

# Pressure, force, displacement, speed, flow

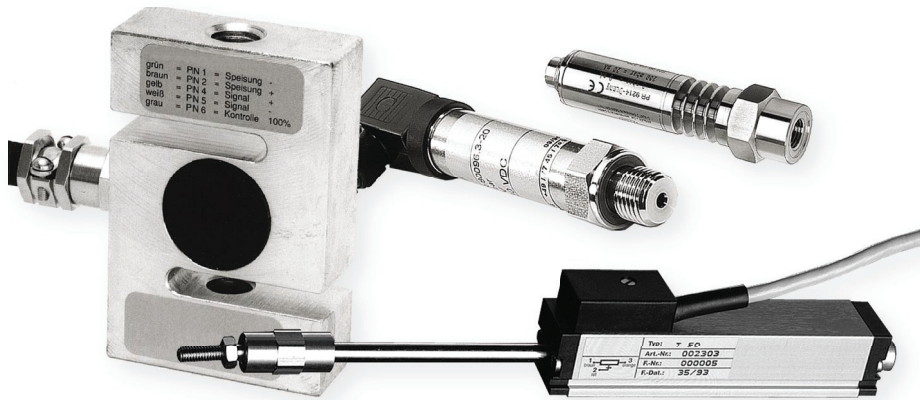
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Pressure

force, displacement, flow

# Pressure



## The Right Pressure Sensor For Any Measuring Task

Different methods are usually used for manufacturing pressure sensors that have been adapted to the corresponding application.

- Thick-Film Sensors
- Thin-Film Sensors
- Piezo-Resistive Sensors

### Thick-Film Sensors

The expansion-sensitive elements are applied to a special steel membrane by screen printing technology.

### Thin-Film Sensors

In a demanding manufacturing process, the wire strain gauges are directly formed on a passivated special steel membrane by a chemical vapour deposition process.

### Piezo-Resistive Sensors

A silicone membrane with diffused in expansion-sensitive resistors is used as the pressure-sensitive element. Due to its compatibility with many substances silicone would limit the use of the sensor. Therefore, a pressure transmission system, consisting of a filling liquid and a special steel membrane has been integrated. The pressure measuring cell is temperature-compensated and is manufactured in demanding vacuum processes.

#### Advantage:

High accuracy within a wide temperature range, particularly suitable for use in high sophisticated measurement and control

Pressure transducers are principally available with 4 pressure calibrations:

- Relative pressure: Pressure related to the environmental pressure
- Absolute pressure: Pressure related to vacuum (0bar)
- Overpressure: Pressure related to atm.

#### Advantage:

Compact design, particularly suitable for use in simple monitoring and control circuits.

#### Advantage:

Very compact and homogeneous design, high long-term stability and dynamic load capacity, particularly suitable for operation in harsh industrial environments in the range of medium and high relative pressures.

tasks, especially for measurement of absolute pressure and low to medium relative pressure.

#### Disadvantage:

Generally, an expensive manufacturing process, however, cost-efficient when produced in large quantities.

Two mechanical designs are available in the ALMEMO® sensor range:

- Pressure sensors for hose connection: The measuring cell is housed in a compact plastic housing with two connecting fittings. The pressure sensors are available for wall mounting or as pressure modules that can be directly

pressure at manufacturing (approx. 1bar)

- Differential press.: Pressure related to a second, variable pressure

#### Disadvantage:

Limited operating temperature range, measured values are subject to a long-term variation

#### Disadvantage:

Very expensive manufacturing process.

plugged into measuring instruments, with measuring ranges for relative or differential pressure measurement in gases, and also for atmospheric pressure measurements.

- Built-In Pressure Transducers:

The measuring cell is suspended in an oil-filled, all-welded special steel enclosure. All parts that come into contact with a substance are made from special steel. Therefore, these transducers are also suitable for use in chemically aggressive substances in various industrial applications.

## Temperature Measurement with Pressure Sensors for Refrigerants

### Option SB0000R

All ALMEMO® Version V5/V6 devices, including ALMEMO® data loggers and

data acquisition systems, can be used for continuous temperature measurement (resolution 0.1K) with absolute pressure sensors (resolution 0.001 bar compulsory !).

Both, pressure and temperature can be selected or continuously indicated and recorded. (cf. page 10.08)

## Pressure Transducer FDA 602 L

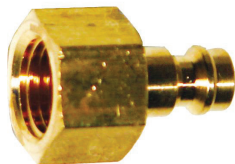


- Compact pressure sensors for industrial applications in liquid and gaseous substances.
- Piezo-resistive, flexibly suspended silicone measuring cell in an oil-filled, all-welded special steel enclosure.
- The stable mechanical construction provides a reliable protection for the measuring cell against the test substance and immunizes it against pressure peaks and vibrations.
- Available with three calibrations.  
Relative pressure: Pressure related to the environmental pressure.  
Absolute pressure: Pressure related to vacuum (0 bar)  
Overpressure: Pressure related to atm. pressure at manufacturing (approx. 1bar).

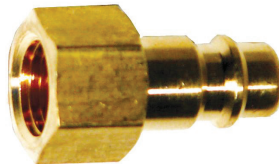
### Technical Data:

Overload	Two times final value
Output signal	0.2 to 2.2 V
Accuracy class (linearity + hysteresis + reproducibility)	±0.5 % of final value
Total error range	
0 to +50 °C	±1.0 % of final value
-10 to +80 °C	±1.5 % of final value
(linearity + hysteresis + reproducibility + temperature coefficients + zero-point + range tolerance)	
Response time (0 to 99 %)	<5 ms
Nominal conditions	22°C ±2 K, 10 to 90 % RH, non-condensing

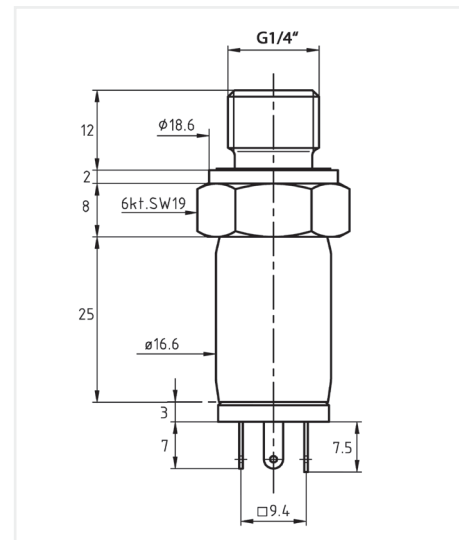
Power supply	6.5 to 15 VDC, consumption <4 mA via ALMEMO® connector
Operating temperature	-40 to +100 °C
Pressure terminal	male thread G1/4" membrane not flush with front
Material in contact with medium	Stainless steel DIN 1.4404/1.1135 External seal Viton
Weight	approx. 50 g
Protective class	IP 65



Quick-release coupling  
nominal width 5  
internal thread G1/4"



nominal width 7,2  
internal thread G1/4"



### Accessories

- PTFE sealing tape, -200 to +260 °C, width 10 mm, thickness 0.1 mm, roll of 12 meters
- Quick-release coupling, nominal width 5, up to 35 bar Connection internal thread G1/4", brass
- Quick-release coupling, nominal width 7.2, up to 35 bar connection internal thread G1/4", brass

### Order no.

- ZB9000TB
- ZB9602N5
- ZB9602N7

**Types:** including ALMEMO® cable 1.5m long

#### Measuring ranges relative pressure:

- up to 2.5 bar **FDA602L3R**
- up to 5 bar **FDA602L4R**
- up to 10 bar **FDA602L5R**

#### Measuring ranges absolute pressure:

- up to 2.5 bar **FDA602L3A**
- up to 5 bar **FDA602L4A**
- up to 10 bar **FDA602L5A**

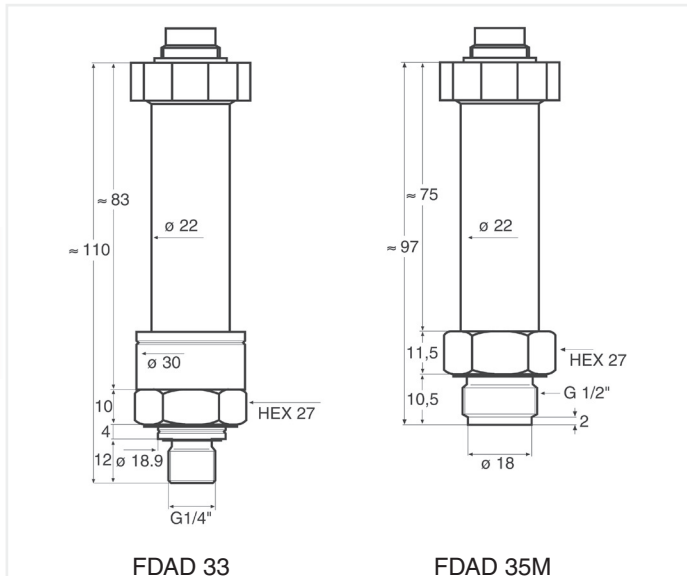
#### Measuring ranges overpressure:

- up to 25 bar **FDA602L2U**
- up to 50 bar **FDA602L3U**
- up to 100 bar **FDA602L4U**
- up to 500 bar **FDA602L6U**

Pressure transducer for measuring the temperature of refrigerants see page 10.08.  
DAkkS / DKD or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)

## High-precision pressure sensor FDAD33/35M

Very accurate over a wide temperature range, digital sensor with ALMEMO® D6 plug



- Stable piezo-resistive transducer with integrated A/D converter and signal processor
- Temperature-dependence and non-linearity are eliminated by means of mathematical compensation; this ensures a high level of accuracy.
- Digital output of measured value
- The current value is measured at the sensor's high sampling rate.
- To acquire transitory pressure fluctuations and pressure peaks the maximum value, minimum value, and average value are calculated from the current values in the ALMEMO® D6 plug and output in three function channels.
- One measuring channel is programmed (at our factory) :  
Pressure (bar, p)  
Up to three function channels can also be activated (via LMEMO® device V6) :  
Maximum value, minimum value, average value. This device can be completely configured directly on a PC via USB adapter cable ZA 1919 AKUV. (see "General accessories for ALMEMO® D6 sensors" page 04.05).

