

Automation

SMARTRONIC MA

Digital Positioner
SMARTRONIC MA R1310
Electro-pneumatic 4-20mA

Type Series Booklet



Legal information/Copyright

Type Series Booklet SMARTRONIC MA
Original operating manual

KSB Aktiengesellschaft

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Automation

Digital Positioner

SMARTRONIC MA



Main applications

- Water
- Waste water
- Energy
- Industry
- Shipbuilding
- Oil and gas

Operating data

Operating data overview

Characteristic	Value
Enclosure	IP 67 to EN 60529
Electromagnetic compatibility	In conformity with the European EMC Directive 2004/108/EC and NF EN 61000-6-2/NF EN 61000-6-4
Operating temperature	-20 °C to +80 °C
Vibrations	To IEC 68-2-6 Test Fc
Compressed air purity class	ISO 8573-1 Class 4

Design details

- SMARTRONIC MA is a digital electro-pneumatic positioner. Power is supplied via the 4-20 mA signal.
- Used for the control of:
 - Quarter-turn actuators from the ACTAIR and DYNACTAIR type series
 - Quarter-turn actuators with standardised VDI/VDE 3845 interface
 - Linear actuators to NAMUR

- SMARTRONIC MA features a LEXAN housing (polycarbonate with 20% glass fibre) accommodating the following 3 components:
 - Electrical connection
 - Printed circuit board
 - Poppet valve with piezoelectric pilot valve (compressed air supply)
- The compressed air supply is connected via the base:
 - Direct connection to ACTAIR and DYNACTAIR
 - Connection via external piping for quarter-turn actuators with standardised VDI/VDE 3845 interface and for linear actuators to NAMUR
- Position signalling via limit switches or proximity sensors along the entire valve travel.
- The actuating times for open/close operations are set via the easily accessible air flow reducer.
- Communication using the HART protocol

Variants

- Actual-position feedback via 4-20 mA signal
- Position signalling via proximity sensors
- SMARTRONIC AS-i, type series booklet No. 8520.806

