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SHARPE
An ASC Engineered Solution

ASC
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Series D400 IOM

INSTALLATION, OPERATION AND MAINTENANCE FOR SHARPE® D400 DIGITAL POSITIONER



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D400 Digital Positioner	
Rotation:	25 - 120 Degrees
Max Air Supply:	90 PSI
Air Delivery:	6.0 SCFM @ 90 PSI
Air Consumption:	≤ 0.015 SCFM
Stroke:	0.4 to 4"
Connections:	1/4" NPT air, 1/2" NPT Cable
Ambient Temperature:	-40° F to 185° F
Charateristic Curves:	Linear, equal %, 1:25, 1:50, 25:1, 50:1, or user configurable
Characteristic deviation:	≤ 0.5%
Deadband:	0.1%, adjustable to 10%
Resolution (A/D) Conversion):	16,000 steps
Sample Rate:	20 msec
Seismic Vibration:	Meets requirements to DIN IEC 68-3-3 Class III for strong and strongest earthquakes
Mechanical Vibration:	≤ 1% up to 10g and 10...80 Hz
Mounting orientation:	≤ 0.5% at 90° Change
EMI:	Complies with EMC directive 89/336/EEC as of May 1989 (Increased EMI Shielding to EN 50082-2 PR as of 11/93)

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1 Safety

1.1 General information and notes for the reader

Read these instructions carefully prior to installing and commissioning the device.

These instructions are an important part of the product and must be kept for later use.

These instructions are intended as an overview and do not contain detailed information on all designs for this product or every possible aspect of installation, operation and maintenance.

For additional information or in case specific problems occur that are not discussed in these instructions, contact the manufacturer.

The content of these instructions is neither part of any previous or existing agreement, promise or legal relationship nor is it intended to change the same.

This product is built based on state-of-the-art technology and is operationally safe. It has been tested and left the factory in a safe, maintenance-free state. The information in the manual must be observed and followed in order to maintain this state throughout the period of operation.

Modifications and repairs to the product may only be performed if expressly permitted by these instructions.

Only by observing all of the safety information and all safety/warning symbols in these instructions can optimum protection of both personnel and the environment, as well as safe and fault-free operation of the device, be ensured.

Information and symbols directly on the product must be observed. They may not be removed and must be fully legible at all times.

1.2 Intended use

D400 positioners are electro-pneumatic positioning devices for use with pneumatically controlled actuators. They are intended for mounting on linear and rotary actuators according to instructions in these operating instructions. The device may only be used for the applications listed in these operating instructions and in the data sheet. All other use is improper use.

The signal circuit as well as the input and output wiring must comply with the specified explosion protection (see "Certificates" in the appendix of the operating instructions).

The maximum allowable ambient temperature range from -40 °C to 85 °C (-40 ... 185 °F) (for type SJ2-S1N (NO) proximity switches) -25 … 85 °C (-13 … 185 °F)) may not be exceeded.

Repairs, alterations, and enhancements, or the installation of replacement parts, are only permissible insofar as these are described in the manual. Approval by ABB Automation Products GmbH must be sought for any activities beyond this scope. Repairs performed by ABB-authorized specialist shops are excluded from this.

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1.3 Plates and symbols

1.3.1 Safety/warning symbols, note symbols



DANGER – <Serious damage to health / risk to life>

This symbol in conjunction with the signal word "Danger" indicates an imminent danger. Failure to observe this safety information will result in death or severe injury.



DANGER – <Serious damage to health / risk to life>

This symbol in conjunction with the signal word "Danger" indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury.



WARNING – <Bodily injury>

This symbol in conjunction with the signal word “Warning“ indicates a possibly dangerous situation. Failure to observe this safety information may result in death or severe injury.



WARNING – <Bodily injury>

This symbol in conjunction with the signal word "Warning" indicates a potential electrical hazard. Failure to observe this safety information may result in death or severe injury.



CAUTION – <Minor injury>

This symbol in conjunction with the signal word “Caution“ indicates a possibly dangerous situation. Failure to observe this safety information may result in minor or moderate injury. This may also be used for property damage warnings.



ATTENTION – <Property damage>!

The symbol indicates a potentially damaging situation.

Failure to observe this safety information may result in damage to or destruction of the product and/or other system components.



IMPORTANT (NOTICE)

This symbol indicates operator tips, particularly useful information, or important information about the product or its further uses. It does not indicate a dangerous or damaging situation.

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1.4 Target groups and qualifications

Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator to do so. The specialist personnel must have read and understood the manual and comply with its instructions.

Prior to using corrosive and abrasive materials for measurement purposes, the operator must check the level of resistance of all parts coming into contact with the materials to be measured. ABB Automation Products GmbH will gladly support you in selecting the materials, but cannot accept any liability in doing so.

The operators must strictly observe the applicable national regulations with regards to installation, function tests, repairs, and maintenance of electrical products.

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1.5 Explosion protection

Depending on the type of explosion protection, one of the following model plates is attached to the left of the positioner beside the main model plate. It shows the explosion protection and your device's applicable EX certificate. More detailed information about your device can be found under "Certificates" in the appendix to the operating instructions.

Warning - General hazards!

Always observe your device's applicable technical data and the special conditions in accordance with the applicable certificate.

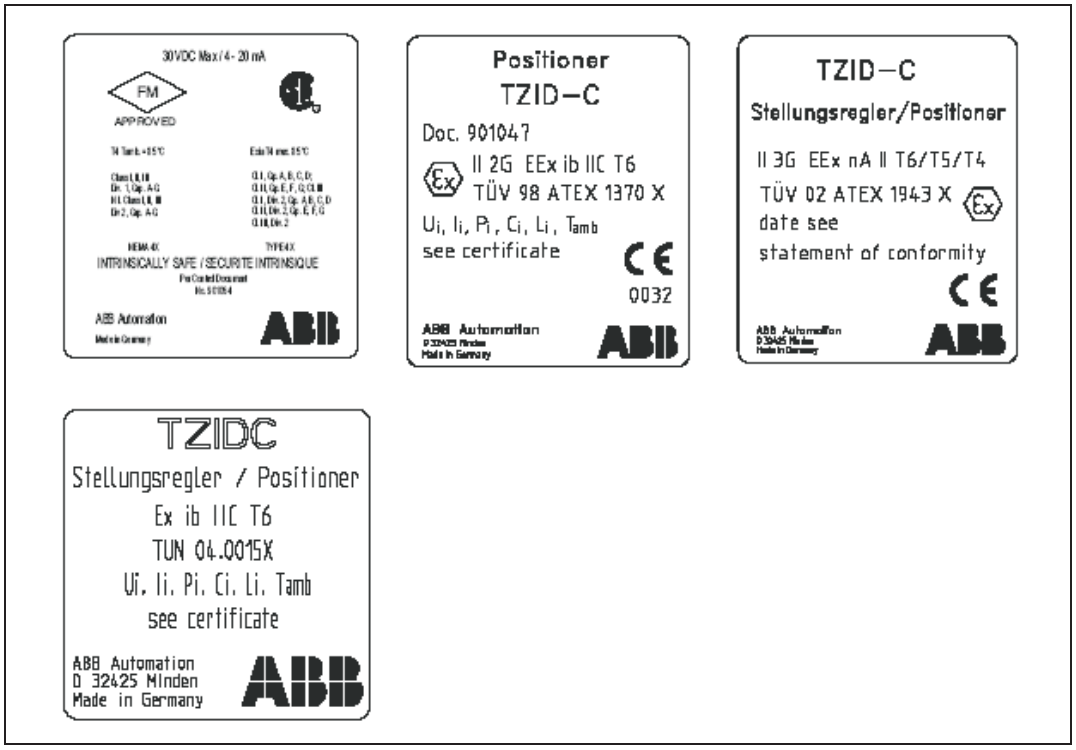


Fig. 1 Explosion protection information on the D400 model plates

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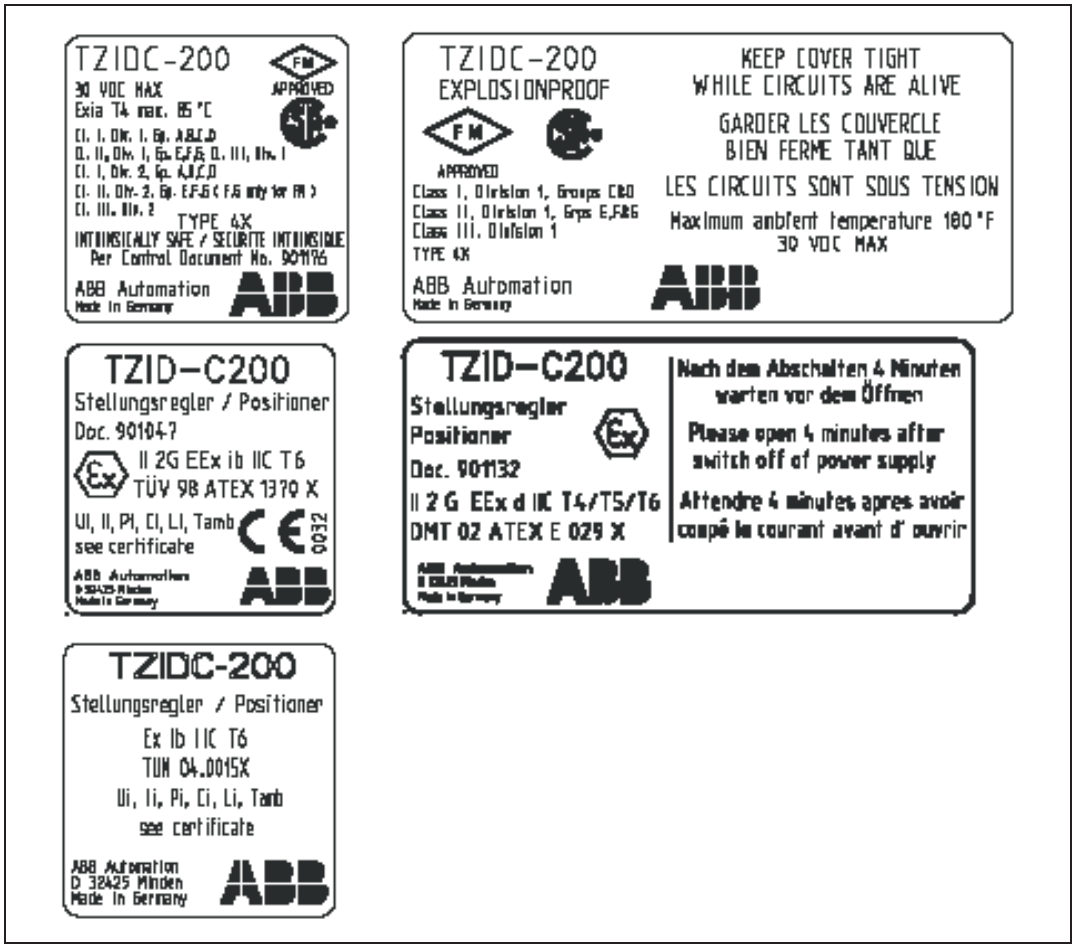


Fig. 2 Explosion protection information on the D400 model plates

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2 Local operation

2.1 General

The D400 positioner features **two operating levels**:

Operating level

On the operating level the D400 positioner operates in one of four possible operating modes (two for automatic control and two for manual adjustment). Parameters cannot be changed or saved on this level.

