

Protrenic 100/500/550/700/750 Digitrenic 500/700

ENA42/62-50012 EN

Manual

Controllers for
process engineering
controllers for industry

Configuration and parameterization

Rev. 03

ENA Control



ELECTRON X
manufacturing & services

Remarks

Preliminary Remarks

The documentation provided on delivery for Protrenic 100 / 500 / 700 / Digitrenic 500/700 consists of the following parts:	
Installation instructions Protrenic 100 / 500 / 550 / 700 / 750	ENNA42/62-50011
or	
Installation instructions Digitrenic 500/700.	ENNA42/61-50011
Commissioning instructions: Configuration and parameter setting	
Protrenic 100 / 500 / 550 / 700 / 750 • Digitrenic 500/700. ENNA42/62-50012	
Operating instructions Protrenic 100 / 500 / 700.	ENNA42/62-50013
or	
Operating instructions Protrenic 550 / 750.	ENNA42/62-55013
or	
Operating instructions Digitrenic 500/700.	ENNA42/61-50013
Also available on request:	
Operating instructions IBIS_R, Free Configuration	ENNA42/62-50030
Interface description (MODBUS)	ENNA42/62-50040

The commissioning includes all information for the menu-guided configuration and parameter Definition of the Protrenic 100/500/550/700/750 and Digitrenic 500/700. 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 ENAControl 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.

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Comments

Comments on the displays in this operating manual

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

Comments on the configuration and parameter Definition tables

I	Instrument	Parameter Definition	
AI	Analog input		
AO	Analog output	L1-P01	Loop 1, Parameter 01 = Kp
BIO, BI/BO	Binary input/output		
Lx	Loop No, number of control circuit State	Configuration	
ZK	corection		
P	Programmer		
P01	Parameter 1	I-B01-Q01	Instrument, Block 1, Query 1 = Language
B01	Block 01	L2-B03-Q02	Loop 2, Block 3, Query 2 = Input signal connection
Q01	Query 01		

Comments on the configuration menu

The input values Alx, Blx 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:

Protrenic 100 has one slot.

Protrenic 500/550 and **700/750** has up to 7 slots (counting from top to bottom).

Digitrenic 500/700 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:

Alxy	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

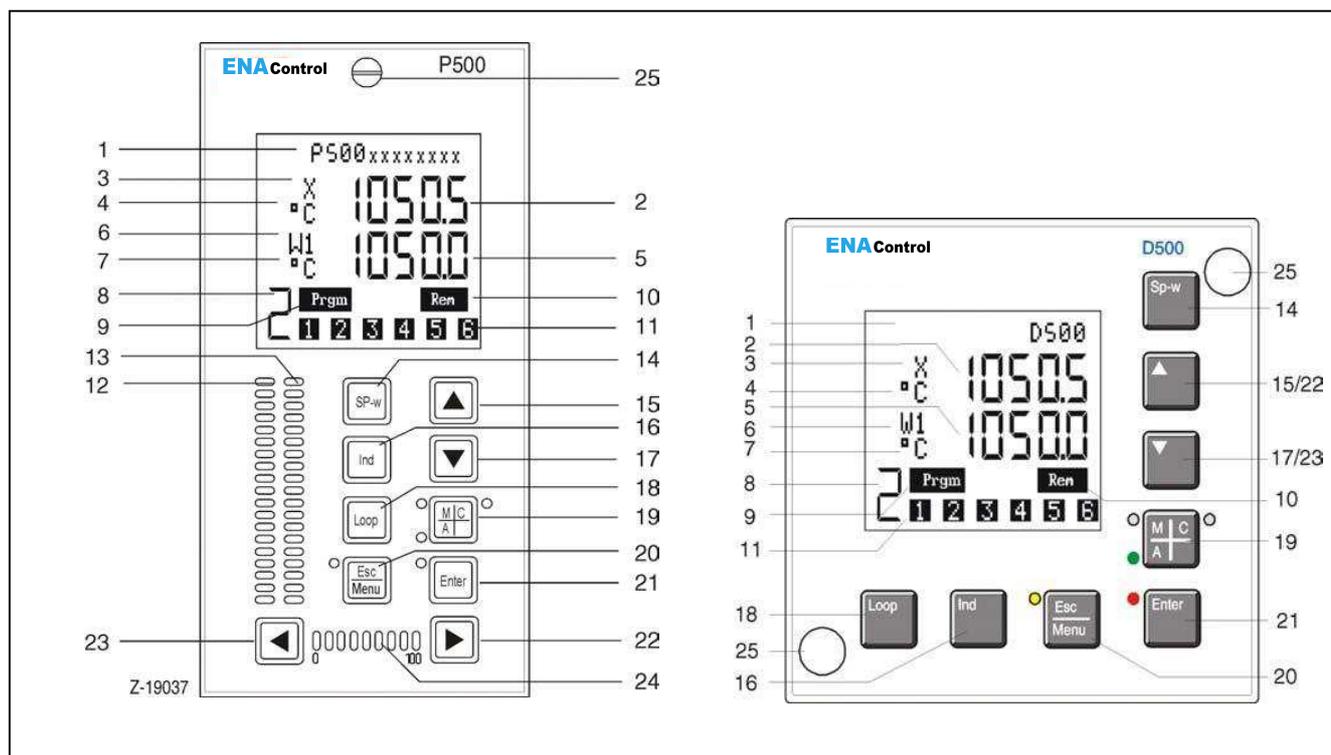


Fig. 1 Front panel Protrenic 100/500/700 (right) • Digitrenic 500/700 (left)

- | | |
|--|---|
| <ul style="list-style-type: none"> 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") | <ul style="list-style-type: none"> 15 Setting "raise" of the value displayed in 5, 6 and 7 16 Display changeover 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 exited.
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 |
|--|---|

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

Menu system

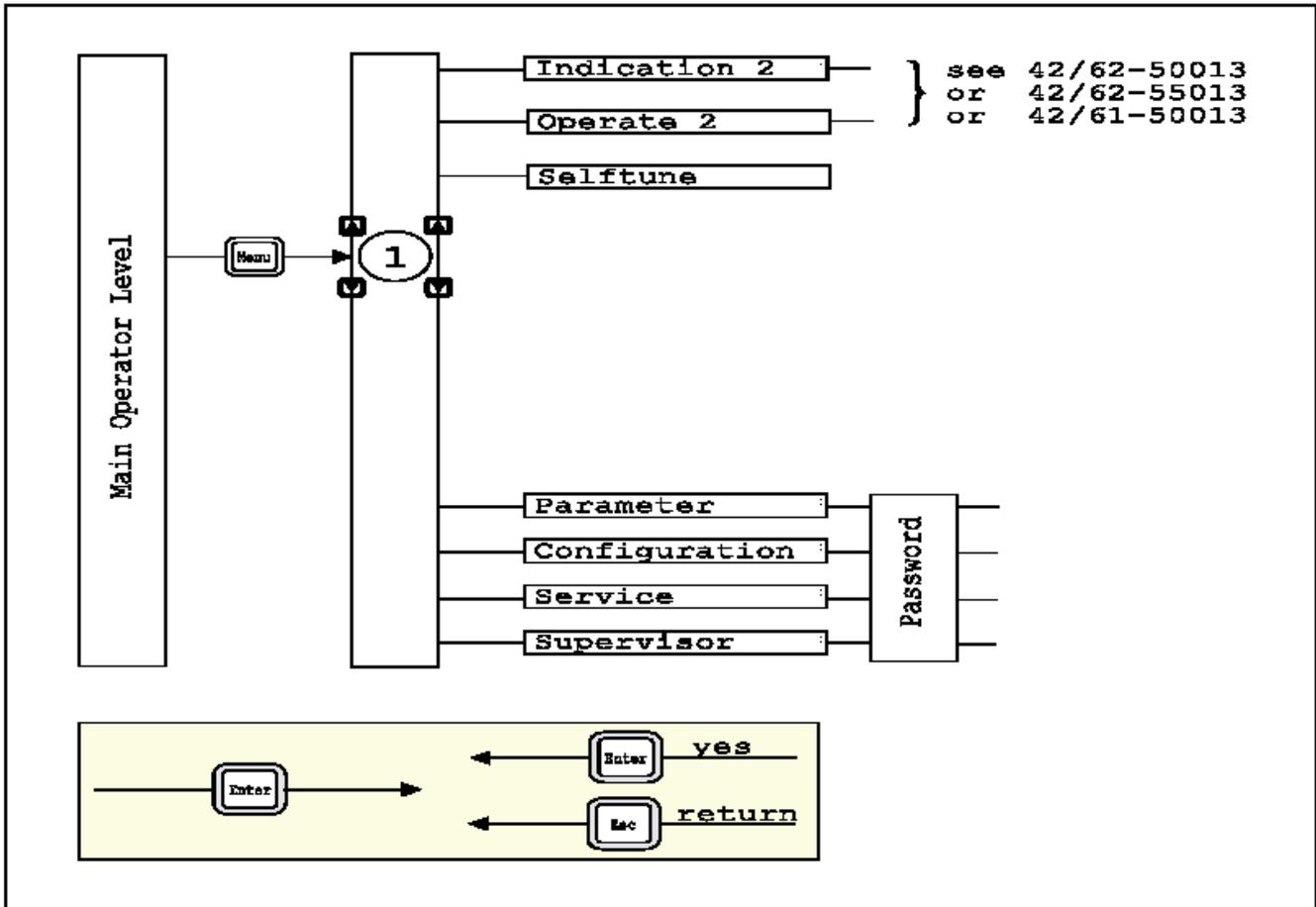


Fig. 2 Menu system

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 ...

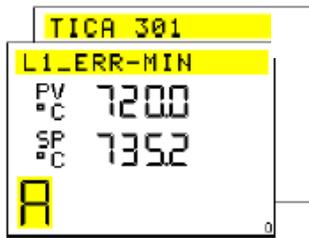
Supervisor

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



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).

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

Password protection



Fig. 4 Password input. 1. field on the right

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 auto-matic return to the operator control level.

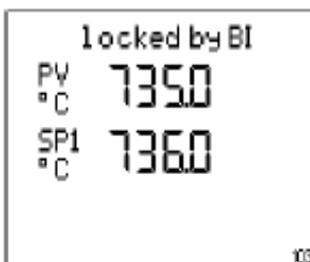


Fig. 5 Blockade of the parameter setting and configuration level by a binary input

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

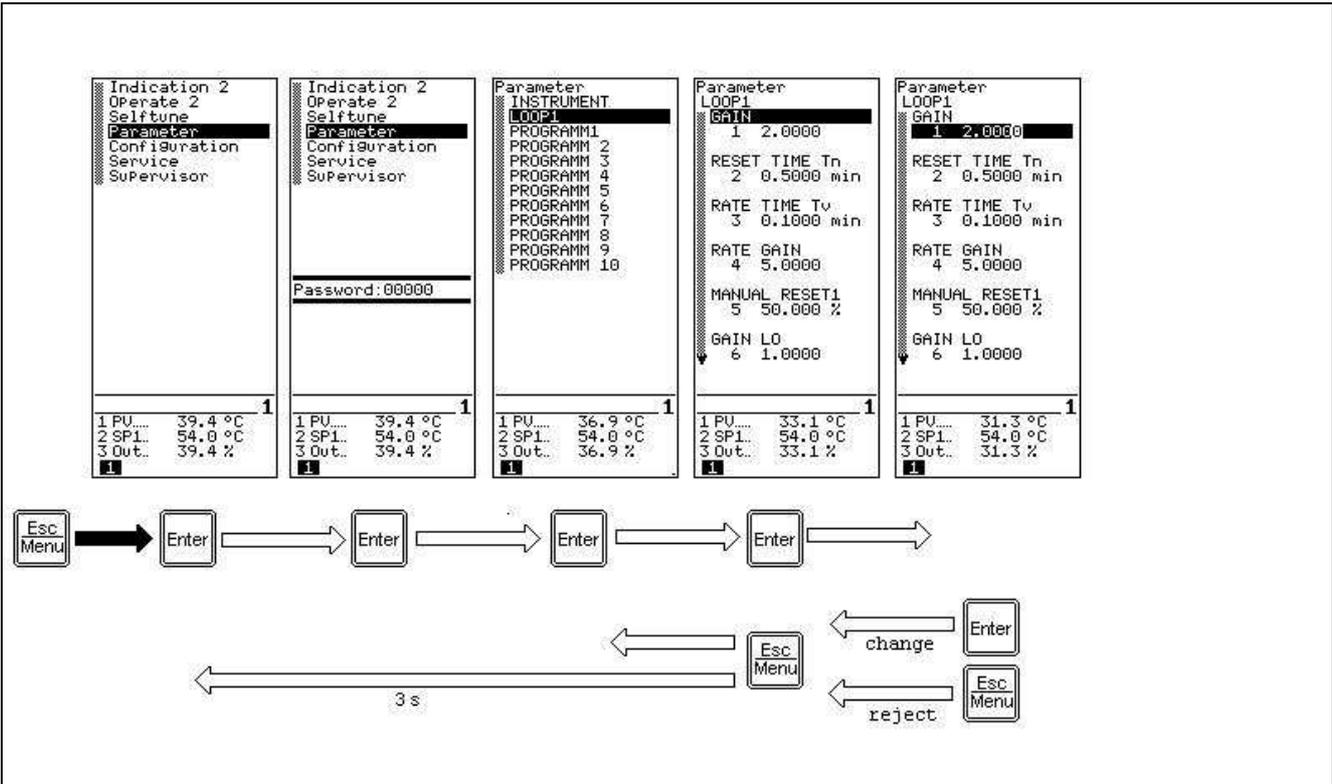
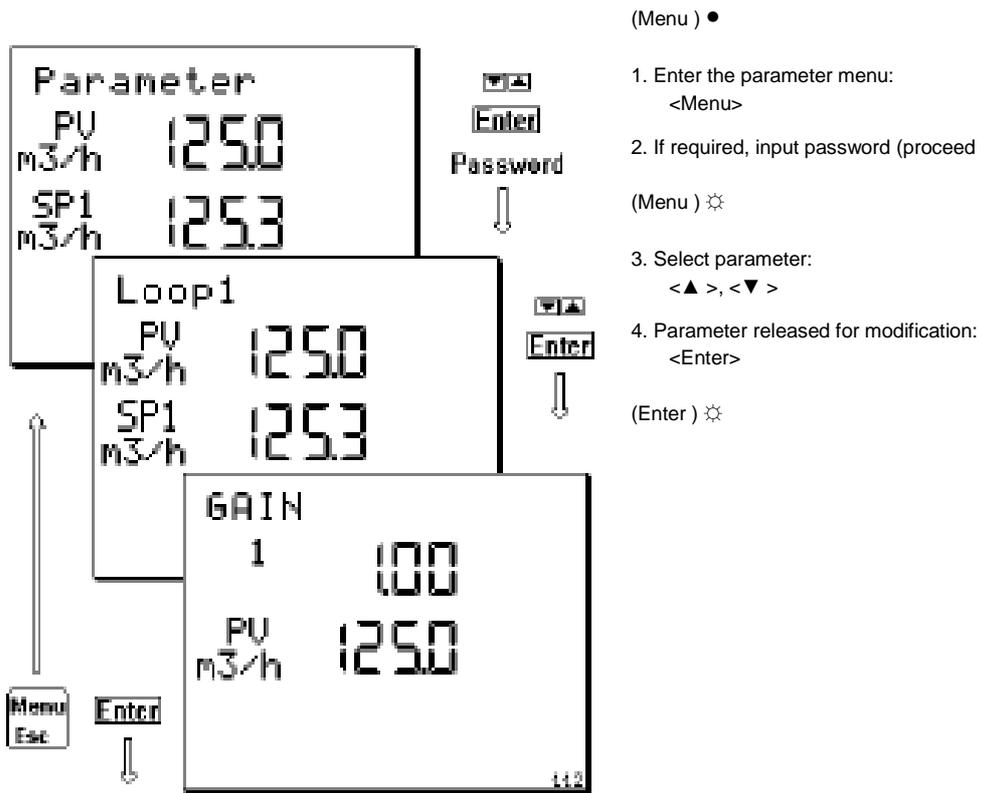


Fig. 6 Parameter setting menu (Protrenic 100: only Loops 1 and 2)

Parameter selection and modification



(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) ☼

Fig. 7 Parameter selection

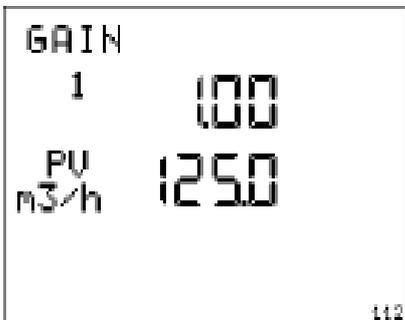


Fig. 8 Gain selected for modification

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 setting 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

(Protrenic 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 can 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 overshoot.

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

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 exited.

Self-tune mode

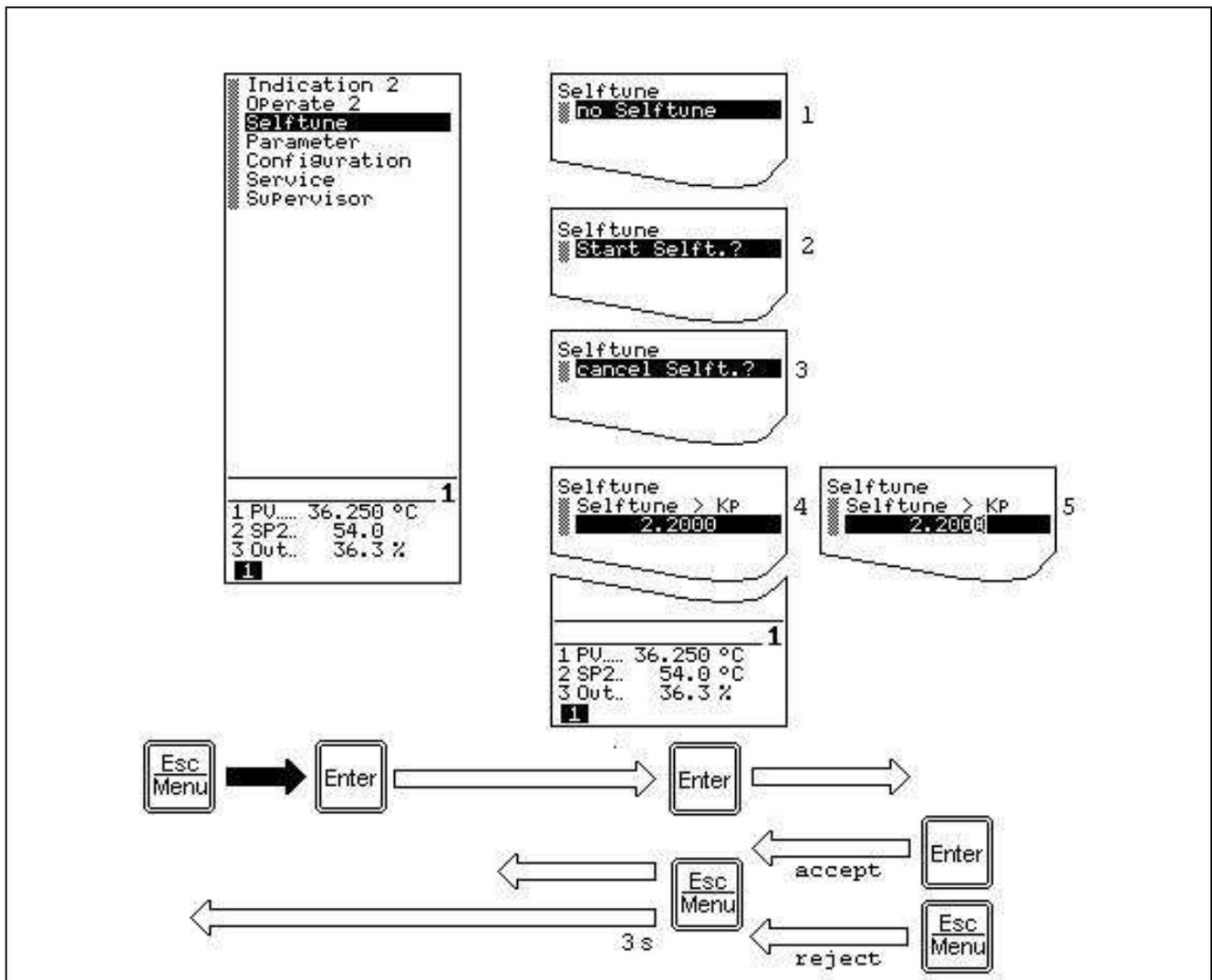


Fig. 10 Self-tuning. Accessible menu points:

- 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:

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.

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. Pos. control deviation Lx-P127

Max. Neg. control deviation Lx-P128

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

Factory setting: 99999 EU

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 T_g .
Factory setting: 0.25 min (15 s).

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

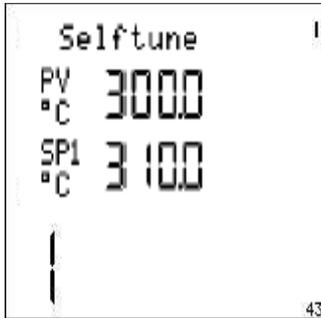


Fig. 11 Self-tuning

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

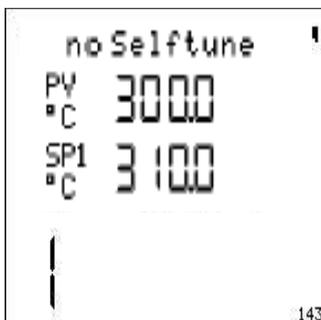


Fig. 12 Inhibited for self-tuning

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.

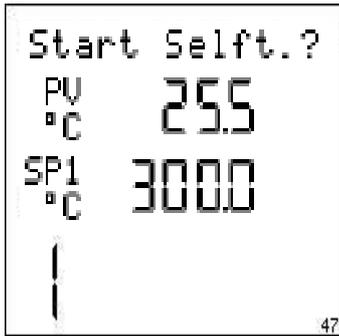


Fig. 13 Start self-tuning?

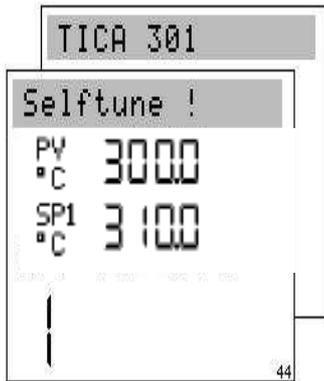


Fig. 14

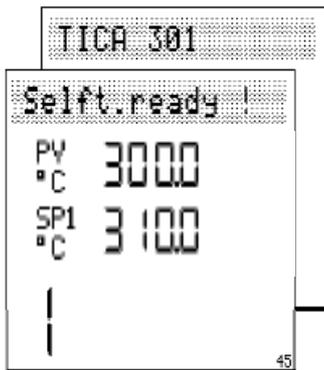


Fig. 15

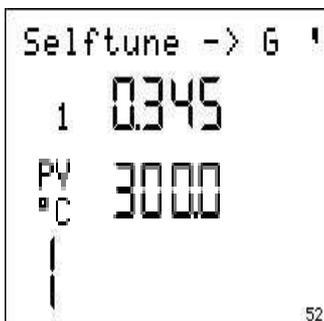


Fig. 16

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

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.

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.

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

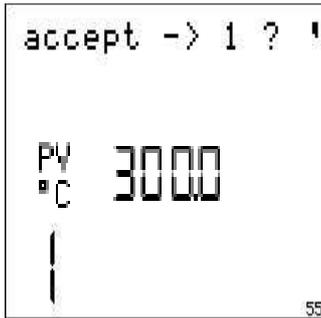


Fig. 17 Accept >1?

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

1. Accept the values:
<Enter>

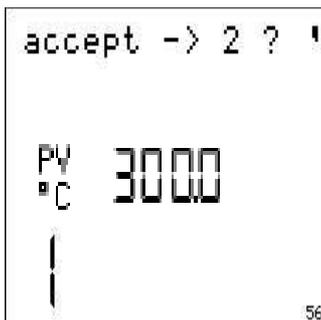


Fig. 18 Accept >2?

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

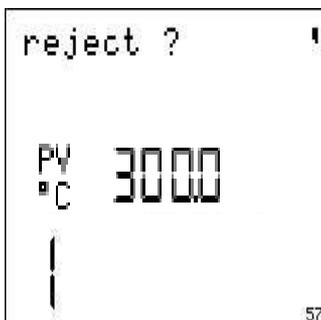


Fig. 19 Reject?

