Protronic 100/500/550

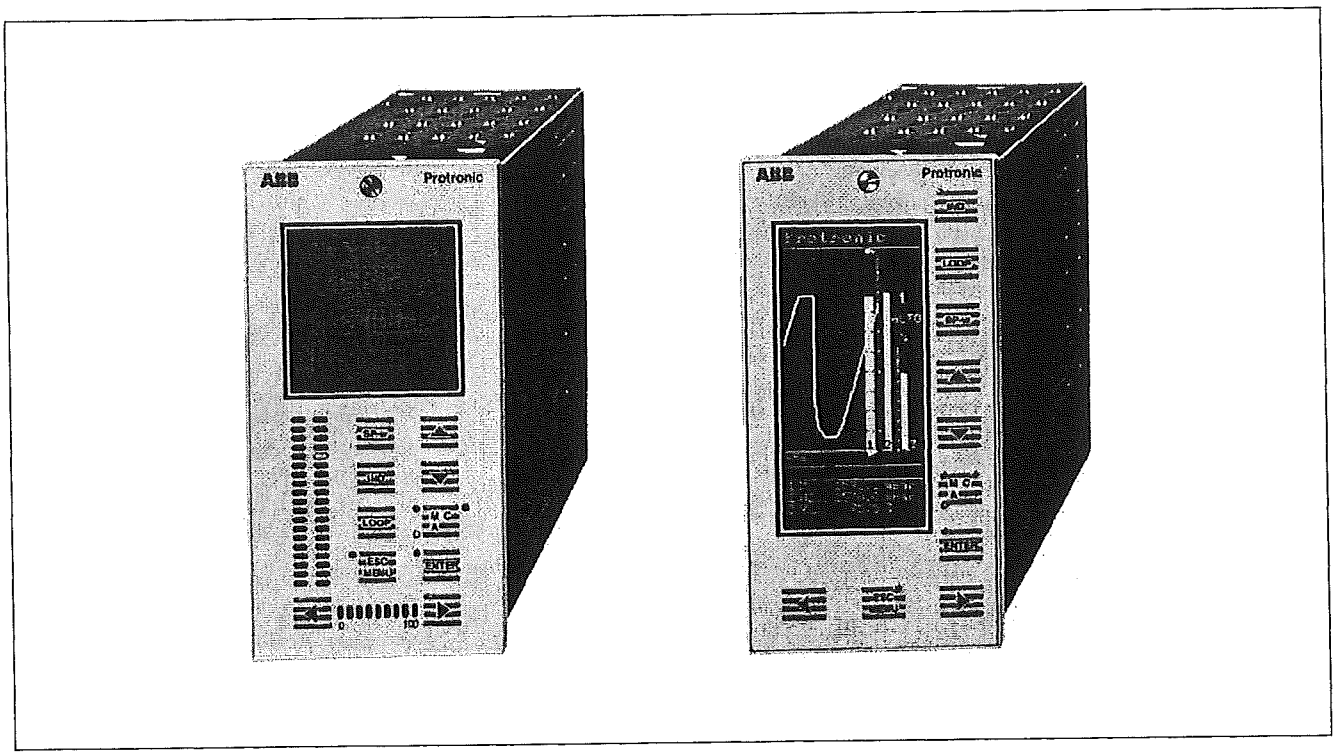
Controllers for
Process engineering

Installation

Manual

42/62-50011 EN

Rev. 04



ABB

Preliminary remarks:

The documentation for the Protronic 100 / 500 / 550 includes the following parts:

Installation Manual Protronic 100 / 500 / 550 ..... **42/62-50011**

Commissioning Manual: Configuration and parameter setting Protronic 100 / 500 / 550 / Digitric 500 ..... 42/62-50012

Operating Manual Protronic 100 / 500 ..... 42/62-50013
respective
Operating Manual Protronic 550 ..... 42/62-55013

Also available on request:

Description of Interfaces (MODBUS) 42/62-50040

Table of contents

Important instructions! Please read and observe!

Correct and safe operation of the Protronic 100/500/550 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 Protronic 100/500/550.

Please take note of
- the contents of this Operating Manual,
- the safety regulations affixed to the Protronic 100/500/ /550 and
- the safety regulations pertaining to the installation and operation of electrical systems.

The directives, norms and guidelines mentioned in this Operation Manual are applicable in the Federal Republic of Germany. When using the Protronic 100/500/550 in other countries, please observe the national regulations prevailing in the respective country.

The Protronic 100/500/550 has been designed and tested in accordance with EN 61 010-1 = IEC 1010-1 = DIN VDE 0411 Part 1 "Protective measures for electrical, logic control and laboratory measuring instruments" and has been supplied in a safe condition. In order to retain this condition and to ensure safe operation, the safety in-structions in this Operating Manual bearing the headline "Caution" must be observed. Otherwise, persons can be endangered and the Protronic 100/500/550 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 A B B Service Department will be delighted to give you more information.

Description and use

The Protronic 100/500/550 process controllers are instruments in the Protronic range which can be used universally. They can be operated as individual instruments under local control as well as with other Protronic controllers in system interconnection with other Protronic controllers, or interconnected to overlayed systems. Protronic 100 and Protronic 500/550 differ in their complementation, Protronic 100/500 differ in respect of their front panels.

Protronic 100/500

This front panel indicates the current measured values and the operating modes qualitatively by LEDs from a long distance. All information is displayed clearly on an LC display for operating purposes.

Protronic 550

Protronic 550 has a graphical front panel. Large volumes of different information can be displayed on a graphics display with 108 x 240 dots. A parallel display of several control channels or the changes with time of measured variables can be selected with keys.

The basic models of Protronic 100/500/550 have...

... a universal input. Thermocouples, Pt100 resistance thermometers, as well as 0/4 to 20 mA standard analog signals, can be connected without changing the hardware of the unit. Linearization is performed in the controller if non-linearizing temperature transmitters are used. The linearization tables for all standard sensors are stored in the unit.

... a mA input, which can be used as disturbance variable or set point input. With step controllers, this input can be used for the position feedback signal.

... a mA output for the positioning signal or other values such as for set point or actual value.

... four binary inputs/outputs. These inputs/outputs can be configured by the user as inputs or outputs, so that they can be used optionally as controller outputs or alarm outputs, as well as inputs for transfers in the controller, such as from manual to automatic.

... a front-panel TTL interface for connecting a parameter-setting and configuring PC. This reduces the setting work during commissioning.

The basic model of Protronic 100 has...

... 1 Module slot for taking up the interface module.

The basic models of Protronic 500/550 have...

... 7 Module slots for expanding the function.

... 1 slot for a MEMORY-Card (front panel).

Front panel

The front panel provides information on the status of the process and makes possible selective intervention into the process action. Luminous pointers on the screen indicate the status of the process from a distance. Numerical displays and clear text information permit precise readout and setting of set point and correction values.

Programmer

Every device includes a configurable programmer to preset a time-dependent set point. The Protronic can save up to 10 programs with 15 sections for each program.

Controller outputs

Z1 2-point PID controller action with or without preliminary contact for strong-weak-off control.

Z2 Controller for heat-off-cool optionally with two switching or one continuous and one switching output.

S Step controller.

K Continuous controller, also optionally split-range output with two continuous positioning signals.

Parameter setting

The parameter-setting level is reached via the <Menu> key after entering a password. At this level it is possible to set parameters such as controller gain Kp or time constants for the existing equipment functions.

Configuration

Configuration can be performed in two ways:

List configuration

The password-protected configuration level is reached via the <Menu> key, and standard functions are selected at this level from a list available in the equipment. Alternatively to using the operator keyboard, it is also possible to make the selection via the **IBIS_*R*** PC program. In this case the setting is particularly simplified if several units are to be set at one time (see Data Sheet 62-6.70 EN). The configuration of a Protronic 100 is acceptable by Protronic 500/550.

Free configuration

(not Protronic 100)

Duly prepared Protronic 500/550 units permit customer-specific configuration, i.e. functions which go beyond the standard functions of the controller.

By adding binary inputs/outputs using the function plan editor (PC program **IBIS_*R*+**, see Data Sheet 62-6.70 EN) it is for example possible to set up an additional logic control in the controller, which intervenes in both the controller and the process.

Installation

Front view

Protronic 100 / 500

Protronic 550

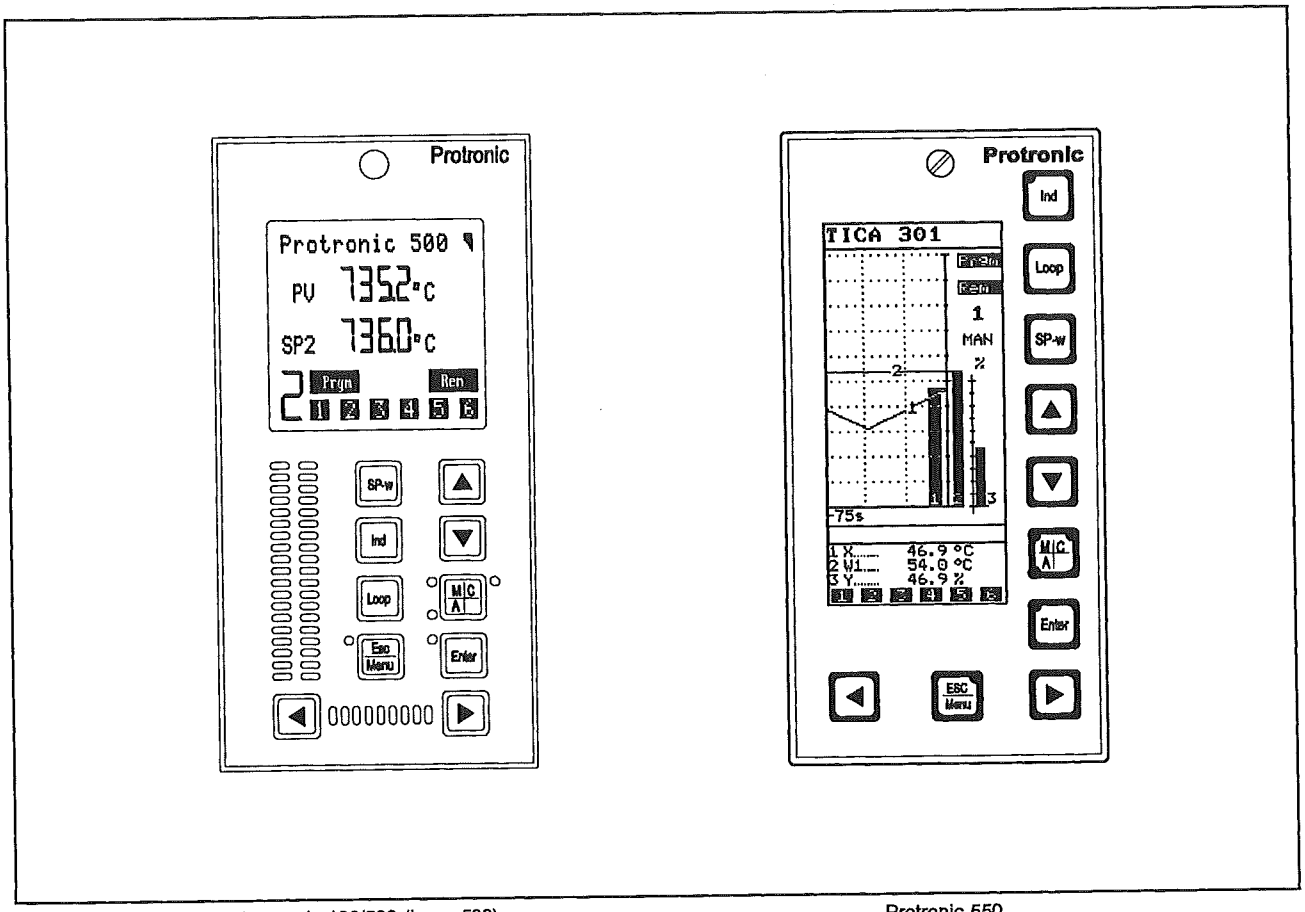


Fig. 1 Protronic 100/500 (here: 500) Protronic 550

Z-19038, Z-19048

1. Identification of the model

The rating plate is used to identify the model. It is located on the side of the case.

2. Installation site

The Protronic 100/500/550 is suitable for front mounting in control rooms, control cabinets and machines.

It must be ensured when selecting the installation site that the limits of climatic and mechanical capability defined in the section "Technical Data" are not exceeded.

⚠ Caution

To maintain protection against shocks, the device may only be operated when fully installed.

3. Mounting

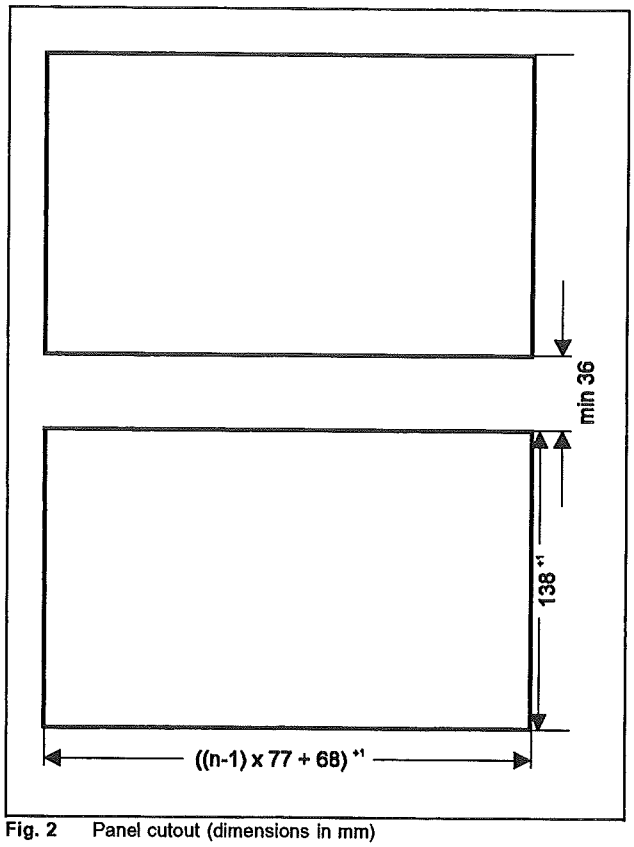


Fig. 2 Panel cutout (dimensions in mm)
Z-19165

1. Panel cutout to DIN 43 700 $68^{+0.7}$mm x 138^{+1}mm.

   With close-packed mounting $((n-1) \times 72 + 68)^{+1} \times 138^{+1}$.

   A space of at least 36 mm top and bottom between the units must also be maintained.

   Note
   The space between the units is required for ventilation and must therefore not be encroached upon by wiring.

2. Slide the unit into the panel cutout from the front

⚠ Caution

Take care not to damage the spring contacts *F* when installing (or dismantling).

and

3. affix with the screw brackets supplied in such way that conduction takes place between the case, screw brackets and panel via the spring contacts.

   Note
   The connected conductor serves to safeguard the EMC characteristics of the device.

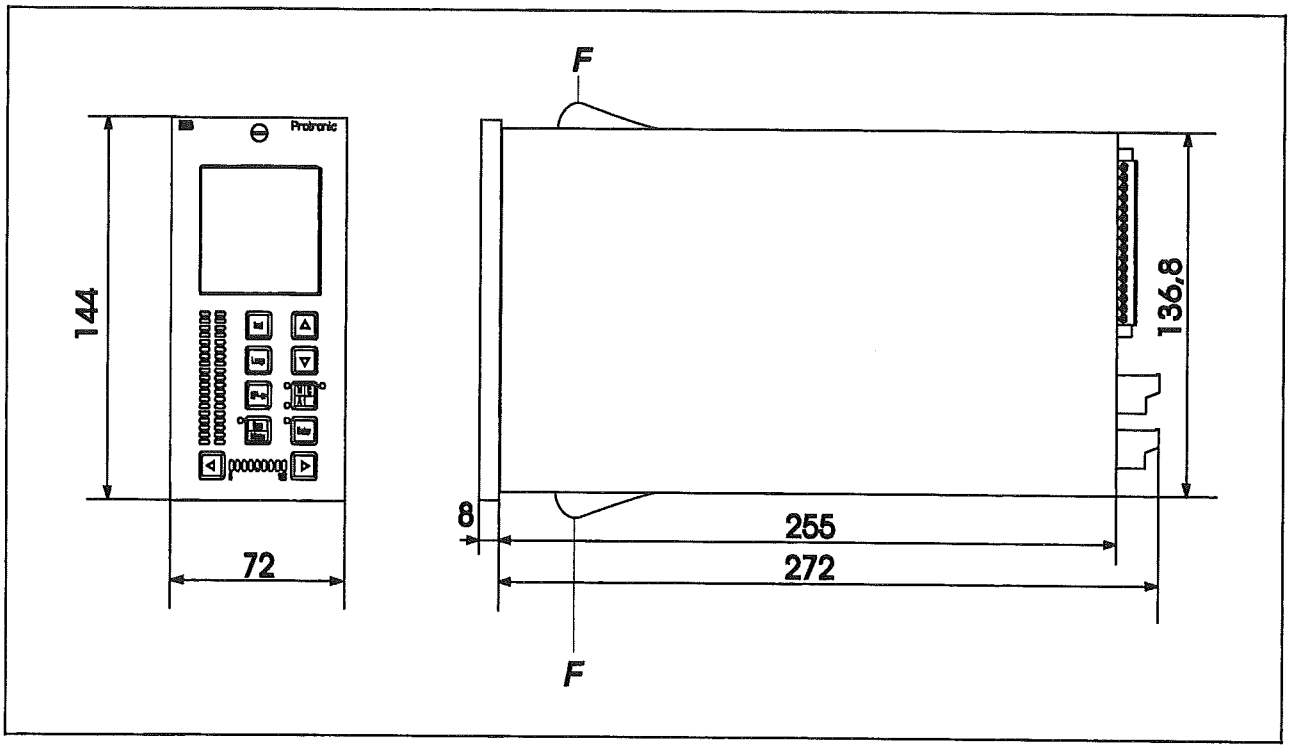


Fig. 3 Dimensional drawing (dimensions in mm)
Z-19176 *F* Spring contacts

4. Connection

Note
After the device has been switched on, some internal checks take place. These checks take about 15 s and are displayed.

Signal connections, basic model

Connect with plug-in screw terminals for solid or stranded wire.
Conductor cross-section up to 1.5 mm^2.

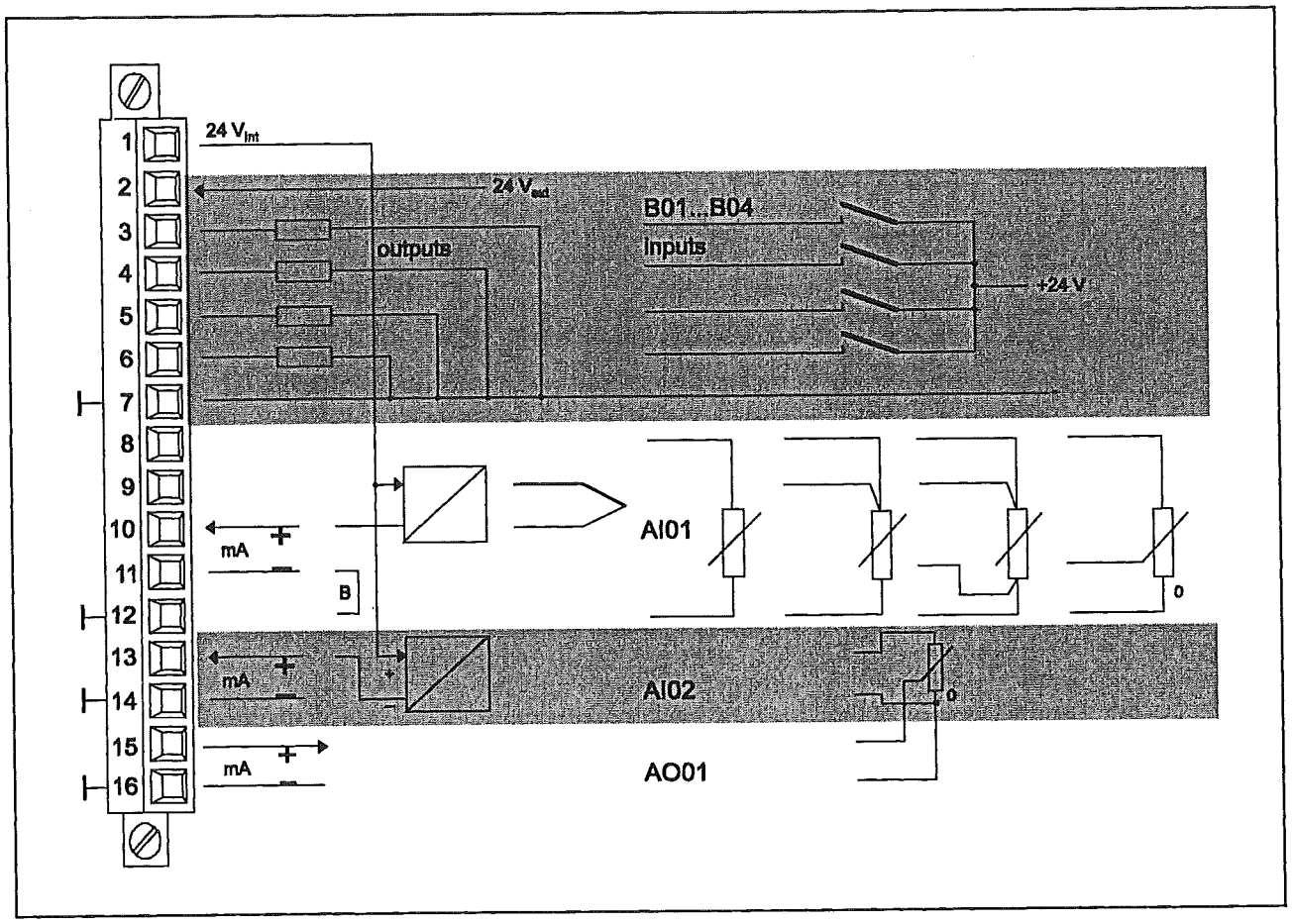


Fig. 4 Signal connections, basic model
Z-19159

1 24 V$_{int}$
2 Input of power supply for binary outputs
3 Binary port 1 (a binary port can be used as binary input or binary output)
4 Binary port 2
5 Binary port 3
6 Binary port 4
7 Zero potential
8 Analog input 1
9 Analog input 1
10 Analog input 1
11 Analog input 1
12 Analog input 1
13 Analog input 2
14 Analog input 2
15 Analog output 1
16 Analog output 1

AA01 Analog output 1 (20 mA)
AE01 Universal input
AE02 Additional current input
B Jumper in case transmitter is supplied by terminal 1
B01.. ..B04 Binary inputs or outputs
FG Teletransmitter connection (e.g. position feedback)

24-V$_{int.}$ Supply for 2-wire transmitter and/or binary inputs and outputs
24-V$_{ext.}$ External power supply

Signal connections, Modules

(not Protronic 100, except interface module, see page 12)

Overview

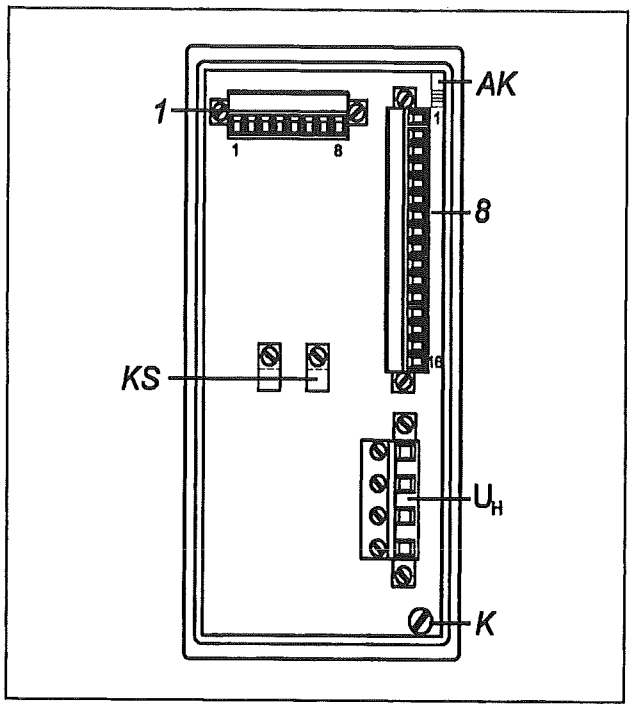


Fig. 5 Protronic 100, rear view with terminal strips
Z-19182

1	Module slot
8	Signal connections basic model (1...16: terminals)
AK	Stop catch
K	Twist screw
KS	Cable clamps (for connecting the cable shielding)
U_H	Power supply connection

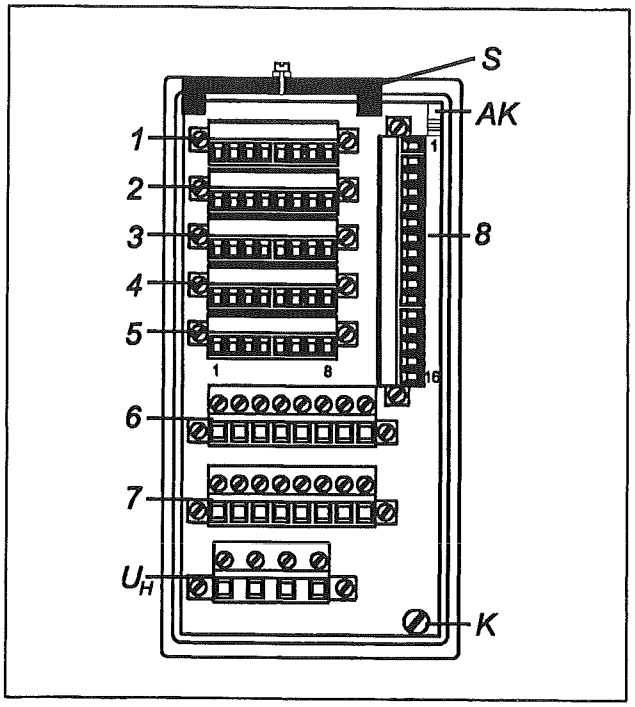


Fig. 6 Protronic 500/550, rear view with terminals
Z-19183

1 .. 7	module slots (1...8: terminals)
8	signal connections basic model (1...16: terminals)
AK	stop catch
K	twist screw
S	shielding connection panel
U_H	power supply connection

PC connection frontside (configuration interface)

1. Loosen screw on the frontside.
2. Tilt the front forward and downward.

The PC interface can now be accessed.

Modules

The **Protronic 500/550** process controllers can be equipped with the following modules. Seven card slots are available for these.

The assignment of the modules to the card slots is arbitrary (exception: interface and relays).

Total wattage of all modules may not be more than 7,7 W.

Protronic 100 can be retroffitted with an interface module.

Connection with plug-in screw terminals for solid or stranded wire. Conductor cross-section up to 1.5 mm^2, 2.5 mm^2 for relays.

Module type	**Technique**	Wattage	Module code								see fig.
				1	2	3	4	5	6	7	
Inputs											
AE4_mV	quadruple thermocouple	E	0,38 W								10
AE2_mA/mV_TR	double thermocouple or mA with electrical isolation	B	0,52 W								9
AE4_PT_2L	quadruple Pt100 2 wire circuit	F	0,26 W								11
AE2_PT_3/4L	double Pt100 3/4 wire circuit	G	0,23 W								12
AE4_f/t[1]	quadruple frequency input	H	0,30 W								13
AE4_mA_MUS[2]	quadruple mA with transmitter supply	C	2,24 W								8
AE4_mA	quadruple mA with electrical isolation	A	0,22 W								7
Binary inputs/outputs											
BEA6_BIN	six-channel binary input/output	M	0,25 W								16
Outputs											
AA3_mA[2]	triple 20 mA	N	1,96 W								14
AA3_mV	triple 10 V	P	0,28 W								15
BA4_REL	quadruple relay	T	0,79 W								17
Interfaces											
RS 485[3]	RS 485, independant from protocol, with bus capability, data rate 187500 Baud	U	0,52 W								18
RS 232	RS 232, independant from protocol, without bus capability	Y	0,53 W								18
PROFIBUS[1]	PROFIBUS DP (Slave)	Z	1,75 W								–

Tab. 1 Module overview

1 only for devices delivered ex plant as from 01.98 or as from firmware version 01.190

2 for each device two modules maximum for any of the slots

3 for each device one module maximum

AE4_MA: Analog input module 4 x mA

4 inputs 0/4...20 mA with electronic potential separation.

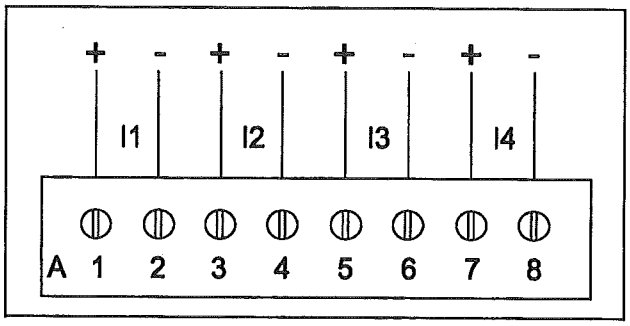


Fig. 7 Analog input module 4 x mA
Z-19152

AE4_MA-MUS: Analog input module 4 x mA with transmitter supply

4 inputs 0/4...20 mA, switchable to 0/2...10 V with respect to reference.

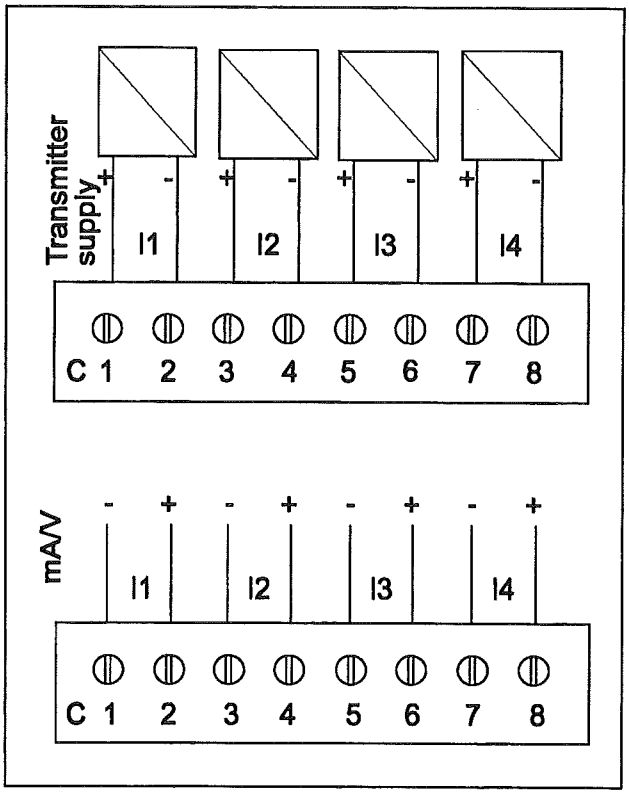


Fig. 8 Analog input module 4 x mA with transmitter supply
Z-19154

AE2_MA/MV-TR: Analog input module 2 x mA or Thermocouple or mV

2 inputs 0/4...20 mA switchable to thermocouple and mV (-10 ...80 mV) with electrical isolation (see Chapter "Upgrading modules").

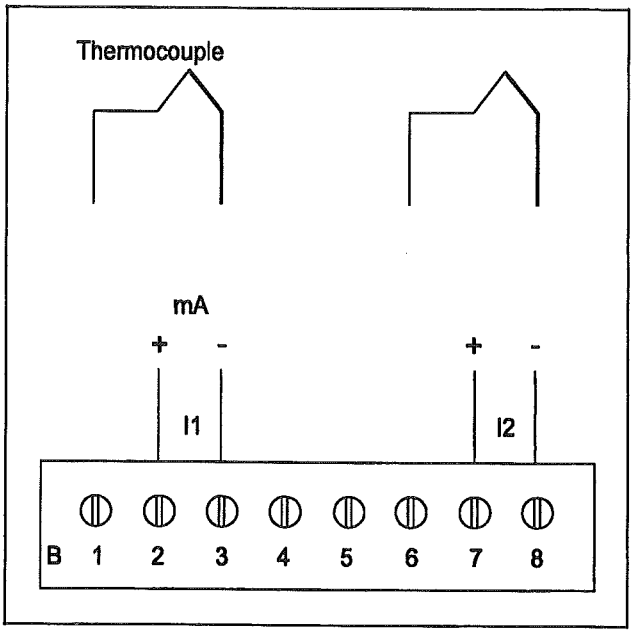


Fig. 9 Analog input module 2 x mA or thermocouple or mV
Z-19148

AE4_MV: Analog input module 4 x thermocouple

4 inputs -10...80 mV with electronic potential separation.

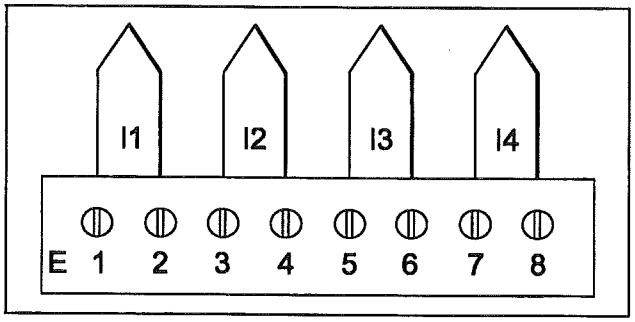


Fig. 10 Analog input module 4 x thermocouple
Z-19156

AE4_PT_2L: Analog input module 4 x Pt 100 in 2-wire connection

4 inputs for Pt 100 in 2-wire connection, linearization permanently programmed.

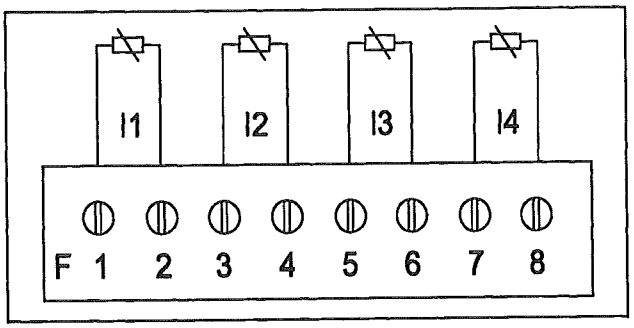


Fig. 11 Analog input module 4 x Pt 100 in 2-wire connection
Z-19155

AE2_PT_3/4L: Analog input module 2 x Pt 100 in 3/4-wire connection

2 inputs for Pt 100 in 3- or 4-wire connection or teletransmitter.

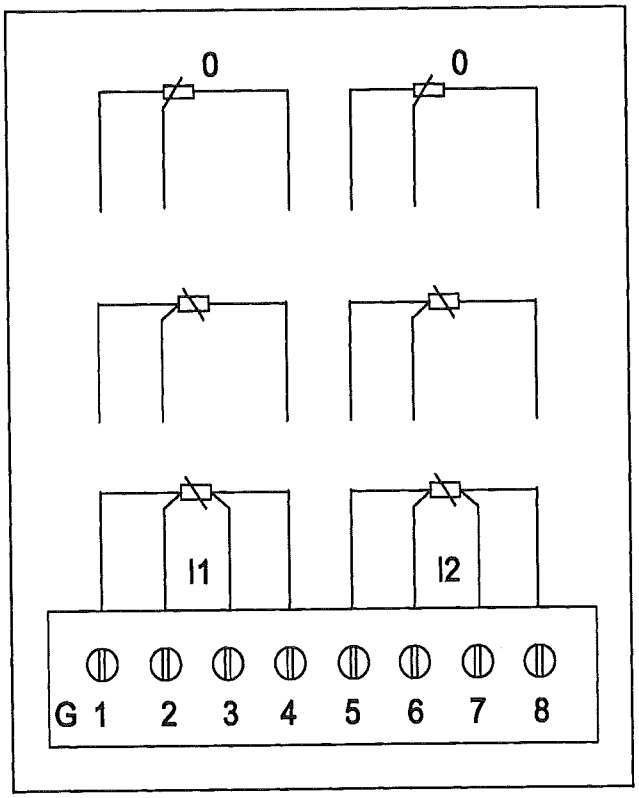


Fig. 12 Analog input module 2 x Pt100 in 3/4-wire connection or teletransmitter
Z-19149

AE4_f/t: Frequency input module 4 × F

4 frequency inputs

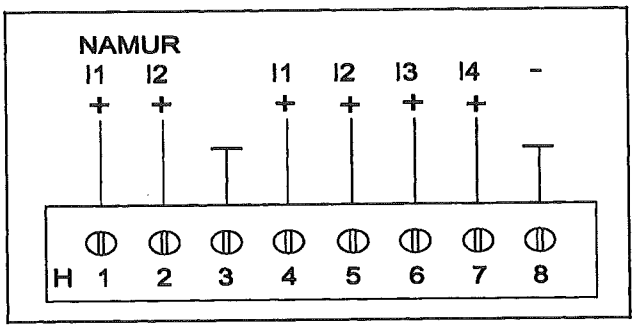


Bild 13 Frequency input module 4 × F
Z-19194

Input	Frequency measure-ment	Time measure-ment	Pulse counter	Incement	Incement with zero
I	AIx1[1]	AIx1	AIx1	AIx1	AIx1
I	AIx2	AIx2	AIx2		
I	AIx3	AIx3	AIx3	AIx3	Zero
I	AIx4	AIx4	AIx4		blocked

Tab. 2 1 with 0...20 kHz only input 1

All four inputs of one module can only be operated under the same measuring task.