Configuration level

On this level most of the parameters of the positioner can be changed locally. The PC is required to change the limit values for the movement counter, the travel counter, and the user-defined characteristic curve.



Caution - Warning!

During external configuration via a PC, the D400 positioner no longer responds to the position demand signal. Prior to external configuration always move the actuator to the safe position and activate manual adjustment.

To simplify operation, the parameters have been categorized in parameter groups through which you can navigate by means of push buttons (see the section “Displays and operating elements”).

On the configuration level the active operating mode is deactivated. The I/P module is in neutral position. The control operation is inactive.

See the chapter “Configuration” for a detailed description of the individual parameter groups.

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2.2 Displays and operating elements

D400 positioners can be operated locally by means of four push buttons and a liquid crystal display.

Liquid crystal display

The liquid crystal display with 160 segments has been specially designed for the D400 positioner.

Important

The display has been designed for a temperature range of -25 °C to 80 °C (-13°F to +176°F). At temperatures outside this range the display is too sluggish and will be switched off.

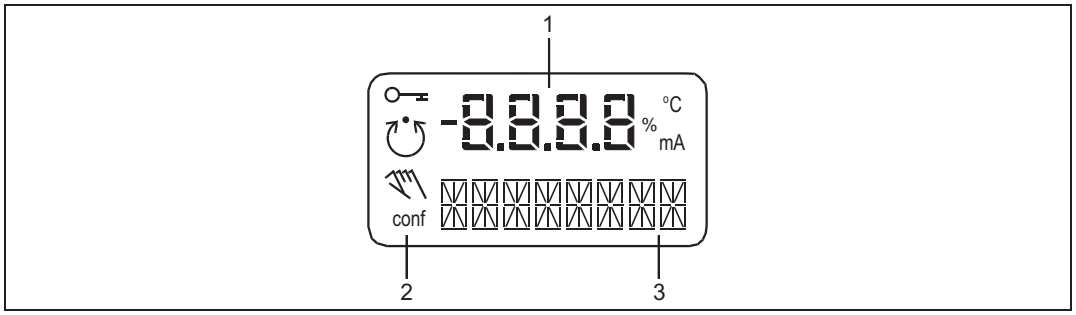


Fig. 3: Liquid crystal display

1 Value display, with unit
2 Symbol display
3 Designator display

Symbol display

The operating modes of the positioner are indicated by the following four symbols.

Symbol	Description
	The **key icon** indicates that operation or access is restricted.
	The **control loop icon** indicates that the control loop is active. The symbol is displayed when the positioner is normally in operating mode **1.0 CTRL_ADP** (adaptive control) or **1.1 CTRL_FIX** (fixed control). On the configuration level there are test functions for which the controller will be active as well. The control loop symbol will also be displayed when these functions are active.
	The **hand icon** indicates manual adjustment. The symbol is displayed when the positioner is operating on the operating level in operating mode **1.2 MANUAL** (manual adjustment within the stroke range) or **1.3 MAN_SENS** (manual adjustment within the sensor range). On the configuration level, manual adjustment is active when setting the valve range limits (parameter **P6.0 MIN_VR** (min. of valve range) and **P6.1 MAX_VR** (max. of valve range). The symbol will also be displayed when these parameters are being set.
conf	The **Configuration icon** indicates that the D400 positioner is in the configuration level. The control operation is inactive.

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Value display with unit

This 7-segment display with four digits indicates parameter values or parameter reference numbers. For values, the physical unit (°C, %, mA) is also displayed.

Designator display

This 14-segment display with eight digits indicates the designators of the parameters with their status, of the parameter groups, and of the operating modes.

Push buttons

The four push buttons ENTER, MODE, ↑ and ↓ are pressed individually or in certain combinations according to the function desired.

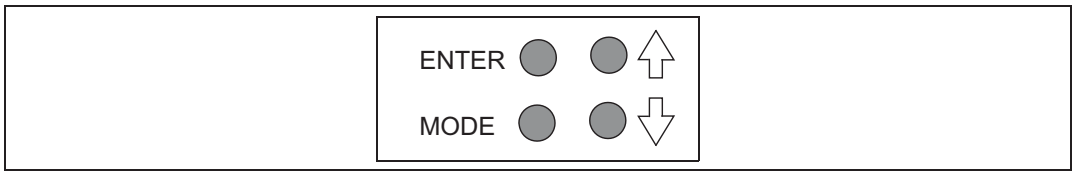


Fig. 4: Push buttons

Basic functions

Push button	Description
ENTER	• To acknowledge a message • Starting an action • Save in the non-volatile memory
MODE	• Choose operating mode (operating level) • Select parameter group or parameter (configuration level)
↑	• UP direction button
↓	• DOWN direction button
Press and hold all four buttons for 5 s	• Reset

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2.2.1 Functions on the operating level

Changing the mode (operating level)

1. Press and hold MODE.

   The reference number (top) and the designator (bottom) of the active mode are displayed.

2. Additionally, press ↑ or ↓ until the reference number and the designator of the desired mode are indicated in the display.

3. Release the buttons.

Important

The desired mode is only activated and saved in the non-volatile memory after releasing the MODE button.

Adjusting the contrast (operating level)

1. Press and hold ENTER.

   After approx. 1.5 seconds the display switches to the contrast value.

2. Additionally, press ↑ or ↓ to change the contrast.

   The value selected is active immediately so that you can check the contrast in the display.

3. Release the buttons.

   After releasing the ENTER button the value is saved in the non-volatile memory.

Switching to the configuration level

1. Simultaneously press and hold the ↑ or ↓ buttons.

2. Briefly press and release ENTER. Press and hold ↑ and ↓ until the countdown from 3 to 0 has been completed (time: appr. 3 seconds).

Important

If you release the direction buttons before the countdown is finished the configuration level is not activated.

3. Release the buttons ↑ or ↓.

   The configuration level appears. The first parameter (**P1.0**) of group 1 **STANDARD** is displayed. The configuration symbol is also shown on the display.

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2.2.2 Functions on the configuration level

Switching to another parameter group

1. Simultaneously press and hold the MODE and ENTER buttons.

   The display indicates the reference number (top) and the designator (bottom) of the current parameter group of the positioner.

2. Additionally press ↑ or ↓ until the reference number and the designator of the desired parameter group are displayed.

3. Release all buttons.

   The first parameter of the newly selected parameter group is displayed. The desired parameter can be adjusted within the group.

Selecting a parameter within a group

1. Press and hold MODE.

   The display indicates the reference number (top) and the designator (bottom) of the current parameter.

2. Additionally, press ↑ or ↓ until the reference number and the designator of the desired parameter are displayed.

3. Release all buttons.

   The display indicates the value of the selected parameter (top). At the bottom the designator is still shown. For parameters that can assume different states (e.g. **ACTIVE** or **INACTIVE**) the reference number is displayed at the top and the state at the bottom. The value/state of the parameter can be changed.

Changing a parameter

1. Press ↑ or ↓ until the desired value or state is shown.

Important

When keeping the respective direction button pressed, parameters with values are changed dynamically. The change rate is increased every second until the limit value of the parameter is reached.

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Saving data and exiting the configuration level

1. Select the **EXIT** parameter for the respective parameter group and set it to one of the two possible states using ↑ or ↓:

NV_SAVE Activates your changes and saves them in the non-volatile memory. The positioner returns to the operating level.

CANCEL Changes are discarded. The positioner returns to the operating level.

Important

The parameters are only saved in the non-volatile memory by leaving the configuration level via EXIT -> SAVE.

Multiple parameters in different groups can also be changed sequentially. When leaving the last parameter group via EXIT -> SAVE, all previously made modifications are saved and applied.

2. Press and hold ENTER until the displayed countdown from 3 to 0 is finished.
3. Release the ENTER button.

   The positioner returns to the operating level. The configuration level was accessed from this mode.

   Depending on the selection the data is saved in the non-volatile memory or discarded. During the save operation a plausibility check is performed. If an error occurs during the check or when data is being saved, an error message is displayed (see the chapter “Error messages").

Starting an action

1. Press and hold ENTER until the displayed countdown from 3 to 0 is finished.
2. Release the ENTER button. The selected action is started.

Important

If you release ENTER before the countdown is finished the action is not started.

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To acknowledge a message

In the course of some actions (e.g. Autoadjust) messages are displayed that have to be acknowledged. Messages that must be acknowledged are identified by the value display (top line) being empty (see adjacent example).



Acknowledgement required

Acknowledgement:

1. Briefly press ENTER.

   The D400 positioner continues with the action and/or finishes the procedure.



No acknowledgement

To cancel an action

1. Briefly press ENTER.

   The D400 positioner cancels the action in progress (e.g. Autoadjust).

2.3 Operation on the operating level

In the operating level, the D400 positioner works in the selected operating mode. There are four operating modes:

- **1.0 CTRL_ADP** (Adaptive control)
- **1.1 CRTL_FIX** (Fixed control)
- **1.2 MANUAL** (Manual adjustment within the stroke range)
- **1.3 MAN_SENS** (Manual operation within the sensor range)

For details regarding switching between the modes refer to the section “Functions in the operating level”.

When the 4 ... 20 mA signal is fed in, the positioner automatically starts up in the previously active mode. Devices from the factory start up in operating mode **1.3**. This also applies to devices that have been reset to the factory setting.

In both manual modes the valve can be adjusted manually by pressing ↑ or ↓.

The two automatic control modes are indicated by the control loop symbol in the display. For the manual modes the hand symbol is shown in the display.

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2.4 Operating modes

2.4.1 Operating mode 1.0: Adaptive control

Controlling operation with automatic adaptation of the control parameters



When operating the D400 positioner in "adaptive mode" **P1.0 CTRL_ADP**, the control parameters are automatically optimized to the operating conditions in small increments. This is especially helpful if valves and fittings could not be operated with reference conditions during Autoadjust.

Since self-optimization in "adaptive mode" is subject to several factors during operation and mismatches could result over a longer period, we recommend that this operating mode only be activated over several hours and be followed by the mode P1.1 CTRL_FIX.

The valve position is indicated as a percentage of the operating range (from 0 ... 100%).



2.4.2 Operating mode 1.1: Fixed control

Controlling operation with fixed parameters



This is the normal recommended operating mode.

In contrast to the operating mode **P1.0 CTRL_ADP**, the control parameters are not automatically adjusted.

The valve position is indicated as a percentage of the operating range (from 0 ... 100%).