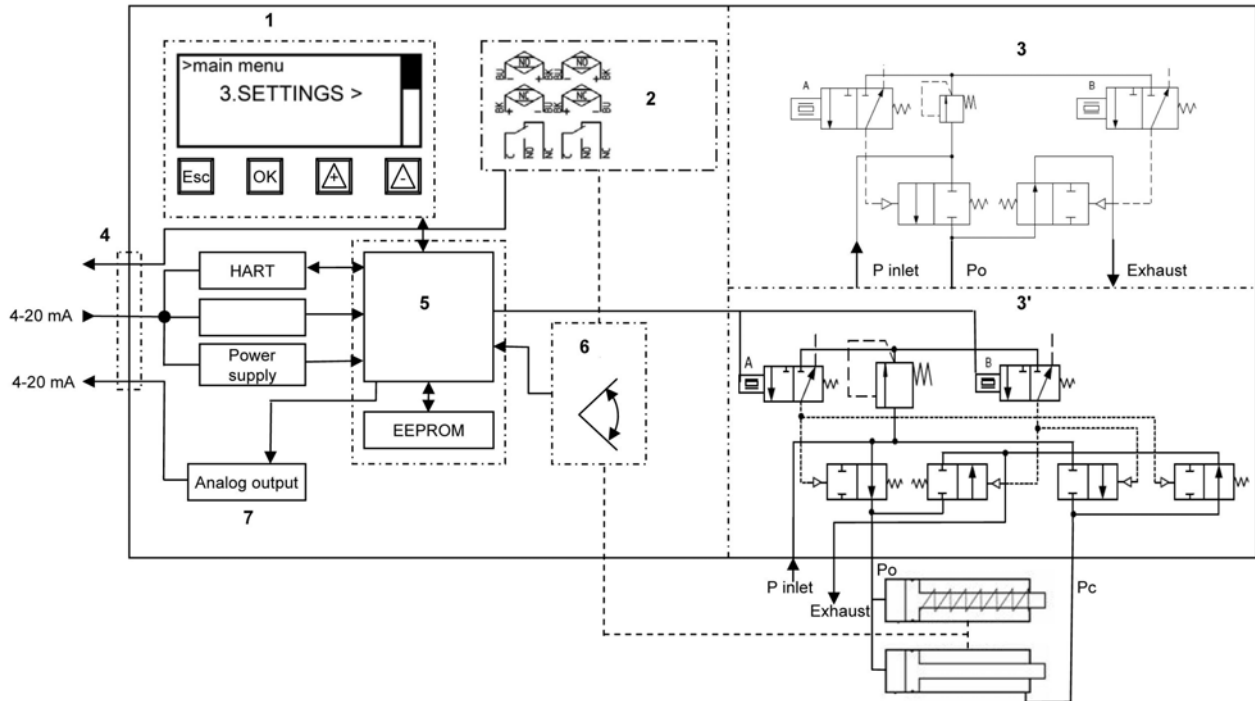
Product benefits

- Quick, straightforward installation and commissioning thanks to auto-calibration which allows optimal positioner adjustment. Can be quickly adapted to all types of actuators.
- Intuitive, user-friendly interface for local control and configuration via display and buttons
- Negligible consumption irrespective of position
- Position indicator under sight glass for remote indication
- Fully enclosed design avoids protruding, moving components
- The adjustable cams are reliable and facilitate the setting of the open/closed positions.
- Direct mounting to ACTAIR and DYNACTAIR
 - No installation components required (bracket and socket)
 - The compressed air is directly supplied via the VDI/VDE interface.
- KSB supplies a complete unit consisting of valve, actuator and positioner, fully tested for the relevant application.
- SMARTRONIC MA is HART compatible.
- The Device Type Manager (DTM) of SMARTRONIC MA and the DTMs employed for KSB pump automation have the same interface ("look and feel").
- The angle sensor adjusts itself automatically to the actuator stroke.

Related documents

Other applicable documents

Document	Reference No.
Operating manual	8520.8041

Technical data
Functional schematic


- | | |
|--|---|
| <ul style="list-style-type: none"> 1 - User interface 2 - Limit switches or proximity sensors 3 - Electro-pneumatic functional schematic for single-acting actuators 3' - Electro-pneumatic functional schematic for double-acting actuators | <ul style="list-style-type: none"> 4 - Terminal strip 5 - Micro-controller and printed circuit board 6 - Angle sensor 7 - Actual-position feedback via 4-20 mA signal |
|--|---|

SMARTRONIC MA moves the valve into the required position in accordance with an analog 4-20 mA setpoint signal.

Control board

- The positioner is of the sequential digital type.
- The actuator is controlled by means of an ON/OFF poppet valve with 3 positions.
- SMARTRONIC MA is supplied with power via the 4-20 mA control signal only (2-wire system).
- In the event of a power supply failure, the valve moves into the fail-safe position which is configured when ordering the SMARTRONIC MA positioner.

Pneumatic poppet valve with piezoelectric pilot valve

- The piezoelectric pilot valves are controlled via the printed circuit board which responds as soon as a difference between the actual position and the setpoint is detected (signal from angle sensor).
- The piezoelectric pilot valves convert this command into a pneumatic signal and ensure the position is adopted quickly and reliably.
- This technology ensures an extremely long service life.

- The linear or rotational movement of the actuator is detected by the angle sensor.

User interface

The user interface features a graphical display with a user-friendly, intuitive drop-down menu and 4 buttons.

It allows the following functions:

- Switching to automatic or manual mode
- Adjusting the valve position along the entire valve travel (manual mode)
- Launching auto-calibration
- Manually adjusting the dead band and gain
- Configuring the split range mode
- Configuring the closing direction of the valve
- Reading diagnostic information
- Continuously reading the valve position
- Displaying the HART data

Technical specification

Housing	
Material	LEXAN (polycarbonate with 20% glass fibre)
Position indicator	Visual position indicator on the cover
Electrical connection	2 M20 ports for cable gland Connection to screw-type terminal strip (max. 1.5 mm ² cable)
Angle of rotation	-5° to 95°
Weight	1.5 kg