With incremental measurement, the direction of rotation/movement is recognized. For this, two inputs are linked to form one input.

With incremental measurement with zero recognition, the direction of rotation/movement is recognized and the measurement input is set to zero via a third input, if this input is set. Thus, an absolute displacement/angular position measurement is possible. For this, three inputs are linked to form one input. In this case, the fourth input can not be used.

AA3_MA: Analog output module 3 x mA

3 current outputs 0/4...20 mA at 750 Ω, short-circuit and open-circuit-proof.

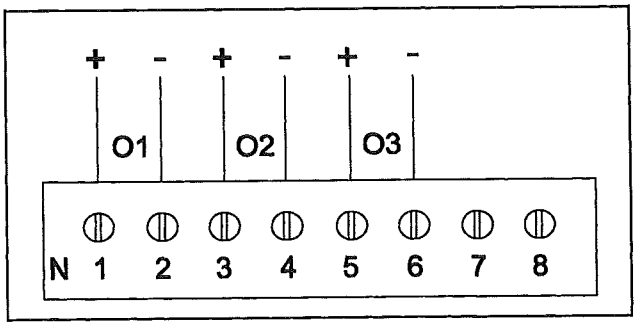


Fig. 14 Analog output module 3 x mA
Z-19150

AA3_V: Analog output module 3 x V

3 voltage outputs 0/2...10 V.

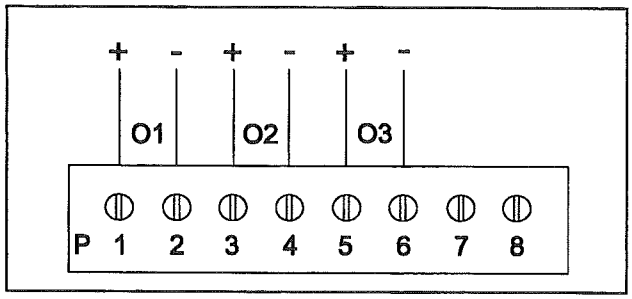


Fig. 15 Analog output module 3 x V
Z-19151

BEA6_BIN: Binary input/output module (with electri. isolation)

6 binary inputs/outputs. Operation as input or output configurable.

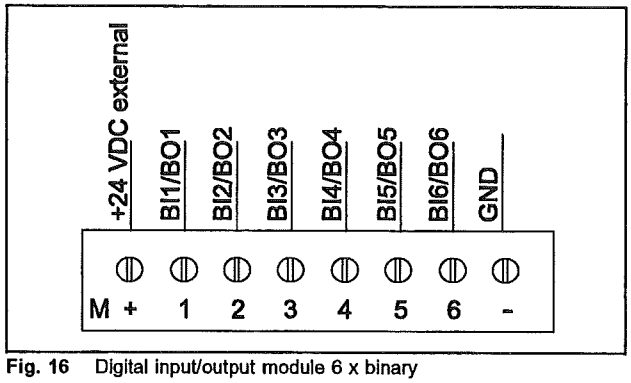


Fig. 16 Digital input/output module 6 x binary
Z-19158

BA4_REL: Binary output module 4 x relays

Can only be used on slots 6 and 7. 4 relays with NO contact.

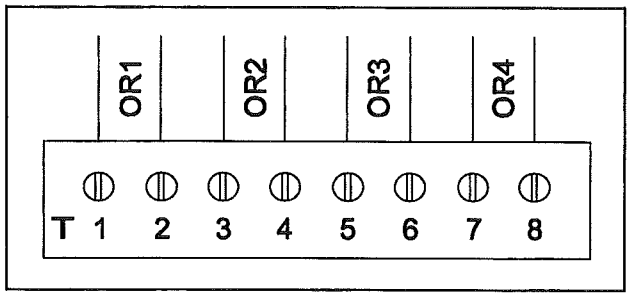


Fig. 17 Digital output module 4 x relays
Z-19157

⚠ Caution

Maximum voltage 250 V AC, maximum current 1 A, cosϕ = 0.9.

If small safety low voltages (≤ 50 V) and mains voltages (≥ 100 V) are to be switched on the same module, one relay must remain disconnected to comply with the creepage distances and clearances between different circuits called for in EN 61 010-1.

RS-232 and RS-485: Interface module
(with electrical isolation)

Can only be used on card slot 2.

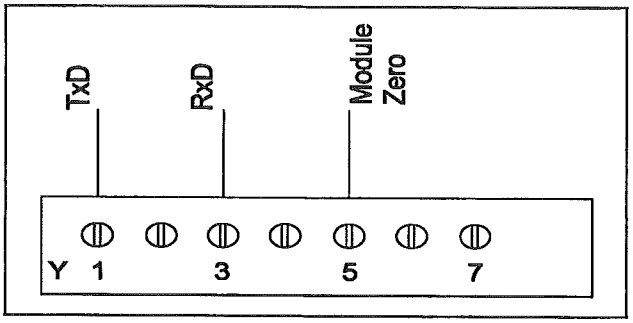


Fig. 18 Interface module RS-232
Z-19180

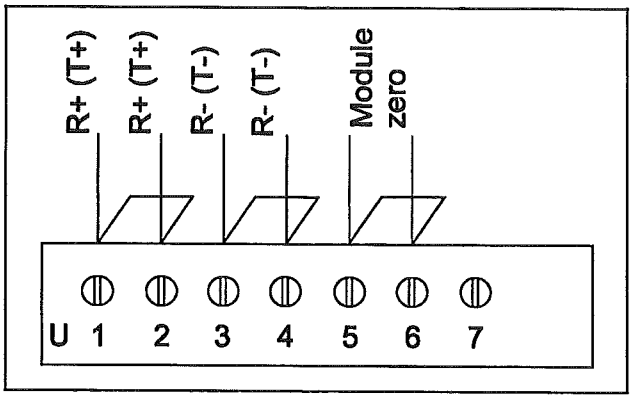


Fig. 19 Interface module RS-485
Z-19181 Jumpers are only necessary if the interface line is not to be broken when plug is withdrawn.

Notes

A shielded, minimum three-core cable with a twisted-core pair for signal transmission and an additional conductor for potential equalization between the "module zero" connection and all further electrically-isolated bus subscribers, is used as bus cable.

The shield of the data cable is necessary for compliance with the radio interference limits, and increases the interference immunity of the interface. For Protronic 100 connection is to the cable clamps *KS* (see Fig. 5, page 8) at the rear of casing, for Protronic 500 and 550 attachment is to the shielding connection plate *S* (see Fig. 24, page 15).

The additional insulated conductor in the data cable can only produce the potential equalisation necessary for the functioning of the interface, if all other bus subscribers (apart from the PC for example) are also electrically isolated.

An additional potential equalisation conductor of sufficiently large cross-section is normally required in parallel with the data cable for operation by non-electrically isolated bus subscribers.

PROFIBUS

see Operating Instructions 42/62-50050

Power supply

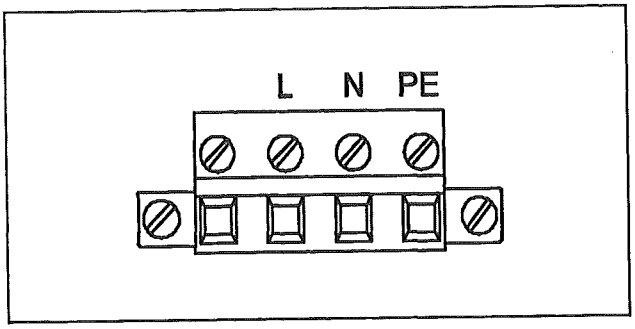


Fig. 20 Connection of the 115/230 V AC power supply
Z-19160 L Live conductor
N Neutral conductor
PE Grounding conductor

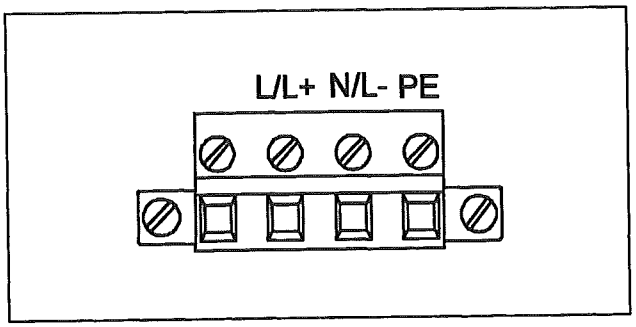


Fig. 21 Connection of the 24 V UC power supply
Z-19162 DC Plus to L+
Zero to L–
AC L and N
PE Grounding conductor

⚠ Caution

When selecting the lead material as well as when installing and connecting the power leads, the specifications for installation of power current systems with rated voltages up to 1000 V (DIN VDE 0100) are to be observed.

Before any other connection is made the protective grounding conductor (PE) shall be connected to a suitable protective ground terminal as protection against electric shock.

Note
It is also necessary to connect the grounding conductor (PE) when using a 24 V power supply.

Connection of power supply

⚠ Caution

Switch off all voltages hazardous to touch (mains voltage at the power supply and at plug-in relay modules) before opening the device.

The input voltage for the unit is on the rating plate printed on the side of the case.

⚠ Caution

The 24 V UC version may only be connected to a power supply with safety extra-low voltage.

According to EN 61 010-1, Section 6.12.2, it must be possible to switch off the unit using an externally assigned isolating device which must be installed.

The live mains connection "L" or "L/L+" is protected internally. The device does not require any external protection through fusing.

Connection with plug-in screw terminals for solid or stranded wire. Conductor cross-section up to 2.5 mm^2.

⚠ Caution

Before switching on the apparatus make sure it is set to the voltage of the power supply.

The input voltage for the unit is on the rating plate printed on the side of the case.

Note
After switching on the device, some internal checks take place. These checks take about 15 s and are displayed.

Upgrading / Modification

⚠ Security advice according to DIN VDE

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. Interfaces may also be live.

The apparatus shall be disconnected from all voltage sources before it is opened for any operations. Operations on the opened apparatus under voltage must only be performed by an expert who is aware of the hazard involved.

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

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

It must be assumed that 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.**

Installing modules

⚠ Caution

All voltages hazardous to touch (mains voltage for the power supply and at relay plug-in modules, i.a. signal current circuits) must be disconnected before installing modules.

The sub-assembly must be slid into the case and interlocked with the twist screw during operation.

The supplied (and plugged) isolating plate must be installed between slots 6 and 7, if either a module is installed in slot 6 or 7 or in both slots. The supplied (and plugged) isolating plate below slot 7 must always be installed.

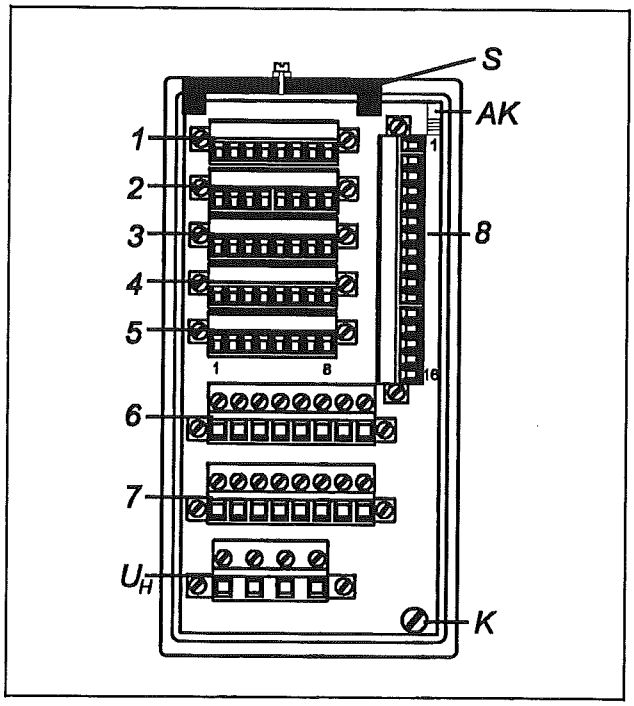


Fig. 22 Rear view (here: Protronic 500/550)
Z-19183
1 .. 7 Module slots
8 Signal connections to standard model (1...16 terminals)
AK Stop catch
K Twist screw
U_H Power supply

1. Release sub-assembly: rotate twist screw a quarter turn anti-clockwise to positon ◍.
2. Press top stop catch downwards and slowly withdraw sub-assembly backwards until it engages.

   The sub-assembly can be pulled out completely if required.

   To do so, press the two stop catches inwards and withdraw the sub-assembly completely.
3. Insert or remove module (for slots see fig. 22 next page). When inserting the module, it must be ensured that it is carefully slid in up to the limit.

Note
When installing an interface module, the shielding connection plate supplied with the interface module must also be installed (see next page).

4. Slowly slide back sub-assembly until it engages in the case.
5. Lock sub-assembly: rotate twist screw clockwise a quarter turn to postion ⊖.

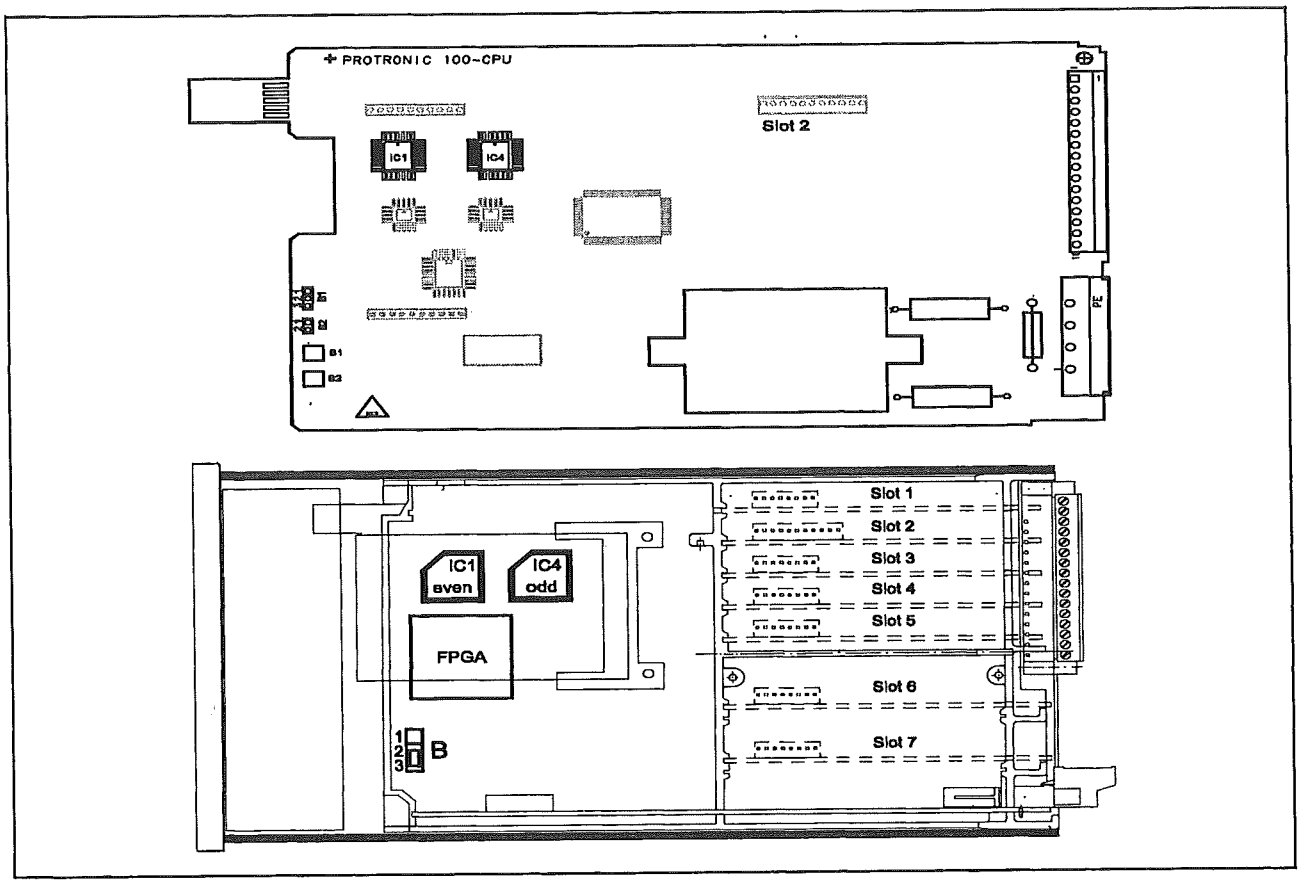
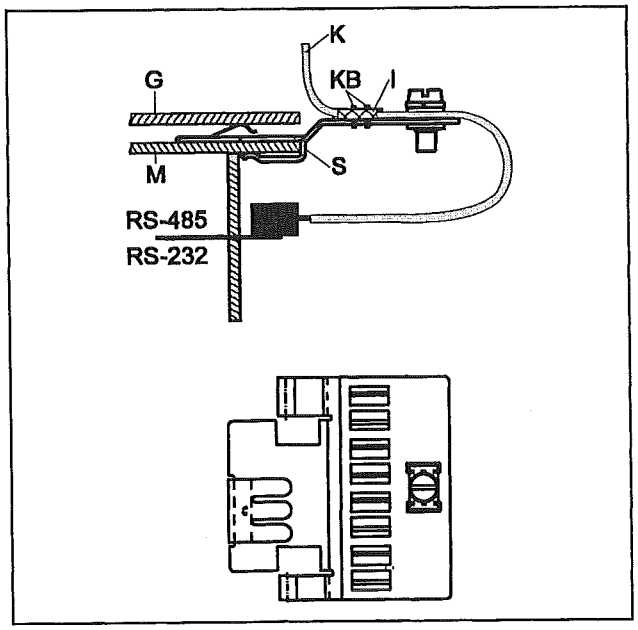


Fig. 23 above Protronic 100: Motherboard
Z-19177 below Protronic 500/550: Motherboard with slots
Z-19178

Installing the shielding connection plate
(not Protronic 100)



1. Clip shielding connection plate *S* (part of the supplied interface module) onto upper side of the module rack *M*.
2. About 10 cm before end of cable, remove the insulation to a length of about 15 mm.
3. Firmly attach the bare part of the cable with the two supplied cable straps onto the shielding connection plate, in such manner that the shielding is well contacted to the plate.
4. If the shielding has an extra wire, connect this to grounding screw of the shielding connection plate.
5. Connect the cables to the interface terminals.

Fig. 24 Shielding connection panel with interface cable
Z-19186
G Housing
I Cable without insulation
K Cable
Kb Cale straps
M Sub-assembly
RS-232
RS-485 Interface module
S Shielding connectionn place

Modification of modules

Analog input module 2 x mA or thermocouple and mV

2 inputs 0/4...20 mA or thermocouple and mV (-10...60 mV) with electrical isolation.

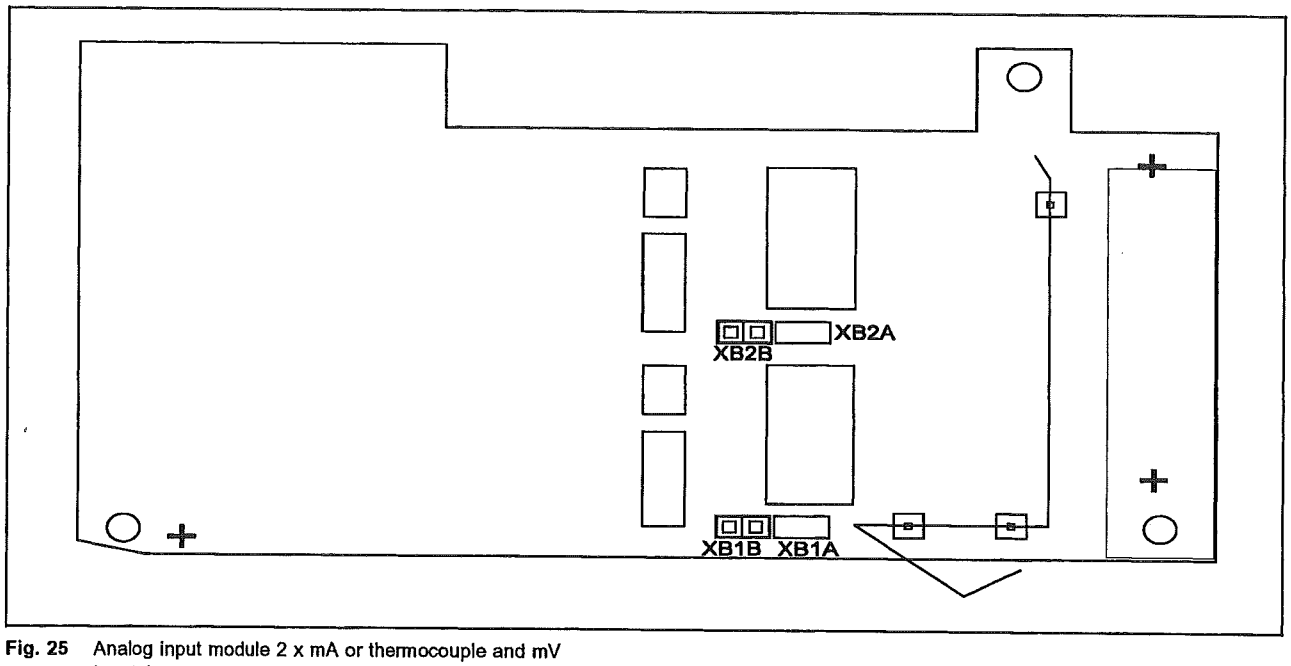


Fig. 25 Analog input module 2 x mA or thermocouple and mV
Z-19185

Input 1:		Input 2:	
mA	XB1 bridged	mA	XB3 bridged
mV	XB2 bridged	mV	XB4 bridged

Analog input module 4 x mA with transmitter power supply

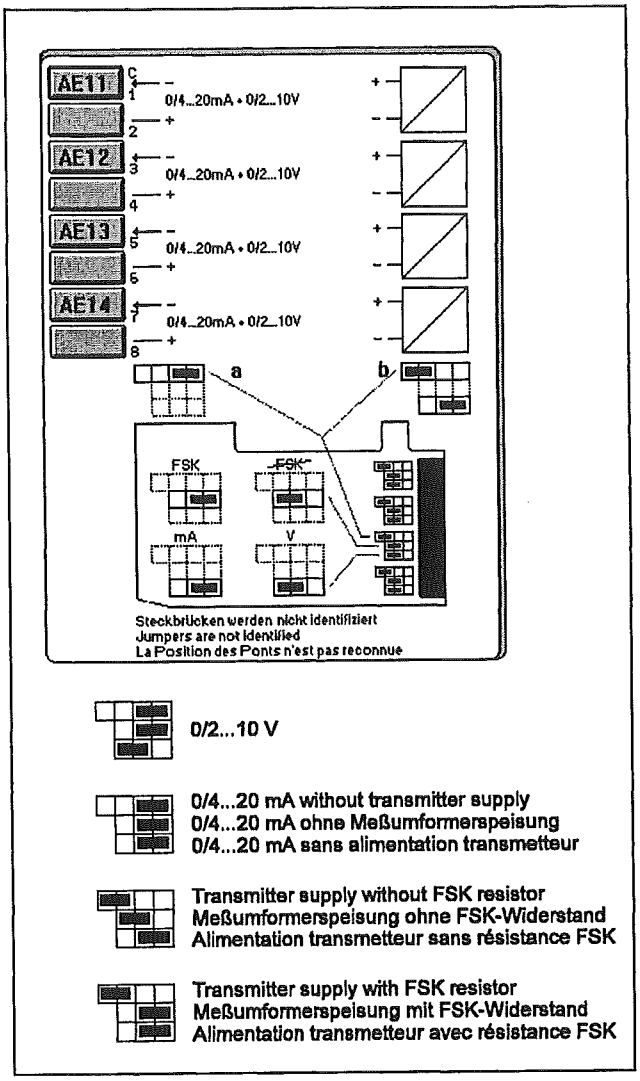


Fig. 26 Analog input module 4 x mA with transmitter power supply
Z-19153

The input card AE4_MA-MUS can be matched to various measuring tasks by using plug-in jumpers.

Bridge	Function
a	The measuring signals come in as external current or voltage signals.
b	The transmitters are supplied from the input module.
FSK	In the mA-input of the module is a resistor active, which prevents FSK signals from being short-circuited.
~~FSK~~	The protective resistor is short-circuited
mA	Input 0/4...20 mA
V	Input 0/2...10 V

Tab. 2 Measuring tasks

Technical data

Technical data for standard model Protronic 100 and 500/550

Input

Common data

Electrical isolation
none

Resolution
12 bit

Measurement tolerance (related to nominal range)
≤ 0.2 %

Effect of temperature
≤ 0.2 % / 10 °C

Hardware input filter limiting frequency
7 Hz

Analog inputs

Universal input AE01

used for standard analog signal

0/4...20 mA at 50 Ω ± 1 %

electronic potential separation

permissible common-mode voltage
≤ ±4 V

Overcurrent/wrong polarity protection
up to ±40 mA

Linearization, square root extraction
configurable

Line break monitoring
at 4...20 mA, response configurable

used for thermocouples

Types

J	-200...1200 °C
E	-200...1000 °C
K	-200...1400 °C
L	-200...1000 °C
U	-200...600 °C
R	0...1700 °C
S	0...1800 °C
T	-200...400 °C
B	0...1800 °C
D	0...2300 °C

Reference junction compensation
internal or external: 0, 20, 50 or 60 °C

Sensor break monitoring
with configurable direction of control action

Electronic potential separation

Permissible common-mode voltage
≤ ±4 V to device zero

used for Pt 100 DIN resistance thermometers

Measuring ranges
-200.0...+200.0 °C
-200.0...+800.0 °C

Measuring current
≤ 1 mA

Measurement circuit
2-wire connection to 250 Ω line resistance

Lead balancing
by software

3-wire connection
for symmetrical cables to 3 x 10 Ω

4-wire connection

Sensor short circuit and break monitoring configurable

Direction of control action configurable

used for resistance teletransmitters

Measuring range
150 Ω (75...200 Ω)
1.5 kΩ (0.75...2 kΩ)

Measuring current
≤ 1 mA

otherwise as resistance thermometer

Analog input 2 (AE02)

Inputs for mA signals such as AE01, but with potential binding to device zero.

4 binary inputs/outputs

Direction of functioning
configurable

Input DIN 19 240	Nominal signal	Voltage range	Current range
Nominal level	24 V DC	20.4...28.8 V	app. 1 mA
1-signal	24 V DC	13.0...30.2 V	app. 1 mA
0-signal	0 V DC	-3.0...5.0 V	< 0,1 mA

Tab. 3 Technical data when configured as input

Output DIN 19 240	Nominal signal	Voltage range	Current range
Nominal level	24 V DC ext.	20.4...28.8 V	100 mA
1-signal	24 V DC	13.0...30.2 V	0...max.
0-signal	0 V DC	-3.0...5.0 V	0...0.2 mA

Tab. 4 Technical data when configured as output

Switching frequency
≤ 8 Hz

Outputs

Analog outputs

As control or measurement data output

0/4...20 mA at max. 750 Ω protected against short circuit and open circuit

Control range
0...≥21 mA

Load dependence
0.1 % / 100 Ω

Resolution
12 Bit

Binary outputs

see binary inputs

Transmitter supply voltage

Output voltage
Protronic 100: 20...23 V DC, 80 mA, short-circuit-proof
Protronic 500/550: 20...23 V DC, 140 mA, short-circuit-proof

Load monitoring
Output switches off automatically in case of overload

Programmer

saving 10 programs, every program:
15 sections
set point in physical units
section time 0...99:99:99 hours, 4 control signal tracks

Serial interfaces

TTL interface accessible after removal of the front module for coupling to the PC via TTL/RS232 converter (Cat. No. 62695-4-0346270) with fixed telegram format matching for parameter definition and configuration program **IBIS_R** (see Data Sheet 10/62-6.70 EN).

Bus-capable RS-485 interface can be retrofitted (see modules).

CPU Data

Measured and correction value resolution
12 Bit

Cycle time
≤ 80 ms

Data protection
Flash EPROM, Option: memory card (not for Protronic 100)

Power supply

Protronic 100

AC power supply

230, 115, 24 V AC	+10...-15 %, 47...63 Hz
Power consumption	14 VA (10 W)
Power failure safety	≥ 20 ms at $U \geq 0.85 \times U_{Nenn}$
Power factor	cos ϕ = 0.7

UC power supply

24 V AC	+10...-15 %, 47...63 Hz
24 V DC	+10...-25 %, residual ripple ≤ ±3 V_{ss}
Power consumption	max. 11 VA (8 W)
Power failure saftey	≥ 20 ms bei U ≥ 0.85 × U_{Nenn}

Protronic 500/550

115 to 230 V AC (90 to 260 V):	47...63 Hz
Power consumption	
Protronic 500 without modules	9 VA (6 W)
Protronic 550 without modules	12 VA (9 W)
with maximum complementation	+12 VA (9 W)
Power failure safety	≥ 150 ms at U ≥ 180 V AC

24 V UC	
24 V AC	-15...+10 %, 47...63 Hz
24 V DC	-25...+30 %, residual ripple ≤ ±3 V_{ss}
Power consumption	
Protronic 500 without modules	10 VA (7 W)
Protronic 550 without modules	13 VA (9 W)
with maximum complementation	+13 VA (9 W)
Power failure safety	≥ 20 ms at $U \geq 0.85 \times U_{Nenn}$

Power factor cosϕ = 0.7

Fusing (Protronic 100 and 500/550) see the following page:

Fusing (Protronic 100 and 500/550)

The device does not require any external fusing. The built-in fuses may not be changed by user:
24 V UC, 115/230 V AC: T2,5, 250V UL permitted!

Ambient conditions

Climatic class
KWF to DIN 40 040

Ambient temperature
0...50 °C

Storage temperature
-20...70 °C

Humidity
relative humidity ≤ 75% on annual average, short-term up to 95%, infrequent and slight condensation permissible.

Electromagnetic compatibility (EMC)

Satisfies protection requirement EMC Guideline 89/336/EEC, 5/89

Interference immunity EN 50 082-2 March 1995 (including IEC 801)

Interference immunity EN 50 081-1 1/92
(Reference to: EN 55 011 alarm class B, General approval)

Industrial standard to NAMUR NE Part 1, May 1993

Connection, case, mounting and safety

Degree of protection to DIN 40 050

Front IP 65

Case IP 00

Terminals IP 20

Electrical safety

Class of protection 1 to EN 61 010 T.1 (VDE 0411 T.1 march 1994)

Air and creepage distances to EN for overvoltage category 3, degree of contamination 2

With the exception of the power supply 230 V AC and the relay outputs, all other inputs and outputs including the interface are functional extra-low voltage circuits to DIN VDE 0100, Part 410. The safe isolation of these circuits meets the requirements of DIN VDE 0106, Part 101.

Mechanical capability

to DIN IEC 68 part 2-27 and 68-2-6
Shock 30g / 18 ms; Vibration 2g / 0.15 mm / 5...150 Hz

Case dimensions
Front 72 mm x 144 mm
Installed depth 272 mm

Panel cutout
68 mm x 138 mm to DIN 43 700

Mounting
in panel or Hartmann & Braun rack
Horizontally close-packed construction possible
Vertical clearance 36 mm
Fixing with clamping screws top and bottom

Mounting orientation
arbitrary

Weight
1 kg without modules
Modules, each approx. 40 g
Relay module approx. 80 g

Electrical connections

Plug-in screw terminals
coded, for solid or stranded wire
up to 1.5 mm^2 for signal lines
up to 2.5 mm^2 for power supply

No shielded cables required, other than for interface cables.

Scope of delivery

2 clamping screws, plug-in screw terminals and operating manual

Technical data for modules

(nott Protronic 100, except interface module)

Analog inputs

Module AE4_MA

4 Inputs
0/4...20 mA with electronic potential separation

Input resistance
approx. 50 Ω

Signal resolution
10000 LSB for 0...20 mA

Permissible common-mode parasitic voltage
±4 V in relation to device zero

Surge immunity
Input current < 50 mA
Voltage between input and device zero ±50 V

Module AE4_MA-MUS

(sum of all output currents ≤ 300 mA)

4 Inputs
0/4...20 mA can be switched over individually to 0/2...10 V with respect to reference

Input resistance
with mA input: approximately 50 Ω
with 10 V input: 20 kΩ

Transmitter supply
20 V, 82 mA

otherwise as module 4_MA

Module AE4_MV (for thermocouple measurement)

4 Inputs
−10...80 mV with electronic potential separation

Signal resolution
20000 for −10...80 mV

Input resistance
approx. 5 MΩ

Permissible common-mode parasitic voltage
±4 V in relation to device zero

Surge immunity
Voltage at one input: 10 V
Voltage between input and device zero: 50 V

Break monitoring
Direction of control action configurable

Reference junction compensation
configurable, internally or externally: 0, 20, 50 or 60 °C

Linearization
configurable

Module AE2_MA/MV-TR

2 Inputs
0/4...20 mA or −10...80 mV with electrical isolation (changeable with jumpers)

Input resistance
at 20 mA 50 Ω
at −10...80 mV approx. 5 MΩ

Surge immunity of the input and output cables to one another and against grounding conductor
Continuous operation: 45 V AC

otherwise as modules 4_MV and 4_MA

Module AE4_PT_2L

4 Inputs
for Pt 100 in 2-wire connection without electrical isolation

Range
0...400 Ω

Signal resolution
10000 LSB for 400 Ω

Measuring current
1.5 mA

Measuring range
configurable
-200.0...+200.0 °C
0,0...+450.0 °C
-200...+800 °C

Lead balancing
by software

Sensor break and short-circuit monitoring
response configurable

Module AE2_PT_3/4L

2 Inputs
2 for Pt 100 in three-wire or four-wire connection or teletransmitter

Ranges as module AE4_PT_2L

Module AE4_f/t

1 to 4 inputs for frequency/period measuring, individual changeover via software

2 NAMUR inputs acc. to DIN 19 234
4 inputs acc. to DIN 19 240 (0/24 V DC)
4 binary inputs (0/5 V DC)

Measuring range
Period 0...20 s
Frequency 0...10 kHz
when using only one input: 0...20 kHz

Signal resolution
Period 1 ms
Frequency 1 kHz

Error of measurement
±0,15 % of measuring range
±0,05 % of measured value
±1 digit

Binary inputs/outputs

Module BEA6_BIN

6 binary inputs/outputs with electrical isolation

Electrical isolation
For continuous operation up to 30 V AC

Function
Configurable as input or output. See operating manual to do this. Operating Manual 42/62-50012 EN "Commissioning".

Technical data as binary inputs/outputs of the basic model.

Module BA4_REL
(can only be used on card slots 6 and 7)

4 Relays
with NO contacts for max. 250 V AC, 1 A, $\cos\phi = 0.9$

Spark quenching
built-in

If small voltages (≤ 50 V) and mains voltages (≥ 100 V) are to be switched on the same module, one relay must remain disconnected to comply with the creepage distances and clearances between different circuits called for in EN 61010-1.

Analog outputs

Module AA3_mA
(sum of all output currents ≤ 300 mA)

Triple current output 0/4...20 mA at 750 Ω

Signal resolution
5000 LSB

Load dependence
0.1 % / 100 Ω.

Output monitoring
Function configurable

Module AA3_V

Triple voltage output 0/2...10 V ≥ 5 kΩ

Interface modules

Module RS-485
(can only be used on card slot 2)

Interface module according to RS-485-specification

Electrical isolation

Not depending on a protocol (the protocol is configured by the Protronic).

Module RS-232
(can only be used on card slot 2)

Interface module according to RS-232 specification

Electrical isolation

Not depending on a protocol (the protocol is configured by the Protronic).

PROFIBUS

see Operating instructions 42/62-50050

Memorycard
(not Protronic 100)

As an option a memory card according to the PCMCIA 2.0-Standard can be used. The memory card can be installed after opening the front. Used to store configuration and parameterization data.

Type: AmC001BFLKA
1 MByte 5.0 – only Flash Memory PC card

Packaging for transport or for return to manufacturer

If the original packing is no longer available the Protronic 100/500/550 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 airtight in 0.2 mm thick polyethylene together with a desiccant (e.g. silica gel). The quantity of the desiccant must correspond to the packing volume and the probable duration of transportation (at least 3 months). Furthermore, for this type of shipment the crate should be lined with a double layer of kraft paper.

Accessoires

Accessories for the Protronic 100/500/550 (100: only in *italics*) are shown in the accessories list below. Please quote the designation and catalog numbers (Cat.No.) of the accessory when ordering. Also be sure to quote the serial and order numbers entered on the rating plate.

The designations in the accessories list, order confirmation, delivery note and invoice may differ from the function-related names used in this instruction manual.

Only the catalog number is relevant!

Designation		Catalog number
Inputs		
AE4_MV	quadruple thermocouple	62619-4-0346280
AE2_MA/MV-TR	double thermocouple or mA with electrical isolation	62619-4-0346250
AE4_PT_2L	quadruple Pt100 in 2-wire connection	62619-4-0346255
AE_PT_3/4L	double Pt100 in 3/4-wire connection	62619-4-0346281
AE4_MA-MUS	quadruple mA with transmitter supply	62619-4-0346441
AE4_MA	quadruple mA with electrical potential separation	62619-4-0346254
AE4_f/t	quadruple frequency input	62619-4-0346444
Binary inputs/outputs		
6_BIN_EA	6-fold binary input/output with electrical isolation	62619-4-0346282
Outputs		
AA3_MA	3-fold 20 mA	62619-4-0346252
AA3_V	3-fold 10 V	62619-4-0346253
BA4_REL	quadruple relay with NO contact	62619-4-0346263

Subject to technical changes.