Caution - Risk

No leakage monitoring.

In control modes **1.0** and **1.1**, various values can be displayed in addition to the current actuator position:

Setpoint display



1. Press and hold the ↑ button.

   The setpoint is displayed.

2. Briefly press ENTER as well.

   The setpoint display is toggled between the setpoint current at the input terminals in mA and the setpoint as a percentage of the stroke range.

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Temperature display



1. Press and hold the ↓ button.

   The temperature inside the case is displayed.
2. Briefly press ENTER as well.
3. The temperature display is toggled between °C and °F.

Display of control deviation



1. Press and hold the ↑ and ↓ buttons.

   The control deviation is displayed as a percentage (%) of the stroke range.

2.4.3 Operating mode 1.2: Manual adjustment within the stroke range

The valve is adjusted manually using the direction buttons ↑ and ↓ within the stroke range.



1. Press and hold the button for the desired direction.
2. Press the second arrow button to switch the device to high-speed mode.



Caution - Risk

If air escapes due to a leakage and the actuator position changes, the positioner will not automatically restore the setpoint.

Configured stroke limit positions and stroke times are not effective in the manual mode.

In this operating mode the valve position is indicated as a percentage (%) of the stroke range.



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2.4.4 Operating mode 1.3: Manual adjustment within the sensor range

see operating mode 1.2





Unlike step 1.2, this operating mode is used to determine whether the available detection range of the position sensor is used correctly after mounting the positioner to the actuator. In this mode, the valve position is indicated in angular degrees with respect to the sensor range (i.e. 0 ...140 °).

Most parameters of the D400 positioner can be set locally, so that configuring via the communication interface (LKS) or FSK modem and a PC or hand-held terminal is only necessary occasionally.

You may also disable local modification and saving of parameters by denying or restricting access to the configuration level.

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2.5 Inhibiting operation

Configuration changes to the program in the D400 positioner can be inhibited completely or partially via the digital input and the parameter **10.0 FUNCTION** in parameter group **DIG_IN** (digital input). This allows the user to prevent or restrict operating actions of unauthorized personnel as desired. When operation is disabled in this way, the key symbol is indicated in the display.

The following levels of configuration locks are possible:

Inhibiting the local configuration

Local operation on the operating level and remote operation and configuration via a PC are still possible.

Inhibiting all local operating functions

No local operating actions can be executed. Both the operating level and the configuration level are locked. Remote operation and setting of parameters via a PC is still possible.

Inhibiting local operation and remote configuration

The D400 positioner can neither be operated or configured locally nor configured remotely from a PC.

Important

This lock can only be deactivated when a voltage of 12 ... 24 V is applied to D400 (see **P10.0 Function selection**).

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3 Configuration

3.1 General information

Most parameters of the D400 positioner can be set locally, so that configuring via the communication interface (LKS) or FSK modem and a PC or hand-held terminal is only necessary occasionally.

You may also disable local modification and saving of parameters by denying or restricting access to the configuration level (see the section “Inhibiting operation” in the chapter “Local operation” and the description of the parameter **P10.0 Function selection**).

To simplify the process, the different parameters are grouped as follows:

The following sections provide an overview in graphic and table formats of the overall structure of the parameter groups and parameters.

ID	Designator	Name
P1._	**STANDARD**	Standard
P2._	**SETPOINT**	Setpoint
P3._	**ACTUATOR**	Actuator
P4._	**MESSAGES**	Messages
P5._	**ALARMS**	Alarms
P6._	**MAN_ADJ**	Manual adjustment
P7._	**CTRL_PAR**	Control parameters
P8._	**ANLG_OUT**	Analog output
P9._	**DIG_OUT**	Digital output
P10._	**DIG_IN**	Digital input
P11._	**FS / IP**	Factory setting, I/P type

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3.2 Parameter overview (table)

Param.	Display	Function	Possible parameter settings	Unit	Factory set.
P1._	**STANDARD**				
P1.0	**ACTUATOR**	Actuator type	LINEAR, ROTARY	-	LINEAR
P1.1	**AUTO_ADJ**	Autoadjust	Command / Function is being run	-	-
P1.2	**ADJ_MODE**	Autoadjust mode	FULL, STROKE, CTRL, PAR, ZERO_POS, LOCKED	-	-
P1.3	**TEST**	Test	Command / Function is being run	-	-
P1.4	**EXIT**	Return to operating level	Command / Function is being run	-	-
P2._	**SETPOINT**				
P2.0	**MIN_RGE**	Min. setpoint range	4.0 … 18.4	mA	4.0
P2.1	**MAX_RGE**	Max. setpoint range	5.6 … 20.0	mA	20.0
P2.2	**CHARACT**	Characteristic	LINEAR, EP 1:25, 1:50, 25:1, 50:1, USERDEF,	-	LINEAR
P2.3	**ACTION**	Action (output signal)	DIRECT, REVERSE	-	DIRECT
P2.4	**SHUT_CLS**	Shut-off value 0%	OFF, 0.1 … 45.0	%	OFF
P2.5	**SHUT_OPN**	Shut-off value 100%	OFF, 55.0 … 100.0	-	OFF
P2.6	**RAMP UP**	Setpoint ramp (up)	OFF, 1 … 200	s	OFF
P2.7	**RAMP_DN**	Setpoint ramp (down)	OFF, 1 … 200	s	OFF
P2.8	**EXIT**	Return to operating level	Command / Function is being run	-	-
P3._	**ACTUATOR**				
P3.0	**MIN_RGE**	Operating range, min.	0.0 ... 100.0	%	0.0
P3.1	**MAX_RGE**	Operating range, max.	0.0 ... 100.0	%	100.0
P3.2	**ZERO_POS**	Zero position	CLOCKWISE, CTCLOCKWISE	-	CTCLOCKW.
P3.3	**EXIT**	Return to operating level	Command / Function is being run	-	-
P4._	**MESSAGES**				
P4.0	**TIME_OUT**	Dead band time limit	OFF, 1 … 200		OFF
P4.1	**POS_SW1**	Switching point SW 1	0.0 ... 100.0	%	0.0
P4.2	**POS_SW2**	Switching point SW 2	0.0 ... 100.0	%	100.0
P4.3	**SW1_ACTV**	Active direction SW1	EXCEED, FALL_BEL	-	FALL_BEL
P4.4	**SW2_ACTV**	Active direction SW2	EXCEED, FALL_BEL	-	EXCEED
P4.5	**EXIT**	Return to operating level	Command / Function is being run	-	-
P5._	**ALARMS**				
P5.0	**LEAKAGE**	Leakage to actuator	ACTIVE, INACTIVE	-	INACTIVE
P5.1	**SP_RGE**	Setpoint time-out	ACTIVE, INACTIVE	-	INACTIVE
P5.2	**SENS_RGE**	Operating range oversh.	ACTIVE, INACTIVE	-	INACTIVE
P5.3	**CTRLER**	Controller inactive	ACTIVE, INACTIVE	-	INACTIVE
P5.4	**TIME_OUT**	Positioning loop monitoring	ACTIVE, INACTIVE	-	INACTIVE
P5.5	**STRK_CTR**	Movement counter	ACTIVE, INACTIVE	-	INACTIVE
P5.6	**TRAVEL**	Travel counter	ACTIVE, INACTIVE	-	INACTIVE
P5.7	**EXIT**	Return to operating level	Command / Function is being run	-	-
P6._	**MAN_ADJ**				
P6.0	**MIN_VR**	Operating range, min.	0.0 ... 100.0	%	0.0
P6.1	**MAX_VR**	Operating range, max.	0.0 ... 100.0	%	100.0
P6.2	**ACTUATOR**	Actuator type	LINEAR, ROTARY	-	LINEAR
P6.3	**SPRNG_Y2**	Spring action (Y2)	CLOCKWISE, CTCLOCKWISE	-	CTCLOCKW.
P6.4	**DANG_UP**	Dead angle open	0.0 … 45.0	%	0.0
P6.5	**DANG_DN**	Dead angle closed	55.0 … 100.0	%	100.0
P6.6	**EXIT**	Return to operating level	Command / Function is being run	-	-
P7._	**CTRL_PAR**				
P7.0	**KP UP**	KP value (up)	0.1 … 120	-	5.0
P7.1	**KP DN**	KP value (down)	0.1 … 120	-	5.0
P7.2	**TVUP**	TV value (up)	10 … 450	ms	200
P7.3	**TVDN**	TV value (down)	10 … 450	ms	200
P7.4	**Y-OFS UP**	Y offset (up)	Y-min … 100.0		24.0
P7.5	**Y-OFS DN**	Y offset (down)	Y-min … 100.0	%	24.0
P7.6	**TOL_BAND**	Tolerance band	0.3 … 10.0	%	1.5
P7.7	**DEADBAND**	Dead band	0.1 ... 10.0	%	0.1
P7.8	**DB_APPR**	Dead-band approach	Slow / medium / fast	-	Fast
P7.9	**TEST**	Test	Command / Function is being run	-	-
P7.10	**EXIT**	Return to operating level	Command / Function is being run	-	-

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Configuration

Param.	Display	Function	Possible parameter settings	Unit	Factory set.
P8._	**ANLG_OUT**				
P8.0	**MIN_RGE**	Min. current range	4.0 … 18.4	mA	4.0
P8.1	**MAX_RGE**	Max. current range	5.6 … 20.0	mA	20.0
P8.2	**ACTION**	Valve action	DIRECT/REVERSE	-	DIRECT
P8.3	**ALARM**	Alarm message	HIGH_CUR, LOW_CUR	-	HIGH_CUR
P8.4	**RB_CHAR**	Count back characteristic curve	DIRECT, RECALC	-	DIRECT
P8.5	**TEST**	Test	NONE, FAILED, ALRM, CUR, CURRENT	-	NONE
P8.6	**EXIT**	Return to operating level	Command / Function is being run	-	-
P9._	**DIG_OUT**				
P9.0	**ALRM_LOG**	Signal level dig. outputs	ACTIV_HI, ACTIV_LO	-	ACTIV_HI
P9.1	**SW1_LOG**	Signal level SW1	ACTIV_HI, ACTIV_LO	-	ACTIV_HI
P9.2	**SW2_LOG**	Signal level SW2	ACTIV_HI, ACTIV_LO	-	ACTIV_HI
P9.3	**TEST**	Test	ALARM_ON, SW1_ON, SW2_ON, ALL_ON, NONE	-	NONE
P9.4	**EXIT**	Return to operating level	Command / Function is being run	-	-
P10._	**DIG_IN**				
P10.0	**FUNCTION**	Digital input	NONE, POS_0%, POS_100%, POS_HOLD, CNF-LOCK, OP_LOCK, ALL_LOCK	-	NONE
P10.1	**EXIT**	Return to operating level	Command / Function is being run	-	-
P11._	**FS / IP**				
P11.0	**FAIL_POS**	Safe position	ACTIVE, INACTIVE	-	INACTIVE
P11.1	**FACT_SET**	Factory setting	Command / Function is being run	-	-
P11.2	**IP_TYP**	I/P module type	NO_F_POS, F_SAFE_1, F_SAFE_2, F_FREEZE_1, F_FREEZE_2	-	NO_F_POS
P11.3	**EXIT**	Return to operating level	Command / Function is being run	-	-

