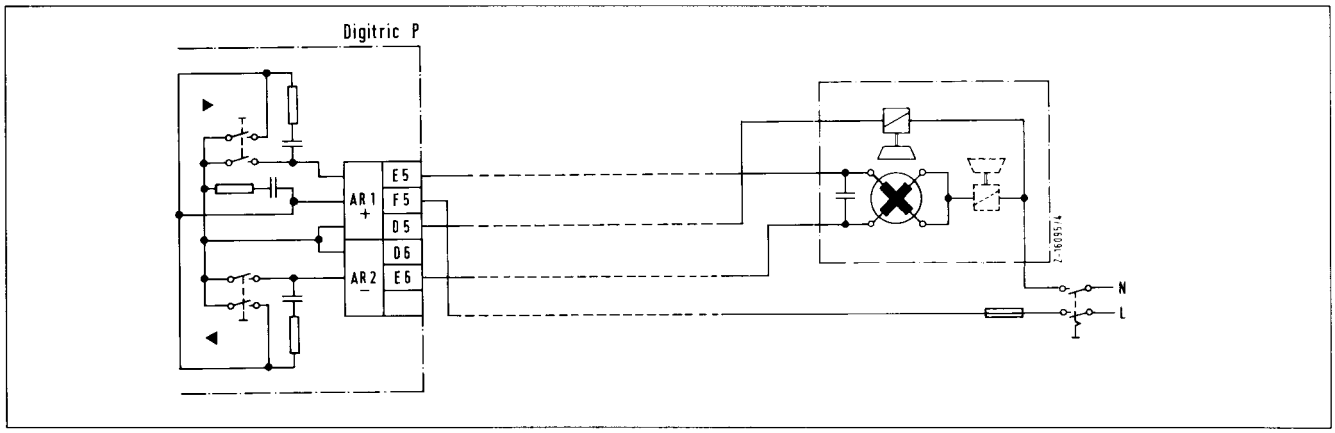
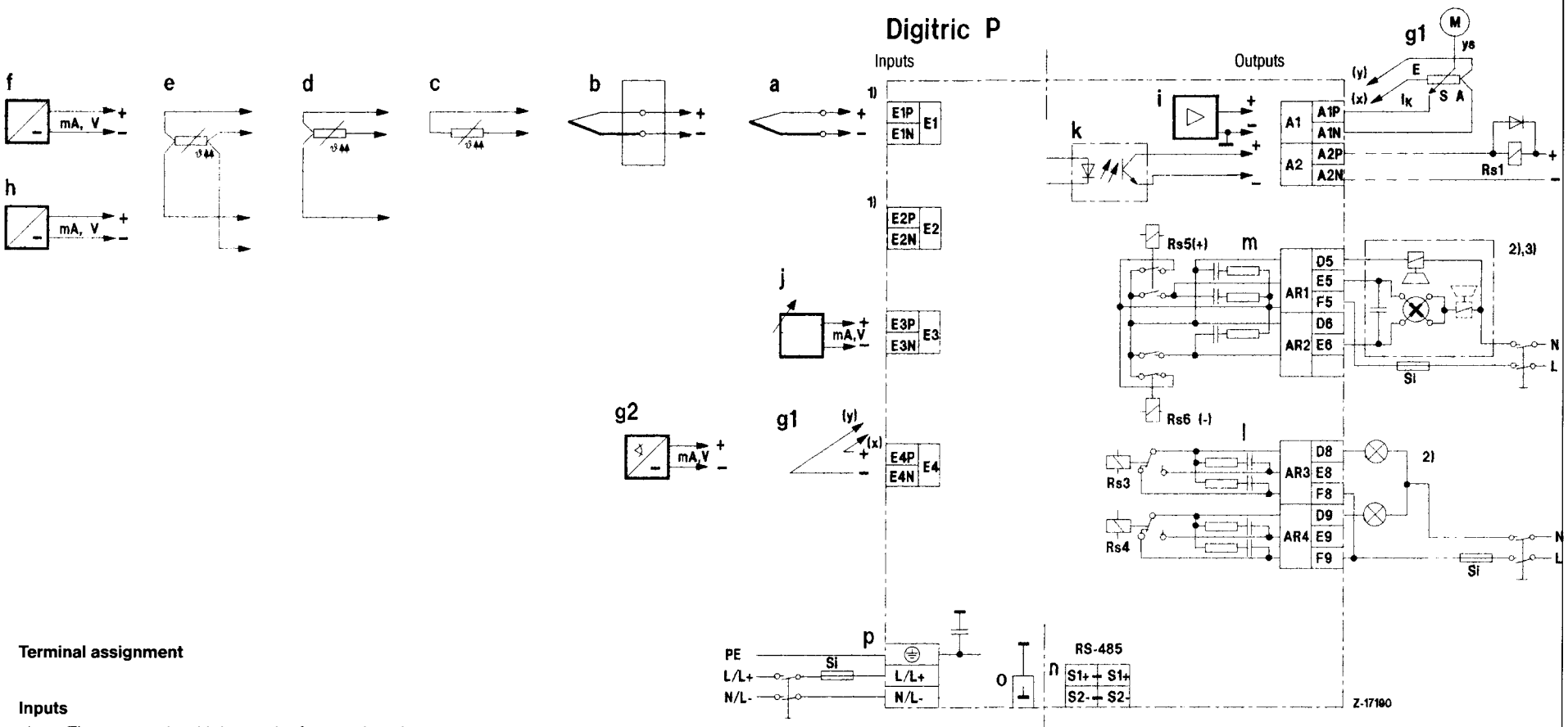


Fig. A5 Step controller with relay output for direct motor activation



Terminal assignment

Inputs

a) Thermocouple with internal reference junction
b) mV or thermocouple with external reference junction
c) Resistance thermometer, 2-wire circuit
d) Resistance thermometer, 3-wire circuit
e) Resistance thermometer, 4-wire circuit
f) Voltage (V) or current (mA)
g1) Position feedback signal (ys), resistance position sensor
Ik = 20 mA constant
g2) Position feedback signal ys, current position sensor
h) Reference variable for ratio controller, current (mA) or voltage (V)
j) External setpoint or programmer, current (mA) or voltage (V)

Outputs

i) Constant current output, Ik = 20 mA, for supply of resistance position sensor
k) Transistor output with optocoupler for operating state MANUAL / AUTOMATIC
l) Relay outputs for alarm signals [2]
m) Relay outputs for step control

General

n) Serial interface RS-485
o) Bonding (⊥)
p) Power supply connection

Terminal assignments correspond to instruments with maximum equipment.

