

SRD998 Intelligent Positioner with HART Communication



The intelligent positioner SRD998 is designed to operate pneumatic valve actuators and can be operated from control systems (e.g. the Foxboro I/A Series System), controllers or PC-based configuration- and operation tools such as the FDT/DTMs VALcare™. The positioner is available with HART 7 communication protocol. The extra-large multi-lingual full text graphical-LCD, in conjunction with the rotary selector, allows a comfortable and easy local configuration and operation. For installations in contact with explosive atmospheres, certificates are available.

MAIN FEATURES

Intelligent

- Auto-start with self-calibration
- Self diagnostics, status- and diagnostic messages
- Easy local operation with the rotary selector
- Extra-large Multi-Lingual full text graphical LCD
- VALcare™ DTM with comprehensive data for fast configuration
- With HART 7 communication
- Stroke 8 to 260 mm (0.3 to 10.2 in) with standard lever; larger stroke with special lever
- Angle range up to 95 ° angle
- Mounting onto any linear or rotary actuator
- Supply air pressure up to 6 bar (90 psig)
- Single or double-acting
- Protection class IP 66 and NEMA 4X
- Explosion protection: Intrinsic Safety according to ATEX / IECEx, INMETRO, NEPSI, ...

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- Electrical classification9

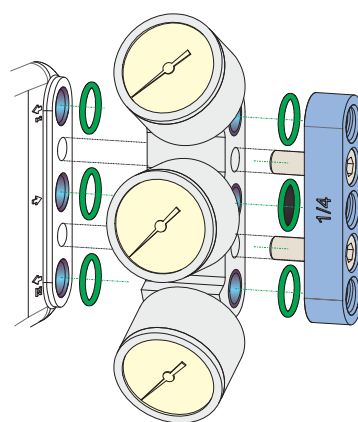
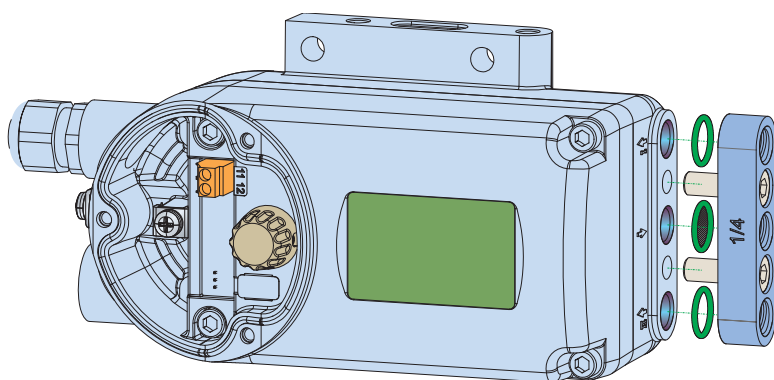
Extended technical data for basic devices:

- With communication HART 10

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DESIGN

Supply

Supply air pressure 1.4 to 6 bar (20 to 87 psig)

Output to actuator 0 to ~100 % of supply air pressure (up to 5.5 bar at 6 bar supply air pressure)

Air supply according to ISO 8573-1

- Solid particle size and density class 2
- Oil rate class 3
- Pressure dew point 10 K under ambient temperature

The use of **filter regulator** for air supply of positioner is strongly recommended. It reduces the air pressure to actuator's maximum pressure and keeps it constant.

For standard pneumatic flow we recommend the **FRS02** (Aluminum) or **FRS03** (SS) filter regulator.

Travel range

Stroke range 8 to 260 mm (0.3 to 10.2 in) with standard feedback levers; special levers on request

Rotation angle range up to 95 °angle without mechanical stop

Response characteristic ^{1) 2)}

Sensitivity < 0.1 % of travel span Non-linearity (terminal

based adjustment) < 0.6 % of travel span

Hysteresis < 0.3 % of travel span

Supply air dependence < 0.1 % / 1 bar (15 psi)

Temperature effect < 0.3 % / 10 K

Mechanical vibration effect acc. IEC 60068-2-6 (2007) for 10 to 500 Hz up to 2 g. .

For Pneumatcs B0S < 0.25% up to 80 Hz and 1 g

< 0.25% up to 70 Hz and 2 g

For Pneumatcs C0S < 0.25% up to 400 Hz and 1 g

< 0.25% up to 70 Hz and 2 g

In case of high vibrations we recommend using remote mounting solution.

Pneumatic Performance - Air flow

\ Air flow at Air Input/output :	1.4 bar	3 bar	6 bar			
Pneumatic Code B0S (single acting - Standard Flow)						
to pressurize actuator	4000	7000	14000			NI/h
to vent actuator	2700	5000	10000			NI/h
Pneumatic Code C0S (double acting - Standard Flow)						
to pressurize actuator	3500	5000	10000			NI/h
to vent actuator	2500	3750	7500			NI/h

Pneumatic Performance - Air consumption ³⁾ [NI/h]

Air consumption at steady state:		1.4 bar	3 bar	6 bar			
Pneumatic Code:	Input signal						
B0S (single acting - Standard Flow)	0 %	<100	<100	<100			NI/h
B0S (single acting - Standard Flow)	100 %	175	250	400			
C0S (double acting - Standard Flow)	0 %	175	250	400			NI/h
C0S (double acting - Standard Flow)	50 %	215	335	570			NI/h
C0S (double acting - Standard Flow)	100 %	175	250	400			NI/h

1) Data measured according to VDI/VDE 2177 and IEC 61514-2

2) With 90° angle, rotary actuator

3) Measured according ANSI / ISA-75.13.01-2013

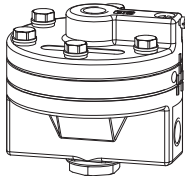
BOOSTERS for increased air flow

Volume Booster Series (to order as accessory) For large actuators or to reduce action time, a volume booster may be necessary.

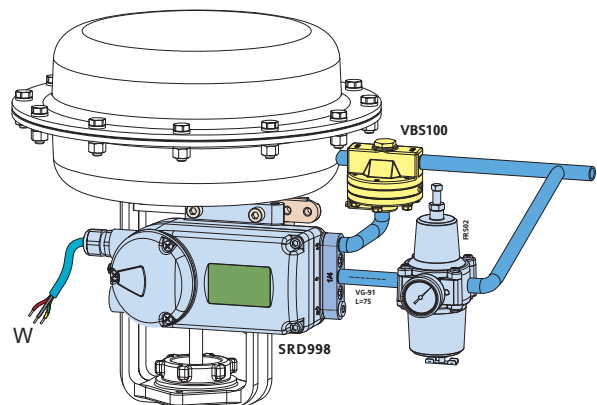
VBS100 / VBS110

Volume boosters with Cv1 and pneumatic connection 1/4", for remote mounting

VBS100 in Aluminum, VBS110 in Stainless Steel 316



Examples for mounting

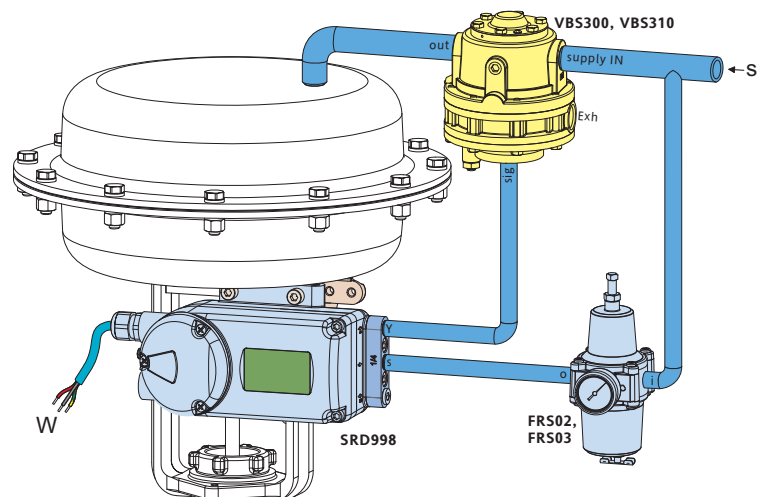
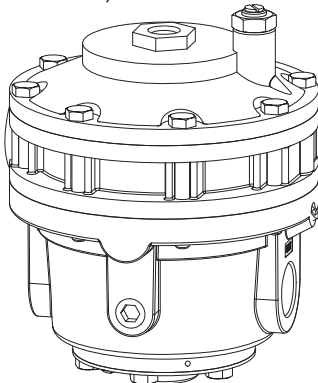