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3.3 Parameter overview (figure)

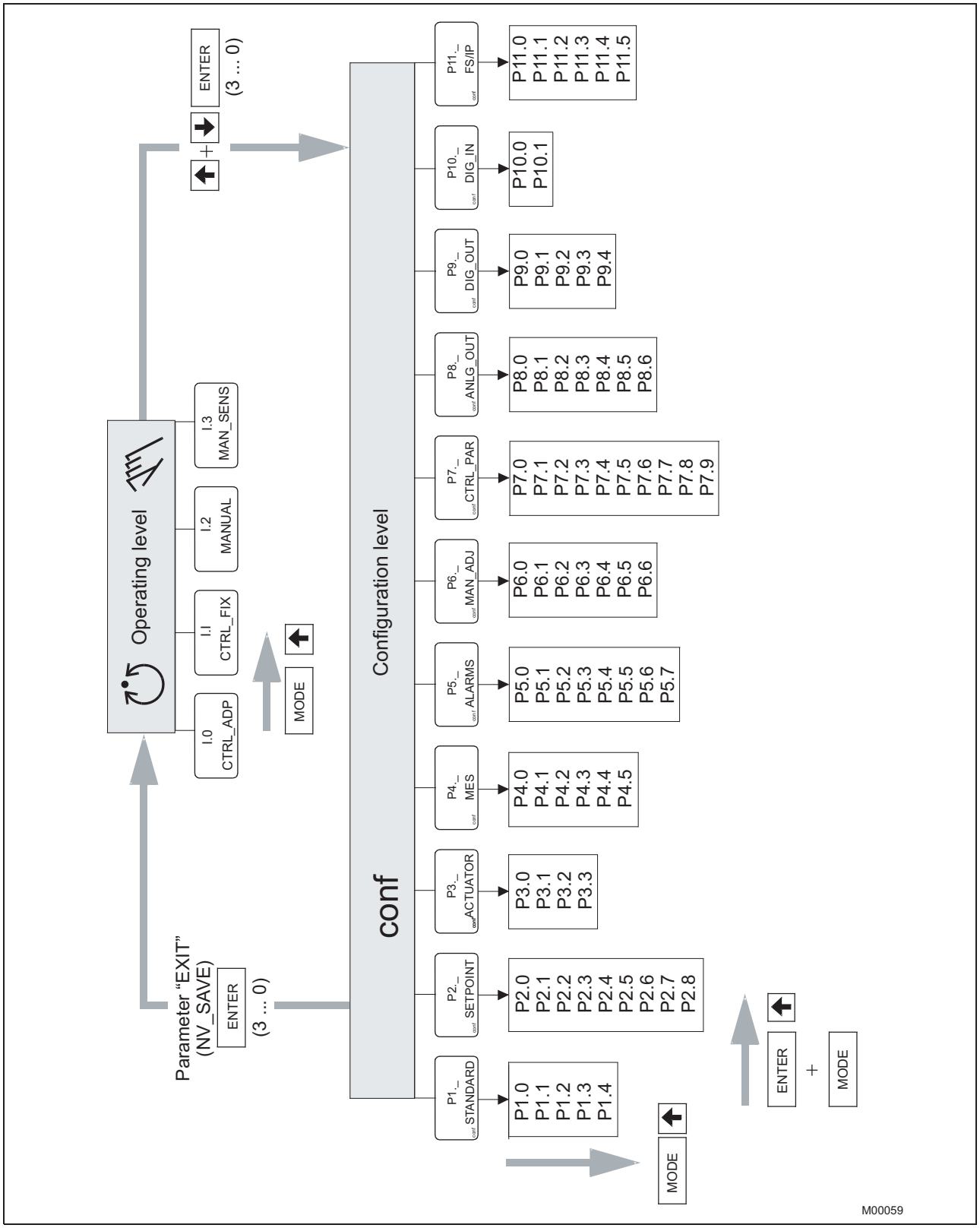


Fig. 5

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3.4 Parameter group 1: Standard



3.4.1 P1.0 Actuator type

With this parameter you can configure the D400 positioner for operation on a linear actuator (sensor range +/-30°) or on a rotary actuator (sensor range +/-45°). No mechanical changes on the positioner are required.



Important

After changing the actuator type, it is recommended that you run Autoadjust to prevent linearity errors.

Selection:

LINEAR	Linear actuator
ROTARY	Rotary actuator
Factory setting:	LINEAR

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3.4.2 P1.1 Autoadjust

The following values are determined during Autoadjust:



- Direction of the actuator
- Direction of reset spring
- Stroking distance of the actuator
- Stroke time for both directions
- Control parameters
- Offset for the I/P module

Important

The mode and scope of the Autoadjust can be selected via parameter **1.2**.



To start the Autoadjust, press and hold ENTER until the countdown from 3 to 0 is finished. During countdown, the Autoadjust mode selected via parameter **P1.2** is indicated in the display. While Autoadjust is running, the control loop symbol flashes in the display, and the current state of Autoadjust is indicated with the messages listed below.

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Important
All messages except RUN must be acknowledged with ENTER.



No acknowledgement

RUN	Autoadjust is running.
CALC_ERR	Error during plausibility check.
COMPLETE	Autoadjust completed successfully.
BREAK	Autoadjust has been stopped by the operator. This can be done locally by pressing ENTER.
OUTOFRNG	Sensor range of the positioner has been exceeded; Autoadjust was stopped.
NO_SCALE	End positions have not yet been determined; therefore, partial Autoadjust cannot be run.
RNG_ERR	Less than 10% of the sensor range is used.
TIMEOUT	Time-out; parameter could not be determined within 200 seconds. Autoadjust was stopped.
SPR_ERR	The actual spring action does not match the configured direction.



Acknowledgement required

When Autoadjust is completed without any errors, the device displays the message RUN in the bottom line and a code number in the top line, indicating the step that has just been performed:

10	Air is completely evacuated from actuator (OUT1). The fully evacuated position is saved.
20	Air is completely ventilated from actuator (OUT1). The fully ventilated position is saved.
30	Stroke time determination is prepared.
31	Actuator travels from 0% to 100%, stroke time is measured and saved.
32	Actuator travels from 0% to 100%, stroke time is measured and saved.
40 - 49	Tolerance band is determined and saved (minimum value). PD parameters for fast control < tolerance band is determined and saved.
50 - 59	PID parameters for precise control of control deviation < tolerance band is determined and saved.
200	Autoadjust is complete.

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When a partial run of Autoadjust has been selected (see Parameter **P6.4**), the following code numbers are shown:

Stops only: Steps **10 – 32** and step **200**

Parameters only: Steps **40 – 120** and step **200**

Zero only:

10 Air is completely evacuated from actuator (OUT1). The fully evacuated position is saved.

200 Autoadjust is complete.

3.4.3 P1.2 Autoadjust

With this parameter you determine the mode or scope of the Autoadjust function.



FULL	Complete Autoadjust
STROKE	Stops only
CTRL_PAR	Control parameters only
ZERO_POS	Zero position only (configured stops required)
LOCKED	No Autoadjust
Factory setting:	FULL

3.4.4 P1.3 Test

With this test the positioner is activated, and you can check the effects of the changes to this parameter group, e.g. by introducing setpoint changes or setpoint ramps using a current source.



Normally, **INACTIVE** is shown in the display. To start the test, press and hold ENTER until the countdown from 3 to 0 is finished. The test is activated. The display shows the control loop symbol and a flashing message. The test is automatically stopped after two minutes and can also be stopped by pressing any button.



Important

It is not possible to start the test when the safe position is active (see parameter **11.0**). Instead, the message **FAIL_POS** is displayed.

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3.4.5 P1.4 Return to operating level



With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).

To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last save to the non-volatile memory.

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3.5 Parameter group 2: Setpoint



3.5.1 P2.0 Minimum of setpoint range

The setpoint range is the input current range as a percentage of the operating range for the valves and fittings (from 0 ... 100 %).



Important

The configured setpoint range must not be smaller than 20% (3.2 mA).

With this parameter you determine the **lower** limit of the setpoint range. You can enter a value within the admissible value range of 4 ... 18.4 mA, with one decimal.

Input value: 4.0 ... 18.4 mA

Factory setting: 4.0 mA

3.5.2 P2.1 Max. of setpoint range

The setpoint range is the input current range as a percentage of the operating range for the valves and fittings (from 0 ... 100 %).



Important

The configured setpoint range must not be smaller than 20% (3.2 mA).

With parameter **P2.0** you determine the **upper** limit of the setpoint range. You can enter a value within the admissible value range of 5.6 ... 20 mA, with one decimal.

Input value: 5.6 ... 20.0 mA

Factory setting: 20.0 mA

Setting examples

Setpoint range: Min. = 8.3 mA, Max. = 15.6 mA

Split range: Min. = 12.0 mA, Max. = 20.0 mA

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3.5.3 P2.2 Characteristic curve



This parameter enables you to select a function that adjusts the behavior of the positioner to the input signal after a predefined course. This linearizes the action of the valves and fittings and improves the overall control loop.

Besides five predefined curves you can also select a user-configurable curve, which can be defined via a PC with the appropriate configuration software and saved in the device.

Selection:

LINEAR linear

EP 1/25 equal percentage 1:25

EP 1/50 equal percentage 1:50

EP 25/1 equal percentage 25:1

EP 50/1 equal percentage 50:1

USERDEF: configurable by user

Factory setting: LINEAR

USERDEF: LINEAR

3.5.4 P2.3 Action (positioning signal)



The action describes the relation between analog setpoint and pneumatic output **OUT1**.

Increasing: Setpoint 0 ... 100% ➔ Output 0 ... 100%

Decreasing: Setpoint 0 ... 100 % ➔ Output 100 ... 0%

Selection:

DIRECT Increasing

Positioning signal 4 ... 20 mA

= Position 0 ... 100%

REVERSE Decreasing

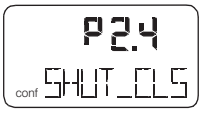
Positioning signal 20 ... 4 mA

= Position 0 ... 100%

Factory setting: DIRECT

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3.5.5 P 2.4 Shut-off value 0%



The shut-off value **SHUT_CLS** is a percentage of the operating range (with one decimal place) from which the 0% position is driven to. Once the specified position limit value is reached, the actuator moves into the 0% end position.

Input value: 0,1 ... 20,0

Factory setting: 1

As a result, the valve is moved in control mode into the 0% end position through full evacuation or ventilation.

In the 0% end position, it continues to be adjusted to the position setpoint.