Fig. A6 Step controller with relay outputs acc. to Suppl. No. 551 (fixed value) and Suppl. No. 553 (ratio)

Design Panel instrument, dimension 96 mm x 96 mm, 72 mm x 144 mm

[1] Input assignment acc. to order
[2] Voltage connections must correspond to one and the same voltage source
[3] For indirect motor control use connections acc. to Fig. A4, page 33

Auxiliary routines

Changing the display loop

- Press and hold ◀ **and** ▶ **and** tap the display changeover switch (1).
  "nor" flashes in the top display line.
- Set "diSp" with ▲ (tap 1 time)

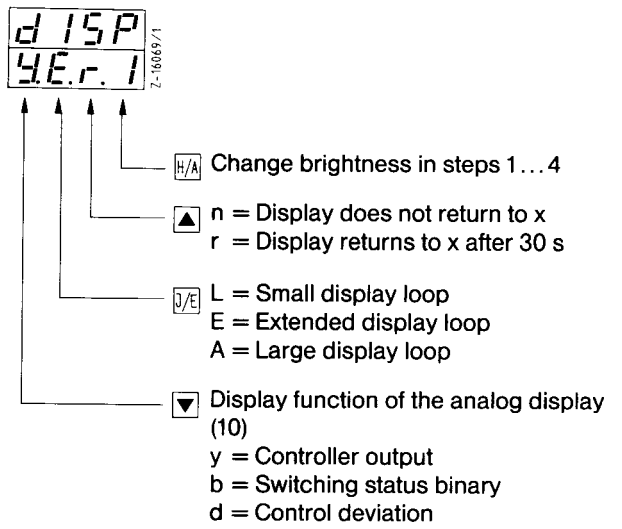


Fig. A7

Return to normal mode

- Press and hold ◀ **and** ▶ **and** tap the display changeover switch (1).
- Press J/E key.
  "nor" flashes for approx. 3 seconds, than changeover to normal mode.

Setting the PID auxiliary routine

- Press and hold ◀ **and** ▶ **and** tap the display changeover switch (1).
  "nor" flashes in the top display line.
- Switch to PID ▲ (2 x)

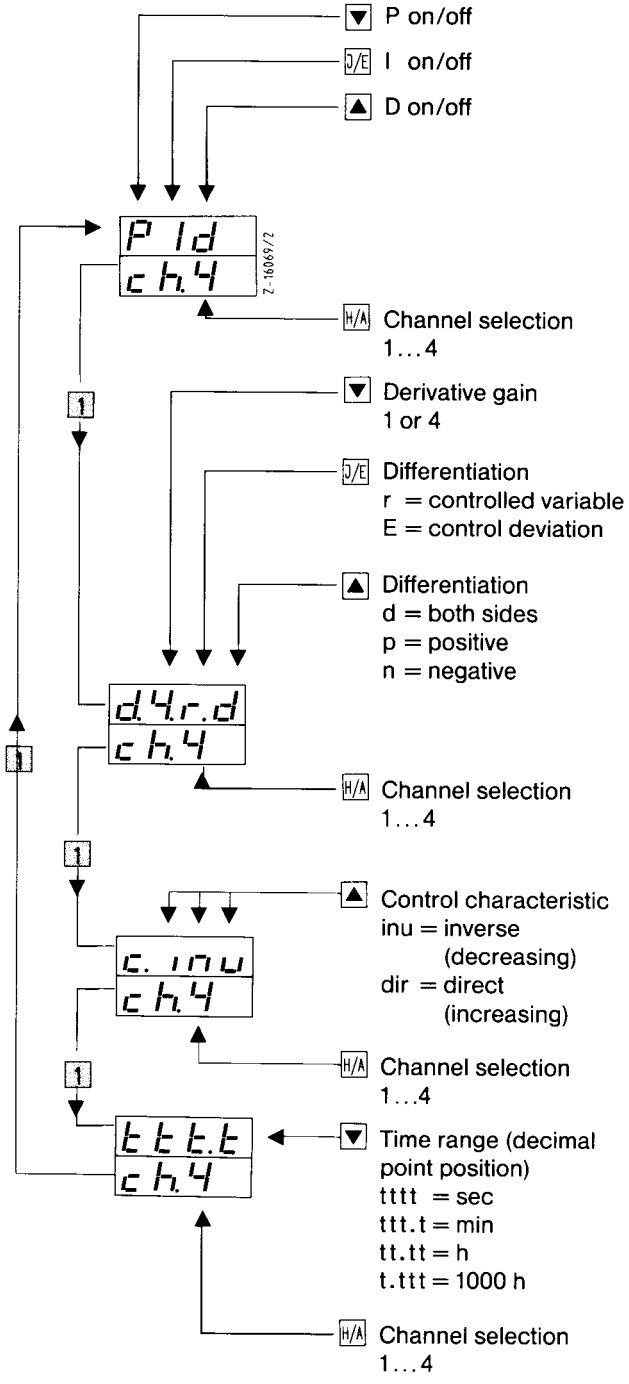


Fig. A8

Return to the normal mode

- Press and hold ◀ **and** ▶ **and** tap the display changeover switch (1).
- Press J/E key.
  "nor" flashes for approx. 3 seconds than changeover to normal mode.

