PosiFlex

Valve Positioners

POSIFLEX

EMERSON

Table of Contents

PosiFlex F10 Pneumatic Positioner
For Spring Return and Double Acting Actuators

Key features and benefits

■ Trouble-Free, Modular Design - incorporates modular and stack-able components in a compact package to provide (highly accurate, versatile control capability.

■ Independent Span and Zero Setting - allows fast and easy setup and adjustment for normal control functions .

■ 3 Lobe Cam - provides linear, quick opening, and equal percentage characteristics to cover all standard ranges and stroke lengths.

■ Application Flexibility - can be used with double or single acting rotary actuators.

■ Durable, Corrosion Resistant Aluminum Housing- features a two part polyurethane finish and "O"ring sealed components for compliance with NEMA 4 and IP65 requirements.
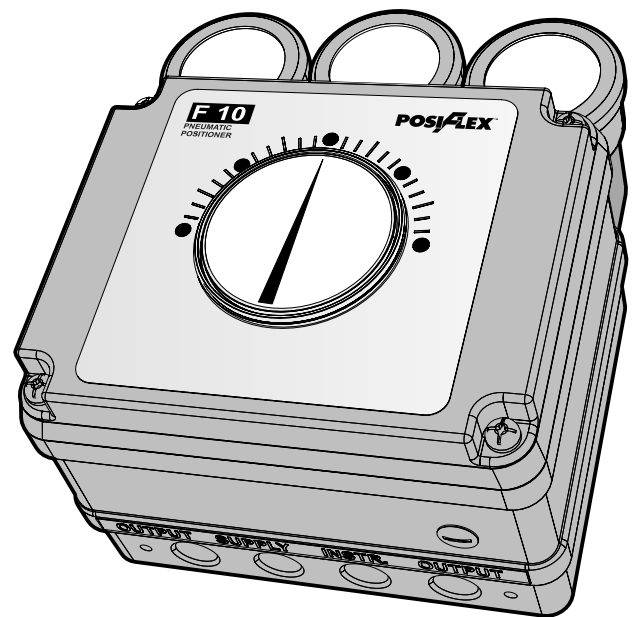
Description

The PosiFlex F10 Pneumatic Positioner is a single stage, force balance instrument that provides stepless positional control for a wide variety of rotary and linear pneumatic actuators. A single universal model can be used for double acting or single acting applications.

The unit operates using a high gain, motion balance principle. This simple operating design allows the unit to be adjusted for all normal control functions such as reverse acting, etc. without the use of additional components.

A comprehensive range of integrated control options is available including gauges, disc or dome type indicators, mechanical or proximity limit switches, position transmitter, and special rotary, range and linear stroke length cams. NAMUR, VDI/VDE 3845-2, and special mounting accessories for any actuator can also be supplied.

Tabelle 1.   General Specifications for F10 Positioner

	Metric	Imperial
Hysteresis:	0.6%	
Linearity:	1.0%	
Air Flow:	210 Nl/min (at 6 bar)	7.4 SCFM (at 87 psi)
Air Consumption:	15 Nl/min (at 6 bar)	0.6 SCFM (at 87 psi)
Min. volume actuator:	0.1 Nl	6.1 in3
Temperature:	-20° to +80°C	-4° to +176°F
Enclosure:	IP65	NEMA 4
Mounting:	VDI/VDE 3845-2	
Air Entry:	G 1/4"	1/4" NPT
Air Supply:	1.4 to 8.6 bar	21 to 125 psi
Input Signal:		
- Standard:	0.2 to 1.0 bar	3 to 15 psi
- Adjustable:	0.2 to 0.6 bar 0.6 to 1.0 bar	3 to 9 psi 9 to 15 psi
Pressure Media:	Non-lubricated instrument air, filtered at 25 micron. Dew point should be 10°C (18°F) below enviromental temperatur. Air quality class 3-2-3 accord. to ISO 8573-1.	
Materials:		
Housing	Aluminium Alloy	
Enclosure	IP65 / NEMA4	
Finish	Polyester powder coated	

Tabelle 2.   Modular Control Options for F10 Positioner

Option Identifier	Description:	See Data Sheet
G1	Gauge block, for instrument and two output pressure	PF.02.G12.EN
PT2	Position transmitter - 2 wire (in module frame)	PF.02.PT2.EN
S2	Two Mechanical Switches	PF.02.S2.EN
IS2	Two Inductive Switches - 2 Wire	PF.02.IS2.EN
PNP	Two Inductive Switches - 3 Wire	PF.02.PNP.EN
POT	Potentiometer	PF.02.POT.EN

Dimensions F10 PosiFlex Positioner:
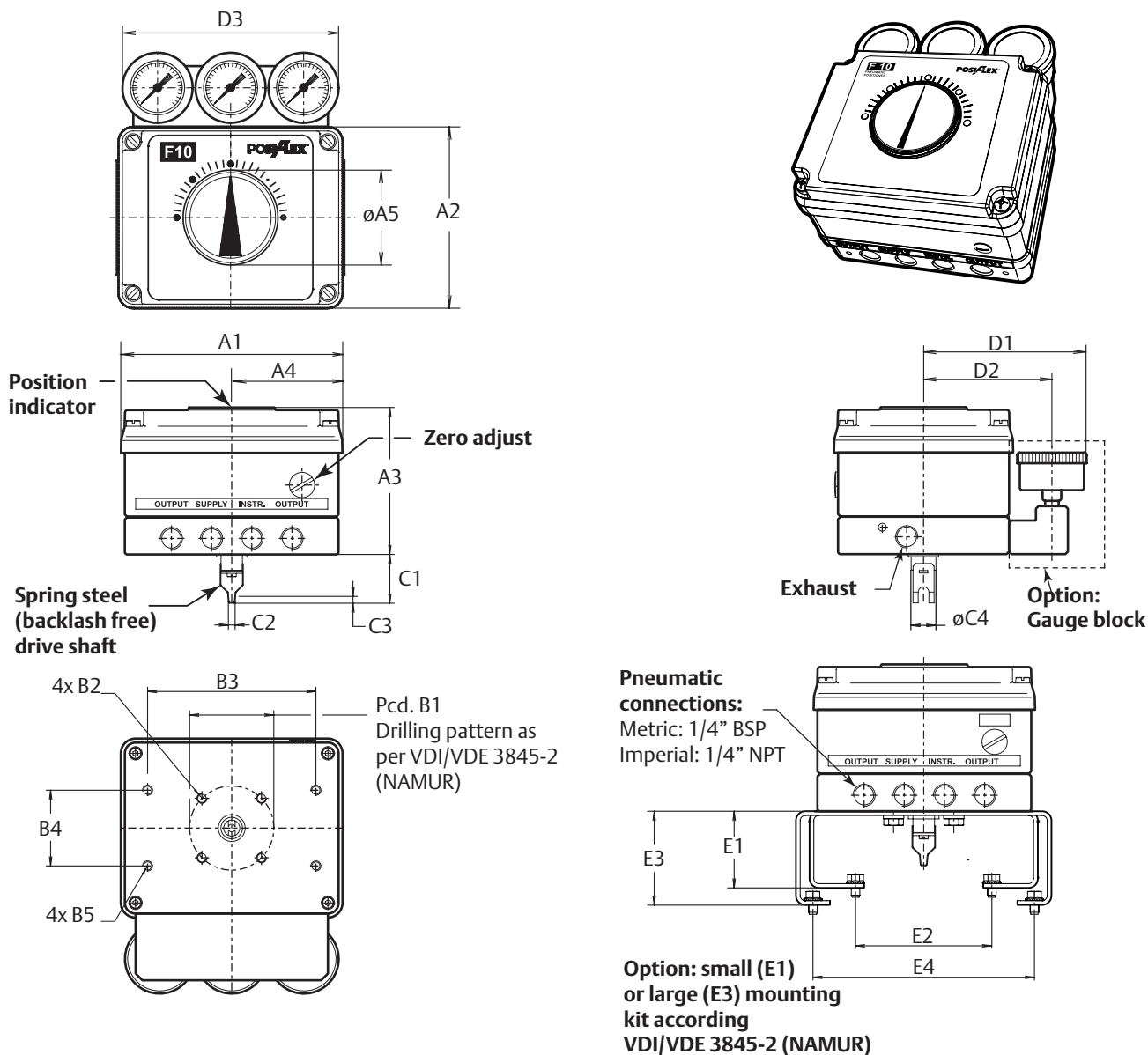
Dim.	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5
mm	132	106	88	66	53	50	M6 x 9	100	45	M6 x 9
Inch	5.20	4.17	3.46	2.60	2.09	1.97	1/4"UNC x 0.35	3.94	1.77	1/4"UNC x 0.35

