Series 23SX

High-precision piezoresistive pressure transmitters

Features

- RS485 interface can be combined with an analog interface
- Analog interface can be ranged via RS485 (turn-down)
- Modbus RTU protocol for process values and configuration
- Excellent long-term stability

Technology

- Insulated and encapsulated piezoresistive pressure sensor
- Fully welded construction without internal seals
- High-quality pressure transducers and proven mathematical compensation
- Based on technology from the well-known 33X series with the highest level of accuracy

Typical applications

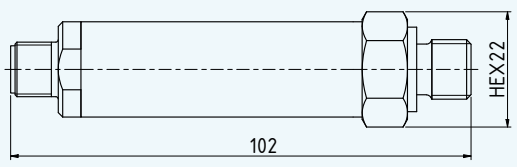
- Engine test benches
- Industrial applications
- Automation technology
- Mobile hydraulics

Accuracy
± 0,1 %FS

Total error band
± 0,25 %FS @ -10…80 °C

Pressure ranges
0…0,16 to 0…1000 bar

Series 23SX: 0…0,16 to 0…160 bar



Series 23SX: 0…250 to 0…1000 bar

Edition 07/2022
Subject to alterations
info@keller-druck.com

Series 23SX – Specifications

Standard pressure ranges

Relative pressure PR		Proof pressure
0…0,16	-0,16…0,16	3
0…0,25	-0,25…0,25	
0…0,4	-0,4…0,4	
0…0,6	-0,6…0,6	
0…1	-1…0	
	-1…1	9
0…1,6	-1…1,6	
0…2,5	-1…2,5	
0…4	-1…4	30
0…6	-1…6	
0…10	-1…10	
0…16	-1…16	90
0…25	-1…25	
bar rel.		bar
Reference pressure at ambient pressure		based on reference pressure

Absolute pressure PAA	Absolute pressure PA	Proof pressure
0,5…1,1		3
0…1		
0…1,6		9
0…2,5		
0…4	0…4	30
0…6	0…6	
0…10	0…10	
0…16	0…16	90
0…25	0…25	
0…40	0…40	
0…60	0…60	300
0…100	0…100	
0…160	0…160	
0…250	0…250	1200
0…400	0…400	
0…600	0…600	
0…1000	0…1000	
bar abs.	bar	bar
Reference pressure at 0 bar abs. (vacuum)	Reference pressure at 1 bar abs.	based on reference pressure

Performance

Pressure

Accuracy @ RT (20…25 °C)	≤ ± 0,1 %FS	Non-linearity (best fitted straight line BFSL), pressure hysteresis, non-repeatability, zero point deviation and amplification deviation
Total error band (-10…80 °C)	≤ ± 0,25 %FS	Max. deviation within the compensated pressure and temperature range. Experience shows that, outside the compensated temperature range, the total error band is expanded by 0,1 %FS within the ambient temperature range.
Compensated temperature range	-10…80 °C	Other temperature ranges within -40…125 °C possible as an option
Long-term stability	≤ ± 0,15 %FS	Per year under reference conditions, yearly recalibration recommended
Position dependency	≤ ± 1,5 mbar	Calibrated in vertical installation position with pressure connection facing downwards
Resolution	0,002 %FS	Digital
Signal stability	0,01 %FS	Digital noise-free
Internal measurement rate	≥ 1800 Hz	For version «3-wire + digital (0…10 V. 0…5 V)» > 6000 Hz
Pressure range reserve	± 10 %	Outside the pressure range reserve, +Inf / -Inf is displayed. If there is an error in the device, NaN is displayed.
Vacuum resistance	For operating pressures ≤ 0,1 bar abs., a vacuum-optimised version is recommended.	
Note	For pressure ranges < 1 bar, accuracy, total error band and long-term stability for 1 bar full-scale (FS) range apply.	

Temperature

Accuracy	≤ ± 2 °C	The temperature is measured on the pressure sensor (silicon chip) that sits behind the metallic separating diaphragm. The specifications apply within the compensated temperature range.
Resolution	≤ 0,01 °C	
Internal measurement rate	> 10 Hz	

Series 23SX – Specifications

Electrical data

Connectivity	digital	2-wire + digital	3-wire + digital	
Analog interface		4…20 mA	0…10 V	0…5 V
Digital interface	RS485	RS485	RS485	RS485
Power supply	3,2…32 VDC	8…32 VDC	13…32 VDC	8…32 VDC
Power consumption (without communication)	< 8 mA	3,5…22,5 mA	< 8 mA	< 8 mA
RS485 voltage insulation	± 32 VDC	± 18 VDC	± 32 VDC	± 32 VDC
Note	Disturbance of the 4…20 mA signal occurs during communication through the digital interface. 3-wire types are suitable for simultaneous operation of the analog and digital interface.			