Modification of the ranges

User-range

■ Press and hold ◄ **and** ► **and** tap the display changeover switch (1).
"nor" flashes in the top display line.

■ Set "USr." with ▲ or ▼

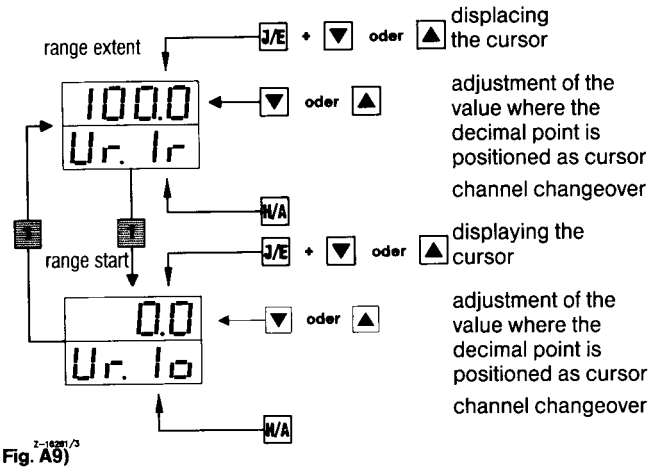


Fig. A9)

Return to normal mode

■ Press and hold ◄ **and** ► **and** tap the display changeover switch (1).

■ Press J / E key.
"nor" flashes for approx. 3 seconds, than changeover to normal mode

Line compensation with Pt100, 2-wire circuit

Only active, if Pt100, 2-wire is entered

■ Press and hold ◄ **and** ► **and** tap the display changeover switch (1).
"nor" flashes in the top display line.
Set "r.LtG" with ▲ or ▼

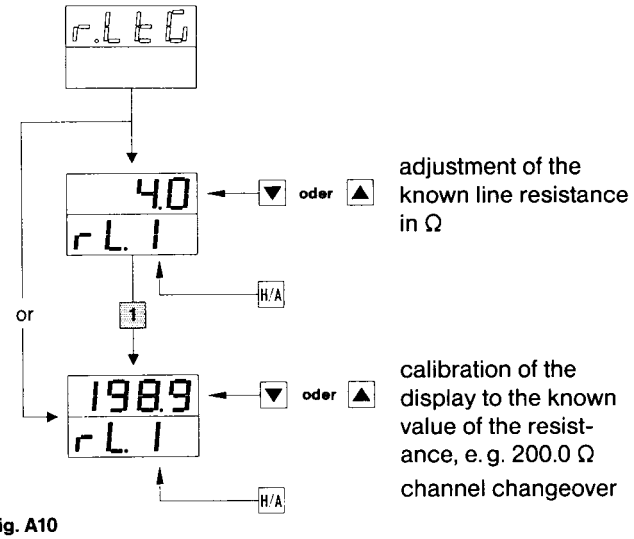


Fig. A10

Return to normal mode

■ Press and hold ◄ **and** ► **and** tap the display changeover switch (1).

■ Press J / E key.
"nor" flashes for approx. 3 seconds, than changeover to normal mode

Index

Displays

Numerical displays

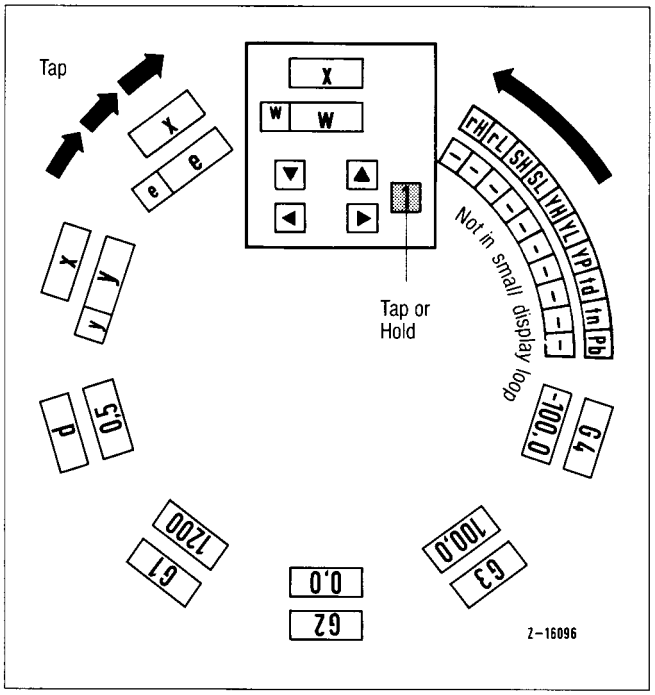


Fig. A8 Controller
Small and extended display loop

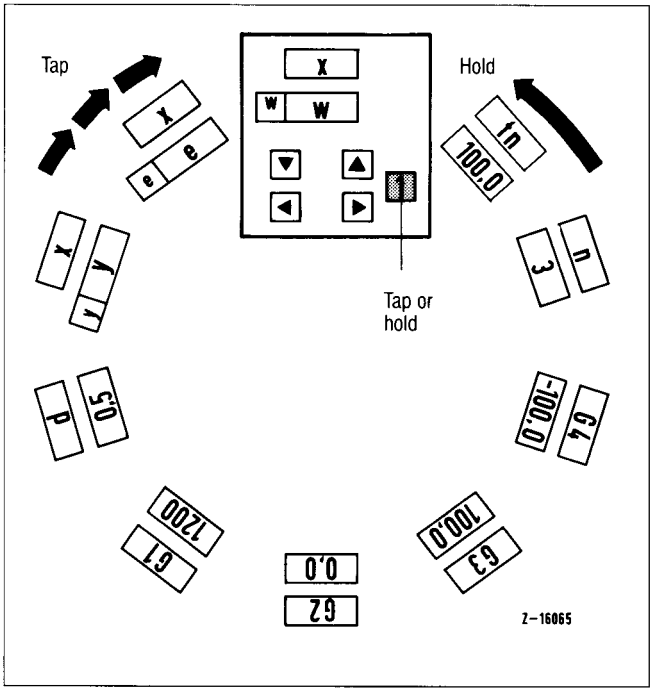


Fig. A9 Programmer, program controller
Small and extended display loop

The main variables **"w", "e"** and **"y"** are shown in the small and in the extended display loop in the **bottom display line** (9) while the controlled variable "x" is visible in the **top display line** (5). In all other cases the name appears in the **top display line** and the value of the selected variable in the **bottom display line.**

- Variables are switched with key 1.
- The set point is selected each time the I/E key is actuated.
- The output variable is selected each time the A/H key is switched to manual (H).