For more information please consult PSS EVE0601.

VBS300 / VBS310

Volume boosters with Cv 7 and pneumatic connection 1", for remote mounting

VBS300 in Aluminum, VBS310 in Stainless Steel 316



For more information please consult PSS EVE0603.

FUNCTIONAL SPECIFICATIONS

Features

Automatic start-up (Autostart functionality)
Automatic determination of the mechanical end positions of the valve (initial value and final value), IP motor parameters, direction of action of the spring and control parameters. The control parameters are optimized dynamically during this routine.
This procedure makes a perfect adjustment and optimization to the actuator possible without additional manual settings! Several autostart modes are available (details see on next pages).

Operation and Configuration

The local LCD enable a fast and easy configuration as well as clear diagnostic messages.

Local..... with local rotary selector
Display..... multi-lingual graphic LCD

The positioner contains following menu languages:

- English • German • French • Chinese
- Portuguese • Spanish ...

Manual local and remote settings:

Actuator mode	linear or rotary actuator
Linear valve	left or right mounted
Rotary actuator	opening clockwise or counter-clockwise
Valve characteristic	linear, equal percentage, invers-equal percentage or custom (22 points)
Valve action	opens or closes with increasing setpoint
Split range	free upper and lower values
Travel limits	free upper and lower values
Cutoffs	free upper and lower values
Stroke range.....	configurable
Temperature unit.....	configurable (°C or °F)
Autostart.....	- Endpoints
	- Standard Autostart
	- Enhanced Autostart
	- Smooth response
	- Fast response
Control parameters	Determined during Autostart.
Working range	freely adjustable (for indication on LCD)
Manual adjustment of	P-gain, I-time, D-time, T63-time, and dead band
Manual operation.....	Manual input of setpoint to drive the valve in steps of 12.5 % or 1 %
Pneumatic test	Function to test the pneumatic output
LCD orientation	standard, and upside down

Software supported configurations:

- By means of Hand Held Terminal (HART)
- PC by means of VALcare DTM Software
- I/A Series System, Foxboro Evo and other DCSs

Failure handling

In case of Single Acting, Safety position at

- Air supply failure pressure y1 = zero
- Electric power failure pressure y1 = zero
- Failure of electronics pressure y1 = zero

In case of Double Acting or spool valve amplifier, safety position at

- Air supply failure..... pressure y1 = zero;
y2 = zero
- Electric power failure pressure y1 = zero;
y2 = full air supply pressure
- Failure of electronics pressure y1 = zero;
y2 = full air supply pressure

PHYSICAL SPECIFICATIONS (common data for all versions)

Mounting

Attachment to stroke actuators

- for casting yoke
acc. to IEC 534-6 (NAMUR) with attachment kit EBZG-H
or -H1
- for pillar yoke
acc. to IEC 534-6 (NAMUR) with attachment kit EBZG-K
or -K1

Stroke range with feedback lever:

- standard (EBZG-A) 8 to 70 mm / 0.31 to 2.76 in
 - extended (EBZG-B) 60 to 120 mm / 2.36 to 4.72 in
 - extended (EBZG-A1) 110 to 260 mm / 4.33 to 10.24 in
- Larger stroke ranges can be realized with special levers.

Attachment to rotary actuators

acc. to VDI/VDE 3845

- with attachment kit EBZG-R
- Further attachment kits see Model Codes page 15/16
- Mounting orientation see attachment dimensions starting from page 17

Materials

- Housing and covers Aluminum Alloy No. 230
(GD-ALSi12) Polyester Powder coated
- Sealings between covers silicone elastomer and
silicone core with Ag/Cu particles
- LCD Window Polycarbonate, U.V.
stabilized
- External Screws Stainless Steel V2A 1.4301
- Motherboard Coated with protective resin
- All moving parts of feedback
system (e.g. shaft) 1.4306 / 1.4571 / 1.4104
- Attachment kits V4A 1.4401 or
(depending upon version) Aluminum Alloy No. 230
(GD-ALSi12) finished with DD varnish
- Mounting bracket Aluminum Alloy No. 230
(GD-ALSi12)
- Pneumatic diaphragms VMQ, PVMQ (Silicone
elastomer, suitable for use in the paint industry)
(depending upon version)

Weight

- With pneumatic B0S approx. 2.1 kg (4.7 lbs)
- C0S approx. 2.3 kg (5.1 lbs)

Pneumatic connection

- NAMUR mounting G 1/4 or 1/4-18 NPT
via manifold

Electrical Connection

- Line entry 1 cable gland M20 x1.5,
1/2-14 NPT with Adapter AD-)
- Cable diameter 6 to 12 mm (0.24 to 0.47 in)
- Screw terminals 2 terminals for input
- Wire cross section 0.3 to 2.5 mm² (AWG 22-14)
max torque 0.6 Nm

Ambient conditions

- Operating conditions acc. to IEC 654-1
- The device can be operated at a class Dx location.
- Ambient temperature
- Operation ¹⁾ -40 to 85 °C (-40 to 185 °F)
- Transport and storage -40 to 85 °C (-40 to 185 °F)
- If the device is exposed to sunlight and the temperature may rise
above 80 °C / 176 °F, we recommend a sun shade.
- Storage conditions
- acc. to IEC 60721-3-1 1K5; 1B1; 1C2; 1S3; 1M2
- Indicators
- LCD (visible) ²⁾ -25 to 70 °C (-13 to 158 °F)
- Relative humidity up to 100 %
- Protection class
- acc. to IEC 60529 IP 66
- acc. to NEMA Type 4X

Electromagnetic compatibility EMC

- Operating conditions industrial environment
- Immunity according to
- EN 61326 fulfilled
- IEC 61326 fulfilled
- EN 61000-6-2 fulfilled
- Emission according to
- EN 61326
- Class A and Class B fulfilled
- EN 61000-6-4 fulfilled
- EN 55011 Group 1,
Class A and Class B fulfilled
- NAMUR recommendation
- EMV NE21 fulfilled

SAFETY REQUIREMENTS

CE label

- Electromagnetic
- Compatibility 2014 / 30 / EC
- Low-voltage regulation not applicable
- See also Declaration of Conformity.

Safety

- According to EN 61010-1
- (or IEC 1010-1) Safety class III
Overvoltage Category I
- External fuses Limitation of power supplies
for fire protection must be observed acc. to
EN 61010-1, appendix F (or IEC 1010-1).