**General features and accessories, ALMEMO® D6 sensors:**  
see page 01.08

## Technical data

Digital pressure sensor (including A/D converter)	
Pressure range	1 to 1000 bar see under variants
Relative pressure	Zero-point at ambient atmospheric pressure, current
Overpressure	Zero-point at ambient atmosph. pressure, production
Absolute pressure	Zero-point, vacuum
Pressure connection	
FDAD33	Outside thread G 1/4" Diaphragm, internal
FDAD35M	Diaphragm, flush with front Outside thread G 1/2" In pressure range 700/1000 bar Outside thread G 3/4"
Storage / operating temperature	-40 to +120 °C
Accuracy	
Error margin* at -10 to +40 °C	0.05 % of final value
Error margin* at -10 to +80 °C	0.1 % of final value
*Linearity, hysteresis, reproducibility, temperature coefficients, zero-point	

Sampling rate, internal	200 Hz
Material in contact with medium	Stainless steel, AISI 316L, Viton
Protection	IP65
Dimensions	see dimensional drawings
Sensor connector	Built-in plug
ALMEMO® connecting cable	Coupling, 2-meter PVC cable, ALMEMO® D6 plug
ALMEMO® D6 plug	
Refresh time	0.005 seconds for all channels
Setting time	0.6 seconds
Delay after sleep mode	1 second
Supply voltage	6 to 13 VDC
Current consumption	approx. 11 mA

Options	Order no.
Connecting cable Total length = 5 m	OD0D33L05
Connecting cable Total length = 10 m	OD0D33L10
Greater lengths up to 100 meters on request..	

## Variants

Digital pressure sensor, plug connection, 2-meter connecting cable with ALMEMO® D6 plug, factory test certificate

Pressure range	Resolution	Overload	Order no. Diaphragm, internal	Order no. Diaphragm, flush with front
<b>Relative pressure</b>				
0 to 1 bar	0.0001 bar	2 bar	<b>FDAD3301R</b>	<b>FDAD35M01R</b>
0 to 3 bar	0.0001 bar	5 bar	<b>FDAD3302R</b>	<b>FDAD35M02R</b>
0 to 10 bar	0.001 bar	20 bar	<b>FDAD3303R</b>	<b>FDAD35M03R</b>
0 to 30 bar	0.001 bar	60 bar	<b>FDAD3304R</b>	<b>FDAD35M04R</b>
<b>Overpressure</b>				
0 to 100 bar	0.01 bar	200 bar	<b>FDAD3305U</b>	<b>FDAD35M05U</b>
0 to 300 bar	0.01 bar	400 bar	<b>FDAD3306U</b>	<b>FDAD35M06U</b>
0 to 700 bar	0.1 bar	1000 bar	<b>FDAD3307U</b>	<b>FDAD35M07U</b>
0 to 1000 bar	0.1 bar	1000 bar	<b>FDAD3308U</b>	<b>FDAD35M08U</b>
<b>Absolute pressure</b>				
0,8 to 1,2 bar	0.0001 bar	2 bar	<b>FDAD3300A</b>	<b>FDAD35M00A</b>
0 to 1 bar	0.0001 bar	2 bar	<b>FDAD3301A</b>	<b>FDAD35M01A</b>
0 to 3 bar	0.0001 bar	5 bar	<b>FDAD3302A</b>	<b>FDAD35M02A</b>
0 to 10 bar	0.001 bar	20 bar	<b>FDAD3303A</b>	<b>FDAD35M03A</b>
0 to 30 bar	0.001 bar	60 bar	<b>FDAD3304A</b>	<b>FDAD35M04A</b>

DAkks / DKD or factory calibration KD9xxx pressure for digital sensor (see chapter Calibration certificates)

# Pressure

## Pressure Sensors FD 8214



- Compact pressure sensors for liquid and gaseous substances.
- Piezo-resistive measuring cell with temperature compensation.
- Pressure membrane and enclosure made from special steel.
- Available with three calibrations.  
Relative pressure:  
Pressure related to the environmental pressure.  
Absolute pressure:  
Pressure related to vacuum (0bar).  
Overpressure:  
Pressure related to atm. pressure at manufacturing (approx. 1bar).



As the pressure is transmitted to the pressure membrane through a small hole in the thread part, the liquids should not be prone to crystallise and gases should not be heavily contaminated with dust.

Options	Order no.		Order no.
Linearity 0.1% (for ranges 1 bar to 600 bar)	OR8214G1	KF25	OR8214KF25
Substance temperature -25 to +100°C	OR8214T1	Food compliant version	
Substance temperature -25 to +150°C (version with cooling fins)	OR8214T2	with vegetable oil ASEOL Food	OR8214ML
Process connection, small flange (for FD8214xxA absolute pressure)		Throttle against excess pressure	OR8214DS
KF16	OR8214KF16	Output 0 to 10V	OR8214V
		Output 0 to 20mA	OR8214A
		Output 4 to 20mA	OR8214R4

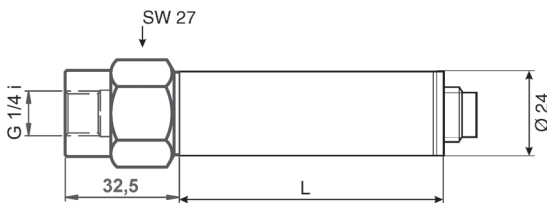
  

Accessories	Order no.		Order no.
Coupler socket with 2m cable and ALMEMO® connector	ZA8214AK	Coupler socket 6-pin Straight version	ZB9030RB
		Coupler socket 6-pin Angled version	ZB9030RBW

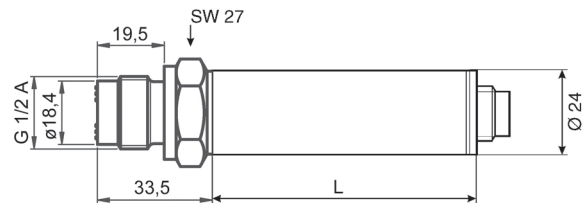
Types	Order no.		G1/4" internal thread	G1/2" external thread
FD 8214:				
Standard version with G1/4" internal thread				
Other threads available on request				
FD 8214 M:				
Membrane (welded with end of thread) flush with front, external thread G1/2", can be sterilised (important for food and pharmaceutical industry)				
Other threads available on request				
			G1/4" internal thread	G1/2" external thread
<b>Measuring ranges relative pressure:</b>				
0 to 100 mbar	FD821401R	FD8214M01R		
0 to 160 mbar	FD821402R	FD8214M02R		
0 to 250 mbar	FD821403R	FD8214M03R		
0 to 400 mbar	FD821404R	FD8214M04R		
0 to 600 mbar	FD821405R	FD8214M05R		
0 to 800 mbar	FD821406R	FD8214M06R		
0 to 1 bar	FD821407R	FD8214M07R		
0 to 1.6 bar	FD821408R	FD8214M08R		
0 to 2.5 bar	FD821409R	FD8214M09R		
0 to 4 bar	FD821410R	FD8214M10R		
0 to 6 bar	FD821411R	FD8214M11R		
0 to 10 bar	FD821412R	FD8214M12R		
			<b>Measuring ranges absolute pressure:</b>	
			Option: Process connection, small flange (see under Options)	
			0 to 1 bar	FD821407A FD8214M07A
			0 to 1.6 bar	FD821408A FD8214M08A
			0 to 2.5 bar	FD821409A FD8214M09A
			0 to 4 bar	FD821410A FD8214M10A
			0 to 6 bar	FD821411A FD8214M11A
			0 to 10 bar	FD821412A FD8214M12A
			<b>Measuring ranges overpressure:</b>	
			0 to 10 bar	FD821412U FD8214M12U
			0 to 16 bar	FD821413U FD8214M13U
			0 to 25 bar	FD821414U FD8214M14U
			0 to 40 bar	FD821415U FD8214M15U
			0 to 60 bar	FD821416U FD8214M16U
			0 to 100 bar	FD821417U FD8214M17U
			0 to 160 bar	FD821418U FD8214M18U
			0 to 250 bar	FD821419U FD8214M19U
			0 to 400 bar	FD821420U FD8214M20U
			0 to 600 bar	FD821421U FD8214M21U
			0 to 1000 bar	FD821422U FD8214M22U
			other measuring ranges on request	
			DAkks / DKD or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)	

## Technical Data

Measuring cell:	piezo-resistive
Overload	Ranges 600 bar, i.e. 1.5 times the final value (minimum 3 bar, maximum 850 bar) Ranges >600 bar, 1500 bar
Output signal, power supply :	Standard 0 to 2 volts, feed 6.5 to 13 volts (from ALMEMO® device), current <4 mA Option : 0 to 10 volts, feed 15 to 30 volts, load >10 kilohms, current <4 mA Option : 0 to 20 mA, feed 9 to 33 volts, (>18 volts at load 500 ohms), current <25 mA Option : 4 to 20 mA, 2 conductors, feed 9 to 33 volts, (>18 volts at load 500 ohms), current <25 mA
Response time:	<1.5 ms / 10 to 90 % nominal pressure
Linearity:	Standard $\pm 0.25$ % of final value Option : $\pm 0.1$ % of final value for ranges 1 bar and up to 600 bar
Media temperature:	0 to +80°C, temperature comp.: 0 to +70°C option: -25 to +100°C, temperature comp.: -25 to +85°C -25 to +150°C, temperature comp.: -25 to +85°C
Temperature drift:	Zero-point $\leq \pm 0.04$ % of final value / °C for ranges >0.5 bar span $\leq \pm 0.02$ % of final value / °C for all ranges
Nominal temperature:	22°C $\pm 2$ K, 10 to 90% rH non-condensing
Material:	housing, pressure connector, membrane: special steel 1.4435
Operat. environment/Sealing:	IP 67
Dimensions:	see drawing
Connecting threads:	Type 8214: internal thread G1/4", wrench SW 27 Option for absolute pressure: small flange KF16 or KF21 Type 8214 M: external thread G1/2", wrench SW 27 Other threads are available on request
Electrical connection	Flush-mounting connector, binder coupling 723, 5-pin
Weight:	approx.. 180 g



