Operating instructions for
Intelligent Positioner 1436 **c**Pos

Positioner 1436 cPos

Operating instructions

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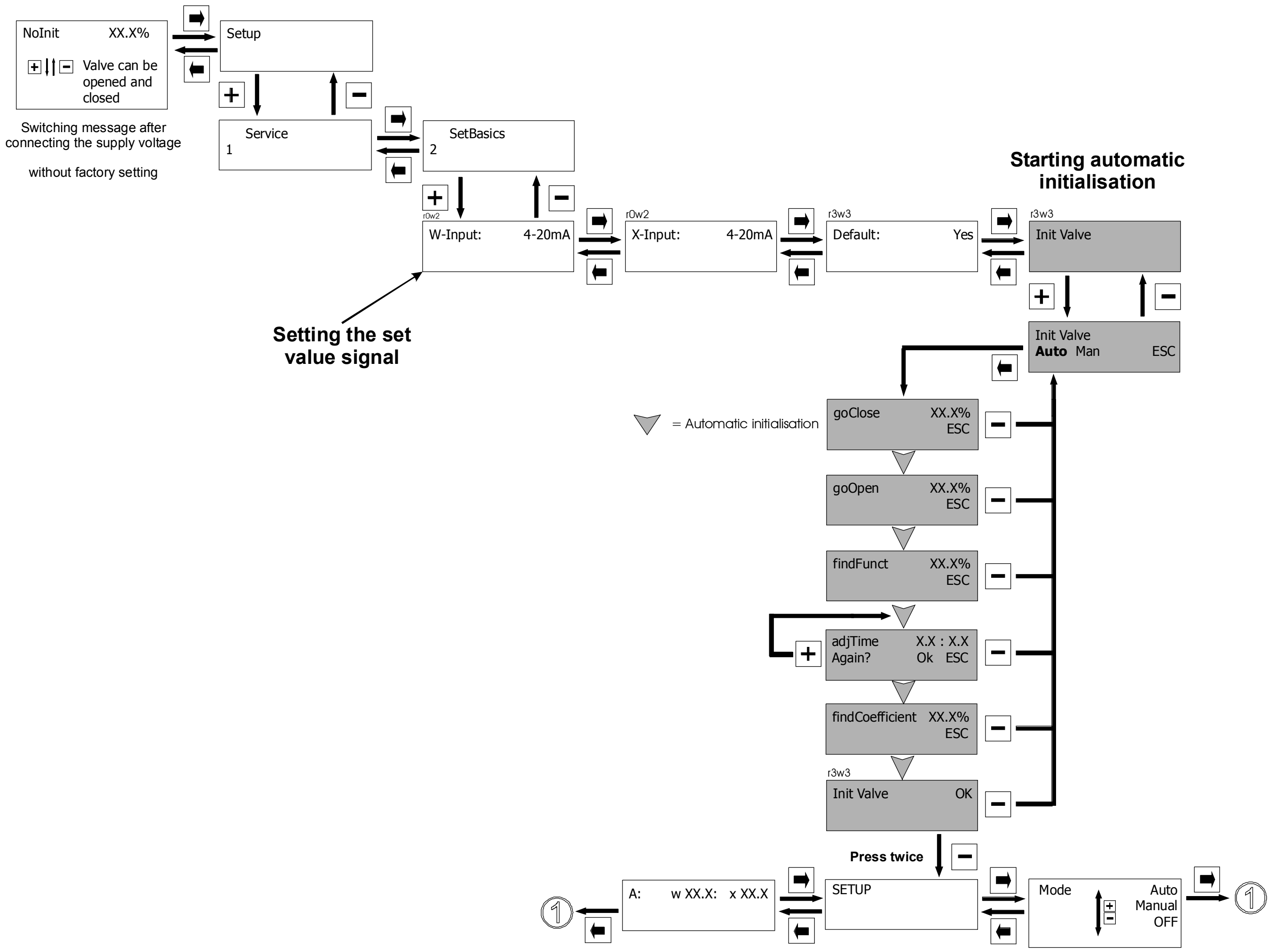
Quick commissioning of the GEMÜ cPos 1436:

Prerequisites:

- **Mounted to the valve**
- **Air supply, max. 7bar, connected**
- **Supply voltage 24V DC connected**
- **Set value and actual value signals need not be present**

For correct commissioning proceed as described in the following flow chart:



CONTENTS

1. Safety instructions

Please read the following safety instructions carefully and observe them!

1.1. General information

Important requirements to ensure the perfect function of this GEMÜ 1436 **c**Pos :

- Proper transport and storage
- Installation and commissioning by trained staff
- Operation according to these operating instructions
- Correct maintenance

The GEMÜ 1436 cPos must be used according to these directions. All information in these operating instructions regarding operation, servicing and maintenance must be observed and applied. If the information is not observed, the operator's guarantee rights and the manufacturer's legal liability cease. The manufacturer shall undertake no responsibility for the GEMÜ cPos 1436 if these safety instructions are not fulfilled.

Therefore, you must observe:

- the contents of these operating instructions
- the relevant safety regulations for the installation and operation of electrical systems
- that this device must not be used in explosion-endangered areas.

The regulations, norms and guidelines named in these instructions are only applicable in Germany. If the GEMÜ 1436 **c**Pos is used in other countries, the local regulations must be observed. When dealing with harmonised European norms, standards and guidelines, these apply within the Single European Market, the operator must also adhere to national rules if applicable.

The descriptions and instructions in these safety instructions refer to the standard design. The safety instructions do not take into account

- coincidences and events that may occur during assembly, operation and servicing
- local safety regulations which must be adhered to by the operator - also with respect to any additional assembly personnel

If you have any questions, please do not hesitate to ask your closest GEMÜ sales office.

1.2. Explanation of symbols and signs

Important information is identified in these operating instructions by the following symbols:

Danger

This symbol indicates danger.
There is **danger to life or health of persons** and/or **considerable material damage** can occur, if the instructions given here are not followed.

Slight bodily injury and **material damage** can occur, if the safety instructions given in connection with this symbol are not observed.

This symbol indicates notices which give important information regarding your GEMÜ 1436 **c**Pos.

1.3. Safety information

Danger

- Only qualified and trained staff should assemble, electrically connect and commission the GEMÜ 1436 **c**Pos.
  Use qualified staff for operation, servicing, inspection and assembly.
  The areas of responsibility should be defined precisely and the monitoring of the staff and their competence carried out by the operator.
  Train staff that have insufficient knowledge or, if necessary, have them trained by the manufacturer / supplier of the GEMÜ 1436 **c**Pos on order by the operator.
  Ensure that all staff understand the safety instructions.
- Ensure the electrical safety of the host devices.
- Ensure that the electrical values are correct.

If the safety instructions are disregarded then persons, the environment and GEMÜ 1436 **c**Pos may be endangered. Furthermore, failure to observe the safety instructions may lead to a complete loss of claims rights.
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Adhere to legal regulations!

1.4. Correct use

The GEMÜ 1436 **c**Pos is suitable for use according to the data sheet.

In order to obtain correct product function, the following instructions should be observed and the information on the product labels must also be complied with.

If these instructions and the general operating instructions are not observed, the guarantee for the GEMÜ 1436 **c**Pos and the legal liability expires.

The GEMÜ 1436 **c**Pos serves solely as a positioner and process controller and must be used according to the data sheet.
Any other or additional use is regarded as contrary to regulations and GEMÜ shall not be liable for any consequential damage. The user carries sole risk.

Please pay attention to the pertinent technical safety regulations when planning both the use and operation of the device. The designer, plant constructor or operator is always responsible for positioning and installation of the GEMÜ 1436 **c**Pos.

1.5. Information on use in damp conditions

The following information is intended to help when assembling and operating the GEMÜ 1436 **c**Pos in damp conditions.

- Lay cables and and pipework so that condensate and rain water that remains on the pipework/cables cannot enter the cable glands of the M12 plugs of the GEMÜ 1436 **c**Pos.
- All cable glands of the M12 plugs and fittings must be checked for tightness.

The GEMÜ 1436 **c**Pos 6 may not be cleaned with a high pressure cleaning device because the protection class IP65 is not sufficient for this.

1.6. Mounting position

The mounting position of the GEMÜ 1436 **c**Pos is optional. When mounted upside down it must be ensured that no liquids or dirt can enter the outlet of the pressure relief valve.

1.7. Tools needed for installation and assembly

The tools needed for installation and assembly are not included in the scope of delivery.

2. Manufacturer's Information

2.1. Supply

Check whether the equipment is complete and undamaged immediately after receipt.
The items in the delivery are detailed in the shipping documents.
Use the order numbers to check whether the type and scope has been delivered as ordered.
If the GEMÜ 1436 **c**Pos positioner is ordered as a complete unit with a valve, these parts and the accessories belonging to them are supplied ready assembled and factory set.
The GEMÜ positioner is then ready for immediate operation.

2.2. Function

The GEMÜ 1436 **c**Pos is an intelligent electropneumatic positioner that can be attached to pneumatic actuators. It can be operated as a positioner or a process controller depending on the design.
Normally the GEMÜ 1436 **c**Pos is attached directly to the actuator. The travel sensor is already integrated in the positioner (the GEMÜ 1436 **c**Pos can be optionally ordered with an M12 cable plug for the external attachment of the travel sensor).
The travel sensor measures the current valve position and registers it to GEMÜ 1436 **c**Pos electronics. It compares the actual valve value with the preset set value and readjusts it if it varies too much from the standard tolerance.

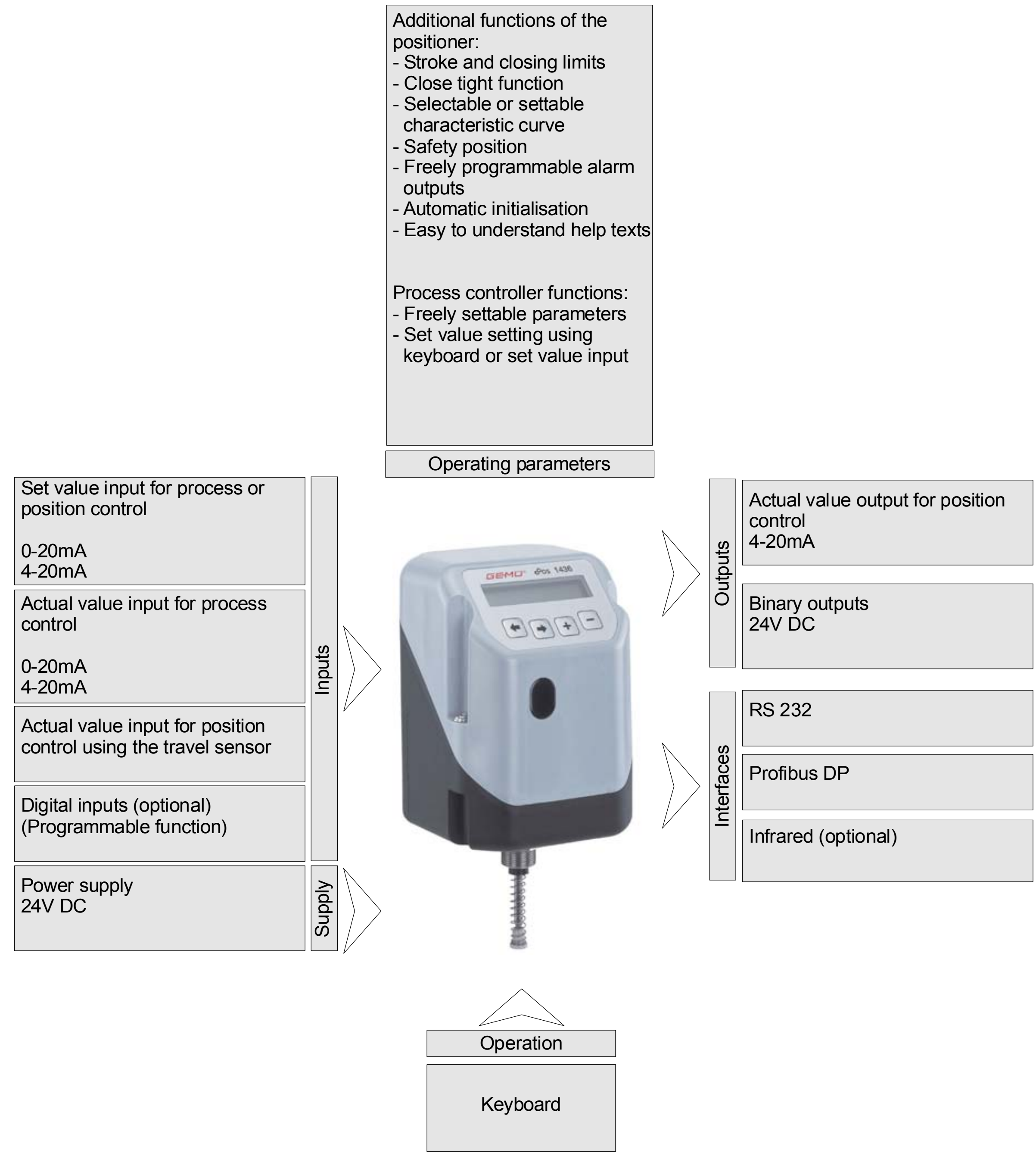
If the positioner is ordered with an additional process controller (optional), a current actual value signal (e.g. level, pressure, temperature, flow) is evaluated and the positioner adopts the function of a process controller.

The information required can be called-up on the two-line display of the GEMÜ 1436 **c**Pos. Self-explanatory help texts that explain the meaning of the parameters called-up are also displayed.
The GEMÜ 1436 **c**Pos is operated using four keys.

2.3. Safety function

The GEMÜ 1436 **c**Pos has a safety function which ensures that the outlets are vented during a pneumatic and electrical power supply failure.
This safety function, however, is not a substitute for necessary plant-specific safety facilities.
The GEMÜ 1436 **c**Pos is not a safety control system.

3. Schematic diagram of the inputs and outputs



4. Mechanical mounting

4.1. Mounting to linear actuators

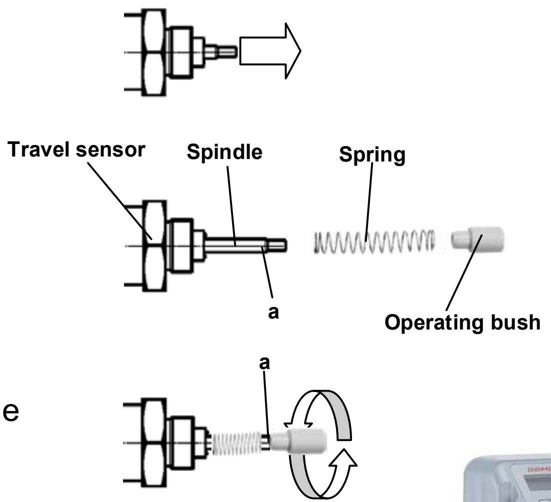
4.1.1. Preparation of the valve actuator

- The actuator must be in the zero position (actuator vented).
- Should there be an optical position indicator in the actuator (a red spindle), it must be removed.

4.1.2. Mounting the travel sensor

Warning: Damage to the spindle surface may lead to failure of the travel sensor!

- Pull out the spindle of the travel sensor up to the limit stop
- Push the spring over the spindle
- Fix the spindle at point **"a"** **(the spindle must not be damaged during this process)**
- Screw the operating bush onto the spindle

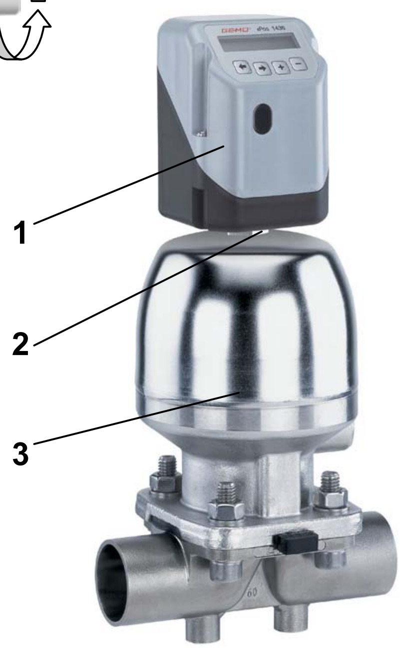


4.1.3. Mounting the positioner

- Place the positioner (1) onto the actuator and fix it to the travel sensor (3) using a suitable M27 wrench.

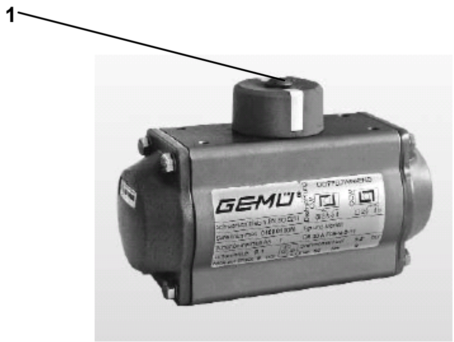
The positioner must not be fixed by turning the housing as this may result in the danger of overturning the internal stop.

If correctly mounted to the valve, the positioner can be turned 370° (before hitting an internal stop)



4.2. Mounting to quarter-turn actuators

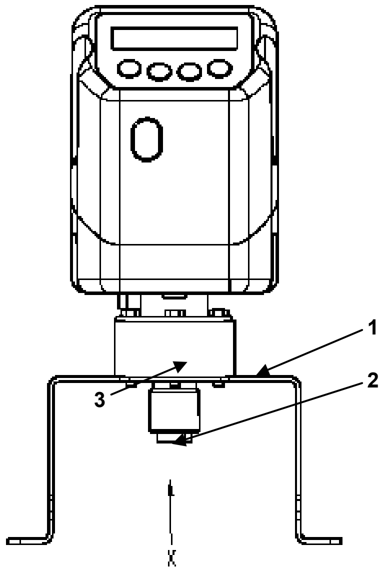
4.2.1. Preparation of the valve actuator



- The actuator must be in the zero position (actuator vented).
  Double acting actuators should be moved to the valve closed position.