3.5.6 P 2.5 Shut-off value 100%



The shut-off value **SHUT_OPN** is a percentage of the operating range (with one decimal place) from which the 100% position is driven to. Once the specified position limit value is reached, the actuator moves into the 100% mechanical end position.

Input value: 80,0 ... 99,9

Factory setting: OFF

In the 100% end position, it continues to be adjusted to the position setpoint.

When entering a value, the valve is moved in control mode into the 100% end position through full evacuation or ventilation.

Settings for Autoadjust:

Rotary actuators = 99

When the limit value is reached, the actuator is fully ventilated.

Linear actuator = 100

Controlling continues in the 100% position.

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3.5.7 P2.6 Setpoint ramp (up)



Here the stroke time for the actuator can be increased. A setpoint change is not directly transferred to the positioner but rather the speed is reduced accordingly. The set value should always be greater than the shortest stroke time determined during Autoadjust.

Input value: OFF ... 1 ... 200 seconds

Factory setting: OFF

Important

- To display the stroke time (stroke time up), press and hold the ENTER button.



Caution - Risk of crushing!

The setpoint ramp is deactivated in the case of any functions which involve approaching the safe position. This even applies in the case of errors.

The drive will therefore move without delay.

- Avoid reaching into the adjustment mechanism.

3.5.8 P2.7 Setpoint ramp (down)



Here the stroke time for the actuator can be increased. A setpoint change is not directly transferred to the positioner but rather the speed is reduced accordingly. The set value should always be greater than the shortest stroke time determined during Autoadjust.

Input value: OFF ... 1 ... 200 seconds

Factory setting: OFF

Important

- To display the stroke time (stroke time down), press and hold the ENTER button.



Caution - Risk of crushing!

The setpoint ramp is deactivated in the case of any functions which involve approaching the safe position. This even applies in the case of errors.

The drive will therefore move without delay.

- Avoid reaching into the adjustment mechanism.

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3.5.9 P2.8 Return to operating level



With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).

To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last save to the non-volatile memory.

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3.6 Parameter group 3: Operating range



3.6.1 P3.0 Minimum of operating range



The operating range can be configured to be smaller than the maximum mechanical operating range.

The setpoint range always refers to the configured operating range. With this parameter you determine the **lower** limit of the operating range.

Caution - Warning!

This function is only effective in control mode.

If auxiliary power fails (electric or pneumatic) and in manual mode, the mechanical stops are reached.

Important

The operating range must be greater than 10 % of the sensor range.

Input value: 0,0 ... 100,0 %

Factory setting: 0,0 %

Important

The display of the D400 positioner in operating modes 1.0 through 1.2 always refers to the configured operating range and indicates the position in %.

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3.6.2 P3.1 Maximum operating range



The operating range can be configured to be smaller than the maximum mechanical operating range.

The setpoint range always refers to the configured operating range. With this parameter you determine the **upper** limit of the operating range.

Caution - Warning!

This function is only effective in control mode.

If auxiliary power fails (electric or pneumatic) and in manual mode, the mechanical stops are reached.

Important

The operating range must be greater than 10% of the sensor range.

Input value:	0,0 ... 100,0 %
Factory setting:	100,0 %

Important

The display of the D400 positioner in operating modes 1.0 through 1.2 always refers to the configured operating range and indicates the position in %.

3.6.3 P3.2 Zero position



With this parameter you can assign the zero position of the display to the zero position of the valves and fittings. It also allows you to select the direction of rotation of the sensor shaft (looking at the open housing).

Important

Normally, the zero position is determined automatically and saved during standard Autoadjust.

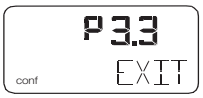
Linear actuators	➔ “counterclockwise”
Rotary actuators	➔ “clockwise”

Selection:

CLOCKW	Stop reached turning clockwise
CTCLOCKW	Stop reached turning counterclockwise
Factory setting:	CTCLOCKW

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3.6.4 P3.3 Return to operating level



With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).

To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last permanent save operation.

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3.7 Parameter group 4: Messages



3.7.1 P4.0 Dead band time limit



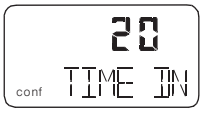
With this parameter you enter the monitoring time until reaching the setpoint.

When the tolerance band is exceeded, the monitoring time is started. If the tolerance band within the predefined time is again not reached by the new position setpoint, an alarm is triggered.

(Parameter **5.4** must be activated.)

Caution - Warning!
With active shutdown function there is no alarm message.

After reaching the setpoint the alarm is automatically reset.



Important
The stroke time to be monitored should be 1.5 to 2 x greater than the shortest stroke time selected during Autoadjust.

Press and hold the ENTER button to display the stroke time. By pressing ENTER briefly again you can toggle between UP stroke time and DOWN stroke time.

Input value: OFF ... 1 ... 200 seconds

Factory setting: OFF

3.7.2 P4.1 Switching point SW1



With this parameter you can define the switching point SW1 as a percentage of the operating range.

If the position exceeds or falls below SW1, the corresponding signal output on the plug-in module is activated (see also parameter group **P9._**).

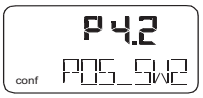
Important
Changing the operating range also changes the positions of the switching points with respect to the position of the valves and fittings.

Input value: 0.0 ... 100.0 %

Factory setting: 0.0 %

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3.7.3 P4.2 Switching point SW2



With this parameter you can define the switching point SW2 as a percentage of the operating range.

If the position exceeds or falls below SW2, the corresponding signal output on the plug-in module is activated (see also parameter group **P9._**).

Important

Changing the operating range also changes the positions of the switching points with respect to the position of the valves and fittings.

Input value: 0.0 ... 100.0 %

Factory setting: 100.0 %

3.7.4 P4.3 Active direction SW1



With this parameter you define whether a message is to be triggered for exceeding or falling below switching point SW1.

EXCEED Message when exceeding switching point SW1.

FALL_BEL Message when falling below switching point SW1.

Factory setting: FALL_BEL

3.7.5 P4.4 Active direction SW2



With this parameter you define whether a message is to be triggered for exceeding or falling below switching point SW2.

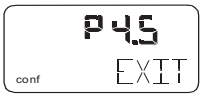
EXCEED Message when exceeding switching point SW2.

FALL_BEL Message when falling below switching point SW2.

Factory setting: EXCEED

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3.7.6 P4.5 Return to operating level



With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).

To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last permanent save operation.

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.8 Parameter group 5: Alarms



Important

Active alarms are signalled at the digital output and through the “Analog feedback” option.

3.8.1 P5.0 Leakage to actuator

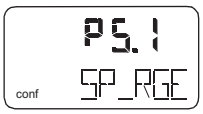


With this parameter you activate leakage detection for the actuator. It is only active in control mode **CTL_ADP**.

If the monitoring function detects leakage at the actuator, a message is issued via alarm output on the mainboard.

ACTIVE	Monitoring active.
INACTIVE	Monitoring inactive.
Factory setting:	INACTIVE

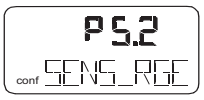
3.8.2 P5.1 Setpoint time-out



With this parameter you can determine that a corresponding alarm is signalled via the digital output when falling below or exceeding the setpoint range (<3.8 mA or above 20.5 mA).

ACTIVE	Setpoint monitoring active.
INACTIVE	Setpoint monitoring inactive.
Factory setting:	INACTIVE

3.8.3 P5.2 Operating range exceeded



With this parameter you can determine that an alarm is signalled via the digital output when the configured operating range is exceeded by 4 %. (Position < -4 % or > +104 %).

This may indicate improperly adjusted mounting or mechanical wear in a limit stop.

ACTIVE	Alarm is activated.
INACTIVE	Alarm is not activated.
Factory setting:	INACTIVE

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.8.4 P5.3 Controller inactive

With this parameter you can determine that an alarm is signalled via digital output when the positioner is not active, i.e. control is interrupted by another operating mode or by configuration.



Important

For details on the states that can result in a message, refer to the chapter "Alarm messages".

ACTIVE	Alarm is activated.
INACTIVE	Alarm is not activated.
Factory setting:	INACTIVE

3.8.5 P5.4 Positioning time-out

With this parameter you activate the “Positioning time-out” function.



The alarm is issued via digital output when the setpoint within the specified monitoring time is not reached in control mode. (The monitoring time is entered with the parameter group **P4.0 Dead band time limit**). The function is only active in control mode **P1.0** and **P1.1**.

ACTIVE	Positioning time-out is activated.
INACTIVE	Alarm is not activated.
Factory setting:	INACTIVE

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.8.6 P5.5 Movement counter

With this parameter you can determine that an alarm is signalled when the movement counter exceeds the specified limit value. The limit value is edited remotely via PC.



ACTIVE Alarm for exceeding travel counter limit value.

INACTIVE No alarm

Factory setting: INACTIVE

3.8.7 P5.6 Travel counter

With this parameter you can determine that an alarm is signalled when the travel counter exceeds the specified limit value. The limit value is edited remotely via PC.



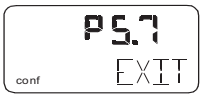
ACTIVE Alarm for exceeding movement counter limit value.

INACTIVE No alarm

Factory setting: INACTIVE

3.8.8 P5.7 Return to operating level

With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).



To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last permanent save operation.

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.9 Parameter group 6: Manual adjustment



3.9.1 P6.0 Minimum of operating range



Normally, the operating range is determined automatically during Autoadjust. A partial run of Autoadjust that is limited to the control parameters (**CTRL_PAR**, see parameter **P6.4**) or valves and fittings without end stops, however, requires manual adjustment of the operating range.

Caution - Risk

After manual adjustment of the end position, it is mandatory under **P3.0** and **P3.1** to limit the operating range to > 0.1 and < 99.9. Otherwise, the valves and fittings may be driven at full speed to an end position.

Danger of injuries!

The range between high and low limit value must be at least 10% of the full range. Otherwise, the message **VR<10%** is displayed.

Important

Use as large are range as possible. This parameter is not active when the safe position is active. The display then shows the message **FAIL_POS**.

With **P6.0** you determine the **lower** limit of the operating range.

↑ or ↓	Press in order to travel to the desired position.
ENTER	Press and hold until the countdown is finished (**MIN_SET**). The position is taken over as min. limit value.
ENTER	Press briefly. The set limit value is displayed for 2 seconds (**MIN_SAVE**).

Setting: 0.0 ... 100.0 % (sensor range) monitoring is not active.

Factory setting: 0.0 %

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.9.2 P6.1 Maximum operating range



Normally, the operating range is determined automatically during Autoadjust. However, a partial run of Autoadjust that is limited to the control parameters (**STANDARD**, see parameter **P1.2**) or fittings without end stops requires manual adjustment of the operating range.

Caution - Risk

After manual adjustment of the end position, it is mandatory under **P3.0** and **P3.1** to limit the operating range to > 0.1 and < 99.9. Otherwise, the valves and fittings may be driven at full speed to an end position.