Multiple channel display and channel changeover

Channel 4	3	2	1	Control deviations (coarse indicator)
				e > 0
				e = 0
				e < 0

The channels (control loops) are displayed by means of horizontal luminous symbols. A decimal point appears after the operational channel.

- Select channel display: With display changeover switch (1) and ▲ or after going through the display loop.
- Select operational channel with ▲.

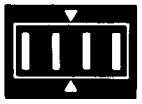
Analog display

When supplied by the manufacturer the analog display (10 or 31) indicates the following information depending on the closed loop control function:

Output variable y in the case of continuous controllers

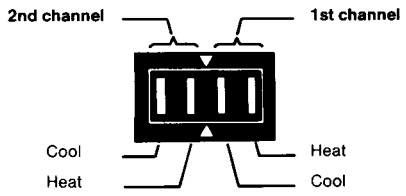
Switching status display

On/off controller Z1:

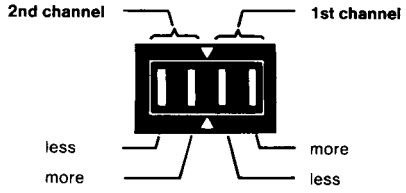


4. 3. 2. 1. channel

On(off controller Z2:



Step controller

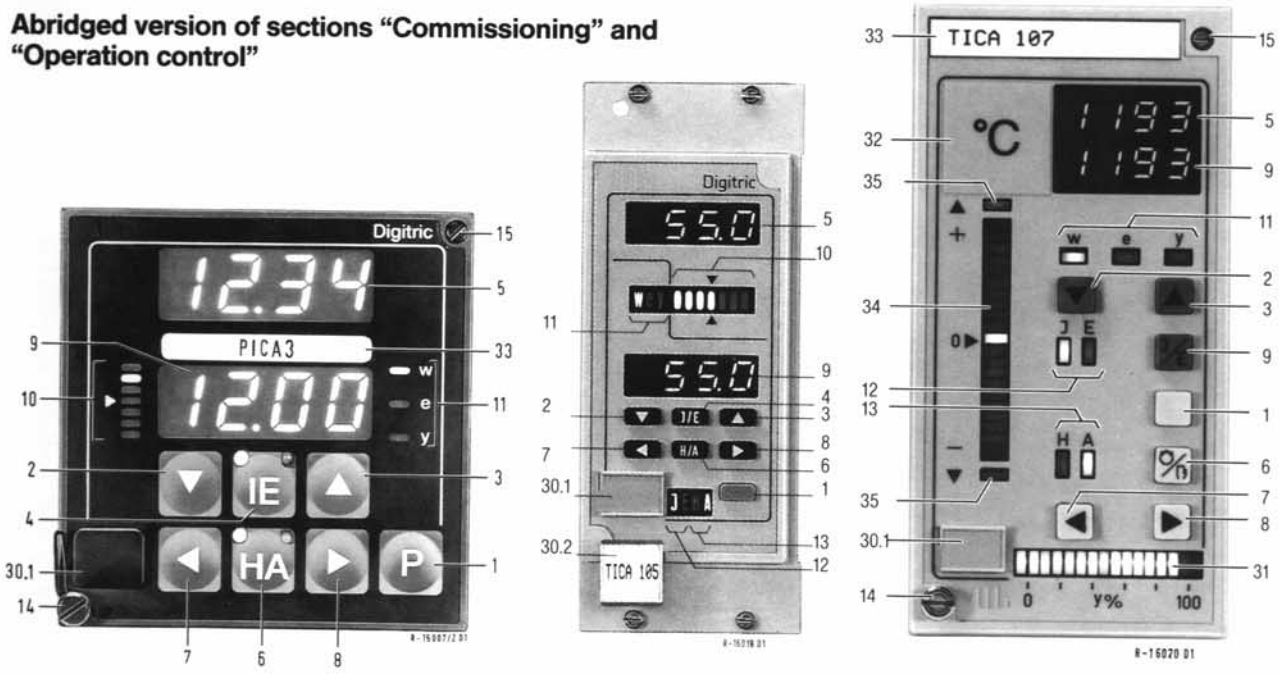


Output variable y in the case of continuous controllers

Disposing of an appropriate configuration, analog display (10) can also be used to show the **control deviation.**

Digitric P, Controller
Displays and manual control elements

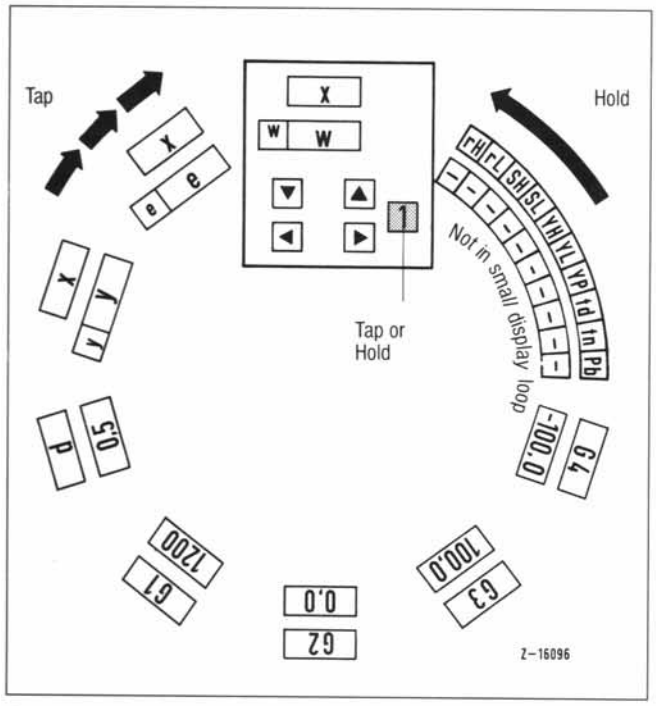
Abridged version of sections "Commissioning" and "Operation control"