Start-up time (power supply ON)	< 250 ms
Overvoltage protection and reverse polarity	± 32 VDC
GND case insulation	> 10 MΩ @ 300 VDC

Analog interface

Load resistance	< (U - 8 V) / 25 mA	2-wire
	> 5 kΩ	3-wire
Limiting frequency	≥ 300 Hz	2-wire
	≥ 1000 Hz	3-wire (0…10 V, 0…5 V)
Note	Filter properties can be adjusted by the customer	

Digital interface

Type	RS485	Half-duplex
Communication protocols	Modbus RTU	
	KELLER bus protocol	Proprietary
Identification	Class.Group: 5.24	Standard settings: bus address 1, baud rate 9600 bit/s. Other default settings available on request. Can be reconfigured via software by the customer later.
Unit of pressure	bar	
Unit of temperature	°C	
Data type	Float32 and Int32	
Baud rates	9600 and 115'200 bit/s	
Lines	up to 1,2 km	

Electrical connection

Standard plug	M12	DIN EN 61076-2-101, A-coded, 5-pin
	Binder series 723	DIN EN 61076-2-106, 5-pin
Alternative plug	GSP (without RS485)	EN 175301-803-A (DIN 43650)
Cable	ø 5,8 mm, PE sheath	5-wire, cable gland
Standard cable lengths	2m, 5m	Other on request

Electromagnetic compatibility

CE conformity as per 2014/30/EU (EMC)	EN 61326-1 / EN 61326-2-3 / EN 61000-6-1 / EN 61000-6-2 / EN 61000-6-3 / EN 61000-6-4

Series 23SX – Specifications

Mechanical data

Materials in contact with media

Pressure connection	Stainless steel AISI 316L	
Pressure transducer separating diaphragm	Stainless steel AISI 316L	
Pressure transducer seal (internal)	None	
Pressure connection seal (external)	FKM (75 Shore) -20…200 °C	For media temperatures < -20 °C wird FVMQ (70 Shore, -60…175 °C) is used Optional: EPDM (-40…150 °C)

Other materials

Pressure transducer oil filling	Silicone oil	Others on request

Further details

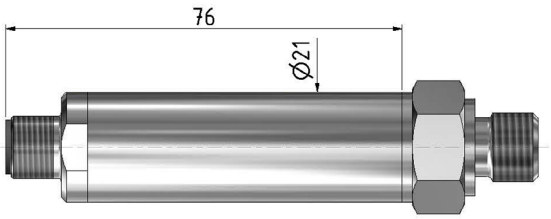
Pressure connection	G1/4 male	See Dimensions and options
	1/4-18NPT male	
Diameter × length	ø 21 mm × approx. 115 mm	
Weight (excluding cable)	approx. 130 g	Low pressure
	approx. 200 g	High pressure

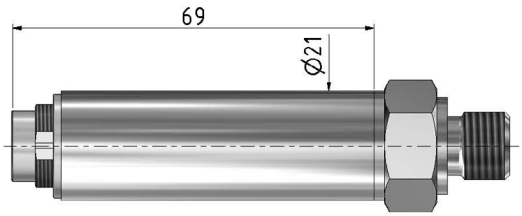
Ambient conditions

Media temperature range	-40…125 °C		Icing not permitted
Ambient temperature range	-20…85 °C	Optional: -40…85 °C	
Storage temperature range	-20…85 °C	Optional: -40…85 °C	
Protection	IP67	M12	for relative pressure IP54
	IP67	Binder series 723	for relative pressure, use a cable with integrated capillary
	IP65	GSP EN175301-803-A	
	IP68	Cable gland	for relative pressure, cable with integrated capillary
Notes	• Protection ratings are valid with the corresponding mating plug. • The design implementation of the ventilation for relative pressure versions can be found in the respective technical drawing.		
Vibration resistance	10 g, 10…2000 Hz, ± 10 mm	IEC 60068-2-6	
Shock resistance	50 g, 11 ms	IEC 60068-2-27	
Pressure endurance @ RT (20…25 °C)	> 10 million pressure cycles	0…100 %FS	For pressures > 600 bar on request

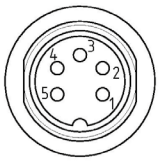
Series 23SX – Dimensions and options

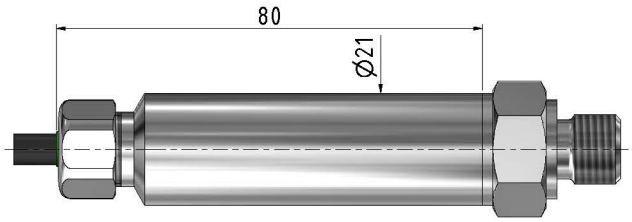
Electrical connections

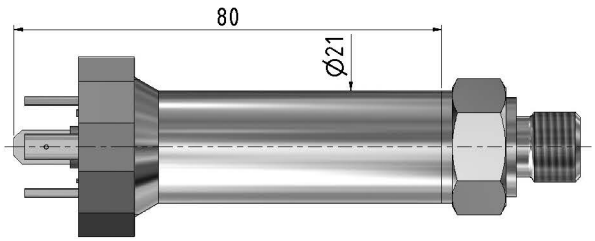


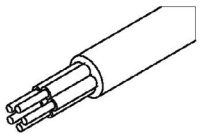


M12	2-wire		3-wire	
M12 × 1	4…20 mA		0…max. 10 V	
	1	OUT/GND	1	GND
	2	n.c.	2	+OUT
	3	+Vs	3	+Vs
	4	RS485A	4	RS485A
	5	RS485B	5	RS485B