1) Details see Certificates of Conformity.

2) Below -20 °C the LCD reacts only slowly;
above +70 °C the background becomes dark

3) Under service as directed

Electrical classification ^{1) 2)}

See Certificates of Conformity EX EVE0108 A

Intrinsically Safe according to ATEX / IEC Ex

Code A1, A2, or A3

A1 = II 2 G Ex ia IIC T4/T6 Gb / II 1 D Ex ia III C T100 °C Da
or

A2 = II 2 G Ex ib IIC T4/T6 Gb / II 2 D Ex ib III C T100 °C Db
or

A3 = II 3 G Ex ic IIC T4/T6 Gc / II 3 D Ex ic III C T100 °C Dc

For use in hazardous areas in certified safe circuits with the following maximum values:

Pi	Ui	Ii	T4	T6
900 mW	30 V	130 mA	−40°C to 80°C	
660 mW	28.1 V	130 mA	−40°C to 80°C	−40°C to 44°C
630 mW	25.7 V	130 mA	−40°C to 80°C	−40°C to 46°C
590 mW	25.3 V	130 mA	−40°C to 80°C	−40°C to 48°C
510 mW	26 V	130 mA	−40°C to 80°C	−40°C to 52°C

Li = < 10 µH

Ci = < 2.5 nF

IP degree acc. to IEC 60529..IP 66

Other electrical certifications in progress.

1) With appropriate order only

2) National requirements must be observed

SRD998 with HART communication**SRD998-Hxxxx**

Signal Input Two wire system
 Reverse polarity protection. standard feature
 Signal range 4 to 20 mA
 Operating range. 3.6 to 21.5 mA
 Input voltage DC 12...36 V ¹⁾ (unloaded)
 Load 420 Ohms, 8.4 V at 20 mA
 Communication signal..... HART 7, 1200 Baud, FSK
 (Frequency Shift Key)
 modulated on 4 to 20 mA
 0.5 Vpp at 1 kOhm load

Input impedance Zi Z = 320 Ohms
 for ac voltage 0.5 to 10 kHz with < 3 dB non-linearity
 Cable capacity and inductance see HART standard
 specifications (e.g. C < 100 nF).

Impedance of other devices at the input (parallel or
 serial) must be within HART spec.

Applications without communication require not to exceed
 input capacitance parallel to the input not higher than 5 µF.

Start-up time..... approx. 3 sec

Interruption time without power down . . . typ. 8 ms ²⁾

1) On request we can specify higher voltage limits

2) Worst case conditions 4-20 mA, i/p-output with max. current

Configuration

The SRD998 can be configured via HART by any host
 system whatever is a PC with a HART Modem, Hand
 Held Terminal or a DCS.

LOCAL (by means of rotary selector and LCD display)
 See page 6

DTM (Device Type Manager)

We are a leading company in term of FDT-DTM
 technology

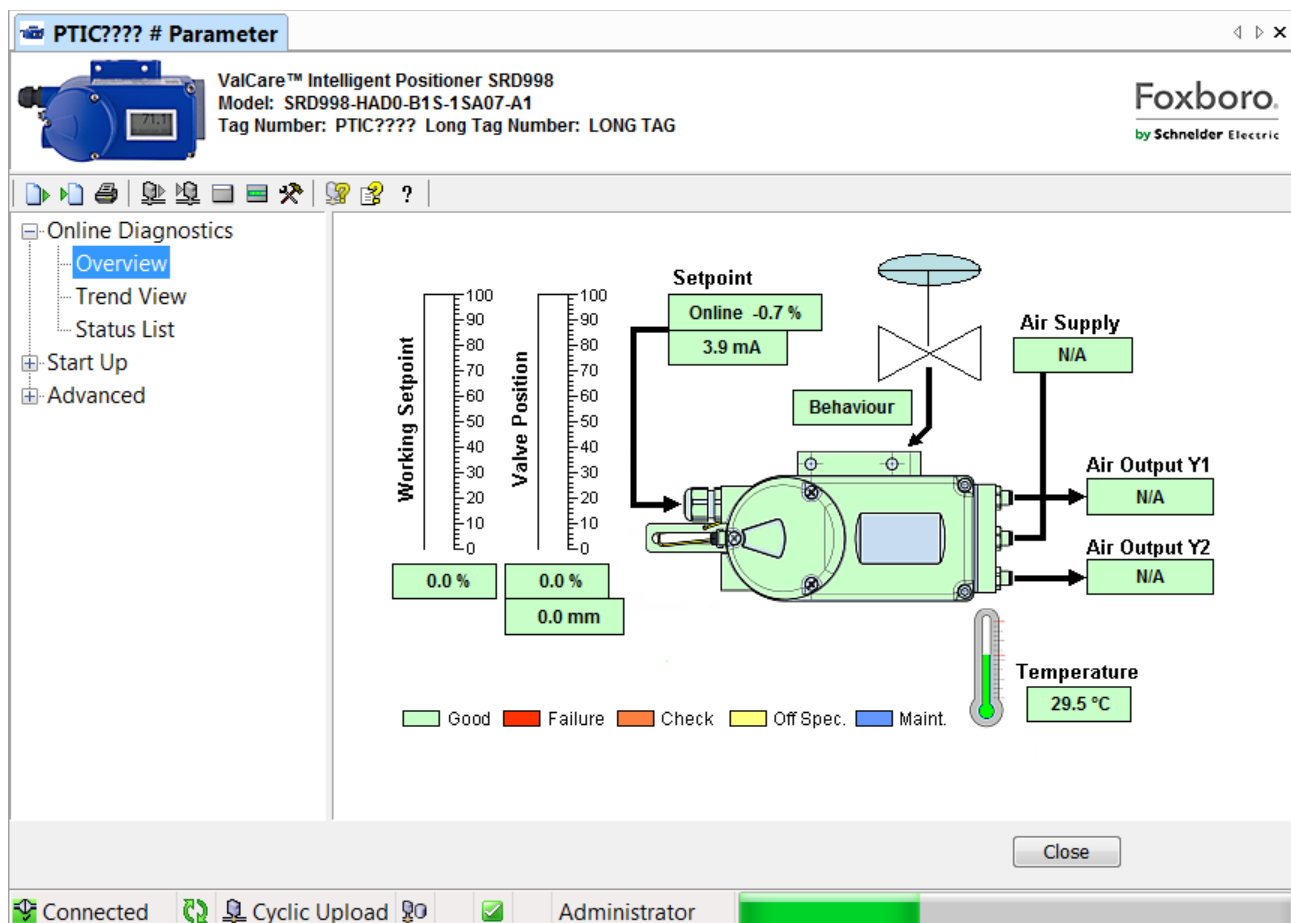
http://www.fdtgroup.org/product-catalog/certified-dtms?company=Foxboro+Eckardt+GmbH&field_device_type_value_many_to_one=All&field_protocol_value_many_to_one=All

Therefore we provide a DTM fully certified for its inter-
 operability and with the state-of-the-art presentation
 and diagnostics features.