Type **FD 8214** standard version with internal thread G1/4"  
L = 45 mm (L = 72 mm with option of medium temperature up to 150 °C with cooling ribs)



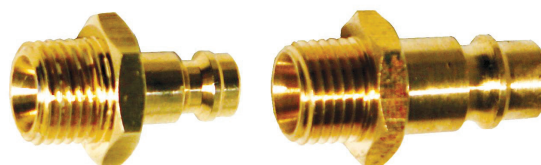
Type **FD8214M** membrane flush with front (welded with end of thread), internal thread G1/2" can be easily sterilized  
L = 45mm  
(L = 72 mm with option of medium temperature up to 150 °C with cooling ribs)

## Accessories

Accessories	Order no.
PTFE sealing tape, -200 to +260 °C, width 10 mm, thickness 0.1 mm, roll of 12 meters	ZB9000TB
Quick-release coupling, nominal width 5, up to 35 bar Connection G1/4" external thread, brass	ZB8214N5

Accessories	Order no.
Quick-release coupling, nominal width 7.2, up to 35 bar Connection 1/4" external thread, brass	ZB8214N7

Quick-release coupling nominal width 5 external thread G1/4"



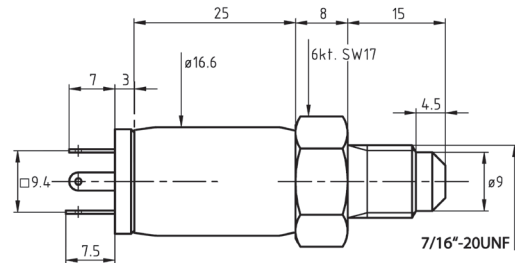
Quick-release coupling nominal width 7.2 external thread G1/4"

# Pressure

## Pressure transducer for measuring the temperature of refrigerants FDA 602 LxAK



- Compact pressure sensors for industrial applications in liquid and gaseous substances.
- Piezo-resistive, flexibly suspended silicone measuring cell in an oil-filled, all-welded special steel enclosure.
- The stable mechanical construction provides a reliable protection for the measuring cell against the test substance and immunizes it against pressure peaks and vibrations.
- Absolute pressure: pressure related to vacuum (0 bar).



### Technical Data:

Overload	Two times final value	Power supply	6.5 to 15 VDC, consumption <4 mA via ALMEMO® connector
Output signal	0.2 to 2.2 V	Operating temperature	-40 to +100 °C
Accuracy class (linearity + hysteresis + reproducibility)	±0.5 % of final value	Pressure terminal	male thread G1/4" membrane not flush with front
Total error range 0 to +50 °C -10 to +80 °C (linearity + hysteresis + reproducibility + temperature coefficients + zero-point + range tolerance)	±1.0 % of final value ±1.5 % of final value	Material in contact with medium	Stainless steel DIN 1.4404/1.1135 External seal, Viton
Response time (0 to 99 %)	<5 ms	Weight	approx. 50 g
Nominal conditions	22°C ±2 K, 10 to 90 % RH, non-condensing	Protective class	IP 65

### Calculation of the refrigerant temperature with device special version SB0000R2

The ALMEMO® Version V6 devices, (2590-2/-3S/-4S, 2690, 2890, 8590, 8690, 5690) can be used for continuous temperature measurement (resolution 0.1K) with absolute pressure sensors (resolution 0.001 bar compulsory!). Both, pressure and temperature can be selected or continuously indicated and recorded.

Technical data for ALMEMO® option SB0000R2:

Refrigerant:	R22	R23	R134a	R404a	R404a
Pressure Range:	0 to 36 bar	0 to 49 bar	0 to 40,5 bar	0 to 32 bar	0 to 32 bar
Temperature Range:	-90°C to +79°C *	-100°C to +26°C *	-75°C to +101°C *	-60°C to +65°C *	-60°C to +65°C *
Operation point	dew-point	dew-point	dew-point	dew-point	boiling point
Refrigerant:	R407C	R407C	R410A	R417A	R507
Pressure Range:	0 to 46 bar	0 to 46 bar	0 to 49 bar	0 to 27 bar	0 bis 37 bar
Temperature Range:	-50°C to +86°C *	-50°C to +86°C *	-70°C to +70°C *	-50°C to +70°C *	-70°C to +70°C *
Operating point	dew-point	boiling point	dew-point	dew-point	dew-point

\*) Der Endtemperaturbereich ergibt sich aus den vorliegenden Daten der Kältemittel. Bei Druckgebern mit kleineren Druckbereichen ändert sich lediglich die angegebene Endtemperatur. (Linearisierungen für weitere Kältemittel auf Anfrage)

Geräte-Sonderausführung Kältemitteltemperatur für ALMEMO® Geräte V6

(Bitte beim Geräteneukauf mitbestellen bzw. vorhandenes Gerät zum Upgrade einschicken)

Order no. SB0000R2

### Types

including ALMEMO® connecting cable, 1.5 m, and programming of a refrigerant measuring channel  
Measuring ranges Absolute pressure (resolution 0.001 bar)

- up to 10bar
- up to 30bar
- up to 50bar

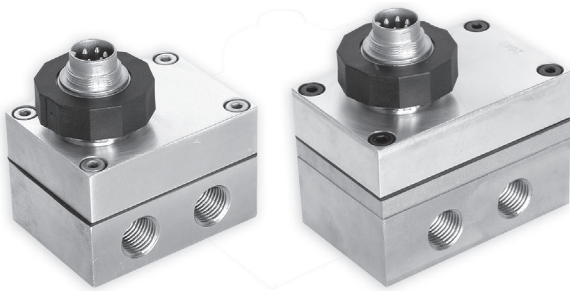
Order no.

- FDA602L5AK
- FDA602L6AK
- FDA602L7AK

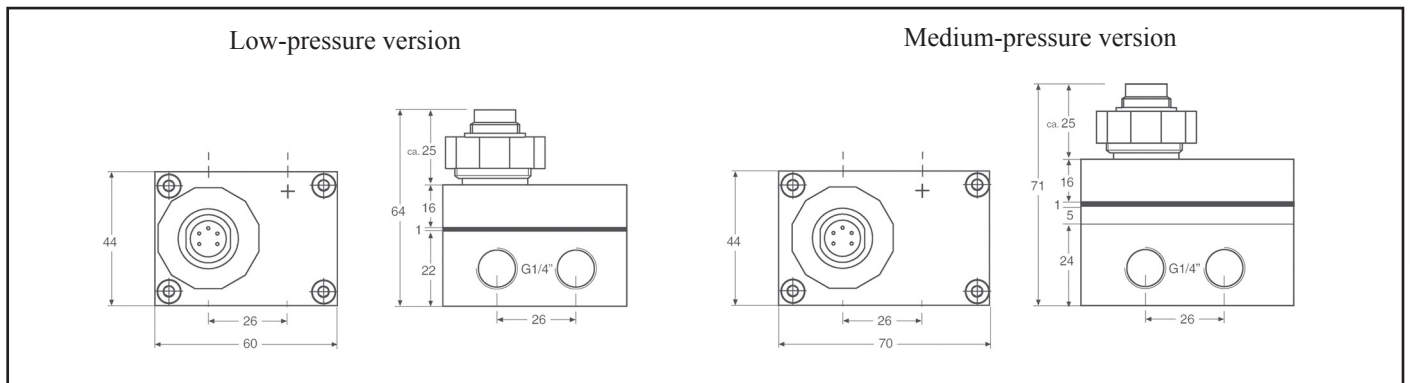
DAkS / DKD or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)



## Differential pressure transmitter FDA 602 D



- This measures the differential pressure in liquid and gaseous media indirectly using two absolute pressure sensors.
- This makes it less expensive but more robust with respect to asymmetrical overload.
- The differential pressure range should be at least 5% of the standard pressure range.
- Each side of the sensor incorporates two pressure connections. The transmitters can thus be used easily and conveniently in pressure pipes.
- It incorporates a high-speed, high-precision microprocessor.
- All reproducible errors affecting the pressure sensors, i.e. involving non-linearity and temperature dependency, can be completely eliminated by means of mathematical error compensation.



### Technical Data:

Standard pressure range (maximum measurable pressure per pressure connection), overload, differential pressure range.  
See versions listed below.