Compressed air supply	
Compressed air supply	1/4" gas port, marked "P" with filter fitted in the base
Exhaust connection	1/4" gas port, marked "E", fitted with silencer or exhaust system connection
Operating pressure	2 to 7 bar
Filtration	ISO 8573-1 Class 4 (< 15 µm)
Dew point	ISO 8573-1 Class 4 (pressure dew point temperature < 3 °C, and in all cases a temperature which is 5 °C below the ambient temperature)
Lubrication	ISO 8573-1 Class 5 (< 30 mg/m ³)
Max. flow rate	260 NI/min at 25 °C
Consumption in "at rest" position	< 0.4 NI/min at 25 °C

Electronic system	
Power supply	Via 4-20 mA control signal
Power consumption	From 40 mW at 4 mA to 200 mW at 20 mA
Control signal	4-20 mA
Minimum operating current	3.8 mA
Required load voltage	10 V DC
Polarity inversion protection	Yes (up to 20 V DC)
Overvoltage protection	Yes
Load resistance	500 to 515 Ohm at 20 mA
Limit of static destruction	40 mA

Positioner	
Hysteresis and dead band	< ± 1% < ± 1%
Linearity	Yes
Repeatability	< ± 0.5%
Law of variation	Linear
Offset adjustment (zero) and full scale adjustment	Manually adjustable via user interface (display + buttons)
Direct (standard) or indirect direction of action – dead band and gains are automatically adjusted – auto-calibration via buttons	

Actual-position feedback (optional)	
Output	4-20 mA, 2-wire system with galvanic/electronic isolation
Retrieval period	0.4 seconds
Resolution	CAN 16 bits
Linearity	< ± 0.01%
Temperature effect, from Tmin to Tmax	< ± 0.05% -10 °C

Open/closed position signalling (optional)	
Adjustment via cams along the entire travel	
Inductive proximity sensors, mechanical limit switches or inductive proximity sensors to ATEX	

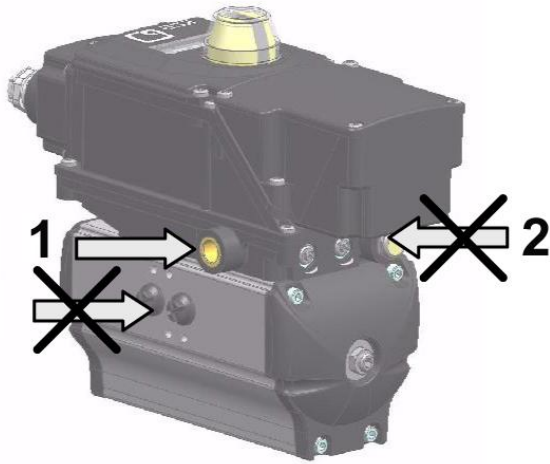
Compressed air supply

The compressed air is connected to the SMARTRONIC MA.

The pneumatic directional control valve requires filtered air to ISO 8573-1, Class 4.

A sintered bronze filter is fitted in the housing's inlet port for safety reasons to prevent clogging and damage to the pneumatic directional control valve.

The operating pressure ranges from 2 to 7 bar.



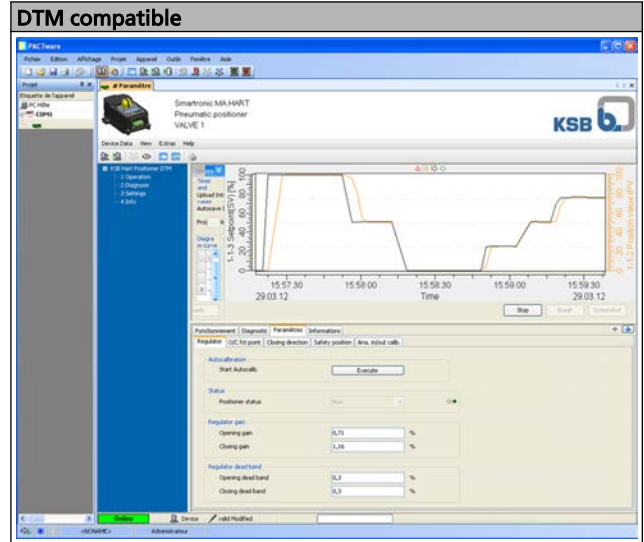
1 - Compressed air supply

2 - Exhaust

Compressed air supply: 1/4" gas port, marked "P"

Exhaust: 1/4" gas port, marked "E", with silencer or exhaust system connection

To prevent any premature mechanical component wear, especially of actuator components, the use of lubricated air (max. 10 mg/m3) is recommended.