1. Reject parameter:
<Enter>

The previously set values remain valid.

Abort the self-tuning mode



Fig. 20 Abort parameter Definition?

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

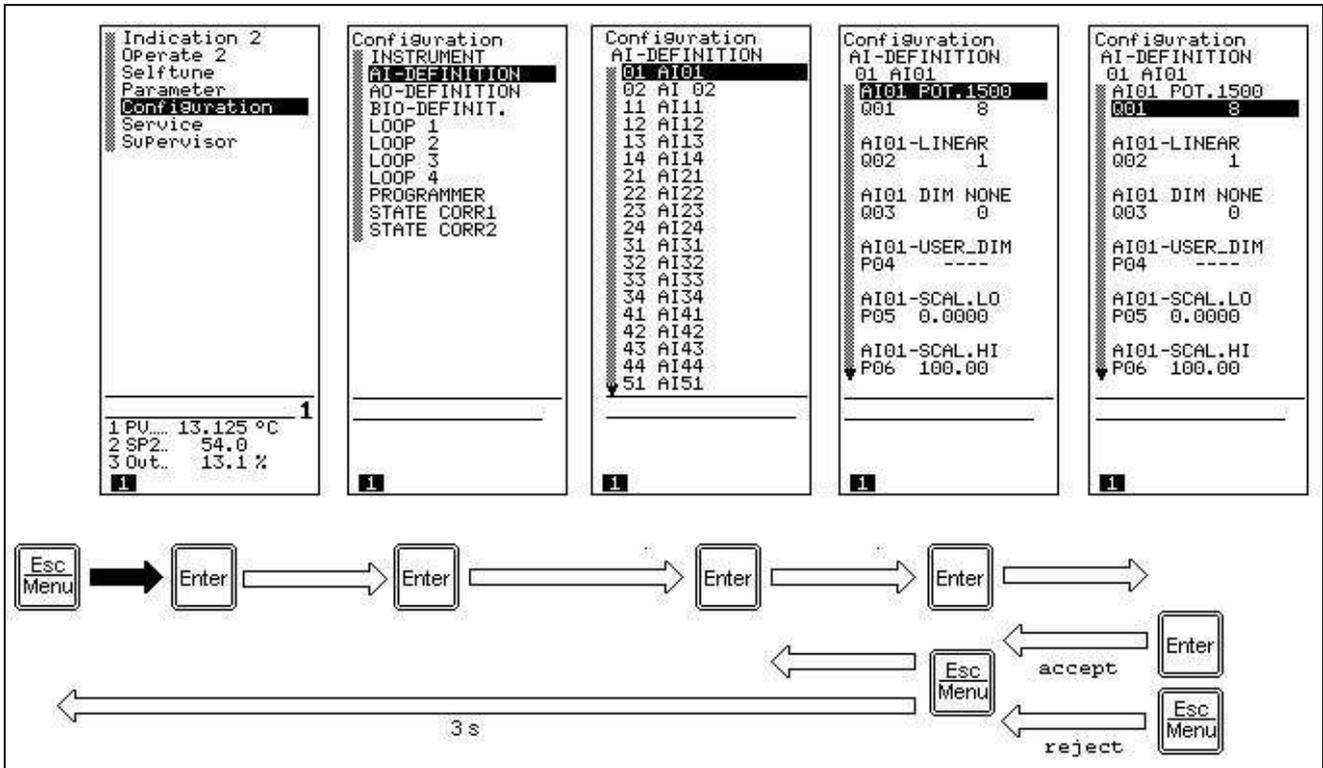


Fig. 21 Configuration menu

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

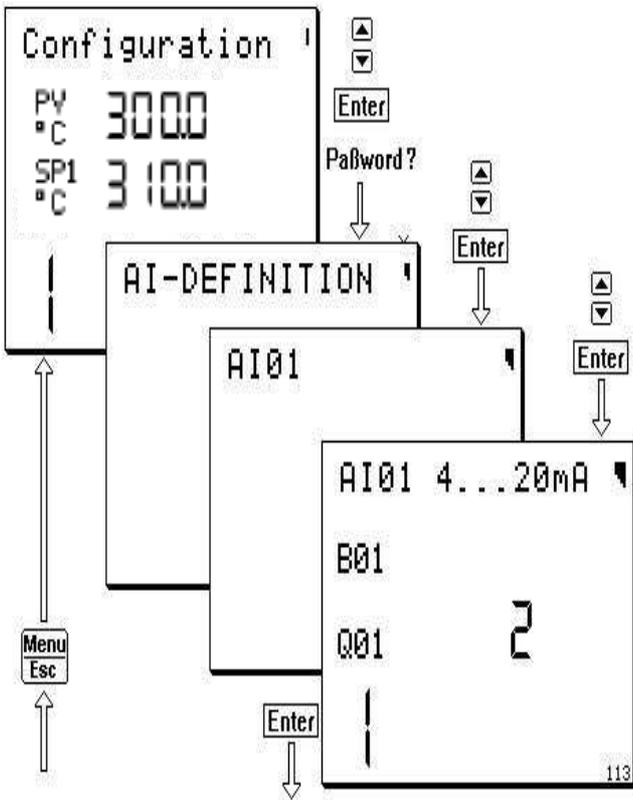


Fig. 22 Select AI → B01 → Q01

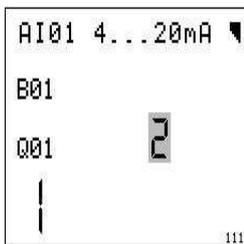


Fig. 23 Change configuration

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 exited.

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

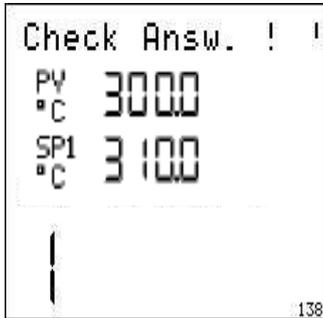


Fig. 24 Check response!

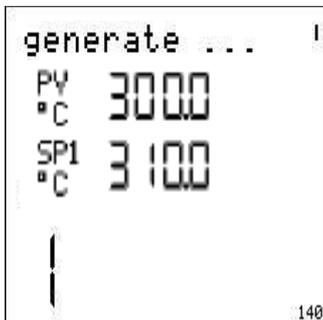


Fig. 25 Generate ...

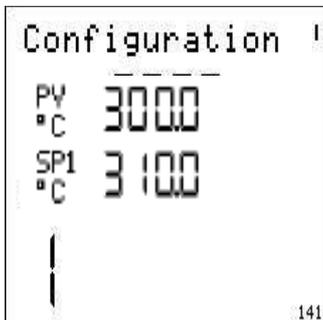


Fig. 26 Configuration

After that, the set functions are conditioned for processing.

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

1. Exit the configuration menu:
<Esc>

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.

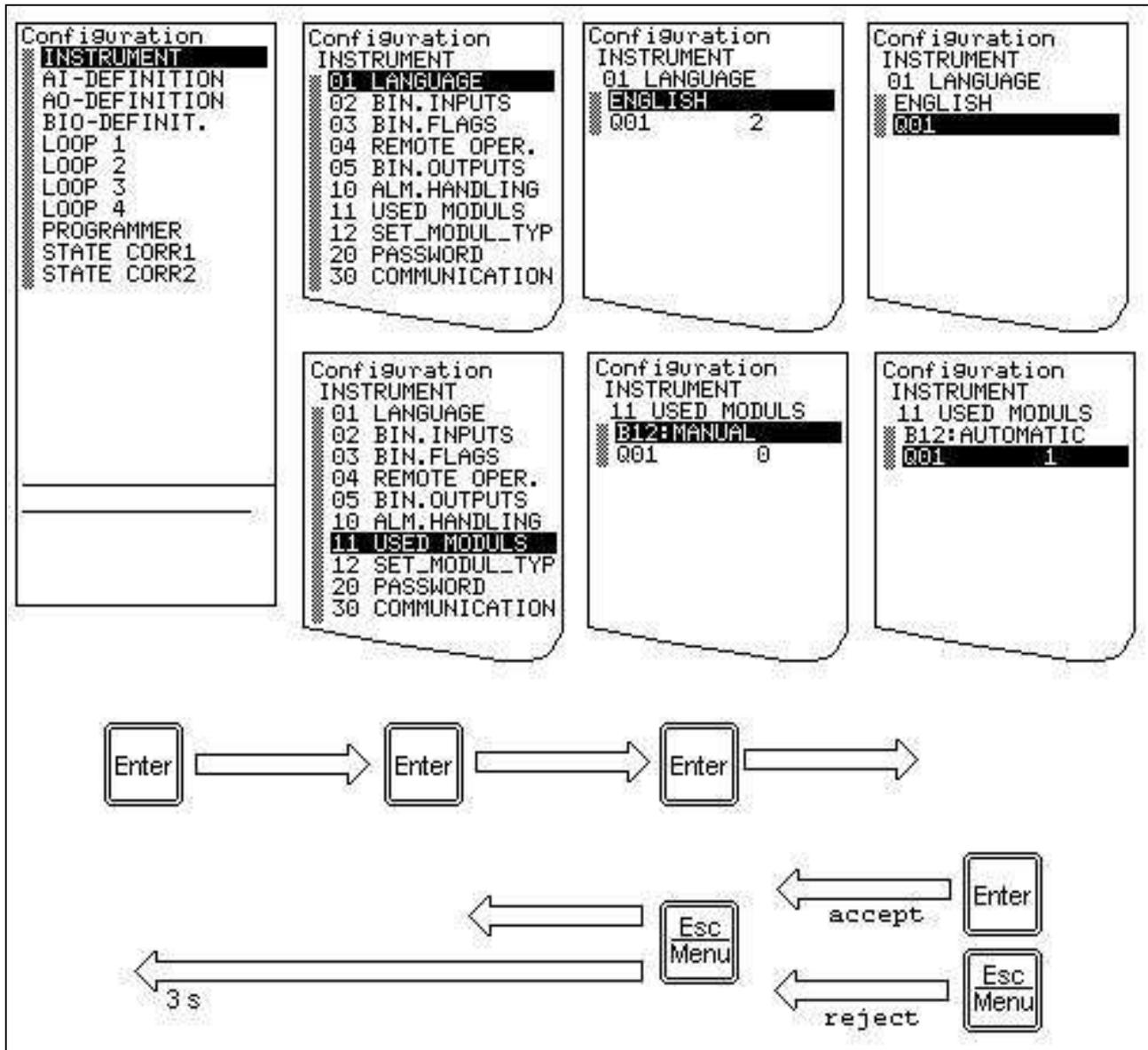


Fig. 27 Configuration menu "Instrument"

Instrument

Hardware



Fig. 28

To be given special attention is Point I-B11-Q01 "Hardware definition". The configurable input/output functions are determined by the existing modules. These are recorded in I-B12-Q01 to Q07 (Digitrenic 500/700: 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 (Digitrenic 500/700: Q04). I-B11-Q01 is automatically reset to 0.

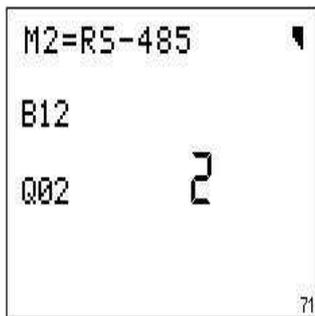


Fig. 29 Display Protrenic 500/700: M2=RS-485 (shown here)
Display Digitrenic 500/700: M4=RS-485

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

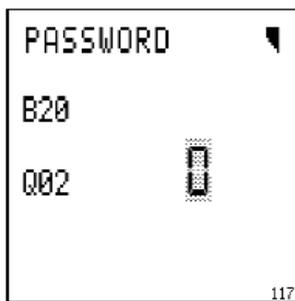


Fig. 30 Password Definition

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

AI Definition

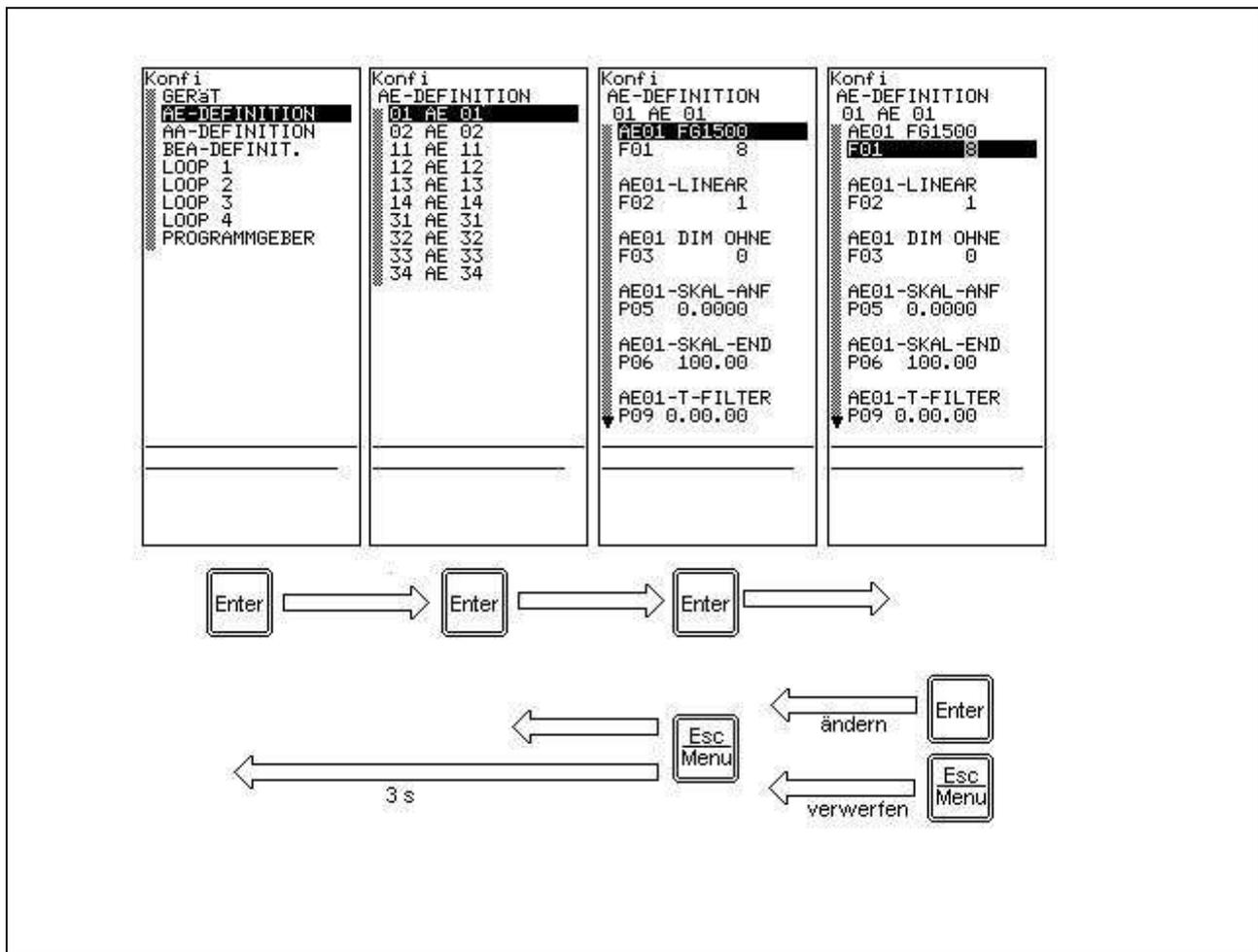


Fig. 31 Analog input menu

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 input type must be input in the AI-B01-Q01.
- AI02 is the current input of the basic unit.
- Alxy 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 normal measuring range, 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

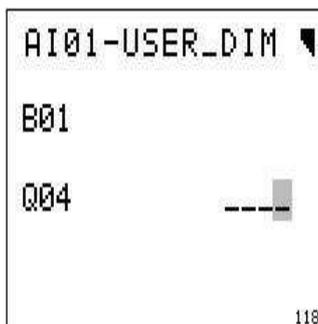


Fig. 32 Creating a user-dedicated dimension

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

To suppress deleterious fluctuations 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.	The range of the transmitter is set by AI-Bxy-P05 and P06.
AI-Bxy-Q03	Measured value is displayed linearly in the selected scaling.	
AI-Bxy-P05	Display at measured value 0 or 4 mA. Display	Example:
AI-Bxy-P06	at measured value 20 mA.	
AI-Bxy-Q02 = 2.3	The measured value is square rooted.	Transmitter
	Below PV0, the resultant measured value is forced to 0, or replaced by a measured value with a linear characteristic.	300 to 700 °C, type K = 0... 20 mA, mV-proportional:
AI-Bxy-P08	is used for setting PV0.	AI-Bxy-Q01 = 1
		AI-Bxy-Q02 = 6
		AI-Pxy-Q05 = 300.0
		AI-Pxy-Q06 = 700.0
AI-Bxy-Q02 = 4...14	If the measured value originates from a non-linearising temperature transmitter, the sensor characteristic can be predefined.	AI-Bxy-Q03 = 3 (automatic)

Thermocouple input

AIxy-Q01 = 3	Thermocouple.
AIxy-Q02 = 4...13	Selection of thermocouple type. Changeable to
AIxy-Q03 = 3	°F AI-Bxy-Q03 = 4. Depending on reference
AIxy-Q07 = 0...4	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 (Digitrenic 500/700: AI02-Q01 = 7 or 8)

Current input AI02 and other current inputs:

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

Characteristics

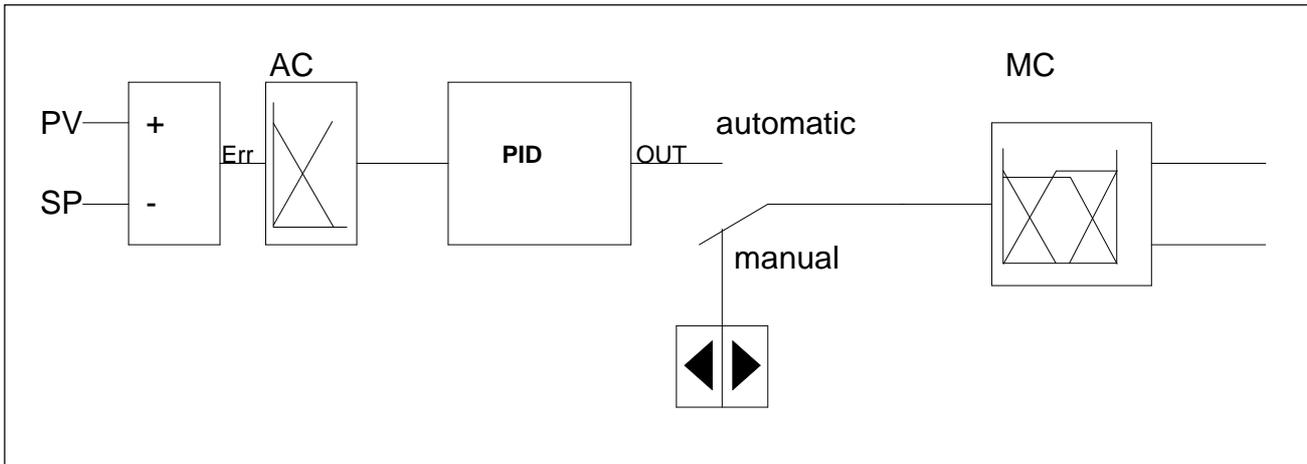


Fig. 34

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 closes 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-Q02 = 0	The current set point is not stored in unit. It cannot be transferred to another unit with the configuration.
Lx-B05-Q01 = 1	Set point can be changed with the keys and via the interface.	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.
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.		

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 cannot 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.

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.

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.

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

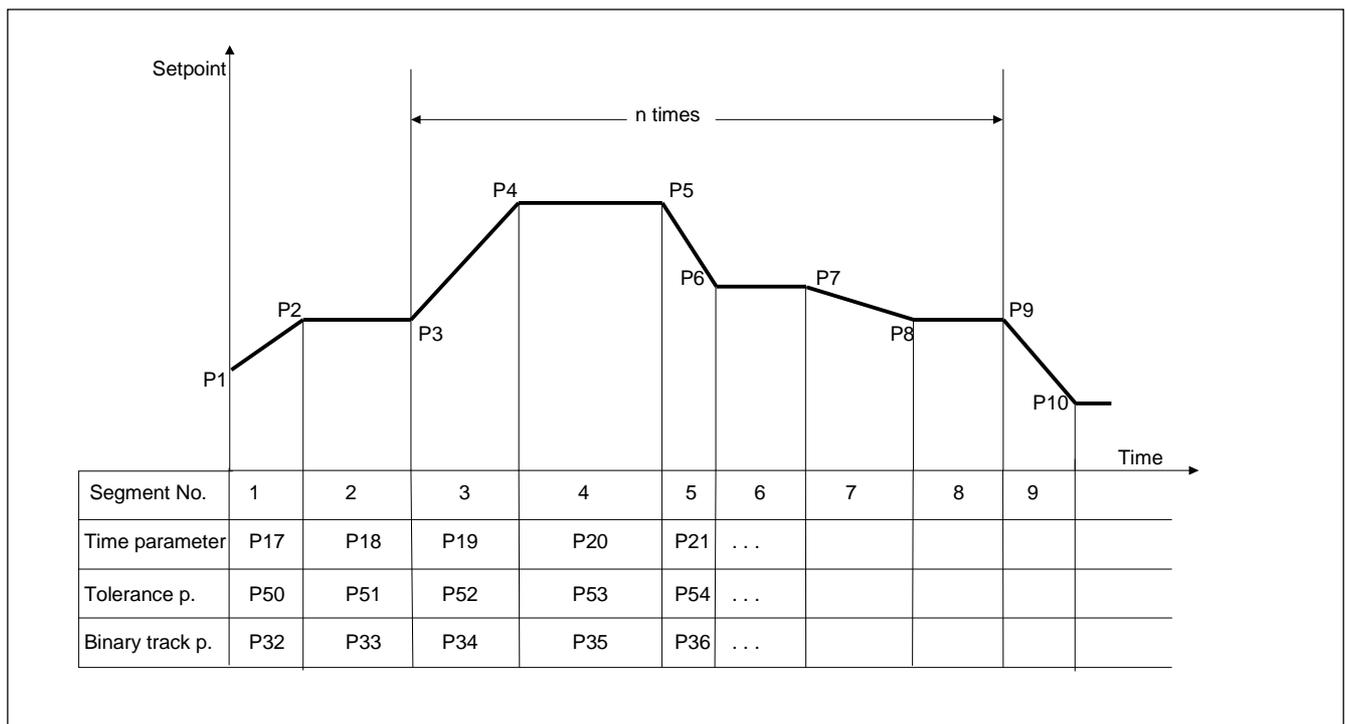


Fig. 35 Programmer with loop Section 3 to Section 8

Fixed value control

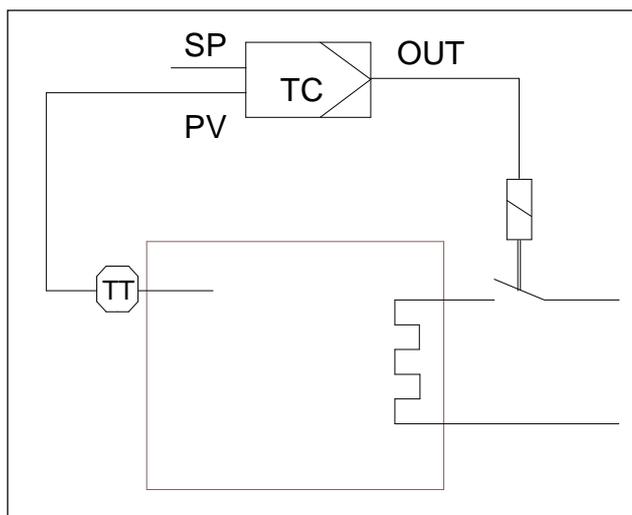


Fig. 36 Fixed value control

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 $K_p = 1$, if the input is changed by P08 - P07, the output will be changed by 100 %.

Example 1

Thermo couple type K measuring range $-200...+1400\text{ }^{\circ}\text{C}$:
The measurement produces between $-200\text{ }^{\circ}\text{C}$ and $+1400\text{ }^{\circ}\text{C}$ correct values.