Storage / operating temperature -40 to +100 °C

Compensated standard range -10 to +80 °C

Error margin  $\leq 0.05\%$  of final value, typical  
 $\leq 0.1\%$  of final value, max.

with respect to standard pressure range  
(linearity + hysteresis + reproducibility + temperature error)

Pressure connections G1/4" thread, female  
(2 per side)

Material in contact with medium Stainless steel, 316L,  
DIN 1.4435

Power supply 6 to 15 VDC via  
ALMEMO® connector

Output 0 to 2 V

Electrical connection Binder plug, including  
ALMEMO® connecting cable,  
2 meters

CE conformance EN61000-6-1 to 4  
with shielded cable

Protective class IP 65

Weight  
Low-pressure version 475 grams  
Medium-pressure version 750 grams

### Types

Differential pressure transmitter, including ALMEMO® cable, 2 meters

Standard pressure range Absolute pressure	Overload	Differential pressure range Please indicate final value	Order no.
<b>Low-pressure version</b>			
0 to 3 bar	10 bar	0 to 0.2 to 3 bar	<b>FDA602D01</b>
0 to 10 bar	20 bar	0 to 0.5 to 10 bar	<b>FDA602D02</b>
0 to 25 bar	40 bar	0 to 1.25 to 25 bar	<b>FDA602D03</b>
<b>Medium-pressure version</b>			
0 to 100 bar	200 bar	0 to 5 to 100 bar	<b>FDA602D10</b>
0 to 300 bar	450 bar	0 to 15 to 300 bar	<b>FDA602D11</b>

DAkKS / DKD or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)

# Pressure

## Digital atmospheric pressure sensor FDAD 12 SA, for barometric pressure Integrated in ALMEMO® D6 plug



**General features and accessories, ALMEMO® D6 sensors**  
see page 01.08

### Special features

- Digital atmospheric pressure sensor with temperature compensation
- Very accurate over a wide temperature range
- The value measured for atmospheric pressure can also be used to compensate other sensors on the ALMEMO® device (programming comment \*P).
- Compact design, without pressure connection sleeve
- Can be connected directly to the measuring instrument.
- One measuring channel is programmed (at our factory).
- Atmospheric pressure (mbar, AP, p)

### Technical Data

Digital atm. pressure sensor (integrated in ALMEMO® D6 plug)		ALMEMO® D6 plug	
Measuring range	700 to 1100 mbar	Refresh rate	1 second for all channels
Accuracy	±2.5 mbar (at 0 to +65 °C)	Supply voltage	6 to 13 VDC
Operating range	-10 to +60 °C 10 to 90 % RH non-condensing	Current consumption	4 mA
Dimensions	62 x 20 x 7.6 mm		

### Variants (including manufacturer's test certificate)

Digital atmospheric pressure sensor for barometric pressure, integrated in ALMEMO® D6 plug  
DAkkS / DKD or factory calibration KD92xx atmospheric pressure for digital sensor (see chapter Calibration certificates)

**Order no.**  
**FDAD12SA**

## Pressure measuring connector for barometric pressure FDA 612 SA



- Compact design - can be plugged directly onto measuring instrument.
- Piezo-resistive pressure sensor - ensures high measuring accuracy.

### Technical Data:

Measuring range	700 to 1050 mbar (total range 0 to 1050 mbar)	Sensor material	aluminum, nylon, silicone, silica gel, brass
Overload capacity	Maximum 1.5 times final value	Operating range	-10 to +60 °C, 10 to 90% RH, non-condensing
Accuracy	±0.5 % of final value	Dimensions	90 x 20 x 7,6 mm
Nominal temperature	25 °C		
Temperature drift	<±1 % final value at 0 to +70 °C		
Hose terminals	Ø 5 mm, 12 mm long		

### Accessories

	Order no.		Order no.
Connecting cable, 0.2 meters	ZA9060AK1	Extension cable, 4 meters	ZA9060VK4
Extension cable, 2 meters	ZA9060VK2		

### Variants (including manufacturer's test certificate)

Pressure measuring connector for barometric pressure with pressure terminal sleeve  
DAkkS / DKD or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)

**Order no.**  
**FDA612SA**

## Pressure measuring connector for differential pressure FDA 612 SR, FDA 602 S2K



- New compact design - can be plugged directly onto measuring instrument.
- Piezo-resistive pressure sensor - ensures high meas. accuracy.



Advisory note when used in conjunction with ALMEMO® 2890, 5690, 5790, 8590, 8690:

The new ALMEMO® pressure measuring connector is very slightly higher (8.8 mm). As a result adjacent input sockets on the ALMEMO® device may be partly covered. However, the 1st input socket can always be used without restriction. Or, alternatively, the ALMEMO® pressure measuring connector can be plugged in at any input socket using connecting cable ZA9060AK1.

### Technical Data

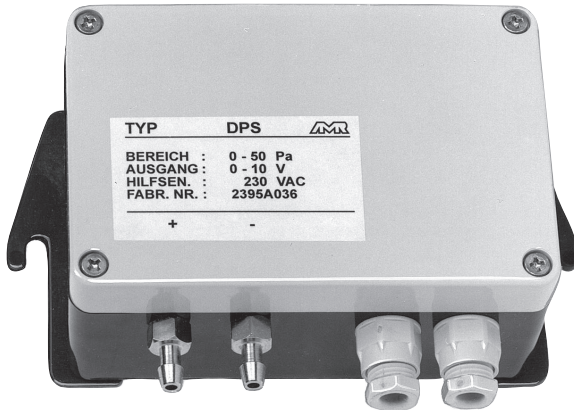
Overload capacity	FDA612SR	max. 1.5 times final value		
	FDA602S2K	maximum 250 mbar		
Accuracy (zero-pt adjusted)		±0.5% of final value in range		
		0 to positive final value		
Common mode pressure		FDA602S2K max. 700 mbar		
Nominal temperature		25 °C		
Temperature drift				
	FDA612SR	< ±1.5 % of final value		
		compensated temperature range 0 to +70 °C		
	FDA602S2K	< ±2 % of final value		
		compensated temperature range -25 to +85 °C		
			Operating range	-10 to +60 °C, 10 to 90% RH, non-condensing
			Dimensions	New 74 x 20 x 8.8 mm
			Hose terminals	Ø 5 mm, 12 mm long
			Sensor material	aluminum, nylon, silicone, silica gel, brass

Accessories	Order no.	Order no.
Connecting cable, 0.2 meters	ZA9060AK1	Extension cable, 4 meters
Extension cable, 2 meters	ZA9060VK2	ZA9060VK4

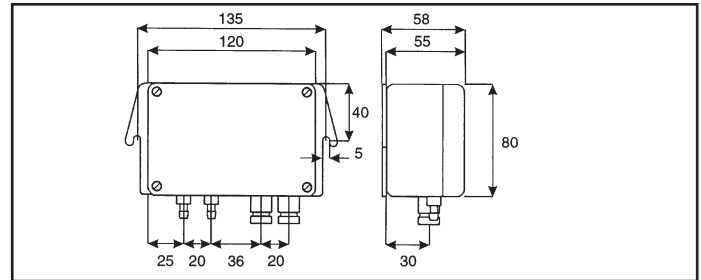
Variants (including manufacturer's test certificate)	Order no.
(including one set of silicone hoses, 2 meters) Pressure measuring connector for differential pressure	
Range ±1000 mbar	<b>FDA612SR</b>
Range ±250 Pa (independent of position)	<b>FDA602S2K</b>
Range ±1250 Pa or ±6800 Pa see page 09.06	
DAkKS / DKD or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)	

# Pressure

## Pressure Sensors for Wall Mounting FD 8612 DPS / APS



- Suitable for use in the laboratory, as well as for use in harsh industrial environments, e.g. HEVAC applications, clean room technology, medical technology, filter technology and finishing pass technology.
- The robust mechanics guarantees long term stability, linearity and good reproducibility.
- Temperature drift reduced to a minimum by specific compensation of the sensors.
- Operation is almost maintenance-free, as a result of the free-from-wear inductive measuring system.
- As standard, the integrated electronics provide a pressure proportional voltage signal from 0 to 2V as output.



### Technical Data:

Linearity:	±1% of final value, option: ±0.2% or ±0.5%
Hysteresis:	±0.1% of final value
Nominal temperature:	23°C
Overload capacity:	up to 400 mb: 5-fold, from 500 mb: 2-fold
Max. common mode pressure:	1 bar (at differential measurement)
Power supply:	6 ... 12 VDC, option: 230V 50/60Hz
Power consumption:	approx. 3.5mA
Output:	0 to 2V, option: 0 to 10V/0(4) to 20mA
Connection:	electrical: screw terminals, screwed cable gland PG 7, pressure: 6.5mm hose connection

Rise time:	$T_{90}$ approx. 0.02s
Temperature drift:	
Zero point	0.03% of final value / K,
range	0.03% of final value / K
Operative range:	+10 to +50°C, air humidity 10 to 90% non-condensing
Storage temperature:	-10 to +70°C
Housing:	material ABS 120 x 80 x 55mm (L x H x D) Safety class: 0
Protection system:	IP 54
Weight:	approx. 300g
Sensor capacity:	approx. 3ml
Volume increase:	approx. 0.2ml at nom. press.k

Optionen	Order no.	Order no.
Linearity 0.2% (DPS from final value / APS from range) with DPS only in ranges $\geq 2.5$ mbar with APS only in range $\leq 100$ mbar	OD8612L2	Power supply : 230 V Output 0 to 10 V (voltage supply 19 to 31 V DC) OD8612N OD8612R2
Linearity 0.5% (DPS from final value / APS from range) with DPS only in ranges $\geq 1$ mbar with APS only in range $\leq 200$ mbar	OD8612L5	Output 0 to 20 mA (voltage supply 19 to 31 V DC) Output 4 to 20 mA (voltage supply 19 to 31 V DC) OD8612R3 OD8612R4

Accessories	Order no.	Order no.
Connecting cable 2m long mounted with connector for connection to ALMEMO® devices	ZA8612AK2	Silicone hose black per m ZB2295SSL
1 set silicone hoses 2m long black/colourless	ZB2295S	Silicone hose colourless per m ZB2295SFL

Types	Order no.	Order no.
<b>Measuring ranges relative and differential pressure:</b> Pressure transducer type DPS 0 to 2.5 mbar ... 1000 mbar Please specify measuring range	<b>FD8612DPS</b>	<b>Measuring ranges absolute pressure:</b> Pressure transducer type APS 0 to 1000 mbar, 900 to 1100 mbar, 800 to 1200 mbar Please specify measuring range
Range 1 mbar (100 Pa), additional charge	<b>OD8612P10</b>	<b>FD8612APS</b>
Range 0.5 mbar (50 Pa), additional charge	<b>OD8612P05</b>	DAkKS / DKD or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)

## Differential pressure transmitter for smallest pressure with automatic zero-point correction, FD 8612 DPT25R8AZ For air and non-aggressive gases



- Adjustable differential pressure measuring transducer for the purposes of monitoring the differential pressure in air and in other non-combustible and non-aggressive gases
- Possible uses include : Monitoring of air filters, of forced-air fans and blowers, of industrial air-cooling circuits, of air flows in ventilation conduits, prevention of overheating in air heaters, regulation of airflow valves and fire protection valves, protection against frost in heat exchangers.