Dim.	C1	C2	C3	C4	D1	D2	D3	E1	E2	E3	E4
mm	29	4	4	14.7	100	75	129	45	80x30	55	130x30
inch	1.14	0.16	0.16	0.58	3.94	2.95	5.08	1.77	3.15 x 1.18	2.17	5.12 x 1.18

PosiFlex F20 Electro-Pneumatic Positioner
## For Spring Return and Double Acting Actuators

Key features and benefits

■ Trouble-Free, Modular Design - incorporates modular and stack-able components in a compact package to provide highly accurate, versatile control capability.

■ 4-20mA Electronic Control - allows the most frequently used control adjustments to be easily located and reset.

■ Application Flexibility - can be used with double or single acting rotary or linear actuators.

■ Durable, Corrosion Resistant Aluminum Housing - features a two part polyurethane finish and "0" ring sealed components for compliance with NEMA 4 and IP65 requirements.

Description

The PosiFlex F20 Series Electro/Pneumatic Positioner is suitable for either double or ingle acting rotary or linear actuators. The unit operates using the principle of analog electronic comparison and uses the analog 4-20 rnA input signal to obtain an accurate position of the actuator.

The PosiFlex Electro/Pneumatic Positioner is a true 2-wire instrument which uses the 4-20 rnA signal to provide both the controlling signal and electronics power supply. An electronic module allows zero, range, and sensitivity control characteristics to be reset using trim pots on the control card.
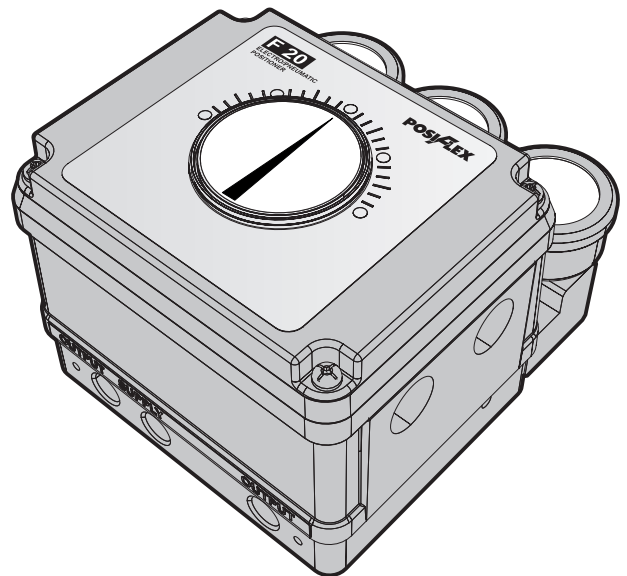
A comprehensive range of integrated control options is available including:

■ Pressure gauge block

■ 4-20mA position transmitter

■ Mechanical SPDT limit switches

■ 2- Wire (NAMUR) or 3- Wire (PNP) proximity limit switches,

■ feedback potentiometers.

