

SIEMENS

SIPART

Electropneumatic positioners SIPART PS2 with 4 to 20 mA/HART

Operating Instructions

6DR50..
6DR51..
6DR52..
6DR53..
6DR59..

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|--|----|
| Introduction | 1 |
| Safety information | 2 |
| Description | 3 |
| Installing/mounting | 4 |
| Connection | 5 |
| Operating | 6 |
| Commissioning | 7 |
| Parameter assignment | 8 |
| Functional safety | 9 |
| Service and maintenance | 10 |
| Diagnostics and troubleshooting | 11 |
| Technical data | 12 |
| Dimension drawings | 13 |
| Product documentation and support | A |
| Installing ILS and MLS (for 6DR50.5/6DR51.5/6DR50.6/6DR51.6) | B |
| External position detection | C |
| Pressure gauge blocks | D |
| Sealing plug / thread adapter | E |
| Booster | F |
| Positioner with remote electronics | G |
| Abbreviations | H |

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

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|  DANGER |
| indicates that death or severe personal injury will result if proper precautions are not taken. |

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|  WARNING |
| indicates that death or severe personal injury may result if proper precautions are not taken. |

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|  CAUTION |
| indicates that minor personal injury can result if proper precautions are not taken. |

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| NOTICE |
| indicates that property damage can result if proper precautions are not taken. |

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

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The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Table of contents

| | | |
|----------|--|-----------|
| 1 | Introduction | 13 |
| 1.1 | Purpose of this documentation | 13 |
| 1.2 | Scope of documentation | 13 |
| 1.3 | Document history PS2 with and without HART..... | 14 |
| 1.4 | Product compatibility | 16 |
| 1.5 | Designated use | 16 |
| 1.6 | Checking the consignment..... | 16 |
| 1.7 | Security information | 17 |
| 1.8 | Transportation and storage | 18 |
| 1.9 | Notes on warranty | 18 |
| 2 | Safety information | 19 |
| 2.1 | Precondition for use..... | 19 |
| 2.2 | Warning symbols on the device | 19 |
| 2.3 | Laws and directives | 19 |
| 2.4 | Conformity with European directives | 20 |
| 2.5 | Conformity with UK directives | 20 |
| 2.6 | Product approval and UL compliance | 20 |
| 2.7 | Improper device modifications..... | 21 |
| 2.8 | Improper modification on positioner 6DR5...6..... | 21 |
| 2.9 | Requirements for special applications..... | 21 |
| 2.10 | Use in hazardous areas..... | 22 |
| 3 | Description | 23 |
| 3.1 | Function | 23 |
| 3.2 | Structure | 23 |
| 3.2.1 | Overview of structure | 23 |
| 3.2.2 | Manufacturer nameplate..... | 26 |
| 3.2.3 | Explanation of Ex information | 26 |
| 3.3 | Device components | 27 |
| 3.3.1 | Overview of device components (without Ex)..... | 27 |
| 3.3.2 | Electronics | 28 |
| 3.4 | Mode of operation | 29 |
| 3.4.1 | Block circuit diagram for single-acting or double-acting actuators | 31 |
| 3.4.2 | Mode of operation of the HART function | 32 |
| 3.4.3 | HART system configuration..... | 32 |

| | | |
|----------|--|-----------|
| 3.4.4 | SIMATIC PDM | 33 |
| 4 | Installing/mounting | 35 |
| 4.1 | Basic safety instructions | 35 |
| 4.1.1 | Proper mounting..... | 37 |
| 4.2 | Mounting to linear actuator | 38 |
| 4.3 | Mounting to part-turn actuator | 43 |
| 4.4 | Setting and locking the transmission ratio | 46 |
| 4.5 | Installing option modules..... | 49 |
| 4.5.1 | General information on installing option modules | 49 |
| 4.5.1.1 | Installation of option modules: Introduction | 49 |
| 4.5.1.2 | Opening the standard and intrinsically safe version | 51 |
| 4.5.1.3 | Closing the standard and and intrinsically safe version..... | 52 |
| 4.5.1.4 | Opening the device version with "flameproof enclosure"..... | 54 |
| 4.5.1.5 | Closing the device version with "flameproof enclosure"..... | 57 |
| 4.5.2 | Digital I/O Module (DIO) 6DR4004-6A / -8A..... | 59 |
| 4.5.3 | Analog Output Module (AOM) 6DR4004-6J / -8J | 60 |
| 4.5.4 | Inductive Limit Switches (ILS) 6DR4004 6G / -8G | 62 |
| 4.5.4.1 | Inductive Limit Switches (ILS) - Mode of operation and equipment features | 62 |
| 4.5.4.2 | Installation procedure for Inductive Limit Switches (ILS) | 63 |
| 4.5.4.3 | Setting limits for Inductive Limit Switches (ILS)..... | 64 |
| 4.5.5 | Mechanic Limit Switches (MLS) 6DR4004-6K..... | 65 |
| 4.5.5.1 | Mechanic Limit Switches (MLS) - Mode of operation and equipment features..... | 65 |
| 4.5.5.2 | Installation procedure for Mechanic Limit Switches (MLS)..... | 66 |
| 4.5.5.3 | Setting limits for Mechanic Limit Switches (MLS) | 67 |
| 4.5.6 | Internal NCS module (iNCS) 6DR4004-5L / -5LE..... | 68 |
| 4.5.7 | Analog Input Module (AIM) 6DR4004-6F / -8F..... | 71 |
| 5 | Connection..... | 75 |
| 5.1 | Basic safety instructions | 75 |
| 5.2 | Electrical wiring | 79 |
| 5.2.1 | Electronics | 79 |
| 5.2.2 | HART: split range, connection diagram | 81 |
| 5.2.3 | Option modules | 82 |
| 5.2.3.1 | Digital I/O Module (DIO) 6DR4004-6A / -8A..... | 82 |
| 5.2.3.2 | Analog Output Module (AOM) 6DR4004-6J / -8J | 82 |
| 5.2.3.3 | Inductive Limit Switches (ILS) 6DR4004-6G / -8G | 83 |
| 5.2.3.4 | Mechanic Limit Switches (MLS) 6DR4004-6K..... | 83 |
| 5.2.3.5 | Analog Input Module (AIM) 6DR4004-6F / -8F..... | 85 |
| 5.2.4 | Optional version M12 device plug | 86 |
| 5.2.4.1 | M12 connector in basic device with and without HART | 86 |
| 5.2.4.2 | M12 Connector in Basic Device with Analog Output Module (AOM) 6DR4004-6J / -8J (-Z D53)..... | 86 |
| 5.2.4.3 | In the basic unit with Position Transmitter (-Z D54)..... | 87 |
| 5.2.4.4 | In the basic unit with Digital I/O Module (DIO) 6DR4004-6A / -8A (-Z D55) | 87 |
| 5.2.4.5 | In the basic unit with Inductive Limit Switches (ILS) 6DR4004-6G / -8G (-Z D56)..... | 87 |
| 5.2.4.6 | In the basic unit with Mechanic Limit Switches (MLS) 6DR4004-6K (-Z D57)..... | 88 |
| 5.3 | Pneumatic connection | 88 |
| 5.3.1 | Basic safety instructions for the pneumatic connection | 88 |

| | | |
|----------|--|------------|
| 5.3.2 | Pneumatic connection in non-flameproof enclosure | 89 |
| 5.3.2.1 | Structure of pneumatic connection | 89 |
| 5.3.2.2 | Integrated pneumatic connection..... | 89 |
| 5.3.3 | Pneumatic connection in the flameproof enclosure | 90 |
| 5.3.4 | Behavior in case of failure of the electrical auxiliary power and/or the supply pressure PZ..... | 91 |
| 5.4 | Restrictors..... | 92 |
| 6 | Operating..... | 93 |
| 6.1 | Operating elements | 93 |
| 6.1.1 | Display..... | 93 |
| 6.1.2 | Buttons..... | 94 |
| 6.1.3 | Firmware version | 95 |
| 6.2 | Operating modes | 96 |
| 6.2.1 | Overview of operating modes | 96 |
| 6.2.2 | Changing the operating mode..... | 97 |
| 6.2.3 | Overview of configuration..... | 98 |
| 6.2.4 | Description of operating modes | 98 |
| 6.2.5 | Optimization of controller data | 100 |
| 7 | Commissioning | 103 |
| 7.1 | Basic safety instructions | 103 |
| 7.2 | Overview | 105 |
| 7.3 | Sequence of automatic initialization..... | 106 |
| 7.3.1 | Sequence of automatic initialization..... | 106 |
| 7.3.2 | Determining the actuator type | 108 |
| 7.3.3 | Starting automatic initialization..... | 108 |
| 7.3.4 | RUN 1: Determination of direction of action | 108 |
| 7.3.5 | RUN 2: Determination of travel..... | 109 |
| 7.3.6 | RUN 3: Determination and display of travel time (leakage test) | 110 |
| 7.3.7 | RUN 4: Minimization of positioning increments | 110 |
| 7.3.8 | RUN 5: Optimization of transient response | 111 |
| 7.3.9 | Step 8 - RUN 6: Inclusion of Valve Signature..... | 111 |
| 7.3.10 | Step 9 – End | 111 |
| 7.4 | Setting the friction clutch..... | 112 |
| 7.5 | Manual adjustment of the pressure sensors..... | 113 |
| 7.6 | Purge air switching | 114 |
| 7.7 | Commissioning linear actuators | 115 |
| 7.7.1 | Preparing linear actuators for commissioning | 115 |
| 7.7.2 | Automatic initialization of linear actuators..... | 116 |
| 7.7.3 | Manual initialization of linear actuators..... | 119 |
| 7.8 | Commissioning part-turn actuators | 121 |
| 7.8.1 | Preparing part-turn actuators for commissioning | 121 |
| 7.8.2 | Automatic initialization of part-turn actuators | 122 |
| 7.8.3 | Manual initialization of part-turn actuators..... | 124 |
| 7.9 | Canceling initialization..... | 126 |
| 7.10 | Replacing the positioner during operation | 126 |
| 7.10.1 | Introduction..... | 126 |

| | | |
|----------|--|------------|
| 7.10.2 | Replacing the positioner with communication | 127 |
| 7.10.3 | Replacing the positioner without communication | 133 |
| 8 | Parameter assignment..... | 135 |
| 8.1 | Introduction to parameter assignment section..... | 135 |
| 8.2 | Configuration schematic for parameter operating principle | 137 |
| 8.3 | Overview of parameters 1 to 52 (HART)..... | 138 |
| 8.4 | Overview of diagnostic parameters | 141 |
| 8.5 | Description of parameters | 144 |
| 8.5.1 | Initialization parameters 1 to 5..... | 144 |
| 8.5.1.1 | '1.YFCT' type of actuator | 144 |
| 8.5.1.2 | '2.YAGL' Rated angle of rotation of feedback | 146 |
| 8.5.1.3 | '3.YWAY' Range of stroke | 147 |
| 8.5.1.4 | '4.INITA' Initialization (automatic)..... | 147 |
| 8.5.1.5 | '5.INITM' Initialization (manual)..... | 148 |
| 8.5.2 | Application parameters 6 to 52 | 148 |
| 8.5.2.1 | '6.SCUR' Current range of setpoint..... | 148 |
| 8.5.2.2 | '7.SDIR' Setpoint direction | 149 |
| 8.5.2.3 | '8.SPRA' Setpoint split range start / '9.SPRE' Setpoint split range start end | 149 |
| 8.5.2.4 | '10.TSUP' Setpoint ramp UP / '11.TSDO' Setpoint ramp DOWN | 150 |
| 8.5.2.5 | '12.SFCT' Setpoint function | 151 |
| 8.5.2.6 | '13.SL0' ... '33.SL20' Setpoint turning point..... | 151 |
| 8.5.2.7 | '34.DEBA' Deadband of closed-loop controller..... | 152 |
| 8.5.2.8 | '35.YA' Start of manipulated variable limit / '36.YE' End of manipulated variable limit..... | 153 |
| 8.5.2.9 | '37.YNRM' Standardization of manipulated variable | 153 |
| 8.5.2.10 | '38.YDIR' Direction of manipulated variable for display and position feedback..... | 155 |
| 8.5.2.11 | '39.YCLS' Tight closing/fast closing with manipulated variable..... | 155 |
| 8.5.2.12 | '40.YCDO' Value for tight closing/fast closing Down | 156 |
| 8.5.2.13 | '41.YCUP' Value for tight closing/fast closing Up..... | 156 |
| 8.5.2.14 | '42.DI1' / '43.DI2' Function digital input..... | 157 |
| 8.5.2.15 | '44.AFCT' Alarm function..... | 158 |
| 8.5.2.16 | '45.A1' / '46.A2' Response threshold of alarm..... | 160 |
| 8.5.2.17 | '47.\IFCT' Function of the fault message output | 160 |
| 8.5.2.18 | '48.\ITIM' Monitoring period for setting of fault message 'Control deviation' | 161 |
| 8.5.2.19 | '49.\LIM' Response threshold of fault message 'Control deviation' | 161 |
| 8.5.2.20 | '50.PRST' Preset (HART/FF)..... | 162 |
| 8.5.2.21 | '51.PNEUM' Pneumatics type..... | 162 |
| 8.5.2.22 | '52.XDIAG' Activating for extended diagnostics | 163 |
| 8.5.3 | Advanced diagnostic parameters A to U..... | 164 |
| 8.5.3.1 | Partial Stroke Test 'A.\PST' (HART) | 164 |
| 8.5.3.2 | Partial Stroke Test 'A.\PST' with option -Z P02 (HART)..... | 169 |
| 8.5.3.3 | Monitoring of dynamic control valve behavior 'b.\DEVI' | 173 |
| 8.5.3.4 | Monitoring/compensation of pneumatic leakage 'C.\LEAK' | 175 |
| 8.5.3.5 | Monitoring of stiction (slipstick) 'd.\STIC'..... | 178 |
| 8.5.3.6 | Monitoring of deadband 'E.\DEBA' | 180 |
| 8.5.3.7 | Monitoring of lower endstop 'F.\ZERO' | 181 |
| 8.5.3.8 | Monitoring of upper endstop 'G.\OPEN'..... | 182 |
| 8.5.3.9 | Monitoring the lower limit temperature 'H.\TMIN' | 184 |
| 8.5.3.10 | Monitoring the upper limit temperature 'J.\TMAX' | 186 |
| 8.5.3.11 | Monitoring of number of total strokes 'L.\STRK' | 187 |

| | | |
|-----------|--|------------|
| 8.5.3.12 | Monitoring of number of changes in direction 'O.\DCHG' | 189 |
| 8.5.3.13 | Monitoring the position average value 'P.\PAVG' | 190 |
| 8.5.3.14 | Pressure monitoring 'U.\PRES' | 193 |
| 8.6 | Overview of the assignment of the HART variables | 196 |
| 9 | Functional safety | 197 |
| 9.1 | Range of applications for functional safety | 197 |
| 9.2 | Safety function | 197 |
| 9.3 | Type A - Safety Integrity Level (SIL) | 199 |
| 9.4 | Settings | 200 |
| 9.5 | Safety characteristics | 201 |
| 9.6 | Maintenance/check | 201 |
| 10 | Service and maintenance | 203 |
| 10.1 | Basic safety instructions | 203 |
| 10.1.1 | Maintenance | 203 |
| 10.2 | Cleaning | 204 |
| 10.2.1 | Positioners 6DR5..0, 6DR5..3 and 6DR5..5 | 204 |
| 10.2.2 | Positioners 6DR5..1, 6DR5..2 and 6DR5..6 | 205 |
| 10.3 | Maintenance and repair work | 205 |
| 10.4 | HART/FF: Replacing electronics | 206 |
| 10.5 | Replacing the pneumatic block | 208 |
| 10.6 | Replace the pressure sensor module | 209 |
| 10.7 | Return procedure | 212 |
| 10.8 | Disposal | 212 |
| 11 | Diagnostics and troubleshooting | 213 |
| 11.1 | Output of system messages in the display | 213 |
| 11.1.1 | System messages before initialization | 213 |
| 11.1.2 | System messages during initialization (HART) | 213 |
| 11.1.3 | System messages when exiting the Configuration mode | 217 |
| 11.1.4 | System messages during operation | 217 |
| 11.2 | Diagnostics | 219 |
| 11.2.1 | Display of diagnostics values | 219 |
| 11.2.2 | Saving the diagnostics values | 219 |
| 11.2.3 | Overview of diagnostics values 1.STRK to 58.LKPER | 220 |
| 11.2.4 | Meaning of the diagnostics values | 222 |
| 11.2.4.1 | Diagnostic value '1.STRKS - Number of total strokes' | 222 |
| 11.2.4.2 | Diagnostic value '2.CHDIR - Number of changes in direction' | 222 |
| 11.2.4.3 | Diagnostic value '3.\CNT - Number of fault messages' | 223 |
| 11.2.4.4 | Diagnostic value '4.A1CNT - Number of alarms 1' / '5.A2CNT - Number of alarms 2' | 223 |
| 11.2.4.5 | Diagnostic value '6.HOURS - Number of operating hours' | 223 |
| 11.2.4.6 | Diagnostic value '7.HOURR - Resettable operating hours counter' | 223 |
| 11.2.4.7 | Diagnostic value '8.WAY - Determined travel' | 224 |
| 11.2.4.8 | Diagnostic value '9.TUP - Travel time up' / '10.TDOWN - Travel time down' | 224 |

| | | |
|-----------|---|-----|
| 11.2.4.9 | Diagnostic value '11.LEAK - Leakage test' | 224 |
| 11.2.4.10 | Diagnostic value '12.PST - Monitoring of Partial Stroke Test' | 225 |
| 11.2.4.11 | Diagnostic value '12.PST - Monitoring of Partial Stroke Test' with option -Z P02 | 226 |
| 11.2.4.12 | Diagnostic value '13.PRPST' - Time since last Partial Stroke Test' | 227 |
| 11.2.4.13 | Diagnostic value '13.PRPST' - Time since last Partial Stroke Test' with option -Z P02 | 228 |
| 11.2.4.14 | Diagnostic value '14.NXPST - Time until next Partial Stroke Test' | 228 |
| 11.2.4.15 | Diagnostics value '15.DEVI - Dynamic control valve behavior' | 228 |
| 11.2.4.16 | Diagnostic value '16.ONLK - Pneumatic leakage' | 228 |
| 11.2.4.17 | Diagnostic value '17.STIC - Stiction (slipstick)' | 229 |
| 11.2.4.18 | Diagnostic value '18.ZERO - Lower endstop' (HART/PA) | 229 |
| 11.2.4.19 | Diagnostic value '19.OPEN - Upper endstop' (HART/PA) | 229 |
| 11.2.4.20 | Diagnostic value '20.PAVG - Average value of position' | 230 |
| 11.2.4.21 | Diagnostic value '21.P0 - Position lower endstop (0%)' / '22.P100 - Position upper endstop (100%)' | 230 |
| 11.2.4.22 | Diagnostic value '23.IMPUP - Pulse length up' / '24.IMPDN - Pulse length down' | 232 |
| 11.2.4.23 | Diagnostic value '25.PAUTP - Pulse interval' | 232 |
| 11.2.4.24 | Diagnostic value '26.DBUP - Deadband up' / '27.DBDN - Deadband down' | 232 |
| 11.2.4.25 | Diagnostic value '28.SSUP - Slow step zone up' / '29.SSDN - Slow step zone down' | 233 |
| 11.2.4.26 | Diagnostic value '30.TEMP - Current temperature' | 233 |
| 11.2.4.27 | Diagnostic value '31.TMIN - Minimum temperature' / '32.TMAX - Maximum temperature'... | 233 |
| 11.2.4.28 | Diagnostic value '33.T1' ... '41.T9' - Number of operating hours in the temperature range 1 to 9 | 234 |
| 11.2.4.29 | Diagnostic value '42.VENT1' / '43.VENT2' | 234 |
| 11.2.4.30 | Diagnostic value '44.VEN1R' / '45.VEN2R' | 234 |
| 11.2.4.31 | Diagnostic value '46.STORE - Save maintenance data' | 235 |
| 11.2.4.32 | Diagnostic value '47.PRUP - Prediction up' / '48.PRDN - Prediction down' | 235 |
| 11.2.4.33 | Diagnostic value '49.WT00' ... '56.WT95' - Number of operating hours in the travel range WT00 to WT95 | 236 |
| 11.2.4.34 | Diagnostic value '57.LKPUL - Length of the leakage compensation pulse' | 236 |
| 11.2.4.35 | Diagnostic value '58.LKPER - Period of the leakage compensation pulse' | 236 |
| 11.2.4.36 | Diagnostic value '59.mA - Setpoint current' | 237 |
| 11.2.4.37 | Diagnostic value '60.PZ Supply pressure PZ' | 237 |
| 11.2.4.38 | Diagnostic value '61.P1 - Actuating pressure Y1' | 237 |
| 11.2.4.39 | Diagnostic value '62.P2 - Actuating pressure Y2' | 238 |
| 11.2.4.40 | Diagnostic value '63.PZMAX Maximum supply pressure PZ | 238 |
| 11.2.4.41 | Diagnostic value '64.N_MIN - Event counter violations of lower limit PZ' | 238 |
| 11.2.4.42 | Diagnostic value '65.N_MAX - Event counter violations of upper limit PZ' | 239 |
| 11.2.4.43 | Diagnostic value '66.N1MAX - Event counter violations limit Y1' | 239 |
| 11.2.4.44 | Diagnostics value '67.LMY1 +/-Leakage at Y1' | 239 |
| 11.2.4.45 | Diagnostics value '68.LMY2 +/-Leakage at Y2' | 240 |
| 11.2.4.46 | Diagnostic value '69.LMUY1 - Maximum positive leakage at Y1' | 240 |
| 11.2.4.47 | Diagnostic value '70.LMUY2 - Maximum positive leakage at Y2' | 240 |
| 11.2.4.48 | Diagnostics value '71.LMDY1 - Maximum negative leakage at Y1' | 241 |
| 11.2.4.49 | Diagnostics value '72.LMDY2 - Maximum negative leakage at Y2' | 241 |
| 11.2.4.50 | Diagnostic value '73.RPL_E - Procedure for adjustment of electronics | 242 |
| 11.2.4.51 | Diagnostic value '74.TRIM - Position adjustment | 242 |
| 11.3 | Online diagnostics | 243 |
| 11.3.1 | Overview of online diagnostics | 243 |
| 11.3.2 | Overview of error codes (HART) | 243 |
| 11.3.3 | XDIAG parameter | 247 |
| 11.3.4 | Meaning of error codes | 247 |
| 11.3.4.1 | 1 Remaining control deviation | 247 |

| | | |
|-----------|--|------------|
| 11.3.4.2 | 2 Device not in "Automatic" mode | 248 |
| 11.3.4.3 | 3 Digital input DI1 or DI2 active | 248 |
| 11.3.4.4 | 4 Monitoring the number of total strokes | 248 |
| 11.3.4.5 | 5 Monitoring the number of changes in direction | 248 |
| 11.3.4.6 | 6 Monitoring the lower endstop / 7 Monitoring the upper endstop..... | 248 |
| 11.3.4.7 | 8 Monitoring deadband | 249 |
| 11.3.4.8 | 9 Partial Stroke Test..... | 249 |
| 11.3.4.9 | 10 Monitoring of dynamic control valve behavior | 249 |
| 11.3.4.10 | 11 Monitoring/compensation of pneumatic leakage | 249 |
| 11.3.4.11 | 12 Monitoring of stiction (slipstick) | 250 |
| 11.3.4.12 | 13 Monitoring the lower limit temperature..... | 250 |
| 11.3.4.13 | 14 Monitoring the upper limit temperature | 250 |
| 11.3.4.14 | 15 Monitoring the position average value..... | 250 |
| 11.3.4.15 | 16 Monitoring the plausibility of values for Partial Stroke Test (HART)..... | 250 |
| 11.3.4.16 | 17 Monitoring of pressure sensor module..... | 250 |
| 11.3.4.17 | 18 Monitoring lower limit PZ..... | 250 |
| 11.3.4.18 | 19 Monitoring specific limits PZ..... | 250 |
| 11.3.4.19 | 20 Monitoring upper limit PZ | 251 |
| 11.3.4.20 | 21 Monitoring upper limit of actuating pressure Y1 | 251 |
| 11.3.4.21 | 22 Monitoring leakage of the pneumatic system | 251 |
| 11.3.4.22 | 23 and 24 device-internal check of the electronics..... | 251 |
| 11.4 | Fault and remedy..... | 251 |
| 12 | Technical data..... | 257 |
| 12.1 | HART operating conditions..... | 257 |
| 12.2 | Pneumatic data for all device versions | 258 |
| 12.3 | Construction for all device versions | 259 |
| 12.4 | Controller for all device versions..... | 260 |
| 12.5 | Electrical data (HART)..... | 261 |
| 12.6 | Electrical data for pressure sensor module | 262 |
| 12.7 | Communication (HART) | 263 |
| 12.8 | Technical data for natural gas as actuator medium..... | 264 |
| 12.9 | Option modules | 265 |
| 12.9.1 | Digital I/O Module (DIO) 6DR4004-6A / -8A..... | 265 |
| 12.9.2 | Analog Output Module (AOM) 6DR4004-6J / -8J | 266 |
| 12.9.3 | Inductive Limit Switches (ILS) 6DR4004-6G / -8G | 267 |
| 12.9.4 | Mechanic Limit Switches (MLS) 6DR4004-6K | 268 |
| 12.9.5 | Analog Input Module (AIM) 6DR4004-6F / -8F..... | 269 |
| 12.9.6 | Internal NCS module 6DR4004-5L / 6DR4004-5LE..... | 269 |
| 12.9.7 | Other technical specifications..... | 270 |
| 13 | Dimension drawings..... | 271 |
| 13.1 | Positioner in non-flameproof enclosure | 271 |
| 13.2 | Terminal strip for positioners..... | 272 |
| 13.3 | Positioner in flameproof enclosure | 273 |

| | | |
|----------|--|------------|
| A | Product documentation and support | 275 |
| A.1 | Product documentation | 275 |
| A.2 | Technical support..... | 276 |
| A.3 | Chinese production license for explosion proof electrical products | 277 |
| B | Installing ILS and MLS (for 6DR50.5/6DR51.5/6DR50.6/6DR51.6) | 279 |
| B.1 | Opening the positioner | 279 |
| B.2 | Installing the option module | 282 |
| B.3 | Closing the positioner | 289 |
| C | External position detection | 293 |
| C.1 | Introduction..... | 293 |
| C.2 | Non-Contacting Sensor | 293 |
| C.2.1 | Mode of operation | 293 |
| C.2.2 | Mounting the NCS | 294 |
| C.2.2.1 | Mounting the NCS to the part-turn actuator | 295 |
| C.2.2.2 | Mounting the NCS to a linear actuator up to 14 mm (0.55 inch)..... | 297 |
| C.2.2.3 | Mounting the NCS to a linear actuator > 14 mm (0.55 inch)..... | 299 |
| C.2.3 | Connecting NCS to Analog Input Module (AIM) | 302 |
| C.2.4 | Commissioning of NCS..... | 303 |
| C.2.4.1 | Prerequisites / default settings..... | 303 |
| C.2.4.2 | Initialization of part-turn actuators | 304 |
| C.2.4.3 | Initializing linear actuators with a stroke range up to 14 mm (0.55 inch)..... | 304 |
| C.2.4.4 | Initializing linear actuators with a stroke range > 14 mm (0.55 inch)..... | 304 |
| C.2.5 | External NCS sensors 6DR4004-6N/8N and 6DR4004-2ES | 305 |
| C.2.6 | Dimensional drawing of non-contacting sensor | 306 |
| C.2.7 | NCS sensor scope of delivery..... | 307 |
| C.2.7.1 | Scope of delivery of NCS for part-turn actuators | 307 |
| C.2.7.2 | Scope of delivery of NCS for linear actuators up to 14 mm (0.55 inch) . | 307 |
| C.2.7.3 | Scope of delivery of NCS for linear actuators > 14 mm (0.55 inch) . | 308 |
| C.3 | External position detection..... | 309 |
| C.3.1 | Mode of operation for external position detection | 309 |
| C.3.2 | Installation of external position detection system | 310 |
| C.3.3 | Connecting to Analog Input Module (AIM)..... | 310 |
| C.3.4 | Technical specifications of the external position detection system | 311 |
| C.3.4.1 | Rated conditions for external position detection | 311 |
| C.3.4.2 | Electrical data for external position detection | 311 |
| D | Pressure gauge blocks | 317 |
| D.1 | Pressure gauge block | 317 |
| D.2 | Venting gauge block | 318 |
| E | Sealing plug / thread adapter | 319 |
| E.1 | Purpose | 319 |
| E.2 | Safety instructions | 319 |
| E.3 | Technical specifications | 320 |

| | | |
|----------|--|------------|
| E.4 | Dimensional drawings for accessory part..... | 321 |
| F | Booster..... | 323 |
| F.1 | Booster introduction | 323 |
| F.2 | Mounting a booster | 323 |
| F.3 | Booster commissioning | 327 |
| F.4 | RUN 3: Determination and display of travel time (leakage test) | 329 |
| F.5 | Booster dimension drawings | 330 |
| F.5.1 | For positioners in non-flameproof enclosure..... | 330 |
| F.5.2 | For positioners in flameproof enclosure..... | 331 |
| F.6 | Technical specifications of booster..... | 331 |
| G | Positioner with remote electronics..... | 333 |
| G.1 | Introduction to remote electronics..... | 333 |
| G.2 | 19-inch control unit | 333 |
| G.2.1 | Description of 19-inch control unit 4 to 20 mA | 333 |
| G.2.2 | Connecting the 19-inch control unit 4 to 20 mA | 334 |
| G.2.2.1 | Grounding concept for 19-inch control unit 4 to 20 mA | 334 |
| G.2.2.2 | Electrical connection of 19" slide-in module 4 to 20 mA..... | 337 |
| G.2.3 | Technical specifications for 19-inch control unit 4 to 20 mA | 339 |
| G.2.4 | Dimension drawing for 19-inch control unit 4 to 20 mA..... | 341 |
| G.2.5 | Scope of delivery of remote electronics | 341 |
| G.3 | Positioner without electronics 6DR5910 | 341 |
| H | Abbreviations..... | 343 |
| H.1 | Abbreviations for PS2 positioners | 343 |
| H.2 | Abbreviations | 344 |
| | Glossary | 347 |
| | Index..... | 355 |

Introduction

1.1 Purpose of this documentation

These instructions contain all information required to commission and use the device. Read the instructions carefully prior to installation and commissioning. In order to use the device correctly, first review its principle of operation.

The instructions are aimed at persons mechanically installing the device, connecting it electronically, configuring the parameters and commissioning it, as well as service and maintenance engineers.

1.2 Scope of documentation

| Article no. | Product |
|--------------------------------|--|
| 6DR50.. | SIPART PS2, |
| 6DR51.. | SIPART PS2, 2-wire (4 mA to 20 mA), with HART |
| 6DR52.. | SIPART PS2, 2-,3-,4-wire (4 mA to 20 mA), with HART |
| 6DR53.. | SIPART PS2, 2-,3-,4-wire (4 mA to 20 mA), without HART |
| 6DR5910-* | SIPART PS2 without basic electronics with Position Transmitter and pneumatics unit |
| 6DR5...-Z D53 | M12 device plug (D coding) for Analog Output Module (AOM) |
| 6DR5...-Z D54 | M12 device plug (D coding) for External Position Transmitter |
| 6DR5...-Z D55 | M12 device plug (D coding) for Digital I/O Module (DIO) |
| 6DR5...-Z D53 | M12 device plug (D coding) for Inductive Limit Switches (ILS) |
| 6DR5...-Z D53 | M12 device plug (D coding) for Mechanic Limit Switches (MLS) |
| 6DR5...-Z F01 | Fail in place |
| 6DR5...-Z P01 | Pressure sensor module with 1 sensor |
| 6DR5...-Z P02 | Pressure sensor module with 2 or 3 sensors |
| A5E00151560 | 19-inch control unit 4 mA to 20 mA with 2-wire connection |
| 6DR4004-6A / -8A | Digital I/O Module (DIO) |
| 6DR4004-6F / -8F | Analog Input Module (AIM) |
| 6DR4004-6J / -8J | Analog Output Module (AOM) |
| 6DR4004-6G / -8G | Inductive Limit Switches (ILS) |
| 6DR4004-6K | Mechanic Limit Switches (MLS) |
| 6DR4004-5L / -5LE | Internal NCS module |
| 6DR4004-6N* / -8N* | Non-contacting sensor |
| 6DR4004-1ES ... -4ES | Position Transmitter |
| 6DR4004-1R / -2R / -1RN / -2RN | Pneumatic terminal strip |

1.3 Document history PS2 with and without HART

| Article no. | Product |
|--|--|
| 6DR4004-8D and TGX:16300-1556 | Installation for NAMUR part-turn actuators |
| 6DR4004-8V / -8L / -8VK / -8VL | Mounting kit for NAMUR linear actuator |
| 6DR4004-1RJ/K/P/Q and 6DR4004-2RJ/K/P/Q | Booster |

1.3 Document history PS2 with and without HART

The table shows the most important changes in the documentation compared to the previous edition.

| Edition | Note |
|---------|---|
| 11/2022 | <ul style="list-style-type: none"> • New firmware version 5.04.00 • Section "Diagnostics and troubleshooting": <ul style="list-style-type: none"> – New diagnostic values 73.RPL_E and 74.TRIM – New error codes 23 and 24 • Section "Commissioning" <ul style="list-style-type: none"> – Replacing the positioner during operation • "Technical specifications" section updated • Appendix Installing ILS and MLS (for 6DR50.5/6DR51.5/6DR50.6 and 6DR51.6) |
| 10/2020 | <ul style="list-style-type: none"> • New firmware version 5.03.00 • All information regarding the new pressure sensors • Section "Connection": Connection of signal source to terminal 7. • Section "Commissioning": <ul style="list-style-type: none"> – New "RUN 6" for Valve Signature (VS) – Option -Z P02 pressure sensor modules – Manual adjustment of the pressure sensors • Section "Parameter assignment": <ul style="list-style-type: none"> – New pressure monitoring U.\PRES – Additional physical variables for HART variables SV, TV and QV • Section "Service and maintenance": Replace pressure sensor module • Section "Diagnostics and troubleshooting": <ul style="list-style-type: none"> – New "RUN 6" – New or changed diagnostic values for parameters 60.PZ to 72.LMDY2 and associated error codes. – Section "Fault and remedy" expanded to include the fault profile for the pressure sensor module. |

| Edition | Note |
|---------|---|
| 11/2019 | <ul style="list-style-type: none"> • New: Scope of documentation • In the entire operating instructions: Option modules renamed • In the entire operating instructions: Binary output renamed to digital output; binary input renamed to digital input • Section "Installing/mounting" <ul style="list-style-type: none"> – Change in figure for option module "Analog Output Module (AOM) 6DR4004-6J / -8J" – Text change for option module "Analog Input Module (AIM) 6DR4004-6F / -8F" • Section "Connection" <ul style="list-style-type: none"> – Change in figure for option module "Analog Input Module (AIM) 6DR4004-6F / -8F" – Terminology change: "Plug M12" renamed to "Device plug M12"; "Outputs" and "Alarm outputs" renamed to "Digital outputs A1 and A2"; Pneumatic connection: "Pneumatic auxiliary power" renamed to "Supply pressure PZ" – Terminological and textual revision of "Behavior in case of failure of the electrical auxiliary power and/or the supply pressure PZ" • Section "Commissioning" <ul style="list-style-type: none"> – Change to the procedure in the flameproof enclosure Ex d for "Setting the friction clutch" – Note on commissioning of a tight closing valve in "Automatic initialization of linear actuators" and "Automatic initialization of part-turn actuators" • Section "Alarm, error and system messages" is now called "Diagnostics and troubleshooting" <ul style="list-style-type: none"> – Format change in section "Fault and remedy", tables were combined into one table. • Section "Technical data" <ul style="list-style-type: none"> – Section "Explosion protection" is now called "Certificates and approvals"; entire section has been revised terminologically; table header for "Basic unit and optional modules" has been changed. – Section "Electrical data for pressure sensor module" completely revised |
| | <ul style="list-style-type: none"> • Section "Spare parts/accessories/scope of delivery": Replacement part "2-wire, Ex, with HART" added • Section "External position detection": 6DR4004-1ES to -4ES added, terminology adapted, C73451-A430-D78 no longer exists and was removed. • Section "Booster": Texts revised, procedures for standard device and Ex d device combined. |

1.4 Product compatibility

The following table describes the compatibility between document output, device revision, engineering system and associated Electronic Device Description (EDD).

| Manual edition | Comments | Device revision | Compatible version of device integration package | |
|----------------|---------------------|--|--|-------------------------|
| | | | | |
| 11/2022 | New device features | FW: 5.04.00 or higher Device revision 8 or higher | SIMATIC PDM V9.1 | EDD: 25.00.00 or higher |
| | | | SIMATIC PDM V8.2 SP1 | EDD: 25.00.00 or higher |
| | | | AMS Device Manager V12.5 | EDD: 25.00.00 or higher |
| | | | SITRANS DTM V4.1 | EDD: 25.00.00 or higher |
| 10/2020 | New device features | FW: 5.03.00 or higher Device revision 8 or higher | SIMATIC PDM V9.1 | EDD: 25.00.00 or higher |
| | | | SIMATIC PDM V8.2 SP1 | EDD: 25.00.00 or higher |
| | | | AMS Device Manager V12.5 | EDD: 25.00.00 or higher |
| | | | SITRANS DTM V4.1 | EDD: 25.00.00 or higher |
| 11/2019 | New manual edition | FW: 5.02.00 or higher Device revision 7 or higher | SIMATIC PDM V9.0 | EDD: 23.00.00 or higher |
| | | | SIMATIC PDM V8.2 SP1 | EDD: 23.00.00 or higher |
| | | | AMS Device Manager V12.5 | EDD: 23.00.00 or higher |
| | | | SITRANS DTM V4.1 | EDD: 23.00.00 or higher |
| | | | Field communicator | EDD: 23.00.00 or higher |

1.5 Designated use

Use the device in accordance with the information on the nameplate and in the Technical data (Page 257).

1.6 Checking the consignment

1. Check the packaging and the delivered items for visible damages.
2. Report any claims for damages immediately to the shipping company.
3. Retain damaged parts for clarification.
4. Check the scope of delivery by comparing your order to the shipping documents for correctness and completeness.



WARNING

Using a damaged or incomplete device

Risk of explosion in hazardous areas.

- Do not use damaged or incomplete devices.

1.7 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit

<https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under

<https://www.siemens.com/cert>.

NOTICE

Unauthorized product information or software

Use only authorized Siemens websites when accessing any product information or software, including firmware updates, device integration files (EDD, for example), as well as other product documentation. Using unauthorized product information or software could result in a security incident, such as breach of confidentiality, or loss of integrity and availability of the system.

For more information, see Product documentation and support (Page 275).

1.8 Transportation and storage

To guarantee sufficient protection during transport and storage, observe the following:

- Keep the original packaging for subsequent transportation.
- Devices/replacement parts should be returned in their original packaging.
- If the original packaging is no longer available, ensure that all shipments are properly packaged to provide sufficient protection during transport. Siemens cannot assume liability for any costs associated with transportation damages.

| |
|---|
| NOTICE |
| Insufficient protection during storage The packaging only provides limited protection against moisture and infiltration. <ul style="list-style-type: none">• Provide additional packaging as necessary. |

Special conditions for storage and transportation of the device are listed in Technical data (Page 257).

1.9 Notes on warranty

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. The sales contract contains all obligations on the part of Siemens as well as the complete and solely applicable warranty conditions. Any statements regarding device versions described in the manual do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of publishing. Siemens reserves the right to make technical changes in the course of further development.

Safety information

2.1 Precondition for use

This device left the factory in good working condition. In order to maintain this status and to ensure safe operation of the device, observe these instructions and all the specifications relevant to safety.

Observe the information and symbols on the device. Do not remove any information or symbols from the device. Always keep the information and symbols in a completely legible state.

2.2 Warning symbols on the device

| Symbol | Explanation |
|---|--------------------------------|
|  | Consult operating instructions |

2.3 Laws and directives

Observe the safety rules, provisions and laws applicable in your country during connection, assembly and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC) (Canada)

Further provisions for hazardous area applications are for example:

- IEC 60079-14 (international)
- EN 60079-14 (EU)

See also

Certificates (<http://www.siemens.com/processinstrumentation/certificates>)

2.4 Conformity with European directives

The CE marking on the device shows conformity with the regulations of the following European guidelines:

| | |
|---|---|
| Electromagnetic compatibility EMC 2014/30/EU | Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to electromagnetic compatibility. |
| Atmosphère explosive ATEX 2014/34/EU | Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres. |
| 2011/65/EU RoHS | Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment |

The directives applied can be found in the EU declaration of conformity for the associated device.

2.5 Conformity with UK directives

The UKCA marking on the device shows conformity with the following UK directives:

| | |
|--|--|
| Electromagnetic Compatibility SI 2016/1091 | Electromagnetic Compatibility Directives 2016 |
| Explosive Atmospheres SI 2016/1107 | Directives for Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres 2016 |
| Directive on the Restriction of the Use of Certain Hazardous Substances SI 2012/3032 | Directives on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment 2012 |

The applicable directives can be found in the UKCA declaration of conformity of the specific device.

2.6 Product approval and UL compliance

Classification according to pressure equipment directive (PED 2014/68/EU) For fluid group 1 gases; fulfills requirements according to article 4, paragraph 3 (good engineering practice SEP)

CE conformity The applicable directives and applied standards can be found in the EU declaration of conformity on the Internet.

UL conformity Conformity has been proven based on US and Canadian safety requirements. For applicable safety requirements, refer to the UL CERTIFICATE OF COMPLIANCE on the Internet at: Certificates (<http://www.siemens.com/processinstrumentation/certificates>)

2.7 Improper device modifications

WARNING

Improper device modifications

Risk to personnel, system and environment can result from modifications to the device, particularly in hazardous areas.

- Only carry out modifications that are described in the instructions for the device. Failure to observe this requirement cancels the manufacturer's warranty and the product approvals.

2.8 Improper modification on positioner 6DR5...6

WARNING

Improper modification on positioner 6DR5...6

Danger of explosion. The pneumatic terminal plate on the SIPART PS2 positioner 6DR5..6 is a safety-related component of the flameproof enclosure.

- Never loosen the screws ① of the pneumatic terminal plate.

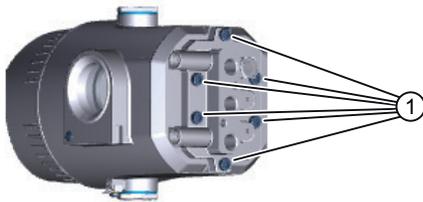


Figure 2-1 Screws of the pneumatic terminal plate on the positioner 6DR5..6

2.9 Requirements for special applications

Due to the large number of possible applications, each detail of the described device versions for each possible scenario during commissioning, operation, maintenance or operation in systems cannot be considered in the instructions. If you need additional information not covered by these instructions, contact your local Siemens office or company representative.

Note

Operation under special ambient conditions

We highly recommend that you contact your Siemens representative or our application department before you operate the device under special ambient conditions as can be encountered in nuclear power plants or when the device is used for research and development purposes.

2.10 Use in hazardous areas

Qualified personnel for hazardous area applications

Persons who install, connect, commission, operate, and service the device in a hazardous area must have the following specific qualifications:

- They are authorized, trained or instructed in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures, aggressive, and hazardous media.
- They are authorized, trained, or instructed in carrying out work on electrical circuits for hazardous systems.
- They are trained or instructed in maintenance and use of appropriate safety equipment according to the pertinent safety regulations.

| |
|---|
|  WARNING |
| Use in hazardous area Risk of explosion. <ul style="list-style-type: none">• Only use equipment that is approved for use in the intended hazardous area and labeled accordingly.• Do not use devices that have been operated outside the conditions specified for hazardous areas. If you have used the device outside the conditions for hazardous areas, make all Ex markings unrecognizable on the nameplate. |

| |
|---|
|  WARNING |
| Loss of safety of device with type of protection "Intrinsic safety Ex i" If the device or its components have already been operated in non-intrinsically safe circuits or the electrical specifications have not been observed, the safety of the device is no longer ensured for use in hazardous areas. There is a risk of explosion. <ul style="list-style-type: none">• Connect the device with type of protection "Intrinsic safety" solely to an intrinsically safe circuit.• Observe the specifications for the electrical data on the certificate and/or in Technical data (Page 257). |

Description

3.1 Function

- The electropneumatic positioner and an actuator form a control loop. The current position of the actuator is detected by a sensor and fed back as actual value x . The setpoint and the actual value are also shown simultaneously on the display.
- The positioner works as a predictive five-point controller, whose output variable $\pm\Delta y$ is used to control the pneumatic block by pulse length modulation.
- These control signals cause pressure changes in the actuator chamber(s) and thus an adjustment of the actuator until the control deviation becomes zero.
- The three buttons and the display are used to operate (manual mode) and configure (structuring, initializing and parameter assignment) with the enclosure cover removed.
- By default, the basic unit has a digital input. This digital input is individually configured and blocks the operating levels, for example.
- Some positioner versions have a friction clutch and a selectable transmission. It can therefore be used on a large number of mechanical part-turn and linear actuators.
- In the case of positioners with the "Fail in Place" function, the current position of the actuator is held if the electric and/or pneumatic auxiliary power fails. Does not function in conjunction with SIL.

3.2 Structure

3.2.1 Overview of structure

The following sections describe the mechanical and electrical structure, components, and principle functionality of the positioner.

The positioner is used to move and control pneumatic actuators. The positioner works electropneumatically, using compressed air as auxiliary power. The positioner is used to control valves, for example, with:

- Linear actuator
- Part-turn actuator VDI/VDE 3845

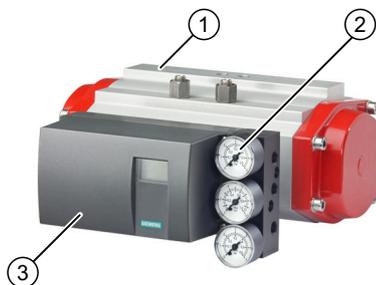
Various add-on extensions are available for linear actuators:

- IEC 60534-6-1 (NAMUR)
- Integrated mounting on ARCA, except with flameproof stainless steel enclosure (6DR5..6)
- Integrated mounting on SAMSON, not for Ex d



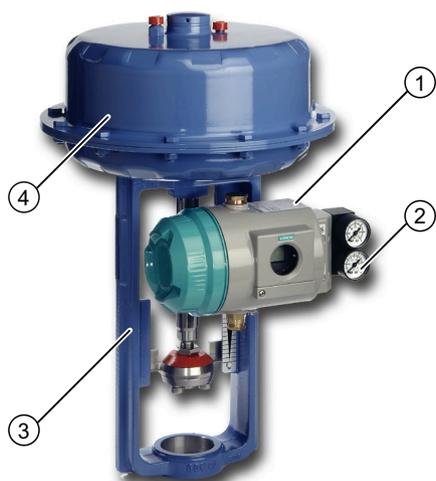
- ① Pressure gauge block, single-acting
- ② Process valve
- ③ Yoke / actuator yoke
- ④ Single-acting positioner in non-flameproof aluminum enclosure
- ⑤ Actuator

Figure 3-1 Positioner attached to a single-acting linear actuator



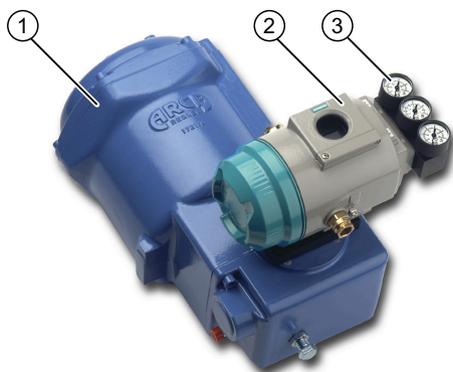
- ① Part-turn actuator
- ② Pressure gauge block, double-acting
- ③ Double-acting positioner in polycarbonate enclosure

Figure 3-2 Positioner attached to double-acting part-turn actuator



- ① Single-acting positioner in flameproof aluminum enclosure
- ② Pressure gauge block, single-acting
- ③ Yoke / actuator yoke
- ④ Actuator

Figure 3-3 Positioner in flameproof aluminum enclosure attached to linear actuator

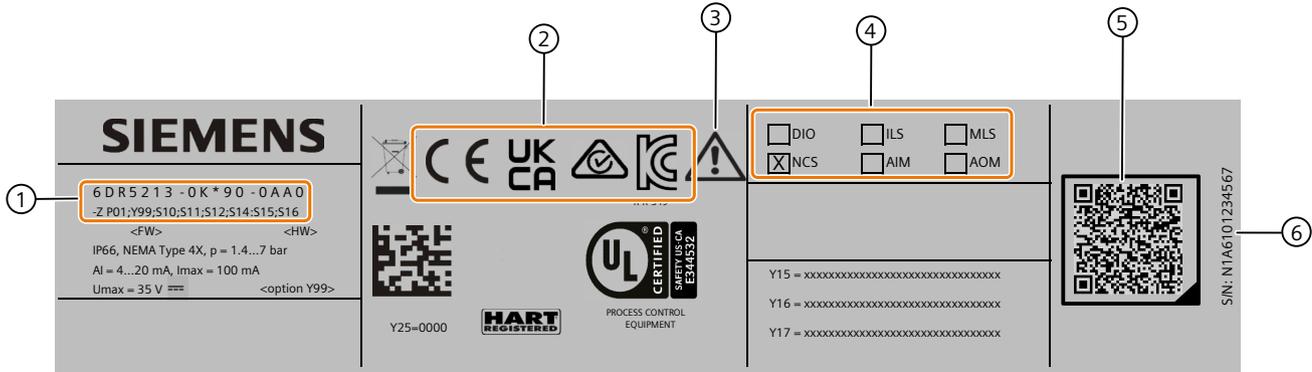


- ① Part-turn actuator
- ② Double-acting positioner in flameproof aluminum enclosure
- ③ Pressure gauge block, double-acting

Figure 3-4 Positioner in flameproof aluminum enclosure attached to part-turn actuator

3.2.2 Manufacturer nameplate

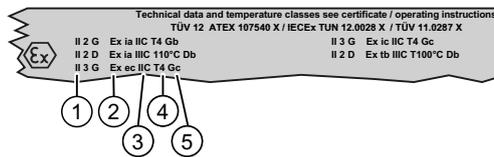
Example



- ① Article number and order suffix (order code)
- ② Conformity with country-specific directives
- ③ Observe the operating instructions
- ④ Built-in option modules
- ⑤ QR code to the mobile website with device-specific product information
- ⑥ Serial number

3.2.3 Explanation of Ex information

Explanation of Ex information

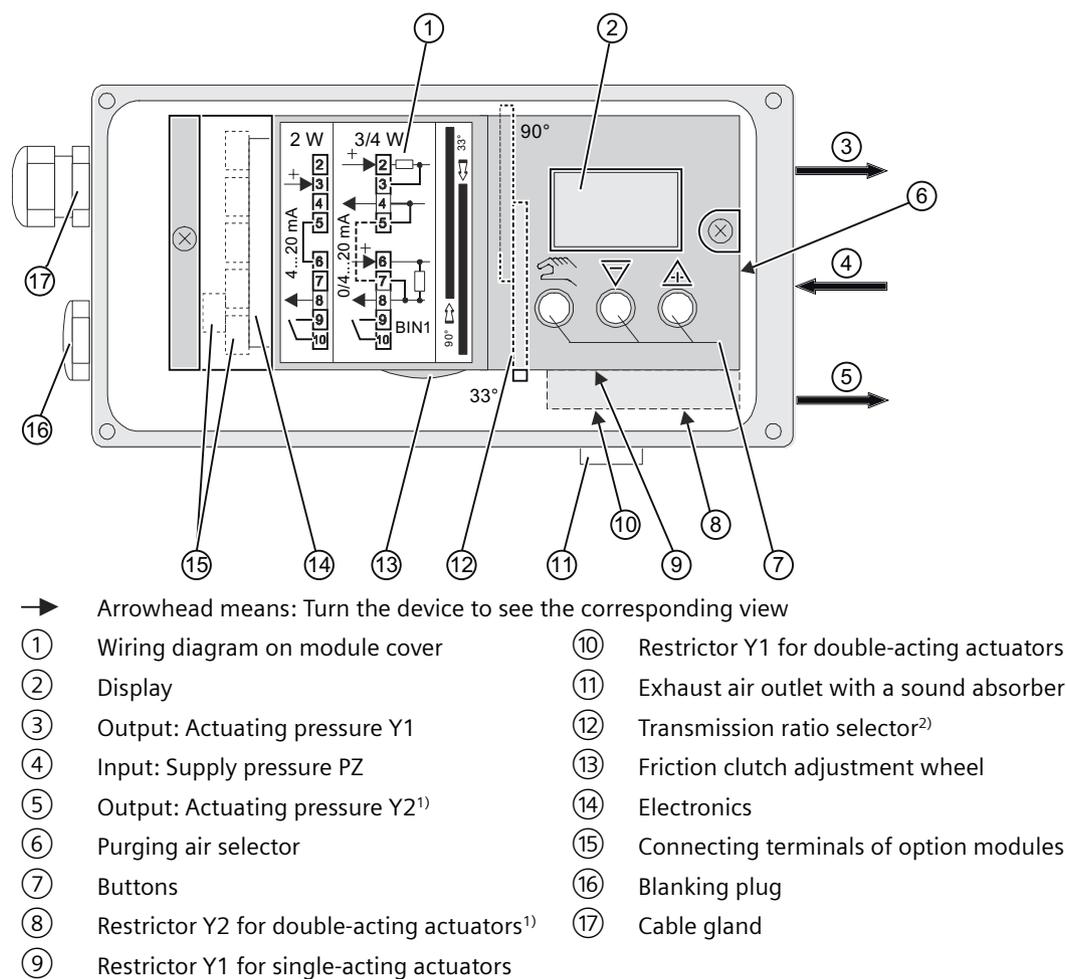


- ① Category for operating range
- ② Type of protection
- ③ Group (gas, dust)
- ④ Maximum surface temperature (temperature class)
- ⑤ Device protection level

Figure 3-5 Explanation of Ex information

3.3 Device components

3.3.1 Overview of device components (without Ex)



¹⁾ for double-acting actuators

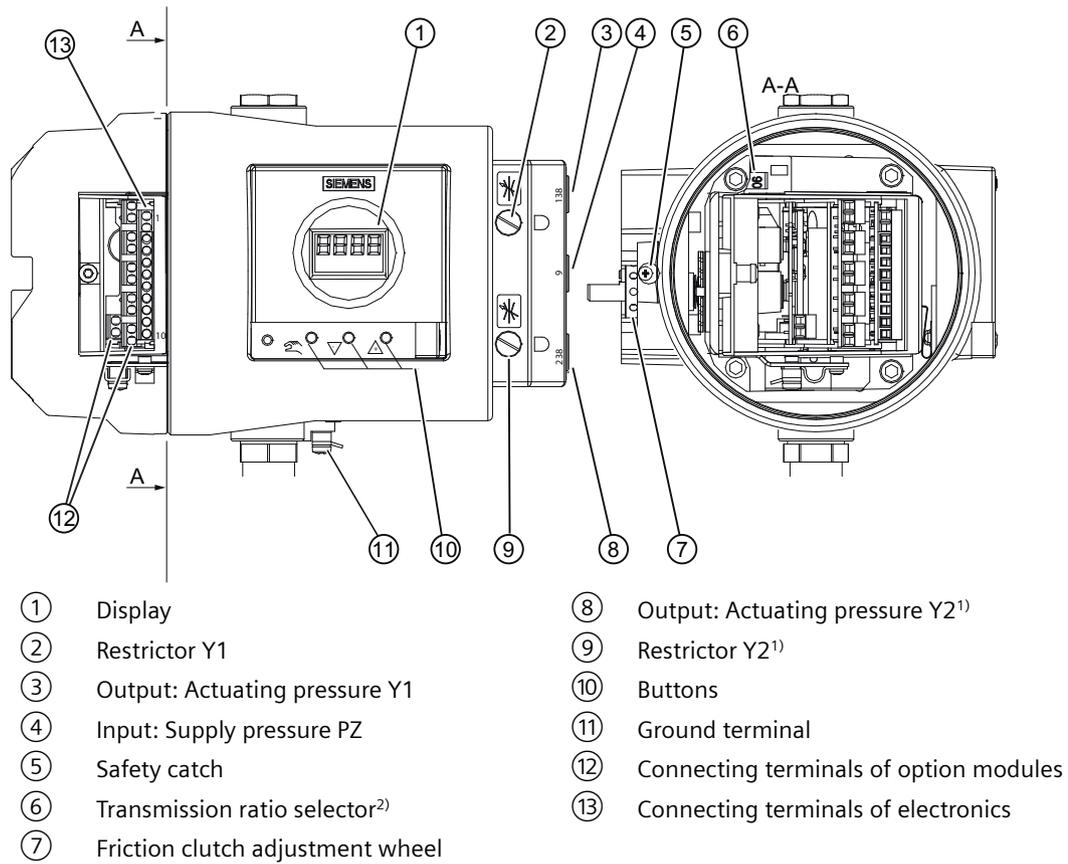
²⁾ visible when the positioner is open

Figure 3-6 View of positioner with cover open

See also

Structure of pneumatic connection (Page 89)

3.3 Device components



¹⁾ for double-acting actuators

²⁾ visible when the positioner is open

Figure 3-7 View of positioner in flameproof enclosure, cover opened

3.3.2 Electronics

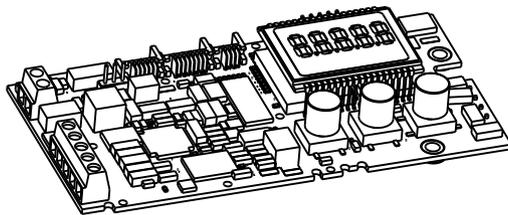


Figure 3-8 Electronics, schematic representation

The electronics contains:

- CPU
- Memory
- Analog-to-digital converter
- Display

- Buttons
- Terminal strips to connect the option modules to the electronics

3.4 Mode of operation

Control loop

The electropneumatic positioner forms a control loop with the pneumatic actuator:

- The actual value x represents the position of the actuator spindle for linear actuators or the position of the actuator shaft for part-turn actuators.
- The higher-level control loop provides the setpoint w .

The stroke or rotary movement of the actuator is transferred to a potentiometer using suitable attachments, positioner shaft and a backlash-free, switchable gear drive, and then to the analog input of the microcontroller.

The current position can also be forwarded to the positioner using an external sensor. A **Non Contacting Position Sensor (NCS)** is used to record the stroke or rotary angle directly on the actuator.

The microcontroller:

- Corrects the angle error of the shaft pick-up if necessary.
- Compares actual value x with setpoint w .
- Calculates the manipulated variable increments $\pm\Delta y$.

Depending on the size and direction of the control deviation ($x-w$), pressurizing or depressurizing occurs via the pneumatic block. The actuator volume integrates the controller increment for the actuating pressure y which is proportional to the drive rod or the drive shaft. This controller increment changes the actuating pressure until the control deviation becomes zero.

Pneumatic actuators are available in single and double-acting versions. In a single-acting version, only one pressure chamber is ventilated and depressurized. The pressure developed works against a spring. In a double-acting version, two pressure chambers work against each other. Ventilating the volume of one chamber simultaneously depressurizes the volume of the other.

Control algorithm

The control algorithm is an adaptive, predictive five-point controller.

In case of large control deviations, the valves are controlled using permanent contact. This takes place in the so-called fast step zone.

In the case of medium-sized control deviations, the pneumatic block is controlled by pulse-length modulated pulses. This takes place in the so-called slow step zone.

3.4 Mode of operation

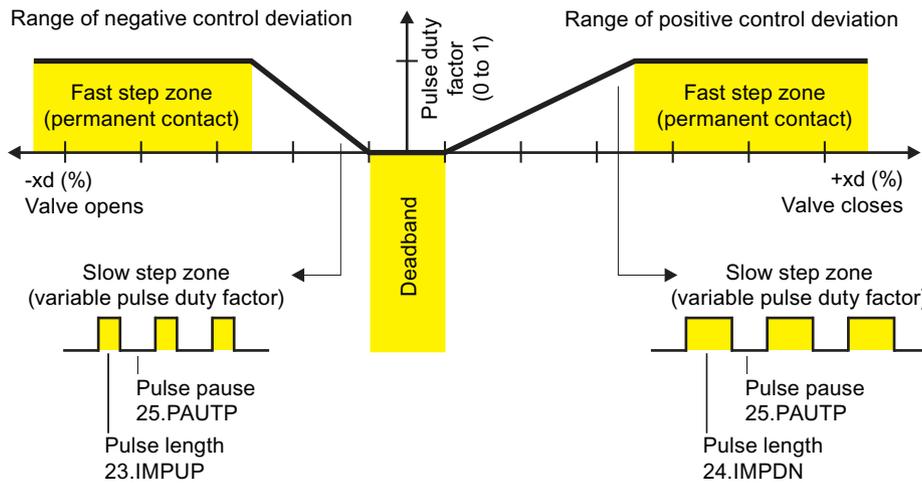


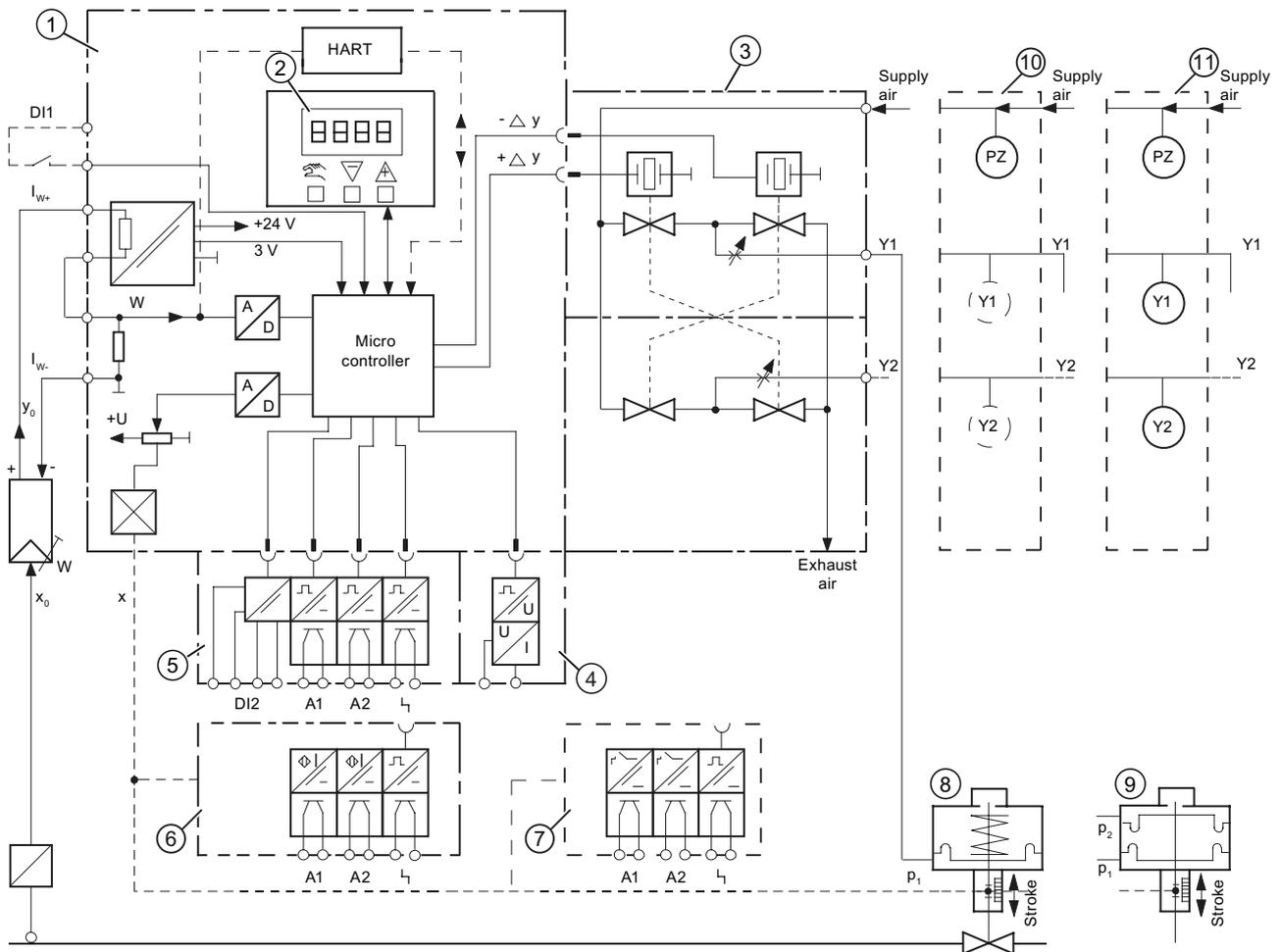
Figure 3-9 Functional principle of five-point controller

Small control deviations do not send control pulses in the zone. This takes place in the so-called adaptive deadband. The deadband adaptation and the continuous adaptation of minimum pulse lengths in "Automatic" mode ensure the best possible control accuracy with the smallest number of operating cycles. The start parameters are determined during the initialization phase and stored in the non-volatile memory. The most important start parameters are:

- The real actuator travel with end positions
- Travel times
- The deadband size

The number of fault messages, changes in direction, and the number of total strokes are continuously determined during operation and saved every 15 minutes. Document and read out these parameters via the communication software, e.g. SIMATIC PDM and AMS. By comparing the old values with the current ones, you can draw conclusions about the wear and tear of the valve. This is done using the diagnostics function.

3.4.1 Block circuit diagram for single-acting or double-acting actuators



- ① Electronics with microcontroller and input circuit
- ② Control pad with display and buttons
- ③ Single-acting or double-acting pneumatic block
- ④ Analog Output Module (AOM) for positioners
- ⑤ Digital I/O Module (DIO) for 3 digital outputs and 1 digital input
- ⑥ Inductive Limit Switches (ILS)
- ⑦ Mechanic Limit Switches (MLS)
- ⑧ Spring-loaded pneumatic actuator (single-acting)
- ⑨ Pneumatic actuator (double-acting)
- ⑩ Pressure sensor module
- ⑪ Pressure gauge block

Figure 3-10 Block circuit diagram for the electropneumatic positioner, functional diagram

Note

Digital I/O Module (DIO), Inductive Limit Switches (ILS) and Mechanic Limit Switches (MLS)

Digital I/O Module (DIO)^⑤, Inductive Limit Switches (ILS)^⑥ and Mechanic Limit Switches (MLS)^⑦ can only be used alternatively.

3.4.2 Mode of operation of the HART function

Note

Priority of operation / failure of power supply

- Operation at the positioner has priority over specifications from the HART communicator.
 - Failure of the auxiliary power to the positioner also interrupts communications.
-

Function

The positioner is also available with built-in HART functionality. The HART protocol allows you to communicate with your device using a HART communicator, PC, or programming unit. You can do the following with your device:

- Convenient configuration
- Store configurations
- Call up diagnostic data
- Show online measured values

Communication takes place as frequency modulation on the existing signal lines for the setpoint of 4 to 20 mA.

The positioner is integrated into the following parameter assignment tools:

- HART communicator
- PDM (Process Device Manager)
- AMS (Asset Management System)

3.4.3 HART system configuration

Overview

The positioner can be used in a number of system configurations:

- Stand-alone, supplied with the required auxiliary power supply; communication with supplementary units (handheld), for example
- As part of a complex system environment, e.g. SIMATIC S7

System communication

Communication is via the HART protocol, using:

- HART Communicator (load 230 ... 1100 Ω)
- PC with HART modem, on which appropriate software is installed, e.g. SIMATIC PDM (load 230 ... 500 Ω)
- Control system which can communicate via the HART protocol, e.g. SIMATIC PCS7

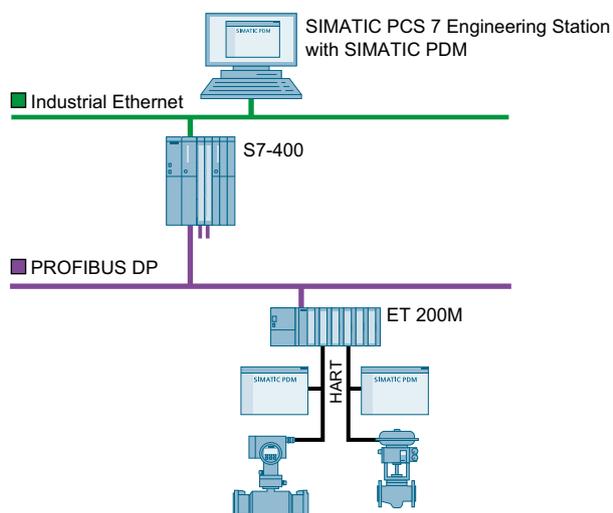


Figure 3-11 Typical system configurations

3.4.4 SIMATIC PDM

SIMATIC PDM is a software package for configuring, parameter assignment, commissioning, diagnostics and maintenance of this device and other process devices.

SIMATIC PDM offers simple monitoring of process values, alarms, and device status information.

SIMATIC PDM allows the process device data to be:

- displayed
- set
- modified
- saved
- diagnosed
- checked for plausibility
- managed
- simulated

Additional information on SIMATIC PDM can be found at www.siemens.com/simatic-pdm (www.siemens.com/simatic-pdm).

See also

Overview of the assignment of the HART variables (Page 196)

Installing/mounting

4.1 Basic safety instructions

 **WARNING**

High operating force with pneumatic actuators

Risk of injury when working on control valves due to the high operating force of the pneumatic actuator.

- Please observe the corresponding safety instructions for the pneumatic actuator in use.

 **WARNING**

Lid gasket may be damaged

If the lid gasket is not positioned correctly in the groove of the base plate, it could be damaged when the lid is mounted and screwed tight.

- Therefore, make sure that the lid gasket is seated correctly.

 **WARNING**

Exceeded maximum permissible operating pressure

Risk of injury or poisoning.

The maximum permissible operating pressure depends on the device version, pressure limit and temperature rating. The device can be damaged if the operating pressure is exceeded. Hot, toxic and corrosive process media could be released.

Ensure that maximum permissible operating pressure of the device is not exceeded. Refer to the information on the nameplate and/or in Technical data (Page 257).

 **WARNING**

Electrostatic charging of nameplates

The nameplates used on the device can reach a capacity of 5 pF.

- Keep the device and the cables at a distance from strong electromagnetic fields.

 **CAUTION**

Unsuitable compressed air

Device damage. As a general rule, the positioner must only be operated with dry and clean compressed air.

- Use the customary water separators and filters. An additional dryer is required in extreme cases.
- Use dryers, especially if you operate the positioner at low ambient temperatures.

 **CAUTION**

Adhere to the following instructions before working on the control valve and when attaching the positioner

Danger of injury.

- Prior to working on the control valve, you must move the actuator and the process valve into a completely pressureless state. Proceed as follows:
 - Depressurize the actuator chambers.
 - Switch off the supply pressure PZ.
 - Secure the process valve.
- Make sure that the actuator has reached the pressureless state.
- If you interrupt the supply pressure PZ to the positioner, the pressureless position can only be reached after a certain waiting time.
- When mounting, adhere strictly to the following order to avoid injuries or mechanical damage to the positioner/mounting kit:
 - Mount the positioner mechanically.
 - Electric connection.
 - Connect supply pressure PZ.
 - Commission the positioner.

 **WARNING**

Mechanical impact energy

In order to ensure the degree of protection of the housing (IP66), protect the housing versions of the positioners listed here from mechanical impact energy:

- 6DR5..3; not greater than 2 Joule
- 6DR5..0; not greater than 1 Joule
- 6DR5..1 with inspection window; not greater than 1 Joule

NOTICE

Torque with NPT screwed gland

Device damage. The maximum torque of the cable gland must not be exceeded.

- To avoid damage to the device, the NPT adapter must be held in place while the NPT gland is screwed into the NPT adapter. Refer to the section "Technical specifications > Construction for all device versions (Page 259)" for the torque value.

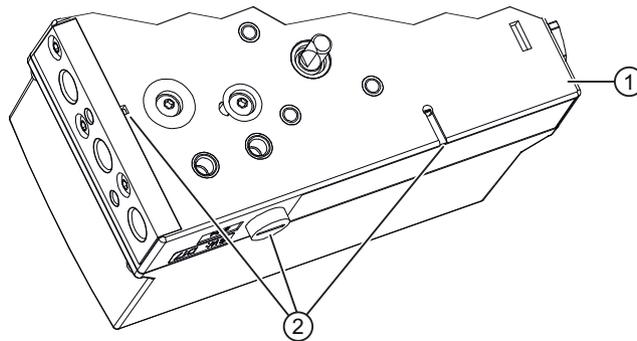
4.1.1 Proper mounting

NOTICE

Freezing of the exhaust air outlets

When devices of the type 6DR5..0/1/2/3 are used, the exhaust air outlets ② may freeze. The function of the device is impaired.

- Do **not** install the positioner with the base plate ① pointing up.



- ① Base plate
- ② Exhaust air outlets

Figure 4-1 Exhaust air outlets, base plate

NOTICE

Incorrect mounting

The device can be damaged, destroyed, or its functionality impaired through improper mounting.

- Before installing ensure there is no visible damage to the device.
- Make sure that process connectors are clean, and suitable gaskets and glands are used.
- Mount the device using suitable tools. Refer to the information in Technical data (Page 257).

4.2 Mounting to linear actuator

Requirements

There are linear actuators for standard mounting in accordance with IEC 60534 and for integrated mounting. Use the reduced mounting kit 6DR4004-8VK for actuators with integrated mounting. Integrated mounting is not possible with flameproof stainless steel enclosure (6DR5..6).

This section describes how to connect the positioner to the linear actuator according to IEC 60534. Depending on the stroke height, you will need the following mounting kit:

- 3 to 35 mm mounting kit 6DR4004-8V
- 35 to 130 mm mounting kit 6DR4004-8V and additional 6DR4004-8L

See also

Construction for all device versions (Page 259)

Procedure

| "Linear actuator IEC 60534 (3 to 35 mm)" mounting kit 6DR4004-8V and 6DR4004-8L | | | |
|---|----------|----------------------------------|---|
| Sr. no. *) | Quantity | Name | Note |
| ① | 1 | NAMUR mounting bracket IEC 60534 | Standardized connection point for mount with fin, column or plane surface |
| ② | 1 | Pick-up bracket | Guides the pulley with the carrier pin and rotates the lever arm. |
| ③ | 2 | Clamping piece | Installs the pick-up bracket on the actuator spindle |
| ④ | 1 | Carrier pin | Installation with pulley ⑤ on lever ⑥ |
| ⑤ | 1 | Pulley | Installation with carrier pin ④ on lever ⑥ |
| ⑥ | 1 | Lever | For the range of stroke from 3 mm to 35 mm The lever 6DR4004-8L is additionally required for ranges of stroke > 35 mm to 130 mm (not included in the scope of delivery). |
| ⑦ | 2 | U-bolts | Only for actuators with columns |
| ⑧ | 4 | Hexagon bolt | M8x20 DIN 933-A2 |
| ⑨ | 2 | Hexagon bolt | M8x16 DIN 933-A2 |
| ⑩ | 6 | Spring lock washer | A8 - DIN 127-A2 |
| ⑪ | 6 | Washer | B8.4 - DIN 125-A2 |
| ⑫ | 2 | Washer | B6.4 - DIN 125-A2 |
| ⑬ | 1 | Spring | VD-115E 0.70 x 11.3 x 32.7 x 3.5 |
| ⑭ | 1 | Spring lock washer | A6 - DIN 137A-A2 |
| ⑮ | 1 | Lock washer | 3.2 - DIN 6799-A2 |
| ⑯ | 3 | Spring lock washer | A6 - DIN 127-A2 |
| ⑰ | 3 | Socket cap screw | M6x25 DIN 7984-A2 |
| ⑱ | 1 | Hexagon nut | M6 - DIN 934-A4 |

| "Linear actuator IEC 60534 (3 to 35 mm)" mounting kit 6DR4004-8V and 6DR4004-8L | | | |
|---|----------|-------------|-----------------|
| Sr. no. ^{*)} | Quantity | Name | Note |
| ⑰ | 1 | Square nut | M6 - DIN 557-A4 |
| ⑳ | 4 | Hexagon nut | M8 - DIN 934-A4 |

^{*)} The serial numbers refer to the images of the description of the installation steps below.

1. Install the clamping pieces ③ on the actuator spindle.
2. Slide the pick-up bracket ② into the milled recesses of the clamping pieces ③.

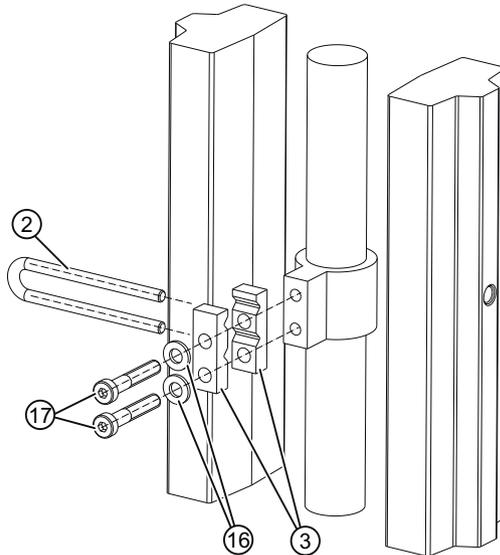


Figure 4-2 Pick-up bracket

3. Tighten the screws ⑰ so that you can still shift the pick-up bracket ②.
4. If you use a short lever, the carrier pin is premounted. If you use the long lever 6DR4004-8L, fasten the carrier pin ④ with the existing parts to the long lever.

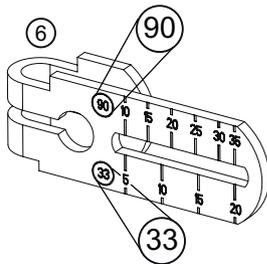


Figure 4-3 Short lever

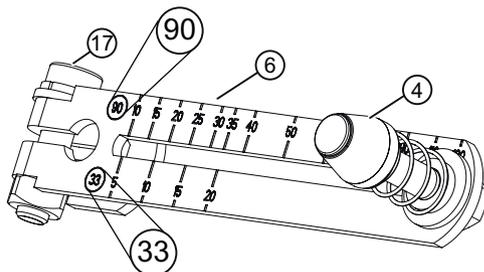


Figure 4-4 Long lever 6DR4004-8L with mounted carrier pin ④ and cylinder head screw ⑰

4.2 Mounting to linear actuator

5. Set the stroke value. The stroke value is specified on the nameplate of the actuator. Position the pin center of the carrier pin ④ on the corresponding value of the scale. If none of the values on the lever scale matches the stroke value of the actuator, select the next higher value on the scale.
 - For devices without transmission ratio selector, use the scale (90).
6. Set the transmission ratio selector (Page 46) to the value of the selected scale.
 - This step is omitted for devices without a transmission ratio selector.
7. If you need the value of actuator travel after initialization in mm: ensure that the configured stroke value matches the value of the "3.YWAY" parameter.
8. Push the pre-installed lever ⑥ up to the endstop on the positioner shaft. Fasten the lever ⑥ with socket cap screw ⑰.
9. Install the mounting bracket ① at the rear side of the positioner. Use 2 hexagon bolts ⑨, 2 spring lock washers ⑩ and 2 flat washers ⑪ for this purpose.

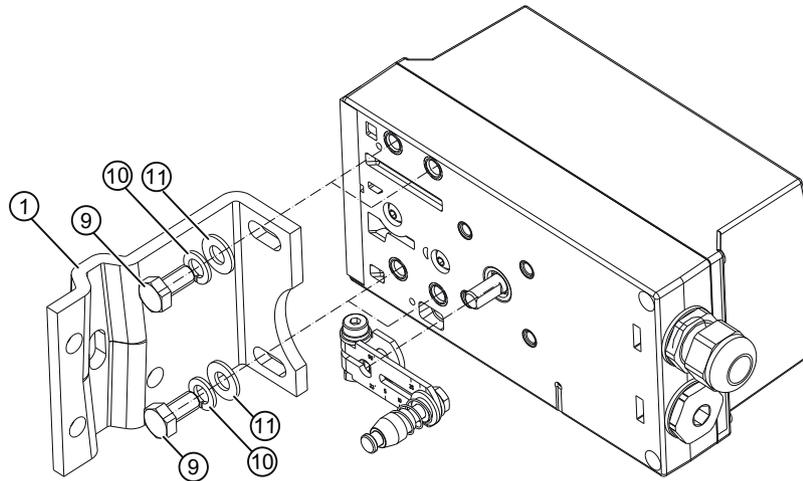


Figure 4-5 Installation with mounting bracket

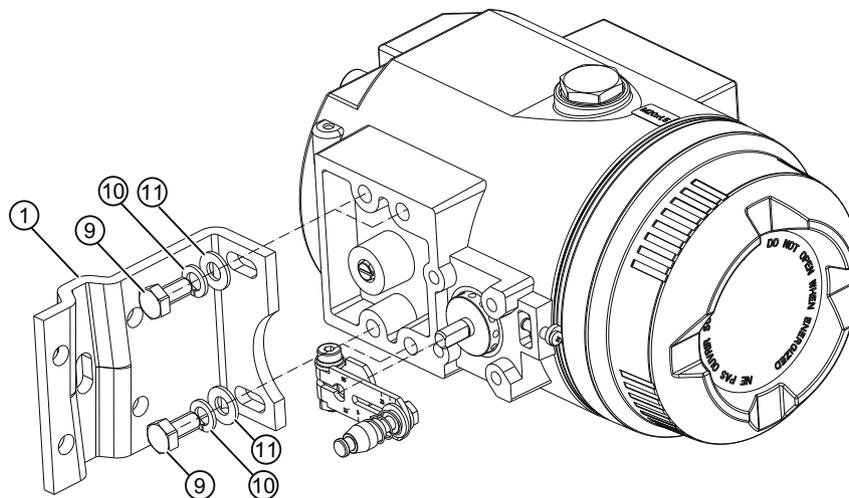


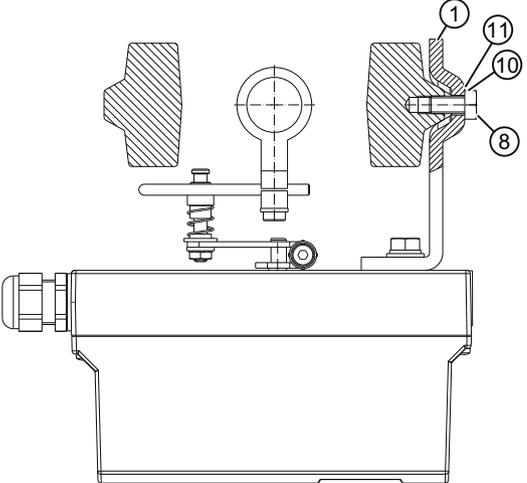
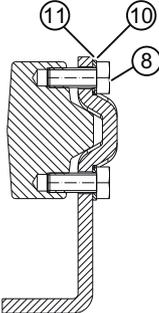
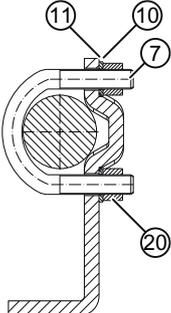
Figure 4-6 Installation with mounting bracket, flameproof enclosure

10. Select the row of holes. The selection of the row of holes depends on the yoke width of the actuator. Select the row of holes in such a way that the carrier pin ④ meshes with the pick-up bracket ② near the spindle.
11. Keep the positioner and the fastening bracket on the actuator. Ensure that the carrier pin ④ for the entire range of stroke of the actuator is guided inside the pick-up bracket ②. Ensure that the carrier pin ④ does not touch the clamping pieces ③.

4.2 Mounting to linear actuator

12. Tighten the pick-up bracket (2).

13. Fasten the positioner on the yoke. Use the installation parts suitable for the corresponding actuator.

| Actuator type | Required installation components | |
|-------------------------|---|--|
| Yoke with fin | <ul style="list-style-type: none"> • Hexagon bolt (8) • Washer (11) • Spring lock washer (10) |  |
| Yoke with plane surface | <ul style="list-style-type: none"> • Four hexagon bolts (8) • Washer (11) • Spring lock washer (10) |  |
| Yoke with columns | <ul style="list-style-type: none"> • Two U-bolts (7) • Four hexagon nuts (20) • Washer (11) • Spring lock washer (10) |  |

Note**Height adjustment of the positioner**

When you fasten the positioner on the yoke, the following applies to its height adjustment:

1. Set the height of the positioner in such a way that the horizontal lever position is near the center of the stroke.
2. Orient yourself by the lever scale of the actuator.
3. If symmetrical mounting is not possible, you must always ensure that the horizontal lever position is maintained within the range of stroke.
 - With 4 ... 20 mA/HART device versions as of FW version 5.04.00, this step is omitted.