1 Display changeover switch
2 Universal setting key "lower"
3 Universal setting key "raise"
4 Set point changeover
5 Top display line
(controlled variable, variable name, fault message)
6 Manual/automatic changeover
7 Manual setting key "lower"
8 Manual setting key "raise"
9 Bottom display line (variable values, channel display)
10 Indicator for control deviation, controller output, switching status
11 Display of the main variables to (9)
12 Status display set point internal/external
13 Status display manual/automatic
14 Closing screw and slide-in unit
15 Additional closing screw
30.1 Cover for configuration jack/designation plate
30.2 Designation plate (only with 19" plug-in card)
31 Output display/switch status
32 Adhesive label for specification of the unit of measurement
33 Inscription field
only with format 72 mm x 144 mm:
34 Control deviation display
35 Light emitting diodes for control deviation for more than ± 10 %

Display and setting possibilities

In the display a number of process variables can be shown and changed with display changeover switch (1).



Small and extended display loop

Setting values

All values, except manipulated variable y, are set with ▲ and ▼ if the name in the top display line (5) and the value of the variable selected in the bottom display line (9) are visible.

Display (5) [1]	Display (9)	Function
Value for x	Channel display	Controlled variable or ratio [1] (Current)
Value for x	Value for w	Controlled variable and set point
Value for x	Value for e	Controlled variable and control deviation
Value for x	Value for y	Controlled variable and output variable
d.	Value	Set point difference ($w_{ext} - w_{int}$)
G1.	Value	Alarm value X max.
G2.	Value	Alarm value X min.
G3.	Value	Alarm value control deviation max.
G4.	Value	Alarm value control deviation min.
r	Value	Secondary variables with ratio
E1	Value	Multicomponents
E2	Value	Reference variable with ratio; multicomponents
E3	Value	Control of output limit Override (YL; YH)
E4	Value	Multicomponents

[1] All displays and setting possibilities are available manifoldly in multichannel instruments.

Operating instructions

Manual operation

After bumpless transfer to "manual" "y" is automatically displayed.

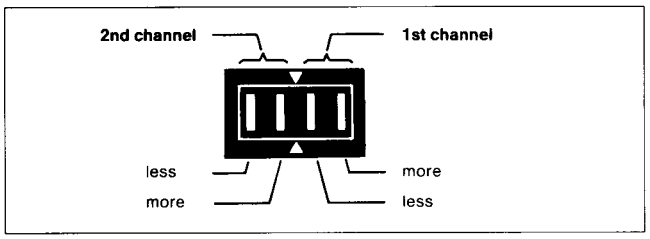
■ y can be adjusted with ◄ or ►.

Continuous controller

■ – Slow change by tapping keys ◄ or ►.
  – Quicker change by holding keys ◄ or ►.
  – Rapid movement to 0 or 100 % by holding keys ◄ or ► and H/A additionally.

Step controller

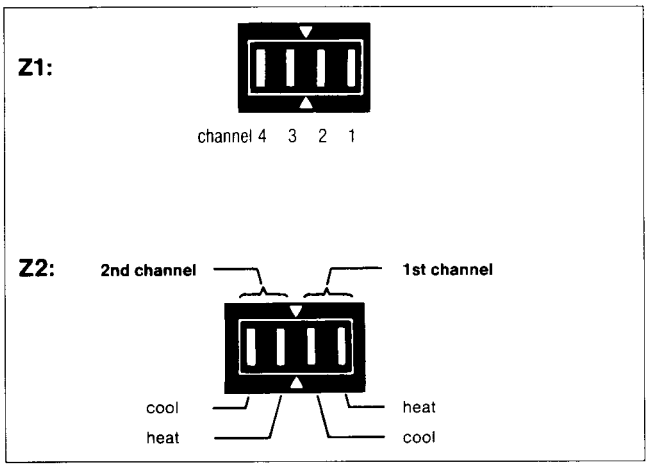
The actuating time depends only on the actuating time of the motor. The switching status of the outputs is displayed.



Switching status display of the step controller

On/off controller

In manual operation the on/off controller generates a pulse train whose average value in time is displayed as y.



Switching status display of the on/off controller

■ – Slow change by tapping keys ◄ or ►.
  – Quicker change by holding keys ◄ or ►.
  – Rapid movement to 0 or 100 % by holding keys ◄ or ► and H/A additionally.

Multichannel controller

Operation is similar to that of the single-channel controller.

An additional channel display is available in the multichannel instruments.

Channel 4	3	2	1	Control deviations (coarse indicator)
	▬			e > 0
▬		▬		e = 0
▬		.	▬	e < 0

The channels (control loops) are displayed by means of horizontal luminous symbols. A decimal point appears after the operational channel.

– Select channel display: With display changeover switch (1) and ▲ or after going through the display loop.
– Select operational channel with ▲.

Cascade controller

The I/E key has two possible positions:

I = cascade is open. Slave controller runs with local set point.

E = cascade is closed.

Channel 2 is always the **slave controller,** channel 1 is the **master controller.**

■ The mode selector switch affects only the slave controller.
  – Actuation of H/A key effects changeover to the slave controller and changeover of its operating mode.
  – Changeover to I/E and H/A is bumpless.