ABB

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http://www.abb.com

Subject to technical changes.
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Protronic 100/500/550
Digitric 500

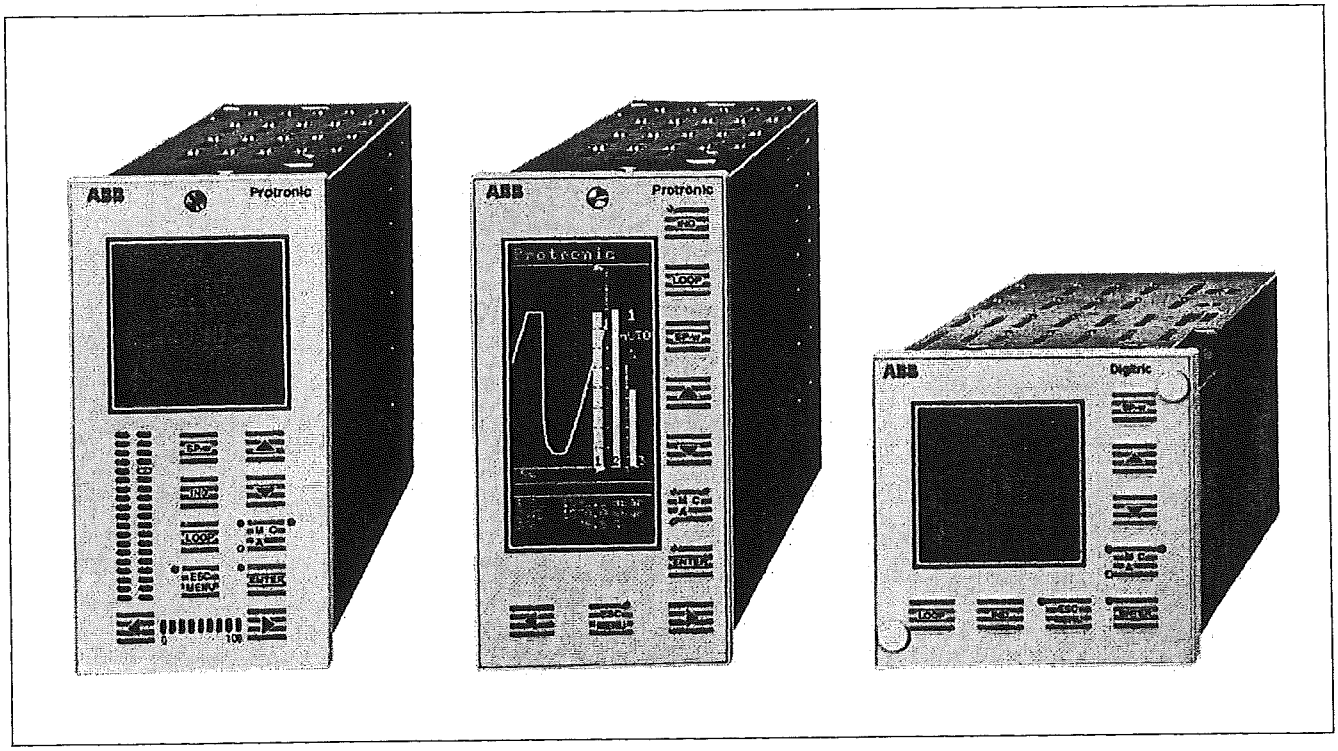
Controllers for process engineering controllers for industry

Configuration and parameterization

Manual

42/62-50012 EN

Rev. 06



ABB

Remarks

Preliminary Remarks

The documentation provided on delivery for Protronic 100 / 500 / Digitric 500 consists of the following parts:

Installation instructions Protronic 100 / 500 / 550	42/62-50011
or	
Installation instructions Digitric 500	42/61-50011
Commissioning instructions: Configuration and parameter setting Protronic 100 / 500 / 550 • Digitric 500	**42/62-50012**
Operating instructions Protronic 100 / 500	42/62-50013
or	
Operating instructions Protronic 550	42/62-55013
or	
Operationg instructions Digitric 500	42/61-50013
Also available on request:	
Operating instructions IBIS_*R* • IBIS_*R*+	42/62-50020
Operating instructions IBIS_*R*+	42/62-50020 and 42/62-50030
Interfac description (MODBUS)	42/62-50040

The commissioning includes all information for the menu-guided configuration and parameter definition of the Protronic 100 / 500 / 550 and Digitric 500. The required inputs can either be made on the device itself or with the help of configuration and parameter definition software IBIS_*R*.

Configurations going above the capabilities of the menus can be undertaken with the help of the configuration and parameter definition software IBIS_*R*+. These configurations are not part of this commissioning manual.

Delivery condition

The devices supplied from the Hartmann & Braun warehouse without any further settings are delivered ex-factory with the following defined functions:

- Single-channel, continuous controller
- Input: 4...20 mA
- Output: 4...20 mA
- Language: German

The exact definition of the instrument is stated in the configuration tables in this Operation Manual and are underlined (= factory setting).

Other variations of this can also be ordered.

Switching on the instrument

On switching on the instrument and or in case of mains restoration, the device conducts an automatic test of the internal functions. The progress of the test is illustrated by changing displays. These can normally be ignored.

Firmware versions

Valid for all firmware versions through 1.190. library 3.5.0.

Z-19119

Contents

Comments

Comments on the displays in this operating manual

<Enter>	Keys of the instrument with their description.
<Ind>, <Loop> <Menu>, <Enter>	Keys are always enabled for operator interventions
[P-W]	Texts or text parts from the digital display.
P-W, A	Flashing texts or text parts from the digital display.
/8/	Comments on numerals in fig. 1.
M✲ ,A✲, C✲ Menu✲ Enter✲	LEDs next to keys with the same name light up
M● ,A●, C● Menu● Enter●	LEDs next to the keys with the same name do not light up.
Wex Hand	Forced set point source or operating mode.

Comments on the configuration and parameter definition tables

I	Instrument
AI	Analog input
AO	Analog output
BIO, BI/BO	Binary input/output
Lx	Loop No, number of control circuit
ZK	State corection
P	Programmer
P01	Parameter 1
B01	Block 01
Q01	Query 01

Parameter definition

L1-P01	Loop 1, Parameter 01 = Kp

Configuration

I-B01-Q01	Instrument, Block 1, Query 1 = Language
L2-B03-Q02	Loop 2, Block 3, Query 2 = Input signal connection

Comments on the configuration menu

The input values AIx, BIx as well as the outputs AO1 and BOx are global variables in the unit.

The binary inputs can control several functions at the same time, such as transferring between AI01 and AI02 and with simultaneous parameter transfer.

The binary outputs can output several items of information logically combined by OR.

Appropriate care is required for the configuration.

Numbering and identification of the inputs and outputs

Basic unit:

The analog inputs/outputs are designated as AI01 and AI02 or AO01.

The binary inputs/outputs are designated as BIO01 to BIO04. Depending on the configuration, they are used in the device as input BI0x or output BO0x.

Modules:

Protronic 100 has one slot.

Protronic 500/550 has up to 7 slots (counting from top to bottom).

Digitric 500 has up to 4 slots (counting from left to right).

Up to four analog or 6 binary inputs and outputs are processed in the modules. In the apparatus the digitalized inputs and outputs are identified as follows:

AIxy	Analog input no. y of the module at position x
AI32	Input 2 of the module on slot 3
BI76	Module 7, binary point 6, configured as input

Description of the Front Panel

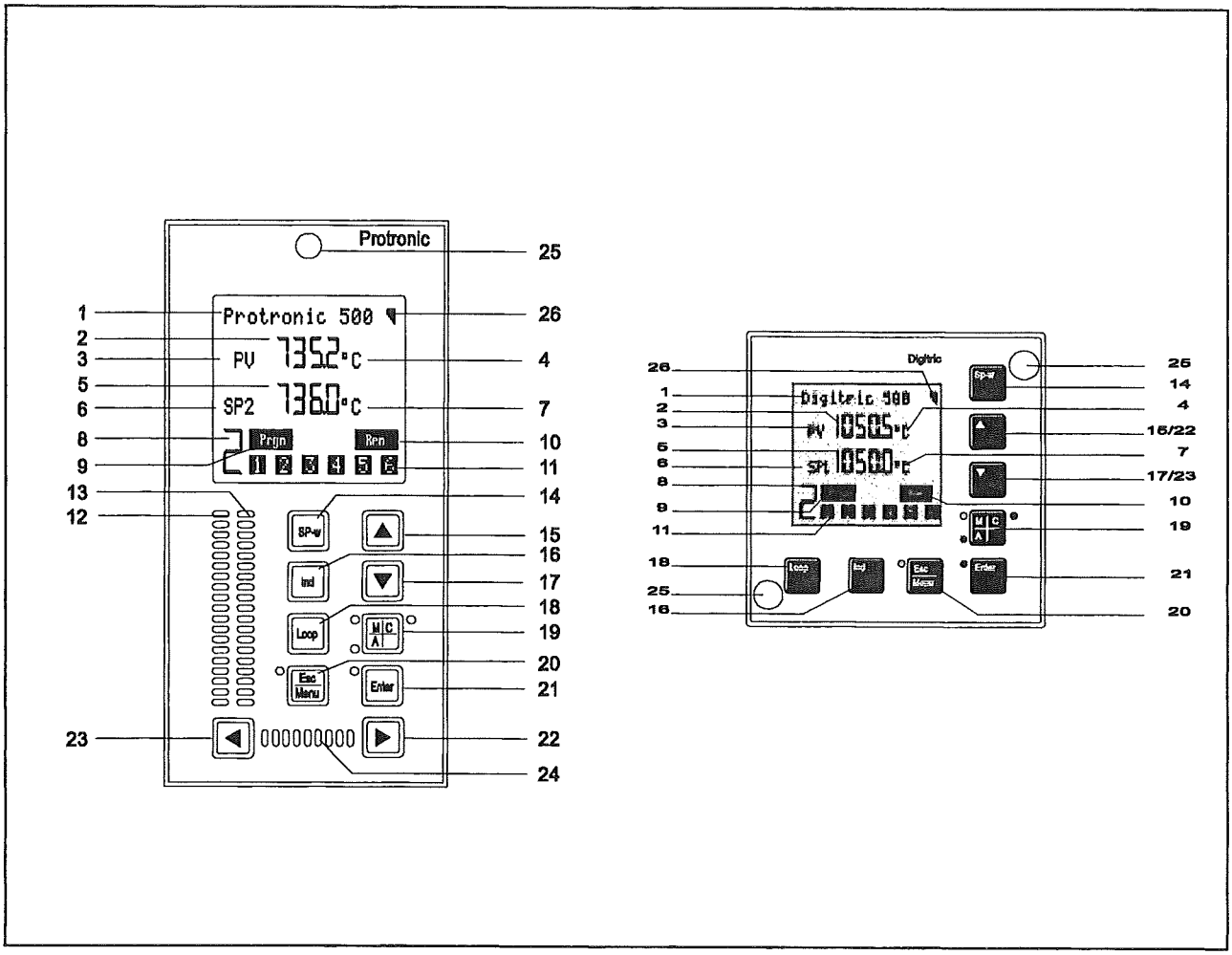


Fig. 1 Front panel Protronic 100 / 500 (right) • Digitric 500 (left)

Z-19037
Z-19062

1 Text line
2 Digital display of controlled variable PV
3 Designation of the controlled variable
4 Dimension of the controlled variable
5 Digital display: in automatic mode set point SP
in manual mode correction value OUT
6 Designation of the displayed value
7 Dimension of the displayed value
8 Number of the control system displayed, alternates in event of alarm with display "A"
9 Display for active programmer
10 Display of activated remote operation
11 Freely configurable binary messages (flags)
12 Analog display of controlled variable PV
13 Analog display of set point SP
14 Set point changeover (see Section on "Set points")
15 Setting "raise" of the value displayed in 5, 6 and 7
16 Displaychangeover switch for displays 5, 6 and 7
17 Setting "lower" of the displayed value in 5, 6 and 7
18 Channel (loop) transfer
19 Operating modes changeover with manual-automatic-cascade with associated signal LEDs
20 Entry into parameter setting and configuration mode. Associated LED lights up immediately the operating level exitted. At the same time, the menu symbol 26 in the text line is visible.
21 Acknowledgment of alarms, parameter setting and configuration data
22 In manual mode "raise"
23 In manual mode "lower"
24 Controller output
25 Closing screw
26 Menu symbol displays the momentary menu level

The numbers of the individual operating and display elements are used identically in all parts of the equipment documentation.

Menu system

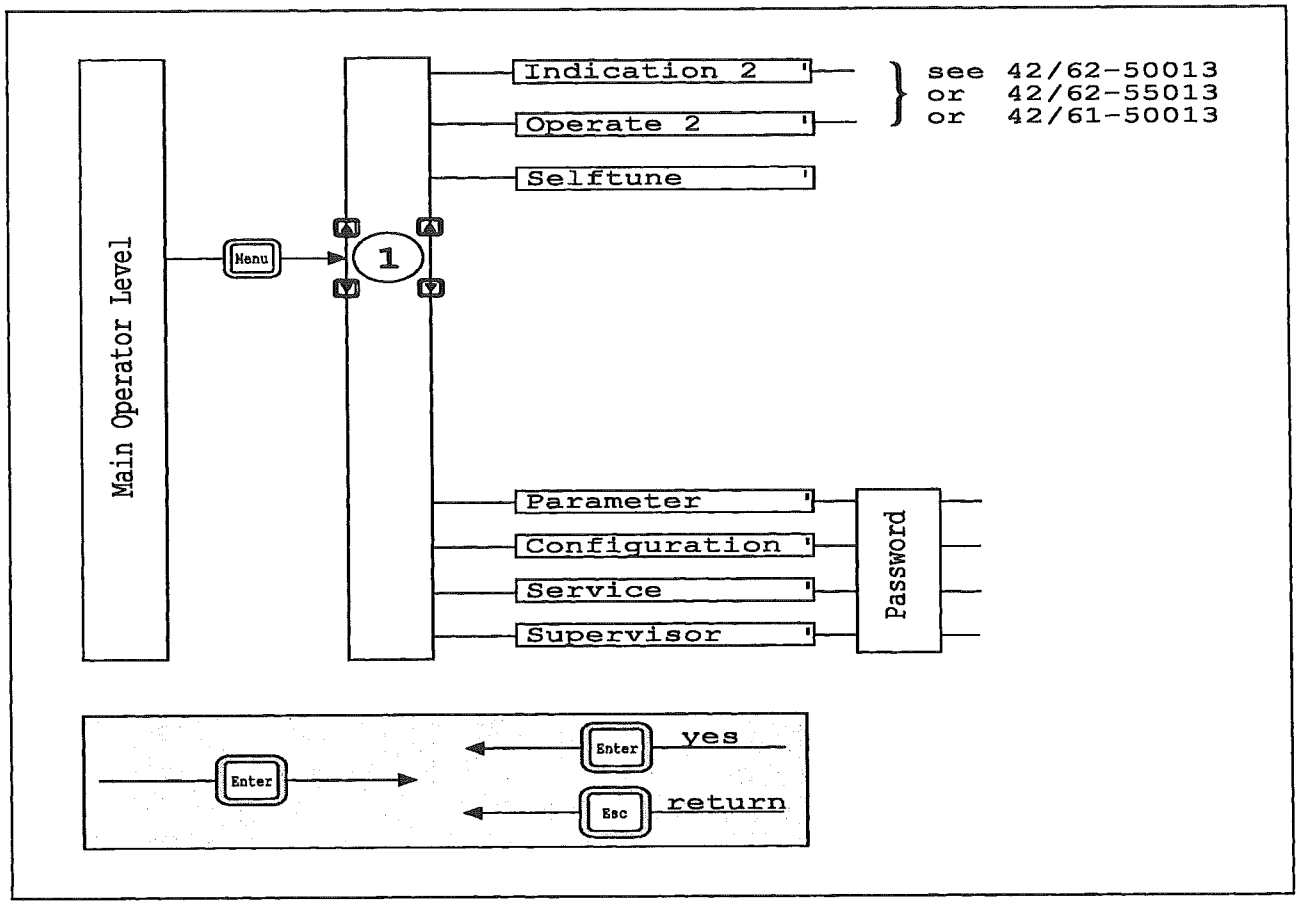


Fig. 2 Menu system
Z-19093

Self-tuning

The self-tuning function is enabled in the configuration menu. Once enabled, it can be used without a password.

Depending on the operating status of the self-tuning feature, the menu of the second level is opened.

Parameter

Setting of the values for the configurable functions. During the parameter setting, the controller is online, i.e. all functions are in operation.

Confi(guration)

Definition of the controller function, e.g. type of controller output, the number of channels etc. During configuration, the controller is offline, i.e. all analog and binary outputs are blocked (frozen).

Service

This menu contains i.a. the functions lead balancing, display illumination adjustment, calibration, diagnosis ...

Supervisor

This menu contains among others the menu item "Factory setting", which enables the controller to be reset to its basic setting (single-channel, continuous controller; inputs 1 and 2: 4...20 mA; output: 4...20 mA). The basic settings are underlined in the configuration tables.

⚠ Attention

All previously set functions are lost in case of a reset!

Alarm treatment

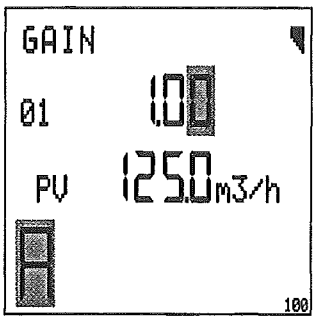


Fig. 3 Gain selected for setting. Alarm message in channel display
Z-19100

In case of alarm, alarm value infringement or error in the processing cycle during parametering or configuration work, the channel display changes over from /8/ to "A".

For acknowledgment, switch back to the operator control level (I-B10).

Password protection

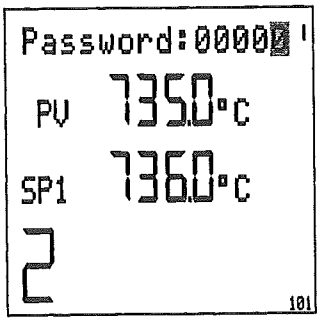


Fig. 4 Password input. 1. field on the right
Z-19101

If a password protection has been configured (I-B20), access to the protected area is gained by changing the default input "00000".

The password is a five-digit figure.

1. Shift the flashing (= changeable) field:
   <Ind>
2. Change the figure:
   <▲>, <▼>
3. Confirm the password:
   <Enter>

With a correct password, access is gained to the desired level. Without having to restate the password, it is now possible to change to any level of the menu system (Query: I-B20-Q01).

If the password is wrong, the display will change back to the main operation level.

If a hardware inhibition has been configured (I-B02-Q01) and the binary output set, any attempt to access a protected level will produce the message "OL inhibited".

The message is displayed for 3 s, after which there is an automatic return to the operator control level.

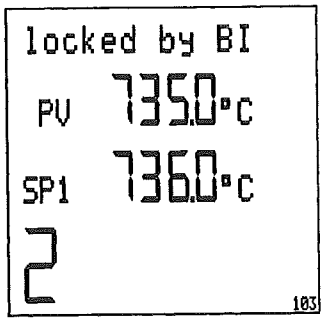


Fig. 5 Blockade of the parameter setting and configuration level by a binary input
Z-19103

Abort the password input

1. Abort the password input:
   <Esc>

Lost password

A lost password can be reset by provisionally changing a plug-in jumper in the device. This is on condition that the control loop has been switched off. Please find detailed information in the Section entitled "Service".

Parameter setting

During the parameter setting mode, the controller is online, i.e. all functions are in operation.

Since the automatic mode can be damaged by parameter modifications, the controller should be switched to "Manual" during configuration.

Parameter setting menu

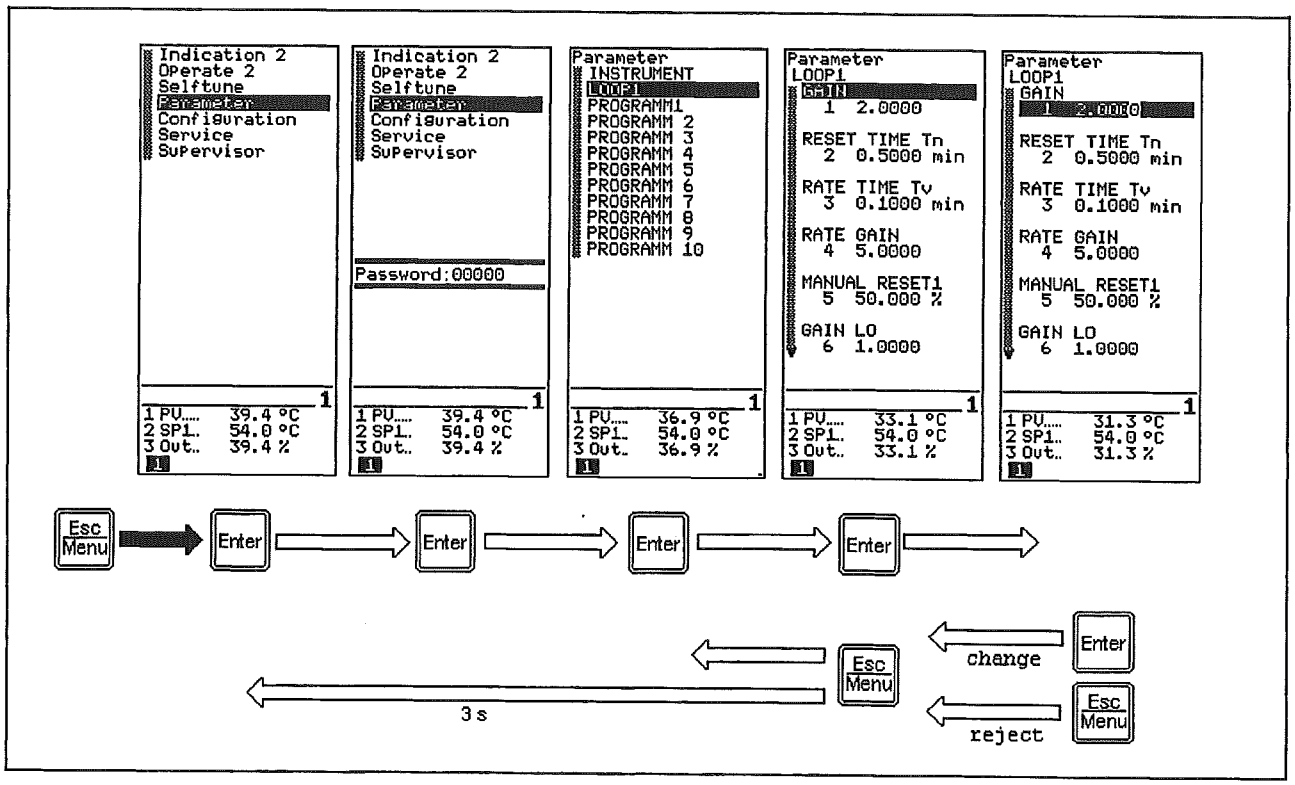


Fig. 6 Parameter setting menu **(Protronic 100: only Loops 1 and 2)**
Z-19036

Parameter selection and modification

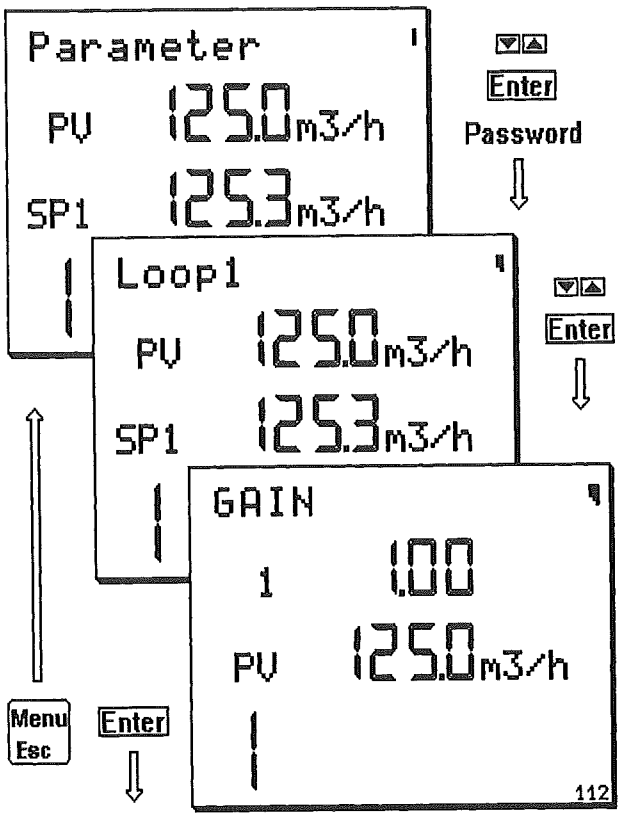


Fig. 7 Parameter selection
Z-19112

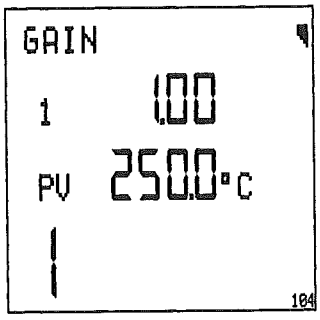


Fig. 8 Gain selected for modification
Z-19104

(Menu●)

1. Enter the parameter menu:
   <Menu>
2. If required, input password (proceed according to steps 4. to 8.):

(Menu✲)

3. Select parameter:
   <▲>, <▼>
4. Parameter released for modification:
   <Enter>

(Enter✲)

The parameter flashes at one position.

5. Modify at the flashing position:
   <Ind>
6. Shift the decimal point:
   Press and hold <Ind>
7. Change value:
   <▲>, <▼>
8. Take over modified parameters (including decimal point change):
   <Enter>

   or

   Reject modification:
   <Esc>

Enter●.

Parameter classification

The parameter stting Tables in this manual (as of page 62) have the following headings:

Device	All parameters valid for the entire device.
Loop 1 to 4	Parameters relating to control loops.
Program 1-10	Program 1 to 10 for the programmer (see Section on "Programmer").

Parameter setting of device

The parameter setting for the device consists of the four linearization tables. The dimension (EU) depends on the configured application. It is not input into the tables.

The tables can be parameterized only when the tables are integrated into the configuration (e.g. AI-Bx-Q02).

Parameter setting of loops 1 to 4
(Protronic 100: only loops 1 and 2)

PID Parameters (Lx-P01 to Lx-P19)

With a normal PID controller only the following parameters are possible:
01 Gain
02 Integral action time
03 Derivative time
04 Derivative gain
05 Operating point (if no integral action component) is accessible.

If a parameter control has been configured (Lx-B02-F7...Q22), the necessary parameters from range P06 to P21 become active and can be seen in the display. The currently active values are always displayed in the menu items "Display", "Parameter" even with active parameter control in P01 to P05.

PID2 Parameters (Lx-P25 - Lx-P37)

The parameters apply to a second controller output (**heat-off-cool** or **split range**). A parameter control of the first controller output is also effective for the second output. If the function is not intended to be effective for the second output, the start and end values must be equal (Gain 2 start = Gain 2 end).

Self-tuning Lx-P125 - Lx-P128

With the parameters P125 to P128, limitations are imposed on the self-tuning which are intended to ensure that no illegal operating situations arise.

Dead time (Parameters Lx-P39 to Lx-P53)

The time constants for the Smith Predictor (dead time algorithms) are set with these parameters. They are only accessible if this function has been configured.

Control output (Parameters Lx-P55 to Lx-P72)

The parameters P55 to P62 con only be seen if the corresponding output function has been configured (Lx-B01-Q02).

Limitations on the positioning signal (P67 to P70) are always available. Factory settings make them inoperative.

The safety correction values P71, P72 are configuration-dependent (Lx-B07-Q03, Q05, Q06 and Lx-B10-Q03, Q05).

Set points (Parameter Lx-P75 to Lx-P84)

The parameters P75 to P80 define the limits for the set points and their rate of change. Factory settings of parameters P77 to P80 make them inoperative.

Parameters P81 to P84 only become visible when the set points are configured as parameters (Lx-B05-Q02 ...).

Alarm values (Parameter Lx-P91 to Lx-P96)

If an alarm value has been configured for monitoring the rate of change, the parameter P96 will determine the time limit during which the values set with P71 to P75 may not be overshot.

P96 has only 3 possible values:

1 = 0:00:01 h = 1 second
2 = 0:01:00 h = 1 minute
3 = 1:00:00 h = 1 hour

Example:

The alarm value 1 should switch on at a change rate of more than 15 °C/min:

AL1	Lx-B08-Q01 = 11	(AL1: function dx/dt)
	Lx-P96 = 2	min
	Lx-P91 = 15	15 (°C, if x in °C)

Input ratio (Parameter Lx-P101 to Lx-P104)

These parameters are displayed during the description of the input circuits.

Input ratio (Parameters Lx-P115 to Lx-P117)

These parameters are only effective in the ratio input circuits. They define the limits of the ratio set point and the magnitude of the bias.

Disturbance variable feedforward (parameters Lx-P120, Lx-P121)

These parameters determine the transfer function of a differential disturbance variable feedforward.

TAG name (parameter Lx-P199)

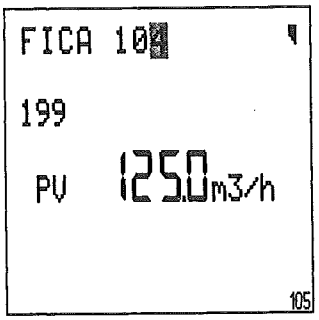


Fig. 9 Parameter 199 'TAG name' selected for setting
Z-19105

The parameter 199, the TAG name is set in the text line.

<▲>, <▼> permit the setting of A...Z, a...z, +, ., /, %, _,), (, °, 9...0, spacing, -

<Enter> terminates the entry and accepts the text input.

<Ind> relocates the entry position.

Exit the parameter definition level

<Menu> jumps to a higher level.

If this key is pressed and held for more than 5 s, the menu system will be exitted.

Self-tune mode

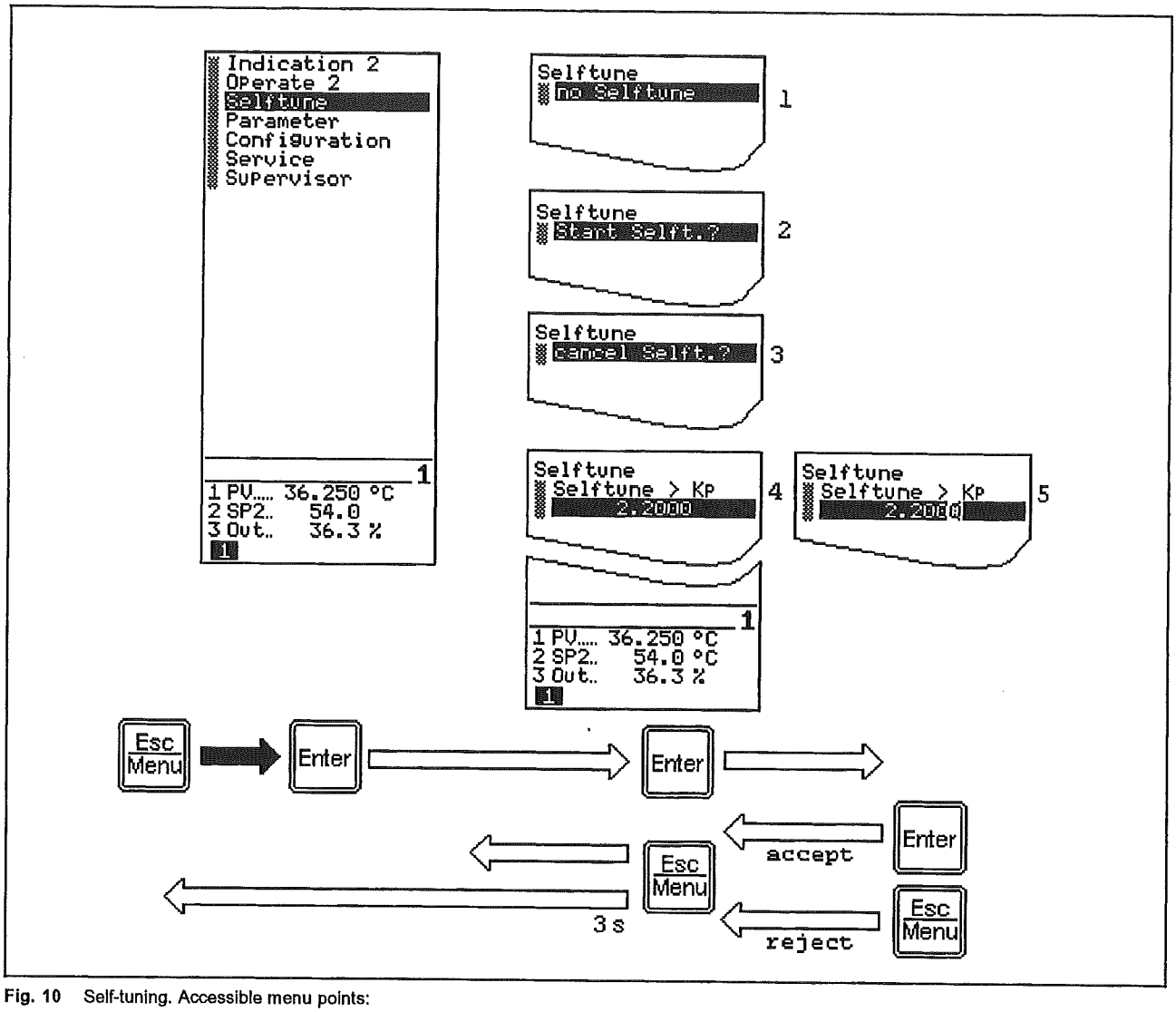


Fig. 10 Self-tuning. Accessible menu points:
Z-19109
1 self-tuning inhibited
2 before the start
3 during self-tuning
4 after calculating the parameter
5 calculated G can be manually altered

Remarks

The self-tuning of several loops in an apparatus must be done after after the other. The self-tuning mode can become active in only one loop at a time.

The self-tuning mode should be only started if the control variable has been constant for some time. This is generally only possible manually prior to the parameter definition.

In order to define a controller with the function heat-off-cool, the temperature of the path must be so high at the start of self-tuning, that cooling can become effective.

Procedure

In order to activate the controlled system, a control jump is applied to the controlled system at the start of the self-tune mode. This is then withdrawn after achieving an adjustable pulse duration.

From this control pulse, the controller identifies the type of controlled system and the first parameters. A further jump takes place for balanced controlled systems to enable more exact calculation of the parameters.

Parameter

In the parameter menu 4 parameters are reserved for self-tuning. If required, these can be matched to the conditions of the controlled system:

Control jump Lx-P125

The selection must be so big that an evaluatable change in the controlled system can take place. Without that, the controlled system would reach a critical limit. Factory setting: +5.0 %.

Max. duration of jump Lx-P126

Duration of the first actuating pulse. The interval ought to reach at least 1/10 of the expected path compensation time Tg. Factory setting: 0.25 min (15 s).

If the length of the 1st test pulse is selected at a length permitting a complete step response to be fully accepted (in both directions), no further step takes place on systems with balancing.

Max. Pos. control deviation Lx-P127
Max. Neg. control deviation Lx-P128

The first control pulse is withdrawn from the start value, if the there is a risk that the control variable could exceed the set range.

Factory setting: 99999 EU

If a second control pulse is given on the controlled system, the controller reduces this second pulse in such manner that no overranging takes place.

Start of self-tuning

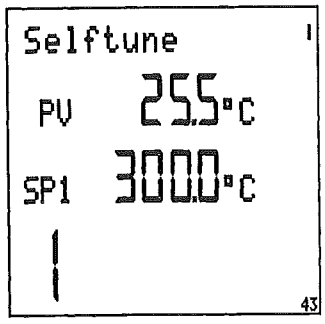


Fig. 11 Self-tuning
Z-19043

1. Call up the self-tune mode:
<Menu> <▼> <▼>

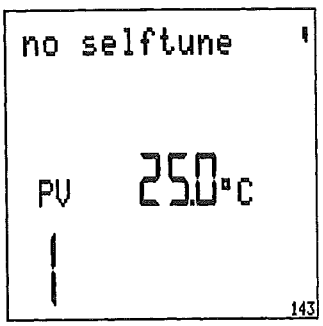


Fig. 12 Inhibited for self-tuning
Z-19143

The self-tune mode can only be started, if enabled in the configuration menu (Lx-B01-Q05 > 0). If the self-tune mode is inhibited, the message "inhibited f. SP". will appear on call-up.

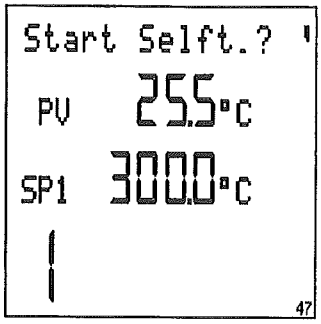


Fig. 13 Start self-tuning?
Z-19047

3. Upon opening the menu point "Self-tune", self-tuning will start:
<Enter>

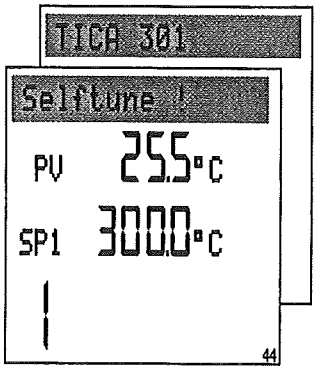


Fig. 14
Z-19044

The display springs back to the main operator control level. A loop changeover is now possible. The display in the text line of the loop with active self-tuning changes between the TAG names and "Selftune!".