### Technical Data:

Measuring element	Piezoelectronic measuring cell	Storage temperature	-20 to +70 °C
Measuring range	(can be selected via jumper) -100 to +100 Pa 0 to +100 Pa 0 to +250 Pa 0 to +500 Pa 0 to +1000 Pa 0 to +1500 Pa 0 to +2000 Pa 0 to +2500 Pa	Ambient humidity	0 to 95 % RH, non-condensing
Measuring accuracy	±1,5 % of the measuring range selected ± 6 Pa for measuring ranges 250Pa, 100Pa, ± 100Pa	Housing, housing cover, connecting muff, conduit muff :	ABS (acrylonitrile butadiene styrene)
Long-term stability	0.1 % per year (typical)	Protection	IP54
Reaction time	0.8 or 4.0 seconds (can be selected)	Dimensions	(LxWxH) 90 x 71.5 x 36 mm
Maximum pressure	25 kPa	Weight	150 g
Bursting pressure	50 kPa	Pressure connection	2 hose muffs Diameter = 5 / 6.3 mm
Medium	Air and non-aggressive gases	Electrical connections	Screw terminals, maximum 1.5 mm <sup>2</sup>
Operating temperature	-5 to +50 °C	Cable entry	M16
		Supply voltage	24 VAC or 24 VDC, ±10 % Power <1 W
		Output signal (can be selected)	0 to 10 V Load 1 kohm minimum 4 to 20 mA, 3 conductors Load 500 ohms maximum.

### Accessories

### Order no.

ALMEMO® connecting cable for FD 8612 DPT, differential pressure, 2 cables connected in the transmitter housing

1. ALMEMO® connecting cable, PVC, length = 2 meters, with ALMEMO® connector

2. Power supply via mains unit ZB1024NA1, 230 VAC / 24 VDC

ZA8612DPTAK

### Variants

### Order no.

Differential pressure transmitter type DPT, for air and non-aggressive gases, with automatic zero-point correction

8 measuring ranges (can be selected via jumper) including standard accessories:

2 fastening screws, 2 plastic conduit muffs, 2-meter plastic hose

**FD8612DPT25R8AZ**

DAkKS / DKD or factory calibration KD9xxx pressure for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)



# Force, Displacement, Flow, Speed

## Technical Features of Force Transducers

The technical features of the force transducers are substantially fixed by VDI/VDE guideline 2637. The most important terms are described below:

### Measuring range:

The load range, for which the guaranteed error limits will not be exceeded.

### Nominal load:

The nominal load is the upper limit of the measuring range. Depending on the sensor, the nominal load can be a tension or compression load.

### Working load:

The working load is the load that can be

applied to the sensor, as well as the nominal load, without affecting the specified characteristics. The working load range should only be used in exceptional cases.

### Load limit:

The load limit is the maximum permissible load that can be applied to the measuring cell without expecting a destruction of the measuring system. At this load the specific error limits are no longer applicable.

### Breaking load:

The breaking load is the load where a permanent change or destruction occurs.

### Maximum dynamic load:

Rated force related oscillation amplitude of a sinusoidally changing force in direction of the measuring axis of the sensor. At a load of 10<sup>7</sup> cycles the sensor, when being repeatedly used up to the rated force, is not subject to significant changes regarding the metrology characteristics.

### Drift error:

The drift error is the maximum permissible change of the output signal of the sensor over the specified time at constant load and stable environmental conditions.

## ALMEMO® Force Measurement

ALMEMO® force transducers allow to adjust the constant load (tare) to zero and to enter the final value as nominal value.

The correction value will be automatically calculated from this by the measuring instrument. An ALMEMO® connector

that switches on this resistor for the adjustment is available for force transducers with integrated reference resistor.

## The Right Displacement Sensor For Any Measuring Task

Different methods can be used depending on the limiting and environmental conditions involved with the measuring task:

### Linear inductive displacement transducers and tracers:

absolutely accurate, high resolution, robust, acceleration resistant, cost-efficient, noise resistant, good long term stability, environmentally stable (contamination, humidity/moisture), point-shaped, almost contactless measurement, easy mounting and handling

### Non-contacting displacement measuring systems based on eddy current:

very accurate, very fast, high resolution, environmentally stable (contamination, moisture/humidity), noise resistant regarding EMI, temperature stable, long term stability, for devices under test made of

all types of electrically conducting materials, nonmagnetic and ferromagnetic, compact sensor designs, extensive application temperature range

### Non-contacting inductive displacement measuring systems:

accurate, temperature stable, fast, cost-efficient, particularly for ferromagnetic test objects

### Long-travel sensors based on eddy current:

large measuring paths, robust and compact, no mechanical wear, easy handling, compression-proof

### Non-contacting inductive optical displacement measuring systems:

point-shaped measurement, accurate, fast, large base distance, material independent

### Cable line displacement sensors:

very accurate, large measuring paths, easy mounting, cost-efficient

### Non-contacting capacitive displacement measuring systems:

extraordinary accurate, very temperature stable, fast, high resolution, very good long term stability, material independent for metal objects under test, also suitable for insulating materials, easy to handle, extensive operating temperature range

### Conductive plastic potentiometer:

high resolution, good linearity, cost-efficient, good temperature and humidity coefficients, extensive operating temperature range

## ALMEMO® Displacement Measurement

Our Potentiometric displacement sensors have been pre-aligned in the factory by storing the correction values in the

ALMEMO® connector before delivery. The precise adjustment can be locally performed by the user with final measures

after the installation

# Force, Displacement, Flow, Speed

## Turbine Flowmeters

The sensor contains a vane or paddle that starts rotating when a flow is present. Unlike the optical method, this method also allows for measurements in cloudy and non-transparent liquids. The rotational speed is proportional to the corresponding quantity of flow. The electrical output signal can be generated by two different methods:

- Inductive Proximity Switch:

The rotor blades are provided with

special steel caps, therefore, the rotor blades approaching the transducer cause a change of the inductance and the generation of a pulse type output signal.

- Hall Sensor:

The rotor is provided with permanent magnets that affect a Hall sensor, which is located on the transducer. The transducer electronics transforms the Hall signal into a pulse type electrical

output signal.

For measuring the volume flow rate or for dosing tasks, the ALMEMO® sensor range includes turbine flowmeters for different measuring ranges and operating conditions:

- Radial turbine flowmeters for large flow quantities.
- Axial turbine flowmeters with rotating vane for small flow quantities

## Optical Rotational Speed Meters

The optical reflection method has become the most accepted method for the measurement of revolutions of shafts, wheels, fans etc.

With single unit retroreflective photoelectric sensors the transmitters and receivers form one single unit. The light sent by the transmitter is, by an opposite located object, reflected to the receiver. The sensor performs a switch when the reflected amount of light exceeds a specific, adjustable limit value at the receiver. This quantity of light depends on the size and the reflection properties of the object. Special reflective tapes are used to increase the sensing range and to improve the

signal-to-noise ratio.

ALMEMO® rotational speed sensors can be used in two measurement setups:

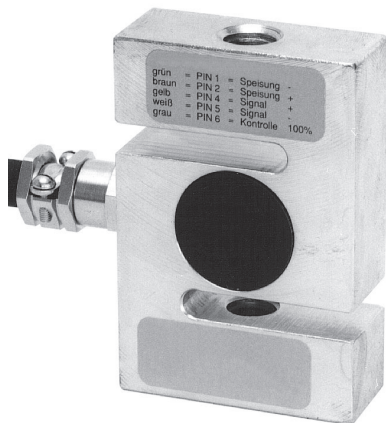
- Retroreflective photoelectric sensor (DIN EN 60947: Type D)  
Detects only opaque objects.  
The sensing range depends on the reflectivity of the object, i.e. on the surface quality and colour.  
Sensitive with regard to contamination and against changes of the reflective properties of the object  
These influences can (within limits) be compensated by means of a sensitivity adjustment control

Only small mounting efforts are required as the sensor is a single unit device and a rough alignment is sufficient in most cases.

- Retroreflective light barrier (DIN EN 60947: Type R)  
Retroreflectors allow for long sensing ranges and an improved signal-to-noise ratio. Low susceptibility to interferences, therefore, highly suitable for use under harsh conditions, e.g. outdoor applications or dirty environments

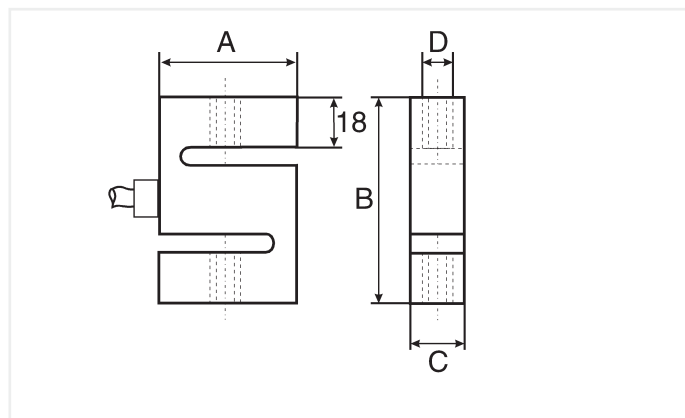
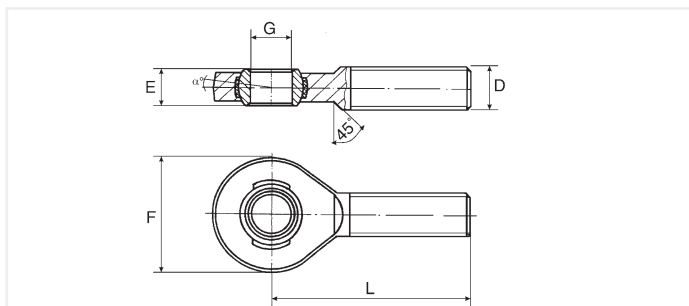


## Tension and Compression Sensor K25



- Wire strain gauges in four-conductor full-bridge circuit.
- Control resistance for final adjustment of the measuring range.
- All measuring ranges that are specified in Newton can also be supplied in kg ranges

! All ALMEMO® devices provide easy push-button adjustment of no-load and final value.