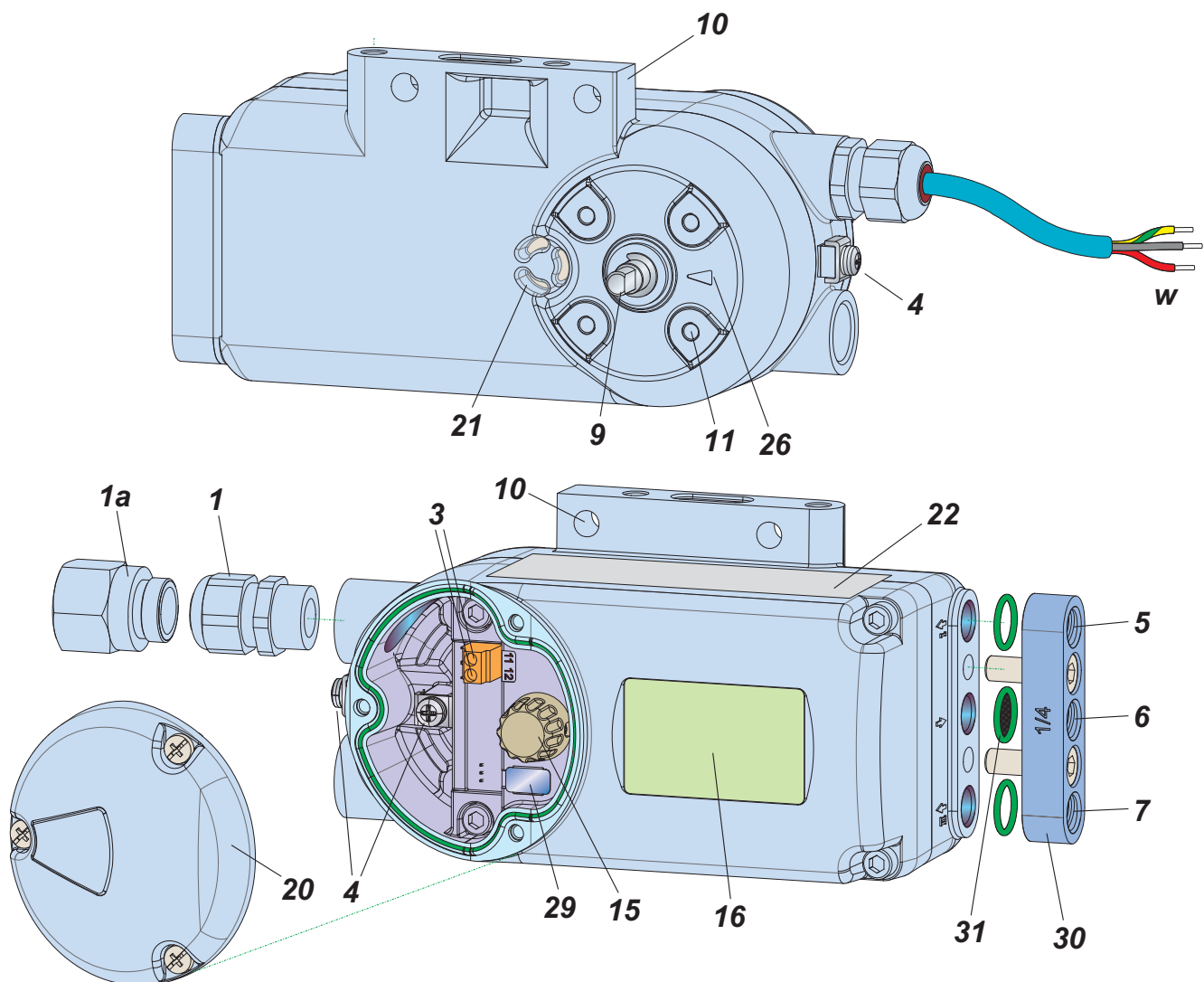
The DTM can be downloaded from our homepage.

DD (Device Description) and EDD (Enhanced Device Description)

In case the host system is not supporting the FDT-DTM
 technology, you can download the DD and/or EDD from
 our homepage.



FUNCTIONAL DESIGNATIONS



- | | |
|--|--|
| 1 Cable gland | 11 Connection base for attachment to rotary actuators |
| 1a Adapter, eg. 1/2"-14 NPT | 15 Rotary selector for select Menu and press to confirm |
| 3 Screw terminals (11 / 12) for input (w) | 16 LCD with true text in different languages |
| 4 Ground connection (inner and outer) | 20 Cover for electrical connection compartment |
| 5 Output I (y1) | 21 Air vent, dust and water protected |
| 6 Air supply (s) | 22 Data label |
| 7 Output II (y2) | 26 Arrow is perpendicular to shaft 9 at angle 0 degree |
| 9 Feedback shaft | 29 Service only |
| 10 Connection manifold for attachment to stroke actuators | 30 Connecting manifold, G 1/4 or 1/4 NPT |
| | 31 Component O-ring with filter, for air supply |

MODEL CODES SRD998

030816

Intelligent Positioner		SRD998 –	
Communication			
HART	H		
Profibus PA (a)	P		
FOUNDATION Fieldbus H1 (a)	Q		
Diagnostics Performance			
Basic Diagnostics	BD		
Advanced Diagnostics (a)	AD		
Premium Diagnostics (a)	PD		
Partial Stroke Testing & Shutdown (a)	SA		
Partial Stroke Testing & SOV Monitoring(a)	SB		
Electrical In-Out Option			
No In-Out Option.	0		
Universal In-Out Option (a)	1		
Version			
Single acting	B		
Double Acting	C		
Pneumatic Performance			
Standard Pneumatic	0		
Enhanced Pneumatic (a)	1		
High Air Output (a)	2		
Fail in case of lost of power			
Fail safe	S		
Fail freeze (a)	F		
Housing			
Aluminum	1		
SST (316) (a).	2		
Aluminium Ex d (a).	3		
SST (316) Ex d (a).	4		
Mounting			
Standard	S		
For direct mounting (a).	T		
For VDI/VDE 3847. (a)	U		
For remote mouting positioner with side mounting potentiometer unit (a).	V		
For remote mouting positioner with top mounting potentiometer unit (a)	W		
For remote mouting positioner without potentiometer unit (to be order separately) (a)	Y		
Pneumatic Connection			
1/4 NPT	A		
1/4 G	B		
1/4 NPT with tapped exhaust (a)	C		
1/4 G with tapped exhaust (a)	D		
Gauges			
without gauge	0		
With 2 standard gauges for single acting (b).	1		
With 2 Nickel plated gauges connection for single acting (b).	2		
With 3 standard gauges for double acting (c).	3		
With 3 Nickel plated gauges connection for double acting (c).	4		
Electrical Connection			
M20x1.5	7		
1/2 NPT (made with an adaptor)	8		

(continued on next page)

MODEL CODES SRD998 (continued)**Electrical Certification**

without certification	ZZ
ATEX / IEC Ex: II 2G Ex ia IIC T4/T6 Gb, II 1D Ex ia IIIC T100 °C Da.	A1
ATEX / IEC Ex: II 2G Ex ib IIC T4/T6 Gb, II 2D Ex ib IIIC T100 °C Db.	A2
ATEX / IEC Ex: II 3G Ex ic IIC T4/T6 Gc, II 3D Ex ic IIIC T100 °C Dc.	A3
FM certification IS (a)	F1
CSA certification IS (a)	C1
EAC certification IS (a)	G1
INMETRO: Ex ia IIC T4/T6 Gb, Ex ia IIIC T100 °C Da, IP66	B1
INMETRO: Ex ib IIC T4/T6 Gb, Ex ib IIIC T100 °C Db, IP66	B2
INMETRO: Ex ic IIC T4/T6 Gc, Ex ic IIIC T100 °C Dc, IP66	B3
NEPSI: Ex ia IIC T4/T6 Ga, Ex ia D20 T100 Da, IP66	N1
NEPSI: Ex ib IIC T4/T6 Gb, Ex ib D21 T100 Db, IP66	N2
NEPSI: Ex ic IIC T4/T6 Gc, Ex ic D22 T100 Dc, IP66.	N3
KOSHA certification IS. (a)	K1
TIS certification IS. (a).	J1
CNS certification IS *	