Danger of injuries!

The range between high and low limit value must be at least 10% of the full range. Otherwise, the message **VR<10%** is displayed.

Important

Use as large are range as possible. This parameter is not active when the safe position is active. The display then shows the message **FAIL_POS**.

With **P6.1** you determine the **upper** limit of the operating range.

↑ or ↓	Press in order to travel to the desired position.
ENTER	Press and hold until the countdown is finished (**MIN_SET**). The position is taken over as min. limit value.
ENTER	Press briefly. The set limit value is displayed for 2 seconds (**MIN_SAVE**).

Setting: 0.0 ... 100.0 % (sensor range) monitoring is not active.

Factory setting: 100,0 %

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.9.3 P6.2 Actuator type

With this parameter you can configure the D400 positioner for operation on a linear actuator (sensor range +/-30°) or on a rotary actuator (sensor range +/-45°). No mechanical modifications to the positioner are required.



Important

After changing the actuator type, it is recommended that you run Autoadjust to prevent linearity errors.

Selection:

LINEAR	Linear actuator
ROTARY	Rotary actuator
Factory setting:	LINEAR

3.9.4 P6.3 Spring action (Y2)

Caution - Risk

Incorrect entries may result in the actuator traveling to a mechanical stop at full speed.

Danger of injuries!



With this parameter you specify the end stop to which the reset spring of the pneumatic actuator drives the valves and fittings in case auxiliary power fails.

The corresponding end stop is determined during Autoadjust. If, however, only the control parameters are determined (**STANDARD**, see parameter **P1.2**), the spring action must be entered manually.

Select the direction of rotation of the sensor shaft (looking at the open housing), if the device is in safe position as a result of the spring force (actuator exhausts via OUT1). For double-acting actuators, the spring action corresponds to filling with air through pneumatic output OUT2.

CLOCKW	Stop reached turning clockwise
CTCLOCKW	Stop reached turning counterclockwise
Factory setting:	**CTCLOCKW**

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3.9.5 P6.5 Dead Angle Open



With this parameter you can cut off the unusable range for valve flow action during positioning. **Dead Angle Open** is a percentage value of the valve's operating range, if the input signal is 19.84 mA.

Input value: 55,0 ... 100,0 %

Factory setting: 100,0 %

3.9.6 P6.4 Dead Angle Close



With this parameter you can cut off the unusable range for valve flow action during positioning. **Dead Angle Close** is a percentage value of the valve's operating range, if the input signal is 4.16 mA.

Input value: 0,0 ... 45,0 %

Factory setting: 0,0 %

3.9.7 P6.6 Return to operating level



With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).

To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last save to the non-volatile memory.

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3.10 Parameter group 7: Control parameters



3.10.1 P7.0 KP value (up)



Important

All control parameters are determined in an optimum way for most actuators during Autoadjust. Changes should only be made when Autoadjust cannot be executed or control stability cannot be achieved.

The KP value is the gain of the controller. The controlling speed and stability are influenced by the KP value. With higher KP values, the controlling speed increases.

Important

The control precision is not affected by the KP value.

To compensate for existing dissymmetries in the controlled system, the KP value should be set separately for both directions (up/down).

For most actuators, satisfactory control action is achieved with a KP value between 2.0 and 10.0.

With parameter **P7.0** you can adjust the KP value for the positioning direction **up** (towards 100%).

Input value: 0.1 … 120.0

Factory setting: 5,0

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.10.2 P7.1 KP value (down)



Important

All control parameters are determined in an optimum way for most actuators during Autoadjust. Changes should only be made when Autoadjust cannot be executed or control stability cannot be achieved.

The KP value is the gain of the controller. The controlling speed and stability are influenced by the KP value. With higher KP values, the controlling speed increases.

Important

The control precision is not affected by the KP value.

To compensate for existing dissymmetries in the controlled system, the KP value should be set separately for both directions (up/down).

For most actuators, satisfactory control action is achieved with a KP value between 2.0 and 10.0.

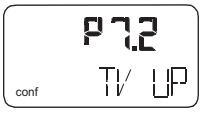
With parameter **P7.1** you can adjust the KP value for the positioning direction **down** (towards 0%).

Input value: 0.1 … 120.0

Factory setting: 5,0

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.10.3 P7.2 TV value (up)



Important

All control parameters are determined in an optimum way for most actuators during Autoadjust. Changes should only be made when Autoadjust cannot be executed or control stability cannot be achieved.

The TV value is the derivative time of the controller.

Speed and stability are affected by the TV value in such a way that it counteracts dynamically to the KP value. The speed of the control action decreases for an increasing TV value.

To compensate for existing dissymmetries in the controlled system, the TV value should be set separately for both directions (up/down).

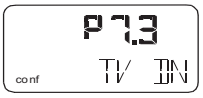
With parameter **P7.2** you can adjust the TV value for the positioning direction **up** (towards 100%).

Input value: 10 … 450 ms

Factory setting: 200 ms

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3.10.4 P7.3 TV value (down)



Important

All control parameters are determined in an optimum way for most actuators during Autoadjust. Changes should only be made when Autoadjust cannot be executed or control stability cannot be achieved.

The TV value is the derivative time of the controller.

Speed and stability are affected by the TV value in such a way that it counteracts dynamically to the KP value. The speed of the control action decreases for an increasing TV value.

To compensate for existing dissymmetries in the controlled system, the TV value should be set separately for both directions (up/down).

With parameter **P7.3** you can adjust the TV value for the positioning direction **down** (towards 0%).

Input value: 10 … 450 ms

Factory setting: 200 ms

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.10.5 P7.4 Y offset (up)



Important

All control parameters are determined in an optimum way for most actuators during Autoadjust. Changes should only be made when Autoadjust cannot be executed or control stability cannot be achieved.

The "offset for the output signal" linearizes the behavior of the I/P module used and enables fast control for even small control deviations. The value is limited a the low end by a minimum value (neutral zone)

The offset substantially affects the controlling speed for control deviations smaller than 5 %.

In manual mode **P1.2** and **P1.3** the offset values are issued for fine adjustment to the I/P module. For larger, slower actuators Autoadjust may determine values higher than 80%. In these cases there will be no noticeable difference between fine and coarse adjustment while in manual mode.

To compensate for existing dissymmetries in the controlled system, the offset should be set separately for both directions (up/down).

For most actuators, satisfactory control is achieved with offset values between 40 and 80%. If the control stability for setpoint changes is less than 2% overshoot, both offset values should be decreased.

Both offset values should be increased when the actuator stops outside the tolerance band.

With parameter **P7.4** you can adjust the Y offset for the positioning direction **up** (towards 100%).

Input value: Y-min ... 100.0%

Factory setting: 48.0 %

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3.10.6 P7.5 Y offset (down)



Important

All control parameters are determined in an optimum way for most actuators during Autoadjust. Changes should only be made when Autoadjust cannot be executed or control stability cannot be achieved.

The "offset for the output signal" linearizes the behavior of the I/P module used and enables fast control for even small control deviations. The value is limited a the low end by a minimum value (neutral zone)

The offset substantially affects the controlling speed for control deviations smaller than 5 %.

In manual mode **P1.2** and **P1.3** the offset values are issued for fine adjustment to the I/P module. For larger, slower actuators Autoadjust may determine values higher than 80%. In these cases there will be no noticeable difference between fine and coarse adjustment while in manual mode.

To compensate for existing dissymmetries in the controlled system, the offset should be set separately for both directions (up/down).

For most actuators, satisfactory control is achieved with offset values between 40 and 80%. If the control stability for setpoint changes is less than 2% overshoot, both offset values should be decreased.

Both offset values should be increased when the actuator stops outside the tolerance band.

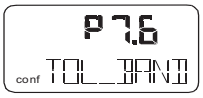
With parameter **P7.5** you can adjust the Y offset for the positioning direction **down** (towards 0%).

Input value: Y-min ... 100.0%

Factory setting: 48.0 %

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3.10.7 P7.6 Tolerance band



The tolerance band **P7.6 TOL_BAND** defines a +/- range around the setpoint. When the position of the valves and fittings reaches this range, the parameter set of the controller is toggled to a fixed PID-algorithm that is used to continue with slow controlling action until reaching a dead band **P7.7 DEADBAND**.

Only when reaching the sensitivity range the system is considered as balanced. (see also parameter **P1.2**).

Input value: 0,3 ... 10,0 %

in steps of 0.1%

Factory setting: **1,5 %**

3.10.8 P7.7 Dead band



The “dead band” **P7.7 Deadband** defines a +/- range around the setpoint. Once the valves and fittings reach this range, the positioner maintains this position.

Important

The dead band must always be 0.2% less than the tolerance band.

Input value: 0,10 ... 10,00 % in steps of 0.01%

Factory setting: 0,10 %

3.10.9 P7.8 Dead-band approach



The parameter **DB_APPR** specifies the speed at which the dead band is approached.

In rare cases, overshooting can occur when the valve position is controlled. This can be prevented by reducing the speed of the dead-band approach.

Input value: Slow

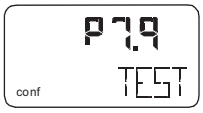
Medium

Fast

Factory setting: Fast

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3.10.10 P7.9 Test



With this test the controller is activated, and you can check the effects of the changes to this parameter group, e.g. by introducing setpoint changes or setpoint ramps using a current source.

Normally, **INACTIVE** is shown in the display. To start the test, press and hold ENTER until the countdown from 3 to 0 is finished. The test is activated. The display shows the control loop symbol and a flashing message.

The test is automatically stopped after two minutes and can also be stopped by pressing any button.

Important

It is not possible to activate the test when the safe position is active (see parameter **11.0**). Instead, the message **FAIL_POS** is displayed.

3.10.11 P7.10 Return to operating level



With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).

To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last save to the non-volatile memory.

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3.11 Parameter group 8: Analog output[1]



3.11.1 P8.0 Minimum of current range

With this parameter you determine the low current range limit for the analog position feedback. The current range corresponds to the configured stroke range.



Important

The current range limits can be freely configured between 4 mA and 18.5 mA. However, the current range must not be smaller than 10% (1.6 mA) of the range.

Input value: 5.6 … 20.0 mA

Factory setting: 4.0 mA

3.11.2 P8.1 Maximum of current range

With this parameter you determine the upper current range limit for the analog position feedback.



Important

The current range limits can be freely configured between 4 mA and 20 mA. However, the current range must not be smaller than 10% (1.6 mA) of the range.

Input value: 4.0 … 20.0 mA

Factory setting: 20.0 mA

3.11.3 P8.2 Valve action

With this parameter you determine the valve action for the analog position feedback.