### Technical Data:

Max. load limit:	150% of final value	Drift error at permanent load:	<0.07% per 30min
Maximum dynamic load:	70% of final value	Permissible lateral forces:	±60% of fin. val.
Reference temperature:	23°C	Protection system:	up to 1kN: IP 65, from 2kN: IP 67
Cable:	3m long, with axial ALMEMO® connector	Material:	up to 1kN: aluminium 2 to 50kN: stainless steel
Accuracy for tension:	<±0.1% of fin. val.	Dimensions in mm	up to 10kN: A=50, B=75, C=20, D=M12 20kN, 50kN: A=65, B=85, C=40, D=M24 x2
Accuracy for tension and compression:	<±0.2% of fin. val.		
Nominal measuring path:	<0.15mm		
Operative range:	-10 to +70°C		

### Options for all Force Transducers

Options for all Force Transducers	Order no.	Options for all Force Transducers	Order no.
Indication of measured values with ALMEMO® devices in kg	OK9000K	Indication of measured values with ALMEMO® devices in N and kg	OK9000NK

### Accessories

Accessories	Order no.	Accessories	Order no.
Knuckle eyes with external thread M 12 (2 pcs) (dimensions in mm: D = M 12, E = 16, F = 32, G = 12, L = 54)	ZB902512	Knuckle eyes with external thread M 24 x 2 (2 pcs) (dimensions in mm: D = M 24 x 2, E = 26, F = 62, G = 25, L = 94)	ZB902524

### Types (including test certificate)

Measuring range 0.02kN 0.05kN, 0.1kN, 0.2kN, 0.5kN, 1kN, 2kN, 5kN or 10kN please specify	<b>FKA0251</b>
Measuring range 20kN	<b>FKA0252</b>
Measuring range 50kN	<b>FKA0255</b>
Factory calibration KK9xxx force (traction / thrust) for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)	

### Other designs are available on request

Tension and compression sensor FKA 012 with male thread terminal up to 1000 kN

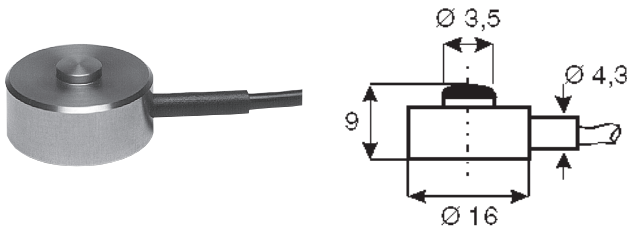


Tension and compression sensor FKA 1563 low height, with male thread terminal up to 2 kN



# Force

## Compression Sensor K 22



- Wire strain gauges in four-conductor full-bridge circuit.
- Control resistance for final adjustment of the measuring range.
- All measuring ranges that are specified in Newton can also be supplied in kg ranges.



All ALMEMO® devices provide easy push-button adjustment of no-load and final value.

### Technical Data:

Max. load limit:	150% of final value
Maximum dynamic load:	70% of final value
Reference temperature:	23°C
Cable:	radial, 3m long with ALMEMO® connector
Accuracy:	<math>\pm 0.5\%</math> of final value

Nominal measuring path:	<math>< 0.2\text{mm}</math>
Operative range:	-10 to +50°C
Drift error at permanent load:	0.1% per 30min
Protection system:	IP 65
Material:	stainless steel

### Type (including test certificate)

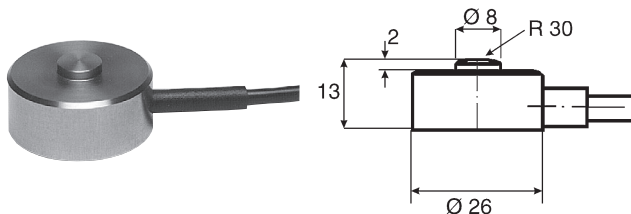
Measuring range 100 N, 200N, 500N, 1000N or 2000N please specify

Factory calibration KK9xxx force (tension or compression) for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)

**Order no.**

**Order no. FKA022**

## Compression Sensor K 1613



- Wire strain gauges in 4-conductor full-bridge circuit.
- Control resistance for final adjustment of the measuring range.
- All measuring ranges that are specified in Newton can also be supplied in kg ranges.



All ALMEMO® devices provide easy push-button adjustment of no-load and final value.

### Technical Data:

Max. load limit:	150% of final value
Maximum dynamic load:	70% of final value
Reference temperature:	23°C
Cable:	radial, 3m long with ALMEMO® connector
Accuracy:	<math>\pm 0.5\%</math> of final value

Nominal measuring path:	<math>< 0.2\text{mm}</math>
Operative range:	-10 to +50°C
Drift error at permanent load:	0.1% per 30min
Protection system:	IP 65
Material:	stainless steel

### Type (including test certificate)

Measuring range 0.5kN, 1kN, 2kN, 5kN, 10kN or 20kN (50 kN on request) please specify

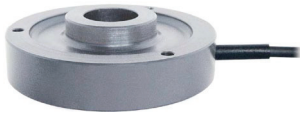
Factory calibration KK9xxx force (tension or compression) for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)

**Order no.**

**FKA613**

## Compression Sensor

Other designs are available on request



Compression sensor FKA 2528  
inexpensive Protective class IP60  
0.2 to 10 kN



Compression sensor FKA 013  
other measuring ranges  
from 10 N up to 100 kN

## Torque sensor

Other designs are available on request



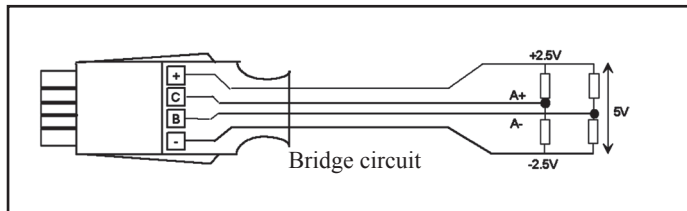
Static torque sensor  
e.g. with square terminal 2 to 5000 Nm



Rotating torque sensor (slip ring)  
e.g. with square terminal 1 to 5000 Nm

## ALMEMO® input connector for measuring bridges, millivolt / volt differential

With zero-symmetrical voltage supply of  $\pm 2.5$  V stabilized from the ALMEMO® device



### Technical Data:

#### Sensor supply:

Voltage UF:	$5V \pm 0.05V$
Temperature coefficient:	$<50\text{ppm}/^\circ\text{C}$
Output current:	max. 100mA
Quiescent current	approx. 3 mA

#### New

Energy saving

So long as the measuring point is not selected, the bridge voltage remains switched OFF.

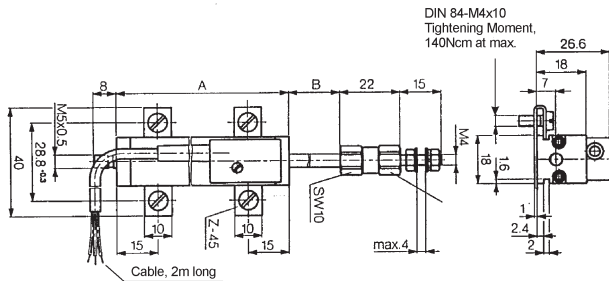
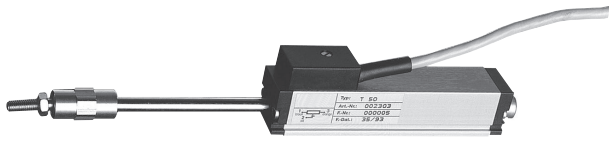
### Types

Model	Meas. Range	Resolution	Order no.
55mV DC	-10.0 to +55.0	1 $\mu\text{V}$	ZA9105FS0
26mV DC	-26.0 to +26.0	1 $\mu\text{V}$	ZA9105FS1
260mV DC	-260.0 to +260.0	10 $\mu\text{V}$	ZA9105FS2
2.6V DC	-2.6 to +2.6*	0.1 mV	ZA9105FS3

\* Data may vary depending on device; (see data sheet per device)

# Displacement

## Displacement Sensor, Potentiometric FWA xxx T



- Displacement transducers are suitable for direct, accurate measurement of displacements in automatic control and metrology.
- The pickup of the displacement is performed by using a pull rod with a universal joint. This allows for an actuation that is free from backlash and transverse forces, even in case of parallel and angular displacements of transducer and measuring direction.
- Elastomer-damped, independently resilient multi-finger noble metal sliding contact for reliable contact, even at high adjustment speed, shock or vibration.
- Long life span of 100 x 106 strokes, extraordinary linearity up to  $\pm 0.075\%$ , pull rod running on two exact bearings, very high adjustment speed of up to 10m/s, shock and vibration resistant.

! Pre-adjusted in the factory by storing the correction values in the ALMEMO® connector.  
The precise adjustment can be locally performed by the user with final measures after the installation.

### Technical Data:

Independent linearity:	T25: $\pm 0.2\%$ ; T50: $\pm 0.15\%$ T75: $\pm 0.1\%$ ; T100: $\pm 0.075\%$ T150: $\pm 0.075\%$	Movability, ball-shaped coupling	$\pm 1\text{mm}$ parallel displacement, $\pm 2.5^\circ$ angular displacement
Housing length (meas. A+1mm):	T25: 63mm; T50: 88mm T75: 113mm; T100: 138mm T150: 188mm	Operating force (horizontal):	$\leq 0.30\text{N}$
Mech. stroke (meas. B $\pm 1.5\text{mm}$ ):	T25: 30mm; T50: 55mm T75: 80mm; T100: 105mm T150: 155mm	Reproducibility:	0.002mm
Total weight (with 2m cable):	T25: 140g; T50: 160g T75: 170g; T100: 190g T150: 220g	Insulation resistance:	$\geq 10\text{MW}$ , (500VDC, 1 bar, 2s)
Weight of the pull rod incl. coupling and sliding contact block:	T25: 35g; T50: 43g T75: 52g; T100: 58g T150: 74g	Dielectric strength:	$\leq 1\text{mA}$ , (50Hz, 2s, 1 bar, 500VAC)
		Max. permissible torque:	140Ncm
		Temperature range:	$-30$ to $+100^\circ\text{C}$
		Temperature coefficient:	typ. 5ppm/ $^\circ\text{C}$
		Vibrations:	5 to 2000Hz/Amax $= 0.75\text{mm}/\text{amax} = 20\text{g}$
		Shock:	50g/11ms
		Life span:	$> 100 \times 106$ strokes
		Protection system:	IP 40

### Option

Plug connection (instead of fixed connected cable), including 3m cable with screwed round socket and ALMEMO® connector

Order no.