- Remove the screw (1) which retains the optical position indicator
- Check turn direction of the actuator

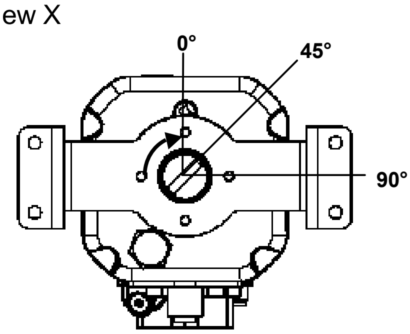
4.2.2. Mounting the travel sensor



- Before mounting the travel sensor to the actuator, make sure that the shaft height and the hole pattern in the actuator match the dimensions of the mounting bracket (1).
- The potentiometer shaft is marked.
  If this marking is exactly positioned at the cable exit, the potentiometer is in mid position.
- The potentiometer range is 45° left and right of the mid position.

4.2.3. Mounting the positioner

View X



- Place the adapter (3) on the shaft of the potentiometer
- Turn the adapter to the position 0°
- Place the positioner with the travel sensor and mounting bracket on the actuator.
- The adapter lug (2) must engage in the actuator shaft groove.
- The turn direction of the actuator must be the same as that of the travel sensor.
- Attach the mounting bracket (1) to the actuator with the enclosed screws.

4.2.4. Checking the mounted assembly

- Connect the positioner to power and air supply
  (see page 15)
- The following message is displayed:

```
NoInit        XX.X%
```

The mounted actuator can be moved to the OPEN and CLOSED positions using the + and − keys.

The displayed valve position must be between 0% and 100% .
If the displayed valve position is not within the range of 0% and 100%, the mechanical mounting must be checked again.

4.3. External mounting to linear and quarter-turn actuators

4.3.1. Preparation of the valve actuator

Please refer to chapters **4.1.1.** and **4.2.1.**

4.3.2. Mounting the travel sensor

Please refer to chapters **4.1.2.** and **4.2.2.**

4.3.3. Checking the mounted assembly

Please refer to chapters **4.2.4**

4.3.4. Mounting the mounting bracket

- Push the positioner connection adapter through the hole in the mounting bracket and attach it with the enclosed nut.
- Use the bolt holes and appropriate fixings to attach the mounting bracket securely.

Ensure adequate stability of the base used for attachment.
The positioner must be protected against mechanical stress by the operator.
Do not use the positioner as a climbing support.

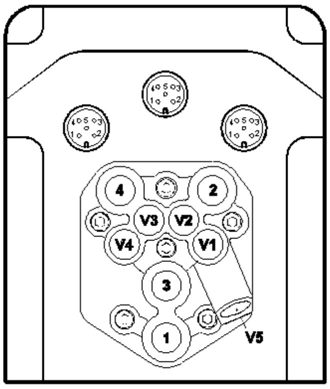
4.3.5. Connecting the travel sensor

The 5 pin M12 travel sensor plug must be connected to the 5 pin positioner socket.

5. Pneumatic connections

- Make the connection between pneumatic positioner outlet A1 (single acting) or A1 and A2 (double acting) and the pneumatic actuator air control inlet.
- Connect the control air supply (additional air) to the air supply connection (1) (max. 7 bar)

Caution: observe max. actuator control pressure!

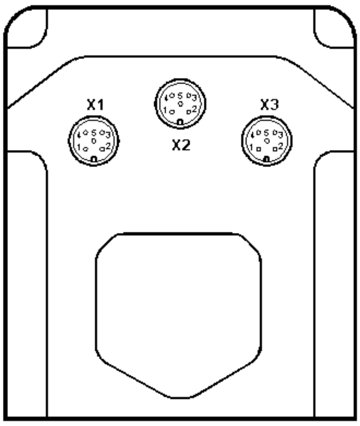


Connection	Description
1	Air supply connection
3	Venting connection G1/8 with a silencer
V1	Additional air throttle for A1
V2	Outgoing air throttle for A1
V3	Outgoing air throttle for A2
V4	Additional air throttle for A2
V5	Non-return valve
2	Working connection for process valves c.f. 1 and 2 (A1)
4	Working connection for process valve c.f. 3 (A2)

All pneumatic connections are G1/8

6. Electrical connections

- Connect analogue input (set value input) 0/4-20mA to plug X3.
- Connect supply voltage 24V DC to plug X1.
- If operating as a process controller, connect analogue input (actual value input) 0/4-20mA to plug X3.



Connection	Pin	Signal name
X1	1	Uv, 24VDC Supply voltage
M12 Plug	2	Make-contact, output K1, 24VDC
A coding	3	GND
	4	Make-contact, output K2, 24VDC
	5	Digital input 1 (optional)

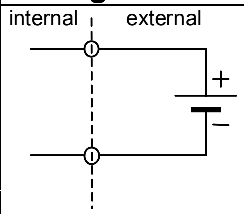
Connection	Pin	Signal name	
X2	1	I+, Actual value output	4-20mA
M12 Plug	2	I-, I Actual value output	Internal supply
B coding	3	RxD , Receive Data, RS232	
	4	TxD, Transmit Data, RS232	
	5	GND, RS232	

Connection	Pin	Signal name	
X3	1	I+, Set value input	
M12 Plug	2	I-, Set value input	
A coding	3	I+, Actual value input	when operated as
	4	I-, Actual value input	process controller
	5	Digital input 2 (optional)	

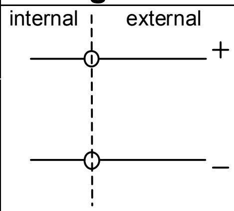
6.1. Connection assignment of M12 plug for external travel sensor

Anschluss	Pin	Signalname
X4	1	U +, Potentiometer signal voltage plus
M12 Socket	2	U , Potentiometer signal output
A coding	3	U -, Potentiometer signal voltage minus
	4	n.c.
	5	n.c.

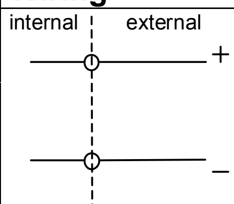
6.2. Supply voltage

Plug	Pin	Signal name	Wiring
X1	1	24V DC supply voltage	 24V DC supply voltage
X1	3	GND	

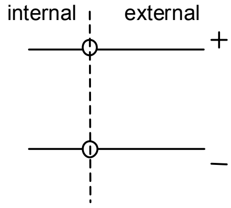
6.3. Set value input (only effective for AUTO operating mode)

Plug	Pin	Signal name	Wiring
X3	1	I+ , set value input	 0/4 – 20mA
X3	2	I -, set value input	GND

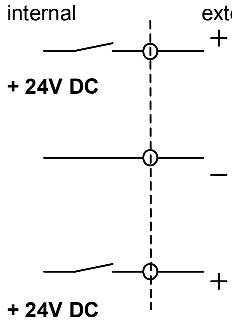
6.4. Actual value input (sensor signal when operating as a process controller)

Plug	Pin	Signal name	Wiring
X3	3	I+ , actual value input	 0/4 – 20mA
X3	4	I - , actual value input	GND

6.5. *Actual value output*

Plug	Pin	Signal name	Wiring
X2	1	I+ , actual value output	 + 4-20 mA (internal supply)
X2	2	I - , actual value output	− GND

6.6. *Outputs*

Plug	Pin	Signal name	Wiring
X1	2	Output K1	 + 24V DC voltage
X1	3	GND	− GND
X1	4	Output K2	+ 24V DC voltage

The output function can be switched from NO (make-contact) to NC (break-contact) using menu item **3 SetFunction – K1 Switch/K2 Switch** (pages 33/49).

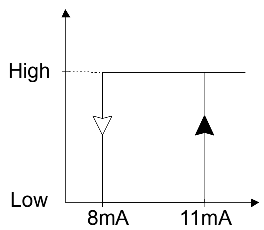
6.7. Digital inputs

GEMÜ cPos 1436 provides the option of using the actual value and set value inputs as digital inputs under certain conditions.
The wiring information under **6.7.1** only applies when the GEMÜ 1436 **c**Pos is supplied without the optional digital input card.

6.7.1. Use of actual value and set value inputs as digital inputs

The actual value and set value inputs can be used as digital inputs under the following conditions:

Control system	**Operating mode**	**Set value input as digital input "In W"**	**Actual value input as digital input "In X"**
Positioner	AUTO		✓
Positioner	MANUAL	✓	✓
Process controller	AUTO		
Process controller	MANUAL	✓	



In order to address the two digital inputs "In W" and "In X" a resistor (R=1.2KΩ ±5%) must be connected in series with the input according to the wiring diagram. The switching levels are > 11mA for a High-Signal and < 8mA for a Low-Signal

Special wiring – Use of set value input as digital input "In W"

Plug	**Pin**	**Signal name**	**Wiring**
X3	1	I+ , Set value input	Internal, external, +, R=1.2KΩ ±5%, Pv=1W, 24V DC voltage (e.g. digital output PLC)
X3	2	I -, Set value input	–, GND

Special wiring – Use of actual value input as digital input "In X"

Plug	**Pin**	**Signal name**	**Wiring**
X3	3	I+ , Actual value input	Internal, external, +, R=1.2KΩ ±5%, Pv=1W, 24V DC voltage (e.g. digital output PLC)
X3	4	I -, Actual value input	–, GND

6.8. Digital inputs (optional)

The GEMÜ cPos 1436 has four digital inputs when a digital input card is installed.

It is possible to use the actual value and set value inputs as digital inputs under the following conditions:

Control system	Operating mode	Set value input as digital input "In W"	Actual value input as digital input "In X"
Positioner	AUTO		✓
Positioner	MANUAL	✓	✓
Process controller	AUTO		
Process controller	MANUAL	✓	

Use of set value input as digital input "In W"

Plug	Pin	Signal name	Wiring
X3	2	I- , Set value input	Internal / external: + High-Level (14...28V DC) Low-Level (0...8V DC)
X1	3	GND	– GND

Use of actual value input as digital input "In X"

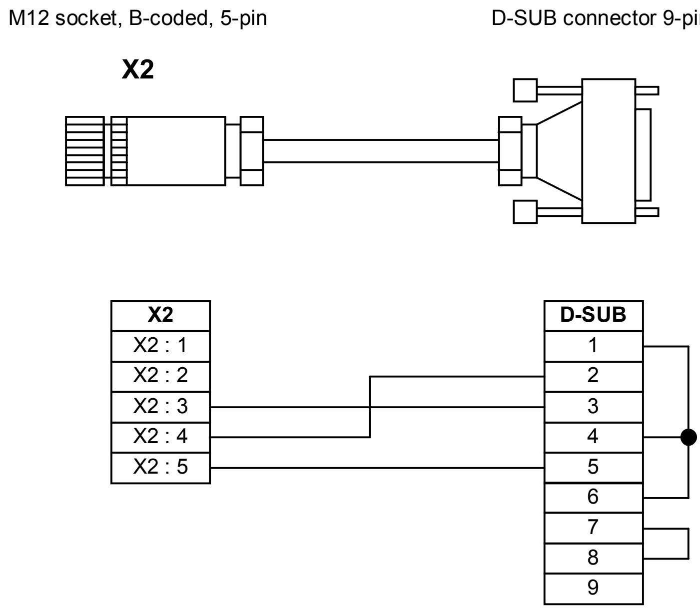
Plug	Pin	Signal name	Wiring
X3	4	I- , Actual value input	Internal / external: + High-level (14...28V DC) Low-level (0...8V DC)
X1	3	GND	– GND

Digital inputs 1 and 2

Plug	Pin	Signal name	Wiring
X1	5	Digital input 1	Internal / external: + High-level (14...28V DC) Low-level (0...8V DC)
X1	3	GND	– GND
X3	5	Digital input 2	+ High-level (14...28 DC) Low-level (0...8V DC)

6.9. RS232 interface

Plug	Pin	Signal name	Wiring
X2	3	RxD; Receive data	
X2	4	TxD, Transmit data	
X2	5	GND	



7. Operation

7.1. Operating and display elements

7.2. Menu levels

The GEMÜ **c**Pos 1436 uses two menu levels. These are the working and configuration levels.

7.2.1. Working level

The GEMÜ 1436 **c**Pos is automatically at this level after the supply voltage is switched on. The menu item **Mode** can be used to select between the operating modes **A (Auto)**, **M (Manual)** and **OFF**.

M (MANUAL):
If **MANUAL** is selected and operated as a positioner, the valve can be opened and closed manually using the + and – keys.
If **MANUAL** is selected together with operation as a process controller, the set value can be changed manually using the + and – keys.

A (AUTO):
The positioner is triggered by an external set value signal when using the **AUTO** operating mode.
The positioner also processes an external actual value signal when operated as a process controller.

OFF:
If **OFF** is selected, the positioner is in pause mode and therefore does not react to signal changes.

7.2.2. *Configuration level*

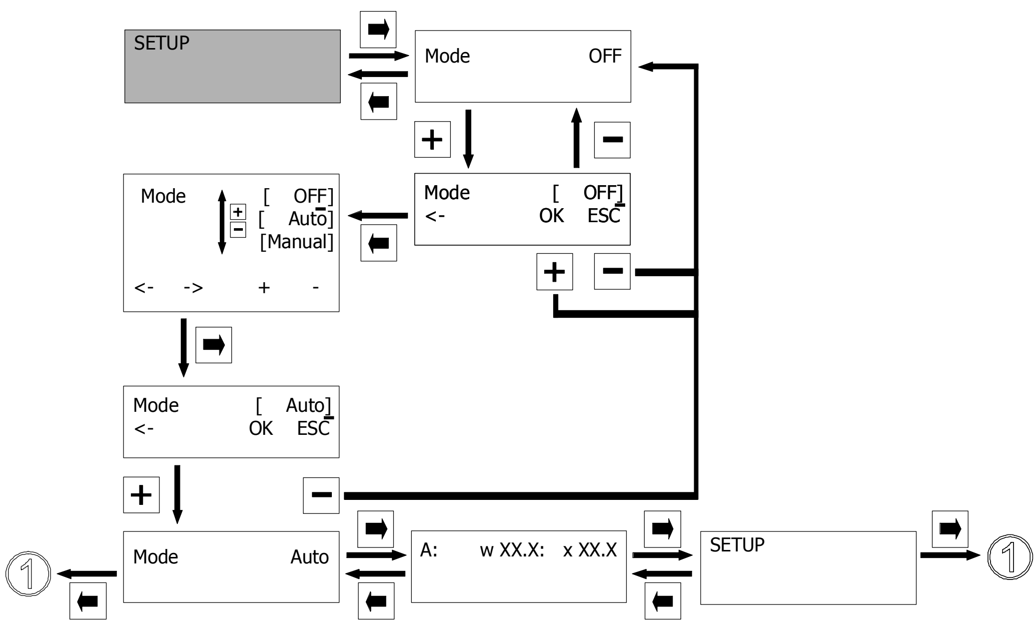
Various parameters can be set at this level (see parameter table, p. 31) in order to realise optimal adaptation to the application conditions.

8. Changing parameters

The keys ⬅ ➡ + − are used for the GEMÜ 1436 **c**Pos to select the various menus according to **11. Configuration menu** (page 29).
The changes to the parameters required are made using brackets that are put round the respective parameters.

Use the ⬅ or ➡ key to move the cursor onto the respective parameter and change it with the + and the − keys.

Example:
The operating mode is to be changed from **OFF** to **Auto**.



9. Commissioning

-Turn on the pneumatic air control supply (observe maximum control pressure for the positioner and the valve!)
-Switch on the 24V DC power supply [plug X1, pin 1 (+) and pin 3 (-)]
-Specify an analogue set value 0/4-20mA
-Specify an analogue actual value (only when operating as a process controller) 0/4-20mA

If the GEMÜ 1436 **c**Pos is *supplied from the factory ready mounted to a valve, it is already works preset (at a control pressure of 5.5 – 6bar) and therefore ready for operation. Re-initialisation (see page 24) is recommended if the system is operated under a different control pressure.*

9.1. General information

In order to be able to make changes to settings and parameters for the GEMÜ 1436 **c**Pos, no parts of the housing need be taken apart or opened!
All parameter settings remain, even after power failure.

9.2. Initial commissioning without factory setting (when supplied without a valve)

After assembly and all electrical and pneumatic connections, the positioner must be initialised.
While doing this, it is possible to choose between **automatic initialisation** and **manual initialisation**.

When connecting the supply voltage, the following message is displayed by GEMÜ 1436 **c**Pos after it has completed a short software check:

NoInit	XX.X%

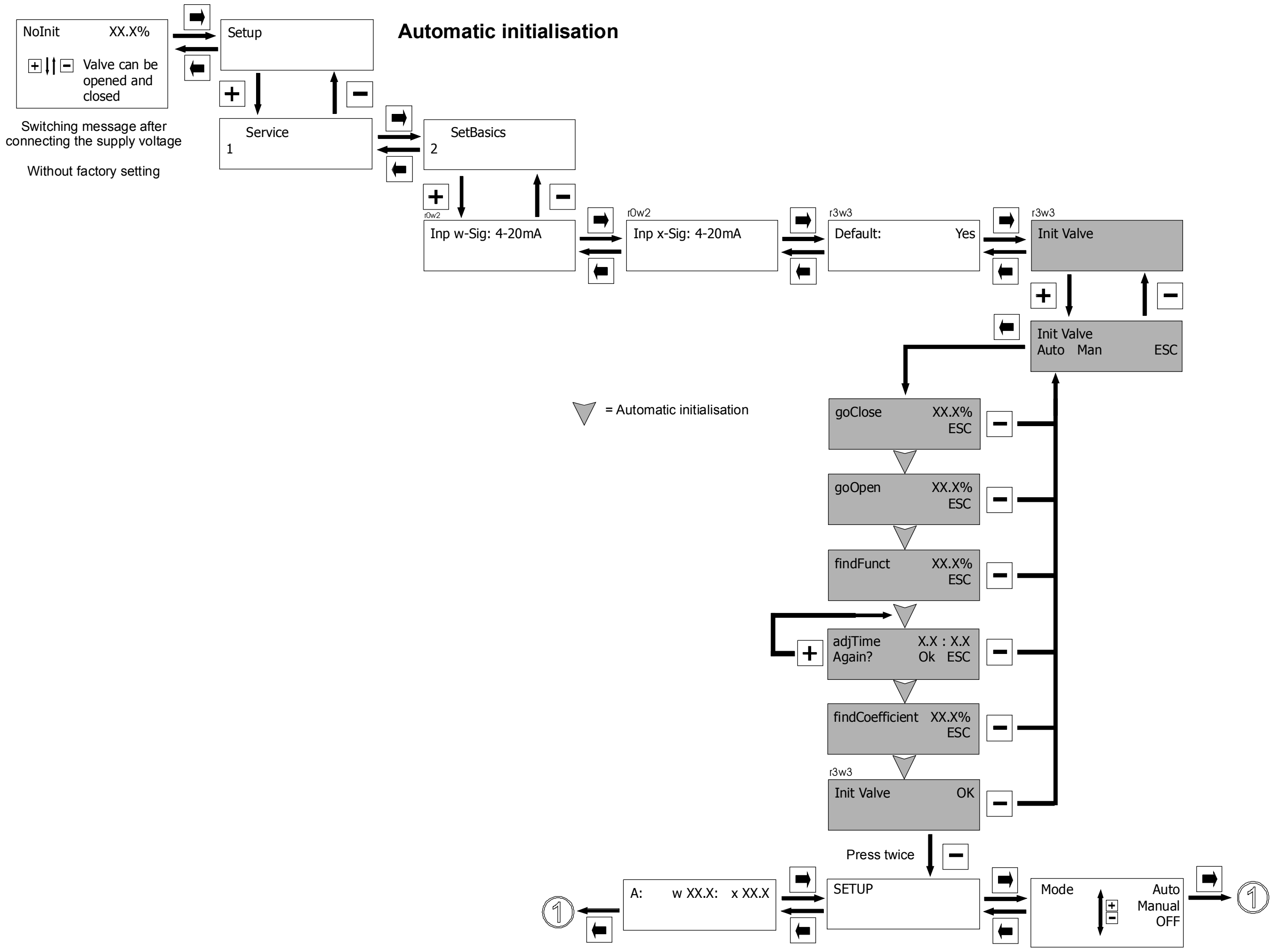
Use the **+** and **–** keys to open and close the valve.