Control range

900.0 to 1100.0 $^{\circ}\text{C}$ with one decimal place after the point:

Lx-B03-Q04 = 3	Display in $^{\circ}\text{C}$.
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 ($^{\circ}\text{C}$)
Lx-B03-P76	SPmax = 1050 ($^{\circ}\text{C}$)

Example 2 (not Protrenic 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 m³/h.

Measuring range

0...20000 m³/h after state correction.

Control range

is equal to measuring range.

Lx-B03-Q04 = 7 Display in m³/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 (m³/h)
Lx-B03-P76 SPmax = 18000 (m³/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 (Digitrenic 500/700: 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 feed forward

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 (Digitrenic 500/700: 46) (Blxy)

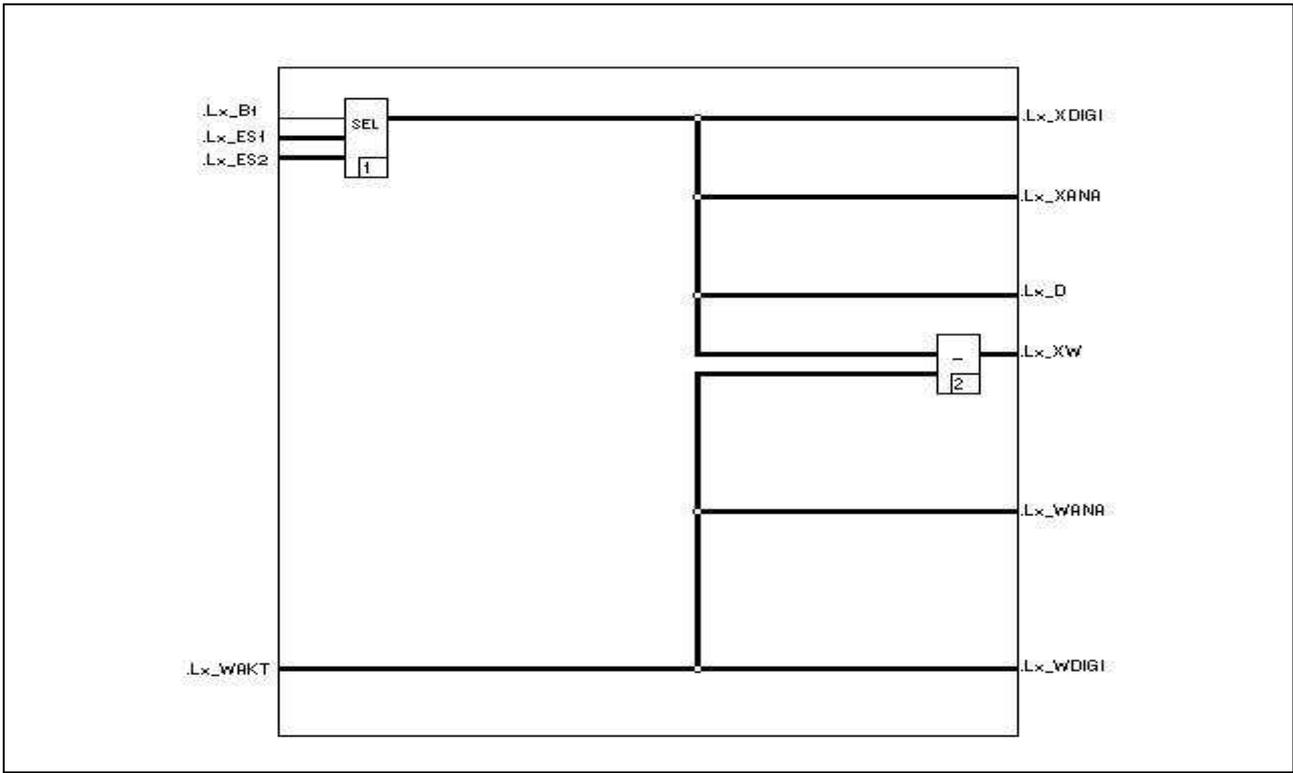


Fig. 37 Input circuit fixed value

- .Lx_B1 Changeover ES1 ↔ ES2 with switch SEL
- .Lx_ES1 Input 1, routes via Lx-B04-Q01
- .Lx_ES2 Input 2, routes via Lx-B04-Q02
- .Lx_WAKT Current set point
- .Lx_XDIGI Digital display of PV
- .Lx_WDIGI Digital display of SP

- .Lx_XANA Analog display of PV
- .Lx_WANA Analog display of SP
- .Lx_D D component Control deviation
- .Lx_XW deviation

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 **Protrenic 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 **Protrenic 100**)

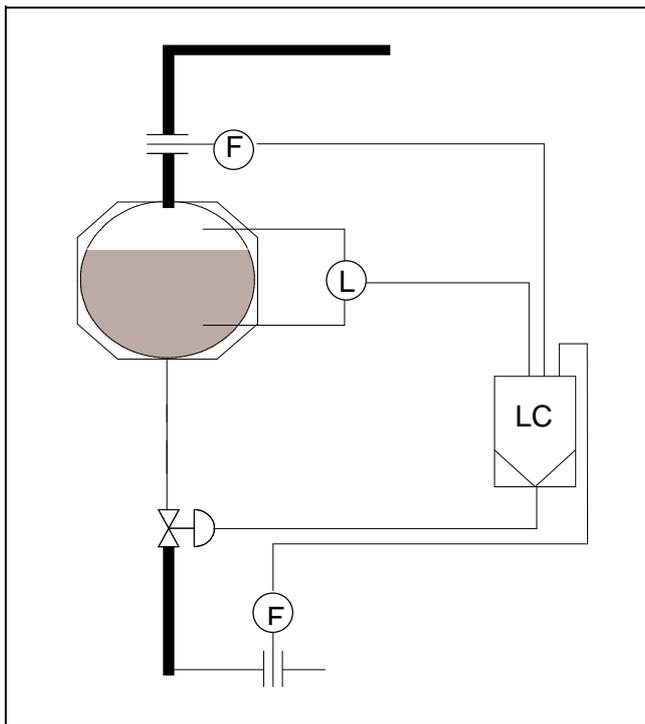


Fig. 38 Drum water level

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:

$$Err = PV + K2 \cdot (ES2 + K3 \cdot ES3) - SP$$

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: $K2 \cdot (ES.2 + K3 \cdot ES.3)$ 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.

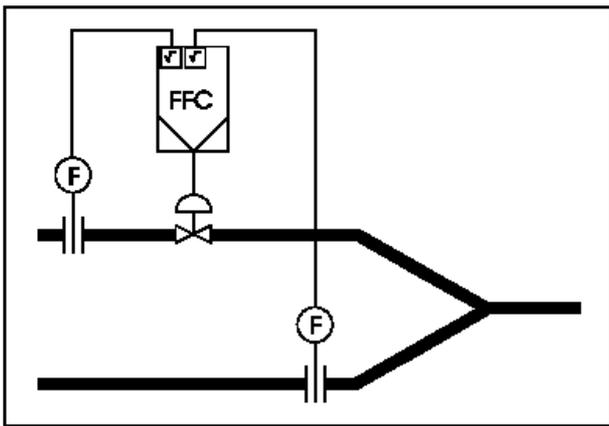


Fig. 39 Total flow

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

$$\text{Err} = \text{ES1} \cdot \text{K1} + \text{K2} (\text{ES2} + \text{K3} \cdot \text{ES3}) - \text{SP}$$

Lx-B03-Q02 = 2

Lx-P101 = 1

Lx-P102 = 1

Lx-P103 = 0

Lx-B03-Q03 to P08

With only two inputs.
According to the configuration of the inputs.

Lx-B03-P16

Lx-B03-P17

Start value of the analog display.
End value of the analog display.

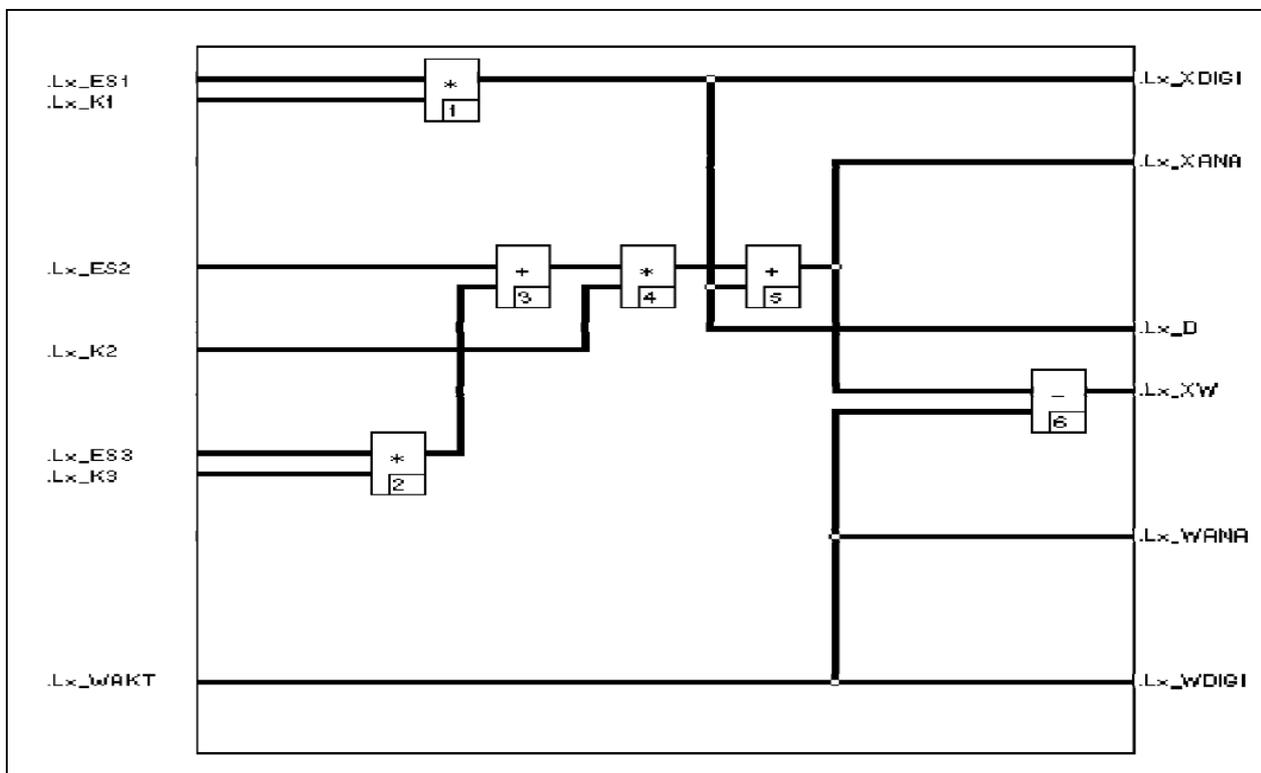


Fig. 40 Input circuit: Multi-components

- .Lx_ESx Inputs of the input circuit
- .Lx_Kx Multi-components routed via Lx-B04-Q0x with the analog inputs Alxy
- .Lx_Kx Evaluation factors K1 to K3 = Lx-P101 to Lx-P103
- .Lx_WAKT Current set point

- .Lx_XDIGI Digital display for PV
- .Lx_WDIGI Digital display for SP
- .Lx_XANA Analog display for PV
- .Lx_WANA Analog display for SP to
- .Lx_D D component Control
- .Lx_XW 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.

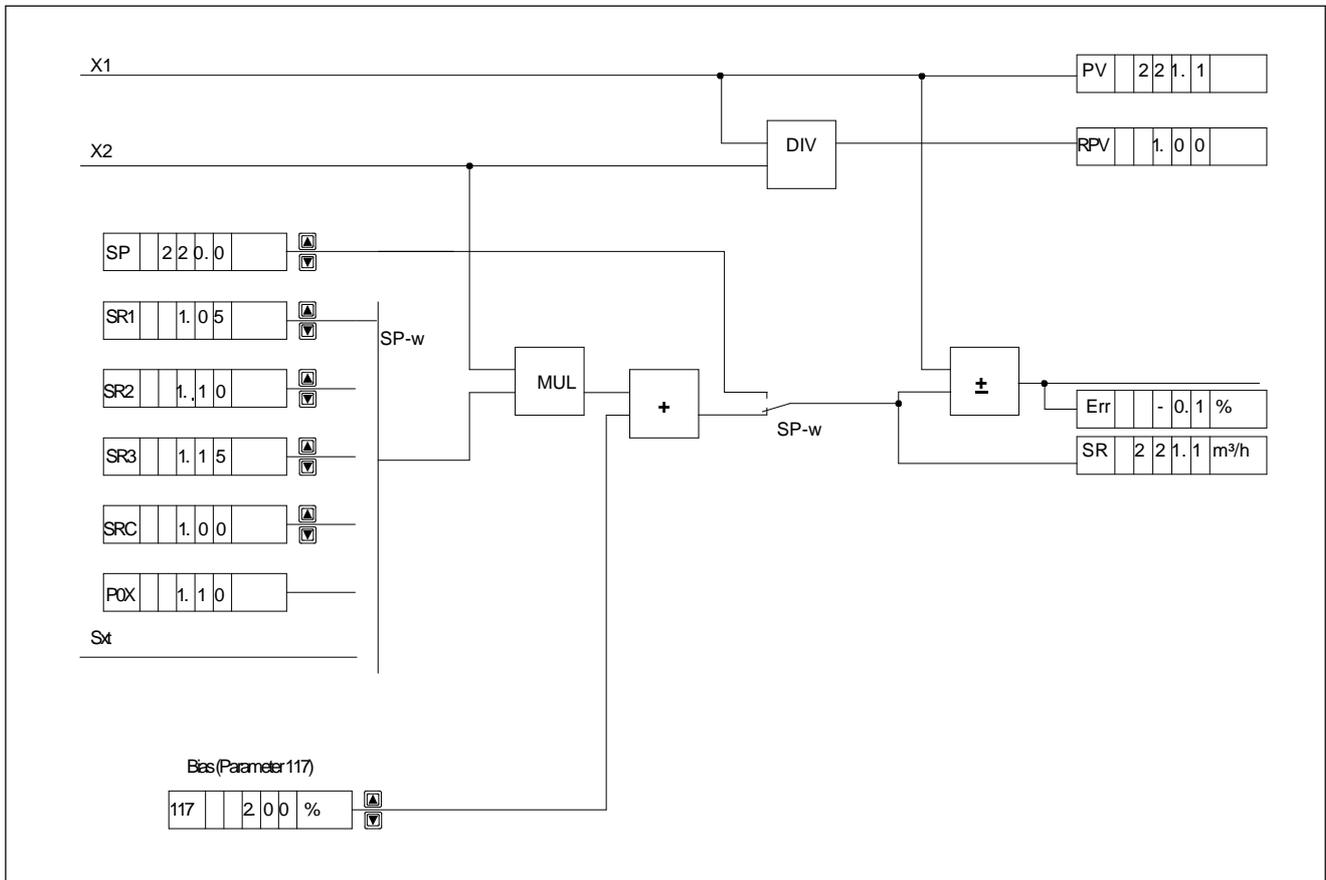


Fig. 41 Functional diagram of the input signal connection "Ratio" without signal conditioning for PV1 and PV2 and without scaling and limiting parameters.

Ratio control I: λ control

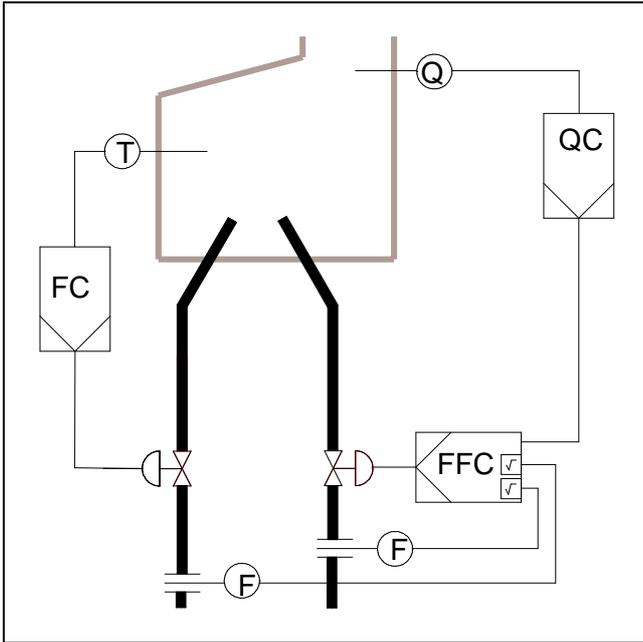


Fig. 42 Ratio control on a gas-fired furnace

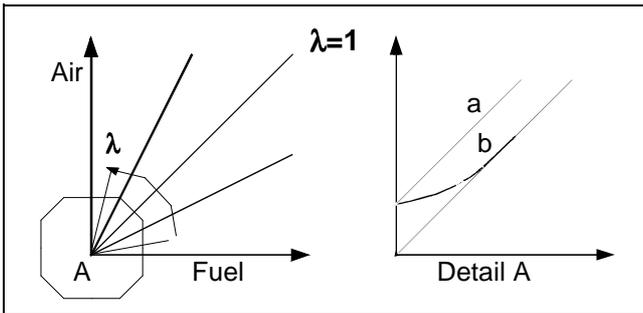


Fig. 43 Superfluous air, a = linear, b = non-linear

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 $\lambda = 1$.

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 $K_p = 1$ 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 V_x (RPV) and the selected R set point V_w .
 Lx-B03-Q09 = 2 Displayed in the digital display are PV (air) and $SP = V_w \cdot \text{fuel}$: V_w 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 = Stoichiometric air/gas for $\lambda = 1$.

Example:

for $\lambda = 1$; air : fuel = 4.15 : 1
 Lx-B03-P14 = 4.15

Analog display

Lx-B03-Q15 = 2 Normally analog display for V_x and V_w .
 Lx-B03-P16 Define the display range for the analog displays.
 Lx-B03-P17

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).

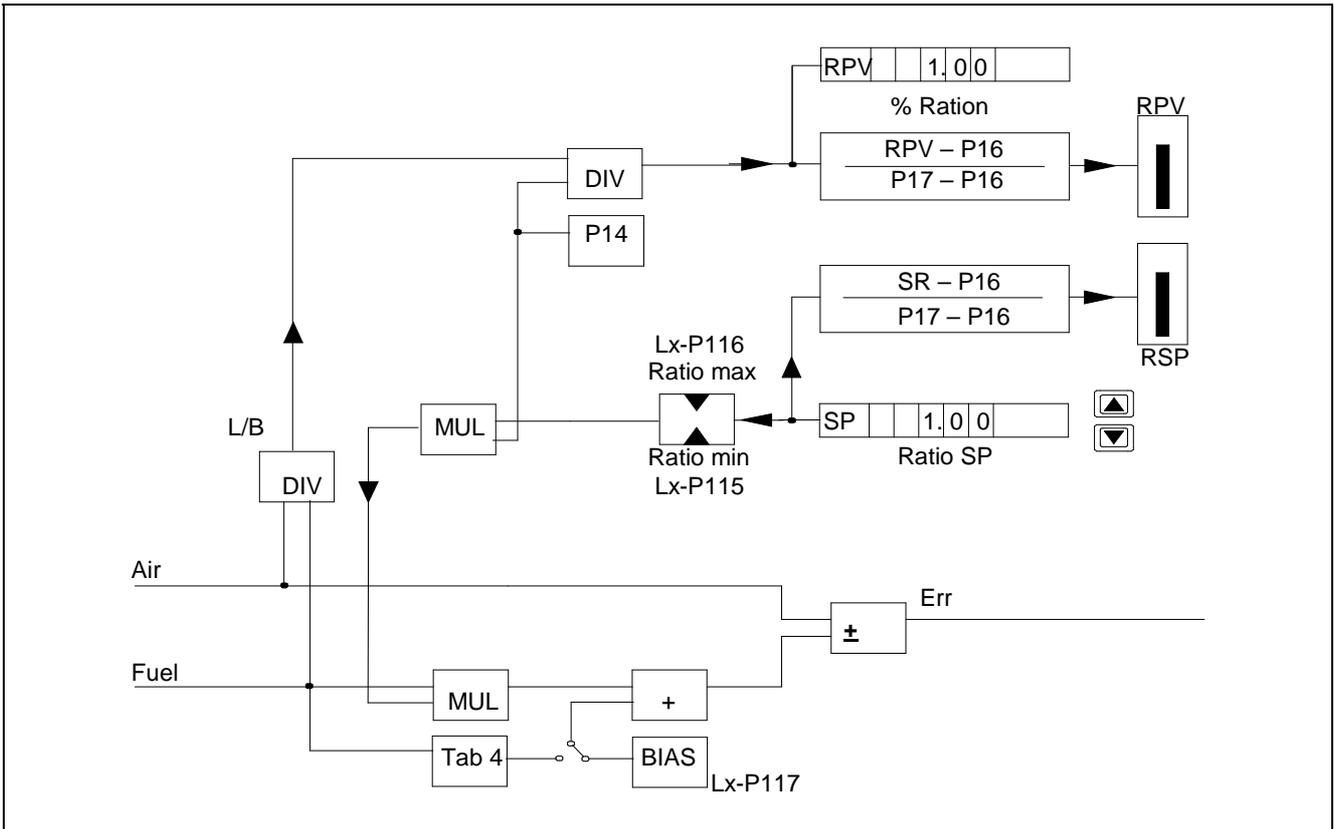


Fig. 44 Structure of the input circuit ratio, displays and creation of the control deviation. Display of RPV and RSP. without combining the input signals

Ratio control II: Mixture control

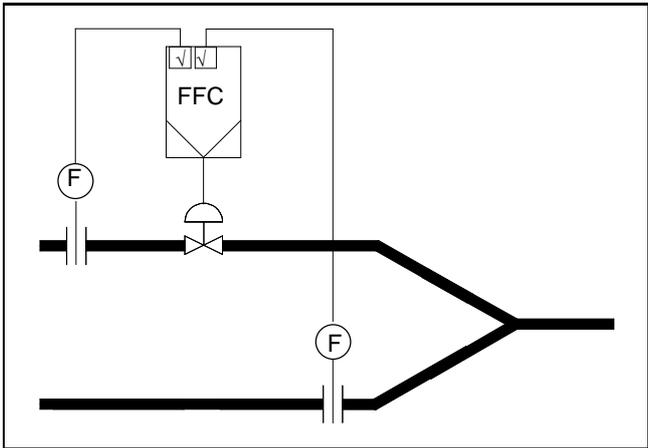


Fig. 45 Mixture control

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 $R = \text{quantity 1} / \text{quantity 2}$
 Example: Neutralisation control

Proportion of a component in the end product:

Ratio 2 $R = \text{quantity 1} / (\text{quantity 1} + \text{quantity 2})$
 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 $R = \text{quantity 1} / \text{quantity 2}$

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 $\text{RSP} \cdot \text{quantity 2}$.
 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 $\text{RSP} \cdot \text{quantity 2}$.
 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
 $V = \text{quantity 1} / (\text{quantity 1} + \text{quantity 2})$

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 %
 Lx-B03-P14 = $\frac{\text{quantity 1 (20mA)}}{\text{quantity 1 (20 mA) + quantity 2 (20 mA)}}$

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

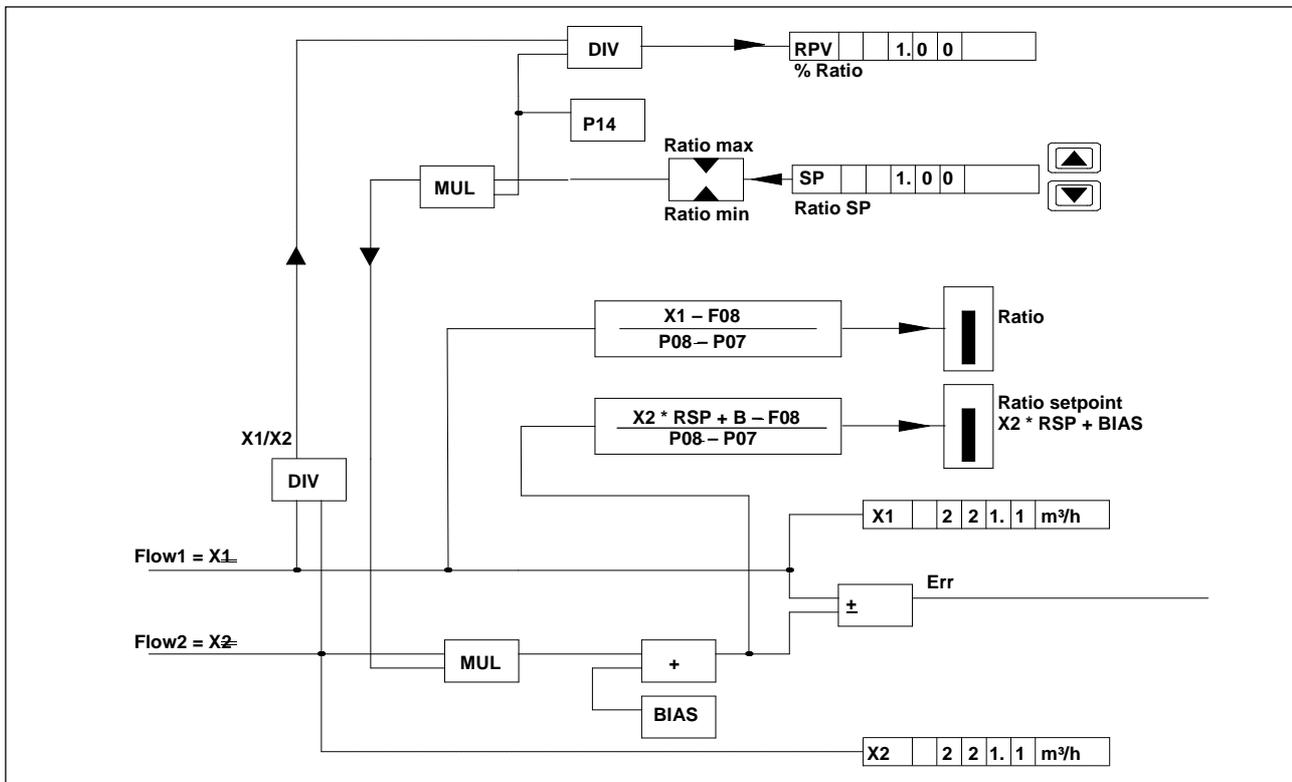


Fig. 46 Structure of the input circuit ratio. Displays and development of the control deviation. Display the quantity 1 and R · quantity 2. Without combination of the input signals.