OWA071AK

### Types

Types	Order no.	Order no.
Working length/resolution, incl. ALMEMO® cable 2m long	100 mm / 0,01 mm	<b>FWA100T</b>
25 mm / 0,001 mm	150 mm / 0,01 mm	<b>FWA150T</b>
50 mm / 0,01 mm	up to 3000mm working length	on request
75 mm / 0,01 mm	included with delivery 2 tensioning clamps Z3-31 including 4 cap screws M4x10, 1 ball-shaped coupling	

### Other designs are available on request

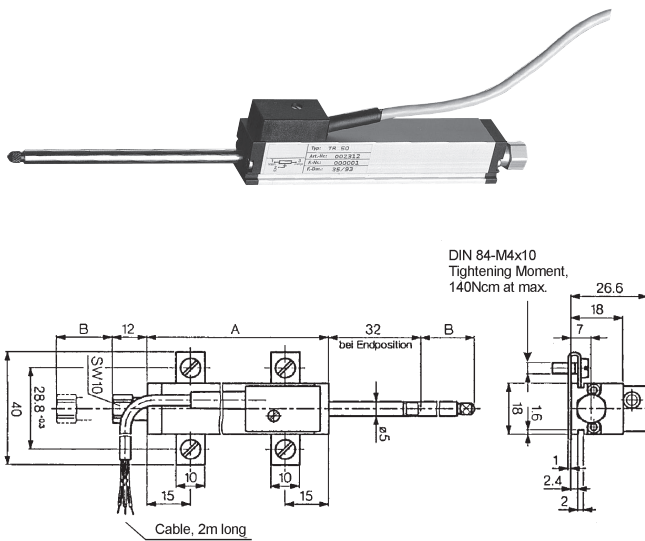


Displacement transducers FWA xxx TEX  
with pivot joint Protective class IP54, 10 to 300 mm



Displacement transducers FWA xxx TX2  
Protective class IP67 with pivot joint, 25 to 300 mm

## Displacement Tracer, Potentiometric FWA xxx TR



- Resistor and collector paths made from conducting plastic.
- Suitable for direct measurements of displacement without a form-locking connection, position detection at stationary measuring objects, tolerance measurements and for continuous contour measurement.
- The pull rod, which is supported on both sides, allows for accepting transverse forces that, for example, occur during a continuous scan of curves or spline parts.
- Rear limit stop is used to provide a simple mechanical coupling of automatic retraction systems, such as pneumatic cylinders or electromagnets.
- Long life span of 100 x 106 strokes, extraordinary linearity up to  $\pm 0.075\%$ , tracer pin running on two exact bearings, DIN compliant standard measuring inserts can be used, shock and vibration resistant.

! Pre-adjusted in the factory by storing the correction values in the ALMEMO® connector. The precise adjustment can be locally performed by the user with final measures after the installation.

### Technical Data:

Independent linearity:	TR25: $\pm 0.2\%$ ; TR50: $\pm 0.15\%$ TR75: $\pm 0.1\%$ ; TR100: $\pm 0.075\%$	Operating force (horizontal):	$\leq 5$ N
Housing length (meas. A+1mm):	TR25: 63mm; TR50: 94.4mm; TR75: 134.4mm; TR100: 166mm	Reproducibility:	0.002mm
Mech. stroke (meas. B $\pm 1.5$ mm):	TR25: 30mm; TR50: 55mm TR75: 80mm; TR100: 105mm	Insulation resistance:	$\geq 10$ MW (500VDC, 1 bar, 2s)
Total weight (with 2m cable):	TR25: 120g; TR50: 150g TR75: 180g; TR100: 200g	Dielectric strength:	$\leq 1$ mA (50Hz, 2s, 1 bar, 500VAC)
Weight of the pull rod incl. coupling and sliding contact block:	TR25: 25g; TR50: 36g TR75: 48g; TR100: 57g	Max. permissible torque:	140Ncm
Max. operating frequency: (for most critical application 'probe tip upright')	TR25: 18Hz; TR50: 14 TR75: 11Hz; TR100: 10Hz	Temperature range:	-30 to +100°C
		Temperature coefficient:	typ. 5ppm/°C
		Vibrations:	5 to 2000Hz/Amax = 0.75mm/amax = 20g
		Shock:	50g/11ms
		Life span:	> 100 x 106 strokes
		Protection system:	IP 40

### Option

Plug connection (instead of fixed connected cable), including 3m cable with screwed round socket and ALMEMO® connector

Order no.

OWA071AK

### Types

Working length/resolution, incl. ALMEMO® cable 2m long  
25 mm / 0,001 mm  
50 mm / 0,01 mm  
75 mm / 0,01 mm

Order no.

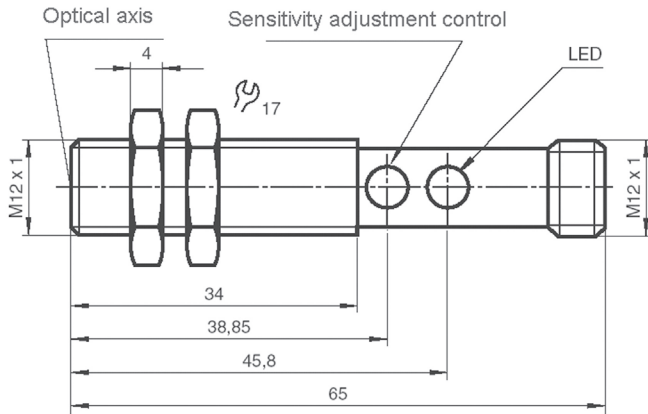
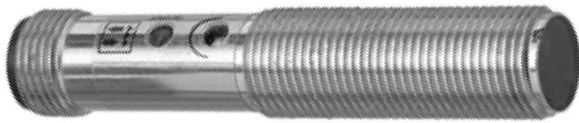
**FWA025TR**  
**FWA050TR**  
**FWA075TR**

Order no.

**FWA100TR**

100 mm / 0,01 mm  
included with delivery  
2 tensioning clamps Z3-31 including 4 cap screws M4x10,  
1 probe tip with hard-metal ball

## Rotational Speed Sensor FUA 9192



- Optical probe for measurements of rotational speed, designed as retroreflective photoelectric sensor for photoelectric detection of rotational speeds or events.
- For evaluation of the pulses, the tachometer probe is equipped with a specific frequency meter module that calculates the number of revolutions per minute from the time period between two pulses. A stable read-out is achieved by averaging over a minimum of 500 ms.
- Easy application:  
A reflective adhesive tape is attached to the moving part and the probe is aligned with it. For function control purposes a yellow signal lamp at the rear side of the probe will be on when the reflective adhesive tape is recognised.
- To increase the operation reliability the sensitivity can be adjusted through a potentiometer.

### Technical Data:

Measuring range:	8 to 3000rpm (maximum)	Optics:	2-lens system PC
Bright-up pulse time:	> 1ms	Permissible shock load:	$b \leq 30g$ , $T \leq 1ms$
Resolution:	1rpm	Permissible vibrational load:	$f \leq 55Hz$ , $a \leq 1mm$
Accuracy:	up to 15000rpm: $\pm 0.02\%$ of m.v. $\pm 1$ digit up to 30000rpm: $\pm 0.05\%$ of m.v. $\pm 1$ digit	No-load current:	$\leq 20mA$
Detection range:	20 to 200mm (depending on the reflector)	Supply voltage:	> 8.5VDC via instrument, mains adapter recommended
Sensitivity:	adjustable with potentiometers	Connection:	Device connector M12x1 including socket M12x1, angled, with 1.5 meters cable and ALMEMO® connector
Detectable object:	opaque or reflector	Material:	housing: brass, nickel plated, lens opening: PMMA
Distance hysteresis:	$\leq 10\%$	Dimensions:	diameter: M12 x 1mm, length: 55mm
Indication of switching status:	LED yellow	Weight:	15g
Type of light:	red light 660nm	Meets standards:	EN 60 947-5-2
Limit for foreign light:	sun light: $\leq 20000lux$ halogen light: $\leq 5000lux$		
Ambient/storage temperature:	$-25/-40^{\circ}C$ to $+55/+70^{\circ}C$		
Protection system:	IP 67 (accord. to EN 60529)		

### Accessories

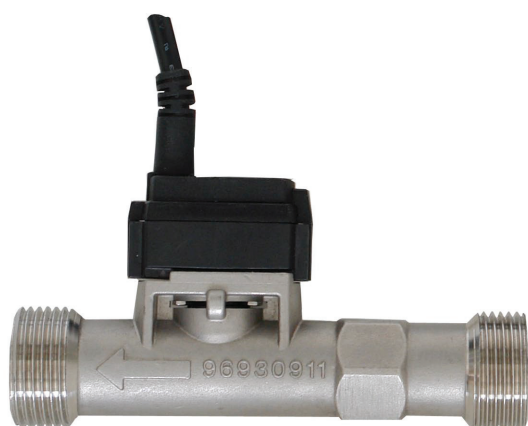
	Order no.
Extension cable, 1 meter long	ZA9060VK1
Extension cable, 2 meters long	ZA9060VK2

### Types

	Order no.
For rotational speeds up to 30000rpm max., incl. 5 reflective adhesive tapes Connecting cable 1.5m long with ALMEMO® connector	<b>FUA9192</b>
DAkKS / DKD or factory calibration KU90xx rotational speed for digital sensor (see chapter Calibration certificates)	