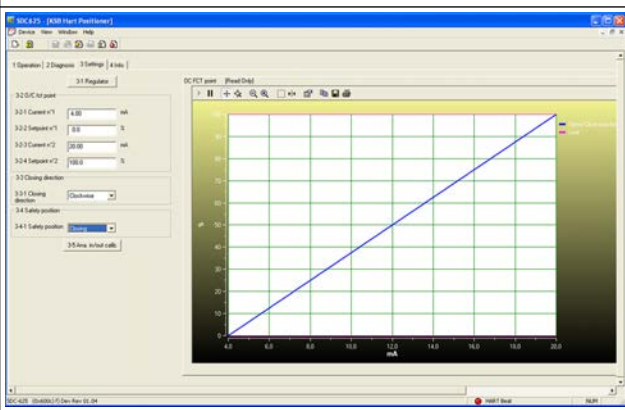
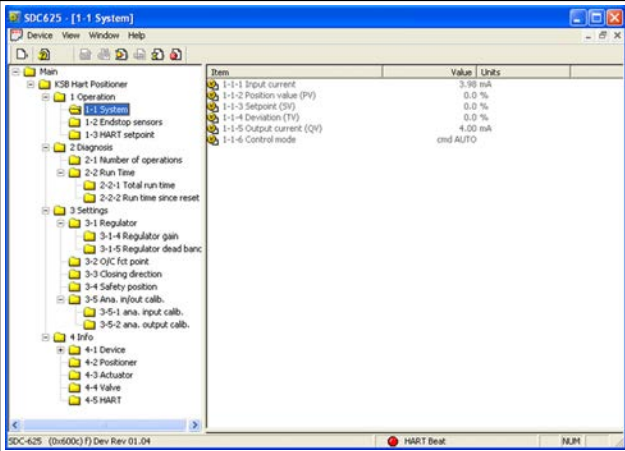
Adjusting the stroke depending on the setpoint signal

The operating staff can define two values for the setpoint current: I min (mA) and I max (mA); the values are assigned position setpoints P1 and P2 respectively.

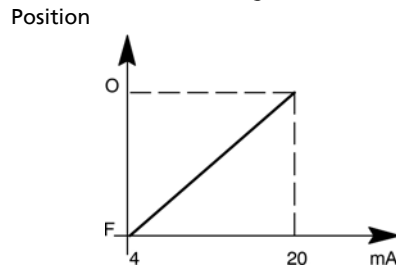
The positioner describes a linear movement between these two points.

HART protocol

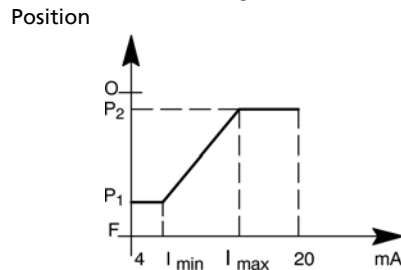
DD/EDD compatible
(.fm6, .fm8, .imf, .imp, .sym)



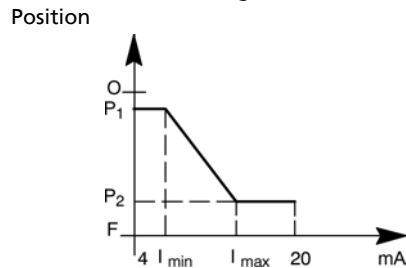
Standard configuration



Manual configuration - Direct direction of action



Manual configuration - Indirect direction of action



O: Open

F: Closed

This allows the definition of the positioner's direct and indirect direction of action and operation in the split range mode.