4.3 Mounting to part-turn actuator

Requirements

You require an actuator-specific VDI/VDE 3845 mount to install the positioner on a part-turn actuator. Because of the high weight of the version in the flameproof stainless steel enclosure 6DR5..6, you should select a particularly stable mount.

Procedure

| "Part-turn actuator" mounting kit 6DR4004–8D | | | |
|--|----------|-----------------------|--|
| Sr. no. *) | Quantity | Designation | Note |
| ① | 1 | Coupling wheel | Installation on positioner shaft |
| ② | 1 | Carrier | Installing on the actuator shaft |
| ③ | 1 | Multiple plate | Display of the position, consisting of scale ⑤ and pointer mark ⑥ |
| ④ | 8 | Scale | Different divisions |
| ⑤ | 2 | Pointer mark | Reference point for scale |
| ⑥ | - | Mounting console | Actuator-specific, VDI/VDE 3845 |
| ⑦ | 4 | Hexagon bolt | M6x12 DIN 933, torque see the section "Technical specifications > Construction for all device versions (Page 259)" |
| ⑧ | 4 | Lock washer | S6 |
| ⑨ | 1 | Socket cap screw | M6x16 DIN 84 |
| ⑩ | 1 | Washer | 6.4 DIN 125 |
| ⑪ | 1 | Hex socket-head screw | For coupling wheel |
| ⑫ | - | Pin | Connects the coupling wheel to the carrier |
| | 1 | Machinist's wrench | For hexagon socket-head screw ⑪ |

*) The serial numbers refer to the images in the description of the steps below.

4.3 Mounting to part-turn actuator

1. Rest the actuator-specific VDI/VDE 3845 mount (6) on the rear side of the positioner. Tighten the mount using the hexagon bolts (7) and lock washers (8).
2. Push the coupling wheel (1) or the stainless steel coupling up to the endstop on the positioner shaft. Then retract the coupling wheel or the stainless steel coupling by approximately 1 mm. Tighten the hexagon socket-head screw (11) using the machinist's wrench provided. Maximum tightening torque = 1 Nm. If you are using the stainless steel coupling, omit the next step.

Note

Coupling wheel

Instead of the polycarbonate coupling wheel (1), it is possible to use a stainless steel coupling (article number TGX:16300-1556).

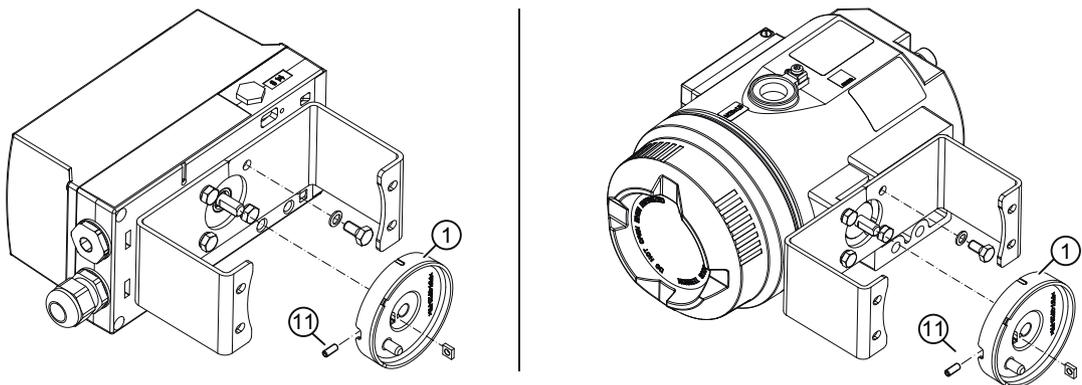


Figure 4-7 Left: Coupling wheel, right: Coupling wheel, flameproof enclosure

3. Place the carrier (2) on the actuator shaft. Tighten the carrier (2) using the socket cap screw (9) and the washer (10).

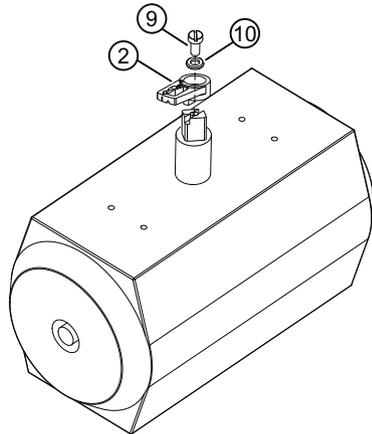


Figure 4-8 Carrier

- Place the positioner and the mount on the actuator carefully. The pin ⑫ of the coupling wheel ① must engage in the carrier ②.

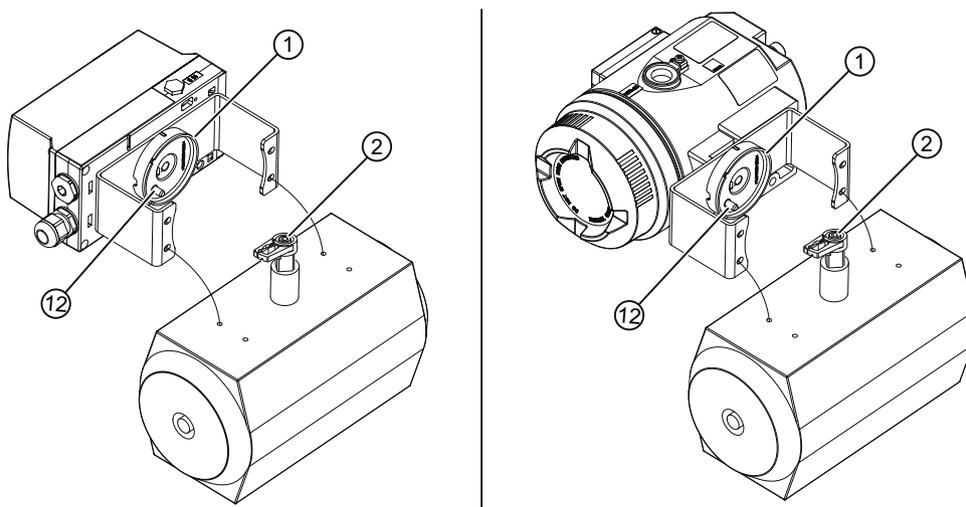


Figure 4-9 Left: Orientation of mount; right: Orientation of mount, flameproof enclosure

- When using the stainless steel coupling (article number TGX:16300-1556): Place the positioner and the mount on the actuator carefully. Place the stainless steel coupling on the stump of the actuator's positioner shaft.
- Align the positioner with mount at the center of the actuator.
- Fasten the positioner with mount.
- Initialize the positioner.
- After commissioning, drive the positioner to the end position.
- Stick the scale ④ with the direction of rotation or the swivel range on the coupling wheel ①. The stickers with scale are self-adhesive.

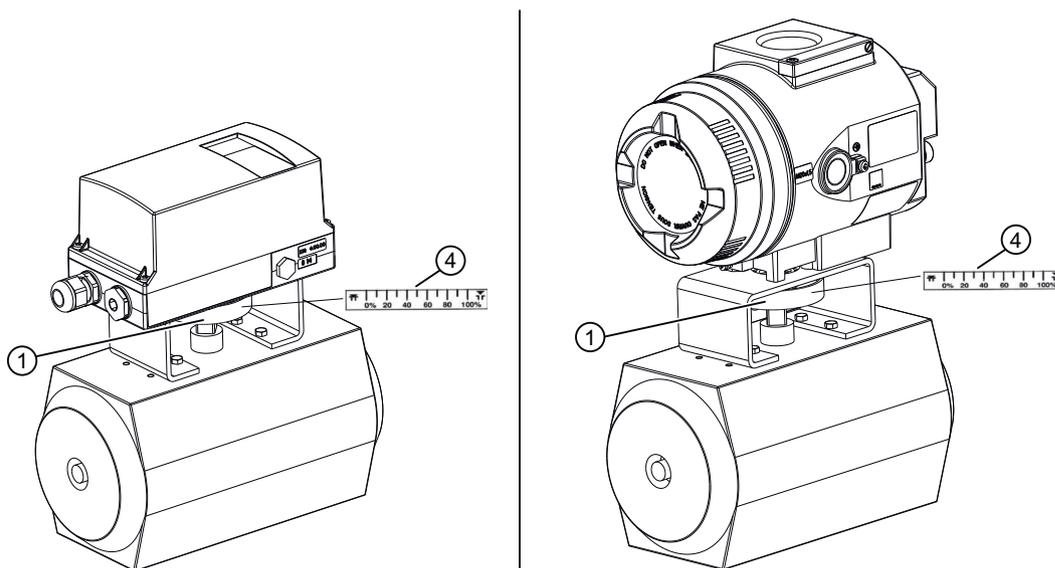
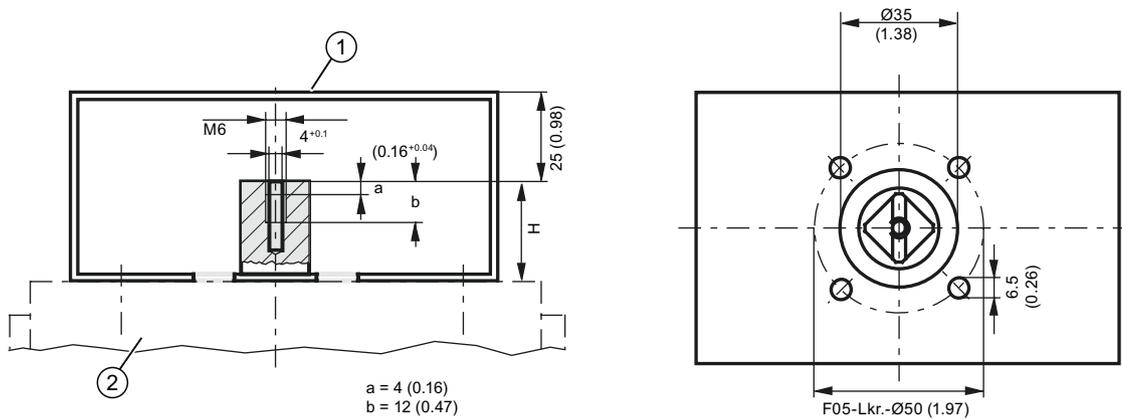


Figure 4-10 Left: Adhesive label with scale; right: Adhesive label with scale, flameproof enclosure

4.4 Setting and locking the transmission ratio



H = height of shaft butt

- ① Fixing level of positioner on mount
- ② Part-turn actuator

Figure 4-11 Dimensions of mount in accordance with VDI/VDE 3845 (depends on actuator)

See also

Preparing part-turn actuators for commissioning (Page 121)

4.4 Setting and locking the transmission ratio

Introduction

Some positioner versions have a friction clutch and a transmission ratio selector. The positioner can therefore be used on a variety of mechanically different part-turn and linear actuators.

- The transmission ratio selector allows you to adapt the positioner to small or large strokes.
- You can then use the friction clutch to adjust the working area.

Strong acceleration forces act on control valves that are subjected to heavy mechanical loads, e.g. breakaway valves, strongly shaking or vibrating valves, as well as in case of "vapor shocks". These forces may be much higher than the specified data. This may move the transmission ratio in extreme cases. In these cases it is possible to lock the transmission ratio selector by means of the gear fixing.

When the positioner is mounted and fully operational, set the friction clutch as described in the section Setting the friction clutch (Page 112).

NOTICE**Wrong registration of the rotary or part-turn movement**

A different setting of the transmission ratio selector and the gear latch results in a hysteresis in position detection. The hysteresis in position detection can result in unstable control response of the higher level control loop.

- Make sure the transmission ratio selector ⑤ and the gear latch ① are set to the same value, either to 33° or to 90°.

Note**Use of external NCS sensor / internal NCS module**

If you use the accessory part "NCS sensor for non-contacting position detection" or a built-in internal NCS module, the locking and fixing measures described in this section are **not** necessary.

Requirement

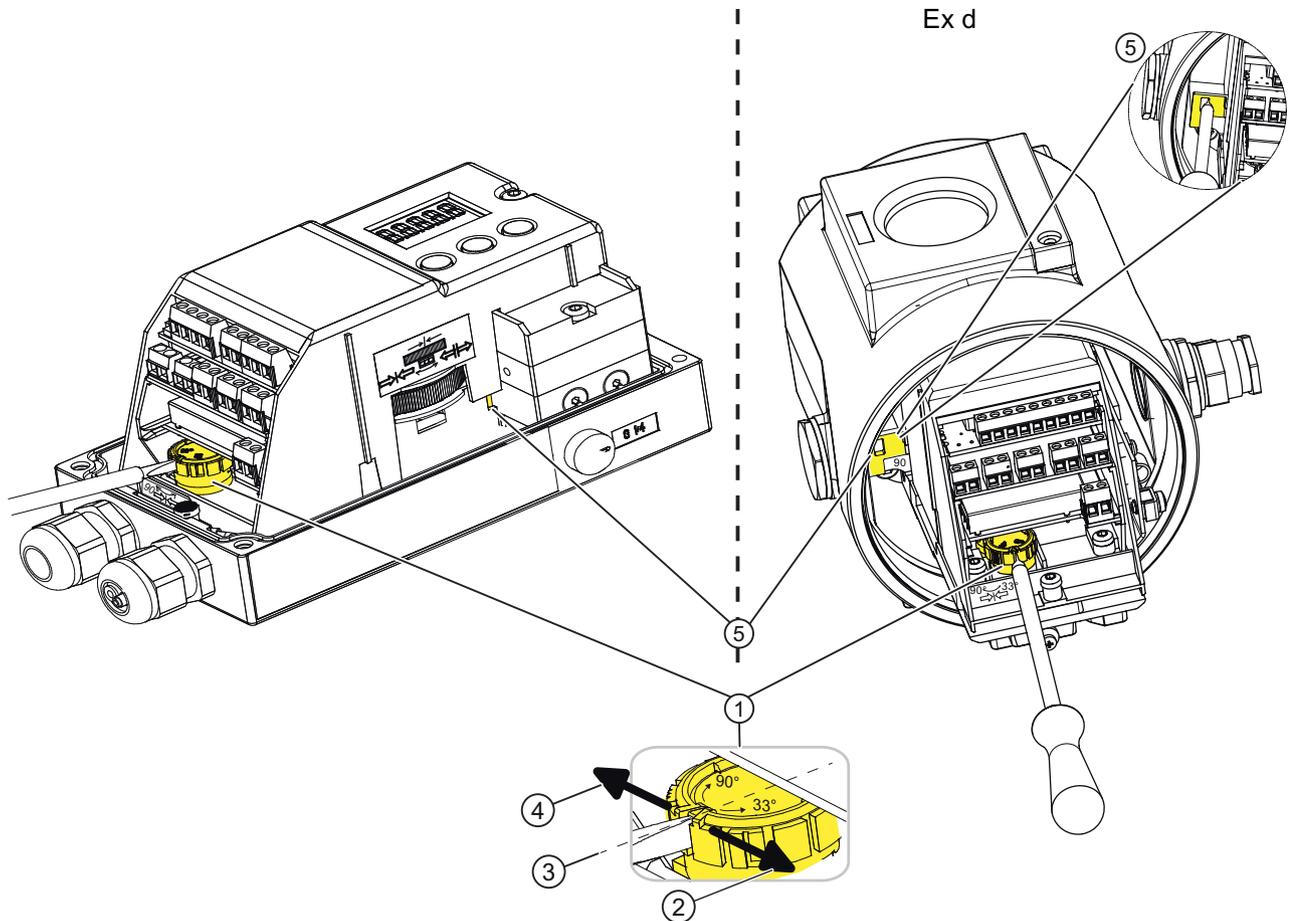
- The positioner is mounted.
- You know whether the transmission ratio is to be set to 33° or 90°.

See also

Commissioning (Page 103)

Procedure

On the right in the graphic the positioner is shown in the flameproof enclosure Ex d with open cover. The procedure is the same for both enclosure versions.



- ① Wheel for gear latch (yellow)
- ② Locking transmission ratio to 33°
- ③ Neutral position

- ④ Locking transmission ratio to 90°
- ⑤ Transmission ratio selector (yellow)

Figure 4-12 Locking the transmission ratio

1. Ensure that the wheel for the gear latch ① is in neutral position ③. The neutral position is between 33° and 90°. The setting of the transmission ratio selector ⑤ can only be changed effectively if the gear latch ① is in the neutral position ③.
2. Make sure the transmission ratio selector ⑤ is set to the same value as the gear latch ①, either to 33° or to 90°.
3. Turn the wheel for the gear latch ① until the gear latch ① perceptibly locks. Use an approx. 4 mm wide standard screwdriver. Turning right locks the transmission ratio to 33° ②. Turning left locks the transmission ratio to 90° ④.

The transmission ratio ② is set and locked.

See also

Opening the device version with "flameproof enclosure" (Page 54)
Commissioning (Page 103)

4.5 Installing option modules

4.5.1 General information on installing option modules

4.5.1.1 Installation of option modules: Introduction

This section describes the installation of the option modules for devices with transmission ratio selector.

For information on installing Inductive Limit Switches (ILS) and Mechanic Limit Switches (MLS) in the 6DR50./6DR51.5/6DR50.6 and 6DR51.6 device versions, refer to the following section:

Installing ILS and MLS (for 6DR50.5/6DR51.5/6DR50.6/6DR51.6) (Page 279)

| |
|--|
|  WARNING |
| Use in hazardous area |
| Risk of explosion. |
| <ul style="list-style-type: none">• Only use equipment that is approved for use in the intended hazardous area and labeled accordingly.• Do not use devices that have been operated outside the conditions specified for hazardous areas. If you have used the device outside the conditions for hazardous areas, make all Ex markings unrecognizable on the nameplate. |

| |
|---|
| NOTICE |
| Improper installation of option modules |
| Risk of explosion in hazardous areas. |
| <ul style="list-style-type: none">• If you upgrade the device with an option module, check the corresponding text box on the type plate as in the example below.• Before you commission the device, follow the safety-related requirements according to the specifications in the valid certificate and in the "Technical specifications" section. |

4.5 Installing option modules

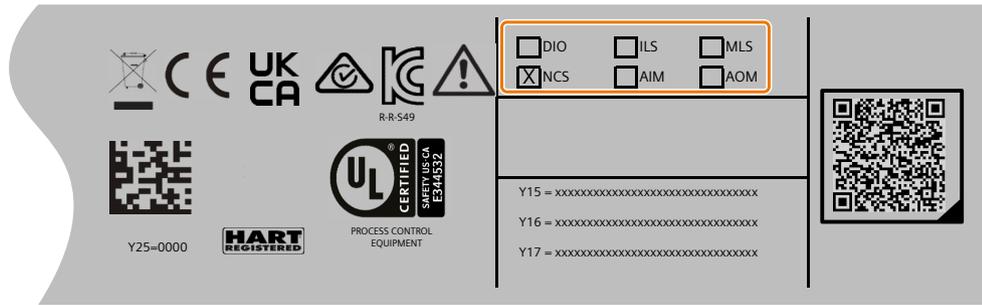
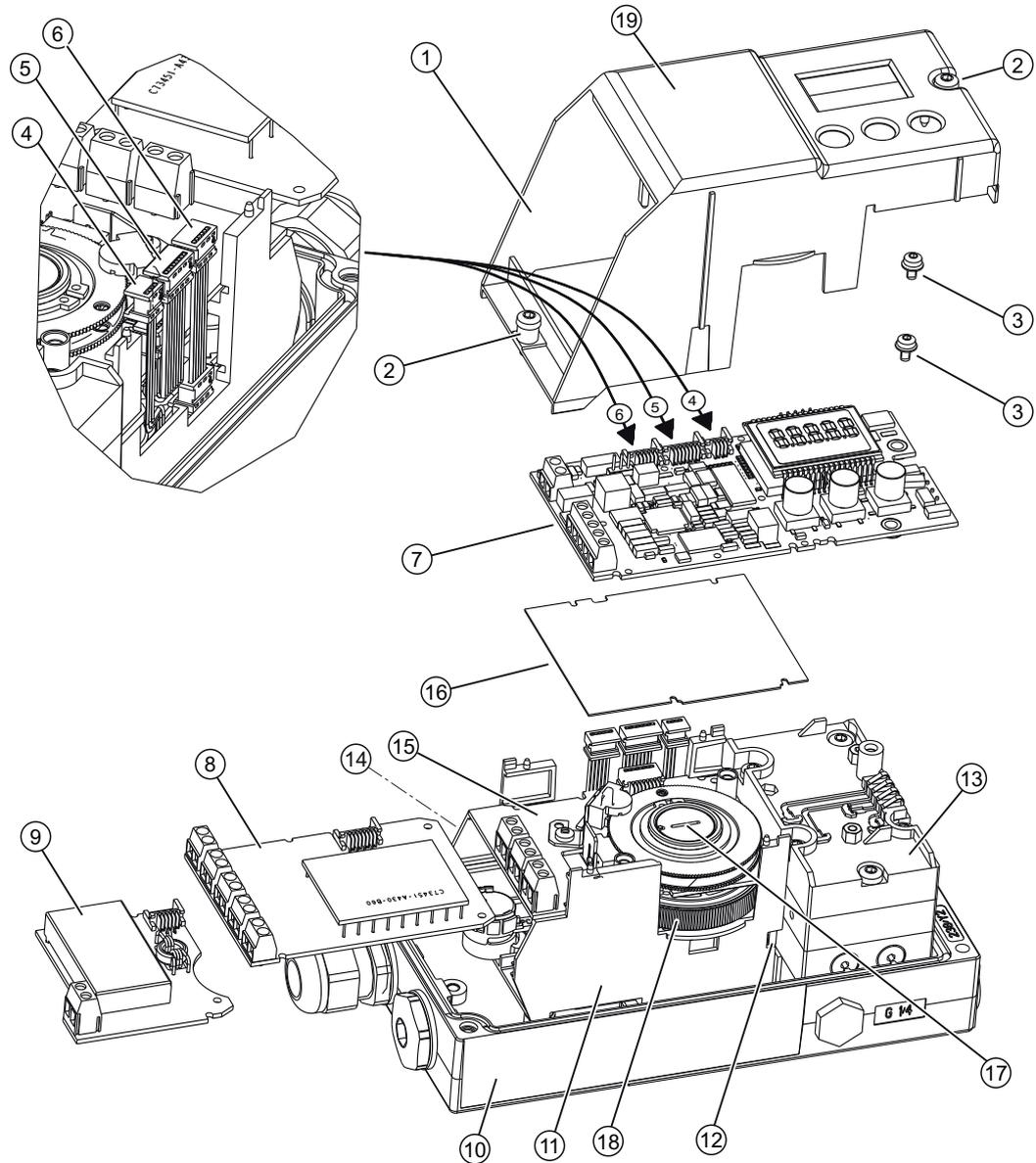


Figure 4-13 Example

4.5.1.2 Opening the standard and intrinsically safe version

Overview screen



- | | | | |
|---|--|---|---|
| ① | Module cover | ⑪ | Adapter |
| ② | Fixing screws module cover | ⑫ | Transmission ratio selector |
| ③ | Fixing screws electronics | ⑬ | Pneumatic block |
| ④ | Ribbon cable/connector for fitted potentiometer or fitted Analog Input Module (AIM) | ⑭ | Warning label on the side opposite the nameplate |
| ⑤ | Ribbon cable/connector for Digital I/O Module (DIO), Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS) | ⑮ | Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS) |

4.5 Installing option modules

- | | |
|---|------------------------------------|
| ⑥ Ribbon cable/connector for Analog Output Module (AOM) | ⑩ Insulating cover, yellow |
| ⑦ Electronics | ⑪ Special screw |
| ⑧ Digital I/O Module (DIO) | ⑫ Friction clutch adjustment wheel |
| ⑨ Analog Output Module (AOM) | ⑬ Wiring diagram on module cover |
| ⑩ Nameplate | |

Figure 4-14 Installing the optional modules in the standard and intrinsically safe version

Procedure: Opening the positioner

1. Loosen the four fixing screws of the enclosure cover. Remove the enclosure cover.
2. Disconnect the power supply cables or de-energize the cables.
3. Disconnect all other electrical connections of the device.
4. Loosen the two fixing screws ② of the module cover ①.
5. Remove the module cover ①.

If you are installing an option module, proceed as described for the respective option modules. For Inductive Limit Switches (ILS), Mechanic Limit Switches (MLS), internal NCS module and Analog Input Module (AIM), remove the electronics.

If you are replacing electronics, a pneumatic block or a pressure sensor module, proceed as described in the corresponding sections under "Service and maintenance (Page 203)".

4.5.1.3 Closing the standard and and intrinsically safe version

Procedure: Closing the positioner

1. Start with the assembly. Place on the module cover ①. Make sure that no ribbon cable is pinched.
2. Turn the fixing screws ② counterclockwise until they noticeably engage in the thread pitch.
3. Tighten both fixing screws ② clockwise.
The module cover protects and locks the optional modules mechanically.

Note

Untimely wear

The module cover is fastened using **self-tapping** screws, one screw for the base plate and one screw for the pneumatic block.

- In order to avoid premature wear of the base plate and pneumatic block, proceed as described.
-

4. Connect the power supply cables or supply the cables with voltage.
5. Put on the enclosure cover.
6. Tighten the fixing screws of the enclosure cover.

See also

Opening the standard and intrinsically safe version (Page 51)

4.5.1.4 Opening the device version with "flameproof enclosure"

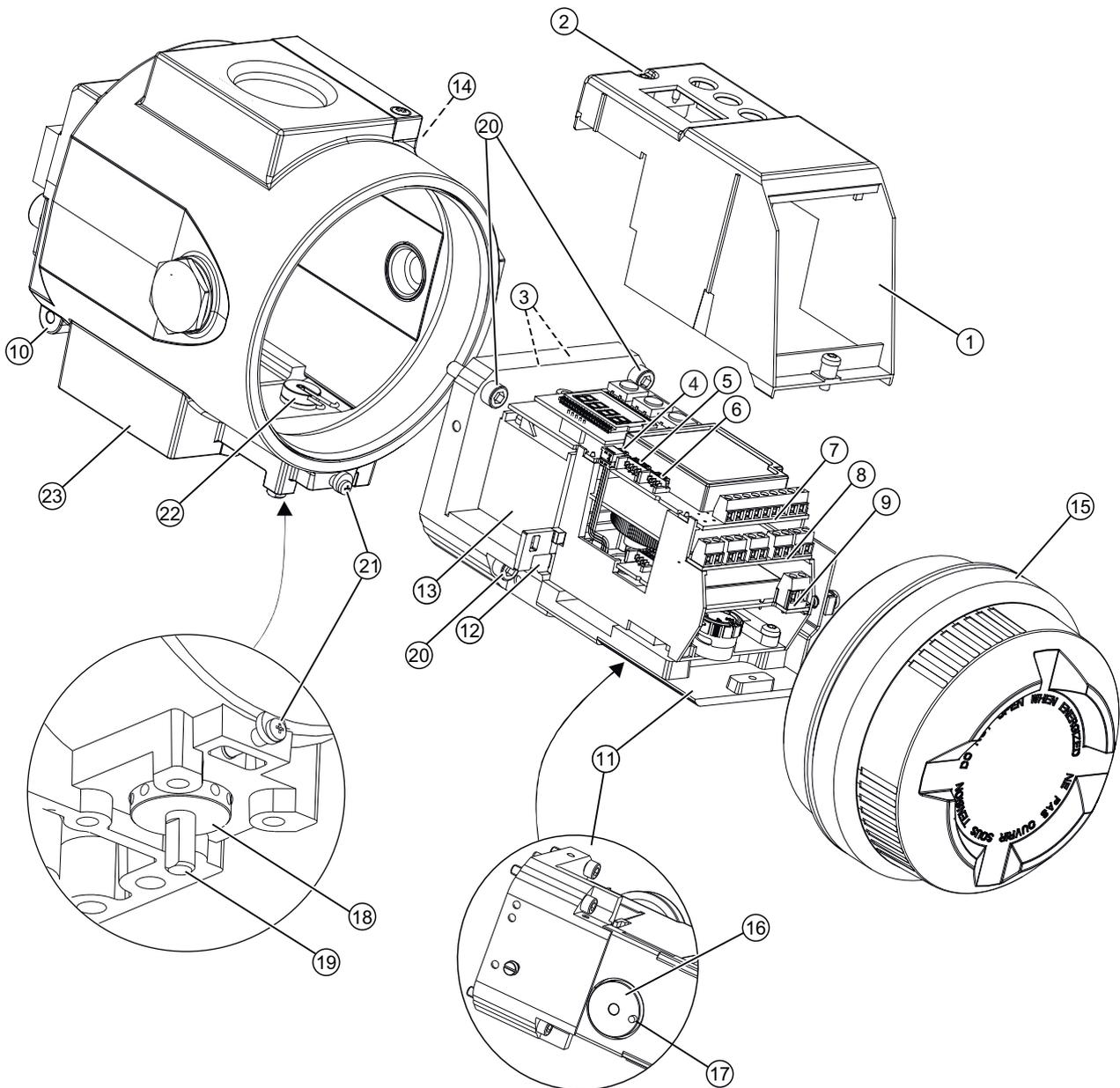
Overview screen

 **DANGER**

Risk of explosion

Before supplying the positioner with auxiliary power in potentially hazardous areas, ensure the following:

- The installed electronic unit has been approved.
- The enclosure of the positioner is closed.
- The duct openings for electronic connections must be closed. Only use the Ex d certified cable entries or sealing plugs.
- If you use a "conduit piping system", install an ignition trap. The maximum distance between the ignition trap and the positioner enclosure is 46 cm (18 inch).



- | | | | |
|---|--|---|--|
| ① | Module cover | ⑬ | Pneumatic block |
| ② | Fixing screws module cover | ⑭ | Warning label on the side opposite the nameplate |
| ③ | Fixing screws electronics | ⑮ | Screw cap |
| ④ | Ribbon cable/connector for fitted potentiometer or Position Transmitter | ⑯ | Feedback lever bracket with pin |
| ⑤ | Ribbon cable/connector for Digital I/O Module (DIO), Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS) | ⑰ | Pin (feedback lever bracket) |
| ⑥ | Ribbon cable/connector for Analog Output Module (AOM) | ⑱ | Adjustment wheel for external friction clutch |
| ⑦ | Electronics | ⑲ | Feedback shaft |
| ⑧ | Digital I/O Module (DIO) | ⑳ | Fixing screws adapter |
| ⑨ | Analog Output Module (AOM) | ㉑ | Safety catch |

4.5 Installing option modules

- | | | | |
|---|-----------------------------|---|-----------|
| ⑩ | Nameplate | ⑳ | Clip |
| ⑪ | Adapter | ㉑ | Enclosure |
| ⑫ | Transmission ratio selector | | |

Figure 4-15 Installing the optional modules in the "flameproof enclosure" version

Procedure: Opening the positioner

1. Disconnect the power supply cables or de-energize the cables.
2. Open the safety catch ㉒.
3. Unscrew the screw cap ⑮.
4. Completely dismantle the positioner from the actuator.
5. Turn the feedback shaft ⑲ on the positioner until the pin (feedback lever bracket) ⑰ below the adapter ⑪ shows in the direction of removal. If you look into the enclosure below the adapter, you will see the position of the pin.
6. Screw out the four fixing screws ㉓ of the adapter ⑪.
7. Completely remove the adapter ⑪ carefully from the enclosure ㉑.
The positioner comes with a clip ㉒ and a pin (feedback lever bracket) ⑰ which interlock and ensure backlash-free position feedback. To ensure backlash-free position feedback make sure you remove the adapter ⑪ carefully.

NOTICE

Displaced O-rings

There are several O-rings between adapter ⑪ and enclosure ㉑. These O-rings may come off during removal.

- Carefully remove the adapter. Make sure the O-rings do not get lost during removal.

8. Loosen the two fixing screws ② of the module cover ①.
9. Remove the module cover ①.

If you are installing an option module, proceed as described for the respective option module. For the internal NCS module, remove the electronics.

If you are replacing the electronics or the pneumatic block, proceed as described in the corresponding sections under "Service and maintenance (Page 203)".

See also

Internal NCS module (iNCS) 6DR4004-5L / -5LE (Page 68)

4.5.1.5 Closing the device version with "flameproof enclosure"

Procedure: Closing the positioner

1. Now start with the assembly. Place on the module cover ①. Make sure that no ribbon cable is pinched.
2. Turn the fixing screws ② counterclockwise until they noticeably engage in the thread pitch. Tighten both fixing screws ② clockwise.
The module cover protects and locks the optional modules mechanically.

Note

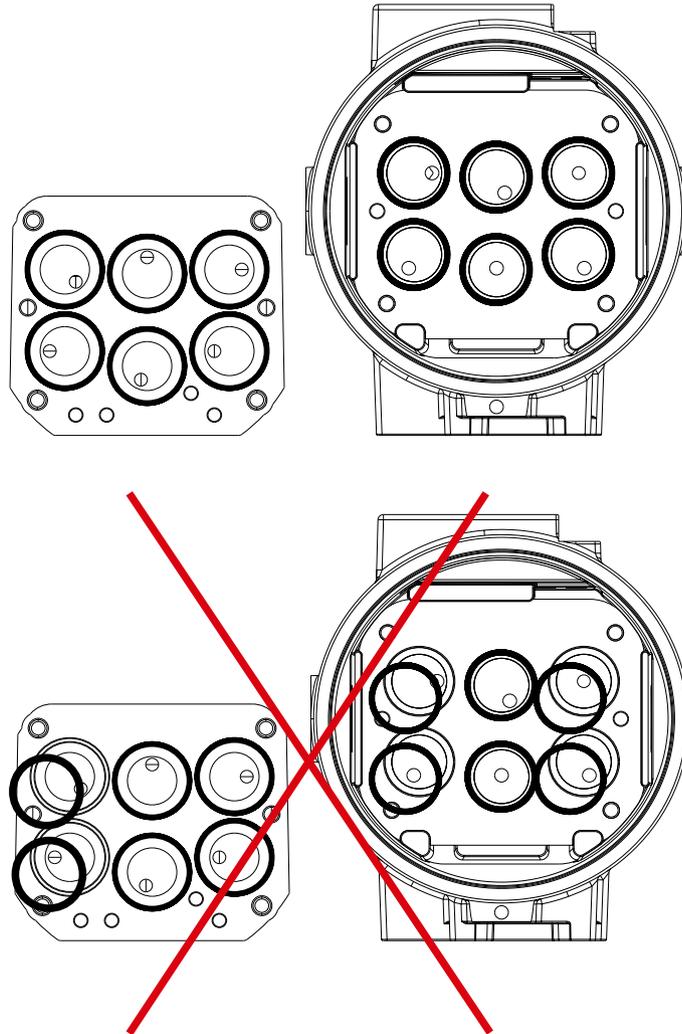
Untimely wear

The module cover is fastened using a **self-tapping** screw for the pneumatic block.

- In order to avoid premature wear of the pneumatic block, proceed as described.
-

4.5 Installing option modules

3. Check whether the position of the O-rings is correct before inserting the adapter into the enclosure.



- With an enclosure made from aluminum, O rings are inside the enclosure and on the rear of the adapter.
 - With an enclosure made from stainless steel, O-rings are on the rear of the adapter.
4. Make sure no loose items in the enclosure interfere with the assembly.
 5. Push the adapter ⑪ fully into the enclosure ⑲.
The positioner comes with a clip ⑳ and a pin (feedback lever bracket) ㉑ which interlock and ensure backlash-free position feedback. To ensure backlash-free position feedback, insert the adapter ⑪ carefully into the enclosure.
 6. Screw in the four fixing screws ㉒ of the adapter ⑪. Tighten the screws.
Check carefully whether the feedback shaft ㉓ can be smoothly turned by 360°. If you feel resistance, do **not** continue to turn but turn the feedback shaft ㉓ back again to the point of removal.
 7. Mount the positioner on the actuator.
 8. Unscrew the screw cap ㉔.

9. Close the safety catch ②.
10. Connect the power supply cables or supply the cables with voltage.

4.5.2 Digital I/O Module (DIO) 6DR4004-6A / -8A

Function

The Digital I/O Module (DIO) triggers fault messages and alarms via three digital outputs.

- If there is no alarm, the digital output is conductive (not triggered).
- If there is an alarm, the digital output is deactivated (triggered).
- Set the following parameters to activate, invert and configure the output of alarms and fault messages:
 - "AFCT" - Alarm function
 - "A1" - Response threshold, alarm 1
 - "A2" - Response threshold, alarm 2
 - "FCT" - Function for fault message output
 - "TIM" - Monitoring time
 - "LIM" - Response threshold

The Digital I/O Module (DIO) also has a digital input DI2 in addition to the digital outputs. Depending on the selected parameters, this digital input is used, for example, to block the actuator or to move it to its end position. You make the corresponding settings with the "DI2" parameter.

Device features

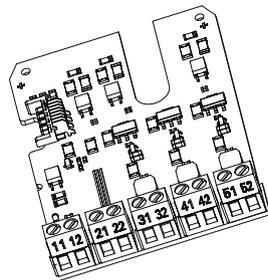


Figure 4-16 Digital I/O Module (DIO), schematic representation

The Digital I/O Module (DIO) has the following features:

- Available in two versions
 - Explosion-proof version for connection to a switching amplifier in conformity with EN 60947-5-6
 - Non-explosion-proof version for connecting to power sources having a maximum of 35 V.
- 3 digital outputs. The digital outputs are galvanically isolated from the standard controller and from each other.
- The digital input DI2 has 2 inputs. Both inputs are implemented as logical OR combination.
 - Digital input DI1 on terminal 11/12: Is electrically isolated, and is triggered by an active signal.
 - Digital input DI2 on terminal 21/22: Is not electrically isolated, and is triggered by a passive NO contact.

Procedure

1. Open the positioner as in the description depending on the device version:
 - Opening the standard and intrinsically safe version (Page 51)
 - Opening the device version with "flameproof enclosure" (Page 54)
2. Slide the Digital I/O Module (DIO) into the adapter below the electronics. Ensure that you slide it up to the endstop.
3. Connect the Digital I/O Module (DIO) to the electronics. To do this, use the 8-pin flat ribbon cable provided.
4. Close the positioner as in the description depending on the device version:
 - Closing the standard and intrinsically safe version (Page 52)
 - Closing the device version with "flameproof enclosure" (Page 57)

4.5.3 Analog Output Module (AOM) 6DR4004-6J / -8J

Function

- The Analog Output Module (AOM) indicates the current position of the actuator as a two-wire signal between 4 mA and 20 mA. The Analog Output Module (AOM) is galvanically isolated from the basic unit.
- The current position is indicated as a passive mA signal only after successful initialization.
- Operational faults are signaled by a fault current of 3.6 mA.

Device features

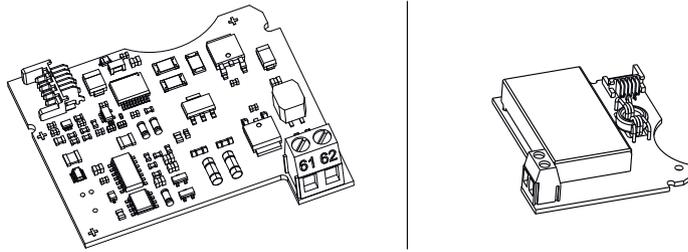


Figure 4-17 Analog Output Module (AOM) 6DR4004-6J (Ex) and 6DR4004-8J (non-Ex), schematic representation

The Analog Output Module (AOM) is:

- Single channel
- Galvanically isolated from the basic device

Requirement

A supply source corresponding to the technical specifications (Page 266) of the option module must be available.

Procedure

1. Open the positioner as in the description depending on the device version:
 - Opening the standard and intrinsically safe version (Page 51)
 - Opening the device version with "flameproof enclosure" (Page 54)
2. Slide the Analog Output Module (AOM) into the lower bay of the adapter as far as it will go.
3. Connect the Analog Output Module (AOM) to the electronics. To do this, use the 6-pin flat ribbon cable provided.
4. Close the positioner as in the description depending on the device version:
 - Closing the standard and and intrinsically safe version (Page 52)
 - Closing the device version with "flameproof enclosure" (Page 57)

4.5.4 Inductive Limit Switches (ILS) 6DR4004 6G / -8G

4.5.4.1 Inductive Limit Switches (ILS) - Mode of operation and equipment features

Function

If the basic unit requires electrically independent limit messages, the Inductive Limit Switches (ILS) with slotted initiators is used instead of the Digital I/O Module (DIO).

- A digital output is used to display a group fault message. Compare with the function of the Digital I/O Module (DIO). The floating digital output is implemented as an automatic fault indicating semiconductor output.
- The other two digital outputs are used to signal the two limits L1 and L2 which can be adjusted mechanically using slotted initiators. These two digital outputs are electrically independent from the remaining electronic unit.

Device features

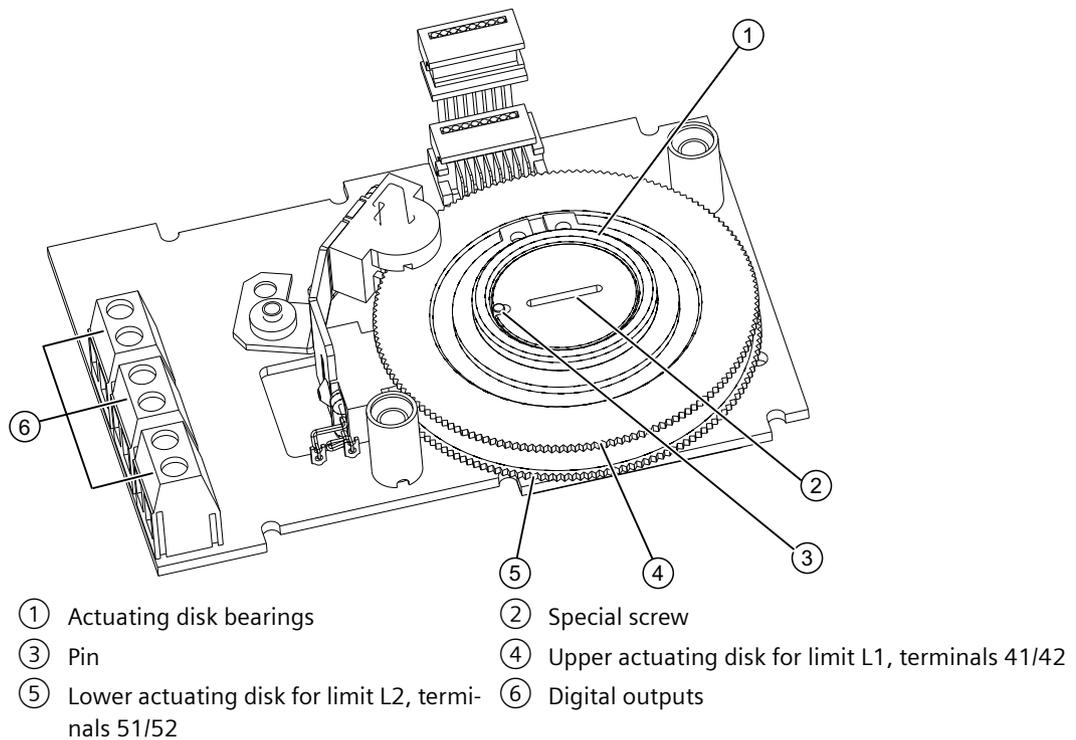


Figure 4-18 Inductive Limit Switches (ILS), schematic representation

The Inductive Limit Switches (ILS) have three digital outputs ⑥.

4.5.4.2 Installation procedure for Inductive Limit Switches (ILS)

Procedure

1. Open the positioner as described in Opening the standard and intrinsically safe version (Page 51).
2. Remove the ribbon cable from the electronics.
3. Remove the two fixing screws of the electronics. Remove the electronics.
4. Insert the Inductive Limit Switches (ILS) from the top to the upper printed circuit board guide of the adapter.
5. Slide the Inductive Limit Switches (ILS) in the printed circuit board of the adapter approx. 3 mm to the right.
6. Screw the special screw ② through the Inductive Limit Switches (ILS) into the positioner shaft. Tighten the special screw ② with a **torque of 2 Nm**.

Note

Pin in the actuating disk bearing

A pin ③ is pressed in the actuating disk bearing ①.

1. Align pin ③ with the groove of the special screw before inserting the head of the special screw ② into the actuating disk bearing ①.
2. Rotate the actuating disk bearing ① and the special screw ② simultaneously so that the pin ③ is inserted into the groove of the special screw ②.

-
7. An insulating cover (yellow) is required over the Inductive Limit Switches (ILS). This insulating cover is supplied with the Inductive Limit Switches (ILS). Place one end of the insulating cover under the electronics contact surface of the adapter. The recesses of the insulating cover must fit into the corresponding webs of the adapter. To tighten the insulating cover, bend the walls of the adapter slightly outwards. Firmly press the other end until the insulating cover is underneath the contact surface of the electronics. The recesses of the insulating cover must fit into the corresponding webs of the adapter.
 8. Place the electronics onto the four holders of the adapter.
 9. Screw in the two fixing screws of the electronics. Tighten the screws.
 10. Reestablish all electrical connections between the electronics and the option modules.
 11. Connect the electronics to the option modules and the potentiometer. Use the corresponding ribbon cables.
 12. Put on the **supplied module cover**. Make sure that no ribbon cable is pinched.

Note

Module cover

Do **not** use the standard module cover. The provided module cover has a larger recess.

13. Select the labels that are already available on the standard version of the module cover from the label set provided. Affix the selected labels onto the installed module cover as per the standard version.

14. Close the positioner as described in Closing the standard and and intrinsically safe version (Page 52).
15. Set the limits L1 and L2 as described in Setting limits for Inductive Limit Switches (ILS) (Page 64).

4.5.4.3 Setting limits for Inductive Limit Switches (ILS)

Procedure: Determining the switch status of the slot-type initiators

You will require a suitable display device to determine the switch status. For example, use the initiator tester type 2 / Ex from Pepperl + Fuchs.

1. Connect the display device to the following terminals of the Inductive Limit Switches (ILS):
 - 41 and 42
 - 51 and 52
2. Read the switch status of the slot-type initiators.

Procedure: Setting the L1 and L2 limits

The consecutive numbers in the following text refer to the figure above in this section. Proceed as follows to set the limits:

1. Move the actuator to the first desired mechanical position.
2. Adjust the upper actuating disk ④ manually until the output signal at terminals 41 and 42 changes. Procedure:
 - Rotate the actuating disc ④ beyond the switching point until you reach the next switching point.
3. Move the actuator to the second desired mechanical position.
4. Adjust the lower actuating disk ⑤ manually until the output signal at terminals 51 and 52 changes. Procedure:
 - Rotate the actuating disc ⑤ beyond the switching point until you reach the next switching point.

Note

Adjusting the actuating disk

The actuating disks ④ and ⑤ are relatively difficult to move. This design prevents their unintentional movement during operation. You can achieve an easier and finer adjustment by reducing stiction temporarily.

- Move the actuator to and fro while simultaneously holding the actuating disks ④ and ⑤.
-

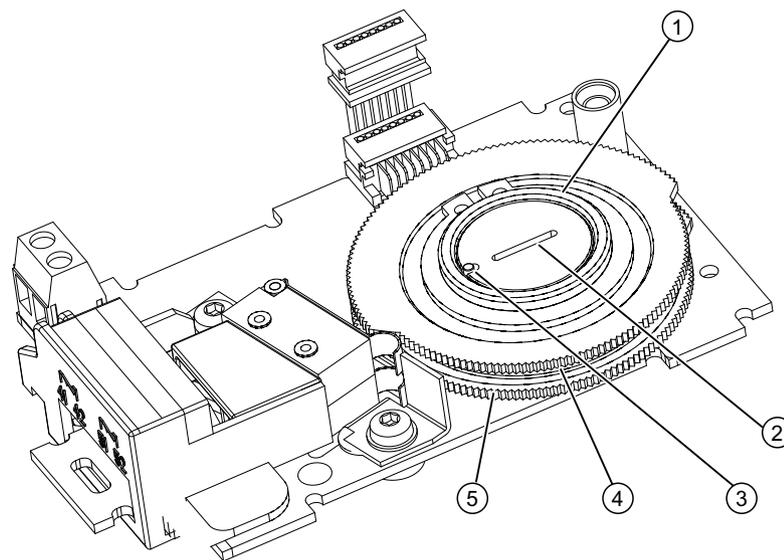
4.5.5 Mechanic Limit Switches (MLS) 6DR4004-6K

4.5.5.1 Mechanic Limit Switches (MLS) - Mode of operation and equipment features

Function

Mechanic Limit Switches (MLS) are used to report two limits. These limits are reported using galvanic switching contacts.

Device features



- | | |
|---------------------------|--|
| ① Actuating disk bearings | ④ Upper actuating disk for limit L1, terminals 51/52 |
| ② Special screw | ⑤ Lower actuating disk for limit L2, terminals 41/42 |
| ③ Pin | |

Figure 4-19 Mechanic Limit Switches (MLS), schematic representation

Mechanic Limit Switches (MLS) contain:

- One digital output to display a group fault message. Compare with the device features of the Mechanic Limit Switches (MLS).
- Two switches to report two mechanically adjustable limits. Both these switches are electrically independent from the remaining electronic unit.

4.5.5.2 Installation procedure for Mechanic Limit Switches (MLS)

Procedure

1. Open the positioner as described in Opening the standard and intrinsically safe version (Page 51).
2. Remove the ribbon cable from the electronics.
3. Remove the two fixing screws of the electronics. Remove the electronics.
4. Insert the Mechanic Limit Switches (MLS) from the top to the upper printed circuit board guide of the adapter.
5. Slide the Mechanic Limit Switches (MLS) in the printed circuit board of the adapter approx. 3 mm to the right.
6. Screw the special screw ② through the Mechanic Limit Switches (MLS) into the positioner shaft. Tighten the special screw ② with a **torque of 2 Nm**.

Note

Pin in the actuating disk bearing

A pin ③ is pressed in the actuating disk bearing ①.

1. Align pin ③ with the groove of the special screw before inserting the head of the special screw ② into the actuating disk bearing ①.
2. Rotate the actuating disk bearing ① and the special screw ② simultaneously so that the pin ③ is inserted into the groove of the special screw ②.

-
7. An insulating cover (yellow) is required over the Mechanic Limit Switches (MLS). This insulating cover is supplied with the Mechanic Limit Switches (MLS). Place one end of the insulating cover under the electronics contact surface of the adapter. The recesses of the insulating cover must fit into the corresponding webs of the adapter. To tighten the insulating cover, bend the walls of the adapter slightly outwards. Firmly press the other end until the insulating cover is underneath the contact surface of the electronics. The recesses of the insulating cover must fit into the corresponding webs of the adapter.
 8. Place the electronics onto the four holders of the adapter.
 9. Screw in the two fixing screws of the electronics. Tighten the screws.
 10. Reestablish all electrical connections between the electronics and the option modules.
 11. Connect the electronics to the option modules and the potentiometer. Use the corresponding ribbon cables.
 12. Put on the **supplied module cover**. Make sure that no ribbon cable is pinched.

Note

Module cover

Do **not** use the standard module cover. The provided module cover has a larger recess.

13. Close the positioner as described in Closing the standard and and intrinsically safe version (Page 52).
14. Set the limits L1 and L2 as described in Setting limits for Mechanic Limit Switches (MLS) (Page 67).

4.5.5.3 Setting limits for Mechanic Limit Switches (MLS)

Procedure: Setting the L1 and L2 limits

1. Move the actuator to the first desired mechanical position.
2. Adjust the upper actuating disk ④ manually until the output signal at terminals 51 and 52 changes. Procedure:
 - Rotate the actuating disc beyond the switching point until you reach the next switching point.
3. Move the actuator to the second desired mechanical position.
4. Adjust the lower actuating disk ⑤ manually until the output signal at terminals 41 and 42 changes. Procedure:
 - Rotate the actuating disc beyond the switching point until you reach the next switching point.

Note

Adjusting the actuating disk

The actuating disks ④ and ⑤ are relatively difficult to move. This design prevents their unintentional movement during operation. You can achieve an easier and finer adjustment by reducing stiction temporarily.

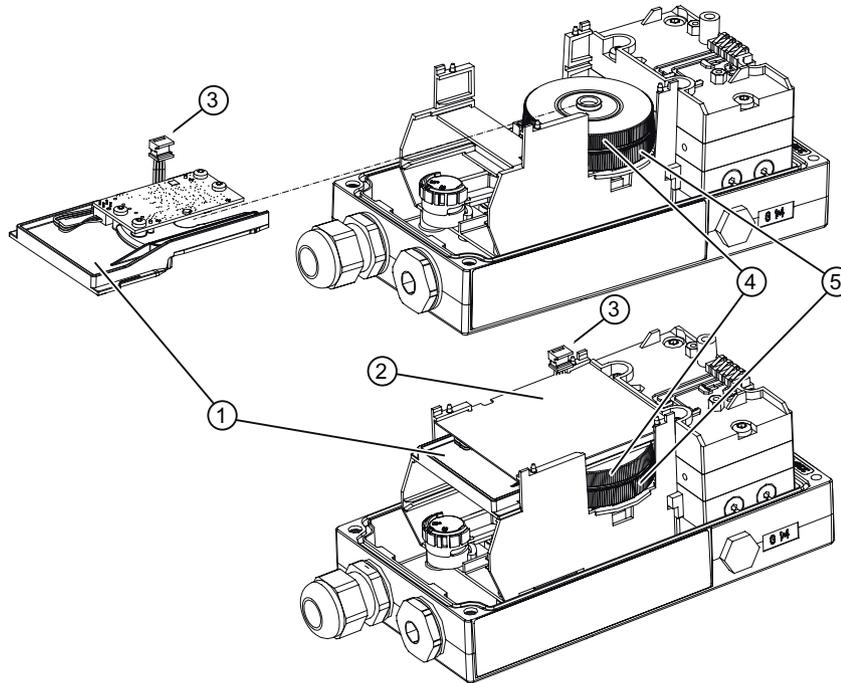
- Move the actuator to and fro while simultaneously holding the actuating disks ④ and ⑤.
-

4.5.6 Internal NCS module (iNCS) 6DR4004-5L / -5LE

Function

Wear-free, non-contacting position detection

Device features



- ① Internal NCS module 6DR4004-5L.
- ② Insulating cover, yellow
- ③ Ribbon cable of the internal NCS module
- ④ Adjustment wheel of the magnet holder
- ⑤ Adjustment wheel for the friction clutch (without function)

Figure 4-20 Installing the internal NCS module, schematic diagram

Requirement

- The slot in the adapter that is needed for the internal NCS module (iNCS) is free. The following option modules use the same slot in the adapter:
 - Digital I/O Module (DIO)
 - Inductive Limit Switches (ILS)
 - Mechanic Limit Switches (MLS)
 - Internal NCS module
- The positioner is mounted, or is to be mounted, directly on the valve using the positioner shaft.

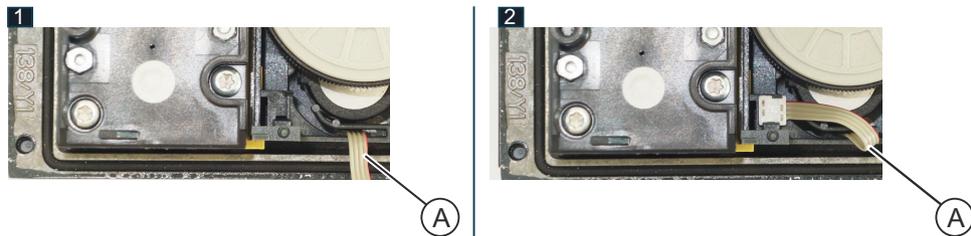
Note

The internal NCS module is not intended for the following positioner designs:

- 2-wire connection in flameproof aluminum enclosure: 6DR50.5 or 6DR51.5
 - 2-wire connection in flameproof stainless steel enclosure: 6DR50.6 or 6DR51.6
-

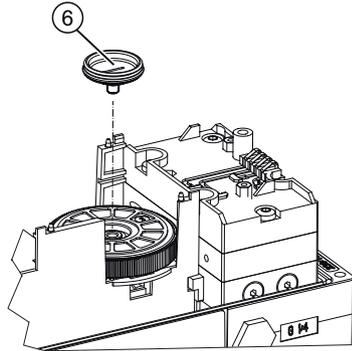
Procedure

1. Open the positioner as in the description depending on the device version:
 - Opening the standard and intrinsically safe version (Page 51)
 - Opening the device version with "flameproof enclosure" (Page 54)
2. Remove the ribbon cable from the electronics.
3. Remove the two fixing screws of the electronics.
4. Remove the electronics.
5. Insert the connector of the ribbon cable (A) into the slot as shown below.
Note: There is no space for the ribbon cable (A) in earlier versions of the positioner. Here you fasten the ribbon cable to the container using a cable tie.

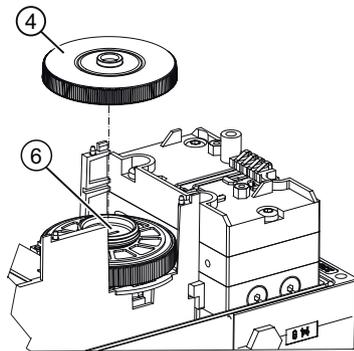


6. Screw the special screw ⑥ into the shaft of the positioner.

7. Tighten the special screw with a torque of 2 Nm.



8. Press the adjustment wheel of the magnet holder (4) firmly onto the special screw (6) of the friction clutch until you clearly hear it click into place.



Installing the internal NCS module

1. Route the ribbon cable (3) of the internal NCS module (1) upwards before you slide the internal NCS module into the adapter.
2. Slide the internal NCS module (1) under the electronics into the adapter until you hear it click into place.
3. An insulating cover (yellow) is required over the module. This insulating cover is supplied with the module. Place one end of the insulating cover (2) under the electronics contact surface of the adapter. The recesses of the insulating cover must fit into the corresponding webs of the adapter.
4. To tighten the insulating cover, bend the walls of the adapter slightly outwards.
5. Firmly press the other end until the insulating cover is underneath the contact surface of the electronics. The recesses of the insulating cover must fit into the corresponding webs of the adapter.

Installing the electronics and closing the positioner

1. Place the electronics onto the four holders of the adapter.
2. Screw in the two fixing screws of the electronics.
3. Tighten the screws.

4. Insert the ribbon cable connector of the internal NCS module ① onto the positioner electronics.
Note for built-in Analog Output Module (AOM): Reestablish all electrical connections between the electronics and the option module.
5. Put on the **supplied module cover**. Make sure that no ribbon cable is pinched.

Note

Module cover

Do **not** use the standard module cover. The provided module cover has a larger recess.

6. Close the positioner as in the description depending on the device version:
 - Closing the standard and and intrinsically safe version (Page 52)
 - Closing the device version with "flameproof enclosure" (Page 57)

Result

The module is installed and connected to the electronics of the positioner. Now configure the module with the parameter "1.YFCT (Page 144)".

4.5.7 Analog Input Module (AIM) 6DR4004-6F / -8F

Function

If you use a Position Transmitter on the positioner, you will need the Analog Input Module (AIM). The Analog Input Module (AIM) forms the interface between the Position Transmitter and the electronics of the positioner.

Device features

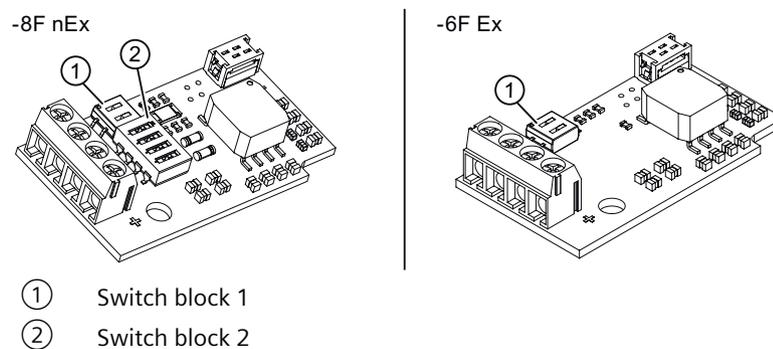


Figure 4-21 Analog Input Module (AIM), schematic representation

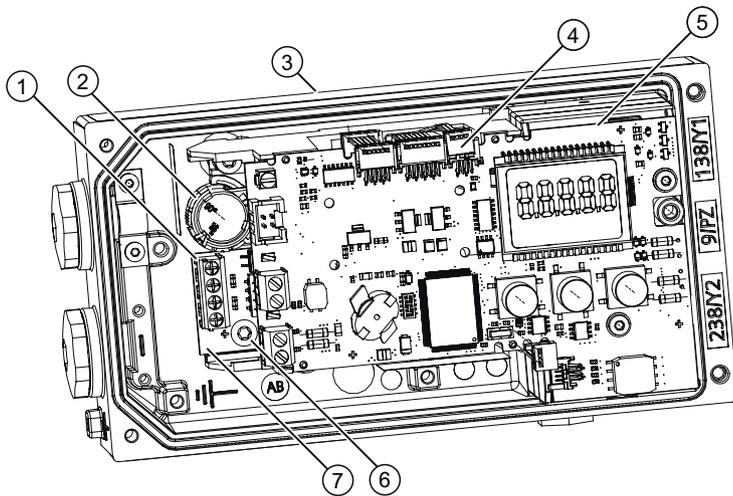
4.5 Installing option modules

- Connection to electronics
- Connection terminals for:
 - Position Transmitter (Potentiometer) with 3 kΩ, 5 kΩ or 10 to 20 kΩ
 - Signals 0 to 20 mA
 - Signals 0 to 10 V

Requirement

- You have at least one of the following modules:
 - 6DR4004-8F Analog Input Module (AIM) - nEx
 - 6DR4004-6F Analog Input Module (AIM) - Ex
- You have opened one of the following Position Transmitters:
 - 6DR4004-6N*/-8N* NCS sensor
 - 6DR4004-1ES Position Transmitter (Potentiometer)
 - 6DR4004-2ES Position Transmitter (NCS)
 - 6DR4004-3ES Position Transmitter (NCS, ILS)
 - 6DR4004-4ES Position Transmitter (NCS, MLS)

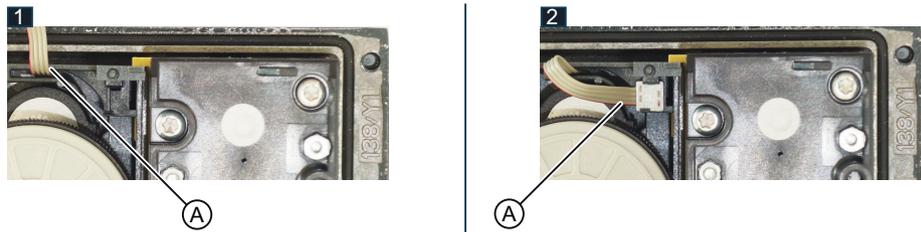
Procedure



- | | |
|---|---|
| ① Terminals of the Analog Input Module (AIM) | ⑤ Electronics |
| ② Yellow wheel for locking the position detection | ⑥ Screw |
| ③ Positioner | ⑦ Analog Input Module (AIM) 6DR4004-6F/-8F |
| ④ Ribbon cable connector of fitted potentiometer or ribbon cable connector of Analog Input Mod- ule (AIM) | |

Figure 4-22 Installation of Analog Input Module (AIM)

1. Open the positioner as described in Opening the standard and intrinsically safe version (Page 51).
2. Remove the ribbon cable from the electronics.
3. Remove the two fixing screws of the electronics ⑤.
4. Remove the electronics.
5. Loosen the screw ⑥ in the connection area of the positioner.
6. Insert the connector of the ribbon cable (A) into the slot as shown below.
Note: There is no space for the ribbon cable (A) in earlier versions of the positioner. Here you fasten the ribbon cable with the supplied cable tie at the container.



7. Secure the Analog Input Module (AIM) using the screw ⑥.
8. Place the electronics ⑤ onto the four holders of the adapter.
9. Screw in the two fixing screws of the electronics ⑤.
10. Tighten the screws.
11. Insert the ribbon cable connector ④ of the Analog Input Module (AIM) onto the electronics of the positioner.
12. Establish all electrical connections between the electronics and the option modules.
13. Close the positioner as described in Closing the standard and and intrinsically safe version (Page 52).

Connection

5.1 Basic safety instructions

| |
|---|
|  WARNING |
| Lever for position detection Danger of crushing and shearing with mounting kits which use a lever for position detection. During commissioning and ongoing operation, severing or squeezing of limbs could occur as a result of the lever. Risk of injury when working on control valves due to the high operating force of the pneumatic actuator. <ul style="list-style-type: none">• Do not reach into the range of motion of the lever following mounting of the positioner and mounting kit. |

| |
|---|
|  WARNING |
| With intrinsically device version (Ex i) Risk of explosion in hazardous areas. For intrinsically safe device versions only the certified circuits may be connected as auxiliary power supply, control and signal circuits. <ul style="list-style-type: none">• Make sure that the power source of the used circuits is marked as intrinsically safe. |

| |
|---|
|  WARNING |
| Leaky threads for "Flameproof enclosure Ex d / XP" type of protection Risk of explosion in hazardous areas. Threads must be completely screwed into the enclosure. <ul style="list-style-type: none">• Screw the cable glands, thread adapter or sealing plug with at least 5 threads into enclosure. |

| |
|---|
|  WARNING |
| Unsuitable cables, cable glands and/or plugs Risk of explosion in hazardous areas. <ul style="list-style-type: none">• Use only cable glands/plugs that comply with the requirements for the relevant type of protection.• Tighten the cable glands in accordance with the torques specified in Technical data (Page 257).• Close unused cable inlets for the electrical connections.• When replacing cable glands, only use cable glands of the same type.• After installation, check that the cables are seated firmly. |

| |
|--|
| NOTICE |
| Ambient temperature too high Damage to cable sheath. <ul style="list-style-type: none">• At an ambient temperature $\geq 60\text{ °C}$ (140 °F), use heat-resistant cables suitable for an ambient temperature at least 20 °C (36 °F) higher. |

| |
|---|
|  WARNING |
| Improper power supply Risk of explosion in hazardous areas as result of incorrect power supply. <ul style="list-style-type: none">• Connect the device in accordance with the specified power supply and signal circuits. The relevant specifications can be found in the certificates, in Technical data (Page 257) or on the nameplate. |

| |
|---|
|  WARNING |
| Lack of equipotential bonding Danger of explosion in hazardous areas by compensating current or ignition sparks due to lack of equipotential bonding. <ul style="list-style-type: none">• Make sure that equipotential bonding exists for the device. |

| |
|---|
|  WARNING |
| Unprotected cable ends Risk of explosion through unprotected cable ends in hazardous areas. <ul style="list-style-type: none">• Protect unused cable ends in accordance with IEC/EN 60079-14. |

| |
|--|
|  WARNING |
| Improper laying of shielded cables Risk of explosion through compensating currents between hazardous area and the non-hazardous area. <ul style="list-style-type: none">• Shielded cables that cross into hazardous areas should be grounded only at one end.• If grounding is required at both ends, use an equipotential bonding conductor. |

⚠ WARNING**Connecting or disconnecting device in energized state**

Risk of explosion in hazardous areas.

- Connect or disconnect devices in hazardous areas only in a de-energized state.
- Install a suitable switch-off device.

Exceptions:

- Devices having the type of protection "Intrinsic safety Ex i" may also be connected in energized state in hazardous areas.

⚠ WARNING**Incorrect selection of type of protection**

Risk of explosion in areas subject to explosion hazard.

This device is approved for several types of protection.

1. Decide in favor of one type of protection.
2. Connect the device in accordance with the selected type of protection.
3. In order to avoid incorrect use at a later point, make the types of protection that are not used permanently unrecognizable on the nameplate.

NOTICE**Standard cable gland/torque**

Device damage.

- Owing the reasons pertaining to tightness (IP enclosure rating) and the required tensile strength, only use the cables having a diameter ≥ 8 mm for standard M20x1.5 cable gland, or use a suitable seal insert in case of smaller diameters.
- In the NPT version, the positioner is delivered with a coupling. When inserting a counter piece in the coupling, ensure that the maximum permissible torque of 10 Nm is not exceeded.

NOTICE**Condensation in the device**

Damage to device through formation of condensation if the temperature difference between transportation or storage and the mounting location exceeds 20 °C (36 °F).

- Before taking the device into operation, let the device adapt for several hours in the new environment.

Two-wire mode

| |
|--|
| NOTICE |
| Connection of voltage source to current input |
| Device damage if a voltage source is connected to the current input I_w (terminals 6 and 7). |
| <ul style="list-style-type: none">• Never connect the current input I_w to a low-resistance voltage source, otherwise the positioner may be destroyed.• Always use a high-impedance power source.• Observe the static destruction limit specified in the "Electrical data (HART) (Page 261)". |

Note

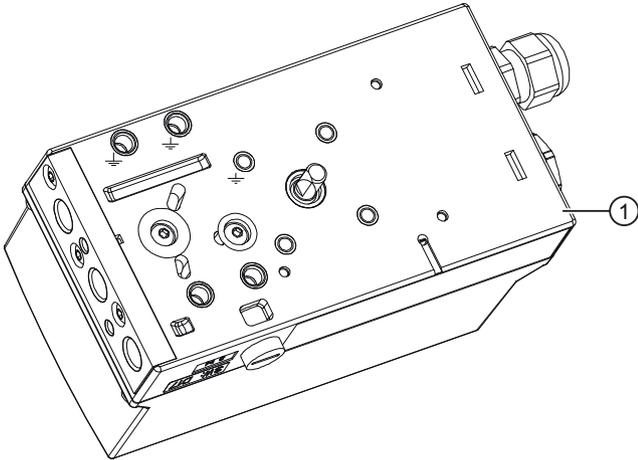
Improvement of interference immunity

- Lay signal cables separate from cables with voltages > 60 V.
- Use cables with twisted wires.
- Keep device and cables at a distance from strong electromagnetic fields.
- Take account of the conditions for communication specified in the Electrical data (HART) (Page 261).
- Use shielded cables to guarantee the full specification according to HART/PA/FF/Modbus/EIA-485/Profibus DP.

Electromagnetic compatibility

The polycarbonate enclosure is metalized from inside to increase the electromagnetic compatibility (EMC) with respect to high-frequency radiation. The shield is connected to the threaded bush shown in the following picture such that it is electrically conductive.

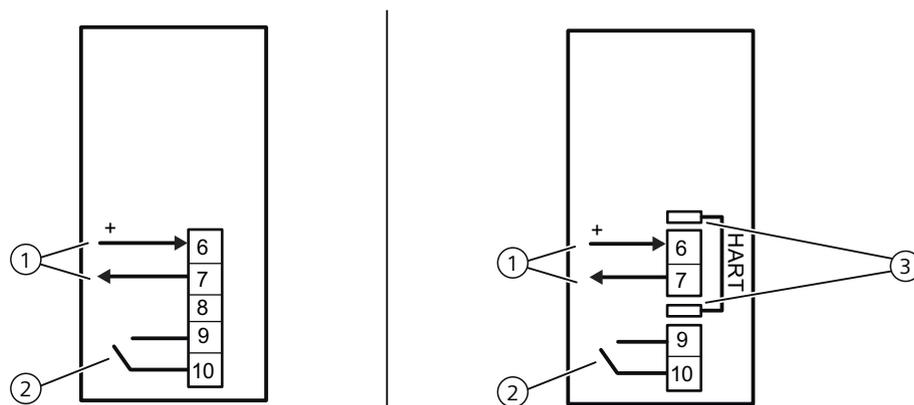
Note that this protection is effective only if you connect at least one of these bushes to the earthed control valves through electrically conductive (bare) attachments.



⊥ Shield
Figure 5-1 Base plate ①

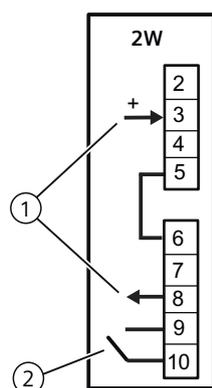
5.2 Electrical wiring

5.2.1 Electronics



- ① Setpoint 4 ... 20 mA, terminals 6 and 7
- ② Digital input DI1, terminals 9 and 10
- ③ HART connection

Figure 5-2 Connection diagram for electronics 2-wire



- ① Setpoint 4 ... 20 mA, terminals 3 and 8
- ② Digital input DI1, terminals 9 and 10

Figure 5-3 Connection diagram for electronics, 2/3/4-wire, with wiring configuration 2-wire

5.2 Electrical wiring

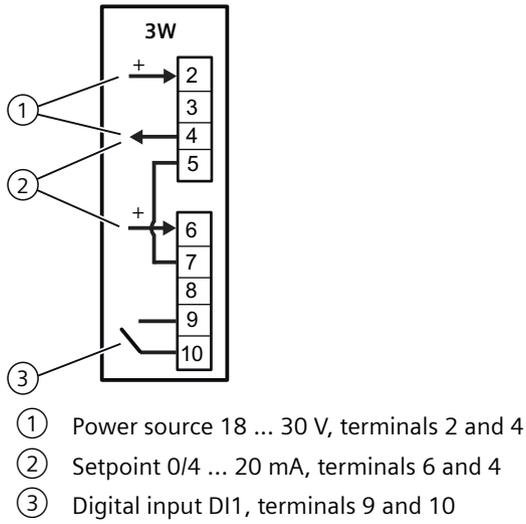


Figure 5-4 Connection diagram for electronics, 2/3/4-wire, with wiring configuration 3-wire

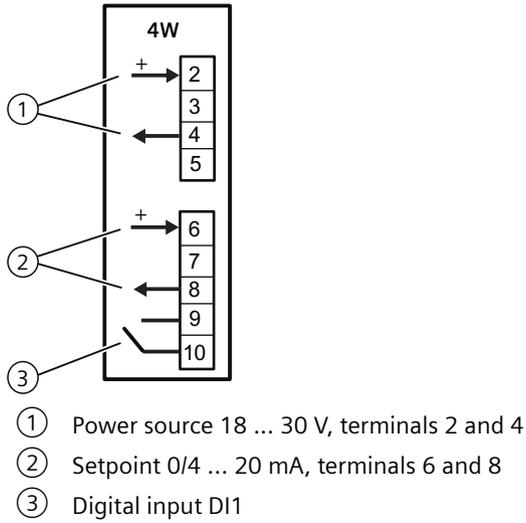
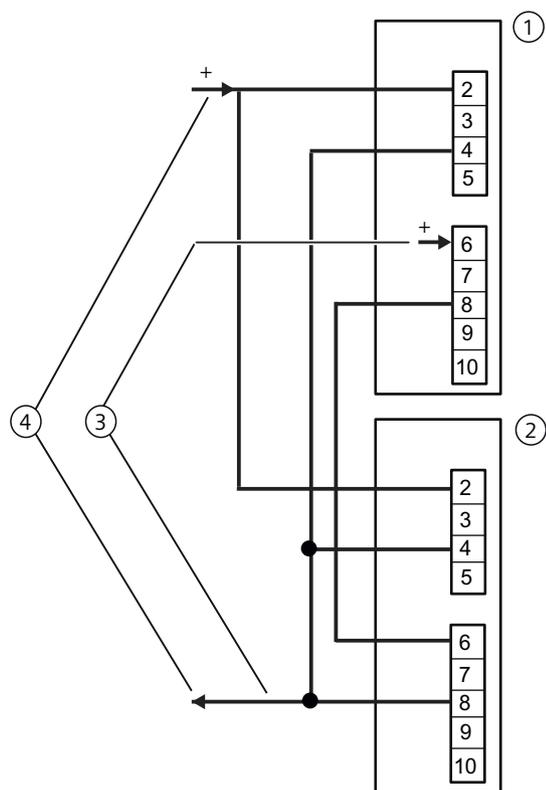


Figure 5-5 Connection diagram for electronics, 2/3/4-wire, with wiring configuration 4-wire

5.2.2 HART: split range, connection diagram

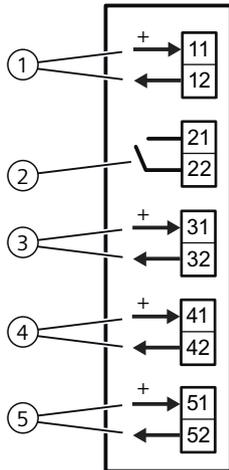


- ① Positioner 1
- ② Positioner 2
- ③ Signal source 0/4 ... 20 mA, terminals 6 and 8
- ④ Power source 18 ... 30 V, terminals 2 and 8

Figure 5-6 Series connection of 2 positioners, e.g. split range

5.2.3 Option modules

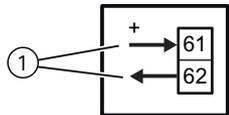
5.2.3.1 Digital I/O Module (DIO) 6DR4004-6A / -8A



- ① Digital input 2, galvanically isolated
- ② Digital input 2, floating contact
- ③ Fault message output
- ④ Digital output 1
- ⑤ Digital output 2

Figure 5-7 Digital I/O Module (DIO)

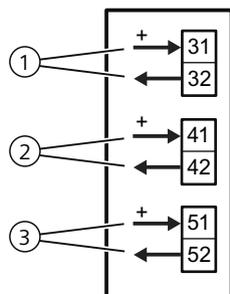
5.2.3.2 Analog Output Module (AOM) 6DR4004-6J / -8J



- ① Analog output AO

Figure 5-8 Analog Output Module (AOM)

5.2.3.3 Inductive Limit Switches (ILS) 6DR4004-6G / -8G

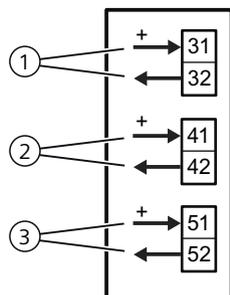


- ① Fault message output, has no function in combination with 6DR4004-3ES
- ② Digital output 1
- ③ Digital output 2

Figure 5-9 Inductive Limit Switches (ILS)

5.2.3.4 Mechanic Limit Switches (MLS) 6DR4004-6K

Connection diagram Mechanic Limit Switches (MLS) 6DR4004-6K



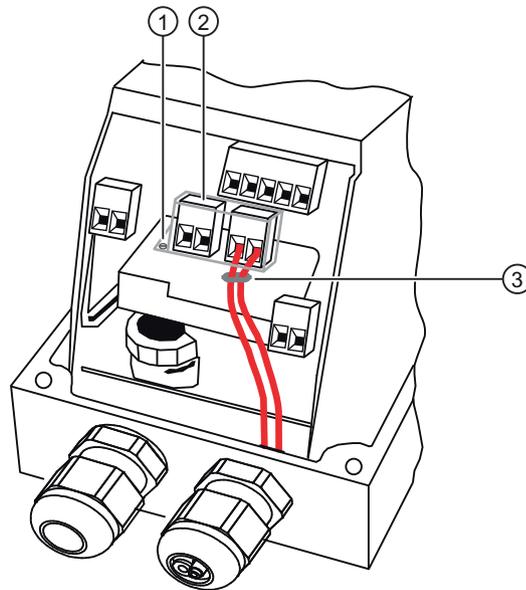
- ① Fault message output, has no function in combination with 6DR4004-4ES
- ② Digital output 1
- ③ Digital output 2

Figure 5-10 Mechanic Limit Switches (MLS)

Procedure

1. Loosen the screw ① on the transparent cover ②.
2. Pull the transparent cover ② up to the front end stop.
3. Tighten every cable in the corresponding terminal.
4. Slide the transparent cover ② up to the end stop of the electronics.

5. Tighten the screw ① of the transparent cover ②.
6. Connect the cables of each switch to the lug of the printed circuit board in pairs. Use the provided cable ties ③ for this purpose.



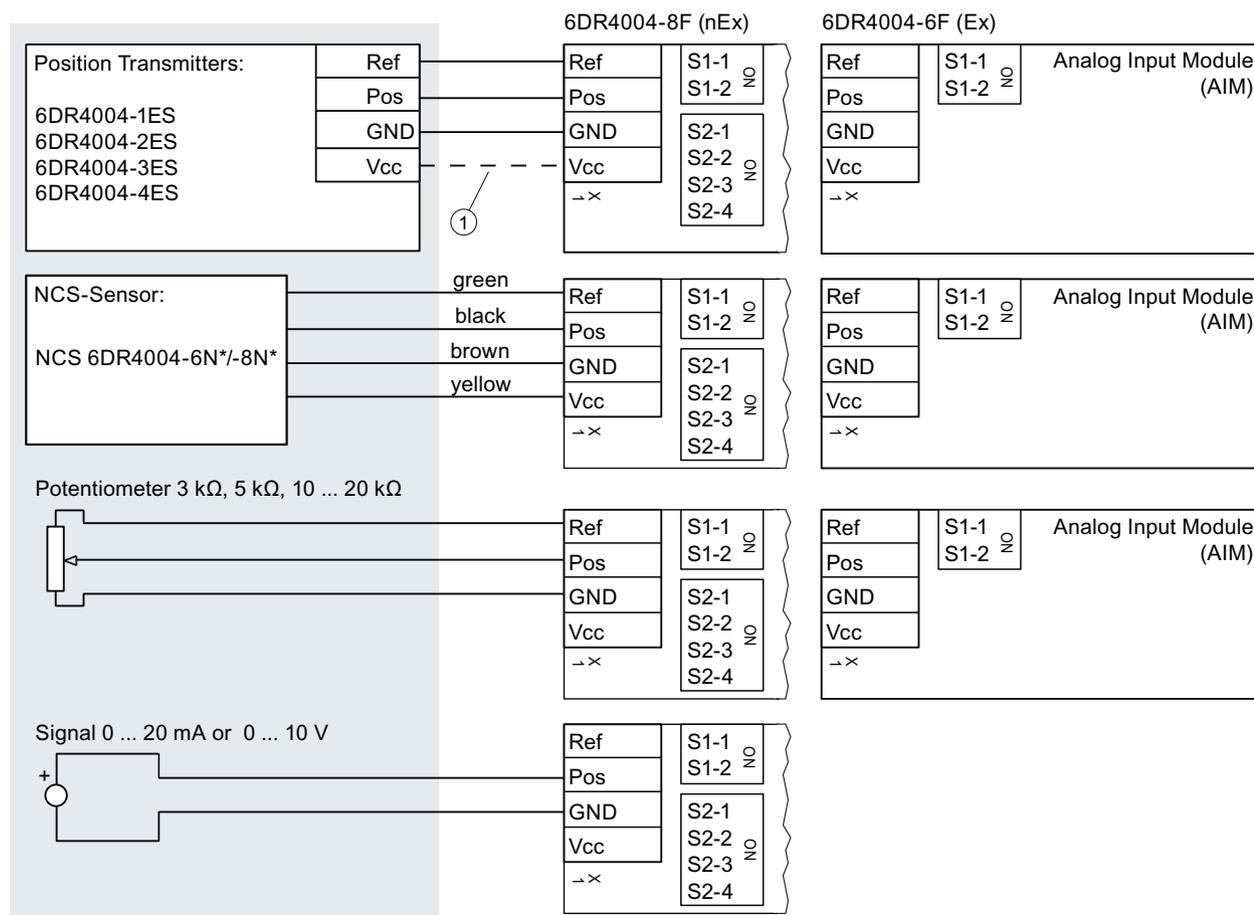
- ① Screw
- ② Cover
- ③ Cable tie

Figure 5-11 Connecting the cables

5.2.3.5 Analog Input Module (AIM) 6DR4004-6F / -8F

Procedure

Connect the external position detection as follows.



① Connection of terminal Vcc is only needed for 6DR4004-2ES, -3ES and -4ES.

If potentiometers or external signal sources are used, configure the switch blocks in accordance with the following table:

| Measuring range | Switch block 1 | | Switch block 2 | | | |
|----------------------------|----------------|------|----------------|------|------|------|
| | S1-1 | S1-2 | S2-1 | S2-2 | S2-3 | S2-4 |
| 6DR4004-.N/P/R (NCS) | ON | OFF | ON | OFF | OFF | OFF |
| 6DR4004-1ES/-2ES/-3ES/-4ES | ON | OFF | ON | OFF | OFF | OFF |
| 10 ... 20 kΩ | ON | OFF | ON | OFF | OFF | OFF |
| 5 kΩ | OFF | ON | ON | OFF | OFF | OFF |
| 3 kΩ | OFF | OFF | ON | OFF | OFF | OFF |
| 20 mA | OFF | OFF | ON | OFF | ON | OFF |
| 10 V | OFF | OFF | OFF | ON | OFF | OFF |

5.2.4 Optional version M12 device plug

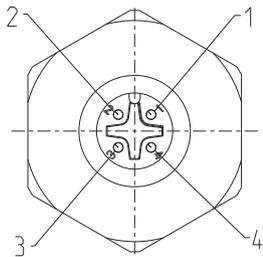
This section describes which terminal of the devices and option modules listed below is connected with the respective pole of the M12 connector.