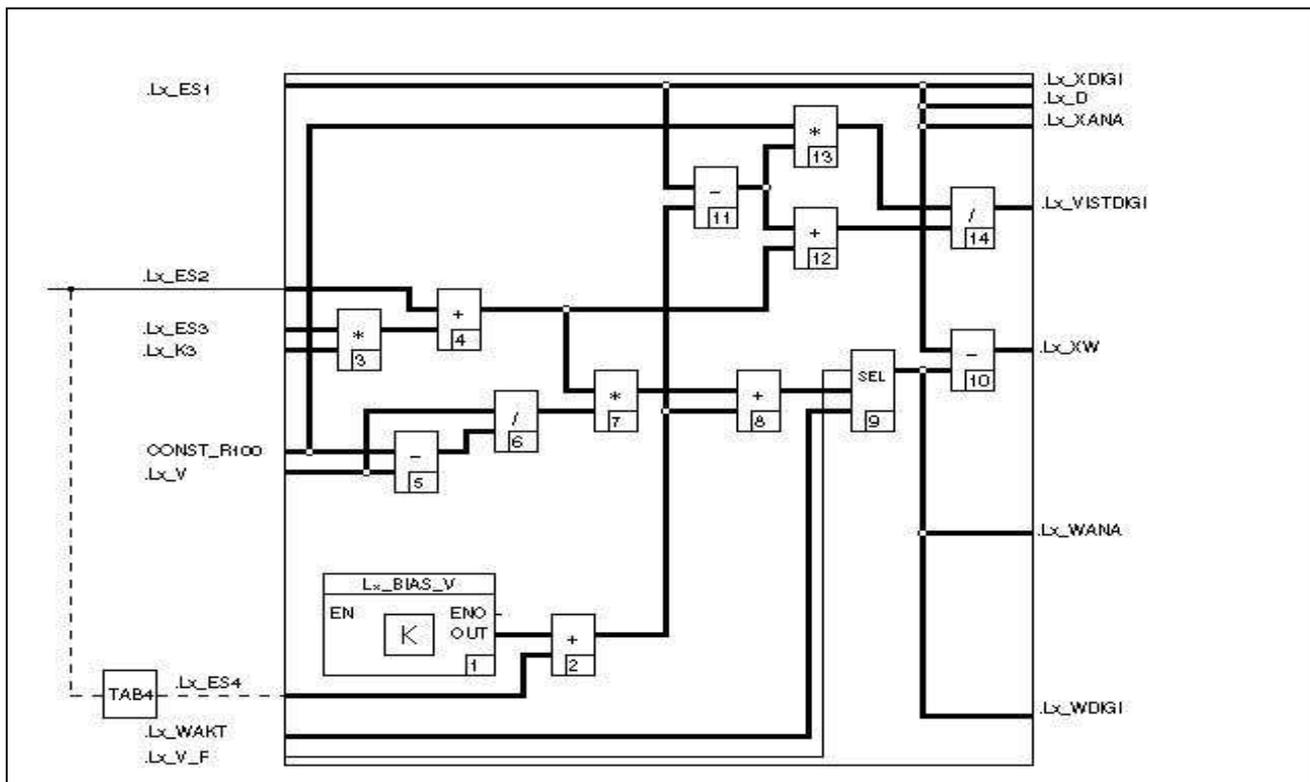


Fig. 47 Input circuit fixed value/ratio 2

.Lx-ESx Inputs of the input circuit ratio route via Lx- B04 to the analog inputs
 .Lx-V R set point
 CONST_R100 100
 .Lx-AKT Current fixed value set point

.Lx-XDIGI Digital display for PV
 .Lx-WDIGI Digital display for SP
 .Lx-VISTDIGI Digital display for RPV
 .Lx-XANA Analog display for PV
 .Lx-WANA Analog display for SP
 .Lx_V_F Changeover fixed value/ratio

Multiplication

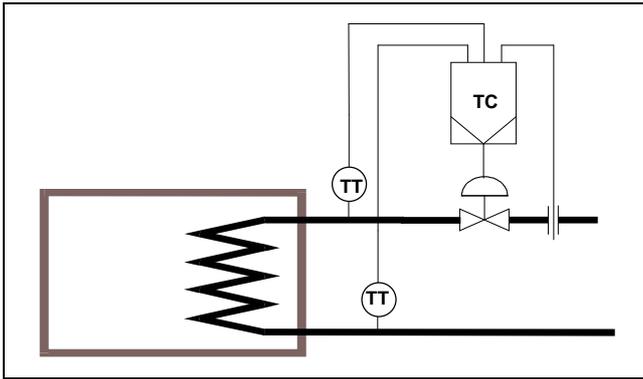


Fig. 48 Heat quantity control with Protronic 500/700

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.

$$Err = E1 \cdot (E2 + K3 \cdot E3) - SP$$

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.

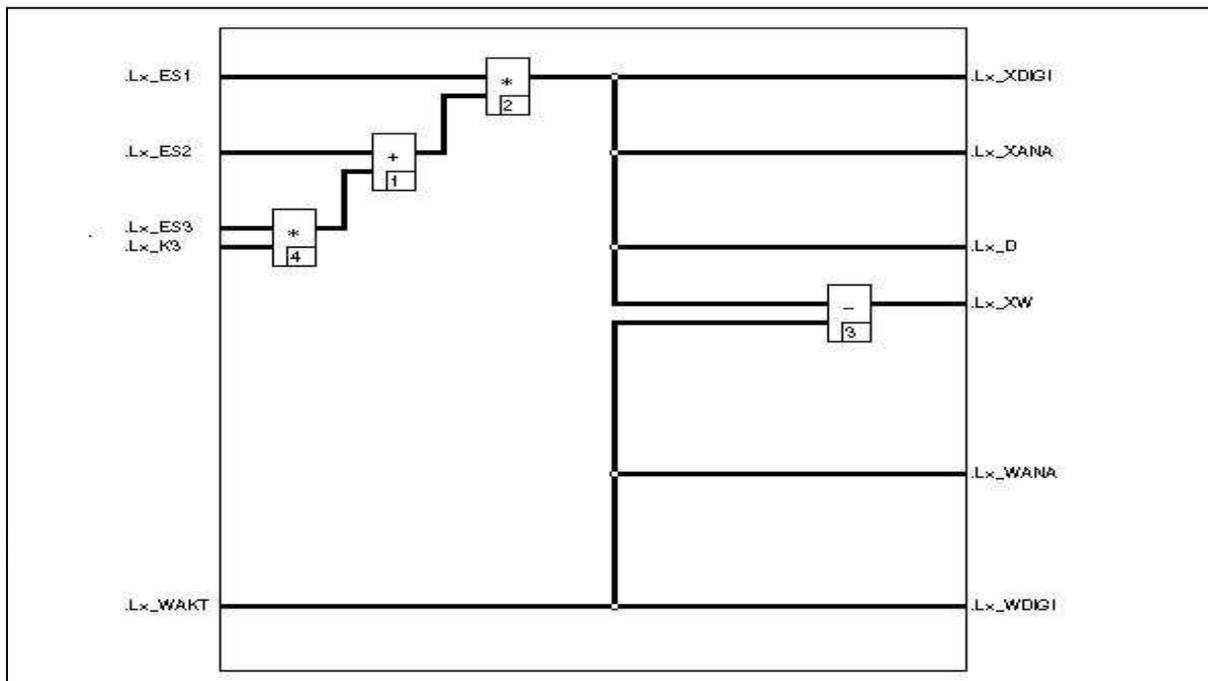


Fig. 49 Input circuit Multiplication

.Lx-ESx Inputs of the input circuit ratio route via Lx-B04 to the analog inputs
 .Lx-K3 Evaluation factor for ES3
 .Lx_WAKT Current set point
 .Lx_XDIGI Digital display for PV

.Lx_WDIGI Digital display for SP
 .Lx_XANA Analog display for PV
 .Lx_WANA Analog display for SP
 .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.

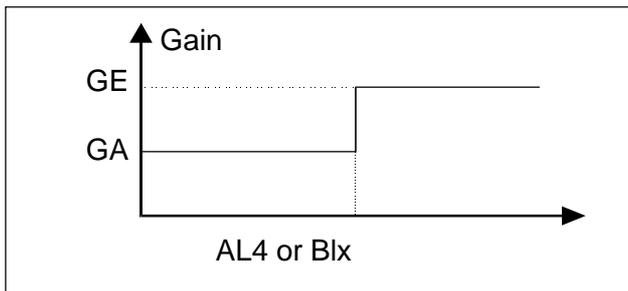


Fig. 50 Gain changeover

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

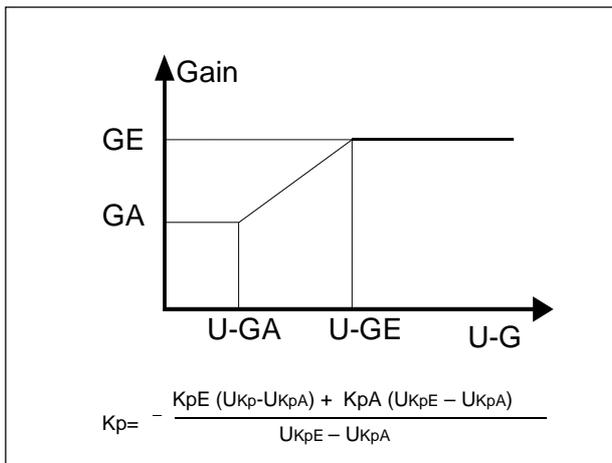


Fig. 51 Linear parameter control, U is the controlling variable

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, output 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.

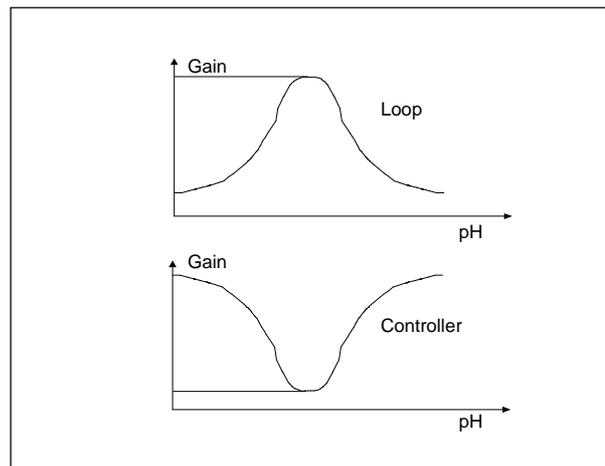


Fig. 52 Non-linear parameter control through the measured value pH

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 measurement 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 m³/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/m³
- 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

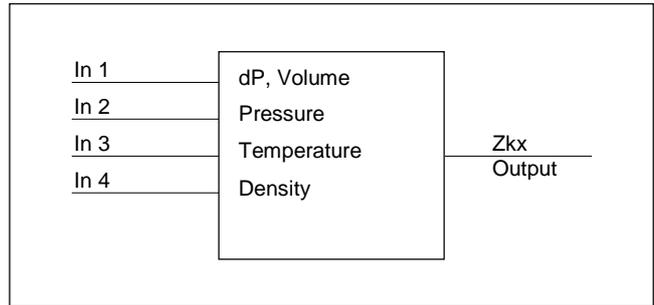


Fig. 53 State correction gas, steam
The parameter and configuration data are illustrated in Tables 3 to 5.

Configuration of water mass flow

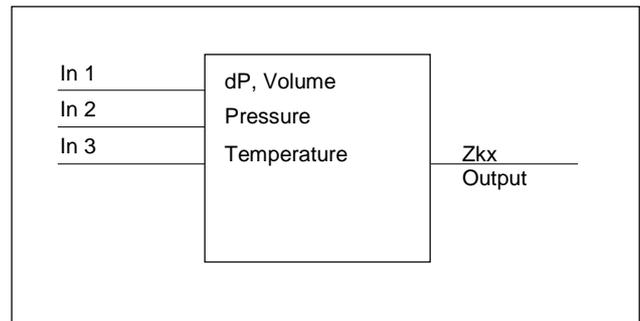


Fig. 54 State correction gas, steam, drum water level
The parameter and configuration data are illustrated in Tables 6 and 7 or 8 and 9.

Configuration of drum water level

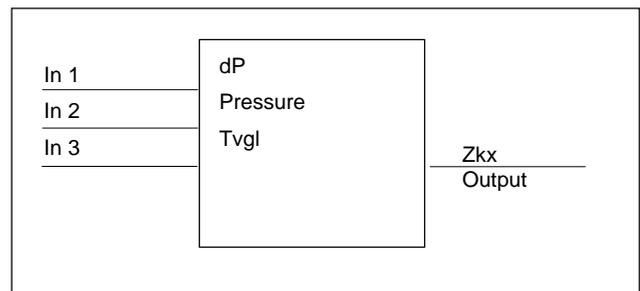


Fig. 55 Water level
The parameter and configuration data are illustrated in Tables 8 and 9.

Gas and steam

Table 3	Query/ Parameter ZKx-B01-	Gas, Differential measurement		Gas, Volume measur ment	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 $Q_{n,r}$ or	P02	Value	Value	Value							Nm ³ /h
Mass flow $Q_{m,r}$	P02	Value	Value	Value	Value	Value	Value	Value	Value	Value	kg/h
Differential pressure $\Delta P_{,r}$	P03	Value			Value		Value		Value		mbar
Atmospheric pressure $P_{atm,rabs}$	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 $Z(P_r, T_r)_{,r}$	P07	Value	Value	Value							–
Standard density $\rho_{n,r}$	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

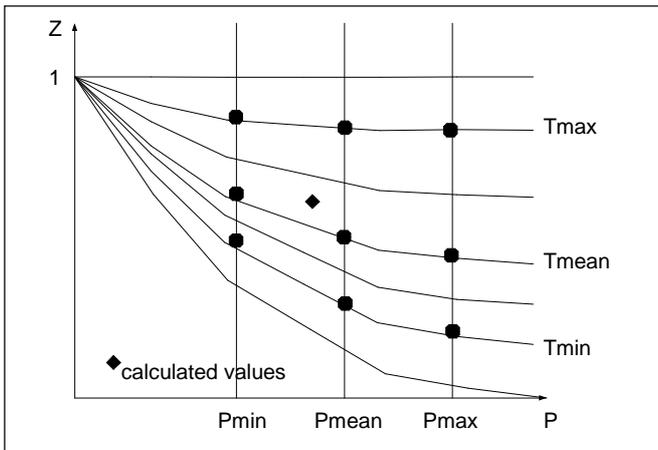


Fig. 56 Principal trend of the characteristic for $Z = f(P, T)$

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 measure- ment	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
Pressure 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/m ³
Density max.	P15	Value	Value	Value							kg/m ³

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 Q _{m,r}	P02	Value	Value	Value	kg/h
Differential pressure dP _{,r}	P03	Value			mbar
Atmospheric pressure Pat _{m,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(P _r , T _r) _{,r}	P07	Value	Value	Value	kg/m ³
Standard density Rho _{,r}	P08	Value	Value	Value	kg/m ³
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/m ³
Density max.	P15	Value	Value	Value	kg/m ³

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

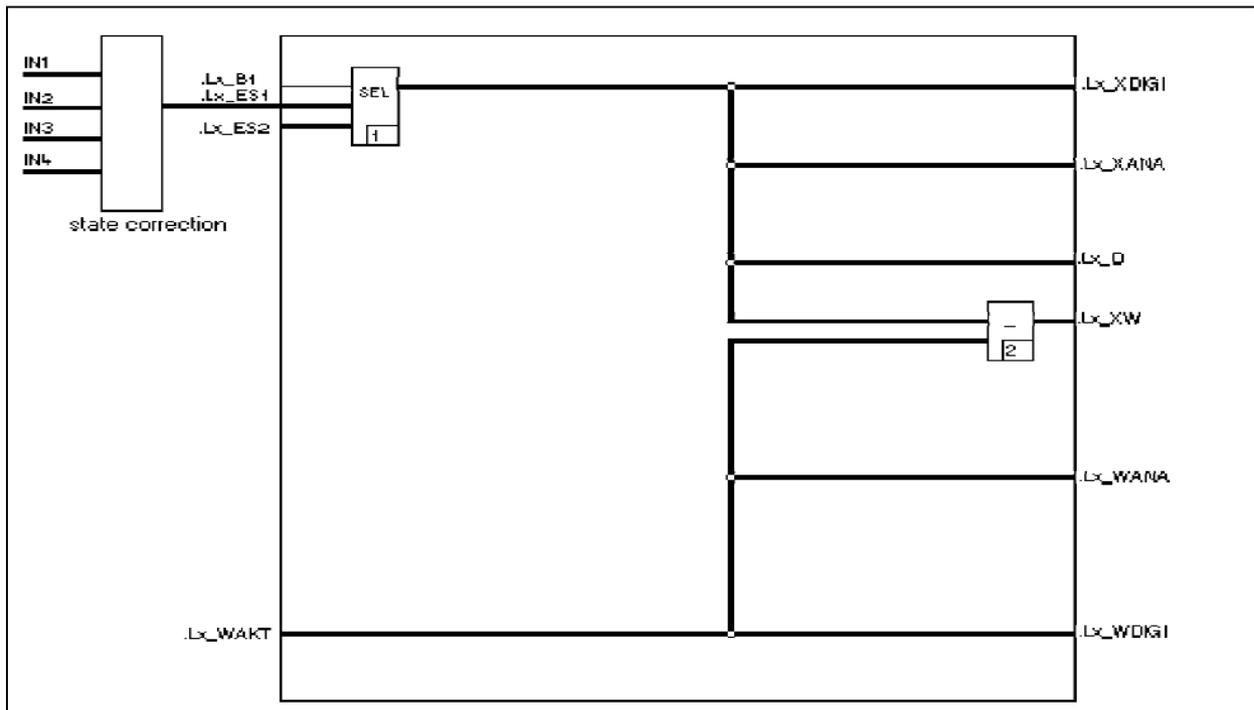


Fig. 57 Input circuit fixed value with additional state correction

.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 to
		.Lx_D	D component Control deviation
		.Lx_XW	

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 strong-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	Switching controller output (cooling) OUT2 at BO01.
L1-B10-Q05 = 1	continuous output (heating) OUT1 at AO01.
L1-B10-Q01 = 1	

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 output 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 Protrenic 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.

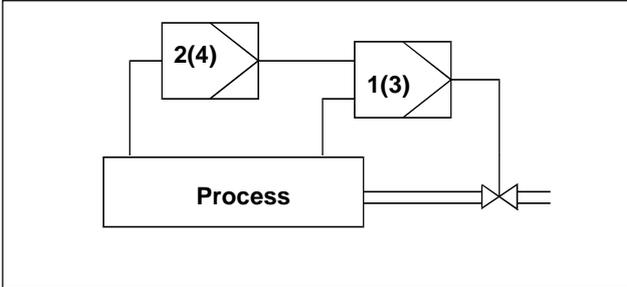


Fig. 58

Configuration

Master controller is loop 2 or loop 4 (**Protrenic 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 Protrenic 100**)

L3-B01-Q01 = 3

The 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 Protrenic 100**)

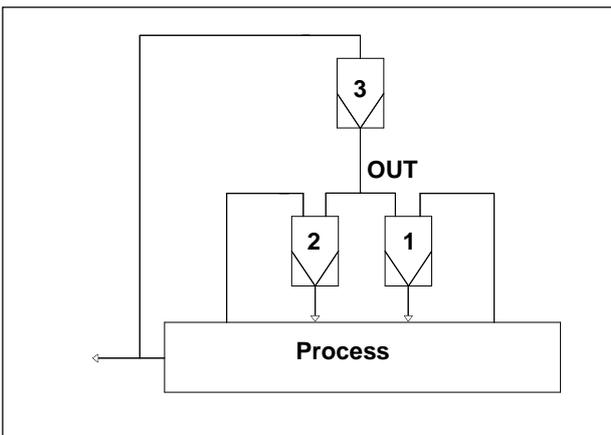


Fig. 59

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 Protrenic 100**)

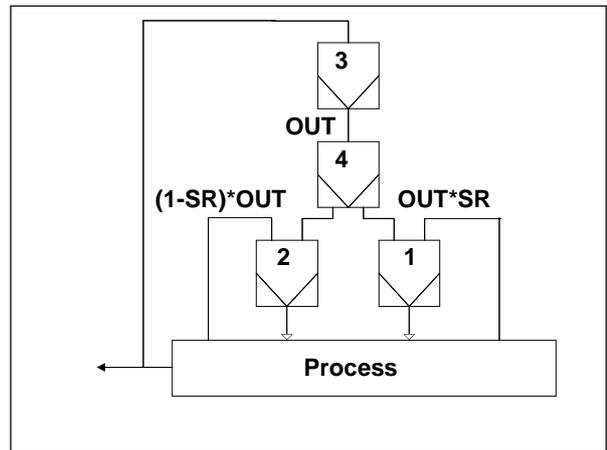


Fig. 60

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)

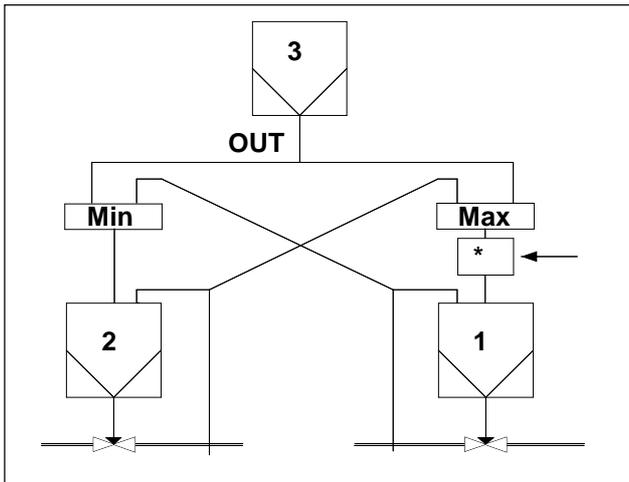


Fig. 61 (not Protronic 100)

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.