Options

Positioner suitable for use of natural gas instead of air supply (a)	-S
Positioner free of copper and its alloys (a)	-C
Approved for SIL2 / SIL3 application (a)	-Q
Stainless Steel Label Fixed With Wire	-L
Positioner with ECEP (a)	-X

Example:

SRD998 – H . . BD . . 0 . – . B . . 0 . . S . – . 1 . . S . . A . . 0 . . 7 . – . A1 . – . L

= Intelligent Positioner, HART, single acting, ATEX / IECEx IS certified, SS Label

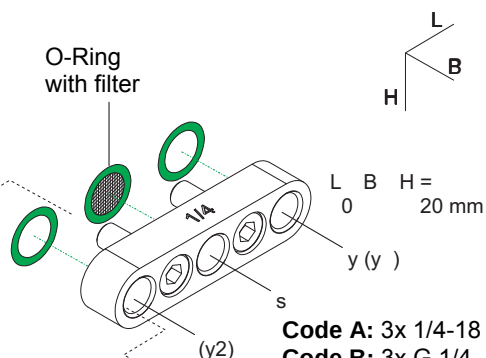
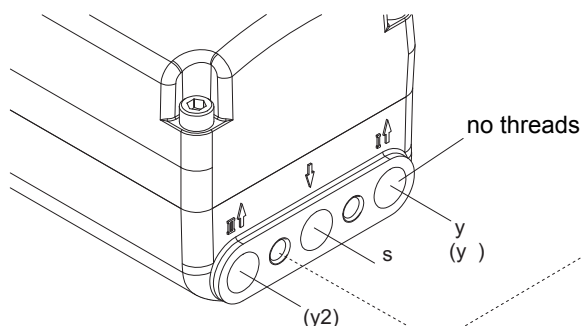
(a) Not released

(b) Only to be ordered with single acting model code Version B

(c) Only to be ordered with double acting model code Version C

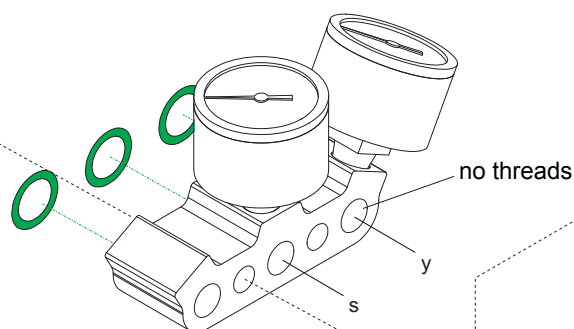
* The SRD998 has the CNS certificate for usage in Taiwan

Accessories, for all basic devices

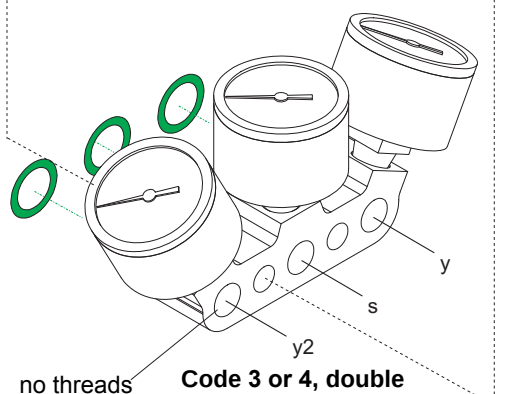


Code A: 3x 1/4-18 NPT
Code B: 3x G 1/4
Connection manifold

Sticker closes
the unused output
at single acting



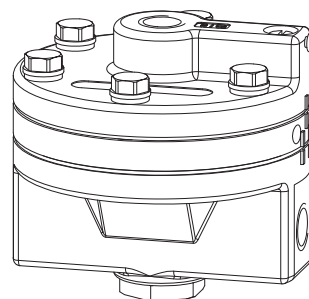
Code 1 or 2, single
Connection manifold for
single acting positioner
with pressure gauges for
supply air s and output y



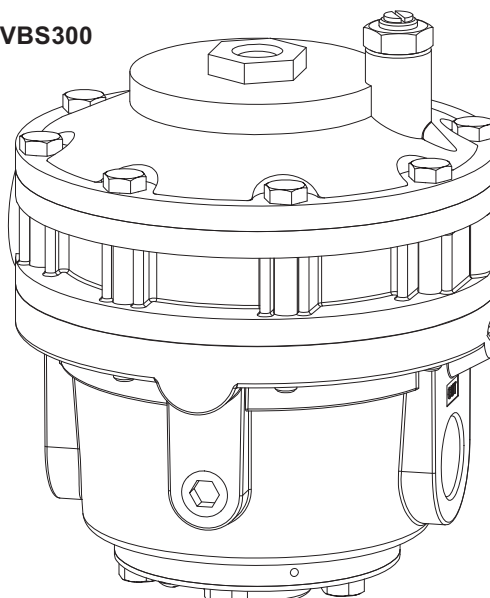
Code 3 or 4, double
Connection manifold for
double acting positioner
with pressure gauges for
supply air s, outputs y1 and y2

Boosters for remote mounting:
(see extra PSS)

VBS100



VBS300



MODEL CODES Accessories

080915

Accessories for SRD998**Filter Regulators**

Filter Regulator for -30°C to 70°C.	FRS02
Stainless Steel (316) Filter Regulator	FRS03
High Flow Filter Regulator 1/2 inch / Aluminium	FRS04
High Flow Filter Regulator 1/2 inch / Stainless Steel.	FRS05
Mounting Bracket for FRS02 or FRS03	EBZG-FR1
Orientable Mounting Bracket for FRS02 or FRS03	EBZG-FR2
Nipple for direct mounting Filter regulator 1/4 NPT both sides	VG-91
Mounting Bracket for FRS04	EBZG-FR4
Mounting Bracket for FRS05	EBZG-FR5
Nipple 1/2 NPT (FRS04/05 side) to 1/4 NPT (SRD998 side) for direct piping.	VG-93

Communication / Modem / DTM

HART USB Modem (made by Ifak) with ATEX IS Certification	MOD900
DTM for SRD Serie for HART / FF / Profibus	VALCARE

Booster Relay (in case of double acting, qty. must be 2 pieces)

Booster Cv1 - Alu Housing - Remote mount	VBS100
Booster Cv1 - SST Housing - Remote mount (a)	VBS110
Booster Cv7 - Alu Housing - Remote mount	VBS300
Booster Cv7 - SST Housing - Remote mount	VBS310

Lock-in Relays

Lock In Relay, Single Acting, Aluminum Casing (a)	LIR01
Lock In Relay, Double Acting, Aluminum Casing. (a)	LIR02
Lock In Relay, Single Acting, SST 316L Casing (a)	LIR03
Lock In Relay, Double Acting, SST 316L Casing. (a)	LIR04

Limit switch

Mechanical Limit Switch weatherproof and plastic housing (TE Sensors XCKN2118P20)	MLS01
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Cable Gland