9.2.1. Automatic initialisation

The positioner adapts to the valve when automatic initialisation is started. All parameters are automatically scanned.
This procedure can take a few minutes, dependent on the valve.

It may be necessary to close the internal positioner throttles a little (V1 and V2 for single acting actuators and V1, V2, V3 and V4 for double acting actuators) if the actuator volume is very low in order to increase the valve operating time.

Before commissioning, familiarise yourself with the operation of the GEMÜ 1436 cPos on page 22.



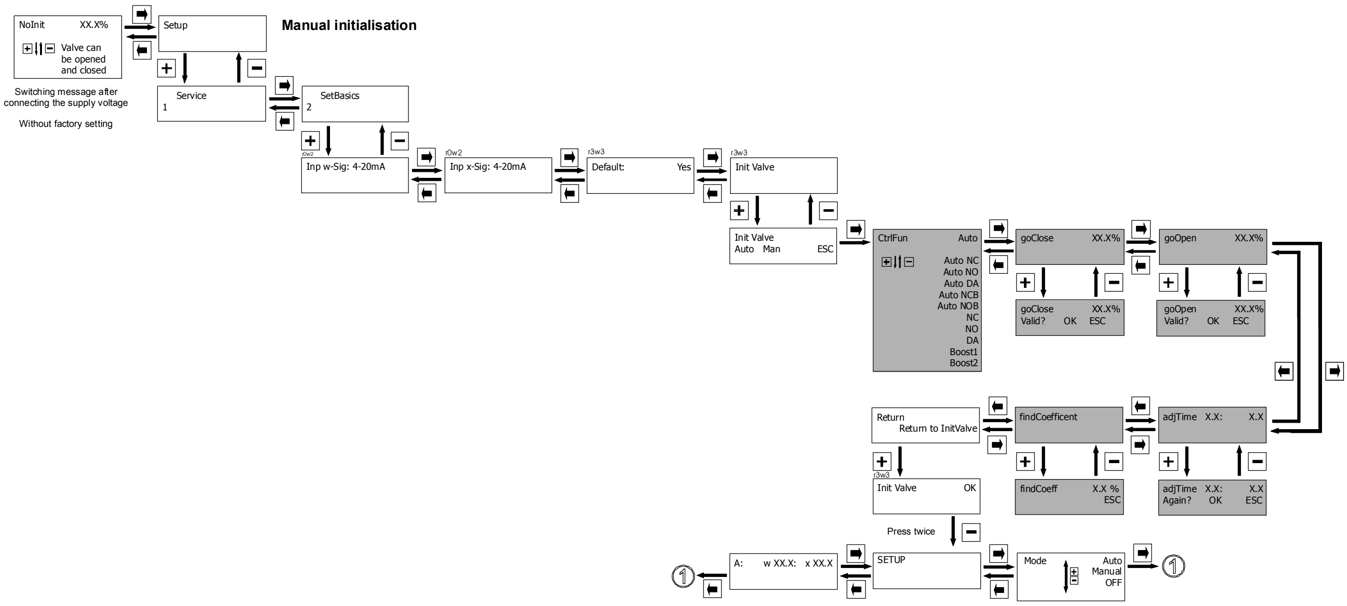
Tip for use:
During automatic initialisation of actuators whose travel is not continuous (i.e. with undefined stops) the end positions cannot be clearly detected.
In this case manual initialisation by the operator with sequential movement through the menu (see page 25) should be used.

9.2.2. Manual initialisation

When manual initialisation is started, the positioner runs through an initialisation program that is similar to the automatic initialisation. However the different program steps for the manual initialisation must be started and confirmed by the operator using the + key.

- Manual initialisation should only be used if the automatic initialisation does not achieve satisfactory control features.
- The menu items **goClose** and **goOpen** should be carried out several times for very small valve strokes in order to ensure an optimum adaptation of the positioner to the valve.
  It may be necessary to close the internal positioner throttles a little (V1 and V2 for single acting actuators and V1, V2, V3 and V4 for double acting actuators) if the actuator volume is very low in order to increase the valve operating time.
- In order to prevent incorrect operation, the parameters from manual initialisation are only accepted when they comply with the requirements for correct function.

Before commissioning, familiarise yourself with the operation of GEMÜ 1436 cPos on page 22.



9.2.3. Initialisation parameters

InitValve:
Automatic or manual initialisation (adaptation of the positioner to the valve) is started.

CtrlFn:
The control function type for the valve can be selected during manual initialisation.
Auto: Automatic control function search
NC: Control function 1 (normally closed)
NO: Control function 2 (normally open)
DA: Control function 3 (double acting)
Boost NC: Control function 1(for larger actuators, higher air volume)
Boost NO: Control function 2(for larger actuators, higher air volume)

goClose:
The closed valve position is scanned during initialisation.
It must be started with the **+ key** if initialising manually and then confirmed.

goOpen:
The open valve position is scanned during initialisation.
It must be started with the **+ key** if initialising manually and then confirmed.

findFnct:
(only available for automatic initialisation)
The valve control function and pilot valve configuration are determined.

adjTime:
(only displayed when "goOpen" and "goClose" were carried out)
The minimum operating times for the valve are scanned during initialisation.
These must be started with the **+ key** if initialising manually and then confirmed.

findCoefficient:
(only displayed if "adjTime" was carried out)
The valve is checked for control features at various positions between the end positions.

9.3. Initial commissioning with factory setting (positioner delivered mounted to the valve)

*If the GEMÜ 1436 **c**Pos was already fully mounted to a valve in the factory, it is already factory preset and therefore immediately operable. We recommend re-initialisation in order to compensate control pressure differences.*
Please proceed as described in item 9.2.1. on page 24.

When connecting the supply voltage, the GEMÜ 1436 **c**Pos emits one of the following two messages in its display after a short software check:

A: w XX.X: x XX.X	or	M: w XX.X: x XX.X

A:
Positioner in automatic mode

M:
Positioner in manual mode

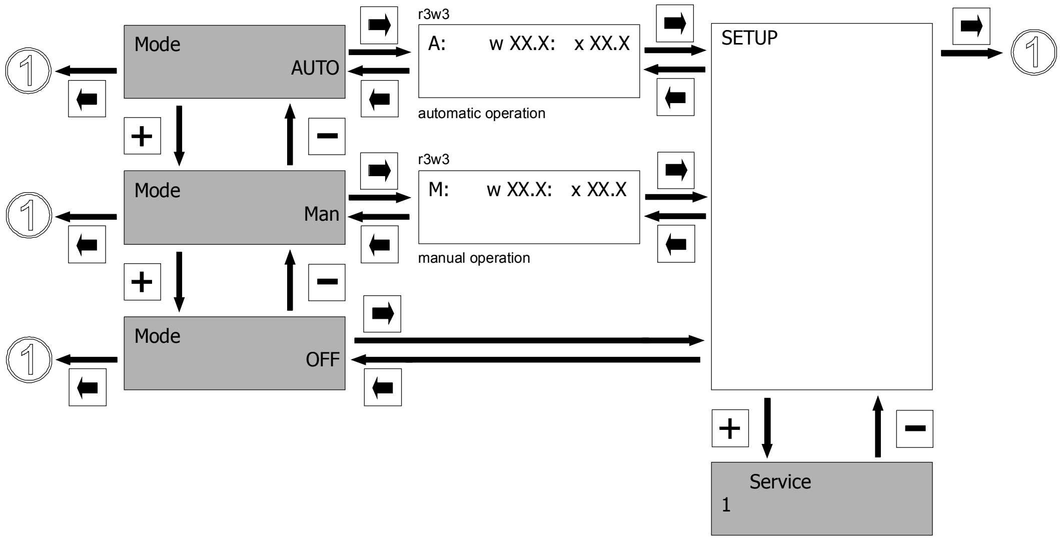
To switch between the operating modes, proceed according to **10. Operating modes** as described on the next page.

10. Operating modes

The GEMÜ 1436 **c**Pos uses the operating modes **A: AUTO**, **M: MANUAL** and **OFF**.

10.1. Operating mode selection

Selection of the operating mode and entering the configuration menu is carried out in the following menu.



10.2. Automatic operation (A:)

Automatic operation is the normal operating mode. The initialised positioner reacts to set value changes and adjusts the valve accordingly.

The **+** and **-** keys have no function in this operating mode.

When operating the device as a positioner, the display on the top left-hand side is operating mode (A), in the middle the current set value (w) and on the top right-hand side the current valve position (x) as a percentage.
When operating the device as a process controller, the display on the top left-hand side is operating mode (A), in the middle the current set value (w) and on the top right-hand side the current actual value (x) of the externally connected process sensor.

10.3. Manual operation (M:)

In manual operating mode as a positioner, the valve can be opened and closed manually using the + and – keys.
In manual operating mode as a process controller the set value can be changed manually using the + and – keys.

10.4. Pause mode (OFF)

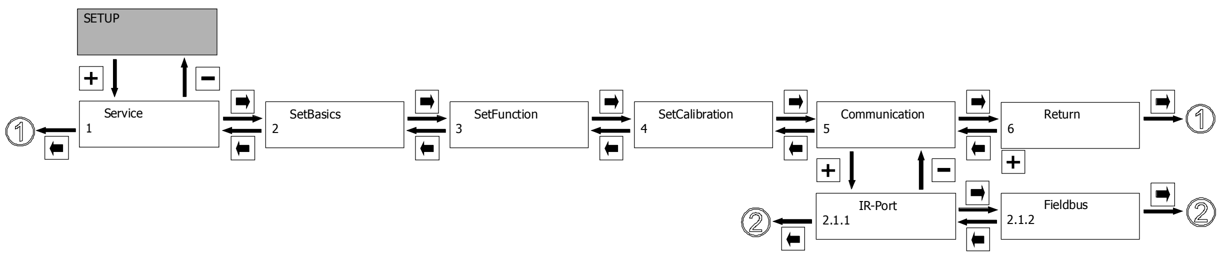
If switched to OFF, the positioner is in pause mode and then does not react to any changes to the input signals.

11. Configuration menu (Setup)

Various parameter values of the GEMÜ 1436 **c**Pos can be changed in the configuration menu. The parameter name appears in the top left line of the display and the parameter value on the right.
In order to enable immediate use of the GEMÜ 1436 **c**Pos, the most common values were entered as factory settings.

The sub-menus which are only required for the process controller are only available for the design with integrated process controller (PA01).

The relevant sub-menus are highlighted in grey.



The configuration menu consists of five sub-menus with the following functions:

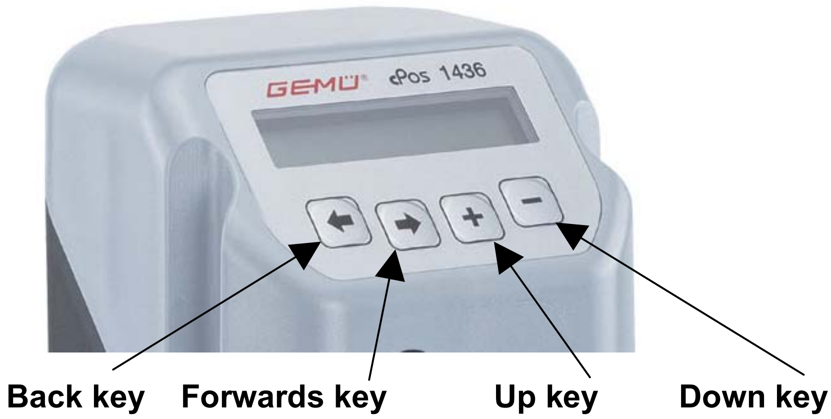
1. Service	This menu enables the reading-off of all information regarding the positioner, the connected signals and errors that occur.
2. SetBasics	SetBasics is used to set the basic settings for the GEMÜ **c**Pos 1436 such as the initialisation, selection of input signals and resetting to factory settings.
3. SetFunction	The special positioner functions are activated or deactivated here and the control parameters set.
4. SetCalibration	SetCalibration is used to set the directions of action, characteristic curves, stroke limits and closing limits and error limit values.
5. Communication	The different communication options for the GEMÜ **c**Pos 1436 can be set here.

11.1. Changes in the configuration menu

Changes can be made to the factory settings according to the menu overview below.

Before making changes in the configuration menu, familiarise yourself with the operation of the GEMÜ 1436 cPos described on page 22.

In this case, the small squares ⬅ ➡ + − represent the GEMÜ 1436 **c**Pos keys that must be pressed to reach the next menu item or within the menu to the various settings.



11.2. Access authorisation in the configuration menu

In order to hinder unwanted changes to the parameter values, the configuration level of the GEMÜ 1436 **c**Pos is secured with three different access codes.

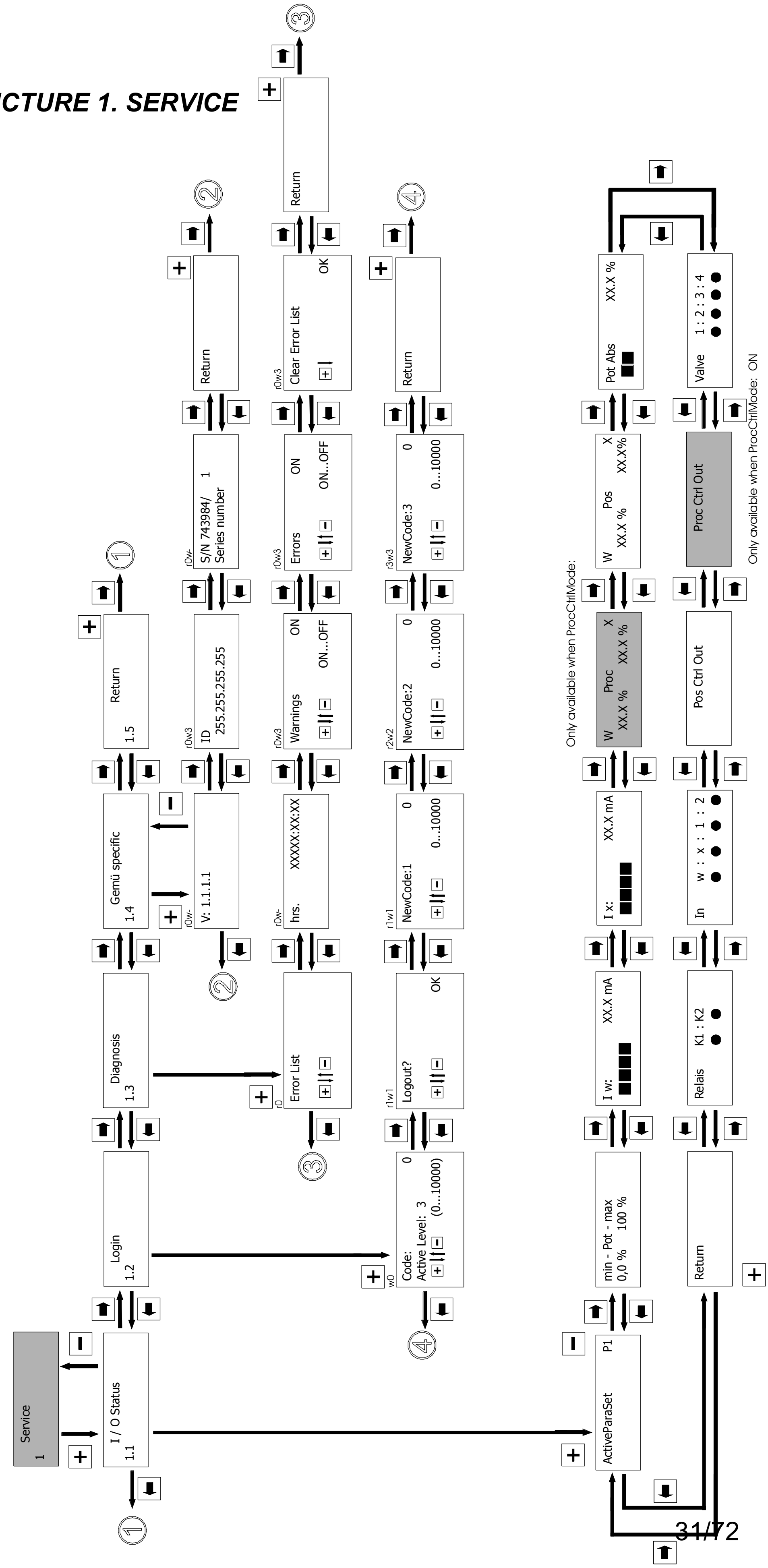
The factory code setting is as follows:

Code 1:	Password **0**	(New Code: 1)
Code 2:	Password **0**	(New Code: 2)
Code 3:	Password **0**	(New Code: 3)

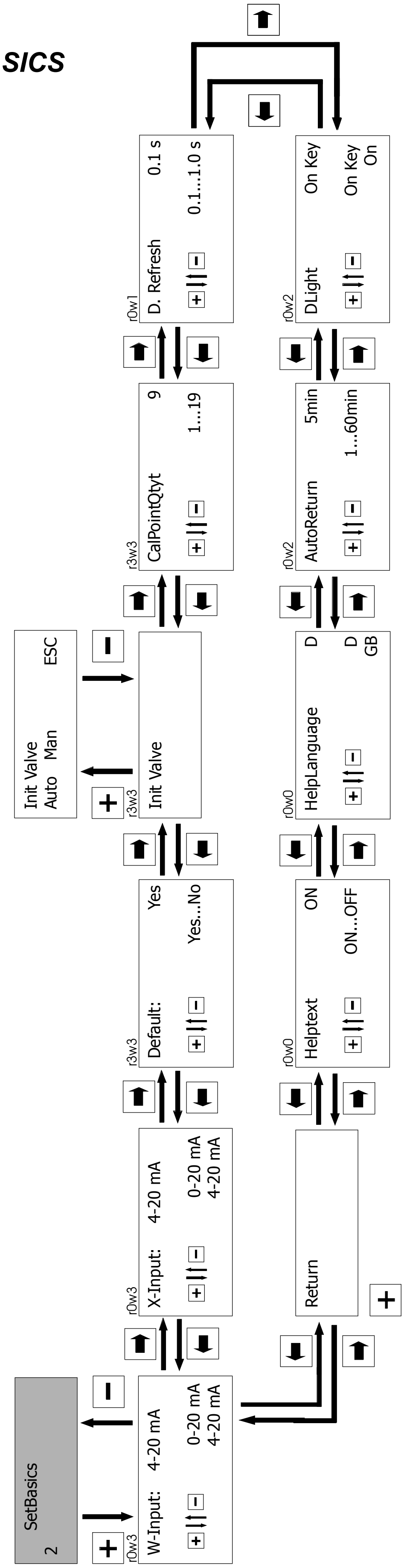
After entering the factory codes, these codes can be changed by the operator at any time. The access priorities needed are marked in the configuration menu.