⚠ Attention

During the determination of the parameters, the loop is in the manual mode. In this situation, the controller output and the set point may not be changed manually. Manual adjustments are enabled for emergency interventions.

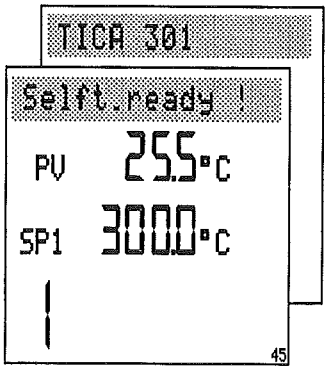


Fig. 15
Z-19045

On completing the self-tuning exercise, the display changes. After re-entering the self-tune mode (fig. 11 and subsequently 16), the calculated values are offered for acceptance.

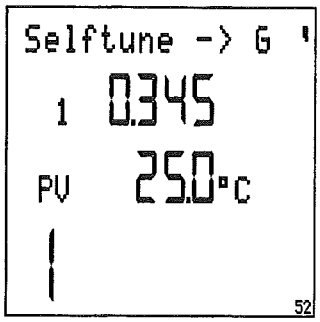


Fig. 16
Z-19052

4. Changeover between the displays G, *Tn* and *Tv*:
<▲>, <▼>

5. Change the displayed value:
<Enter>
<▲>, <▼>

or

5. Exit the self-tune mode:
<Esc>

Acceptance of parameters

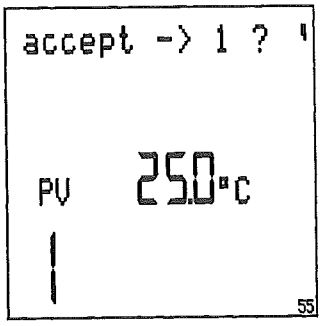


Fig. 17 Accept >1?
Z-19055

After displaying and modifying, if necessary, the determined values, these can be accepted.

1. Accept the values:
   <Enter>

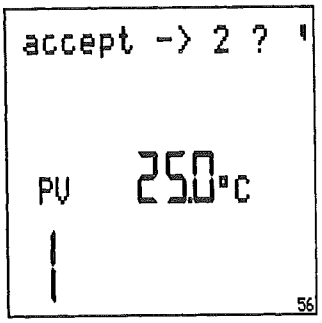


Fig. 18 Accept >2?
Z-19056

For controllers with two control functions heat-off-cool or split range, it must be decided, if the obtained parameter set for heat (accept > 1) or cool (accept > 2) should be used.

Rejection of parameters

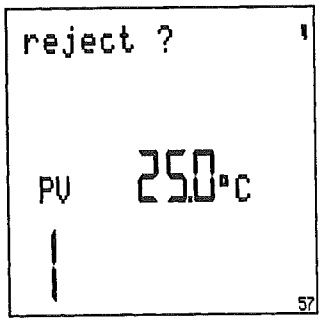


Fig. 19 Reject?
Z-19057

1. Reject parameter:
   <Enter>

The previously set values remain valid.

Abort the self-tuning mode

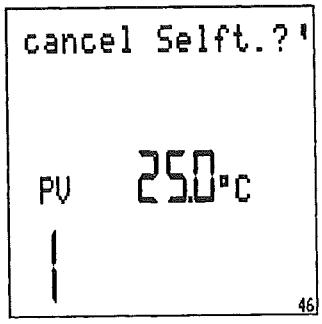


Fig. 20 Abort parameter definition?
Z-19046

Whilst self-tuning is in process, it can be aborted by reaccessing the operation level 2 and opening the menu item self-tuning.

1. Abort the self-tuning exercise:
   <Enter>

or

1. Do not abort the self-tuning exercise:
   <Menu>

The display springs back to the second operation level 2.

Configuration

Selection of the configuration menu

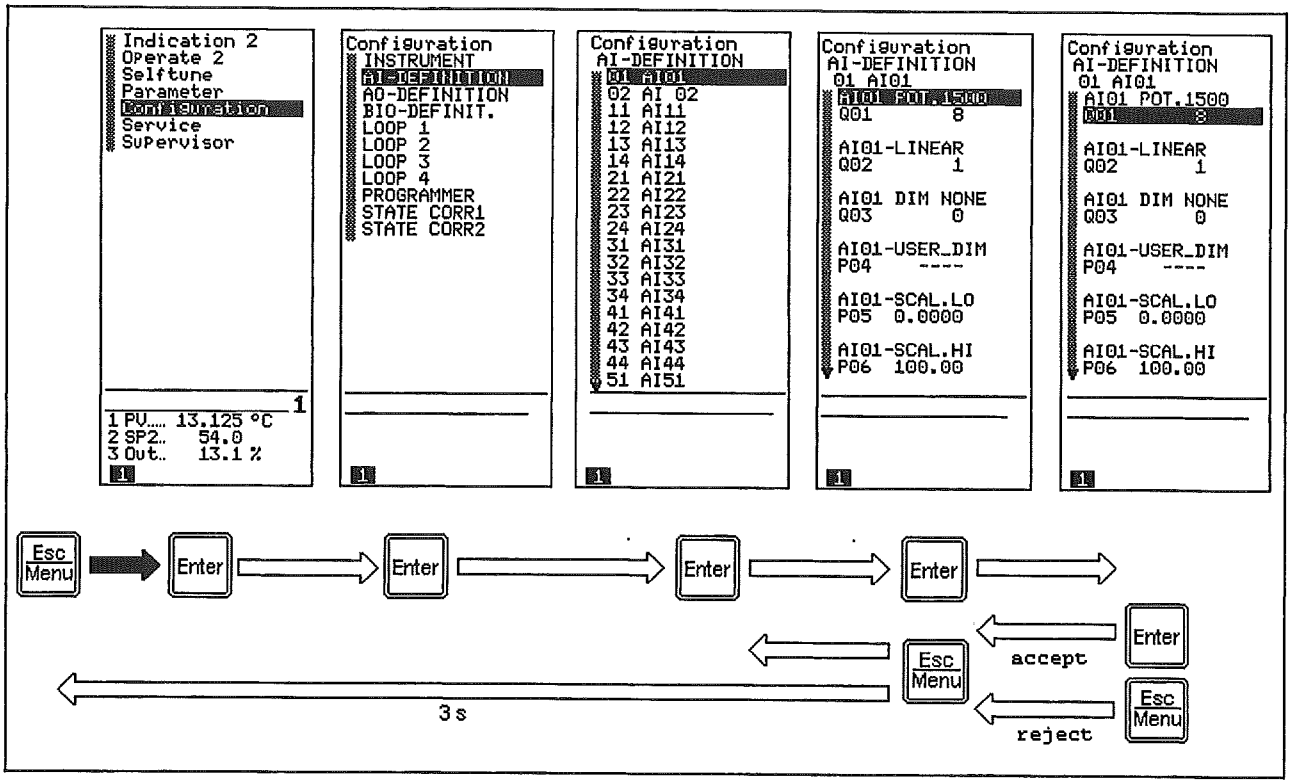


Fig. 21 Configuration menu
Z-19061

Classification of the configuration tables

The configuration tables (as of page 74) provided in this instruction manual are classified as follows:

Unit	all functions which apply to the entire instrument
AI-Definition	define analog inputs with the functions sensor, linearization, filtering, scaling
AO-Definition	define signal ranges of the analog outputs
BIO-Definition	define the binary inputs/outputs as inputs or outputs
Loop 1 to 4	configure control tasks with the functions control output, input signal connection, PID structure
State corr-x	select and parameter-set state correction
Programmer	activate programs

Configuration sequence

The following sequence is suggested for the configuration of a new unit:

1. Unit
2. Analog inputs
3. State correction, if provided
4. Analog outputs
5. Binary input/outputs
6. Controller function

Changing the configuration

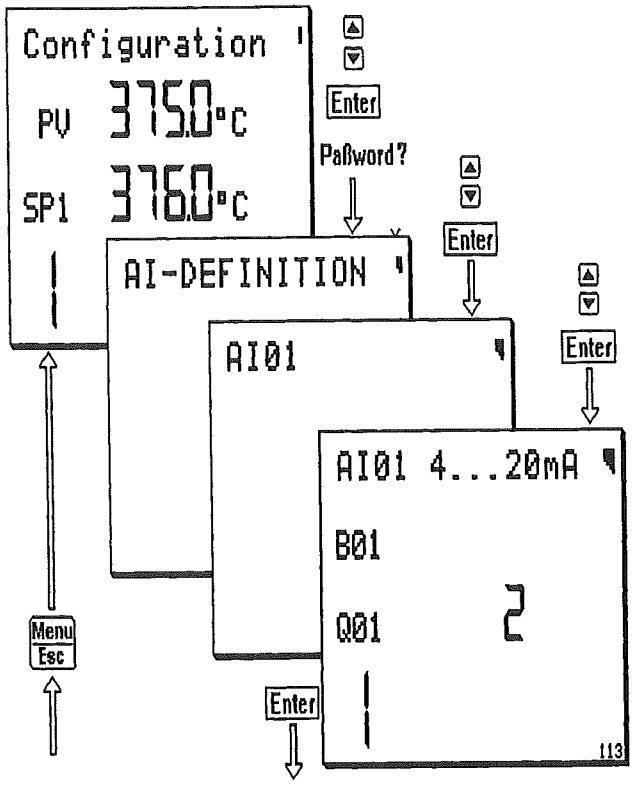


Fig. 22 Select AI → B01 → Q01
Z-19113

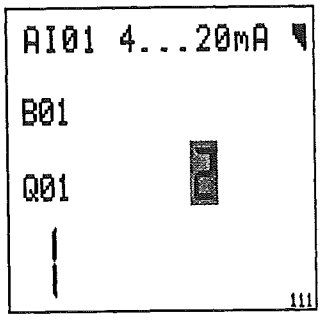


Fig. 23 Change configuration
Z-19111

During configuration, queries (Fx) or parameters (Px) can be provided for adjustment.

⚠ Attention

If a free configuration is loaded, this is displayed on calling up the configuration menu through "Confi(free)" (instead of "Confi").

Only a few menu items can be called up. These are identified in the configuration tables provided as of page 74.

1. The selected query / the selected parameters for adjustment are enabled:
   <Enter>

Enter✲

The response enabled for change flashes.

Queries are responded to with one- or two-digit figures. Parameters require the input of one- to 5-digit values (see Chapter on "Parameter setting").

2. Change the flashing position:
   <▲>, <▼>
3. Shift the flashing position:
   <Ind>
4. Shift the decimal point:
   hold <Ind>

The text corresponding to the currently visible numeral is displayed in the text line.

5. Accept the selected response with:
   <Enter>

Enter●

The response ceases to flash.

Exit the configuration menu

<Menu> jumps up one level higher.

If you keep this key pressed for more than 5 s, the menu is exitted.

When the plausibility check is switched on (see Section on "Supervisor"), the unit checks the configuration for completeness and plausibility on exitting the configuration menu.

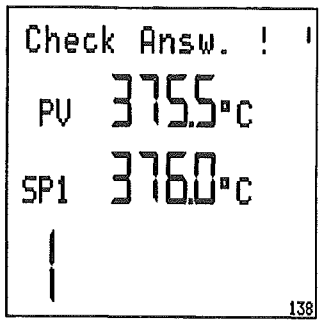


Fig. 24 Check response!
Z-19138

After that, the set functions are conditioned for processing.

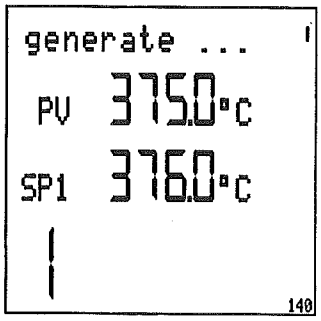


Fig. 25 Generate ...
Z-19140

After successfully taking over the configuration, the unit returns to the configuration menu.

1. Exit the configuration menu:
   <Esc>

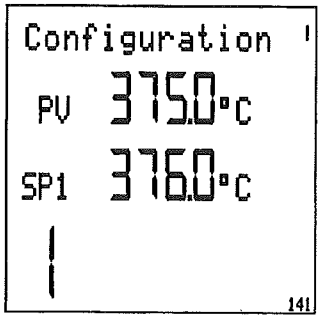


Fig. 26 Configuration
Z-19141

Configuration Examples

The following configuration examples are detailed illustrations of some of the most important configurations.

The configuration tables (as of page 74) illustrate complete configuration possibilities.

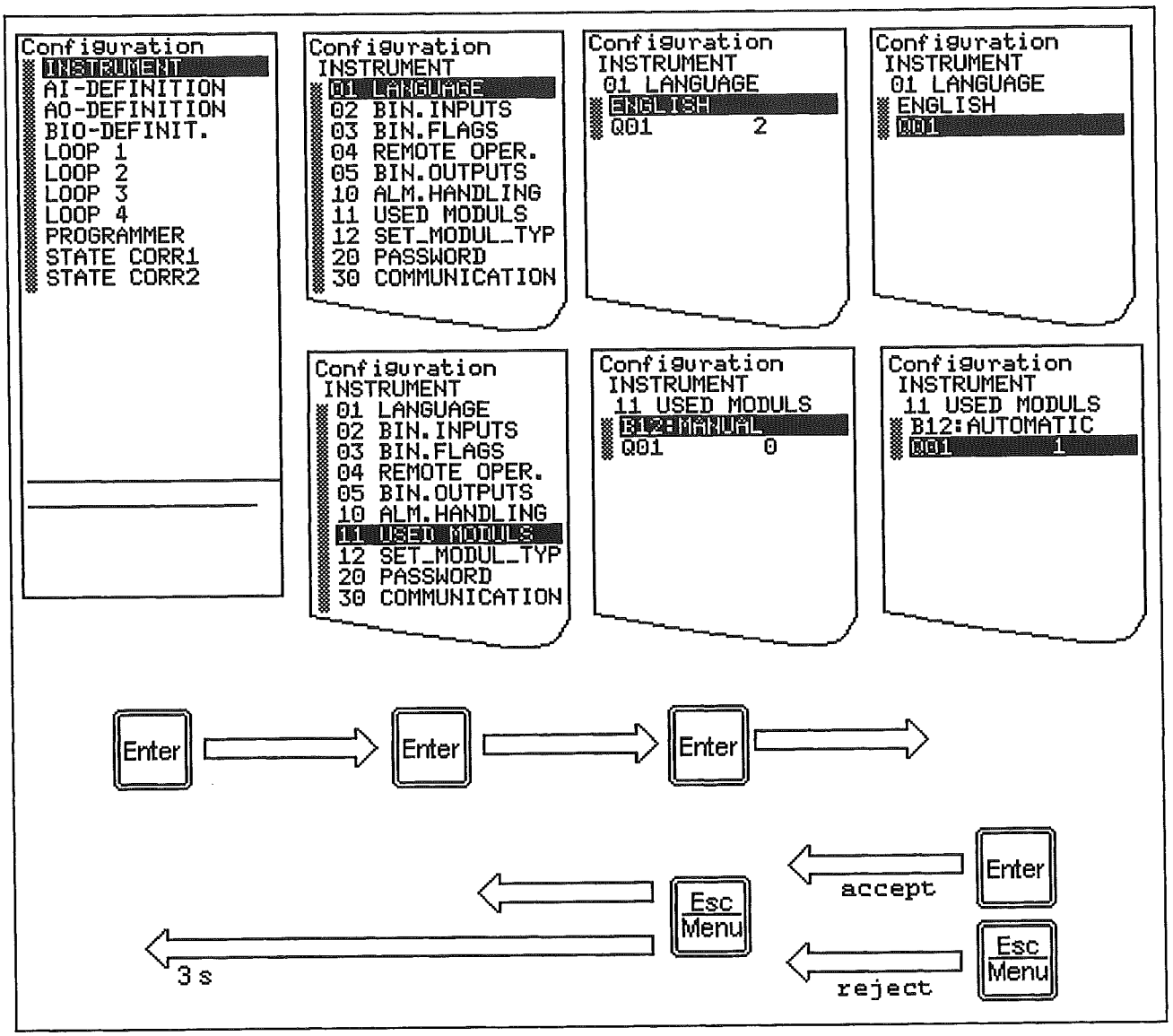


Fig. 27 Configuration menu "Instrument"
Z-19074

Instrument

Hardware

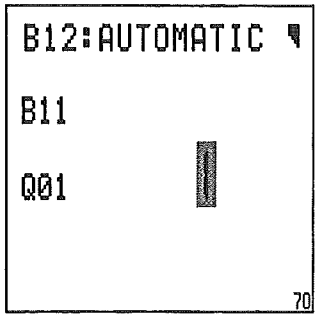


Fig. 28
Z-19070

To be given special attention is Point I-B11-Q01 "Hardware definition". The configurable input/output functionen are determined by the existing modules. These are recorded in I-B12-Q01 to Q07 (Digitric 500: Q04). If the hardware identification is switched on (I-B11-Q01=1), the existing modules will be automatically recognized and recorded in I-B12-Q01 to Q07 (Digitric 500: Q04). I-B11-Q01 is automatically reset to 0.

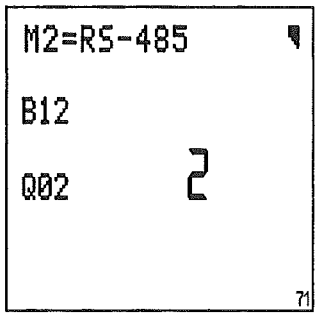


Fig. 29 Display Protronic 500: B2=RS-485 (shown here)
Z-19071 Display Digitric 500: B4=RS-485

By manually changing the inputs in I-B12, it is possible also to include modules in the configuration which are not (yet) available. It is not possible to commission a unit with incomplete hardware. An error message "Module slot x" is generated.

Password

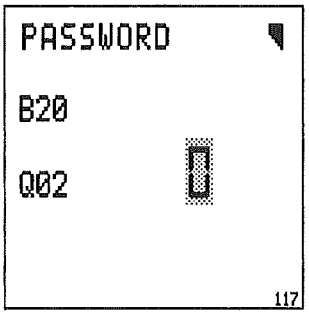


Fig. 30 Password definition
Z-19117

The password is a five-digit figure.

I-B20-Q01 = 0	The existing password is switched off.
I-B20-Q01 = 1	The password protection is activated. On exitting the menu system, the password protection becomes immediately active.
I-B20-Q01 = 2	Password protection remains switched off for a further 30 s after exitting the menu system. During this period it is possible to restate the parameter setting or configuration level without having to restate the password.
I-B20-Q02	The stated password is released for modification. It is changed in the same way as parameters.

AI Definition

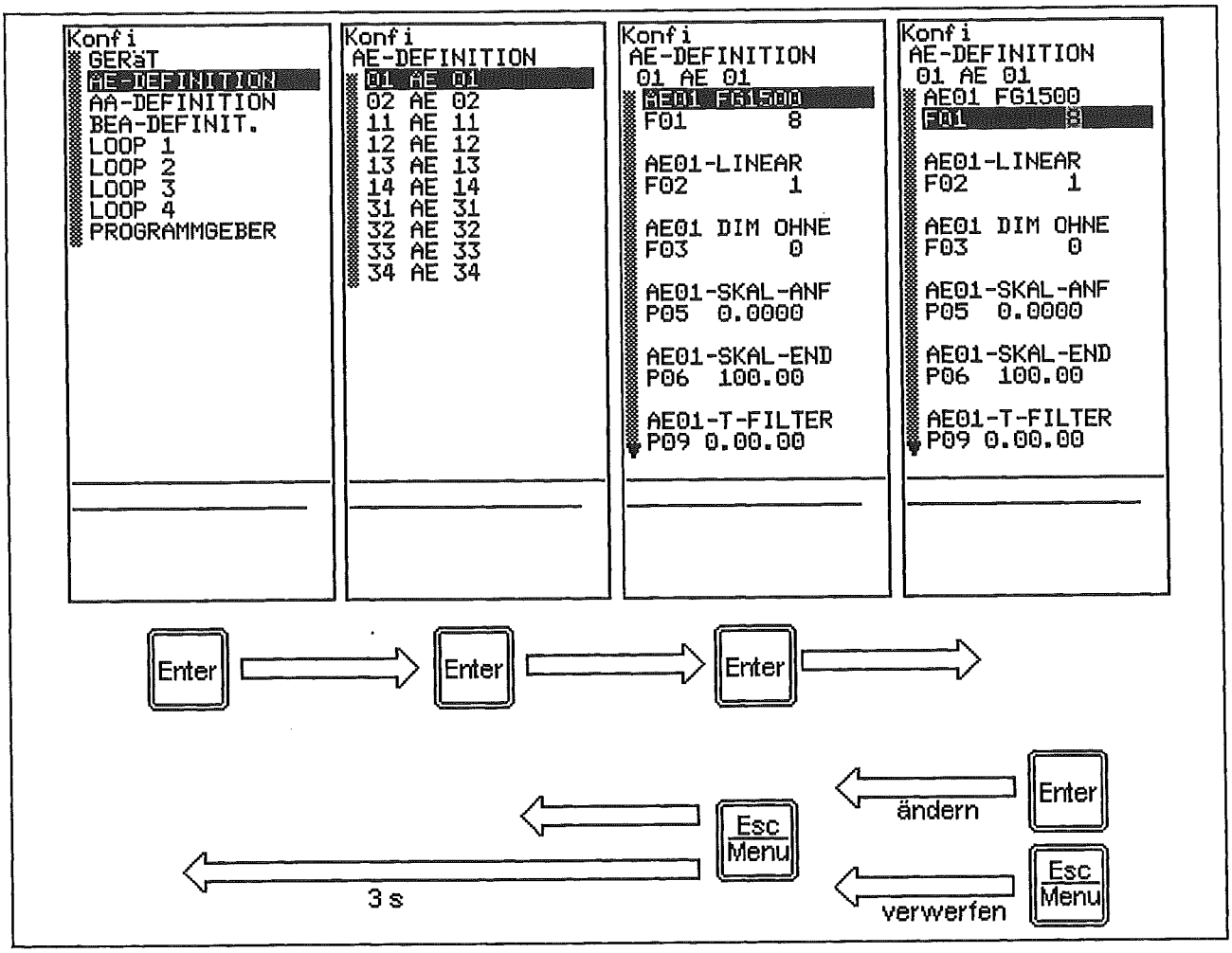


Fig. 31 Analog input menu
Z-19049

General

All analog inputs must be scaled for further use in the device. The values so defined are used as floating decimal point values for all further calculations in the device.

The display of an analog input as control variable PV can be adjusted independent of range and the number of additional decimal points.

Example:

Thermocouple type K
Measuring range of the sensor: −200...+1400 °C
Control range: 300.0...500.0 °C

AI01 is the universal input of the basic unit. The primary detector is connected according to type and according to the relevant connection diagram. In the device, the inut type must be input in the AI-B01-Q01.

AI02 is the current input of the basic unit.

AIxy are the analog inputs of the modules. x defines the card slot, y the number of the input on the module.

Sensor fault

Monitoring is implemented at all inputs and for all types of sensors.

1. Reaction of controller:

AI-Bxy-Q10 = 1

The missing measured value is replaced by a default value if there is a sensor fault/line break. This can be inside or outside the mormal measuring reange, so that an appropriate controller response is forced.

AI-Bxy-Q10 = 2

The controller receives an unchanged measured value simulated. The controller output does **not** respond to sensor fault.

2. Signalling:

Alarm signalling independent of the controller response can be effected if AI-Bxy-Q12 > 0 and AI-Bxy-Q13 > 0.

Dimension

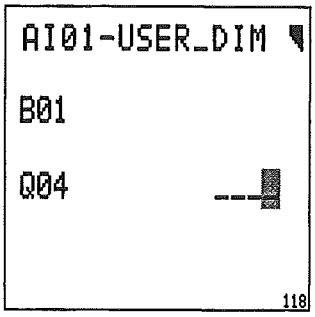


Fig. 32 Creating a user-dedicated dimension
Z-19118

Each input is scaled in itself and can be provided with a dimension.

In the case of inputs for temperature sensors, "°C" is automatically provided as dimension. It is possible to change over to "°F" with automatic conversion.

AI-Bxy-Q03 offers a number of dimensions. If the dimension required is not available, then a four-digit dimension can be generated in AI-Bxy-Q04 = 1 using AI-Bxy-Q04.

Filtering

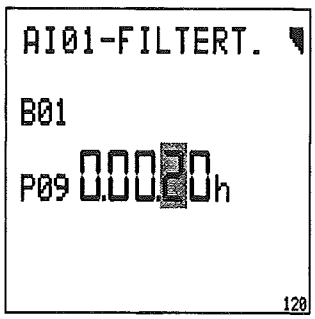


Fig. 33 Filter time constant 0.00.20 h = 20 s
Z-19120

To suppress deleterious fluctations in measured values, all measured signals can be attenuated by a first order delay filter 1. The time constant is set with AI-Bxy-Q09 (maximum 0.02.00 h = 2 min).

mA Inputs

AI-Bxy-Q01 = 1.2	Signal range 0 or 4 to 20 mA.
AI-Bxy-Q03	Measured value is displayed linearly in the seclected scaling.
AI-Bxy-P05	Display at measured value 0 or 4 mA.
AI-Bxy-P06	Display at measured value 20 mA.
AI-Bxy-Q02 = 2.3	The measured value is square rooted. Below PV0, the resultant measured value is forced to 0, or replaced by a measured value with a linear characteristic.
AI-Bxy-P08	is used for setting PV0.
AI-Bxy-Q02 = 4...14	If the measured value originates from a non-linearising temperature transmitter, the sensor characteristic can be predefined.

The range of the transmitter is set by AI-Bxy-P05 and P06.

Example:

Transmitter
300 to 700 °C, type K = 0... 20 mA, mV-proportional:

AI-Bxy-Q01 = 1
AI-Bxy-Q02 = 6
AI-Pxy-Q05 = 300.0
AI-Pxy-Q06 = 700.0
AI-Bxy-Q03 = 3 (automatic)

Thermocouple input

AIxy-Q01 = 3	Thermocouple.
AIxy-Q02 = 4...13	Celection of thermocouple type.
AIxy-Q03 = 3	Changeable to °F AI-Bxy-Q03 = 4.
AIxy-Q07 = 0...4	Depending on reference junction compensation.

Resistance thermometer input

AI-Bxy-Q01 = 4, 5, 6	Depending on mode of connections used.
AI-B01-Q02	Distinguishes between 2 ranges: = 13 -200,0...+200.0 °C = 15 -200,0...+800.0 °C
AI-B02-Q02	doesn't permit Pt100 measurement.

Lead balancing must be performed with two-wire circuit (see Section "Service").

Teletransmitter input

Balancing for start and end is normally required with teletransmitter measurement. The balancing is described in the section on "Service". The scaling and linearization correspond to the mA inputs.

Universal input AI01 for teletransmitter measurement:

AI01-Q01 = 7 or 8 (Digitric 500: AI02-Q01 = 7 or 8)

Current input AI02 and other current inputs:

AI02-Q01 = 1 (0...20 mA)

Characteristics

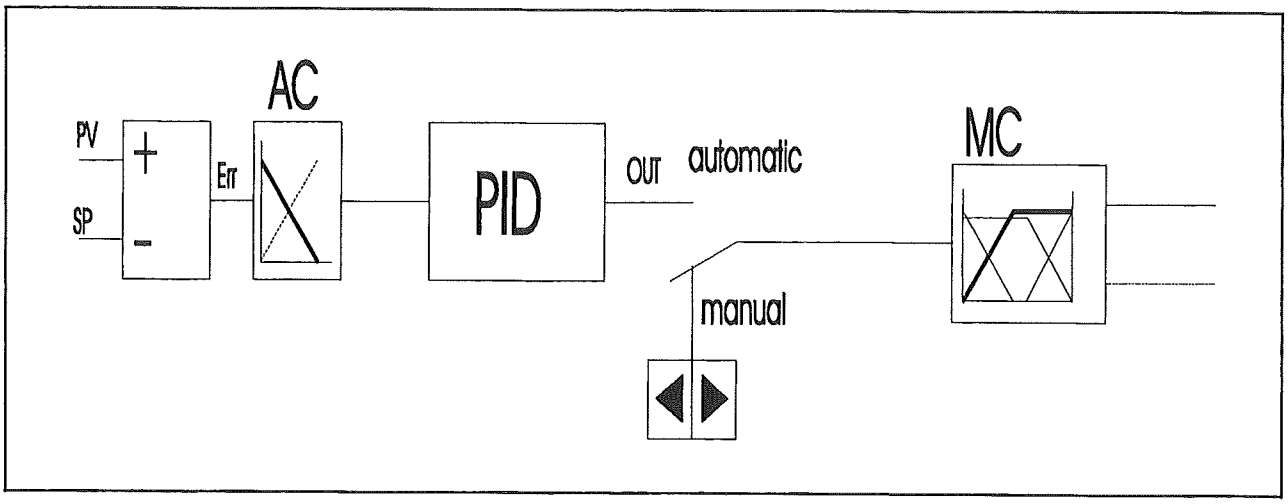


Fig. 34
Z-19079

There are two characteristics for controllers, whose setting must be conducted as follows:

Manual characteristic (MC) Lx-B01-Q03

The manual characteristic determines how the controller output behaves when the manual keys <◂> and <▸> are actuated (in step controllers this function is defined by the wiring).

The requirements for this are dictated by the safety precautions taken for the regulating unit.

Example:

The valve opens with spring force and closes proportionally to the regulating current, which means it is opened in current-free condition

or

the valve coloses with spring force and opens proportionally to the regulating current, which means it is closed in current-free condition.

By selecting the appropriate characteristic, the key <▸> can be used to open a valve of any type. An open valve is always displayed with y = 100 %.

The block MC further contains an optional classification of the output signal of the PID function on two output signals with equal or different characteristic (split range).

Automatic characteristic (AC) Lx-B02-Q01

The automatic characteristic determines, how the controller reacts to a change in the controller variable. Should the output rise or fall in case of increasing controlled variable? Should there be more cooling or less heating in case of increasing temperature?

When setting the automatic characteristic, please pay attention to the manually set characteristic.

Set points

Up to 7 set point sources are provided in the controllers:
- up to 4 manual set points which can be set via the serial interface,
- 1 external set point, linked with an analog input,
- 1 Computer set point and
- 1 Programmer (only once in the unit).

Which set points are available is defined by configuration.

Set point 1

Lx-B05-Q01 = 0	Set point 1 is switched off in applications with only external set point.
Lx-B05-Q01 = 1	Set point can be changed with the keys and via the interface.
Lx-B05-Q01 = 2	if another set point is active, set point 1 follows the the active set point. This makes bumpless resetting to set point 1 possible.

Lx-B05-Q02 = 0	The current set point is not stored in unit. It cannot be transferred to another unit with the configuration.
Lx-B05-Q02 = 1	At the parameter level, Lx-P81 is set and stored as set point 1. This value can be transferred to other units. Process-related set point changes at the operator control level are not stored.

Set point 2 to 4 = Ratio set point 1 to 3

It is possible to configure individually, if these set points
- can be activated,
- can be adjusted from the front panel or
- can be adjusted and stored as parameters Lx-P82 to Lx-P84 or
- can be effective as absolute or differential value to set point 1 (adjusting the differential is only possible at the parameter setting level).

Computer set point

The computer set point can only be changed via the interface.

Set point ramp

A set point ramp is always activated, although it is practically inoperative because of its factory setting 99999 EU/s.

The ramp function becomes active by setting Lx-P77 and Lx-P79 to lower values.

Set point display during the transition from old set point to target set point:

Lx-B05-Q09 = 1	Target value to which the set point will change.
Lx-B05-Q09 = 2	The current set point determined by the ramp.

Programmer

One programmer is available for each unit. This programmer can store up to ten programs, each with 15 sections.

Activating programs

The individual programs are activated in the configuration menu (P-B01-Q01 bis Q10):

0 The program has not been activated and connot be selected on the front panel.

1 At the start of the program, the program starts at the programmed start set point Px-P01.

2 If the current measured value is within the first section, then the program starts with this value. The section is shortened accordingly. If the value lies outside of the section, then the program is started with the start set point.

Parameter setting of programs

How the program behaves at start of the program (start at set point or at the control variable) is determined in the configuration (P-B01-Q01 to Q10).

The parameters of programs 1 to 10 are set separately.

Parameters Px-P01 to Px-P31

The programmer parameters Px01 to Px31 define the behaviour of the set point as a function of time. The parameter Px-P01 is the start value. The value of parameter Px-P02 is attained after the time Px-P17 is reached. The time is set to "0" for a step-shaped curve.

⚠ Attention

Sections which have the end values -9999 are sprung over by the program.

Parameters P-P32 to P-P46

The binary channels are synchronised chronologically with the sections of the set point program. Up to four binary flags can be set in each section. In the parameters, the required numeral to be input is calculated as follows:

Flag 1 set: P0x = 1
Flag 2 set: P0x = 2
Flag 3 set: P0x = 4
Flag 4 set: P0x = 8

Example:
In section 2 flags 1, 3 and 4 are to be set:
P-P33 = 13.

Parameters P-P47 to P-P49

With the parameters Px-P47 to Px-P49 it is possible to define and configure a loop between Px-P47 and Px-P48, which the programmer so often repeats upon reaching the end of section Px-P48, until the value Px-P49 is obtained. It is after that that the remaining sections are processed.

Parameters P-P50 to P-P64

Using the parameters P-P50 to P-P64, it is possible to define whether the program is to be stopped in individual sections, if the measured value cannot follow the prescribed set point curve.

Ramps are stopped with them, stop times start running when the measured value is within the tolerance range. The factory settings 99999 make this function inoperative.

Parameter setting for one program

Section	Value	Time	Tolerance	Binary track
Start value	Px-P1			
1	Px-P2	Px-P17	Px-P50	Px-P32
2	Px-P3	Px-P18	Px-P51	Px-P33
3	Px-P4	Px-P19	Px-P52	Px-P34
4	Px-P5	Px-P20	Px-P53	Px-P35
5	Px-P6	Px-P21	Px-P54	Px-P36
6	Px-P7	Px-P22	Px-P55	Px-P37
7	Px-P8	Px-P23	Px-P56	Px-P38
8	Px-P9	Px-P24	Px-P57	Px-P39
9	Px-P10	Px-P25	Px-P58	Px-P40
10	Px-P11	Px-P26	Px-P59	Px-P41
11	Px-P12	Px-P27	Px-P60	Px-P42
12	Px-P13	Px-P28	Px-P61	Px-P43
13	Px-P14	Px-P29	Px-P62	Px-P44
14	Px-P15	Px-P30	Px-P63	Px-P45
15	Px-P16	Px-P31	Px-P64	Px-P46

Tab. 1

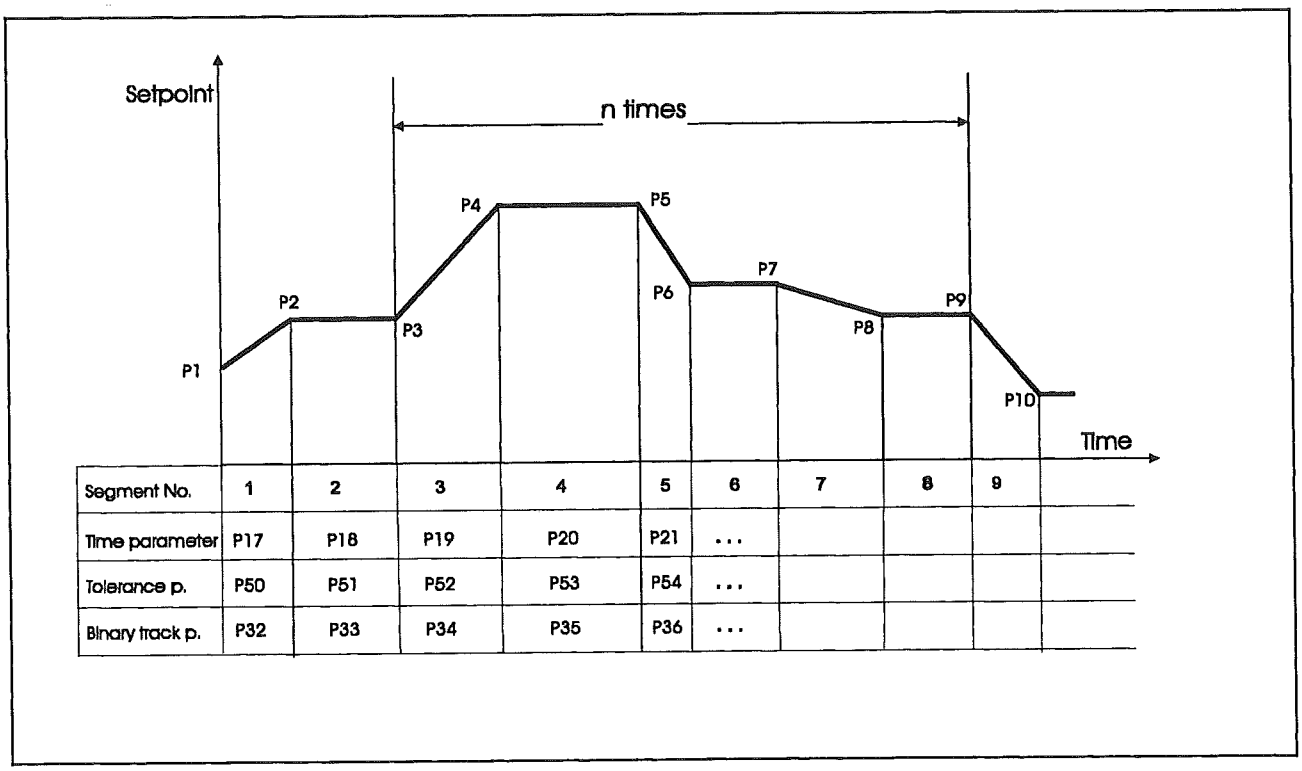


Fig. 35 Programmer with loop Section 3 to Section 8
Z-19102

Fixed value control

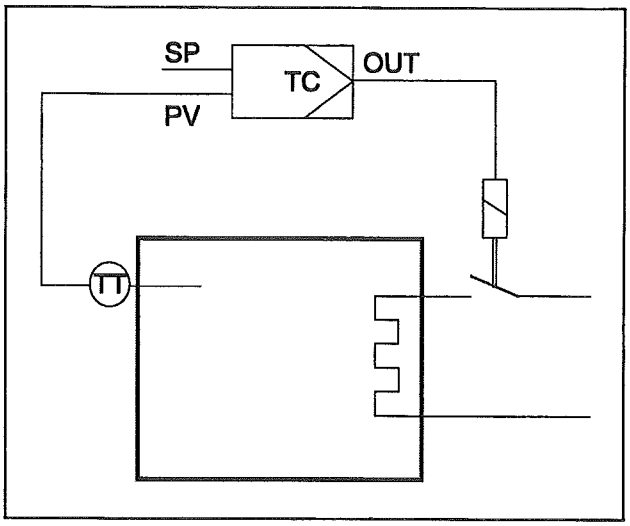


Fig. 36 Fixed value control
Z-19066

The fixed value input circuit is possible in:
- single- and multi-channel controllers and
- in slave controllers of cascades.