## Flow sensors for liquids FVA 645 GVx

### Variant in stainless steel without any moving parts, with integrated temperature measuring



- Measuring section in robust, industry-quality stainless steel
- Without any moving parts, no wear and tear
- Integrated temperature measuring
- Low pressure loss
- Wide temperature range
- High-speed reaction time
- Using with water and water-glycol mixture
- For heat output measurement in heating systems and cooling plant

### Technical Data:

Flow		Suitable conditions	
Measuring principle	Pressure pulsation Kármán vortex street	Media	Water, water-glycol ( max. 42 % glycol)
Measuring range	see variants	FVA645GV12QT/40QT	Viscosity < 4 mm <sup>2</sup> /s,
Accuracy	using water as medium at 0 to +100°C ±1.5 % of final value	FVA645GV100QT/200QT	Viscosity < 2 mm <sup>2</sup> /s)
FVA645GV12QT/40QT:	by water-glycol ( 42 % ) 30 to +100°C (Viscosity < 4 mm <sup>2</sup> /s) ±5 % of final value	Temp. of medium	0 to +100 °C
Resolution	see variants	Ambient temperature	-25 to +60 °C
Reaction time (63 %)	< 1 s ( < 3 s for FVA645GV12QT)	Ambient humidity	up to 95 % RH, non-condensing
Temperature		Electrical connections	
Measuring range	0 to +100 °C	Output signal	2x 0.5 to 3.5 V
Accuracy	±1 K at +25 to +80 °C ±2 K at 0 to +100 °C	Power supply	5 VDC (±5 %), <10 mA via ALMEMO® connector
Resolution	0.5 K	Connection	Sensor with 2.9-meter connecting cable and ALMEMO® connector
Reaction time (63 %)	<1 second under flow conditions 50% of final value	Fitting length	
Process connection	2x male thread see variants	see variants	
Pressure	10 bar (bursting pressure >16 bar)	Materials (in contact with media)	
Pressure loss	0.1 bar, typical under flow conditions, 50 % of final value	Corrosion-resistant coating EPDM, PPS, PPA 40-GF	
		Pipe piece	Stainless steel 1.4408; (inside pipe PPA 40-GF)

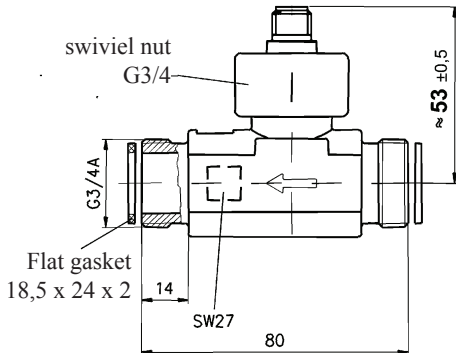
### Variants

Sensor for flow rate and temperature over a measured section, including ALMEMO® connecting cable, 2.9 meters

Measuring range	Resolution	Process connection	Fitting length	Order no.
1 to 12 l/min	0.06 l/min	G 3/4" male thread	ca. 110 mm	<b>FVA645GV12QT</b>
2 to 40 l/min	0.2 l/min	G 3/4" male thread	ca. 110 mm	<b>FVA645GV40QT</b>
5 to 100 l/min	0.5 l/min	G 1" male thread	ca. 129 mm	<b>FVA645GV100QT</b>
10 to 200 l/min	1.0 l/min	G 1 1/4" male thread	ca. 137.5 mm	<b>FVA645GV200QT</b>

Factory calibration KV91xx flow for sensor (see chapter Calibration certificates)

## Axial turbine flowmeter for liquids FVA 915 VTH



- For measuring the volume flow rate or for dosing tasks with small flow rates.
- Extraordinary compact design.
- Wide, usable measuring range.
- Various options for operation:  
Cooling water flow, medical technology, plastics industry, solar systems, baker's equipment, machine tools, catering equipment, photographic laboratory equipment, dispensers, dosing equipment, cooling equipment, heating applications, calorimetry.

### Technical Data:

Nominal diameter	DN 15		(from ALMEMO® device)
Measuring range	2 to 40 l / min continuous load max. 20 l/min	Electrical connection	4-pin connector M12x1 including PVC line (Tmax =70 °C) with ALMEMO® connector
Measuring accuracy	±1% of finale value	<b>Materials</b>	
Reproducibility :	± 0,2 %	pipe section	
Signal output	from 0.3 l/min	FV A915 VTH M	brass CuZn36Pb2As
maximum size of particles in medium	0.5 mm	FV A915 VTH K	plastic PPO Noryl GFN3
maximum temperature of medium	85°C	Flat gasket	NBR
Nominal pressure	PN10	Turbine cage	PEI ULTEM
Process connection	G 3/4" external thread and union nuts	Rotating vane	PEI ULTEM
Pressure loss in bar	$\Delta p = 0.00145 \times Q^2$ (Q in l/min) approx. 0.6 bar at 20 l / min approx. 2.3 bar at 40 l / min	Rotor complements	hard ferrite magnets
Protection system	IP 54	Axle / bearing	axle Arcap AP1D with hard metal pins in saphire bearings
Output signal		Bearing support	Arcap AP1D
Pulse rate / K factor	940 pulses / liter	Sensor	PPO Noryl GFN3
Resolution	1.1 ml / pulse	O-ring	NBR
Signal form	rectangular signal, NPN, open collector	Knurled swivel nut *	PA GF 30
Measuring transducer	Hall sensor	* not coming into contact with the medium	
Supply voltage	4,5 ... 24 V DC		

### Types

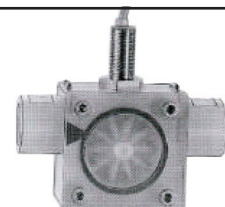
incl. connecting cable, 6m long with ALMEMO® connector turbine body made of brass  
Turbine body made of plastic  
Factory calibration KV91xx flow for digital sensor (see chapter Calibration certificates)

### Order no.

**FVA915VTHM**  
**FVA915VTHK**

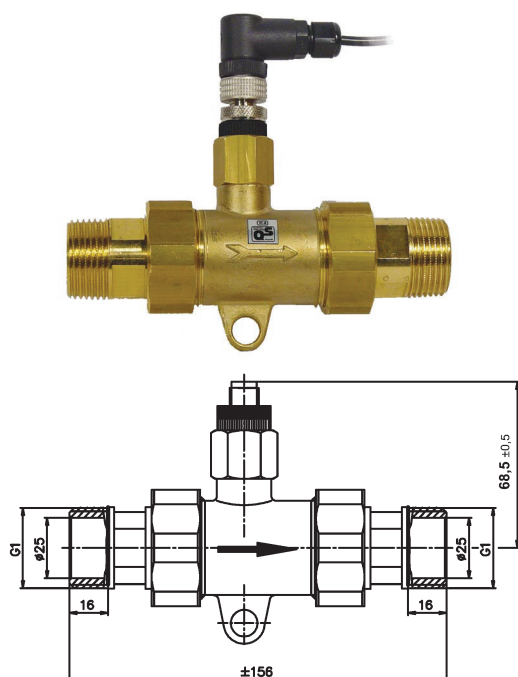
### Other designs are available on request

Axial turbine flowmeters FVA 915 VTWx for water-glycol mixture up to 150 °C, 25 bar, 2 to 30 l/min Figure - similar to above  
Axial turbine flowmeters FVA915VTPx for water up to 150 °C, 300 bar, 2 to 40 l/min Figure - similar to above  
Radial turbine flowmeters FVA 915 VR10x for small flow rates 0.5 to 1.5 l/min or 1 to 4 l/min





## Axial turbine flowmeter for liquids FVA 915 VTH25



- For measuring the volume flow rate or for dosing tasks with large flow rates.
- Compact design.
- Wide useful operating range.
- Wide variety of applications :
  - Cooling water flow, medical technology, plastics industry, solar systems, baker's equipment, machine tools, catering equipment, photographic laboratory equipment, dispensers, dosing equipment, cooling equipment, heating applications, calorimetry.

### Technical Data

Nominal diameter	DN 25
Measuring range	4 to 160 l/min
Continuous load	max. 80 l/min
Measuring accuracy	±5% of measured value up to 5l/min ±7% of measured value
Reproducibility :	±0.5%
Signal output	from < 1 l/min
maximum size of particles in medium	0.63 mm
maximum temperature of medium	85°C
Nominal pressure	PN10
Process connection FVA915VTH25M	G 1¼" external thread including adapter for R 1" (absolutely necessary)
Pressure loss	approx. 0.1 bar at 80 l / min approx. 0.45 bar at 160 l / min
Protection system	IP 54
Output signal Pulse rate / K factor	65 pulses / liter

Resolution	15 ml / pulse
Signal form	NPN, open collector
Measuring transducer	Hall sensor
Supply voltage	4,5 ... 24 V DC (from ALMEMO® device)
Electrical connection	4-pin connector M12x1 including PVC line (Tmax =70 °C) with ALMEMO® connector

#### Materials

Pipe section FV A915 VTH25M	brass, CW602N
Turbine cage	PPO Noryl GFN 1630V
Rotation vane	PPO Noryl GFN 1520V
Rotor complements	Hard Ferrite Magnets
Axle / bearing	stainless steel 1.4539 / saphire, PA
Sensor socket	PPO Noryl GFN 1630V
O-ring	EPDM

### Type

incl. connecting cable, 6 m long, with ALMEMO® connector turbine body made of brass  
Factory calibration KV91xx flow for digital sensor (see chapter Calibration certificates)

**Order no.**  
**FVA915VTH25M**

### Other designs are available on request

Axial turbine flowmeters FVA 915 VTH40 6.7 to 417 l/min, DN40  
Figure - similar to above

Turbine flowmeters FVA 915 VTRx  
Stainless steel, up to 120 °C, up to 250 bar for different flow rates  
from 1.8 l/min to 1133 l/min