In order to change the access codes, please refer to chapter **13.1.2. Activating or deactivating the user access** on page 40.

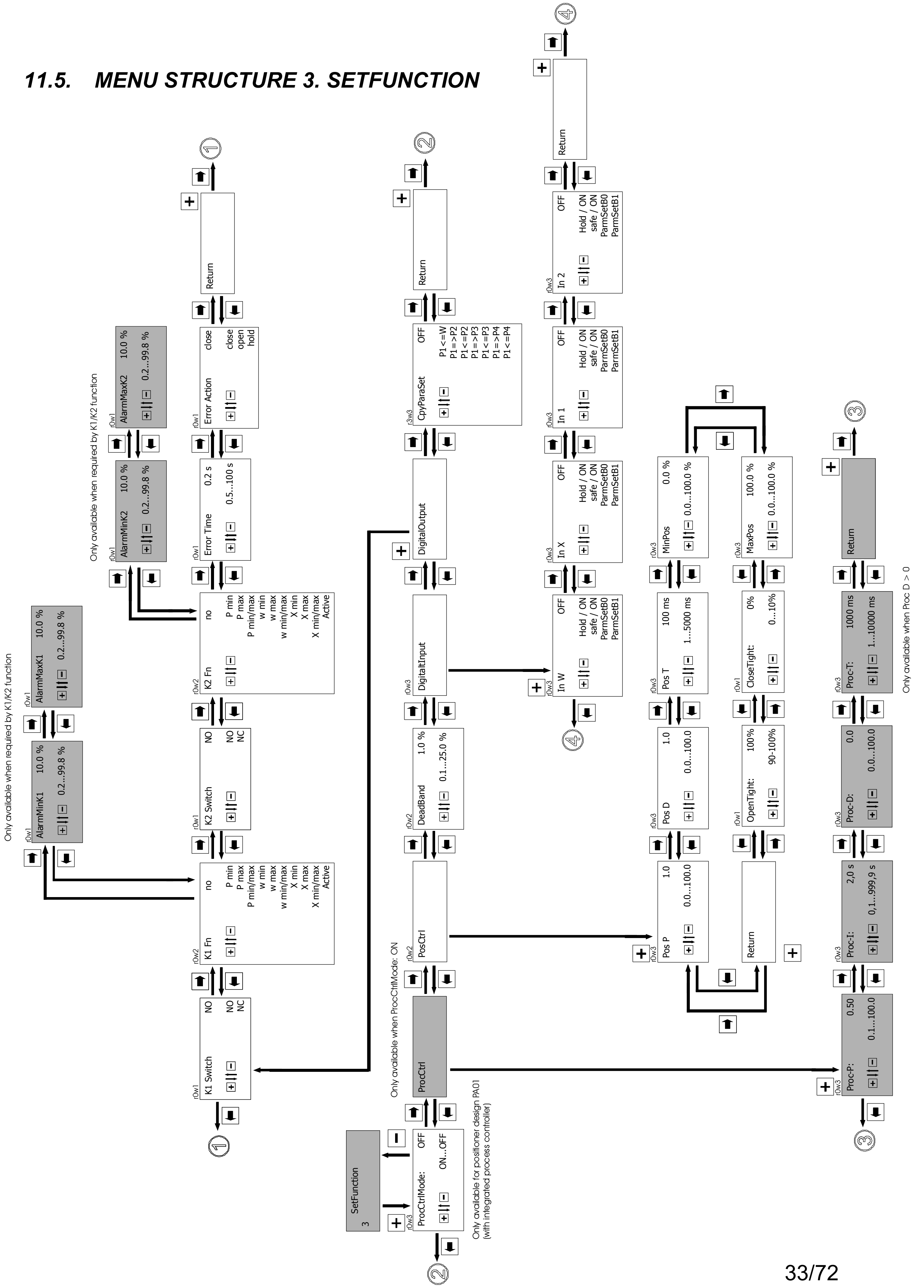
11.3. MENU STRUCTURE 1. SERVICE



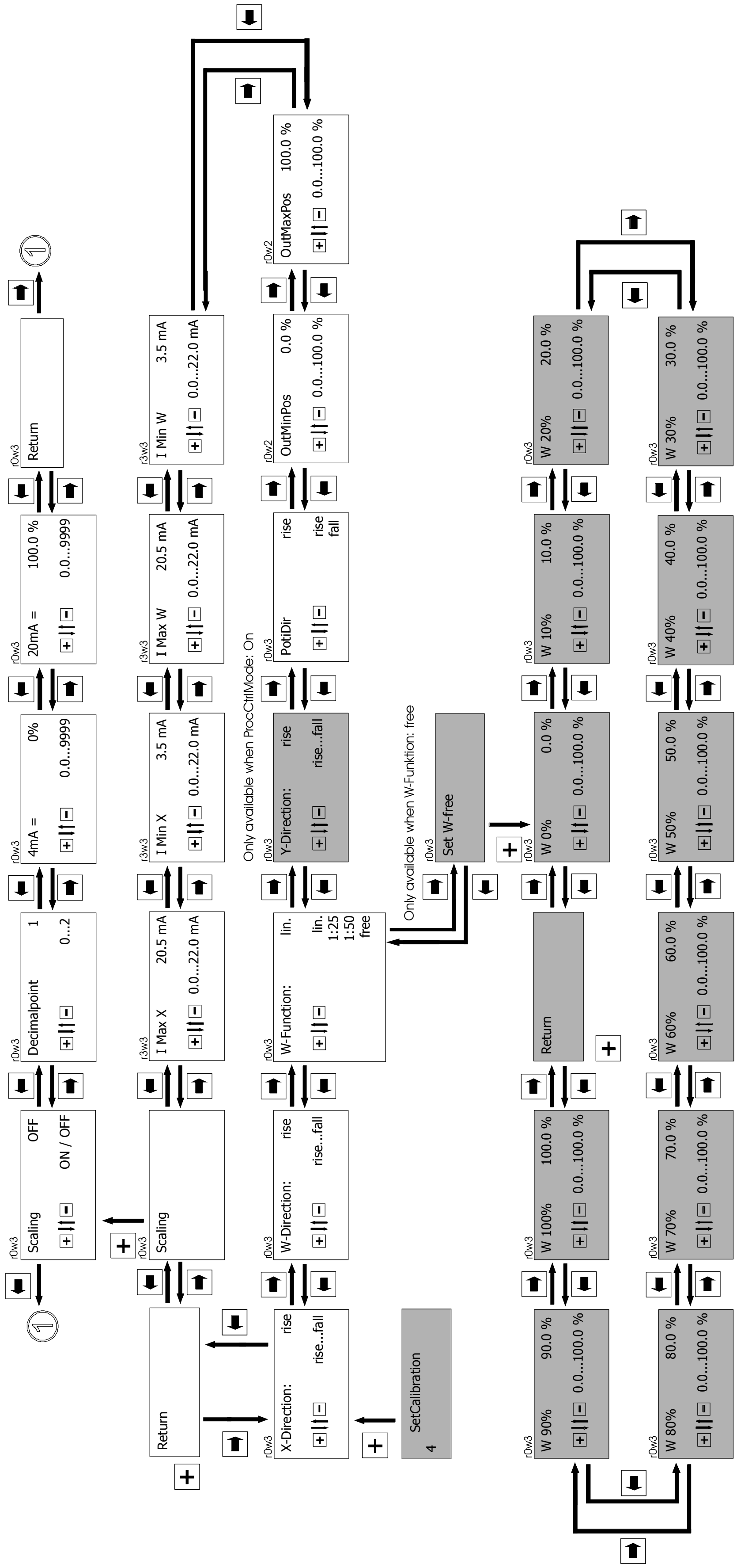
11.4. MENU STRUCTURE 2. SETBASICS



11.5. MENU STRUCTURE 3. SETFUNCTION



11.6. MENU STRUCTURE 4. SETCALIBRATION



12. Parameter table

Configuration level	Display	Function	Value range	Default setting
	Mode	Select operating modes	AUTO MAN OFF	AUTO
1 Service	ActiveParaSet	Displays the current active parameter set	P1...P4	P1
	Min-Pot-Max	Displays travel sensor position in percent		
	I w	Value of set value signal in mA		
	I x	Value of actual value signal in mA as a process controller		
	W Proc X	Value of set value signal in relation to actual value signal		
	W Pos X	Comparison of set value and valve position		
	Pot Abs	Travel sensor position		
	ProcCtrlOut	Deviation between set value and actual value (process controller)		
	PosCtrlOut	Deviation between set value and actual value (positioner)		
	In w:x:1:2	Displays the current signals of the digital inputs		
	Relay K1:K2	Displays the current position of the internal outputs		
	Valve	Displays the current position of the internal pilot valves		
	Code	Password entry	0...10000	0
	Logout	Block access	OK	
	New Code:	Release the lowest priority	0...10000	0
	New Code:	Release the medium priority	0...10000	0
	New Code:	Release the top priority	0...10000	0
	Error List	Displays error messages		
	Warnings	Superimpose warnings during operation	ON / OFF	ON
	Errors	Superimpose errors during operation	ON / OFF	ON
	Clear Error List	Delete error list	OK	
2 SetBasics	W-Input	Type of set value signal	4-20mA 0-20mA	4-20mA
	X-Input	Type of actual value signal	4-20mA 0-20mA	4-20mA
	Default	Reset to factory settings	Yes / No	Yes
	Init Valve	Starting initialisation		
	GoClose	Scanning the closed position		
	GoOpen	Scanning the open position		
	AdjTime	Scanning the operating times		
	FindCoefficient	Optimising the control features		
	CalPointQty	Quantity of support points when initialising	1...19	9
	D.Refresh	Time for display refresh	0.1...1.0s	0.1s
	Dlight	Setting the display lighting	On Key / On	On Key
	AutoReturn	Time for an automatic return to working level	1...60min	5min
	HelpText	Superimpose the help text	ON / OFF	ON
	HelpLanguage	Text language	D / GB	D

Configuration level	Display	Function	Value range	Factory setting
3 SetFunction	ProcCtrlMode	Switch process controller on or off	ON / OFF	OFF
	ProcCtrl	Sub-menu for setting process controller parameters		
	Proc-P	KP amplification of the process controller	0.0...100.0	0.5
	Proc-I	KI reset time for the process controller	0.1...999.9s	2.0s
	Proc-D	KD share of the process controller	0.0...100.0	0.0
	Proc-T	Process controller delay time	1...10000ms	1000ms
	Pos P	P amplification of the control parameters	0.0...100.0	1.0
	Pos D	D amplification of the control parameters	0.0...100.0	0.0
	Pos T	Decay time of the D share of the control parameters	1...5000ms	100ms
	MinPos	Lower position for stroke limitation as a control range	0.0...100.0%	0.0%
	MaxPos	Upper position for stroke limitation as a control range	0.0...100.0%	100.0%
	CloseTight	Lower close tight function	0.0...10.0%	0.0%
	OpenTight	Upper close tight function	90.0...100.0%	100.0%
	DeadBand	Permissible control deviation	0.1...25.0%	1.0%
	Digital Input	Sub-menu for setting digital inputs		
	In W	Determines the function of the digital input “In W“	OFF/ON Safe/ON ParmSetB0 ParmSetB1	OFF
	In X	Determines the function of the digital input “In X“	OFF/ON Safe/ON ParmSetB0 ParmSetB1	OFF
	In 1	Determines the function of the digital input “In 1“	OFF/ON Safe/ON ParmSetB0 ParmSetB1	OFF
	In 2	Determines the function of the digital input “In 2“	OFF/ON Safe/ON ParmSetB0 ParmSetB1	OFF
	K1 Switch	Defines the type of relay function	NC / NO	NO
	K1 Fn	Determines the function of relay K1	P min P max P min/max W min W max W min/max X min X max X min/max Active Error	no

Configuration level	Display	Function	Value range	Factory setting
	K2 Switch	Defines the type of relay function	NC / NO	NO
	K2 Fn	Determines the function of relay K 2	P min P max P min/max W min W max W min/max X min X max X min/max Active Error	no
	Error Time	Determines the delay time between error recognition and error message	0.5...100.0s	0.2s
	ErrorAction	Determines the function of the process valve if there is an error message	Close/Open/Hold	Close
	AlarmMaxK1	Trigger threshold that switches after K1 is exceeded	0.2...99.8%	10.0%
	AlarmMinK1	Trigger threshold that switches after K1 is undershot	0.2...99.8%	90.0%
	AlarmMaxK2	Trigger threshold that switches after K2 is exceeded	0.2...99.8%	10.0%
	AlarmMinK2	Trigger threshold that switches after K2 is undershot	0.2...99.8%	90.0%
	CpyParamSet	Copies parameters to various working memories (P1/P2/P3/P4)		

Configuration level	Display	Function	Value range	Factory setting
4 SetCalibration	X-Direction	Sets the direction of the actual value signal (rising/falling)	rise / fall	rise
	W-Direction	Sets the direction of the set value signal (rising/falling)	rise / fall	rise
	W-Function	The control curve is defined	lin./1:25/1:50/free	lin.
	Set W-free	10 control curve points can be programmed as desired	W 0% 0...100% W10% 0...100% W20% 0...100% W30% 0...100% W40% 0...100% W50% 0...100% W60% 0...100% W70% 0...100% W80% 0...100% W90% 0...100% W100% 0...100%	0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0% 80.0% 90.0% 100.0%
	Y-Direction	Determines the direction of the process controller output (rising/falling)	rise / fall	rise
	PotDir	Defines the direction of the actual value potentiometer of the valve	rise / fall	rise
	OutMinPos	Actual value output at 0/4mA	0.0...100.0%	0.0%
	OutMaxPos	Actual value output at 20mA	0.0...100.0%	100.0%

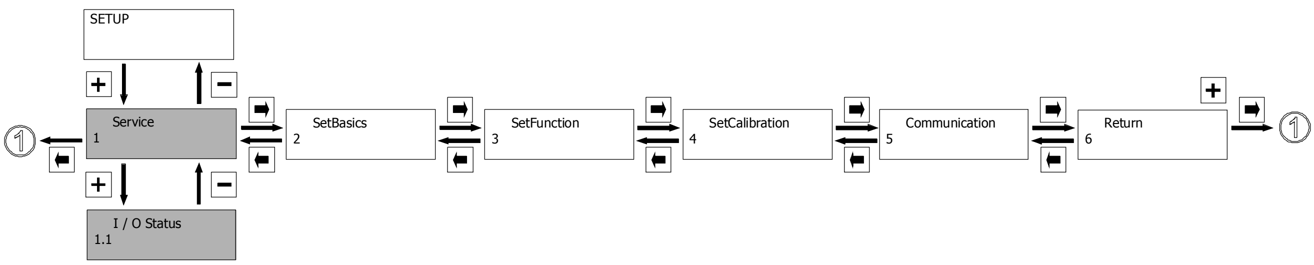
Configuration level	Display	Function	Value range	Factory setting
	I Min W	Switch-off limit for cable break recognition of the set value	0.0...22.0 mA	3.5 mA
	I Max W	Switch-off limit for excess current recognition of the set value	0.0...22.0 mA	20.5 mA
	I Min X	Switch-off limit for cable break recognition of the actual value	0.0...22.0 mA	3.5 mA
	I Max X	Switch-off limit for excess current recognition of the actual value	0.0...22.0 mA	20.5 mA
	Scaling	Sub-menu for scaling the actual value and set value display		
	Scale	Switching on the scaled display	ON / OFF	OFF
	Decimalpoint	Determines the decimal points displayed	0...2	1
	4mA≙	Defines the display which corresponds to a 0/4mA signal		0 %
	20mA≙	Defines the display which corresponds to a 20mA signal		100 %

13. Explanation of parameters

Mode:
It is possible to choose between the operating modes **AUTO (A:), MANUAL (M:)** and **OFF** (Pause mode).

13.1. 1 Service

13.1.1. Scanning the input and output signals



ActiveParaSet
Displays the current active memory which is read off. This memory can be changed using the parameter **CpyParaSet** (page 50).

min – Pot – max:
Displays the minimum and maximum travel sensor position in percent. For perfect operation, this value must lie between 2% and 98%.