Increasing = position 0 ... 100 % = signal 4 ... 20 mA

Decreasing = position 0 ... 100% = signal 20 ... 4 mA

Factory setting: DIRECT

[1] on the plug-in module for analog feedback

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3.11.4 P8.3 Alarm message[2]

When an alarm/message is generated in the D400 positioner, it is signaled via the digital and analog output. With the parameter **P8.3** you can select a higher or lower alarm current for analog feedback.



Important

Without electrical energy or for initialization, the output signal > 20.5 mA. In special versions (hardware modification) < 3.8 mA is also possible.

HIGH_CUR	Alarm current I > 20.5 mA
LOW_CUR	Alarm current I < 3.8 mA
Factory setting:	HIGH_CUR

3.11.5 P8.4 Count back characteristic curve

With this parameter you can determine whether the position indicator and the analog position feedback follow the characteristic curve set in parameter **P2.2 Characteristic curve**.



3.11.6 P8.5 Test

Test is for simulation of the analog output. The test allows you to simulate effects during commissioning without affecting the normal process.



Important

The test is automatically stopped after two minutes.

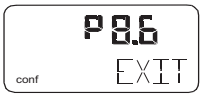
While the test is running, the corresponding message (see below) flashes in the display.

NONE	no function.
FAILED	Simulation of position feedback failure (CPU). I > 20.5 mA (default setting) or I < 3.8 mA (special version, modified hardware)
ALRM_CUR	Simulation of an alarm current < 3.8 mA or I > 20.5 mA
CURRENT	Output of the current setpoint as current value via analog output. All configurations and settings of the analog input or output must be taken into consideration.

[2] on the plug-in module for analog feedback

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3.11.7 P8.6 Return to operating level



With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).

To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last save to the non-volatile memory.

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.12 Parameter group 9: Digital output



3.12.1 P9.0 Signal level digital outputs[3]



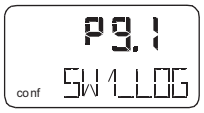
With this parameter you can determine the logic level of the alarm output.

Selection:

ACTIV_HI active = output current I > 2 mA

ACTIV_LO active = output current I < 1 mA

3.12.2 P9.1 Signal level SW1



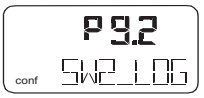
With this parameter you can determine the active level for switching output SW1*.

Selection:

ACTIV_HI active = output current I > 2 mA

ACTIV_LO active = output current I < 1 mA

3.12.3 P9.2 Signal level SW2



With this parameter you can determine the active level for switching output SW2*.

Selection:

ACTIV_HI active = output current I > 2 mA

ACTIV_LO active = output current I < 1 mA

[3] SW1 and SW2 are on the plug-in module for digital feedback

It is the responsibility of the customer to determine the suitability of Sharpe® valves products in their particular application.
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3.12.4 P9.3 Test

Test is for simulation for the digital output.



Important

The test is automatically stopped after two minutes and can be aborted by pressing any button.

While the test is running, the corresponding message (see below) flashes in the display.

NONE	No function
ALRM_ON	Alarm is simulated (DO active)
SW1_ON	Reaching switching point 1 is simulated (SW1 active)
SW2_ON	Reaching switching point 2 is simulated (SW2 active)
ALL_ON	Alarm and switching points are simulated (all DOs active)

3.12.5 P9.4 Return to operating level

With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).



To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE	Saves settings in the non-volatile memory.
CANCEL	Discards all changes made since the last permanent save operation.

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3.13 Parameter group 10: Digital input



3.13.1 P10.0 Digital input



For the digital input, one of the following protective functions can be selected via local operation.

- No function (default)
- Move to 0 % position
- Move to 100 % position
- Hold previous position
- Lock the configuration on-site
- Lock the configuration and operation on-site
- Lock all access (on-site or via PC)

The selected function is activated when the 24 V signal is no longer connected to the digital output (< 10 V DC).

The safety functions **POS_0%**, **POS_100%** and **POS_HOLD** run in the operating level in both types of control modes **P1.0** or **P1.1**. **BIN_CTRL** is shown in the display.

If a corresponding function is active, a corresponding value is defined internally for the positioner. The actuator is then driven into the end position or position specified under consideration of the setpoint ramp, configured operating range, selected behavior.

After selecting a lock **CNF_LOCK**, **OP_LOCK** or **ALL_LOCK**, the key icon is displayed, indicating that the lock will be activated at the next save.

After saving and without 24 V at the digital input, the key is permanently displayed.

Important

The lock **CNF_LOCK**, **OP_LOCK** or **ALL_LOCK** is displayed only if the voltage is connected to the digital input.

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CNF_LOCK Restricts local access to the configuration level. However, local operation on the operating level is possible. The D400 positioner can be configured externally (via LKS / modem and PC).

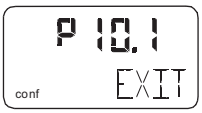
When the operator tries to activate the configuration level, the text **CNF_LOCK** is displayed for approx. 5 seconds.

OP_LOCK Fully restricts local operation and configuration. With every attempt to perform local operating actions, the text **OP_LOCK** is displayed for approx. 5 seconds.

The D400 positioner can be configured externally (via LKS/modem and PC).

ALL_LOCK Restricts local operation (operating level and configuration level) and external configuration via LKS / modem and PC. With every attempt to perform local operating actions, the text ALL_LOCK is shown for approx. 5 seconds.

3.13.2 P10.1 Return to operating level



With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).

To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last permanent save operation.

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3.14 Parameter group 11: Safe position



3.14.1 P11.0 Safe position

This parameter must be used to activate the safe position prior to loading the factory settings (parameter **P11.1**) or changing the I/P module type (parameter **P11.2**). Note that this step is mandatory.



Important

After setting parameters **P11.1** and **P11.2** as required, the safe position must be deactivated again manually.

The safe position that is activated, i.e. fail safe or fail freeze, depends on the I/P module installed.

Activating/deactivating the safe position:

Press and hold ENTER until the displayed countdown from 3 to 0 is finished. Then release ENTER.

The safe position is activated or deactivated, respectively.

3.14.2 P11.1 Factory settings

With this parameter you can reset the D400 positioner to the factory setting. This is necessary, e.g., if an already configured positioner has to be installed on a different actuator and subsequently reconfigured.



Caution - Risk

Make sure that the I/P module type parameter corresponds to the actual I/P module type of the device after loading the factory settings. Otherwise dangerous situations may occur when operating in control mode. It may happen that the actuator is driven at full speed to the end position.

Danger of injuries!

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Important

You can only load the factory settings when the actuator is in safe position (parameter **11.0**). Otherwise, the action is inhibited and the message **NO_F_POS** is indicated in the display.

If you save the settings in the non-volatile memory after loading the factory setting, operating mode 1.3 is automatically activated on the operating level.

To load factory settings:

Press and hold ENTER until the displayed countdown from 3 to 0 is finished.

The D400 positioner is reset to the factory settings. The message **COMPLETE** is displayed.

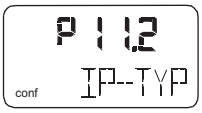
Press ENTER to acknowledge the message.

Selection:

FS_LOAD Loads the factory settings

3.14.3 P11.2 I/P module type

With this parameter the software can be adapted to the installed I/P module. This parameter must be set when installing another I/P module type.



Caution - Risk

Make sure that the I/P module type parameter corresponds to the actual I/P module type of the device after loading the factory settings. Otherwise dangerous situations may occur when operating in control mode. It may happen that the actuator is driven at full speed to the end position.

Danger of injuries!

Caution - Risk

For safety reasons this parameter must be checked for correct setting after restoring the factory settings.

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3.14.4 P11.3 Return to operating level



With this parameter you can leave the configuration level. The positioner returns to the operating level. Here you can either save data in the non-volatile memory or discard all previously made changes (also the changes in other parameter groups).

To leave the configuration level (with or without saving), press and hold ENTER until the countdown from 3 to 0 is finished.

The active saving process is indicated by the message **NV_SAVE**. After saving a plausibility check is executed.

If an error occurs during the check or while saving, the data cannot be saved; an error message is displayed instead (see the chapter “Error messages”).

Selection:

NV_SAVE Saves settings in the non-volatile memory.

CANCEL Discards all changes made since the last save to the non-volatile memory.

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4 Error messages

4.1 Error codes

Error description	Error code
Meaning: The supply voltage was interrupted or low for more than 20 ms. This error is displayed after resetting the device to indicate the reason for the reset. **Measure(s):** Check the power source and the wiring.	ERROR 10
Meaning: The supply voltage has fallen below the minimum voltage. **Impact:** The actuator is moved to the safe position. After appr. 5 seconds the D400 positioner is automatically reset and starts up again with the message **ERROR**. If a local communication interface (LKS) is connected, the device will go to operating mode “**LKS Supply**“. **Measure(s):** Check the power source and the wiring.	ERROR 11
Meaning: The position is outside the sensor range. Possible reason is a malfunction in the position sensor. **Impact:** In control mode: The actuator is moved to the safe position. On the configuration level: The output is set to neutral until a button is pressed. After appr. 5 seconds the D400 positioner is automatically reset in control mode and in the configuration level. **Measure(s):** Check the mounting.	ERROR 12

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Error messages

Error description	Error code
Meaning: No access possible to the data in the EEPROM. **Impact:** The actuator is moved to the safe position. After appr. 5 seconds the D400 positioner is automatically reset. Attempts are made to restore the data. This compensates for intermittent errors in the communication environment with the EEPROM. **Measure(s):** If there is still no access to the EEPROM data after resetting the device, load the factory settings. If the error still persists, the device must be returned for repair to the manufacturer.	ERROR 20
Meaning: Error while processing the measured values, pointing to an error in the working data (RAM). **Impact:** The actuator is moved to the safe position. After appr. 5 seconds the D400 positioner is automatically reset and the RAM is initialized. **Measure(s):** If the error still persists after resetting the D400 positioner, return the device for repair to the manufacturer.	ERROR 21
Meaning: Error during the table processing, pointing to an error in the working data (RAM). **Impact:** The actuator is moved to the safe position. After appr. 5 seconds the D400 positioner is automatically reset and the RAM is initialized. **Measure(s):** If the error still persists after resetting the D400 positioner, return the device for repair to the manufacturer.	ERROR 22

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Error description	Error code
Meaning: Error when verifying the checksum of the configuration data (RAM). **Impact:** The actuator is moved to the safe position. After appr. 5 seconds the D400 positioner is automatically reset and the RAM is initialized. **Measure(s):** If the error still persists after resetting the D400 positioner, return the device for repair to the manufacturer.	ERROR 23
Meaning: Error in the processor function registers (RAM). **Impact:** The actuator is moved to the safe position. After appr. 5 seconds the D400 positioner is automatically reset and the RAM is initialized. **Measure(s):** If the error still persists after resetting the D400 positioner, return the device for repair to the manufacturer.	ERROR 24
Meaning: Internal error. **Impact:** The actuator is moved to the safe position. After appr. 5 seconds the D400 positioner is automatically reset. **Measure(s):** If the error can be reproduced and occurs in the same position after resetting, the device must be returned for repair to the manufacturer.	ERROR 50 ⋮ ERROR 99