Task

The controlled variable PV is controlled to a set point SP produced in the controller or outside it. A state correction can be switched on in quantity control of steam or gas (see Section on "State correction")

Configuration

Input signal connection

Lx-B03-Q01 = 1	Input circuit fixed value.
Lx-B03-Q02	Does not apply.
Lx-B03-Q03	Normally 2, Err in EU.
Lx-B03-Q04	Dimension for PV/SP display.
Lx-B03-P05	User-defined dimension.
Lx-B03-Q06	Decimal point position in the digital display.
Lx-B03-P07	Numerical value for digital display for start of measuring range.
Lx-B03-P08	Numerical value display for end of measuring range.
Lx-B03-P16	Required starting value for analog display.
Lx-B03-P17	Required end value for analog display.

The difference between Lx-B03-P08 and Lx-B03-P07 is the reference value for G. For a P controller with Kp = 1, if the input is changed by P08 – P07, the output will be changed by 100 %.

Example 1

Thermo couple type K measuring range –200...+1400 °C: The measurement produces between –200 °C and +1400 °C correct values.

Control range

900.0 to 1100.0 °C with one decimal place after the point:

Lx-B03-Q04 = 3	Display in °C.
Lx-B03-Q06 = 1	Decimal point position 0000.0.

Note
If the number of decimal point positions of the measured value and decimal places is more than the number of displayable positions, the number of decimal places will automatically be reduced.

Lx-B03-P07 = 900	Lower-range value.
Lx-B03-P08 = 1100	Upper-range value.

The placing of a decimal point is not necessary.

Analog display

Lx-B03-P16 = 900	Start of measuring range.
Lx-B03-P17 = 1100	End of measuring range.

Every other setting within the range –200 to +1400 is possible and permissible, if it appears meaningful for the system.

It is not necessary to set a decimal point position.

Set point limits

The set point limit should be set to meaningful values within the control range.

Lx-B03-P75	SPmin = 900 (°C)
Lx-B03-P76	SPmax = 1050 (°C)

Example 2
(not Protronic 100)

Fixed value control with state correction.

The inputs required for calculating the flow must be configured in the required units (mbar, bar, °C). The resultant signal is calculated for example in m^3/h.

Measuring range

0...20000 m^3/h after state correction.

Control range

is equal to measuring range.

Lx-B03-Q04 = 7 Display in m^3/h.
Lx-B03-Q06 = 0 No decimal point position.

Note
For displays up to 20000 no decimal position is possible after the decimal point.

Lx-B03-P07 = 0 Measuring range start.
Lx-B03-P08 = 20000 Measuring range end.

Analog display

Lx-B03-P16 = 0 Measuring range start.
Lx-B03-P17 = 20000 Measuring range end.

Set point limits

The set point limits are to be set to meaningful values within the control range.

Lx-B03-P75 SPmin = 5000 (m^3/h)
Lx-B03-P76 SPmax = 18000 (m^3/h)

Routing of analog inputs

The following normally applies to single-channel controllers without modules:
L1-B04-Q01 = 1: 1. input = control variable PV.

In the case of multi-channel controllers, the configuration is according to the arrangement of the available inputs.

The second analog input can perform different tasks:

1. Position feed back signal for step controllers
   L1-B01-Q04 = 2

2. External set point
   L1-B05-Q06 = 2

3. 2nd adjustable measured value source
   L1-B04-Q02 = 2 together with
   L1-B04-Q06 = 1 to 76 (Digitric 500: 46), depending on the binary input available

   Note
   The two measured values must have the same dimension but not the same measuring range.

   Application examples:
   - Level control on two different tanks.
   - Temperature control
     with thermocouple measurement up to 1200 °C
     and with
     pyrometer between 1000 and 2500 °C.

4. Parameter control
   G L1-B02-Q07 = 13 or/and
   Tn L1-B02-Q10 = 13 or/and
   Tv L1-B02-Q13 = 13 or/and
   OUT0 L1-B02-Q16 = 13 or/and
   TT L1-B02-Q19 = 13 or/and
   T1 L1-B02-Q22 = 13
   KS L1-B02-Q25 = 13

5. Disturbance variable feedforward
   L1-B02-Q25 = 2 together with
   L1-B02-Q26 = 1 to 4

6. Y tracking (at times, controller output is forced to the value of input 2, not for step controllers)
   L1-B10-Q10 = 2 together with
   L1-B09-Q11 = 1 to 76 (Digitric 500: 46) (BIxy)

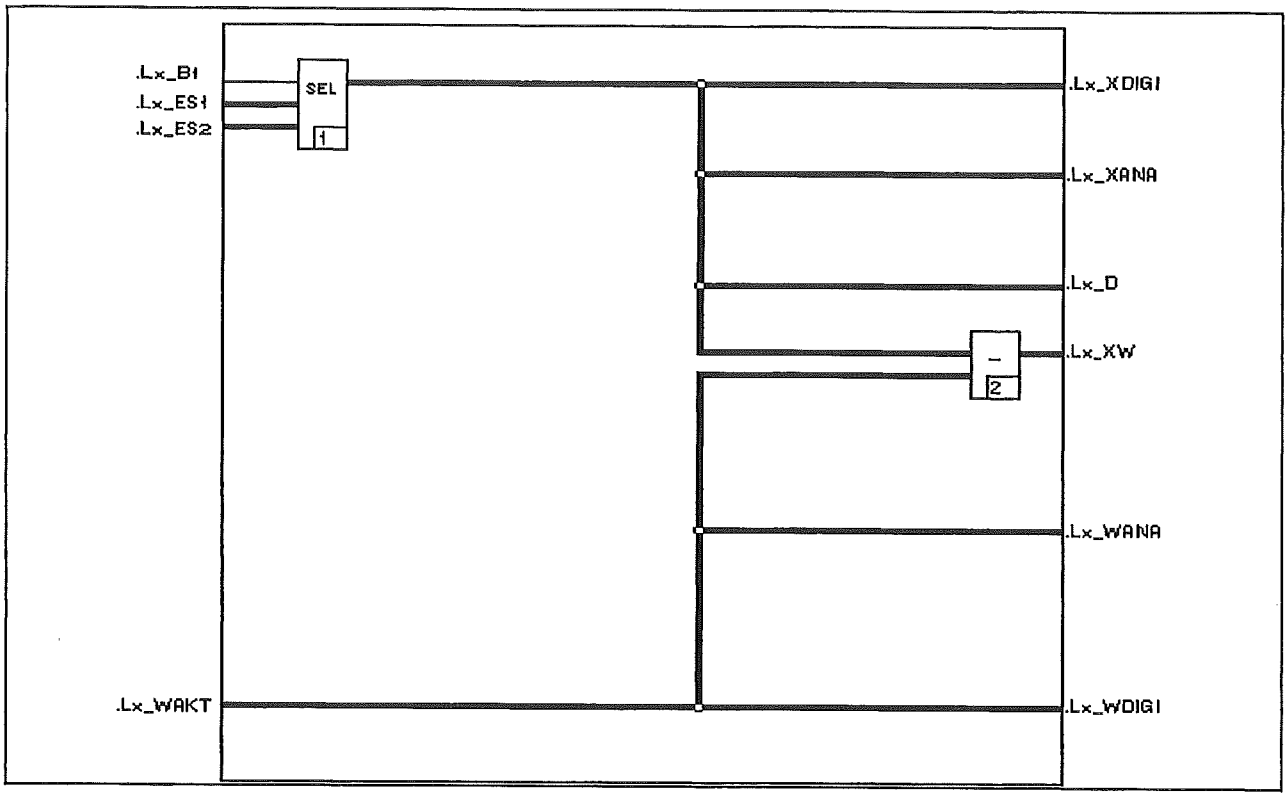


Fig. 37 Input circuit fixed value

Z-19069

.Lx_B1	Changeover ES1 ←→ ES2 with switch SEL	.Lx_XANA	Analog display of PV
.Lx_ES1	Input 1, routes via Lx-B04-Q01	.Lx_WANA	Analog display of SP
.Lx_ES2	Input 2, routes via Lx-B04-Q02	.Lx_D	to D component
.Lx_WAKT	Current set point	.Lx_XW	Control deviation
.Lx_XDIGI	Digital display of PV		
.Lx_WDIGI	Digital display of SP		

Multi-component control

The multi-component input circuit is possible in:
- single- and multi-component controllers
- in slave controllers of cascades.

It normally requires additional analog inputs.

Applications

1. Feed water control of drum water tanks. Instead of this circuit, a cascade circuit can be used (see section on "Cascades") (**not Protronic 100**).
2. Additional interconnection of measuring signals or set points. Example: Control of the total of two quantity signals.

For both quantity measurements, an additional state correction can be coupled for gas or steam (see section on "State correction").

Configuration on 1.
(not Protronic 100)

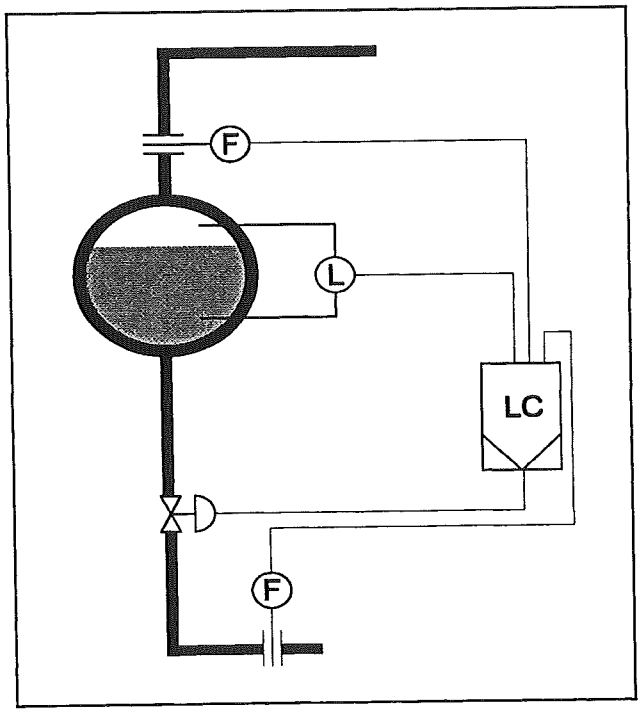


Fig. 38 Drum water level
Z-19122

Multi-component input circuit

Lx-B03-Q01 = 2

The difference between feed water and quantity of steam can be injected linearly or differentially, depending on the task definition.

Linear feed:

Err = PV + K2 × (ES2 + K3 × ES3) - SP

Lx-B03-Q02 = 2	Displayed water level is falsified by the difference between feed water and quantity of steam.
Lx-B03-Q02 = 3	Unfalsified water level display.

Differential feed:

Err = PV - SP

A D component: K2 × (ES.2 + K3 × ES.3) requires PID control:
Lx-B02-Q02 = 4

Lx-B03-Q03 = 1	Preferably display of the control deviation in %.
Lx-B03-Q04 - Q08	Corresponds to the configuration of ES1.
Lx-B03-P16	Corresponds to the configuration of ES1.
Lx-B03-P17	Corresponds to the configuration of ES1.
Lx-P101 to P103	Must be adapted in the commissioning.

Routing the inputs Lx-B04 as a function of the available analog inputs.

Configuration of 2.

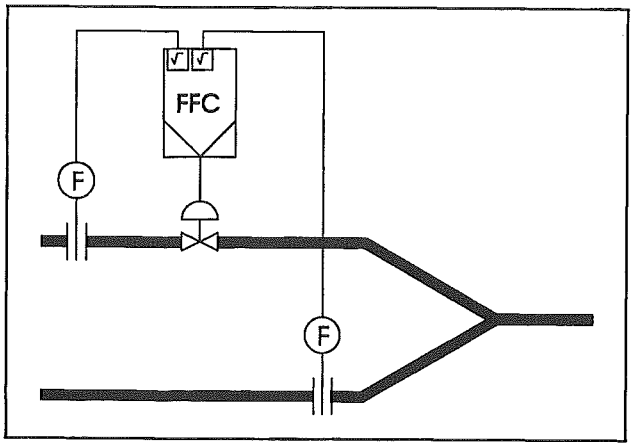


Fig. 39 Total flow
Z-19068

If only two values are to be added in a single-channel controller, it is also possible under certain circumstances to operate with the basic unit.

Multi-component input circuit:

Lx-B03-Q01 = 2	Err = ES1 × K1 + K2 (ES2 + K3 × ES3) − SP
Lx-B03-Q02 = 2	
Lx-P101 = 1	
Lx-P102 = 1	
Lx-P103 = 0	With only two inputs.
Lx-B03-Q03 to P08	According to the configuration of the inputs.
Lx-B03-P16	Start value of the analog display.
Lx-B03-P17	End value of the analog display.

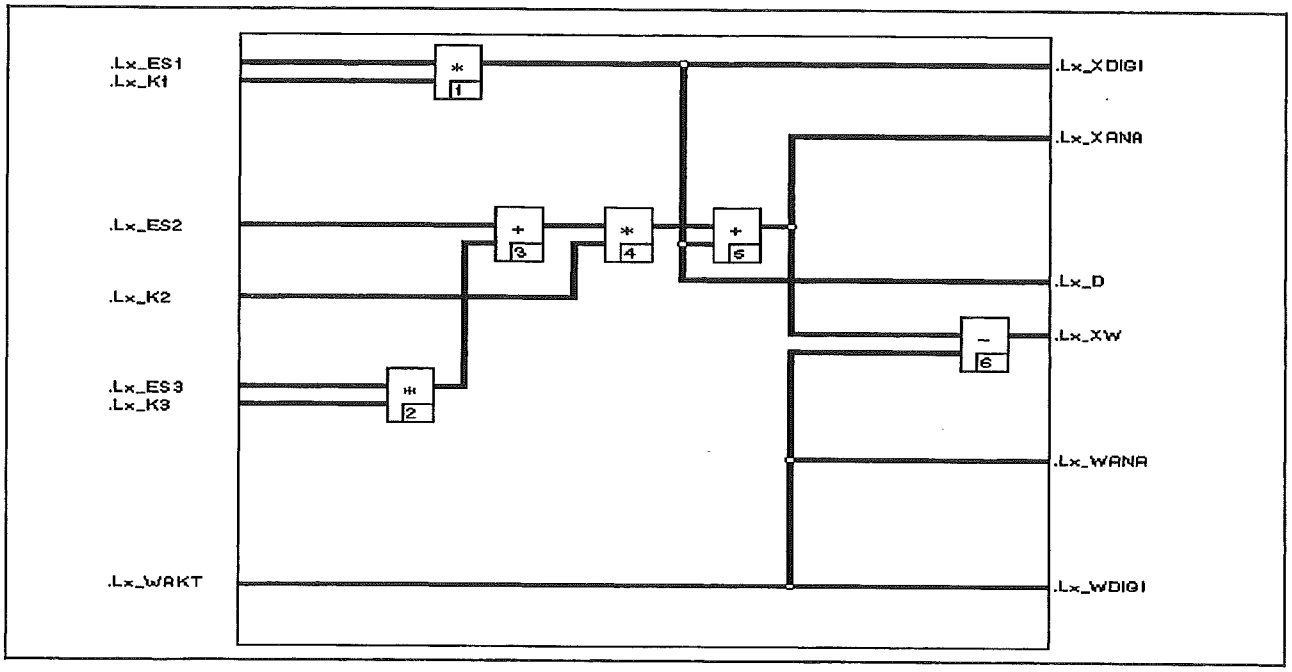


Fig. 40 Input circuit: Multi-components
Z-19095

.Lx_ESx	Inputs of the input circuit Multi-components routed via Lx-B04-Q0x with the analog inputs AIxy	.Lx_XDIGI	Digital display for PV
		.Lx_WDIGI	Digital display for SP
		.Lx_XANA	Analog display for PV
.Lx_Kx	Evaluation factors K1 to K3 = Lx-P101 to Lx-P103	.Lx_WANA	Analog display for SP
		.Lx_D	to D component
.Lx_WAKT	Current set point	.Lx_XW	Control deviation

Ratio control

The input circuit ration is possible in:
- single-channel controllers,
- controllers with several independent channels and
- master and slave controllers of cascades.

Ratio and set points

An external (current signal) set point, the programmer and a computer are available as set point sources SP1 to SP3 in ratio control.

All ratio input circuits as well as fixed value input/ratio input circuits can be used. There is also the set point SP1 for this application.

The ratio set point SP1 - as long as not used - can be tracked in such a way that bumpless changeover to the ratio → fixed value can take place.

Configuration:

Lx-B05-Q01 = 3 The set point 1 is tracked to the current ratio.

The ratio-set point Vw1 can be configured in such a way that with fixed-value control or when using another ratio set point, it is tracked to this so that bumpless resetting to the ratio set point 1 SP1 is possible.

Configuration:

Lx-B05-Q03 = 6 The set point 2 = SP1 is tracked to the current ratio.

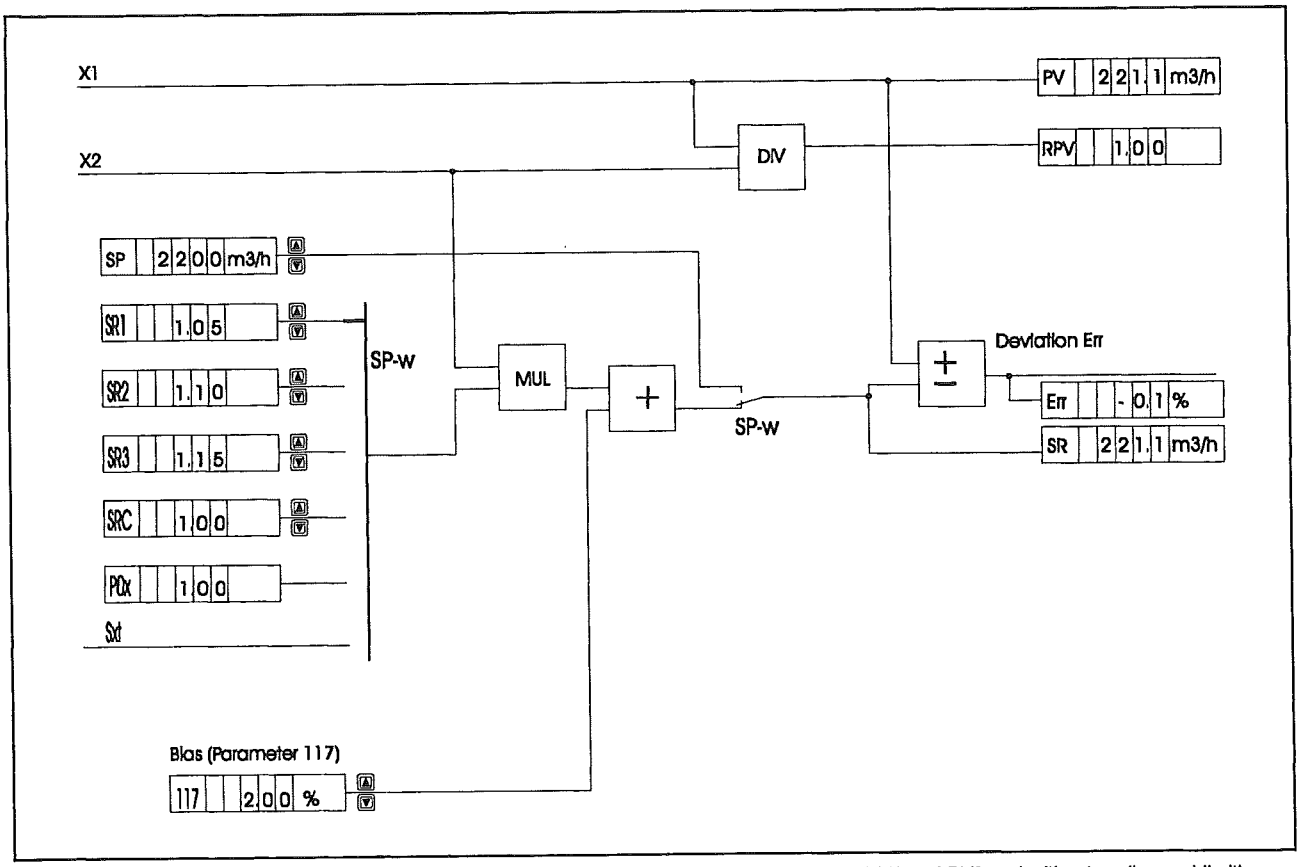


Fig. 41 Functional diagram of the input signal connection "Ratio" without signal conditioning for PV1 and PV2 and without scaling and limiting parameters.
Z-19125

Ratio control I: λ control

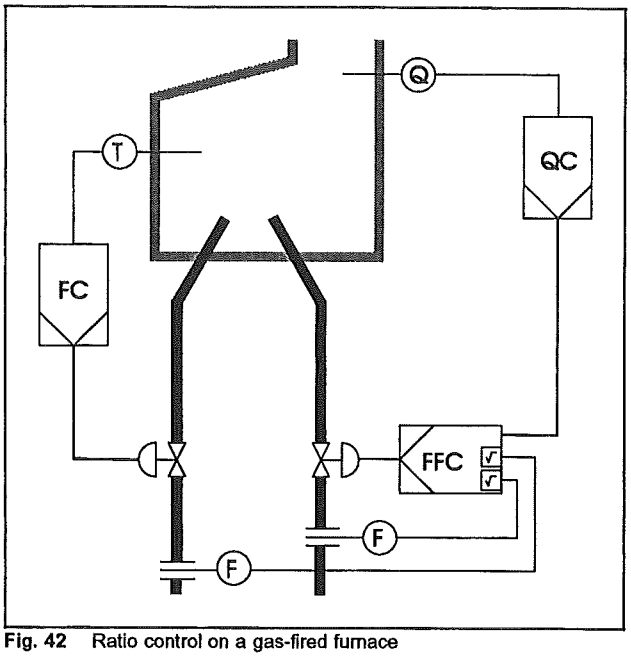


Fig. 42 Ratio control on a gas-fired furnace
Z-19067

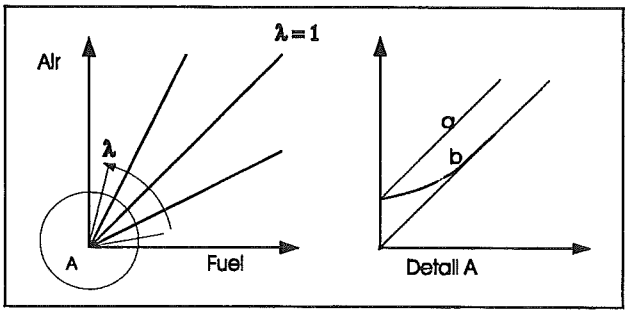


Fig. 43 Superfluous air, a = linear, b = non-linear
Z-19073

The atmosphere of an oil- or gas-fired furnace is to be controlled, λ being regarded as the set point. Optimum combustion is defined as λ = 1.

Excess air is to be guaranteed in the lower load range (A).

λ is defined as the air/fuel ratio. The air signal must therefore always be linked to ES1, irrespective of the controlling air or fuel.

Examples of configuration

The following modules must be configured for the loop x:

Lx-B03-Q01 = 4, 5	Ratio or fixed value/ratio changeable.
Lx-B03-Q02	disabled.
Lx-B03-Q03 = 0	Err in %, produces qualitative information.

Configuration air (PV1)

Lx-B03-Q04 =	e.g. m3/h.
Lx-B03-Q06 = 1	1 decimal point position.
Lx-B03-P07 = 0	Digital display transmitter range start value = 0.
Lx-B03-P08 =	Digital display transmitter range end.

The difference of Lx-B03-P08 and P07 is the reference value for G. An P controller with Kp = 1 produces an output of about 100 %, if the input is changed at this difference.

Configuration, display for ratio

Lx-B03-Q09 = 1	Displayed in the digital display. Displayed in the digital display are *Vx* (RPV) and the selected R set point *Vw*.
Lx-B03-Q09 = 2	Displayed in the digital display are PV (air) and SP = *Vw* × fuel: *Vw* can be selected with <Ind>.
Lx-B03-Q10 = 0	Dimension for R.
Lx-B03-Q12 = 2	With two digits to the right of the decimal point
Lx-B03-P14 =	Stochiometric air/gas for λ = 1.
	Example: for λ = 1:, air : fuel = 4.15 : 1 Lx-B03-P14 = 4.15

Analog display

Lx-B03-Q15 = 2	Normally analog display for *Vx* and *Vw*.
Lx-B03-P16	Define the display range for the
Lx-B03-P17	analog displays.
	Example: Display range 0.75 to 1.25 Lx-B03-P16 = 0.75

Lx-B03-P17 = 1.25

In the case of fixed value/ratio, the pair of values Lx-B03-P07/P08 is used as analog display for fixed value.

Excess air

The excess air is attained by setting a "Bias".

Linear:
A linear bias is set with the parameter Lx-P117. It always has the dimension of the air signal.

Non-linear:
The bias is derived from the fuel quantity.

Configuration:

Lx-B04-Q04 = 94	The value of ES4 is obtained from Table 4.
Lx-B04-Q02	is equal to Lx-B04-Q05. The input of Table 4 is the same as the input ES2 (fuel).

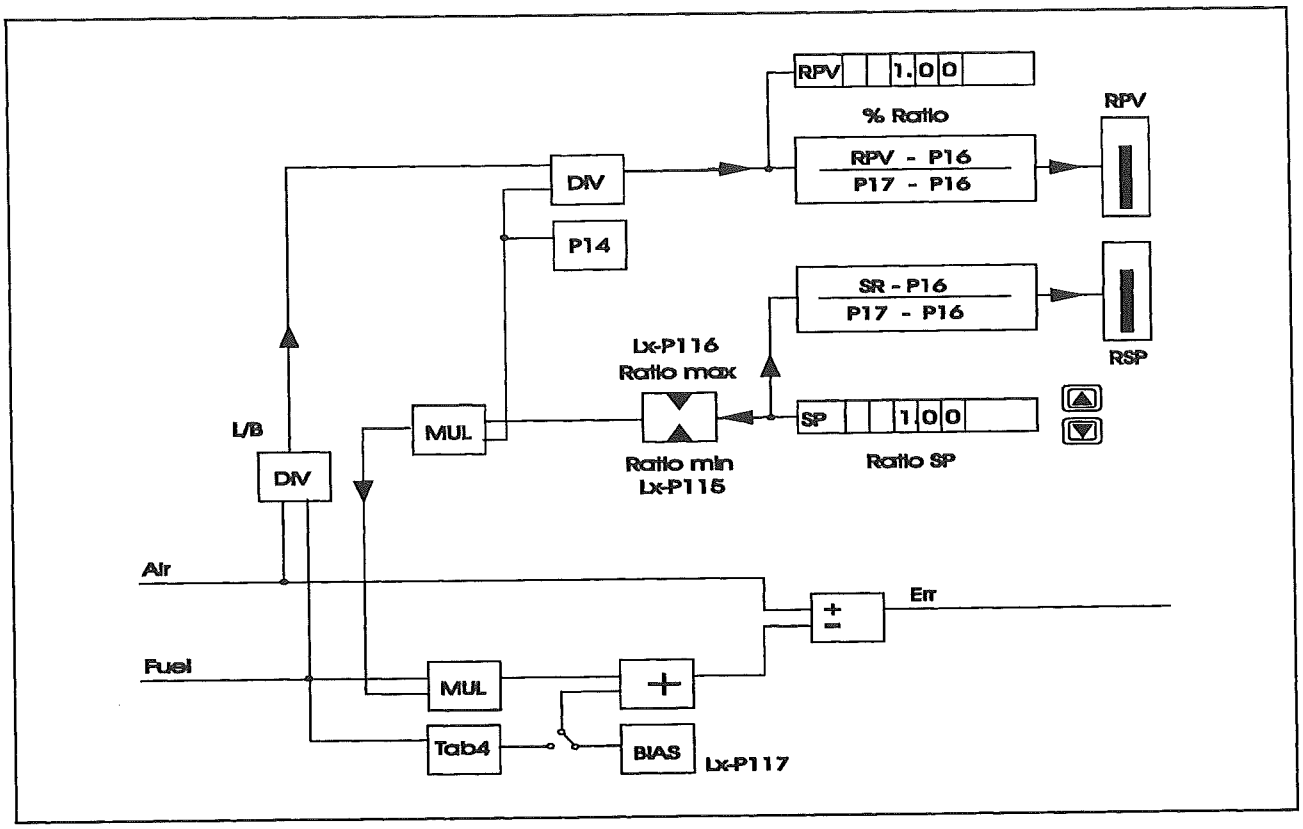


Fig. 44 Structure of the input circuit ratio, displays and creation of the control deviation. Display of RPV and RSP. without combining the input signals
Z-19123

Ratio control II: Mixture control

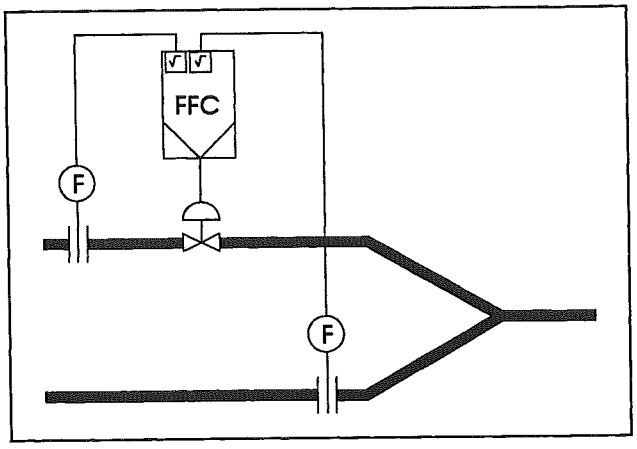


Fig. 45 Mixture control
Z-19068

In mixture control, two different setting procedures for the nominal ratio are required in process engineering.

Mixing ratio of the two components to one another:

Ratio 1 R = quantity 1 / quantity 2
Example: Neutralisation control

Proportion of a component in the end product:

Ratio 2 R = quantity 1 / (quantity 1 + quantity 2)
Example: Fat percentage in milk products

The routing of the inputs is defined by the definition of R. The signal in the counter must always be combined with ES1, irrespective of whether quantity 1 or quantity 2 is controlling.

The configuration below is required, as well as the routing of the inputs as a function of the input modules and their arrangement:

Configuration ratio 1

Mixture control R = quantity 1 / quantity 2

Theoretically, R can accept any value between 0 and infinity as the actual value.

Lx-B03-Q01 = 4 or 5 ratio or fixed value/ratio

Depending on user requirement, the analog display can be defined as follows:

Lx-B03-Q15 = 2	Mixture ratio is actual value and set point.
Lx-B03-Q03 = 0	Control deviation in % as qualitative statement.
or	
Lx-B03-Q15 = 1	Quantity 1 and quantity 2 × R set point.
Lx-B03-Q03 = 1	Control deviation display in EU as quantity 1, e.g. in m^3/h.

Configuration quantity 1:

Lx-B03-Q04	Dimension e.g. m^3/h.
Lx-B03-Q06	Decimal point depending on use.
Lx-B03-P07	Lower-range value (normally 0).
Lx-B03-P08	Upper-range value.

Configuration ratio:

Lx-B03-Q09	Digital display RPV and RSP or PV (quantity 1) and RSP × quantity 2.
Lx-B03.Q10	Dimension for R e.g without or %.
Lx-B03-Q12	Digits right to the decimal point for R display.
Lx-B03-P14	Quantity 1 (20 mA) / quantity 2 (20 mA) Numerical value of the quotient of the scaled input signals with equal measured values in mA e.g. upper-range value.
Lx-B03-Q15	Analog display RPV and RSP or PV and RSP × quantity 2.
Lx-B03-P16	Analog display of required lower-range value.
Lx-B03-P17	Required upper-range value.
Lx-B03-Q18	Output of the display defined by Lx-B03-Q15 to P17 on analog output.

Configuration ratio 2

Mixture control component in the end product
V = quantity 1 / (quantity 1 + quantity 2)

As actual value and set point, R can only assume the value range 0 to 1. Scaling is therefore normally performed in 0 to 100 % or part ranges thereof.

Configuration is effected as with ratio 1, with the following differences:

Lx-B03-Q09 normally %

$$\text{Lx-B03-P14} = \frac{\textit{quantitity1(20 mA)}}{\textit{quantitity1(20 mA)} + \textit{quantitity2(20 mA)}}$$

The numerical value of the quotients of the scaled input signals with equal easured values in mA e.g. upper-range value.