Note

Technical specifications

Observe the specifications for the electrical data in the certificate and/or in section "Technical data (Page 257)".

View of the mating side pole pattern



| Pole designation | Wire color of M12 basic connector socket |
|------------------|--|
| 1 | Brown |
| 4 | Black |
| 3 | Blue |
| 2 | White |

5.2.4.1 M12 connector in basic device with and without HART

You have a positioner 6DR50/1..-0.R.. or 6DR50/1..-0.S. In this version of the positioner, the current input I_w 4 to 20 mA of the electronics is connected via the M12 device plug.

Table 5-1 Assignment diagram

| Current input terminal | Pole designation |
|-----------------------------|------------------|
| 6 (+) | 1 - Brown |
| Shield support of enclosure | 4 - Black |
| 7 and 8 (-) | 3 - Blue |

5.2.4.2 M12 Connector in Basic Device with Analog Output Module (AOM) 6DR4004-6J / -8J (-Z D53)

You have a positioner with order suffix -Z order code D53. In this version of the positioner, the current output of Analog Output Module (AOM) is electrically connected to the M12 connector.

Table 5-2 Assignment diagram

| Current output terminal | Pole designation |
|-----------------------------|------------------|
| 61 (+) | 1 - Brown |
| Shield support of enclosure | 4 - Black |
| 62 (-) | 3 - Blue |

5.2.4.3 In the basic unit with Position Transmitter (-Z D54)

You have a positioner with order suffix -Z order code D54. In this version of the positioner, the installed Analog Input Module (AIM) 6DR4004-6F/-8F is electrically connected to the M12 connector. You connect the Position Transmitter 6DR4004-1ES/-2ES using the M12 connector.

Table 5-3 Assignment diagram

| Terminal | Pole designation |
|----------|------------------|
| REF | 2 - White |
| POS | 3 - Blue |
| GND | 4 - Black |
| VCC | 1 - Brown |

5.2.4.4 In the basic unit with Digital I/O Module (DIO) 6DR4004-6A / -8A (-Z D55)

You have a positioner with order suffix -Z order code D55. In this version of the positioner, the current output of Digital I/O Module (DIO) is electrically connected to the M12 connector.

Table 5-4 Assignment diagram

| Terminal of digital outputs A1 and A2 | Pole designation |
|---------------------------------------|------------------|
| 41 (+) | 1 - Brown |
| 52 (-) | 4 - Black |
| 42 (-) | 3 - Blue |
| 51 (+) | 2 - White |

5.2.4.5 In the basic unit with Inductive Limit Switches (ILS) 6DR4004-6G /-8G (-Z D56)

You have a positioner with order suffix -Z order code D56. In this version of the positioner, the digital outputs A1 and A2 of the Inductive Limit Switches (ILS) are electrically connected to the M12 device plug.

Table 5-5 Assignment diagram

| Terminal of digital outputs A1 and A2 | Pole designation |
|---------------------------------------|------------------|
| 41 (+) | 1 - Brown |
| 52 (-) | 4 - Black |
| 42 (-) | 3 - Blue |
| 51 (+) | 2 - White |

5.2.4.6 In the basic unit with Mechanic Limit Switches (MLS) 6DR4004-6K (-Z D57)

You have a positioner with order suffix -Z order code D57. In this version of the positioner, the digital outputs A1 and A2 of the Mechanic Limit Switches (MLS) are electrically connected to the M12 connector.

Table 5-6 Assignment diagram

| Terminal of digital outputs A1 and A2 | Pole designation |
|---------------------------------------|------------------|
| 41 (+) | 1 - Brown |
| 52 (-) | 4 - Black |
| 42 (-) | 3 - Blue |
| 51 (+) | 2 - White |

5.3 Pneumatic connection

5.3.1 Basic safety instructions for the pneumatic connection

| |
|--|
|  WARNING |
| Supply pressure PZ For safety reasons, the supply pressure PZ can be fed after installation only if the positioner is switched to "P-Manual mode" when an electrical signal is present. This operating mode is preset in the delivery state. |

Note

Specifications regarding air quality

Observe the specifications regarding the air quality in section "Technical specifications > Pneumatic data for all device versions (Page 258)".

Note

Leakage

Besides continuous air consumption, a leakage can cause the positioner to try to compensate the position deviation. This will result in premature wear in the entire control device.

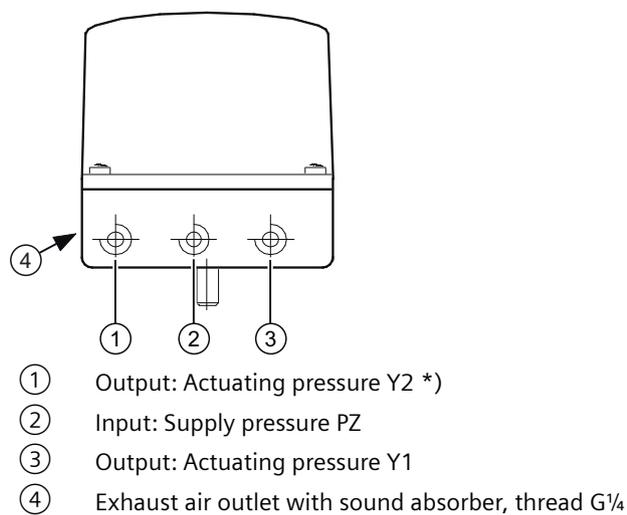
- Check offline for leakage using the "11.LEAK" diagnostic parameter.
- If there is leakage, check the pneumatic connections for leaks.

See also

Behavior in case of failure of the electrical auxiliary power and/or the supply pressure PZ (Page 91)

Changing the operating mode (Page 97)

Diagnostic value '11.LEAK - Leakage test' (Page 224)

5.3.2 Pneumatic connection in non-flameproof enclosure**5.3.2.1 Structure of pneumatic connection**

*) for double-acting actuators

Figure 5-12 Pneumatic connection, example

5.3.2.2 Integrated pneumatic connection

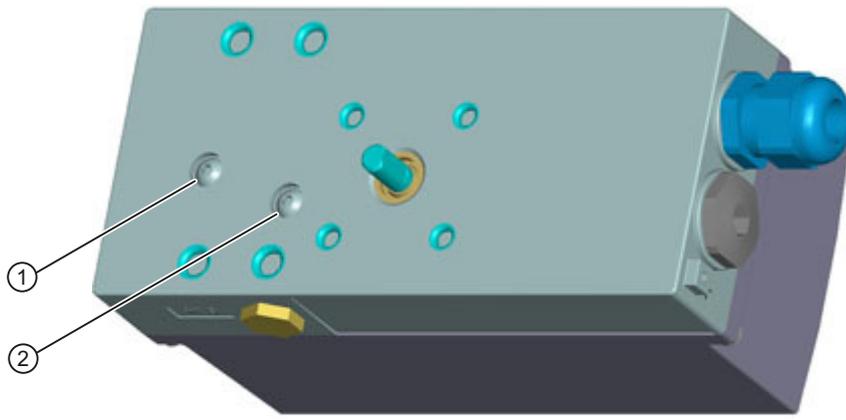
The following pneumatic connections are provided at the rear side of the basic device for the integrated attachment for single-acting linear actuators:

- Actuating pressure Y1
- Exhaust air outlet

These connections are sealed with screws when the device is delivered.

The exhaust air outlet is corrosion-resistant for the blanketing of the pick-up room and the spring chamber with dry instrument air.

5.3 Pneumatic connection



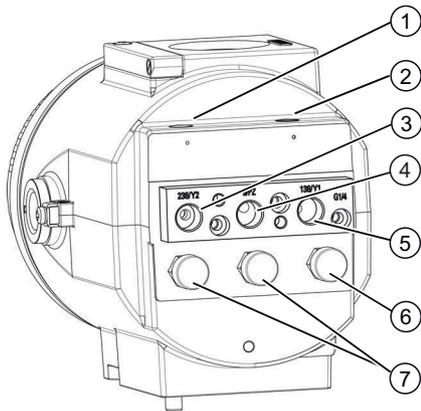
- ① Actuating pressure Y1
- ② Exhaust air outlet

Figure 5-13 Integrated pneumatic connection

5.3.3 Pneumatic connection in the flameproof enclosure

Structure

The pneumatic connections are provided on the right side of the positioner.



- ① Restrictor Y2 *)
 - ② Restrictor Y1
 - ③ Output: Actuating pressure Y2 *)
 - ④ Input: Supply pressure PZ
 - ⑤ Output: Actuating pressure Y1
 - ⑥ Exhaust air outlet
 - ⑦ Enclosure ventilation (2x)
- *) for double-acting actuators

Figure 5-14 Pneumatic connection in the flameproof enclosure

5.3.4 Behavior in case of failure of the electrical auxiliary power and/or the supply pressure PZ

Overview

 **CAUTION**

Note the following before working on the control valve

Note that, before working on the control valve, you must first move it to the safety position. Make sure that the process valve has reached the safety position. If you only interrupt the supply pressure PZ to the positioner, the safety position may in some cases only be attained after a certain delay period.

The difference between a failure of supply pressure PZ and a failure of electrical auxiliary power:

- Failure of **electrical auxiliary power** means:
 - Device version 2-wire: Failure of signal source 4 to 20 mA
 - Device version 3/4-wire: Failure of power source 18 to 30 V
- Failure of the **supply pressure PZ**

With 3-wire/4-wire device version, the 0% position is approached if the 4 to 20 mA signal source fails. The following table shows the pneumatic connection versions for different actuator types, regulating action and safety position after failure.

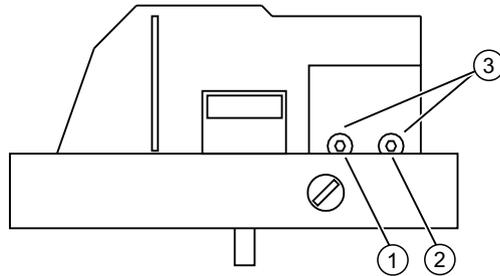
Table 5-7 Behavior in case of failure:

| | Single-acting actuator type | Double-acting actuator type |
|---|-----------------------------|--|
| Fail to close | | |
| • Failure of electrical auxiliary power | Y1 = depressurized | Y1 = pressurized Y2 = depressurized |
| • Failure of supply pressure PZ | Y1 = depressurized | Y1 = closed Y2 = closed |
| Fail in Place, additional order code F01 or 6DR5...-.....-..F* | | |
| • Failure of electrical auxiliary power | Y1 = closed | Y1 = closed Y2 = closed |
| • Failure of supply pressure PZ | Y1 = closed | Y1 = closed Y2 = closed |
| Fail to Open 6DR5...-.....-..G* | | |
| • Failure of electrical auxiliary power | Y1 = pressurized | Y1 = pressurized Y2 = depressurized |
| • Failure of supply pressure PZ | Y1 = closed | Y1 = closed Y2 = closed |

With single-acting actuator type, the actuator goes to safety position.

5.4 Restrictors

- Reduce the air output to achieve travel times of $T > 1.5$ s for small actuators. Use restrictors Y1 ① and Y2 ② for this purpose.
- When turned clockwise, they reduce the air output and finally shut it off.
- In order to set the restrictors, we recommend closing them and then opening slowly.
- In case of double-acting valves, ensure that both restrictors have approximately the same setting.



- ① Restrictor Y1
- ② Restrictor Y2, only in the version for double-acting actuators *)
- ③ Hexagon socket-head screw 2.5 mm

Figure 5-15 Restrictors

*) Restrictor Y2 ② is not active for single-acting Fail in Place F01

See also

Sequence of automatic initialization (Page 106)

Operating

6.1 Operating elements

6.1.1 Display

Introduction

Note

Repetition rate display

When operated in temperature ranges below -10°C, the liquid crystal display of the positioner becomes sluggish and the repetition rate display reduces considerably.

The display has two lines. These two lines are segmented differently. Each element in the upper line has 7 segments, whereas that in the lower line has 14 segments. Contents of the display depend on the selected mode.

Display options as per the mode

An overview of mode-specific display options is given below.

| Operating mode | Representation in the display | Pos. | Legend |
|---------------------|-------------------------------|------|---|
| P manual mode | | ① | Sensor setting [%] |
| | | ② | Blinking indicator for the non-initialized status. |
| Initialization mode | | ① | Sensor setting [%] |
| | | ② | Display of the current status of initialization or a fault message. |
| | | ③ | Indicator for ongoing initialization or a fault message. |
| Configuring | | ① | Parameter value |
| | | ② | Parameter name |
| | | ③ | Parameter number |

6.1 Operating elements

| Operating mode | Representation in the display | Pos. | Legend |
|-------------------|-------------------------------|------|--------------------|
| Manual mode (MAN) | | ① | Position [%] |
| | | ② | Setpoint [%] |
| | | ③ | Fault message |
| Automatic (AUT) | | ① | Position [%] |
| | | ② | Setpoint [%] |
| | | ③ | Fault message |
| Diagnostics | | ① | Diagnostics value |
| | | ② | Diagnostics name |
| | | ③ | Diagnostics number |

See also

System messages before initialization (Page 213)

Changing the operating mode (Page 97)

6.1.2 Buttons

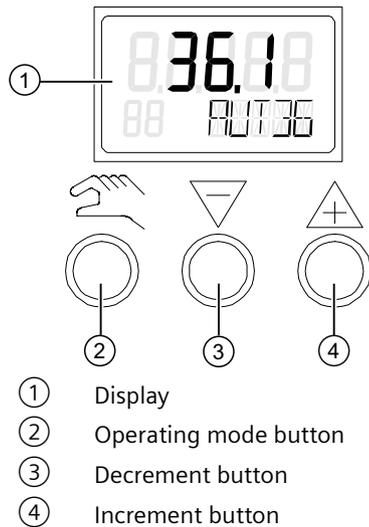


Figure 6-1 Display and buttons of the positioner

- You can use three buttons to operate the positioner.
- The function of the buttons depends on the mode selected.
- In a positioner with a flameproof enclosure, the buttons are protected by a lid. The button lid can be opened after unlatching the locking screw.

Note**Button lid**

In positioners with flameproof enclosures, the button lid prevents liquids from seeping through. The IP66 / type 4X degree of protection is not ensured when the enclosure or the button lid is open.

You have to remove the enclosure lid to operate the buttons of the basic device or the "intrinsically safe" version.

Note**Degree of protection**

The IP66 / type 4X degree of protection is not ensured as long as the positioner is open.

Function of buttons:

- The  button is used to select the modes and to forward the parameters.
- The  button is used to select parameter values in "Configuration" mode. You can use this button to move the actuator in "Manual" mode.
- The  button is also used to select parameter values in "Configuration" mode. You can use this button to move the actuator in "Manual" mode.

Note**Order**

Parameters are activated in the reverse order when the  and  buttons are pressed simultaneously.

6.1.3 Firmware version

The current firmware version is displayed when you exit the operating mode "Configuration".

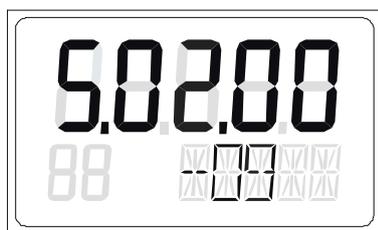


Figure 6-2 Firmware version, example

6.2 Operating modes

6.2.1 Overview of operating modes

You have five operating modes at your disposal to operate the positioner:

1. P-manual mode (as-delivered condition)
2. Configuration and initialization mode
3. Manual mode (MAN)
4. Automatic (AUT)
5. Diagnostics

6.2.2 Changing the operating mode

The following picture illustrates the available operating modes and switching between the operating modes.

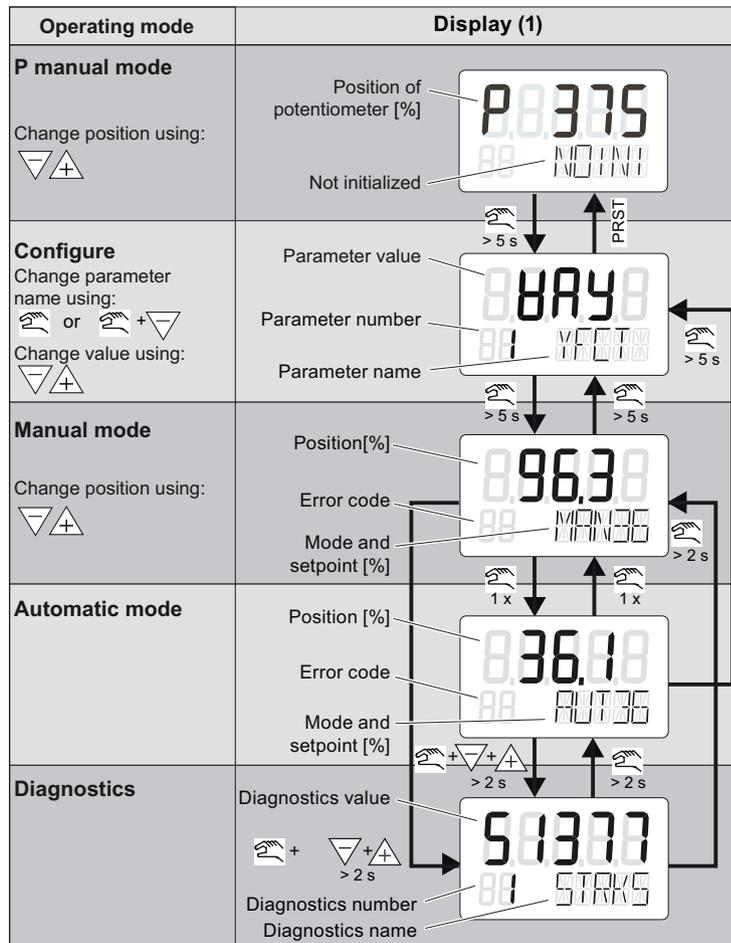


Figure 6-3 Switching between the operating modes

See also

Display (Page 93)

6.2.3 Overview of configuration

The following picture illustrates the handling of operating modes such as "Configuration" and "Initialization mode":

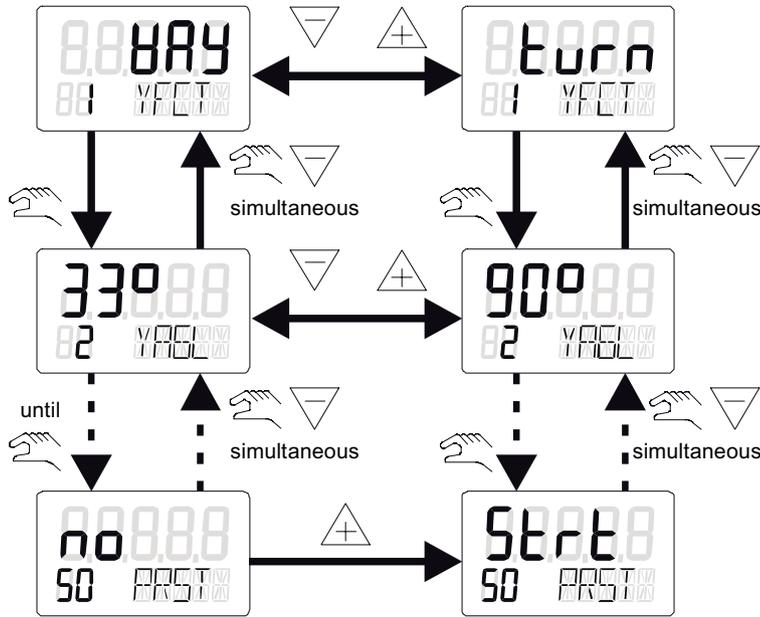


Figure 6-4 Overview of the "Configuration" operating mode

6.2.4 Description of operating modes

P manual mode

Note

Delivery state

The "P manual mode" is preset for the positioner in the delivery state.

The display of the positioner shows the current potentiometer position in the upper line. "NOINI" flashes in the second line of the display.

Move to the actuator with the ▽ or ▲ buttons.

Switch to "Configuration" mode to adapt the actuator to the positioner.

Alarms or position feedbacks can be triggered after initializing the positioner completely.

Configuration and initialization

To get to the "Configuration" mode, press the button for at least 5 seconds.

You can use the "Configuration" mode to adjust the positioner individually as per your actuator and start commissioning or initialization.

The positioner reports the "Configuration" mode with a configurable fault message. A position feedback or display of limits A1 and A2 is not possible.

Note**Failure of electrical auxiliary power**

If electrical auxiliary power supply fails when configuring, the positioner responds as follows when the power supply is reestablished:

- The positioner switches over to the first parameter.
- Settings of the values already configured are retained.

In order to save the changed parameter values, exit the "Configuration" mode or switch to another parameter. When "Configuration" mode is restarted, the output in the display switches to the last activated parameter.

Manual mode (MAN)

In this mode, you move the actuator with ∇ or \triangle . The positioner holds the selected position irrespective of the setpoint current or any leakages that have occurred.

Note**Accelerating the actuator movement**

Proceed as follows:

1. Keep one of the two direction buttons pressed.
 2. Press the remaining direction button simultaneously.
-

Note**Power supply failure**

When the power supply is reestablished after a failure, the positioner switches to "Automatic" mode.

Automatic (AUT)

Automatic is the standard mode. In this mode, the positioner compares the setpoint position with the actual position. The positioner moves the actuator until the control deviation reaches the configurable deadband. If the deadband is not reached, a fault message is output.

Diagnostics

Proceed as follows to call the "Diagnostics" mode from the "Automatic" or "Manual" modes:

Simultaneously press the 3 buttons of the positioner for at least 2 seconds.

Current operating data can be called and displayed in this mode, e.g.:

- Number of total strokes
- Number of changes in direction
- Number of fault messages

Note

Setting the mode

The "Automatic" and "Manual" modes remain set when switching to the "Diagnostics" mode. The positioner responds as per the configured mode:

- The predefined setpoint is used as the control variable in "Automatic" mode.
 - The last reached position is retained in "Manual" mode.
-

See also

Overview (Page 105)

Overview of diagnostic parameters (Page 141)

Overview of diagnostics values 1.STRK to 58.LKPER (Page 220)

6.2.5 Optimization of controller data

Note

Initializing

Initialize the positioner automatically before changing the parameter settings as per your specific requirements.

The positioner determines the data for control quality automatically during the initialization process.

The data determined is optimized for a short transient time in the case of minor overshoots.

The adjustment can be accelerated or the attenuation can be intensified by optimizing the data.

The following special cases are suitable for targeted data optimization:

- Small actuators with travel times < 1 s.
- Operation with boosters, described in section "Booster commissioning (Page 327)"

Procedure

1. Switch to "Diagnostics" mode.
2. Select the diagnostics parameters.

3. Press the three buttons of the positioner at the same time for at least 2 seconds.
4. Activate the setting function. Press the  or  button for at least 5 seconds.

The modified diagnostics values are effective immediately. The effects on the controller results can then be tested.

In order to optimize the controller data, change the values of the diagnostics parameters listed below.

Diagnostics parameters '23.IMPUP' Impulse length UP / '24.IMPDN' Impulse length DOWN

You can use these diagnostics parameters to determine the smallest impulse lengths for each actuating direction. The actuator is then moved with these lengths. The optimum value depends in particular on the volume of the actuator. Small values lead to small controller increments and frequent activation of the actuator. Large values are advantageous for large actuator volumes.

Note

Controller increments

- There is no movement if the values are too small.
- Large controller increments also lead to large movements with small actuators.

Diagnostics parameters '28.SSUP' Slow step zone UP / '29.SSDN' Slow step zone DOWN

The slow step zone is the area of mean control deviation. For more information on the slow step zone, refer to the section "Mode of operation (Page 29)".

Select small values to achieve high speeds of shifting even with small control deviations. Select large values to reduce overshoots particularly in case of large changes in the setpoint.

NOTICE

Overshoots or too low speeds of shifting

Too small values can result in overshoots.

- Enter a higher value.

Too large values result in too slow speeds of shifting near the adjusted status.

- Enter a smaller value.

Diagnostics parameters '47.PRUP' Prediction UP / '48.PRDN' Prediction DOWN

These diagnostics parameters act as attenuation factors and are used to set the control dynamics. Changes in the diagnostics values have the following results:

- Small values result in quick adjustments with overshoots.
- Large values result in slow adjustments without overshoots.

Note

Reference variable

It is advantageous to use a fixed reference variable to optimize the control data. Therefore, change the deadband of the controller in the '34.DEBA' parameter from "Auto" to a fixed value.

Commissioning

7.1 Basic safety instructions

 WARNING**Lever for position detection**

Danger of crushing and shearing with mounting kits which use a lever for position detection. During commissioning and ongoing operation, severing or squeezing of limbs could occur as a result of the lever. Risk of injury when working on control valves due to the high operating force of the pneumatic actuator.

- Do not reach into the range of motion of the lever following mounting of the positioner and mounting kit.

 WARNING**Improper commissioning in hazardous areas**

Device failure or risk of explosion in hazardous areas.

- Do not commission the device until it has been mounted completely and connected in accordance with the information in Technical data (Page 257).
- Before commissioning take the effect on other devices in the system into account.

See also

Basic safety instructions (Page 103)

 WARNING**Commissioning and operation with pending error**

If an error message appears, correct operation in the process is no longer guaranteed.

- Check the gravity of the error.
- Correct the error.
- If the error still exists:
 - Take the device out of operation.
 - Prevent renewed commissioning.

 **WARNING****Loss of explosion protection**

Risk of explosion in hazardous areas if the device is open or not properly closed.

- Close the device as described in Installing/mounting (Page 35).

 **WARNING****Opening device in energized state**

Risk of explosion in hazardous areas

- Only open the device in a de-energized state.
- Check prior to commissioning that the cover, cover locks, and cable inlets are assembled in accordance with the directives.

Exception: Devices having the type of protection "Intrinsic safety Ex i" may also be opened in energized state in hazardous areas.

 **WARNING****Water in compressed air line**

Device damage and possibly loss of type of protection. The factory setting for the purging air selector is "IN". In the "IN" position, water from the compressed air line may enter the device from the pneumatics during initial commissioning.

- Before commissioning, make sure that no water is present in the compressed air line.

If you cannot be sure that there is no water in the compressed air line:

- Set the purging air selector to "OUT". In this way, you prevent water from the compressed air line from penetrating the device.
- Only set the purging air selector to "IN" again when all water has been discharged from the compressed air line.

 **CAUTION****Increased sound pressure level**

Changes to the sound absorber of the positioner or the mounting of pneumatic components or pneumatic options on the positioner can cause a sound pressure with a level of 80 dBA to be exceeded.

- Wear suitable hearing protection to protect yourself against hearing damage.

When operating the positioner with natural gas, you must follow and adhere to the following safety notes:

**WARNING****Operation with natural gas**

1. Only positioners and option modules which are connected to power supplies with type of protection "Intrinsic safety, protection level [ia]" may be operated with natural gas.
2. Do not operate the positioner with natural gas in closed spaces.
3. Natural gas is continuously blown off, depending on the model. Special care must therefore be taken during maintenance activities near the positioner. Always ensure that the immediate surroundings of the positioner are adequately ventilated. The maximum values for ventilation are listed in section "Technical data (Page 257)".
4. If you operate the positioner with natural gas, it is not permitted to use Mechanic Limit Switches (MLS).
5. You must depressurize devices operated with natural gas adequately for maintenance work. Open the lid in an explosion-free atmosphere and depressurize the device for at least two minutes.

Note**Quality of natural gas**

Only use natural gas which is clean, dry and free from additives.

7.2 Overview

Note

- During the initialization process, the operating pressure must be at least one bar more than that required to close or open the valve. However, the operating pressure should not be greater than the maximum permissible operating pressure for the actuator.

General information about commissioning

1. After installing the positioner on a pneumatic actuator, you must supply electric and pneumatic auxiliary power to it.
2. The positioner is in the "P manual mode" before initialization. At the same time, "NOINI" blinks in the lower line of the display.
3. Position feedback: You can adjust the range of position detection using the friction clutch if necessary.
4. Adjust the positioner as per the respective actuator with the help of the initialization process and by setting the parameters. If required, use the "PRST" parameter to cancel the adjustment of the positioner on the actuator. The positioner is again in the "P manual mode" after this process.

Types of initialization

You can initialize the positioner as follows:

- Automatic initialization:
during automatic initialization, the positioner determines the following one after the other:
 - The direction of action
 - The actuator travel and angle of rotation
 - The travel time of the actuator

The positioner also adjusts the control parameters as per the dynamic response of the actuator.

- Manual initialization:
the actuator travel and the angle of rotation of the actuator are set manually. The remaining parameters are automatically determined. This function is useful for valves which are lined, for example, with PTFE.
- Copying the initialization data when replacing a positioner:
the initialization data of a positioner can be read and copied into another positioner. A defective device can thus be replaced without interrupting an ongoing process through initialization.

You have to define a few parameters for the positioner before initialization. Owing to the preset values, you cannot adjust further parameters for initialization.

With a suitable parameter assignment of the "DI1" parameter and activated digital input DI1, you protect the settings that were made against unintentional adjustment.

See also

Overview of operating modes (Page 96)

7.3 Sequence of automatic initialization

7.3.1 Sequence of automatic initialization

Overview

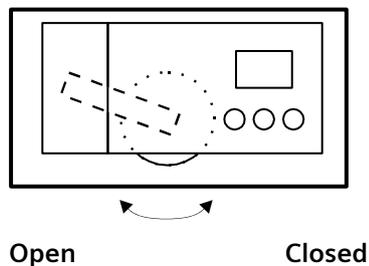
The automatic initialization takes place in the following phases:

| Automatic initialization phase | Description |
|--------------------------------|--|
| Start | - |
| RUN 1 | Determination of direction of action. |
| RUN 2 | Check of actuator travel and adjustment of lower and upper endstops. |
| RUN 3 | Determination and display of the travel time (leakage test) |
| RUN 4 | Minimization of controller increments |

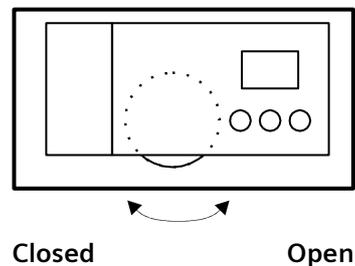
| Automatic initialization phase | Description |
|--------------------------------|--|
| RUN 5 | Optimization of the transient response |
| RUN 6 with option -Z P02 | Recording of the Valve Signature (VS) |
| End | - |

The following structured charts describe the sequence of initialization. The "Up/Down" names indicate the direction of action of actuators.

Linear actuator



Part-turn actuator



7.3.2 Determining the actuator type

| | | |
|---|--|--|
| Part-turn actuator | | |
| | | |
| Linear actuator | | |
| | | |
| Linear actuator - external linear potentiometer (e.g. with cylinder drives) | | |
| | | |

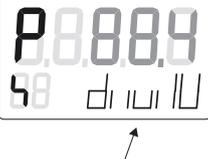
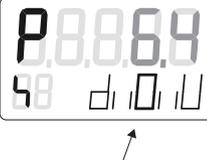
7.3.3 Starting automatic initialization

| | |
|--|--|
| | Press > 5 s. The remaining steps run automatically. |
|--|--|

7.3.4 RUN 1: Determination of direction of action

| Possible messages | | |
|-------------------|-------------------------|--|
| Display | Meaning | Measures |
| | Actuator does not move. | Acknowledge message with: <ul style="list-style-type: none"> Pressure supply checked? Restrictor(s) checked and, if necessary, opened? Move the actuator into the working area with: Restart device. Repeat initialization. |
| | | |

7.3.5 RUN 2: Determination of travel

| | | | |
|---|--|--|---|
|  | Determination of the travel. Zero point and stroke are adjusted from endstop to endstop. | | |
| Possible messages | | | |
| | Display | Meaning | Measures |
| |  | The "Down" tolerance band is fallen below or exceeded. | <p>Option with transmission ratio selector: Set transmission ratio selector. Continue with: </p> <p>Option with friction clutch: Adjust friction clutch until the display indicates the following:</p>  <p>Continue with:  or </p> |
| |  | The friction clutch (optional) has been adjusted. | For linear actuator: Set the pick-off lever perpendicular to the actuator spindle with:   Continue with:  |
| |  | The "UP" tolerance band is exceeded. | <p>Acknowledge message with: </p> <p>Set the next higher stroke value on the lever. Restart the initialization.</p> <p>For part-turn actuator, the following is additionally possible: Adjust the tolerance band with   until the display indicates the following:</p>  <p>Continue with: </p> |
| |  | The "UP-Down" span is under-shot. | <p>Acknowledge message with: </p> <p>Set the next lower stroke value on the lever. Restart the initialization.</p> |

7.3.6 RUN 3: Determination and display of travel time (leakage test)

| | | | |
|--|---|--|--|
|  | The travel time is determined and displayed with "down" (dxx.x) and "up" (Uxx.x). Stop with: ▾ | | |
| | PNEUM | | |
| | Std / FIP | Start leakage measurement with: ▲ | |
| | booSt | Display of the overshoot down (3.2 oSuP), up (2.9 oS-do) ▲ | |
| Possible messages | | | |
| Display | Meaning | Measures | |
| Std / FIP   | Actuator does not move. The travel time cannot be changed. | Acknowledge message with:  Change the travel time using the restrictor screws. Continue with: ▾ ▲ | |
| booSt   | The overshoot is determined. | Adjust the booster bypass using the adjusting screw on the booster until the display indicates the following:  Continue with: ▾ ▲ | |

7.3.7 RUN 4: Minimization of positioning increments

| | |
|---|--|
|  | The minimum length of the controller increments is determined. |
|---|--|

7.3.8 RUN 5: Optimization of transient response

| | |
|---|--|
|  | |
|---|--|

7.3.9 Step 8 - RUN 6: Inclusion of Valve Signature

| | |
|---|---|
|  | Inclusion of Valve Signature; only for positioners with option -Z P02 |
|---|---|

7.3.10 Step 9 – End

| | |
|--|--|
|  | <p>Initialization was completed successfully.</p> <p>Travel in mm for linear actuators. Angle of rotation for part-turn actuators.</p> |
|--|--|

If you want to change the direction of action, set the "1.YFCT" parameter on an actuator with inverse direction of action, e.g. "turn" to "-turn".

7.4 Setting the friction clutch

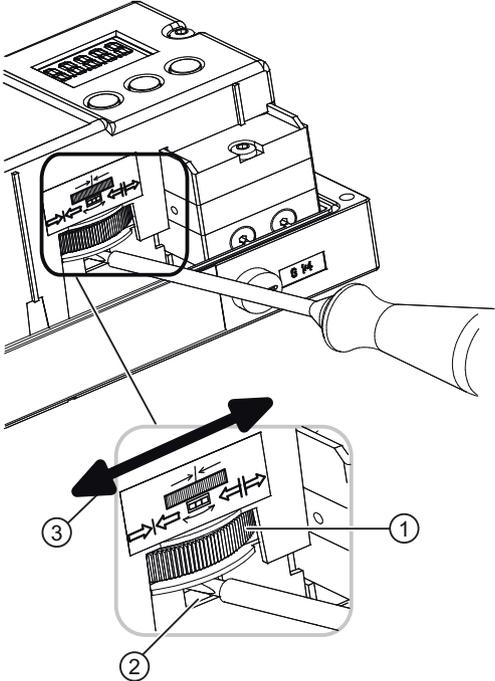
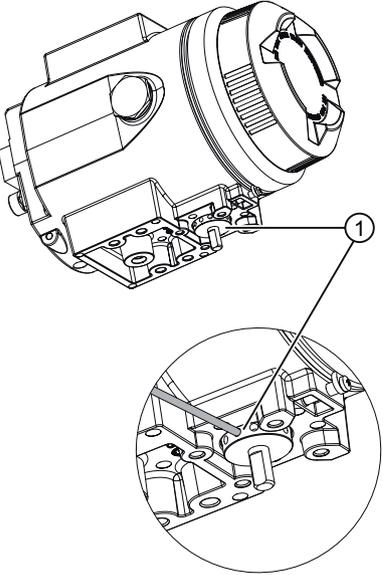
Introduction

In order for the positioner to be used on a wide variety of mechanically different part-turn and linear actuators, some positioner versions have a friction clutch and a selectable transmission (Page 46). Use the friction clutch to adjust the position detection area. For positioners in non-flameproof enclosures, you also have the option of locking the friction clutch.

Requirement

- The positioner is mounted.

Procedure

| In non-flameproof enclosure | In flameproof enclosure Ex d |
|--|--|
|  |  |
| <ol style="list-style-type: none"> 1. Adjust the working area to your application by turning the adjustment wheel of the friction clutch ①. 2. Fasten the friction clutch. Insert a standard approx. 4 mm wide screwdriver in the friction clutch gear latch ②. 3. Use the screwdriver to turn the friction clutch gear latch ② counterclockwise ③ until it engages. The friction clutch ① is locked. | <ol style="list-style-type: none"> 1. Adjust the working range by slightly turning the adjustment wheel of the friction clutch ① over the hole with a pin. <p>CAUTION Follow the steps below to avoid damage to your device.</p> <ul style="list-style-type: none"> • The friction clutch ① is outside the flameproof enclosure at the bottom. • Do not loosen the screws on the adjustment wheel of the friction clutch ①. • Frequent twisting of the friction clutch is not provided for due to the design. • It is not necessary to lock the friction clutch. |

7.5 Manual adjustment of the pressure sensors

Adjust the pressure sensors manually in the following cases:

- If manual initialization is to be performed with initialization parameter 5.INITM (Page 148).
- If the device is operated at an elevation greater than 160 m above sea level.

Requirement

- The positioner is connected electrically and switched on.
- The positioner is depressurized.
- The positioner is not connected pneumatically.
- Pneumatic outputs PZ, Y1 and Y2 are open to the environment.

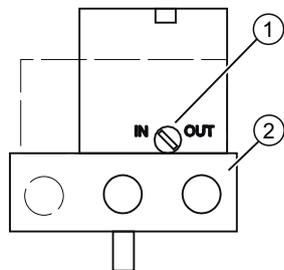
Procedure

1. Call up the diagnostics values as described in Display of diagnostics values (Page 219).
2. Select the pressure value you want to adjust to the atmospheric pressure.
3. Adjust the atmospheric pressure by pressing the Δ button for 5 seconds. You can find out what the associated diagnostics values mean and what the values mean under "60.PZ (Page 237)", "61.P1 (Page 237)" and "62.P2 (Page 238)".

7.6 Purge air switching

When the enclosure is open, the purging air selector above the pneumatic manifold on the pneumatic block can be accessed.

- In the IN position, the enclosure is flushed from inside with a small volume of clean and dry instrument air.
- In the OUT position, the purge air is directly directed towards outside.



- ① Purging air selector
- ② Pneumatic connections Y1, PZ and Y2

Figure 7-1 Purging air selector on the pneumatic block; view of the pneumatic connection side of the positioner with open lid

The factory setting is the "IN" position.

7.7 Commissioning linear actuators

7.7.1 Preparing linear actuators for commissioning

Requirement

You have already installed the positioner using the suitable mounting kit.

Setting the transmission ratio selector

Note

Commissioning

The setting of the transmission ratio selector is extremely important to commission the positioner.

| Stroke [mm] | Position of the transmission ratio selector |
|-------------|---|
| 5 to 20 | 33° |
| 25 to 35 | 90° |
| 40 to 130 | 90° |

Connecting the positioner

1. Connect a suitable power supply. The positioner is now in "P manual mode". The current sensor setting (P) in percent is shown in the top line of the display, e.g. "P37.5", and 'NOINI' flashes in the bottom line:



2. Connect the actuator and the positioner to the pneumatic lines.
3. Supply the positioner with supply pressure PZ.

Setting the actuator

1. Check whether the mechanical unit can be moved freely in the entire travel range. Move the actuator to the respective end position for this purpose using the  or  button.

Note

End position

By simultaneously pressing the  and  buttons, you reach the end position faster.

2. Now move the actuator to the horizontal position of the lever.
3. A value between 'P48.0' and 'P52.0' is shown on the display.
4. If a value beyond this value range is shown on the display, you must move the friction clutch. Move the friction clutch until a value between 'P48.0' and 'P52.0' is reached. The closer this value is to 'P50.0', the more accurately the positioner determines the stroke travel.

Note

For device versions with flameproof enclosure

The inner friction clutch is fixed. Therefore, only move the outer friction clutch. This also applies when using an internal NCS module.

The following applies to device versions without flameproof enclosure with internal NCS module 6DR4004-5L.:

The inner friction clutch has no function. Therefore, only adjust the adjustment wheel of the magnet holder; see section "Internal NCS module (iNCS) 6DR4004-5L / -5LE (Page 68)". Requirement: The '1.YFCT' type of actuator (Page 144) parameter is set.

See also

Mounting to linear actuator (Page 38)

Opening the device version with "flameproof enclosure" (Page 54)

7.7.2 Automatic initialization of linear actuators

Requirements

The following conditions must be fulfilled before activating the automatic initialization:

1. The actuator spindle can be moved completely.
2. The actuator spindle is at a central position after travel.

Initializing the linear actuator automatically

Note

Interrupting initialization

An ongoing initialization can be interrupted at any time. To do this, press . The settings configured until then are retained.

All parameters are reset to factory settings only if you have explicitly activated the preset settings in the "PRST" parameter.

Note

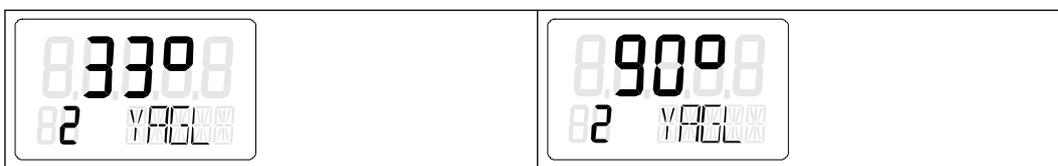
Commissioning of a tight-closing valve

If the valve is tight-closing, set the "YCLS (Page 155)" parameter before commissioning. This ensures that the end positions are approached for at least 15 seconds during initialization.

1. Switch to the "Configuration" mode. To do this, keep the  button pressed for at least 5 seconds. The display shows the following:



2. Call the "2.YAGL" parameter. To do this, press . The following is shown on the display depending on the setting:



3. Check whether the value displayed in the "2.YAGL" parameter matches the setting of the transmission ratio selector. If required, change the setting of the transmission ratio selector to 33° or 90°.

- 4. Set the "3.YWAY" parameter to determine the total stroke in mm. The setting of parameter 3 is optional. The display shows the determined total stroke at the end of the initialization phase.
 - Press the  button if you do not require any information about the total stroke in mm. You then reach parameter 4.
 - Call the "3.YWAY" parameter. To do this, press . The display shows the following:

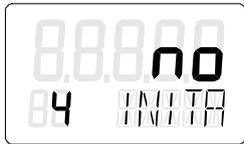


Note

Set the "3.YWAY" parameter

- 1. On the scale of the lever, read the value marked by the carrier pin.
- 2. Set the parameter with the buttons  and  to the read value.

- 5. Call the "4.INITA" parameter. To do this, briefly press the  button. The display shows the following:



- 6. Start the initialization process. To do this, keep the  button pressed for at least 5 seconds until the display shows the following:



The positioner runs through several initialization steps during the automatic initialization process. The lower line of the display indicates which initialization step is currently being run through. The initialization process depends on the actuator used, and takes up to 15 minutes.

- 7. The following display indicates that the initialization is complete:



See also

Sequence of automatic initialization (Page 106)

7.7.3 Manual initialization of linear actuators

You can use this function to initialize the positioner without needing to move the actuator to the lower and upper endstops. The lower and upper endstops of the actuator travel are set manually. When the control parameters are optimized, the further initialization process runs automatically.

Requirements

The following requirements must be met before you activate the manual initialization:

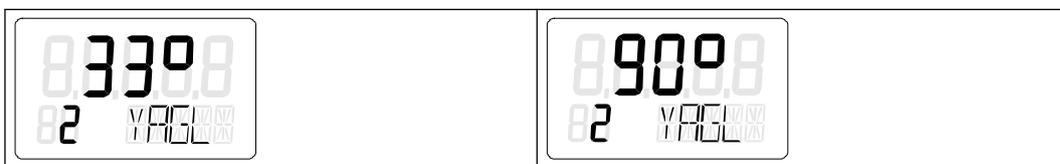
1. The positioner is prepared for use on linear actuators.
2. The actuator spindle can be moved completely.
3. The displayed sensor setting is within the permissible range of "P5.0" to "P95.0".
4. For positioners with option -Z P02, adjust the pressure sensors manually as described in Manual adjustment of the pressure sensors (Page 113).

Initializing the linear actuator manually

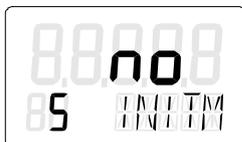
1. Switch to "Configure" mode by pressing the  button for at least 5 seconds.



2. Navigate to the "2.YAGL" parameter with the  button. The following is shown on the display depending on the setting:



3. Check whether the value displayed in the "2.YAGL" parameter matches the setting of the transmission ratio selector. If required, change the setting of the transmission ratio selector to 33° or 90°.
 - This step is omitted for devices without a transmission ratio selector.
4. Navigate to the "5.INITM" parameter with the  button. The display shows the following:



- 5. Start the initialization by pressing the  button for at least 5 seconds. After 5 seconds, the display shows the position for the lower end position (YEND1).



- 6. Set the YEND1 position of the actuator by pressing the  or  button.
- 7. Confirm with the  button.

Note

"RANGE" appears on the display

The lower end position is outside the permissible measuring range.

- Adjust the friction clutch until the display shows "OK" and press the  button.

- 8. Set the YEND2 position (upper end position) of the actuator by pressing the  or  button.



- 9. Confirm with the  button. The position of the actuator is applied.

Note

"RANGE" appears on the display

The upper end position is outside the permissible measuring range.

1. Adjust the friction clutch until the display shows "OK" and press the  button.
2. Start the initialization process again.

- 10. The initialization process is automatically resumed. The lower line of the display indicates which initialization step is currently being run through. The following display indicates that the initialization is complete:



Determining total stroke (optional)

1. On the scale of the lever, read the value marked by the carrier pin.
2. In "Configure" mode, navigate to the "3.YWAY" parameter with the  button.



3. Set the parameter to the read value with the  or  button.
Once the initialization phase has ended, the display shows the determined total stroke in mm.

7.8 Commissioning part-turn actuators

7.8.1 Preparing part-turn actuators for commissioning

Note

Setting of the adjustment angle

The usual adjustment angle for part-turn actuators is 90°.

- Set the transmission ratio selector in the positioner to 90°.
-

Condition

The following conditions must be fulfilled before activating the initialization:

1. You have installed the positioner for the part-turn actuators using the suitable mounting kit.
2. You have connected the actuator and the positioner to the pneumatic lines.
3. Supplying the positioner with the supply pressure PZ.
4. The positioner has been connected to a suitable power supply.

Setting the actuator

1. The positioner is in the "P manual mode". The current potentiometer voltage P in percent is shown on the upper line in the display. "NOINI" blinks in the lower line of the display. Examples of corresponding displays are given below:



2. Check whether the mechanical unit can be moved freely in the entire travel range. Move the drive to the respective end position for this purpose using the ▲ or ▼ button.

Note

End position

By simultaneously pressing the ▲ and ▼ buttons, you reach the end position faster.

3. After checking, move the actuator to a central position. This accelerates the initialization process.

7.8.2 Automatic initialization of part-turn actuators

Requirement

The following conditions must be fulfilled before activating the automatic initialization:

1. The travel range of the actuator can be passed through completely.
2. The actuator shaft is at a central position.

Initializing the part-turn actuator automatically

Note

Interrupting initialization

An ongoing initialization can be interrupted at any time. To do this, press . The settings configured until then are retained.

All parameters are reset to factory settings only if you have explicitly activated the preset settings in the "PRST" parameter.

Note

Commissioning of a tight-closing valve

If the valve is tight-closing, set the "YCLS (Page 155)" parameter before commissioning. This ensures that the end positions are approached for at least 15 seconds during initialization.

1. Switch to the "Configuration" mode. To do this, press the  button for at least 5 seconds until the display shows the following:



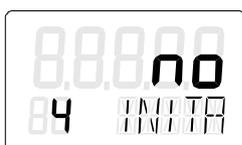
2. Use the  button to change from linear actuator to part-turn actuator until the display shows the following:



3. Call the "2.YAGL" parameter. To do this, briefly press the  button. This parameter has already been set to 90° automatically. The display shows the following:



4. Call the "4.INITA" parameter. To do this, briefly press the  button. The display shows the following:



5. Start the initialization process. To do this, press the  button for at least 5 seconds until the display shows the following:



The positioner runs through several initialization steps during the automatic initialization process. The lower line of the display indicates which initialization step is currently being run through. The initialization process depends on the actuator used, and takes up to 15 minutes.

6. The following display indicates that the initialization is complete. The total angle of rotation of the actuator is shown in the upper line of the display.



See also

Sequence of automatic initialization (Page 106)

7.8.3 Manual initialization of part-turn actuators

You can use this function to initialize the positioner without needing to move the actuator to the lower and upper endstops. The lower and upper endstops of the actuator travel are set manually. When the control parameters are optimized, the further initialization process runs automatically.

Requirements

The following requirements must be met before you activate the manual initialization:

1. The positioner is prepared for use on part-turn actuators.
2. The actuator can be moved completely.
3. The displayed potentiometer position is within the permissible range between "P5.0" and "P95.0".

Note

Setting of the adjustment angle

The usual adjustment angle for part-turn actuators is 90°. Accordingly set the transmission ratio selector in the positioner to 90°.

4. For positioners with option -Z P02, adjust the pressure sensors manually as described in Manual adjustment of the pressure sensors (Page 113)

Initializing the positioner manually

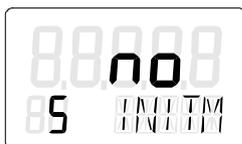
1. Switch to "Configure" mode by pressing the  button for at least 5 seconds.
2. Set the "1.YFCT" parameter (Actuator type) to "turn" by pressing the  or  button.



3. Navigate to the "2.YAGL" parameter with the  button. The display shows the following:



4. Navigate to the "5.INITM" parameter with the  button. The display shows the following:



5. Start the initialization by pressing the  button for at least 5 seconds. After 5 seconds, the display shows the position for the lower end position (YEND1).



6. Set the YEND1 position of the actuator by pressing the  or  button.
7. Confirm with the  button.

Note

"RANGE" appears on the display

The lower end position is outside the permissible measuring range.

- Adjust the friction clutch until the display shows "OK" and press the  button.

8. Set the YEND2 position (upper end position) of the actuator by pressing the  or  button.



9. Confirm with the  button. The position of the actuator is applied.

Note

"RANGE" appears on the display

The upper end position is outside the permissible measuring range.

1. Adjust the friction clutch until the display shows "OK" and press the  button.
2. Start the initialization process again.

10. The initialization process is automatically resumed. The lower line of the display indicates which initialization step is currently being run through. The following display indicates that the initialization is complete:



7.9 Canceling initialization

1. Press the  button.
 - Canceling automatic initialization: the display shows "INITA".
 - Canceling manual initialization: the display shows "INITM".The positioner is in the "Configuration" mode.
2. Exit the "Configuration" mode. To do this, press the  button for at least 5 seconds. The software version is displayed. After releasing the  button, the positioner is in "P manual mode". The positioner is not initialized.

7.10 Replacing the positioner during operation

7.10.1 Introduction

There are two ways of replacing a positioner when the equipment is in operation, without having to interrupt the process.

The two options depend on whether your positioner has communication.

Note

Initialization

The positioner can be replaced without having to interrupt the ongoing process. However, copying and transferring of the initialization parameters only allows an approximate adjustment of the positioner to your actuator. Following initialization, the positioner initially works with the manually defined parameters.

- For this reason, an automatic or manual initialization should be carried out as soon as possible.

Note

Deferred initialization

Initialize the new positioner as soon as possible. The following properties can be ensured only after initializing:

- Optimum adjustment of the positioner as per the mechanical and dynamic properties of the actuator
 - Non-deviating position of endstops
 - Correctness of the maintenance data
-

General requirements

- The rotation angle range is $\leq 100^\circ$.
- The positioners are interchangeable with the following HW versions:

| HW version on the name-plate | Interchangeable with | $\geq 1.00.xx$ | $\geq 1.01.xx$ |
|------------------------------|----------------------|----------------|----------------|
| $\geq 1.00.xx$ | \Rightarrow | ✓ | ✓ |
| $\geq 1.01.xx$ | \Rightarrow | - | ✓ |

The devices that do not have a HW version on the nameplate correspond to HW version $\geq 1.00.xx$.

7.10.2 Replacing the positioner with communication

Requirement

You have an engineering system with the current device description file.

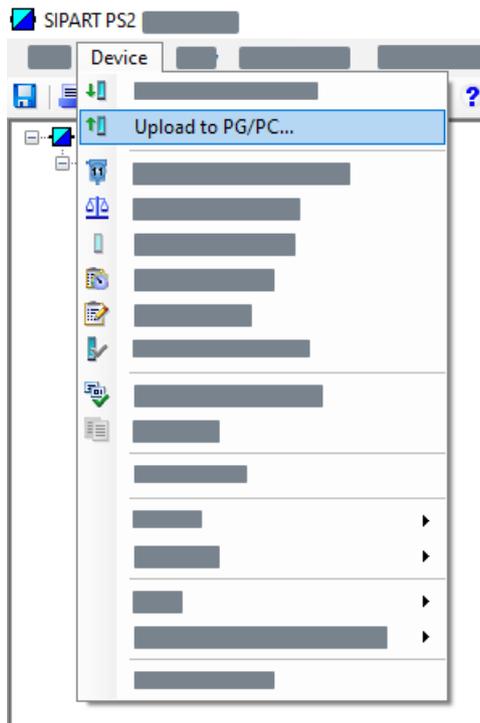
Product compatibility (Page 16)

Your previous positioner is already initialized and in operation.

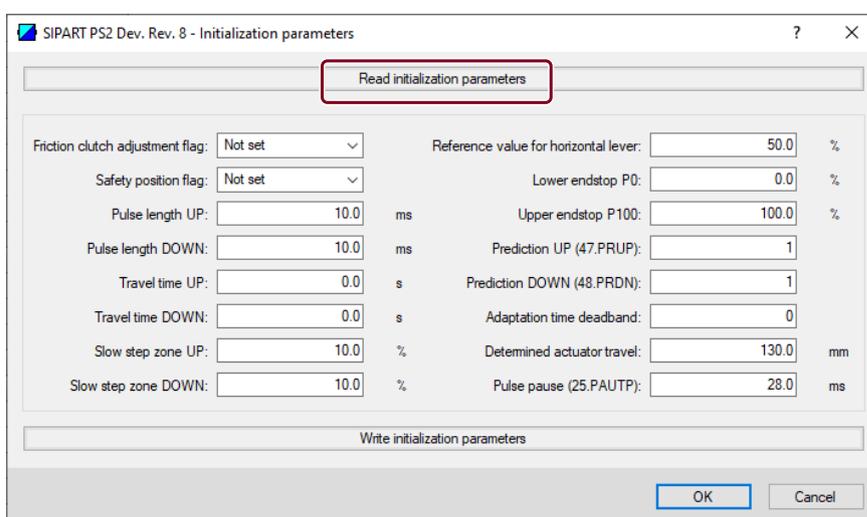
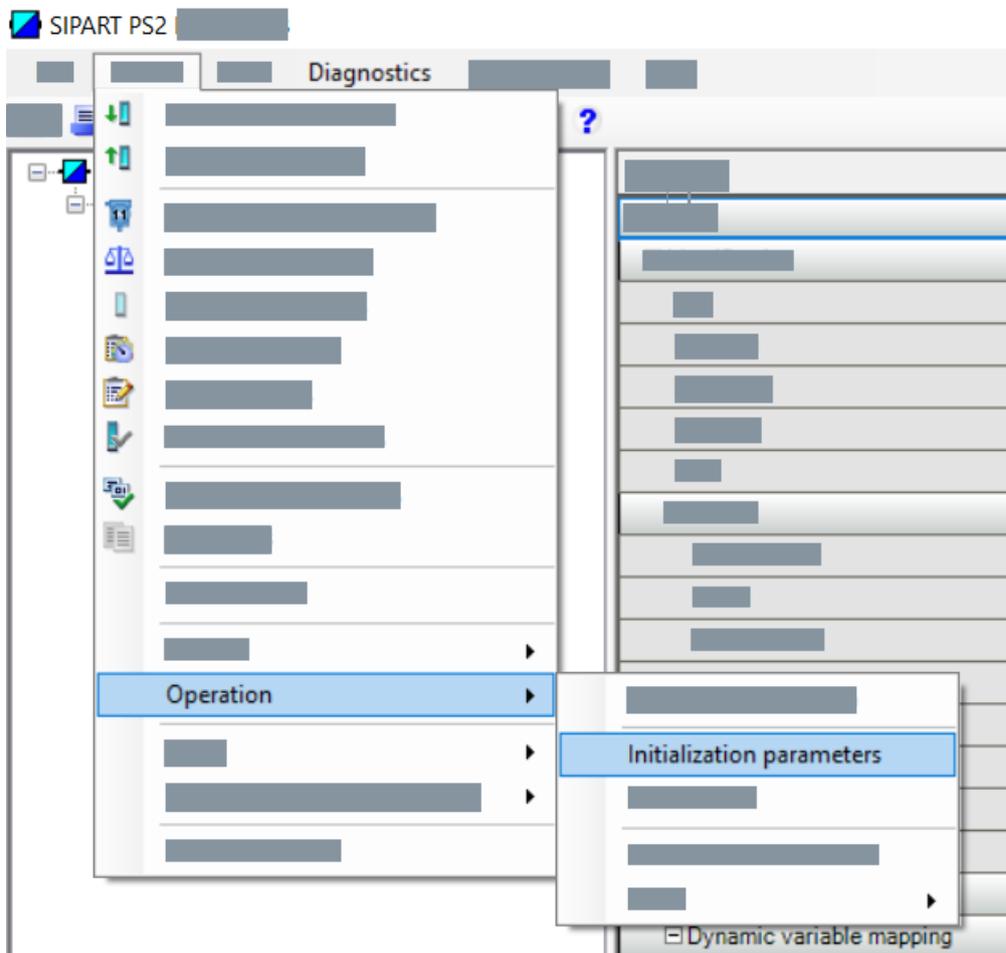
With communication

1. Fix the actuator at its current position mechanically or pneumatically.
Use the locking function of your mounting kit, if available.
2. Note the actual position value from the previous positioner.

3. Transfer the configuration parameters of the previous positioner to the Engineering System. Shown below using SIMATIC PDM as an example:



- Transfer the initialization parameters from the previous positioner to the engineering system using the "Initialization parameters" function:

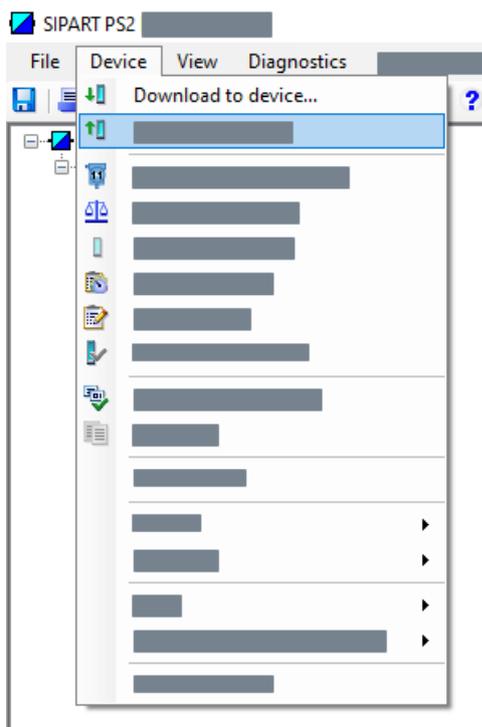


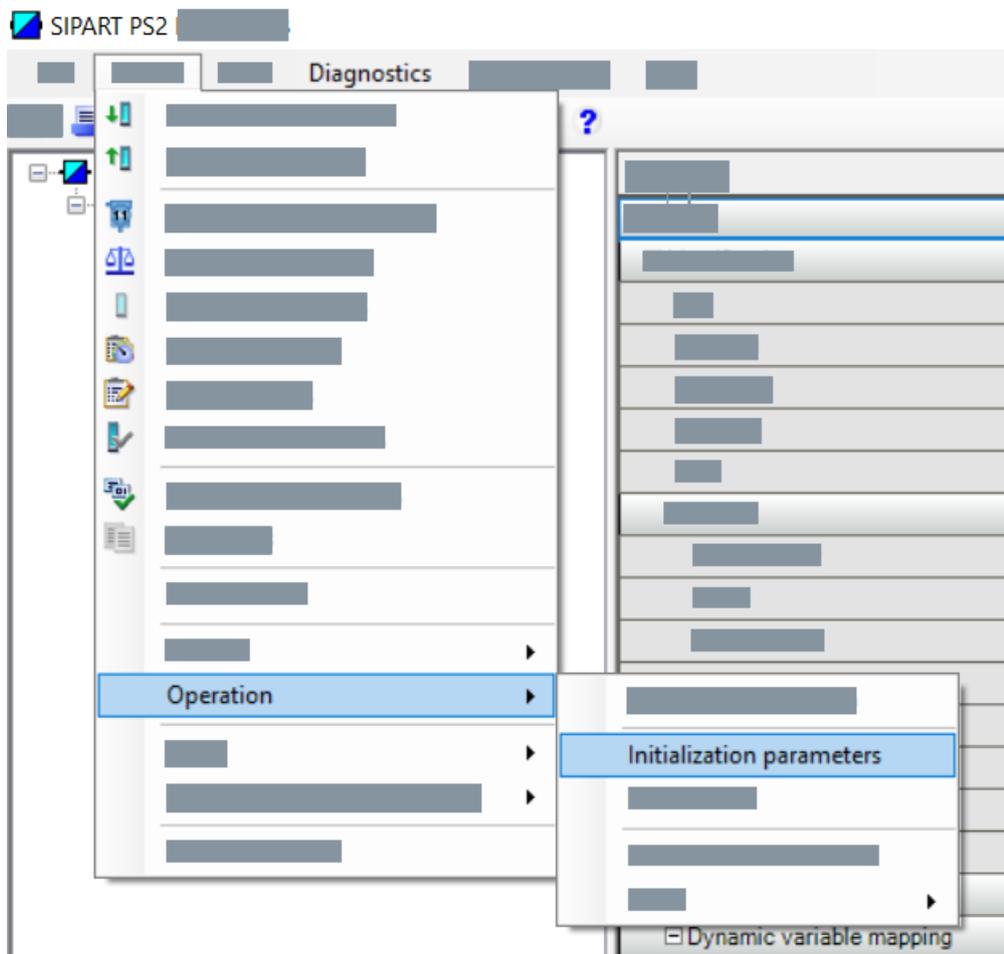
- Save the configuration and initialization parameters in the engineering system by clicking on the  icon.

7.10 Replacing the positioner during operation

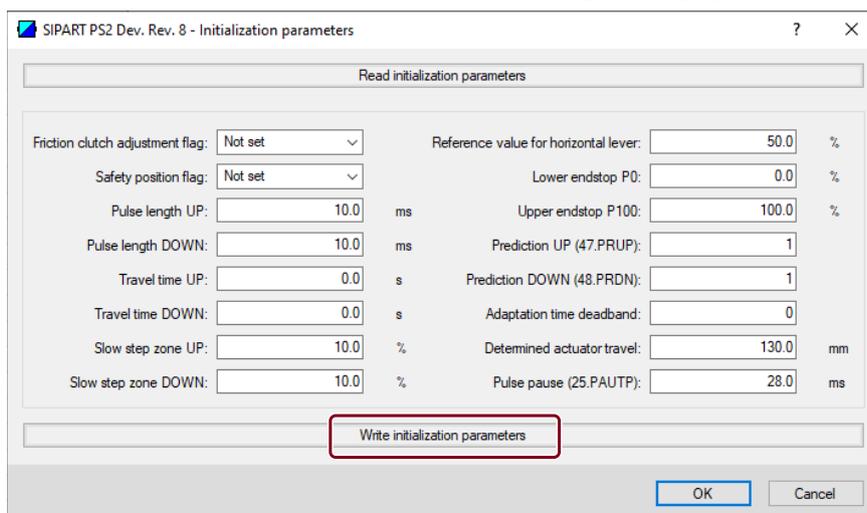
6. Replace the positioner.

7. Transfer the configuration parameters from the engineering system to the new positioner.





8. Transfer the initialization parameters from the engineering system to the new positioner.



9. Correct the deviation between the displayed actual position value and the noted actual position value using diagnostic parameter 74.
Diagnostic value '74.TRIM - Position adjustment (Page 242)
 - If your device version does not display diagnostic parameter 74, correct the deviation by adjusting the friction clutch.
10. Loosen the locking mechanism.

Note

Use the "P manual mode" operating mode for this step.

Result

The positioner is ready for operation.
You can switch to automatic mode.

7.10.3 Replacing the positioner without communication**Replacing the positioner without communication**

1. Fix the actuator at its current position mechanically or pneumatically. Use the locking function of your mounting kit, if available.
2. Note the actual position value from the previous positioner.
3. Dismount the previous positioner from the actuator.
4. To prevent interference with the ongoing process, initialize the new positioner on an actuator with a similar stroke or swivel range. Attach the new positioner to this actuator. Initialize the new positioner.
5. Then dismount the new, initialized positioner from this actuator.
6. Mount the new, initialized positioner on the fixed actuator.
7. If the displayed actual position value deviates from the noted value, follow these steps:
 - If you have a device with a friction clutch, correct the deviation by adjusting the friction clutch.
 - If you have a device without a friction clutch, set the noted actual position value with the diagnostic parameter 74 using the buttons:
Diagnostic value '74.TRIM - Position adjustment (Page 242)
8. Use the buttons on the positioner to enter the parameters which deviate from the factory setting, such as type of actuator or tight closing.
9. Switch to automatic mode (AUT) with the  button:
Section "Description of operating modes (Page 98)"
10. Release the fixing of the actuator.

7.10 Replacing the positioner during operation

Parameter assignment

8.1 Introduction to parameter assignment section

A positioner is responsible for controlling a valve and for monitoring the status of a valve. The parameters described in this section are used to optimally adapt the positioner to the valve and its application.

The parameters are divided into initialization parameters, application parameters and diagnostic parameters.

- **"1.YFCT" to "5.INITM" – Initialization parameters** (Page 144)
You use these parameters to start the automatically running initialization and adapt the positioner to the actuator. The actuator is ready for operation.
- **"6.SCUR" to "52.XDIAG" – Application parameters** (Page 148)
You use these parameters to adapt the positioner to the valve application. The following additional functions are available:
 - Setpoint preparation
 - Actual value preparation
 - Digital signals
 - Tight closing function
 - Limit detection
- **"A.PST" to "U.PRES" – Diagnostic parameters** (Page 164)
You use these parameters to set the diagnostic functions of the positioner. These include leakage monitor as well as the Partial Stroke Test. Following activation of these functions, the positioner continuously monitors the status of the valve. If you enter thresholds in the parameters of the diagnostics functions, the positioner actively signals high or low violation of these thresholds. The current monitoring state for these thresholds is displayed as a diagnostic value. For additional details on diagnostics and diagnostic values, refer to the section Diagnostics (Page 219).

Note

Display

Diagnostic parameters A to U and their sub-parameters are only displayed if setting "On1", "On2" or "On3" has been activated in parameter "XDIAG (Page 163)". The content of the diagnostic parameter is displayed if the diagnostic parameter has been activated with "On".

The positioners with a HART communication interface in combination with a host system, e.g. SIMATIC PDM or HART communicator, offer the following advantages:

- Offline tests such as Full Stroke Test (FST), Step Response Test (SRT), Multi Step Response Test (MSRT) and Valve Performance Test (VPT)
- Diagnostics cockpit, which provides an overview of the state of positioner and valve

8.1 Introduction to parameter assignment section

- Logbook with time stamp for documentation of all events, such as violation of thresholds
- Wizards that guide you through the relevant parameters during commissioning, the Partial Stroke Test and the offline tests

8.2 Configuration schematic for parameter operating principle

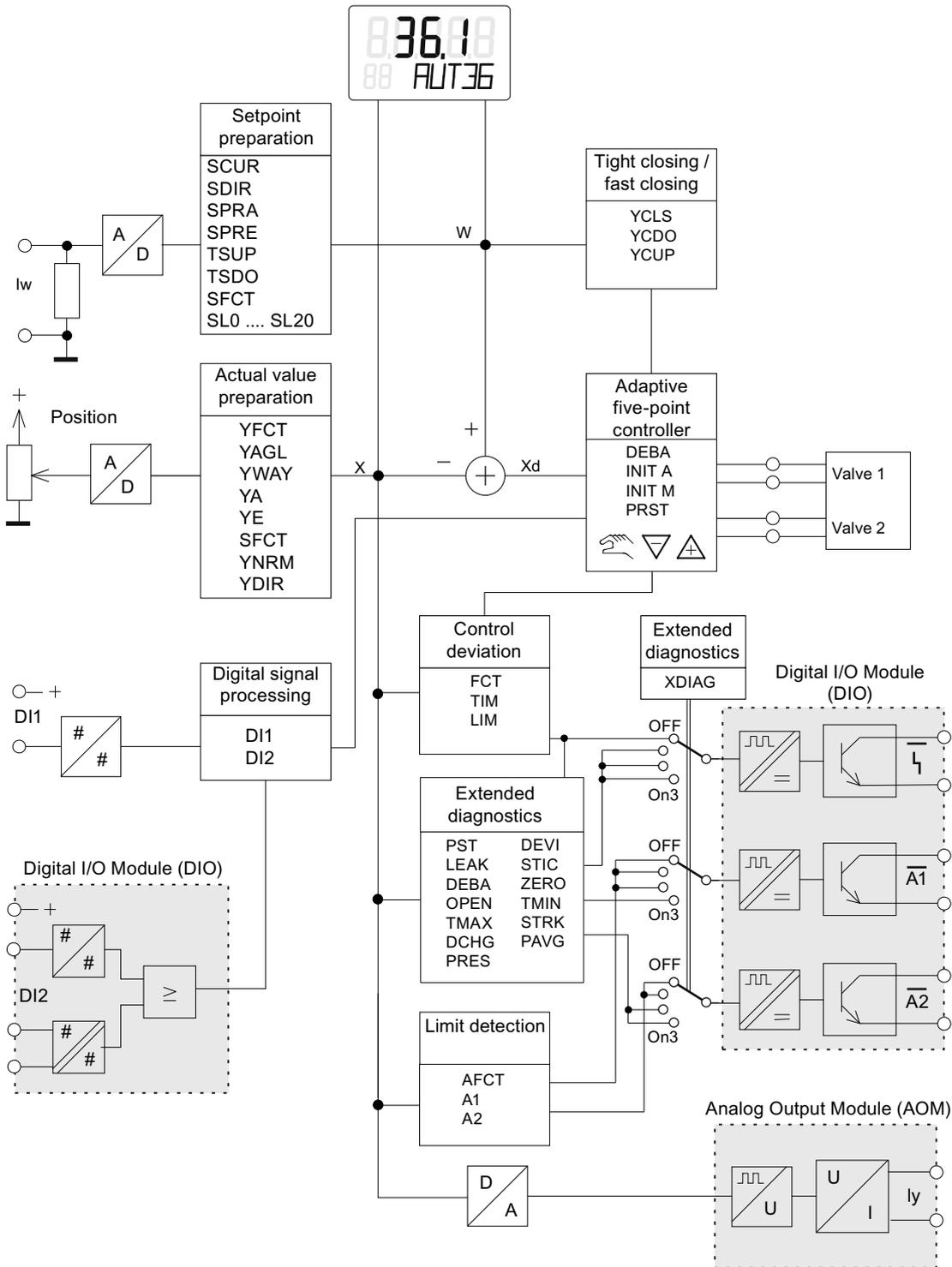


Figure 8-1 Configuration block schematic

8.3 Overview of parameters 1 to 52 (HART)

| Parameter | Function | Parameter values | | Unit |
|----------------------|---|--|---|---------|
| 1.YFCT | Type of actuator (Page 144) | Normal | Inverted | |
| | Part-turn actuator | turn | -turn | |
| | Linear actuator | WAY | -WAY | |
| | Linear actuator - carrier pin on actuator spindle | FWAY | -FWAY | |
| | Linear actuator - external linear potentiometer (e.g. with cylinder drives) | LWAY | -LWAY | |
| | Part-turn actuator with NCS/iNCS | ncSt | -ncSt | |
| | Linear actuator with NCS | ncSL | -ncSL | |
| | Linear actuator with NCS/iNCS and lever | ncSLL | -ncLL | |
| 2.YAGL | Rated angle of rotation of positioner shaft (Page 146) ¹⁾ | | | Degrees |
| | | | 33° | |
| | | | 90° | |
| 3.YWAY ²⁾ | Range of stroke (Page 147) (optional setting) ³⁾ | | | mm |
| | | | OFF | |
| | | | 5 10 15 20 (Short lever 33°, range of stroke 5 to 20 mm) | |
| | | | 25 30 35 (Short lever 90°, range of stroke 25 to 35 mm) | |
| | | 40 50 60 70 90 110 130 (Long lever 90°, range of stroke 40 to 130 mm) | | |
| 4.INITA | Initialization (automatic) (Page 147) | NOINI no / ###.# Strt | | |
| 5.INITM | Initialization (manual) (Page 148) | NOINI no / ###.# Strt | | |
| 6.SCUR | Current range of setpoint (Page 148) | | | |
| | 0 ... 20 mA | 0 mA | | |
| | 4 ... 20 mA | 4 mA | | |
| 7.SDIR | Setpoint direction (Page 149) | | | |
| | Rising | riSE | | |
| | Falling | FALL | | |
| 8.SPRA | Setpoint split range start (Page 149) | 0.0 ... 100.0 | | % |
| 9.SPRE | Setpoint split range end (Page 149) | 0.0 ... 100.0 | | % |
| 10.TSUP | Setpoint ramp up (Page 150) | Auto / 0 ... 400 | | s |
| 11.TSDO | Setpoint ramp down (Page 150) | 0 ... 400 | | s |

| Parameter | Function | Parameter values | Unit | |
|-------------------------------------|--|-------------------------------|---------|--|
| 12.SFCT | Setpoint function (Page 151) | | | |
| | Linear | LIN | | |
| | Equal percentage | 1 : 25 | 1 - 25 | |
| | | 1 : 33 | 1 - 13 | |
| | | 1 : 50 | 1 - 50 | |
| | Inverse equal percentage | 25 : 1 | n1 - 25 | |
| | | 33 : 1 | n1 - 33 | |
| | | 50 : 1 | n1 - 50 | |
| Freely adjustable | FrEE | | | |
| 13.SLO ... 33.SL20 ⁴⁾ | Setpoint turning point (Page 151) at | | | |
| 13.SLO | 0 % | 0.0 ... 100.0 | % | |
| 14.SL1 ... | 5 % | | | |
| 32.SL19 | 95 % | | | |
| 33.SL20 | 100 % | | | |
| 34.DEBA | Deadband of closed-loop controller (Page 152) | Auto / 0.1 ... 10.0 | % | |
| 35.YA | Start of the manipulated variable limit (Page 153) | 0.0 ... 100.0 | % | |
| 36.YE | End of the manipulated variable limit (Page 153) | 0.0 ... 100.0 | % | |
| 37.YNRM | Standardization of manipulated variable (Page 153) | | | |
| | To mechanical travel | MPOS | | |
| | To flow | FLoW | | |
| 38.YDIR | Direction of action of manipulated variable for display and position feedback (Page 155) | | | |
| | Rising | riSE | | |
| | Falling | FALL | | |
| 39.YCLS | Tight closing / fast closing with manipulated variable (Page 155) | | | |
| | None | no | | |
| | Tight closing Up | uP | | |
| | Tight closing Down | do | | |
| | Tight closing Up and Down | up do | | |
| | Fast closing Up | Fu | | |
| | Fast closing Down | Fd | | |
| | Fast closing Up and Down | Fu Fd | | |
| | Tight closing Up and fast closing Down | uP Fd | | |
| | Fast closing Up and tight closing Down | Fu do | | |
| 40.YCDO | Lower value for fast closing / tight closing (Page 156) | 0.0 ... 0.5 ... 100.0 | % | |
| 41.YCUP | Upper value for fast closing / tight closing (Page 156) | 0.0 ... 99.5 ... 100.0 | % | |

8.3 Overview of parameters 1 to 52 (HART)

| Parameter | Function | Parameter values | | Unit |
|-------------------------------------|--|---------------------------|------------|------|
| 42.DI1 ⁵⁾ | Function digital input DI1 (Page 157) | NO contact | NC contact | |
| | None | OFF | | |
| | Message only | on | -on | |
| | Block configuration | bLoc1 | | |
| | Block configuring and manual operation | bLoc2 | | |
| | Move process valve to position YE | uP | -uP | |
| | Move process valve to position YA | doWn | -doWn | |
| | Block movement | StoP | -StoP | |
| | Partial Stroke Test | PSt | -PSt | |
| 43.DI2 ⁵⁾ | Function digital input DI2 (Page 157) | NO contact | NC contact | |
| | None | OFF | | |
| | Message only | on | -on | |
| | Move process valve to position YE | uP | -uP | |
| | Move process valve to position YA | doWn | -doWn | |
| | Block movement | StoP | -StoP | |
| | Partial Stroke Test | PSt | -PSt | |
| | 44.AFCT ⁶⁾ | Alarm function (Page 158) | Normal | |
| None | | OFF | | |
| A1 = Min, A2 = Max | | 0000A | 0000A | |
| A1 = Min, A2 = Min | | 0000 | 0000 | |
| A1 = Max, A2 = Max | | 0000 | 0000 | |
| 45.A1 | Response threshold, alarm 1 (Page 160) | 0.0 ... 10.0 ... 100.0 | | % |
| 46.A2 | Response threshold, alarm 2 (Page 160) | 0.0 ... 90.0 ... 100.0 | | % |
| 47. ⁴⁾ FCT ⁶⁾ | Function of fault message output (Page 160) | Normal | Inverted | |
| | Fault | 04000 | 04000 | |
| | Fault + not automatic ⁷⁾ | 04nA | 04nA | |
| | Fault + not automatic + DI ⁷⁾ | 04nAb | 04nAb | |
| 48. ⁴⁾ TIM | Monitoring period for setting of fault message 'Control deviation' (Page 161) | Auto / 0 ... 100 | | s |
| 49. ⁴⁾ LIM | Response threshold for fault message 'Control deviation' (Page 161) | Auto / 0 ... 100 | | % |
| 50.PRST | Preset (Page 162) | | | |
| | Reset all parameters which can be reset by "Init", "PArA" and "diAg". | ALL | | |
| | Reset parameters 'YFCT' to 'INITM'. | Init | | |
| | Reset parameters 'SCUR' to 'LIM'. | PArA | | |
| | Reset parameters A to U of the extended diagnostics function as well as parameter 'XDIAG'. | diAg | | |
| 51.PNEUM | Pneumatics type (Page 162) | | | |
| | Standard pneumatic block | Std | | |
| | Fail in Place pneumatic block | FIP | | |
| | Operation with boosters | booSt | | |

| Parameter | Function | Parameter values | Unit |
|-----------|---|------------------|------|
| 52.XDIAG | Activation of extended diagnostics (Page 163) | | |
| | Off | OFF | |
| | Single stage message | On1 | |
| | Two stage message | On2 | |
| | Three stage message | On3 | |

- 1) Set transmission ratio selector accordingly.
- 2) Parameter only appears with "WAY", "-WAY", "ncSLL" and "-NCLL"
- 3) If used, the value on the actuator must correspond to the set range of stroke on the lever arm. Carrier must be set to the value of the actuator travel or, if this value is not scaled, to the next higher scaled value.
- 4) Setpoint turning points only appear when '12.SFCT = FrEE' is selected.
- 5) NO contact: Action when signal state is 1; NC contact: Action when signal state is 0
- 6) Normal: conductive, no fault; Inverted: deactivated, fault
- 7) '+' means: OR logic operation

8.4 Overview of diagnostic parameters

| Parameter | Function | Parameter values | Unit |
|---------------------|---|-----------------------------|------|
| A. ^L PST | Partial Stroke Test (PST) with the following parameters: | | |
| A1.STPOS | Start position | 0.0 ... 100.0 | % |
| A2.STTOL | Start tolerance | 0.1 ... 2.0 ... 10.0 | % |
| A3.STRKH | Stroke height | 0.1 ... 10.0 ... 100.0 | % |
| A4.STRKD | Stroke direction | uP / do / uP do | |
| A5.RPMD | Ramp mode | OFF / On | %/s |
| A6.RPRT | Ramp rate | 0.1 ... 1.0 ... 100.0 | |
| A7.FLBH | Behavior after failed PST | Auto / HoLd / AirIn / AirOu | |
| A8.INTRV | Test interval | OFF / 1 ... 365 | Days |
| A9.PSTIN | Reference stroke time for PST | NOINI/(C)##.#/FdIni/rEAL | s |
| AA.FACT1 | Factor 1 | 0.1 ... 1.5 ... 100.0 | |
| Ab.FACT2 | Factor 2 | 0.1 ... 3.0 ... 100.0 | |
| AC.FACT3 | Factor 3 | 0.1 ... 5.0 ... 100.0 | |
| A. ^L PST | Partial Stroke Test (PST) with option -Z P02 with the following parameters: | | |

8.4 Overview of diagnostic parameters

| Parameter | Function | Parameter values | Unit |
|-----------|---|--|------|
| A1.STPOS | Start position | 0.0 ... 100.0 | % |
| A2.STTOL | Start tolerance | 0.1 ... 2.0 ... 10.0 | % |
| A8.INTRV | Test interval | OFF / 1 ... 365 | Days |
| Ad.ENPOS | End position | 0.0 ... 90.0 ... 100.0 | % |
| AE.ENTOL | End tolerance | 1.0 ... 5.0 ... 20.0 | % |
| AF.BOLIM | Breakout pressure limit | 0.1 ... 7.0 | bar |
| AG.BOTOL | Breakout pressure tolerance | 0.1 ... 6.0 | bar |
| AH.PSTDO | Time to end position | 1 ... 80 ... 300 | s |
| AJ.PSTUP | Time back to start position | 0 ... 300 | s |
| AL.PSTRP | Test repetitions | 0 ... 3 | |
| AY.PSTIN | Start PST reference | " leer " / C-Err / oCAY / noINI / FdInI / SdrEF | |
| b.↳DEVI | Monitoring of dynamic control valve behavior with the following parameters: | | |
| b1.TIM | Time constant | Auto / 1 ... 400 | s |
| b2.LIMIT | Limit | 0.1 ... 1.0 ... 100.0 | % |
| b3.FACT1 | Factor 1 | 0.1 ... 5.0 ... 100.0 | |
| b4.FACT2 | Factor 2 | 0.1 ... 10.0 ... 100.0 | |
| b5.FACT3 | Factor 3 | 0.1 ... 15.0 ... 100.0 | |
| C.↳LEAK | Monitoring/compensation of pneumatic leakage with the following parameters: | | |
| C1.LIMIT | Limit | 0.1 ... 30.0 ... 100.0 | % |
| C2.FACT1 | Factor 1 | 0.1 ... 1.0 ... 100.0 | |
| C3.FACT2 | Factor 2 | 0.1 ... 1.5 ... 100.0 | |
| C4.FACT3 | Factor 3 | 0.1 ... 2.0 ... 100.0 | |

| Parameter | Function | Parameter values | Unit |
|--|--|-------------------------------|------|
| d.↳STIC | Monitoring of stiction (slipstick) with the following parameters: | | |
| d1.LIMIT | Limit | 0.1 ... 1.0 ... 100.0 | % |
| d2.FACT1 | Factor 1 | 0.1 ... 2.0 ... 100.0 | |
| d3.FACT2 | Factor 2 | 0.1 ... 5.0 ... 100.0 | |
| d4.FACT3 | Factor 3 | 0.1 ... 10.0 ... 100.0 | |
| E.↳DEBA | Monitoring of deadband with the following parameters: | | |
| E1.LEVL3 *) | Threshold | 0.1 ... 2.0 ... 10.0 | % |
| *) The values are monitored in the range of '0.1' to '2.9'. Values between '3.0' and '10.0' are not monitored. | | | |
| F.↳ZERO | Monitoring of lower endstop with the following parameters: | | |
| F1.LEVL1 | Threshold 1 | 0.1 ... 1.0 ... 10.0 | % |
| F2.LEVL2 | Threshold 2 | 0.1 ... 2.0 ... 10.0 | |
| F3.LEVL3 | Threshold 3 | 0.1 ... 4.0 ... 10.0 | |
| G.↳OPEN | Monitoring of upper endstop with the following parameters: | | |
| G1.LEVL1 | Threshold 1 | 0.1 ... 1.0 ... 10.0 | % |
| G2.LEVL2 | Threshold 2 | 0.1 ... 2.0 ... 10.0 | |
| G3.LEVL3 | Threshold 3 | 0.1 ... 4.0 ... 10.0 | |
| H.↳TMIN | Monitoring of lower limit temperature with the following parameters: | | |

| Parameter | Function | Parameter values | | Unit | |
|-----------|---|-----------------------------|----------------------|---------|---------------------|
| H1.TUNIT | Temperature unit | °C | °F | °C / °F | |
| | H2.LEVL1 | Threshold 1 | -40 ... -25 ... 90 | | -40 ... -13 ... 194 |
| | H3.LEVL2 | Threshold 2 | -40 ... -30 ... 90 | | -40 ... -22 ... 194 |
| | H4.LEVL3 | Threshold 3 | -40 ... 90 | | -40 ... 194 |
| J.↳TMAX | Monitoring of upper limit temperature with the following parameters: | | | | |
| J1.TUNIT | Temperature unit | °C / °F | °F | °C / °F | |
| | J2.LEVL1 | Threshold 1 | -40 ... 75 ... 90 | | -40 ... 167 ... 194 |
| | J3.LEVL2 | Threshold 2 | -40 ... 80 ... 90 | | -40 ... 176 ... 194 |
| | J4.LEVL3 | Threshold 3 | -40 ... 90 | | -40 ... 194 |
| L.↳STRK | Monitoring of number of total strokes with the following parameters: | | | | |
| L1.LIMIT | Limit | 1 ... 1E6 ... 1E8 | | | |
| | L2.FACT1 | Factor 1 | 0.1 ... 1.0 ... 40.0 | | |
| | L3.FACT2 | Factor 2 | 0.1 ... 2.0 ... 40.0 | | |
| | L4.FACT3 | Factor 3 | 0.1 ... 5.0 ... 40.0 | | |
| O.↳DCHG | Monitoring of number of changes in direction with the following parameters: | | | | |
| O1.LIMIT | Limit | 1 ... 1E6 ... 1E8 | | | |
| | O2.FACT1 | Factor 1 | 0.1 ... 1.0 ... 40.0 | | |
| | O3.FACT2 | Factor 2 | 0.1 ... 2.0 ... 40.0 | | |
| | O4.FACT3 | Factor 3 | 0.1 ... 5.0 ... 40.0 | | |
| P.↳PAVG | Monitoring the position average value with the following parameters: | | | | |
| P1.TBASE | Time basis of average value generation | 0.5h / 8h / 5d / 60d / 2.5y | | | |
| P2.STATE | Status of monitoring of position average value | IdLE / rEF / ###.# / Strt | | | |
| P3.LEVL1 | Threshold 1 | 0.1 ... 2.0 ... 100.0 | | % | |
| P4.LEVL2 | Threshold 2 | 0.1 ... 5.0 ... 100.0 | | % | |
| P5.LEVL3 | Threshold 3 | 0.1 ... 10.0 ... 100.0 | | % | |

See also

'52.XDIAG' Activating for extended diagnostics (Page 163)

8.5 Description of parameters

| Parameter | Function | Parameter values | Unit |
|-----------|------------------------------|------------------------|------|
| U.4PRES | Pressure monitoring | | |
| U1.PUNIT | Pressure unit | bAr / PSI / MPA | |
| U2.P_HYS | Hysteresis for limits | 0.200 ... 1.000 | bar |
| | | 2.90 ... 14.50 | psi |
| | | 0.020 ... 0.100 | MPa |
| U3.PFRL | Behavior lower limit PZ | Cont / HoLd | |
| U4.PFRUL | Behavior upper limit PZ | Cont / HoLd | |
| U5.PZMLL | Lower limit PZ | 1.400 ... 7.000 | bar |
| | | 20.30 ... 101.52 | psi |
| | | 0.140 ... 0.700 | MPa |
| U6.PZMUL | Upper limit PZ | 1.400 ... 7.000 | bar |
| | | 20.30 ... 101.52 | psi |
| | | 0.140 ... 0.700 | MPa |
| U7.PCL | Limit actuating pressure Y1 | 0.000 ... 7.000 | bar |
| | | 0.00 ... 101.52 | psi |
| | | 0.000 ... 0.700 | MPa |
| U8.LRL | Limit +/- Leakage | 0.000 ... 7.000 | bar |
| | | 0.00 ... 101.52 | psi |
| | | 0.000 ... 0.700 | MPa |
| U9.TPMT | Time pressure measurement Y1 | 1 ... 100 | s |

8.5 Description of parameters

8.5.1 Initialization parameters 1 to 5

8.5.1.1 '1.YFCT' type of actuator

Requirement: Type of actuator as well as mounting type and direction of action are known.

| | | |
|--------------------|--|--|
| Possible settings: | Actuator with normal direction of action | Actuator with inverted direction of action |
| | <ul style="list-style-type: none"> • turn • WAY • FWAY • LWAY • ncSt • ncSL • ncSLL | <ul style="list-style-type: none"> • -turn • -WAY • -FWAY • -LWAY • -ncSt • -ncSL • -ncLL |

| | |
|--------------|---|
| Purpose: | <p>Use this parameter to adjust the positioner to the respective actuator.</p> <ul style="list-style-type: none"> • turn/-turn: Use this setting for a part-turn actuator with a directly mounted positioner. • WAY/-WAY: Use this setting. <ul style="list-style-type: none"> – For a linear actuator with a carrier pin mounted on the lever – In conjunction with devices that use an internal sensor • FWAY/-FWAY: Use this setting. <ul style="list-style-type: none"> – For a linear actuator with a carrier pin mounted on the actuator spindle – In conjunction with devices that use an internal sensor • LWAY/-LWAY: Use this setting for an external linear potentiometer on a linear actuator (e.g. with cylinder drives). • ncSt/-ncSt: Use this setting for a part-turn actuator for: <ul style="list-style-type: none"> – An NCS sensor 6DR4004-.N.10 and -.N.40 – A positioner 6DR5...-0..9.-....- L1A with internal NCS module – A positioner 6DR59* with accessory NCS module 6DR4004-5L/-5LE – Position Transmitter 6DR4004-2ES, -3ES and -4ES • ncSL/-ncSL: Use this setting for an NCS sensor 6DR4004-.N.20 on a linear actuator for strokes < 14 mm (0.55 inch). • ncSLL/-ncLL: Use this setting for a linear actuator for: <ul style="list-style-type: none"> – An NCS sensor 6DR4004-.N.30 for strokes > 14 mm (0.55 inch). – A positioner 6DR5...-0..9.-....- L1A with internal NCS module – A positioner 6DR59* with accessory NCS module 6DR4004-5L/-5LE – Position Transmitter 6DR4004-2ES, -3ES and -4ES <p>In the case of actuators with inverted direction of action, use the settings with the minus sign, e.g. -turn.</p> |
| Description: | <p>Meaning of actuator with normal direction of action:</p> <ul style="list-style-type: none"> • Part-turn actuator closes when the drive shaft, positioner shaft or magnet of the NCS sensor rotates in the clockwise direction. • Linear actuator closes when the actuator spindle moves downwards and the positioner shaft or magnet of the NCS sensor rotates in the anti-clockwise direction. <p>Meaning for actuator with inverted direction of action:</p> <ul style="list-style-type: none"> • Part-turn actuator closes when the drive shaft, positioner shaft or magnet of the NCS sensor rotates in the anti-clockwise direction. • Linear actuator closes when the actuator spindle moves upwards and the positioner shaft or magnet of the NCS sensor rotates clockwise. |

Additional information:

- The '3.YWAY' Range of stroke (Page 147) parameter is displayed only for 'WAY', '-WAY', 'ncSLL' or '-ncLL'.
- turn/-turn: The '2.YAGL' Rated angle of rotation of feedback (Page 146) parameter is automatically set to 90° and cannot be changed.
- WAY/-WAY: The positioner compensates the non-linearity. The non-linearity is caused by the transformation of the linear movement of the linear actuator into the rotary movement of the positioner shaft. For correct compensation, follow the instructions in section "Preparing linear actuators for commissioning (Page 115)".