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4.2 Alarm codes

Alarm description	Alarm code
Meaning: Leakage between D400 positioner and actuator. **Impact:** Depending on how well the leakage can be compensated, small control actions are required at regular intervals. **Measure(s):** Check the piping.	ALARM 1
Meaning: The setpoint current is outside the admissible range, i.e. it is < 3.8 mA or > 20.5 mA. **Impact:** None. **Measure(s):** Check the power source.	ALARM 2
Meaning: Alarm of the zero monitor. The zero position has shifted by more than 4 %. **Impact:** None. In control mode a position outside the valve range can only be reached by driving to the limit stops, as the setpoint is limited to 0 ... 100 %. **Measure(s):** Correct the mounting.	ALARM 3
Meaning: Controlling is inactive, because the device does not operate in control mode or the digital input is active. **Impact:** The controller does not follow the setpoint. **Measure(s):** Switch to control mode or switch off the digital input.	ALARM 4

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Alarm description	Alarm code
Meaning: Positioning timed out. The settling time needed exceeds the configured stroke time. **Impact:** None, or adaptive control is performed (in adaptive mode). **Measure(s):** Ensure that • the actuator is not blocked • the supply air pressure is adequate • the given time limit is higher than 1.5 times the longest stroke time of the actuator. If adaption cannot run uninterruptedly for an actuator, adaption should be switched on until the alarm does not occur anymore during controlling actions.	ALARM 5
Meaning: The defined limit value for the stroke counter has been exceeded. **Impact:** None. **Measure(s):** Reset the counter (only possible via a connected PC with SMART VISION).	ALARM 6
Meaning: The specified limit value for the travel counter has been exceeded. **Impact:** None. **Measure(s):** Reset the counter (only possible via a connected PC with SMART VISION).	ALARM 7

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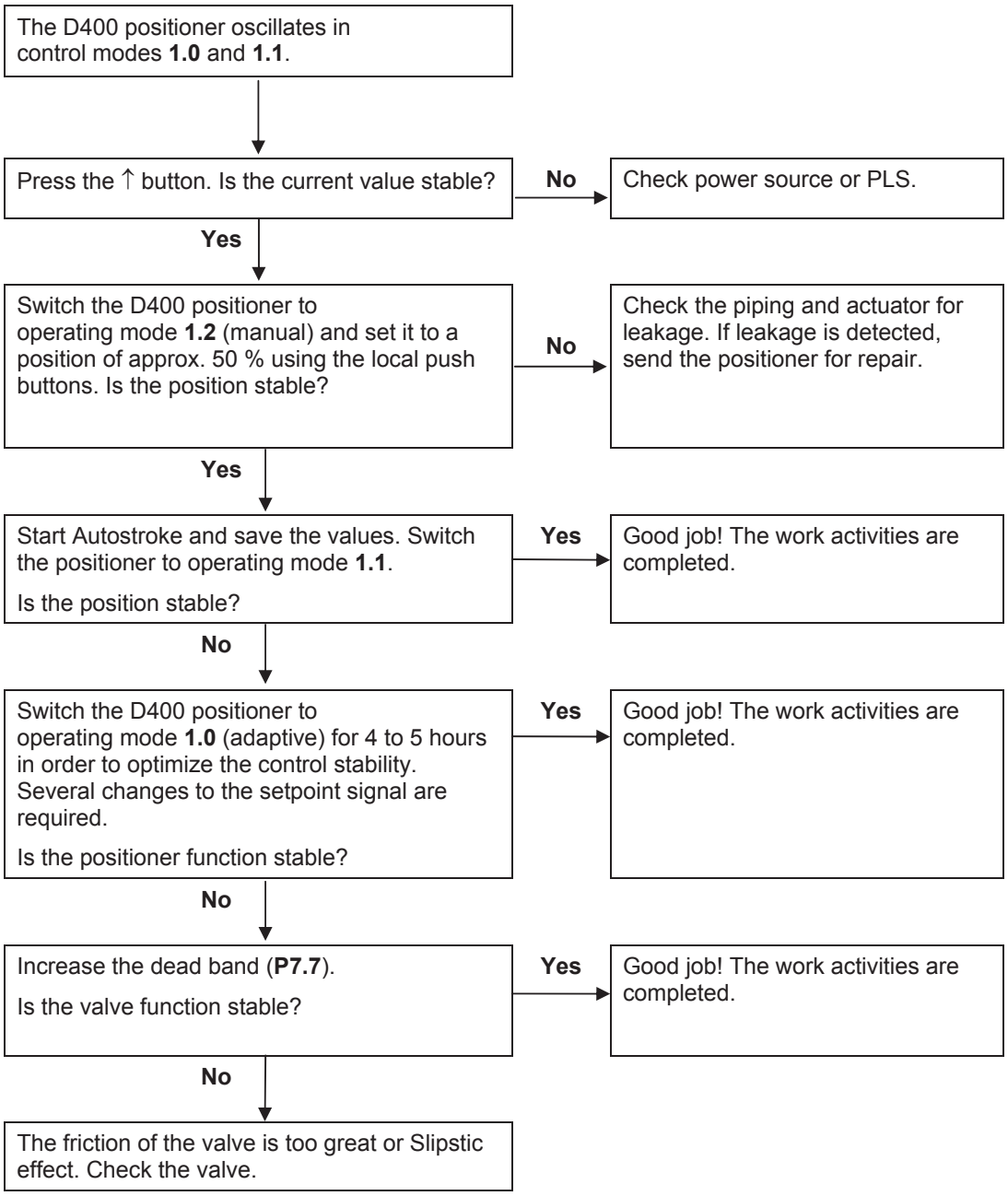
4.3 Message codes

Message description	Message code
Action stopped by operator.	BREAK
Error during plausibility check.	CALC_ERR
Action completed, acknowledgement required.	COMPLETE
Memory error, data could not be saved.	EEPR_ERR
Safe position is active, action cannot be executed.	FAIL_POS
Safe position required, but not active.	NO_F_POS
Valve range limits have not yet been determined; therefore, partial Autoadjust cannot be run.	NO_SCALE
Data is saved in the non-volatile memory.	NV_SAVE
Sensor range is exceeded, Autoadjust was automatically stopped.	OUTOFRNG
Data (factory settings) are being loaded.	LOAD
Less than 10 % of the sensor range is used.	RNG_ERR
Action running.	RUN
Simulation has been started externally from a PC via HART, Protocol; switching outputs, alarm output and analog position feedback are no longer influenced by the process.	SIMUL
Actual spring action is different from the adjusted one.	SPR_ERR
Time-out; parameter could not be determined within two minutes; Autoadjust was automatically stopped.	TIMEOUT

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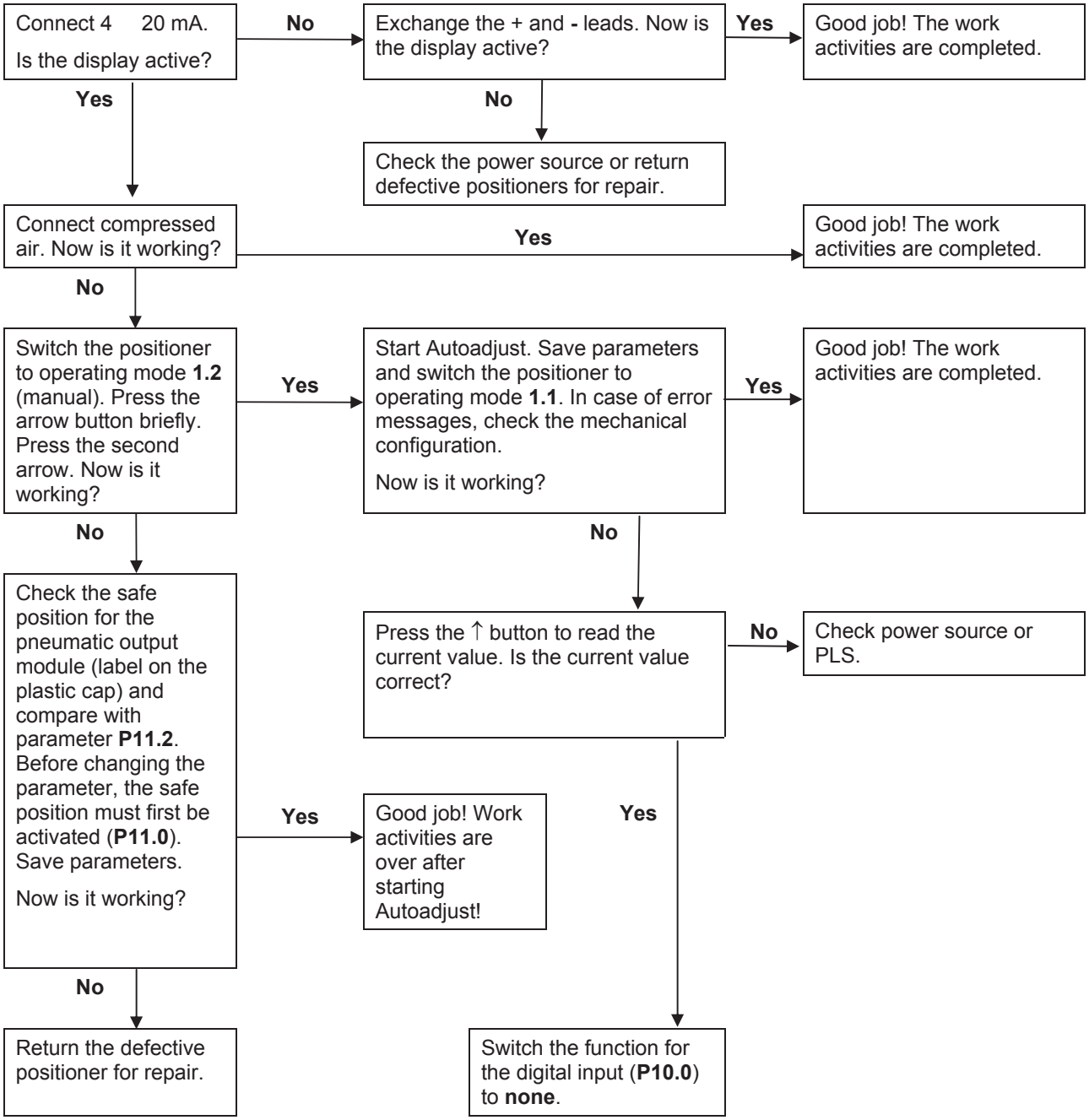
4.4 Error handling D400

4.4.1 Oscillation problem



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4.4.2 No function



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5 Appendix

5.1 Additional documents

- Operating instructions for electro-pneumatic positioner D400
- Data sheet for intelligent positioner D400
- Operating instructions for electro-pneumatic positioner D400
- Data sheet for intelligent positioner D400

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