Cable Gland, M20x1.5 Plastics, Color Gray/Black	BUSG-K6
Cable Gland, M20x1.5 Plastics, Color Blue	BUSG-K7
Cable Gland, M20x1.5 Plastics, Color White.	BUSG-K9
Cable Gland, M20x1.5 Stainless Steel.	BUSG-S6

Adapter

Adapter (Brass With Nickel Coating) M20 x 1.5 To 1/2 - 14 NPT (Internal Thread).	AD-A5
Adapter (ss) M20x1.5 to 1/2-14 NPT (Internal Thread)	AD-A6

(a) not released

MODEL CODES Accessories

010413

Accessories for SRD998**Attachment Kits****EBZG**

For diaphragm actuators with casting yoke acc. NAMUR (incl. standard Couple lever)	-H
For diaphragm actuators with pillar yoke acc. NAMUR (incl. standard Couple lever).	-K
For FoxTop / FoxPak (g)	-E1
For mounting to rotary actuators acc. VDI/VDE 3845 (without bracket)	-R
Brackets VDI/VDE 3845 (A = 80 mm / 3.15 in; B = 20 mm / 0.79 in)	-C1
Brackets VDI/VDE 3845 (A = 80 mm / 3.15 in; B = 30 mm / 1.18 in)	-C2
Brackets VDI/VDE 3845 (A = 130 mm / 5.12 in; B = 50 mm / 1.97 in).	-C3
Brackets VDI/VDE 3845 (A = 130 mm / 5.12 in; B = 30 mm / 1.18 in).	-C4
Universal Brackets VDI/VDE 3845 (A = 80 or 130 mm; B=20 or 30 or 50 mm)	-C5

Couple Lever**EBZG**

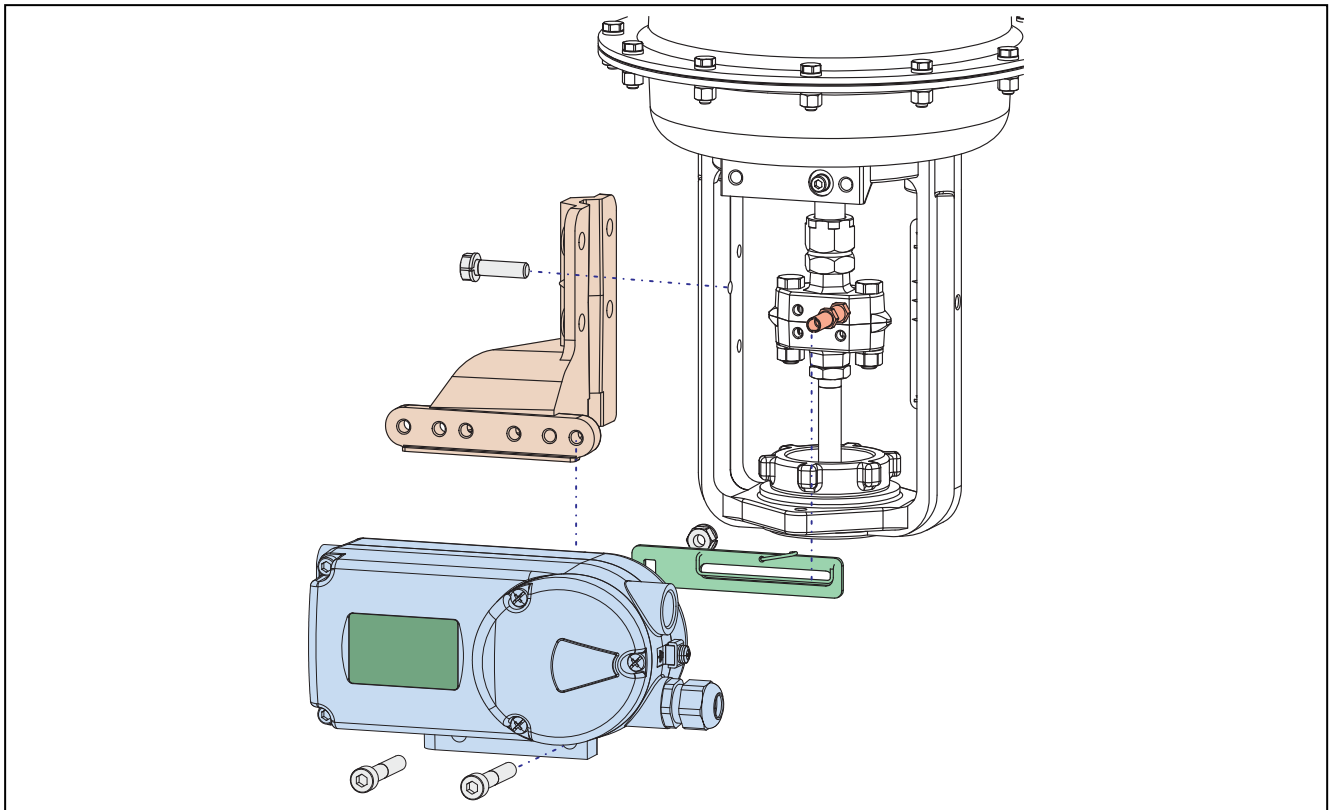
Standard (stroke max. 80 mm)	A
Extended (stroke max. 260 mm)	-A1
Reduced (stroke < 8 mm)	-A2
Fold feedback lever (stroke 8 to 70 mm)	-A3
Short stroke (stroke 8 to 35 mm)	-A4
Couple Lever Folded (stroke special)	-A5
Extended (stroke max. 120 mm)	-B

Carrier bolt**SRXG**

Carrier bolt extra short 23 mm	-A
Adjustable carrier bolt 20 to 37 mm	-B
Carrier bolt 38 mm	-C
Carrier bolt 47 mm	-D
Carrier bolt 57 mm	-E
Carrier bolt 65 mm	-F
Adjustable carrier bolt with fixing system for stem diameter up to 21 mm	-G
Adjustable carrier bolt with fixing system for stem diameter up to 34 mm	-H
Carrier Bolt 80 mm	-I
Adjustable carrier bolt for thread 3/8"	-J
Adjustable carrier bolt for thread 5/16"	-K
Extension for carrier bolt	-L
Adjustable carrier bolt with fixing system centered for stem diameter up to 64 mm	-M
Adjustable carrier bolt with fixing system centered for stem diameter up to 21 mm	-G1
Adjustable carrier bolt with fixing system centered with extension up to 80 mm for stem diameter up to 21 mm	-G2