■ VDI/VDE 3845-2 (NAMUR) mounting kits

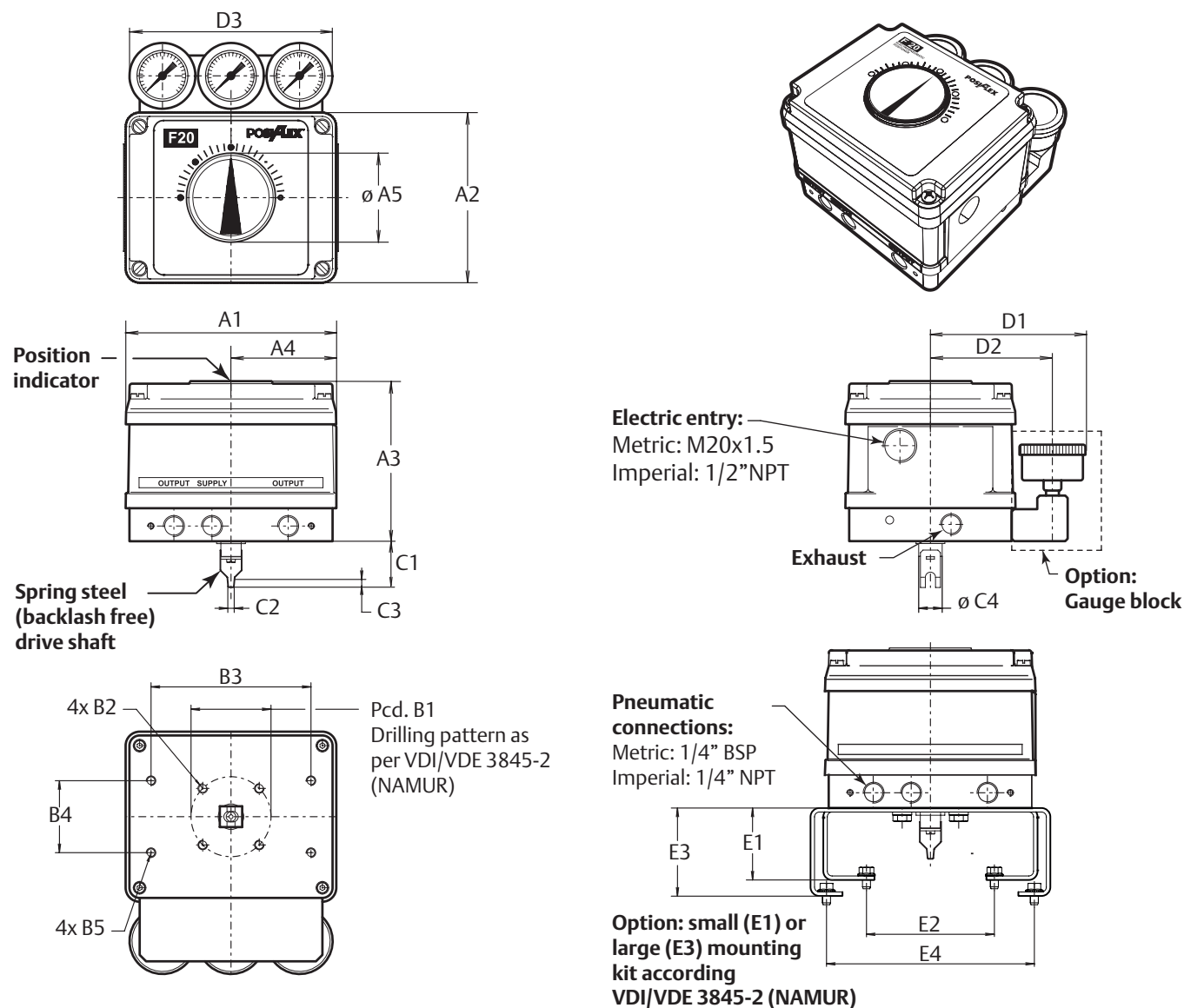■ Low temperature version -50°C to +80°C

Tabelle 3.   General specifications for F20 PosiFlex Positioner

	Metric	Imperial
Hysteresis	0.60%	
Linearity	1.00%	
Air Flow	210 Nl/min (6 bar)	7.4 SCFM (87psi)
Air Consumption	10 Nl/min (6 bar)	0.4 SCFM (87psi)
Min. volume actuator	0.1 Nl	6.1 in^3
Temperature	-20° / +80° C.	-4° / +176°F
Enclosure	IP 65	NEMA 4
Mounting	VDI/VDE 3845-2	
Pressure Media		
Air quality	Non-lubricated instrument air, filtered at 25 micron. Dew point should be 10°C (18°F) below environmental temperature. Air quality class 3-2-3 accord. to ISO 8573-1.	
Air Supply	1.4 - 8.6 bar.	21 to 125 psi
Air Entry	G 1/4".	1/4" NPT
Electrical data		
- Standard	2 wire: 4 - 20 mA (~ 8VDC).	
- Adjustable (for split range)	4-12mA / 12-20 mA	
Resistance (at 20 mA)	350 Ohm	
Electrical Entry	M20 x 1.5	1/2"NPT
Materials:		
Housing	Aluminium Alloy	
Enclosure	IP65 / NEMA4	
Finish	Polyester powder coated	

Modular Control Options for F20 Positioner

Option identifier	Description:	See Data Sheet
G2	Gauge block, for supply and two output pressure	PF.02.G12.EN
PT2	Position transmitter - 2 wire	PF.02.PT2.EN
PTF20	Position transmitter - 2 wire (build-in for F20)	PF.02.PTF.EN
S2	Two Mechanical Switches	PF.02.S2.EN
IS2	Two Inductive Switches - 2 Wire (Instrinsically safe)	PF.02.IS2.EN
PNP	Two Inductive Switches - 3 Wire	PF.02.PNP.EN
POT	Potentiometer	PF.02.POT.EN

Dimensions F20 PosiFlex Positioner:

Position indicator

Spring steel (backlash free) drive shaft

4x B2

Pcd. B1
Drilling pattern as per VDI/VDE 3845-2 (NAMUR)

4x B5

Electric entry:
Metric: M20x1.5
Imperial: 1/2"NPT

Exhaust

Option: Gauge block

Pneumatic connections:
Metric: 1/4" BSP
Imperial: 1/4" NPT

Option: small (E1) or large (E3) mounting kit according VDI/VDE 3845-2 (NAMUR)

Dim.	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5
mm	132	106	102	66	53	50	M6 x 9	100	45	M6 x 9
Inch	5.20	4.17	4.02	2.60	2.09	1.97	1/4"UNC x 0.35	3.94	1.77	1/4"UNC x 0.35

Dim.	C1	C2	C3	C4	D1	D2	D3	E1	E2	E3	E4
mm	29	4	4	14.7	100	75	129	45	80x30	55	130x30
inch	1.14	0.16	0.16	0.58	3.94	2.95	5.08	1.77	3.15 x 1.18	2.17	5.12 x 1.18

Positioner Option G1 or G2
Gauge Block

Key features and benefits

■ Large and clear pressure gauges with metric (bar) and imperial (psi) scales.

■ Easy identification of the pressure status.

■ Heavy duty gauges with stainless steel housings.

■ Suitable for double acting and spring return applications

■ Mountable on both sides of the base positioners

■ Versions for Pneumatic- or Electro-Pneumatic positioners.

■ is available as factory fitted or as retrofit kit.

Description

The Gauge Block kits are available as option in two forms:

■ G1 kits have two output gauges for the actuator operating pressure and one gauge for the incoming instrument pressure. G1 gauge blocks are for basic F10 pneumatic positioners.

■ G2 kits have two output gauges and one gauge for the incoming supply pressure. G2 gauge blocks are for electro/pneumatic positioner, type F20.

Both kits are suitable for double acting or single acting positioners. When used on a single acting actuator only one of the two output gauges will show a pressure. If required the inactive gauge may be replaced with a (G 1/8") blanking plug and the removed gauge stored to be used as a spare.