I w:
Displays the value of the current set value signal in mA

I x:
Displays the value of the current actual value signal (when operated as a process controller)

W Proc X:
Displays the value of the current set value signal compared to the current actual value signal (when operated as a process controller)

W Pos X:
Displays the value of the current set value signal compared to the current valve position in %.

Pot Abs:
Displays the current travel sensor position **(Caution, this value may be different to the Pos x value as the valve does not make full use of the full 0-100% range of the travel sensor).**

Valve:
Displays the current position of the internal pilot valves (● = valve open).

Proc Ctrl Out:
Displays the deviation between set value and actual value (when operated as a process controller).

If the deviation is too large, this is shown by a dot on the left-hand side or right-hand side of the display. In this case, the positioner can no longer work. All parameters on the control system route must be checked.

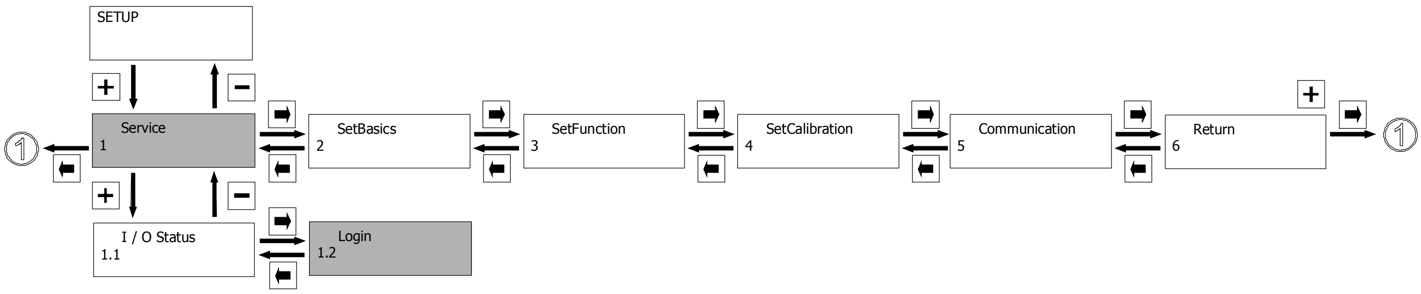
Pos Ctrl Out:
Displays the deviation between set value and actual value (when operated as a positioner).

If the deviation is too large, this is shown by a dot on the left-hand side or right-hand side of the display. In this case, the positioner can no longer work. All parameters on the control system route must be checked.

In w:x:1:2
Displays the current conditions of the digital inputs (● = High signal) .

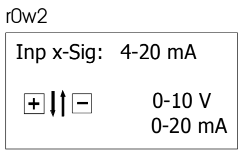
Relay:
Displays the current position of the internal relays K1 and K2 (● = Relay switched).

13.1.2. Activating or deactivating the user access



The configuration level of the GEMÜ 1436 **c**Pos is protected in certain areas by various codes against improper changing of parameters.
All menu items are marked by symbols indicating their write and read protection.

Example



The following symbols are used for this purpose:

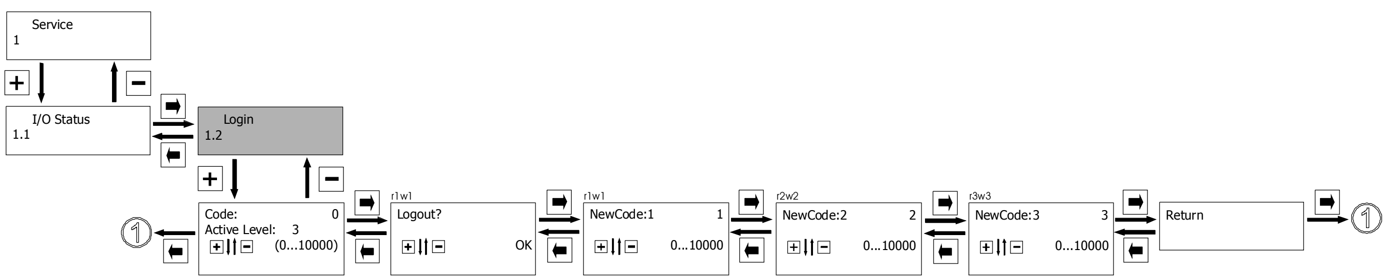
r0 : no release required for reading
w0 : no release required for writing

r1 : lowest priority release code 1 required for reading
w1 : lowest priority release code 1 required for writing

r2 : medium priority release code 2 required for reading
w2 : medium priority release code 2 required for writing

r3 : top priority release code 3 required for reading
w3 : top priority release code 3 required for writing

The codes can be changed or activated in the following menu:



Code:
Enter code for user access. The currently released code is displayed at Active Level .
e.g. In **Active Level 0** the controller is disabled in all three user levels.
Only the parameters marked by the symbol **r0w0** can be read and changed.

Logout:
Serves to log out of write protected and read protected areas in the menu. This function disables various menus depending on the user level activated.
User level 0 is displayed in parameter **Active Level**.

NewCode1:
Enter the new code for the lowest user level (user level 1) (factory setting 0).

NewCode2:
Enter the new code for the medium user level (user level 2) (factory setting 0).

NewCode3:
Enter the new code for the top user level (user level 3) (factory setting 0).

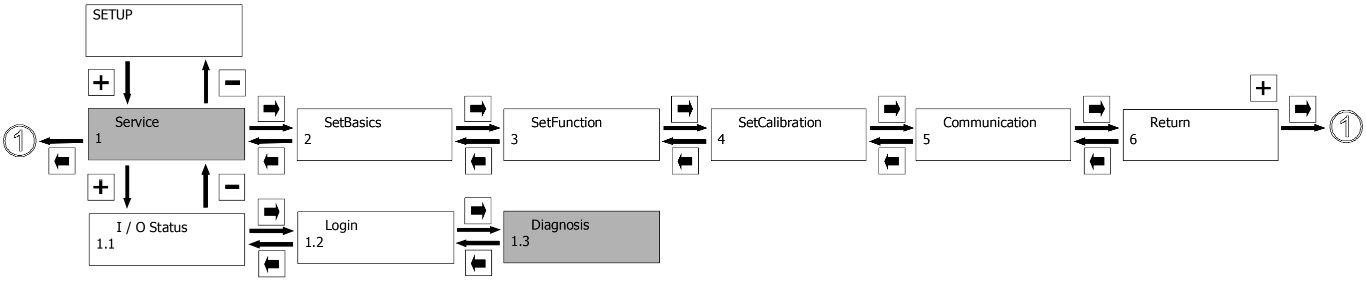
Factory setting 0 means that all three codes are assigned 0. This means that all parameter menus are released.

e.g.: If user level 2 is to be disabled, user level 2 and also user level 3 must be assigned a code.

During activation or deactivation of the codes via the RS232-interface other codes can be assigned in the same way as the direct input of codes via the GEMÜ cPos 1436 keypad.
This ensures specific disabling of the use of the positioner either directly via the positioner or via the RS232-interface depending on the type of operation.

The codes for operation via the RS232-interface can only be assigned, activated or deactivated via the RS232-interface. The codes for direct operation via the GEMÜ cPos 1436 keypad can only be assigned, activated or deactivated via the keypad on the unit itself.

13.1.3. Reading out, deleting and deactivating error messages



ErrorList:
The positioner stores all error messages in this menu.

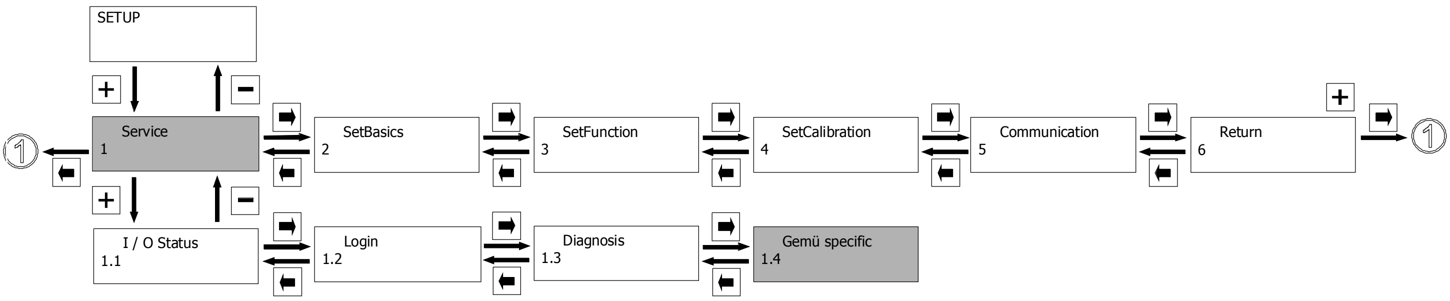
hrs:
The positioner operation hours are counted here.

Warnings:
The warning messages can be masked or displayed.
The positioner continues normal operation when a warning is given.
Messages are stored in the **Error List** (see error list page 55)

Errors:
Error messages can be hidden or displayed.
The positioner goes to the error mode when there is an error message and moves to the position defined under **Error Action** .
Messages are stored in the **Error List**. (see error list page 55)

ClearErrorList:
Use + to delete the positioner error list.

13.1.4. Display of series number, software release and ID

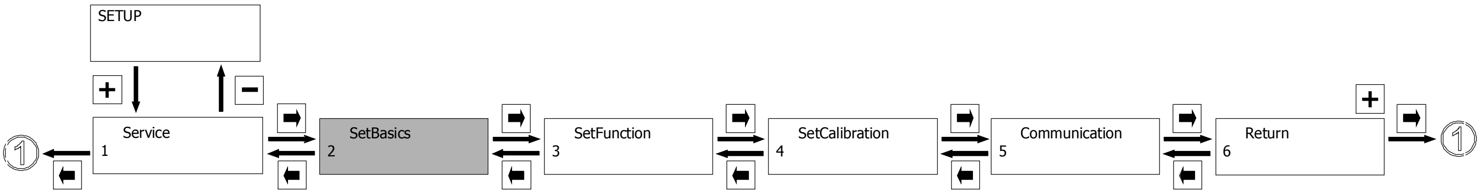


V:X.X.X.X:
Displays the current software release.

ID:
Displays the network address.

S/N:
Displays the positioner series number.

13.2. 2 SetBasics



13.2.1. Definition of actual value and set value inputs

W-Input:
Defines the type of set value input signal 0-20mA / 4-20mA / (0-10V optional).

X-Input:
Defines the type of actual value input signal 0-20mA / 4-20mA / (0-10V optional).

13.2.2. Reset

Default:
Serves to reset the positioner to the factory settings. All values changed by the operator are consequently deleted. An initialisation that has already taken place will also be deleted.
Only the parameter set currently stored in the working memory is reset, however. Stored parameter sets remain unchanged (see page 50).

13.2.3. Initialisation

InitValve:
Automatic or manual initialisation (adaptation of the positioner to the valve) is started.

CtrlFn:
The type of valve control function can be selected during manual initialisation.
Auto: Automatic searching the control function
NC: Control function 1 (normally closed)
NO: Control function 2 (normally open)
DA: Control function 3 (double acting)
Boost NC: Control function 1 (for larger actuators, higher air volume)
Boost NO: Control function 2 (for larger actuators, higher air volume)

goClose:
The closed valve position is scanned during initialisation.
It must be started with the **+ key** if initialising manually and then confirmed.

goOpen:
The open valve position is scanned during initialisation.
It must be started with the **+ key** if initialising manually and then confirmed.

findFnct:
The valve control function and configuration of the pilot valves are determined.

adjTime:
(only displayed when "goOpen" and "goClose" are carried out)
The minimum operating times for the valve are scanned during initialisation.

findCoefficient:
(only displayed if "adjTime" was carried out)
The valve is checked for control features at various positions between the end positions.

CalPointQty:
The quantity of set points when initialising can be changed.
Example. QtyCalPoint=9 means -> the valve will be examined for control features between the end positions stops in 9 positions (10% steps here).

13.2.4. Making the display settings

D.Refresh:
The time for display refresh can be changed.

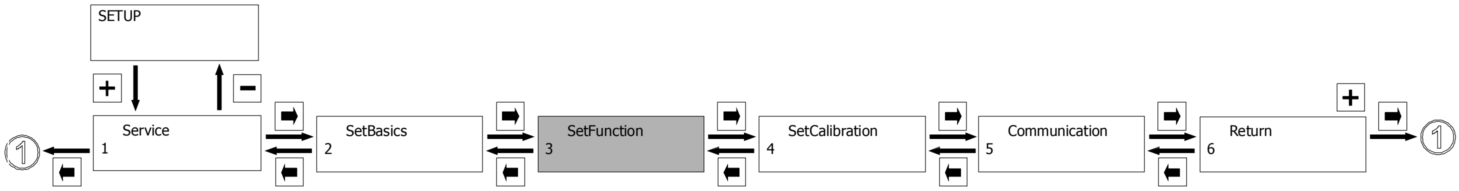
DLight (this function is not yet available in the hardware)**:**
The features of the display lighting can be switched between the following settings:
OnKey – Display lighting is activated by pressing a key. The display lighting remains activated after the last key is pressed for the period set using **AutoReturn**.
On – The display lighting is permanently activated.

AutoReturn:
The time for the automatic return to the working level after last activating a key can be set. This time setting is also effective for the display lighting (**DLight)**.

HelpText:
The help texts that appear as a default in the second line of the display can be masked. If the help texts are masked, the key assignment is displayed.

HelpLanguage:
The text output language may be selected between D-German and GB-English.

13.3. 3 SetFunction



13.3.1. Setting the process controller parameters (optional)

This menu is only available for the design with integrated process controller (PA01).

ProcCtrlMode
Switches the process controller on or off.

ProcCtrl
Sub-menu for setting process controller parameters. Only available when **ProcCtrlMode** is **ON**.

Proc-P
Indicates the KP amplification of the process controller.

Proc-I
Indicates the T resetting time for the process controller.

Proc-D
Indicates the KD process controller differential share.

Proc-T
Indicates the Tv delay time for the process controller. Only available if Proc-D > 0.

13.3.2. Setting the positioner parameters

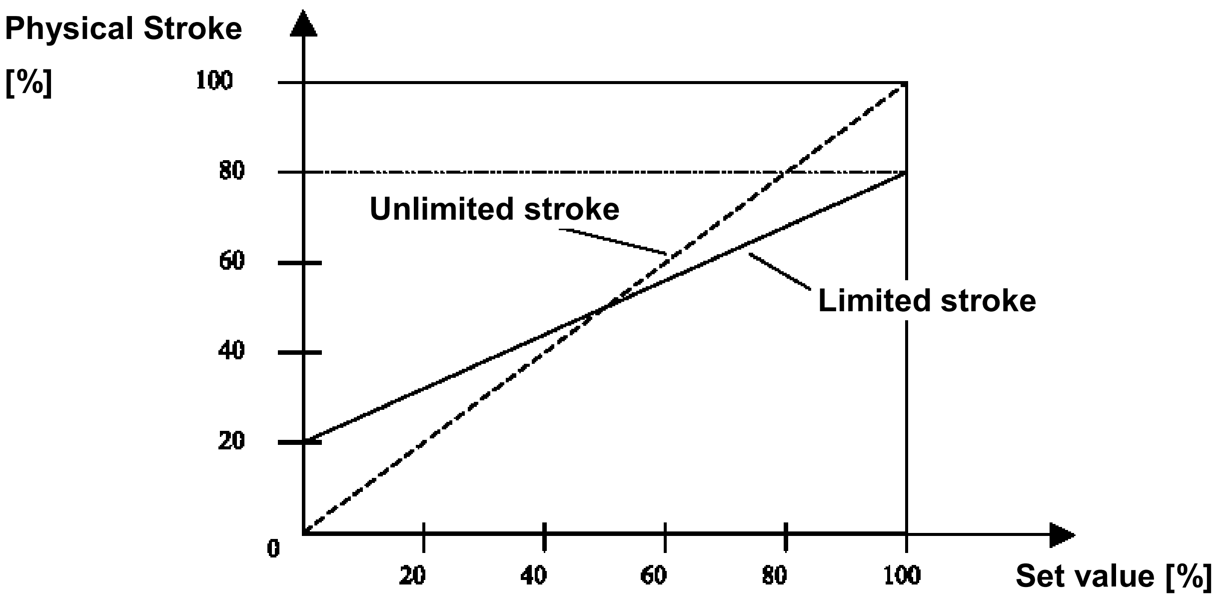
PosCtrl
Makes parameters available for the positioner.

Pos P
Matches the positioner's KP amplification.
The optimum value is determined by the positioner during initialisation.

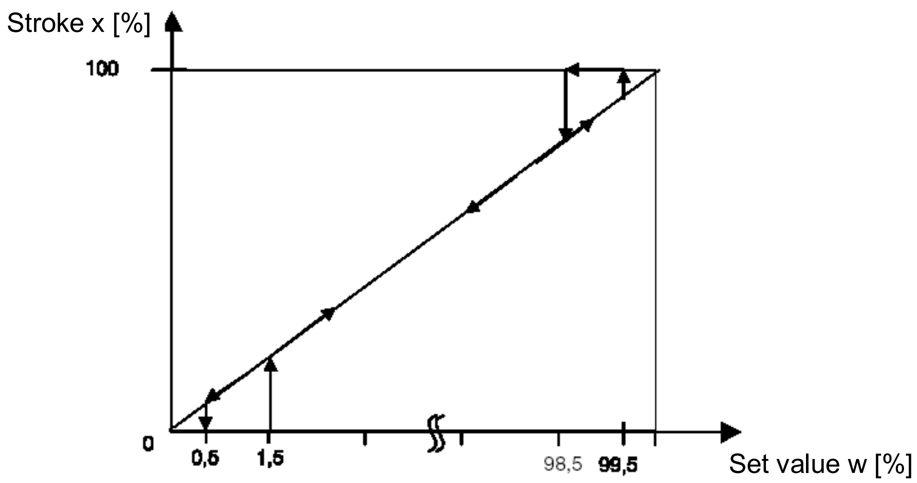
Pos D
Matches the positioner's D amplification.

Pos T
Matches the decay time for the positioner's D share.

MinPos
Defines the lower position of the control range (serves as a closing limit).
MaxPos
Defines the upper position of the control range (serves as a stroke limit).