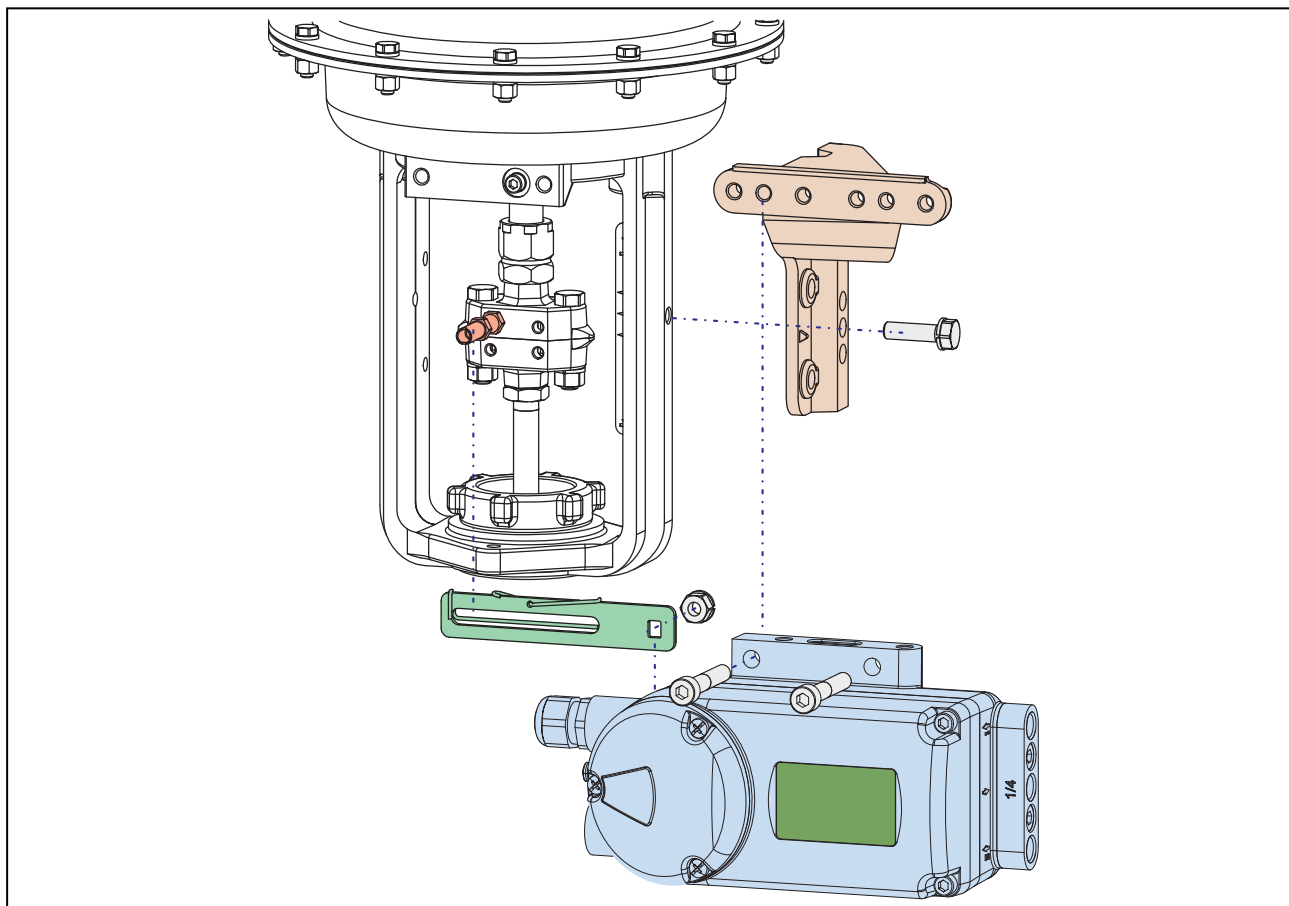
MOUNTING TO LINEAR ACTUATORS

Attachment to stroke actuators acc. to IEC 534-6 (NAMUR), left hand



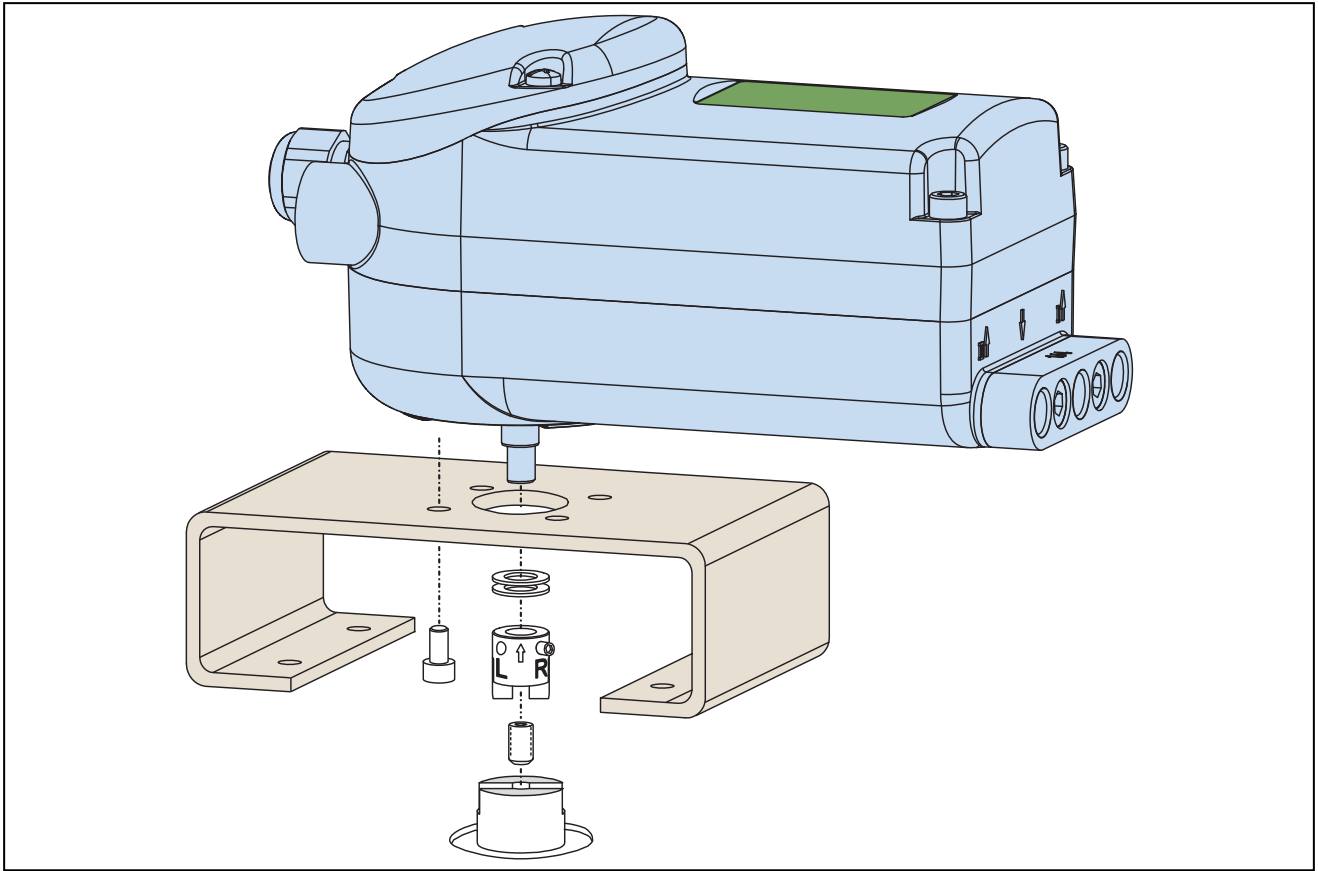
MOUNTING TO LINEAR ACTUATORS

Attachment to stroke actuators acc. to IEC 534-6 (NAMUR), right hand