The gauges are heavy duty type with stainless steel housings and are graduated in metric (bar) and Imperial (psi) units.
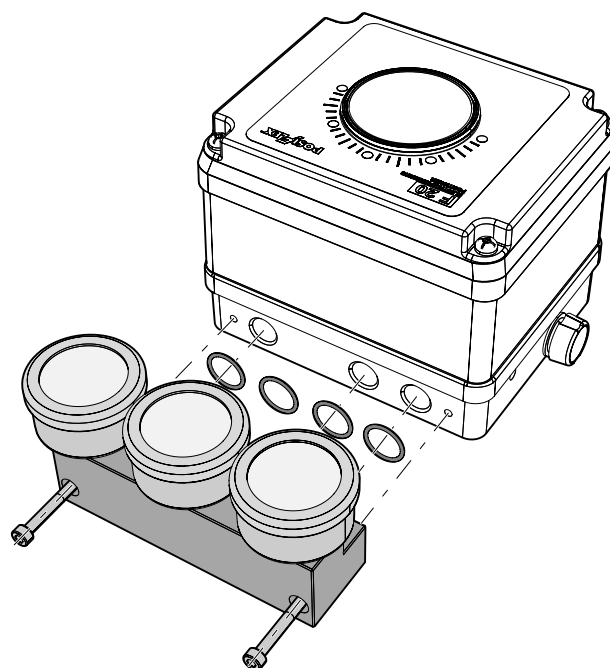
Construction

Gauge blocks are normally attached to the positioner base at the opposite side to the air supply and output ports. Alternatively they may be fitted to the air inlet face, this way is more suitable for linear actuators.

Tabelle 4.   Specifications Gaugeblock G1 / G2

Gauges	G1 For F10	G2 for F20
- Input	0 to 1.6 bar	0 to 10 bar
	0 to 30 psi	0 to 160 psi
- Output	0 to 10 bar.	0 to 10 bar
	0 to 160 psi.	0 to 160 psi
- Connections	G 1/8"	
Temperature	-20° to +80°C (-4°F to +176°F)	
Gauge block	Aluminium Alloy	
Gauges	Stainless steel	
Finish	Anodized	

PosiFlex Option PTF20
Position transmitter

Key features and benefits

■ Provides a 4-20 mA output signal, independent from the input signal.

■ Provides a continuous output signal in proportion to the mechanical position of the positioner.

■ Designed for F20 PosiFlex positioners as a "build-in" option.

■ Trimmers for easy adjusting of zero and span settings.

■ 2-wire connection for power supply and output signal.

■ Jumpers for easy action setting.

■ is available as factory fitted or as retrofit kit.

Description

The PTF20 position transmitter provides a continuous 4-20 mA output signal in proportion to the mechanical position of the positioner. The two wire function is independent from the input signal.

PTF20 position transmitter is specially designed for F20 PosiFlex positioners as a "Built-in" option and is available as factory fitted or as retrofit kit.

Construction

The PTF20 position transmitter card is directly mounted on top of the main board in the enclosure of the F20 positioner. The card (1) has its own feedback potentiometer (2), trimmers for zero (3) and span (4) adjustments and terminals (5) for the 2-wire-connections, which are used for power supply for the electronics as well as the output signal.

The trimmers for zero and span can be set throughout the complete range. This way split range and reverse acting is possible. The positioners indicator spindle provides the drive for the potentiometer. Jumpers (6) are provided to select the action (direct or reverse).
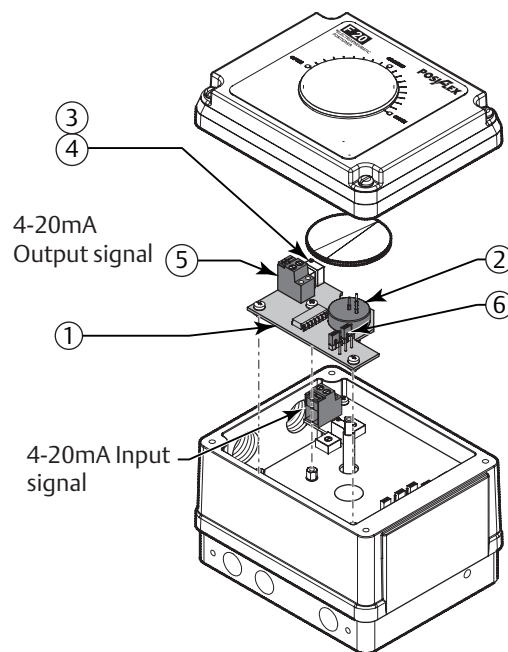

4-20mA Output signal

4-20mA Input signal

Tabelle 5.   Specifications PTF20 Option

Voltage	15 - 30 VDC. (external)
Output	4 - 20 mA With full range adjustment for zero and range
Jumper setting	Action (direct or reverse).
Temperature	-20° to +80°C (-4°F to +176°F)
Housing	Aluminium Alloy
Enclosure	IP65 / NEMA4
Finish	Polyester powder coated

PosiFlex Option PT2

Position transmitter

Key features and benefits

■ Provides a 4-20 mA output signal, independent from the input signal.

■ Provides a continuous output signal in proportion to the mechanical position of the positioner.

■ Stackable postion feedback module can easy added by inserting it between the base housing and the cover.

■ Trimmers for easy adjusting of zero and span settings.

■ 2-wire connection for power supply and output signal.

■ Jumpers for easy action setting.

■ is available as factory fitted or as retrofit kit.

Description

The PT2 position transmitter provides a continuous 4-20 mA output signal in proportion to the mechanical position of the positioner. The two wire function is independent from the input signal and has a separate electrical entry.

PT2 position transmitters may be used with PosiFlex F1 (or F20) positioners and are available as factory fitted or as retrofit kit.

The position transmitter module (1) is pre-assembled with it's circuit board (7) and has a potentiometer, trimmers for zero (3) and range (4) adjustments and terminals (5) for the external power supply. Jumpers (6) are provided to select the action (direct or reverse).

Construction

The PT2 module (1) is assembled to the base positioner by inserting it between the base housing and the cover. The indicator spindle of the positioner provides the drive for the potentiometer (3). The option modules are stackable and fully modular, so that combinations of position sensors and switch modules can be realized as required.
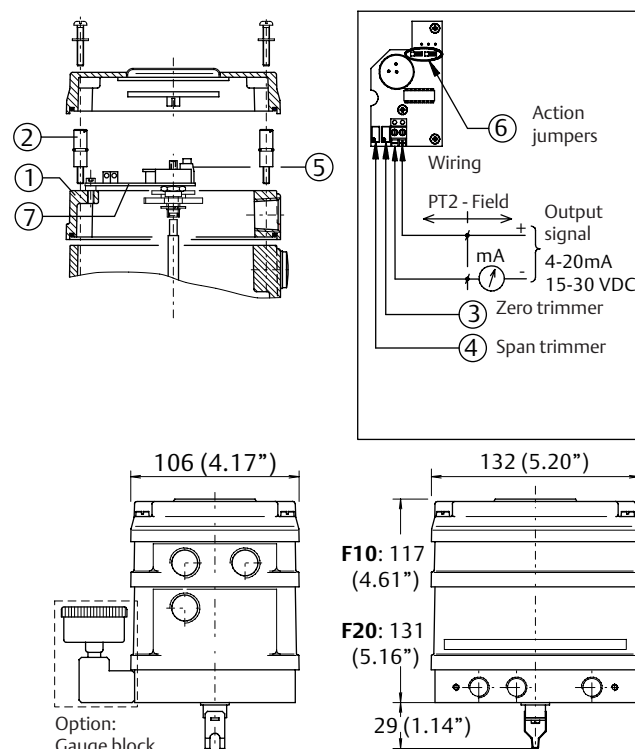