Fail-safe position

The SMARTRONIC MA is configured to allow the valve to move into a fail-safe position in the event of a 4-20 mA signal failure or if the electric current falls below 3.6 mA. Possible fail-safe positions: Fail Open or Fail Close

Option: proximity sensors

The printed circuit board of the SMARTRONIC MA positioner is fitted with:

- 2 limit switches (standard)
- 2 inductive proximity sensors (optional)

The limit positions can be adjusted via the cams for the entire stroke.

Mechanical limit switches: technical data

Mechanical limit switches, Crouzet			
Supplier:	Crouzet		
Material:	Housing	Glass-fibre reinforced thermoplastic polyester	
	Button	Glass-fibre reinforced polyamide UL 94 VO	
	Switching contact	Silver nickel	
Switching capacity:	Current (Ohmic resistance): 6 A Breaking capacity to IEC 947.5.1		
Life expectancy:	Electrical	At I = 5 A At I = 1 A At I = 0.2 A	10 ⁵ operating cycles 10 ⁶ operating cycles 10 ⁷ operating cycles
	Mechanical	3 x 10 ⁷ operating cycles	

Max. permissible current in A	Alternating current			
	220 V	127 V	48 V	24 V
Control of resistive loads and solid state loads with isolation by optocouplers	5	5	5	5
Control of static loads with transformer isolation	2.5	3	4	4
Control of electromagnetic loads	2.5	3	4	4

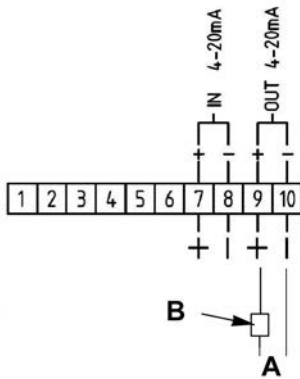
Max. permissible current in A	Direct current		
	115 V	48 V	24 V
Control of resistive loads and solid state loads with isolation by optocouplers	0.6	2	5
Control of static loads with transformer isolation	0.3	1	3
Control of electromagnetic loads	0.04	0.15	0.6

Proximity sensors: technical data

Proximity sensors, IFM XC035	
Supplier:	IFM
Housing material:	Polybutylene therephthalate
Power supply:	5 to 36 V DC
Max. current rating:	
- Peak:	200 mA
- Continuous:	200 mA
Min. current rating:	4 mA
Max. voltage drop:	<= 4.6 V
Leakage current:	<= 0.8 mA
Max. switching frequency:	2 kHz
Operating status indication:	LED

Option: actual-position feedback

SMARTRONIC MA can optionally be equipped with an additional printed circuit board for actual-position feedback via a 4-20 mA signal.

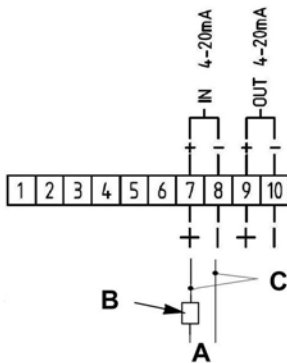


- A - Power supply 15 to 24 V DC
- B - Max. load resistance 1000 Ohm

Power supply	15 to 24 V DC
Output	4-20 mA, 2-wire system with galvanic/electronic isolation
Load resistance	0 - 1000 Ohm
Hysteresis and dead band	< ± 0.1 % of full scale
Linearity	< ± 0.1 % of full scale
Temperature effect, from T °C min. to T °C max.	< ± 0.05 % of full scale

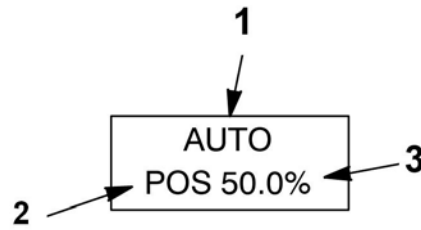
Connection to HART communicator

The positioner's printed circuit board can communicate with a HART communicator. For this purpose, it is sufficient to connect the HART modem or the input of the field communicator 375 or 475 in parallel to the 4-20 mA input of the positioner.