Override controller (limit controller)

Channel 2 is always the **master controller,** channel 1 is the **limit controller.**

■ The mode selector switch H/A affects only the master controller.
  – Actuation of H/A key effects changeover to the master controller and changeover of its operating mode.
  – Changeover to H/A ist bumpless.

Setpoint changeover

If an input for the external set point is fitted, changeover can be effected between the internal and external set point.

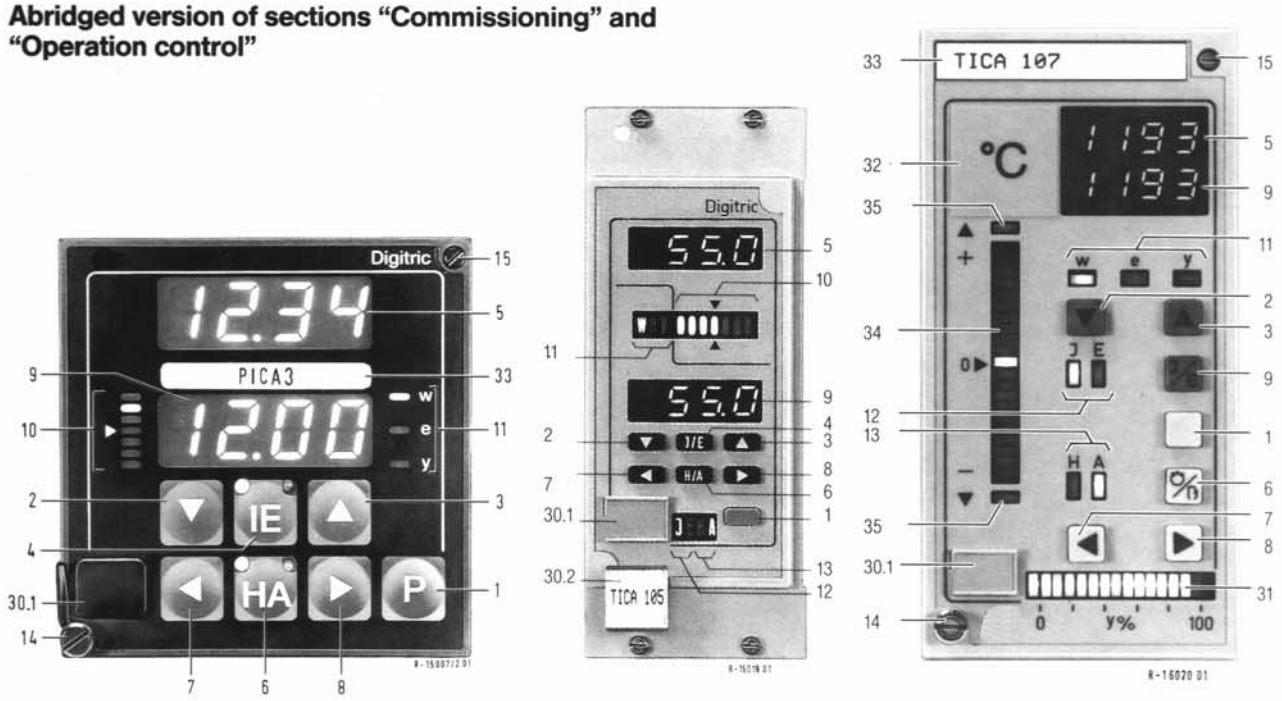
– Changeover **external → internal:** is bumpless.
  The last external set point is the new internal set point.
– Changeover **internal → external:** In the variable "d", the difference between the internal and external set point can be read. If there is a difference while switching over the active set point approaches the external set point with 6 %/s.

■ If the I/E key is activated, "w" is always displayed.
■ In position "I" internal and "w" in the display (11), the set point can be set with keys ▲ or ▼.

Digitric P, Programmer, program controller

Displays and manual control elements

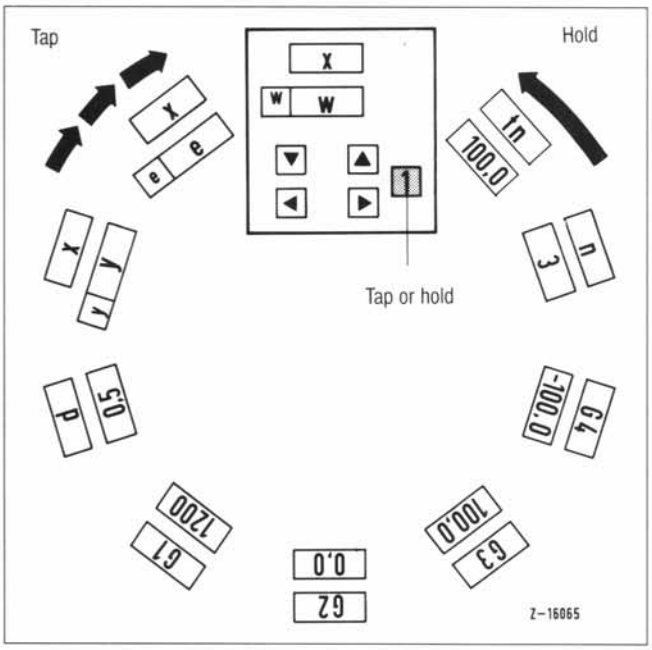
Abridged version of sections "Commissioning" and "Operation control"



1 Display changeover switch
2 Universal setting key "lower"
3 Universal setting key "raise"
4 Set point changeover
5 Top display line (controlled variable, variable name, fault message)
6 Manual/automatic changeover
7 Manual setting key "lower"
8 Manual setting key "raise"
9 Bottom display line (variable values, channel display)
10 Indicator for control deviation, controller output, switching status
11 Display of the main variables to (9)
12 Status display set point internal/external
13 Status display manual/automatic
14 Closing screw and slide-in unit
15 Additional closing screw
30.1 Cover for configuration jack/designation plate
30.2 Designation plate (only with 19" plug-in card)
31 Output display/switch status
32 Adhesive label for specification of the unit of measurement
33 Inscription field
only with format 72 mm x 144 mm:
34 Control deviation display
35 Light emitting diodes for control deviation for more than ± 10 %

Display and setting possibilities

In the display a number of process variables can be shown and changed with display changeover switch (1).