Tabelle 6.   Specifications PT2

Voltage	15 - 30 VDC. (external)
Output	4 - 20 mA
Adjustments	Zero Range Jumpers for action setting (direct / reverse)
Entries	Metric units: 2x M20x1.5 Imperial unitx: 2x 1/2" NPT
Temperature	-20° to +80°C (-4°F to +176°F)
Housing	Aluminium Alloy
Enclosure	IP65 / NEMA4
Finish	Polyester powder coated

PosiFlex Option S2
Mechanical Switch option

Key features and benefits

■ Addition of two mechanical switches to provide an electrical indication at the end of stroke positions.

■ Stack-able switch module for easy inserting between the base positioner housing and the cover.

■ Easy switch point adjustment.

■ Pre-wired to easily accessible terminal blocks.

■ Module frame is fitted with two electrical entries.

■ Is available as factory fitted or as retrofit kit.

Description

This S2 PosiFlex positioner option offers the addition of two mechanical switches (1) to provide an electrical indication at the end of stroke positions. The mechanical switches are of the SPDT type with a NC and NO contact.

Construction

The switches are operated by two cams (2) on an extension (3) of the positioner indicator spindle.

The three leads of both switches are pre-wired to terminal blocks (4) which are easily accessible when the positioner cover (5) is removed. All mechanical parts are contained within the enclosure.

Both switches are independently adjustable throughout the operating stroke, but are normally set to indicate at about 5° before each end position.

Two electrical entries (6) are provided, one of which is fitted with a blanking plug.

The S2 switch modules may be added to standard PosiFlex F10 or F20 positioners and are available a as factory fitted or as retrofit kit. The S2 switch module is assembled to the basic positioner by inserting it between the base housing and the cover.
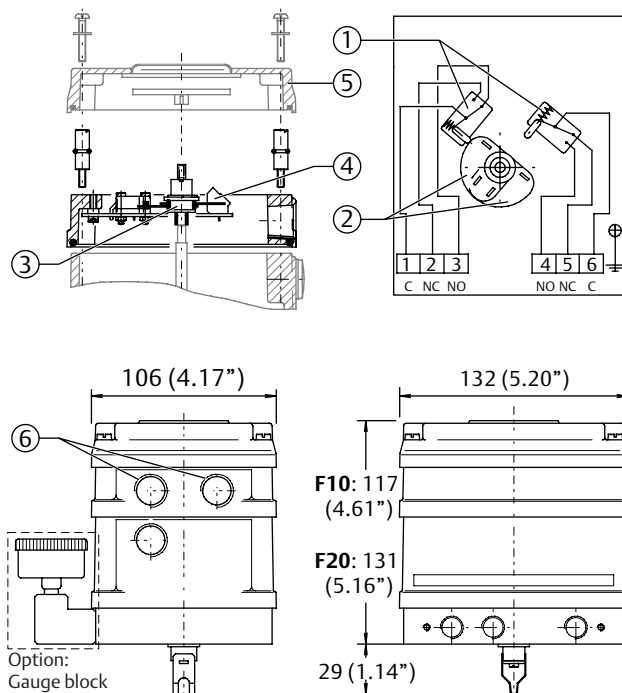
PosiFlex Control Options are stack-able and fully modular so that combinations of position transmitters and switch modules can be assembled as required.

Tabelle 7.   Specification S2 Option

Switches Type	V3 Mechanical
Voltage	250 VAC / VDC
Current	11 A at250 V AC 1 A at 12 V DC 250m at A 250V DC
Contacts	Single pole, change over - Normally open and normally closed
Entries	Metric units: 2x M20x1.5 Imperial unitx: 2x 1/2" NPT
Temperature	-20° C to +80° C (-4°F to +176°F)
Housing	Aluminium Alloy
Enclosure	IP65 / NEMA4
Finish	Polyester powder coated

PosiFlex Option PNP

3 wire inductive switches

Key features and benefits

■ Addition of two 3 wire inductive switches to provide an electrical indication at the end of stroke positions.

■ Stack-able switch module can easy added by inserting it between the base housing and the cover.

■ Easy switch point adjustment.

■ Pre-wired to easily accessible terminal blocks.

■ Module frame is fitted with two electrical entries.

■ Is available as factory fitted or as retrofit kit.

Description

This PNP PosiFlex positioner offers the addition of two 3 wire inductive switches (1) to provide indication at the end of stroke positions.

These electronic switches are contact free and provide an exceptionally "clean" output signal, they are inductive proximity switches and incorporate their own solid state line amplifiers and so provide a direct switching current of up to 100 mA.

Construction

The switches are operated by two cams (2) on an extension (3) of the positioner indicator spindle.

The three leads of both switches are pre-wired to terminal blocks (4) which are easily accessible when the positioner cover (5) is removed. All mechanical parts are contained within the enclosure.

Both switches are independently adjustable throughout the operating stroke, but are normally set to indicate at about 5° before each end position.

Two electrical entries (6) are provided, one of which is fitted with a blanking plug.
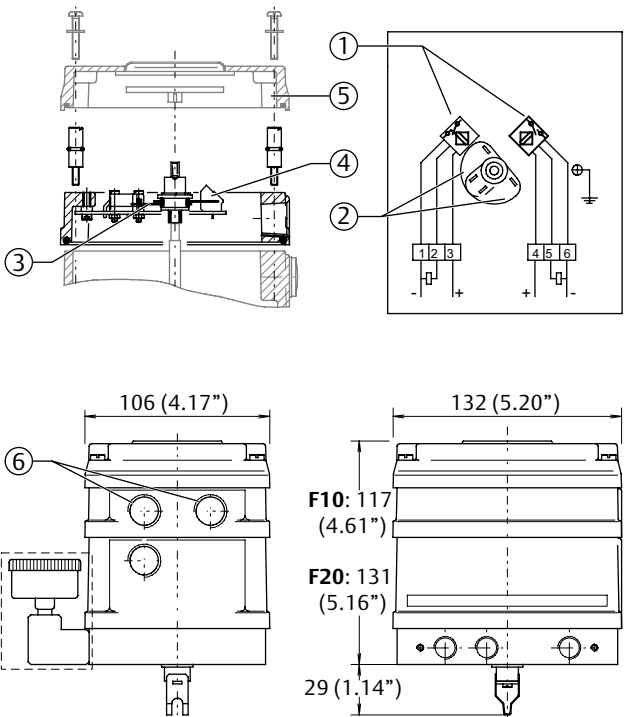
The PNP switch modules may be added to standard PosiFlex F10 or F20 positioners and are available as factory fitted or as retrofit kit. The PNP switch module is assembled to the basic positioner by inserting it between the base housing and the cover.