Factory setting: WAY

8.5.1.2 '2.YAGL' Rated angle of rotation of feedback

Condition: Transmission ratio selector and the value set in the '2.YAGL' parameter match. Only then does the value shown on the display match the actual position.

- Possible settings:
- 33°
 - 90°

Purpose: Use this parameter for a linear actuator. For a linear actuator, set an angle of 33° or 90° depending on the range of stroke. The current setting of the actuator is then measured more accurately. The following is applicable:

- 33°: Strokes ≤ 20 mm
- 90°: Strokes 25 mm to 35 mm
- 90°: Strokes > 40 mm to 130 mm

Use the mounting kit:

- 6DR4004-8V for strokes up to 35 mm
- 6DR4004-8L for strokes greater than 35 mm up to 130 mm

'2.YAGL' can only be adjusted if '1.YFCT' is set to 'WAY'/'-WAY' or 'FWAY'/'-FWAY'.

With all other settings of '1.YFCT', an angle of 90° is automatically set for '2.YAGL'.

Factory setting: 33°

See also

Sequence of automatic initialization (Page 106)

8.5.1.3 '3.YWAY' Range of stroke

| | |
|--------------------|--|
| Condition: | <ul style="list-style-type: none"> Positioner is mounted. Carrier pin is mounted on the lever in accordance with the actuator's range of stroke as described in section Mounting to linear actuator (Page 38). |
| Possible settings: | <ul style="list-style-type: none"> OFF 5.0 10.0 15.0 20.0 25.0 30.0 35.0 40.0 50.0 60.0 70.0 90.0 110.0 130.0 |
| Purpose: | <p>Use this parameter to display the determined stroke value in mm when initialization of a linear actuator has been completed.</p> <p>If you select the 'OFF' setting, the real stroke is not displayed after initialization.</p> <p>From the possible settings shown above, select the value which corresponds to the range of stroke of your actuator in mm.</p> <p>If the range of stroke of the actuator does not correspond to a possible setting, use the next higher value. Use the value specified on the nameplate of the actuator for this purpose.</p> <p>'3.YWAY' is only displayed if '1.YFCT' is set to 'WAY'/'-WAY' or 'ncSLL'/'ncLL'.</p> |
| Factory setting: | OFF |

See also

'1.YFCT' type of actuator (Page 144)

8.5.1.4 '4.INITA' Initialization (automatic)

| | |
|--------------------|---|
| Possible settings: | <ul style="list-style-type: none"> NOINI no / ###.# Strt |
| Purpose: | <p>Use this parameter to start the automatic initialization process.</p> <ol style="list-style-type: none"> Select the "Strt" setting. Then press the  button for at least 5 seconds. <p>The lower line of the display indicates which initialization step is currently being run through.</p> |
| Factory setting: | NOINI |

8.5 Description of parameters

8.5.1.5 '5.INITM' Initialization (manual)

| | |
|--------------------|--|
| Possible settings: | <ul style="list-style-type: none">• NOINI• no / ###.#• Strt |
| Purpose: | Use this parameter to start the manual initialization process. <ol style="list-style-type: none">1. Select the "Strt" setting.2. Then press the  button for at least 5 seconds. |
| Description: | If the positioner has already been initialized and if the "4.INITA" and "5.INITM" values are set, it is possible to reset the positioner to the non-initialized status. To do this, press the  button for at least 5 seconds. |
| Factory setting: | NOINI |

8.5.2 Application parameters 6 to 52

8.5.2.1 '6.SCUR' Current range of setpoint

| | |
|--------------------|--|
| Requirement: | <ul style="list-style-type: none">• You have a positioner in the 2-wire, 3-wire, 4-wire version.• Positioner is connected in accordance with the connection graphics for 2/3/4-wire systems shown in section "Electrical wiring (Page 79)". |
| Possible settings: | <ul style="list-style-type: none">• 0 MA• 4 MA |
| Purpose: | This parameter is used to set the current range of the setpoint. The selection of the current range depends on the type of connection. The "0 MA" setting (0 to 20 mA) is only possible for three-wire and four-wire connections. |
| Factory setting: | 4 MA |

8.5.2.2 '7.SDIR' Setpoint direction

| | |
|--------------------|--|
| Possible settings: | <ul style="list-style-type: none"> • riSE • FALL |
| Purpose: | <p>This parameter is used to set the setpoint direction. The setpoint direction is used to reverse the direction of action of the setpoint.</p> <ul style="list-style-type: none"> • Rising (riSE): A higher value at the setpoint input results in opening of the valve. • Falling (FALL): A higher value at the setpoint input results in closing of the valve. <p>The setpoint direction is primarily used for the split-range mode and for single-acting actuators with the safety setting 'uP'.</p> |
| Factory setting: | riSE |

8.5.2.3 '8.SPRA' Setpoint split range start / '9.SPRE' Setpoint split range start end

| | | |
|-------------------|---|--------------------|
| Adjustment range: | 0.0 ... 100.0 | |
| Purpose: | <p>With these two parameters in combination with parameter "'7.SDIR' Setpoint direction (Page 149)", you can limit the effective setpoint. Solve split-range tasks with the following characteristic curves:</p> <ul style="list-style-type: none"> • Rising/falling • Falling/rising • Falling/falling • Rising/rising | |
| Factory setting: | With "SPRA": 0.0 | With "SPRE": 100.0 |

8.5 Description of parameters

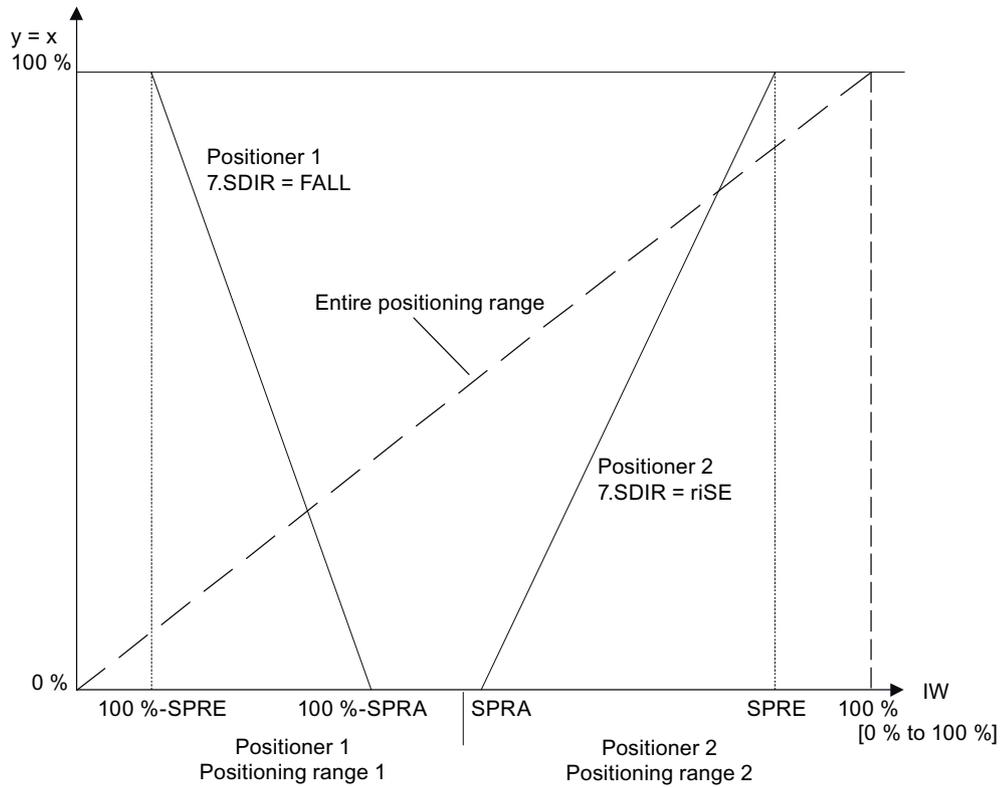


Figure 8-2 Example: Split-range operation with 2 positioners

8.5.2.4 '10.TSUP' Setpoint ramp UP / '11.TSDO' Setpoint ramp DOWN

Possible settings:

With "TSUP"

- Auto
- 0 ... 400

With "TSDO"

- 0 ... 400

Purpose:

The setpoint ramp is effective in "Automatic" mode and limits the speed of change of the effective setpoint. The parameter specifies the duration in seconds that the positioner needs to move the stroke from 0 to 100%. Example: If "TSUP" = 10 is set, the positioner needs 10 s to move the stroke from 0 to 100% and 1 s to move the stroke from 0 to 10%.

When switching over from "Manual" mode to "Automatic" mode, the setpoint ramp is used to adjust the effective setpoint to the setpoint of the positioner.

This smooth switching from "Manual" mode to "Automatic" mode prevents pressure excess in long pipelines.

The "TSUP = Auto" parameter means that the slower of the two actuating times determined during initialization is used for the setpoint ramp. Parameter value "TSDO" then has no effect.

Factory setting:

0

8.5.2.5 '12.SFCT' Setpoint function

- Possible settings:
- Lin
 - 1 - 25
 - 1 - 33
 - 1 - 50
 - n1 - 25
 - n1 - 33
 - n1 - 50
 - FrEE
- Purpose: This parameter is used to linearize nonlinear process valve characteristics. Optional flow characteristics as shown in the figure in the '13.SL0' ... '33.SL20' Setpoint turning point (Page 151) parameter description are simulated for linear process valve characteristics.
- Factory setting: Lin

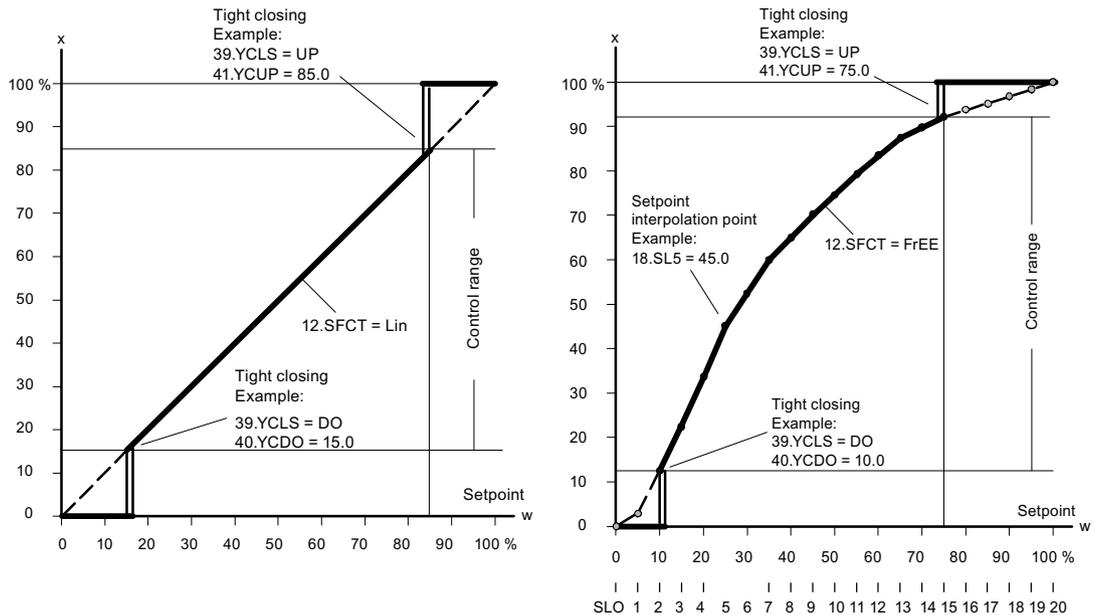
Seven process valve characteristics are stored in the positioner and are selected using the 'SFCT' parameter:

| Process valve characteristic | | Set with parameter value |
|------------------------------|------|--------------------------|
| Linear | | Lin |
| Equal percentage | 1:25 | 1-25 |
| Equal percentage | 1:33 | 1-33 |
| Equal percentage | 1:50 | 1-50 |
| Inverse equal percentage | 25:1 | n1-25 |
| Inverse equal percentage | 33:1 | n1-33 |
| Inverse equal percentage | 50:1 | n1-50 |
| Freely adjustable | | FrEE |

8.5.2.6 '13.SL0' ... '33.SL20' Setpoint turning point

- Setting range: 0.0 ... 100.0
- Purpose: These parameters are used to assign a flow coefficient in units of 5% to each setpoint turning point. The setpoint breakpoints form a polyline with 20 linear segments which models the process valve characteristic; see figure below.
- Factory setting: "0", "5" ... "95", "100"

8.5 Description of parameters



Setpoint characteristic curves, standardization of manipulated variables, and tight closing function

Input of the setpoint turning points is only possible if the "'12.SFCT' Setpoint function (Page 151)" parameter is set to "FrEE". You can only enter one monotone rising characteristic curve and two consecutive interpolation points must differ by at least 0.2%.

8.5.2.7 '34.DEBA' Deadband of closed-loop controller

Possible settings:

- Auto
- 0.1 ... 10.0

Purpose:

This parameter is used with the "Auto" setting to adjust the deadband in automatic mode continually and adaptively to the requirements of the control loop. If a regulator oscillation is detected, then the deadband is incrementally enlarged. The reverse adaptation takes place using a time criterion.

The deadband is set using the values 0.1 to 10.0. The value is given in percent. Control oscillations can then be suppressed. The smaller the deadband, the better the control accuracy.

Factory setting:

Auto

8.5.2.8 '35.YA' Start of manipulated variable limit / '36.YE' End of manipulated variable limit

| | | |
|------------------|---|------------------|
| Setting range: | 0.0 ... 100.0 | |
| Purpose: | <p>These parameters are used to limit the mechanical actuator travel from stop to stop to the configured values. The value is given in percent. This allows the mechanical travel range of the actuator to be limited to the effective flow, preventing integral saturation of the controlling closed-loop controller.</p> <p>See the figure in the description of the '37.YNRM' Standardization of manipulated variable (Page 153) parameter.</p> <p>'Dead angle' function</p> <p>The dead angle is the angle range in which the process valve allows no flow. The dead angle range starts at the lower endstop of the valve, for example, and ends at the angle at which the medium begins to flow. Use this function if you want to use the entire signal range for valve control (for example, 4 mA to 20 mA).</p> <p>To now use the entire signal range for process valve control, set the lower manipulated variable limit (YA) to the percentage value at which the medium begins to flow.</p> <p>To display the new initial value as 0%, set '37.YNRM' Standardization of manipulated variable (Page 153) to 'Flow'.</p> | |
| Factory setting: | When 'YA': 0.0 | When 'YE': 100.0 |

Note

'YE' must always be set larger than 'YA'.

8.5.2.9 '37.YNRM' Standardization of manipulated variable

| | |
|--------------------|--|
| Possible settings: | <ul style="list-style-type: none"> • MPOS • FLoW |
| Purpose: | <p>Use the '35.YA' Start of manipulated variable limit / '36.YE' End of manipulated variable limit (Page 153) parameters to limit the manipulated variable. This limitation causes two different scaling types 'MPOS' and 'FLoW' for the display and for the position feedback through the current output.</p> <p>The MPOS scale shows the mechanical positions from 0% to 100% between the upper and lower endstops of the initialization. The position is not influenced by the '35.YA' Start of manipulated variable limit / '36.YE' End of manipulated variable limit (Page 153) parameters. The 'YA' and 'YE' parameters are shown in the MPOS scale.</p> |

8.5 Description of parameters

The FLoW scale is the standardization from 0% to 100% in the range between the 'YA' and 'YE' parameters. Over this range, the setpoint w is also always 0% to 100%. This results in a more or less flow-proportional display and position feedback. The flow-proportional display and position feedback also results from the use of process valve characteristics.

In order to calculate the control deviation, the setpoint in the display is also shown in the corresponding scale.

Below, the example of an 80-mm linear actuator is used to illustrate the dependence of the stroke on the scaling as well as on the 'YA' and 'YE' scaling parameters; see the following figure.

Factory setting:

MPOS

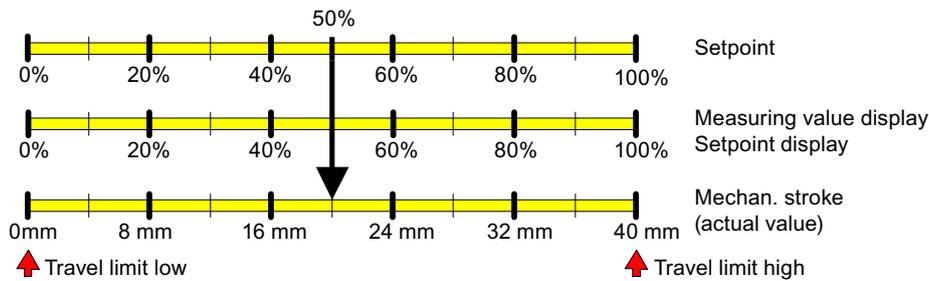


Figure 8-3 YNRM = MPOS or YNRM = FLoW; default: YA = 0 % and YE = 100 %

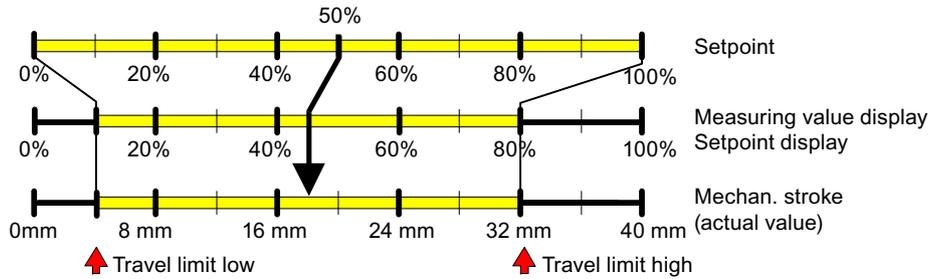


Figure 8-4 Example: YNRM = MPOS with YA = 10 % and YE = 80 %

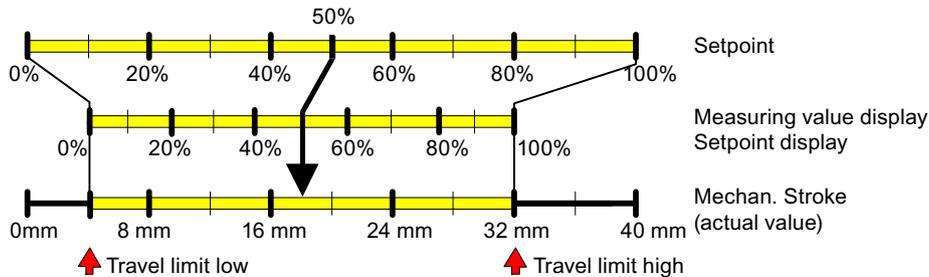


Figure 8-5 Example: YNRM = FLoW with YA = 10 % and YE = 80 %

See also

'39.YCLS' Tight closing/fast closing with manipulated variable (Page 155)

8.5.2.10 '38.YDIR' Direction of manipulated variable for display and position feedback

Possible settings: • riSE
 • FALL

Purpose: This parameter is used to set the direction of action of the display and the position feedback. The direction is rising or falling.

Factory setting: riSE

8.5.2.11 '39.YCLS' Tight closing/fast closing with manipulated variable

Possible settings: no None
 uP Tight closing Up
 do Tight closing Down
 uP do Tight closing Up and Down
 Fu Fast closing Up
 Fd Fast closing Down
 Fu Fd Fast closing Up and Down
 uP Fd Tight closing Up and fast closing Down
 Fu do Fast closing Up and tight closing Down

Purpose: This parameter is used to drive the control valve to the endstops. If the parameter is not activated, the control valve controls the two endstops which were determined during the initialization.
With tight closing, the control valve requires longer to leave the endstops. With fast closing, the endstops of the control valve are left immediately.
The tight closing and fast closing functions are activated on one side or for both endstops. Parameter 'YCLS' becomes effective if the effective setpoint:

- Is at or below the value set in the '40.YCDO' Value for tight closing/fast closing Down (Page 156)' parameter.
- Is at or above the value set in the '41.YCUP' Value for tight closing/fast closing Up (Page 156)' parameter.

Factory setting: no

8.5 Description of parameters

See the figure in the description of the '37.YNRM' Standardization of manipulated variable (Page 153) parameter and the figure in the description of the '13.SL0' ... '33.SL20' Setpoint turning point (Page 151) parameters.

Note

Activated tight closing/fast closing function

If the function is activated, then the monitoring of control deviation is turned off in the respective overflow direction for the "49.LIM" Response threshold of fault message 'Control deviation' (Page 161)' parameter. The following applies: 'YCDO: < 0 %' and 'YCUP: > 100 %'. This functionality is especially advantageous for valves with lining. For long-term monitoring of the positions of the endstops, we recommend that you activate the 'F.ZERO' and 'G.OPEN' parameters.

8.5.2.12 '40.YCDO' Value for tight closing/fast closing Down

| | |
|-------------------|--|
| Requirement: | '39.YCLS' Tight closing/fast closing with manipulated variable (Page 155) Parameter is set to 'do', 'uP do', 'Fd', 'Fu Fd', 'uP Fd' or 'Fu do' |
| Adjustment range: | 0.0 ... 100.0 |
| Purpose: | Use the 'YCDO' parameter to set the value as of which the "Tight closing/fast closing Down" function is activated. If the effective setpoint is at or below the value set here, the actuator moves in tight closing Down or fast closing Down. |
| Factory setting: | 0.5 |

Note

The value in the 'YCDO' parameter is always smaller than that in 'YCUP'. The tight closing/fast closing function has a fixed hysteresis of 1%. The 'YCDO' parameter is relative to the mechanical stops. The 'YCDO' is independent of the values set in the '7.SDIR' Setpoint direction (Page 149) and '38.YDIR' Direction of manipulated variable for display and position feedback (Page 155) parameters.

8.5.2.13 '41.YCUP' Value for tight closing/fast closing Up

| | |
|-------------------|---|
| Requirement: | '39.YCLS' Tight closing/fast closing with manipulated variable (Page 155) Parameter is set to 'do', 'uP do', 'Fd', 'Fu Fd', 'uP Fd' or 'Fu do' |
| Adjustment range: | 0.0 ... 100.0 |
| Purpose: | Use the 'YCUP' parameter to set the value as of which the tight closing Up or fast closing Up is activated. If the effective setpoint is at or above the value set here, the actuator moves in tight closing Up or fast closing Up. |
| Factory setting: | 99.5 |

Note

The value in the 'YCDO' parameter is always smaller than that in 'YCUP'. The tight closing/fast closing function has a fixed hysteresis of 1%. The 'YCUP' parameter is relative to the mechanical stops. The 'YCUP' is independent of the values set in the '7.SDIR' Setpoint direction (Page 149) and '38.YDIR' Direction of manipulated variable for display and position feedback (Page 155) parameters.

8.5.2.14 '42.DI1' / '43.DI2' Function digital input

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------|---|-------------------|-------------------|-----|-----|----|-----|-------|-----|-------|-------|----|-------|------|------|------|--|-----|--|-------------------|-------------------|-----|-----|----|-----|----|-----|------|-------|------|-------|-----|------|
| Setting option | <ul style="list-style-type: none"> • Digital input DI1 <table border="0"> <tr> <td>NO contact</td> <td>NC contact</td> </tr> <tr> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>on</td> <td>-on</td> </tr> <tr> <td>bloc1</td> <td>-uP</td> </tr> <tr> <td>bloc2</td> <td>-doWn</td> </tr> <tr> <td>uP</td> <td>-StoP</td> </tr> <tr> <td>doWn</td> <td>-PST</td> </tr> <tr> <td>StoP</td> <td></td> </tr> <tr> <td>PST</td> <td></td> </tr> </table> <ul style="list-style-type: none"> • Digital input DI2 <table border="0"> <tr> <td>NO contact</td> <td>NC contact</td> </tr> <tr> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>on</td> <td>-on</td> </tr> <tr> <td>uP</td> <td>-uP</td> </tr> <tr> <td>doWn</td> <td>-doWn</td> </tr> <tr> <td>StoP</td> <td>-StoP</td> </tr> <tr> <td>PST</td> <td>-PST</td> </tr> </table> | NO contact | NC contact | OFF | OFF | on | -on | bloc1 | -uP | bloc2 | -doWn | uP | -StoP | doWn | -PST | StoP | | PST | | NO contact | NC contact | OFF | OFF | on | -on | uP | -uP | doWn | -doWn | StoP | -StoP | PST | -PST |
| NO contact | NC contact | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| OFF | OFF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| on | -on | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| bloc1 | -uP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| bloc2 | -doWn | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| uP | -StoP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| doWn | -PST | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| StoP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PST | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NO contact | NC contact | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| OFF | OFF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| on | -on | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| uP | -uP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| doWn | -doWn | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| StoP | -StoP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PST | -PST | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Purpose: These parameters determine the function of the digital inputs. The possible functions are described below. The direction of action can be adapted to a normally closed or normally open mode.

- DI1 or DI2 = On or -On
Digital messages from I/O devices, e.g. from pressure or temperature switches, are read out over the communication interface or result in a response from the fault message output through an OR logic operation with other messages.
- DI1 = bLoc1
Use this parameter value to interlock the "Configuration" mode against adjustment. The lock is performed e.g. with a jumper between terminals 9 and 10.
- DI1 = bLoc2
If the DI1 digital input has been activated, 'Manual' mode is blocked in addition to "Configuration" mode.

8.5 Description of parameters

- DI1 or DI2 =
Contact uP or doWn closes or
Contact -uP or -doWn opens
If the digital input is activated, the actuator uses the value defined by the "'35.YA' Start of manipulated variable limit / '36.YE' End of manipulated variable limit (Page 153)" parameter for controlling in 'Automatic' mode.
- DI1 or DI2 =
Contact StoP closes or
Contact -StoP opens
If the digital input is activated, control of the pneumatic block is blocked in "Automatic" mode. The actuator remains at the last position. Leakage measurements can be performed in this way without using the initialization function.
- DI1 or DI2 = PSt or -PSt
By means of digital input DI1 or DI2, a Partial Stroke Test is initiated by actuation of a normally closed or normally open contact depending on the selection.
- DI1 or DI2 = OFF
No function
Special function of digital input DI1: If digital input DI1 is activated in 'P-manual mode' by means of a jumper between terminals 9 and 10, the firmware version will be displayed when the  button is pressed.

If one of the above-named functions is activated with the "DI1" and "DI2" parameters simultaneously, then: "Blocking" has priority over "uP". "uP" has priority over "doWn". "doWn" has priority over "PST".

Factory setting: OFF

8.5.2.15 '44.AFCT' Alarm function

Possible settings: See corresponding representation below

Purpose: This parameter can be used to determine the value at which going above or below a given offset or angle will result in a message. The triggering of alarms (limits) is relative to the MPOS scale. The alarms are signaled via the Digital I/O Module (DIO). In addition, alarms can also be read via the communication interface.

The direction of action of the digital outputs can be adjusted from "High active" to "Low active" for the next systems.

Factory setting: OFF

| Direction of action and hysteresis | | | |
|------------------------------------|--------------------|--------------------------|---------------|
| | | Digital I/O Module (DIO) | |
| | Examples | A1 | A2 |
| | A1 = 48 | AFCT = MIN / MAX | |
| | A2 = 52 | | |
| | Way =45 | Active | |
| | Way =50 | | |
| | Way =55 | | Active |
| | A1 = 48 | AFCT = -MIN / -MAX | |
| | A2 = 52 | | |
| | Way =45 | | Active |
| | Way =50 | Active | Active |
| | Way =55 | Active | |
| | A1 = 52 | AFCT = MIN / MAX | |
| | A2 = 48 | | |
| Way =45 | Active | | |
| Way =50 | Active | Active | |
| Way =55 | | Active | |
| A1 = 52 | AFCT = -MIN / -MAX | | |
| A2 = 48 | | | |
| Way =45 | | Active | |
| Way =50 | | | |
| Way =55 | Active | | |

Note

If extended diagnostics is activated using parameter "'52.XDIAG' Activating for extended diagnostics (Page 163)" with setting "On3", then the alarms are not output through the Digital I/O Module (DIO). Alarm A1 is output with setting "On2". However, notification via the communication interface is possible at any time.

8.5.2.18 '48.\TIM' Monitoring period for setting of fault message 'Control deviation'

| | |
|--------------------|---|
| Possible settings: | <ul style="list-style-type: none">• Auto• 0 ... 100 |
| Purpose: | The 'TIM' parameter is used to set the time in seconds within which the positioner must have reached the regulated condition. The corresponding response threshold is specified in the parameter. When the configured time is exceeded, the fault message output is set. |
| Factory setting: | Auto |

Note

Activated tight closing/fast closing function

If the function is activated, then for the 'LIM' parameter the monitoring of control deviation is turned off in the appropriate overflow direction. The following applies: 'YCD0: < 0 %' and 'YCUP: > 100 %'. This functionality is especially advantageous for valves with lining. For long-term monitoring of the end positions, we recommend that you activate the 'F.LZERO' and 'G.LOPEN' parameters.

8.5.2.19 '49.\LIM' Response threshold of fault message 'Control deviation'

| | |
|--------------------|--|
| Possible settings: | <ul style="list-style-type: none">• Auto• 0 ... 100 |
| Purpose: | This 'LIM' parameter is used to set a value for the permissible size of the control deviation to trigger a fault message. The value is given in percent. If the 'TIM' and 'LIM' parameters are set to 'Auto', then the fault message is set if the slow step zone is not reached within a certain period of time. Within 5 to 95% of the actuator travel, this time is twice the initialization travel time, and ten times the initialization travel time outside of 10 to 90%. |
| Factory setting: | Auto |

Note

Activated tight closing/fast closing function

If the function is activated, then for the 'LIM' parameter the monitoring of control deviation is turned off in the appropriate overflow direction. The following applies: 'YCD0: < 0 %' and 'YCUP: > 100 %'. This functionality is especially advantageous for valves with lining. For long-term monitoring of the end positions, we recommend that you activate the 'F.LZERO' and 'G.LOPEN' parameters.

8.5.2.20 '50.PRST' Preset (HART/FF)

| | |
|--------------------|---|
| Possible settings: | <ul style="list-style-type: none"> • ALL • Init • PArA • diAg |
| Purpose: | <p>Use this parameter to restore the factory settings for most parameters. The following parameter groups are available:</p> <ul style="list-style-type: none"> • ALL: Reset all parameters together which can be reset by 'Init', 'PArA' and 'diAg'. • Init: Reset initialization parameters '1.YFCT' to '5.INITM'. • PArA: Reset application parameters '6.SCUR' Current range of set-point (Page 148) to '49.\LIM' Response threshold of fault message 'Control deviation' (Page 161). • diAg: Resetting the extended diagnostic parameters A to U (Page 164) as well as parameter '52.XDIAG' Activating for extended diagnostics (Page 163). <p>An overview of the parameters and factory settings can be found in section Parameter assignment (Page 135).</p> <p>In order to select one of the parameter groups listed above, repeatedly press the ▾ button until the desired setting is output in the display. Start the function by keeping the ▲ button pressed until 'oCAY' is output in the display. The values of the parameter group are now the factory settings.</p> |
| Description: | <p>If you wish to use a previously initialized positioner on a different control valve, set the parameters to the factory settings prior to a new initialization. To do this, use the 'ALL' or 'Init' setting.</p> |
| Factory setting: | ALL |

See also

Display of diagnostics values (Page 219)

8.5.2.21 '51.PNEUM' Pneumatics type

| | | |
|--------------------|-------|--|
| Requirement: | FIP | You have a positioner with the "Fail in place" function with order suffix -Z, order code F01. |
| Possible settings: | booSt | You operate the positioner with a booster. |
| | Std | Standard pneumatic block |
| | FIP | Fail in Place pneumatic block |
| | booSt | Operation with boosters |
| Purpose: | | <p>Start the function by pressing the ▲ button for at least 5 seconds. The display shows 'WAI' during these 5 seconds. Set the desired function after 5 seconds.</p> <p>Std Setting for a standard pneumatic block.</p> |

| | |
|-------|---|
| FIP | If you order a positioner for Fail in Place applications, the position is then equipped with a special pneumatic block. The "PNEUM" parameter is preset to "FIP". The parameter must be set to "FIP" again when the electronics are replaced. |
| booSt | Use this function if you operate the positioner with a booster. This function then shows the actuator overshoot. You can find a description of how to operate the booster under Booster (Page 323). |

8.5.2.22 '52.XDIAG' Activating for extended diagnostics

Use this parameter to activate the extended diagnostics functions and simultaneously the online diagnostics. You also define which maintenance level is to be signaled. Maintenance levels in the order of increasing importance are maintenance required, maintenance demanded, maintenance alarm. At the factory, extended diagnostics are deactivated. 'XDIAG' parameter is set to 'OFF'. To activate extended diagnostics, there are three modes available:

- On1: Extended diagnostics is activated. Threshold 3 messages will be output via the error message output. Single-stage alarm (maintenance alarm)
- On2: Extended diagnostics is activated. Threshold 2 messages will be activated via alarm output 2. Threshold 3 messages will also be output via the error message output. Two-stage alarm (maintenance demanded, maintenance alarm)
- On3: Extended diagnostics is activated. Threshold 1 messages will be activated via alarm output 1. Threshold 2 messages will be activated via alarm output 2. Threshold 3 messages will also be output via the error message output. Three-stage alarm (maintenance required, maintenance demanded, maintenance alarm)

Note

Activation of extended diagnostics

Note that the extended diagnostic parameters are only shown in the display after selecting one of the operating modes 'On1' to 'On3'

With the factory setting, the extended diagnostic parameters are disabled by default. 'XDIAG' parameter is set to 'OFF'. The corresponding parameters are only displayed after you activate the appropriate menu item with 'On'.

Note

Resetting messages after successful maintenance

If a high or low threshold is violated, the positioner generates a message in the form of an error code and a bar in the display. The message disappears automatically after successful maintenance. Depending on the application, the message is displayed for several hours until the message disappears. The message disappears immediately if you perform one or more of the following tasks:

- Deactivate the monitoring.
 - Re-initialize the high and low stops of the device.
 - Reset the counter.
 - Reset the threshold.
-

8.5 Description of parameters

With extended diagnostics, the threshold of the message is displayed using columns ① in addition to the error code ②, Overview of error codes (HART) (Page 243). These columns ① and the error code ② are shown on the display as follows:



Figure 8-6 Display of a threshold 1 error message with one column (maintenance required)



Figure 8-7 Display of a threshold 2 error message with two columns (maintenance demanded)



Figure 8-8 Display of a threshold 3 error message with three columns (maintenance alarm)

The factory setting is 'OFF'.

8.5.3 Advanced diagnostic parameters A to U

8.5.3.1 Partial Stroke Test 'A.\PST' (HART)

A.\PST - Partial Stroke Test

- Requirement: The parameter "52.XDIAG (Page 163)" is set to "On1", "On2" or "On3".
- Possible settings:
- OFF
 - On

| | |
|------------------|--|
| Purpose: | Activates the Partial Stroke Test. Start the Partial Stroke Test via: <ul style="list-style-type: none">• Local operation• A digital input• Remote operation• A cyclic test interval The current status of the Partial Stroke Test is displayed in the diagnostic value "12.PST (Page 225)". Diagnostic values "13.PRPST (Page 227)" and "14.NXPST (Page 228)" provide additional information on the Partial Stroke Test. |
| Factory setting: | OFF |

A1.STPOS - Start position

| | |
|------------------|--|
| Setting range: | 0.0 ... 100.0 |
| Purpose: | Defines the start position of the Partial Stroke Test. The triggering of alarms (limits) is relative to the MPOS scale. Value in percent. The actuator moves from the start position to the target position during the Partial Stroke Test. The target position is determined from the interaction between start position (A1.STPOS), stroke height (A3.STRKH) and stroke direction (A4.STRKD). |
| Factory setting: | 100.0 |

A2.STTOL - Start tolerance

| | |
|------------------|---|
| Setting range: | 0.1 ... 10.0 |
| Purpose: | Defines the start tolerance of the Partial Stroke Test. Value in percent. |
| Example: | You have set "50.0" as start position and "2.0" as start tolerance. In this case, a Partial Stroke Test is only executed between a position of 48% and 52%. |
| Factory setting: | 2.0 |

A3.STRKH - Stroke height

| | |
|------------------|---|
| Setting range: | 0.1 ... 100.0 |
| Purpose: | Defines the stroke height of the Partial Stroke Test. Value in percent. |
| Factory setting: | 10.0 |

A4.STRKD - Stroke direction

| | |
|--------------------|---|
| Possible settings: | <ul style="list-style-type: none"> • uP • do • uP do |
| Purpose: | <p>Defines the stroke direction of the Partial Stroke Test.</p> <p>uP: Actuator only moves upward</p> <ul style="list-style-type: none"> • The actuator moves from its start position to the upper target position. • After reaching the upper target position, the actuator moves back to the start position. |
| Formula (uP): | <p>Upper target position = Start position (A1.STPOS) ± Start tolerance (A2.STTOL) + Stroke height (A3.STRKH)</p> <p>do: Actuator only moves downward</p> <ul style="list-style-type: none"> • The actuator moves from its start position to the lower target position. • After reaching the lower target position, the actuator moves back to the start position. |
| Formula (do): | <p>Low target position = Start position (A1.STPOS) ± Start tolerance (A2.STTOL) - Stroke height (A3.STRKH)</p> <p>uP do: Actuator moves upwards and downwards</p> <ul style="list-style-type: none"> • The actuator first moves from its start position to the upper target position. • It then moves from the upper target position to the lower target position. • After reaching the lower target position, the actuator moves back to the start position. |
| Formula (uP do) | <p>Target position = Start position (A1.STPOS) ± Start tolerance (A2.STTOL) ± Stroke height (A3.STRKH)</p> |
| Factory setting: | do |

A5.RPMD - Ramp mode

| | |
|------------------|---|
| Setting options: | <ul style="list-style-type: none"> • OFF • On |
| Purpose: | <p>Activates ramp mode.</p> <ul style="list-style-type: none"> • OFF: The Partial Stroke Test is executed in an uncontrolled manner. • On: The Partial Stroke Test is executed in a controlled manner. The positioner controls according to the ramp rate set in parameter "A6.RPRT". <p>Use ramp mode to shorten or extend the duration of the Partial Stroke Test. Extend the Partial Stroke Test to give the higher-level control loop a chance to react to the Partial Stroke Test.</p> |
| Factory setting: | OFF |

A6.RPRT - Ramp rate

| | |
|------------------|---|
| Setting range: | 0.1 ... 100.0 |
| Purpose: | Defines the ramp rate to shorten or extend the duration of the Partial Stroke Test. The ramp rate refers to the total stroke of the control valve and is set in % stroke per second (%/s). Smaller values extend the duration, larger values shorten the duration of the Partial Stroke Test. Example: Setting "10.0" means that the Partial Stroke Test is run with 10% stroke per second. |
| Factory setting: | 1.0 |

A7.FLBH - Behavior after failed PST

| | |
|------------------|--|
| Setting options: | <ul style="list-style-type: none">• Auto• HoLd• AirIn• AirOu |
| Purpose: | Defines how the positioner is to respond if a Partial Stroke Test fails. Note: A Partial Stroke Test fails if the limit threshold assigned in "Factor 3 (AC.FACT3)" is exceeded. <ul style="list-style-type: none">• Auto: Switch to "Automatic" mode. "AUT" is displayed on the device.• HoLd: Hold current position.• AirIn: Ventilate actuator with supply pressure PZ.• AirOu: Depressurize actuator. |
| Factory setting: | Auto |

A8.INTRV - Test interval

| | |
|------------------|---|
| Setting range: | OFF, 1 ... 365 |
| Purpose: | Defines the interval time for the cyclic Partial Stroke Test in days. |
| Factory setting: | OFF |

A9.PSTIN - PST reference stroke time

| | |
|----------------------------|--|
| Indication on the display: | <ul style="list-style-type: none">• NOINI• (C)##.#• FdIni• rEAL |
| Purpose: | Status for reference stroke time in seconds |

8.5 Description of parameters

| | |
|------------------|--|
| Description: | <p>Measures the reference stroke time for the Partial Stroke Test. The reference stroke time corresponds to the controlled movement from the start position to the target position.</p> <p>If the positioner has already been initialized, the calculated average travel time of the control valve is displayed as a reference value.</p> <ul style="list-style-type: none"> • NOINI: Positioner has not yet been initialized. • (C)##.#: An average travel time of 1.2 seconds, for example, is shown in the display as "C 1.2", whereby "C" stands for 'calculated'. The average travel time can be used as a reference stroke time. However, it merely represents a rough guideline value. • FdIni: If the start position cannot be approached or the stroke target cannot be reached, "FdIni" is displayed. "FdIni" stands for "failed PST initialization". • rEAL: Set the sub-parameters "A1.STPOS" to "A5.RPMD" according to your requirements. Then start measuring the reference stroke time by pressing the  button for at least 5 seconds. The display shows "rEAL" during these 5 seconds. The device then moves to the configured start position automatically and executes the desired stroke. The current position in percent is continuously shown on the display. "inPST" for "initialize partial stroke test" appears in the lower line of the display. |
| Factory setting: | NOINI |

AA.FACT1 - Factor 1

| | |
|------------------|---|
| Setting range: | 0.1 ... 100.0 |
| Purpose: | <p>Defines the factor to form threshold 1.</p> <p>The threshold is the product of the reference stroke time and "AA.FACT1". The process to determine the reference stroke time is described under "A9.PSTIN".</p> <p>The threshold 1 message is displayed when threshold 1 is exceeded. This message is only output if threshold 2 or 3 is not exceeded at the same time. The process to activate and display this message is described in the "XDIAG" parameter.</p> |
| Factory setting: | 1.5 |

Ab.FACT2 - Factor 2

| | |
|------------------|---|
| Setting range: | 0.1 ... 100.0 |
| Purpose: | Defines the factor to form threshold 2. The threshold is the product of the reference stroke time and "Ab.FACT2". The process to determine the reference stroke time is described under "A9.PSTIN". The threshold 2 message is displayed when threshold 2 is exceeded. This message is only output if threshold 3 is not exceeded at the same time. The process to activate and display this message is described in the "XDIAG" parameter. |
| Factory setting: | 3.0 |

AC.FACT3 - Factor 3

| | |
|------------------|---|
| Setting range: | 0.1 ... 100.0 |
| Purpose: | Defines the factor to form threshold 3. The threshold is the product of the reference stroke time and "AC.FACT3". The process to determine the reference stroke time is described under "A9.PSTIN". The threshold 3 message is displayed when threshold 3 is exceeded. The process to activate and display this message is described in the "XDIAG" parameter. The positioner responds in accordance with the option set in the sub-parameter "A7.FLBH". |
| Factory setting: | 5.0 |

8.5.3.2 Partial Stroke Test 'A.\PST' with option -Z P02 (HART)

A.\PST - Partial Stroke Test (PST) with option -Z P02

| | |
|--------------------|--|
| Requirement: | The parameter "52.XDIAG" is set to "On1", "On2" or "On3". |
| Possible settings: | <ul style="list-style-type: none">• OFF• On |

8.5 Description of parameters

| | |
|------------------|--|
| Purpose: | <p>Activates the Partial Stroke Test (PST). Start the Partial Stroke Test via:</p> <ul style="list-style-type: none"> • Local operation • A digital input • Remote operation • A cyclic test interval <p>The current status of the Partial Stroke Test is displayed in the diagnostic value "12.PST". Diagnostic values "13.PRPST" and "14.NXPST" provide additional information on the Partial Stroke Test.</p> |
| Factory setting: | OFF |

A1.STPOS - Start position

| | |
|------------------|---|
| Setting range: | 0.0 ... 100.0 |
| Purpose: | <p>Defines the start position of the Partial Stroke Test. Value in percent. The actuator moves from the start position to the end position + end tolerance during the reference PST. The actuator moves from the start position to the end position during the Partial Stroke Test.</p> |
| Factory setting: | 100.0 |

A2.STTOL - Start tolerance

| | |
|------------------|--|
| Setting range: | 0.1 ... 10.0 |
| Purpose: | Defines the start tolerance of the Partial Stroke Test. Value in percent. |
| Example: | <p>You have set "100.0" as start position and "2.0" as start tolerance.</p> <ul style="list-style-type: none"> • The reference PST travels from each current position to the start position. When the position 98% is exceeded, the start position is considered reached. • The Partial Stroke Test only starts if the current position is between 98 and 102. |
| Factory setting: | 2.0 |

A8.INTRV - Test interval

| | |
|------------------|---|
| Setting range: | OFF, 1 ... 365 |
| Purpose: | Defines the interval time for the cyclic Partial Stroke Test in days. |
| Factory setting: | OFF |

Ad.ENPOS - End position

| | |
|------------------|--|
| Setting range: | 0.0 ... 100.0 |
| Purpose: | Defines the end position of the Partial Stroke Test. <ul style="list-style-type: none">• The actuator moves from the start position to the end position + end tolerance during the reference PST.• The actuator moves from the start position to the end position during the Partial Stroke Test. |
| Factory setting: | 90.0 |

AE.ENTOL - End tolerance

| | |
|------------------|--|
| Setting range: | 1.0 ... 20.0 |
| Purpose: | Defines an end tolerance of the Partial Stroke Test relative to the end position. Value in percent. |
| Example: | You have set "75.0" as end position and "5" as end tolerance. <ul style="list-style-type: none">• The reference PST travels to position "70". The end tolerance is fully utilized when the end position is approached.• The Partial Stroke Test travels to position "75". |
| Factory setting: | 5.0 |

AF.BOLIM - Breakout pressure limit

| | |
|------------------|--|
| Setting range: | 0.1 ... 7 |
| Purpose: | The limit corresponds to the pressure at which there must be a process valve breakout. The reference PST determines the limit. Value in bar. Only change the parameter using expert mode and via HART, if possible. |
| Example: | You have set "1.5" as breakout pressure limit and "0.2" as breakout pressure tolerance. The breakout must be detected before the pressure has reached 1.3 bar. For double-acting actuators, the value relates to the pressure difference P2 minus P1. |
| Factory setting: | 7 |

AG.BOTOL - Breakout pressure tolerance

| | |
|----------------|--|
| Setting range: | 0.1 ... 6 |
| Purpose: | Defines the tolerance for the breakout pressure of the Partial Stroke Test. Value in bar. Only change the parameter via HART, if possible. |

8.5 Description of parameters

| | |
|------------------|--|
| Example: | You have set "1.5" as breakout pressure limit and "0.2" as breakout pressure tolerance. The breakout must be detected before the pressure has reached 1.3 bar. For double-acting actuators, the value relates to the pressure difference P2 minus P1. |
| Factory setting: | 0.1 |

AH.PSTDO - Time to end position

| | |
|------------------|--|
| Setting range: | 1 ... 300 |
| Purpose: | Defines the time required by the Partial Stroke Test to travel to the end position. Value in seconds. The time refers to the minimum duration used by the Partial Stroke Test for depressurizing to travel from the start position to the end position with consideration of the end tolerance. |
| Example: | You have entered the value "1". Depending on the process drive, the Partial Stroke Test needs a minimum time to cover the distance. With the value "1", the actuator travels to the end position at the maximum possible speed. |
| Factory setting: | 80 |

AJ.PSTUP - Time back to start position

| | |
|------------------|---|
| Setting range: | 0 ... 300 |
| Purpose: | Defines the time required by the Partial Stroke Test to return to the start position. Value in seconds. The time refers to the minimum duration used by the Partial Stroke Test for pressurizing to travel from the end position back to the start position with consideration of the start tolerance. |
| Example 1: | You have left the value at the factory setting "0". Immediately after stabilization of the end position, the Partial Stroke Test returns to the start position. |
| Example 2: | You have entered the value "1". Depending on the process drive, the Partial Stroke Test needs a minimum time to cover the distance. With the set value "1", the actuator travels to the start position in increments. |
| Factory setting: | 0 |

AL.PSTRP - Test repetitions

| | |
|------------------|---|
| Setting range: | 0 ... 3 |
| Purpose: | Defines how often the Partial Stroke Test will be repeated if it fails. |
| Factory setting: | 0 |

AY.PSTRF - Start PST reference

| | |
|-------------------|---|
| Setting | rEAL |
| Possible displays | Activates the reference PST. Results are shown in the display and have the following meaning: |
| | "empty" Nothing on the display |
| | C-Err Configuration error |
| | oCAY Reference PST was completed successfully. |
| | noIni Positioner has not yet been initialized. |
| | FdIni Reference PST failed. |
| | SdrEF Reference PST was canceled. |
| Factory setting: | "empty" |

8.5.3.3 Monitoring of dynamic control valve behavior 'b.\DEVl'

b.\DEVl - Monitoring of dynamic control valve behavior

| | |
|--------------------|--|
| Requirement: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. |
| Possible settings: | <ul style="list-style-type: none"> • OFF • On |
| Purpose: | <p>This parameter allows you to monitor the dynamic control valve behavior. The actual position course is compared with the expected position course for this purpose. This comparison helps in drawing a conclusion about the correct operational response of the control valve. Monitoring is performed in three steps. To activate monitoring, set the parameter to 'On'. Sub-parameters are displayed. Appropriately set the sub-parameters.</p> <p>The current value is displayed in Diagnostics value '15.DEVI - Dynamic control valve behavior' (Page 228). The positioner triggers a message if the current value exceeds one of the three thresholds.</p> |
| Factory setting: | OFF |

b1.TIM - Time constant

| | |
|--------------------|--|
| Possible settings: | <ul style="list-style-type: none"> • Auto • 1 ... 400 |
| Purpose: | Use this sub-parameter to define the attenuation effect of the low-pass filter. The unit is seconds. The time constant 'b1.TIM' is calculated from the travel times 'uP' and 'doWn' determined during the initialization. This time constant becomes effective when the 'b1.TIM' parameter is set to 'Auto'. |

8.5 Description of parameters

If the time constant is inadequate, the setting of 'b1.TIM' can be changed manually. Set the time constant in a range from '1' to '400'. In this case:

- Setting '1' indicates a very weak attenuation.
- Setting '400' indicates a strong attenuation.

The currently determined deviation is displayed in Diagnostics value '15.DEVI - Dynamic control valve behavior' (Page 228). The positioner triggers a message if the current value exceeds one of the three parameterizable thresholds.

Factory setting: Auto

b2.LIMIT - Limit

Adjustment range: 0.1 ... 100.0

Purpose: Use this sub-parameter to set a base limit in percent. The base limit defines the magnitude of the permissible deviation from the expected position course. The limit serves as a reference variable for the fault message factors.

Set the base limit in a range from '0.1' to '100.0'.

Factory setting: 1.0

b3.FACT1 - Factor 1

Adjustment range: 0.1 ... 100.0

Purpose: Use this sub-parameter to set the factor for formation of threshold 1. Set the factor in a range from '0.1' to '100.0'. The threshold is the product of 'b2.LIMIT' and 'b3.FACT1'.

The threshold 1 message is displayed when threshold 1 is exceeded. This message is only output if threshold 2 or 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter.

Factory setting: 5.0

b4.FACT2 - Factor 2

Adjustment range: 0.1 ... 100.0

Purpose: Use this sub-parameter to set the factor for formation of threshold 1. Set the factor in a range from '0.1' to '100.0'. The threshold is the product of 'b2.LIMIT' and 'b4.FACT2'.

The threshold 2 message is displayed when threshold 2 is exceeded. This message is only output if threshold 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter.

Factory setting: 10.0

b5.FACT3 - Factor 3

| | |
|-------------------|--|
| Adjustment range: | 0.1 ... 100.0 |
| Purpose: | Use this sub-parameter to set the factor for formation of threshold 1. Set the factor in a range from '0.1' to '100.0'. The threshold is the product of 'b2.LIMIT' and 'b5.FACT3'. The threshold 3 message is displayed when threshold 3 is exceeded. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 15.0 |

8.5.3.4 Monitoring/compensation of pneumatic leakage 'C.\LEAK'**C.\LEAK - Monitoring/compensation of pneumatic leakage**

Note**Accuracy of results**

Note that this monitoring only delivers results in the case of single-acting, spring-loaded actuators and a setpoint from 5% to 95%.

Note**Activated tight closing/fast closing function**

Note that monitoring with an activated '39.YCLS' Tight closing/fast closing with manipulated variable (Page 155) function only delivers results in the case of a setpoint with the following values:

- Value for tight closing/fast closing **Down** (YCDO) +5% to
- value for tight closing/fast closing **Up** (YCUP) -5%

'40.YCDO' Value for tight closing/fast closing Down (Page 156)

and '41.YCUP' Value for tight closing/fast closing Up (Page 156)

Note**Update of the message**

When the leakage has been rectified, the new status is displayed as message after some time.

- To determine the current leakage, start the online leakage test with Diagnostic value '11.LEAK - Leakage test' (Page 224).
-

8.5 Description of parameters

| | |
|--------------------|--|
| Condition: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. Operating mode 'Automatic' (AUT) is set for the leakage compensation. |
| Possible settings: | <ul style="list-style-type: none"> • OFF • On |
| Purpose: | <p>This parameter is used to activate leak monitoring and leakage compensation. Leakages mainly occur in the actuator or in the pipe installation. To activate monitoring or compensation, set the parameter to 'On'. Sub-parameters are displayed. Appropriately set the sub-parameters.</p> <p>The leakage compensation compensates the leakage in control phases with constant setpoint. The control quality is increased by reducing or preventing the typical, periodic oscillations of leaky valves. The leakage compensation compensates leakages up to 2% of the positioner's air performance.</p> <p>The two following diagnostics values indicate the length and period of the current leakage compensation pulse: Diagnostic value '57.LKPUL - Length of the leakage compensation pulse' (Page 236), Diagnostic value '58.LKPER - Period of the leakage compensation pulse' (Page 236)</p> <p>The leak monitoring is carried out in three stages for all control phases (dynamic and static setpoints).</p> <p>The current value of the monitoring is displayed in Diagnostic value '16.ONLK - Pneumatic leakage' (Page 228).</p> |
| Factory setting: | OFF |

C1.LIMIT - Limit

| | |
|-------------------|---|
| Adjustment range: | 0.1 ... 100.0 |
| Purpose: | Use this sub-parameter to set the limit of the leakage indicator in percent. Set the limit in a range from '0.1' to '100.0'. If no leakage exists, monitoring of the pneumatic leakage is automatically calibrated in such a way during the initialization (section Commissioning (Page 103)) that the leakage indicator remains below the value 30. A value above 30 means that a leakage exists. '30.0' is therefore an advisable setting for the parameter. After a certain time this limit can be varied slightly depending on the application. |

To optimize the sensitivity of the monitoring of the pneumatic leakage to your specific application, follow these steps:

1. After initializing the positioner automatically, use a calibration device to initiate a ramp movement.
2. Conditions for the ramp movement:
 - The ramp covers the normal operating range of the valve.
 - The steepness of the ramp matches the dynamic requirements of the corresponding application.
 - The characteristic of the ramp corresponds to the characteristic of the setpoint that actually occurs.
3. During the ramp movement, the Diagnostic value '16.ONLK - Pneumatic leakage' (Page 228) provides information about the actual values. Define the limit of the leakage indicator accordingly.

The positioner triggers a message if the current value exceeds one of the three thresholds. How to set the three thresholds is described below.

Factory setting: 30.0

C2.FACT1 - Factor 1

Adjustment range: 0.1 ... 100.0

Purpose: Use this sub-parameter to set the factor for formation of threshold 1. Set the factor in a range from '0.1' to '100.0'. The threshold is the product of 'C1.LIMIT' and 'C2.FACT1'.

A leakage was detected when threshold 1 is exceeded. The control quality is not affected. The threshold 1 message is shown. This message is only output if threshold 2 or 3 is not exceeded at the same time.

The process to activate and display this message is described in the 'XDIAG' parameter.

Factory setting: 1.0

C3.FACT2 - Factor 2

Adjustment range: 0.1 ... 100.0

Purpose: Use this sub-parameter to set the factor for formation of threshold 2. Set the factor in a range from '0.1' to '100.0'. The threshold is the product of 'C1.LIMIT' and 'C3.FACT2'.

A leakage was detected when threshold 2 is exceeded. The control quality is affected. Maintenance is recommended. The threshold 2 message is shown. This message is only output if threshold 3 is not exceeded at the same time.

The process to activate and display this message is described in the 'XDIAG' parameter.

Factory setting: 1.5

C4.FACT3 - Factor 3

| | |
|-------------------|--|
| Adjustment range: | 0.1 ... 100.0 |
| Purpose: | <p>Use this sub-parameter to set the factor for formation of threshold 3. Set the factor in a range from '0.1' to '100.0'. The threshold is the product of 'C1.LIMIT' and 'C4.FACT3'.</p> <p>A leakage was detected when threshold 3 is exceeded. The control quality is strongly affected. Maintenance is necessary. The threshold 3 message is shown.</p> <p>The process to activate and display this message is described in the 'XDIAG' parameter.</p> |
| Factory setting: | 2.0 |

See also

11 Monitoring/compensation of pneumatic leakage (Page 249)

8.5.3.5 Monitoring of stiction (slipstick) 'd.\STIC'

d.\STIC - Monitoring of stiction (slipstick)

| | |
|--------------------|--|
| Requirement: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. |
| Possible settings: | <ul style="list-style-type: none">• OFF• On |
| Purpose: | <p>Use this parameter to continuously monitor the current stiction (slipstick effect) of the control valve. If the parameter is activated, the positioner detects the slipstick that can occur. Sudden changes in the process valve position, so-called slip jumps, indicate excessive stiction. Where slip jumps are detected, the filtered step height is stored as a slipstick value. If slip jumps no longer exist, the stiction (slipstick effect) is reduced slowly. Monitoring is performed in three steps. To activate monitoring, set the parameter to 'On'. Sub-parameters are displayed. Appropriately set the sub-parameters.</p> <p>The current value is displayed in Diagnostic value '17.STIC - Stiction (slipstick)' (Page 229). The positioner triggers a message if the current value exceeds one of the thresholds.</p> |
| Factory setting: | OFF |

Note

Incorrect interpretation in case of travel times below one second

If the travel times are less than one second, the positioner does not accurately differentiate between a normal movement of the actuator and a sudden change. Therefore, increase the travel time if required.

d1.LIMIT - limit for slipstick detection

| | |
|------------------|---|
| Setting range: | 0.1 ... 100.0 |
| Purpose: | Use this sub-parameter to set the base limit for slipstick detection in percent. Set the base limit in a range from '0.1' to '100.0'. |
| Factory setting: | 1.0 |

d2.FACT1 - Factor 1

| | |
|------------------|---|
| Setting range: | 0.1 ... 100.0 |
| Purpose: | Use this sub-parameter to set the factor for formation of threshold 1. Set the factor in a range from '0.1' to '100.0'. The threshold is the product of the values entered for 'd1.LIMIT' and 'd2.FACT1'. The threshold 1 message is displayed when threshold 1 is exceeded. This message is only output if threshold 2 or 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 2.0 |

d3.FACT2 - Factor 2

| | |
|------------------|--|
| Setting range: | 0.1 ... 100.0 |
| Purpose: | Use this sub-parameter to set the factor for formation of threshold 2. Set the factor in a range from '0.1' to '100.0'. The threshold is the product of the values entered for 'd1.LIMIT' and 'd3.FACT2'. The threshold 2 message is displayed when threshold 2 is exceeded. This message is only output if threshold 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 5.0 |

d4.FACT3 - Factor 3

| | |
|------------------|---|
| Setting range: | 0.1 ... 100.0 |
| Purpose: | Use this sub-parameter to set the factor for formation of threshold 3. Set the factor in a range from '0.1' to '100.0'. The threshold is the product of the values entered for 'd1.LIMIT' and 'd4.FACT3'. The threshold 3 message is displayed when threshold 3 is exceeded. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 10.0 |

8.5.3.6 Monitoring of deadband 'E.\DEBA'

E.\DEBA - Monitoring of deadband

| | |
|--------------------|---|
| Requirement: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On'. The '34.DEBA' Deadband of closed-loop controller (Page 152) parameter is set to 'Auto'. |
| Possible settings: | <ul style="list-style-type: none">• OFF• On |
| Purpose: | Use this parameter to continuously monitor the automatic adaptation of the deadband. Monitoring is performed in one step. To activate monitoring, set the parameter to 'On'. The sub-parameter is displayed. Appropriately set the sub-parameter. The current value is displayed in Diagnostic value '26.DBUP - Deadband up' / '27.DBDN - Deadband down' (Page 232). The positioner triggers a message if the current value exceeds the threshold. |
| Factory setting: | OFF |

E1.LEVL3 - Threshold

| | |
|-------------------|---|
| Adjustment range: | 0.1 ... 3.0 |
| Purpose: | Use this sub-parameter to set the threshold to the deadband in percent. Set the threshold in a range from '0.1' to '10.0'. The values are monitored in the range of '0.1' to '2.9'. Values between '3.0' and '10.0' are not monitored. The threshold 3 message is displayed when the current deadband exceeds the threshold during the test. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 2.0 |

Note

Fault message display

The three-stage fault message display has not been implemented for monitoring of the deadband. The positioner triggers only threshold 3 messages depending on the setting.

8.5.3.7 Monitoring of lower endstop 'F.\ZERO'

F.\ZERO - Monitoring of lower endstop

Note**Fault detection**

Monitoring of lower endstop not only responds to faults in the valve. If the limit thresholds of the lower endstop are exceeded due to misalignment of the position feedback, the misalignment also triggers a diagnostics message.

| | |
|--------------------|--|
| Requirement: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. The '39.YCLS' Tight closing/fast closing with manipulated variable (Page 155) parameter is set to one of the following values: 'do', 'uP do', 'Fd', 'Fu Fd', 'uP Fd', 'Fu do'. |
| Possible settings: | <ul style="list-style-type: none">• OFF• On |
| Purpose: | Use this parameter to activate continuous monitoring of the lower endstop. Monitoring is always carried out if the 'YCLS' parameter is set to one of the following values: 'do', 'uP do', 'Fd', 'Fu Fd', 'uP Fd', 'Fu do' It checks whether the lower endstop has changed compared to its value during initialization. Monitoring is performed in three steps. Set the following sub-parameters appropriately. To activate monitoring, set the parameter to 'On'. Sub-parameters are displayed. The current value is displayed in Diagnostic value '18.ZERO - Lower endstop' (HART/PA) (Page 229). The positioner triggers a message if the current value undershoots one of the three thresholds. |
| Factory setting: | OFF |

F1.LEVL1 - threshold 1

| | |
|------------------|--|
| Setting range: | 0.1 ... 10.0 |
| Purpose: | Use this sub-parameter to set threshold 1 for the lower endstop in percent. Set the threshold in a range from '0.1' to '10.0'. The positioner triggers a threshold 1 message if the difference between the lower endstop and the initialization value undershoots threshold 1. This message is only output if threshold 2 or 3 is not undershot at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 1.0 |

F2.LEVL2 - threshold 2

| | |
|------------------|---|
| Setting range: | 0.1 ... 10.0 |
| Purpose: | Use this sub-parameter to set threshold 2 for the lower endstop in percent. Set the threshold in a range from '0.1' to '10.0'. The positioner triggers a threshold 2 message if the difference between the lower endstop and the initialization value undershoots threshold 2. This message is only output if threshold 3 is not undershot at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 2.0 |

F3.LEVL3 - threshold 3

| | |
|------------------|---|
| Setting range: | 0.1 ... 10.0 |
| Purpose: | Use this sub-parameter to set threshold 3 for the lower endstop in percent. Set the threshold in a range from '0.1' to '10.0'. The positioner triggers a threshold 3 message if the difference between the lower endstop and the initialization value undershoots threshold 3. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 4.0 |

8.5.3.8 Monitoring of upper endstop 'G.\OPEN'

G.\OPEN - Monitoring of upper endstop

Note

Fault detection

Monitoring of upper endstop not only responds to faults in the valve. If the limit thresholds of the upper endstop are exceeded due to misalignment of the position feedback, the misalignment also triggers a message.

| | |
|--------------------|---|
| Requirement: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. The '39.YCLS' Tight closing/fast closing with manipulated variable (Page 155) parameter is set to one of the following values: 'uP', 'uP do', 'Fu', 'Fu Fd', 'uP Fd', 'Fu do' |
| Possible settings: | <ul style="list-style-type: none">• OFF• On |

| | |
|------------------|--|
| Purpose: | Use this parameter to activate continuous monitoring of the upper endstop. Monitoring is always carried out if the 'YCLS' parameter is set to one of the following values: 'uP', 'uP do', 'Fu', 'Fu Fd', 'uP Fd', 'Fu do' It checks whether the upper endstop has changed compared to its value during initialization. Monitoring is performed in three steps. Set the following sub-parameters appropriately. To activate monitoring, set the parameter to 'On'. Sub-parameters are displayed. The value is displayed in Diagnostic value '19.OPEN - Upper endstop' (HART/PA) (Page 229). The positioner triggers a message if the current value exceeds one of the three thresholds. |
| Factory setting: | OFF |

G1.LEVL1 - threshold 1

| | |
|------------------|---|
| Setting range: | 0.1 ... 10.0 |
| Purpose: | Use this sub-parameter to set threshold 1 for the upper endstop in percent. Set the threshold in a range from '0.1' to '10.0'. The positioner triggers a threshold 1 message if the difference between the upper endstop and the initialization value exceeds threshold 1. This message is only output if threshold 2 or 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 1.0 |

G2.LEVL2 - threshold 2

| | |
|------------------|--|
| Setting range: | 0.1 ... 10.0 |
| Purpose: | Use this sub-parameter to set threshold 2 for the upper endstop in percent. Set the threshold in a range from '0.1' to '10.0'. The positioner triggers a threshold 2 message if the difference between the upper endstop and the initialization value exceeds threshold 2. This message is only output if threshold 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 2.0 |

G3.LEVL3 - threshold 3

| | |
|------------------|---|
| Setting range: | 0.1 ... 10.0 |
| Purpose: | Use this sub-parameter to set threshold 3 for the upper endstop in percent. Set the threshold in a range from '0.1' to '10.0'. The positioner triggers a threshold 3 message if the difference between the upper endstop and the initialization value exceeds threshold 3. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 4.0 |

8.5.3.9 Monitoring the lower limit temperature 'H.\\TMIN'

H.\\TMIN - Monitoring the lower limit temperature

| | |
|--------------------|---|
| Requirement: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. |
| Possible settings: | <ul style="list-style-type: none">• OFF• On |
| Purpose: | The current temperature inside the enclosure of the field device is detected by a sensor on the electronics. Use this parameter to activate continuous monitoring of the lower limit temperature inside the enclosure. Monitoring is performed in three steps. To activate monitoring, set the parameter to 'On'. Sub-parameters are displayed. Appropriately set the sub-parameters. The value is displayed in Diagnostic value '31.TMIN - Minimum temperature' / '32.TMAX - Maximum temperature' (Page 233). The positioner triggers a message if the current value undershoots one of the three thresholds. |
| Factory setting: | OFF |

H1.TUNIT - temperature unit

| | |
|--------------------|--|
| Possible settings: | °C °F |
| Purpose: | Use this sub-parameter to set the temperature unit '°C' or '°F'. The selected temperature unit is then also applicable for all other temperature-based parameters. |
| Factory setting: | °C |

H2.LEVL1 - threshold 1

| | |
|-------------------|--|
| Adjustment range: | -40.0C ... 90.0C -40.0F ... 194.0F |
| Purpose: | Use this sub-parameter to set the temperature for threshold 1. The positioner triggers a threshold 1 message if the current temperature inside the enclosure undershoots threshold 1. This message is only output if threshold 2 or 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | -25.0C |

H3.LEVL2 - threshold 2

| | |
|-------------------|---|
| Adjustment range: | -40.0C ... 90.0C -40.0F ... 194.0F |
| Purpose: | Use this sub-parameter to set the temperature for threshold 2. The positioner triggers a threshold 2 message if the current temperature inside the enclosure undershoots threshold 2. This message is only output if threshold 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | -30.0C |

H4.LEVL3 - threshold 3

| | |
|-------------------|--|
| Adjustment range: | -40.0C ... 90.0C -40.0F ... 194.0F |
| Purpose: | Use this sub-parameter to set the temperature for threshold 3. The positioner triggers a threshold 3 message if the current temperature inside the enclosure undershoots threshold 3. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | -40.0C |

See also

'39.YCLS' Tight closing/fast closing with manipulated variable (Page 155)

8.5.3.10 Monitoring the upper limit temperature 'J.\TMAX'**J.\TMAX - Monitoring the upper limit temperature**

| | |
|--------------------|--|
| Requirement: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. |
| Possible settings: | <ul style="list-style-type: none"> • OFF • On |
| Purpose: | <p>The current temperature inside the enclosure of the field device is detected by a sensor on the electronics. Use this parameter to activate continuous monitoring of the upper limit temperature inside the enclosure. Monitoring is performed in three steps. To activate monitoring, set the parameter to 'On'. Sub-parameters are displayed. Appropriately set the sub-parameters.</p> <p>The value is displayed in Diagnostic value '31.TMIN - Minimum temperature' / '32.TMAX - Maximum temperature' (Page 233). The positioner triggers a message if the current value exceeds one of the three thresholds.</p> |
| Factory setting: | OFF |

J1.TUNIT - temperature unit

| | |
|--------------------|--|
| Possible settings: | <ul style="list-style-type: none"> °C °F |
| Purpose: | Use this sub-parameter to set the temperature unit '°C' or '°F'. The selected temperature unit is then also applicable for all other temperature-based parameters. |
| Factory setting: | °C |

J2.LEVL1 - threshold 1

| | |
|-------------------|---|
| Adjustment range: | -40.0C ... 90.0C -40.0F ... 194.0F |
| Purpose: | <p>Use this sub-parameter to set the temperature for threshold 1.</p> <p>The positioner triggers a threshold 1 message if the current temperature inside the enclosure exceeds threshold 1. This message is only output if threshold 2 or 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter.</p> |
| Factory setting: | 75.0C |

J3.LEVL2 - threshold 2

| | |
|-------------------|---|
| Adjustment range: | -40.0C ... 90.0C -40.0F ... 194.0F |
| Purpose: | Use this sub-parameter to set the temperature for threshold 2. The positioner triggers a threshold 2 message if the current temperature inside the enclosure exceeds threshold 2. This message is only output if threshold 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 80.0C |

J4.LEVL3 - threshold 3

| | |
|-------------------|--|
| Adjustment range: | -40.0C ... 90.0C -40.0F ... 194.0F |
| Purpose: | Use this sub-parameter to set the temperature for threshold 3. The positioner triggers a threshold 3 message if the current temperature inside the enclosure exceeds threshold 3. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 90.0C |

8.5.3.11 Monitoring of number of total strokes 'L.\STRK'

L.\STRK - Monitoring of number of total strokes

| | |
|--------------------|---|
| Condition: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. |
| Possible settings: | <ul style="list-style-type: none">• OFF• On |
| Purpose: | Use this parameter to continuously monitor the total strokes covered by the actuator. A total stroke corresponds to the path from the lower endstop of the actuator to the upper endstop and back again, in other words twice the travel. During operation, partial strokes of the actuator are added together into total strokes. Monitoring is performed in three steps. To activate monitoring, set the parameter to 'On'. Sub-parameters are displayed. Appropriately set the sub-parameters. The current value is displayed in Diagnostic value '1.STRKS - Number of total strokes' (Page 222). The positioner triggers a message if the current value exceeds one of the three thresholds. This message is only output if threshold 2 or 3 is not exceeded at the same time. |
| Factory setting: | OFF |

L1.LIMIT - Limit

| | |
|-------------------|---|
| Adjustment range: | 1 ... 1.00E8 |
| Purpose: | Use this sub-parameter to set the base limit for the number of total strokes. Set the base limit in a range from '1' to '1.00E8'. |
| Factory setting: | 1.00E6 |

L2.FACT1 - Factor 1

| | |
|-------------------|---|
| Adjustment range: | 0.1 ... 40.0 |
| Purpose: | Use this sub-parameter to set the factor for formation of threshold 1. Set the factor in a range from '0.1' to '40.0'. The threshold is the product of 'L1.LIMIT' and 'L2.FACT1'. The threshold 1 message is displayed when threshold 1 is exceeded. This message is only output if threshold 2 or 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 1.0 |

L3.FACT2 - Factor 2

| | |
|-------------------|--|
| Adjustment range: | 0.1 ... 40.0 |
| Purpose: | Use this sub-parameter to set the factor for formation of threshold 2. Set the factor in a range from '0.1' to '40.0'. The threshold is the product of 'L1.LIMIT' and 'L3.FACT2'. The threshold 2 message is displayed when threshold 2 is exceeded. This message is only output if threshold 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 2.0 |

L4.FACT3 - Factor 3

| | |
|-------------------|---|
| Adjustment range: | 0.1 ... 40.0 |
| Purpose: | Use this sub-parameter to set the factor for formation of threshold 3. Set the factor in a range from '0.1' to '40.0'. The threshold is the product of 'L1.LIMIT' and 'L4.FACT3'. The threshold 3 message is displayed when threshold 3 is exceeded. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 5.0 |

See also

Display of diagnostics values (Page 219)

8.5.3.12 Monitoring of number of changes in direction 'O.\DCHG'

O.\DCHG - Monitoring of number of changes in direction

| | |
|--------------------|---|
| Condition: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. |
| Possible settings: | <ul style="list-style-type: none"> • OFF • On |
| Purpose: | <p>Use this parameter to continuously monitor the number of changes in direction of the actuator beyond the deadband. Monitoring is performed in three steps. Set the following sub-parameters appropriately. To activate monitoring, set the parameter to 'On'. Sub-parameters are displayed.</p> <p>The current value is displayed in Diagnostic value '2.CHDIR - Number of changes in direction' (Page 222). The positioner triggers a message if the current value exceeds one of the three thresholds.</p> |
| Factory setting: | OFF |

O1.LIMIT - Limit

| | |
|-------------------|--|
| Adjustment range: | 1 ... 1.00E8 |
| Purpose: | Use this sub-parameter to set the base limit for the changes of direction of the actuator. Set the base limit in a range from '1' to '1.00E8'. |
| Factory setting: | 1.00E6 |

O2.FACT1 - Factor 1

| | |
|-------------------|--|
| Adjustment range: | 0.1 ... 40.0 |
| Purpose: | <p>Use this sub-parameter to set the factor for formation of threshold 1. Set the factor in a range from '0.1' to '40.0'. The threshold is the product of 'O1.LIMIT' and 'O2.FACT1'.</p> <p>The threshold 1 message is displayed when threshold 1 is exceeded. This message is only output if threshold 2 or 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter.</p> |
| Factory setting: | 1.0 |

O3.FACT2 - Factor 2

| | |
|-------------------|--|
| Adjustment range: | 0.1 ... 40.0 |
| Purpose: | Use this sub-parameter to set the factor for formation of threshold 2. Set the factor in a range from '0.1' to '40.0'. The threshold is the product of 'O1.LIMIT' and 'O3.FACT2'. The threshold 2 message is displayed when threshold 2 is exceeded. This message is only output if threshold 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 2.0 |

O4.FACT3 - Factor 3

| | |
|-------------------|---|
| Adjustment range: | 0.1 ... 40.0 |
| Purpose: | Use this sub-parameter to set the factor for formation of threshold 3. Set the factor in a range from '0.1' to '40.0'. The threshold is the product of 'O1.LIMIT' and 'O4.FACT3'. The threshold 3 message is displayed when threshold 3 is exceeded. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 5.0 |

See also

Display of diagnostics values (Page 219)

8.5.3.13 Monitoring the position average value 'P.\PAVG'

P.\PAVG - Monitoring the position average value

| | |
|--------------------|--|
| Requirement: | The '52.XDIAG' Activating for extended diagnostics (Page 163) parameter is set to 'On1', 'On2' or 'On3'. |
| Possible settings: | <ul style="list-style-type: none">• OFF• On |
| Purpose: | Use this parameter to activate the test to calculate and monitor the average value of position. During the test, the average values of position and reference are always compared at the end of a time interval. The current value is displayed in Diagnostic value '20.PAVG - Average value of position' (Page 230). The positioner triggers a message if the current average value of position undershoots one of the three thresholds. |
| Factory setting: | OFF |

P1.TBASE - Time basis of average value generation

| | |
|--------------------|--|
| Possible settings: | 0.5h / 8h / 5d / 60d / 2.5y |
| Purpose: | Use this sub-parameter to set the time interval to calculate the average value of position. The following values are available to define the time intervals: <ul style="list-style-type: none">• 30 minutes• 8 hours• 5 days• 60 days• 2.5 years After start of the average reference value calculation and expiration of the time interval, the average position value over the interval is calculated and compared with the average reference value. The test is then restarted. |
| Factory setting: | 0.5h |

P2.STATE - Status of monitoring position average value

| | |
|--------------------|---|
| Possible settings: | IdLE / rEF / ###.# / Strt |
| Purpose: | Use this sub-parameter to start the calculation of the average position value. If an average reference value has never been determined, the parameter value is 'IdLE'. Then start the calculation by pressing the  button for 5 seconds. The value in the display changes from 'IdLE' to 'rEF'. The average reference value is calculated. When the time interval expires, the calculated average reference value is shown on the display. |
| Factory setting: | IdLE |

Note

Current average position value

The current average position value in each case is displayed in the Diagnostic value '20.PAVG - Average value of position' (Page 230). If no average position value has been calculated, 'COMP' is displayed as the diagnostics value.