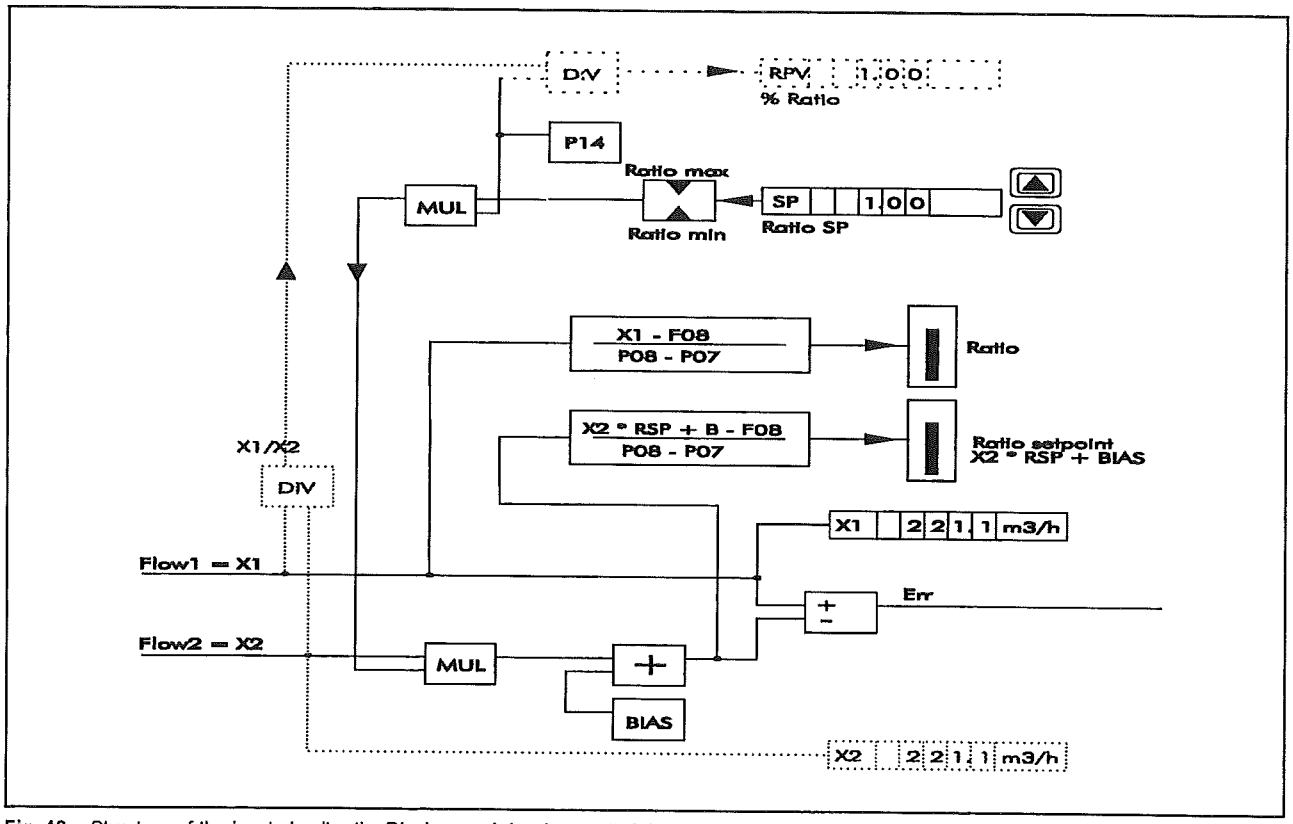


Fig. 46 Structure of the input circuit ratio. Displays and development of the control deviation. Display the quantity 1 and R × quantity 2. Without combination of the input signals.
Z-19124

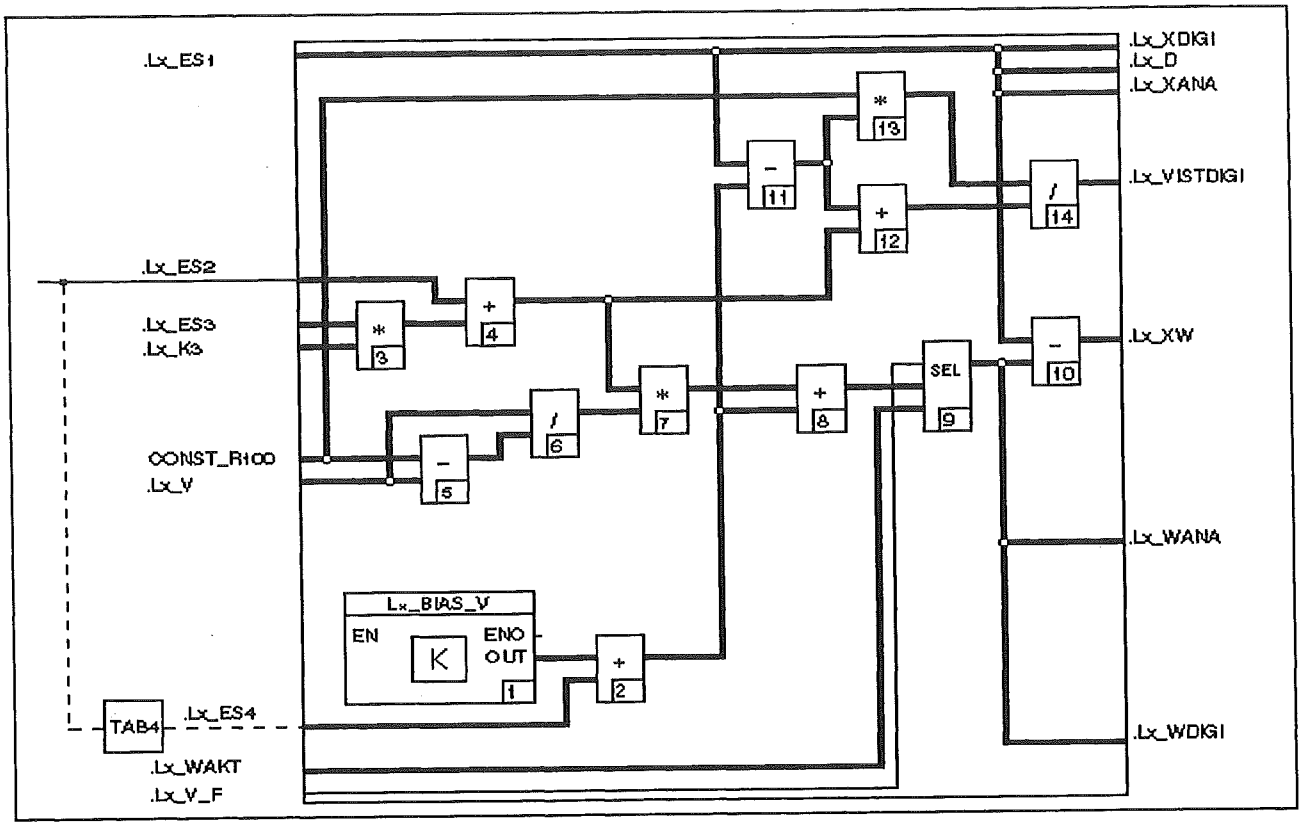


Fig. 47 Input circuit fixed value/ratio 2

Z-19126

.Lx-ESx	Inputs of the input circuit ratio route via Lx-B04 to the analog inputs	.Lx-XDIGI	Digital display for PV
.Lx-V	R set point	.Lx-WDIGI	Digital display for SP
CONST_R100	100	.Lx-VISTDIGI	Digital display for RPV
.Lx-AKT	Current fixed value set point	.Lx-XANA	Analog display for PV
		.Lx-WANA	Analog display for SP
		.Lx_V_F	Changeover fixed value/ratio

Multiplication

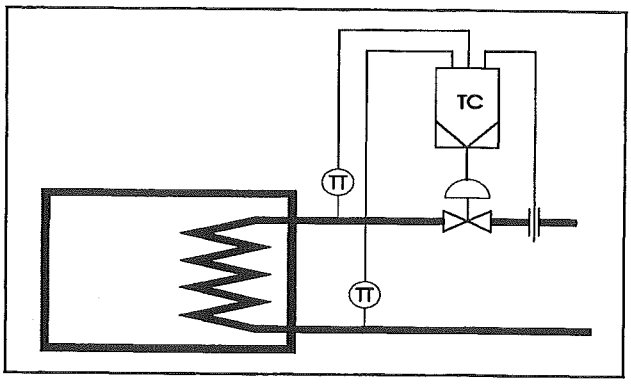


Fig. 48 Heat quantity control with Protronic 500
Z-19127

The input signal connection multiplication enables the control of a product of two input variables. Instead of one input variable, the evaluated sum can also consist of two variables.

Err = E1 × (E2 + K3 × E3) - SP

One user application example is the heat quantity control. This involves the measurement of the inflowing (or outflowing) quantity of a heat transfer system on an energy consuming unit e.g. water and the temperature difference between feed forward and feedback.

For an exact measurement, the quantity is corrected according to pressure and temperature (for water, it is usually a temperature correction). Depending on the arrangement of the flow rate measurement - inflow or outflow - the associated inflow or outflow temperature must be corrected.

Configuration

The three inputs should be scaled with their dimensions.

Input signal connection:
Lx-B03-Q01 = 3 Multiplication.

Routing of state correction:
ZK1-B02-Q01 = Flow rate signal depending on the input used.
ZK1-B02-Q02 = 0 No pressure correction.
ZK1-B02-Q03 = Inlet temperature depending on the input used.
ZK1-B02-Q04 = 0 No density correction.

Routing of the input connection signal:
Lx-B03-Q01 = 91 Corrected quantity signal from state correction 1.
Lx-B03-Q02 = Inlet temperature depending on the input used.
Lx-B03-Q03 = Outlet temperature depending on the input used.

Parameter:
Lx-P102 = -1 Makes the required subtraction from the addition.

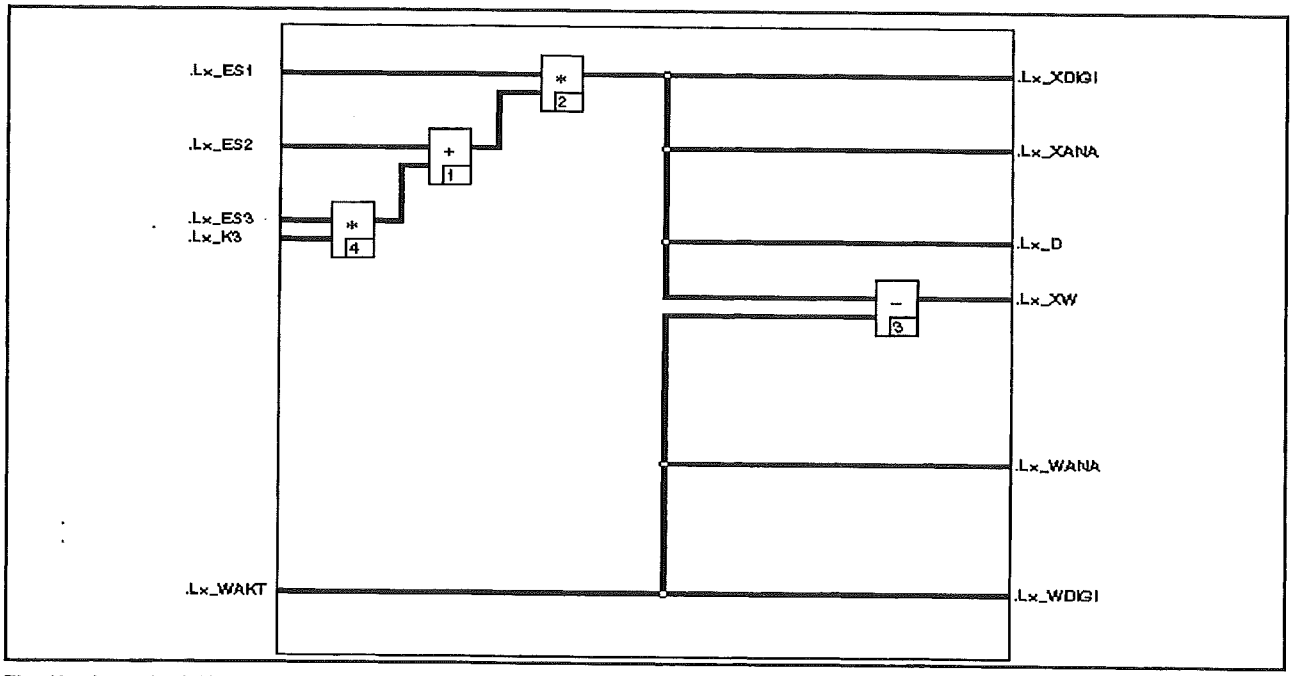


Fig. 49 Input circuit Multiplication
Z-19096

.Lx-ESx	Inputs of the input circuit ratio route via Lx-B04 to the analog inputs	.Lx_WDIGI	Digital display for SP
.Lx-K3	Evaluation factor for ES3	.Lx_XANA	Analog display for PV
.Lx_WAKT	Current set point	.Lx_WANA	Analog display for SP
.Lx_XDIGI	Digital display for PV	.Lx_D	to D component
		.Lx_XW	Control deviation

Parameter variation

Parameter control permits selective adaptation to reproducibly changing conditions in the process.

Parameter changeover

One or several parameters can be changed over, depending on an alarm value or a binary input. This is necessary when transferring between two different measured signals as controlled variable, for example.

The changeover is not necessary when transferring between transmitters with different measuring ranges for the same physical variable. The measured value doesn't change at the changeover because of the scaling of the inputs.

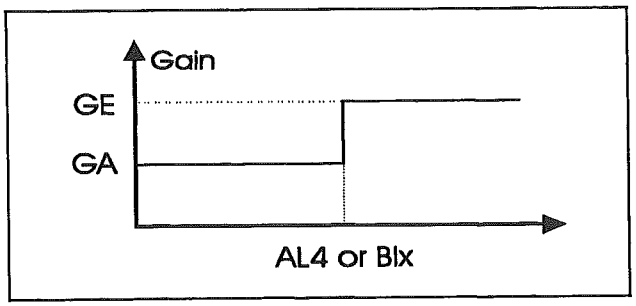


Fig. 50 Gain changeover
Z-19086

Configuration and parameter setting:
Lx-B02-Q07 = 11 or 12 Changeover through AL4 or Blx.
Lx-P07 = GS
Lx-P08 = GE

Special case P-PI changeover:

For instance, here is to TnA = 0. As long as TnA is effective, the I component remains switched off.

Parameter control

Linear

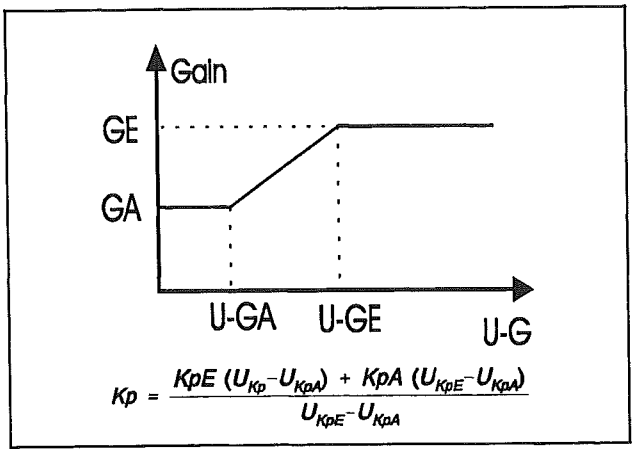


Bild 51 Linear parameter control, U is the controlling variable
Z-19085

The active parameter between a start value and an end value is changed linearly as a function of freely selectable analog variables (set point, measured value, ouput variable etc.).

Configuration and parameter setting:
Lx-B02-Q07 = 1 to 5 or 13 Gain control through selected variable e.g. set point (Lx-B02-Q07 = 2).

Lx-P06 = GS
Lx-P07 = GE
Lx-P08 = U-GA
Lx-P09 = U-GE

Non-linear

The system gain with pH control changes considerably with the pH value. The gain is at its maximum at about pH 7 and decreases very rapidly for pH0 and pH14. Inverse gain is required in the controllers.

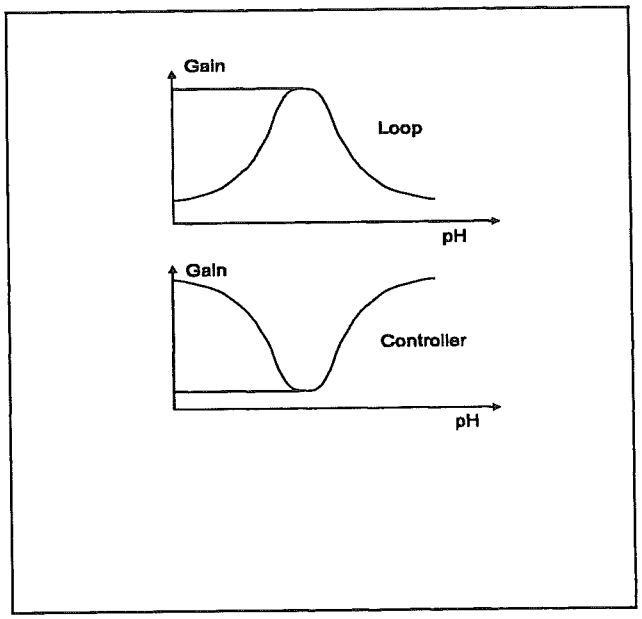


Fig. 52 Non-linear parameter control through the measured value pH
Z-19099

Configuration:
Lx-B02-Q07 = 7 Parameter control by the control variable PV via Table 1.

Table 1 is defined with the controller circuit gain G (by using the titration curve).

State correction

(not Protronic 100)

For the measurement of gases or steam, the measuring unit is designed for certain pressure and temperature values. If the actual values differ from the projected values, the result will be drastic measurment errors. To correct these errors, compensation adjustment possibilities are provided for the correction of both ideal and real gases.

The state correction calculates the standard quantities (0 °C and 1.013 bar) from the current measured values.

The state correction is possible with all input signal connections.

Within the unit, a maximum of two corrections are available simultaneously.

The state correction normally requires additional analog inputs. The state correction can only be processed after it has been integrated into the configuration (e.g. with Lx-B04-Q01 = 91 (flow control with state correction).

Routing the inputs and outputs

The routing of the inputs of the state correction unit depends on the module location of the analog inputs. **The inputs must each be scaled.** It is irrelevant whether a temperature reading is fed directly or via transmitter.

Abbreviations and terms

Index "r" for "computing values" (values for defining orifice)

Qv	Operating volume flow in m^3/h
Qn	Volume flow in standard condition in m3/h
Qm	Mass flow in standard condition t/h
P	in absolute bar or overpressure (depending on the transmitter)
Pr	in absolute pressure
T	Temperature in °C
Pn	Standard pressure 1.0135 bar
Tn	Standard temperature 273,15 K = 0 °C
RHO	Density in kg/m^3
RHO-MIN	Correction range for RHO
RHO-MAX	Correction range for RHO
Patm	atmospheric pressure in absolute bar
Pr	in absolute bar
Zn	Real gas factor for Pn and Tn (compressibility figure)
Pmin/Pmax	Correction range for P (according to transmitter)
Tmin/Tmax	Correction range for T
P20...28	Real gas factors (factory setting 1.00) (compressibility figure)

	Tmin	Tmitte	Tmax
Pabsmin	P20	P23	P26
Pabsmitte	P21	P24	P27
Pabsmax	P22	P25	P28

Tab. 2

HAB	Nozzle spacing in mm is equal water level in mm
Tvgl	Temperature of the reference column in °C

Configuration of gases and steam

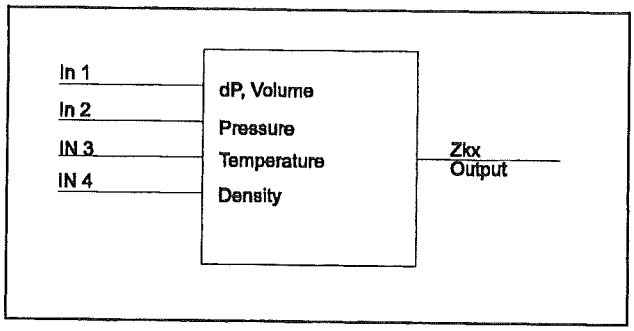


Fig. 53 State correction gas, steam
Z-19144 The parameter and configuration data are illustrated in Tables 3 to 5.

Configuration of water mass flow

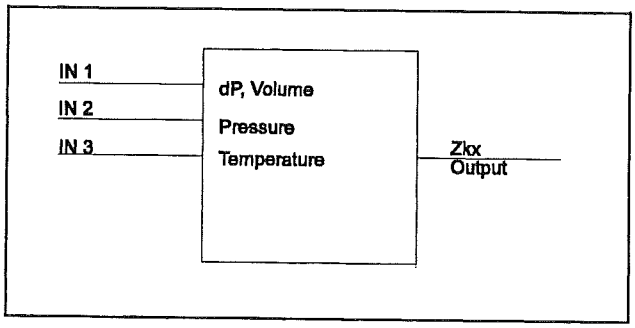


Fig. 54 State correction gas, steam, drum water level
Z-19145 The parameter and configuration data are illustrated in Tables 6 and 7 or 8 and 9.

Configuration of drum water level

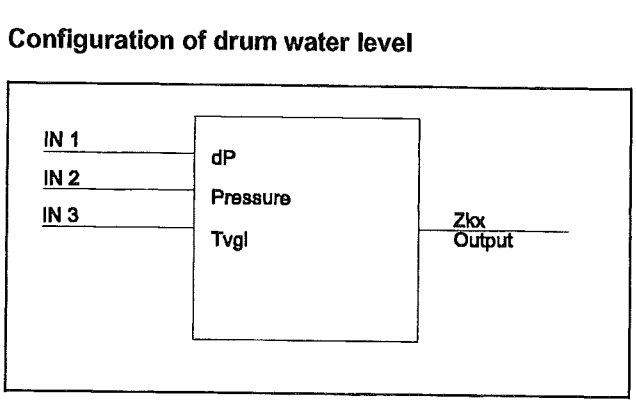


Fig. 55 Water level
Z-19146 The parameter and configuration data are illustrated in Tables 8 and 9.

Gas and steam

Table 3	Query/ Parameter ZKx-B01-	Gas, Differential measurement		Gas, volumem easurment	Steam, mass flow, differential pressure		Saturated steam mass flow, differential pressure pressure correction		Saturated steam mass flow, differential pressure temperature correction		Dim.
		linear	square-rooted		linear	square-rooted	linear	square-rooted	linear	square-rooted	
	Q01	1	1	2	3	3	4	4	5	5	–
Square rooting	Q29	0	1		0	1	0	1	0	1	–
Standard flow Qn,r or	P02	Value	Value	Value							Nm^3/h
Mass flow Qm,r	P02	Value	Value	Value	Value	Value	Value	Value	Value	Value	kg/h
Differential pressure ΔP,r	P03	Value			Value		Value		Value		mbar
Atmospheric pressure Patm,rabs	P04	Value	Value	Value	Value	Value	Value	Value			bar abs
Pressure P,r abs	P05	Value	Value	Value	Value	Value	Value	Value			bar abs
Temperature T,r	P06	Value	Value	Value	Value	Value			Value	Value	°C
Real gas factor Z(Pr,Tr),r	P07	Value	Value	Value							–
Standard density ϱn,r	P08	Value	Value	Value							kg/m^3

Tab. 3 Specification values of the measuring unit (computation values)
Linear no square rooting in transmitter or in analog input
Square-rooted Square rooting in transmitter or in analog input
Grey
underground no input required, inputs are ignored

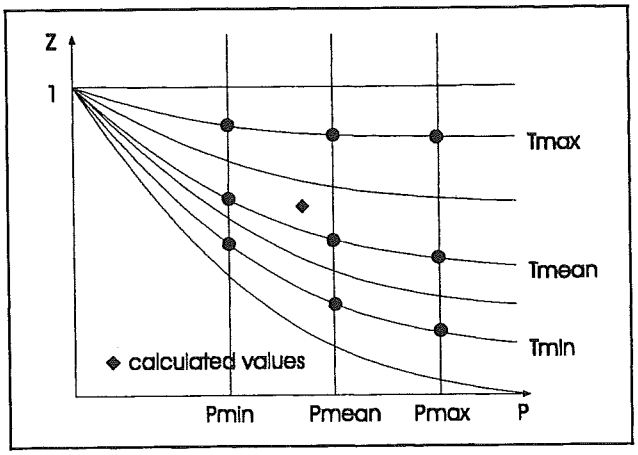


Fig. 56 Principal trend of the characteristic for Z = f(P,T)
Z-19147

Table 4	Tmin	Tmitte	Tmax
Pabs,min	Value (P20)	Value (P23)	Value (P26)
Pabs,middle	Value (P21)	Value (P24)	Value (P27)
Pabs,max	Value (P22)	Value (P25)	Value (P28)

Tab. 4 Real gas factors (factory setting 1.00 for ideal gases). The real gas factors must be additionally determined during the calculation of the orifice and made provided for the commissioning.

Table 3	Query/ Parameter ZKx-B01-	Gas, differential pressure measurement		Gas, volume measurement	Steam, mass flow, differential pressure		Saturated steam mass flow, differential pressure correction		Saturated steam Mass flow, Differential pressure temperature corection		Dim.
		linear	sq. rooted		linear	sq. rooted	linear	sq. rooted	linear	sq. rooted	
	Q01	1	1	2	3	3	4	4	5	5	–
Pressure transmitter											
Overpressure	Q18	1	1	1	1	1	1	1	1	1	–
Absolute pressure	Q18	2	2	2	2	2	2	2	2	2	–
Correction thresholds:											
Pressure min.	P10	Value	Value	Value	Value	Value	Value	Value			bar
Drcuk max.	P11	Value	Value	Value	Value	Value	Value	Value			bar
Temperature min.	P12	Value	Value	Value	Value	Value			Value	Value	°C
Temperature max.	P13	Value	Value	Value	Value	Value			Value	Value	°C
Density min.	P14	Value	Value	Value							kg/m³
Density max.	P15	Value	Value	Value							kg/m³

Tab. 5 Measured values and correction range

The threshold limits for the pressure correction should be input as in the case of the pressure transmitter:

- **Overpressure transmitter requires pressure thresholds in overpressure**
- **Absolute pressure transmitter requires pressure thresholds in absolute pressure**

If one or several measured signals are not available, the correction thresholds should be input identically with the computation values. In the case of a missing pressure measurement, Q18 must be additionally input and stated, if the thresholds stand for absolute pressure or for overpressure.

Water mass flow

Table 6	Query/ Parameter ZKx-B01-	Water, differential pressure measurement		Water, volume measurement	Dimension
		linear	square-rooted		
	Q01	6	6	7	–
Square rooting	Q29	0	1		–
Mass flow Qm,r	P02	Value	Value	Value	kg/h
Differential pressure dP,r	P03	Value			mbar
Atmospheric pressure Patm,r	P04	Value	Value	Value	bar abs
Pressure P,r abs	P05	Value	Value	Value	bar abs
Temperature T,r	P06	Value	Value	Value	°C
Real gas factor Z(Pr,Tr),r	P07	Value	Value	Value	kg/m³
Standard density Rho,r	P08	Value	Value	Value	kg/m³
Pressure transmitter					
Overpressure	Q18	1	1	1	
Absolute pressure	Q19	2	2	2	
Correction thresholds					
Pressure min.	P10	Value	Value	Value	bar
Pressure max.	P11	Value	Value	Value	bar
Temperature min.	P12	Value	Value	Value	°C
Temperature max.	P13	Value	Value	Value	°C
Density min.	P14	Value	Value	Value	kg/m³
Density max.	P15	Value	Value	Value	kg/m³

Tab. 6 Specification values of the measuring unit (computation values)

The thresholds for the pressure correction are to be input in the same way as for the pressure transmitter:

- **Overpressure transmitter requires pressure thresholds in overpressure**
- **Absolute pressure transmitter requires pressure thresholds in absolute pressure**

If one or more measuring signals are missing, then the correction limits must be input as calculated values. If the pressure measuring is missing, then in Q18 must be input if the limits are given in absolute pressure or overpressure.

Drum water level

Table 8	Question	Level measurement	Dimension
	Q01 =	8	-
Pipe socket distance HAB	P16 =	Value	mm
Tcomp[1]	P17 =	Value	°C
Tmin	P12 =	Value	°C
Tmax	P13 =	Value	°C

Tab. 7 Evaluation values of the measuring unit (computation values)
1 as of version 3.4.1

In case of missing temperature measurement, Tmin = Tmax should be adjusted to the temperature of the reference column (as of version 3.4.1).

Table 9	Question	Level measurement	Dimension
Differential pressure End value dP	Q09 =	value	mbar
Pressure correction Min limit Pmin	Q10 =	value	bar
Pressure correction Max limit Pmax	Q11 =	value	bar
Output range start	Q30 =	value	mm
Output range end	Q31 =	value	mm

Tab. 8 Measured values and correction range

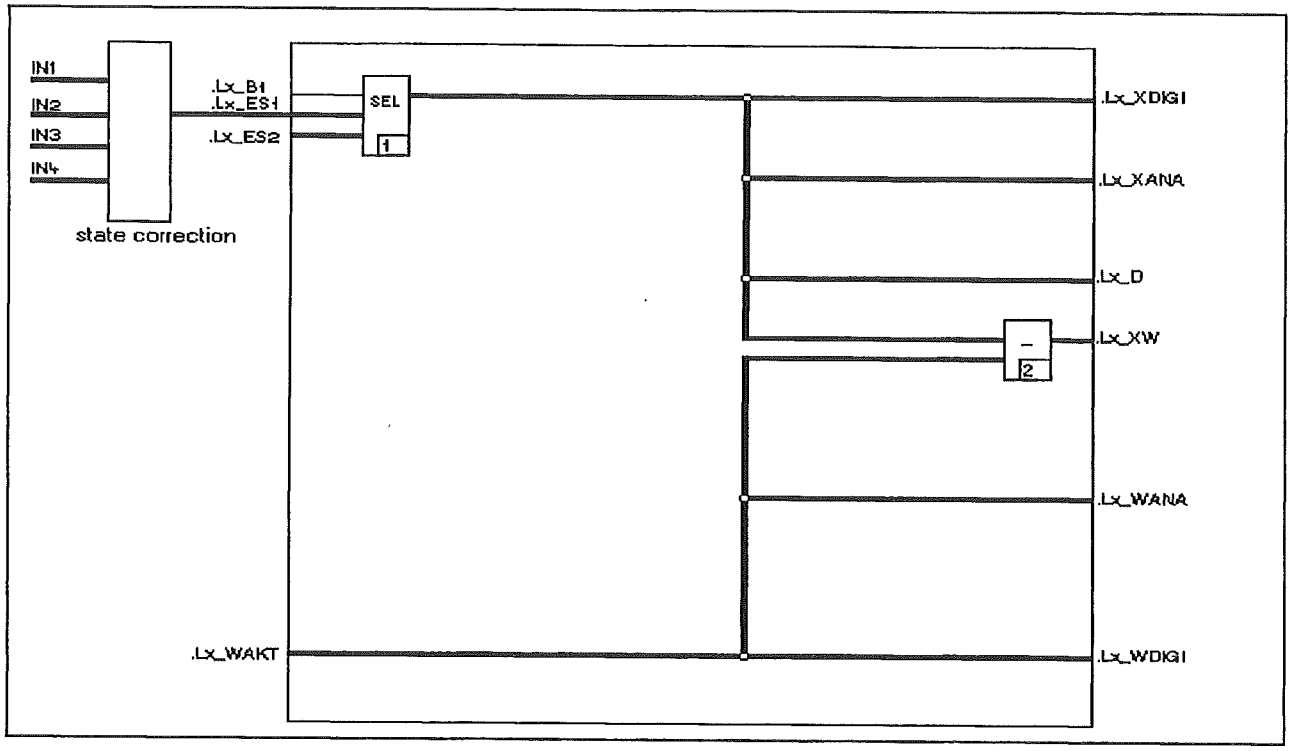


Fig. 57 Input circuit fixed value with additional state correction
Z-19072

.EZKx	Input routing of the state correction ZKx-B02-Fx	.Lx_XDIGI	Digital display for PV
.Lx-B1	Changeover ES1 ←→ ES2 with switch SEL	.Lx_WDIGI	Digital display for SP
.Lx-ESx	Routed inputs of the input circuit fixed value routed via state correction	.Lx_XANA	Analog display for PV
.Lx_WAKT	Current set point	.Lx_WANA	Analog display for SP
		.Lx_D	to D component
		.Lx_XW	Control deviation

Definition of an analog output from the state correction

In the configuration shown in fig. 57, the state correction provides the computation result of the input circuit directly as a measured value.

If an additional analog current/voltage output with the state correction result is required, this can be defined with the following parameters:

ZKx-B01-P30 Start of range = measured value for 0 % = 0/4 mA or 0/2 V
ZKx-B01-P30 End of range = measured value for 100 % = 20 mA or 10 V

The values for P30 and P31 can lie within or without the expected calculation results.

The statement of ZKx-B01-Q32 and ZKx-B01-P33 is optional. They are of no significance to the unit, but they provide easy control during retrospective checks of the configuration.

A free analog output of the correction results is defined with ZKx-B03-Q01.

Controller outputs

In the controllers, the following controller outputs can be configured:

Two-position controller
- with transistor output or
- with relay output

(strong-weak-off-control e.g. Δ-OUT-off = two-position controller with precontact).

Three-position controller (heat-off-cool)
- with transistor output or
- with relay output,

Optionally 1 output, also continuous (parameters Lx-P25 to P27 are active).

Step controller and positioner
- with transistor step controller output or
- with relay output.

Continuous controller
optionally also with split range output (the parameters Lx-P25 to P27 are active).

The controller outputs of master and override controllers cannot be configured. They are automatically adjusted to the continuous output signal.

In the following examples, the binary outputs BO01 and BO02 are used as examples. It is also possible to use other BOxy.

Two-position controller

Single-channel with transistor output in the basic unit

Binary definition:	
BIO-B01-Q01 = 3	BIO01 is output with quiescent current action = BO01.
L1-B01-Q02 = 3	Two-position controller.
L1-B10-Q04 = 1	Controller output OUT1 to BO01.

Two-position controller for stron-weak-off

Binary definition:	
BIO-B01-Q01 = 3	BIO01 is output with quiescent current action = BO01.
BIO-B02 = 3	BIO02 is output with. quiescent current action = BO02.
L1-B01-Q02 = 3	Two-position controller with precontact.
L1-B08-Q03 = 4	Alarm value 3 as precontact max.
L1-P93 = −3 bis −5 %	Adjust to exact value for commissioning.
L1-B10-Q04 = 1	Controller output to BO01.
L1-B11-Q03 = 2	Alarm value 3 on BO02. switches from "strong" to "weak".

Single-channel controller with relay output and multi-channel Controller

For multi-channel controllers and controllers with relay output, the existing outputs should be configured accordingly.

Three-position controller

(Heat-off-cool)

Single-channel with transistor output in the basic unit

BIO-B01-Q01 = 3	BIO01 is output with quiescent current action = BO01.
BIO-B02-Q01 = 3	BIO02 is output with quiescent current action = BO02.
L1-B01-Q02 = 5	Three-position controller.
L1-B10-Q04 = 1	1. Controller output (heating) OUT1 at BO01.
L1-B10-Q05 = 2	2. Controller output (cooling) OUT2 at BO02.

Three-position (heat-off-cool) with continuous controller output for heat

Binary definition	
BIO-B01-Q01 = 3	BIO01 is output with quiescent-current action = BO01.
L1-B01-Q01 = 6	
L1-B10-Q05 = 1	Switching controller output (cooling) OUT2 at BO01.
L1-B10-Q01 = 1	continuous output (heating) OUT1 at AO01.

single-channel controllers with relay output and multi-channel controllers

With multi-channel controllers and with controllers having relay output, the available outputs must be configured accordingly.

Step controller

If using the basic unit without modules, the second signal input can either be used for the feedback signal or for another function.

L1-B01-Q04 = 2	Position feedback signal to AI02.
AO-B01-Q01 = 5	Analog output supplies 20 mA for feeding a position feedback signal via AI02.
AI-B02-Q01 = 1	AI02 = 0...20 mA.

Balancing of 0 and 100 % see Section on "Service".

Outputs:

BIO-B01-Q01 = 3	Binary BIO01 is output with quiescent current action = BO01.
BIO-B02-Q01 = 3	Binary BIO02 is output with quiescent current action = BO02.
L1-B10-Q04 = 1	Controller output "more" OUT1 to BO01.
L1-B10-Q05 = 2	Controller output "less" OUT2 to BO02.

Positioner

A positioner is a step controller which drives an electrical control actuator to a - mostly externally preset - position. A positioner requires a position feedback signal as measured value.

L1-B01-Q01 = 11	Positioner.
L1-B03-Q01 = 1	Input circuit fixed value.
L1-B04-Q01 = 1	Position feedback signal to AI01.
L1-B05-Q06 = 2	External set point to AI02.

Controller output as for step controller

Single channel controllers with relay output and multi-channel controllers

In the cases of multi-channel controllers and controllers with relay output, configuration must be performed according to the available outputs.

Continuous controller

In the basic unit, only a continuous controller with one controller ouput is possible. For a second analog controller output, a continuous output module is required.

One controller output (corresponds to factory setting):

L1-B01-Q02 = 1	
AO-B01-Q01 = 1 or 2	Depending on the signal range.
L1-B10-Q01 = 1	1. Controller output OUT1 to AO01.

Two controller outputs (split range) **(not Protronic 100)**:

Output module e.g. to slot 3	
L1-B01-Q01 = 7	
L1-B10-Q02 = 31	2. Controller output to 1. output of the output module to slot 3.
AO-B31=Q01 = 1 or 2	Depending on the signal range.

Cascades

Cascade with one slave controller

This configuration is possible in the basic unit if no particular demands are made on inputs and outputs.

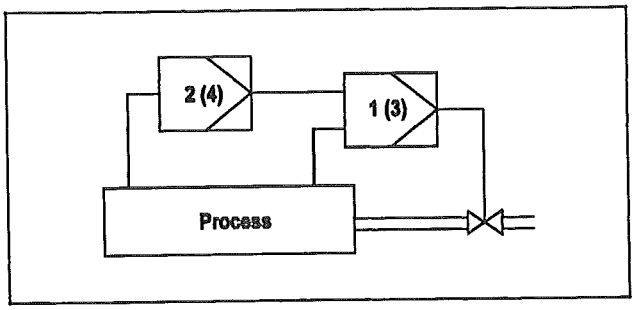


Fig. 58
Z-19076

Configuration

Master controller is loop 2 or loop 4 (**Protronic 100**: Loop 2)
L2-B01-Q01 = 2 or
L4-B01-Q01 = 2

Slave controller to loop 2 is loop 1
L1-B01-Q01 = 3

Slave controller to loop 4 is loop 3 (**not Protronic 100**)
L3-B01-Q01 = 3

Die input signal connections of the controllers can be selected as single-channel controllers.

The controller output of the controllers 1 (3) can be freely configured.

Cascade with two slave controllers
(not Protronic 100)

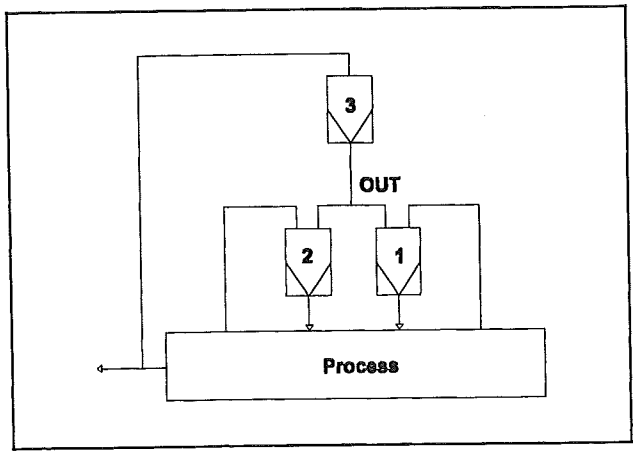


Fig. 59
Z-19077

Configuration

Master controller is loop 3:
L3-B01-Q01 = 2

Slave controllers are loop 1 and loop 2:
L1-B01-Q01 = 3
L2-B01-Q01 = 3

The input signal connections of the controllers can be selected as for single-channel controllers.

The controller output of the controllers 1 (2) can be configured freely.

Cascade control with two slave controllers and ratio station
(not Protronic 100)

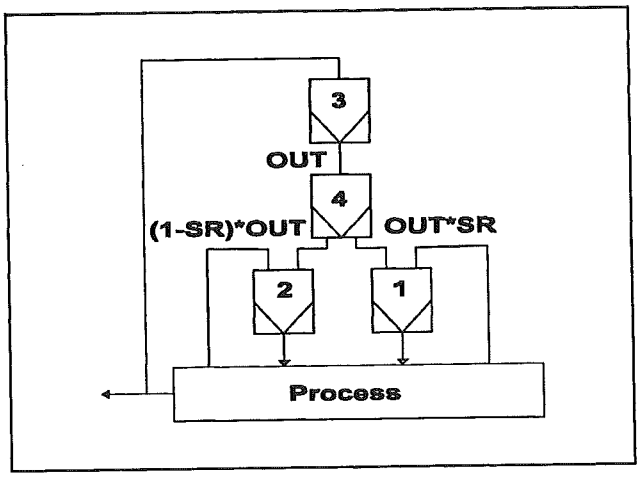


Fig. 60
Z-19078

Configuration

Master controller is loop 3:
L3-B01-Q01 = 2

Slave controllers are loop 1 and loop 2:
L1-B01-Q01 = 3
L2-B01-Q01 = 3

Ratio station is loop 4:
L4-B01-Q01 = 12

The input signal connections of the controller can be selected as for single-channel controllers.