Small and extended display loop

Programmer

Display (5)	Display (9)	Function
w-program	Channel display	Only with multichannel instruments
w-program	w active	Program set point, active set point
n	1...7	No. of section being currently processed
tn	Value	Time which has elapsed in the section currently running (4)

Program controller

Display (5)	Display (9)	Function
Value for x	Channel display	1st channel = controller 2nd channel = programmer
Value for x	Value for w	Controlled variable and active set point
Value for x	Value for w	Controlled variable and control deviation
Value for x	Value for y	Controlled variable and output variable
d.	Value	Set point difference ($W_{program} - W_{int}$)
G1.	Value	Alarm value X max.
G2.	Value	Alarm value X min.
G3.	Value	Alarm value control deviation max.
G4.	Value	Alarm value control deviation min.
n	1....7	No. of section being currently processed
tn	Value 0...100 %	Time which has elapsed in the section currently running (%)

Operating as a programmer

Operating modes

■ The operating modes are set with H/A key or J/E key.

H Stop. The program run stops. The set point remains constant at the last value reached.

HA Program runs.

■ Rapid forward at 16 s per section.

J Internal set point is set with ▲ or ▼ on the instrument.

E Program set point.

Manual operation of the programmer

The display "H" ligts up.

- **Reset** ■ Jump to the program start by **simultaneously** pressing ◀ and ▶.
- **Forwards** ■ Skip parts of the program with ▶. Actuate H/A key additionally to jump to the next checkpoint.
- **Backwards** ■ Repeat program with ◀. Actuate H/A key additionally to jump to the preceding checkpoint,
- **Start** ■ Switch to "HA" with H/A key.

Channel changeover

An additional channel display is available for multichannel instruments.

Channel 4 3 2 1	Control deviations (coarse indicator)
	e > 0
	e = 0
	e < 0

The channels (control loops) are displayed by means of horizontal luminous symbols. A decimal point appears after the operational channel.

■ Select channel display: With display changeover switch (1) and ▲ or after going through the display loop.
■ Select operational channel with ▲.

Operating as a programm controller

Manual operation

After bumpless transfer to "manual" "y" is automatically displayed.

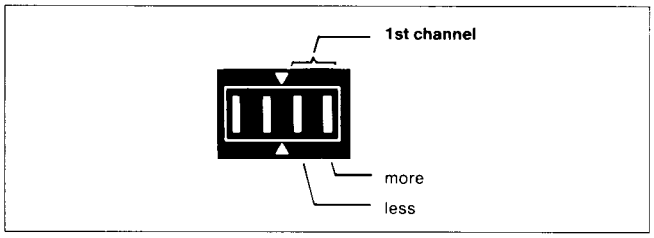
■ y can be adjusted with ◀ or ▶.

Continuous controller

■ – Slow change by tapping keys ◀ or ▶.
– Quicker change by holding keys ◀ or ▶.
– Rapid movement to 0 or 100 % by holding keys ◀ or ▶ and H/A additionally.

Step controller

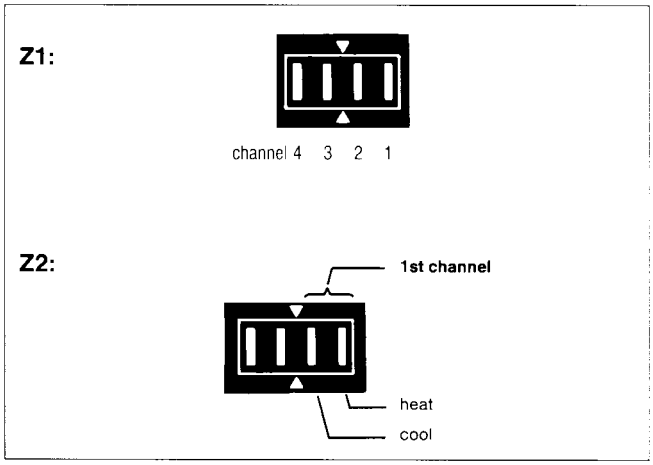
The actuating time only depends on the actuating time of the motor. The switching status of the outputs is displayed.



Switching status display of the step controller

On/off controller

In manual operation the on/off controller generates a pulse train whose average value in time is displayed as y.



Switching status display of the on/off controller

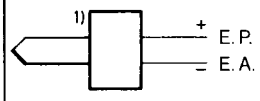
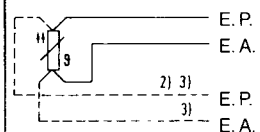
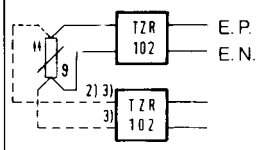
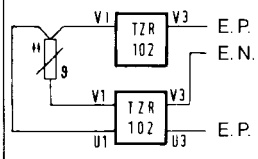
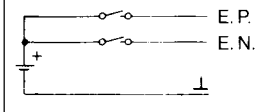
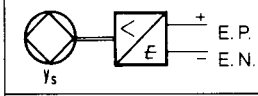
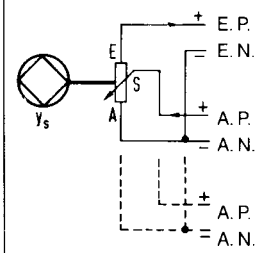
Setpoint changeover

In program controllers the program set point acts as external set point.

- Changeover **E → J:** The last external set point is the new internal set point.
  Changeover is bumpless.
- Changeover **J → E:** Having selected the variable "d", the difference between the internal and external set point can be read.
  If there is a difference while switching over the active set point approaches the external set point with 6 %/s.