P3.LEVL1 - threshold 1

| | |
|--------------------|--|
| Possible settings: | 0.1 ... 100.0 |
| Purpose: | Use this sub-parameter to set threshold 1 for the maximum deviation of the current average position value from the average reference value. The value is given in percent. Set the threshold in a range from '0.1' to '100.0'. The positioner outputs the threshold 1 message if the difference between the average position value and the average reference value exceeds threshold 1. This message is only output if threshold 2 or 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 2.0 |

P4.LEVL2 - Threshold 2

| | |
|--------------------|---|
| Possible settings: | 0.1 ... 100.0 |
| Purpose: | Use this sub-parameter to set threshold 2 for the maximum deviation of the current average position value from the average reference value. The value is given in percent. Set the threshold in a range from '0.1' to '100.0'. The positioner outputs the threshold 2 message if the difference between the average position value and the average reference value exceeds threshold 2. This message is only output if threshold 3 is not exceeded at the same time. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 5.0 |

P5.LEVL3 - Threshold 3

| | |
|--------------------|--|
| Possible settings: | 0.1 ... 100.0 |
| Purpose: | Use this sub-parameter to set threshold 3 for the maximum deviation of the current average position value from the average reference value. The value is given in percent. Set the threshold in a range from '0.1' to '100.0'. The positioner outputs the threshold 3 message if the difference between the average position value and the average reference value exceeds threshold 3. The process to activate and display this message is described in the 'XDIAG' parameter. |
| Factory setting: | 10.0 |

8.5.3.14 Pressure monitoring 'U.\PRES'

U.\PRES - Pressure monitoring

| | |
|--------------------|---|
| Requirement: | The parameter "XDIAG (Page 163)" is set to "On1", "On2" or "On3". |
| Possible settings: | On / OFF |
| Purpose: | Activates or deactivates all pressure-based diagnostics. If the "U.PRES" parameter has been set to "On" after the initialization, then re-initialize the positioner. All pressure-based diagnostics can be executed. |
| Factory setting: | On |

U1.PUNIT - Pressure unit

| | |
|--------------------|---|
| Possible settings: | bAr / PSI / MPA |
| Purpose: | Defines the pressure unit for all pressure-based diagnostic parameters. |
| Factory setting: | bAr |

U2.P_HYS - Hysteresis for limits

| | |
|--------------------|---|
| Possible settings: | 0.200 ... 1.000 (bar) 2.90 ... 14.50 (psi) 0.020 ... 0.100 (MPa) |
| Purpose: | Uniformly defines the hysteresis for the following limits: 1. Lower limit of supply pressure (PZMLL) 2. Upper limit of supply pressure (PZMUL) 3. Limit of actuating pressure on Y1 connection (PCL) |
| Factory setting: | 0.200 |

U3.PFRLL - Behavior lower limit PZ

| | |
|--------------------|---|
| Possible settings: | Cont / HoLd |
| Purpose: | Defines the behavior of the device as soon as the lower limit of the supply pressure PZ is violated. Cont = The positioner continues to follow the setpoint. HoLd = The current position is held. The device only follows the setpoint again when supply pressure PZ has exceeded the lower limit of the supply pressure. |
| Factory setting: | Cont |

U4.PFRUL - Behavior upper limit PZ

| | |
|--------------------|---|
| Possible settings: | Cont / HoLd |
| Purpose: | Defines the behavior of the positioner as soon as the upper limit of the supply pressure PZ is violated. Cont = The positioner continues to follow the setpoint. HoLd = The current position is held. The device only follows the setpoint again when supply pressure PZ has fallen below the upper limit of the supply pressure. |
| Factory setting: | Cont |

U5.PZMLL - Lower limit PZ

| | |
|--------------------|---|
| Possible settings: | 1.400 ... 7.000 (bar) 20.30 ... 101.52 (psi) 0.140 ... 0.700 (MPa) |
| Purpose: | Defines the minimum required supply pressure PZ. When the value is undershot, the error code "18 (Page 250)" appears on the display in "Automatic" and "Manual" modes. When the value of the supply pressure PZ is higher by the value set in "U2.P_HYS", the error code is no longer displayed. When "U3.PFRLL" is set to "HoLd", control is active again. |
| Factory setting: | 1.400 |

U6.PZMUL - Upper limit PZ

| | |
|--------------------|--|
| Possible settings: | 1.400 ... 7.000 (bar) 20.30 ... 101.52 (psi) 0.140 ... 0.700 (MPa) |
| Purpose: | Defines the maximum allowable supply pressure PZ. When the value is exceeded, the error code "20 (Page 251)" appears on the display in "Automatic" and "Manual" modes. When the value of the supply pressure PZ is lower by the value set in "U2.P_HYS", the error code is no longer displayed. When "U4.PFRUL" is set to "HoLd", control is active again. |
| Factory setting: | 7.000 |

U7.PCL - Limit actuating pressure Y1

| | |
|--------------------|---|
| Possible settings: | 0.000 ... 7.000 (bar) 0.00 ... 101.52 (psi) 0.000 ... 0.700 (MPa) |
| Purpose: | Defines the maximum allowable actuating pressure Y1. When the value is exceeded, the error code "21 (Page 251)" appears on the display in "Automatic" and "Manual" modes. The positioner holds the position. When the value of the actuating pressure is lower by the value set in "U2.P_HYS", the error code is no longer displayed. Control is active once again. |
| Factory setting: | 7.000 |

U8.LRL - Limit +/- Leakage

| | |
|--------------------|---|
| Possible settings: | 0.000 ... 7.000 (bar/min) 0.00 ... 101.52 (psi/min) 0.140 ... 0.700 (MPa) |
| Purpose: | Defines the pressure increase/leakage. The set value should not fall below "0.100". When the value is exceeded, the error code "22 (Page 251)" appears on the display in "Automatic" and "Manual" modes. Eliminate the leakage. Reset the min/max pointer. The min/max pointer can also be reset via HART communication. The error code is no longer displayed. When "LRL" = 0 (factory setting) is set, no error code is displayed. |
| Factory setting: | 0.000 |

U9.TPMT - Time pressure measurement Y1

| | |
|--------------------|---|
| Possible settings: | 1 ... 1000 s |
| Purpose: | Defines the time interval between 2 pressure measurements on the Y1 connection after the function has been triggered via HART. During the configured duration, the positioner holds the position and does not follow the setpoint. |
| Factory setting: | 1 |

8.6 Overview of the assignment of the HART variables

Dynamic variables for device revision 6, as of firmware 5.01.xx HART 7

For positioners with HART communication, the variables PV, SV, TV and QV are assigned as follows:

| Variable | Meaning | Physical variable |
|-------------------------------|------------------------|-----------------------------|
| HART Primary Variable (PV) | Primary variable | W (setpoint) in % |
| HART Secondary Variable (SV) | 1st secondary variable | X (actual value) in % |
| HART Tertiary Variable (TV) | 2nd secondary variable | Xd (control deviation) in % |
| HART Quaternary Variable (QV) | 3rd secondary variable | t (temperature) in °C |

Additional physical variables for Device Revision 8, as of firmware 5.03.xx HART 7

Starting with Device Revision 8, the following additional physical variables are available for the SV, TV and QV variables:

- W (setpoint) in %
- X (actual value on the LUI) in %
- Xd (control deviation) in %
- t (temperature) in °C or °F
- X (internal actual value) in %
- C (coded status of digital inputs and alarm outputs) in °C
- PZ (supply pressure PZ) in bar/psi/MPa
- Y1 (actuating pressure Y1 connection) in bar/psi/MPa
- Y2 (actuating pressure Y2 connection) in bar/psi/MPa

Functional safety

9.1 Range of applications for functional safety

The positioner is suitable for use on valves that satisfy the special requirements in terms of functional safety up to SIL 2 in accordance with IEC 61508 or IEC 61511. The 6DR5.1.-0....-.....-Z C20 versions are available for this.

These are single-acting positioners for mounting on pneumatic actuators with spring return.

The positioner automatically depressurizes the actuator on demand or in case of faults. The actuator brings the process valve to the specified safety position in this way.

This positioner meets the following requirement:

- Functional safety up to SIL 2 in accordance with IEC 61508 or IEC 61511 for safe venting

See also

Functional safety in process instrumentation (<http://www.siemens.com/SIL>)

9.2 Safety function

Depressurizing of the connected actuator is the safety function for the SIPART PS2 positioner. The built-in spring brings the process valve to the required safety position. Depending on the direction of action of this spring, the process valve is completely opened or closed.

The positioner starts the depressurizing process of the connected pneumatic actuator at the latest 100 ms after the request. The progress of the depressurizing process depends on the connections and properties of the pneumatic actuator.

This safety function can be triggered by:

- With 2-wire connection: a signal source with 0 mA.
- With 3/4-wire connection: a power supply source with 0 V.

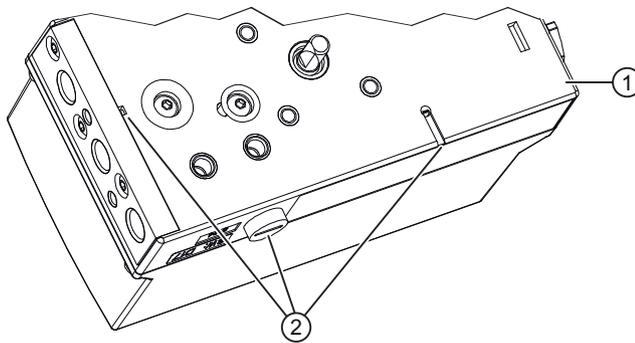
The safety function is not affected by other device functions, particularly the microcontroller, software and communication interface. With respect to this safety function, the positioner must therefore be considered as a type A subsystem in accordance with IEC 61508-2.

Situations in which it is not possible to depressurize the actuator on demand or in the case of a fault represent hazardous failure.

| |
|--|
| <p>⚠ WARNING</p> <p>Disregarding conditions for fulfilling the safety function</p> <p>Disregarding conditions can result in a malfunction of the process system or application, for example, process pressure too high, maximum level exceeded.</p> <p>The mandatory settings and conditions are listed in sections "Settings (Page 200)" and "Safety characteristics (Page 201)".</p> <ul style="list-style-type: none"> • These conditions must be met in order to fulfill the safety function. |
|--|

The pneumatic block of the positioner pressurizes and depressurizes the actuator. The characteristic service life of the pneumatic block depends on the load. On average, it is approx. 200 million switching cycles. The number of control procedures for the switching cycles is called in the local display or via HART communication. For more details, see Diagnostic value '42.VENT1' / '43.VENT2' (Page 234).

| |
|--|
| <p>NOTICE</p> <p>Freezing of the exhaust air outlets</p> <p>When devices of the type 6DR5..0/1/2/3 are used, the exhaust air outlets ② may freeze. The function of the device is impaired.</p> <ul style="list-style-type: none"> • Do not install the positioner with the base plate ① pointing up. |
|--|



- ① Base plate
- ② Exhaust air outlets

Figure 9-1 Exhaust air outlets, base plate

Safety-instrumented system in single-channel operation (SIL 2)

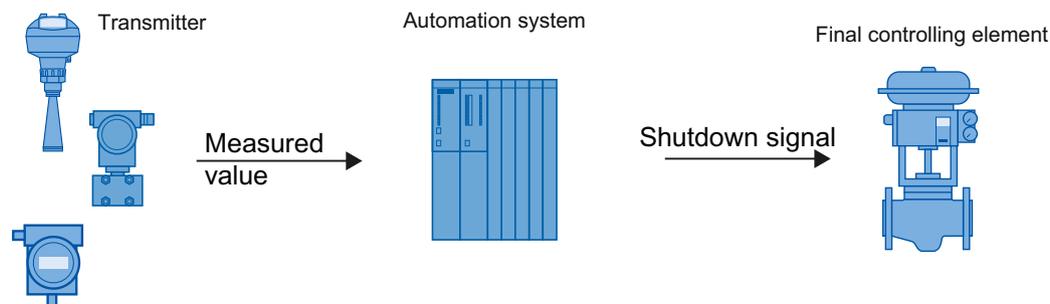


Figure 9-2 Safety-instrumented system in single-channel operation

The combination of transmitter, automation system and final controlling element forms a safety-instrumented system that performs a safety function.

The transmitter generates a process-related measured value that is transferred to the automation system. The automation system monitors this measured value. If the measured value violates the high or low limit, the automation system generates a shutdown signal for the connected final controlling element, which switches the corresponding process valve to the specified safety position.

9.3 Type A - Safety Integrity Level (SIL)

The international standard IEC 61508 defines four discrete Safety Integrity Levels (SIL) from SIL 1 to SIL 4. Each level corresponds to a range of probability for failure of a safety function.

Description

The following table shows the dependency of the SIL on the "average probability of dangerous failure of a safety function of the entire safety-instrumented system" (PFD_{AVG}). "Low demand mode" is examined. The safety function is required a maximum of once per year on average.

Table 9-1 Safety Integrity Level

| SIL | Interval |
|-----|------------------------------------|
| 4 | $10^{-5} \leq PFD_{AVG} < 10^{-4}$ |
| 3 | $10^{-4} \leq PFD_{AVG} < 10^{-3}$ |
| 2 | $10^{-3} \leq PFD_{AVG} < 10^{-2}$ |
| 1 | $10^{-2} \leq PFD_{AVG} < 10^{-1}$ |

The "average probability of dangerous failure of the entire safety-related system" (PFD_{AVG}) is normally split between the following three components:

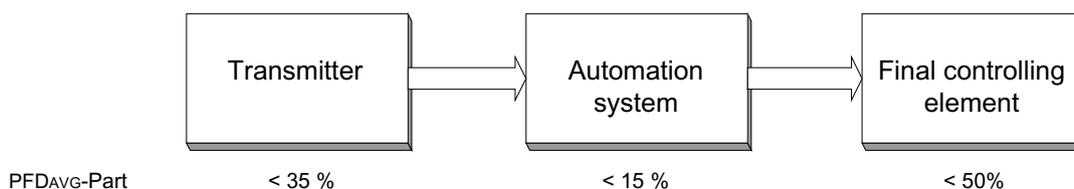


Figure 9-3 PFD distribution

The following table shows the achievable Safety Integrity Level (SIL) for the entire safety-related system for type A devices depending on the safe failure fraction (SFF) and the hardware fault tolerance (HFT).

- Type A devices include analog transmitters and solenoid valves **without** complex components, e.g. microprocessors (see also IEC 61508, Section 2).
- The specific values for your device are listed in the manufacturer's declaration of the device (SIL Declaration of Conformity, Functional Safety according to IEC 61508 and IEC 61511): Certificates (<http://www.siemens.com/processinstrumentation/certificates>).

| SFF | HFT for type A devices | | |
|-----------|------------------------|-------|-------|
| | 0 | 1 | 2 |
| < 60% | SIL 1 | SIL 2 | SIL 3 |
| 60 to 90% | SIL 2 | SIL 3 | SIL 4 |
| 90 to 99% | SIL 3 | SIL 4 | SIL 4 |
| > 99% | SIL 3 | SIL 4 | SIL 4 |

9.4 Settings

No special parameter settings are required for the safety function.

Protection against configuration changes

You should attach the enclosure cover so that the device is protected against unwanted and unauthorized changes/operation.

Checking the safety function

Prerequisite for checking the safety function

- Positioner is in operation.
- The actuator belonging to the positioner is **not** in the safety position.

Procedure

1. On the positioner, switch the signal source to 0 mA or the power supply source to 0 V.
2. Reduce the supply pressure (PZ) to one-third of the maximum supply pressure.
3. Always carry out the validation of the safety function with positioner, actuator and process valve under operating conditions.

Result

The actuator brings the process valve to the specified safety position.

See also

Safety function (Page 197)

9.5 Safety characteristics

The safety characteristics necessary for use of the system are listed in the SIL declaration of conformity. These values apply under the following conditions:

- The positioner is only used in applications with low demand rate for the "Low demand mode".
- The positioner is blocked against unwanted and unauthorized changes/operation.
- The signal source with 0 mA or the power supply source with 0 V for the SIPART PS2 positioner is generated by a safe system that fulfills SIL 2 for single-channel operation.
- The connected actuator must be single-acting and return the process valve to the safe end position by spring force in the following scenarios:
 - With an actuating pressure (Y1 connection) up to one-third of the maximum available supply pressure (PZ connection)
- The air outlet does not contain any additional cross-sectional contractions leading to an increased dynamic pressure. In particular, a silencer is only allowed if icing or other contamination is ruled out.
- The restrictor in the Y1 circuit may not be completely closed during operation.
- According to ISO 8573-1, the air quality is Class 3 maximum and free of oil, water and dirt.
- The average temperature viewed over a long period is 40 °C.
- Fault rates are calculated on the basis of a mean time to repair (MTTR) of 8 hours.
- In case of a fault, the pneumatic outlet of the positioner is depressurized. A spring in the pneumatic actuator must move the process valve to the pre-defined, safe end position.
- A dangerous failure of the positioner is one in which the pressure outlet is not depressurized or the safety position is not reached when the signal source is 0 mA or the power supply source is 0 V.

See also

Settings (Page 200)

9.6 Maintenance/check

Interval

We recommend that the functioning of the positioner is checked at regular intervals of one year.

Checking the safety function

Check the safety function as detailed in chapter "Settings (Page 200)"

Checking safety

Verify the safety function of the entire safety circuit on a regular basis in accordance with IEC 61508/61511. The test intervals are determined in the course of calculations for each safety circuit of a system (PFD_{AVG}).

Service and maintenance

10.1 Basic safety instructions

10.1.1 Maintenance

The device is maintenance-free. However, a periodic inspection according to pertinent directives and regulations must be carried out.

An inspection can include, for example, check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover
- Reliability of power supply, lightning protection, and grounds

| |
|--|
|  WARNING |
|--|

| |
|-------------------------------|
| Dust layers above 5 mm |
|-------------------------------|

| |
|---------------------------------------|
| Risk of explosion in hazardous areas. |
|---------------------------------------|

| |
|---|
| Device may overheat due to dust build up. |
|---|

- | |
|---|
| <ul style="list-style-type: none">• Remove dust layers in excess of 5 mm. |
|---|

| |
|--|
|  CAUTION |
|--|

| |
|------------------------------|
| Releasing button lock |
|------------------------------|

| |
|---|
| Improper modification of parameters could influence process safety. |
|---|

- | |
|--|
| <ul style="list-style-type: none">• Make sure that only authorized personnel may cancel the button locking of devices for safety-related applications. |
|--|

| |
|---------------|
| NOTICE |
|---------------|

| |
|--|
| Penetration of moisture into the device |
|--|

| |
|----------------|
| Device damage. |
|----------------|

- | |
|---|
| <ul style="list-style-type: none">• Make sure when carrying out cleaning and maintenance work that no moisture penetrates the inside of the device. |
|---|

10.2 Cleaning

The positioner is maintenance-free to a large extent. Screens are installed in the pneumatic connections of the positioners to protect them from rough dirt particles. If there are dirt particles in the supply air (PZ), they damage the screens and hamper the function of the positioner. Clean the screens as described in the following two chapters.

Cleaning the enclosure

- Clean the outside of the enclosure with the inscriptions and the display window using a cloth moistened with water or a mild detergent.
- Do not use any aggressive cleansing agents or solvents, e.g. acetone. Plastic parts or the painted surface could be damaged. The inscriptions could become unreadable.

 **WARNING**

Electrostatic charge

Risk of explosion in hazardous areas if electrostatic charges develop, for example, when cleaning plastic surfaces with a dry cloth.

- Prevent electrostatic charging in hazardous areas.

10.2.1 Positioners 6DR5..0, 6DR5..3 and 6DR5..5

Procedure for removal and cleaning of the sieves

1. Switch off the supply pressure PZ.
2. Remove the pneumatic pipelines.
3. Unscrew the lid of the 6DR5..0 or 6DR5..3 enclosure.
4. Remove the three screws on the pneumatic terminal strip.
5. Remove the sieves and O-rings behind the terminal strip.
6. Clean the sieves, e.g. using compressed air.

Procedure for installation of the sieves

 **CAUTION**

Damage to the polycarbonate enclosure 6DR5..0

- The enclosure is damaged due to screwing in the self-tapping screws improperly.
- Ensure that the available thread pitches are used.
- Turn the screws anticlockwise until they engage noticeably in the thread pitch.
- Tighten the self-tapping screws only after they have engaged.

1. Insert the sieves into the recesses of the enclosure.
2. Place the O-rings on the sieves.
3. Insert the pneumatic terminal strip.
4. Tighten the three screws. Note: With the polycarbonate enclosure, the screws are self-tapping.
5. Place the lid on and tighten it.
6. Connect the pneumatic pipelines again.

10.2.2 Positioners 6DR5..1, 6DR5..2 and 6DR5..6

Removal, cleaning and installation of the screens

1. Switch off the supply pressure PZ.
2. Remove the pneumatic connecting cables.
3. Remove the metal screen from the bores carefully.
4. Clean the metal screens, e.g. using compressed air.
5. Insert the screens.
6. Connect the pneumatic pipelines again.

10.3 Maintenance and repair work

Send defective devices to the repairs department, together with information on the malfunction and the cause of the malfunction. When ordering replacement devices, please provide the serial number of the original device. You can find the serial number on the nameplate.

| |
|--|
|  WARNING |
| Impermissible repair of the device |
| <ul style="list-style-type: none"> • Repair must be carried out by Siemens authorized personnel only. |

| |
|--|
|  WARNING |
| Maintenance during continued operation in a hazardous area |
| There is a risk of explosion when carrying out repairs and maintenance on the device in a hazardous area. |
| <ul style="list-style-type: none"> • Isolate the device from power. <p>- or -</p> <ul style="list-style-type: none"> • Ensure that the atmosphere is explosion-free (hot work permit). |

| |
|---|
|  WARNING |
| Impermissible accessories and spare parts |
| Risk of explosion in areas subject to explosion hazard. |
| <ul style="list-style-type: none">• Only use original accessories or original spare parts.• Observe all relevant installation and safety instructions described in the instructions for the device or enclosed with the accessory or spare part. |

| |
|--|
|  WARNING |
| Improper connection after maintenance |
| Risk of explosion in areas subject to explosion hazard. |
| <ul style="list-style-type: none">• Connect the device correctly after maintenance.• Close the device after maintenance work. |
| Refer to Electrical wiring (Page 79). |

10.4 HART/FF: Replacing electronics

Condition

- You are familiar with the general procedure described in the section "General information on installing option modules (Page 49)".

Procedure

Note

Possible movement of the actuator

When the electronics are being replaced, the actuator can be unintentionally depressurized.

- Observe the procedure described below.
-

Removing

1. Switch off the supply pressure PZ and depressurize the actuator.
2. Open the positioner as in the description depending on the device version:
 - Opening the standard and intrinsically safe version (Page 51)
 - Opening the device version with "flameproof enclosure" (Page 54)
3. Remove the ribbon cables and the electrical connections from the electronics.
4. Remove the two fixing screws of the electronics.

5. Remove the electronics.
6. Place the new electronics onto the four holders of the adapter.

Installation

1. Screw in the two fixing screws of the electronics.
2. Tighten the screws.
3. Connect the ribbon cables and the electrical connections.
4. Close the positioner as in the description depending on the device version:
 - Closing the standard and intrinsically safe version (Page 52)
 - Closing the device version with "flameproof enclosure" (Page 57)
5. For a positioner with order option -Z F01 "Fail in Place", adjust the parameter "PNEUM" from "Std" to "FIP".
6. For a positioner with linear actuator, adjust the electronics with the "73. RPL_E" parameter.
7. Switch on the supply pressure PZ.
8. Initialize the positioner as described in section "Commissioning (Page 103)".

10.5 Replacing the pneumatic block

Requirement

- You are familiar with the general procedure described in the section "General information on installing option modules (Page 49)".

Procedure

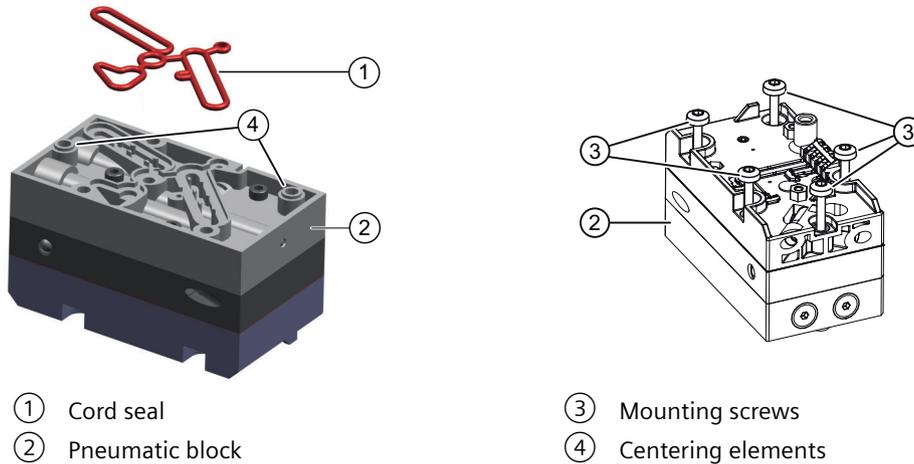


Figure 10-1 Pneumatic block

Removing

- Switch off the supply pressure PZ and depressurize the actuator.
- Open the positioner as in the description depending on the device version:
 - Opening the standard and intrinsically safe version (Page 51)
 - Opening the device version with "flameproof enclosure" (Page 54)
- Remove the ribbon cable from the electronics.
- Remove the two fixing screws of the electronics.
- Remove the electronics.
- Unscrew the fixing screws (3) of the pneumatic block (2).
4 screws for single-acting pneumatic block. 5 screws for double-acting pneumatic block.
- Remove the pneumatic block (2) and the cord seal (1).
- Blow any dirt off the surface on which the pneumatic block was placed.

Installation

- Insert the new cord seal (1) into the new pneumatic block (2).
- Press the cord seal (1) evenly into the groove on the pneumatic block (2).
- Place the new pneumatic block on the base plate.
Make sure that the pneumatic block engages with the centering elements (4) on the base plate.

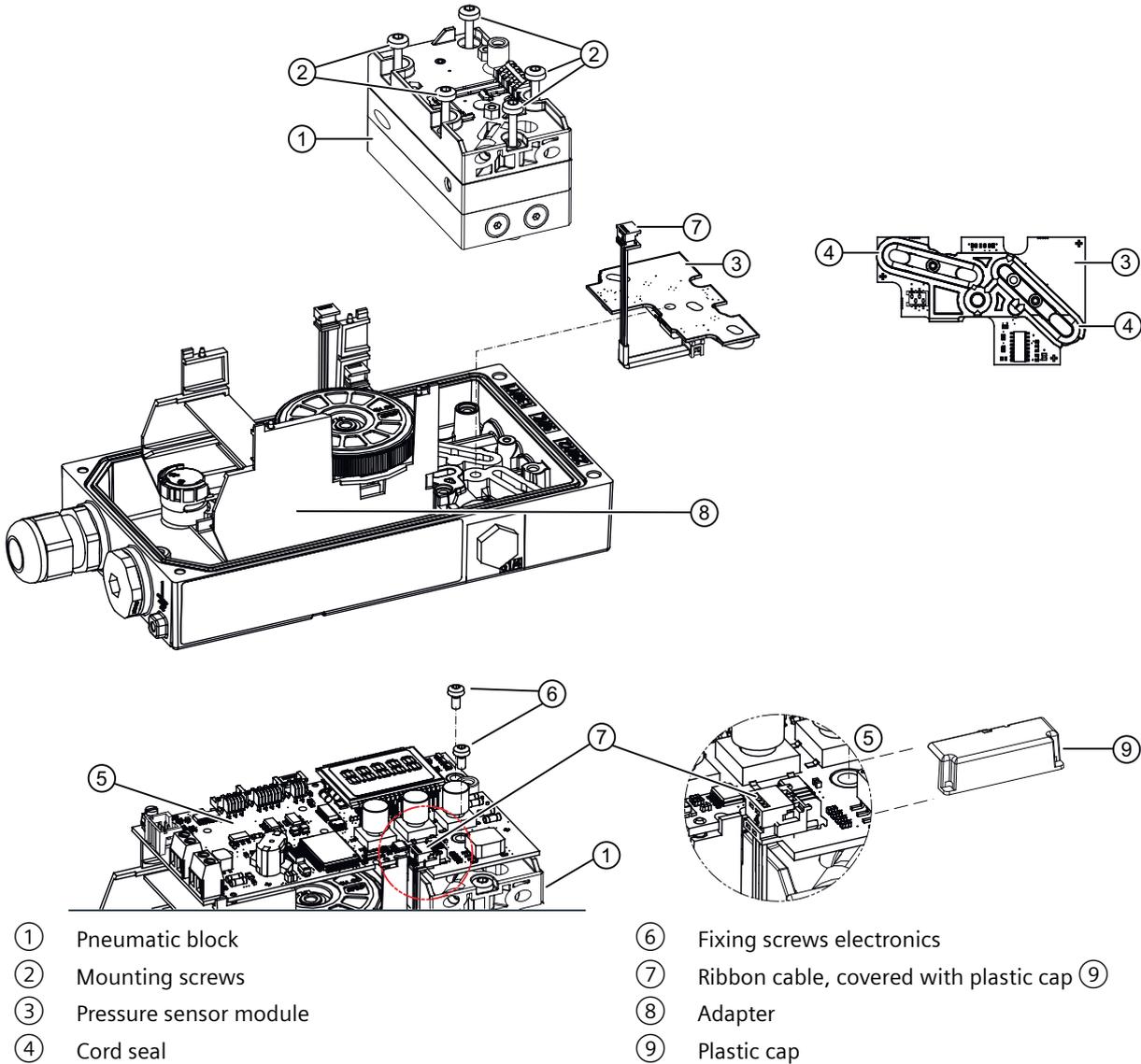
4. Screw the supplied fixing screws ③ into the pneumatic block.
5. Tighten the fixing screws with a torque of 1.1 Nm.
6. Place the electronics onto the four holders of the adapter.
7. Screw in the two fixing screws of the electronics.
8. Tighten the fixing screws.
9. Close the positioner as in the description depending on the device version:
 - Closing the standard and intrinsically safe version (Page 52)
 - Closing the device version with "flameproof enclosure" (Page 57)
10. For a positioner with order option -Z F01 "Fail in Place", adjust the parameter '51.PNEUM' Pneumatics type (Page 162) from "Std" to "FIP".
11. Switch on the supply pressure PZ.
12. Initialize the positioner as described in section "Commissioning (Page 103)".

10.6 Replace the pressure sensor module

Requirement

- You have a positioner with a built-in pressure sensor module, order suffix -Z P01 or -Z P02.
- You are familiar with the procedure described in section "Replacing the pneumatic block (Page 208)".

Overview screen



- ① Pneumatic block
- ② Mounting screws
- ③ Pressure sensor module
- ④ Cord seal
- ⑤ Electronics
- ⑥ Fixing screws electronics
- ⑦ Ribbon cable, covered with plastic cap ⑨
- ⑧ Adapter
- ⑨ Plastic cap

Figure 10-2 Pressure sensor, schematic diagram

Procedure

Removing

1. Switch off the supply pressure PZ and depressurize the actuator.
2. Open the positioner as described in section "Opening the standard and intrinsically safe version (Page 51)".
3. Remove the plastic cap ⑨.
4. Remove the ribbon cable ⑦ and all other ribbon cables from the electronics ⑤.

5. Remove the two fixing screws ⑥ of the electronics.
6. Remove the electronics ⑤.
7. Unscrew the fixing screws ② of the pneumatic block ①.
4 screws for single-acting pneumatic block. 5 screws for double-acting pneumatic block.
8. Remove the pneumatic block ①.
Make sure that the cord seal ④ of the pneumatic block is in the pneumatic block.
9. Blow any dirt off the surface on which the pneumatic block was placed.
10. Remove the pressure sensor module ③ and the cord seal ④ of the pressure sensor module.

Installation

1. Insert the new cord seal ④ into the new pressure sensor module ③.
2. Press the cord seal ④ into the groove on the pressure sensor module ③ on all sides.
3. Place the pressure sensor module ③ on the baseplate.
4. Place the pneumatic block ① on the pressure sensor module ③.
 - Make sure that the cord seal ④ of the pneumatic block is in the pneumatic block.
 - Make sure that the pneumatic block engages with the centering elements ④ (Page 208) on the base plate.
5. Screw the fixing screws ② into the pneumatic block ①.
6. Tighten the fixing screws ② with a torque of 1.1 Nm.
7. Place the electronics ⑤ onto the four holders of the adapter ⑧.
8. Screw in the two fixing screws ⑥ of the electronics.
9. Tighten the fixing screws ⑥.
10. Insert the ribbon cable ⑦ and all other ribbon cables onto the electronics ⑤.
11. Place the plastic cap ⑨.
12. Close the positioner as described in section "Closing the standard and and intrinsically safe version (Page 52)".
13. For a positioner with order option -Z F01 "Fail in Place", adjust the parameter '51.PNEUM' Pneumatics type (Page 162) from "Std" to "FIP".
14. Switch on the supply pressure PZ.
15. Initialize the positioner as described in section "Commissioning (Page 103)".

Result

The pressure sensor module is ready to use again.

See also

Closing the device version with "flameproof enclosure" (Page 57)

Parameter assignment (Page 135)

General information on installing option modules (Page 49)

10.7 Return procedure

Enclose the bill of lading, return document and decontamination certificate in a clear plastic pouch and attach it firmly to the outside of the packaging.

Required forms

- Delivery note
- Return document (<http://www.siemens.com/processinstrumentation/returngoodsnote>) with the following information:
 - Product (item description)
 - Number of returned devices/replacement parts
 - Reason for returning the item(s)
- Decontamination declaration (<http://www.siemens.com/sc/declarationofdecontamination>)
With this declaration you warrant "that the device/replacement part has been carefully cleaned and is free of residues. The device/replacement part does not pose a hazard for humans and the environment."
If the returned device/replacement part has come into contact with poisonous, corrosive, flammable or water-contaminating substances, you must thoroughly clean and decontaminate the device/replacement part before returning it in order to ensure that all hollow areas are free from hazardous substances. Check the item after it has been cleaned. Any devices/replacement parts returned without a decontamination declaration will be cleaned at your expense before further processing.

10.8 Disposal



Devices described in this manual should be recycled. They may not be disposed of in the municipal waste disposal services according to the Directive 2012/19/EC on waste electronic and electrical equipment (WEEE).

Devices can be returned to the supplier within the EC, or to a locally approved disposal service for eco-friendly recycling. Observe the specific regulations valid in your country.

Further information about devices containing batteries can be found at: Information on battery/product return (WEEE) (<https://support.industry.siemens.com/cs/document/109479891/>)

Diagnostics and troubleshooting

11.1 Output of system messages in the display

11.1.1 System messages before initialization

Remarks about the tables:

- nn Stands for variable numeric values
- ↳ Error symbol
- / (slash): the texts on the left and right of the slash flash alternately

Messages before initialization (first commissioning)

| Message | Line | | Meaning / cause | Measure |
|--------------|------|------|--|--|
| | Up | Down | | |
| CPU Start | X | X | Message after application of electrical auxiliary power | <ul style="list-style-type: none"> • Maintenance |
| Pnnn.n | X | | Potentiometer voltage of a non-initialized positioner (P-manual mode) (actual position value in % of the measuring range). | <ul style="list-style-type: none"> • Check whether the complete travel can be covered using the ▲ and ▼ buttons and that "P---" is never displayed. • Execute the initialization process. |
| P--- | X | | Measuring range was exceeded, the potentiometer is in the inactive zone, the transmission ratio selector or the effective lever arm are not adjusted as per the actuator travel. | <ul style="list-style-type: none"> • Switch the transmission ratio selector to 90°, especially in the case of part-turn actuators. • Adjust the effective lever length of linear actuators as per the measuring range. |
| NOINI | | X | Positioner is not initialized. | <ul style="list-style-type: none"> • Start initialization. |

See also

Display (Page 93)

11.1.2 System messages during initialization (HART)

Remarks about the tables:

- nn Stands for variable numeric values
- ↳ Error symbol
- / (slash): the texts on the left and right of the slash flash alternately

Messages during initialization

| Message | Line | | Meaning/cause | Measure |
|---------|------|-------------|--|---|
| | Top | Bot- tom | | |
| P--- | X | | Measuring range was exceeded, the potentiometer is in the inactive zone, the transmission ratio selectors or the effective lever arm are not adjusted as per the actuator travel | <ul style="list-style-type: none"> Switch the transmission ratio selector to 90°, especially in the case of part-turn actuators. Adjust the effective lever length of linear actuators as per the measuring range. |
| RUN 1 | | X | Initialization was started, part 1 is active (the direction of action is determined) | <ul style="list-style-type: none"> Wait. |
| RUN 2 | | X | Initialization part 2 is active (actuator travel check and determination of stops) | <ul style="list-style-type: none"> Wait. |
| RUN 3 | | X | Initialization part 3 is active (determination and display of travel times) | <ul style="list-style-type: none"> Wait. |
| RUN 4 | | X | Initialization part 4 is active (determination of the minimum controller increment length) | <ul style="list-style-type: none"> Wait. |
| RUN 5 | | X | Initialization part 5 is active (optimization of the transient response) | <ul style="list-style-type: none"> Wait until "FINSH" is displayed. Initialization was completed successfully. For option -Z P02: Wait. |
| RUN 6 | | X | Initialization part 6 is active (determination of Valve Signature) | <ul style="list-style-type: none"> Wait until "FINSH" is displayed. Initialization was completed successfully. |
| YEND1 | | X | The first position of the stop can be approached only in case of a manual initialization | <ol style="list-style-type: none"> Approach first position of the stop with the button  or . Acknowledge using  button. |
| YEND2 | | X | The second position of the stop can be approached only in case of a manual initialization | <ol style="list-style-type: none"> Approach second position of the stop with the button  or . Acknowledge using  button. |
| RANGE | | X | The position of the stop or the measuring span is beyond the permissible measuring range only in case of a manual initialization | <ul style="list-style-type: none"> Approach a different position of the stop using  or  button and acknowledge using  button. Move the friction clutch until "ok" is displayed, and then acknowledge with the  button. Terminate the initialization process using the  button, switch to the P-manual mode, and correct the actuator travel and the position displacement sensor. |
| ok | | X | The permissible measuring range of end positions is achieved only in case of a manual initialization | <ul style="list-style-type: none"> Use the  button to acknowledge; the remaining steps ("RUN 1" to "FINSH") run automatically. |

11.1 Output of system messages in the display

| Message | Line | | Meaning/cause | Measure |
|------------------|------|-------------|--|--|
| | Top | Bot- tom | | |
| RUN 1 / ERROR | | X | Error in "RUN 1", no movement e.g. due to the lack of compressed air Possible causes: <ul style="list-style-type: none"> • Insufficient supply of compressed air. • Restrictor(s) closed. • Actuator does not move freely. • Position sensor not connected before starting the device. | Measures: <ol style="list-style-type: none"> 1. Eliminate cause. 2. Restart device. 3. Repeat initialization. |
| VS-ER | | X | Error in "RUN 6". Valve Signature (VS) could not be recorded successfully. Start/end position or return position not reached. Pressure sensor module defective. | <ul style="list-style-type: none"> • Check supply pressure. • Check whether application ranges are adhered to. • Check the pressure sensor module. Pressure values in the Diagnostics menu Parameter 60, 61, and 62 are plausible. |
| ↳d__U | | X | Bar graph display of the zero point is outside the tolerance range | <ol style="list-style-type: none"> 1. Set between "P 4.0" and "P 9.9" (>0<) using friction clutch. 2. Continue using  or  button. |
| ↳UP > | | X | "UP" tolerance range was exceeded or the inactive zone of the potentiometer was covered. | <ol style="list-style-type: none"> 1. Increase the effective lever length of the linear actuators or switch the transmission ratio selector to 90°. 2. Briefly acknowledge using  button. 3. Restart initialization. |
| ↳90_95 | | X | Possible only in case of part-turn actuators: actuator travel is not in the range between 90 and 95% | <ol style="list-style-type: none"> 1. Use the  or  button to move it in the range between 90 and 95%. 2. Briefly acknowledge using  button. |

11.1 Output of system messages in the display

| Message | Line | | Meaning/cause | Measure |
|---------|------|-------------|---|---|
| | Top | Bot- tom | | |
| hU-d> | | X | Adjustment of the electronics not yet completed for a positioner with linear actuator. For the device versions: <ul style="list-style-type: none"> • 6DR50.5 • 6DR51.5 • 6DR50.6 • 6DR51.6 | <ol style="list-style-type: none"> 1. Switch to operating mode "P manual mode". 2. Press the  or  button so that the lever of the mounting kit reaches the horizontal position or as close as possible to the horizontal position. 3. In "Diagnostics" mode, select the diagnostic value "73. RPL_EL". "SEt" is displayed. 4. Start the adjustment by keeping the  button pressed. After 5 seconds, "oCAY" is displayed. The adjustment is complete. 5. Restart initialization. |
| | | | "Up-Down" measuring span was fallen below | <ol style="list-style-type: none"> 1. Decrease the effective lever length of the linear actuators or switch the transmission ratio selector to 33°. 2. Briefly acknowledge using  button. 3. Restart initialization. |
| U nn.n | X | | Display of the "Up" travel time | <ul style="list-style-type: none"> • Wait until initialization continues in RUN 4. • To change the travel time, interrupt the initialization process using the  button. • Activate the leakage test using the  button. |
| D->U | | X | | |
| D nn.n | X | | Display of the "Down" travel time | <ul style="list-style-type: none"> • Wait until initialization continues in RUN 4. • To change the travel time, interrupt the initialization process using the  button. • Activate the leakage test using the  button. |
| U->d | | X | | |
| NOZZL | | X | Actuator stops (the initialization process was interrupted using the "-" button when the actuation speed display was active) | <ol style="list-style-type: none"> 1. The travel time can be changed by adjusting the restrictor(s). 2. Redetermine the positioning speed using the  button. 3. Continue using  button. |
| TEST | X | | Leakage test active (the "+" button was pressed when the actuation speed display was active) | <ul style="list-style-type: none"> • Wait for one minute. |
| LEAKG | | X | | |
| nn.n | X | | Value and unit of the result after the leakage test | <ul style="list-style-type: none"> • Rectify the leakage if the value is too large. • Continue using  button. |
| %/MIN | | X | | |
| nn.n | X | | Initialization completed successfully with the display of actuator travel or the actuator angle | <ol style="list-style-type: none"> 1. Briefly acknowledge using  button. 2. Leave configuration level with a long press on the  button. |
| FINISH | | X | | |

See also

System messages before initialization (Page 213)

Overview of diagnostics values 1.STRK to 58.LKPER (Page 220)

11.1.3 System messages when exiting the Configuration mode

Remarks about the tables:

nn Stands for variable numeric values

⌋ Error symbol

/ (slash): the texts on the left and right of the slash flash alternately

Messages when exiting the configuration mode:

| Message | Line | | Operating mode | | | Meaning / cause | Measure |
|----------------|------|-------------|----------------|-------------|---------------|---|---------------------|
| | Up | Bot- tom | Automatic | Manual mode | P manual mode | | |
| n.nn.nn- nn | X | X | | | | Software version | • Maintenance |
| Error SLnn | X | X | | | | Monotony interrup- tion of the free charac- teristic on the setpoint turning point n | • Correct the value |

11.1.4 System messages during operation

Remarks about the tables:

nn Stands for variable numeric values

⌋ Error symbol

/ (slash): The texts on the left and right of the slash flash alternately

Messages during operation

| Message | Line | | Operating mode | | | Meaning/cause | Measure |
|---------------|------|-------------|----------------|----------------|-----------------------|---|-------------------------|
| | Top | Bot- tom | Auto- matic | Manual mode | P man- ual mode | | |
| CPU START | X | X | | | | Message after application of elec- trical auxiliary power. | • Wait |
| HW / ERROR | | X | | | | Fault in the hardware. | • Replace electronics. |
| NOINI | | X | | | X | Positioner is not initialized. | • Start initialization. |

11.1 Output of system messages in the display

| Message | Line | | Operating mode | | | Meaning/cause | Measure |
|-------------|------|-------------|----------------|----------------|-----------------------|--|---|
| | Top | Bot- tom | Auto- matic | Manual mode | P man- ual mode | | |
| nnn.n | X | | X | X | | Actual position [in %] for initialized positioner. Flashing decimal point shows communication with a class 2 master. | |
| AUTnn | | X | X | | | Automatic mode (nn = setpoint) | |
| MANnn | | X | | X | | Manual mode (nn = setpoint) | <ul style="list-style-type: none"> Switch to automatic mode with . |
| HTnn | | x | x | | | Setpoint specification via HART | <ul style="list-style-type: none"> Do not specify the setpoint via HART anymore or restart device. |
| oFL / 127.9 | X | | X | X | | Display range exceeded. Possible causes: <ul style="list-style-type: none"> Friction clutch or Transmission ratio selector was moved or Positioner was installed on a different actuator without being re-initialized. | <ul style="list-style-type: none"> Offset friction clutch so that, when the actuator moves, the actual value display stays between 0.0 and 100.0, or Adjust the transmission ratio selector or Perform factory settings (Preset) and initialization. |
| EXSTP | | X | X | | | Actuator was stopped by the digital input. | |
| EX UP | | X | X | | | Actuator is moved to the upper endstop by the digital input. | |
| EXDWN | | X | X | | | Actuator is moved to the lower endstop by the digital input. | |
| EXPSt | | | | | | Partial Stroke Test was activated, e.g. by the digital input. | |
| InPSt | | | | | | Cyclic Partial Stroke Test. | |
| FST | | X | X | | | Full Stroke Test is running. | |
| SRT | | X | X | | | Step Response Test is running. | |
| MSRT | | X | X | | | Multi Step Response Test is running. | |
| VPT | | X | X | | | Valve Performance Test is running. | |
| VS | | X | X | | | Valve Signature Test is running. | |
| LEAKR | | X | X | | | A leakage test started by communication is running. | |

11.2 Diagnostics

11.2.1 Display of diagnostics values

Structure of the diagnostics display

The display in "Diagnostics" mode has a structure similar to that in "Configuration" mode:

- The upper line shows the value of the diagnostics variable.
- The lower line shows the number and the abbreviation of the displayed variable.

Some diagnostics value can be greater than 99999. In such a case, the display switches over to the exponential view. Example: The value "1234567" is shown as "1.23E6".

General procedure

1. Press all three buttons at the same time for at least 2 seconds. You are now in the diagnostics display.
2. Use the  button to select the next diagnostics value.
3. Press the  button for at least 2 seconds in order to exit the diagnostics display.

How to show the diagnostics values in reverse order

Press the  and  buttons simultaneously.

How to set values to zero

Specific values can be set to zero by pressing the  button for at least 5 seconds. The diagnostics values which can be reset are listed in the table in section "Overview of diagnostics values 1.STRK to 58.LKPER (Page 220)".

11.2.2 Saving the diagnostics values

The diagnostic values are written into a non-volatile memory every 15 minutes so that, in the event of a power failure, only the diagnostic values of the previous 15 minutes are lost. The values in the resettable parameters can be set to zero.

To do this, press the  button for at least 5 seconds.

The diagnostic values which can be reset can be found in the table in section Overview of diagnostics values 1.STRK to 58.LKPER (Page 220).

11.2.3 Overview of diagnostics values 1.STRK to 58.LKPER

Explanatory notes on the following table

- The "Representable diagnostic values" column shows the factory-set diagnostic values for the diagnostic parameters in **bold**.
- The "Properties" column shows the properties of the diagnostics parameters:
 - ① Diagnostic value can be read and reset
 - ② Diagnostic value can be read but **not** reset
 - ③ Diagnostic value can be read but **not** reset. A function can be executed.
 - ④ Diagnostic value can be read, manually reset, and manually changed

Overview of diagnostic values

| No. | Short designation | Meaning | Representable diagnostic values | Unit | Properties |
|-----|-------------------|-------------------------------------|---|-------------|------------|
| 1 | STRKS | Number of total strokes | 0 ... 4.29E9 | - | ① |
| 2 | CHDIR | Number of changes in direction | 0 ... 4.29E9 | - | ① |
| 3 | LCNT | Number of fault messages | 0 ... 4.29E9 | - | ① |
| 4 | A1CNT | Number of alarms 1 | 0 ... 4.29E9 | - | ① |
| 5 | A2CNT | Number of alarms 2 | 0 ... 4.29E9 | - | ① |
| 6 | HOURS | Number of operating hours | 0 ... 4.29E9 | Hours | ② |
| 7 | HOURR | Resettable operating hours counter | 0 ... 4.29E9 | | ① |
| 8 | WAY | Determined travel | 0 ... 130 | mm or ° | ② |
| 9 | TUP | Travel time up | 0.0 / 0 ... 1000 | s | ② |
| 10 | TDOWN | Travel time down | 0.0 / 0 ... 1000 | s | ② |
| 11 | LEAK | Leakage test | - / 0.0 ... 100.0 | %/minute | ③ |
| 12 | PST | Monitoring of Partial Stroke Test | OFF / ###.#, FdInI, notSt, SdtSt, fdtSt, notoL, Strt, StoP | s for ###.# | ③ |
| 13 | PRPST | Time since last Partial Stroke Test | ### , notSt , Sdtst, fdtSt | Days | ② |
| 14 | NXPST | Time until next Partial Stroke Test | OFF / ### | Days | ② |
| 15 | DEVI | Dynamic control valve behavior | 0.0 ... 100.0 | % | ② |
| 16 | ONLK | Pneumatic leakage | 0.0 ... 100.0 | - | ② |
| 17 | STIC | Stiction (slipstick) | 0.0 ... 100.0 | % | ② |
| 18 | ZERO | Lower endstop | 0.0 ... 100.0 | % | ② |
| 19 | OPEN | Upper endstop | 0.0 ... 100.0 | % | ② |
| 20 | PAVG | Average value of position | OFF , IdLE, rEF, COMP 0.0 ... 100.0 | % | ② |
| 21 | P0 | Position of lower endstop (0%) | 0.0 ... 100.0 | % | ③ |
| 22 | P100 | Position of upper endstop (100%) | 0.0 ... 100.0 | % | ③ |
| 23 | IMPUP | Pulse length up | 6 ... 160 | ms | ④ |

| No. | Short designation | Meaning | Representable diagnostic values | Unit | Properties |
|-----|-------------------|--|---------------------------------|----------|------------|
| 24 | IMPDN | Pulse length down | 6 ... 160 | ms | ④ |
| 25 | PAUTP | Pulse pause | 2 ... 28 ... 320 | ms | ④ |
| 26 | DBUP | Deadband up | 0.1 ... 10.0 | % | ② |
| 27 | DBDN | Deadband down | 0.1 ... 10.0 | % | ② |
| 28 | SSUP | Slow step zone up | 0.1 ... 10.0 ... 100.0 | % | ④ |
| 29 | SSDN | Slow step zone down | 0.1 ... 10.0 ... 100.0 | % | ④ |
| 30 | TEMP | Current temperature | -50 ... 100 -58 ... 212 | °C °F | ② |
| 31 | TMIN | Minimum temperature (min/max pointer) | -50 ... 100 -58 ... 212 | °C °F | ② |
| 32 | TMAX | Maximum temperature (min/max pointer) | -50 ... 100 -58 ... 212 | °C °F | ② |
| 33 | T1 | Number of operating hours in temperature range 1 | 0 ... 4.29E9 | Hours | ② |
| 34 | T2 | Number of operating hours in temperature range 2 | 0 ... 4.29E9 | Hours | ② |
| 35 | T3 | Number of operating hours in temperature range 3 | 0 ... 4.29E9 | Hours | ② |
| 36 | T4 | Number of operating hours in temperature range 4 | 0 ... 4.29E9 | Hours | ② |
| 37 | T5 | Number of operating hours in temperature range 5 | 0 ... 4.29E9 | Hours | ② |
| 38 | T6 | Number of operating hours in temperature range 6 | 0 ... 4.29E9 | Hours | ② |
| 39 | T7 | Number of operating hours in temperature range 7 | 0 ... 4.29E9 | Hours | ② |
| 40 | T8 | Number of operating hours in temperature range 8 | 0 ... 4.29E9 | Hours | ② |
| 41 | T9 | Number of operating hours in temperature range 9 | 0 ... 4.29E9 | Hours | ② |
| 42 | VENT1 | Number of switching cycles of pneumatic block, valve 1 | 0 ... 4.29E9 | - | ② |
| 43 | VENT2 | Number of switching cycles of pneumatic block, valve 2 | 0 ... 4.29E9 | - | ② |
| 44 | VEN1R | Number of switching cycles of pneumatic block, valve 1, resettable | 0 ... 4.29E9 | - | ① |
| 45 | VEN2R | Number of switching cycles of pneumatic block, valve 2, resettable | 0 ... 4.29E9 | - | ① |
| 46 | STORE | Save the current values as 'last maintenance' (press  button for 5 seconds) | - | - | ③ |
| 47 | PRUP | Prediction up | 1 ... 40 | - | ④ |
| 48 | PRDN | Prediction down | 1 ... 40 | - | ④ |
| 49 | WT00 | Number of operating hours in the travel range WT00 | 0 ... 4.29E9 | Hours | ① |
| 50 | WT05 | Number of operating hours in the travel range WT05 | 0 ... 4.29E9 | Hours | ① |
| 51 | WT10 | Number of operating hours in the travel range WT10 | 0 ... 4.29E9 | Hours | ① |
| 52 | WT30 | Number of operating hours in the travel range WT30 | 0 ... 4.29E9 | Hours | ① |
| 53 | WT50 | Number of operating hours in the travel range WT50 | 0 ... 4.29E9 | Hours | ① |
| 54 | WT70 | Number of operating hours in the travel range WT70 | 0 ... 4.29E9 | Hours | ① |
| 55 | WT90 | Number of operating hours in the travel range WT90 | 0 ... 4.29E9 | Hours | ① |
| 56 | WT95 | Number of operating hours in the travel range WT95 | 0 ... 4.29E9 | Hours | ① |

11.2 Diagnostics

| No. | Short designation | Meaning | Representable diagnostic values | Unit | Properties |
|-----|-------------------|---|--|------------------------|------------|
| 57 | LKPUL | Length of the leakage compensation pulse | -256 ... 0 ... 254 | ms | ② |
| 58 | LKPER | Period of the leakage compensation pulse | 0.00 ... 600.00 | s | ② |
| 59 | mA | Setpoint current | 0.0 ... 20.0 | mA | ② |
| 60 | PZ | Supply pressure PZ | 9.999 | bar | ③ |
| 61 | P1 | Actuating pressure Y1 | 999.99 | psi | ③ |
| 62 | P2 | Actuating pressure Y2 | 9.999 | MPa | ③ |
| 63 | PZMAX | Maximum supply pressure PZ | | | ① |
| 64 | N_MIN | Event counter violations of lower limit PZ | 0 ... 99999 | - | ① |
| 65 | N_MAX | Event counter violations of upper limit PZ | | | |
| 66 | N1MAX | Event counter violations limit Y1 | | | |
| 67 | LMY1 | +/- Leakage at Y1 | ±0.000 ... 9.999 | bar / min | ② |
| 68 | LMY2 | +/- Leakage at Y2 | ±0.000 ... 0.999 ±0.00 ... 99.99 | MPa / min psi / min | |
| 69 | LMUY1 | Maximum positive leakage at Y1 | +0.000 ... 9.999 | bar / min | ① |
| 70 | LMUY2 | Maximum positive leakage at Y2 | +0.000 ... 0.999 +0.00 ... 99.99 | MPa / min psi / min | |
| 71 | LMDY1 | Maximum negative leakage at Y1 | -9.999 ... -0.000 | bar / min | ① |
| 72 | LMDY2 | Maximum negative leakage at Y2 | -0.999 ... -0.000 -99.99 ... -0.000 | MPa / min psi / min | |
| 73 | RPL_E | Procedure for adjustment of electronics | - | - | ③ |
| 74 | TRIM | The position of the replaced positioner is adjusted to the position of the previous positioner. | -10.0 ... 110.0 | % | ④ |

11.2.4 Meaning of the diagnostics values

11.2.4.1 Diagnostic value '1.STRKS - Number of total strokes'

Display range: 0 ... 4.29E9
 Purpose: In operation, the movements of the actuator are summed up and displayed in this diagnostics parameter as the number of strokes.
 Unit: 100% strokes, i.e. the path between 0% and 100% and back.

11.2.4.2 Diagnostic value '2.CHDIR - Number of changes in direction'

Display range: 0 ... 4.29E9
 Purpose: Every change in direction of the actuator is noted in the controller and added to the number of changes in direction.

11.2.4.3 Diagnostic value '3.\CNT - Number of fault messages'

| | |
|----------------|---|
| Display range: | 0 ... 4.29E9 |
| Purpose: | Every fault is noted in the closed-loop controller with '3.\CNT' and added to the number of fault messages. |

11.2.4.4 Diagnostic value '4.A1CNT - Number of alarms 1' / '5.A2CNT - Number of alarms 2'

| | |
|----------------|--|
| Requirement: | '44.AFCT' Alarm function (Page 158) parameter is activated. |
| Display range: | 0 ... 4.29E9 |
| Purpose: | This value indicates how often the alarm has been triggered. |

11.2.4.5 Diagnostic value '6.HOURS - Number of operating hours'

| | |
|----------------|--|
| Display range: | 0 ... 4.29E9 |
| Purpose: | The runtime meter is incremented every hour as soon as electric auxiliary power is supplied to the positioner. |

11.2.4.6 Diagnostic value '7.HOURR - Resettable operating hours counter'

| | |
|----------------|---|
| Display range: | 0 ... 4.29E9 |
| Purpose: | The runtime meter is incremented every hour as soon as electric auxiliary power is supplied to the positioner. In contrast to Diagnostic value '6.HOURS - Number of operating hours' (Page 223), this value can be reset. |
| Description: | In order to minimize the control valve wear resulting from a poor control quality, it makes sense to optimize the positioner's parameters. You can recognize optimum parameter settings when the values of the Diagnostic value '44.VEN1R' / '45.VEN2R' (Page 234) are low. Low values mean that the switching frequency of the positioner pneumatics is also low. In order to carry out a comparison with various parameter settings, determine the number of switching cycles per hour. To do this, use the values of the Diagnostic value '44.VEN1R' / '45.VEN2R' (Page 234) and '7.HOURR'. These three parameters can be reset to enable simpler determination of the values. |

11.2.4.7 Diagnostic value '8.WAY - Determined travel'

| | |
|--------------------------------|--|
| Condition for linear actuator: | The travel is set in the '3.YWAY' Range of stroke (Page 147) parameter. |
| Display range: | 0 ... 130 |
| Purpose: | This value in mm or ° specifies the travel determined during the initialization. |

11.2.4.8 Diagnostic value '9.TUP - Travel time up' / '10.TDOWN - Travel time down'

| | |
|----------------|--|
| Display range: | 0 ... 1000 |
| Purpose: | This value indicates the current UP or DOWN travel time in seconds determined during the initialization. |

11.2.4.9 Diagnostic value '11.LEAK - Leakage test'

| | |
|----------------|---|
| Condition | The positioner is initialized and in manual mode (MAN). |
| Display range: | <ul style="list-style-type: none">-0.0 ... 100.0 |

| | |
|--------------|---|
| Purpose: | <p>You can use this diagnostics parameter to read the last test result or start an offline leakage test with which you can detect leakages in the actuator or in the pipe installation. Display is percent stroke per minute referred to the total stroke. A test result originates from one of the following options:</p> <ul style="list-style-type: none"> • Function '11.LEAK' has already been carried out. • Leakage test was already carried out during initialization, see procedure of RUN 3 in section Sequence of automatic initialization (Page 106). • 'Offline leakage test' function was already executed by a HOST system. <p>"-" in the display can have the following causes:</p> <ul style="list-style-type: none"> • A leakage test has not yet been carried out. • Resetting to the factory settings was carried out using the '50.PRST' Preset (HART/FF) (Page 162) > ALL parameter. • Positioner is not initialized. <p>How to start the test</p> <ol style="list-style-type: none"> 1. Move the actuator to the position at which you wish to start the test. 2. In 'Diagnostics' mode, go to the '11.LEAK' diagnostic value as described in section Display of diagnostics values (Page 219). 3. Start the function by pressing the  button for at least 5 seconds. |
| Description: | <p>'Strt' is output in the display. The function is started after 5 seconds. 'tEst' and the current position of the actuator (actual value) are then displayed alternately for one minute.</p> <p>After one minute, the display shows the difference in the actuator position before and after the test. This means: the actuator position has changed by the displayed value in one minute.</p> |

11.2.4.10 Diagnostic value '12.PST - Monitoring of Partial Stroke Test'

| | |
|----------------------------|--|
| Indication on the display: | <ul style="list-style-type: none"> • OFF • C-ERR • FdIni • notSt • ###.# • SdtSt • FdtSt |
| Purpose: | <p>This diagnostics parameter indicates the measured stroke time of the last Partial Stroke Test.</p> <p>A Partial Stroke Test can be initiated manually or an active Partial Stroke Test can be interrupted by pressing the  button.</p> |

11.2 Diagnostics

- Description of indications on the display:
 - OFF: The Partial Stroke Test function is deactivated.
 - C-ERR: Configuration error. Partial Stroke Test cannot be started. Settings in the 'A1.STPOS start position', 'A3.STRKH stroke height' and 'A4.STRKD stroke direction' are not plausible.
 - FdIni - Failed PST Initialization: The reference stroke time measurement of the Partial Stroke Test has failed.
 - notSt - No Test: A Partial Stroke Test has not yet been executed.
 - ###.#: Corresponds to the measured stroke time in seconds. The last Partial Stroke Test was successfully executed.
 - SdtSt - Stopped Test: The last Partial Stroke Test was interrupted.
 - FdtSt - Failed Test: The last Partial Stroke Test failed.
- Status messages:

The following status messages appear when you hold the  button pressed:

 - notoL - No Tolerance: The valve is outside the tolerance range for start of the Partial Stroke Test. No manual Partial Stroke Test will be started.
 - Strt - Start: A manual Partial Stroke Test is started after the button is pressed for five seconds.
 - WAIT - Wait: The Partial Stroke Test is being executed.
- Factory setting: OFF

11.2.4.11 Diagnostic value '12.PST - Monitoring of Partial Stroke Test' with option -Z P02

The monitoring of the Partial Stroke Test for positioners with pressure sensor module is described below.

- Indication on the display:
 - OFF
 - C-ERR
 - FdIni
 - notSt
 - norEF
 - oCAY
 - SdtSt
 - FdtSt

Purpose: This diagnostics parameter indicates the status of the last Partial Stroke Test.

A Partial Stroke Test can be initiated manually or an active Partial Stroke Test can be interrupted by pressing the  button.

| | |
|--|--|
| Description of indications on the display: | <ul style="list-style-type: none"> • OFF: The function of the Partial Stroke Test is disabled. • C-ERR: Configuration error. Partial Stroke Test cannot be started. Settings in the "A1.STPOS start position" and "Ad.ENPOS end position" parameters are not plausible. • FdInI - Failed PST Initialization: A reference abort pressure is determined with the parameter "AF.PSTRF". This test failed. • notSt - No Test: A Partial Stroke Test has not yet been executed. • norEF: A reference Partial Stroke Test has not yet been executed. • oCAY: The last Partial Stroke Test was successfully executed. • SdtSt - Stopped Test: The last Partial Stroke Test was interrupted. • FdtSt - Failed Test: The last Partial Stroke Test failed. |
| Status messages: | <p>The following status messages appear when you hold the  button pressed:</p> <ul style="list-style-type: none"> • notoL - No Tolerance: The valve is outside the tolerance range for start of the Partial Stroke Test. No manual Partial Stroke Test will be started. • Strt - Start: A manual Partial Stroke Test is started after the button is pressed for 5 seconds. 'WAIT' is indicated in the display. • StoP - Stop: The current Partial Stroke Test was interrupted. • WAIt - Wait: The Partial Stroke Test is being executed. |
| Factory setting: | OFF |

11.2.4.12 Diagnostic value '13.PRPST' - Time since last Partial Stroke Test'

| | |
|----------------------------|--|
| Indication on the display: | <ul style="list-style-type: none"> • ### • notSt • Sdtst • FdtSt |
| Purpose: | This diagnostics parameter shows the elapsed time in days since the last Partial Stroke Test. |
| Status messages: | <ul style="list-style-type: none"> • notSt - No Test: A Partial Stroke Test has not yet been executed. • SdtSt - Stopped Test: The last Partial Stroke Test was interrupted. • FdtSt - Failed Test: The last Partial Stroke Test failed |

11.2.4.13 Diagnostic value '13.PRPST' - Time since last Partial Stroke Test' with option -Z P02

- Indication on the display:
- ###
 - notSt
 - norEF
 - Sdtst
 - FdtSt

Purpose: This diagnostics parameter shows the elapsed time in days since the last Partial Stroke Test.

- Status messages:
- notSt - No Test: A Partial Stroke Test has not yet been executed.
 - norEF: A reference PST has not yet been executed.
 - SdtSt - Stopped Test: The last Partial Stroke Test was interrupted.
 - FdtSt - Failed Test: The last Partial Stroke Test failed

11.2.4.14 Diagnostic value '14.NXPST - Time until next Partial Stroke Test'

- Requirement:
- The Partial Stroke Test is activated in 'Configuration' mode.
 - The test interval is set in the 'A8.INTRV' parameter.

- Indication on the display:
- OFF
 - ###

Purpose: This diagnostics parameter shows the time in days until the next Partial Stroke Test. If one of the above-mentioned conditions is not met, 'OFF' is shown on the display.

11.2.4.15 Diagnostics value '15.DEVI - Dynamic control valve behavior'

Requirement: Monitoring of dynamic control valve behavior 'b.\DEVI' (Page 173) parameter is activated.

Display range: 0.0 ... 100.0

Purpose: This value in percent provides information about the current dynamically determined deviation from the model response.

11.2.4.16 Diagnostic value '16.ONLK - Pneumatic leakage'

Requirement: Monitoring/compensation of pneumatic leakage 'C.\LEAK' (Page 175) parameter is activated.

Display range: 0 ... 100

Purpose: This diagnostics parameter shows the current leakage indicator.

11.2.4.17 Diagnostic value '17.STIC - Stiction (slipstick)'

| | |
|----------------|---|
| Requirement: | Monitoring of stiction (slipstick) 'd.\STIC' (Page 178) parameter is activated. |
| Display range: | 0.0 ... 100.0 |
| Purpose: | This diagnostics parameter shows the filtered value of the slip jumps in percent resulting from the stiction. |

11.2.4.18 Diagnostic value '18.ZERO - Lower endstop' (HART/PA)

| | |
|----------------|---|
| Requirement: | Monitoring of lower endstop 'F.\ZERO' (Page 181) parameter is activated. '39.YCLS' Tight closing/fast closing with manipulated variable (Page 155) Parameter is set to one of the following values: 'do', 'uP do', 'Fd', 'Fu Fd', 'uP Fd', 'Fu do' |
| Display range: | 0.0 ... 100.0 |
| Purpose: | Indication of how many percent the lower endstop has changed compared to its value during initialization. |

11.2.4.19 Diagnostic value '19.OPEN - Upper endstop' (HART/PA)

| | |
|----------------|---|
| Requirement: | Monitoring of upper endstop 'G.\OPEN' (Page 182) parameter is activated. '39.YCLS' Tight closing/fast closing with manipulated variable (Page 155) parameter is set to one of the following values: 'uP', 'uP do', 'Fu', 'Fu Fd', 'uP Fd', 'Fu do' |
| Display range: | 0.0 ... 100.0 |
| Purpose: | An indication of the current shift of the upper endstop compared to its initialization value. |

11.2.4.20 Diagnostic value '20.PAVG - Average value of position'

- Indication on the display:
- OFF
 - IdLE
 - rEF
 - COMP

Purpose: This value shows the last calculated comparison average. Meaning of the displays:

- OFF: The underlying function is deactivated in the configuration menu.
- IdLE : Inactive. The function has not been started yet.
- rEF: The reference average is calculated. The function was started, and the reference interval is in progress at the moment.
- COMP: The comparison average is calculated. The function was started, and the comparison interval is in progress at the moment.

11.2.4.21 Diagnostic value '21.P0 - Position lower endstop (0%)' / '22.P100 - Position upper endstop (100%)'

- Display range:
- NO
 - 0.0 ... 100.0

'NO': Changing the low or upper endstop is not possible in the current state of the control valve. Initialize the positioner again.

Condition 1 - read values: The positioner is initialized.

Purpose 1

Read values

You can use the P0 and P100 parameters to read the values for the lower endstop (0%) and the upper endstop (100%) of the position measurement as determined during the automatic initialization. The values of manually approached end positions are applicable for manual initialization.

Condition 2 - change values

- The positioner is initialized and in manual mode (MAN) or automatic mode (AUT).
- The current position of the actuator is within the range -10% to +10% of the lower endstop (P0).
- The current position of the actuator is within the range 90% to 110% of the upper endstop (P100).

Purpose 2:

Change values

You can use these two parameters to change the lower endstop (P0) and the upper endstop (P100).

Since initialization is not usually carried out under process conditions, the values for the lower endstop (P0) and the upper endstop (P100) can change when the process is started. These changes can result from temperature changes with the associated thermal expansion of the material. If the Monitoring of lower endstop 'F.\ZERO' (Page 181) and Monitoring of upper endstop 'G.\OPEN' (Page 182) parameters are active, the thresholds set in these two parameters can be exceeded as a result of thermal expansion. An error message is output in the display.

The process-dependent thermal expansion might represent the normal state in your application. You do not wish to receive an error message as a result of this thermal expansion. Therefore reset the 'P0' and/or 'P100' parameters after the process-dependent thermal expansion has had its complete effect on the control valve. The procedure is described in the following.

Description:

Procedure for manual mode (MAN)

1. Move the actuator to the desired position of the lower endstop (upper endstop) using the  and  buttons.
2. Switch to diagnostics mode.
3. Go to diagnostic value 21.P0 (22.P100).
4. Apply the setting by pressing the  button for at least 5 seconds. After 5 seconds, '0.0' (with 22.P100: '100.0') is displayed. Result: The lower endstop (upper endstop) now corresponds to the current position of the actuator.
5. Switch to manual mode (MAN). Result: Values for the upper endstop (lower endstop) have changed.

Procedure for automatic mode (AUT)

1. Check in the display whether the current position of the actuator is at the desired position of the lower endstop (upper endstop).
2. Switch to diagnostics mode.
3. Go to diagnostic value 21.P0 (22.P100).
4. Apply the setting by pressing the  button for at least 5 seconds. After 5 seconds, '0.0' (with 22.P100: '100.0') is displayed. Result: The lower endstop (upper endstop) now corresponds to the current position of the actuator.
5. Switch to automatic mode (AUT).

See also

Changing the operating mode (Page 97)

11.2.4.22 Diagnostic value '23.IMPUP - Pulse length up' / '24.IMPDN - Pulse length down'

| | |
|------------------|---|
| Display range: | 6 ... 160 |
| Purpose: | The smallest impulse lengths that can be used to move the actuator are determined during the initialization process. They are separately determined for the 'Up' and 'Down' directions and displayed here. Display in ms. In the case of special applications you can additionally set the smallest impulse lengths in these two parameters. |
| Factory setting: | 6 |

See also

Mode of operation (Page 29)
Optimization of controller data (Page 100)

11.2.4.23 Diagnostic value '25.PAUTP - Pulse interval'

| | |
|------------------|--|
| Display range: | 2 ... 320 |
| Purpose: | This value is not changed during an initialization process. Display in ms. For applications with high stiction (slipstick), adjusting this parameter improves the control quality. This parameter can be set for special applications. |
| Factory setting: | 28 |

See also

Mode of operation (Page 29)

11.2.4.24 Diagnostic value '26.DBUP - Deadband up' / '27.DBDN - Deadband down'

| | |
|----------------|--|
| Display range: | 0.1 ... 10.0 |
| Purpose: | In this parameter, you can read the deadbands of the controller in the 'Up' and 'Down' directions. Display in percent. The values correspond either to the manually configured value of the '34.DEBA' Deadband of closed-loop controller (Page 152) parameter or to the value automatically adapted by the device if 'DEBA' was set to 'Auto'. |

11.2.4.25 Diagnostic value '28.SSUP - Slow step zone up' / '29.SSDN - Slow step zone down'

| | |
|------------------|--|
| Display range: | 0.1 ... 100.0 |
| Purpose: | The slow step zone is the zone of the closed-loop controller in which control signals are issued in a pulsed manner. Display is in percent. The impulse length is thus proportional to the control deviation. If the control deviation is beyond the slow step zone, the valves are controlled using permanent contact. This parameter can be set for special applications. |
| Factory setting: | 10.0 |

See also

Mode of operation (Page 29)
Optimization of controller data (Page 100)

11.2.4.26 Diagnostic value '30.TEMP - Current temperature'

| | |
|----------------|---|
| Display range: | °C: -50 ... 100 °F: -58 ... 212 |
| Purpose: | Current temperature in the positioner enclosure. The sensor is present on the electronics. In order to switch over the temperature display between °C and °F, press the  button. |

11.2.4.27 Diagnostic value '31.TMIN - Minimum temperature' / '32.TMAX - Maximum temperature'

| | |
|----------------|---|
| Display range: | °C: -50 ... 100 °F: -58 ... 212 |
| Purpose: | The minimum and maximum temperatures within the enclosure are constantly determined and saved as with a min/max pointer. This value can only be reset in the factory. In order to switch over the temperature display between °C and °F, press the  button. |

11.2.4.28 Diagnostic value '33.T1' ... '41.T9' - Number of operating hours in the temperature range 1 to 9

Display range: 0 ... 4.29E9
 Purpose: Statistics about the duration of operation in different temperature ranges is maintained in the device. An average of the measured temperature is taken every hour and the counter assigned to the corresponding temperature range is incremented. This helps in drawing conclusions about the past operating conditions of the device and the entire control valve.
 The temperature ranges are classified as follows:

| | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 |
|------------------------|-------|-------|-------|------|------|------|------|------|------|
| Temperature range [°C] | - | ≥ -30 | ≥ -15 | ≥ 0 | ≥ 15 | ≥ 30 | ≥ 45 | ≥ 60 | ≥ 75 |
| | ≤ -30 | < -15 | < 0 | < 15 | < 30 | < 45 | < 60 | < 75 | - |

Operating hours in temperature ranges T1 to T2

11.2.4.29 Diagnostic value '42.VENT1' / '43.VENT2'

'42.VENT1' number of switching cycles pneumatic block, valve 1
 '43.VENT2' number of switching cycles pneumatic block, valve 2
 Display range: 0 ... 4.29E9
 Purpose: Control procedures of the pneumatic block are summarized and displayed in this parameter.
 Description: The pneumatic block of the positioner pressurizes and depressurizes the actuator. The characteristic service life of the pneumatic block depends on the load. The average service life is approx. 200 million switching cycles. The number of control procedures for the switching cycles serves to assess the switching frequency of the pneumatic block.
 Counting procedure for single-acting actuators:

- Pressurize => 42.VENT1
- Depressurize => 43.VENT2

 Counting procedure for double-acting actuators:

- Pressurize (Y2) / Depressurize (Y1) => 42.VENT1
- Depressurize (Y1) / Pressurize (Y2) => 43.VENT2

 The value is written hourly into a nonvolatile memory.

11.2.4.30 Diagnostic value '44.VEN1R' / '45.VEN2R'

'44.VEN1R' number of switching cycles pneumatic block, valve 1, resettable
 '45.VEN2R' number of switching cycles pneumatic block, valve 2, resettable
 Display range: 0 ... 4.29E9

| | |
|--------------|---|
| Purpose: | Control procedures of the pneumatic block are counted since the last time this parameter was reset, and displayed here. |
| Description: | Corresponds to the description for Diagnostic value '42.VENT1' / '43.VENT2' (Page 234) referred to the diagnostics parameters 'VEN1R' and 'VEN2R' described here. |

11.2.4.31 Diagnostic value '46.STORE - Save maintenance data'

| | |
|----------|---|
| Purpose: | <p>The minimum and maximum temperatures within the enclosure are constantly determined and saved as with a min/max pointer. This value can only be reset in the factory. In order to switch over the temperature display between °C and °F, press the  button for at least 5 seconds in order to initiate a save function. The values of the diagnostics parameters Diagnostic value '8.WAY - Determined travel' (Page 224) to Diagnostic value '11.LEAK - Leakage test' (Page 224) and Diagnostic value '21.P0 - Position lower endstop (0%)' / '22.P100 - Position upper endstop (100%)' (Page 230) to Diagnostic value '28.SSUP - Slow step zone up' / '29.SSDN - Slow step zone down' (Page 233) are saved in the non-volatile memory as 'data of last maintenance'. This diagnostics data contains selected values whose changes can give information about mechanical wear and tear of the valve.</p> <p>This function is normally operated through the PDM, menu command 'Diagnostics-> Save maintenance information'. The data of the last maintenance operation can be compared with the current data using SIMATIC PDM.</p> |
|----------|---|

11.2.4.32 Diagnostic value '47.PRUP - Prediction up' / '48.PRDN - Prediction down'

| | |
|------------------|--|
| Display range: | 1 ... 40 |
| Purpose: | <p>This value specifies the prediction of the controller for the up (PRUP) and down (PRDN) movements.</p> <p>For more information, refer also to the section Optimization of controller data (Page 100).</p> |
| Factory setting: | 1 |

11.2.4.33 Diagnostic value '49.WT00' ... '56.WT95' - Number of operating hours in the travel range WT00 to WT95

Display range: 0 ... 4.29E9
 Purpose: When the positioner is in "Automatic" mode, statistics are continuously maintained regarding the duration for which a process valve is operated in a particular section of the travel range. The entire travel range is divided into 8 sections from 0 to 100 %. The positioner records the current position continuously and increments the runtime meter assigned to the corresponding travel range every hour. This helps in drawing conclusions about the past operating conditions and especially in assessing the control properties of the control loop and the entire control valve.

| Travel range | WT00 | WT05 | WT10 | WT30 | WT50 | WT70 | WT90 | WT95 |
|--------------------------|------|------|------|------|------|------|------|------|
| Travel range section [%] | - | ≥ 5 | ≥ 10 | ≥ 30 | ≥ 50 | ≥ 70 | ≥ 90 | ≥ 95 |
| | < 5 | < 10 | < 30 | < 50 | < 70 | < 90 | < 95 | - |

Division of travel ranges

You can simultaneously set the eight operating hours counters to zero.

TIP: Since the travel ranges are provided at the end of the diagnostics parameters, press the  button several times along with the  button. This will help you to access the desired diagnostics parameters faster.

11.2.4.34 Diagnostic value '57.LKPUL - Length of the leakage compensation pulse'

Display range: -256 ... 0 ... 254
 Purpose: This value in milliseconds indicates the length of a compensation pulse when Monitoring/compensation of pneumatic leakage 'C.\LEAK' (Page 175) is active. The sign indicates the control direction of the pulse.
 Factory setting: 0

11.2.4.35 Diagnostic value '58.LKPER - Period of the leakage compensation pulse'

Display range: 0.00 ... 600.00
 Purpose: This value in seconds indicates the period of the leakage compensation pulses when Monitoring/compensation of pneumatic leakage 'C.\LEAK' (Page 175) is active.
 Factory setting: 0.00

11.2.4.36 Diagnostic value '59.mA - Setpoint current'

Here you can display the current setpoint in mA.

11.2.4.37 Diagnostic value '60.PZ Supply pressure PZ'

Indication on the display: #.### (bar)

###.## (psi)

#.### (MPa)

Purpose:

Shows the current supply pressure PZ. The value refers to the pressure unit assigned in "U1.PUNIT (Page 193)".

If the supply pressure is the same as the pressure level of the environment, the pressure value shown in the display is 0. Depending on the height at which you use the positioner, the displayed pressure value is $\neq 0$. Press the Δ button for at least 5 seconds to set the value to 0. "rESEt" is shown in the display for as long as you press the Δ button. This calibration is only possible if the displayed pressure value is in the following pressure range:

- -0.500 ... 0.500 (bar)
- -72.51 ... 72.51 (psi)
- -0.050 ... 0.050 (MPa)

If the pressure value displayed is outside of the pressure range, "no-toL" is shown in the display when you attempt to set the value to 0.

11.2.4.38 Diagnostic value '61.P1 - Actuating pressure Y1'

Indication on the display: #.### (bar)

###.## (psi)

#.### (MPa)

Purpose:

Shows the current actuating pressure Y1. The value refers to the pressure unit assigned in "U1.PUNIT (Page 193)".

If the actuating pressure is the same as the pressure level of the environment, the pressure value shown in the display is 0.

Depending on the height at which you use the positioner, the displayed pressure value is $\neq 0$. Press the Δ button for at least 5 seconds to set the value to 0. "rESEt" is shown in the display for as long as you press the Δ button. This calibration is only possible if the displayed pressure value is in the following pressure range:

- -0.500 ... 0.500 (bar)
- -72.51 ... 72.51 (psi)
- -0.050 ... 0.050 (MPa)

If the pressure value displayed is outside of the pressure range, "no-toL" is shown in the display when you attempt to set the value to 0.

11.2.4.39 Diagnostic value '62.P2 - Actuating pressure Y2'

Indication on the display: #.### (bar)
###.## (psi)
#.### (MPa)

Purpose: Shows the current actuating pressure Y2. The value refers to the pressure unit assigned in "U1.PUNIT (Page 193)".
If the actuating pressure is the same as the pressure level of the environment, the pressure value shown in the display is 0.
Depending on the height at which you use the positioner, the displayed pressure value is ≠0. Press the Δ button for at least 5 seconds to set the value to 0. "rESEt" is shown in the display for as long as you press the Δ button. This calibration is only possible if the displayed pressure value is in the following pressure range:

- -0.500 ... 0.500 (bar)
- -72.51 ... 72.51 (psi)
- -0.050 ... 0.050 (MPa)

If the pressure value displayed is outside of the pressure range, "no-toL" is shown in the display when you attempt to set the value to 0.

11.2.4.40 Diagnostic value '63.PZMAX Maximum supply pressure PZ'

Indication on the display: #.### (bar)
###.## (psi)
#.### (MPa)

Purpose: The supply pressure PZ is continuously monitored and the maximum value (min/max pointer) is displayed.
The min/max pointer can be reset via HART communication.

11.2.4.41 Diagnostic value '64.N_MIN - Event counter violations of lower limit PZ'

Display range: 0 ... #####

Purpose: Each new measured value of the supply pressure PZ is compared with the value set in "U5.PZMLL (Page 193)". The counter increases when the supply pressure falls below the configured limit.
The counter can be reset via HART communication at the same time as the "65.N_MAX" counter.