- A - Power supply 4 - 20 mA
- B - Max. load resistance 250 Ohm
- C - HART communicator (modem, field communicator 375 ...)

Display



- 1 Operating mode:
- 2 Parameter:
- 3 Parameter value

AUTO: Automatic positioning (4-20 mA setpoint)
MANU: Manual positioning (local control)
HART: Positioning via HART protocol (HART setpoint)
NO CALIB: Instrument is not calibrated
SSR: Absolute angle sensor value (if NO CALIB)

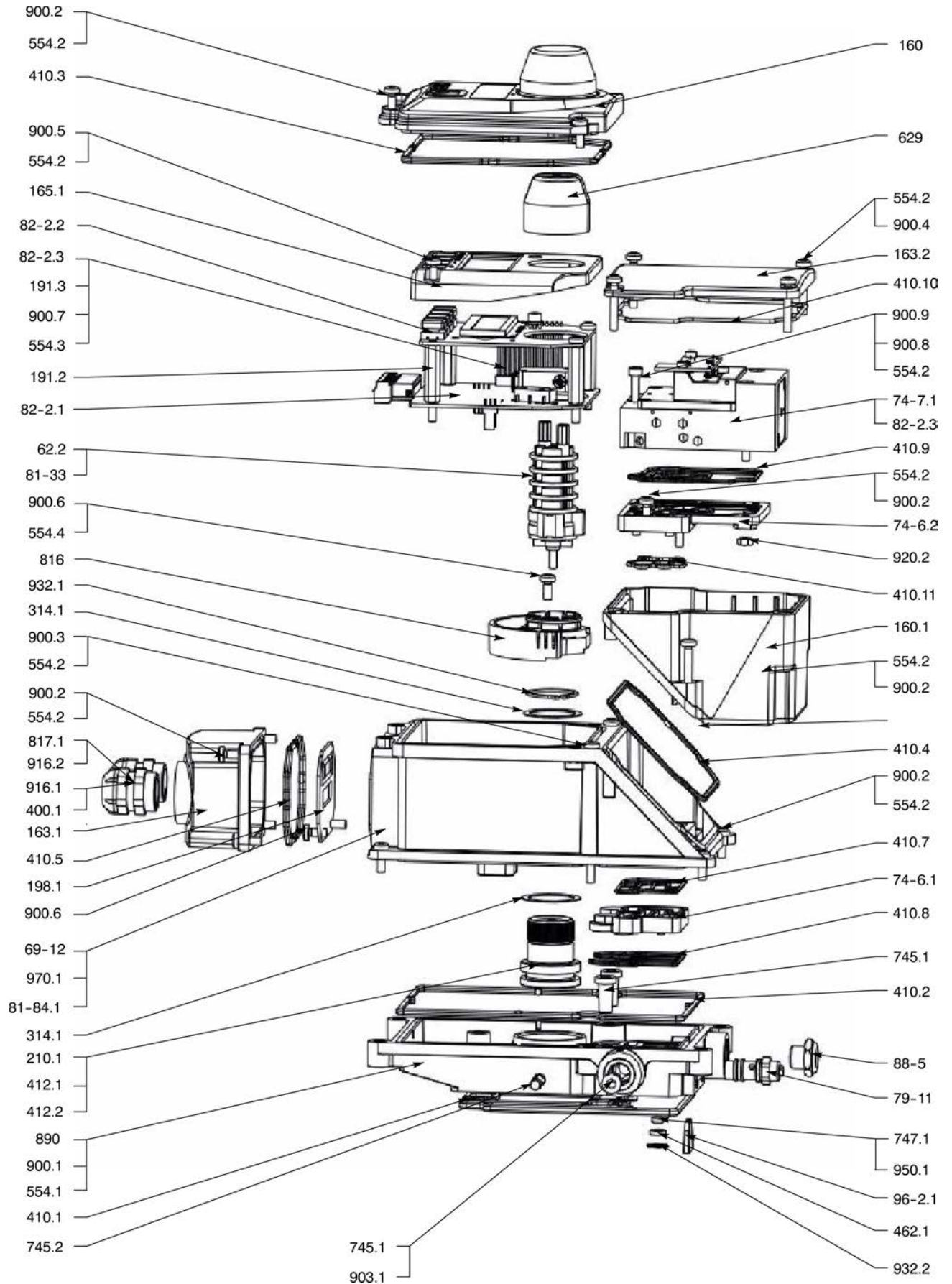
The display provides information about the operating mode and the valve position.