PosiFlex Control Options are stack-able and fully modular so that combinations of position transmitters and switch modules can be assembled as required.

Tabelle 8. **Specification PNP switch Option**

Switch type	3-Wire inductive PNP - NBB2-V3-E2
Voltage	Ub=10 to 30 V DC
Output current	Max. : 100 mA
Connections	Terminals inside the casing.
Entries	Metric units: 2x M20x1.5 Imperial unitx: 2x 1/2" NPT
Temperature	-20° to +80°C (-4°F to +176°F)
Housing	Aluminium Alloy
Enclosure	IP65 / NEMA4
Finish	Polyester powder coated

PosiFlex Option IS2
2 wire inductive switches (NAMUR)

Key features and benefits

■ Addition of two 2 wire inductive switches to provide an electrical indication at the end of stroke positions.

■ Stack-able switch module can easy added by inserting it between the base housing and the cover.

■ Easy switch point adjustment.

■ Pre-wired to easily accessible terminal blocks.

■ Module frame is fitted with two electrical entries.

■ Is available as factory fitted or as retrofit kit.

Description

This IS2 PosiFlex positioner option offers the addition of two 2 wire inductive switches to provide indication at the end of stroke positions.

These electronic switches are contact free and provide an exceptionally "clean" output signal and they are ultra low power inductive proximity switches.

Construction

The switches are operated by two cams (2) on an extension (3) of the positioner indicator spindle.

Both leads of both switches are pre-wired to terminal blocks (4) which are easily accessible when the positioner cover (5) is removed. All mechanical parts are contained within the enclosure.

Both switches are independently adjustable throughout the operating stroke, but are normally set to indicate at about 5° before each end position.

Two electrical entries (6) are provided, one of which is fitted with a blanking plug.

The IS switch modules may be added to standard Posiflex F10 or F20 positioners and are available as factory fitted or as retrofit kit. The IS2 switch module is assembled to the basic positioner by inserting it between the base housing and the cover.
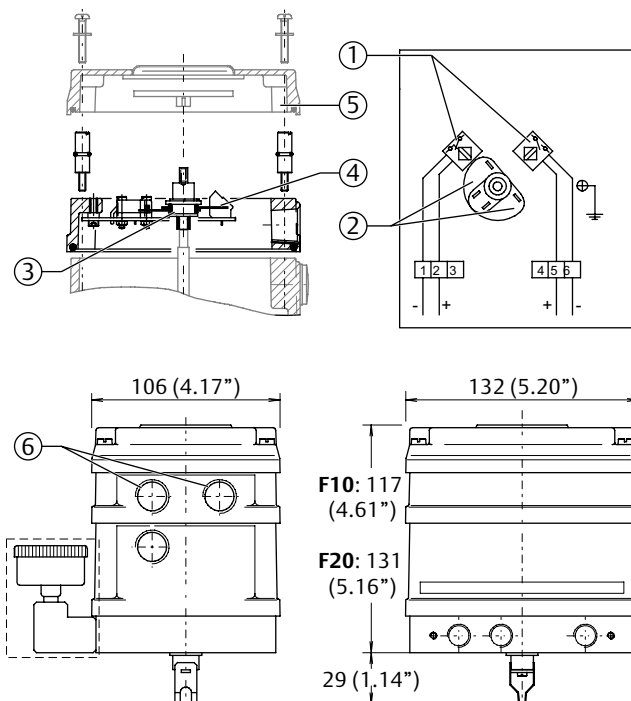
PosiFlex Control Options are stack-able and fully modular so that combinations of position transmitters and switch modules can be assembled as required.

Tabelle 9.   Specification IS2 Switch Option

Type	Inductive, 2 wire, SJ 3.5 N
Voltage	7 to 9V DC (acc. to DIN 19234)
Output	Un-switched: > 3 mA Switched:< 1 mA
Connections	Terminals inside the casing
Entries	Metric units: 2x M20x1.5 Imperial unitx: 2x 1/2" NPT
Temperature	-20° to +80°C (-4°F to +176°F)
Housing	Aluminium Alloy
Enclosure	IP65 / NEMA4
Finish	Polyester powder coated

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PosiFlex Option POT
Potentiometer

Key features and benefits

■ Provides a voltage output signal, by means of a 1 KOhm potentiometer.

■ Provides a continuous output signal in proportion to the mechanical position of the positioner.

■ Stack-able module can easy added by inserting it between the base housing and the cover.

■ Pre-wired to easily accessible terminal blocks.

■ Module frame is fitted with two electrical entries.

■ Is available as factory fitted or as retrofit kit.

Description

This positioner option offers the addition of a 1 KOhm potentiometer (1) and provides a continuous output signal in proportion to the mechanical position of the positioner and independent from the input signal.

When connected as shown, a voltage signal will indicate an analog position.

Construction

The potentiometer (1) is operated by gears (2) on an extension (3) of the positioner indicator spindle.

The potentiometer is pre-wired to terminal blocks (4) which are easily accessible when the positioner cover (5) is removed. All mechanical parts are contained within the enclosure.

Two electrical entries (6) are provided, one of which is fitted with a blanking plug.