The controller output of the controllers 1 (2) can be freely configured.

Combustion control: Load control
(not Protronic 100)

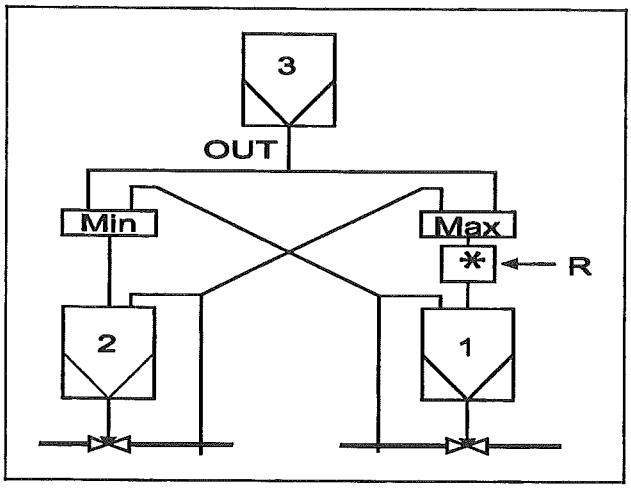


Fig. 61 (not Protronic 100)
Z-19087

Combustion control is preferably applied in steam generation and in furnace construction. It also depends on ensuring optimum combustion - even with load changes - in both applications.

During steam generation, care is taken to ensure that air scarcity never causes poor combustion and thereby poor exhaust quality. If a higher volume of steam is required, the air quantity is first increased before increasing the fuel. A provisionally bigger air surplus is, in most cases, more acceptable for quicker control than when the efficiency of the system is unsatisfactory during this time.

Comment
The air set point with ration = 1 is shown in the diagrams below. The control of the set point is steeper or flatter with other ratios.

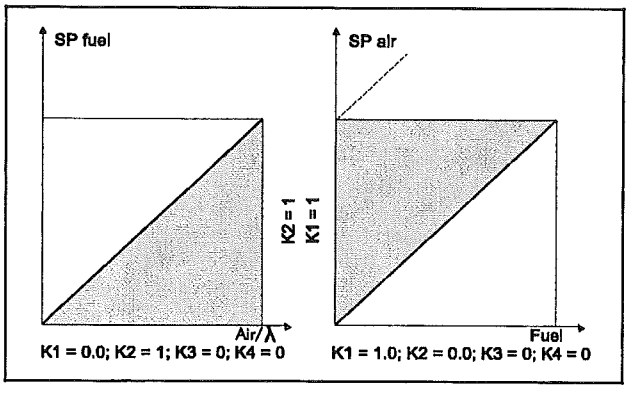


Fig. 62 Combustion control on steam boilers, grey fields stand for
Z-19089 permissible set points

Furnaces for the thermal treatment of iron and steel:

In furnaces in which the material to be heated to incandescence is exposed to the furnace atmosphere, it is important to keep the oxygen within specific limits in order to be able to control any oxidation or reduction of the material. This is achieved by limiting the permissible set point change when the load changes.

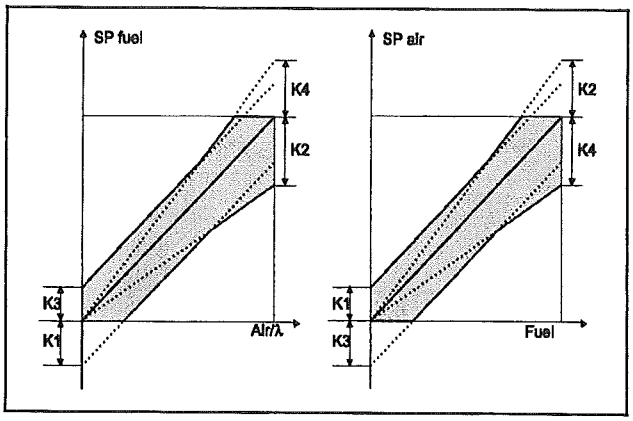


Fig. 63 Combustion control in furnace construction: grey areas indi-
Z-19088 cate permissible set points

Configuration

The following classification is required for the configuration of the control loops:

Master controller loop 3	L3-B01-Q01 = 2
Air controller	L1-B01-Q01 = 3
(only loop 1)	L1-B03-Q01 = 12
Fuel controller	L2-B01-Q01 = 3
(only loop 2)	L2-B03-Q01 = 13

Parameter definition

The different requirements of the load control input circuit are satisfied by diffeent parameter settings. The parameters define the limit in the grey-background fields within which the set point can move.

Parameters: Lx-P101 to 104

Steam generation (all values positive)

	Air controller		Fuel controller	
K1:	L1-P101 =	1.0	L2-P101 =	0.0
K2:	L1-P102 =	0.0	L2-P102 =	1.0
K3:	L1-P103 =	0.0	L2-P103 =	0.0
K4:	L1-P104 =	0.0	L2-P104 =	0.0

Furnace construction:

K1 to K4 as required

Drum water level control in cascade
(not Protronic 100)

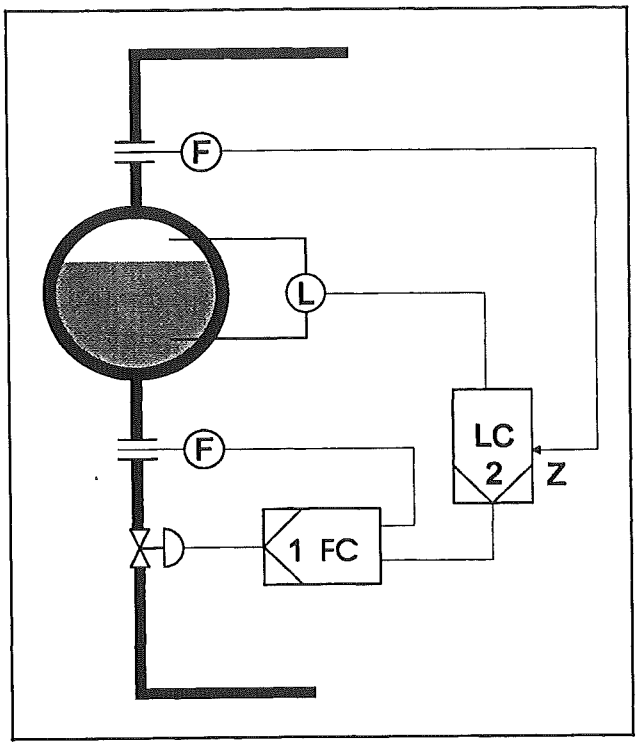


Fig. 64 Steam quantity fed as disturbance variable on output of controller 1 **(not Protronic 100)**
Z-19121

The loop shown in Fig. 64 is easier to put into operation than the classical multi-component control (fig. 38).

A level correction can be swiched onto the level loop. When dealing with heavily fluctuating pressures on the steam side, a steam correction is recommended.

Configuration

Master controller = loop 2
L2-B01-Q01 = 2

Slave controller = loop 1
L1-B01 = 3

Input signal connection for loop 1 in the most uncomplicated case
L2-B03-Q01 = 1 Fixed value.
or
L2-B03-Q01 = 91 State correction 1.
ZK1-B01-Q01 = 8 Drum water level.

Feedforward control (Z)
L2-B02-Q25 = 1..74 (Digitric 500: 44) depending on the existence of analog input.
L2-B02-Q26 = 1 Linear feedforward of Z.
or
L2-B02-Q26 = 92 State correction 2.
ZK2-B01-Q01 = 3 Steam correction.

Input signal connection for loop 2
L1-B03-Q01 = 1 Fixed value.

Override control

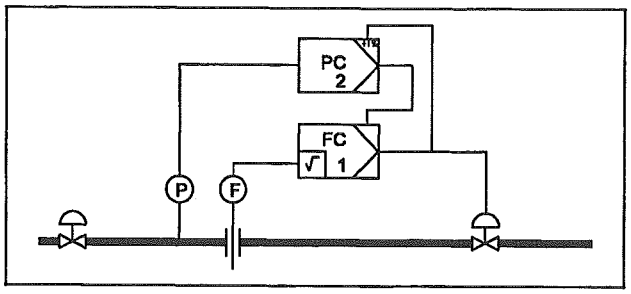


Fig. 65 Override control with one master controller and one override controller
Z-19097

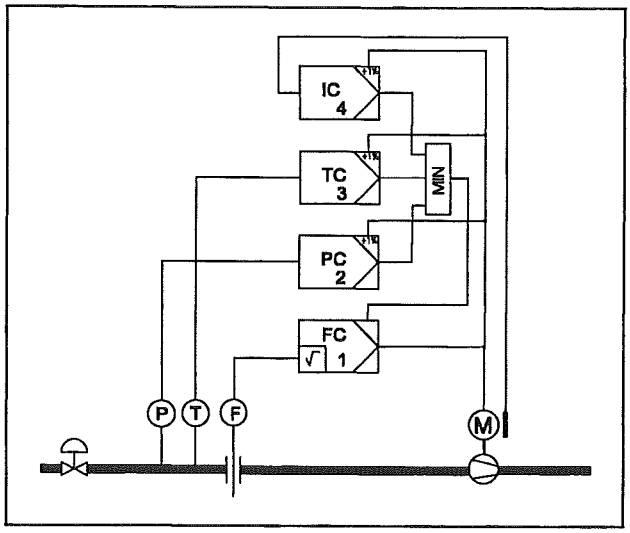


Fig. 66 Override control with one master controller and up to three override controllers **(not Protronic 100)**
Z-19098

Application

In normal operation, the master controller (1) in the illustrated applications is in the intervention mode. The override controllers ensure that even during irregular operation the other variables - pressure, temperature, power consumption - do not shoot over the set thresholds.

Configuration

Master controller:

L1-B01-Q01 = 4 or 5	Master controller with min. or max. selector.

Override controller:

L2-B01-Q01 = 6 or 7	Override controller with min. or max. selector.
L3-B01-Q01 = 0, 6, 7	Override controller with min. or max. selector **(not Protronic 100)**
L4-B01-Q01 = 0, 6, 7	Override controller with min. or max. selector **(not Protronic 100)**

The min. or max. selection must be uniform for all controllers involved.

If varying adjustments are required, these can be achieved only via the "Free configuration" feature with IBIS_R+.

Dead time, Smith predictor

A controller with Smith Predictor is used for the control of control systems with dead time, or of control sysems with large values of delay time Tu in comparison with the system time constants.

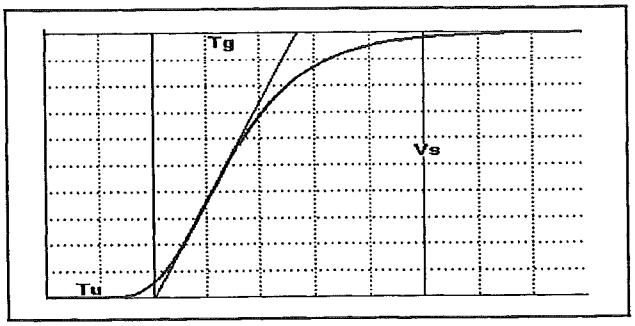


Fig. 67 Controlled system with Tu/Tg ≈ 1
Z-19053

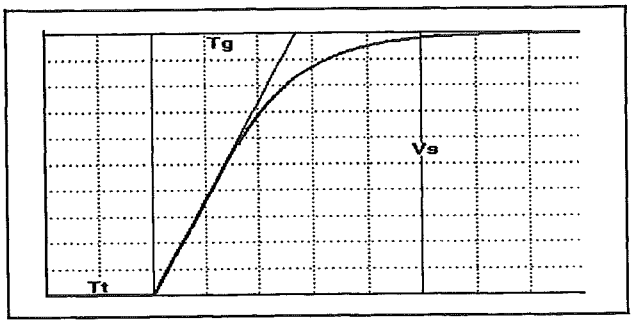


Fig. 68 Controlled system with dead time
Z-19050

Configuration

The Smith Predictor is possible in combination with all control actions and input signal connections.

Lx-B02-Q02 = 5 PI controller with Smith Predictor (PI suffices in most cases)

Parameter definition

The following must be adjusted as parameters for the Smith Predictor:

1. Lx_P39 T_t on the value of the controlled system dead time.
   Lx_P40 T1 on the value of Tg.
3. Lx_P41 Ks on the value of Vs.

For the first commissioning, Tn ≈ Tg and Kp ≈ 1/Vs should be adjusted.

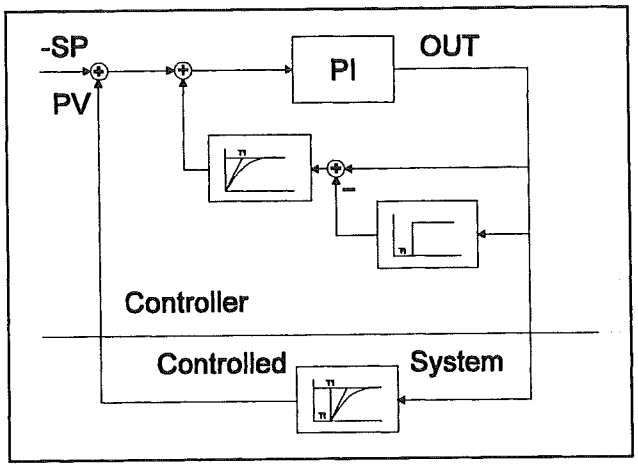


Fig. 69 Controller should be adjusted with Smith predictor to the controlled system with dead time
Z-19108

Service

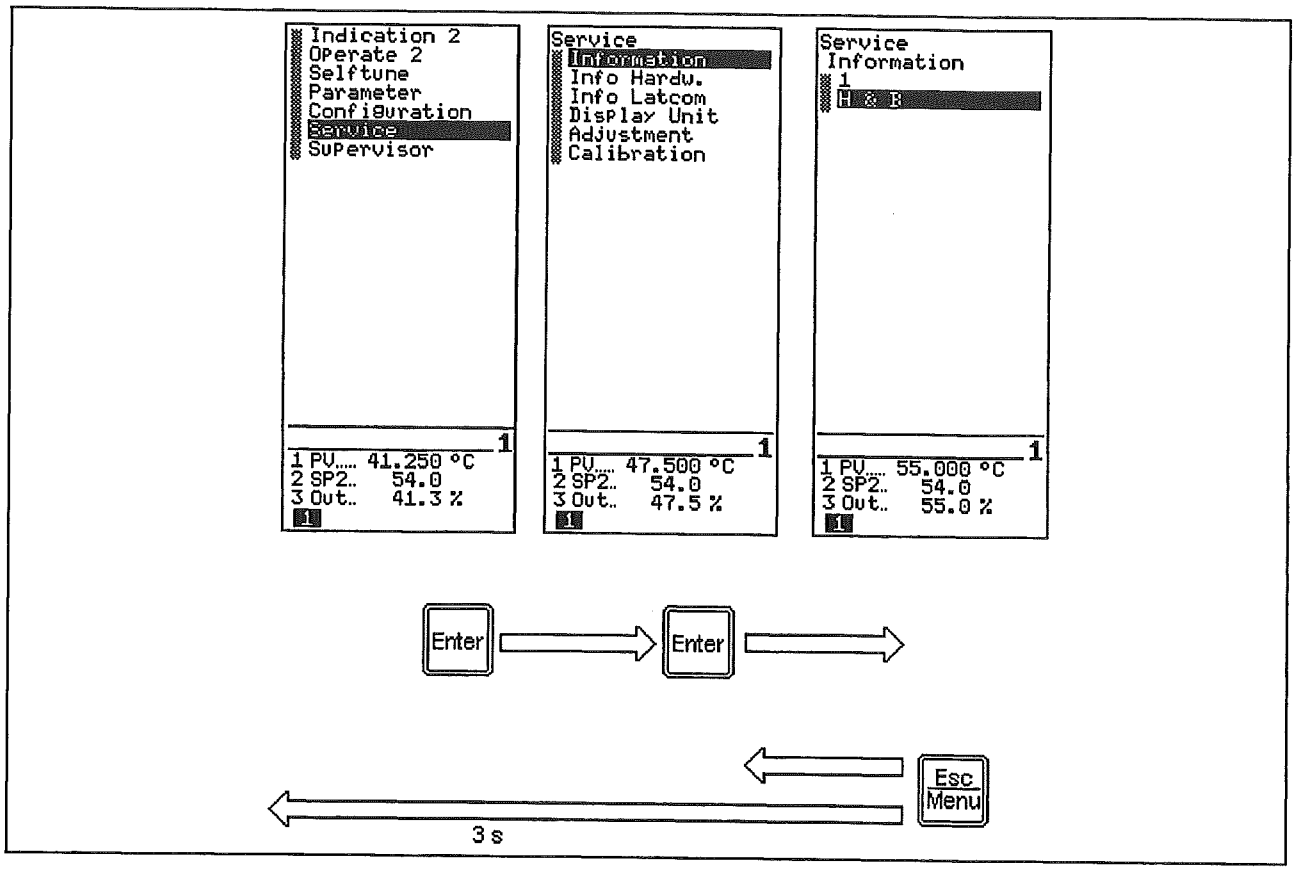


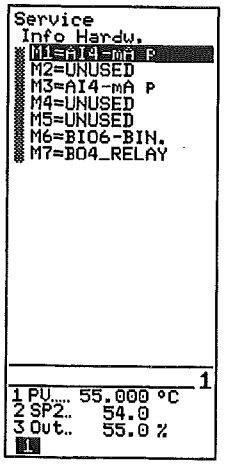
Fig. 70 Service menu (**Protronic 100**: only module 1)
Z-19115

General information (Info.allg.)

This menu shows information input by manufacturer during production (or retrospective repair) and which cannot be modified by customer:

Item	Description	in unit
1	Manufacturer	H & B
2	unit type	Protronic 500
3	Motherboard index	CPU: ...
4	Serial number	F: ...
5	Date of manufacture	F-Dat: ...
6	Configuration No.	Konfi-Nr.: ...
7	Repair date	Rep.-Dat: ...
8	free text	...

Information Hardware



This menu shows the slotted modules.

These modules are not automatically available in the configuration.

They are input with I-B11-Q01 = 1.

Fig. 71
Z-19116

Info Latcom

This menu item shows if a lateral communication was configured, and if yes, which status it has.

If no lateral communication was configured, the following display will appear upon calling up the menu item:

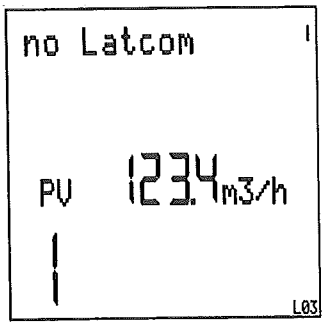
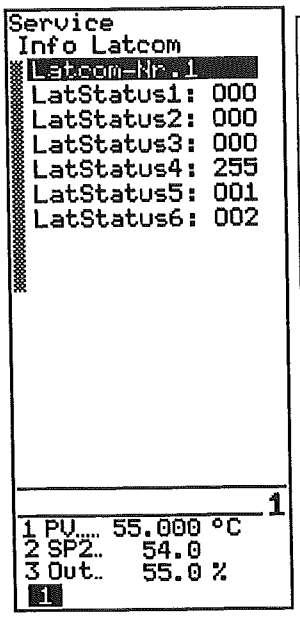


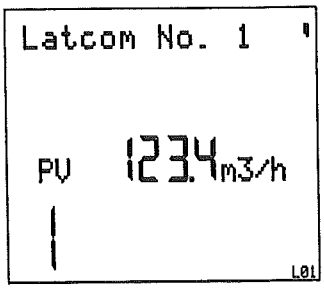
Fig. 72
Z-19059

or

Protronic 550



Protronic 100 / 500, Digitric 500



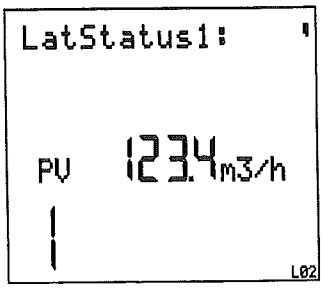


Fig.s 73, 74, 75
Z-19060, z-19054, Z-19058

If the lateral communication is configured, the following display will appear on calling up the menu item:

Left (Protronic 550):

1. Lines: Status of the controller with the subscriber 1.
and with <▲>, <▼>
status of subscribers.

Right (other controllers):

Call up of the status of the lateral communication on the controller and subscriber No. 1 on the lateral bus and
with <Enter> and <▲>, <▼>
status of subscribers.

Possible status information

0 Lateral communication information required for processing FBD or AL are also received correctly and correspond to the structural description which existed in the connection file during plausibility check.

1 Lateral communication information is received correctly, but do **not** correspond to the structural description which existed in the connection file during plausibility. This data is however not required for processing the FBD or AL.

2 Lateral communication information is received correctly, but do **not** correspond to the structural description which existed in the connection file during plausibility. This data is however required for processing the FBD or AL.

3 Your own data were not transmitted for 5 seconds. This is normally the case when a lateral communication subscriber has not yet been connected to a second subscriber via RS-485.

4 The data of a unit participating in the lateral communication have not been received for 5 seconds, even though these are required. This happens when the respective subscriber suffers a breakdown.

5 Despite participation in the lateral communication, thee is no description of the data to be transmitted.

6 The transmission data buffer is faulty.

7 Subscriber can neither receive nor transmit lateral communication data.

8 No RS-485 module was found. This information applies to the particular unit in question, but is output for all third-party devices.

9 The reporting subscriber has suffered a breakdown.

255 The subscriber has not been configured for the lateral communication.

Display

Brightness LED
(not Protronic 550)

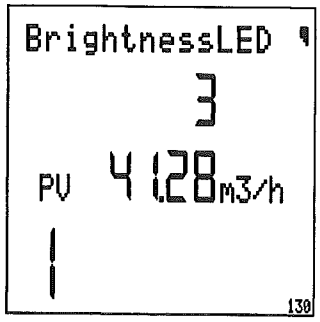


Fig. 76
Z-19130

1. Modify brightness (in four steps, step 1 is the least bright):
   <▲>, <▼>
2. Acknowledge modification:
   <Enter>

Contrast LCD

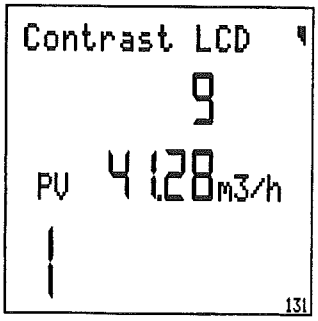


Fig. 77
Z-19131

1. Modify contrast (in nine steps, step 1 is the least contrast):
   <▲>, <▼>
2. Acknowledge modification:
   <Enter>

By modifying the contrast, colour tolerances of several controllers mounted beside each other can be compensated for.

Background illumination LCD
(not Protronic 550)

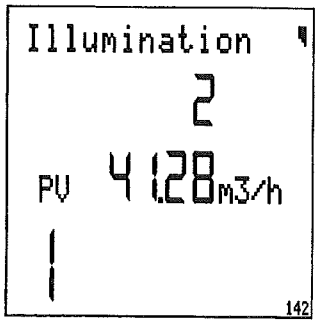


Fig. 78
Z-19142

1. Modify brightness (in two steps, step 1 is least bright):
   <▲>, <▼>
2. Acknowledge modification:
   <Enter>

Balancing

The balancing for the measurement with Pt100 resistance thermometers in 2-wire technique and the balancing of teletransmitters are undertaken in this menu.

Balancing Pt100

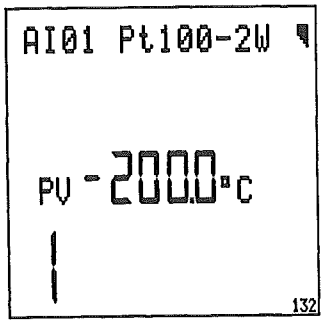


Fig. 79 Balancing for AI01 is selected
Z-19132

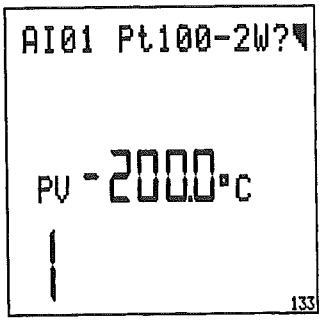


Fig. 80 Should balancing be started?
Z-19133

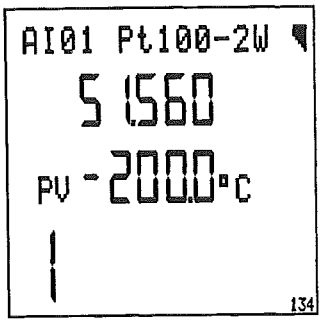


Fig. 81
Z-19134

⚠ Attention

Do not conduct balancing with input open!

Select the balancing point separately for the respective inputs in the basic unit and for the modules.

The submenu point AIxy Pt100-2L can only be selected if the Pt100 2-wire measurement for the respective input was configured.

Balancing steps

0. On the sensor, short-circuit the line between sensor and controller.

In the lower line, the controller displays the set reference value.

1. Call up the balancing mode on controller:
   <Enter>

In the first line "?" is supplemented.

Enter✲

2. Start balancing:
   <Enter>

For three seconds after completing balancing, "AIxy adjusted" is written in the text lines, a balancing variable is written and stored in the upper line of the display.

Enter●

Balancing is now successfully completed.

3. Exit the balancing menu:
   <Esc>

4. **Undo the short-circuiting on sensor!**

Teletransmitter balancing

The menu items for teletransmitter balancing can be selected when the respective input for "Teletransmitter" or for "0/4... 20 mA" is configured. The balancing procedure is the same in both cases. Balancing is always required, when the teletransmitter or a measured signal (e.g. position feedback signal) cannot be fully utilized as a valid measured value.

Application

Position feedback signal with potentiometer via teletransmitter input (AI01 or Pt100 module for 3/4-wire circuitry) or current input 0...20 mA AI02.

Zero point balancing

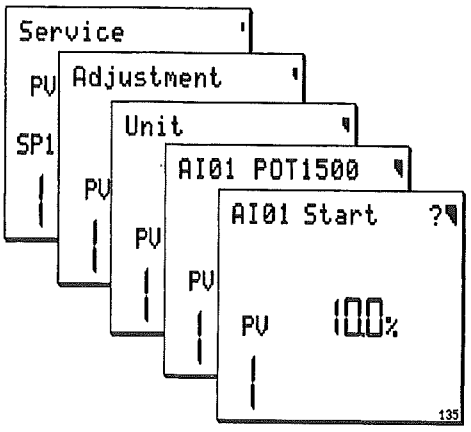


Fig. 82
Z-19135

1. Call up the balancing routine by pressing <Enter> several times in the menu "Service".

The signal "AI01 start" prompts you to return the teletransmitter to its start position mechanically.

2. Bring the teletransmitter to its start position mechanically.
3. Acknowledge "AI01 start" with <Enter>.

Balancing is effected, the message cursor springs to "AI01 end":

Span balancing

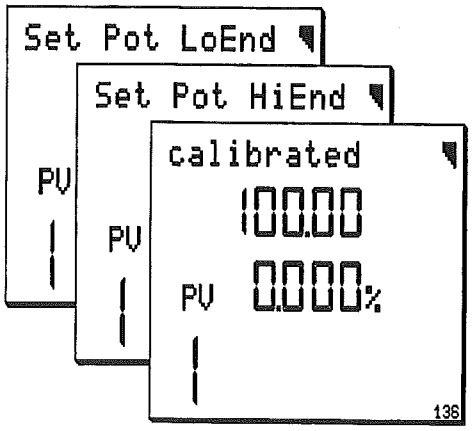


Fig. 83
Z-19136

4. Bring the teletransmitter mechanically to its final position.
5. Acknowledge "AI01 end" with <Enter>.

The balancing routine returns to the next higher operator control level via the message "AI01 adjusted".

Return to the main operator control level with <Esc>.

The position feedback signal is balanced in the same way, using a 0/4...20 mA current or a potentiometer fed with constant current. The signal "AIxy Pot150x" is then replaced by "AIxy20mA p. Pot".

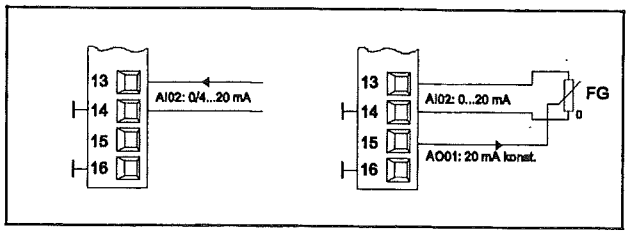


Fig. 84
Z-19128, Z-19129

Fig. 84

left	right
AI-B02-Q01 = 1 or 2	AI-B02-Q01 = 1
AI-B02-Q01 = 1	AI-B02-Q02 = 1
AI-B02-Q03 = 2	AI-B02-Q03 = 2
AI-B02-P05 = 0	AI-B02-P05 = 0
AI-B02-P06 = 100	AI-B02-P06 = 100
	AO-B01-Q01 = 5

Calibration

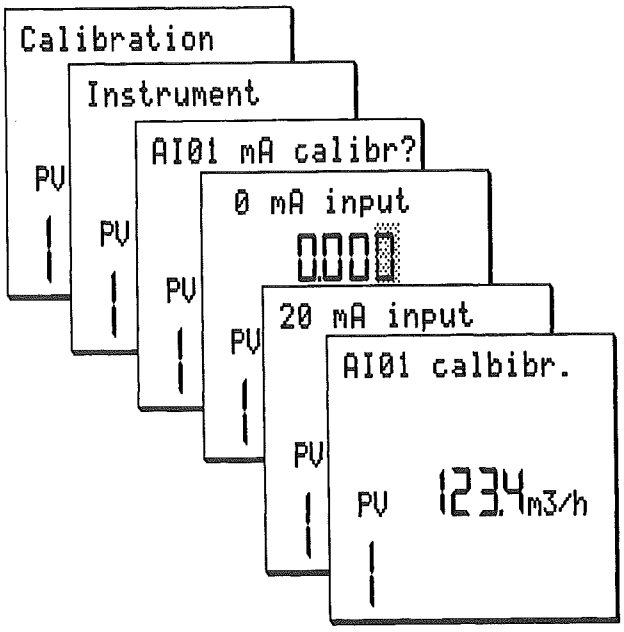


Fig. 85
Z-19075

Both inputs of the basic unit can be calbirated with the calibration routine. To accomplish this, external transmitters with the required accuracy are necessary.

Upon calling up the calibration routine, this provides the calibration of the inputs AI01 and AI02 of the basic unit in the configured type of measurement.

During calibration, the following values are made available with the stated adjustment ranges.

For calibration, the exact measured values must be stated in the ranges provided on the terminals. Adjust the values in the display to the required data with the keys <▾> and <▴> acknowldege with <Enter>.

mA Input

Display: **`AI0x mA calib.?`**

AI		Display	Range
01	mA	0.000	−1.00 ... +5.00
		20.000	15.00 ... 22.00
02	mA	0.000	−1.00 ... +5.00
		20.000	15.00 ... 22.00

Tab. 9 mA input

Adjust the values in the display to the required data with the keys <▾> and <▴> acknowldege with <Enter>. The calibration must be conducted for both items. 0 mA is provided in default by short-circuiting terminals 10 and 11.

mV Measurement

Display: **`AI01 mV calib.?`**

AI		Display	Range
01	mV	−10.000	−10.00 ... −5.00
		80.000	60.00 ... 85.00

Tab. 10 mV measurement

Adjust the values in the display to the required data with the keys <▾> and <▴> acknowldege with <Enter>. The calibration must be conducted for both items.

Pt100 measurement

Display: `AI01 Pt calib.?`

Calibration is effected in 4-wire technique, independent of the configuration. The resistance teletransmitter is connected with two lines each to terminals 8, 9 and 11, 12.

AI		Display	Range
01	Ω	0.000	0
	Ω	60.000	50.0 ... 85.0
	Ω	150.000	130.0 ... 200.0
	Ω	200.000	180.0 ... 220.0
	Ω	400.000	360.0 ... 450.0

Tab. 11 Pt100 measurement

Adjust the values in the display to the required data with the keys <▾> and <▴> acknowldege with <Enter>. The calibration must be conducted for all four items.

Teletransmitter measurement

Display: `AI01 Fg calib.?`

The total resistance of the teletransmitter is calibrated in 4-wire techniquae. The teleransmitter is connected with two lines each to terminals 8, 9 (start) and 11, 12 (end).

AI		Display	Range
01	Ω	800.0	700.0 ... 1100.0
	Ω	1000.0	1000.0 ... 1200.0
	Ω	2000.0	2000.0 ... 2500.0

Tab. 12 mA Input

Adjust the values in the display to the required data with the keys <▾> and <▴> acknowldege with <Enter>. The calbiration is to be conducted for the point closest to the resistance value of the teletransmitter.

Supervisor

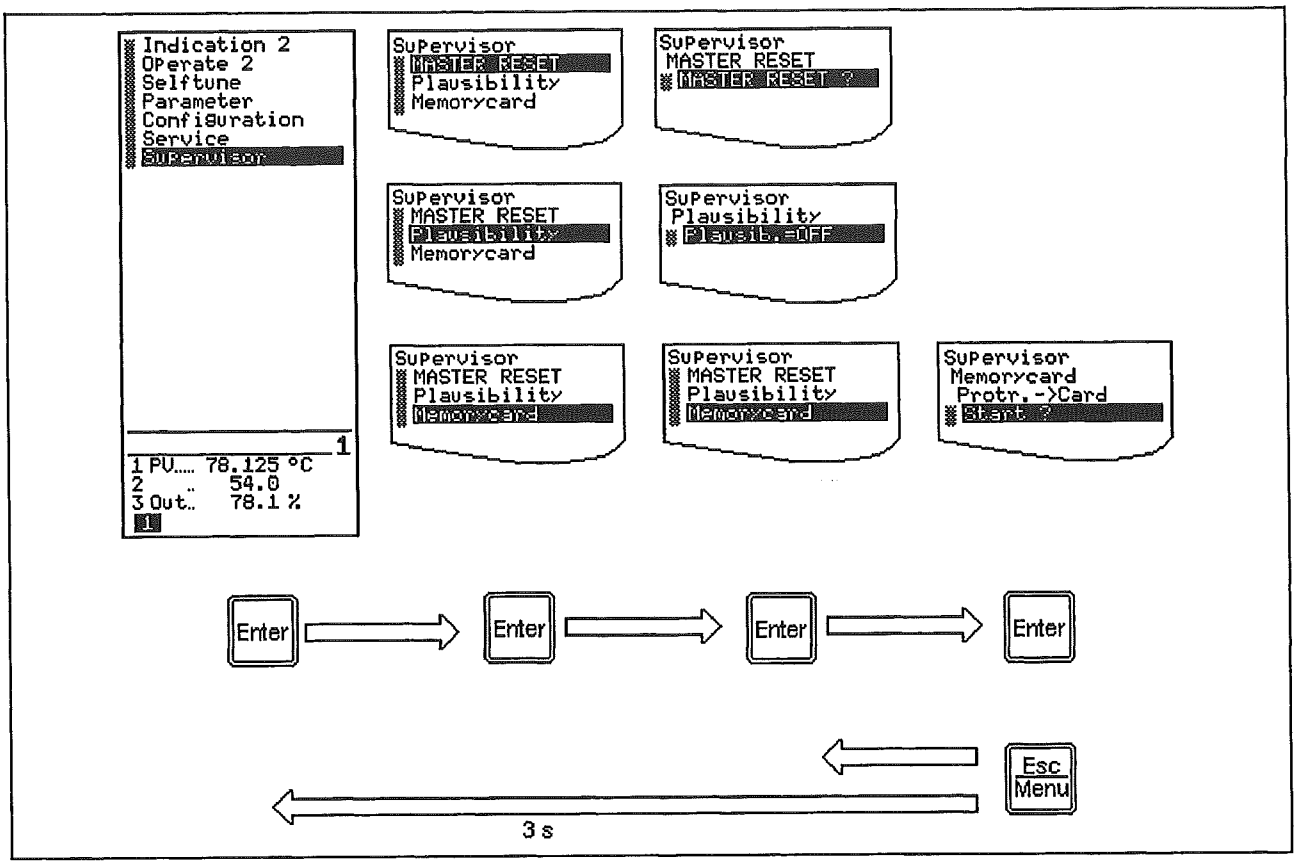


Fig. 86
Z-19110

Plausibility check

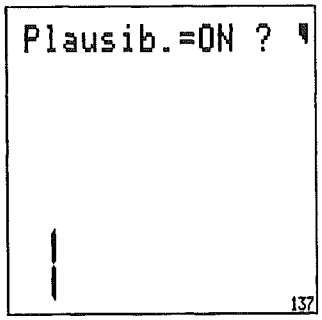


Fig. 87 Switch on plausibility check?
Z-19137

The plausibility check is used to verify, if the various configuration inputs are correct and complete.

After selecting the plausibility check, a query appears to inquire if the plausibility check should be switched on or off, depending on the current plausibility function.

1. For changeover between the queries:
   <▲>, <▼>

Enter✲

2. Acknowledge query:
   <Enter>

The question mark is deleted.