OpenTight and **CloseTight**
Determines the close tight function areas (complete pressurization or ventilation of the actuator).
With this function the valve can be moved into the seat using the maximum possible actuator force. The close tight function can be activated for one end or both end positions.
Example
If the setting Close tight 0.5% and Open tight 98.5% is made, the valve closes or opens fully according to the following diagram.
The hysteresis is 1%.



If the control characteristic curve (W function page 52) is changed to the values 1:25 or 1:50, the close tight value should be set at >2.0 (if the characteristic curve is 1:50) or >4.0 (if the characteristic curve is 1:25), in order to shut the valve fully.

13.3.3. Setting the dead zone

DeadBand
Defines the permissible deviation – dead zone between set value and actual value.
Effects both the positioner and the process controller.

13.3.4. Setting the optional digital input parameters

Digital Input:
Sub-menu for setting the digital inputs

In W:
Defines the functions of the High signal at digital input In W (connection at set value input, only effective for manual operation).

In X:
Defines the functions of the High signal at digital input In X (connection at actual value input, only effective when operating as a positioner)

In 1: (optional)
Defines the functions of the High signal at digital input 1

In 2: (optional)
Defines the functions of the High signal at digital input 2

Parameter	Function	Function at Low signal level	Function at High signal level
OFF	Digital inputs deactivated		
OFF/ON	Sets the positioner to the pause mode	**OFF:** Positioner in pause mode	**ON:** Positioner active
Safe/ON	Moves the positioner into a safe position	**Safe:** Positioner moves to the position defined under Error Action	**ON:** Positioner active
ParmSetB0	Loads parameter sets into working memory	See following table	
ParmSetB1	Loads parameter sets into working memory		

Current signal for ParmSetBO	Current signal for ParmSetB1	Memory which is read out
0	0	**P1**
0	1	**P2**
1	0	**P3**
1	1	**P4**

Before loading another parameter set, it has to be loaded to the respective memory (see 13.3.7 CpyParamSet page 50).

13.3.5. Setting output functions and switch points

DigitalOutput
Defines the switch conditions for the internal outputs K1 and K2.

K1 Switch
Defines the relay contact type.
NO – make-contact or NC – break-contact

K1 fn
Establishes the function of relay K1.

(no)	No function
(P min)	Lower than the alarm position preset under **AlarmMinK1**
(P max)	Exceeds the alarm position preset under **AlarmMaxK1**
(P min/max)	Lower or higher than the preset alarm positions
(W min)	Lower than the set value preset under **AlarmMinK1**
(W max)	Exceeds the set value preset under **AlarmMaxK1**
(W min/max)	Lower or higher than the preset set value
(X min)	Lower than the actual value preset under **AlarmMinK1**
(X max)	Exceeds the actual value
(X min/max)	Lower or higher than the actual value
Active	Active if the positioner is in the OFF-mode
Error	Error message

AlarmMinK1
Sets the trigger threshold in % under which relay K1 is switched.
AlarmMaxK1
Sets the trigger threshold in % over which relay K1 is switched.

K2 Switch
Defines the relay contact type.
NO – make-contact or NC – break-contact

K2 fn
Determines the function of the relay K2.

(no)	No function
(P min)	Lower than the alarm position preset under **AlarmMinK2**
(P max)	Exceeds the alarm position preset under **AlarmMaxK2**
(P min/max)	Lower or higher than the preset alarm positions
(W min)	Lower than the set value preset under **AlarmMinK2**
(W max)	Exceeds the set value preset under **AlarmMaxK2**
(W min/max)	Lower or higher than the preset set value
(X min)	Lower than the actual value preset under **AlarmMinK2**
(X max)	Exceeds the actual value
(X min/max)	Lower or higher than the actual value
Active	Active if the positioner is in the OFF-mode
Error	Error message

AlarmMinK2
Sets the trigger threshold in % under which relay K2 is switched.

AlarmMaxK2
Sets the trigger threshold in % over which relay K2 is switched.

13.3.6. Setting the error time and error action

ErrorTime
Determines the delay between error recognition and error message.

ErrorAction
Defines the behaviour of the valve if there is an error message and when switching to the **OFF-MODE**.
Close: Valve is vented
Open: Valve is pressurized
Hold: Valve remains in its current position.

13.3.7. Storing parameter sets

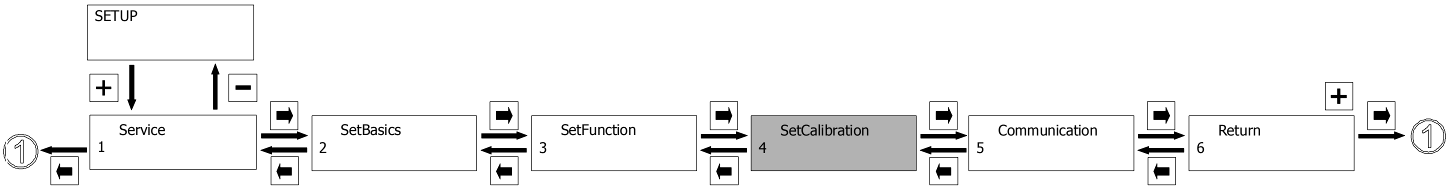
CpyParamSet
The current positioner settings can be copied and read out in different memories.
It is not possible to load all changed control parameters into the programme memories. Please refer to page 64 for an overview of the parameters which can be stored. If a parameter cannot be stored, it is active in all memories.

(P1<=W)	Write from W to P1
(P1=>P2)	Write from P1 to P2
(P1<=P2)	Read from P2 to P1
(P1=>P3)	Write from P1 to P3
(P1<=P3)	Read from P3 to P1
(P1=>P4)	Write from P1 to P4
(P1<=P4)	Read from P4 to P1
(OFF)	Storage function deactivated

P1: Memory 1
P2: Memory 2
P3: Memory 3
P4: Memory 4
W: Factory settings

The GEMÜ 1436 cPos automatically stores all parameters in working memory P1.

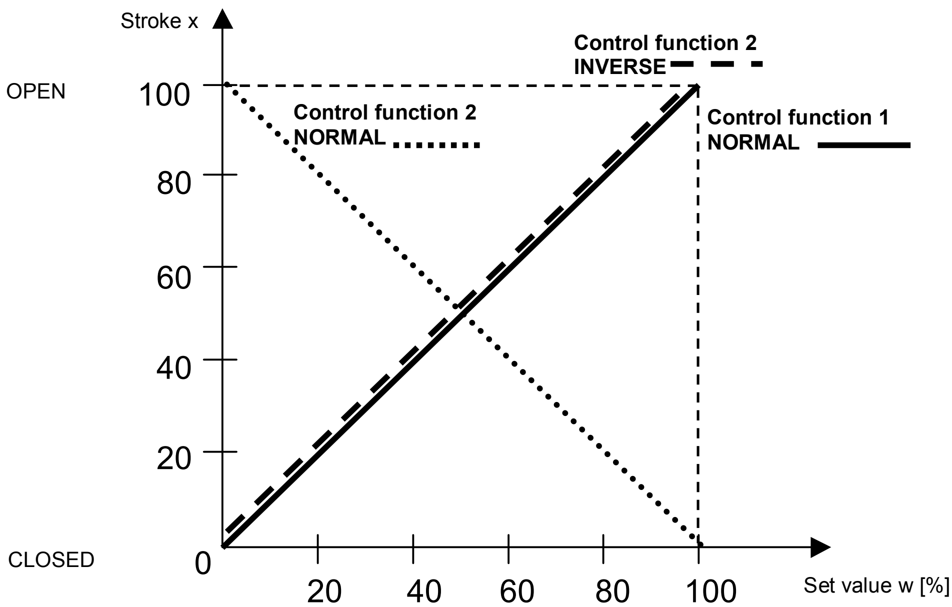
13.4. 4 SetCalibration



13.4.1. Determining the direction of actual value and set value

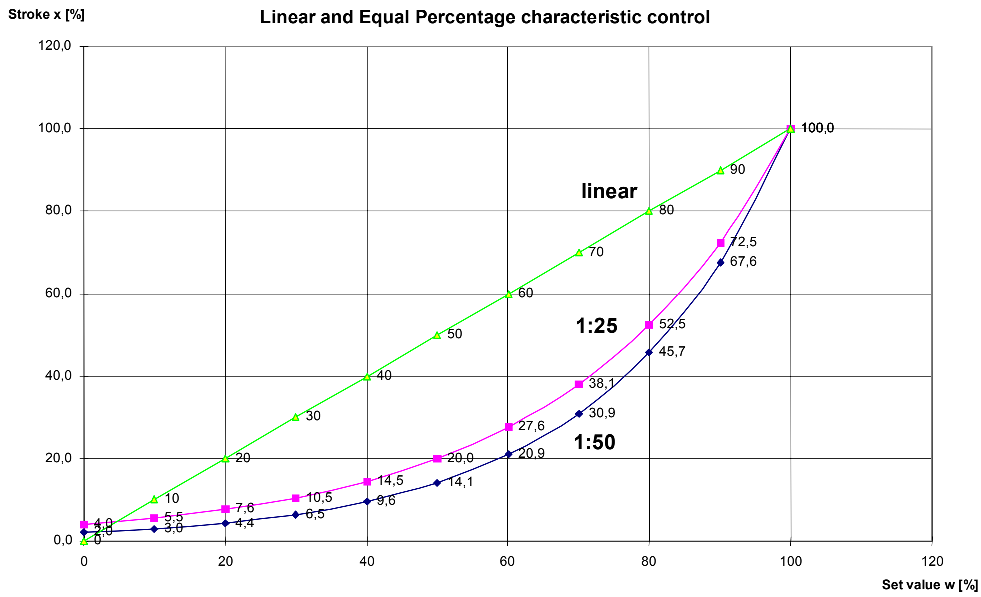
X-Direction:
Defines the direction of the actual value signal (rising/ falling).

W-Direction:
Defines the direction of the set value signal (rising/ falling).



13.4.2. Defining the characteristics of the control curve

W-Function:
The characteristics of the control curve can be defined (linear/ 1:25 / 1:50 / free)



In order to be able to close the valve fully at an equal % selection of 1:25 or 1:50, the close tight function (see p. 47) must be set to the value >2.0 (for equal % 1:50) or >4.0 (for equal % 1:25).

SetW-free:
Eleven set points on the control curve can be programmed as required.

Y-Direction
Defines the direction of the process controller output (rising/falling)

13.4.3. Defining the direction of the travel sensor

Pot Dir:
The direction of the actual value potentiometer can be defined.

13.4.4. Defining the actual value output signal

OutMinPos:
Defines the valve position at which an actual value signal of 0/4 mA is emitted at the output.

OutMaxPos:
Defines the valve position at which an actual value signal of 20 mA is emitted at the output.

13.4.5. Determining switch points for error monitoring

I Min W:
Defines the point below which the set value signal activates an error message

I Max W:
Defines the point above which the set value signal activates an error message

I Min X:
Defines the point below which the actual value signal activates an error message

I Max X:
Defines the point above which the actual value signal activates an error message

13.4.6. Scaling the actual value and set value display

Scaling:
Sub-menu for scaling the actual value and set value display.

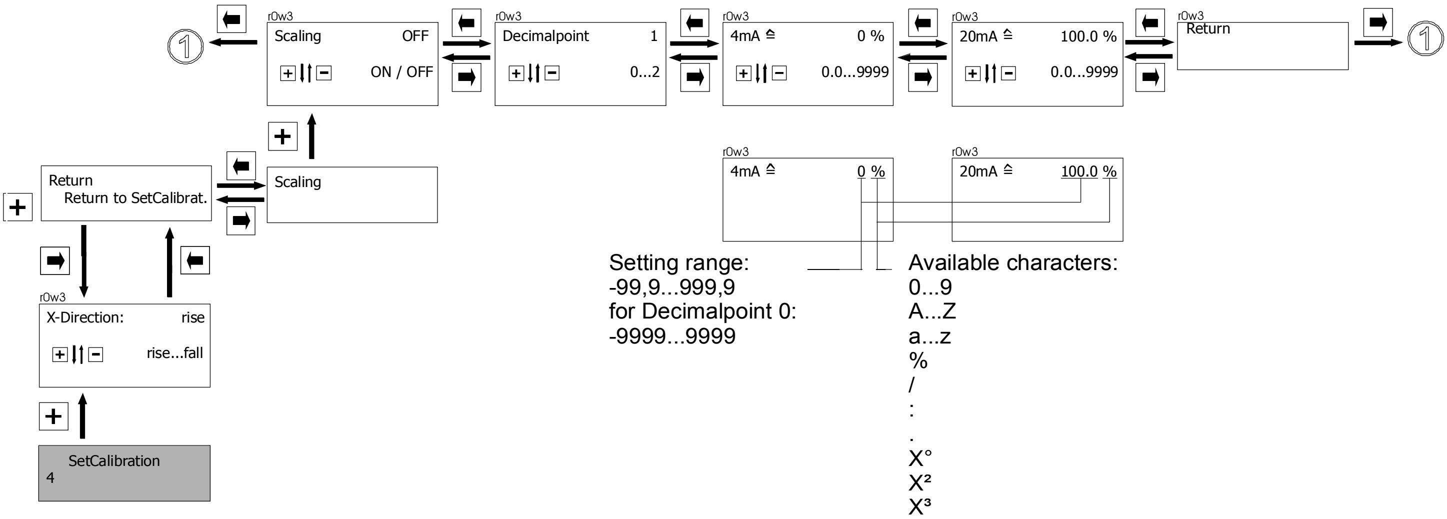
Scale:
Defines whether the actual and set value display is to be displayed as scaled variable or in percent.
ON: Display as scaled variable
OFF: Display in percent

Decimalpoint:
Determined the displayed decimal points.

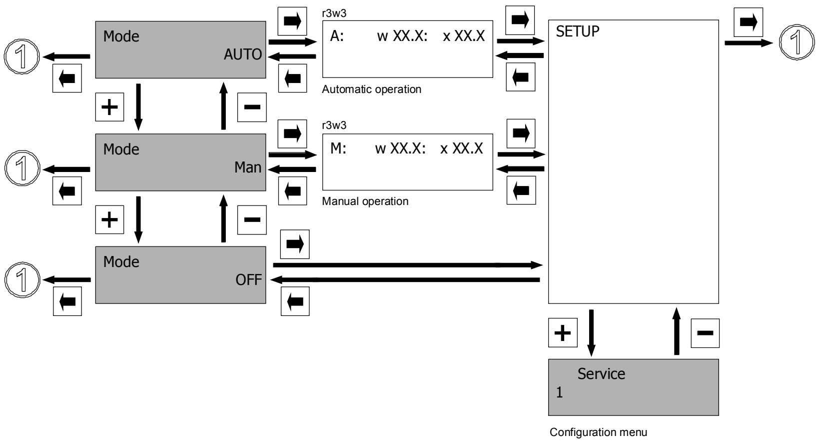
4mA≙:
Defines the value which is displayed when there is a 0/4mA signal .

20mA≙:
Defines the value which is displayed when there is a 20mA signal.

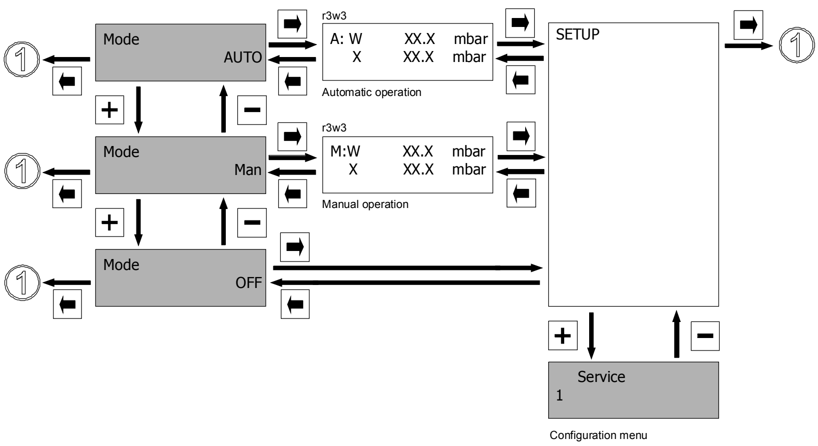
Possible setting values for the freely scalable actual and set value inputs:



Display when Scale OFF is set:

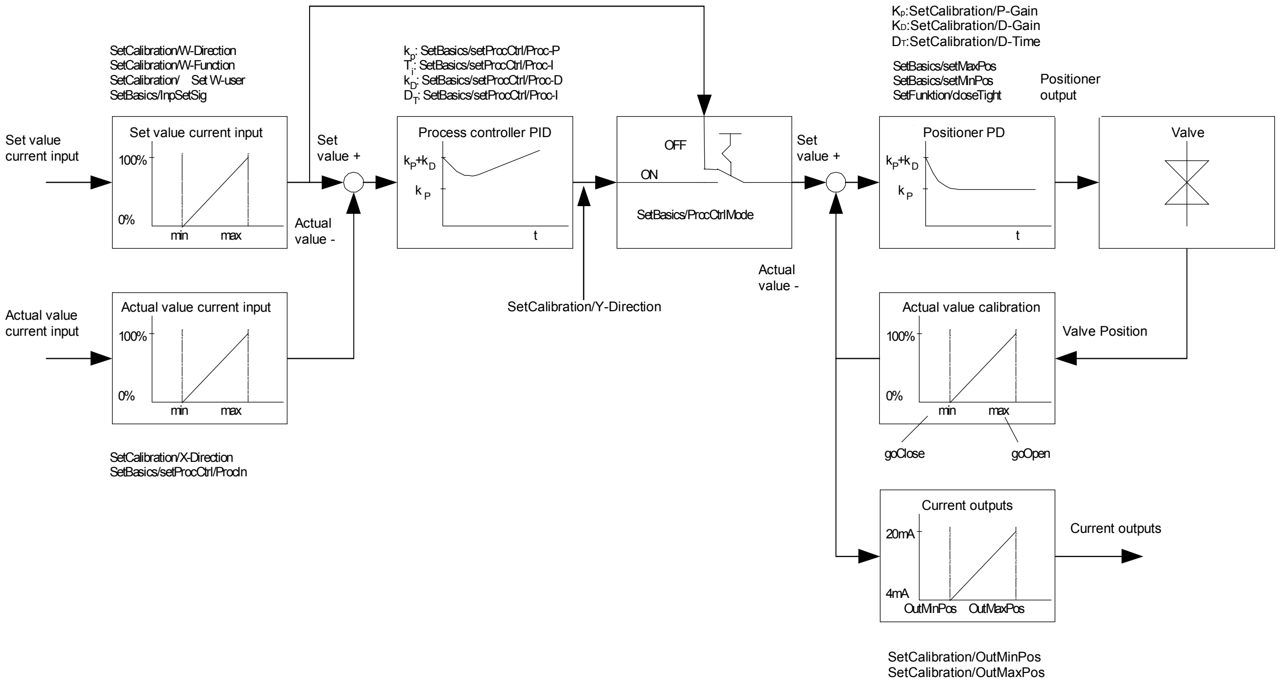


Display when Scale ON (e.g. mbar) is set:



Changing the scaling values is also directly possible in this menu level by selecting the corresponding parameters.