11.2.4.42 Diagnostic value '65.N_MAX - Event counter violations of upper limit PZ'

| | |
|----------------|---|
| Display range: | 0 ... ##### |
| Purpose: | Each new measured value of the supply pressure PZ is compared with the value set in "U6.PZMUL". The counter increases when the supply pressure exceeds the configured limit. The counter can be reset via HART communication at the same time as the "64.N_MIN" counter. |

11.2.4.43 Diagnostic value '66.N1MAX - Event counter violations limit Y1'

| | |
|----------------|---|
| Display range: | 0 ... ##### |
| Purpose: | Each new measured value of the actuating pressure Y1 is compared with the value set in "U7.PCL". The counter increases when the actuating pressure Y1 exceeds the configured limit. The counter can be reset via HART communication. |

11.2.4.44 Diagnostics value '67.LMY1 +/-Leakage at Y1'

| | |
|----------------|--|
| Display range: | $\pm 0.000 \dots \#.###$ (bar/min) $\pm 0.000 \dots \#.###$ (psi/min) $\pm 0.00 \dots \#\#.##$ (MPa/min) |
| Purpose: | Shows the pressure increase/leakage per minute on actuating pressure Y1. The value is determined in the controlled state. Negative values (leakage) can indicate a leak in the pneumatic system. Positive values (pressure increases) can indicate a pneumatic short circuit between supply pressure PZ and actuating pressure Y1. |

See also

Pressure monitoring 'U.\PRES' (Page 193)

11.2.4.45 Diagnostics value '68.LMY2 +/-Leakage at Y2'

Display range: ±0.000 ... #.### (bar/min)
 ±0.000 ... #.### (psi/min)
 ±0.00 ... ##.## (MPa/min)

Purpose: Shows the pressure increase/leakage per minute on actuating pressure Y2. The value is determined in the controlled state.
 Negative values (leakage) can indicate a leak in the pneumatic system.
 Positive values (pressure increases) can indicate a pneumatic short circuit between supply pressure PZ and actuating pressure Y2.

11.2.4.46 Diagnostic value '69.LMUY1 - Maximum positive leakage at Y1'

Display range: +0.000 ... #.### (bar/min)
 +0.000 ... #.### (psi/min)
 +0.00 ... ##.## (MPa/min)

Purpose: The pressure change at Y1 is continuously monitored in the controlled state. The maximum pressure increase is displayed.
 If a limit defined in "U8.LRL (Page 193)" is exceeded, the error code "22 (Page 251)" is shown in the display. A message is entered in the logbook. To reset the error code, eliminate the leakage. The parameter can also be reset via HART communication. If you cannot eliminate the leakage, increase the "U8.LRL" parameter or set the parameter to 0.

11.2.4.47 Diagnostic value '70.LMUY2 - Maximum positive leakage at Y2'

Display range: +0.000 ... #.### (bar/min)
 +0.000 ... #.### (psi/min)
 +0.00 ... ##.## (MPa/min)

Purpose: The pressure change at Y2 is continuously monitored in the controlled state. The maximum pressure increase is displayed.
 If a limit defined in "U8.LRL (Page 193)" is exceeded, the error code "22 (Page 251)" is shown in the display. A message is entered in the logbook. To reset the error code, eliminate the leakage. The parameter can also be reset via HART communication. If you cannot eliminate the leakage, increase the "U8.LRL" parameter or set the parameter to 0.

11.2.4.48 Diagnostics value '71.LMDY1 - Maximum negative leakage at Y1'

| | |
|----------------|--|
| Display range: | +0.000 ... #.### (bar/min) +0.000 ... #.### (psi/min) +0.00 ... ##.## (MPa/min) |
| Purpose: | The pressure change at Y1 is continuously monitored in the controlled state. The maximum pressure decrease (leakage) is displayed. If a limit defined in "U8.LRL (Page 193)" is exceeded, the error code 22 (Page 251) is shown in the display. A message is entered in the logbook. To reset the error code, eliminate the leakage. The parameter can also be reset via HART communication. If you cannot eliminate the leakage, increase the "U8.LRL" parameter or set the parameter to 0. |

11.2.4.49 Diagnostics value '72.LMDY2 - Maximum negative leakage at Y2'

| | |
|----------------|--|
| Display range: | +0.000 ... #.### (bar/min) +0.000 ... #.### (psi/min) +0.00 ... ##.## (MPa/min) |
| Purpose: | The pressure change at Y2 is continuously monitored in the controlled state. The maximum pressure decrease (leakage) is displayed. If a limit defined in "U8.LRL (Page 193)" is exceeded, the error code 22 (Page 251) is shown in the display. A message is entered in the logbook. To reset the error code, eliminate the leakage. The parameter can also be reset via HART communication. If you cannot eliminate the leakage, increase the "U8.LRL" parameter or set the parameter to 0. |

11.2.4.50 Diagnostic value '73.RPL_E - Procedure for adjustment of electronics

- Purpose: Provides a step-by-step procedure for improving linearity of a linear actuator positioner.
- Description: Adjustment of the electronics after you have replaced the electronics of the positioner.
1. Switch to operating mode "P manual mode".
 2. Press the  or  button so that the lever of the mounting kit reaches the horizontal position or as close as possible to the horizontal position.
 3. Switch to "Diagnostics" mode by pressing all three buttons for at least 2 seconds.
 4. Select the diagnostic value "73.RPL_EL".
"SEt" is displayed.
 5. Start the adjustment by keeping the  button pressed.
After 5 seconds, "oCAY" is displayed.
The adjustment is complete.
 6. Exit "Diagnostics" mode.
 7. Restart initialization.
 8. Switch to automatic mode.

11.2.4.51 Diagnostic value '74.TRIM - Position adjustment

- Display range: -10.0 ... 110.0 %
- Purpose: Used to adjust the position of the replacement positioner to the position of the previous positioner.
1. To adjust the position of the replacement positioner, press and hold the  or  button for at least 5 seconds.
 2. Acknowledge the position with the  button.
The position is adjusted immediately.
 3. Exit "Diagnostics" mode by keeping the  button pressed for at least 2 seconds.

For more information on replacing the positioner during operation, see:

Replacing the positioner with communication (Page 127)

11.3 Online diagnostics

11.3.1 Overview of online diagnostics

Online diagnostics means diagnostics during ongoing operation. During operation of the positioner, a few important values and parameters are continually monitored. In configuration mode, you can configure that monitoring so that the fault message output will be activated if, for instance, a limit is exceeded.

Information about what events can activate the fault message output can be found in the table in section "Overview of error codes (HART) (Page 243)".

This section contains particular information about the following situations:

- Possible causes of the fault message.
- Events which activate the fault message output or alarm outputs.
- Settings of parameters needed for event monitoring.
- Cancelling an error message

When the fault message output is triggered in "Automatic" or "Manual" mode, the display shows which fault triggered the message. The two digits on the lower left show the corresponding error code. If multiple triggers occur at the same time, they are displayed one after the other cyclically. The device status, including all fault messages, can be called up using command "#48" over HART.

See also

'52.XDIAG' Activating for extended diagnostics (Page 163)

Advanced diagnostic parameters A to U (Page 164)

11.3.2 Overview of error codes (HART)

Overview of error codes that activate the fault message output

You can find where the error codes are output in the display under "52.XDIAG (Page 163)".

| Error code | Number of thresholds | Event | Parameter setting | Error message disappears when | Possible causes |
|------------|----------------------|--|---|---|--|
| ↳1 | 1 | Control deviation: Actual value response has exceeded values for TIM and LIM | Always active | ... the actual value response falls below the value for LIM | Supply pressure PZ missing, actuator fault, process valve fault (e.g. blockage). |
| ↳2 | 1 | Device not in "Automatic" mode | ** .↳FCT ¹⁾ =↳nA or =↳nAB | ... the device is changed to "Automatic" mode. | The device has been configured or is in the manual mode |

11.3 Online diagnostics

| Error code | Number of thresholds | Event | Parameter setting | Error message disappears when | Possible causes |
|------------|----------------------|---|--|--|--|
| 43 | 1 | Digital input DI1 or DI2 active | **. ₄ FCT ¹⁾ = ₄ nAB and digital function DI1 or DI2 set to "On" | ... the digital input is no longer activated. | The contact connected to the digital input was active (e.g. packing gland monitoring, overpressure, temperature switch). |
| 44 | 3 | Limit for number of total strokes exceeded | L. ₄ STRK≠OFF | ... the stroke counter is reset or the thresholds are increased | The total path covered by the actuator exceeds one of the configured thresholds. |
| 45 | 3 | Limit for number of changes in direction exceeded | O. ₄ DCHG≠OFF | ... the counter for changes of direction is reset or the thresholds are increased. | The number of changes of direction exceeds one of the configured thresholds. |
| 46 | 3 | Lower endstop limit exceeded | F. ₄ ZERO≠OFF **. ₄ YCLS = do or up do | ... the deviation of the endstop disappears or the device is re-initialized. | Wear and tear of the process valve, deposits or foreign bodies in the process valve, mechanical misalignment, friction clutch moved. |
| 47 | 3 | Upper endstop limit exceeded | G. ₄ OPEN≠OFF **. ₄ YCLS ¹⁾ = do or up do | ... the deviation of the endstop disappears or the device is re-initialized. | Wear and tear of the process valve, deposits or foreign bodies in the process valve, mechanical misalignment, friction clutch moved. |
| 48 | 1 | Deadband limit exceeded | E. ₄ DEBA≠OFF **. ₄ DEBA ¹⁾ = Auto | ... the limit is undershot again | Increased packing gland friction, mechanical gap in the position feedback. |

| Error code | Number of thresholds | Event | Parameter setting | Error message disappears when | Possible causes |
|------------|---|--|-------------------|---|--|
| 49 | 3 | Case 1: Partial Stroke Test exceeds reference stroke time. | A.4PST≠OFF | Case 1: ... a Partial Stroke Test is successfully executed within the reference stroke time or the function is deactivated. | Case 1: Process valve is stuck or rusted. Increased stiction. |
| | | Case 2: Start position outside the start tolerance | | Case 2: ... the actuator is moved into the range of the PST start tolerance. Or: ... the PST start tolerance is increased until the actuator (PST start position) is within the PST start tolerance. Restart the Partial Stroke Test. | Case 2: Valve is present in the safety position. |
| | For Partial Stroke Test with option -Z P02: | | | | |
| | 1 | Partial Stroke Test failed | A.4PST≠OFF | ... the next execution of the Partial Stroke Test is successful. | <ul style="list-style-type: none"> • Unexpectedly large step height detected during execution. • Lower limit of the internal breakout pressure violated • Lower limit of the internal rupture pressure violated • End position not reached • Return position not reached. |
| 10 | 3 | Deviation from expected dynamic control valve behavior | b.4DEVI≠OFF | ... the position is again in a narrow corridor between the setpoint and the model, or the function is deactivated. | Actuator fault, process valve fault, process valve jams, increased stiction, decreased supply pressure PZ |
| 11 | 3 | Valve leakage | C.4LEAK≠OFF | ... the valve leakage has been remedied or the function is deactivated. | Pneumatic leakage |
| 12 | 3 | Stiction limit (slipstick) exceeded | d.4STIC≠OFF | ... Slipjumps can no longer be detected, or the function is deactivated. | Increased stiction, process valve no longer moves smoothly but in jerky motion. |
| 13 | 3 | Temperature undershot | H.4TMIN≠OFF | ... the low temperature thresholds are no longer undershot. | Ambient temperature too low |
| 14 | 3 | Temperature overshoot | J.4TMAX≠OFF | ... the high thresholds are no longer overshoot. | Ambient temperature too high |
| 15 | 3 | Position average deviates from the reference value | P.4PAVG≠OFF | ... the average position value calculated after a comparison interval is again within the thresholds for the reference value, or the function is deactivated. | In the last comparison interval, the process valve characteristic was changed so significantly that a deviating average value of position was calculated. |

¹⁾ You can find additional information on the parameter in the corresponding parameter descriptions

11.3 Online diagnostics

The following table shows error codes that are displayed when pressure monitoring is activated:

| Error code | Number of thresholds | Event | Parameter setting | Error message disappears when | Possible causes |
|------------------|----------------------|--|----------------------------------|--|---|
| 16 ¹⁾ | 1 | Partial Stroke Test (PST) is performed with non-plausible parameter values | A.4PST≠OFF and U.4PRES≠OFF | ...the parameter values entered in A1.STPOS, A3.STRKH and A4.STRKD are plausible. For Partial Stroke Test with option -Z P02: <ul style="list-style-type: none"> ... the parameter values entered in A1.STPOS, A2.STTOL and Ad.ENPOS are plausible. ... a higher pressure level exists for A1.STPOS than for Ad.ENPOS. For double-acting actuators, the pressure difference P2 minus P1 is decisive. | Parameters for Partial Stroke Test are not plausible Extended diagnostics parameters were reset. |
| 17 | 1 | Pressure sensor module defective | U.4PRES≠OFF | ... the device is restarted with functioning pressure sensor module. ... the pressure monitoring U.4PRES is set to OFF and the device is restarted. | Pressure sensor module was overloaded. Electrical connection was terminated. |
| 18 | 1 | Lower limit of supply pressure fallen below | U.4PRES≠OFF | ... the supply pressure PZ is higher than the limit value in U2.PRMLL plus the hysteresis in U2.P_HYS. | Supply pressure PZ is too low |
| 19 | 1 | Supply pressure PZ out of specification | U.4PRES≠OFF | ... the supply pressure PZ is within the positioner specification of 1.4 to 7.0 bar plus the hysteresis in U2.P_HYS. | Supply pressure PZ too high or too low |
| 20 | 1 | Upper limit of supply pressure PZ exceeded | U.4PRES≠OFF | ... the supply pressure PZ is lower than the limit value in U6.PRMUL minus the hysteresis in U2.P_HYS. | Supply pressure PZ too high |
| 21 | 1 | Limit of actuating pressure at Y1 | U.4PRES≠OFF | ... the actuating pressure at Y1 is lower than the limit value in U7.PCL minus the hysteresis in U2.P_HYS. | Actuating pressure at Y1 too high |
| 22 | 1 | Limit +/- Leakage exceeded | U.4PRES≠OFF | ... when the cause has been eliminated and the relevant diagnostic values LMUY1, LMUY2, LMDY1 and LMDY2 are reset. ... or when LRL = 0 is set. | Pneumatic system is leaky. |

¹⁾ The fault message is displayed but not reported via the fault message output.

The following error codes are displayed after an internal device check of the electronics:

| Error code | Number of thresholds | Event | Parameter setting | Error message disappears when | Possible causes |
|------------|----------------------|---|-------------------|---|-----------------|
| 23 | 1 | Initialization data contains errors | - | ... initialization successfully performed. If the error persists, the device electronics may have a defect. <ul style="list-style-type: none"> Replace the electronics. | - |
| 24 | 1 | Calibration data for position detection contains errors | - | Replace the electronics. | - |

11.3.3 XDIAG parameter

You can use the extended diagnostics parameters to display error messages in one, two or three stages. In addition to the fault message output, the digital outputs A1 and A2 are then used. For this purpose, set the "XDIAG" parameter as described in the following table:

| XDIAG settings | Message due to |
|----------------|--|
| OFF | Extended diagnostics not activated |
| On1 | Fault message output for threshold 3 error message (maintenance alarm, single-stage) |
| On2 | Fault message output for threshold 3 error messages and digital output A2 for threshold 2 error messages (maintenance demanded, two-stage) |
| On3 | Fault message output for threshold 3 error messages, digital output A2 for threshold 2 error messages and digital output A1 for threshold 1 error messages (maintenance required, three-stage) |

Possible parameter setting 'XDIAG'

11.3.4 Meaning of error codes

11.3.4.1 1 Remaining control deviation

The deviation between the setpoint and the actual value is continuously monitored in "Automatic" mode. The fault message for a remaining control deviation is activated depending on the setting of the application parameters "hTIM" - monitoring time for setting the fault messages - and "hLIM" - response threshold for the fault message. The fault message is cancelled as soon as the control deviation drops below the response threshold. This monitoring function is always active.

11.3.4.2 2 Device not in "Automatic" mode

When the device is not in automatic mode, an error message is generated if the 'hFCT' parameter (function of fault message output) is set correctly. A warning is then sent to the control system if the device was switched to manual or configuration mode on-site.

11.3.4.3 3 Digital input DI1 or DI2 active

If the digital input is activated and the 'hFCT' and 'DI1' parameters are set accordingly, a fault message is generated. A fault message can be generated, for example, by a switch to monitor the packing glands, a temperature switch, or a limit switch (e.g. for pressure).

Configure the digital input DI2 on the Digital I/O Module (DIO) in the same way.

11.3.4.4 4 Monitoring the number of total strokes

The diagnostics value "1 STRKS" is constantly compared with the thresholds that are determined from the "L1.LIMIT" to "L4.FACT3" parameters. If the thresholds are exceeded, the fault message output or the digital outputs A1 and A2 respond, depending on the operating mode of the extended diagnostics. These two functions can be deactivated using the parameter setting "OFF" for "L.hSTRK".

11.3.4.5 5 Monitoring the number of changes in direction

The diagnostics value "2 CHDIR" is constantly compared with the thresholds that are determined from the "O1.LIMIT" to "O4.FACT3" parameters. If the thresholds are exceeded, the fault message output or the digital outputs A1 and A2 respond, depending on the operating mode of the extended diagnostics. These two functions can be deactivated using the parameter setting "OFF" for "O.hDCHG".

11.3.4.6 6 Monitoring the lower endstop / 7 Monitoring the upper endstop

If the parameter "F.hZERO" is set to "ON", monitoring of the lower endstop is activated. This function can be used to detect the errors in the process valve. If the limit is exceeded, this indicates the presence of deposits or foreign bodies in the process valve. If the limit is fallen below, this indicates wear of the process valve. A mechanical misalignment of the position feedback also triggers this fault message.

Monitoring is always carried out whenever the process valve is in the "tight closing/fast closing Down" position. The current position is compared with the position that was determined as the lower endstop at the time of initialization. Requirement: '39.YCLS' Tight closing/fast closing with manipulated variable (Page 155) parameter is set to one of the following values: 'do', 'uP do', 'Fd', 'Fu Fd'.

Example: A value of 3% is set. The position is normally adopted for "tight closing/fast closing Down". A fault is reported if a value $> 3\%$ or $< -3\%$ is determined instead.

The fault message remains activated until either subsequent monitoring remains within the tolerance or a re-initialization process is executed. Even the deactivation of monitoring ("F.hZERO"=OFF) may trigger an error message.

This monitoring function does not deliver any utilizable results if the endstops were not determined automatically at the time of initialization, but the limits were set manually (manual initialization, "5.INITM").

Similar diagnostics is carried out for the upper endstop. The "G.4OPEN" parameter is used to set the limit for this. Requirement: '39.YCLS' Tight closing/fast closing with manipulated variable (Page 155) parameter is set to one of the following values: 'uP', 'uP do', 'Fu', 'Fu Fd', 'uP Fd', 'Fu do'.

11.3.4.7 8 Monitoring deadband

If the deadband increases disproportionately when adjusting it automatically ("DEBA"=Auto parameter), it indicates an error in the system (e.g. severely increased packing gland friction, play in the position displacement sensor, leakage). A limit can therefore be entered for this value ("E1.LEVL3", threshold for deadband monitoring). An error message output is activated when this value is exceeded.

11.3.4.8 9 Partial Stroke Test

This fault message is generated when a manual or cyclic Partial Stroke Test is initiated and the test cannot be started because the process valve is not within the start tolerance. The fault message also appears when one of the three thresholds of the Partial Stroke Test, which result from reference stroke time 'A9.PSTIN' multiplied by factors 'AA.FACT1', 'Ab.FACT2' and 'AC.FACT3', is violated. The severity of the fault message is shown by the number of bars on the display. The severity of the fault message is simultaneously displayed using the fault message output or digital outputs A1 and A2 depending on the mode of extended diagnostics.

For Partial Stroke Test with option -Z P02

If a reference Partial Stroke Test is performed via 'AY.PSTIN', no fault message is output.

The fault message is output for errors that occur during the execution of a manual or cyclically triggered Partial Stroke Test. If the preconditions are not met, e.g. the start position is outside the start tolerance, no fault message is output.

11.3.4.9 10 Monitoring of dynamic control valve behavior

The monitoring of the operational behavior responds when the actual process valve position shifts from a narrow corridor between the setpoint and the expected position course. In this case, the deviation between the expected and actual position course is output filtered. The deviation is compared with the configured thresholds that are determined from the "b2.LIMIT" limit multiplied by the factors "b3.FACT1" to "b5.FACT3".

11.3.4.10 11 Monitoring/compensation of pneumatic leakage

This fault message appears if a leakage is present. For additional information, see Monitoring/compensation of pneumatic leakage 'C.\\LEAK' (Page 175).

11.3.4.11 12 Monitoring of stiction (slipstick)

If the stiction of the control valve increases during operation or if an increasing number of Slipjumps is detected, "d1.LIMIT" could be exceeded and result in this fault message.

11.3.4.12 13 Monitoring the lower limit temperature

This fault message appears when the lower limit temperature thresholds are undershot.

11.3.4.13 14 Monitoring the upper limit temperature

This fault message appears when the upper limit temperature thresholds are overshot.

11.3.4.14 15 Monitoring the position average value

This fault message appears when a position value calculated after the expiry of a comparison interval deviates from the reference value by more than the configured thresholds.

11.3.4.15 16 Monitoring the plausibility of values for Partial Stroke Test (HART)

For Partial Stroke Test:

If, on start of a Partial Stroke Test, the plausibility check of the "A1.STPOS (Page 164)", "A3.STRKH" and "A4.STRKD" parameters was not successful, this fault message is displayed.

For Partial Stroke Test with option -Z P02:

If, on start of a Partial Stroke Test, the plausibility check of the "A*." configuration parameters was not successful, this fault message is displayed, but not reported via the fault message output.

11.3.4.16 17 Monitoring of pressure sensor module

If the pressure sensor module is activated and defective, this fault message is displayed.

11.3.4.17 18 Monitoring lower limit PZ

If the supply pressure falls below the configured lower limit (U5.PZMLL (Page 193)), this fault message is displayed.

11.3.4.18 19 Monitoring specific limits PZ

If the supply pressure lies outside the positioner specification from 1.4 bar to 7.0 bar, this alarm message is displayed.

11.3.4.19 20 Monitoring upper limit PZ

If the supply pressure exceeds the configured upper limit (U6.PZMUL (Page 193)), this fault message is displayed.

11.3.4.20 21 Monitoring upper limit of actuating pressure Y1

If the actuating pressure at Y1 exceeds the configured limit (U7.PCL (Page 193)), this fault message is displayed.

11.3.4.21 22 Monitoring leakage of the pneumatic system

If the determined pressure increase or leakage at Y1 (single-acting) or Y2 (double-acting) exceeds the configured limit (U8.LRL (Page 193)), this fault message is displayed.

11.3.4.22 23 and 24 device-internal check of the electronics

When the device is switched on, an internal device check of the electronics is performed. Errors of the non-volatile memory are detected during the check.

11.4 Fault and remedy

| Fault profile (symptoms) | Possible causes | Remedy |
|--------------------------------|--|---|
| Positioner remains in "RUN 1". | <ul style="list-style-type: none"> Initialization started from the end position The response time of a maximum of 1 minute was not observed Supply pressure PZ not connected or supply pressure PZ too low. Compressed air line blocked, e.g. solenoid valve | <ul style="list-style-type: none"> A waiting time of up to 1 minute is required Do not start initialization from the end position. Ensure supply pressure PZ. Free up blocked lines |
| Positioner remains in "RUN 2". | <ul style="list-style-type: none"> Transmission ratio selector and parameter 2 "YAGL" and the real stroke do not match. Incorrectly set stroke on the lever Pneumatic block does not switch. | <ul style="list-style-type: none"> Check settings: Parameters 2 and 3 Check the stroke setting on the lever |
| Positioner remains in "RUN 3". | <ul style="list-style-type: none"> Actuator travel time is too high | <ul style="list-style-type: none"> Open the restrictor completely and/or set supply pressure PZ to the highest permissible value. Use a booster if required. |

11.4 Fault and remedy

| Fault profile (symptoms) | Possible causes | Remedy |
|---|---|---|
| Positioner remains in "RUN 5", does not go to "FINISH" (waiting time > 5 min.). | <ul style="list-style-type: none"> "Gap" (play) in the positioner - actuator - control valve system | <ul style="list-style-type: none"> Part-turn actuator: Check for firm seating of set screw on coupling wheel Linear actuator: Check for firm seating of lever on positioner shaft. Correct any other play between the actuator and the control valve. |
| | <ul style="list-style-type: none"> Diagnostic value "9.TUP" or "10.TDOWN" < 1.5 s | <ul style="list-style-type: none"> Adjust the travel speed to > 1.5 s with the internal restrictors. Set the "1.YFCT" parameter on a drive with inverse direction of action, e.g. "turn" to "-turn". |
| Direction of action incorrectly determined, e.g. direction "Valve open and Valve closed" is incorrect. | - | <ul style="list-style-type: none"> Set the "1.YFCT" parameter on a drive with inverse direction of action, e.g. from "turn" to "-turn". |
| "CPU test" flashes on the local display approximately every 2 seconds. | <ul style="list-style-type: none"> Water in the pneumatic block (due to wet compressed air) | <ul style="list-style-type: none"> At an early stage, this fault can be rectified with subsequent operation using dry air, in a temperature cabinet at 50 to 70 °C if required. Otherwise: Repair |
| Pneumatic block does not switch. | <ul style="list-style-type: none"> Moisture in the pneumatic block | |
| In the manual and automatic modes, the actuator cannot be moved or can be moved only in one direction. | <ul style="list-style-type: none"> Moisture in the pneumatic block | <ul style="list-style-type: none"> Tighten the screw; correct jam, if required. Repair or a new device; built-in fine screen, can also be replaced and cleaned. Clean all contact surfaces with spirit; bend the pneumatic block contact springs slightly if required. |
| Pneumatic block does not switch. A gentle click sound is also not audible when the ▲ or ▼ buttons are pressed in manual mode. | <ul style="list-style-type: none"> The screw between the cover and the pneumatic block has not been tightened firmly or the cover is jammed. Dirt (swarf, particles) in the pneumatic block Deposits on contacts between the electronics board and the pneumatic block can develop due to abrasion resulting from continuous strong vibration loads. | |
| Actuator does not move. | Compressed air < 1.4 bar | Set supply pressure PZ to > 1.4 bar. |
| Pneumatic block does not switch (however, a gentle clicking sound can be heard when the ▲ or ▼ button is pressed in "Manual" mode.) | <ul style="list-style-type: none"> Restrictors on the pneumatic block are closed (screw at the right end-stop) | <ul style="list-style-type: none"> Open the restrictor screw by turning it to the left. |
| | <ul style="list-style-type: none"> Dirt in the pneumatic block | <ul style="list-style-type: none"> Repair or a new device; built-in fine screen, can also be replaced and cleaned. |
| The pneumatic block continually switches in stationary automatic mode (constant setpoint) and in "Manual" mode. | <ul style="list-style-type: none"> Pneumatic leakage in the positioner - actuator system; start the leakage test in "RUN 3" (initialization). | <ul style="list-style-type: none"> Rectify leakage in the actuator and/or feed line. In case of an intact actuator and tight feed line: Repair or new device |
| | <ul style="list-style-type: none"> Dirt in the pneumatic block | <ul style="list-style-type: none"> Repair or a new device; built-in fine screen, can also be replaced and cleaned. |

| Fault profile (symptoms) | Possible causes | Remedy |
|---|--|---|
| The pneumatic block continually switches and the actuator oscillates around a mean value in stationary automatic mode (constant setpoint) and in "Manual" mode. | <ul style="list-style-type: none"> Stiction of the packing gland from the control valve or actuator too large | <ul style="list-style-type: none"> Reduce stiction or increase deadband of positioner (parameter "dEbA") until the oscillation stops. |
| | <ul style="list-style-type: none"> Looseness (play) in the positioner/ actuator/control valve system | <ul style="list-style-type: none"> Part-turn actuator: Check for firm seating of set screw on coupling wheel. Linear actuator: Check for firm seating of lever on positioner shaft. Correct any other play between the actuator and the control valve. |
| | <ul style="list-style-type: none"> Actuator too fast | <ul style="list-style-type: none"> Increase travel times using restrictor screws. If a quick travel time is needed, increase the deadband (parameter "dEbA") until the oscillation stops. |
| Positioner does not move control valve to the endstop (at 20 mA). | Supply pressure is too low. Load on the feeding controller or system output is too low. | <ul style="list-style-type: none"> Increase supply pressure, insert ballast converter Select 3-/4-wire operation. |
| Zero point displaces sporadically (> 3%). | Impact or shock loads result in accelerations so high that the friction clutch moves, e.g. due to "vapor shocks" in vapor lines. | <ul style="list-style-type: none"> Rectify the causes for shock loads. Re-initialize the positioner. |
| The device function has completely failed: No representation on the display either. | Electrical auxiliary power is not adequate. | Check the electrical auxiliary power. |
| | In case of very high continuous loads due to vibrations (oscillations): <ul style="list-style-type: none"> Screws of the electrical connecting terminals may be loosened. Electrical connecting terminals and/or electronic components may be knocked out. | <ul style="list-style-type: none"> Tighten the screws firmly and secure using sealing wax. Repair For prevention: Install the positioner on damping pads. |

Pressure sensor module

| Fault profile (symptoms) | Possible causes | Remedy |
|--|--|--|
| Display shows "VS-ERR". | Valve Signature could not be recorded successfully. Possible causes: <ul style="list-style-type: none"> Pressure sensor module defective Actuator does not move or no pressure change is detected | <ul style="list-style-type: none"> Check whether the pressure sensor module supplies plausible pressure values; diagnostic values 60, 61 and 62. Restart the initialization. Contact Support. Check actuator and supply pressure PZ. |
| Display shows fault message "16". | The Partial Stroke Test is not configured correctly. | <ul style="list-style-type: none"> Execute stroke direction from high pressure level to lower pressure level. For double-acting actuators, the pressure difference P2 minus P1 is decisive. The "A1.STPOS". "Ad.ENPOS" and "A2.STTOL" parameters must be selected in such a way that the following condition is true: $A1.STPOS - A2.STTOL > Ad.ENPOS + 5\%$ (higher pressure level at 100%) $A1.STPOS + A2.STTOL < Ad.ENPOS - 5\%$ (higher pressure level at 0%) |
| Display shows "99999" for diagnostic value "60.PZ", "61.P1" and "62.P2". | Pressure sensor module defective | Replace pressure sensor module |
| Display shows fault message "17". | | |
| Display shows fault message "18". | Supply pressure PZ falls below the lower limit (U5.PZMLL). | Increase supply pressure PZ until the limit (U5.PZMLL) plus hysteresis (U2.P_HYS) is exceeded. |
| Display shows fault message "19". | Supply pressure PZ is out of specification | Adjust supply pressure PZ until the device-specific limits of 1.4 to 7 bar +/- hysteresis (U2.P_HYS) are adhered to. |
| Display shows fault message "20". | Supply pressure exceeds the upper limit (U6.PZMUL) | Reduce supply pressure PZ until the limit (U6.PZMUL) minus hysteresis (U2.P_HYS) is fallen below. |
| Display shows fault message "21". | Chamber pressure at Y1 exceeds the limit (U7.PCL) | <ul style="list-style-type: none"> Check to determine why the chamber pressure was exceeded. Reduce the chamber pressure by moving the positioner in the opposite direction. |

| Fault profile (symptoms) | Possible causes | Remedy |
|-------------------------------------|---|--|
| Display shows fault message "HoLd". | <ul style="list-style-type: none"> Device is at "Hold position", when "HoLd" is assigned as the response (U3.PFRLL or U4.PFRUL). | <ul style="list-style-type: none"> Increase or reduce supply pressure according to fault message "18" or "20". |
| | <ul style="list-style-type: none"> The actuating pressure at Y1 exceeds the limit (U7.PCL) | <ul style="list-style-type: none"> Check to determine why the actuating pressure was exceeded. Reduce the actuating pressure by moving the positioner in the opposite direction. |
| Display shows fault message "22". | <ul style="list-style-type: none"> Pressure increase / leakage (pressure decrease) exceeds the limit (U8.LRL) | <ul style="list-style-type: none"> Find and eliminate the cause of the pressure increase / leakage. Also reset diagnostic values 69, 70, 71 and 72. Reset the "U8.LRL" limit to 0. |

See also

- Diagnostic value '60.PZ Supply pressure PZ' (Page 237)
- 17 Monitoring of pressure sensor module (Page 250)
- 18 Monitoring lower limit PZ (Page 250)
- 19 Monitoring specific limits PZ (Page 250)
- Pressure monitoring 'U.\\PRES' (Page 193)
- Replace the pressure sensor module (Page 209)
- Diagnostic value '61.P1 - Actuating pressure Y1' (Page 237)
- Diagnostic value '62.P2 - Actuating pressure Y2' (Page 238)
- Diagnostic value '16.ONLK - Pneumatic leakage' (Page 228)
- 22 Monitoring leakage of the pneumatic system (Page 251)
- 21 Monitoring upper limit of actuating pressure Y1 (Page 251)
- 20 Monitoring upper limit PZ (Page 251)

Technical data

12.1 HART operating conditions

| Rated conditions | |
|---|---|
| Ambient conditions | For use indoors and outdoors. |
| Ambient temperature | In hazardous areas, observe the maximum permissible ambient temperature corresponding to the temperature class. |
| <ul style="list-style-type: none"> Permissible ambient temperature for operation ²⁾³⁾ | -30 ... +80 °C (-22 ... +176 °F) |
| <ul style="list-style-type: none"> Maximum permissible height above sea level | Up to 2000 m |
| <ul style="list-style-type: none"> Relative humidity | 0 ... 100% |
| Degree of pollution | 2 |
| Overvoltage category | II |
| Degree of protection ¹⁾ | IP66 / Type 4X to UL 50E |
| Vibration resistance | |
| <ul style="list-style-type: none"> Harmonic oscillations (sine) according to IEC 60068-2-6 | 3.5 mm (0.14"), 2 ... 27 Hz, 3 cycles/axis 98.1 m/s ² (321.84 ft/s ²), 27 ... 300 Hz, 3 cycles/axis |
| <ul style="list-style-type: none"> Bump (half-sine) according to IEC 60068-2-27 | 150 m/s ² (492 ft/s ²), 6 ms, 1000 shocks/axis |
| <ul style="list-style-type: none"> Noise (controlled digitally) according to IEC 60068-2-64 | 10 ... 200 Hz; 1 (m/s ²) ² /Hz (3.28 (ft/s ²) ² /Hz) 200 ... 500 Hz; 0.3 (m/s ²) ² /Hz (0.98 (ft/s ²) ² /Hz) 4 hours/axis |
| <ul style="list-style-type: none"> Recommended range of continuous operation of the entire control valve | ≤ 30 m/s ² (98.4 ft/s ²) without resonance peak |
| Climate class | |
| <ul style="list-style-type: none"> Storage | 1K5, -40 ... +80 °C (-40 ... +176 °F) |
| <ul style="list-style-type: none"> Transport | 2K4, -40 ... +80 °C (-40 ... +176 °F) |

¹⁾ Max. impact energy 1 Joule for enclosure with inspection window 6DR5..0 and 6DR5..1 or max. 2 Joule for 6DR5..3

²⁾ At ≤ -10 °C (≤ 14 °F) the display refresh rate of the indicator is limited.

³⁾ The following applies to order suffix (order code) **-Z M40**: -40 ... +80 °C (-40 ... +176 °F)

See also

Proper mounting (Page 37)

12.2 Pneumatic data for all device versions

| Pneumatic data | |
|---|---|
| Auxiliary power (air supply) | Compressed air, carbon dioxide (CO ₂), nitrogen (N), noble gases or cleaned natural gas |
| • Pressure ¹⁾ | 1.4 ... 7 bar (20.3 ... 101.5 psi) |
| Air quality to ISO 8573-1 | |
| • Solid particulate size and density | Class 3 |
| • Pressure dew point | Class 3 (min. 20 K (36 °F) below ambient temperature) |
| • Oil content | Class 3 |
| Unrestricted flow (DIN 1945) | |
| • Pressurize actuator ²⁾ | |
| 2 bar; 0.1 KV (29 psi; 0.116 CV) | 4.1 Nm ³ /h (2.6 scfm) |
| 4 bar; 0.1 KV (58 psi; 0.116 CV) | 7.1 Nm ³ /h (4.4 scfm) |
| 6 bar; 0.1 KV (87 psi; 0.116 CV) | 9.8 Nm ³ /h (6.1 scfm) |
| • Depressurize actuator for all versions except fail in place ²⁾ | |
| 2 bar; 0.2 KV (29 psi; 0.232 CV) | 8.2 Nm ³ /h (5.1 scfm) |
| 4 bar; 0.2 KV (58 psi; 0.232 CV) | 13.7 Nm ³ /h (8.5 scfm) |
| 6 bar; 0.2 KV (87 psi; 0.232 CV) | 19.2 Nm ³ /h (12.0 scfm) |
| • Depressurize actuator for fail in place version | |
| 2 bar; 0.1 KV (29 psi; 0.116 CV) | 4.3 Nm ³ /h (2.7 scfm) |
| 4 bar; 0.1 KV (58 psi; 0.116 CV) | 7.3 Nm ³ /h (4.5 scfm) |
| 6 bar; 0.1 KV (87 psi; 0.116 CV) | 9.8 Nm ³ /h (6.1 scfm) |
| Valve leakage | < 6·10 ⁻⁴ Nm ³ /h (3.7·10 ⁻⁴ scfm) |
| Throttle ratio | Adjustable up to ∞: 1 |
| Typical auxiliary power consumption in the controlled state | 0.01 Nm ³ /h (0.006 scfm) |
| Sound pressure level | L _{Aeq} < 75 dB L _{Amax} < 80 dB |
| Sound pressure with installed booster ³⁾ | L _{Aeq} < 95.2 dB L _{Amax} < 98.5 dB |

¹⁾ The following applies to fail in place double acting: 3 ... 7 bar (43.5 ... 101.5 psi)

²⁾ When using device versions Ex d (6DR5..5-... and 6DR5..6-...), values are reduced by approximately 20%.

³⁾ Read the warning notice "Increased sound pressure level (Page 103)".

See also

Basic safety instructions (Page 103)

12.3 Construction for all device versions

| Construction | |
|--|---|
| How does it work? | |
| • Range of stroke (linear actuator) | 3 to 130 mm (0.12 to 5.12") |
| • Angle of rotation (part-turn actuator) | 30° ... 100° 15° ... 160° |
| | • For 6DR50.5, 6DR51.5, 6DR50.6 and 6DR51.6 |
| Mounting method | |
| • On the linear actuator | Using mounting kit 6DR4004-8V and, where necessary, an additional lever arm 6DR4004-8L on actuators according to IEC 60534-6-1 (NAMUR) with a fin, columns, or a plane surface. |
| • On the part-turn actuator | Using mounting kit 6DR4004-8D or TGX:16300-1556 on actuators with mounting plane according to VDI/VDE 3845 and IEC 60534-6-2: The required mount must be provided on the actuator-side. |
| Weight, positioner without option modules or accessories | |
| • 6DR5..0 Glass-fiber reinforced polycarbonate enclosure | Approx. 0.9 kg (1.98 lb) |
| • 6DR5.11 aluminum enclosure, only single-acting | Approx. 1.3 kg (2.86 lb) |
| • 6DR5..2 stainless steel enclosure | Approx. 3.9 kg (8.6 lb) |
| • 6DR5..3 aluminum enclosure | Approx. 1.6 kg (3.53 lb) |
| • 6DR5..5 aluminum enclosure, flameproof, rugged | Approx. 5.2 kg (11.46 lb) |
| • 6DR5..6 stainless steel enclosure, flameproof, rugged | Approx. 8.4 kg (18.5 lb) |
| Material | |
| • Enclosure | |
| 6DR5..0 polycarbonate | Glass-fiber reinforced polycarbonate (PC) |
| 6DR5.11 aluminum, only single-acting | GD AlSi12 |
| 6DR5..2 stainless steel | Austenitic stainless steel 316Cb, mat. No. 1.4581 |
| 6DR5..3 aluminum | GD AlSi12 |
| 6DR5..5 aluminum, flameproof, rugged | GK AlSi12 |
| 6DR5..6 stainless steel enclosure, flameproof, rugged | Austenitic stainless steel 316L, mat. No. 1.4409 |
| • Pressure gauge block | Aluminum AlMgSi, anodized or stainless steel 316 |
| Versions | |
| • In the polycarbonate enclosure 6DR5..0 | Single-acting and double-acting |
| • In aluminum enclosure 6DR5.11 | Single-acting |
| • In aluminum enclosures 6DR5..3 and 6DR5..5 | Single-acting and double-acting |
| • In stainless steel enclosures 6DR5..2 and 6DR5..6 | Single-acting and double-acting |
| Torques | |
| • Part-turn actuator fixing screws DIN 933 M6x12-A2 | 5 Nm (3.7 ft lb) |
| • Linear actuator fixing screws DIN 933 M8x16-A2 | 12 Nm (8.9 ft lb) |
| • Gland pneumatic G $\frac{1}{4}$ | 15 Nm (11.1 ft lb) |
| • Pneumatic gland 1/4-18 NPT | |

Technical data

12.4 Controller for all device versions

| Construction | |
|---|---|
| Without sealant | 12 Nm (8.9 ft lb) |
| With sealant | 6 Nm (4.4 ft lb) |
| • Cable glands | |
| Screw-in torque for plastic gland in all enclosures | 4 Nm (3 ft lb) |
| Screw-in torque for cable gland made of metal/stainless steel in polycarbonate enclosure | 6 Nm (4.4 ft lb) |
| Screw-in torque for metal/stainless steel glands in aluminum/stainless steel enclosure | 6 Nm (4.4 ft lb) |
| Screw-in torque for NPT adapter made of metal/stainless steel in polycarbonate enclosure | 8 Nm (5.9 ft lb) |
| Screw-in torque for NPT adapter made of metal/stainless steel in aluminum/stainless steel enclosure | 15 Nm (11.1 ft lb) |
| Screw-in torque for NPT gland in the NPT adapter | 68 Nm (50 ft lb) |
| NOTE: To avoid damage to the device, the NPT adapter must be held in place while the NPT gland is screwed into the NPT adapter. | |
| Tightening torque for union nut made of plastic | 2.5 Nm (1.8 ft lb) |
| Tightening torque for union nut made of metal/stainless steel | 4 Nm (3 ft lb) |
| • Pressure gauge block fixing screws | 6 Nm (4.4 ft lb) |
| Manometer | |
| • Degree of protection | |
| Manometer made of plastic | IP31 |
| Manometer, steel | IP44 |
| Manometer made of stainless steel 316 | IP54 |
| • Vibration resistance | In accordance with DIN EN 837-1 |
| Connections, electrical | |
| • Screw terminals | 2.5 mm ² AWG30-14 |
| • Cable gland | |
| Without Ex protection as well as with Ex i | M20 x 1.5 or 1/2-14 NPT |
| With explosion protection Ex d | Ex d-certified M20 x 1.5; 1/2-14 NPT or M25 x 1.5 |
| Connections, pneumatic | Female thread G ¹ / ₄ or 1/4-18 NPT |

12.4 Controller for all device versions

| Controller | |
|-------------------------|---------------------------|
| Control unit | |
| • Five-point controller | Adaptive |
| • Dead zone | |
| dEbA = auto | Adaptive |
| dEbA = 0.1 ... 10 % | Can be set as fixed value |

| Controller | |
|-----------------------------|------------------------------|
| Analog-to-digital converter | |
| • Scanning time | 10 ms |
| • Resolution | ≤ 0,05 % |
| • Transmission error | ≤ 0,2 % |
| • Temperature influence | ≤ 0.1 %/10 K (≤ 0.1 %/18 °F) |

12.5 Electrical data (HART)

| | Electronics without explosion protection | Electronics with explosion protection Ex "db" | Electronics with explosion protection Ex "ia", "db ia" | Electronics with explosion protection Ex "ic", "ec", "tb" |
|--|---|---|--|---|
| Current input I_w | | | | |
| Rated signal range | 4 ... 20 mA | | | |
| Test voltage | 840 V DC, 1 s | | | |
| Digital input DI1 (terminals 9/10; galvanically connected to basic device) | Suitable only for floating contact; max. contact load < 5 µA at 3 V | | | |
| 2-wire connection | | | | |
| 6DR50.. and 6DR53.. 4 ... 20 mA | | | | |
| 6DR51.. and 6DR52.. HART | | | | |
| Current to maintain the auxiliary power | ≥ 3.8 mA | | | |
| Required load voltage U _b (corresponds to Ω at 20 mA) | | | | |
| • 6DR50.0/1/2/3 | | | | |
| Typical | 6.36 V (= 318 Ω) | 6.36 V (= 318 Ω) | 7.8 V (= 390 Ω) | 7.8 V (= 390 Ω) |
| Max. | 6.53 V (= 327 Ω) | 6.53 V (= 327 Ω) | 8.3 V (= 415 Ω) | 8.3 V (= 415 Ω) |
| • 6DR50.5/6 | | | | |
| Typical | 8.25 V (= 413 Ω) | 8.25 V (= 413 Ω) | 7.9 V (= 395 Ω) | 7.9 V (= 395 Ω) |
| Max. | 8.8 V (= 440 Ω) | 8.8 V (= 440 Ω) | 8.5 V (= 425 Ω) | 8.5 V (= 425 Ω) |
| • 6DR51.0/1/2/3 | | | | |
| Typical | 6.6 V (= 330 Ω) | 6.6 V (= 330 Ω) | - | - |
| Max. | 6.79 V (= 340 Ω) | 6.79 V (= 340 Ω) | - | - |
| • 6DR51.5/6 | | | | |
| Typical | 8.75 V (= 438 Ω) | 8.75 V (= 438 Ω) | 8.45 V (= 423 Ω) | 8.45 V (= 423 Ω) |
| Max. | 9.3 V (= 465 Ω) | 9.3 V (= 465 Ω) | 9 V (= 450 Ω) | 9 V (= 450 Ω) |
| • 6DR52.. | | | | |
| Typical | - | 8.4 V (= 420 Ω) | 8.4 V (= 420 Ω) | 8.4 V (= 420 Ω) |
| Max. | - | 9 V (= 450 Ω) | 9 V (= 450 Ω) | 9 V (= 450 Ω) |
| • 6DR53.. | | | | |

12.6 Electrical data for pressure sensor module

| | Electronics without explosion protection | Electronics with explosion protection Ex "db" | Electronics with explosion protection Ex "ia", "db ia" | Electronics with explosion protection Ex "ic", "ec", "tb" |
|---|--|---|--|---|
| Typical | 7.9 V (= 395 Ω) | - | - | - |
| Max. | 8.4 V (= 420 Ω) | - | - | - |
| Static destruction limit | ± 40 mA | ± 40 mA | - | - |
| Effective inner capacitance C_i | - | - | 11 nF | "ic": 11 nF |
| Effective inner inductance L_i | - | - | 209 μH | "ic": 209 μH |
| For connecting to circuits with the following peak values | - | $U_{max} \leq 35 \text{ V}$ $P_{max} \leq 2.5 \text{ W}$ | $U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ $P_i \leq 1 \text{ W}$ | "ic": $U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ "ec"/"tb": $U_n \leq 30 \text{ V}$ $I_n \leq 100 \text{ mA}$ |
| 3-/4-wire connection | | | | |
| 6DR52.. HART | | | | |
| 6DR53.. 4 ... 20 mA | | | | |
| Load voltage at 20 mA | | | | |
| • 6DR52.. | - | - | $\leq 1 \text{ V (= } 50 \Omega)$ | $\leq 1 \text{ V (= } 50 \Omega)$ |
| • 6DR53.. | $\leq 0.2 \text{ V (= } 10 \Omega)$ | $\leq 0.2 \text{ V (= } 10 \Omega)$ | - | - |
| Auxiliary power U_{Aux} | 18 ... 35 V DC | 18 ... 35 V DC | 18 ... 30 V DC | 18 ... 30 V DC |
| Current consumption I_{Aux} | $(U_{Aux} - 7.5 \text{ V}) / 2.4 \text{ k}\Omega$ [mA] | | | |
| For connecting to circuits with the following peak values | - | $U_{max} \leq 35 \text{ V}$ $P_{max} \leq 2.5 \text{ W}$ | $U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ $P_i \leq 1 \text{ W}$ | "ic": $U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ "ec"/"tb": $U_n \leq 30 \text{ V}$ $I_n \leq 100 \text{ mA}$ |
| Effective inner capacitance C_i | - | - | 11 nF | 11 nF |
| Effective inner inductance L_i | - | - | 312 μH | 312 μH |
| Galvanic isolation | Between U_{Aux} and I_W | Between U_{Aux} and I_W | Between U_{Aux} and I_W (2 intrinsically safe circuits) | Between U_{Aux} and I_W |

12.6 Electrical data for pressure sensor module

| | Electronics without explosion protection | Electronics with explosion protection Ex "db" | Electronics with explosion protection Ex "ia", Ex "db ia" | Electronics with explosion protection Ex "ic", "ec", "tb" |
|--|--|---|---|---|
| Electronics for the pressure sensor module | | | | |
| 6DR51.. -Z P01 und -Z P02 HART, non-Ex | | | | |
| 6DR51.. -Z P01 und -Z P02 HART, Ex | | | | |
| Current input I_W | | | | |

| | Electronics without explosion protection | Electronics with explosion protection Ex "db" | Electronics with explosion protection Ex "ia", Ex "db ia" | Electronics with explosion protection Ex "ic", "ec", "tb" |
|--|--|---|---|---|
| • Rated signal range | | | 4 ... 20 mA | |
| • Test voltage | | | 840 V DC, 1 s | |
| • Digital input DI1 (terminals 9/10; galvanically connected to basic device) | | Suitable only for floating contact; max. contact load < 5 µA at 3 V | | |
| Current to maintain the auxiliary power | | | ≥ 3.8 mA | |
| Required load voltage U_b (corresponds to Ω at 20 mA) | 9.4 V (= 470 Ω) | 9.4 V (= 470 Ω) | 9 V (= 450 Ω) | 9 V (= 450 Ω) |
| Static destruction limit | ± 30 V | ± 30 V | - | - |
| Effective inner capacitance C_i | - | - | 12.2 nF | "ic": 12.2 nF |
| Effective inner inductance L_i | - | - | 105 µH | "ic": 105 µH |
| For connecting to circuits with the following peak values | - | $U_{max} \leq 35$ V $P_{max} \leq 2.5$ W | $U_i \leq 30$ V $I_i \leq 100$ mA $P_i \leq 1$ W | "ic": $U_i \leq 30$ V $I_i \leq 100$ mA "ec"/"tb": $U_n \leq 30$ V $I_n \leq 100$ mA |

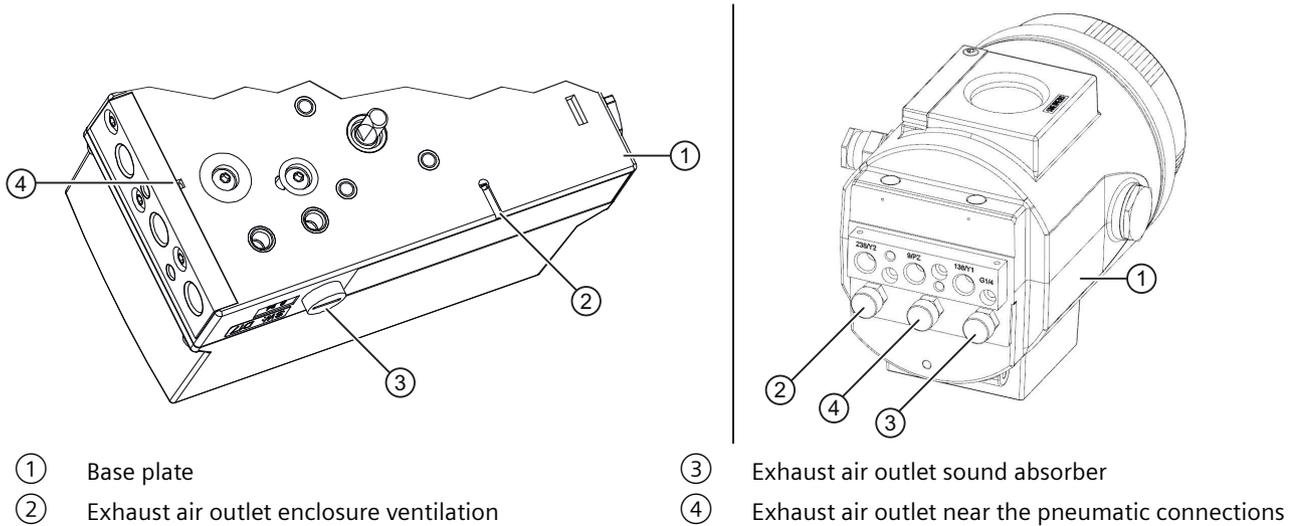
12.7 Communication (HART)

| HART communication | |
|----------------------------------|--|
| HART version | 7 |
| PC parameter assignment software | SIMATIC PDM; supports all device objects. The software is not included in the scope of delivery. |

12.8 Technical data for natural gas as actuator medium

Introduction

For operation with natural gas, note that used natural gas escapes at the exhaust air outlets.



① Base plate

② Exhaust air outlet enclosure ventilation

③ Exhaust air outlet sound absorber

④ Exhaust air outlet near the pneumatic connections

Note

The following applies for exhaust air outlet with sound absorber ③:

The positioner is supplied as standard with a sound absorber. To provide an outlet for the exhaust air, replace the sound absorber by a G $\frac{1}{4}$ pipe coupling.

The following applies for enclosure ventilation ② and control air outlet ④:

1. With the "flameproof enclosure" device version in an aluminum enclosure with order suffix -Z K50 "Operation with natural gas", you can completely collect and discharge the escaping natural gas.
2. In all other device versions, the escaping natural gas is released into the environment.

Maximum values for escaping natural gas

- The quantity of escaping natural gas is negligible during regulated operation.
- If a control error occurs, a maximum of 30 NI/min of natural gas will escape at the enclosure vent ② and a maximum of 89 NI/min at the control air outlet ④.

See also

Proper mounting (Page 37)

12.9 Option modules

12.9.1 Digital I/O Module (DIO) 6DR4004-6A / -8A

| | Without explosion protection or suitable for use in Ex "db" version | With explosion protection Ex "ia", "db ia" | With explosion protection Ex "ic", "ec", "tb" |
|---|---|---|---|
| | 6DR4004-8A | 6DR4004-6A | 6DR4004-6A |
| 3 digital output current circuits | | | |
| <ul style="list-style-type: none"> Digital output A1: Terminals 41 and 42 Digital output A2: Terminals 51 and 52 Fault message output: Terminals 31 and 32 | | | |
| Auxiliary power supply U_{Aux} | ≤ 35 V and the current consumption is to be limited to < 25 mA | - | - |
| Signal status | | | |
| High (not addressed) | Conductive, $R = 1$ k Ω , $+3/-1$ % *) | ≥ 2.1 mA | ≥ 2.1 mA |
| Low *) (addressed) | Deactivated, $I_R < 60$ μ A | ≤ 1.2 mA | ≤ 1.2 mA |
| *) The status is also Low if the basic device is faulty or without a auxiliary power. | *) When using in the flame-proof enclosure, the current consumption must be restricted to 10 mA per digital output. | Switching threshold for supply according to EN 60947-5-6: $U_{Aux} = 8.2$ V, $R_i = 1$ k Ω | Switching threshold for supply according to EN 60947-5-6: $U_{Aux} = 8.2$ V, $R_i = 1$ k Ω |
| For connecting to circuits with the following peak values | - | $U_i \leq 15$ V DC $I_i \leq 25$ mA $P_i \leq 64$ mW | "ic": $U_i \leq 15$ V DC $I_i \leq 25$ mA "ec"/"tb": $U_n \leq 15$ V DC |
| Effective internal capacitance | - | $C_i \leq 5.2$ nF | $C_i \leq 5.2$ nF |
| Effective internal inductance | - | $L_i =$ negligibly small | $L_i =$ negligibly small |
| 1 digital input current circuit | | | |
| <ul style="list-style-type: none"> Digital input DI2: Terminals 11 and 12, terminals 21 and 22 (jumper) Galvanically connected with the basic device | | | |
| Signal status 0 | | Floating contact, open | |
| Signal status 1 | | Floating contact, closed | |
| Contact load | | 3 V, 5 μ A | |
| Electrically isolated from the basic device | | | |
| Signal status 0 | | ≤ 4.5 V or open | |
| Signal status 1 | | ≥ 13 V | |
| Internal resistance | | ≥ 25 k Ω | |

12.9 Option modules

| | Without explosion protection or suitable for use in Ex "db" version | With explosion protection Ex "ia", "db ia" | With explosion protection Ex "ic", "ec", "tb" |
|---|--|--|---|
| | 6DR4004-8A | 6DR4004-6A | 6DR4004-6A |
| • Static destruction limit | ± 35 V | - | - |
| • Connecting to circuits with the following peak values | - | $U_i \leq 25.2 \text{ V DC}$ | "ic": $U_i \leq 25.2 \text{ V DC}$ "ec"/"tb": $U_n \leq 25.2 \text{ V DC}$ |
| Effective internal capacitance | - | $C_i = \text{negligibly small}$ | $C_i = \text{negligibly small}$ |
| Effective internal inductance | - | $L_i = \text{negligibly small}$ | $L_i = \text{negligibly small}$ |
| Galvanic isolation | The three digital outputs, the DI1 digital input and the basic device are galvanically isolated from each other. | | |
| Test voltage | DC 840 V, 1 s | | |

12.9.2 Analog Output Module (AOM) 6DR4004-6J / -8J

| | Without explosion protection or suitable for use in Ex d version | With explosion protection Ex "ia", "db ia" | With explosion protection Ex "ic", "ec", "tb" |
|---|---|---|---|
| | 6DR4004-8J | 6DR4004-6J | 6DR4004-6J |
| Direct current output for position feedback | 1 current output, terminals 61 and 62 | | |
| | 2-wire connection | | |
| • Rated signal range | 4 ... 20 mA, short-circuit proof | | |
| • Dynamic range | 3.6 ... 20.5 mA | | |
| • Auxiliary power supply U_{Aux} | +12 ... +35 V | +12 ... +30 V | +12 ... +30 V |
| • External load R_b [kΩ] | $\leq (U_{Aux} [\text{V}] - 12 \text{ V})/I [\text{mA}]$ | | |
| • Transmission error | $\leq 0.3\%$ | | |
| • Temperature influence | $\leq 0.1\%/10 \text{ K} (\leq 0.1\%/18 \text{ °F})$ | | |
| • Resolution | $\leq 0.1\%$ | | |
| • Residual ripple | $\leq 1 \%$ | | |
| • For connecting to circuits with the following peak values | - | $U_i \leq \text{DC } 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ $P_i \leq 1 \text{ W}$ | "ic": $U_i \leq \text{DC } 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ "ec"/"tb": $U_n \leq \text{DC } 30 \text{ V}$ $I_n \leq 100 \text{ mA}$ $P_n \leq 1 \text{ W}$ |
| Effective internal capacitance | - | $C_i \leq 11 \text{ nF}$ | $C_i \leq 11 \text{ nF}$ |
| Effective internal inductance | - | $L_i = \text{negligibly small}$ | |
| Galvanic isolation | Electrically isolated from the alarm option and safely isolated from the basic device | | |
| Test voltage | DC 840 V, 1 s | | |

12.9.3 Inductive Limit Switches (ILS) 6DR4004-6G / -8G

| | Without explosion protection | With explosion protection Ex "ia", "db ia" | With explosion protection Ex "ic", "ec", "tb" |
|--|---|--|---|
| | 6DR4004-8G | 6DR4004-6G | 6DR4004-6G |
| Limit encoder with slotted initiators and fault message output | | | |
| 2 slotted initiators | | | |
| <ul style="list-style-type: none"> Digital output 1: Terminals 41 and 42 Digital output 2: Terminals 51 and 52 | | | |
| • Connection | 2-wire technology in accordance with EN 60947-5-6 (NAMUR), for switching amplifiers connected on load side | | |
| • Signal state High (not triggered) | | > 2.1 mA | |
| • Signal state Low (triggered) | | < 1.2 mA | |
| • 2 slotted initiators | Type SJ2-SN | | |
| • Function | NC contact (NC, normally closed) | | |
| • Connecting to circuits with the following peak values | Rated voltage 8 V, power consumption: ≥ 3 mA (limit not activated), ≤ 1 mA (limit activated) | $U_i \leq$ DC 15 V $I_i \leq$ 25 mA $P_i \leq$ 64 mW | "ic": $U_i \leq$ DC 15 V $I_i \leq$ 25 mA "ec"/"tb": $U_n \leq$ DC 15 V $P_n \leq$ 64 mW |
| Effective internal capacitance | - | $C_i \leq$ 161 nF | $C_i \leq$ 161 nF |
| Effective internal inductance | - | $L_i \leq$ 120 μ H | $L_i \leq$ 120 μ H |
| 1 fault message output | | | |
| <ul style="list-style-type: none"> Digital output: Terminals 31 and 32 | | | |
| • Connection | At switching amplifier in accordance with EN 60947-5-6: (NAMUR), $U_{Aux} = 8.2$ V, $R_i = 1$ k Ω). | | |
| • Signal state High (not triggered) | $R = 1.1$ k Ω | > 2.1 mA | > 2.1 mA |
| • Signal state Low (triggered) | $R = 10$ k Ω | < 1.2 mA | < 1.2 mA |
| • Auxiliary power U_{Aux} | $U_{Aux} \leq$ DC 35 V $I \leq$ 20 mA | - | - |
| • Connecting to circuits with the following peak values | - | $U_i \leq$ DC 15 V $I_i \leq$ 25 mA $P_i \leq$ 64 mW | "ic": $U_i \leq$ DC 15 V $I_i \leq$ 25 mA "ec"/"tb": $U_n \leq$ DC 15 V $P_n \leq$ 64 mW |
| Effective internal capacitance | - | $C_i \leq$ 5.2 nF | $C_i \leq$ 5.2 nF |
| Effective internal inductance | - | $L_i =$ negligibly small | $L_i =$ negligibly small |
| Galvanic isolation | The 3 outputs are galvanically isolated from the basic device. | | |
| Test voltage | DC 840 V, 1 s | | |

12.9.4 Mechanic Limit Switches (MLS) 6DR4004-6K

| | Without explosion protection | With explosion protection Ex "ia", "db ia" | With explosion protection Ex "ic", "tb" |
|--|--|---|--|
| Limit encoder with mechanical switching contacts | | | |
| 2 limit contacts | | | |
| <ul style="list-style-type: none"> Digital output DO1: Terminals 41 and 42 Digital output DO2: Terminals 51 and 52 | | | |
| • Max. switching current AC/DC | 100 mA | - | - |
| • For connecting to circuits with the following peak values | - | $U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ $P_i \leq 750 \text{ mW}$ | "ic": $U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ "tb": $U_n \leq 30 \text{ V}$ $I_n \leq 100 \text{ mA}$ |
| Effective internal capacitance | - | $C_i =$ negligibly small | $C_i =$ negligibly small |
| Effective internal inductance | - | $L_i =$ negligibly small | $L_i =$ negligibly small |
| • Max. switching voltage AC/DC | DC 30 V | DC 30 V | DC 30 V |
| 1 fault message output | | | |
| <ul style="list-style-type: none"> Digital output: Terminals 31 and 32 | | | |
| • Connection | On switching amplifier according to EN 60947-5-6: (NAMUR), $U_{Aux} = 8.2 \text{ V}$, $R_i = 1 \text{ k}\Omega$. | | |
| • Signal state High (not triggered) | $R = 1.1 \text{ k}\Omega$ | $> 2.1 \text{ mA}$ | $> 2.1 \text{ mA}$ |
| • Signal state Low (triggered) | $R = 10 \text{ k}\Omega$ | $< 1.2 \text{ mA}$ | $< 1.2 \text{ mA}$ |
| • Auxiliary power | $U_{Aux} \leq \text{DC } 35 \text{ V}$ $I \leq 20 \text{ mA}$ | - | - |
| • Connecting to circuits with the following peak values | - | $U_i \leq 15 \text{ V}$ $I_i \leq 25 \text{ mA}$ $P_i \leq 64 \text{ mW}$ | "ic": $U_i \leq 15 \text{ V}$ $I_i \leq 25 \text{ mA}$ "tb": $U_n \leq 15 \text{ V}$ $I_n \leq 25 \text{ mA}$ |
| Effective internal capacitance | - | $C_i \leq 5.2 \text{ nF}$ | $C_i \leq 5.2 \text{ nF}$ |
| Effective internal inductance | - | $L_i =$ negligibly small | $L_i =$ negligibly small |
| Galvanic isolation | The 3 outputs are galvanically isolated from the basic device | | |
| Test voltage | 3150 V DC, 2 s | | |
| Rated condition height | Max. 2 000 m above sea level. At altitudes greater than 2 000 m above sea level, use a suitable power supply. | - | - |

12.9.5 Analog Input Module (AIM) 6DR4004-6F / -8F

| | Without explosion protection | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec", "tb" |
|--|------------------------------|---|--|
| | 6DR4004-8F | 6DR4004-6F | 6DR4004-6F |

The Analog Input Module (AIM) 6DR4004-6F and -8F is required to connect a Non-Contacting Sensor (NCS) or Position Transmitter 6DR4004-1ES to -4ES.

For devices without explosion protection, other types of potentiometers with resistance values between 3 and 20 KΩ can be connected.

R-potentiometer

| | | | |
|--|------------------------|--|------------------------|
| <ul style="list-style-type: none"> Peak values when supplied by other basic devices (6DR50/1/2/3/9) | $U_{max} = 5\text{ V}$ | $U_o \leq 5\text{ V}$ $I_o \leq 100\text{ mA}$ $P_o \leq 33\text{ mW}$ $C_o \leq 1\text{ }\mu\text{F}$ $L_o \leq 1\text{ mH}$ | $U_{max} = 5\text{ V}$ |
| <ul style="list-style-type: none"> Maximum values when powered by the base unit with PA (6DR55) or FF communication (6DR56) | $U_{max} = 5\text{ V}$ | $U_o \leq 5\text{ V}$ $I_o \leq 75\text{ mA static}$ $I_o \leq 160\text{ mA transient}$ $P_o \leq 120\text{ mW}$ $C_o \leq 1\text{ }\mu\text{F}$ $L_o \leq 1\text{ mH}$ | $U_{max} = 5\text{ V}$ |

Signal 20 mA

| | | |
|--------------------------|-------------|---|
| Rated signal range | 0 ... 20 mA | - |
| Internal load R_b | 200 Ω | - |
| Static destruction limit | 40 mA | - |

Signal 10 V

| | | |
|---------------------------|------------|---|
| Rated signal range | 0 ... 10 V | - |
| Internal resistance R_i | 25 kΩ | - |
| Static destruction limit | 20 V | - |

Supply and signal power circuits

Galvanically connected with the basic device

12.9.6 Internal NCS module 6DR4004-5L / 6DR4004-5LE

| Additional modules | Without explosion protection | With explosion protection Ex "ia", "db ia" | With explosion protection Ex "ic", "ec", "tb" |
|---|------------------------------|---|--|
| | 6DR4004-5L | 6DR4004-5LE | 6DR4004-5LE |
| Linearity (after corrections made by positioner) | | $\pm 1\%$ | |
| Hysteresis | | $\pm 0.2\%$ | |
| For connecting to circuits with the following peak values | | $U_i \leq 5\text{ V}$ $I_i \leq 160\text{ mA}$ $P_i \leq 120\text{ mW}$ | $U_i \leq 5\text{ V}$ |

12.9 Option modules

| Additional modules | Without explosion protection | With explosion protection Ex "ia", "db ia" | With explosion protection Ex "ic", "ec", "tb" |
|--------------------------------|------------------------------|--|--|
| | 6DR4004-5L | 6DR4004-5LE | 6DR4004-5LE |
| Effective internal capacitance | - | $C_i = 110 \text{ nF} + 110 \text{ nF per meter of connecting cable}$ | |
| Effective internal inductance | - | $L_i = 270 \text{ }\mu\text{H} + 6.53 \text{ }\mu\text{H per meter of connecting cable}$ | |

12.9.7 Other technical specifications

Technical specifications for additional option modules and accessories is available at:

- External NCS sensors 6DR4004-6N/8N and 6DR4004-2ES (Page 305)
- Technical specifications of the external position detection system (Page 311)
- Sealing plug / thread adapter (Page 319)
- Positioner with remote electronics (Page 333)

Dimension drawings

13.1 Positioner in non-flameproof enclosure

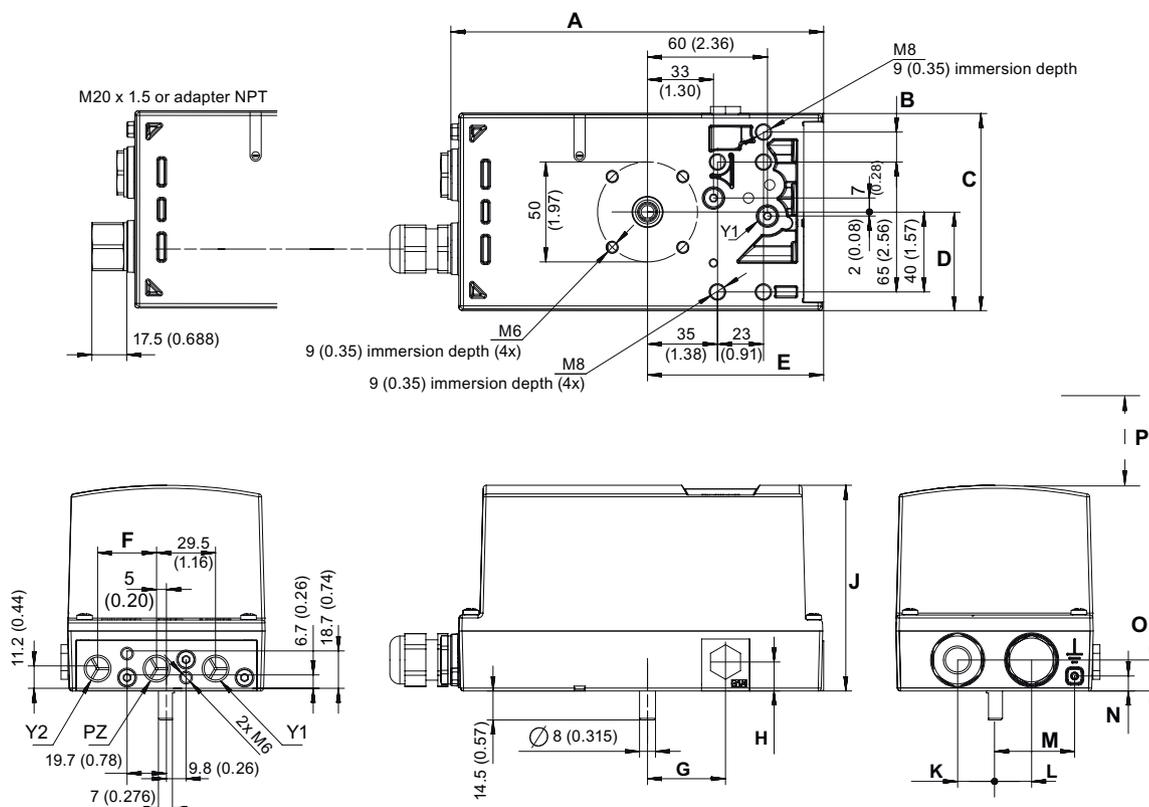


Figure 13-1 SIPART PS2, non-flameproof enclosure, dimensions in mm (inch)

| | 6DR5..0 | | 6DR5..1 | 6DR5..2 | 6DR5..3 | |
|-----------------|-----------------|-----------------------|-------------|--------------|-----------------|-----------------------|
| | G $\frac{1}{4}$ | $\frac{1}{4}$ -18 NPT | | | G $\frac{1}{4}$ | $\frac{1}{4}$ -18 NPT |
| A | 184.5 [7.26] | 186.5 [7.34] | 185 [7.28] | 186.5 [7.34] | 186.5 [7.34] | 188.5 [7.42] |
| B | - | - | - | - | 15 [0.59] | |
| C | 95 [3.74] | | 84 [3.31] | 99 [3.90] | 98.6 [3.88] | |
| D | 47.5 [1.87] | | 49.5 [1.95] | 49.5 [1.95] | 49.3 [1.94] | |
| E | 88.5 [3.48] | | 88.8 [3.50] | 88.5 [3.48] | 88.8 [3.50] | |
| F ¹⁾ | 29.5 [1.16] | | - | 29.5 [1.16] | 29.5 [1.16] | |
| G | 39 [1.54] | | 44 [1.73] | 39 [1.54] | 39 [1.54] | |
| H | 14.5 [0.57] | | 16 [0.63] | 16 [0.63] | 14.5 [0.57] | |
| J | 96.6 [3.80] | | 96.6 [3.80] | 98.5 [3.88] | 103 [4.06] | |
| K | 18.5 [0.73] | | 22 [0.87] | 18.5 [0.73] | 18.5 [0.73] | |
| L | 18.5 [0.73] | | 7 [0.23] | 18.5 [0.73] | 18.5 [0.73] | |

13.2 Terminal strip for positioners

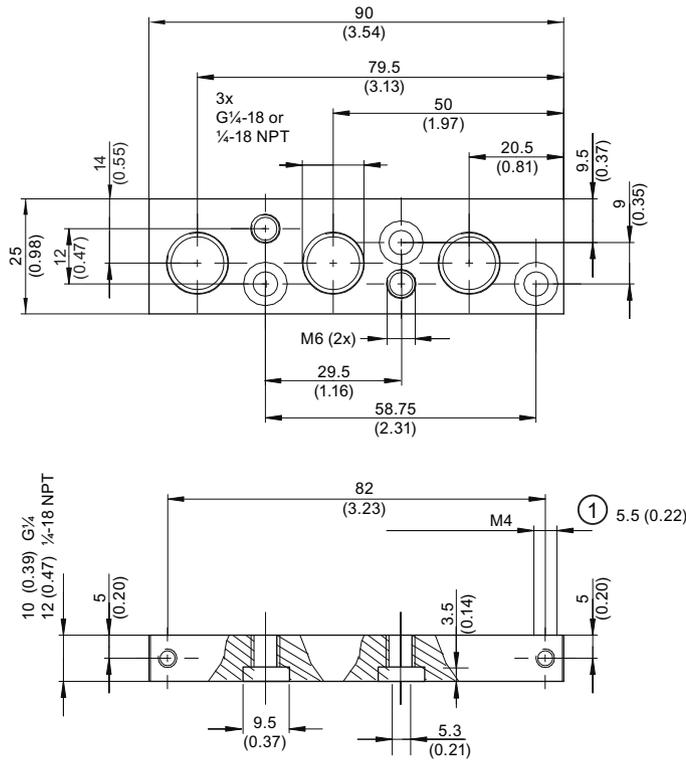
| | 6DR5..0 | | 6DR5..1 | 6DR5..2 | 6DR5..3 | |
|---|---|-----------------------|-------------|-------------|-----------------|-----------------------|
| | G $\frac{1}{4}$ | $\frac{1}{4}$ -18 NPT | | | G $\frac{1}{4}$ | $\frac{1}{4}$ -18 NPT |
| M | - | | 26.5 [1.04] | 41.5 [1.53] | 40 [1.57] | |
| N | - | | 7.5 | 7.5 | 7.5 | |
| O | 14.5 [0.57] | | 14.5 [0.57] | 14.5 [0.57] | 15.5 [0.61] | |
| P | > 150 (5.91) Adhere to this minimum clearance P for service and maintenance above the lid. | | | | | |

Dimensions in mm [inch]

1) Dimension applies only to double-acting actuators.

- 6DR5..0 Polycarbonate enclosure; dimensions with pneumatic connection G $\frac{1}{4}$ or $\frac{1}{4}$ -18 NPT
- 6DR5..1 Aluminum enclosure, single-acting
- 6DR5..2 Stainless steel enclosure, without inspection window
- 6DR5..3 Aluminum enclosure, single/double-acting; dimensions with pneumatic connection G $\frac{1}{4}$ or $\frac{1}{4}$ -18 NPT

13.2 Terminal strip for positioners



① Thread depth

Figure 13-2 Terminal strip, dimensions in mm (inch)

13.3 Positioner in flameproof enclosure

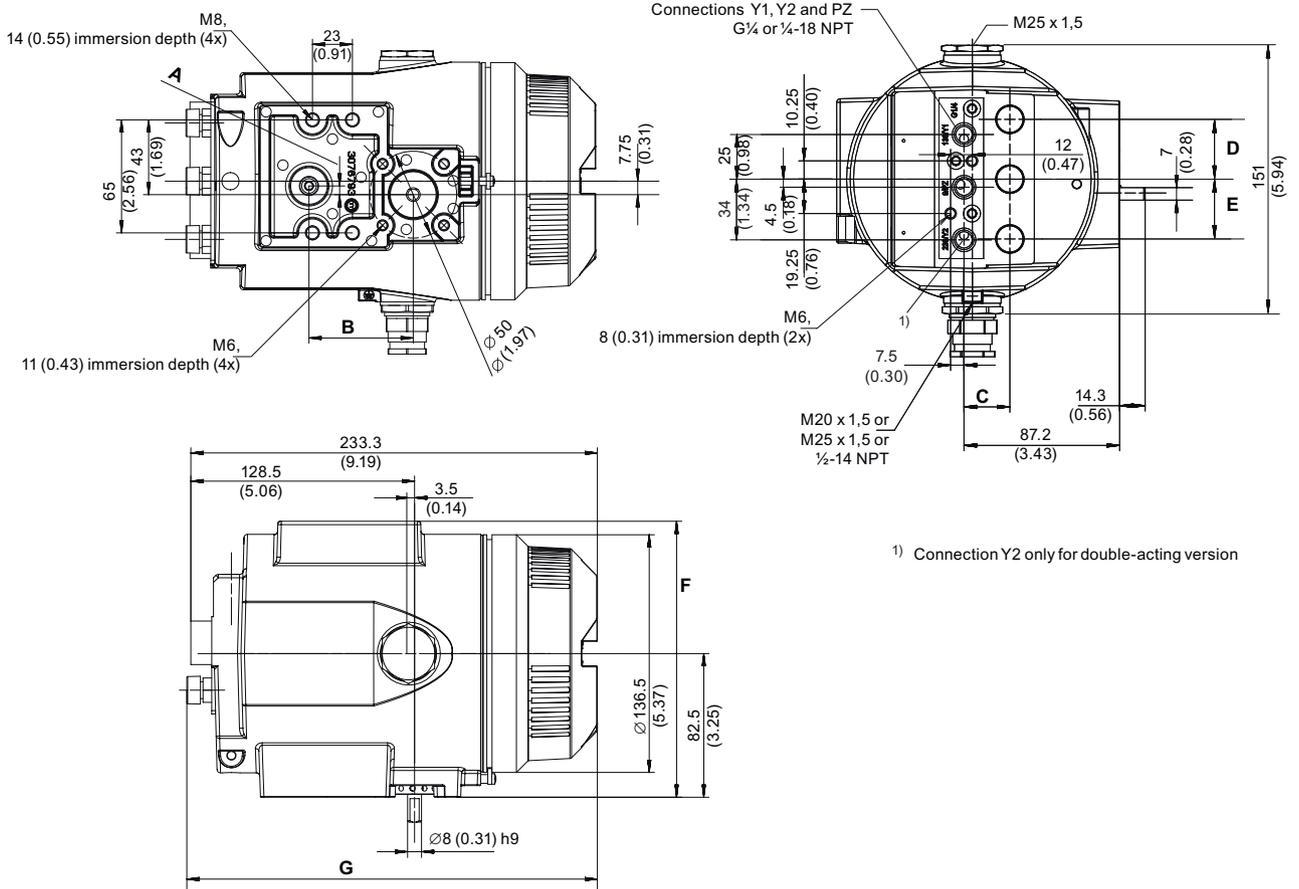


Figure 13-3 SIPART PS2, flameproof enclosure, dimensions in mm (inch)

| | 6DR5..5 | 6DR5..6 |
|---|--------------|--------------|
| A | 5 [0.2] | - |
| B | 60 (2.36) | - |
| C | 25.7 (1.01) | 21.7 (0.85) |
| D | 33.5 (1.32) | 25 [0.99] |
| E | 33.5 (1.32) | - |
| F | 158.5 [6.24] | 160 [6.3] |
| G | 235.3 [9.26] | 227.6 [8.96] |

Dimensions in mm [inch]

6DR5..5 Aluminum enclosure, flameproof; dimensions with pneumatic connection G 1/4 or 1/4-18 NPT

6DR5..6 Stainless steel enclosure, flameproof

Product documentation and support

A.1 Product documentation

Process instrumentation product documentation is available in the following formats:

- Certificates (<http://www.siemens.com/processinstrumentation/certificates>)
- Downloads (firmware, EDDs, software) (<http://www.siemens.com/processinstrumentation/downloads>)
- Catalog and catalog sheets (<http://www.siemens.com/processinstrumentation/catalogs>)
- Manuals (<http://www.siemens.com/processinstrumentation/documentation>)
You have the option to show, open, save, or configure the manual.
 - "Display": Open the manual in HTML5 format
 - "Configure": Register and configure the documentation specific to your plant
 - "Download": Open or save the manual in PDF format
 - "Download as html5, only PC": Open or save the manual in the HTML5 view on your PC

You can also find manuals with the Mobile app at Industry Online Support (<https://support.industry.siemens.com/cs/ww/de/sc/2067>). Download the app to your mobile device and scan the device QR code.

Product documentation by serial number

Using the PIA Life Cycle Portal, you can access the serial number-specific product information including technical specifications, spare parts, calibration data, or factory certificates.

Entering a serial number

1. Open the PIA Life Cycle Portal (<https://www.pia-portal.automation.siemens.com>).
2. Select the desired language.
3. Enter the serial number of your device. The product documentation relevant for your device is displayed and can be downloaded.

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

Scanning a QR code

1. Scan the QR code on your device with a mobile device.
2. Click "PIA Portal".

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

A.2 Technical support

Technical support

If this documentation does not completely answer your technical questions, you can enter a Support Request (<http://www.siemens.com/automation/support-request>).

For help creating a support request, view this video here (www.siemens.com/opensr).

Additional information on our technical support can be found at Technical Support (<http://www.siemens.com/automation/csi/service>).

Service & support on the Internet

In addition to our technical support, Siemens offers comprehensive online services at Service & Support (<http://www.siemens.com/automation/serviceandsupport>).

Contact

If you have further questions about the device, contact your local Siemens representative at Personal Contact (<http://www.automation.siemens.com/partner>).

To find the contact for your product, go to "all products and branches" and select "Products & Services > Industrial automation > Process instrumentation".

Contact address for business unit:

Siemens AG

Digital Industries

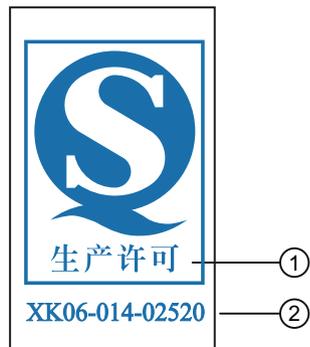
Process Automation

Östliche Rheinbrückenstr. 50

76187 Karlsruhe, Germany

A.3 Chinese production license for explosion proof electrical products

防爆电气产品生产许可证标志



- ① 生产许可
- ② 生产许可证书编号

Installing ILS and MLS (for 6DR50.5/6DR51.5/6DR50.6/6DR51.6)

B

B.1 Opening the positioner

Requirement

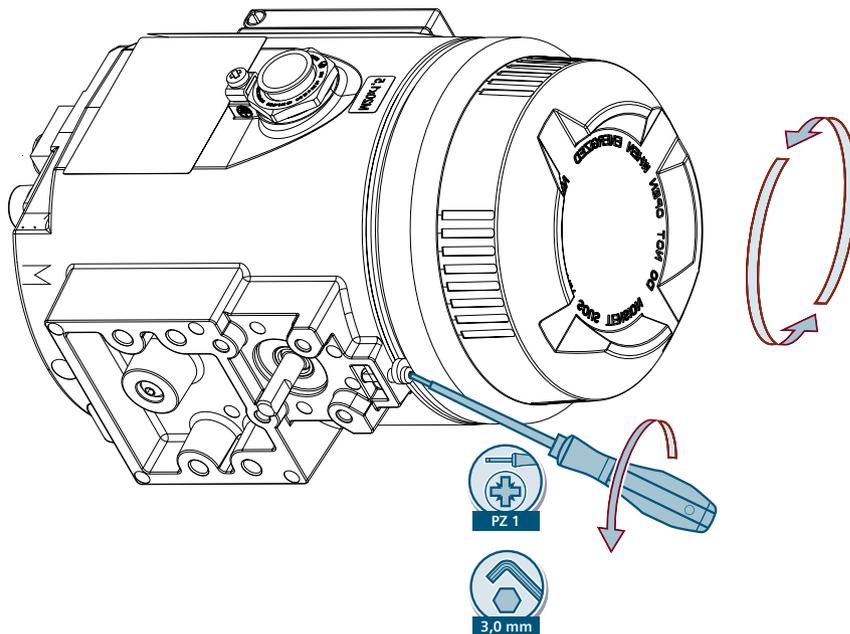
The positioner has been removed from the actuator.