Enter●

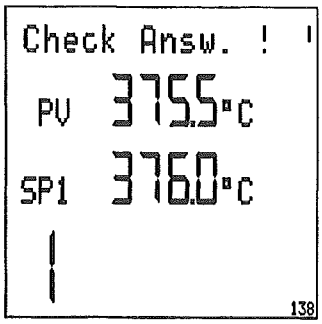


Fig. 88 Message when exitting the configuration
Z-19138

If the plausibility check mode is set, the following message appears when exitting the configuration:

Factory setting

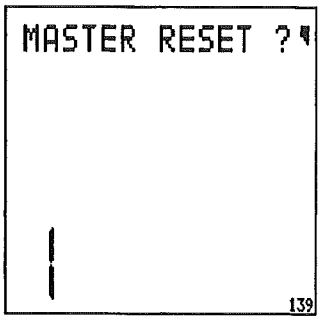


Fig. 89 Reset configuration and factory setting?
Z-19139

The menu item called factory setting permits all configurations to be reset to the factory settings at a go.

⚠ Attention

A reset to the factory setting results in the loss of all previously effected configurations! Only the language setting remains unchanged.

1. Call up the factory setting menu.

After call-up of the menu item, the query apprears, if the factory setting should be restored (fig. 89).

Enter✲

Either

2. Acknowledge query:
   <Enter>

"?" is changed to "!". With a few messages which disclose the progress of the factory settings, there is an automatic switch-back to the main operator control level.

Enter●

or

2. Abort:
   <Esc>

Memory card

(only Protronic 500 / 550)

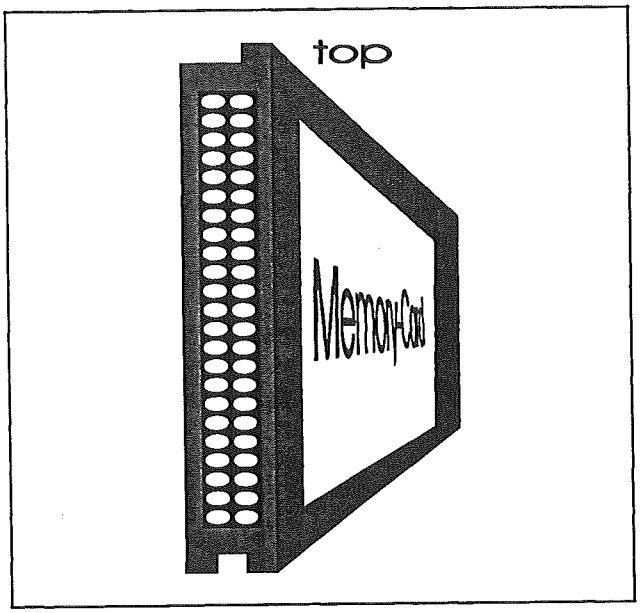


Fig. 90 Memory card
Z-19092

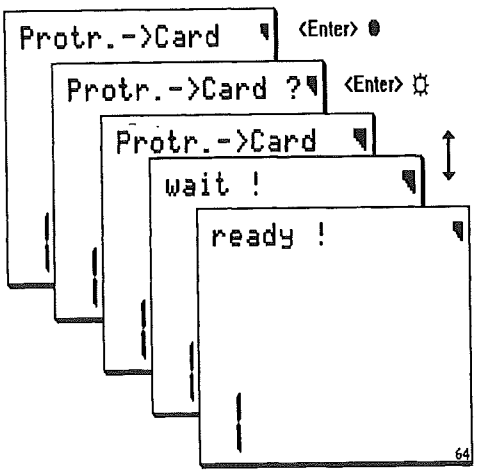


Fig. 91
Z-19064

In the memory card menu the configuration of a controller can be stored on a memory card or the configuration of a controller can be loaded from a memory card.

1. Remove the front module.
2. Plug memory card into the vertical slot as shown in fig. 90, irrespective of the arrangement of the label (wrong polarity not possible due to mechanical polarity protection).
3. Call up the memory card.

Either

4. Call up "Protr→Card".

After call-up of the menu item with <Enter>, the menu line is supplemented with a "?".

5. Acknowledge query:
   <Enter>

The progress of the saving mode is illustrated with "... wait" and "completed". If a fault occurs, the message "Fault" will appear instead of "completed".

or

4. Call up "Card→Protr":

After call-up of the menu item with <Enter>, the menu line is supplemented by a "?".

5. Acknowldege query:
   <Enter>

The progress of the loading is illustrated with "... wait" and "completed". If a fault occurs, the message "Fault" will appear instead of "completed".

Delete password (as of FW 1.163)

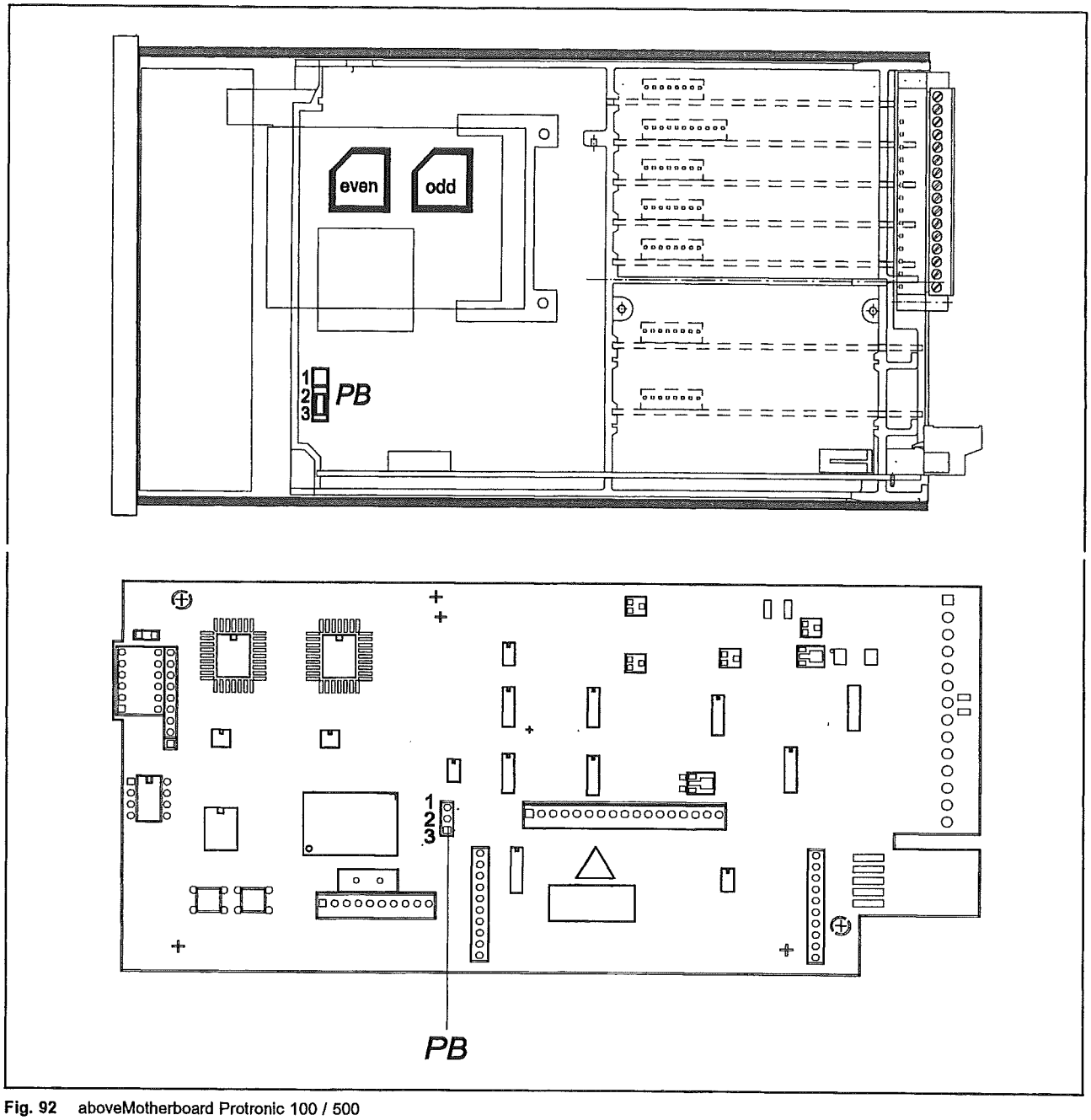


Fig. 92 aboveMotherboard Protronic 100 / 500
Z-19090 below Motherboard Digitric 500
Z-19091 *PB* Password bridge

1. Switch off power supply.
2. Dismantle unit and open.
   (Protronic 100/ 500: Operation Manual 42/62-50011).
   (Digitric 500: Operation Manual 42/61-50011).

If the plug-in jumpers *PB* connect posts 1 and 2, the adjusted password will be active. If the plug-in jumper is changed to posts 2 and 3, the adjusted password will no longer be required.

3. Change the plugging of bridge *PB*.
4. Close unit and install.
5. Connect power supply.

The levels protected with password are freely accessible.

6. Read password and eventually modify.
7. Replug the plug-in jumper according to steps 1-5.

Parameter Definition Tables

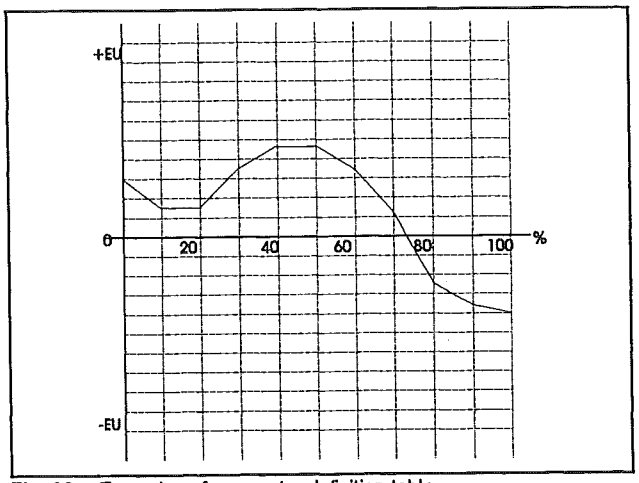


Fig. 93 Examples of parameter definition table

Instrument			Range		Unit	Resolution	Factory setting	System setting	Rem. p.66
Param. No.	Parameter text	Parameter	Min.	Max.					
	Table 1								
10	TAB-1.0	Checkpt. 0 at 0%	-9999	99999	EU	1 Digit	0.0		1
11	TAB-1.1	Checkpt. val. 1 at 10%					0.1		
12	TAB-1.2	Checkpt. val. 2 at 20%					0.2		
13	TAB-1.3	Checkpt. val. 3 at 30%					0.3		
14	TAB-1.4	Checkpt. val. 4 at 40%					0.4		
15	TAB-1.5	Checkpt. val. 5 at 50%					0.5		
16	TAB-1.6	Checkpt. val. 6 at 60%					0.6		
17	TAB-1.7	Checkpt. val. 7 at 70%					0.7		
18	TAB-1.8	Checkpt. val. 8 at 80%					0.8		
19	TAB-1.9	Checkpt. val. 9 at 90%					0.9		
20	TAB-1.10	Checkpt.val.10 at 100%					1.0		
	Table 2								
30	TAB-2.0	Checkpt. val. 0 at 0%	-9999	99999	EU	1	0.0		1
31	TAB-2.1	Checkpt. val. 1 at 10%					0.1		
32	TAB-2.2	Checkpt. val. 2 at 20%					0.2		
33	TAB-2.3	Checkpt. val. 3 at 30%					0.3		
34	TAB-2.4	Checkpt. val. 4 at 40%					0.4		
35	TAB-2.5	Checkpt. val. 5 at 50%					0.5		
36	TAB-2.6	Checkpt. val. 6 at 60%					0.6		
37	TAB-2.7	Checkpt. val. 7 at 70%					0.7		
38	TAB-2.8	Checkpt. val. 8 at 80%					0.8		
39	TAB-2.9	Checkpt. val. 9 at 90%					0.9		
40	TAB-2.10	Checkpt.val.10 at 100%					1.0		

Instrument			Range		Unit	Resolution	Factory setting	System setting	Rem. p.66
Param. No.	Parameter text	Parameter	Min.	Max.					
50	TAB-3.0	As tables 1 and 2							1
	|								
60	TAB-3.10								
70	TAB-4.0	As tables 1 and 2							1
	|							
80	TAB-4.10								

1 For all parameters, which can be illustrated in EUs the possible start and final values are 5-digit figures with arbitrary decimal point position. The numerical volume ranges from -9999 to 99999. The statement "Resolution = 1" means that the parameters can be adjusted by one digit at the last numerical position irrespective of the decimal position selected.

Loop 1 - 4

Protronic 100: Loops 1 and 2

Param.-No.	Parameter text	Parameter	Range Min.	Range Max.	Unit	Resolution	Factory setting	System setting	Rem. p.71
	PID Parameter (single-loop, slave controller, master controller)								
1	GAIN G	Controller gain G (active)	0.001	1000	without	0.0001	1		1
2	RESET-TIME	Reset time Tn (active)	0 min	600 min	min	0,0001 min	0.5 min		1, 8
3	RATE TIME	Rate time Tv (active)	0 min	600 min	min	0,0001 min	0.1 min		1, 8
4	RATE GAIN	Rate gain Vv	1	10	without	0.0001	5		
5	MANUAL RESET 1	Manual reset OUT0 (active)	-100	+100	%	0.1	50		1
	Parameter control $G = \frac{GE(U1-U10) + GA(U1E-U1)}{U1E-U10}$ U1 controls G		U1 < U10: G = GA U1 > U1E: G = GE						
6	GAIN LO	G for parameter control	0.001	1000	without	0.0001	1		7
7	GAIN HI	G for parameter control	0.001	1000	without	0.0001	1		7
8	U-GAIN-LO	Value of U1 for GA	Defined as variable U1 through Lx-B02-F07						2
9	U-GAIN-HI	Valaue of U1 for GE							
	Tn control as G control								
10	Tn_LO	Tn for parameter control	0 min	600 min	min	0,0001 min	0.5 min		7, 8
11	Tn_HI	Tn for parameter control	0 min	600 min	min	0,0001 min	0.5 min		7, 8
12	U_Tn_LO	Value of U2 for TnA	Defined as variable U2 through Lx-B02-F10						
13	U_Tn_HI	Value of U2 for TnE							
	Tv control as G control								
14	Tv-LO	Tv for parameter control	0 min	600 min	min	0,0001 min	0.1 min		7, 8
15	Tv HI	Tv for parameter control	0 min	600 min	min	0,0001 min	0.1 min		7, 8
16	U-Tv_LO	Value of U3 for TvA	Defined as variable U3 through Lx-B02-F13						
17	U-Tv_HI	Value of U3 for TvE							
	OUT0 control as G control								
18	MR_LO	OUT0 for parameter control	-100	+100	%	0.1	50		7
19	MR_HI	OUT0 for parameter control	-100	+100	%	0.1	50		7
20	U-MR-LO	Value of U4 for OUT0 start	Defined as variable U4 through Lx-B02-F16						
21	U-MR-HI	Value for U4 for OUT0 end							

Loop 1 - 4 Protronic 100: Loops 1 and 2			Range			Resolu-tion	Factory setting	System setting	Rem. p.71
Param.-No.	Parameter text	Parameter	Min.	Max.	Unit				
	Parameter for split range (only displayed in case of configured split range or three-step control)								
25	GAIN 2	Controller gain G (active)	0.001	1000	without	0.01 min	1		1, 7
26	RESET-TIME 2	Reset time Tn (active)	0 min	600 min	min	0,0001 min	0.5 min		1, 7, 8
27	RATE TIME 2	Rate time Tv (active)	0 min	600 min	min	0,0001 min	0.1 min		1, 8
28	RATE GAIN 2	Rate gain Vv2	1	10	without	0.0001	5		
29	MANUAL RESET 2	Manual reset OUT0 (active)	-100	+100	%	0.1	50		1
	Parameter control split range								
	G2 control variable as G1								
30	GAIN2_LO	G for parameter control	0.001	1000	without	0.01	1		7
31	GAIN2_HI	G for parameter control	0.001	1000	without	0.01	1		7
	Tn2 control variable as Tn1								
32	Tn2-LO	Tn for parameter control	0 min	600 min	min	0,0001 min	0.5 min		7, 8
33	Tn2_HI	Tn for parameter control	0 min	600 min	min	0,0001 min	0.1 min		7, 8
	Tv2 control variable as Tv1								
34	Tv2_LO	Tv for parameter control	0 min	600 min	min	0,0001 min	0.1 min		7, 8
35	TV2_HI	Tv for parameter control	0 min	600 min	min	0,0001 min	0.1 min		7, 8
	OUT02 control variable as Y01								
36	MR2_LO	OUT0 for parameter control	-100	+100	%	1	50		7
37	MR2_HI	OUT0 for parameter control	-100	+100	%	1	50		7
	Smith Predictor								
39	DEAD-TIME Tt	acive dead time Smith Predictor	0.01 min	60 min	min	0,0001 min	0.01 min		
40	MODEL TIME T1	Time constant for Smith Predictor (active)	0.01 min	600 min	min	0,0001 min	0.01 min		
41	MODEL GAIN Gs	Gain of Smith Predictor	0.0001	100	without	0.0001	1		
	Parameter control Smith Predictor								
	Td control as G control								
42	Td_LO	Dead time for parameter control	0 min	60 min	min	0,0001 min	0.01 min		7
43	Td_HI	Dead time for parameter control	0 min	60 min	min	0,0001 min	0.01 min		7
44	U-Td_LO	Value for U5 for Td_LO	Defined as variable U5 through Lx-B02-F19						
45	U-Td_HI	Value for U5 for Td_HI							

Loop 1 - 4 Protronic 100: Loops 1 and 2			Range			Resolu-tion	Factory setting	System setting	Rem. p.71
Param.-No.	Parameter text	Parameter	Min.	Max.	Unit				
	T1 control as G control								
46	T1_LO	T1 for parameter control	0.0 min	600 min	min	0.01 min	0.01 min		7
47	T1_HI	T1 for parameter control	0.0 min	600 min	min	0.01 min	0.01 min		7
48	U-T1_LO	Value for U6 for T1_LO	Defined as variable U6 through Lx-B02-F22						
49	U-T1_HI	Value for U6 for T1_HI							
50	Gs_LO	Gs for parameter control	0.001	100	without	0.0001	1		
51	Gs_HI	Gs for parameter control	0.001	100	without	0.0001	1		
52	U-Gs_LO	Value for U7 for Gs_LO	control variable U7 is defined through x-B02-F25						
53	U-Gs_HI	Value for U7 for Gs_HI							
	Controller output								
55	DEAD ZONE	Dead zone	0	25	%	0.1	1		
56	PULS DURAT.	Minimum ON period Step controller	0	5 s	s	0.05	0.05		
57	N PER min_1	Transfers per minute Z1	0.05	60	1/min	0.05	6	6	
58	N PER min_2	Transfers per minute Z2	0.05	60	1/min	0.05	6	6	
67	OUT-MIN	Control variable min.	-5	100	%	0.1	0		
68	OUT-MAX	Control variable max.	0	105	%	0.1	100		
69	RAMP OUT +	Output variable ramp rising	0.1	9999	%/s	0.001	9999		
70	RAMP OUT -	Output variable ramp falling	0.1	9999	%/s	0.001	9999		
71	OUT S1	Safety control outp. 1	-5	105	%	0.1	0		
72	OUT S2	Safety control outp. 2	-5	105	%	0.1	0		

Loop 1 - 4 Protronic 100: Loops 1 and 2			Range			Resolu-tion	Factory setting	System setting	Rem. p.71
Param.-No.	Parameter text	Parameter	Min.	Max.	Unit				
	Set points and alarms								
75	Sp_MIN	Set point min.	-9999	99999	EU	1	-9999		4
76	SP_MAX	Set point max.	-9999	99999	EU	1	99999		4
77	RAMP SP +	Set point ramp rising	0.0001	99999	EU/s	0.0001	99999		
78	TOL.RAMP SP+	Permissible difference between set point and actual value (Ramp stop)	0	99999	EU	1	99999		4
79	RAMP SP -	Set point ramp falling	0.0001	99999	EU/s	0.0001	99999		
80	TOL.RAMP SP-	as 63	0	99999	EU	1	99999		4
81	SP1	Set point 1	-9999	99999	EU	1	0		4
82	SP2	Set point 2 or delta for set point 1	-9999	99999	EU	1	0		4
83	SP3	Set point 3 or delta for set point 1	-9999	99999	EU	1	0		4
84	SP4	Set point 4 or delta for set point 1	-9999	99999	EU	1	0		4
	Alarm values								
91	ALARM 1	Alarm value 1	-9999	99999	EU	1	-9999		4
92	ALARM 2	Alarm value 2	-9999	99999	EU	1	99999		4
93	ALARM 3	Alarm value 3	-9999	99999	EU	1	99999		4
94	ALARM 4	Alarm value 4	-9999	99999	EU	1	99999		4
95	HYSTERESIS	Hysteresis	0	99999	EU	1	1		
96	TIME-UNIT	Time unit for dx/dt alarm value	1	3	without	1 = s 2 = min 3 = h	1		5
	Weighting factors of the input circuits								
101	K1	Weighting factor in input signal connection	-9999	+99999		0.0001	1.00		
102	K2	Weighting factor in input signal connection	-9999	+99999		0.0001	1.00		
103	K3	Weighting factor in input signal connection	-9999	+99999		0.0001	1.00		
104	K4	Weighting factor in input signal connection	-9999	+99999		0.0001	1.00		
	Ratio 1: Err = PV - [R x PV1 + Bias] **Ratio 2: Err = PV -[(R / (1 - R)) x PV1 + Bias]**								
115	RATIO MIN	Ratio min.	0	99999	EU	0.0001	0.00		
116	RATIO MAX.	Ratio max.	0	99999	EU	0.0001	2.00		
117	BIAS	Bias ratio control	-9999	99999	EU	0.0001	0		

Loop 1 - 4 Protronic 100: Loops 1 and 2			Range						
Param.-No.	Parameter text	Parameter	Min.	Max.	Unit	Resolution	Factory setting	System setting	Rem. p.71
	Disturbance value feedforward								
120	FF:TIME-CONST	Time constant d/dt	0.00.01 h	1.00.00	h.mm.ss	0	0.00.15 h		
121	FF:DIFF-GAIN	Differential gain	0	10	without	0.1	1		
	Selftune								
125	dY-AMOUNT	1. positioning step	-100.0	+100.0	%	0.1	5.0		
126	MAX.OUT. DUR.	Max. step duration	0.00.09 h	20.00 h	h.mm.ss	1 s	15 s		
127	MAX.POS. ERR	Max. permissible positive control deviation	0.0001	99999	EU	0.0001	99999		
128	MAX.NEG. ERR	Max. permissible negative control deviation	0.0001	99999	EU	0.0001	99999		
199	Keys ▲ and ▼ act on text line	TAG name A...Z, a...z, +,. , /, %, _,), (, °, 9...0, spacing, -, 12 character	Default entry '----------'						3, 9

1 Active parameter. Can be set if no parameter control has been configured. This value will only be displayed if a parameter control has been configured.

2 The units for U1 to U8 depend on the variables to be controlled. If PV or SP is controlling, then U1 to U8 are in EU (e.g. °C); if OUT is controlling, the unit is %.

3 Using the keys <▼> and <▲> in conjunction with <Ind>, the text is input by scrolling the letters and the numerals.

4 The value is set in EU. 1 EU corresponds to the first significant digit left of the desired decimal point position.

5 Selection possibilities, min, h. If alarm values for monitoring the rate of change have been configured, the value is set with the alarm value parameter and the time constant set with parameter 96.

Example: Set alarm value for 15 °C per minute:
Parameter 96 = "min", alarm value = 15 °C.
AL1: Lx-B08-F01 = 11
Lx-P91 = 15
Lx-P96 = 2

6 The minimum switch-on time and the minimum switch-off time are calculated as follows:

$t_{on,min} = t_{off,min} = 60\ s / 4 \times N$, $N = 6 / min$
$t_{on,min} = t_{off,min} = 2.5\ s$

7 Without function if controlled via table.

8 0 min switches I- or D part off.

9 9-digit for the versions prior to 1.174

Programmer

The tables for programs 1 to 10 can only be edited after the programmer has been activated as set point source in a loop (Lx-B05-F08 = 1) and the respective program (P-B01-Fx > 0) has been activated.

Program 1			Ranges			Resolution	Factory setting	System setting	Rem. p.70
Param.-No.	Parameter text	Parameter	Min.	Max.	Unit				
01	VALUE 1.0	Start value, value 0	-9999	99999	EU	1	-9999		
02	VALUE 1.1	Value 1					-9999		
00	VALUE 1.2	Value 2					-9999		
04	VALUE 1.3	Value 3					-9999		
		|					-9999		
15	VALUE 1.14	Value 14					-9999		
16	VALUE 1.15	Value 15					-9999		
17	TIME 1.1	Time for segment 1	0.00.00 h	99.59. h	h.mm.ss	v	0.10.00 h		1
18	TIME 1.2	Time for segment 2					0.10.00 h		
		|					0.10.00 h		
30	TIME 1.14	Time for segment 14					0.10.00 h		
31	TIME 1.15	Time for segment 15					0.10.00 h		
	Binary track								
32	SEGMENT1 BIN.	Section 1 (0 = off, 1 = bin. marker 1, 2 = bin. marker 2, ...	0	15 (1+2+ +4+8)	without	1	2		
33	SEGMENT2 BIN	Segment 2					2		
		|					2		
45	SEGMENT14 BIN	Segment 14					2		
46	SEGMENT15 BIN	Segment 15					2		
	Loop								
47	PGR.LOOP_BEG	from segment	1	14	without	1	1		
48	PGR.LOOP_END	up to segment	2	15	without	1	15		
49	# OF LOOPS	Number of loop executions	1	9999	without	1	1		

Program 1			Ranges						
Param.-No.	Parameter text	Parameter	Min.	Max.	Unit	Resolution	Factory setting	System setting	Rem. p.70
50	TOL.SEG1	If the measured value deviates from the setpoint by more than the set tolerance, the program sequence in ramps is stopped. The holding time only begins once the set point has reached the holding time and the measured value is within the tolerance on the set point.	0	99999	EU	1	99999	3	
51	TOL.SEG2								
52	TOL.SEG3								
63	TOL.SEG14								
64	TOL.SEG15								

Program 2			Ranges						
Param.-No.	Parameter text	Parameter	Min.	Max.	Unit	Resolution	Factory setting	Sytem setting	Rem. p.70
01	VALUE 2.0	Start value, value 0	-9999	99999	EU	1	-9999		
02	VALUE 2.1	Value 1					-9999		
to									
64									

to

Program 10			Ranges						
Param.-Nr.	Parameter-text	Parameter	Min.	Max.	Unit	Resolution	Factory setting	System setting	Rem. p.70
01	VALUE 10.1	Start value, value 0	-9999	99999	EU	1	-9999		
02	VALUE 10.2	Value 1					-9999		
to									
64									

1 The resolution varies according to the momentary time value. In the lower range (display "0.00.00") the resolution amounts to one second, in the upper range (display "00.00") the resolution amounts to 1 minute.

Configuration tables

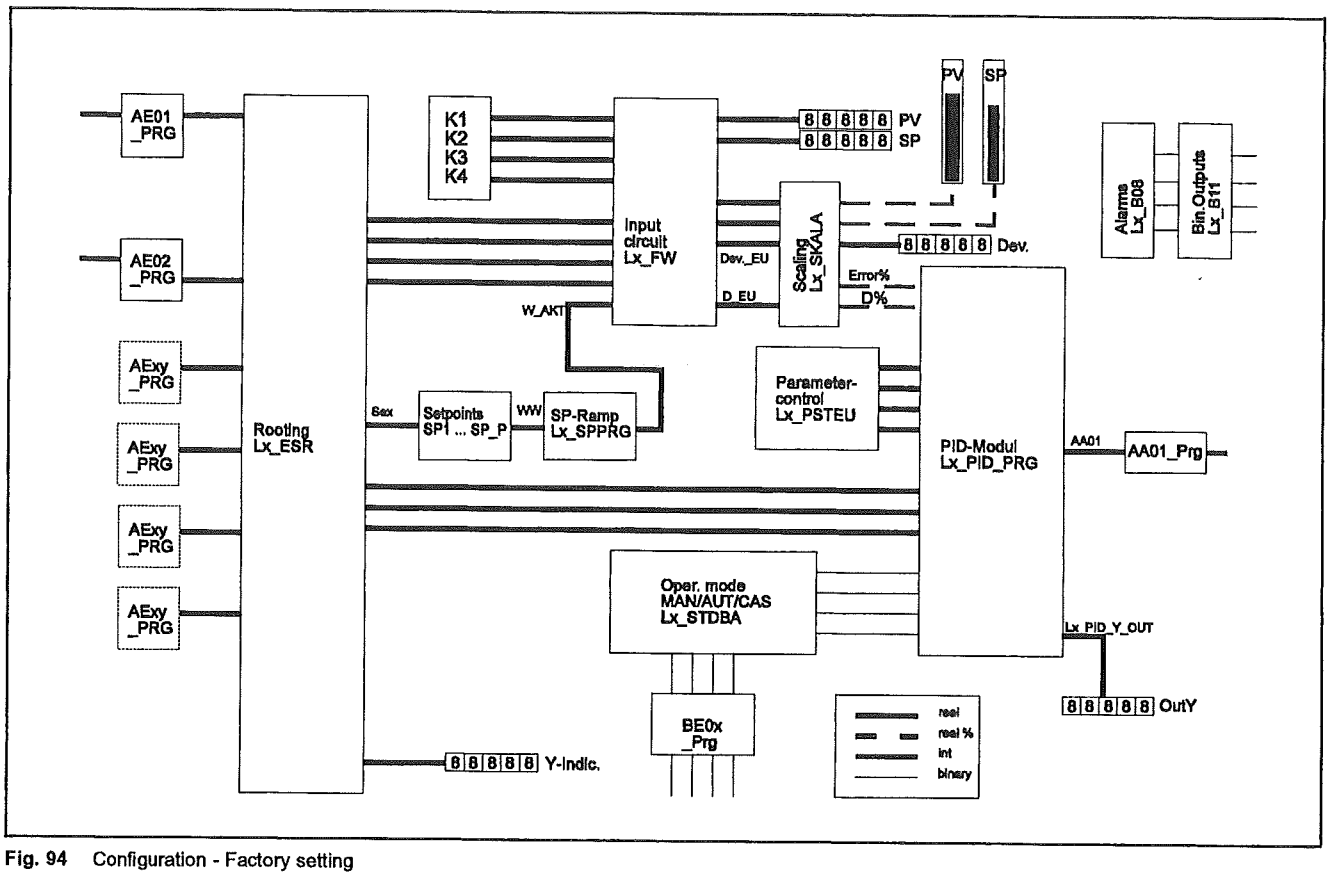


Fig. 94 Configuration - Factory setting

⚠ Important information

1. If a free Configuration is loaded, only a part of the following described configuration modules and queries are accessible.

   These are characterized by "fC" (see 2.)

2. Meanings in der "Response" column
   D = Digitric 100,
   1 = Protronic 100,
   5 = Protronic 500/550,
   • = available,
   – = not available,
   fC = free Configuration and
   + = changeable via key despite free Configuration.

3. The factory setting is underlined.

4. Instead of the values quoted for Protronic 500/550:
   - AI74,
   - AO73,
   - BI76 and BO76,

   the following values are for Protronic 100:
   - AI02,
   - AO01,
   - BI02 and BO02, and

   the following values are for Digitric 500:
   - AI44,
   - AO43,
   - BI46 and BO46.

5. Any other differences between the controllers are marked at the appropriate position.

Instrument							Function	Rem. p.78
Module	Query Param.	Response						
01						**LANGUAGE**		
	Q01	D	1	5	fC			
		●	●	●	+	1 DEUTSCH	German texts	
		●	●	●		2 ENGLISH	English texts	
		●	●	●		3 FRENCH	French texts	
		●	●	●		4 ...	...	
02						**BINARY INPUTS**		
	Q01	D	1	5	fC		Inhibition of parameter def. and confi. levels	
		●	●	●	+	0 LOCK PAR OFF	no inhibition	
		●	●	●		1 LOCK PAR.BI01	with BI01	
		●	●	●		|	|	
		●	●	●		4 LOCK PAR.BI04	with BI04	
		●	–	●		|	|	
		●	–	●		46 LOCK PAR.BI46	with BI46	
		–	–	●		|	|	
		–	–	●		76 LOCK PAR.BI76	with BI76	
	Q02	D	1	5	fC		Inhibition of all operator interventions	
		●	●	●	+	0 LOCK OP.BIOFF	no hardware inhibition	
		●	●	●		1 LOCK OP.BI01	BI01	
		●	●	●		|	|	
		●	●	●		4 LOCK OP.BI04	BI04	
		●	–	●		|	|	
		●	–	●		46 LOCK OP.BI46	BI46	
		–	–	●		|	|	
		–	–	●		76 LOCK OP.BI76	BI76	
	Q03	D	1	5	fC		Alarm acknowledgement with bin.inp.	
		●	●	●	+	0 NO ALM.QUIT	No alarm acknowledgement with bin.inp.	
		●	●	●		1 QUIT ALM.BI01	BI01	
		●	●	●		|	|	
		●	●	●		4 QUIT ALM.BI01	BI04	
		●	–	●		|	|	
		●	–	●		46 QUIT ALM.BI46	BI46	
		–	–	●		|	|	
		–	–	●		76 QUIT ALM.BI76	BI76	
03						**BINARY FLAGS**		
	Q01	D	1	5	fC		Flag1 coupled with binary-input / output	
		●	●	●		0 FLAG1 BX. OFF	not coupled	
		●	●	●		1 FLAG1_Bx01	Bx01	
		●	●	●		|	|	
		●	●	●		4 FLAG1_Bx04	Bx04	
		●	–	●		|	|	
		●	–	●		46 FLAG1_Bx46	Bx46	
		–	–	●		|	|	
		–	–	●		76 FLAG1_Bx76	Bx76 x = I or O	
	Q02- Q06	like Flag 1					like Flag 1	
04						**REMOTE OPERATION** via port or binary inputs		
	Q01	D	1	5	fC		Local/Remote	
		●	●	●	+	1 LOCAL OPER.	Local operation on unit only	
		●	●	●		2 LOC/REM	Local operation on unit or via port Changeover in operation 2	
		●	●	●		3 REMOTE	Local operation via port only	
		●	●	●		4 LOCAL & REMOTE	Local operation equally on unit or via port	

Instrument							Function	Rem. p.78
Module	Query Param.	Response						
05							**BINARY OUTPUTS**	
	Q01	D	1	5	fC		Self-test	2
		●	●	●		0 SELFTEST=NO BO	No output	
		●	●	●		1 SELFTEST BO01	BO01	
		●	●	●		|	|	
		●	●	●		4 SELFTEST BO04	BO04	
		●	–	●		|	|	
		●	–	●		46 SELFTEST BO46	BO46	
		–	–	●		|	|	
		–	–	●		76 SELFTEST BO76	BO76	
	Q02	D	1	5	fC		Error in telegram communication	2
		●	●	●		0 COM_ERR=NO BO	No output	
		●	●	●		1 COM_ERR=BO01	BO01	
		●	●	●		|	|	
		●	●	●		4 COM_ERR=BO04	BO04	
		●	–	●		|	|	
		●	–	●		46 COM_ERR=BO46	BO46	
		–	–	●		|	|	
		–	–	●		76 COM_ERR=BO76	BO76	
10							**ALARM TREATMENT**	
	Q01	D	1	5	fC		Alarm ind	
							Alarm texts are not displayed on front panel	
		●	●	●	+	0 ALM IND OFF	Alarm text are displayed	
		●	●	●		1 ALM_IND_ON		
	Q02	D	1	5	fC		Alarm acknowledgement	
		●	●	●	+	0 QUIT OFF	No acknowledgement envisaged	
		●	●	●		1 QUIT_SINGLE	Only the alarm displayed is acknowledged	
		●	●	●		2 QUIT_ALL	All alarms are always acknowledged	
11							**MODULE ASSIGNMENT**	
	Q01	D	1	5	fC			1
		●	●	●		0 B12:MANUAL	Modules must be input manually in G-B12	
		●	●	●		1 B12:AUTOMATIC	Unit recognizes the existing modules	
12							**MODULE PRESETTING**	
	Q01	D	1	5	fC		Slot 1	
		●	–	●	+	0 M1=UNUSED	free	
		●	–	●		10 M1=AI4-mV	4 x thermocouple/ mV	
		●	–	●		15 M1=AI2-mAmA i	2 x mA with electrical isolation	
		●	–	●		16 M1=AI2-mAmV i	1 x mA + 1 x thermocouple with isolation	
		●	–	●		17 M1=AI2-mVmA i	1 x thermocouple + 1 x mA with isolation	
		●	–	●		18 M1=AI2-mVmV i	2 x thermocouple with isolation	
		●	–	●		20 M1=AI4 mA p	4 x mA with potential isolation	
		●	–	●		24 M1=AI4-f/t	Frequency or time measurement	
		●	–	●		25 M1=AI4_mA_MUS	4 x mA with transmitter supply	
		●	–	●		30 M1=AI4-Pt-2W	4 x Pt100 2-wire circuit	
		●	–	●		35 M1=AI2-Pt-3/4	2 x Pt100 3/4-wire circuit	
		●	–	●		40 M1=AO3-V	Output 3 x V	
		●	–	●		50 M1=AO3-mA	Output 3 x 20 mA	
		●	–	•		60 M1=BIO6-BIN.	6-fold binary input/output	
		●	–	–		70 M1=BO4-RELAIS	Output 4 x relays	
		●	–	–		2 M1=RS485	Serial interface	
		●	–	●		4 M1=PROFIBUS	PROFIBUS module	