The POT modules may be added to standard Posiflex F10 or F20 positioners and are available as factory fitted or as retrofit kit. The POT module is assembled to the basic positioner by inserting it between the base housing and the cover.
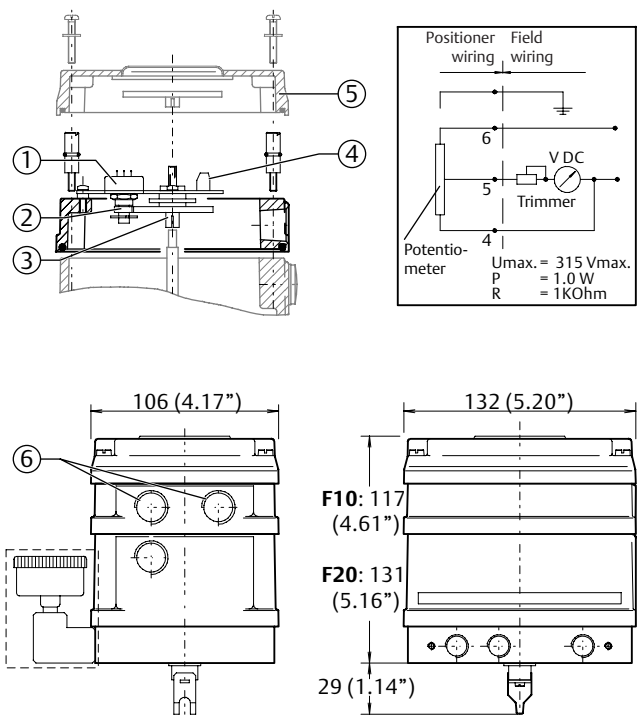
PosiFlex Control Options are stack-able and fully modular so that combinations of position transmitters and switch modules can be assembled as required.

Tabelle 10.   Specification POT Potentiometer Option:

Voltage	Up to 315 V
Power	Max. 1.0 Watt
Resistance	1 KOhm (±20%)
Linearity	≤ 1%
Entries	Metric units: 2x M20x1.5 Imperial unitx: 2x 1/2" NPT
Temp.	-20° to +80°C (-4°F to +176°F)
Housing	Aluminium Alloy
Enclosure	IP65 / NEMA4
Finish	Polyester powder coated

PosiFlex Option MTK

Actuator Mounting kits

Key features and benefits

- Default mounting kits are suitable for accessory mounting interfaces according VDI/VDE 3845-2

- Stainless steel brackets and fasteners provides excellent corrosion resistance.

- Fasteners for positioner and actuator included.

Description

This positioner option offers the addition of a mounting bracket with fasteners to mount the PosiFlex positioners on top of pneumatic actuators with an accessory mounting interface according VDI/VDE3845-2 (NAMUR).

Two variations are available for smaller and larger actuators. The brackets are made of stainless steel and are shipped with:

- Stainless steel fasteners for mounting the positioners on the bracket and

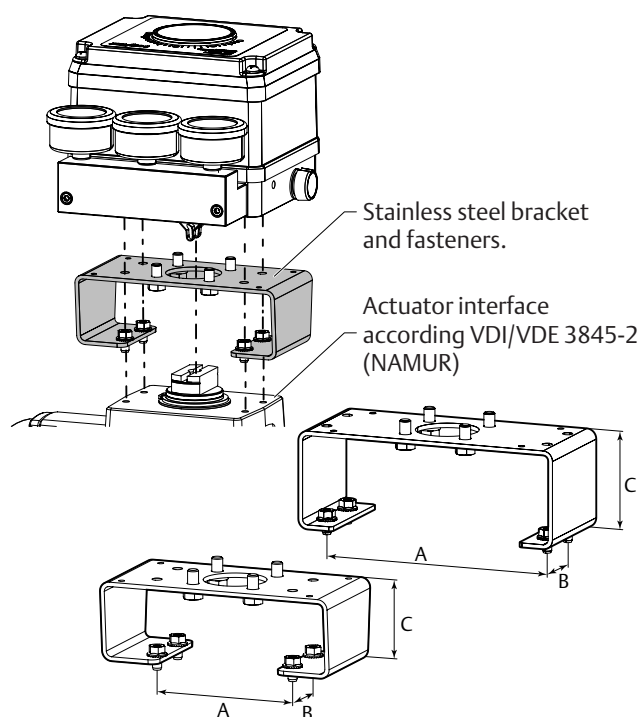- Stainless steel fasteners for mounting the complete assembly on the actuator.

Stainless steel bracket and fasteners.

Actuator interface according VDI/VDE 3845-2 (NAMUR)

Tabelle 11.   Specifications NAMUR Mounting Kits

Materials	
Bracket	AISI 304 Stainless steel
Fasteners	Stainless steel, grade A2
Dimensions small bracket	
A	80 mm / 3.15"
B	30 mm / 1.18"
C	45 mm / 1.77" - suitable for pinion top heights of 20 mm / 0.79"
Dimensions large bracket	
A	130 mm / 3.15"
B	30 mm / 1.18"
C	55 mm / 2.16" - suitable for pinion top heights of 30 mm / 1.18"

Block Dimensions F10 Positioner on Actuator
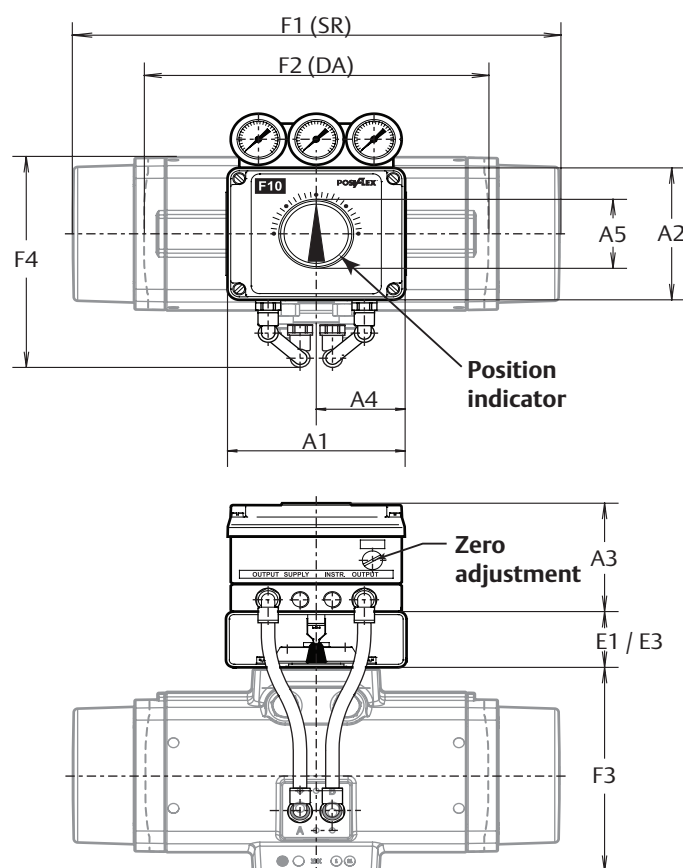## Dimensions on EL-O-Matic F-Series

Tabelle 12.   General Dimensions

Dim.	A1	A2	A3	A4	A5	E1	E3
mm	132	106	88	66	53	45	55
Inch	5.20	4.17	3.46	2.60	2.09	1.77	2.17

Notes:
1. For more detailed information of Posiflex positioners and options. Please consult data sheet PF.00.00.EN
2. Dimension F4 is a guide dimension. Actual F4 dimension might differ depending on actual used pipe fitting.
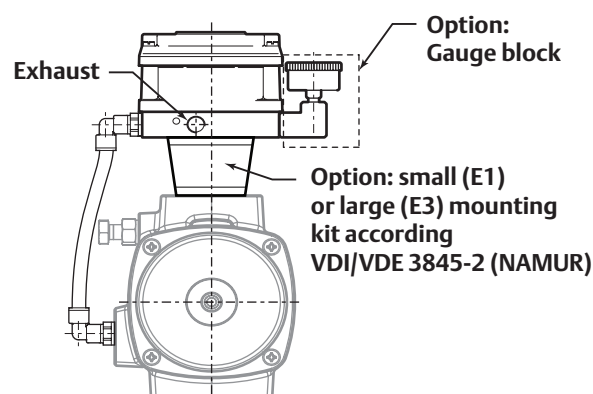3. A dedicated bracket is available for actuator size F12.