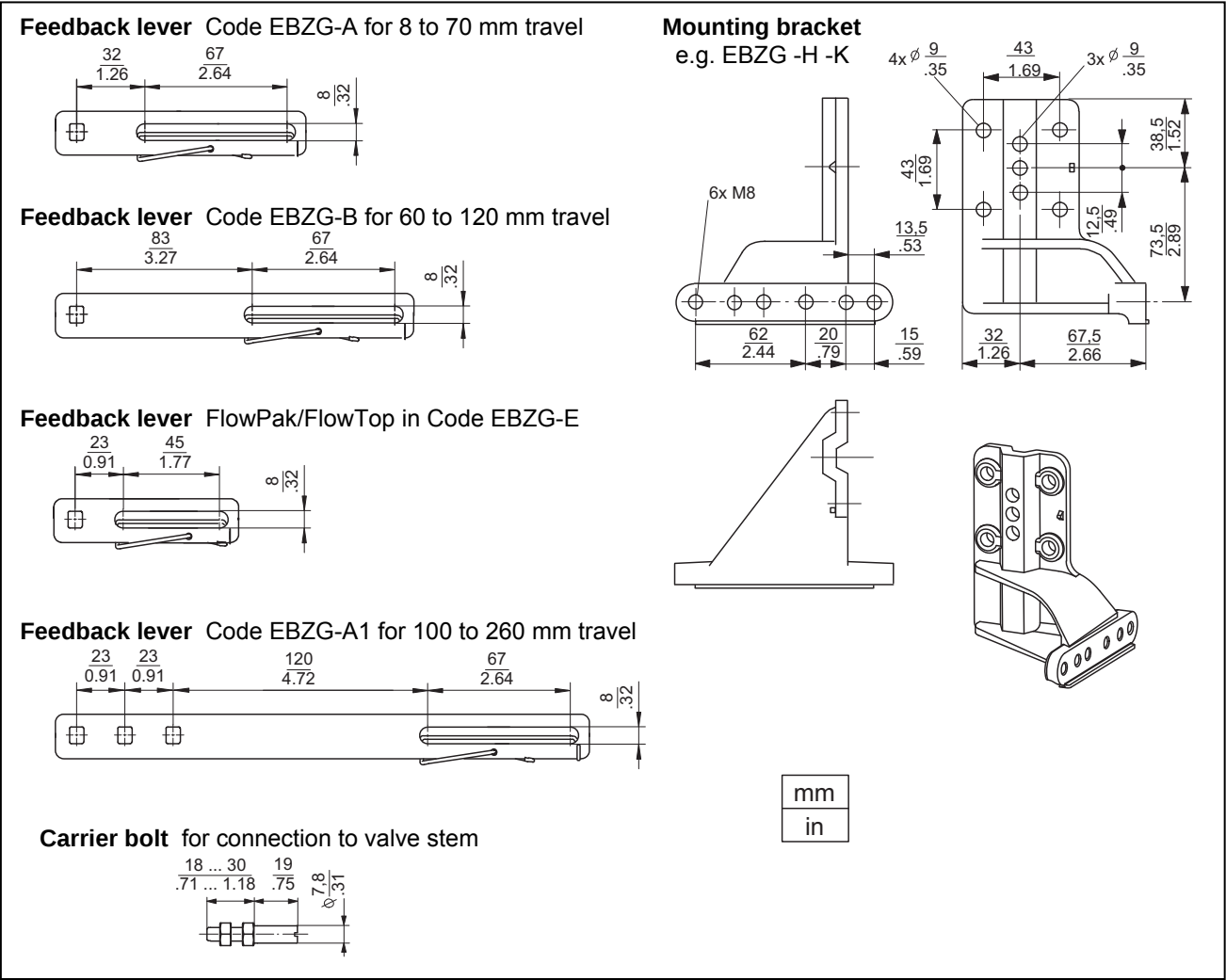
MOUNTING TO ROTARY ACTUATORS

Delivery of bracket by manufacturer of actuator

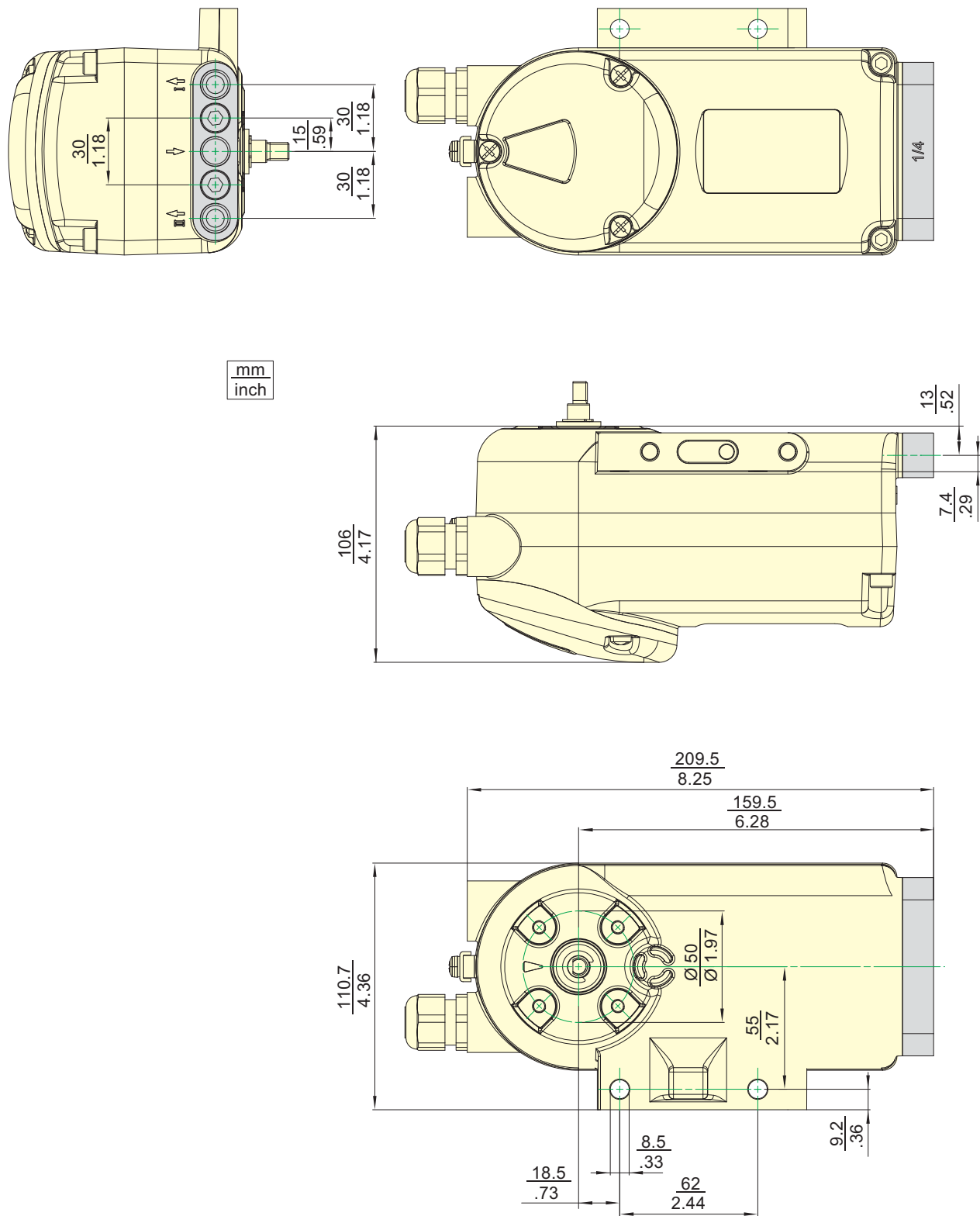


DIMENSIONS

Components of Attachment kits (samples)



DIMENSIONS with manifold



DIMENSIONS with gauges and manifold