Procedure: Standard and intrinsically safe device version

1. De-energize the device.
2. Remove the enclosure cover.

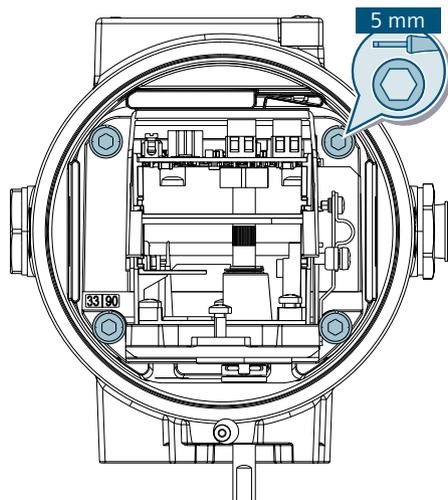
Procedure: Device version with "flameproof enclosure"

1. De-energize the device.
2. Open the enclosure by loosening the locking screw and unscrewing the enclosure cover.

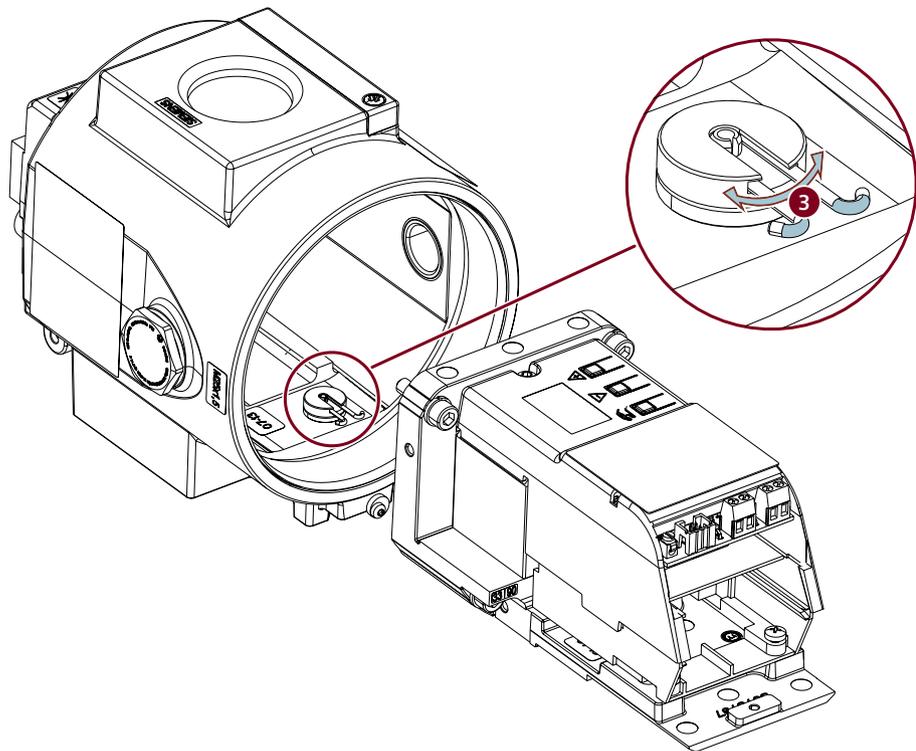
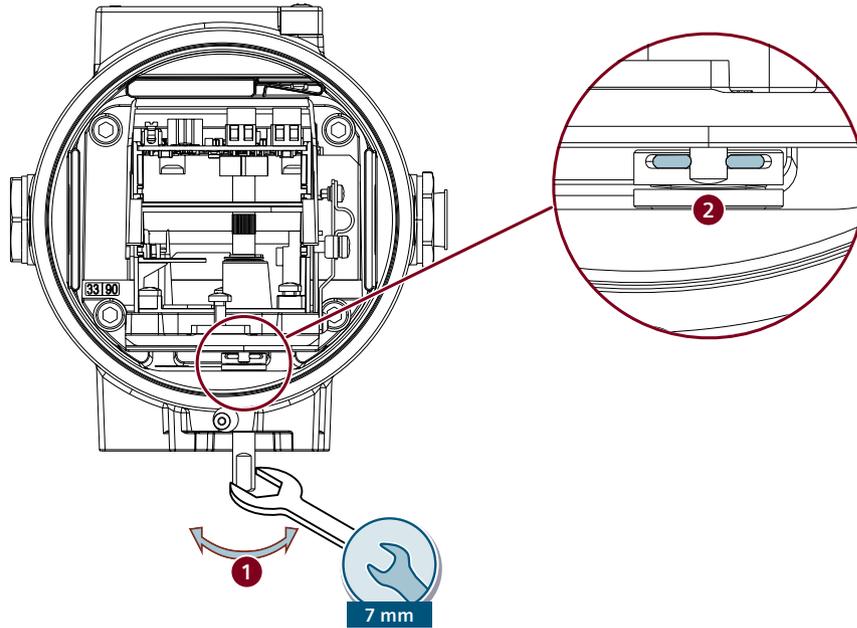


B.1 Opening the positioner

3. Unscrew the adapter.



4. Turn the feedback shaft ① until the clip is oriented as shown in ②.



5. Remove the adapter from the enclosure.

B.2 Installing the option module

- There are several O-rings between the adapter and enclosure.

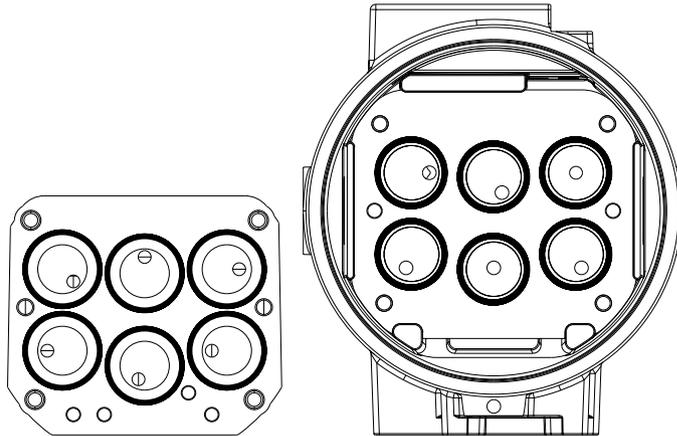


Figure B-1 O-rings on the adapter and in the enclosure of 6DR5..5. (no O-rings in the enclosure of 6DR5..6)

- The O-rings may come off during removal. Be sure to save the O-rings when removing the adapter.

B.2 Installing the option module

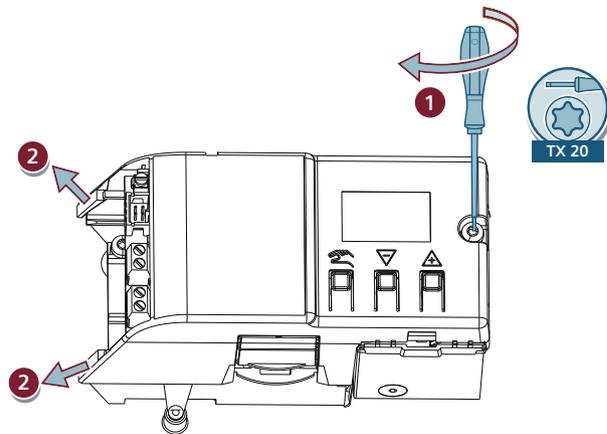
Requirement

You have opened the positioner.

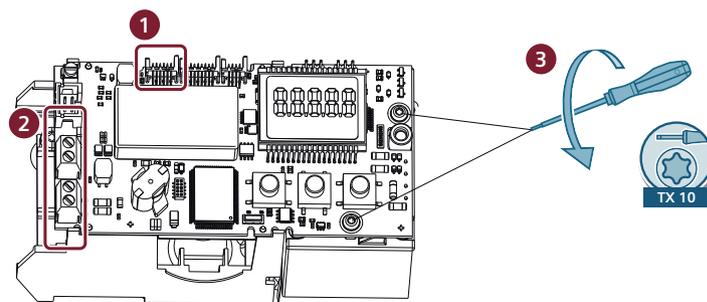
- Opening the positioner (Page 279)

Procedure

1. Loosen the module cover.

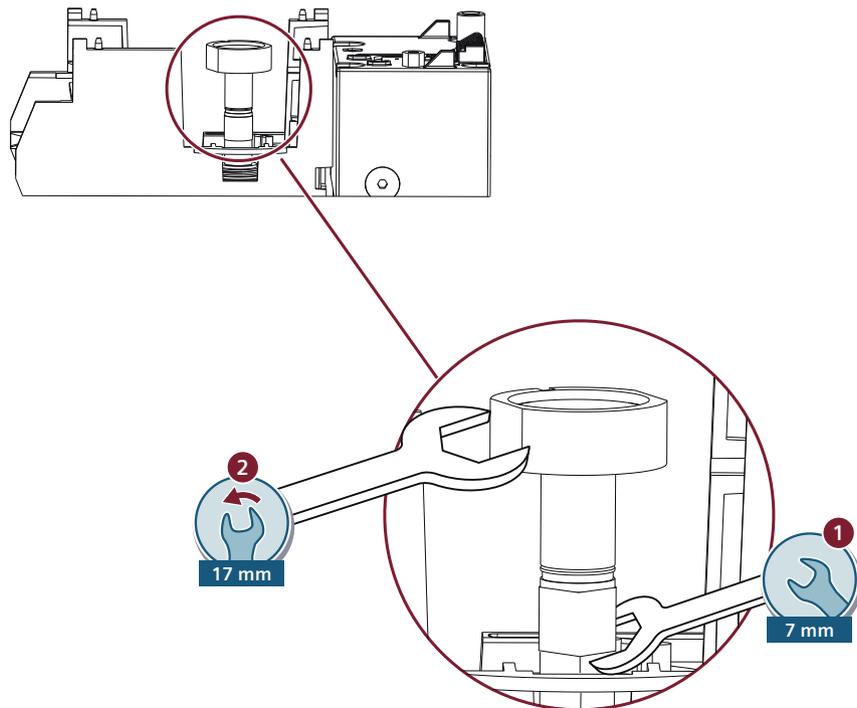


2. Remove the electronics by disconnecting the optional ribbon cable, electrical connectors and screws.



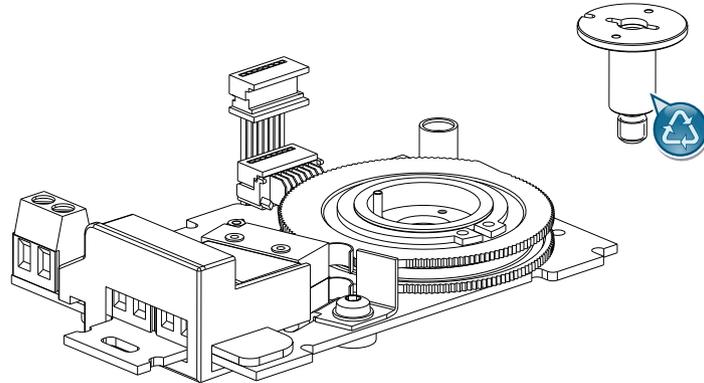
B.2 Installing the option module

3. Remove the magnet holder.

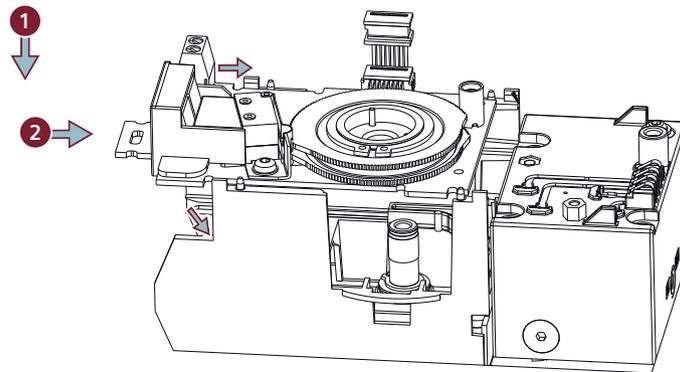


4. Install the option module.

- Remove the special screw from the option module. The special screw is no longer required.



- Install the option module as follows:



- Ensure that the shaft is visible through the option module.

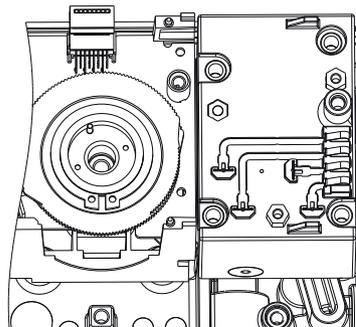
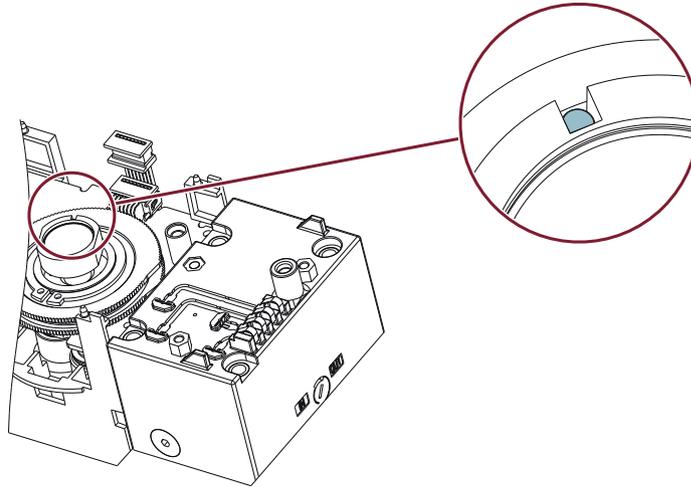


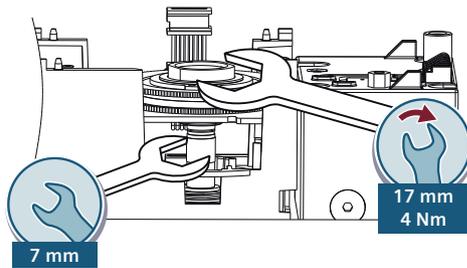
Figure B-2 Top view

B.2 Installing the option module

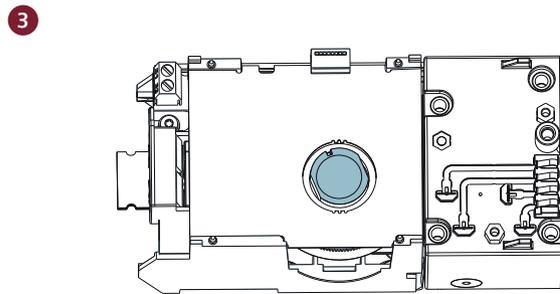
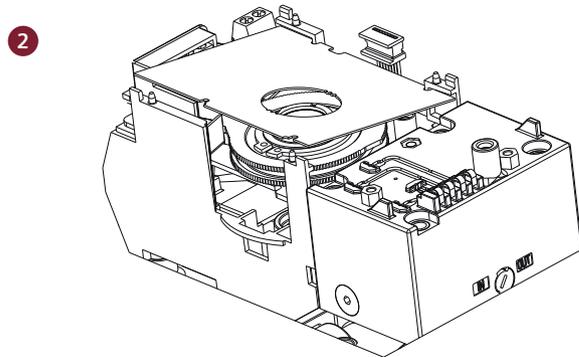
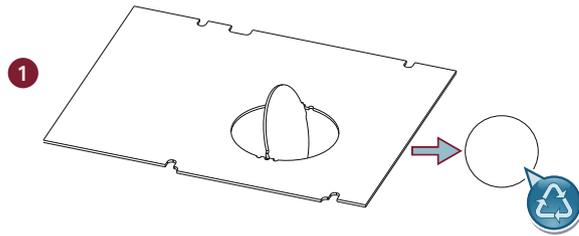
5. Screw the magnet holder tight.
 - Ensure that the carrier pin of the option module is in the groove of the magnet holder.



- Tighten the magnet holder:

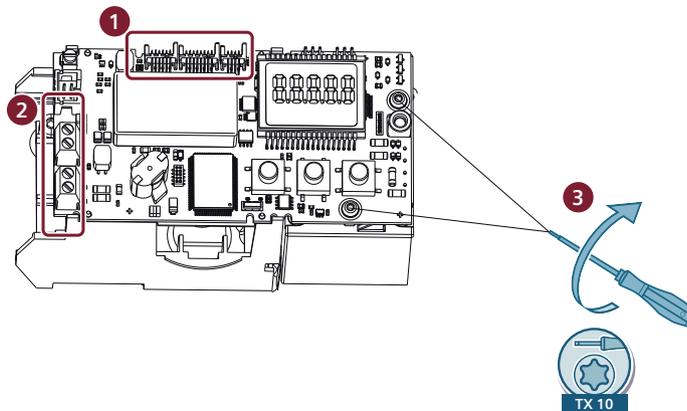


- Cover the option module with the supplied insulating plate (optional).

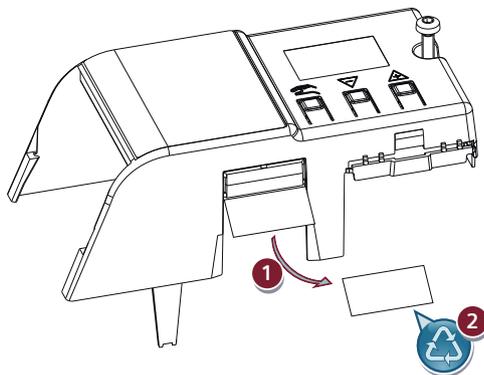


B.2 Installing the option module

6. Install the electronics.
 - Screw the electronics tight.
 - Connect the ribbon cables and the electrical connections.



7. Install the module cover.
 - Break off the module cover as follows:



- Adhere the supplied connection diagram to the module cover:

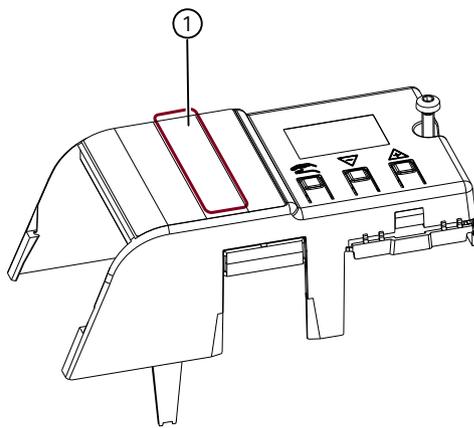
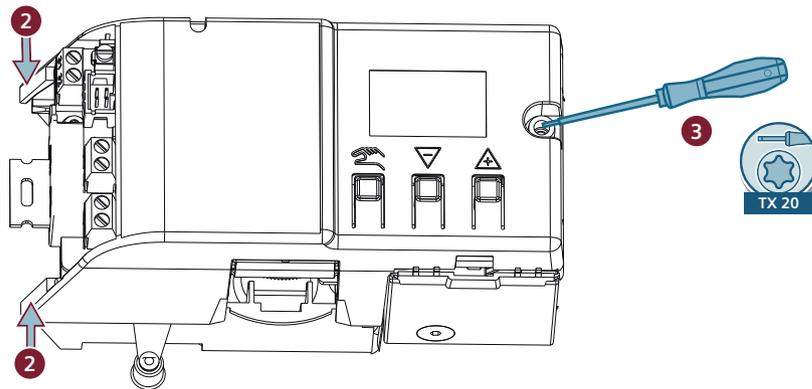
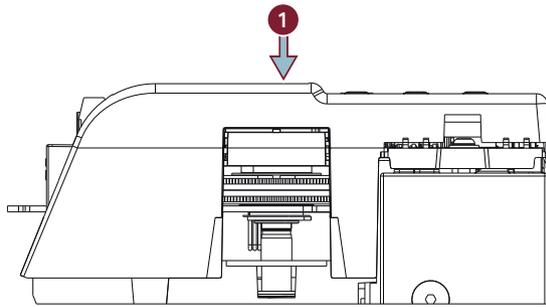


Figure B-3 ① Place for connection diagram of the ILS or MLS

- Be careful not to pinch any cables.



- Make sure that the module cover is seated correctly.

Result

The option module and the module cover are installed.

To close the positioner, follow the steps in the following section:

- Closing the positioner (Page 289)

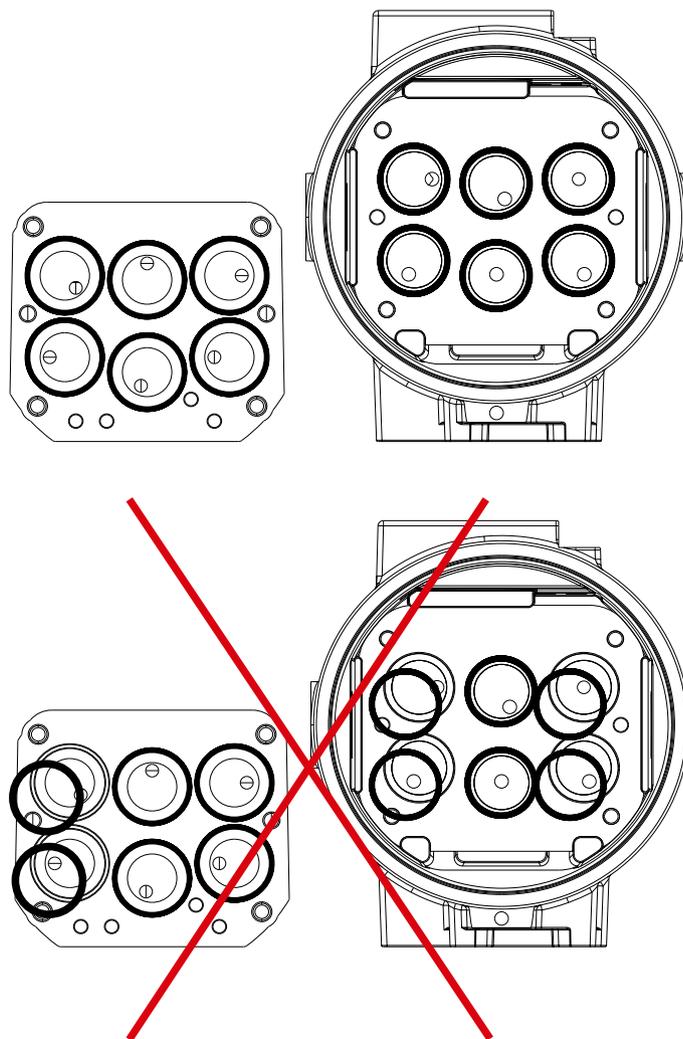
B.3 Closing the positioner

Procedure: Standard and intrinsically safe device version

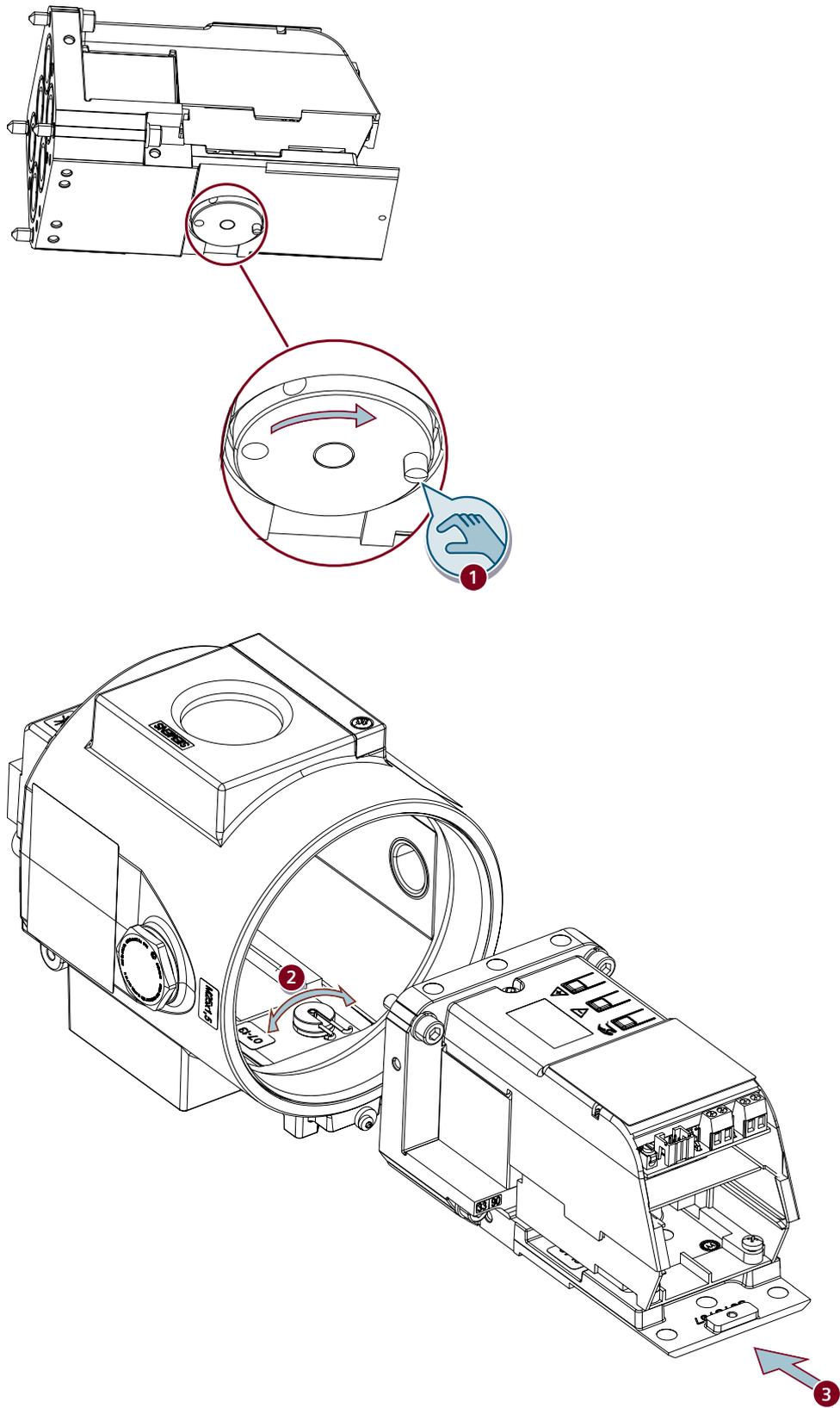
1. Put on the enclosure cover.
2. Tighten the fixing screws of the enclosure cover.

Procedure: Device version with "flameproof enclosure"

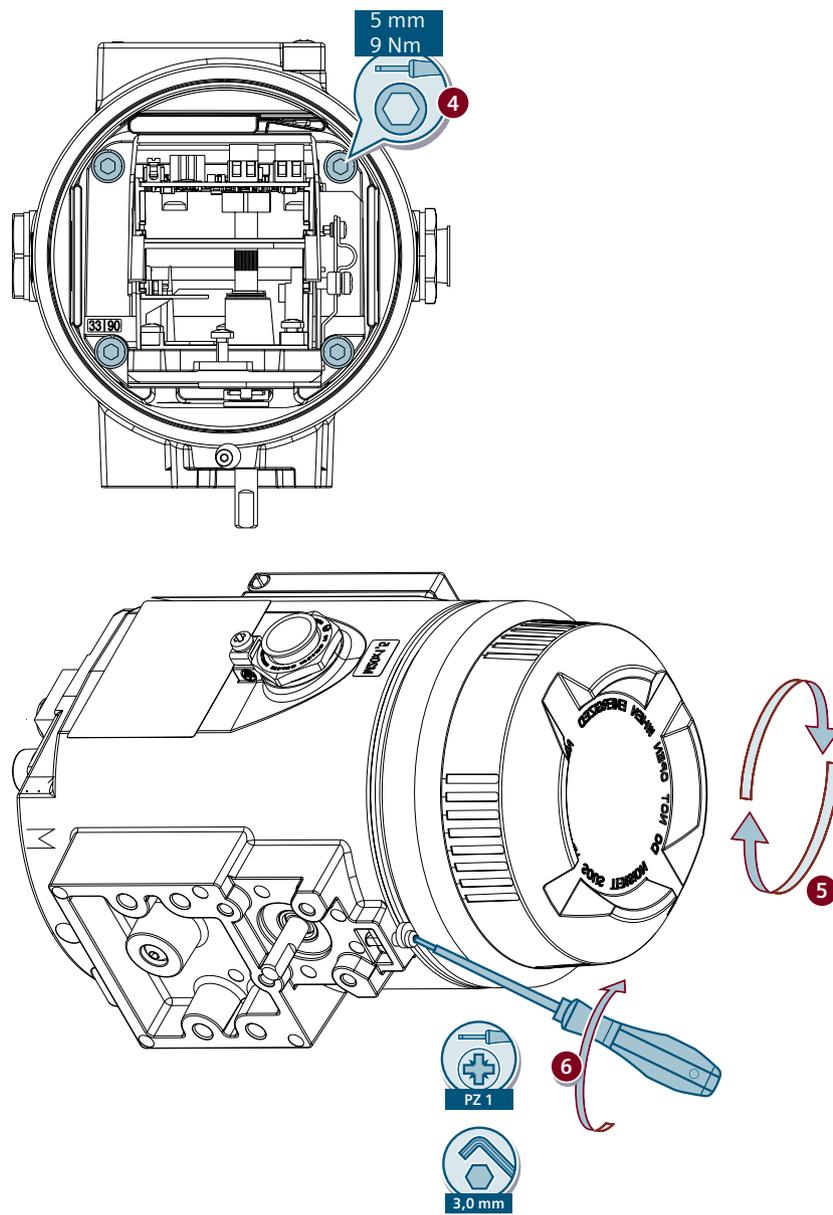
1. Ensure that the O-rings of the adapter and enclosure are in the correct position.



2. Insert the adapter into the enclosure.



B.3 Closing the positioner



External position detection

C.1 Introduction



WARNING

Position Transmitter

Device versions with flameproof enclosures may only be operated with a Position Transmitter with the same type of protection.

In some cases it makes sense to mount the position detection and the controller unit separately. A separate mounting the case, for example, with continuous and strong vibrations, high or too low ambient temperatures and nuclear radiation. A universal component is available for this purpose. It is suitable for part-turn and linear actuators. You will require the following:

One of the following Position Transmitters

- Position Transmitter with Article No. 6DR4004-2ES, 3ES or 4ES
- NCS sensor for non-contacting position detection 6DR4004-6NI/-8N
- Potentiometers with 3 k Ω , 5 k Ω or 10 k Ω
- Position sensor with a signal range from 0 to 20 mA
- Position sensor with a signal range from 0 to 10 V

And a positioner

- Positioner in combination with Analog Input Module (AIM) 6DR5..0/1/2/3-0...2/3 or retrofitted as accessory 6DR4004-6FI-8F
 - An Analog Input Module (AIM) as an accessory is provided in a set along with cable clamps and M20 cable glands.

C.2 Non-Contacting Sensor

C.2.1 Mode of operation

The NCS contains a magnetic field sensor. This sensor changes its electrical resistance in response to the immediate presence of a permanent magnet. The sensor has a high signal-to-noise ratio to external magnetic fields due to the measurement method used.

The following figure shows the mode of operation with a rotating magnet.

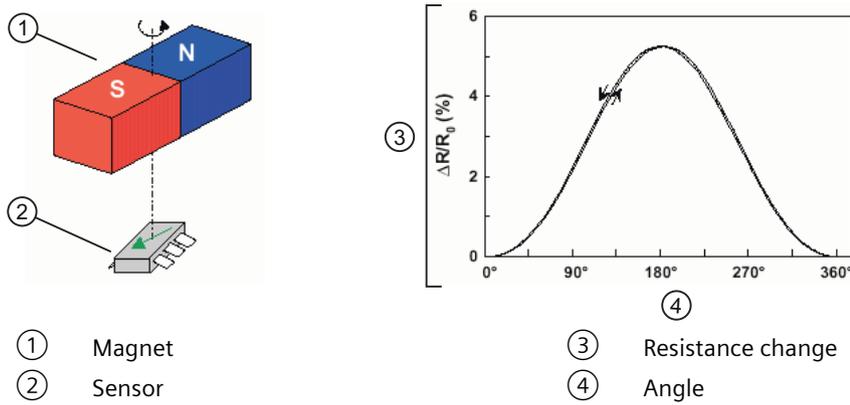


Figure C-1 Relative resistance change depending on the angle of the magnet

The figure shows that a circular movement of the magnet generates a sinusoidal change of the resistance. The mechanical stops of the fitting ensure that only one part (quadrant) of the sinusoidal curve is used at any one time. The principle-related non-linearity of the curve is corrected by means of software based on a curve that is stored in the positioner.

A linear movement of the magnet in the sensor range also generates a resistance change that is used to identify the position. The following figure highlights the principle:

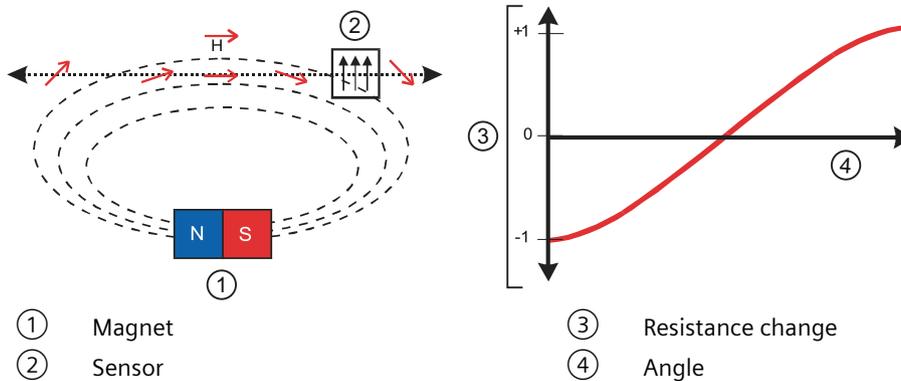


Figure C-2 Resistance change depending on the position of the magnet

Non-linearity is corrected automatically in the positioner by software.

The great advantage of this principle is the absence of wear. Moreover, vibration, dampness and temperature only have a minor impact on the measurement result.

C.2.2 Mounting the NCS

Function

The positioner facilitates the separate installation of the position detection system. The stroke or rotary angle is measured directly at the actuator by means of a non-contacting sensor. It is therefore possible to install the controller unit at some distance away, e.g. on a mounting pipe or similar. The positioner is connected to the position detection system by means of an electrical cable.

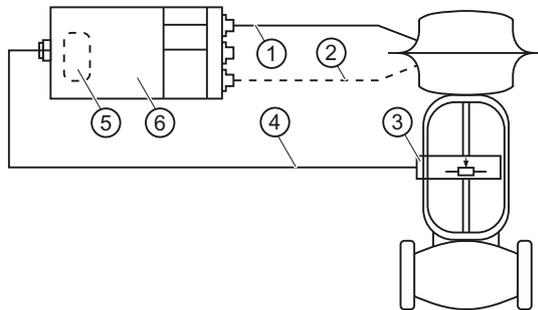
Such a separate installation is useful whenever the ambient conditions at the valve exceed the specified positioner values.

The NCS consists of a molded sensor for fixed installation and a magnet. The magnet is mounted to the spindle on linear actuators, or to the stub shaft on part-turn actuators. The sensor housing is mounted onto the console on part-turn actuators and to the bracket on linear actuators. The bracket can be a NAMUR type, or any other mounting bracket.

Auxiliary power is supplied to the NCS via the Analog Input Module (AIM) 6DR4004-6F and EMC compatibility is ensured at the same time.

You have the following options:

- To order the Analog Input Module (AIM) already installed in the positioner, Catalog FI 01
- To retrofit the Analog Input Module (AIM) in the positioner; article number 6DR4004-6F. For information on retrofitting the Analog Input Module (AIM), refer to the Installing/mounting (Page 35) section of the positioner operating instructions.



- ① Pneumatic line
- ② Pneumatic line for double-action actuators
- ③ Position detection system (10 k Ω potentiometer or NCS)
- ④ Electrical cable
- ⑤ Retrofittable Analog Input Module (AIM) (in the positioner)
- ⑥ Positioner

Figure C-3 Separate installation of the NCS and positioner

C.2.2.1 Mounting the NCS to the part-turn actuator

Requirement

1. An Analog Input Module (AIM) built into the positioner
2. A non-contacting sensor for part-turn actuators 6DR4004-.N.10 or 6DR4004-.N.40
3. A part-turn actuator with interface acc. to VDI/VDE 3845 and mounting console acc. to VDI/VDE 3845, or
A part-turn actuator with manufacturer-specific interface

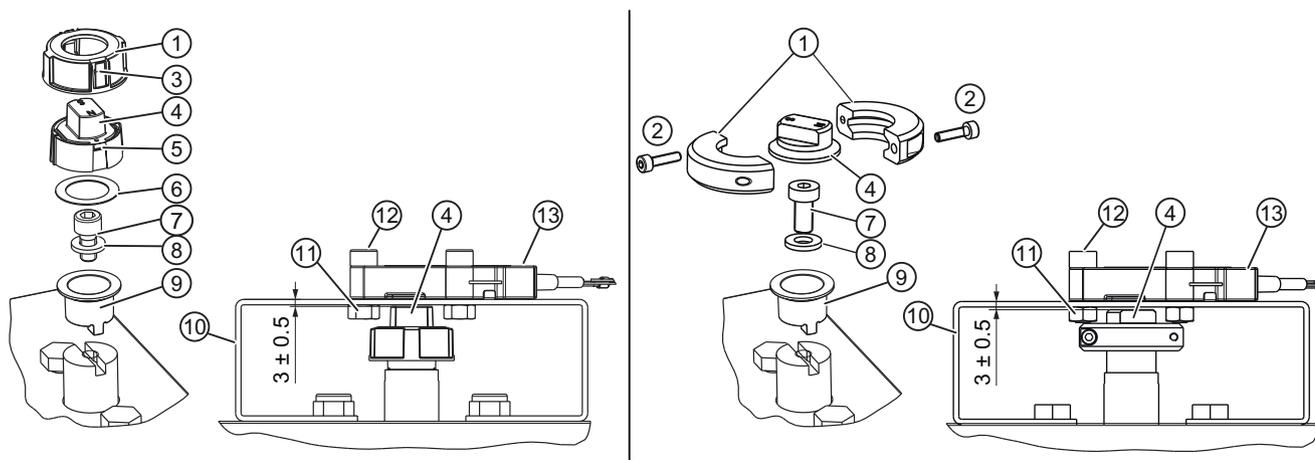
NOTICE

Incorrect mounting

A clearance of 3 mm must be maintained between the magnet and the mounting console in order to ensure correct measurement of the actuator position. The values transferred may be incorrect if this clearance is not given.

- Maintain a clearance of 3 mm between the top edge of the magnet (4) and the top edge of the mounting console (10).

Description



- | | | | |
|---|----------------------------------|---|----------------------------------|
| ① | Tensioning ring | ⑧ | Washer |
| ② | Hex socket head screw size M3x12 | ⑨ | Clamping table |
| ③ | Spring element | ⑩ | Mounting console |
| ④ | Magnet | ⑪ | Hexagon nut |
| ⑤ | Hooks | ⑫ | Hex socket head screw size M6x25 |
| ⑥ | Plastic washer | ⑬ | Non Contacting Sensor (NCS) |
| ⑦ | Hex socket head screw size M6x12 | | |

Figure C-4 Mounting on part-turn actuator with magnet holder made of glass fiber reinforced polyester (left figure) or anodized aluminum (right figure)

Procedure for the part-turn actuator to VDI/VDE 3845

1. Slide the clamping table (9) onto the stub shaft of the part-turn actuator.
2. Mount the clamping table (9) to the stub shaft using a hex socket head screw (7) and washer (8).

3. Depending on the material of the magnet holder, proceed as follows:

| Magnet holder made of glass fiber reinforced polyester | Magnet holder made of anodized aluminum |
|--|---|
| <ol style="list-style-type: none"> 1. Insert the plastic washer (6) into the magnet (4). 2. Fix the magnet (4) onto the clamping table (9). The magnet (4) can now be rotated easily on the clamping table (9). 3. Slide the tensioning ring (1) over the magnet (4). Make sure that the spring elements (3) and the hook (5) on the magnet (4) are lined up above one another and that they engage. You will now have more resistance when turning the tensioning ring (1) and magnet (4). | <ol style="list-style-type: none"> 1. Place the magnet (4) onto the clamping table (9). 2. Secure the magnet (4) to the clamping table (9) by connecting the two parts of the tensioning ring (1) to the two hex socket head screws (2). The magnet (4) can now be rotated easily on the clamping table (9). 3. Then tighten the two hex socket head screws (2). The magnet (4) can then no longer be rotated on the clamping table (9). |

4. Screw the NCS (13) onto the mounting console (10) using the hexagon socket-head screw (12), hex nut (11) and the washer (8).
5. Once the NCS (13) is mounted, the clearance of 3 mm between the top edge of the magnet (4) and the top edge of the mounting console (10) is set automatically.

Procedure for part-turn actuators with manufacturer-specific interface

1. Steps 1 to 4 as above
2. Set a clearance of 3 mm between the top edge of the magnet (4) and the top edge of the mounting console (10). Extend the stub shaft accordingly, or insert washers underneath the NCS housing (13).

Reference

For information on the scope of delivery, refer to section "Scope of delivery of NCS for part-turn actuators (Page 307)".

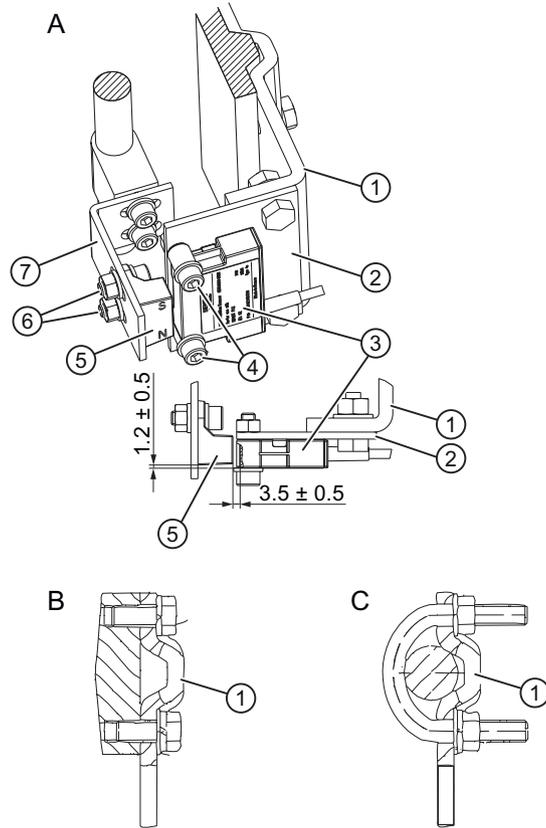
C.2.2.2 Mounting the NCS to a linear actuator up to 14 mm (0.55 inch)

Requirement

1. An Analog Input Module (AIM) built into the positioner.
2. An NCS for linear actuators up to 14 mm (0.55 inch) 6DR4004-.N.20.
3. A linear actuator with interface to NAMUR. This installation must be carried out individually. Only a NAMUR mounting bracket can be used as mounting base. The following figure shows the assembly with NAMUR mounting bracket. Or:
A linear actuator without interface to NAMUR and individual mounting solution.

Description

The dimensions of magnet and NCS can be found under Dimensional drawing of non-contacting sensor (Page 306).



Dimensions in mm

- | | | | |
|---|---|---|--|
| A | Mounting on a yoke with fin | ③ | Non Contacting Sensor (NCS) |
| B | Mounting on a yoke with plane surface | ④ | Hex socket head screw M6x25 |
| C | Mounting on a yoke with columns | ⑤ | Magnet |
| ① | NAMUR mounting bracket IEC 60534 - not included in the scope of delivery | ⑥ | Hex socket head screw M6x12 |
| ② | Assembly panel for Non Contacting Sensor (NCS) - individual solution; not included in the scope of delivery | ⑦ | Mounting bracket for the magnet - individual solution; not included in the scope of delivery |

Figure C-5 Example of the assembly on a linear actuator with a stroke up to 14 mm (0.55 inch)

Procedure

1. Produce the mounting panel ② and mounting bracket ⑦ individually.
2. Align the sensor to the center of the stroke. Observe the dimensions specified in the figure.

Reference

For information on the scope of delivery, refer to section "Scope of delivery of NCS for linear actuators up to 14 mm (0.55 inch) . (Page 307)".

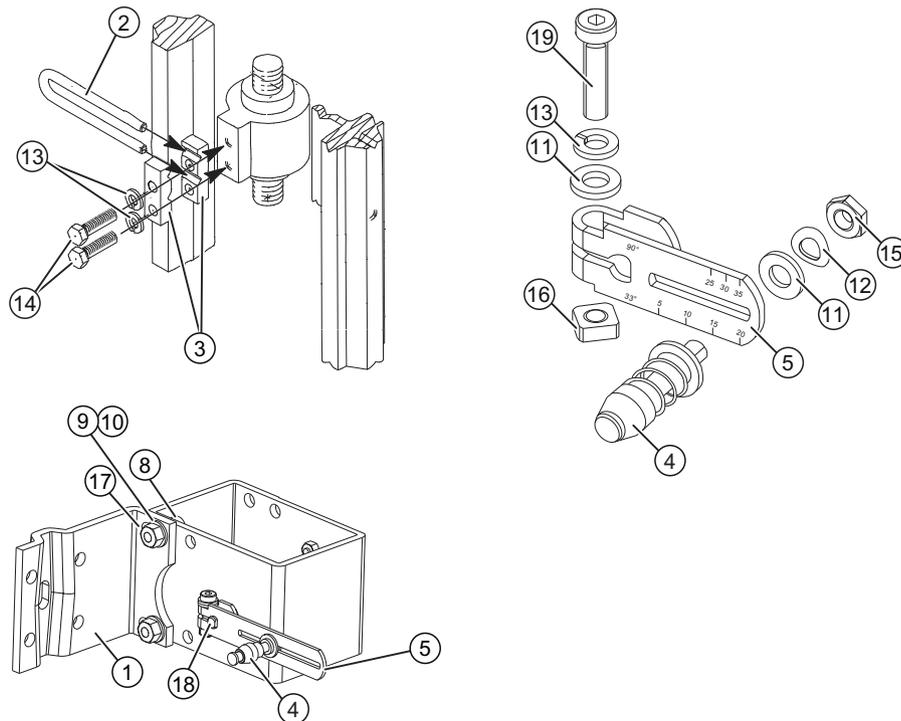
C.2.2.3 Mounting the NCS to a linear actuator > 14 mm (0.55 inch)

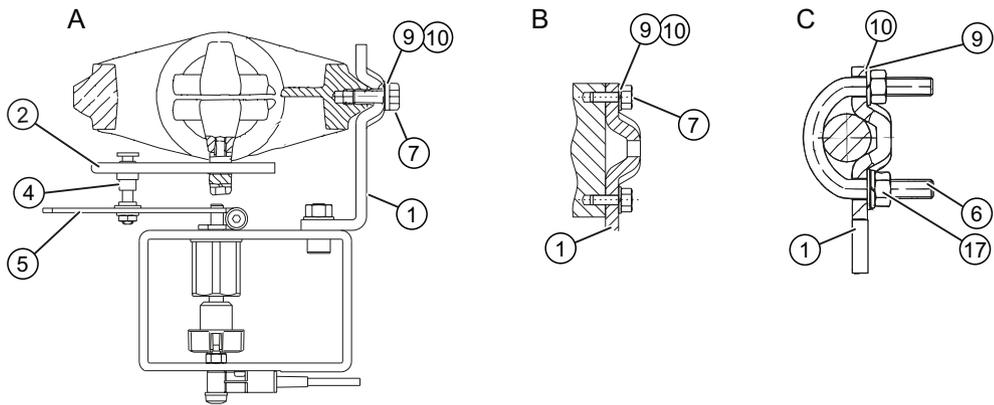
Requirement

1. An Analog Input Module (AIM) built into the positioner.
2. An NCS for linear actuators > 14 mm (0.55 inch) 6DR4004-.N.30.
3. Linear actuator with interface to NAMUR
Item no. based on the respective stroke range: 6DR4004-8V or 6DR4004-8V + 6DR4004-8L.
or
linear actuator without interface to NAMUR and individual mounting solution. Item No. 6DR4004-8VK or 6DR4004-8VL can be used as individual assembly solution, depending on the stroke range.

Description

You can find the dimensions in the dimension drawing in the section "Scope of delivery of NCS for linear actuators > 14 mm (0.55 inch) . (Page 308)".





- | | | | |
|---|---------------------------------------|---|----------------------------------|
| A | Mounting on a yoke with fin | ⑨ | Spring washer A8 |
| B | Mounting on a yoke with plane surface | ⑩ | Washer B 8.4 |
| C | Mounting on a yoke with columns | ⑪ | Washer B 6.4 |
| ① | NAMUR mounting bracket IEC 60534 | ⑫ | Spring lock washer |
| ② | Pick-up bracket | ⑬ | Spring washer A6 |
| ③ | Clamping piece | ⑭ | Hexagonal screw size M6x25 |
| ④ | Carrier pin | ⑮ | Hexagonal nut M6 |
| ⑤ | Lever | ⑯ | Square-head nut M6 |
| ⑥ | U bracket | ⑰ | Hexagonal nut M8 |
| ⑦ | Hexagonal screw size M8x20 | ⑱ | Shaft |
| ⑧ | Hexagonal screw size M8x16 | | Hex socket head screw size M6x25 |

Figure C-6 Mounting instructions for linear actuators with a stroke > 14 mm (0.55 inch)

Procedure

1. Mount the clamping pieces ③ to the actuator spindle using the hexagonal screw ⑭ and spring washers ⑬.
2. Slide the pick-up bracket ② into the milled recesses of the clamping pieces.
3. Set the necessary length.
4. Tighten the screws so that you can still shift the pick-up bracket ②.
5. Set the center of the pin ④ to the stroke range value specified on the actuator, or to the next higher scaling value of the lever ⑤. The actuating distance in mm will be displayed on successful initialization if you set the same value at parameter "3.YWAY" when commissioning the system.
6. Slide the lever ⑤ onto the shaft ⑱ up to the endstop.
7. Secure the lever ⑤ using the hex socket head screw ⑲.

8. Mount the bracket ① to the NCS mounting kit using:

- Two hexagonal screws ⑧
- Spring washer ⑨
- Washer ⑩
- Hexagonal nut ⑰

The selection of the row of holes depends on the yoke width of the actuator. Make sure that the dog pin ④ engages in the pick-up bracket ② as close as possible to the spindle over the complete stroke range. The dog pin must not touch the clamping pieces.

9. Place the NCS assembly kit with the mounting bracket ① onto the actuator. Ensure that the dog pin ④ is guided inside the pick-up bracket ②.

10. Tighten the pick-up bracket ②.

11. Prepare the assembly parts for the relevant actuator type for installation:

- For mounting on yoke with fin: hexagonal screw ⑦, washer ⑩ and spring washer ⑨.
- For mounting on a yoke with plane surface: Four hexagonal screw ⑦ with washer ⑩ and spring washer ⑨.
- For actuator with columns: Two U brackets ⑥, four hexagonal screw ⑰ with washer ⑩ and spring washer ⑨.

12. Mount the NCS assembly kit to the yoke using the assembly parts that you prepared.

Note**Observe the height**

Adjust the height of the NCS assembly kit so that the lever position is in line horizontally with the stroke center. Use the lever scale on the actuator for orientation. If a symmetrical assembly is not possible, you must always ensure that the lever is in horizontal position within the range of the stroke.

C.2.3 Connecting NCS to Analog Input Module (AIM)

Requirement

You need the Analog Input Module (AIM), article number 6DR4004-6F or -8F, for the electrical connection of the accessory part "NCS sensor for non-contacting position measurement" to the positioner. The positioner supplies auxiliary power to the NCS sensor via the option module.

Wiring diagram

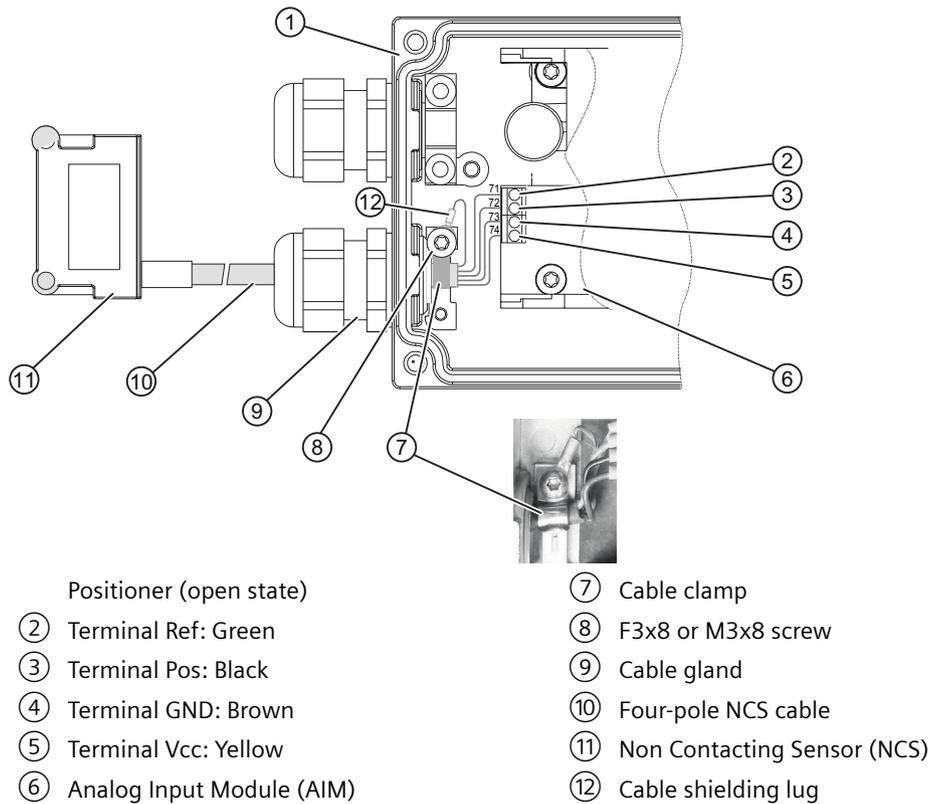
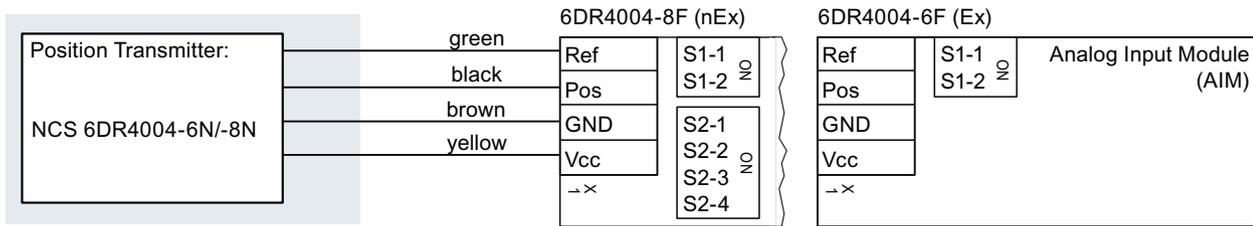


Figure C-7 Example of connecting the NCS to the Analog Input Module (AIM)

Procedure

The NCS sensor is equipped with a shielded 4-pin cable. Connect this 4-pin cable to the positioner as follows:

1. Feed the 4-pin NCS cable ⑩ through the union nut and the cable gland. Note: The type of cable gland depends on the positioner version.
2. Tighten the cable gland ⑨.
3. Connect the 4-pin NCS cable ⑩ to the Analog Input Module (AIM) of the positioner in accordance with the wiring diagram.
4. Place the cable clamp ⑦ onto the outer insulation of the 4-pin NCS cable ⑩.
5. Use the screw ⑧ to bond the cable shielding lug ⑫ and the cable clamp ⑦ to the ground terminal of the positioner.
6. Grounding:
The rear steel panel of the NCS sensor is inevitably bonded to the ground potential of the system when mounting on the console. This ground connection is only functional if there is a low-impedance connection to ground potential of the system. Ensure this connection by measuring the resistance. If necessary, ensure proper grounding by means of an additional cable from the NCS sensor to ground potential.

If potentiometers or external signal sources are used, configure the switch blocks in accordance with the following table:

| Measuring range | Switch block 1 | | Switch block 2 | | | |
|----------------------------|----------------|------|----------------|------|------|------|
| | S1-1 | S1-2 | S2-1 | S2-2 | S2-3 | S2-4 |
| 6DR4004-.N/PIR (NCS) | ON | OFF | ON | OFF | OFF | OFF |
| 6DR4004-1ES/-2ES/-3ES/-4ES | ON | OFF | ON | OFF | OFF | OFF |
| 10 ... 20 kΩ | ON | OFF | ON | OFF | OFF | OFF |
| 5 kΩ | OFF | ON | ON | OFF | OFF | OFF |
| 3 kΩ | OFF | OFF | ON | OFF | OFF | OFF |
| 20 mA | OFF | OFF | ON | OFF | ON | OFF |
| 10 V | OFF | OFF | OFF | ON | OFF | OFF |

C.2.4 Commissioning of NCS

C.2.4.1 Prerequisites / default settings

1. Supply electrical and pneumatic auxiliary power to the positioner. The top row of the display shows the current sensor voltage (0 to 100%), while the "NOINI" info flashes in the bottom row. The pneumatic actuator does not move.
2. If the positioner has already been initialized, perform a reset. Carry out the reset of parameter group "Init" in the '50.PRST' Preset (HART/FF) (Page 162) parameter.

3. Preset for part-turn actuators:
While the process valve is closed, align the magnet so that the north pole is in the direction of the cable; "N" in position ⑦ in "Figure C-4 Mounting on part-turn actuator with magnet holder made of glass fiber reinforced polyester (left figure) or anodized aluminum (right figure) (Page 296)".
4. Monitor the display of the positioner while adjusting the actuator to its mechanical stops by means of ▲ and ▼ at the positioner. Verify that the displayed values never exceed the range from P2.0 to P98.0.

Note

This condition cannot be met with slipping flaps or linear actuators that exceed the mechanical actuation limits.

C.2.4.2 Initialization of part-turn actuators

Procedure

1. For part-turn actuators operating in standard control direction, set parameter "1.YFCT" to "ncSt", or to "-ncSt" in case of inverse control direction.
2. Launch initialization as usual with "INITA".

C.2.4.3 Initializing linear actuators with a stroke range up to 14 mm (0.55 inch)

Requirements

1. Set the "1.YFCT" parameter of the positioner to "ncSL" or - with inverse control direction - to "-ncSL".
2. Launch initialization as usual with "INITA".

C.2.4.4 Initializing linear actuators with a stroke range > 14 mm (0.55 inch)

Note

Parameter values "ncSLL" and "-ncLL" are only available for devices of the 6DR5... series and only with the firmware version > C4. Set the value to 90° on devices of the 6DR5... series with firmware version < C5 (YAGL). This setting is also necessary for devices of the 6DR4... series. Resultant non-linearity can be corrected by means of the programmable characteristic by setting the parameter value from "SFCT" to "FrEE" and adapting the interpolation points.

Requirements

1. Set the "1.YFCT" parameter of the positioner to "ncSLL" or - with inverse control direction - to "-ncLL".
2. Launch initialization as usual with "INITA".

C.2.5 External NCS sensors 6DR4004-6N/8N and 6DR4004-2ES

| Additional modules | Without Ex protection | With Ex protection Ex "ia" | With explosion protec- tion Ex "ic", "ec" |
|--|---|--|---|
| Travel range | | | |
| • Linear actuator 6DR4004-6/8N.20 | | 3 to 14 mm (0.12 to 0.55") | |
| • Linear actuator 6DR4004-6/8N.30 | 10 to 130 mm (0.39 to 5.12"); up to 200 mm (7.87") on request | | |
| • Part-turn actuator | | 30 to 100° | |
| Linearity (after corrections made by positioner) | | ± 1 % | |
| Hysteresis | | ± 0.2 % | |
| Temperature influence (range: rotation angle 120° or stroke 14 mm) | ≤ 0.1 %/10 K (≤ 0.1 %/18 °F) for -20 to +90 °C (-4 to +194 °F) | | |
| | ≤ 0.2%/10 K (≤ 0.2%/18 °F) for -40 to -20 °C (-40 to -4 °F) | | |
| Climate class | According to IEC/EN 60721-3 | | |
| • Storage | 1K5, but -40 to +90 °C (-40 to +194 °F) | | |
| • Transport | 2K4, but -40 to +90 °C (-40 to +194 °F) | | |
| Vibration resistance | | | |
| • Harmonic oscillations (sine) according to IEC 60068-2-6 | 3.5 mm (0.14"), 2 to 27 Hz, 3 cycles/axis 98.1 m/s ² (321.84 ft/s ²), 27 to 300 Hz, 3 cycles/axis | | |
| • Bumping according to IEC 60068-2-29 | 300 m/s ² (984 ft/s ²), 6 ms, 4000 shocks/axis | | |
| Torque for cable gland nut made of | Plastic | Metal | Stainless steel |
| | 2.5 Nm (1.8 ft lb) | 4.2 Nm (3.1 ft lb) | 4.2 Nm (3.1 ft lb) |
| Torque of hexagon socket-head screw M6x12 (shaft end or mounting bracket) | 4 Nm (3 ft lb) | | |
| Torque of hexagon socket head screw M6x25 (mounting console or mounting plate) | 4 Nm (3 ft lb) | | |
| Torque of hexagon socket head screw M3x12 (clamping ring) | 1 Nm (0.7 ft lb) | | |
| Degree of protection | IP68 / type 4X | | |
| For connecting to circuits with the following peak values | | U _i = 5 V I _i = 160 mA P _i = 120 mW | U _i = 5 V |

| Additional modules | Without Ex protection | With Ex protection Ex "ia" | With explosion protection Ex "ic", "ec" |
|--------------------------------|-----------------------|-------------------------------|--|
| Effective internal capacitance | - | $C_i = 1^1)$ | $C_i = 1^1)$ |
| Effective internal inductance | - | $L_i = 2^2)$ | $L_i = 2^2)$ |

¹⁾ $C_i = 110 \text{ nF} + 110 \text{ nF}$ per meter of connecting cable

²⁾ $L_i = 270 \text{ } \mu\text{H} + 6.53 \text{ } \mu\text{H}$ per meter of connecting cable

C.2.6 Dimensional drawing of non-contacting sensor

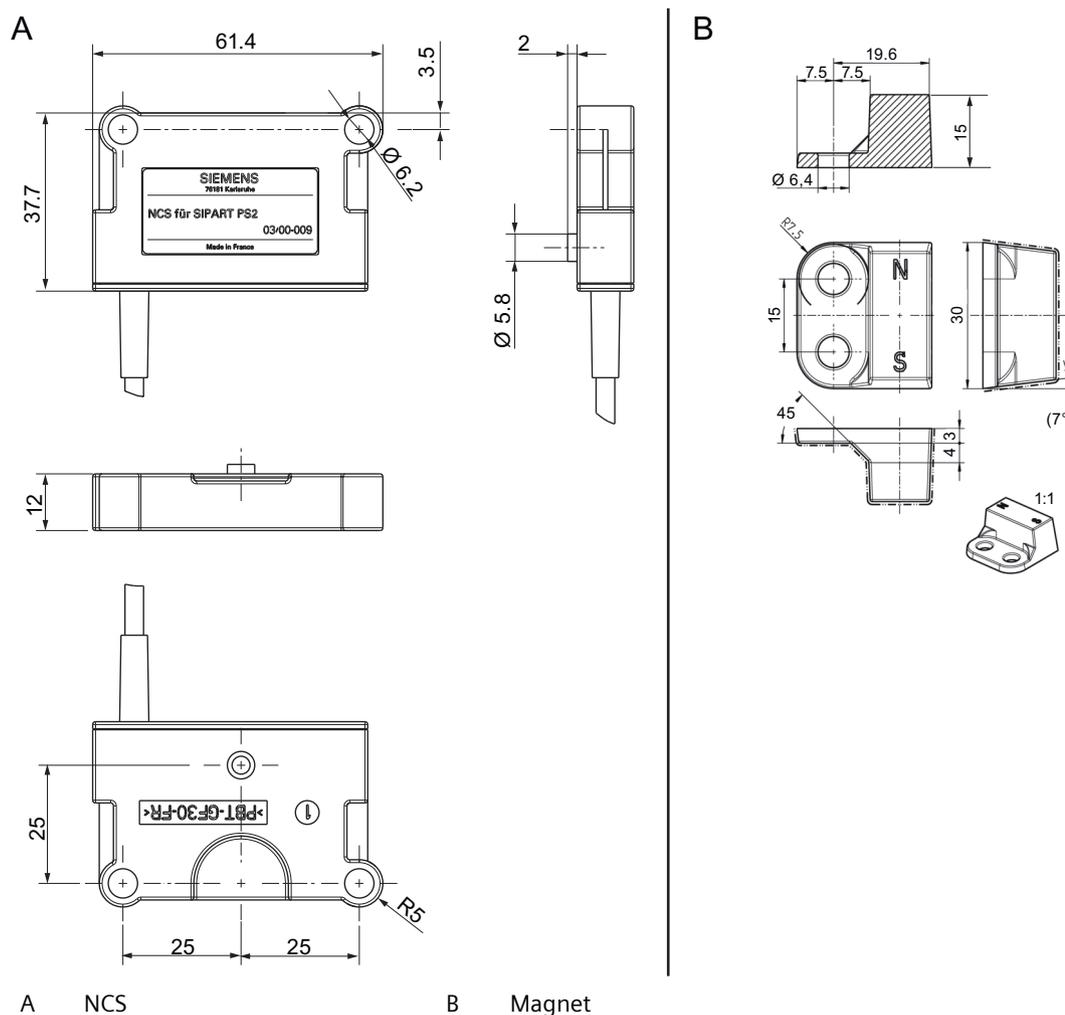


Figure C-8 Dimensional drawing of the NCS and magnet

C.2.7 NCS sensor scope of delivery

C.2.7.1 Scope of delivery of NCS for part-turn actuators

| 6DR4004-.N.10 | 6DR4004-.N.40 | | |
|---------------|---------------|--|--------------------------------|
| Quantity | Quantity | Name | Note |
| 1 | 1 | Magnet holder | |
| 5 | 5 | Washer | 6 |
| 2 | 2 | Hex socket head screw | M6x12 |
| 1 | - | Plastic washer | |
| 1 | 1 | Magnet | |
| 1 | 2 | Tensioning ring | |
| 4 | 4 | Hexagon nut | M6 |
| 2 | 2 | Hex socket head screw | M6x25 |
| - | 2 | Hex socket head screw | M3x12 |
| 1 | 1 | Non-contacting sensor | Cable lengths as ordered |
| 1 | 1 | Self-tapping screw for polycarbonate enclosure | F3x8 |
| 1 | 1 | Metric screw for metal enclosure | M3x8 |
| 1 | 1 | Sealing | For cable bushings |
| 1 | 1 | Plugs | For closing the sealing insert |
| 1 | 1 | Cable clamp | |
| 1 | 1 | DVD | with documentation |

See also

Mounting the NCS (Page 294)

C.2.7.2 Scope of delivery of NCS for linear actuators up to 14 mm (0.55 inch) .

| Linear actuator with a stroke range up to 14 mm (0.55 inch) 6DR4004-.N.20 | | |
|---|--|--------------------------|
| Quantity | Designation | Notes |
| 1 | Magnet | |
| 5 | Washer | 6 |
| 2 | Hex socket head screw | M6x12 |
| 4 | Hexagon nut | M6 |
| 2 | Hex socket head screw | M6x25 |
| 1 | Non-contacting sensor | Cable lengths as ordered |
| 1 | Self-tapping screw for polycarbonate enclosure | F3x8 |
| 1 | Metric screw for metal enclosure | M3x8 |

| Linear actuator with a stroke range up to 14 mm (0.55 inch) 6DR4004-.N.20 | | |
|---|-------------|--------------------------------|
| Quantity | Designation | Notes |
| 1 | Sealing | For cable bushings |
| 1 | Plugs | For closing the sealing insert |
| 1 | Cable clamp | |
| 1 | DVD | with documentation |

See also

Mounting the NCS (Page 294)

C.2.7.3 Scope of delivery of NCS for linear actuators > 14 mm (0.55 inch) .

| Linear actuator > 14 mm (0.55 inch) 6DR4004-.N.30 | | |
|---|--|---|
| Quantity | Designation | Notes |
| 1 | NCS assembly kit, completely assembled | Mounting by means of assembly kit for NAMUR linear actuators Mounting kit available on separate order, see 'Accessories' in Catalog FI 01. |

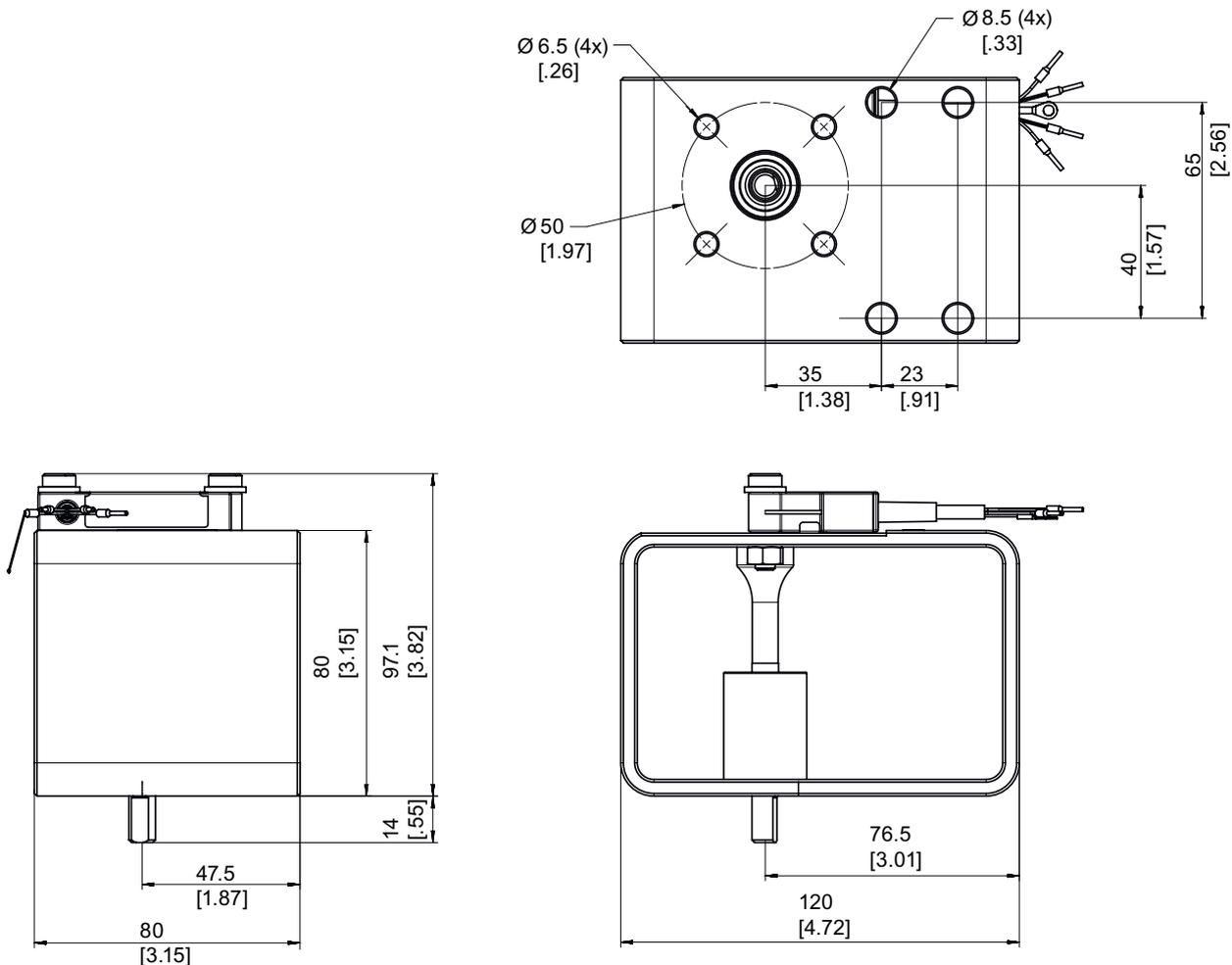


Figure C-9 Dimension drawing NCS module > 14 mm (0.55 inch)

C.3 External position detection

C.3.1 Mode of operation for external position detection

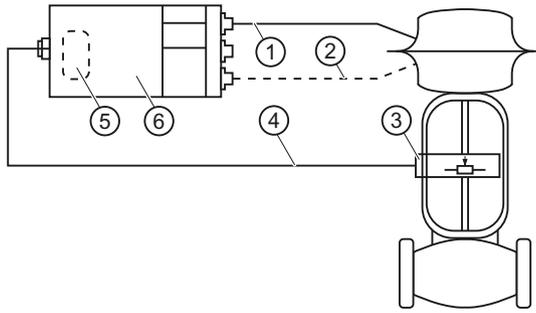
The Position Transmitter essentially consists of an enclosure and an internal position detection system. The position is recorded by a potentiometer or an internal NCS module, section "Mode of operation (Page 293)". The controller unit is separated from the positioner.

Such a separate installation is useful whenever the ambient conditions at the valve exceed the specified positioner values.

The Position Transmitter is secured to a console with part-turn actuators and to a mounting bracket with linear actuators, section "Mounting to linear actuator (Page 38)".

Auxiliary power is supplied to the Position Transmitter via the Analog Input Module (AIM) and EMC compatibility is ensured at the same time.

C.3 External position detection



- ① Pneumatic line
- ② Pneumatic line for double-action actuators
- ③ Position Transmitter
- ④ Electrical cable
- ⑤ Analog Input Module (AIM) (fitted in the positioner or retrofittable)
- ⑥ Positioner

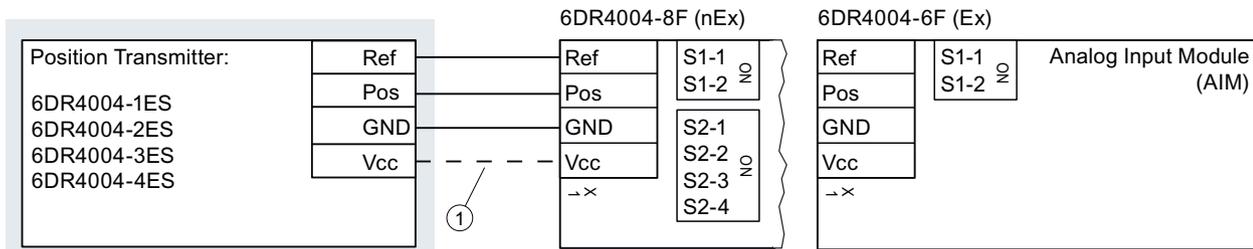
Figure C-10 Position Transmitter and positioner

C.3.2 Installation of external position detection system

Mounting of the Position Transmitter corresponds to the mounting of the positioner in a non-flameproof enclosure. Proceed as described in Section "Installing and mounting (Page 35)". The connection of the Analog Input Module (AIM) is described in the section "Analog Input Module (AIM) 6DR4004-6F / -8F (Page 85)".

C.3.3 Connecting to Analog Input Module (AIM)

Wiring diagram



- ① Connection of terminal Vcc is only needed for 6DR4004-2ES, -3ES and -4ES.

C.3.4 Technical specifications of the external position detection system

C.3.4.1 Rated conditions for external position detection

| Rated conditions | |
|---|---|
| Ambient temperature | In hazardous areas, observe the maximum permissible ambient temperature corresponding to the temperature class. |
| • Permissible ambient temperature for operation | -40 ... +90 °C (-40 ... +194 °F) |
| Degree of protection ¹⁾ | IP66 / Type 4X to UL 50E |
| Climate class | According to IEC/EN 60721-3 |
| • Storage | 1K5, but -40 ... +90 °C (1K5, but -40 ... +194 °F) |
| • Transport | 2K4, but -40 ... +90 °C (2K4, but -40 ... +194 °F) |
| • Operation | 4K3, but -40 ... +90 °C (4K3, but -40 ... +194 °F) |

¹⁾) Impact energy max. 1 joule.

C.3.4.2 Electrical data for external position detection

External NCS sensors 6DR4004-6N / -8N

| | Without explosion protection | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec" |
|--|---|---|--------------------------------------|
| | 6DR4004-8N | 6DR4004-6N | 6DR4004-6N |
| Travel range | | | |
| • Linear actuator 6DR4004-6/-8N.20 | | 3 to 14 mm (0.12 to 0.55") | |
| • Linear actuator 6DR4004-6/-8N.30 | 10 to 130 mm (0.39 to 5.12"); up to 200 mm (7.87") on request | | |
| • Part-turn actuator | | 30 to 100° | |
| Linearity (after corrections made by positioner) | | ± 1 % | |
| Hysteresis | | ± 0.2 % | |
| Temperature influence (range: rotation angle 120° or stroke 14 mm) | | ≤ 0.1 %/10 K (≤ 0.1 %/18 °F) for -20 to +90 °C (-4 to +194 °F) ≤ 0.2%/10 K (≤ 0.2%/18 °F) for -40 to -20 °C (-40 to -4 °F) | |
| Climate class | | According to IEC/EN 60721-3 | |
| • Storage | | 1K5, but -40 to +90 °C (-40 to +194 °F) | |
| • Transport | | 2K4, but -40 to +90 °C (-40 to +194 °F) | |
| Vibration resistance | | | |
| • Harmonic oscillations (sine) according to IEC 60068-2-6 | | 3.5 mm (0.14"), 2 to 27 Hz, 3 cycles/axis 98.1 m/s ² (321.84 ft/s ²), 27 to 300 Hz, 3 cycles/axis | |
| • Bumping according to IEC 60068-2-29 | | 300 m/s ² (984 ft/s ²), 6 ms, 4000 shocks/axis | |

External position detection

C.3 External position detection

| | Without explosion protection | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec" |
|--|---|--|--------------------------------------|
| | 6DR4004-8N | 6DR4004-6N | 6DR4004-6N |
| Torque for cable gland nut made of | Plastic 2.5 Nm (1.8 ft lb) | | Metal 4.2 Nm (3.1 ft lb) |
| Torque of hexagon socket-head screw M6x12 (shaft end or mounting bracket) | | 4 Nm (3 ft lb) | |
| Torque of hexagon socket head screw M6x25 (mounting console or mounting plate) | | 4 Nm (3 ft lb) | |
| Torque of hexagon socket head screw M3x12 (clamping ring) | | 1 Nm (0.7 ft lb) | |
| Degree of protection | IP68 according to IEC/EN 60529; Type 4X according to UL 50E | | |
| For connecting to circuits with the following peak values | | $U_i \leq 5\text{ V}$ $I_i \leq 160\text{ mA}$ $P_i \leq 120\text{ mW}$ | $U_i \leq 5\text{ V}$ |
| Effective internal capacitance | - | $C_i = 110\text{ nF} + 110\text{ nF per meter of connecting cable}$ | |
| Effective internal inductance | - | $L_i = 270\text{ }\mu\text{H} + 6.53\text{ }\mu\text{H per meter of connecting cable}$ | |

Position Transmitter (Potentiometer) 6DR4004-1ES

| Additional modules | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec", "tb" |
|---|---|--|
| Degree of protection | IP66 according to IEC/EN 60529; Type 4X according to UL 50E | |
| For connecting to circuits with the following peak values | $U_i \leq 5\text{ V}$ | $U_i \leq 5\text{ V}$ |
| Effective internal capacitance | $C_i \leq 10\text{ nF}$ | - |
| Effective internal inductance | $L_i \leq 240\text{ }\mu\text{H}$ | - |

Position Transmitter (NCS) 6DR4004-2ES

| | Without explosion protection | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec", "tb" |
|--|------------------------------|---|--|
| Travel range | | | |
| • Linear actuator | | 3 to 14 mm (0.12 to 0.55") 10 to 130 mm (0.39 to 5.12"); up to 200 mm (7.87") on request | |
| • Part-turn actuator | | 30 to 100° | |
| Linearity (after corrections made by positioner) | | $\pm 1\%$ | |
| Hysteresis | | $\pm 0.2\%$ | |
| Temperature influence (range: rotation angle 120° or stroke 14 mm) | | $\leq 0.1\%/10\text{ K}$ ($\leq 0.1\%/18\text{ }^\circ\text{F}$) for -20 to +90 °C (-4 to +194 °F) $\leq 0.2\%/10\text{ K}$ ($\leq 0.2\%/18\text{ }^\circ\text{F}$) for -40 to -20 °C (-40 to -4 °F) | |

| | Without explosion protection | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec", "tb" |
|--|---|--|--|
| Climate class | According to IEC/EN 60721-3 | | |
| • Storage | 1K5, but -40 to +90 °C (-40 to +194 °F) | | |
| • Transport | 2K4, but -40 to +90 °C (-40 to +194 °F) | | |
| Vibration resistance | | | |
| • Harmonic oscillations (sine) according to IEC 60068-2-6 | 3.5 mm (0.14"), 2 to 27 Hz, 3 cycles/axis 98.1 m/s ² (321.84 ft/s ²), 27 to 300 Hz, 3 cycles/axis | | |
| • Bumping according to IEC 60068-2-29 | 300 m/s ² (984 ft/s ²), 6 ms, 4000 shocks/axis | | |
| Torque for cable gland nut made of | Plastic | Metal | |
| | 2.5 Nm (1.8 ft lb) | 4.2 Nm (3.1 ft lb) | |
| Torque of hexagon socket-head screw M6x12 (shaft end or mounting bracket) | 4 Nm (3 ft lb) | | |
| Torque of hexagon socket head screw M6x25 (mounting console or mounting plate) | 4 Nm (3 ft lb) | | |
| Torque of hexagon socket head screw M3x12 (clamping ring) | 1 Nm (0.7 ft lb) | | |
| Degree of protection provided by enclosure | IP66 according to IEC/EN 60529; Type 4X according to UL 50E | | |
| For connecting to circuits with the following peak values | - | U _i ≤ 5 V I _i ≤ 160 mA P _i ≤ 120 mW | U _i ≤ 5 V |
| Effective internal capacitance | - | C _i = 110 nF + 110 nF per meter of connecting cable | |
| Effective internal inductance | - | L _i = 270 μH + 6.53 μH per meter of connecting cable | |

Position Transmitter (NCS, ILS) 6DR4004-3ES

| | Without explosion protection | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec", "tb" |
|---|---|--|---|
| Degree of protection provided by enclosure | IP66 according to IEC/EN 60529; type 4X according to UL 50E | | |
| NCS module (NCS) | 6DR4004-5L | 6DR4004-5LE | 6DR4004-5LE |
| • For connecting to circuits with the following peak values | - | U _i ≤ 5 V I _i ≤ 160 mA P _i ≤ 120 mW | U _i ≤ 5 V I _i ≤ 160 mA |
| • Effective internal capacitance | - | C _i = 110 nF + 690 pF/m Connecting cable | - |
| • Effective internal inductance | - | L _i = 270 μH + 6,53 μH/m Connecting cable | - |
| Inductive Limit Switches (ILS) | 6DR4004-8G | 6DR4004-6G | 6DR4004-6G |

External position detection

C.3 External position detection

| | Without explosion protection | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec", "tb" |
|---|--|--|---|
| 2 slotted initiators | | | |
| • Digital output (slot-type initiators) A1: Terminals 41 and 42 | | | |
| • Digital output (slot-type initiators) A2: Terminals 51 and 52 | | | |
| • Connection | 2-wire system according to EN 60947-5-6 (NAMUR), for switching amplifier connected on load side | | |
| • Signal state High (not triggered) | | > 2.1 mA | |
| • Signal state Low (triggered) | | < 1.2 mA | |
| • 2 slotted initiators | | Type SJ2-SN | |
| • Function | | NC (normally closed) | |
| • Connecting to circuits with the following peak values | Rated voltage 8 V, power consumption: ≥ 3 mA (limit not activated), ≤ 1 mA (limit activated) | $U_i \leq$ DC 15 V $I_i \leq$ 25 mA $P_i \leq$ 64 mW | $U_n \leq$ DC 15 V $I_n \leq$ 25 mA |
| Effective internal capacitance | - | $C_i \leq$ 161 nF | - |
| Effective internal inductance | - | $L_i \leq$ 120 μ H | - |
| 1 fault message output | | | |
| • Digital output: Terminals 31 and 32 | | | |
| • Connection | At switching amplifier in accordance with EN 60947-5-6: (NAMUR), $U_{Aux} = 8.2$ V, $R_i = 1$ k Ω) | | |
| • Signal state High (not triggered) | $R = 1.1$ k Ω | > 2.1 mA | > 2.1 mA |
| • Signal state Low (triggered) | $R = 10$ k Ω | < 1.2 mA | < 1.2 mA |
| • Auxiliary power U_{Aux} | $U_{Aux} \leq$ DC 35 V $I \leq$ 20 mA | - | - |
| • Connecting to circuits with the following peak values | - | $U_i \leq$ DC 15 V $I_i \leq$ 25 mA $P_i \leq$ 64 mW | $U_i \leq$ 15 V $I_i \leq$ 25 mA |
| Effective internal capacitance | - | $C_i = 5.2$ nF | - |
| Effective internal inductance | - | $L_i =$ negligibly small | $L_i =$ negligibly small |
| Galvanic isolation | The 3 digital outputs are galvanically isolated from the basic unit. | | |
| Test voltage | DC 840 V, 1 s | | |

Position Transmitter (NCS, MLS) 6DR4004-4ES

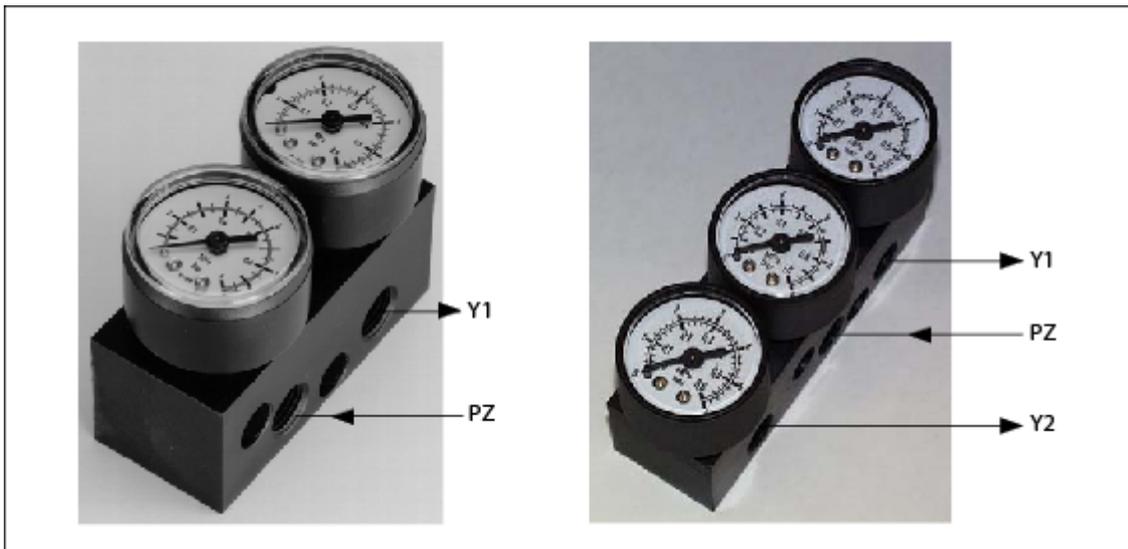
| | Without explosion protection | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec", "tb" |
|--|---|--|---|
| Degree of protection provided by enclosure | IP66 according to IEC/EN 60529; type 4X according to UL 50E | | |
| NCS module (NCS) | 6DR4004-5L | 6DR4004-5LE | 6DR4004-5LE |

| | Without explosion protection | With explosion protection Ex "ia", "db ia", "ic" | With explosion protection Ex "ec", "tb" |
|--|--|---|--|
| • For connecting to circuits with the following peak values | | $U_i \leq 5 \text{ V}$ $I_i \leq 160 \text{ mA}$ $P_i \leq 120 \text{ mW}$ | $U_i \leq 5 \text{ V}$ $I_i \leq 160 \text{ mA}$ |
| • Effective internal capacitance | | $C_i = 110 \text{ nF} + 690 \text{ pF/m}$ Connecting cable | - |
| • Effective internal inductance | | $L_i = 270 \text{ }\mu\text{H} + 6,53 \text{ }\mu\text{H/m}$ Connecting cable | - |
| Mechanic Limit Switches (MLS), 6DR4004-6K | | | |
| 2 limit contacts | | | |
| • Digital output (switching contact) A1: Terminals 41 and 42 | | | |
| • Digital output (switching contact) A2: Terminals 51 and 52 | | | |
| • Max. switching current AC/DC | 100 mA | - | - |
| • For connecting to circuits with the following peak values | - | $U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ $P_i \leq 750 \text{ mW}$ | $U_n \leq 30 \text{ V}$ $I_n \leq 100 \text{ mA}$ |
| Effective internal capacitance | - | $C_i = \text{negligibly small}$ | - |
| Effective internal inductance | - | $L_i = \text{negligibly small}$ | - |
| • Max. switching voltage AC/DC | DC 30 V | DC 30 V | DC 30 V |
| 1 fault message output | | | |
| • Digital output: Terminals 31 and 32 | | | |
| • Connection | On switching amplifier according to EN 60947-5-6: (NAMUR), $U_{Aux} = 8.2 \text{ V}$, $R_i = 1 \text{ k}\Omega$ | | |
| • Signal state High (not triggered) | $R = 1.1 \text{ k}\Omega$ | $> 2.1 \text{ mA}$ | $> 2.1 \text{ mA}$ |
| • Signal state Low (triggered) | $R = 10 \text{ k}\Omega$ | $< 1.2 \text{ mA}$ | $< 1.2 \text{ mA}$ |
| • Auxiliary power | $U_{Aux} \leq \text{DC } 35 \text{ V}$ $I \leq 20 \text{ mA}$ | - | - |
| • Connecting to circuits with the following peak values | - | $U_i \leq 15 \text{ V}$ $I_i \leq 25 \text{ mA}$ $P_i \leq 64 \text{ mW}$ | $U_n \leq 15 \text{ V}$ $I_n \leq 25 \text{ mA}$ |
| Effective internal capacitance | - | $C_i = 5.2 \text{ nF}$ | $C_i = 5.2 \text{ nF}$ |
| Effective internal inductance | - | $L_i = \text{negligibly small}$ | |
| Galvanic isolation | The 3 digital outputs are galvanically isolated from the basic unit | | |
| Test voltage | 3150 V DC, 2 s | | |
| Rated condition height | Max. 2 000 m above sea level. At altitudes greater than 2 000 m above sea level, use a suitable power supply. | - | - |

Pressure gauge blocks

D.1 Pressure gauge block

Pressure gauge blocks that are available as accessories are illustrated below. The gauges display measured values for the actuating pressure and supply pressure. The figure to the left shows the pressure gauge block for single-acting actuators. The image to the right shows the pressure gauge block for double-acting actuators.