If the instrument has never been calibrated, the angle sensor value is displayed (SSR).

Text display may be adjusted according to the positioner's installation position.

Materials

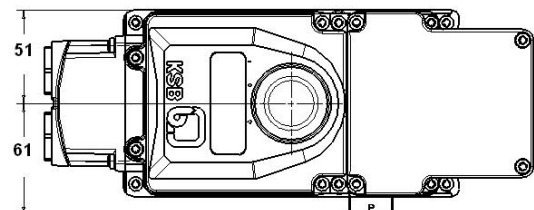
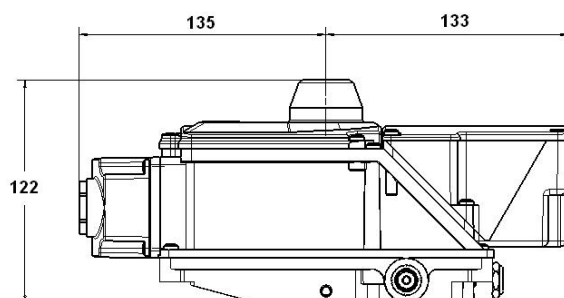
Exploded view



List of components

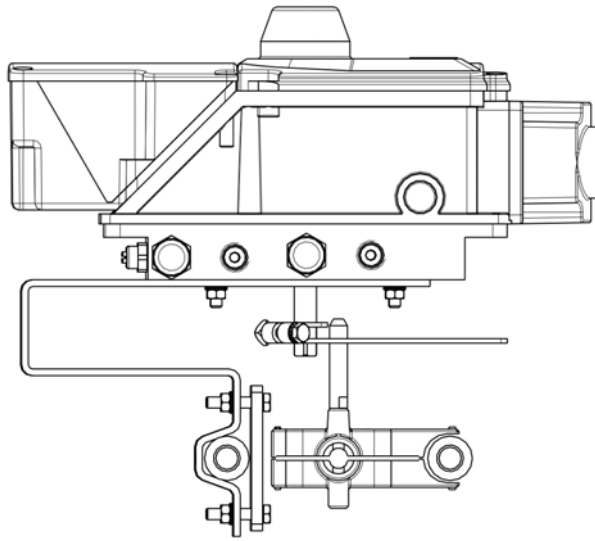
Part No.	Description	Materials
69-12	Housing	LEXAN (polycarbonate with 20% glass fibre)
160	Cover	LEXAN (polycarbonate with 20% glass fibre)
160.1	Cover (directional control valve)	LEXAN (polycarbonate with 20% glass fibre)
163.1	Housing (directional control valve)	LEXAN (polycarbonate with 20% glass fibre)
163.2	Cover	Polycarbonate
165.1	Cover	
191.2	Support	Nickel-plated brass
191.3	Crossbar	
198.1	Connection plate	
210.1	Actuating stem	Polycarbonate SM60/0
314.1	Stop disc	Stainless steel 304L
400.1	Gasket	Neoprene
410.1	Profile joint	NBR70
410.2	Profile joint	NBR70
410.3	Profile joint	NBR70
410.4	Profile joint	NBR70
410.5	Profile joint	NBR70
410.7	Profile joint	NBR70
410.8	Profile joint	NBR70
410.9	Profile joint	NBR70
410.10	Profile joint	NBR70
410.11	Profile joint	NBR70
412.1	O-ring	NBR70
412.2	O-ring	NBR70
462.1	Spring washer	
554.1	Washer	Stainless steel
554.2	Washer	Stainless steel
554.3	Washer, flat	Steel
554.4	Serrated washer	Steel
629	Visual indicator assembly	
62-2	Adjustable cams assembly	