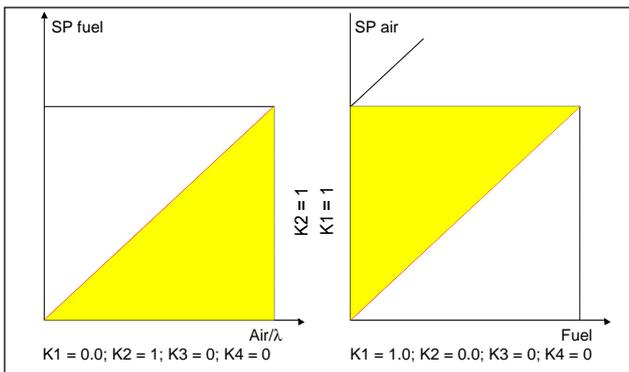


Fig. 62 Combustion control on steam boilers, grey fields stand for permissible set points

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.

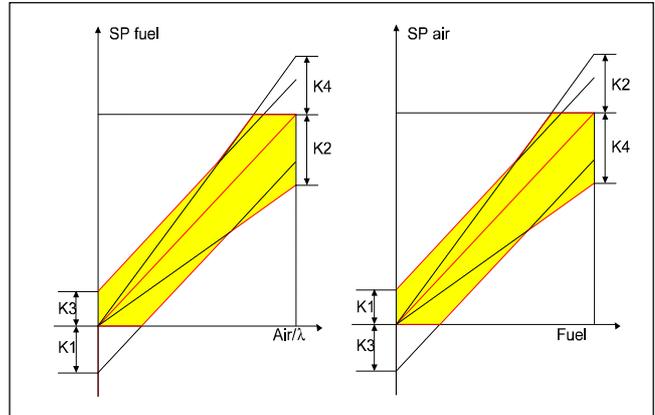


Fig. 63 Combustion control in furnace construction: grey areas indicate permissible set points

Configuration

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

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

Parameter Definition

The different requirements of the load control input circuit are satisfied by different 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)

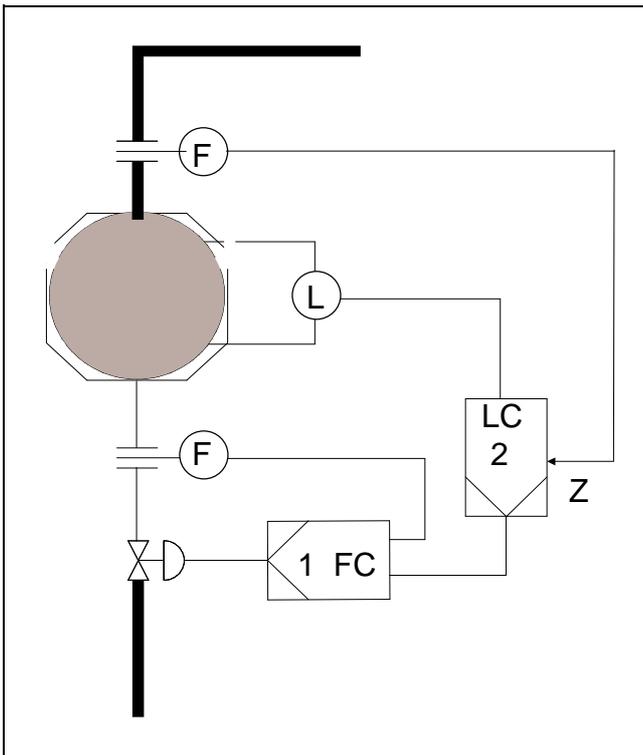


Fig. 64 Steam quantity fed as disturbance variable on output of controller 1 (not Protronic 100)

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 switched 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 (Digitrenic 500/700: ...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

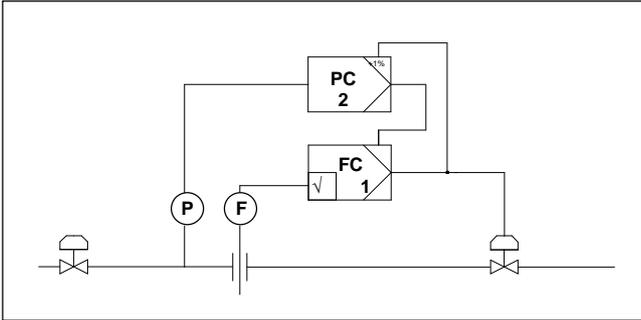


Fig. 65 Override control with one master controller and one override controller

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.

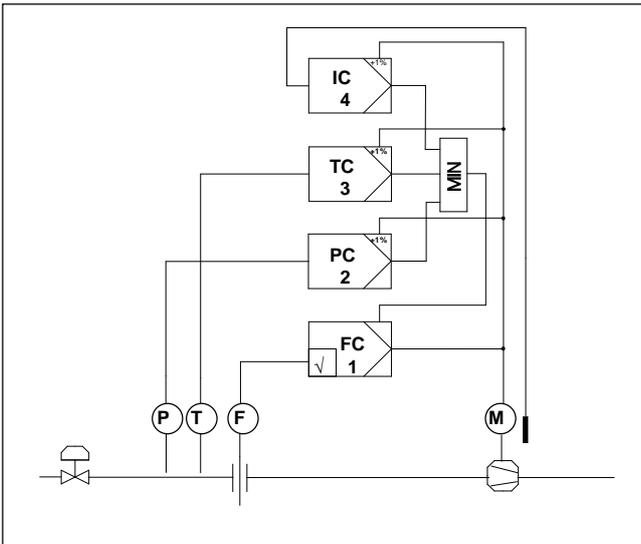


Fig. 66 Override control with one master controller and up to three override controllers (not Protrenic 100)

Override controller: L2-B01-Q01 = 6 or 7
 L3-B01-Q01 = 0, 6, 7
 L4-B01-Q01 = 0, 6, 7
 Override controller with min. or max. selector.
 Override controller with min. or max. selector
 (not Protrenic 100)
 Override controller with min. or max. selector
 (not Protrenic 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 systems with large values of delay time T_u in comparison with the system time constants.

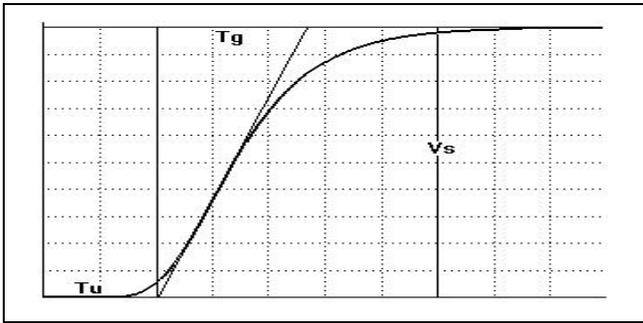


Fig. 67 Controlled system with $T_u/T_g \approx 1$

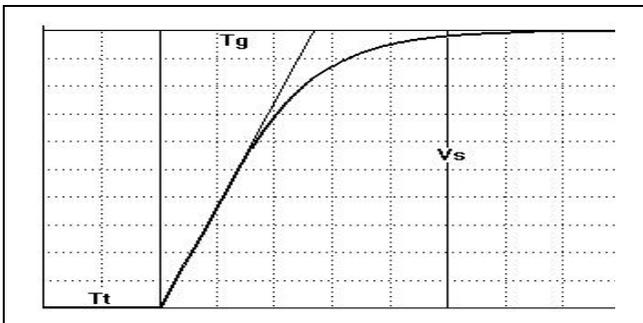


Fig. 68 Controlled system with dead time

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_i on the value of the controlled system dead time.
2. Lx_P40 T_1 on the value of T_g .
3. Lx_P41 K_s on the value of V_s .

For the first commissioning, $T_n \approx T_g$ and $K_p \approx 1/V_s$ should be adjusted.

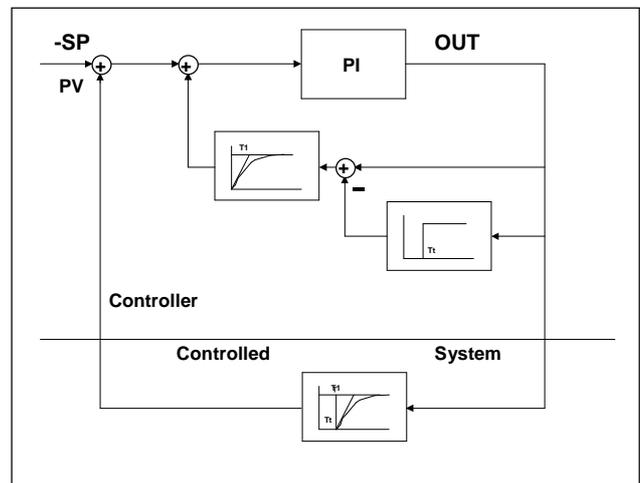


Fig. 69 Controller should be adjusted with Smith predictor to the controlled system with dead time

Service

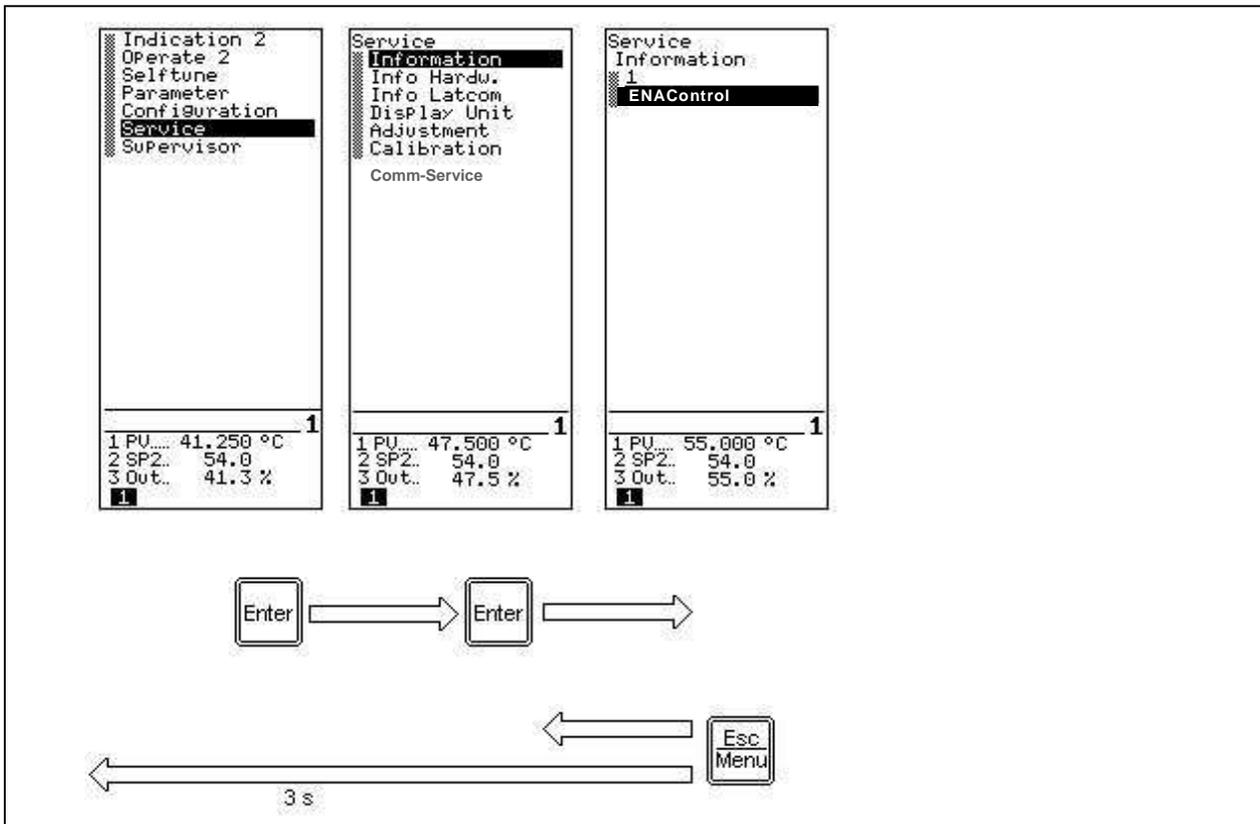


Fig. 70 Service menu (Protrenic 100: only module 1)

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	ENAControl
2	unit type Motherboard	Protrenic 500
3	index Serial number	CPU: ...
4		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

Info Latcom



Fig. 72

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:

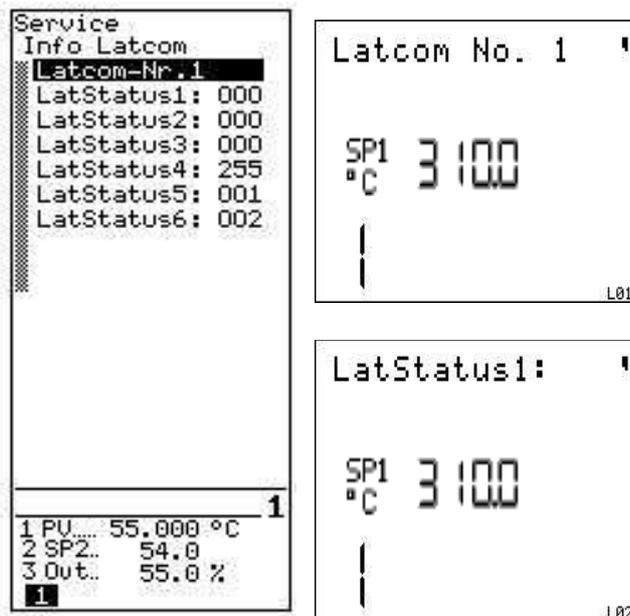


Fig.s 73, 74, 75

Protrenic 5x0/7x0, Digitrenic 500/700

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

Left (Protrenic 550/750):

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, there 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 Protrenic 550/750)

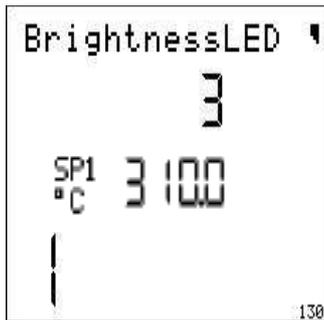


Fig. 76

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

Contrast LCD

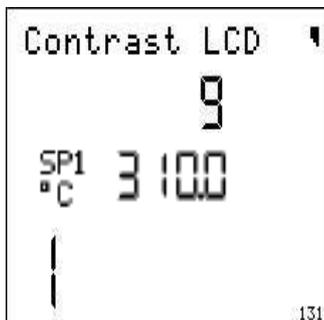


Fig. 77

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 Protrenic 550/750)

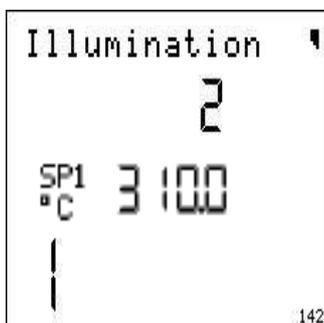


Fig. 78

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

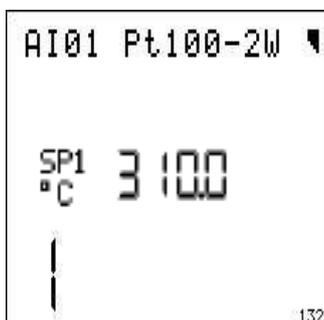


Fig. 79 Balancing for AI01 is selected



Fig. 80 Should balancing be started?

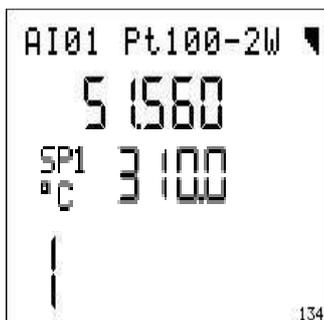


Fig. 81

⚠ 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 Alxy 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, "Alxy 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

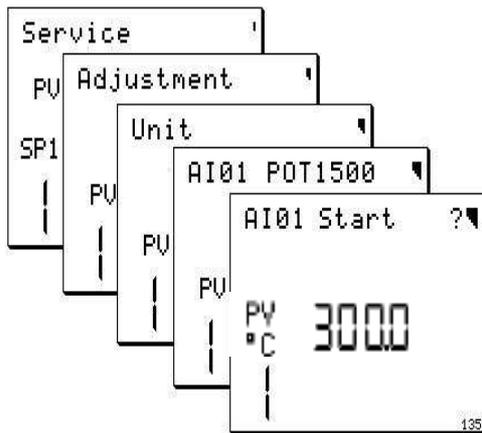


Fig. 82

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

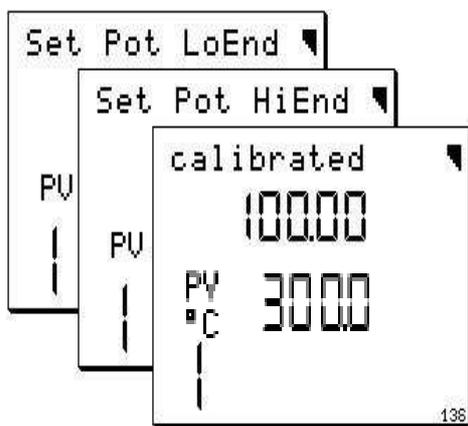


Fig. 83

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 "Alxy Pot150x" is then replaced by "Alxy20mA p. Pot".

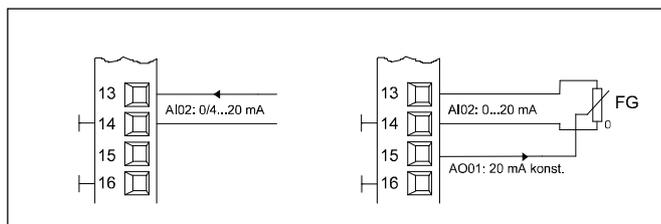


Fig. 84

Fig. 84

left
 AI-B02-Q01 = 1 or 2
 AI-B02-Q01 = 1
 AI-B02-Q03 = 2
 AI-B02-P05 = 0
 AI-B02-P06 = 100

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

Calibration

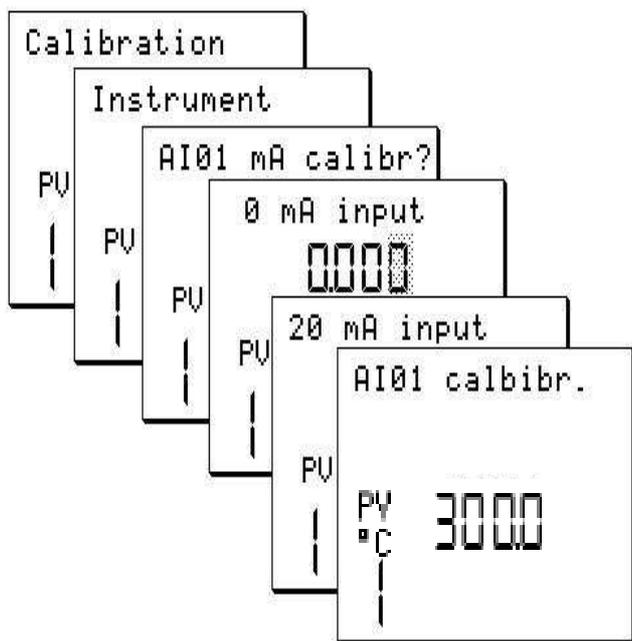


Fig. 85

Both inputs of the basic unit can be calibrated 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 <▼> acknowledge 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 <▼> acknowledge with <Enter>. The calibration must be conducted for both items. 0 mA is provided in default by shortcircuiting 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 <▼> acknowledge 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 <▼> acknowledge 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 technique. The teletransmitter 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

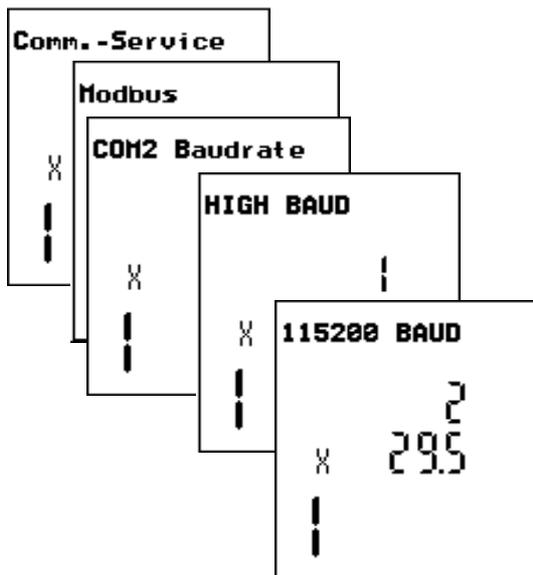
Tab. 12 mA Input

Adjust the values in the display to the required data with the keys <▲> and <▼> acknowledge with <Enter>. The calibration is to be conducted for the point closest to the resistance value of the teletransmitter.

Comm.-Service

Selection of the COM 2 Baudrate

Advice Only for Protrenic 700/750 with COM_module installed in Slot A.



Supervisor

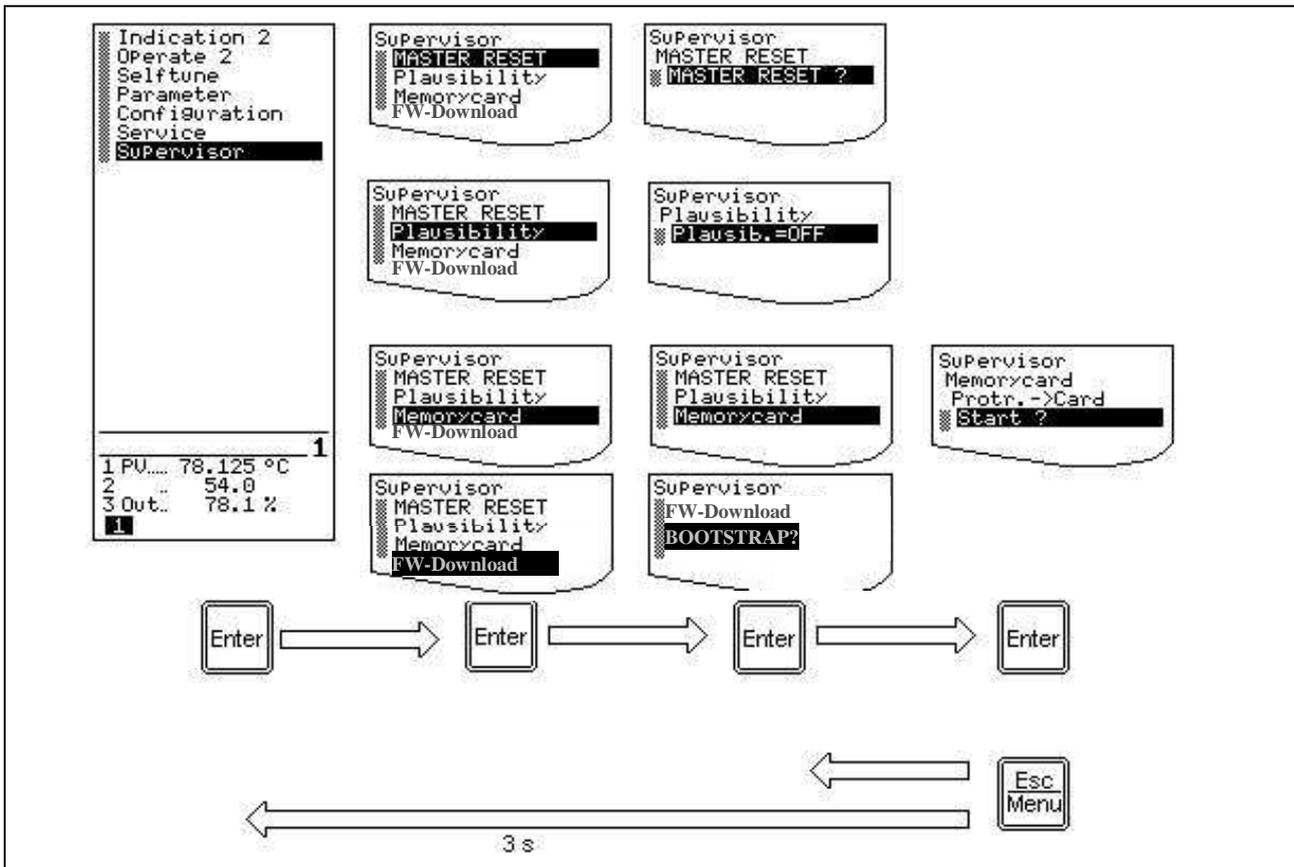


Fig. 86

Plausibility check

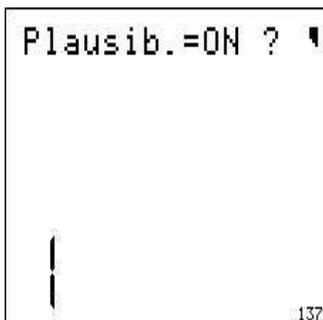


Fig. 87 Switch on plausibility check?