14. Positioner structure cPos 1436



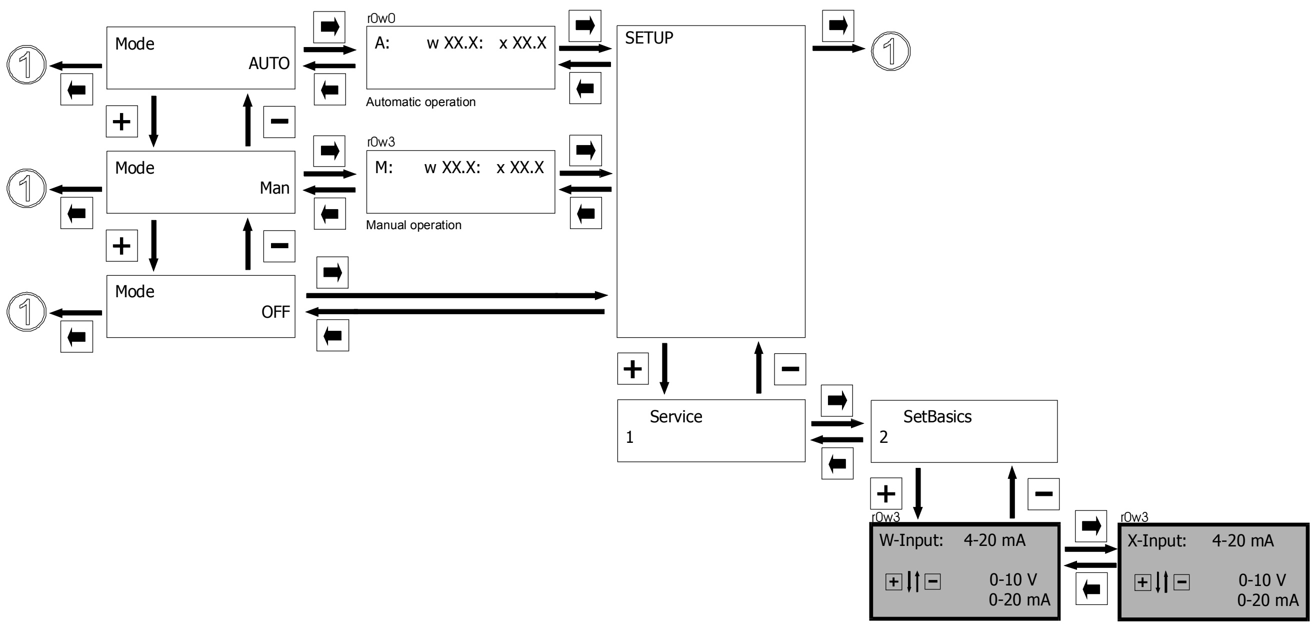
15. Error messages

Error no.	Error text	Description	Condition for the occurrence of the error	Error cause
000	NO ERROR	There are no errors		
010	Iw < 4mA **Error**	The set value signal is lower than 4mA	The positioner is in automatic mode	A cable break at the set value input
011	Iw > 20mA **Error**	The set value signal is higher than 20mA	The positioner is in automatic mode	The set value signal is higher than 20mA
012	Ix < 4mA **Error**	The actual value signal is lower than 4mA	The process controller is active	A cable break at the actual value input
013	Ix > 20mA **Error**	The actual value signal is higher than 20mA	The process controller is active	The actual value signal is higher than 20mA
020	Pot wrong dir **Error**	The potentiometer has recognised the wrong control function during initialisation	Parameter “CtrlFn“ is set to AUTO and a valve with control function 3 is recognised, from which the actuator has moved in the wrong direction. Parameter “CtrlFn“ is set for a fixed control function. This set control function is not in accordance with the control function determined during initialisation.	The pneumatic connections for “CLOSED” and “OPEN“ on the valve have been switched or the parameter “Pot Dir“ is set on “fall“ The wrong control function is set
021	Wrong function **Error**	An incorrect control function was recognised during automatic initialisation	Parameter “CtrlFn“ is set for a fixed control function. This set control function is not in accordance with the control function determined during initialisation.	The wrong control function is set in the “CtrlFn“ parameter. If the parameter is set to AUTO, the 1436 determines the corresponding control function and leaves it there.
030	Air missing **Warning**	A failure of the compressed air was discovered.	The 1436 tries to change the valve position, but it changes in the wrong direction. **Caution:** Dependent on the positioner’s set value reaction time, the error may be acknowledged in the meantime. It then recurs.	No compressed air. Failure of the internal pilot valves.

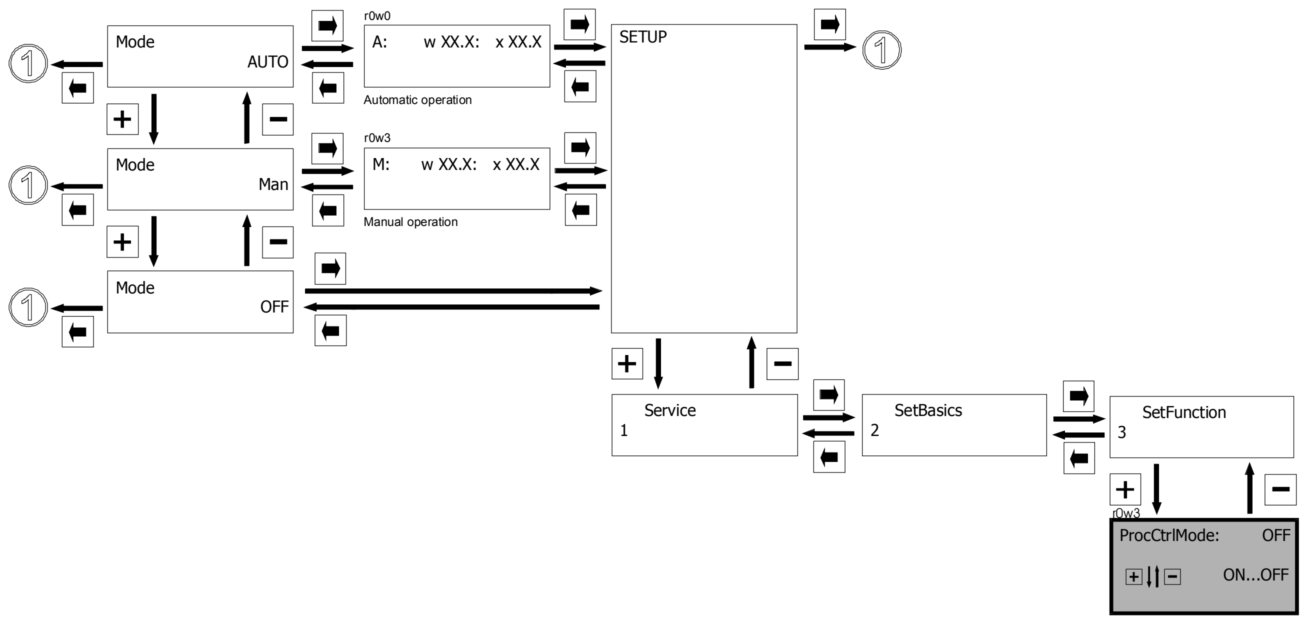
All error messages can be read in the menu item **ErrorList (1 Service/ 1.3 Diagnosis)**. The menu item **ClearErrorList (1 Service/ 1.3 Diagnosis)** can be used to clear the internal error memory.

16. Abbreviated instructions

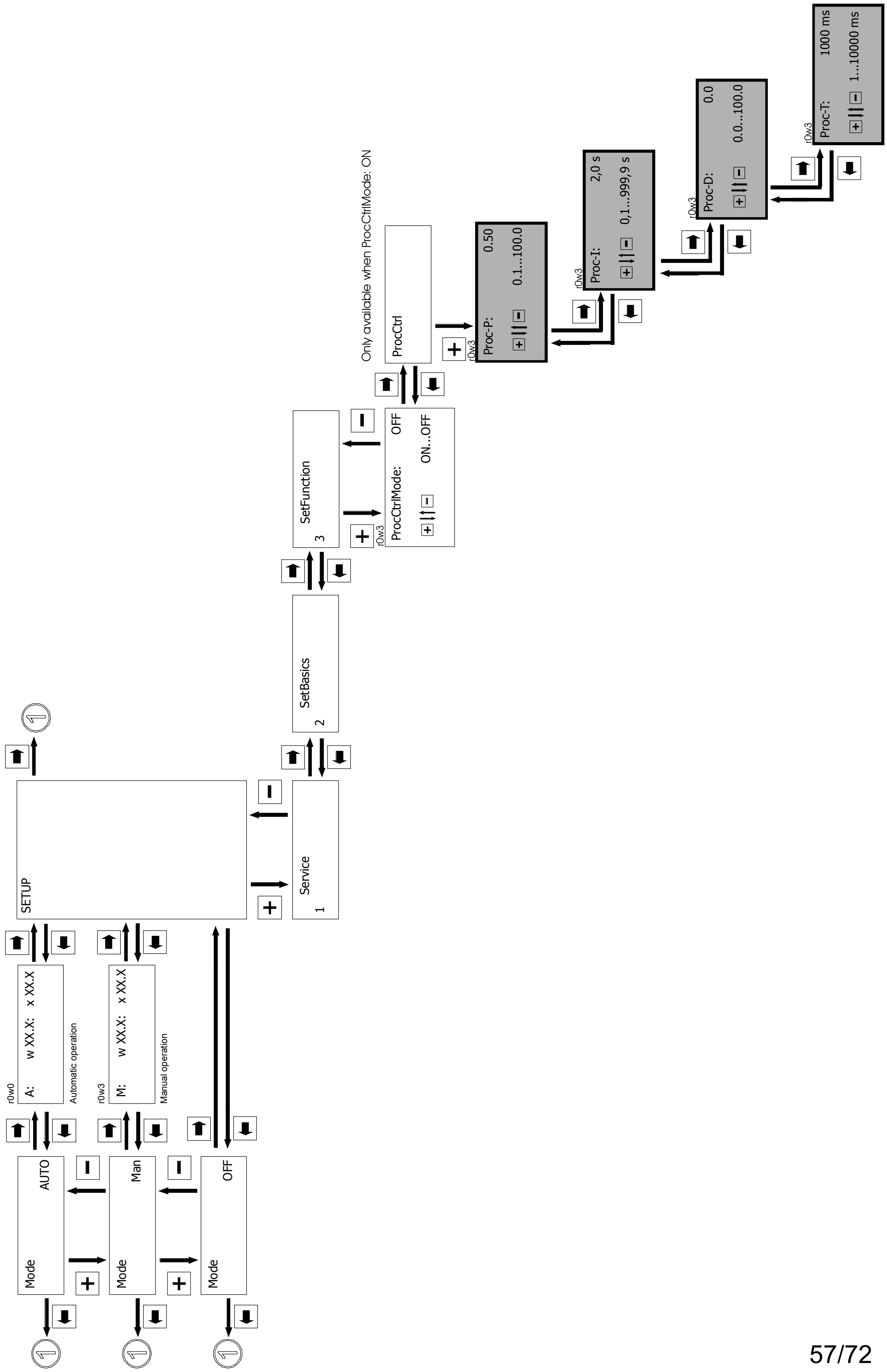
16.1. Changing the set value signal and actual value signal



16.2. Switching the process controller on or off (optional)

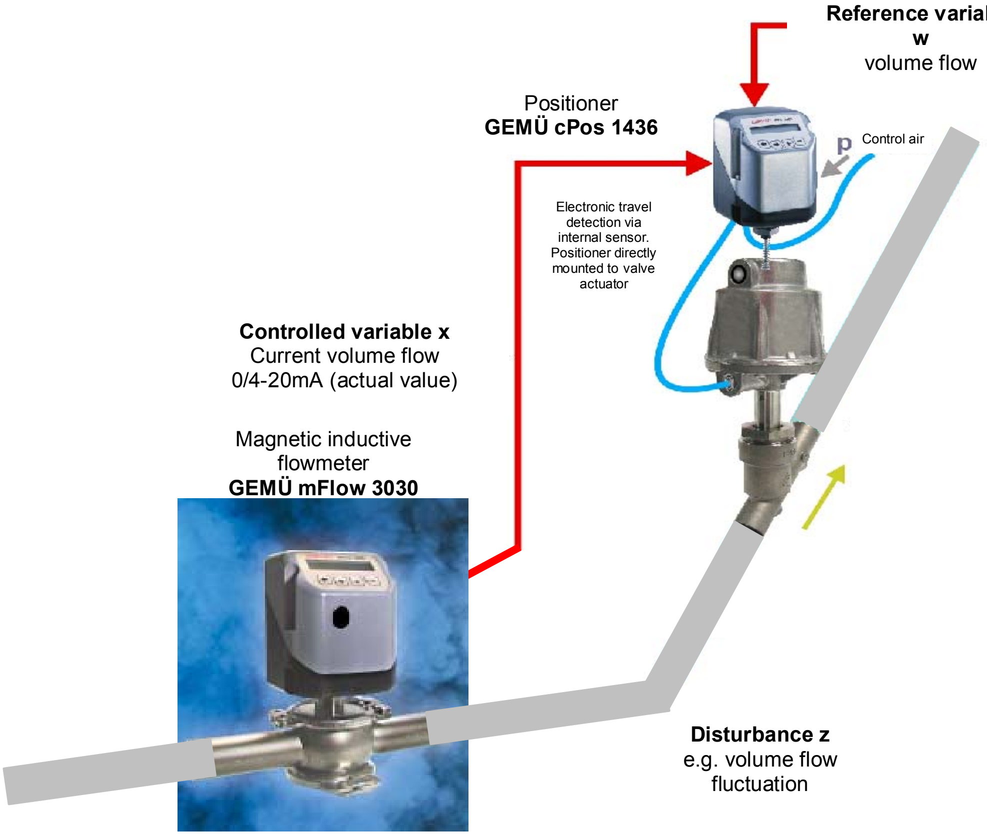


16.3. Changing the control parameters (Proc P, Proc I, Proc D and Proc T)



17. General information regarding control technology

17.1. The control circuit



17.2. Control technology terminology

Reference variable (Set value) w:
The input variable (set value) for the control circuit. The controlled variable x should follow it with a pre-determined dependency.

Controlled variable (Actual value) x:
The volume flow currently measured.

System deviation x_d:
The difference between reference variable w and controlled variable x, $\mathbf{x_d = w - x}$

Correcting variable y:
Input variable for the controlled system. The process controller guidance to the positioner regarding the position in which the triggered control valve must be driven in order to achieve the desired volume flow.

Disturbance variable z:
An external variable that influences the controlled system that normally cannot be influenced (e.g. volume flow fluctuations).

17.3. Control parameters

Explanation of parameters of GEMÜ cPos 1436:

Proc P → K_P
Proc I → T_n
Proc D → K_D
Proc T → T_v

Proportional range X_p:
The proportional range tells us the extent to which the controlled variable x changes when the correcting variable y is adjusted.
X_p can be used to adapt the positioner amplification to the controlled system.
If a small proportional range is selected, it has a large correcting variable y (e.g. 20mA) as a result, i.e. the positioner reacts more swiftly and harder with a small proportional range. If a too small proportional range is chosen, this leads to oscillation of the control circuit.

Proportional correction value K_p:
Instead of the description proportional range, the expression proportional correction value K_p is used frequently.
Conversion of X_p to K_p is:

$$X_p = 100[\%] / K_p \qquad \text{or} \qquad K_p = 100[\%] / X_p$$

The K_p value tells us to what degree the controlled variable x changes if the correcting variable y is adjusted.

$$K_p = \Delta x / \Delta y = x_2 - x_1 / y_2 - y$$

In order to obtain a unit-independent relationship in the equation above, x and y must be divided by their respective maximum values (100%).
In this case, a high K_p value results in smaller deviation. However, if the K_p value is set too high, it leads to an increased tendency for the control circuit to oscillate.

Rate time T_v:
It is used to set the intensity of the D share.

Differential share (D share):
The D share “brakes” the positioner when starting up to the set value. It can be used to avoid oscillating above and beyond the controlled variable. If the controlled variable is changed, the D share counteracts this change.
For an inverse positioner (heating) this would mean:
- If the controlled variable is reduced due to a disturbance in the controlled system, the D share counteracts the change by creating a positive regulation ratio.
- If the controlled variable increases due to a disturbance in the controlled system, the D share counteracts this change by creating a negative regulation ratio.

The higher the rate time T_v is set, the stronger the dampening reaction.

Integral share (IShare) K_i:
The I share **K_i** changes the positioner regulation ratio continuously until the actual value reaches the set value.
The regulation ratio will be integrated upwards or downwards as long as a deviation exists. The influence of the I share will become larger the longer a deviation exists. The shorter the resetting time **T_n** and the larger the deviation, the stronger (faster) the effect of the I share.
The I share hinders a constant deviation.

Resetting time T_n:
The resetting time **T_n** determines the duration how long a deviation is adjusted.
If a high value is preset for the resetting time **T_n**, this means a small influence of the I share and vice-versa.
During the resetting time **T_n**, the controlled variable change caused by the P share is added again. Thus there is a fixed relationship between the P share and the I share. If the P share is thus changed, the time response changes too if the **T_n** value remains constant.

$$\mathbf{K_i = 1 / T_n}$$

17.4. Adaptation of the positioner to the controlled system

Optimisation of the positioner:
In order to achieve good behaviour of the control circuit it is necessary to adapt the positioner to the process.
Good valve behaviour, for instance, can be quick adjustment of maximum power for pre-shooting or non-overshooting-free adjustment of maximum power if the adjustment of power takes longer.
With varying plant conditions, the optimum adjustment parameters must be determined by trial and error through experimentation or rule of thumb.
The meaning of parameters for the GEMÜ 1436 cPos:

Proc P → **K_P**
Proc I → **T_n**
Proc D → **K_D**
Proc T → **T_v**

Interpretation of the positioner parameters according to Ziegler-Nichols:

The following process is intended to help to adapt the positioner to the controlled system (however this process can only be implemented on controlled systems where it is possible to let the controlled variable oscillate of its own accord).