Part No.	Description	Materials
745.1	Filter	
745.2	Filter	Bronze
74-6.1	Distribution plate	
74-6.2	Distribution plate	
74-7.1	Directional control valve	
747.1	Profile joint (valve)	
79-11	Flow reducer	
816	Angle sensor assembly	
817.1	Cable gland	
81-33	Detection plate	Steel
81-84.1	Circuit diagram	
82-2.1	Printed circuit board	
82-2.2	Printed circuit board	
82-2.3	Actual-position feedback	
88-5	Silencer	Bronze
890	Base	LEXAN (polycarbonate with 20% glass fibre)
900.1	Screw	A2-70
900.2	Socket head cap screw	A2-70
900.3	Socket head cap screw	A2-70
900.4	Socket head cap screw	A2-70
900.5	Socket head cap screw	A2-70
900.6	Sheet metal screw	A2-80
900.7	Hexagon socket head cap screw	A2-80
900.8	Socket head cap screw	A2-70
900.9	Socket head cap screw	A2-70
903.1	Plug	
916.1	Screw plug	
916.2	Protective cap	Rubber
920.2	Hexagon nut	A2-70
932.1	Circlip	Steel
932.2	Reinforced circlip	Steel
950.1	Closing spring	
96-2.1	Locking plate	Polycarbonate SM60/0
970.1	Plate	Adhesive polyester

Dimensions


Variants

Mounting to linear actuator NAMUR



Base for actuators with VDI/VDE 3845 interface, not applicable to ACTAIR and DYNACTAIR



Purchase order data

SMARTRONIC MA coding

SMARTRONIC MA	R001310	.	0	0	0	1	.	.	.	B	.	.	2	.	0	6	0	0
Sensors																		
Limit switch on printed circuit board		1	0	0	0													
Proximity sensor on printed circuit board		2	0	0	0													
Position signalling																		
1/Open and 1/Closed						1												
Actual-position feedback																		
None									0									
Actual-position feedback via passive 4-20 mA signal (2 wires)									4									
Electrical output																		
None										0								
2 cable glands, plastic, M20 IP67 (diameter: 6 to 12)										1								
2 cable glands, metal, M20 IP67 (diameter: 6 to 12)										2								
Directional control valve																		
4/3 double, centre closed - Position (POS)											S							
3/3 single, centre closed - Position (POS)											T							
Power supply, directional control valve																		
24 V DC (Piezo)												B						

SMARTRONIC MA	R001310	.	0	0	0	1	.	.	.	B	.	.	2	.	0	6	0	0
Actuator																		
ACTAIR 3 to 200, stop position: Closed										S			2					
ACTAIR 3 to 200, stop position: Open										S			3					
ACTAIR 400 to 1600										S			4					
DYNACTAIR 1.5 to 25, Fail Close in the event of air supply failure										T			6					
DYNACTAIR 1.5 to 25, Fail Open in the event of air supply failure										T			7					
DYNACTAIR 50 to 100, Fail Close in the event of air supply failure										T			8					
DYNACTAIR 50 to 100, Fail Open in the event of air supply failure										T			9					
DYNACTAIR 200 to 800, Fail Close in the event of air supply failure										T			J					
DYNACTAIR 200 to 800, Fail Open in the event of air supply failure										T			K					
Pneumatic quarter-turn actuator, double-acting										S			W					
Pneumatic quarter-turn actuator, single-acting										T			X					
Pneumatic linear actuator, double-acting										S			Y					
Pneumatic linear actuator, single-acting										T			Z					
Fail-safe position																		
Fail Close in the event of power supply failure													A					
Fail Open in the event of power supply failure													B					
SMARTRONIC function																		
Intelligent positioner													2					
Field bus																		
Hart														D				
Heating resistor																		
None															0			
Indicator																		
3D sight glass																6		
Configuration																		
None																	0	
Diagnosis																		
None																		0