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 ●

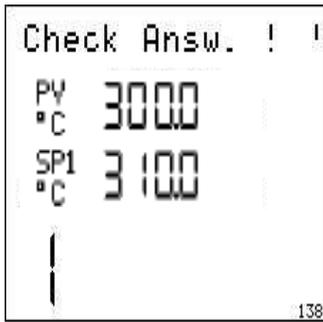


Fig. 88 Message when exiting the configuration

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

Factory setting

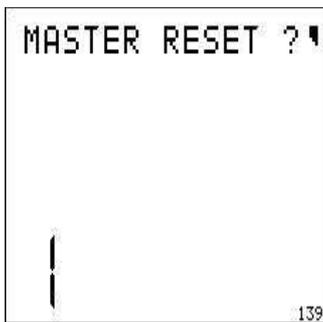


Fig. 89 Reset configuration and factory setting?

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 appears, 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 Protrenic 500/550/700/750)

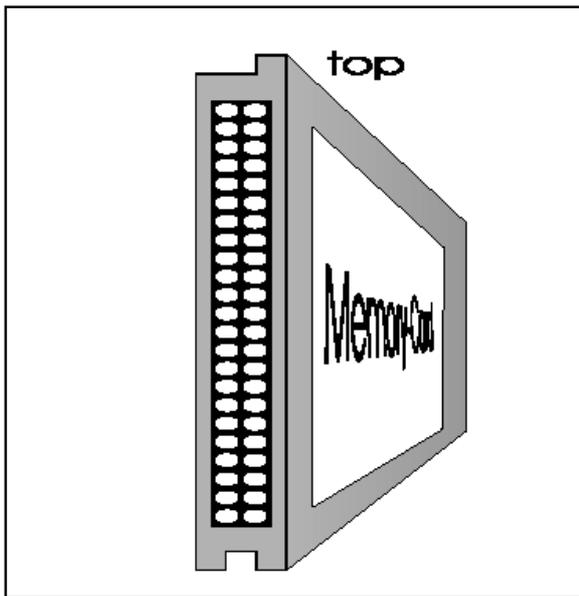


Fig. 90 Memory card

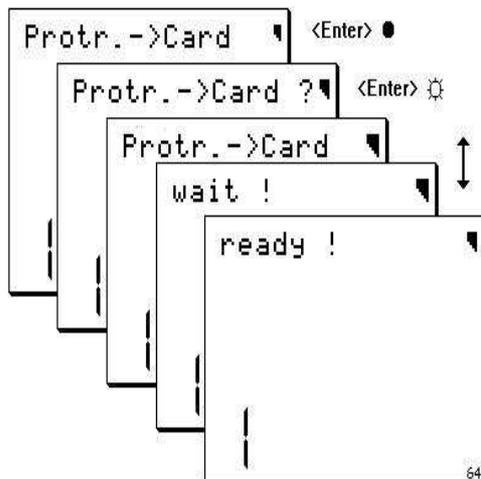


Fig. 91

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. Acknowledge 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".

FW-Download (only Digitrenic700 and Protrenic 700/750)



Please only call up the menu item "FW-Download" (Firmware-Download) , if you really want to download a new Controller Firmware with the Downloader-Software (order-no. 62619-9760245).

If you call up this menu item and enter the Bootstrap mode anyway, you have to restart the device by disconnecting it from power supply.

Delete password (as of FW 1.163)

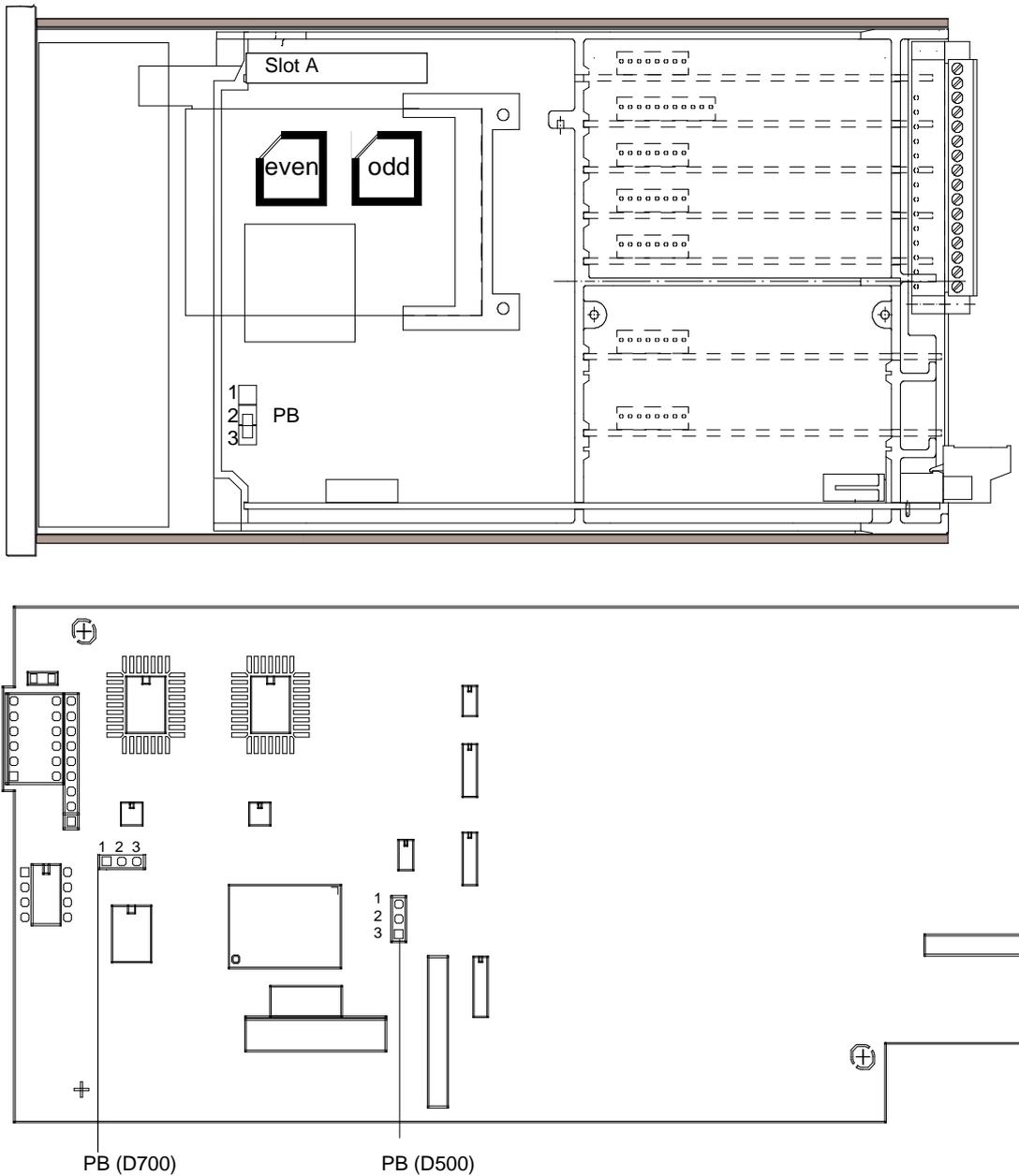


Fig. 92 above Motherboard Protrenic 100 / 500 with "even" and "odd", only Motherboard Protrenic 700 with "slot A"
 below Motherboard Digitrenic 500/700
 PB Password bridge

1. Switch off power supply.
2. Dismantle unit and open.
 (Protrenic 100/500/700: Operation Manual ENA42/62-50011).
 (Digitrenic 500/700: Operation Manual ENA42/61-50011).

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

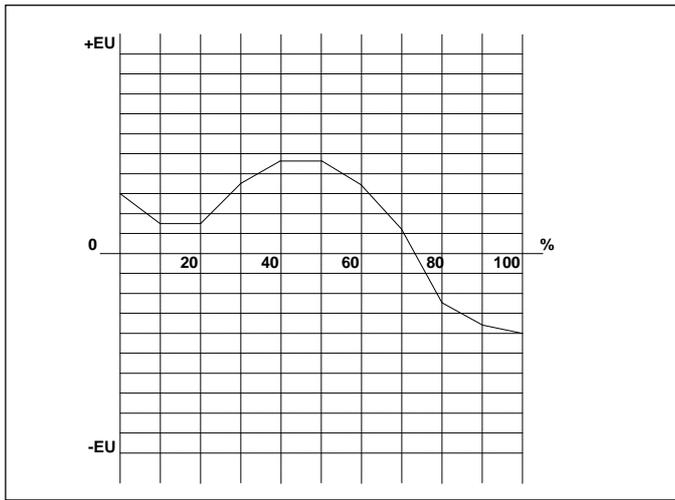


Fig. 93 Examples of parameter Definition table

Instrument			Range		Unit	Resolu- tion	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	Resolu- tion	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 Protrenic 100: Loops 1 and 2			Range		Unit	Resolu- tion	Factory setting	System setting	Rem. p.71
Param.- No.	Parameter- text	Parameter	Min.	Max.					
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									
$G = \frac{GE(U1-U10) + GA(U1E-U1)}{U1E-U10}$ <p style="text-align: center;">U1 controls G</p> <div style="display: flex; justify-content: space-between;"> <div> $U1 < U10: G = GA$ $U1 > U1E: G = GE$ </div> </div>									
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	Value 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			Range		Unit	Resolu- tion	Factory setting	System setting	Rem. p.71	
Param.- No.	Parameter - text	Parameter	Min.	Max.						
Protrenic 100: Loops 1 and 2										
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	active 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 Protrenic 100: Loops 1 and 2			Range		Unit	Resolu- tion	Factory setting	System setting	Rem. p.71
Param.- No.	Parameter- text	Parameter	Min.	Max.					
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 RAMP	Control variable max.	0	105	%	0.1	100		
69	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			Range		Unit	Resolu- tion	Factory setting	System setting	Rem. p.71
Param.- No.	Parameter - text	Parameter	Min.	Max.					
Protronic 100: Loops 1 and 2									
Set points and alarms									
75	SP_MIN	Set point min.	-9999	99999	EU	1	-9999		4
76	SP_MAX RAMP	Set point max.	-9999	99999	EU	1	99999		4
77	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 Time unit for	0	99999	EU	1	1		
96	TIME-UNIT	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 × PV1 + Bias]									
Ratio 2: Err = PV - [(R / (1 - R)) × 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 Protrenic 100: Loops 1 and 2			Range		Unit	Resolu- tion	Factory setting	System setting	Rem. p.71
Param.- No.	Parameter text	Parameter	Min.	Max.					
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:

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

$$t_{on,min} = t_{off,min} = 2.5 \text{ s}$$

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		Unit	Resolut- ion	Factory setting	System setting	Rem. p.71
Param.- No.	Parameter text	Parameter	Min.	Max.					
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		Unit	Resolut- ion	Factory setting	System setting	Rem. p.70
Param.- No.	Parameter- text	Parameter	Min.	Max.					
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		Unit	Resolut- ion	Factory setting	System setting	Rem. p.70
Param.- No.	Parameter- text	Parameter	Min.	Max.					
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		Unit	Resolut- ion	Factory setting	System setting	Rem. p.70
Param.- Nr.	Parameter- text	Parameter	Min.	Max.					
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

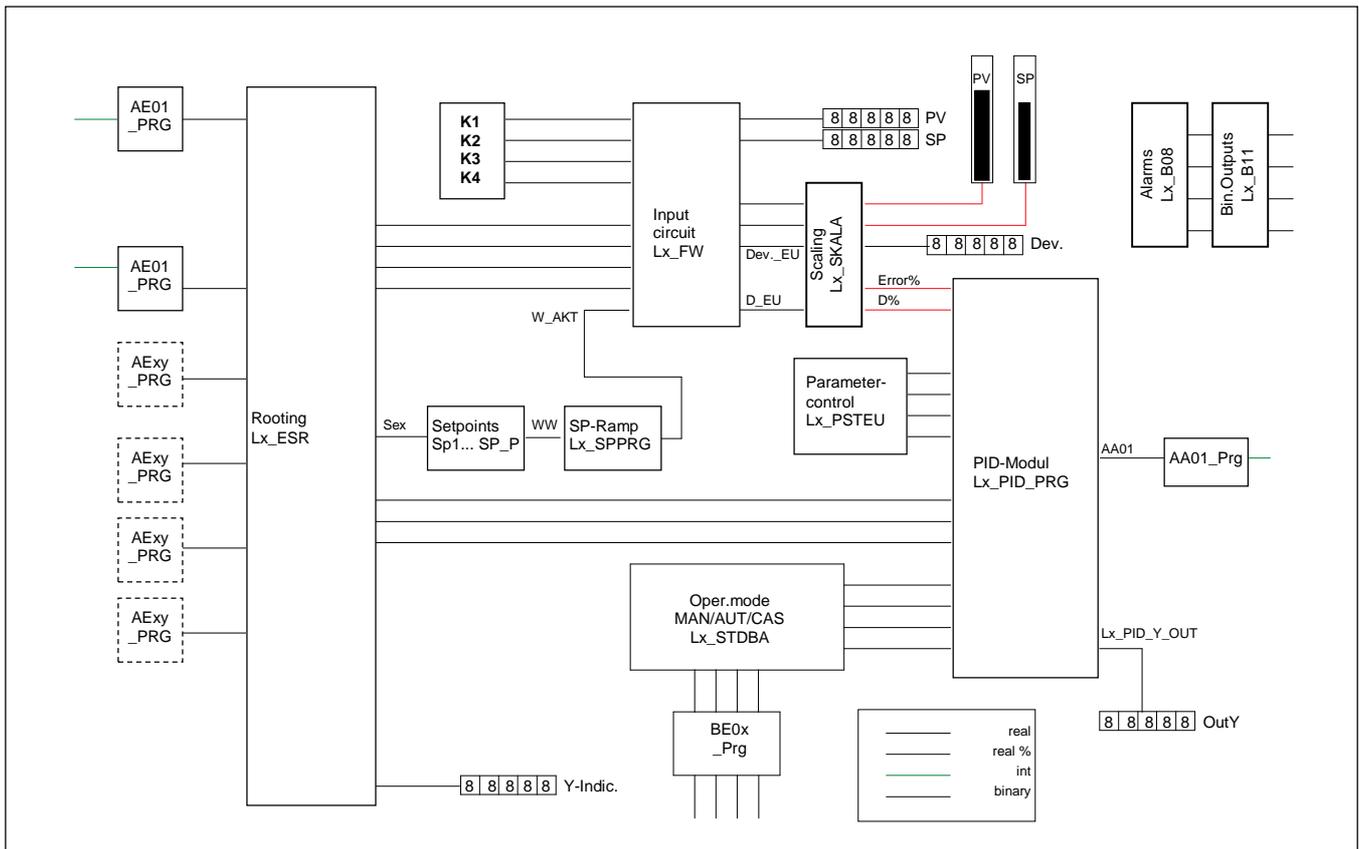


Fig. 94 Configuration - Factory setting

⚠ 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 = Digitrenic 500/700,

1 = Protrenic 100,

5 = Protrenic 500/550/700/750,

• = 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 Protrenic 500/550/700/750:

- AI74,
- AO73,
- BI76 and BO76,

the following values are for Protrenic 100:

- AI02,
- AO01,
- BI02 and BO02, and

the following values are for Digitrenic 500/700:

- 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 <u>DEUTSCH</u> 2 ENGLISH 3 FRENCH 4 ...	German texts English texts French texts ...
02 BINARY INPUTS						
Q01	D	1	5	fC	+ 0 <u>LOCK PAR OFF</u> 1 LOCK PAR.BI01 4 LOCK PAR.BI04 46 LOCK PAR.BI46 76 LOCK PAR.BI76	Inhibition of parameter def. and confi. levels <u>no inhibition</u> with BI01 with BI04 with BI46 with BI76
Q02	D	1	5	fC	+ 0 <u>LOCK OP.BIOFF</u> 1 LOCK OP.BI01 4 LOCK OP.BI04 46 LOCK OP.BI46 76 LOCK OP.BI76	Inhibition of all operator interventions <u>no hardware inhibition</u> BI01 BI04 BI46 BI76
Q03	D	1	5	fC	+ 0 <u>NO ALM.QUIT</u> 1 QUIT ALM.BI01 4 QUIT ALM.BI01 46 QUIT ALM.BI46 76 QUIT ALM.BI76	Alarm acknowledgement with bin.inp. <u>No alarm acknowledgement with bin.inp.</u> BI01 BI04 BI46 BI76
03 BINARY FLAGS						
Q01	D	1	5	fC	+ 0 <u>FLAG1 BX. OFF</u> 1 FLAG1_Bx01 4 FLAG1_Bx04 46 FLAG1_Bx46 76 FLAG1_Bx76	Flag1 coupled with binary-input / output <u>not coupled</u> Bx01 Bx04 Bx46 Bx76
Q02-	like Flag 1				like Flag 1	
Q06					x = I or O	
04 REMOTE OPERATION via port or binary inputs						
Q01	D	1	5	fC	+ 1 <u>LOCAL OPER.</u> 2 LOC/REM 3 REMOTE 4 LOCAL & REMOTE	Local/Remote <u>Local operation on unit only</u> Local operation on unit or via port Changeover in operation 2 Local operation via port only 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	0 SELFTEST=NO BO	Self-test No output
					1 SELFTEST BO01	BO01
	•	•	•			
	•	•	•		4 SELFTEST BO04	BO04
	•	•	•			
	•	—	•		46 SELFTEST BO46	BO46
	•	—	•			
	—	—	•		76 SELFTEST BO76	BO76
	—	—	•			
Q02	D	1	5	fC	0 COM_ERR=NO BO	Error in telegram communication 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
					0 ALM_IND_OFF	Alarm texts are <u>not displayed</u> on front panel
	•	•	•	+	1 ALM_IND_ON	Alarm text are <u>displayed</u>
Q02	D	1	5	fC	0 QUIT OFF	Alarm acknowledgement No acknowledgement envisaged
					1 QUIT_SINGLE 2	Only the alarm displayed is acknowledged
	•	•	•		QUIT_ALL	All alarms are always acknowledged
11 MODULE ASSIGNMENT						
Q01	D	1	5	fC	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	0 M1=UNUSED	Slot 1 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
	•	—	•		64 M1=BIO4-RTC	4-fold binary input/output, Real-time-Clock
	•	—	—		70 M1=BO4-RELAIS	Output 4 x relays
	•	—	—		2 M1=RS232/485	Serial interface
	•	—	•		4 M1=PROFIBUS	PROFIBUS module

Instrument					Function	Rem. p. 78	
Module	Query Param.	Response					
12	Q02	D	1	5	fc	Slot 2	
		•	-	•	+	<u>free</u>	
		•	-	•		0 M2=UNUSED 10 M2=AI4-mV 15 M2=AI2-mAmA i 16 M2=AI2-mAmV i 17 M2=AI2-mVmA i 18 M2=AI2-mVmV i 20 M2=AI4 mA p 24 M2=AI4-f/t 25 M2=AI4 mA MUS 30 M2=AI4-Pt-2W 35 M2=AI2-Pt-3/4 40 M2=AO3-V 50 M2=AO3-mA 60 M2=BIO6-BIN. 64 M1=BIO4-RTC 2 M2=RS-232/485 4 M2=PROFIBUS	4 x thermocouple/ mV 2 x mA with electrical isolation 1 x mA + 1 x thermocouple with isolation 1 x thermocouple + 1 x mA with isolation 2 x thermocouple with isolation 4 x mA with potential isolation Frequency or time measurement 4 x mA with transmitter supply 4 x Pt100 2-wire circuit 2 x Pt100 3/4-wire circuit Output 3 x V Output 3 x 20 mA 6-fold binary input/output 4-fold binary input/output, Real-time-Clock Serial port PROFIBUS module
	Q03	D	1	5	fc	Slot 3	
		•	-	•	+	<u>free</u>	
		•	-	•		0 M3=UNUSED 10 M3=AI4-mV 15 M3=AI2-mAmA i 16 M3=AI2-mAmV i 17 M3=AI2-mVmA i 18 M3=AI2-mVmV i 20 M3=AI4 mA p 24 M3=AI4-f/t 25 M3=AI4 mA MUS 30 M3=AI4-Pt-2W 35 M3=AI2-Pt-3/4 40 M3=AO3-V 50 M3=AO3-mA 60 M3=BIO6-BIN. 64 M1=BIO4-RTC 4 M3=PROFIBUS	4 x thermocouple/ mV 2 x mA with electrical isolation 1 x mA + 1 x thermocouple with isolation 1 x thermocouple + 1 x mA with isolation 2 x thermocouple with isolation 4 x mA with potential isolation Frequency or time measurement 4 x mA with transmitter supply 4 x Pt100 2-wire circuit 2 x Pt100 3/4-wire circuit Output 3 x V Output 3 x 20 mA 6-fold binary input/output PROFIBUS module 4-fold binary input/output, Real-time-Clock PROFIBUS module
	Q04	D	1	5	fc	Slot 4	
		•	-	•	+	<u>free</u>	
		•	-	•		0 M4=UNUSED 10 M4=AI4-mV 15 M4=AI2-mAmA i 16 M4=AI2-mAmV i 17 M4=AI2-mVmA i 18 M4=AI2-mVmV i 20 M4=AI4 mA p 24 M4=AI4-f/t 25 M4=AI4 mA MUS 30 M4=AI4-Pt-2W 35 M4=AI2-Pt-3/4 40 M4=AO3-V 50 M4=AO3-mA 60 M4=BIO6-BIN. 64 M1=BIO4-RTC 2 M4=RS-232/485 4 M4=PROFIBUS	4 x thermocouple/ mV 2 x mA with electrical isolation 1 x mA + 1 x thermocouple with isolation 1 x thermocouple + 1 x mA with isolation 2 x thermocouple with isolation 4 x mA with potential isolation Frequency or time measurement 4 x mA with transmitter supply 4 x Pt100 2-wire circuit 2 x Pt100 3/4-wire circuit Output 3 x V Output 3 x 20 mA 6-fold binary input/output 4-fold binary input/output, Real-time-Clock Serial port PROFIBUS module
	Q05	for Protrenic 500/550/700/750 like slot 3				like slot 3	2

Instrument						Function	Rem. p.78	
Module	Query Param.	Response						
12	Q06	D	1	5	fC	Slot 6 <u>free</u> 4 x thermocouple/ mV 2 x mA with electrical isolation 1 x mA + 1 x thermocouple with isolation 1 x thermocouple + 1 x mA with isolation 2 x thermocouple with isolation 4 x mA with potential isolation Frequency or time measurement 4 x mA with transmitter supply 4 x Pt100 2-wire circuit 2 x Pt100 3/4-wire circuit Output 3 x V Output 3 x 20 mA 6-fold binary input/output 4-fold binary input/output, Real-time-Clock Output 4 x relay PROFIBUS module	2	
	Q07	like slot 6					like slot 6	
20	Q01	D	1	5	fC	PASSWORD <u>Password protection is switched off,</u> <u>not activated, but available</u> Password protection is activated Password protection is activated, but stays off for about 30 s after returning to the operating level.		
	P02	D	1	5	fC	Password definition -----		
30	COMMUNICATION							
	P01	D	1	5	fC	Unit address on bus 00 = Global address 1 = Factory setting		
	Q02	D	1	5	fC	ADDRESS <u>1...127</u> Baud rate 300 600 1200 2400 4800 <u>9600</u> 19200 38400 57600 115200 187500	187500 } only for lateral communication Protrenic 500/550/700/750, Digitrenic500/700	
	Q03	D	1	5	fC	Protocol <u>Modbus RTU</u>		
	Q04	D	1	5	fC	Parity no parity test <u>even</u>		
	Q05	D	1	5	fC	Time out, time monitoring of miss. telegr. on bus without monitoring <u>1 s</u> 25 SECONDS 25 s		
	Q06	D	1	5	fC	PROFIBUS device address <u>1 = Factory setting</u> DP-SLAVE-ADDR <u>1...125</u>		