- Set the values for K_p **(Proc P)** and T_v **(Proc T)** to their minimum and the T_n **(Proc I)** value to 0 (this leads to the smallest possible effect of the positioner).
- Enter the desired set value manually in manual mode.
- Slowly increase K_p **(Proc P)** (decrease X_p) until the controlled variable starts to oscillate harmoniously. Ideally the control circuit should be stimulated to oscillate by erratic set value changes during the K_p adjustment.
- Note the K_p value thus obtained as a critical proportional correction value, $K_{p,krit}$.
- Following this, determine the duration of an oscillation as T_{krit}. If possible, use a stopwatch to measure several oscillations and use the arithmetic mean as T_{krit}.
- Use the values thus determined for $K_{p,krit}$ and T_{krit} to calculate the missing **Kp,** T_n and T_v parameters according to the following table.

	K_p = Proc P	T_n = Proc I	Proc D	T_v = Proc T
P	0.50 x $K_{p,krit}$	0	0	0
PI	0.45 x $K_{p,krit}$	0.85 x T_{krit}	0	0
PID	0.59 x $K_{p,krit}$	0.50 x T_{krit}	0.59 x $K_{p,krit}$	0.12 x T_{krit}

- If necessary, re-adjust the K_p and T_n values a little until the control system shows satisfactory behaviour

17.5. Differential equation for the GEMÜ 1436 cPos

$$y = \mathrm{ProcP} * \left[x_d + \frac{1}{\mathrm{ProcI}} * \int x_d \, dt \right] + \mathrm{ProcD} * \left[\frac{dx_d}{dt} - \mathrm{ProcTv} * \frac{dy}{dt} \right]$$

17.6. Effects of the control parameters on the control system

Proc P:

Larger:	The positioner reacts quicker, however it tends to oscillate and controls less accurately. The set value is achieved quicker.
Smaller:	The positioner controls slower. The set value is achieved slower. Control is more precise.

Proc D:

Larger:	Control is slower.
Smaller:	Set value is achieved quicker.

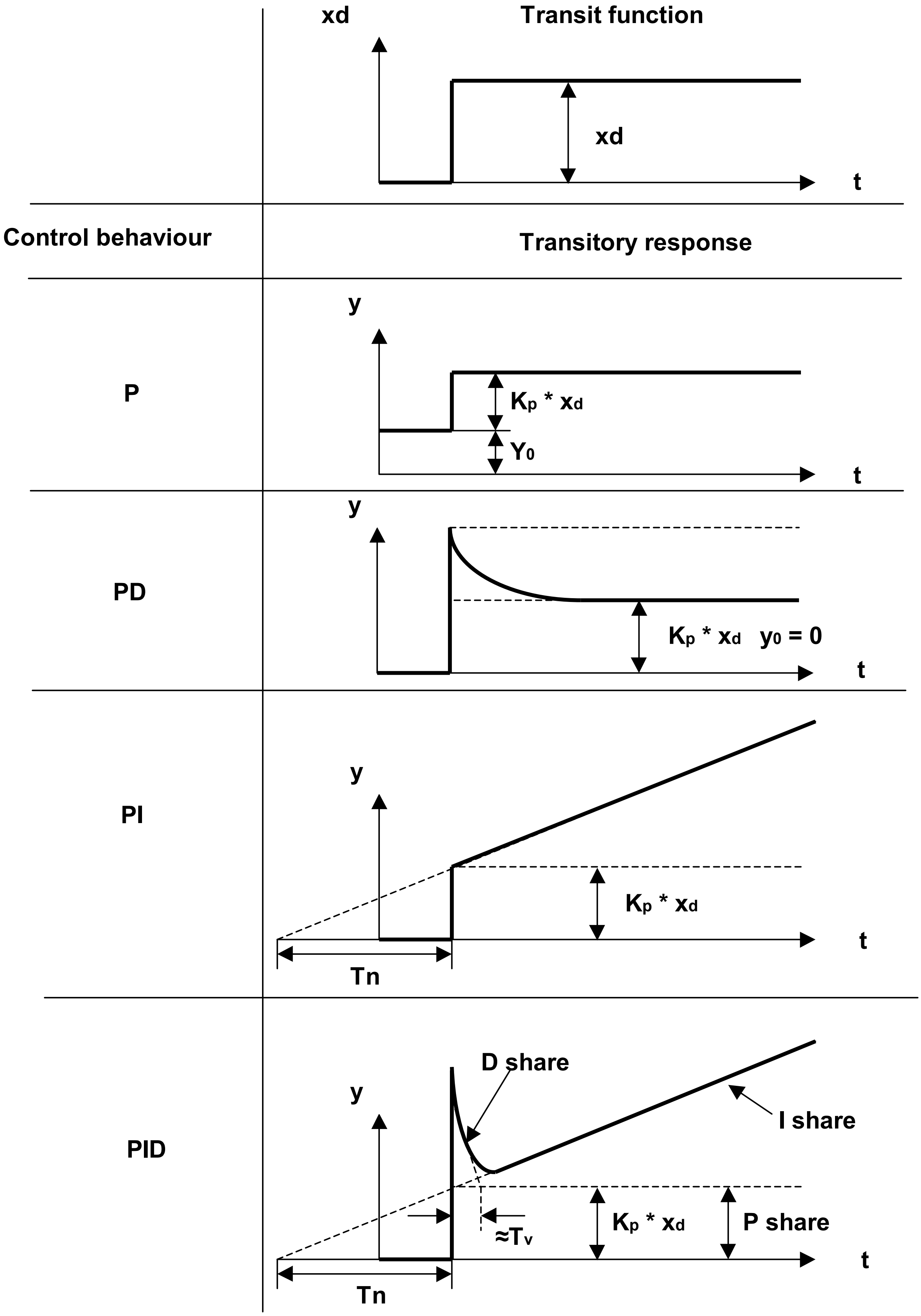
Proc I:

Larger:	The positioner reacts slower to actual value changes. Proc I should be increased for actual value sensors with relatively slow output signals.
Smaller:	The positioner reacts quicker to actual value changes.

Proc T:

Larger:	The system deviation has a longer effect although set value = actual value

17.7. Control characteristics and transitory responses



18. Table for changes to the factory settings

18.1. Changed control parameters

Fields marked by X cannot be written into the individual memories but are active for all memories.

Configuration level	Display	Function	P1	P2	P3	P4	Factory settings
1 Service	New Code: 1	Release lowest priority		X	X	X	0
	New Code: 2	Release medium priority		X	X	X	0
	New Code: 3	Release top priority		X	X	X	0
	Warnings	Superimpose warnings during operation					ON
	Errors	Superimpose errors during operation					ON
2 SetBasics	W-Input	Type of set value signal					4-20mA
	X-Input	Type of actual value signal					4-20mA
	CalPointQty	Quantity of set points when initialising					9
	D.Refresh	Time for display refresh		X	X	X	0.1s
	DLight	Setting the display lighting					OnKey
	AutoReturn	Time for automatic return to the working level					5min
	HelpText	Superimpose the help text					ON
	HelpLanguage	Text output language					D
3 SetFunction	ProcCtrlMode	Switch the process controller on or off					OFF
	Proc-P	KP amplification of process controller					0.5
	Proc-I	KI resetting time for the process controller					2.0s
	Proc-D	KD share of the process controller					0.0
	Proc-T	Process controller delay time					1000ms
	Pos P	P amplification of the control parameters					1.0
	Pos D	D amplification of the control parameters					0.0
	Pos T	Decay time of the D share of the control parameters					100ms
	MinPos	Lower position for stroke limitation as a control range					0.0%
	MaxPos	Upper position for stroke limitation as a control range					100.0%
	CloseTight	Lower close tight function					0.0%
	OpenTight	Upper close tight function					100.0%
	DeadBand	Permissible control deviation					1.0%

Configuration level	Display	Function	P1	P2	P3	P4	Factory settings
	In W	Determines the function of digital input In W		X	X	X	OFF
	In X	Determines the function of digital input In X		X	X	X	OFF
	In 1	Determines the function of digital input In 1		X	X	X	OFF
	In 2	Determines the function of digital input In 1		X	X	X	OFF
	K1 Switch	Defines the type of relay function					NO
	K1 Fn	Determines the function of relay K1					no
	K2 Switch	Defines the type of relay function					NO
	K2 Fn	Determines the function of relay K2					no
	Error Time	Determines the delay time between error recognition and error message					0.2s
	ErrorAction	Determines the function of the process valve if there is an error message					Close
	AlarmMaxK1	Trigger threshold that switches after K1 is exceeded					10.0%
	AlarmMinK1	Trigger threshold that switches after K1 is undershot					90.0%
	AlarmMaxK2	Trigger threshold that switches after K2 is exceeded					10.0%
	AlarmMinK2	Trigger threshold that switches after K2 is undershot					90.0%
4 SetCalibration	X-Direction	Sets the direction of the actual value signal (rising/falling)					rise
	W-Direction	Sets the direction of the set value signal (rising/falling)					rise
	W-Function	The control system curve is defined					lin.
	Y-Direction	Determines the direction of the process controller output (rising/falling)					rise
	PotDir	Defines the direction of the actual value valve potentiometer					rise
	OutMinPos	Actual value output at 0/4mA					0.0%
	OutMaxPos	Actual value output at 20mA					100.0%
	I Min W	Switch-off limit for cable break recognition of the set value					3.5 mA
	I Max W	Switch-off limit for excess current recognition of the set value					20.5 mA
	I Min X	Switch-off limit for cable break recognition of the actual value					3.5 mA
	I Max X	Switch-off limit for excess current recognition of the actual value					20.5 mA
	Scaling	Switches the scaled display on					OFF
	Decimalpoint	Determines the displayed decimal points					1
	4mA=	Defines the display that corresponds to a 0/4mA signal					0 %
	20mA=	Defines the display that corresponds to a 20mA signal					100 %

18.2. Set values for the freely programmable characteristic curve

Configuration level	Display	Characteristic curve point	P1	P2	P3	P4	Factory setting
4 SetCalibration	Set W-free	0%					0%
		10%					10%
		20%					20%
		30%					30%
		40%					40%
		50%					50%
		60%					60%
		70%					70%
		80%					80%
		90%					90%
		100%					100%

19. Technical data

General specifications	
Protection class acc. to EN 60529	IP 65
Weight	600 g
Dimensions	see data sheet
Electrical specifications	
Supply voltage	
Supply voltage	U_V= 24V DC ± 10%
Current consumption	**for Flow rate Code 01** I_{typ}= 100mA (@24V DC) **for Flow rate Code 02** I_{typ}= 140mA (@24V DC)
Analogue input signals	
Set value	0/4 – 20mA
Actual value	0/4 – 20mA
External travel sensor	R_g 1-10kΩ
Digital input signals	
Voltage	24V DC
Analogue output signals	
Position indication	4 – 20mA
Digital output signals	
2 relay outputs	24V DC
Current	≤ 0.5 A

Operating conditions	
Ambient temperature	0 to +60°C
Storage temperature	0 to +60°C
Control medium	**Air or inert gases, filtered 50µm, lubricated or unlubricated**
Air supply	1.5 to 7 bar
Air consumption	
(when idle)	0 L/min
Air output	**for Flow rate Code 01** 100 L/min **for Flow rate Code 02** 180 L/min
Travel sensor	**For direct mounting**
Linear version	
Stroke	0-30 / 0-50 / 0-75 mm
Resistance	3 / 5 / 5 kΩ
Minimum stroke	≤ 8% of the stroke length
Quarter turn version	
Angle of turn	0-93°
Resistance	3 kΩ

20. Accessories – Connection set

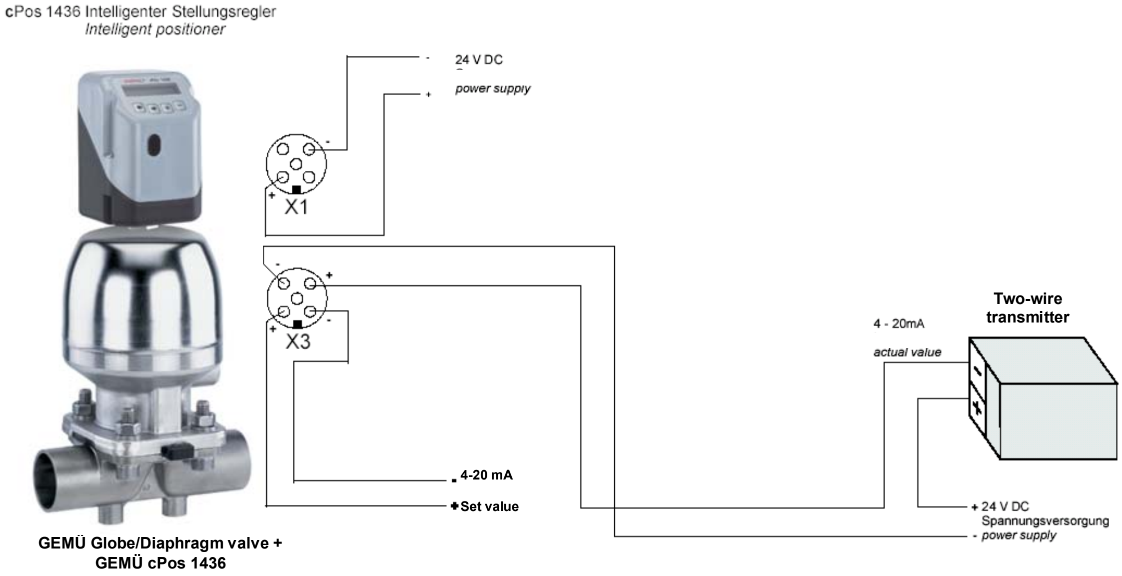
Field bus	Code
Connection set	S01
Accessories	**Code**
	Z
Connection X1 and X3, A coding	**Code**
without connector socket, with M12 protection cap	0000
M12 female angled connector A coding, screw terminal	00M0
M12 female angled connector A coding, adapter cable A/B coding for Profibus DP	DPM0
M12 female angled connector A coding, with 5m PUR cable, 0.34mm²	05M0
M12 female angled connector A coding, with 10m PUR cable, 0.34mm²	10M0

Connection X2, B coding	Code
without connector socket, with M12 protection cap	0000
M12 female angled connector B coding, screw terminal	00M0
M12 female angled connector B coding, screw terminal for Profibus DP	DPM0
Y cable + 1 x M12 female angled connector B, screw terminal	00Y0
Y cable + 1 x M12 female angled connector B, with 5m PUR cable, 0,34mm² and 5m SUB-D connecting cable	05Y0
Y cable + 1 x M12 female angled connector B, with 10m PUR cable, 0,34mm² and 10m SUB-D connecting cable	10Y0

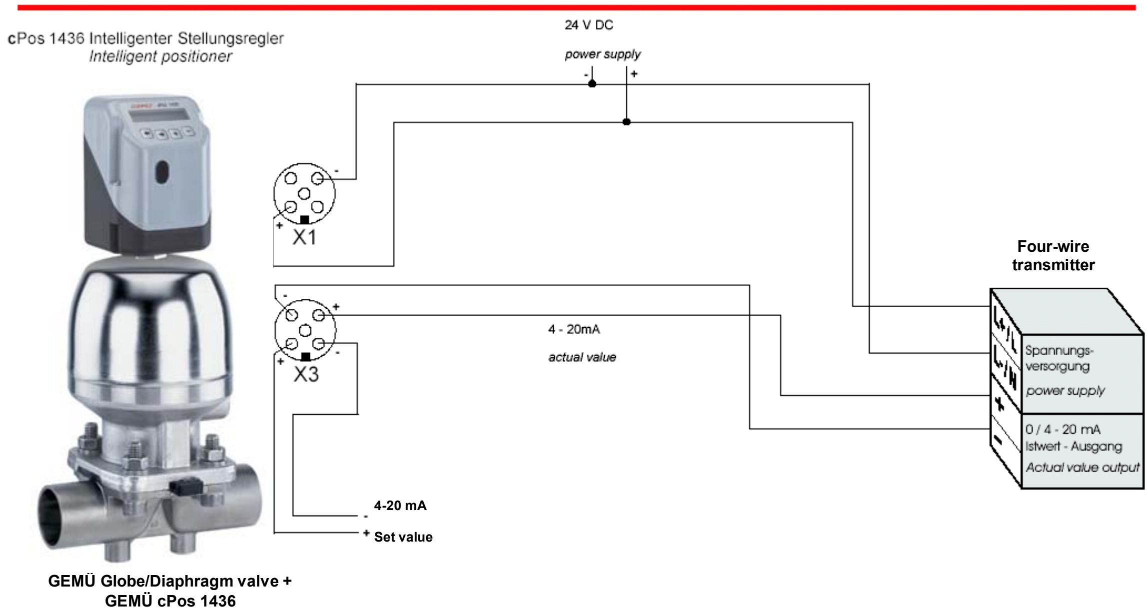
Order example	1219	S01	Z	0000	0000
Type	1219				
Field bus		S01			
Accessories			Z		
Connection X1 and X3, A coding				0000	
Connection X2, B coding					0000

21. Application examples

cPos 1436 as process controller + two-wire transmitter



cPos 1436 as process controller + four-wire transmitter



22. List of terms

K

L

M

N

O

P

R

Manufacturer's declaration
According to the EC Machine Directive 98/37/EC, Appendix II B

We hereby declare that the device described in this specification is intended for installation in a machine or application whose commissioning is prohibited until it has been determined that this machine / application conforms to EC Directive 98/37/EC.

Handling, assembly and commissioning, in addition to setting and adjustment of the machine must be performed only by authorised specialist staff.

Subject to alteration · 07/2004 · 88243865

UNTERNEHMENSBEREICH
VENTIL-, MESS- UND REGELSYSTEME

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