Tabelle 13.   Assembly Dimensions of Actuator and Positioner

Dim. in mm	Actuator size												
	0012	0025	0040	0065	0100	0150	0200	0350	0600	0950	1600	2500	4000
F1	118	166	192	217	247	304	362	385	476	658	732	877	959
F2	103	166	192	217	247	235	265	284	356	400	462	550	649
F3	60	91	112	124	131	157	163	201	248	268	302	354	389
F4	115	124	132	143.5	155	162	193.5	227.5	278.5	330	373	424	427
Inch	0012	0025	0040	0065	0100	0150	0200	0350	0600	0950	1600	2500	4000
F1	4.65	6.54	7.56	8.54	9.72	11.97	14.25	15.16	18.74	25.91	28.82	34.53	37.76
F2	4.06	6.54	7.56	8.54	9.72	9.25	10.43	11.18	14.02	15.75	18.19	21.65	25.55
F3	2.36	3.58	4.41	4.88	5.16	6.18	6.42	7.91	9.76	10.55	11.89	13.94	15.31
F4	4.53	4.88	5.2	5.65	6.1	6.38	7.62	8.96	10.96	12.99	14.69	16.69	16.81

Block Dimensions F20 Positioner on Actuator
Dimensions on EL-O-Matic F-Series

Position indicator
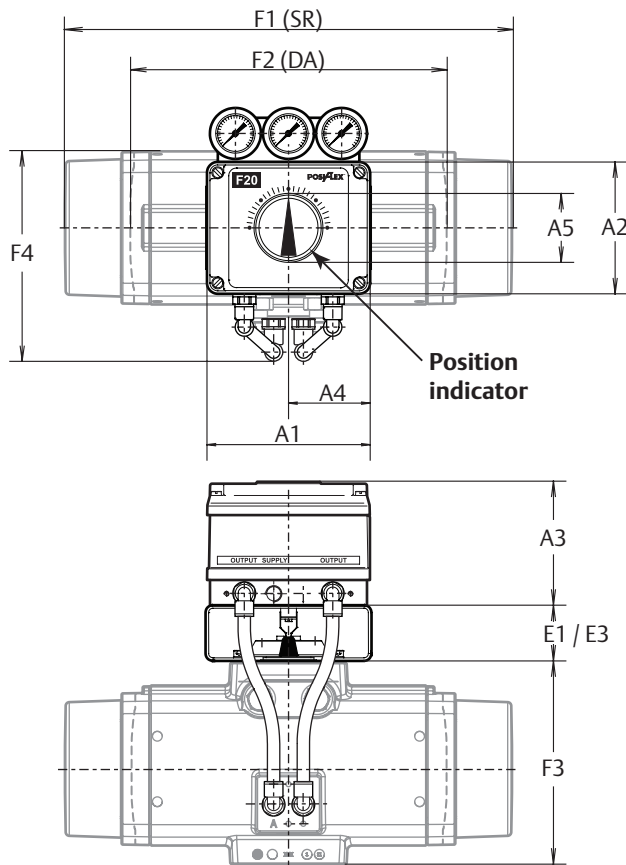
Tabelle 14. **General Dimensions**

Dim.	A1	A2	A3	A4	A5	E1	E3
mm	132	106	102	66	53	45	55
Inch	5.20	4.17	4.02	2.60	2.09	1.77	2.17

Notes:
1. For more detailed information of Posiflex positioners and options please consult data sheet PF.00.00.EN
2. Dimension F4 is a guide dimension. Actual F4 dimension might differ depending on actual used pipe fitting.
3. A dedicated bracket is available for actuator size F12

Electric entry:
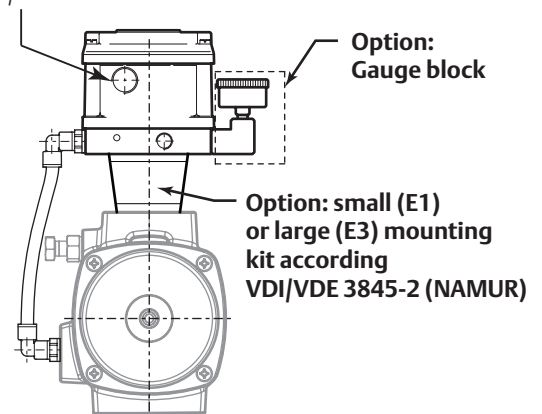Metric: M20x1.5
Imperial: 1/2"NPT

**Option:
Gauge block**

**Option: small (E1)
or large (E3) mounting
kit according
VDI/VDE 3845-2 (NAMUR)**

Tabelle 15. **Assembly Dimensions of Actuator and Positioner**

Dim. in mm	Actuator size												
	0012	0025	0040	0065	0100	0150	0200	0350	0600	0950	1600	2500	4000
F1	118	166	192	217	247	304	362	385	476	658	732	877	959
F2	103	166	192	217	247	235	265	284	356	400	462	550	649
F3	60	91	112	124	131	157	163	201	248	268	302	354	389
F4	115	124	132	143.5	155	162	193.5	227.5	278.5	330	373	424	427
Inch	0012	0025	0040	0065	0100	0150	0200	0350	0600	0950	1600	2500	4000
F1	4.65	6.54	7.56	8.54	9.72	11.97	14.25	15.16	18.74	25.91	28.82	34.53	37.76
F2	4.06	6.54	7.56	8.54	9.72	9.25	10.43	11.18	14.02	15.75	18.19	21.65	25.55
F3	2.36	3.58	4.41	4.88	5.16	6.18	6.42	7.91	9.76	10.55	11.89	13.94	15.31
F4	4.53	4.88	5.2	5.65	6.1	6.38	7.62	8.96	10.96	12.99	14.69	16.69	16.81

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