AI Definition			Function	Rem. p.81			
Module	Query Param.						
01	Q02	fC	1 <u>AI01-LINEAR</u> 2 AI01-SQR1 3 AI01-SQR2 4 AI01-TYPE L 5 AI01-TYPE J 6 AI01-TYPE K 7 AI01-TYPE U 8 AI01-TYPE R 9 AI01-TYPE S 10 AI01-TYPE T 11 AI01-TYPE B 12 AI01-TYPE D 13 AI01-TYPE E 14 AI01-RTD-200 15 AI01-RTD-450 16 AI01-RTD-800 17 AI01-TAB1 18 AI01-TAB2 19 AI01-TAB3 20 AI01-TAB4	Linearization <u>linear</u> Square rooting (switch-off < PV0) Square rooting (linear under PV0) Type L (-200...1000 °C) Type J (-200...1200 °C) Type K (-200...1400 °C) Type U (-200... 600 °C) Type R (0...1700 °C) Type S (0...1800 °C) Type T (-200... 400 °C) Type B (0...1800 °C) Type D (0...2300 °C) Type E (-200...1000 °C) Pt 100 -200 ... 200 °C Pt 100 0 ... 450 °C Pt 100 -200 ... 800 °C Table 1 Table 2 Table 3 Table 4	2		
		Q03	fC +	0 <u>AI01_DIM NONE</u> 1 AI01 DIM USER 2 AI01 DIM % 3 AI01 DIM °C 4 AI01 DIM °F 5 AI01 DIM mbar 6 AI01 DIM bar 7 AI01 DIM m3/h 8 AI01 DIM kg/h 9 AI01 DIM t/h 10 AI01 DIM l/h 11 AI01 DIM hl/h 12 AI01 DIM pH 13 AI01 DIM mm 14 AI01 DIM m 15 AI01 DIM m/h 16 AI01 DIM mV 17 AI01 DIM V 18 AI01 DIM mA 19 AI01 DIM A	Dimension for AI01 <u>none</u> 4-digit user-defined °C °F automatic range switch-over		
		P04	fC +	AI01-USER-DIM - - - -	Edit dimension in the display, if Q03 = 1		
		to ..	P05	fC +	AI01-SCAL.LO Value	Start of scaling (for sensor automatically in °C) Range: -9999 to 99999 Resolution : 1 <u>Factory setting 0 % of measuring range (0.00000)</u>	4
			P06	fC +	AI01-SCAL.HI Value	End of scaling (for sensor automatically in°C) Range: -9999 to 99999 Resolution : 1 <u>Factory setting 100 % of measuring range (100.00)</u>	4

AI Definition			Function	Rem. p.81
Module	Query Param.			
	Q07	fc 0 AI01 NONE 1 AI01 TREF INT 2 AI01 TREF 0 C 3 AI01 TREF 20C 4 AI01 TREF 50C 5 AI01 TREF 60C	Reference junction compensation no reference junction <u>internal</u> external 0 °C external 20 °C external 50 °C external 60 °C	5
	P08	fc AI01-SQR Value	Square rooting value of PV0 Range -9999 to +99999, Resolution 0.01 <u>Factory setting 0.0</u>	
	P09	fc AI01-FILTERT. Value	T-Filter time constant Range 0 to 120 s Resolution 1 s <u>Factory setting 0 s (0.00.00 h)</u>	
	Q10	fc 1 AI01-FAIL.VAL 2 AI01-OLD VAL.	Default value strategy for sensor fault <u>Default value</u> Hold last measured value	
	P11	fc AI01-FAIL.VAL Value	Default value Range 0 to 102 % Resolution 0.0001 <u>Factory setting 102 %</u>	
	Q12	fc 0 AI01-ERR=N.BO 1 AI01-ERR=BO01 76 AI01-ERR=BO76	Error message via BOx <u>No message</u> BO01 BO76	
	Q13	fc 0 AI01=N.FLG 1 AI01ERR=FLG01 2 AI01ERR=FLG02 3 AI01ERR=FLG03 4 AI01ERR=FLG04 5 AI01ERR=FLG05 6 AI01ERR=FLG06	Error message via Flag <u>No message</u> via Flag 1 via Flag 2 via Flag 3 via Flag 4 via Flag 5 via Flag 6	
	Q15	fc 1 NAMUR + 2 NAMUR - 3 NAMUR +/- 4 24 V POS 5 24 V NEG 6 24 V +/- 7 TTL POS 8 TTL NEG 9 TTL +/-	Pick-up acc. to NAMUR DIN 19 232 positive edge Pick-up acc. to NAMUR DIN 19 232 negative edge Pick-up acc. to NAMUR DIN 19 232 both edges binary signal 0/24 V positive edge binary signal 0/24 V negative edge binary signal 0/24 V both edges TTL signal 0/5 V positive edge TTL signal 0/5 V negative edge TTL signal 0/5 V both edges	6

1 Only for AI01 and module 2_Pt100_3/4L.

2 For modules for Pt 100.

3 Text in unit Alxy-Bxy-Fn
Module number is identical with input number
x = Module on slot, y = input y on module x

4 Scaling is according to the transmitter data. The scaling for the control variable can deviate from this. See Lx-B03-P07, P08.

5 Reference junction only for thermocouple.

6 Only modules.

7 If only one input per module is used.

8 Two pulse inputs required for measuring.

9 Three pulse inputs required for measuring.

AO Definition			function	Rem. p. 81	
Module	Query Param.				
01 to ... <p style="text-align: center;"> Protrenic 100: AO01 Protrenic 500/550/700/750: AO01 ... AO73 Digitrenic 500/700: AO01 ... AO43 (Analog outputs) </p>					
Q01	fc	+	0 UNUSED 1 AO01 DEAD ZERO 2 AO01 LIFE ZERO 4 AO01 10 mA 5 AO01 20 mA	Signal range output AOxy unused (not for AO01) 0...20 mA 4...20 mA 10 mA constant current for current module 20 mA constant current for current module	1 1
Q02	fc		0 AO01 LD=N.BO 1 AO01 LD.=BO01 76 AO01 LD.=BO76	Output of impedance monitoring, Output via <u>No output</u> BO01 BO76	
Q03	fc		0 AO01 LD=N.FLG 1 AO01 LD=FLG01 2 AO01 LD=FLG02 3 AO01 LD=FLG03 4 AO01 LD=FLG04 5 AO01 LD=FLG05 6 AO01 LD=FLG06	Error message via Flag <u>No message</u> via Flag 1 via Flag 2 via Flag 3 via Flag 4 via Flag 5 via Flag 6	

- 1 For output module AO3_V:
 0...20 mA stands for 0...10 V
 4...20 mA stands for 2...10 V

BIO-Definition			Function	Rem. p. 81	
Module	Query Param.				
01 to ... <p style="text-align: center;"> Protrenic 100: BIO01 ... BIO 04 Protrenic 500/550/700/750: BIO01 ... BIO74 Digitrenic 500/700: BIO01 ... BIO46 </p>					
Q01	fc	+	0 UNUSED 1 BI01 DIRECT 2 BI01 INVERS 3 BO01 ENGISED 4 BO01 DENGISED	Unused for modules <u>Binary 1 = input contact = "1"</u> Binary 1 = input contact = "0" Binary 1 = output - operating current Binary 1 = output - quiescent current	1 2

- 1 In Digitrenic 500/700, BO03 and BO04 are designed as relay outputs and cannot be configured as inputs.
 Q01 = 0 not for BIO01 to BIO04

- 2 With free configuration, only the following functions can be exchanged subsequently in the list configuration:
 function 1 for 3 and/or function 2 for 4.

Loop 1					Function	Rem. s.96																																
Module	Query Param.	Response																																				
01 CONTROLLER FUNCTION																																						
Q01	D • • • • • • • • • •	1 • • • • • • • • • •	5 • • • • • • • • • •	fc +	<u>1 SINGLE LOOP</u> 3 SLAVE CONTR. 4 OVERR.M.MIN 5 OVERR.M.MAX 8 MANUALSTATION 9 SETPT.STATION 10 RATIO STATION 11 POSITIONER	<u>Single-channel controller</u> Slave controller in cascade Min. override adjustment Master controller Max. override adjustment Master controller Single-channel manual station Single-channel set point station Single-channel ratio station Single-channel positioner Controller output																																
Q02	D • • • • • • • •	1 • • • • • • • •	5 • • • • • • • •	fc	<u>1 CONTINUOUS</u> 2 STEP CONTR. 3 ON/OFF CONTR. 5 H-OFF-C (S+S) 6 H-OFF-C (C+S) 7 SPLIT.R.(C+C)	<u>K = continuous</u> S = step Z = two-position D = three position heat-o-cool (relay) D = three-position Heat (cont.)-o-cool (relay) KK = split range with 2 continuous outputs																																
Q03	D • • • • • • •	1 • • • • • • •	5 • • • • • • •	fc	1 M:CHAR-DIR 2 M:CHAR-INV 3 M:INV-DIR 4 M:DIR-DIR 5 M:INV-INV 6 M:DIR-INV	Manual characteristic Position display = <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;">0 %</td> <td style="text-align: center;">50 %</td> <td style="text-align: center;">100 %</td> </tr> <tr> <td>Z=K</td> <td style="text-align: center;">off</td> <td></td> <td style="text-align: center;">on</td> </tr> <tr> <td></td> <td style="text-align: center;">on</td> <td></td> <td style="text-align: center;">off</td> </tr> </table> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>D</td> <td>out2on</td> <td>out2off</td> <td>outloff</td> <td>outlon</td> </tr> <tr> <td>=</td> <td>out2off</td> <td>out2on</td> <td>outloff</td> <td>outlon</td> </tr> <tr> <td>KK</td> <td>out2on</td> <td>out2off</td> <td>outlon</td> <td>outloff</td> </tr> <tr> <td></td> <td>out2off</td> <td>out2on</td> <td>outlon</td> <td>outloff</td> </tr> </table> S independent of wiring off = permanently off or 0/4 mA; on = permanently on or 20 mA		0 %	50 %	100 %	Z=K	off		on		on		off	D	out2on	out2off	outloff	outlon	=	out2off	out2on	outloff	outlon	KK	out2on	out2off	outlon	outloff		out2off	out2on	outlon	outloff
	0 %	50 %	100 %																																			
Z=K	off		on																																			
	on		off																																			
D	out2on	out2off	outloff	outlon																																		
=	out2off	out2on	outloff	outlon																																		
KK	out2on	out2off	outlon	outloff																																		
	out2off	out2on	outlon	outloff																																		
Q04	D • • • • • • • •	1 • • • • • • • •	5 • • • • • • • •	fc +	<u>0 NO PS.FBACK</u> 1 POS.FBCK=AI01 2 POS.FBCK=AI02 44 POS.FBCK=AI44 74 POS.FBCK=AI74	y-feedback signal and display <u>No y-feedback signal</u> AI01 AI02 AI44 AI74																																
Q05	D • • • • • • •	1 • • • • • • •	5 • • • • • • •	fc +	<u>0 SELFTUNE OFF</u> 1 SELFTUNE1 ON	Self-tuning <u>Off</u> On																																
02 CONTROLLER PARAMETER																																						
Q01	D • • • • • • •	1 • • • • • • •	5 • • • • • • •	fc	1 A:CHAR.-DIR. 2 A:CHAR.-INV.	Aut. characteristic automatic direct action characteristic <u>Automatic indirect action characteristic</u>																																
Q02	D • • • • • • • •	1 • • • • • • • •	5 • • • • • • • •	fc +	1 P CONTROL <u>2 PI CONTROL</u> 3 PD CONTROL 4 PID CONTROL 5 PI+DEADTIME 6 PID+DEADTIME	PI-behaviour P (I for step controller) <u>PI</u> PD (not with step controller) PID Smith Predictor with PI Smith Predictor with PID																																
Q03	D • • • • • • •	1 • • • • • • •	5 • • • • • • •	fc	<u>1 DIFF. PV</u> 2 DIFF. ERROR	D compartment connected with <u>controlled variable</u> Controller deviation																																

Loop 1						Function	Rem. s.96	
Module	Query Param.	Response						
03	Q06	D • • • • • •	1 • • • • •	5 • • • • • •	fC + • • • • •	0 P,S 10000. 1 P,S 1000.0 <u>2 P,S 100.00</u> 3 P,S 10.000 4 P,S 1.0000 5 P,S FLOAT.PT.	Decimal places for PV, SP 0 decimal places 1 decimal place <u>2 decimal places</u> 3 decimal places 4 decimal places Display of floating decimal point	
	P07	D •	1 •	5 •	fC •	DIG.IND.LO. Value	Scaling for PV, SP Start <u>Factory setting SP = 0,0</u> Range -9999 to 9999	3
	P08	D •	1 •	5 •	fC •	DIG.IND.HI Value	Scaling for PV, R(SP) End Factory setting SP = 100,0 Range -9999 to 9999	3
	Q09	D • •	1 • •	5 • •	fC + • •	<u>1 RATIO IS/SP</u> 2 ES1, RATIO × ES2	Digital display for ratio <u>Ract and Rset</u> IC1 and R × IC2	
	Q10	D • • •	1 • • •	5 • • •	fC + • • •	<u>0 NO DIM.</u> 1 USER DIM. 2 DIM.= %	Dimension R ratio for ratio and multiplication <u>without dimension (e.g. ratio)</u> 4-digit dimension freely Definable <u>% (Factory setting for ratio 2)</u>	
	P11	D •	1 •	5 •	fC + •	R USER DIM. - - - -	Edit the user dimension ratio (if Q04 = 1) see AI Definition Q04	
	Q12	D • • • • • •	1 • • • • • •	5 • • • • • •	fC • • • • • •	0 R 10000. 1 R 1000.0 <u>2 R 100.00</u> 3 R 10.000 4 R 1.0000 5 R FLOAT.PT.	Decimal places of R-points for R-display 0 Decimal places 1 Decimal places <u>2 Decimal places</u> 3 Decimal places 4 Decimal places Display of floating decimal point	
	P14	D •	1 •	5 •	fC •	SCAL.RATIO Value	Scaling for ratio <u>Factory setting R = 100.0</u> Range -9999 to 9999	
	Q15	D • •	1 • •	5 • •	fC • •	<u>1 ANALOG PV,SP</u> 2 ANALOG RATIO	Analog display for ratio <u>PV1 and R × PV2</u> Ract and Rset	8
	P16	D •	1 •	5 •	fC •	ANALOG.0 Value	Analog.0% s. B03-Q15 Value of analog display for 0 % <u>Factory setting 0.0</u> Range -9999 to 9999	9
	P17	D •	1 •	5 •	fC •	ANALOG.100 Value	Analog.100% see B03-Q15 Value of analog display for 100 % <u>Factory setting 100.0</u> Range -9999 to 9999	9
	Q18	D • • • • - -	1 • • • • - -	5 • • • • • •	fC • • • • • •	<u>0 PV,R=NO AO</u> 1 PV,R=AO01 43 PV,R=AO43 73 PV,R=AO73	PV retransmission Current control variable or Ract to <u>Not routed to output</u> Analog output AO01 Analog output AO43 Analog output AO73	

Loop 1					Function	Rem. s.96
Module	Query Param.	Response				
ROUTING_ES-AI						
04 Routing of the analog inputs and the input circuit)						
Q01	D	1	5	fC	Routing_IC1 IC1 of input circuit connected with: fixed value 0 % <u>AI01 for loop</u> AI02 AI04 AI74 Output of the state correction 1 Output of the state correction 2 Output of Table 4 Fixed value 100 %	
	•	•	•		0 ES1=0%	
	•	•	•		<u>1 ES1=AI01</u>	
	•	•	•		2 ES1=AI02	
	•	-	•			
	•	-	•		44 ES1=AI44	
	-	-	•			
	-	-	•		74 ES1=AI74	
	•	-	•		91 ES1=FC_1	
	•	-	•		92 ES1=FC_2	
	•	•	•		94 ES1=TAB4	
	•	•	•		100 ES1=100%	
Q02	D	1	5	fC	Routing_IC2 IC2 of the input circuit connected with: as IC1	
					like Q01	
Q03	D	1	5	fC	Routing_IC3 IC3 of the input circuit connected with: like IC1	
					like Q01	
Q04	D	1	5	fC	Rangier_IC4 IC4 of the input circuit connected with: like IC1	
					like Q01	
Q05	D	1	5	fC	TAB4.AI Table 4 connected with <u>Not individually used</u> AI01 AI02 AI44 AI74	
	•	•	•		<u>0 TAB4 NO.AI</u>	
	•	•	•		1 TAB4.AI01	
	•	•	•		2 TAB4.AI02	
	•	-	•			
	•	-	•		44 TAB4.AI44	
	-	-	•			
	-	-	•		74 TAB4.AI74	
Q06	D	1	5	fC	Routing_B1 Routing of binary signal with BIX <u>B1 unused</u> BI01 BI04 BI46 BI76	
	•	•	•		<u>0 B1 NO BI</u>	
	•	•	•		1 B1=BI01	
	•	•	•			
	•	•	•		4 B1=BI04	
	•	-	•			
	•	-	•		46 B1=BI46	
	-	-	•			
	-	-	•		76 B1=BI76	
SETPOINTS						
Q01	D	1	5	fC	Setpoint 1 of controller 1 off <u>can only be changed per keys or interface follows</u> current set point	
	•	•	•		0 SP1.INT=OFF	
	•	•	•		<u>1 SP1.INT=ON</u>	
	•	•	•		2 SP1.INT=TRACK	
Q02	D	1	5	fC	Type SP1 SP1 as parameter (then becomes part of the configuration and can be taken over by other unit per Confi) <u>no</u> yes is not tracked	
	•	•	•		<u>0 SP1=NO PARAM.</u>	
	•	•	•		1 SP1=PARAM.	

Loop 1						Function	Rem. s.96															
Module	Query Param.	Response																				
05	Q03	D • • • • •	1 • • • •	5 • • • •	fC	<u>0 SP2.INT=OFF</u> 1 SP2.INT=ON 2 SP2.INT=PARA.FLX 3 SP2=DELTA.PAR 4 SP2=RATIO.TRK	Set point 2 = ratio set point 1 SR1 <u>off</u> Only changeable per key or interface Only operatable at paralevel Delta only operatable at paralevel SR1 follows actual ratio															
	Q04	D • • • •	1 • • • •	5 • • • •	fC	<u>0 SP3.INT=OFF</u> 1 SP3.INT=ON 2 SP3.INT=PARA.FLX 3 SP3=DELTA.PAR	Set point 3 = ratio set point 2 SR2 <u>off</u> Only changeable per key or interface Only operatable at paralevel Delta only operatable at paralevel															
	Q05	D • • • •	1 • • • •	5 • • • •	fC	<u>0 SP4.INT=OFF</u> 1 SP4.INT=ON 2 SP4.INT=PARA.FLX 3 SP4=DELTA.PAR	Set point 4 = ratio set point 3 SR3 <u>off</u> only changeable per keys or interface Only operatable at paralevel Delta only operatable at paralevel															
	Q06	D • • • • • - -	1 • • • • - -	5 • • • • • • •	fC	<u>0 SP.EXT=OFF</u> 1 SP.EXT=AI01 2 SP.EXT=AI02 44 SP.EXT=AI44 74 SP.EXT=AI74	External set point <u>off</u> AI01 AI02 AI44 AI74															
	Q07	D • •	1 • •	5 • •	fC	<u>0 SP.COMP=OFF</u> 1 SP.COMP=ON	Computer set point <u>off</u> on															
	Q08	D • •	1 • •	5 • •	fC	<u>0 SP.PRGRM=OFF</u> 1 SP.PRGRM=ON	Program transmitter set point <u>off</u> on	4														
	Q09	D • •	1 • •	5 • •	fC +	<u>1 SP:IND/TARGET</u> <u>2 SP:IND.RAMP</u>	SP Display Display of set point falsified temporarily by ramp <u>Display of the targeted set point</u> Display of the falsified value. The targeted set point is displayed during set point adjustment, 3 s after the last actuating key of the current set point.															
	Q10	D • • • • - -	1 • • • • - -	5 • • • • • •	fC	<u>0 SP.ACT.NO AO</u> 1 SP.ACT=AO01 43 SP.ACT=AO43 73 SP.ACT=AO73	Current set point to AOx <u>Set point not on output</u> Analog output AO01 Analog output AO43 Analog output AO73															
Q11	D fC • • •	1 • • •	5 • • •		<u>0 SP.TRANS=OFF</u> 1 SP1-SP2 Bix 2 SP1-SP4 BIy	SP Changeover Set point changeover <u>off</u> <table border="1"> <thead> <tr> <th>Bix</th> <th>BIy</th> <th>Setpoint</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>2</td> </tr> <tr> <td>0</td> <td>1</td> <td>3</td> </tr> <tr> <td>1</td> <td>1</td> <td>4</td> </tr> </tbody> </table> Definition Bix, BIy see B09-Q13, Q14	Bix	BIy	Setpoint	0	0	1	1	0	2	0	1	3	1	1	4	
Bix	BIy	Setpoint																				
0	0	1																				
1	0	2																				
0	1	3																				
1	1	4																				

Loop 1					Function	Rem. s.96	
Module	Query Param.	Response					
08 ALARMS							
Q01	D	1	5	fc	0 ALARM1=OFF 1 ALARM1 SP.MIN 2 ALARM1 SP.MAX 3 ALM1 ERR-MIN 4 ALM1 ERR-MAX 6 ALM1 ERR -MX 7 AL1 ER-SP%MIN 8 AL1 ER-SP%MAX 10 AL1 ERR S%,MAX 11 AL1 DX/DT-MAX 12 AL1 RATIO MIN 13 AL1 RATIO MAX 14 AL1 OUT-MIN 15 AL1 OUT-MAX	Alarm value 1 Alarm value without function Alarm value to PV - Min Alarm value to PV - Max Alarm value to Err - Min Alarm value to Err - Max Alarm value to Err - Max Alarm value to Err - Min in % of SP Alarm value to Err - Max in % of SP Alarm value to Err - Max in % of SP Alarm value dx/dt Max Alarm value R = Min. for input Ratio Alarm value R = Max. for input Ratio Alarm value to Out - Min Alarm value to Out - Max	
Q02	D	1	5	fc	2 ALARM2 SP.MAX	Alarm value 2 like alarm value 1 default alarm value to PV - Max	
Q03	D	1	5	fc	3 ALM3 ERR-MIN	Alarm value 3 like alarm value 1 Alarm value to Err - Min	
Q04	D	1	5	fc	4 ALM4 ERR-MAX	Alarm value 4 like alarm value 1 Alarm value to Err - Max	
Q05	D	1	5	fc	1 ALM1 OP/OP 2 ALM1 PAR/OP 3 ALM1 PAR/PAR	Type Alarm 1 adjustable to displayed in ----- Operation level Operation level Para-Level Operation level Para-Level Para-Level	
Q06	D	1	5	fc	1 ALM2 OP/OP 2 ALM2 PAR/OP 3 ALM2 PAR/PAR	Type Alarm 2 adjustable to displayed in ----- Operation level Operation level Para-Level Operation level Para-Level Para-Level	
Q07	D	1	5	fc	1 ALM3 OP/OP 2 ALM3 PAR/OP 3 ALM3 PAR/PAR	Type Alarm 3 adjustable to displayed in ----- Operation level Operation level Para-Level Operation level Para-Level Para-Level	
Q08	D	1	5	fc	1 ALM4 OP/OP 2 ALM4 PAR/OP 3 ALM4 PAR/PAR	Type Alarm 4 adjustable to displayed in ----- Operation level Operation level Para-Level Operation level Para-Level Para-Level	
09 BINARY INPUTS							
Q01	D	1	5	fc	0 MAN.BI OFF 1 MAN.BI01 4 MAN.BI04 46 MAN.BI46 76 MAN.BI76	Changeover to Manual with last Out-value No function BI01 BI04 BI46 BI76	