■ If the J/E key is activated "w" is always displayed.
■ In position "J" and "w" in the display (11), the set point can be set with keys ▲ or ▼.

Digitric P
Connection diagram for inputs

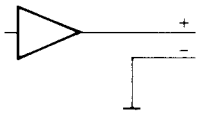
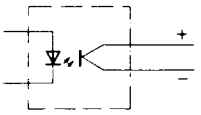
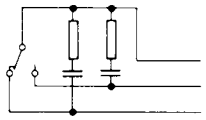
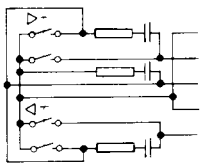
Input circuit	Panel instrument	19″ plug-in card [5][8]	Remarks
	E1 E2 E3 E4 A1/A2 A3/A4 B1/B2 B3/B4	E1 E2 E3 E4 4a/4c 10a/12a 6a/6c 14a/14c	Input for the thermocouple, mV, V und mA [4]
	A1/A2 A3/A4 B1/B2 B3/B4 E2 A3/A4 E4 B3/B4	4a/4c 10a/12a 6a/6c 14a/14c E2 16a/12a E4 14a/14c	Input for resistance thermometer [4] Additional inputs for resistance thermometers in 3- and 4-wire circuit
	A1/A2 A3/A4 B1/B2 E2 A3/A4 E4 B3/B4	4a/4c 6a/6c E2 10a/12a E4 14a/14c	Resistance thermometer with explosion protection barriers TZR [4] Additional inputs for resistance thermometers in 3- and 4-wire circuit
	A1/A2 B1/B2 E2 A3 E4 B3	4a/4c 6a/6c E2 10a E4 14a	Resistance thermometer with explosion protection barrier TZR [4] in 3-wire circuit
	A1/A2 A3/A4 B1/B2 B3/B4 ⊥	4a/4c 10a/12a 6a/6c 14a/14c	Binary inputs (current sinking) [5] Active Sensor Same connections with passive sensors
	A3/A4 B1/B2 B3/B4	10a/12a 6a/6c 14a/14c	Step controller: Position feetback signal Current
	A3/A4 B1/B2 B3/B4 A2 C3/C4 A1[7] A3 C1/C2 G7/F7 A1[7] A3 C1/C2 G7/F7 A2 A2P/A2N A1[7] A3 A1P/A1N D8/E8 A1[7] A3 A1P/A1N D8/E8	10a/12a 6a/6c 14a/14c A2 16a/16c A1[7] A3 8a/8c 18c/18a A1[7] A3 8a/8c 18c/18a Z-16064/1	Step controller Potentiometer For dimensions 72 mm × 144 m

E1 ... E4 = Number of the input
A1 ... B4 = Terminal designation of the panel instrument
2a ... 32c = Designation of the terminal strip

1) Optionally external reference junction
2) 3-wire circuit
3) 4-wire circuit
4) See 42/61-29-. EN for range setting
5) See 42/61-29-. EN for modification possibility
6) For plugs of type F the terminal designations are changed: (a) becomes (z) and (c) becomes (d) e. g. 4a → 4z 4c → 4d
7) With controllers without relay outputs output A3 should be connected instead of A1.
8) Including process interface Digitric P-19″

Note:
Each unit features a **connection diagram** showing its input and output assignments, the functions (binary or analog) of the inputs and outputs and the ranges.

Digitric P
Connection diagram for outputs

Output circuit	Panel instruments	19″-plug-in card [1)2)]	Remarks
	Format 96mm×96mm Format 48mm 96 mm A1 C1 C2 · A2 C3 C4 · A3 F7 · A4 E7 D7 Format A1P A1N · A2P A2N · D8 E8 · D9 E9	Controller: A1 9a 8c · A2 16a 16c 19″-Output extension: A3 18c 18a · A4 16a 16c	Current and voltage output
	Format 96mm×96mm Format 48mm 96 mm A1 C1 C2 · A2 C3 C4 · A3 F7 · A4 E7 D7 Format A1P A1N · A2P A2N · D8 E8 · D9 E9	A1 8a 8c · A2 16a 16c A3 18c 18a · A4 16a 16c	Optoelectronic coupler output
	19″-Output extension AR1 D5 E5 F5 · AR2 D6 E6 F6 · AR3 D8 E8 F8 · AR4 D9 E9 F9	AR1 30c 32c 32a · AR2 26a 26c 28a · AR3 6c 8c 8a · AR4 2c 4a 2a	Relay output Residual current of spark quenching element approx. 15 mA [3)]
	AR1/AR2 D5 E5 F5 D6 E6 · AR3/AR4 D8 E8 F8 D9 E9	AR1/AR2 30c 32c 32a 26a 26c · AR3/AR4 6c 8c 8a 2c 4a	Relay output for direct motor activation Residual current of spark quenching element approx. 30 mA [3)]
Power supply			
PE — L/L+ — N/L− —	⏚ L/L+ N/L−	28a 28c 30c 32c	

A1 to A4 = Outputs 1...4
AR1 to Ar4 = Relay outputs 1...4

C1 to F9 = Terminal designation of the panel instruments
a2...c32 = Designation of the terminal strip

Each unit features a **connection diagram** showing its input and output assignments, the functions (binary or analog) of the inputs and outputs and the ranges.

1) For plugs of type F the terminal designations are changed:
(a) becomes (z) and (c) becomes (d), e.g. 4a → 4z; 4c → 4d

2) Including process interface Digitric P-19″

3) **Note:**
See complementary connection diagrams for step controller on pages 33 and 34

ABB Automation Products GmbH
Höseler Platz 2
D-42579 Heiligenhaus
Phone +49 (0)20 56) 12 - 51 81
Fax +49 (0)20 56) 12 - 50 81
http://www.abb.com

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