- Y1 Actuating pressure
- PZ Supply pressure
- Y2 Actuating pressure

Mounting

The pressure gauge block is fixed onto the lateral pneumatic connection of the positioner using the screws provided. Use the provided O-rings as sealing elements.

D.2 Venting gauge block

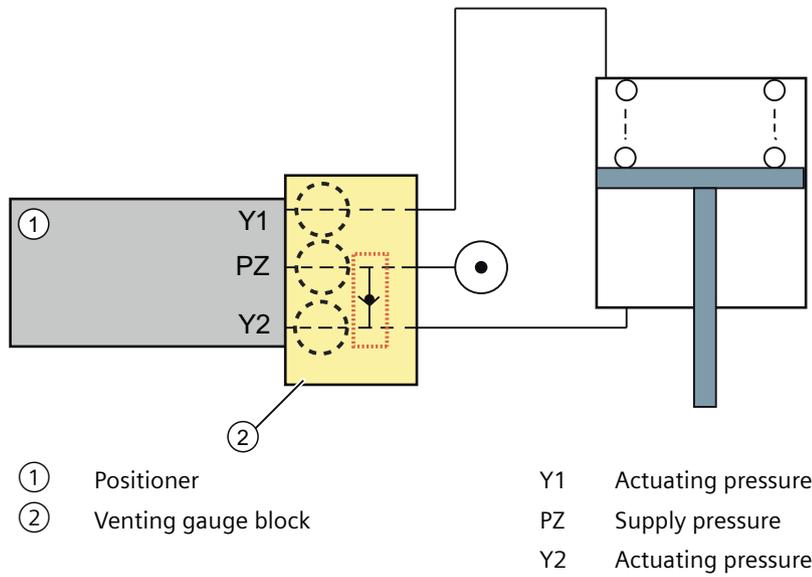


Figure D-1 Mode of operation of venting gauge block

Sealing plug / thread adapter

E.1 Purpose

The sealing plug and the thread adapter (components) can be used for installation in electrical equipment of flameproof "Ex d" type of protection of groups IIA, IIB, IIC as well as dust protection by enclosure "Ex t" type of protection.

E.2 Safety instructions

| |
|---|
| <p> WARNING</p> <p>Incorrect assembly</p> <ul style="list-style-type: none"> The component can be damaged or destroyed or its functionality impaired through incorrect assembly. <ul style="list-style-type: none"> Mount the component using a suitable tool. Refer to the information in Chapter "Technical specifications (Page 320)", for example, torques for installation. For "Explosion-proof Ex d" type of protection: To ensure an engagement depth of 8 mm, the enclosure must have a wall thickness of at least 10 mm. <p>Improper modifications</p> <p>Danger to personnel, system and environment can result from modifications and repairs of the component, particularly in hazardous areas.</p> <ul style="list-style-type: none"> Any modification which deviates from the delivery state is not permitted. <p>Loss of enclosure type of protection</p> <p>IP protection is not guaranteed without sealant.</p> <ul style="list-style-type: none"> Use a suitable thread sealant. If you are using the component in type of protection dust protection by enclosure "Ex t", use the supplied sealing ring (①, figure in Chapter "Dimensional drawings for accessory part (Page 321)"). <p>Unsuitable fluids in the environment</p> <p>Danger of injury or damage to device.</p> <p>Aggressive media in the environment can damage the sealing ring. Type of protection and device protection may no longer be guaranteed.</p> <ul style="list-style-type: none"> Make sure that the sealing material is suitable for the area of use. |
|---|

Note**Loss of type of protection**

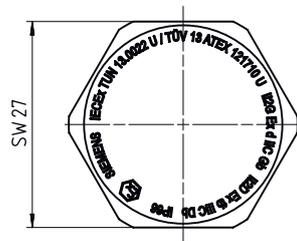
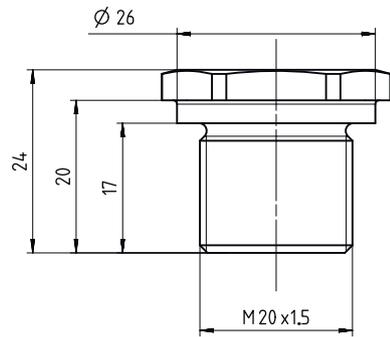
Changes in the ambient conditions can loosen the component.

- As part of the recommended maintenance intervals: Check the compression fitting for tight fit and tighten, if necessary.

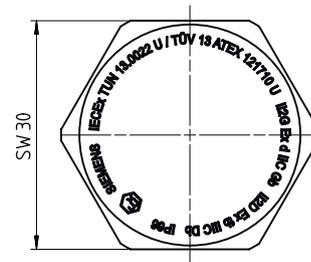
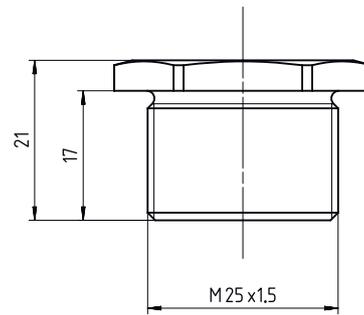
E.3 Technical specifications

| Technical specifications sealing plug and thread adapter | |
|--|--|
| Sealing plug suitable for types of protection | Explosion-proof enclosure "db" of groups IIA, IIB, IIC Dust protection by enclosure "ta" |
| Standard compliance | The components meet Directive 2014/34/EU. They meet the requirements of standards IEC/EN 60079-0; IEC/EN 60079-1; IEC/EN 60079-31. |
| Explosion protection | |
| • Gas explosion protection | II2G Ex db IIC Gb |
| • Dust explosion protection | II1D Ex ta IIIC Da |
| Certificates | IECEX TUN 13.0022 U TÜV 13 ATEX 121710 U |
| Material for sealing plug / thread adapter | Stainless steel |
| Material for seal | AFM 30 |
| Ambient temperature range | -40 ... +100 °C (-40 ... +212 °F) |
| For "Ex d" type of protection: | |
| Required wall thickness for tappings | 10 mm |
| Torque | |
| • For thread size M20 x 1.5 | 40 Nm |
| • For thread size M25 x 1.5 | 55 Nm |
| • For thread size ½-14 NPT | 95 Nm |
| Width A/F for thread size M20 x 1.5 | 27 |
| Width A/F for thread size M25 x 1.5 | 30 |
| Key size for thread size ½-14 NPT | 10 |

E.4 Dimensional drawings for accessory part



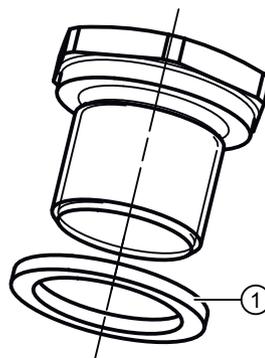
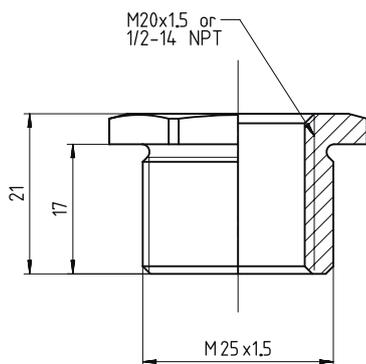
Sealing plug Ex d, M20 x 1.5, dimensions in mm



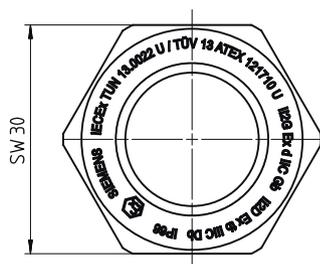
Sealing plug Ex d, M25 x 1.5, dimensions in mm

Sealing plug / thread adapter

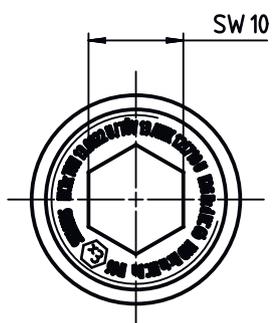
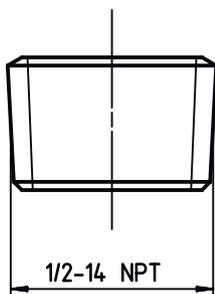
E.4 Dimensional drawings for accessory part



① Sealing ring: Use for dust protection "Ex t" type of protection.



Thread adapter Ex d, M25 x 1.5 on M20 x 1.5 and M25 x 1.5 on 1/2-14 NPT, dimensions in mm



Sealing plug Ex d 1/2 -14 NPT



CAUTION

Increased sound pressure level

Changes to the sound absorber of the positioner or the mounting of pneumatic components or pneumatic options on the positioner can cause a sound pressure with a level of 80 dBA to be exceeded.

- Wear suitable hearing protection to protect yourself against hearing damage.

F.1 Booster introduction

In order to shorten the travel times, use a booster between the positioner and actuator.

Note

Positioner with booster, double-acting

If the supply pressure PZ fails, the booster changes the failure behavior of the positioner. The position of the valve is random.

The booster has no effect in the event of an electrical power failure.

F.2 Mounting a booster

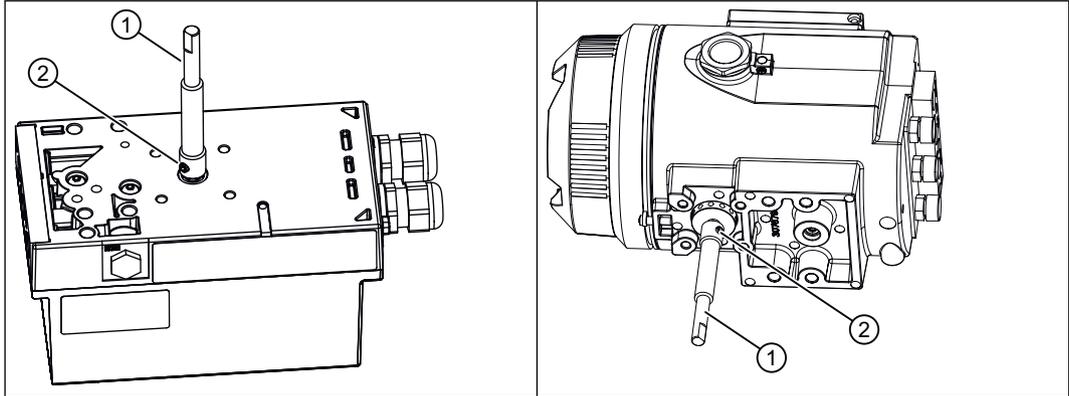
Requirement

1. You are familiar with the safety instructions in section "Installing and mounting (Page 35)".
2. You have one of the following boosters:
 - With single-acting positioners, booster with the article numbers 6DR4004-1RJ, -1RK, -1RP or -1RQ
 - With double-acting positioners, booster with the article numbers 6DR4004-2RJ, -2RK, -2RP or -2RQ

A. Mount extension shaft and booster

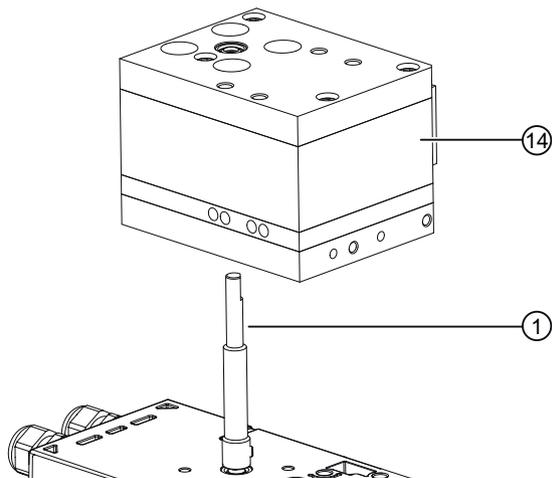
Using the example of a single-acting positioner.

1. Plug the extension shaft ① onto the shaft of the positioner.
2. Tighten the locking screw ② at the flat end of the positioner shaft.
Picture right: Positioner in flameproof enclosure

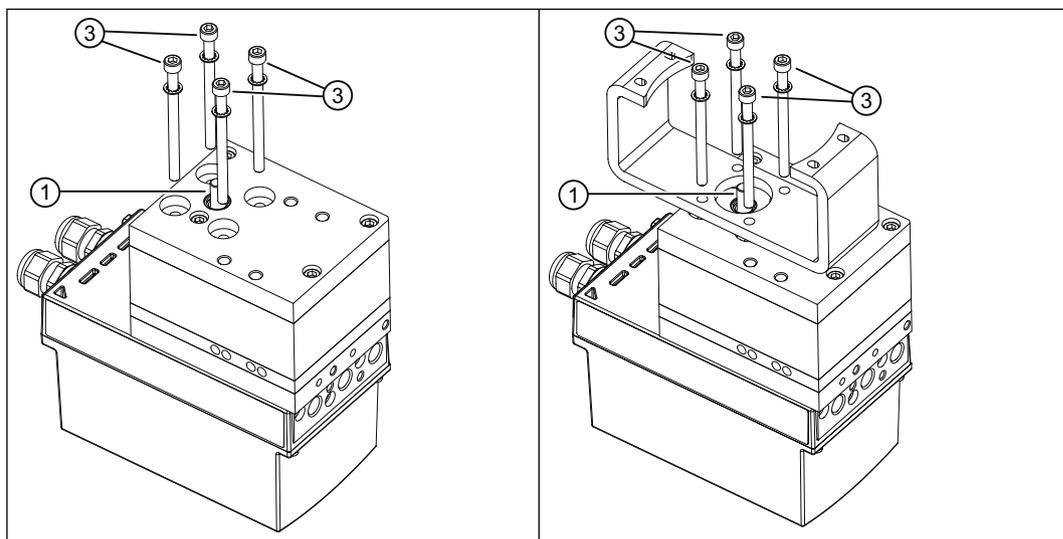


3. Check that the extension shaft ① sits properly.

4. Slide the booster (14) over the extension shaft (1).



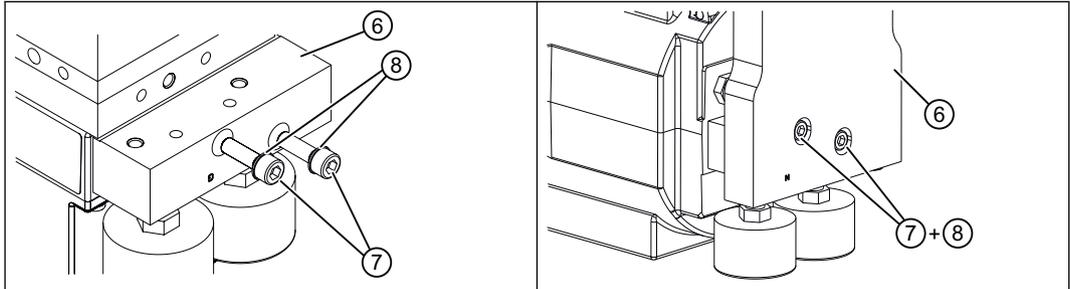
5. Fasten the booster (14) to the positioner with the screws (3).
Picture left: Linear actuator. Use M6 x 85 mm screws (3)
Picture right: Part-turn actuator. Use M6 x 95 mm screws (3)



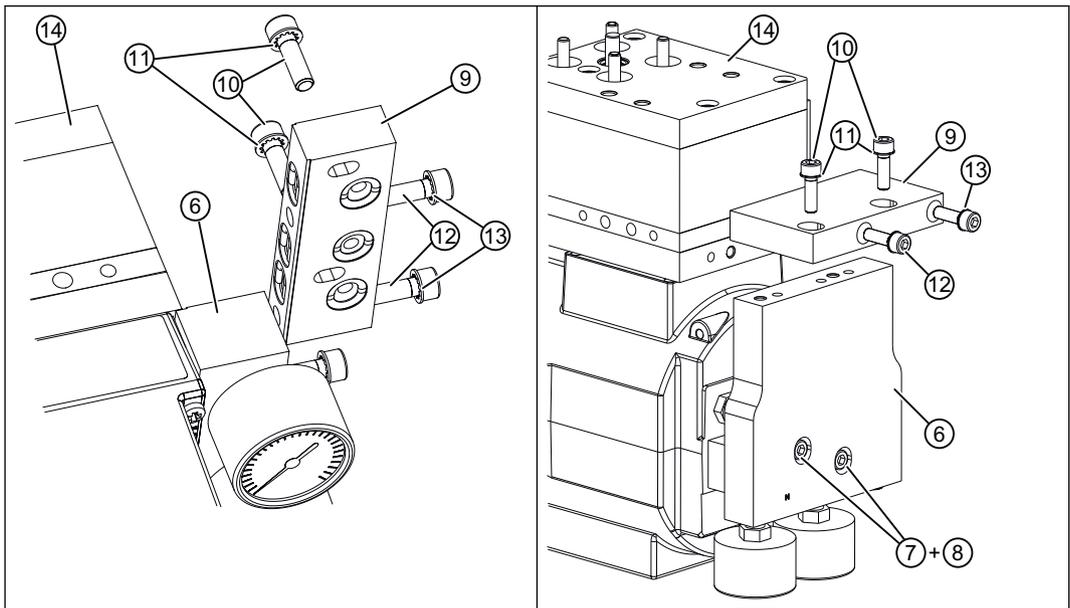
When tightening the screws, ensure that the shaft (1) can be turned easily.

B. Mounting the pressure gauge and connection block

1. Check whether the O-rings are in the pressure gauge block. There are two O-rings in the single-acting version. There are three O-rings in the double-acting version.
2. Fasten the **pressure gauge block** ⑥ with the screws ⑦ and lock washers ⑧. Position the screws, do **not** tighten them.

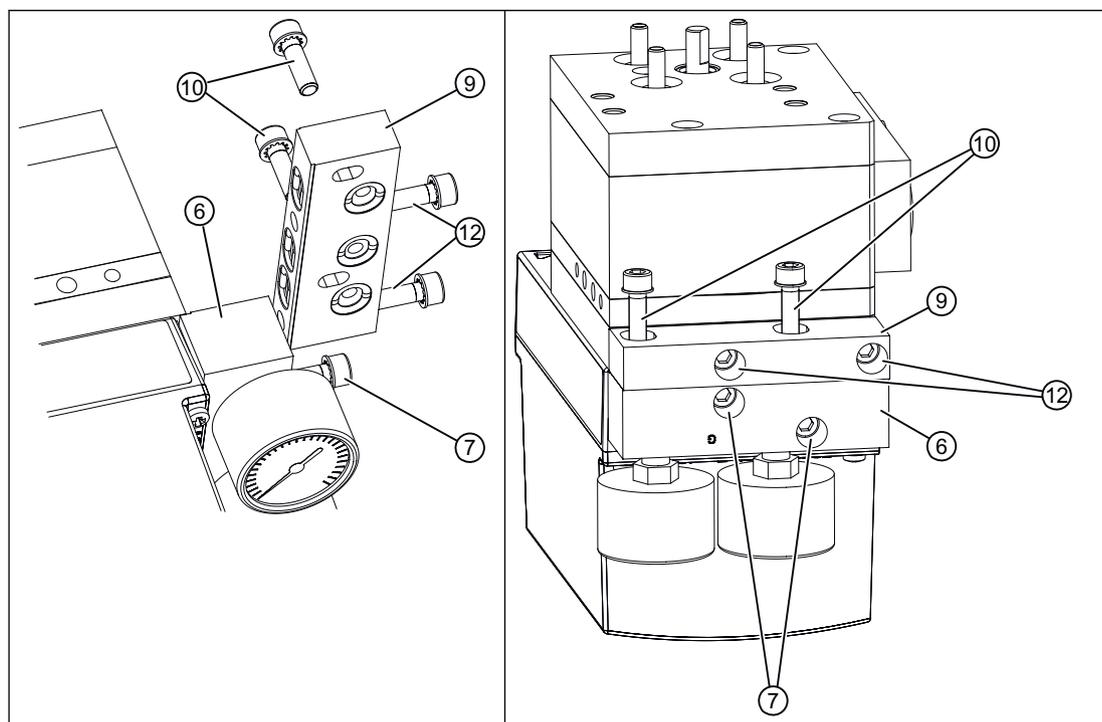


3. Fasten the connection block ⑨ with the screws ⑩, ⑫ and lock washers ⑪, ⑬. Position the screws, do **not** tighten them.



C. Tightening screws

Tighten the screws in the following order.



1. Screws ⑦ which are used to fasten the pressure gauge block ⑥ to the positioner
2. Screws ⑫ which are used to fasten the connection block ⑨ to the booster
3. Screws ⑩ which are used to fasten the connection block ⑨ to the pressure gauge block ⑥
4. Mount the positioner on the actuator as described in:
 - Mounting to linear actuator (Page 38)
 - Mounting to part-turn actuator (Page 43)
5. Use the existing interfaces on the booster.

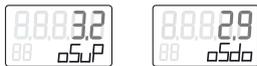
F.3 Booster commissioning

Requirement

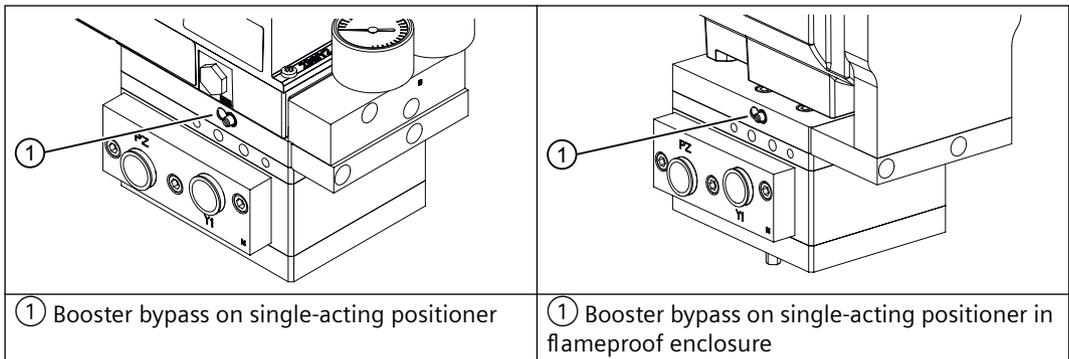
1. You operate the positioner with a booster.
2. '51.PNEUM' Pneumatics type (Page 162) parameter is set to 'booSt'.

Procedure for commissioning the booster

1. Check whether the restrictor(s) on the positioner are completely open. With a new positioner, the restrictors are factory-set to open. The position of the restrictors is shown in the figure in section Device components (Page 27).
2. Set '34.DEBA' Deadband of closed-loop controller (Page 152) to the largest value permissible for your process. The largest value is usually 0.5.
3. Start the automatic initialization process as described under Commissioning (Page 103).
4. With RUN 3, the initialization is stopped for five seconds. During these five seconds, start the function for setting the booster using the  button.
A cycle is started which continuously determines the overshoots. The values 'oSUP' and 'oSdo' are shown alternately in the display. 'oSUP' and 'oSdo' represent the values of the overshoot in % of the total stroke.



5. During the automatic initialization, adjust the booster bypass using the adjustment screw on the booster. For single-acting actuators, there is one adjustment screw; there are two adjustment screws for double-acting actuators.



If 'oCAY' is shown on the display, the overshoot is less than 3%.



6. Press the  or  button. The positioner again runs through the initialization step RUN 3, starting with determination of the travel times. The following figure schematically shows the RUN 3 sequence for the booster.
7. 'FINISH' is shown on the display when the initialization has been completed.

If the process value on the display does not remain stable or if a constant manipulated variable cannot be achieved for a constant setpoint, further optimization of the controller data is necessary. This is described in section Optimization of controller data (Page 100).

See also

Sequence of automatic initialization (Page 106)

F.4 RUN 3: Determination and display of travel time (leakage test)

| | | |
|--|---|---|
|  | The travel time is determined and displayed with "down" (dxx.x) and "up" (Uxx.x). Stop with: ▾ | |
| | PNEUM | |
| | Std / FIP | Start leakage measurement with: ▲ |
| | booSt | Display of the overshoot down (3.2 oSuP), up (2.9 oS-do)▲ |
| Possible messages | | |
| Display | Meaning | Measures |
| Std / FIP   | Actuator does not move. The travel time cannot be changed. | Acknowledge message with:  Change the travel time using the restrictor screws. Continue with: ▾▲ |
| booSt   | The overshoot is determined. | Adjust the booster bypass using the adjusting screw on the booster until the display indicates the following:  Continue with: ▾▲ |

F.5 Booster dimension drawings

F.5.1 For positioners in non-flameproof enclosure

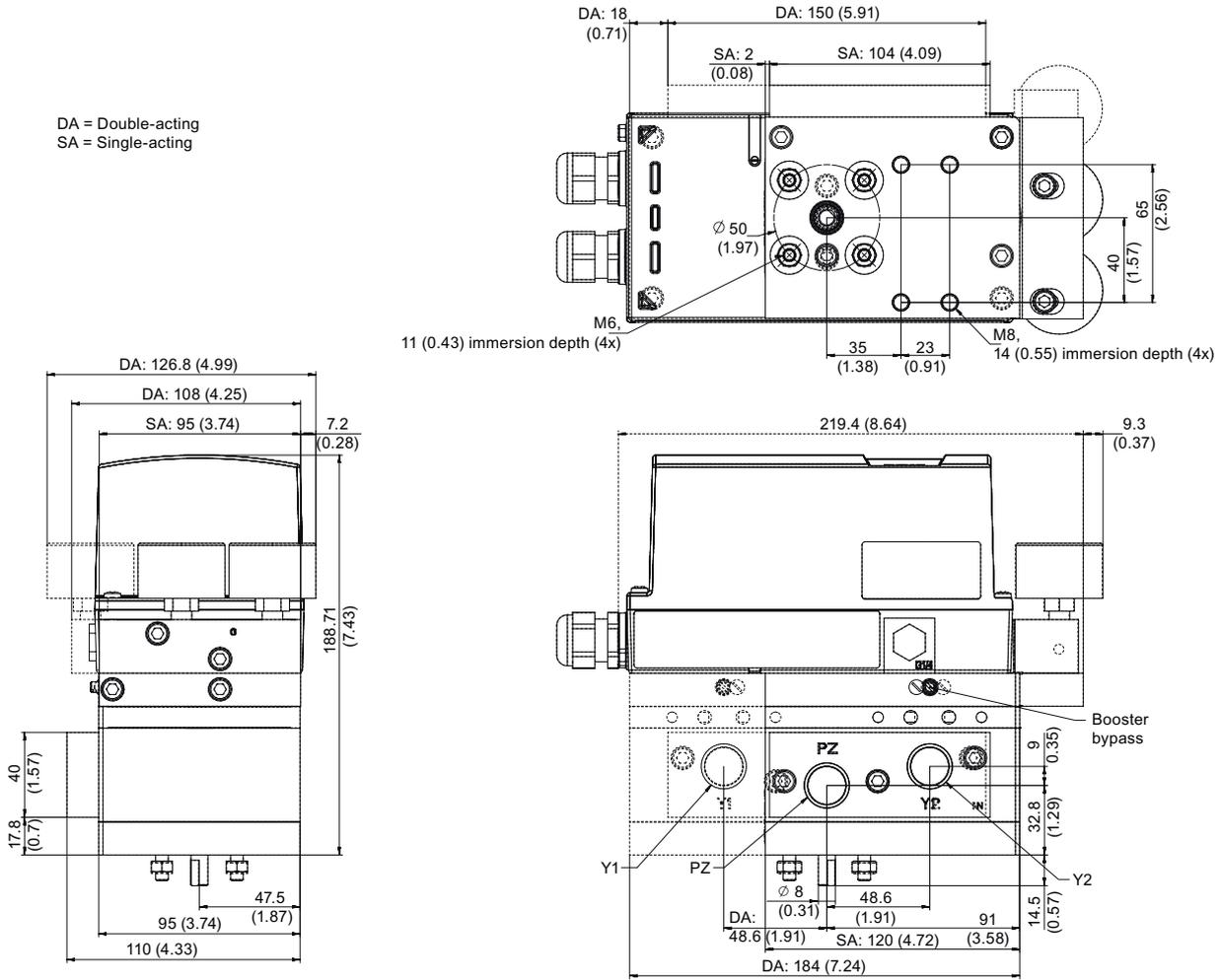


Figure F-1 Dimension drawings booster mounted on positioner, dimensions in mm (inch)

F.5.2 For positioners in flameproof enclosure

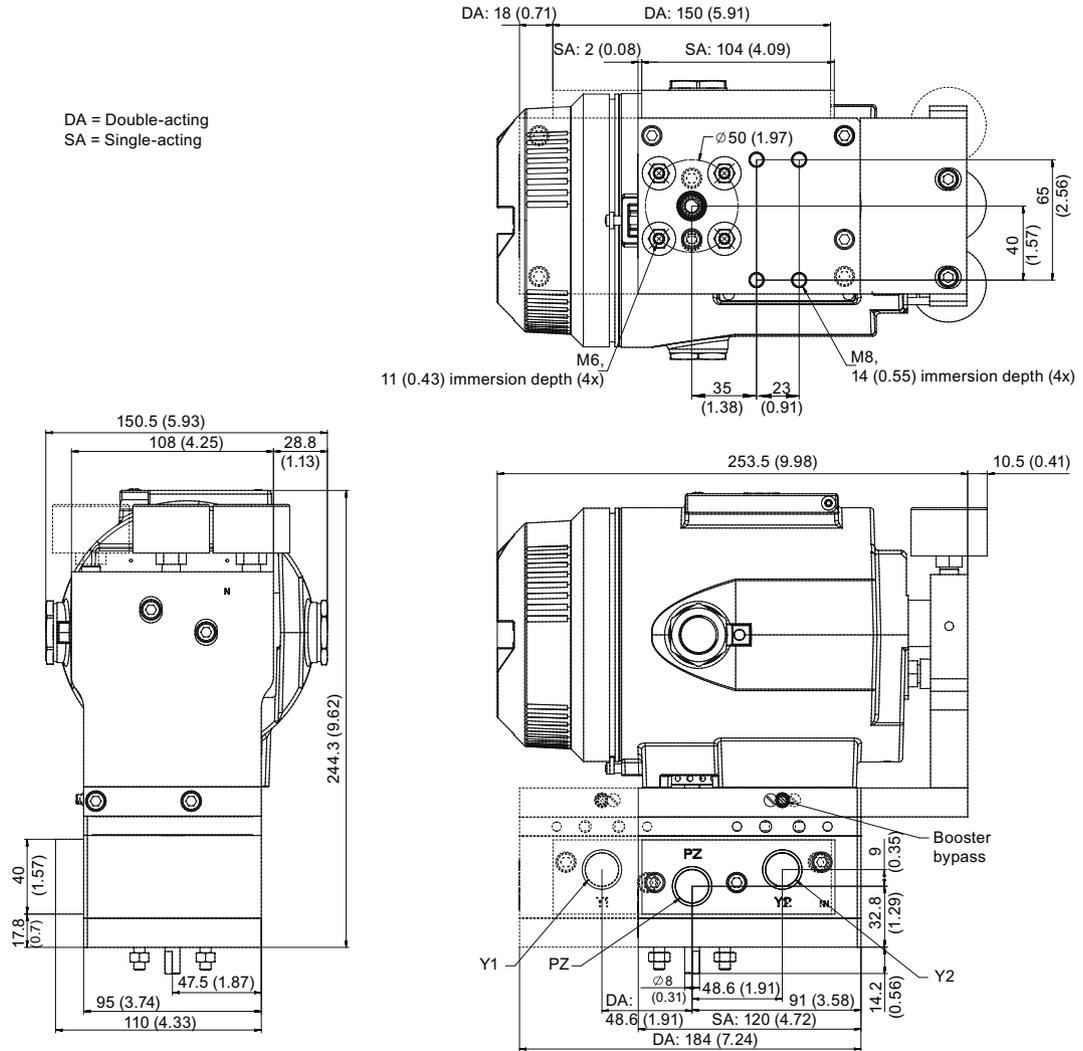


Figure F-2 Dimension drawings booster mounted on positioner in a flameproof enclosure, dimensions in mm (inch)

F.6 Technical specifications of booster

| Booster | |
|---------------------------------------|------------------|
| Weight booster, single-acting | |
| • BOOSTER KIT for 6DR5.10 and 6DR5.13 | 2.9 kg (6.5 lb) |
| • BOOSTER KIT for 6DR5.15 | 3.3 kg (7.3 lb) |
| Weight booster, double-acting | |
| • BOOSTER KIT for 6DR5.20 and 6DR5.23 | 4.3 kg (9.4 lb) |
| • BOOSTER KIT for 6DR5.25 | 4.7 kg (10.4 lb) |

Booster

F.6 Technical specifications of booster

| Booster | |
|------------------------|--|
| Connections, pneumatic | 1/2-14 NPT or G½ |
| Air consumption | 1.2 x 10 ⁻² Nm ³ /h (0.007 scfm) |
| Pressure gauge | Made of steel IP44. Scaling MPa, bar, psi |
| Flow capacity | Cv 2.0 |

Positioner with remote electronics

G.1 Introduction to remote electronics

In some cases it is advisable to use the positioner separately from the electronics. The option of separating the electronics of the positioner is available for this purpose. The positioner is in a different location than the electronics. The remote electronics of the positioner allows the valves to be controlled in radiation environments, since all the highly integrated electronic components are located in an area that is protected from radiation. Highly integrated electronic components are, for example, memory blocks and microprocessor blocks.

For the above described deployment you required the two following components:

- Component 1, consisting of the electronics in the form of a 19-inch control unit. The 19-inch control unit is installed in a control cabinet. Available in the following variants:
 - 19-inch control unit as 4 to 20 mA with 2-wire connection, Article No. A5E00151560
- Component 2 consisting of the positioner without electronics. The positioner without electronics is mounted on the valve.
 - Positioner without electronics with Position Transmitter and pneumatic unit, mounted on the valve, Article No. 6DR5910-ONG00-0AA0
Positioner without electronics 6DR5910 (Page 341)

Components 1 and 2 are connected electrically to each other. The components are described below.

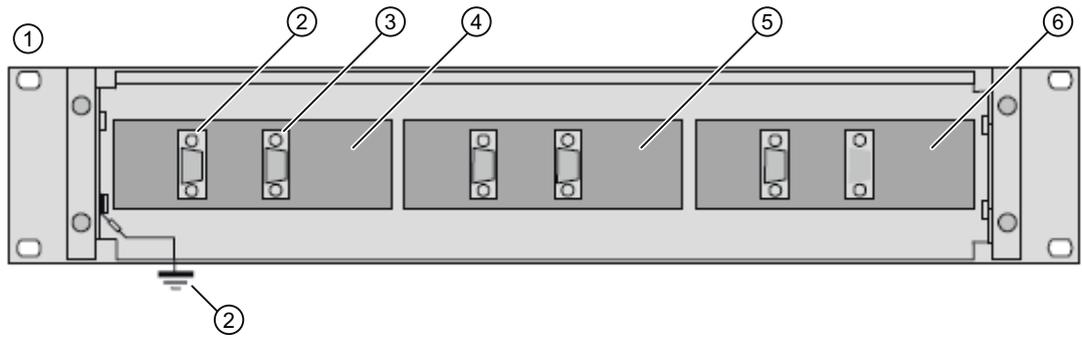
G.2 19-inch control unit

G.2.1 Description of 19-inch control unit 4 to 20 mA

This component comprises the electronics in a 19-inch control unit in 4 to 20 mA version. Commissioning is only possible in conjunction with a positioner component 6DR5910. The 19-inch control unit has three channels and controls up to three valves.

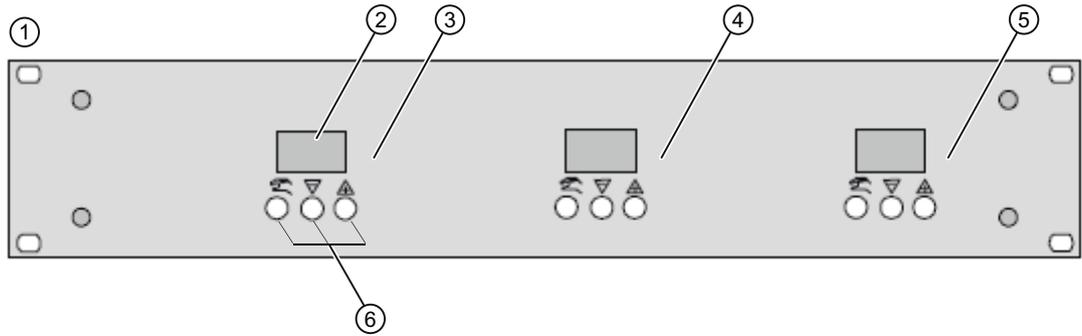
The electronics supplies the current position of the valve in the form of a current of 4 to 20 mA, which corresponds to the position feedback.

G.2 19-inch control unit



- ① 19-inch control unit 4 to 20 mA
- ② Sub-D 15-pin socket connector for cable to the valve
- ③ Sub-D male connector 9-pin for cable to the control system
- ④ Channel 3
- ⑤ Channel 2
- ⑥ Channel 1

Figure G-1 Device view 19-inch control unit, 4 to 20 mA, rear view



- ① 19-inch control unit 4 to 20 mA
- ② Display
- ③ Channel 1
- ④ Channel 2
- ⑤ Channel 3
- ⑥ Input keys

Figure G-2 Device view 19-inch control unit, 4 to 20 mA, front view

G.2.2 Connecting the 19-inch control unit 4 to 20 mA

G.2.2.1 Grounding concept for 19-inch control unit 4 to 20 mA

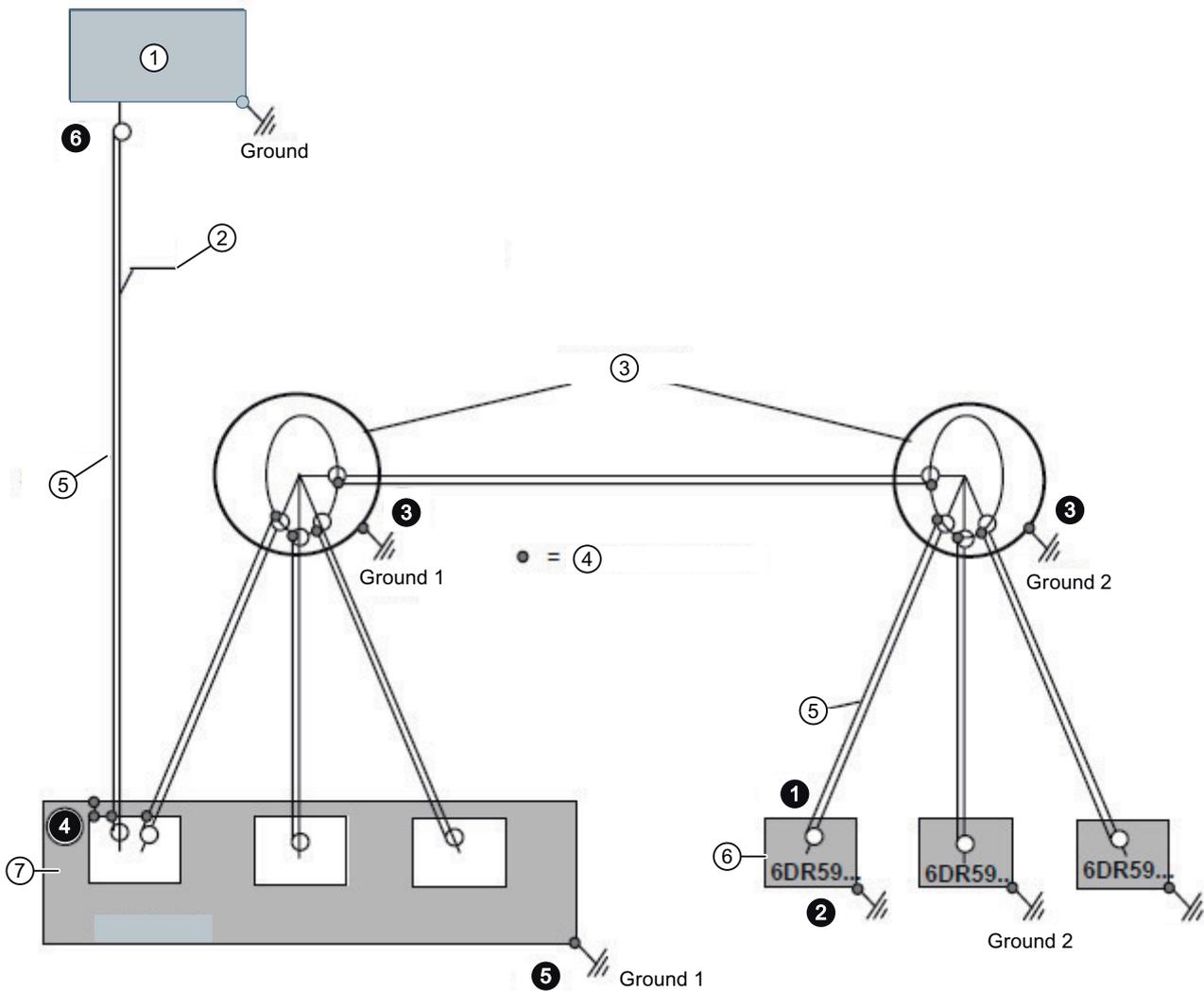
| |
|---|
| NOTICE |
| Interference |
| To dissipate interference pulses the positioner components must be connected to an equipotential bonding cable (ground potential) using a low resistance. |
| <ul style="list-style-type: none"> Connect the positioner 6DR5910 according to the grounding concept described below. |

Note

Properties of the cable

To avoid interference, the cable between the 19-inch control unit, positioners 6DR59.. and field distributors should have the following signal pairs (twisted pair):

- Discharge - / Discharge +
 - Supply - / Supply +
 - GND / POS
 - V_REF GND
-



- ① Control system
- ② 3 x 1 cable to the control system
- ③ Field distributor
- ④ Connection point
- ⑤ Shield
- ⑥ Positioner 6DR5910
- ⑦ 19-inch control unit

Ground

Figure G-3 Grounding concept for 19-inch control unit 4 to 20 mA version

Notes on the individual connection points:

- ① The cable shield is not connected to the positioner 6DR5910.
- ② The positioner 6DR5910 is connected via the mechanical assembly to Ground 2, see Installing/mounting (Page 35). Section Basic safety instructions (Page 75) describes how to ground the enclosure.
- ③ Each field distributor is grounded. The cable shields in the field distributor are not grounded. The cable shields are interconnected.
- ④ The cable shields on the 19-inch control unit are connected to the field distributor.

- ⑤ The 19-inch control unit is connected to Ground 1.
- ⑥ The cable shields on the control system are not connected to ground.

G.2.2.2 Electrical connection of 19" slide-in module 4 to 20 mA

Requirement

You have read sections Connection (Page 75) and Grounding concept for 19-inch control unit 4 to 20 mA (Page 334).

Connecting

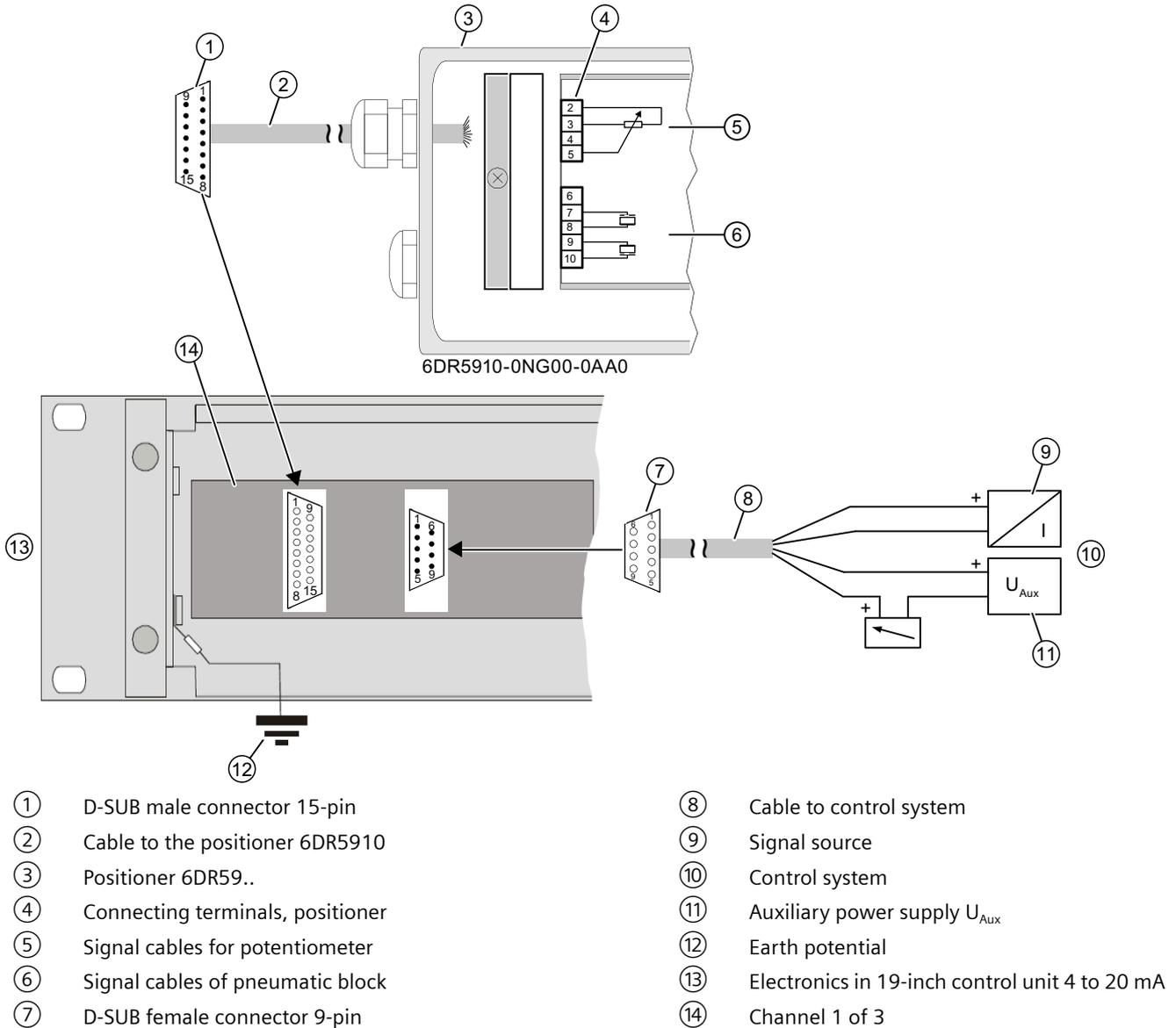


Figure G-4 Connecting electronics electrically

Procedure

Observe the safety instructions for connection in section Basic safety instructions (Page 75).

1. Strip 5 mm of the cable shield on the cable ②.
2. Open the positioner 6DR5910. Unscrew the four fixing screws of the enclosure cover.
3. Insert the prepared cable ② through the cable entry of the positioner.
4. Tighten the cable entry.

5. Connect the wires of the cable ② to the connecting terminals ④ and to the SUB-D male connector ① according to the following table:

| Connecting terminals ④ / ⑤ | Assignment | Assignment, male connector ① | Connecting terminals ④ / ⑥ | Assignment | Assignment, male connector ① |
|----------------------------|------------|------------------------------|----------------------------|--------------|------------------------------|
| 2 | GND | 7 | 6 | Not assigned | - |
| 3 | Vref | 6 | 7 | Discharge + | 2 |
| 4 | not used | - | 8 | Discharge - | 1 |
| 5 | Vpos | 4 | 9 | Supply + | 15 |
| | | | 10 | Supply - | 14 |

6. Connect the positioner 6DR5910 ③ to the 19-inch control unit ⑬ using the SUB-D male connector ①.
7. Connect the wires of the cable ⑧ to the signal source ⑨ and the power source ⑪ as well as the SUB-D female connector ⑦ according to the following table:

| Assignment of female connector ⑦ for ⑨ | | Assignment of female connector ⑦ for ⑪ | |
|--|-----------------|--|--------------------|
| 1 | Signal source + | 6 | - |
| 2 | Signal source - | 7 | - |
| 3 | - | 8 | U _{Aux} + |
| 4 | - | 9 | U _{Aux} - |
| 5 | - | | |

8. Connect the 19-inch control unit ⑬ to the control system ⑩ using the SUB-D female connector ⑦.

G.2.3 Technical specifications for 19-inch control unit 4 to 20 mA

You can find the valid technical specifications for the positioner in Technical data (Page 257). Below are the technical specifications for the 19-inch control unit 4 to 20 mA.

| Rated conditions | |
|---|---|
| Degree of protection | |
| • Front | IP40 acc. to DIN EN 60529 |
| • Back page | IP20 acc. to DIN EN 60529 |
| Mounting position | |
| | Any |
| Vibration resistance | |
| • Harmonic oscillations (sine wave) according to DIN EN 60082-2-6/05.96 | 3.5 mm (0.14"), 5 ... 8.4 Hz, 4 cycles/axle 10 m/s ² (33 ft/s ²), 8.4 ... 500 Hz, 4 cycles/axle |
| • Oscillations (sinusoidal) according to DIN EN 60068-2-6/04.96 | KWU DD 7080.9/93 KTA 3503 from 11.86 |
| • Shock (half-sine) according to DIN EN 60068-2-27/02.2010 | 150 m/s ² (492 ft/s ²), 11 ms, 6 shocks/axle |

| Construction | |
|---------------------------------|--|
| Weight | Approx. 1.8 kg |
| Material body | 19-inch control unit 2 U, aluminum |
| Number of channels, electronics | 3 |
| Climate class | According to IEC/EN 60721-3 |
| • Storage | -25°C to 80°C, 75% at 25°C, without condensation |
| • Transport | -25°C to 80°C, 75% at 25°C, without condensation |
| • Operation | 0°C to 50°C, 75% at 25°C, without condensation |

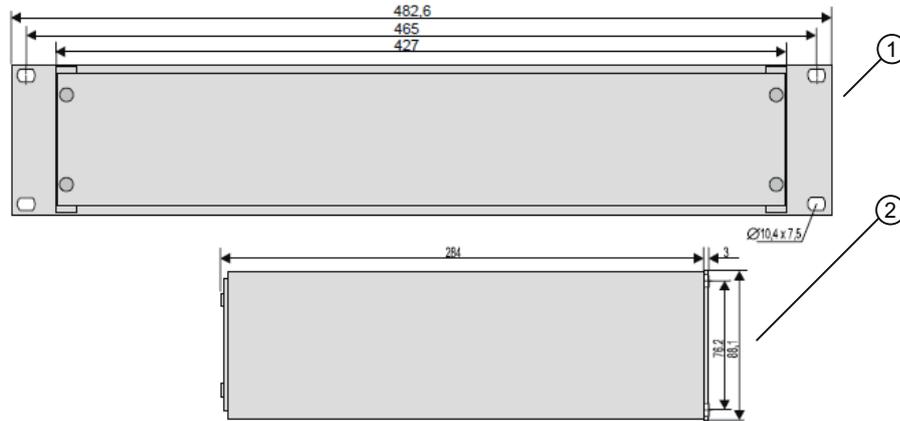
| Electrical data | |
|--|---|
| Electrical connection | 9-pin Sub-D plug 15-pin Sub-D female connector |
| Current input I_w | |
| • Rated signal range | 4 to 20 mA |
| • Current to maintain the auxiliary power | ≥ 3.6 mA |
| 2-wire connection | |
| • Current to maintain the auxiliary power | ≥ 3.6 mA |
| • Required load voltage U_b (corresponds to Ω at 20 mA) | 6.4 V (= 320 Ω) |
| • Static destruction limit | ± 40 mA |

Technical specifications for the controller unit is available at Controller for all device versions (Page 260).

Technical specifications of the Analog Output Module (AOM) are available at Analog Output Module (AOM) 6DR4004-6J / -8J (Page 266).

| Cable data (minimum requirements) | |
|--|------------------------------|
| Cable length | ≤ 130 m |
| Capacity wire / wire | ≤ 150 nF/km |
| Capacity wire / shield | ≤ 200 nF/km |
| Inductance | ≤ 1 mH/km |
| Copper resistance | ≤ 100 Ω /km |
| Insulation conductance | $\geq 0.5 \times 10^7$ S/km |
| Ambient temperature | -30 ... +80 °C |
| Number of poles | |
| • Cable to the control system (min/max) | 4 or 9 |
| • Cable to the positioner 6DR5910 | 8 or 15 |
| Connection | |
| • Cable to the control system (min/max) | 9-pin Sub-D female connector |
| • Cable to the positioner 6DR5910 | 15-pin Sub-D male connector |

G.2.4 Dimension drawing for 19-inch control unit 4 to 20 mA



① Rear view

② Side view

Figure G-5 19-inch control unit 4 to 20 mA, dimensions in mm

The dimensions of the positioner without electronics 6DR5910 correspond to the dimensions 6DR5..0. You can find these dimensions in the Positioner in non-flameproof enclosure (Page 271) section.

G.2.5 Scope of delivery of remote electronics

| Description | Article number |
|--|----------------|
| 19-inch control unit in 4 to 20 mA version, aluminum, 3 channels, not Ex | A5E00151560 |
| SIPART PS2 without electronics, single-acting, polycarbonate enclosure, non-Ex | 6DR5910-... |

G.3 Positioner without electronics 6DR5910

This component comprises the positioner without electronics (6DR5910). Commissioning is only possible in conjunction with a electronics component in the form of a 19" slide-in module. The positioner without electronics is available in the device version in polycarbonate enclosure, single-acting.

The following section describes how you mount, connect and commission the positioner without electronics.

Installing/mounting

Mounting of this positioner without electronics corresponds to the mounting of the positioner in non-flameproof enclosure. Proceed as described in Section "Installing/mounting (Page 35)".

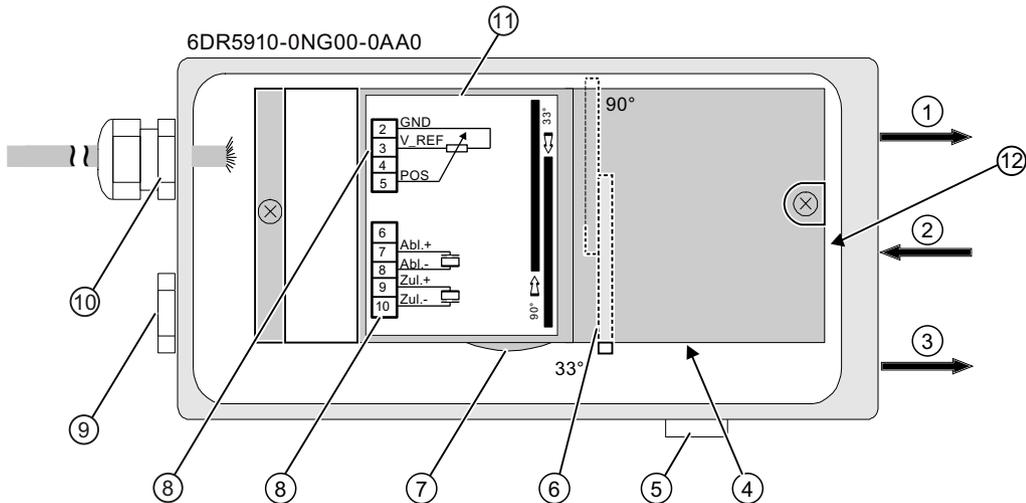
Connecting

Connect the positioner as described in Section "Positioner without electronics 6DR5910 (Page 341)". Please also observe Basic safety instructions (Page 75) for connection.

Commissioning

Commission the positioner as described in Section "Commissioning (Page 103)".

Device view of positioner 6DR5910



- ① Output: Actuating pressure Y1
- ② Input: Supply pressure PZ
- ③ Output: Actuating pressure Y2 (not for 6DR59..)
- ④ Restrictor Y1
- ⑤ Exhaust air outlet with a sound absorber
- ⑥ Transmission ratio selector
- ⑦ Friction clutch adjustment wheel
- ⑧ Connecting terminals, positioner
- ⑨ Blanking plug
- ⑩ Cable gland
- ⑪ Wiring diagram on module cover
- ⑫ Purging air selector

Abbreviations

H.1 Abbreviations for PS2 positioners

| Abbreviation | Long form | Meaning |
|--------------|---|--|
| A/D | Analog-to-digital converter | - |
| AC | Alternating current | Alternating current |
| AI | Analog Input | - |
| AMS | Asset Management Solutions | Communication software from Emerson Process comparable with SIMATIC PDM |
| AO | Analog Output | - |
| AUT | Automatic | Operating mode |
| ATEX | Atmosphère explosible | Product and operation directive of European Commission for explosion protection. |
| CENELEC | Comité Européen de Normalisation Electrotechnique | Standards organization, responsible for European standardization in the field of electrical engineering. |
| CPU | Central Processing Unit | Master processor |
| CSA | Canadian Standard Association | Canadian standards organization |
| DC | Direct current | Direct current |
| DI | Digital Input | - |
| DIN | Deutsche Industrie Norm | - |
| DO | Digital Output | - |
| DTM | Device Type Manager | - |
| EDD | Electronic Device Description | - |
| Ex | Explosion protection | - |
| EMC | Electromagnetic compatibility | - |
| FDT | Field Device Tool | - |
| FF | FOUNDATION Fieldbus | Fieldbus of the Fieldbus Foundation |
| FM | Factory Mutual | American testing agency/insurance company |
| FW | Firmware | Device-specific software |
| GSD | Device master data | - |
| HART® | Highway Addressable Remote Transducer | Communication system for the development of industrial field busses. |
| IEC | International Electrotechnical Commission | International standards organization for standards in electrical engineering and electronics. |
| IP | International Protection Ingress Protection | International degrees of protection (long form as per DIN) Seepage protection (long form as used in US) |
| ISO | International Organization for Standardization | |
| LC | Liquid Crystal | Liquid crystal |
| MAN | Manual | Operating mode |

Abbreviations

H.2 Abbreviations

| Abbreviation | Long form | Meaning |
|-----------------|--|---|
| NAMUR | Standards working group for measurement and control technology in the chemicals industry | Association of users in process conductor technology |
| μC | Microcontroller | One-Chip computer system |
| NCS | Non-Contacting Sensor | Sensor for non-contacting position detection |
| NEMA | National Electrical Manufacturers Association | US standards institution National Electrical Manufacturers Association |
| NPT | National Pipe Thread Taper | Pipe threading for self-sealing threads as per ANSI B.1.20.1 |
| OPOS interface® | Open Positioner Interface | Standard interface for the connection between a positioner and a pneumatic linear or part-turn actuator |
| PA | Process Automation | Process automation |
| PDM | Process Device Manager | Siemens communication software / Engineering tool |
| PROFIBUS | Process Field Bus | Fieldbus |
| RSS feed | Rich Site Summary Feed | Shows changes in regular intervals to web sites you are subscribed to. |
| VDE | Verband der Elektrotechnik, Elektronik und Informationstechnik e. V. | Industrial and professional association |
| VDI | Verein Deutscher Ingenieure e. V. | Technical/scientific association |

H.2 Abbreviations

| Abbreviation | Full term in English | Meaning |
|--------------------|--|---|
| FIT | Failure in Time | Frequency of failure Number of faults within 10 ⁹ hours |
| HFT | Hardware Fault Tolerance | Hardware fault tolerance: Capability of a function unit to continue executing a required function in the presence of faults or deviations. |
| MooN | "M out of N" voting | Classification and description of the safety-instrumented system in terms of redundancy and the selection procedures used. A safety-instrumented system or part that consists of "N" independent channels. The channels are connected to each other in such a way that "M" channels are in each case sufficient for the device to perform the safety instrumented function. Example: Pressure measurement: 1oo2 architecture. A safety-instrumented system decides that a specified pressure limit has been exceeded if one out of two pressure sensors reaches this limit. In a 1oo1 architecture, there is only one pressure sensor. |
| MTBF | Mean Time Between Failures | Average period between two failures |
| MTTR | Mean Time To Restoration | Average period between the occurrence of a fault in a device or system and restoration of functionality |
| PFD | Probability of Dangerous Failure on Demand | Probability of dangerous failures of a safety function on demand |
| PFD _{AVG} | Average Probability of Dangerous Failure on Demand | Average probability of dangerous failures of a safety function on demand |

| Abbreviation | Full term in English | Meaning |
|--------------|----------------------------|--|
| SFF | Safe Failure Fraction | Proportion of safe failures: Proportion of failures without the potential to bring the safety-instrumented system into a dangerous or non-permissible functional status. |
| SIL | Safety Integrity Level | The international standard IEC 61508 defines four discrete Safety Integrity Levels (SIL 1 to SIL 4). Each level corresponds to a range of probability for failure of a safety function. The higher the Safety Integrity Level of the safety-instrumented system, the lower the probability that it will not execute the required safety functions. |
| SIS | Safety Instrumented System | A safety-instrumented system (SIS) executes the safety functions that are required to achieve or maintain a safe status in a system. It consists of sensors, logic unit/control system and final controlling elements. |

Glossary

Actuator

Converter that converts electric signals into mechanical or other non-electric variables.

Actuator chamber

For pneumatic actuators which consist of two pressure chambers in double-acting versions and of a pressure chamber and a spring chamber in single-acting versions.

Analog

A signal type which represents data using continuously varying, measurable and physical quantities, e.g. current or voltage. Opposite to digital. The range between 4 and 20 mA is often used to transfer analog signals.

Analog-to-digital converter

An analog-to-digital converter is an interface between the analog environment and the digitally working computers. Only then can the computers be used for measurement and control tasks.

Analog-to-digital converters convert analog input signals to digital signals. Analog measurement data is thus converted into digital information. On the other hand, a digital-to-analog converter converts digital information into analog signals.

Asset Management Solution (AMS)

Software package by Emerson Process. The AMS Device Manager, which is somewhat similar to the PDM, is the most significant part of the package.

ATEX

ATEX is the abbreviation of the French term "Atmosphère explosible". ATEX stands for the two directives of the European Community in the field of explosion protection: the ATEX product directive 2014/34/EU and the ATEX operation directive 1999/92/EC.

Auxiliary voltage

Auxiliary voltage is an electric supply or reference voltage that is required by some electric circuits in addition to the standard supply. The auxiliary voltage can, for example, be specially stabilized, have a particular level or polarity and/or other properties which are important for the correct functioning of switch components. Auxiliary voltage is used, for example, with four-wire systems.

Chamber

A largely or completely enclosed cavity in a machine or apparatus.

Conduit piping system

A piping system for the American market, wherein the electric and pneumatic lines are protected by a casing.

Configuring

See parameter assignment.

Control fitting

A valve consisting of an actuator + control valve + positioner.

Decrement

From the Latin word decrementare, decrease. Decrement is the defined amount of change when decreasing a variable gradually. IT term that refers to a step-by-step decrease in a numeric value. →Increment.

Degree of protection

The degree of protection of a device indicates the extent of protection. The extent of protection includes the safety of persons against coming in contact with live or rotating parts, and the protection of electric resources against the penetration of water, foreign bodies and dust. The degrees of protection of electric machines are indicated by an abbreviation comprising two letters and two numbers (e.g. IP55). The degree of protection is coded using the IP code. The degrees of protection are standardized in DIN EN 60529.

Device category 1

Category 1 devices must be procured such that they ensure an extremely high degree of safety. Devices in this category must ensure an extremely high degree of safety even for faults that occur rarely. Even if two faults occur in the device, it should not lead to ignition. Devices in this category are suitable for use in zone 0 or 20.

Device category 2

Category 2 devices must be procured such that they ensure a high degree of safety. Devices in this category must ensure the required degree of safety in case of frequent faults or ones that can be normally expected, e.g. defects in the device, and avoid ignition sources. Devices in this category are suitable for use in zone 1 or 21.

Device category 3

Category 3 devices must be procured such that they ensure a normal degree of safety. Devices in this category must ensure the required degree of safety in case of frequent faults or ones that can be normally expected, e.g. defects in the device, and avoid ignition sources. Devices in this category are suitable for use in zone 2 or 22.

Digital

Representation of a variable in the form of characters or numbers. The functional course of an originally changeable analog variable is simulated in predefined stages. Predefined values are assigned to these stages. Opposite to "analog".

EEPROM

EEPROM (Electrically Erasable Programmable Read-Only Memory; literally: elektrisch löschbarer, programmierbarer Nur-Lese-Speicher in German) is a non-volatile electronic memory. EEPROMs are often used when individual data bytes change over long time periods and need to be saved in a manner protected against power failure, e.g. configuration data or operating hours counters.

Electromagnetic compatibility

Definition as per the EMC law: EMC is the capability of a device to operate satisfactorily in an electromagnetic environment without itself emitting electromagnetic signals which interfere with other devices in that environment.

Ex d

"Flameproof enclosure" type of protection. When the potentially explosive mixtures enter the enclosure of a resource and an ignition source exists in the enclosure. The transfer of the explosion inside the enclosure to the surrounding space must be ruled out.

- d: flameproof enclosure

Ex ia / Ex ib / Ex ic

If potentially explosive mixtures enter the enclosure of a resource, it should not lead to ignition. Demarcation of energy and increased temperatures.

Ex n

Equipment containing energy-limiting, non-sparking contacts as well as circuits whose contacts are supplied with limited energy.

Ex t

Dust ignition protection with "t" enclosure. Dust ignition protection where the electric equipment has an enclosure providing protection against dust ingress and a measure for limiting the surface temperature.

Factory Mutual

Industrial property insurer and certification agency in the USA. FM Global is one of the largest industrial insurers in the world who are specialized in the field of technically-supported property insurance. It offers services like product research, testing and certification.

Firmware

Firmware (FW) is software that is embedded on a chip in electronic devices – in contrast to software which is saved on hard disks, CD-ROMs or other media. These days, firmware is mostly stored in a flash memory or an EEPROM. Firmware is software in the hardware, and is thus an intermediate between software and hardware. Firmware is normally model-specific. This means that it does not function on other device models and is delivered by the manufacturing company. The corresponding devices cannot function without the firmware. The firmware mostly contains elementary functions to control the device, as well as input and output routines.

Frequency shift keying

ENGLISH: Frequency shift keying (FSK)

Frequency shift keying is a simple modulation format in which digital values 0 and 1 are represented by two different frequencies.

GSD file

The file that describes the properties of a PROFIBUS DP slave or a PROFINET IO device.

The GSD file is a database file for PROFIBUS devices. The device manufacturer provides the corresponding GSD file containing the description of device properties. The information in the file can be read using Engineering Tools.

HART

HART (Highway Addressable Remote Transducer) is a standardized and widely used communication system for configuring industrial fieldbuses. This communication system enables digital communication of multiple participants (field devices) using a common data bus. HART implements the widely used 4/20 mA standard to transfer analog sensor signals. Existing cables of the old system can be used directly and both systems can be operated simultaneously. HART specifies several protocol levels in the OSI model. HART enables transfer of process and diagnostics information and control signals between field devices and the higher-level control system. Standardized parameter sets can be used for manufacturer-independent operation of all HART devices.

HART communication

HART devices use the 4 to 20 mA lines for data exchange, and communicate with each other using the HART protocol. The process enables bidirectional data exchange even in hazardous environments. With HART communication, digital data from an FSK modem is modulated to the analog 4 to 20 mA signals. As a result, additional information such as measuring and/or device data can be transmitted without influencing the analog signals. The FSK modem

required for this is installed in the field device or HART communicator. In the case of an operator station, the connection is made externally via the serial interface. A point-to-point connection is used between the field and HMI device. In this case, a HART HMI device is connected to exactly one HART field device. However, further devices can be integrated using a multiplexer.

HART communicator

For parameter assignment with the HART Communicator, the connection is made directly to the 2-wire cable. For parameter assignment with a laptop or a PC, a HART modem is connected in between.

Increment

From the Latin word incrementare, increase. Increment is the defined amount of change when increasing a variable gradually. IT term that refers to a step-by-step increase in a numeric value. →Decrement.

Initialization

Setting the most important basic parameters. Requirement for commissioning the positioner.

IP code

The abbreviation IP stands for International Protection as per DIN. In English-speaking countries, IP stands for Ingress Protection.

Microcontroller

Microcontrollers (also μ Controller, μ C, MCU) are single-chip computer systems in which almost all components such as master processor, program memory, working memory and input/output interfaces are included in a single chip.

NAMUR

Standardization association for measurement and control in chemical industries. NAMUR is an association of users of process control technology. The members are mainly companies from German-speaking countries. The association was formed in Leverkusen in 1949.

NEMA

National Electrical Manufacturers Association. NEMA is a standardization institute in the USA. NEMA was formed in 1926 with the merge of Associated Manufacturers of Electrical Supplies and the Electric Power Club.

Parameter assignment

Individual parameter settings are specifically changed to adjust the positioner as per the actuator or other requirements. Parameter assignment is carried out after the complete commissioning of the positioner.

Piezoelectric effect

Name of a physical phenomenon. Due to mechanical compression loads on a crystal, an electric potential develops on specific crystal surfaces. In a reverse case, applying an electric field to specific crystal surfaces leads to crystal deformation.

Potentially explosive atmosphere

Mixture of air, combustible gases, fluff, fibers or dusts.

Pressure chamber

The pneumatic actuators are available in single and double-acting versions. In a single-acting version, only one pressure chamber is pressurized and depressurized. The pressure developed works against a spring. In a double-acting version, two pressure chambers work against each other. Pressurizing the volume of one chamber simultaneously depressurizes the volume of the other.

Process Device Manager

PDM is a Siemens software package for configuration, parameter assignment, commissioning and maintenance of network configurations and field devices. Part of SIMATIC STEP 7. Used for configuration and diagnostics.

Protection level

- ia: Protection level. Electric equipment operating fault-free, and with existence of two countable errors.
- ib: Protection level. Electric equipment operating fault-free, and with existence of one countable error.
- ic: Protection level. Electrical equipment is not able to cause an ignition when operating fault-free.

Protocols

Protocols contain information about data formats, time sequences and error handling when exchanging data between computers.

A protocol is a convention about establishing, monitoring and terminating a connection. Different protocols are required for a data connection. Protocols can be assigned to every layer of the reference model. Transport protocols are used for the lower four layers of the reference model and higher protocols are used for control, data provision and application.

Sensor

Converter that converts mechanical or other non-electric variables into electric signals.

SIMATIC software

Programs for process automation (e.g. PCS 7, WinCC, WinAC, PDM, STEP 7).

Type 4X

according to UL 50E. This standard contains additional requirements relating to the design and performance of enclosures which are to be used indoors and outdoors.

Zone 0

Area in which potentially explosive atmospheres build up often, regularly or over long durations during the normal operation of a device.

Zone 1

Area in which potentially explosive atmospheres build up occasionally during the normal operation of a device.

Zone 2

Area in which a potentially explosive atmosphere normally never builds up or builds up only for a short while during the normal operation of a device.

Zone 20

Zone 20 is an area in which a potentially explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, over a long period, or frequently.

Zone 21

Zone 21 is an area in which a potentially explosive atmosphere in the form of a cloud of combustible dust in air can be occasionally produced during normal operation.

Zone 22

Zone 22 is an area in which a potentially explosive gaseous atmosphere in the form of a cloud of combustible dust in air never develops or develops only for a short while during normal operation.

Index

A

- Actuating pressure
 - Figure, 89
 - Position, 27, 90
- Alarm module
 - see Digital I/O Module (DIO), 82
- Amplifier, (See booster)
- Analog Input Module (AIM)
 - Figure of ribbon cable, 51
 - Installation, 72
 - Retrofitting, 295
- Analog Output Module
 - Installation, 60
- Analog Output Module (AOM), 82
 - Position, 52, 55
- Article number
 - on the nameplate, 26

B

- Basic electronics
 - See Electronics, 27, 28
- Blanking plug
 - Position, 27
- Block circuit diagram, 31
- Booster, 323
- Buttons
 - Position, 27

C

- Cable gland
 - Position, 27
 - Technical specifications, 260
- Carrier, 43
- Carrier pin, 118, 121
- Catalog
 - catalog sheets, 275
- Certificates, 19, 275
- characteristics
 - Safety, 201
- Cleaning, 204
- Commissioning
 - Automatically, 117, 122
 - Cancel, 126

- Interrupting, 117
 - Manual, 119, 124
- Compressed air, 36
- Conformity with UK directives, 20
- Connecting
 - Inductive Limit Switches (ILS), 83
 - NCS sensor, 302
 - Pressure sensor module, 79
- Connecting terminals
 - Option modules, 27
- Connection
 - Pneumatic, 89, 114
- Construction
 - Technical specifications, 259, 260
- Control system, 199
- Customer Support, (Refer to Technical support)

D

- Dead angle function, 153
- Diagnostics, 219
 - During ongoing operation, 243
 - Extended, 164
- Digital I/O Module (DIO), 82, 87
 - Installation, 59
 - Position, 51, 52, 55
- Display
 - Position, 27
- Disposal, 212
- Documentation
 - Edition, 14
- Downloads, 275
- Dynamic variables, 196

E

- Electronics
 - Graphic, 28
 - Position, 27, 52, 55
- EMC filter module
 - See Analog Input Module (AIM), 72, 87
- Exhaust air outlet
 - Position, 27
- Extended diagnostics, 164
- External position detection system
 - See Position Transmitter, 87

F

- Factory setting
 - Reset to ~, 117, 122
- Fast closing, 155
- Final controlling element, 199
- Five-point controller, 23, 30
- Freezing
 - Exhaust air outlet, 37, 198
- Friction clutch, 23
 - Position, 27, 52
 - Set, 113

G

- Gear
 - switchable, 23
- Gear latch, 48

H

- HART
 - Modem, 33
- HART module, 32
- HART variables, 196
- Hazardous area
 - Laws and directives, 19
 - Qualified personnel, 22
- History, 14
- Hotline, (Refer to Support request)

I

- I/Os
 - Technical specifications, 260
- iNCS
 - Installation, 68
- Inductive Limit Switches (ILS)
 - Connecting, 83
 - Installation, 63
 - Position, 51, 55
- Initialization
 - Automatically, 106
 - Cancel, 126
 - Interrupting, 122
- Installation
 - Analog Output Module, 60
 - Digital I/O Module (DIO), 59
 - Mechanic Limit Switches (MLS), 65, 66

- Insulating cover, 52, 68
- Internal NCS module
 - Commissioning, 116
 - Installation, 47, 68
- ly module, (See Analog Output Module (AOM))

L

- Laws and directives
 - Disassembly, 19
 - Personell, 19
- Leakage test
 - Offline, 225
- Linear actuator
 - Add-on extensions, 23
 - Automatic commissioning, 117
 - Automatic commissioning (flowchart), 107
 - Manual commissioning, 119
 - Pneumatic connection, integrated, 89
 - Single-acting, 24

M

- Maintenance, 203
- Manifold, 114
- Manometer
 - Mounting, 317
 - Technical specifications, 260
- Manuals, 275
- Material
 - Technical specifications, 259
- Mechanic Limit Switches (MLS), 105
 - Installation, 65, 66
 - Position, 51, 55
- Mechanical limit switch module
 - See Mechanic Limit Switches (MLS), 65, 105
 - See Mechanic Limit Switches (MLS), 66
- Mode of operation, 29, 31
- Modifications
 - correct usage, 21
 - improper, 21
- Module cover
 - Position, 51, 55
- Motherboard, (See Electronics)
- Mounting console
 - Dimensions, 46
- Mounting kit
 - Linear actuator, 38

N

- Nameplate
 - Position, 52, 56
- Natural gas, 264
 - Operation, 105
- NCS
 - Installation, 47
- NCS module
 - Internal, 47
- NCS sensor
 - Connecting to Analog Input Module (AIM), 302

O

- Offline leakage test, 225
- Online diagnostics, 243
- Operation
 - Natural gas, 105
- Option modules
 - Installation, 52

P

- Part-turn actuator
 - Automatic commissioning, 122
 - Automatic commissioning (flowchart), 107
 - Double-acting, 24
 - Manual commissioning, 124
 - Mounting, 43
- Pneumatic actuator, 29
- Pneumatic block
 - Position, 51, 55
 - Purging air selector, 114
 - Replacing, 208
 - see Pneumatic block, 51, 55
- Pneumatic connections, 114
- Position feedback module
 - see Analog Output Module (AOM), 55, 82
 - See Analog Output Module (AOM), 52
- Positioner
 - Replacing, 127
- Potentiometer
 - Position, 51, 55
- Pressure gauge block, 24
 - Torque, 260
- Pressure sensor module
 - Connecting, 79
- Printed circuit board, (See Electronics)

- Purging air selector, 114
 - Position, 27

Q

- Qualified personnel, 22

R

- Reading initialization parameters, 127
- Restrictor
 - Position, 27
- Return procedure, 212
- Ribbon cable
 - Figure, 51, 55

S

- Safety position, 91
- Scope of delivery, 16
- Screen
 - Cleaning of~, 204
- Sealing plug
 - Technical specifications, 320
- Service, 276
- Service and support
 - Internet, 276
- Settings, 200
- SIA module
 - See Inductive Limit Switches (ILS), 62, 83
- SIL 2, 199
- Single-channel operation, 199
- Slot initiator, (See Inductive Limit Switches (ILS))
- Sound absorber
 - Position, 27
- Special screw
 - Position, 52
- Supply air PZ, 201
- Supply pressure
 - Position, 27
- Support, 276
- Support request, 276
- System pressure, (See Supply air)

T

- Technical support, 276
 - partner, 276
 - personal contact, 276
- Test certificates, 19

Threaded adapter
 Technical specifications, 320
Tight closing, 155
Tightening torque
 Technical specifications, (Torque)
Torque, 259, 320
Transmission ratio selector, 48
 Position, 27, 51, 56
Transmitter, 199

V

Valve block, (see Pneumatic block)
Venting gauge block, 318
Version
 Technical specifications, 259

W

Warning label
 Position, 51, 55
Warranty, 18
Weight
 Technical specifications, 259
Wiring diagram
 Position, 27
Wiring diagram on module cover, 52

Y

Y1, 201