Loop 1						Function	Rem. s.96
Module	Query Param.	Response					
09	Q12	D	1	5	fc	<u>0 SRAMP BI OFF</u> 1 SRAMP=0.BI01 4 SRAMP=0.BI04 46 SRAMP=0.BI46 76 SRAMP=0.BI76	Ramp stop static SP ramp stopped. like query 1
	Q13	D	1	5	fc	<u>0 SP1-4 BIX OFF</u> 1 SP1-4 BIX=BI01 4 SP1-4 BIX=BI04 46 SP1-4 BIX=BI46 76 SP1-4 BIX=BI76	SP changeover: Definition of BIX (B05-Q11) <u>No setpoint changeover with BIX</u> with BI01 BI04 BI46 with BI76
	Q14	D	1	5	fc	<u>0 SP1-4 BIY OFF</u> 1 SP1-4 BIY=BI01 4 SP1-4 BIY=BI04 46 SP1-4 BIY=BI46 76 SP1-4 BIY=BI76	SP changeover: Definition of BIY (B05-Q11) <u>No setpoint changeover with BIY</u> with BI01 BI04 BI46 with BI76
	Q15	D	1	5	fc	<u>0 SPI-EXT BI OFF</u> 1 SPI-EXT.BI01 4 SPI-EXT.BI04 46 SPI-EXT.BI46 76 SPI-EXT.BI76	SPint <-> SPext static changeover <u>like query 1</u>
	Q16	D	1	5	fc	<u>0 CHAR BI OFF</u> 1 CHAR BI.BI01 4 CHAR BI.BI04 46 CHAR BI.BI46 76 CHAR BI.BI76	DIR <-> INV static Changeover of characteristic <u>like query 1</u>
	Q17	D	1	5	fc	<u>0 LOCK SP BI OFF</u> 1 LOCK SP.BI01 4 LOCK SP.BI04 46 LOCK SP.BI46 76 LOCK SP.BI76	Locking SP change static Inhibition of the SP adjustment capability with <u>like query 1</u>
	Q18	D	1	5	fc	<u>0 REMOTE BI=OFF</u> 1 REMOTE SP 2 REMOTE OUT 3 A=SP,M=OUT	Enabling of teleadjustment (static) <u>Inhibition of teleadjustment</u> only setpoint (in all operation states) only correction value (in manual) setpoint in automatic, Out in manual

Loop 1						Function	Rem. s.96	
Module	Query Param.	Response						
09	Q19	D	1	5	fc	<u>0 MORE BI OFF</u> 1 MORE.BI01 4 MORE.BI04 46 MORE.BI46 76 MORE.BI76	Teleadjustment (more) 100%/60s- adjustment with BI01 with BI04 with BI46 with BI76	
	Q20	D	1	5	fc	<u>1 LESS BI OFF</u> 4 LESS.BI04 46 LESS.BI46 76 LESS.BI76	Teleadjustment (less) 100%/60s-adjustment with BI01 with BI04 with BI46 with BI76	
	Q21	D	1	5	fc	<u>0 CR BI OFF</u> 1 CR BI01 4 CR BI04 46 CR BI46 76 CR BI76	Computation ready <u>not used</u> via binary input BI01 via binary input BI04 via binary input BI46 via binary input BI76	
ROUTE OUT								
(Routing of the controller outputs)								
10	Q01	D	1	5	fc	0 OUT1 NO AO <u>1 OUT1.CON=AO01</u> 43 OUT1.CON=AO43 73 OUT1.CON=AO73	Routing Out1 to AOx first continuous controller output to for switching controllers <u>Analog output AO01</u> Analog output AO43 Analog output AO73	
	Q02	D	1	5	fc	0 OUT2 NO AO 1 OUT2.CON=AO01 43 OUT2.CON=AO43 73 OUT2.CON=AO73	Routing Out2 to AOx second continuous controller output (split range) <u>Unused</u> Analog output AO01 Analog output AO43 Analog output AO73	
	Q03	D	1	5	fc	0 OUTA NO AO 1 OUTA.CON=AO01 43 OUTA.CON=AO43 73 OUTA.CON=AO73	Routing Out to AOx Diagram of position display Out for switching controllers and split range <u>No output</u> Analog output AO01 Analog output AO43 Analog output AO73	
	Q04	D	1	5	fc	0 OUT1=NO BO 1 OUT1=BO01 4 OUT1=BO04 46 OUT1=BO46 76 OUT1=BO76	Routing Out1 to BOx First switch contact (for step controller 'more') <u>for continuous controller</u> to binary output B001 to binary output B004 to binary output B046 to binary output B076	

Loop 1						Function	Rem. s.96
Module	Query Param.	Response					
11	Q03	D	1	5	fc	0 ALARM3.NO BO 1 ALARM3.BO01 4 ALARM3.BO04 46 ALARM3.BO46 76 ALARM3.BO76	Alarm value 3 to output <u>like alarm value 1</u>
	Q04	D	1	5	fc	0 ALARM4.NO BO 1 ALARM4.BO01 4 ALARM4.BO04 46 ALARM4.BO46 76 ALARM4.BO76	Alarm value 4 to output <u>like alarm value 1</u>
	Q05	D	1	5	fc	0 MAN NO BO 1 MAN NO.BO01 4 MAN NO.BO04 46 MAN NO.BO46 76 MAN NO.BO76	Feedback signal manual to output <u>like alarm value 1</u>
	Q06	D	1	5	fc	0 AUTO NO BO 1 AUTO NO.BO01 4 AUTO NO.BO04 46 AUTO NO.BO46 76 AUTO NO.BO76	Feedback signal automatic to output <u>like alarm value 1</u>
	Q07	D	1	5	fc	0 CASC.NO BO 1 CASC.NO.BO01 4 CASC.NO.BO04 46 CASC.NO.BO46 76 CASC.NO.BO76	Feedback signal cascade to output <u>like alarm value 1</u>
	Q08	D	1	5	fc	0 WEXT NO BO 1 WEXT NO.BO01 4 WEXT NO.BO04 46 WEXT NO.BO46 76 WEXT NO.BO76	Feedback signal - external set point <u>like alarm value 1</u>
	Q09	D	1	5	fc	0 PRG.END NO BO 1 PRG.END NO BO01 4 PRG.END NO BO04 46 PRG.END NO BO46 76 PRG.END NO BO76	Program end signal to output <u>like alarm value 1</u>

Loop 1						Function	Rem. s.96	
Module	Query Param.	Response						
11	Q10	D	1	5	fc	0 PRG.BIN1 NO BO 1 PRG.BIN1 NO B001 4 PRG.BIN1 NO B004 46 PRG.BIN1 NOB046 76 PRG.BIN1 NOB076	Binary track 1 of the programmer to binary output <u>like alarm value 1</u>	
	Q11	D	1	5	fc	0 PRG.BIN2 NO BO 1 PRG.BIN2 NO B001 4 PRG.BIN2 NO B004 46 PRG.BIN2 NOB046 76 PRG.BIN2 NOB076	Binary track 2 of the programmer to binary output <u>like alarm value 1</u>	
	Q12	D	1	5	fc	0 PRG.BIN3 NO BO 1 PRG.BIN3 NO B001 4 PRG.BIN3 NO B004 46 PRG.BIN3 NOB046 76 PRG.BIN3 NOB076	Binary track 3 of the programmer to binary output <u>like alarm value 1</u>	
	Q13	D	1	5	fc	0 PRG.BIN4 NO BO 1 PRG.BIN4 NO B001 4 PRG.BIN4 NO B004 46 PRG.BIN4 NOB046 76 PRG.BIN4 NOB076	Binary track 4 of the programmer to binary output <u>like alarm value 1</u>	
BINARY FLAGS								
(Function of binary flags in display)								
12	Q01	D	1	5	fc	0 ALARM1.NO FLG 1 ALARM1.FLG1 6 ALARM1.FLG6	Alarm value1 Alarm value1 not connected to Flag1 Display with Flag 1 Display with Flag 6	
	Q02	D	1	5	fc	0 ALARM2.NO FLG 1 ALARM2.FLG1 6 ALARM2.FLG6	Alarm value 2 like query 1	
	Q03	D	1	5	fc	0 ALARM3.NO FLG 1 ALARM3.FLG1 6 ALARM3.FLG6	Alarm value 3 like query 1	
	Q04	D	1	5	fc	0 ALARM4.NO FLG 1 ALARM4.FLG1 6 ALARM4.FLG6	Alarm value 4 like query 1	

Note

The state correction can only be edited, after it has been integrated into the configuration in a loop.

State correction 1/2 (not Protrenic 100)				Function						Rem. p.101		
Module	Query Param.	Response										
01				TASK								
Q01	D 1 5 fC	<ul style="list-style-type: none"> • • • 0 UNUSED • - • 1 GAS ORIF • - • 2 GAS VOLUM • - • 3 STEAM,ORI • - • 4 SATSTEAM,P • - • 5 SATSTEAM,T • - • 6 WATER ORI • - • 7 WATER VOL • - • 8 BOIL.LEV. 		State correction Unused Gas flow (m3/h) - differential pressure method Gas flow (m3/h) - volume measurement Steam mass flow - differential pressure Saturated steam pressure correction Saturated steam temperature correction Water mass flow - differential pressure Water mass flow - volume measurement Tank water level								
	D 1 5 fC	Q01 = >		Required parameters for								
				1	2	3	4	5	6	7	8	
P02	Qn-CALCUL Value			Qn,r Qm,r	-	Qm,r	Qm,r	Qm,r	Qm,r	-	-	
P03	dP-CALCUL Value			dP,r	-	dP,r	dP,r	dP,r	dP,r	-	-	
P04	P-atm-CALCUL Value			Patm,r	Patm,r	Patm,r	Patm,r	-	Patm,r	Patm,r		
P05	P-CALCUL Value			Pü,r	-	Pü,r	Pü,r	-	Pü,r	Pü,r	-	
P06	T-CALCUL Value			T,r	-	T,r	-	T,r	T,r	-	-	
P07	Z-CALCUL (P,r;T,r) Value			Z,r	-	-	-	-	-	-	-	
P08	RHO-CALCUL Value			RHOnr	RHOnr	-	-	-	-	-	-	
P10	P-MIN Value			Pmin	Pmin	Pmin	Pmin	-	Pmin	Pmin	Pmin	
P11	P-MAX Value			Pmax	Pmax	Pmax	Pmax	-	Pmax	Pmax	Pmax	
P12	T-MIN Value			Tmin	Tmin	Tmin	-	Tmin	Tmin	Tmin	-	
P13	T-MAX Value			Tmax	Tmax	Tmax	-	Tmax	Tmax	Tmax	-	
P14	RHO-MIN Value			Rho min	Rho min	-	-	-	-	-	-	
P15	RHO-MAX Value			Rho max	Rho max	-	-	-	-	-	-	
P16	DISTANCE Value			-	-	-	-	-	-	-	HAB	
P17	T-REFERENC Value				-	-	-	-	-	-	Tvgl	1
Q18	0 OVERPRESSURE 1 ABS. PRESSURE			x x	x x	x x	x x	- -	x x	x x	x x	
P20	COMP.COEF Z1 Value			Z(1)	Z(1)	-	-	-	-	-	-	
...	to			-	-	-	-	-	-	
				1	2	3	4	5	6	7	8	
P28	COMP.COEF Z9 Value			Z(9)	Z(9)	-	-	-	-	-	-	

State correction 1/2 (not Protrenic 100)			Function								Rem. p.101	
Module	Query Param.	Response										
	Q29	0 LINEAR 1 SQR		-						-	-	
	P30	RANGE LO Value	0	0	0	0	0	0	0	0	Value	0 = pre- set
	P31	Value RANGE HI	upper range value of the corrected signal corresponds to 20 mA for analog output									
	Q32	0 NO DIM. 1 DIM USER DIM. 7 DIM = m ³ /h 8 DIM = kg/h 9 DIM = t/h n	Dimension for AI01 <u>No dimension</u> 4-digit, freely Definable Q33 m ³ /h kg/h t/h see AI-Bxy-Q03									
	P33	DIMENSION - - - -	Editing of the user dimension if query 32 = 1									
ROUTING AI												
02 (Routing of the analog inputs to the state correction)												
	Q01	D 1 5 fC • - • • - • • - • • - • - - • - - •	1 IFC_Q=AI01 2 IFC_Q=AI02 44 IFC_Q=AI44 74 IFC_Q=AI74	Flow measured value, differential pressure when B01-Q01 = 8 AI01 AI02 AI44 AI74								
	Q02	D 1 5 fC • - • • - • • - • • - • - - • - - •	0 IFC_P_CALC 1 IFC_P=AI01 2 IFC_P=AI02 44 IFC_P=AI44 74 IFC_P=AI74	Pressure measured value (P) in bar Not used P = Pr AI01 AI02 AI44 AI74								
	Q03	D 1 5 fC • - • • - • • - • • - • - - • - - •	0 IFC_T_CALC 1 IFC_T=AI01 2 IFC_T=AI02 44 IFC_T=AI44 74 IFC_T=AI74	Temperature measured value (T) in °C not used T = Tr AI01 AI02 AI44 AI74								
	Q04	D 1 5 fC • - • • - • • - • • - • - - • - - •	0 IFC_DENS=CALC 1 IFC_D=AI01 2 IFC_D=AI02 44 IFC_D=AI44 74 IFC_D=AI74	Density measured value in kg/m ³ not used Rho = Rhonr AI01 AI02 AI44 AI74								
ROUTING AO												
03 (Routing of the result of the state correction on analog output)												
	Q01	D 1 5 fC • - • • - • • - • • - • - - • - - •	0 FC1=NO_AO 1 FC1=AO01 43 FC1=AO43 73 FC1=AO73	State correction on analog output <u>No output</u> AO01 AO43 AO73								

- 1 Up to version 3.4.0. Afterwards replaced by
T-MIN = T-MAX = Tvgl or direct measured values.
Routing ZKx-B02-Q03. Then T-MIN unequal to T-MAX.

Abbreviations and terms

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

Qv	Operating volume flow in m ³ /h
Qn	Volume flow in standard condition in m ³ /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	T middle	Tmax
Pabsmin	P20	P23	P26
Pabs middle	P21	P24	P27
Pabsmax	P22	P25	P28

HAB Nozzle spacing in mm produces water level in mm.

Tvgl Temperature of the reference column in °C
(up to version 3.4.0. After that replaced by
T-MIN = T-MAX = Tvgl or direct measured value.
Routing ZKx-B02-Q03.
Then T-MIN unequal to T- MAX).

Notice

The programs can only be edited, when the programmer has been activated as set point source in a loop (Lx-B05-Q08 = 1).

Programmer						Function	Rem.
Module	Query Param.	Response					
PROGRAMMER							
01	1	D	1	5	fC	0 <u>PROGR1=OFF</u> 1 PG1-START SP0 2 PG1-START PV	Program 1 Not activated, without function Start at programmed value Start at instantaneous value
							Program 2 to 9
	10	D	1	5	fC	0 <u>PROGR10=OFF</u> 1 PG10-START SP0 2 PG10-START PV	Program 10 Not activated, without function Start at programmed value Start at instantaneous value

Fault messages

Unit fault messages

When reading or writing in the non-volatile flash memory (all controllers) or in the memory card (only Protrenic 500/550/700/750), faults can occur. These are reported in the upper text line of the display as

!Fault

Instead of the four dots, the fault number of the particular fault will be stated (4-digit). Table 10 gives information on the cause and eventual remedy of the faults involved. The input "xy" in a fault number refers to Table 11 on page 99, which provides more exact details on the faults.

It can happen that a fault cannot be remedied, despite the information provided for remedy. In such case, the manufacturer should be informed, supplying the following details:

- unit version,
- firmware version,
- IBIS_R/IBIS_R version, action
- already undertaken,
- configuration,
- project and
- fault number.

Fault messages

Fault number	Fault description	Remarks on fault remedy
32	faults have occurred during download of a configuration	reset unit to factory setting and restart the downloading of the configuration after approximately 2 minutes
3100	insufficient flash memory available for storing a configuration	reset unit to factory setting and restart the downloading of the configuration after approximately 2 minutes or reduced configuration and restart the download exercise
3200 3201	internal computing process is incorrect	inform the manufacturer
40xy	a fault has occurred during the storage of back documentation information	after approximately 2 minutes of configuration without reverse documentation information, restart the download
41xy	a fault has occurred during the storage of the project head	inform the manufacturer
42xy	a fault has occurred during the storage of the list configuration	inform the manufacturer
43xy 44xy	a fault has occurred during the storage of the project version data	inform the manufacturer
45xy	a fault has occurred during the storage of the hardware configuration	inform the manufacturer
46xy	a fault has occurred during the storage of the self-tuned variables.	inform the manufacturer
47xy		
48xy	a fault has occurred during the storage of changes made on the online parameters	inform the manufacturer
49xy		
60xy	the reverse documentation cannot be read	reset unit to factory setting and restart the downloading of the configuration again, if the error persists, let the Flash-memory be exchanged by the manufacturer

Fault number	Fault description	Remarks on fault remedy
61xy	the project head cannot be read	as 60xy
62xy	the list configuration cannot be read	as 60xy
63xy	the project version data cannot be read	as 60xy
64xy		
65xy	the hardware configuration cannot be read	as 60xy
66xy	the self-tuned variables cannot be read	inform the manufacturer
67xy	the free configuration cannot be read	as 60xy
68xy	the changes in the online parameters cannot be read	as 65xy
69xy		
80xy	general hardware fault	let manufacturer conduct maintenance
81xy	flash memory cannot be initialized completely	as 65xy
82xy	due to grave fault in the flash memory, this has been completely deleted	as 60xy
83xy 84xy 85xy 86xy 87xy		

Tab. 13 Instrument error messages

- 1 During download of a configuration, it can take up to 2 minutes until the data is stored in the failproof flash memory. In case of power failure during this time, not all configuration parts will be found upon starting.

Fault legend

xy	Fault description (refers to flash memory in unit)
0	CRC error when reading a block
1	no free block is found during writing
2	an invalid block number is output during a function call-up
3	a much bigger address offset is stated during a function call-up
4	the flash memory is faulty
5	the flash memory is not available
6	(memory) block not found
7	the stated files were not found
8	(memory) block cannot be deleted
9	power failure
10	power failure during initialization
20	(memory) block content cannot be deleted
21 - 24, 29	incorrectible errors have been made during writing
26	type of memory card invalid
27, 35	no memory card found
28	write protection for memory card active
30	no free storage space available
31 - 34, 36, 39	internal fault
37	read file on memory card is faulty
38	required utility is not available

Tab. 14 Fault legend

Fault messages in the controller self-tune mode

The fault is output in the form

S.Par.Err.X

Here is **X** the fault numbers 1 to 5:

Fault number	Faulty behaviour	Recommendation
1	<p>general errors</p> <p>the conditions for a fault-free processing of the self-tune mode are not provided, however, it cannot be clearly determined, if there is any faulty behaviour</p>	restart the self-tuning exercise
2	<p>rauschband</p> <p>the rauschband determined by the unit itself at the beginning of self-tuning has turned out to be too small in the course of the self-tuning exercise, this is then the case when interferences greatly increase during self-tuning</p>	restart the self-tuning exercise
3	<p>change of control variable</p> <p>to be able to analyse the controlled system behaviour, there is too little movement in the controlled system</p>	the Definable output variable change should be increased
4	<p>time overflow</p> <p>in the controlled system, no movement was determined for a period of 10 hours</p>	the measured value wiring and configuration should be checked for errors, if there are no errors, then the controlled system cannot be identified, due to a too great dead time
5	<p>no relaxation</p> <p>within a time window, no relaxation of the controlled system can be perceived, a stationary condition of the controlled system is however necessary for identification</p>	exit the self-tune mode and switch the control loop to "Manual", wait until the controlled systems no longer show any "visible" movements, restart the self-tuning exercise
6	only for Selftune2	

Tab. 15 Error messages of the controller self-tune mode

Error messages of the input/output level

On switching on the supply voltage, the unit checks the calibration data for the inputs and outputs. If during this, errors are discovered, these are output in clear text.

Error text	Error description	Remarks for error remedy
E_AI01CONFI 3	at least one calibration of AI01 has infringed upon the lower alarm threshold only the values required according to configuration AI01-Q01 are checked here	configured mA- or thermocouple input, the signal transmitters can be recalibrated by way of the front panel, in case of Pt100 input, the calibration must be made by the manufacturer
E_AI01CONFI 4	at least one calibration value of AI01 has infringed upon the upper alarm threshold only the values required according to configuration AI01-Q01 are checked here	as E_AI01CONFI 3
E_AI02CONFI 3	at least one calibration value of AI02 has infringed upon the lower alarm threshold	since AI02 can only be configured as mA input, it can be recalibrated via the front panel with the appropriate signal transmitters
E_AI02CONFI 4	at least one calibration value of AI02 has infringed upon the upper alarm threshold	as E_AI02CONFI 3
E_BIOCONFI 3	at least one calibration value from BIO01 to BIO04 has infringed upon the lower alarm threshold	the calibration must be done by the manufacturer
E_BIOCONFI 4	at least one calibration value from BIO01 to BIO04 has infringed upon the upper alarm threshold	as E_BIOCONFI 3

Tab. 16 Error messages of the input/output level

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General menu overview

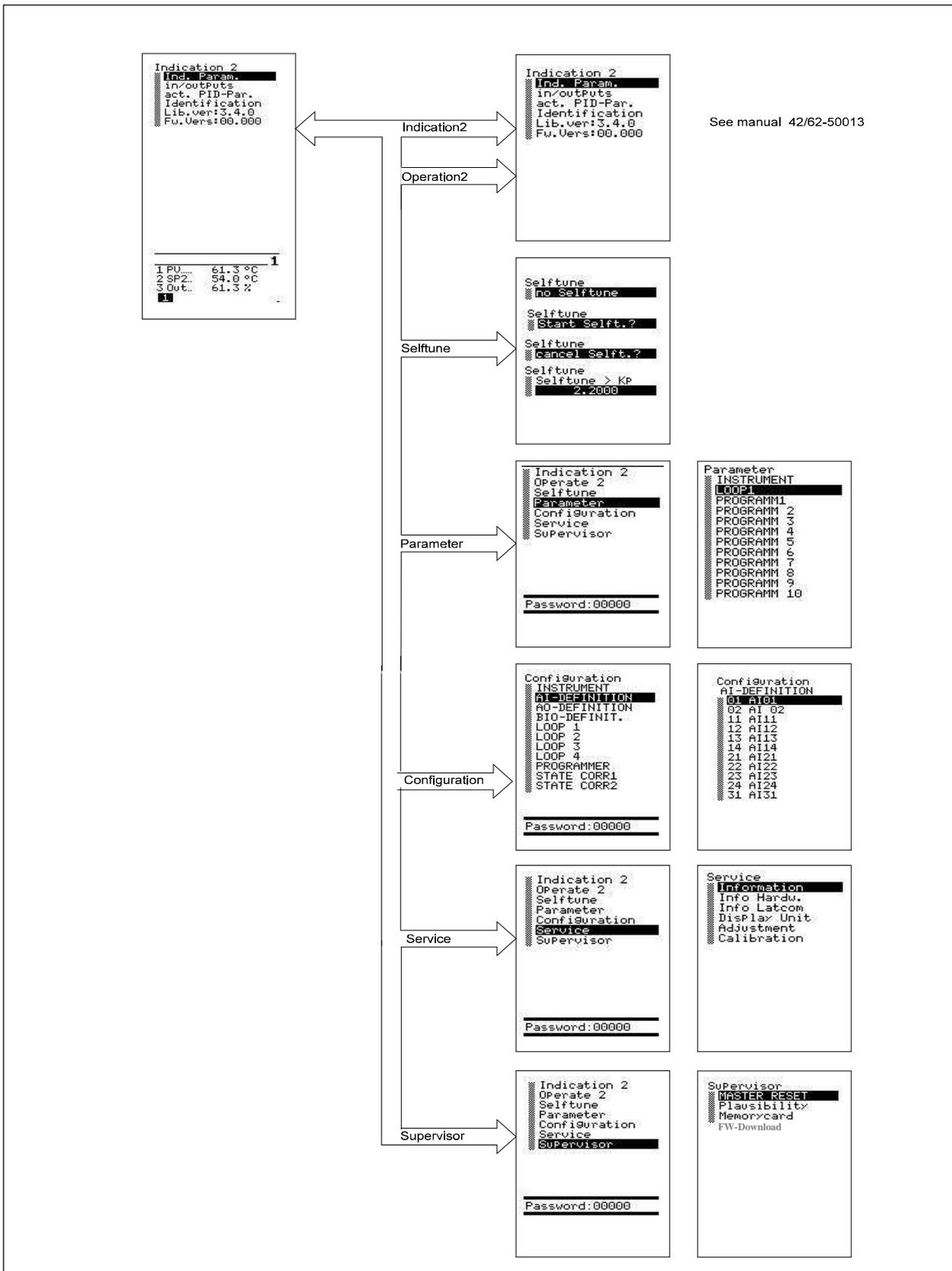


Fig. 95 General menu overview

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