Binder series 723	2-wire		3-wire	
M16 × 0,75	4…20 mA		0…max. 10 V	
	1	OUT/GND	1	GND
	2	n.c.	2	+OUT
	3	+Vs	3	+Vs
	4	RS485A	4	RS485A
	5	RS485B	5	RS485B





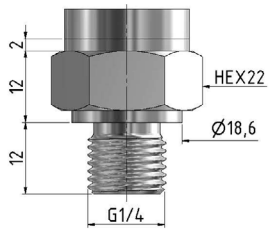
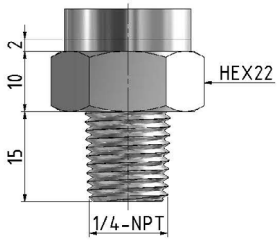
Cable gland	2-wire		3-wire	
Cable ø 5,8	4…20 mA		0…max. 10 V	
	WH	OUT/GND	WH	GND
	RD	n.c.	RD	+OUT
	BK	+Vs	BK	+Vs
	BU	RS485A	BU	RS485A
	YE	RS485B	YE	RS485B
	Shield on CASE		Shield on CASE	

GSP EN 175301-803-A	2-wire			3-wire	
□ 18	4…20 mA			0…max. 10 V	
		*Standard*	*Alternative*		*Standard*
	1	OUT/GND	n.c	1	GND
	2	n.c.	OUT/GND	2	+OUT
	3	+Vs	+Vs	3	+Vs
	⏚	CASE	CASE	⏚	CASE

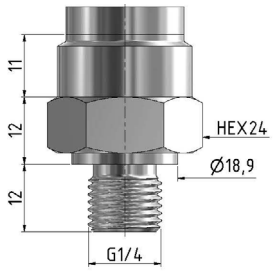
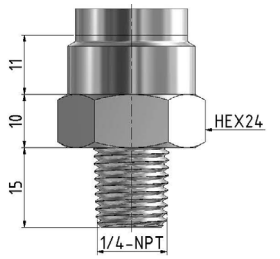
Series 23SX – Dimensions and options

Available pressure connections

For pressure range ≤ 160 bar

G1/4	1/4-18NPT
	
DIN EN ISO 1179-2	ASME/ANSI B 120.1

For pressure range > 160 bar

G1/4	1/4-18NPT
	
DIN EN ISO 1179-2	ASME/ANSI B 120.1

Other pressure connections available on request.

Other customer-specific options

- Other compensated pressure ranges
- Other compensated temperature ranges within -40…125 °C
- Other electrical connections
- Parts that come into contact with media made from Hastelloy C-276, Iconel 718 or titanium
- O-Rings made of other materials
- Other oil filling types for pressure transducers: e.g. special oils for oxygen applications
- Vacuum-optimised version for operating pressures ≤ 0.1 bar abs.
- Integration of application-specific calculations
- Modifications to customer-specific applications

Examples of related products

- Series 23SXc: Pressure transmitters with CANopen interface
- Series 33X: Pressure transmitters with accuracy up to 0,01 %FS
- OEM series: Pressure transducer with electronics (e.g. series 9LX or 20SX with thread) for integration in one's own systems

Series 23SX – Software, scope of delivery and accessories

Modbus interface

The X-line products have a digital interface (RS485 half-duplex), which supports the MODBUS RTU and KELLER bus protocols. Details of the communication protocols can be found at www.keller-druck.com. Documentation, a Dynamic Link Library (DLL) and various programming examples are available for integrating the communication protocol into your own software.

Interface converters

The connection to a computer is established via an RS485-USB interface converter To ensure smooth operation, we recommend the K-114 with the corresponding mating plug, robust driver module, fast RX/TX switching and connectable bias and terminating resistors.

«CCS30» software

The licence-free software CCS30 is used to carry out configurations and record measured values.

Measurement collection
- Live visualisation
- Adjustable measuring and storage interval
- Export function
- Parallel recording in bus operation
- Up to 100 measured values per second

Configuration
- Call up of information (pressure and temperature range, software version, serial number etc.)
- Readjustment of zero point and amplification
- Rescaling of analog output (unit, pressure range)
- Adjustment of low-pass filter
- Selection of instrument address and baud rate

Scope of delivery

KELLER test report	Mating plug to Binder 723	Female connector to DIN43650
		

Accessories

Calibration certificate	Interface converter			Mating plug to M12
				
Issued by the external calibration laboratory of the German accreditation body DAkkS or the Swiss accreditation body SAS	K-114 • Analog measurement 0…10 V and 4…20 mA • 12 V measuring device supply via USB • USB interface electrically isolated • Bias and terminating resistors can be activated	K-114BT • With Bluetooth interface and integrated rechargeable battery • Wireless connection via Serial Port Profile (SPP) • 15 V measuring device supply from the converter's internal battery	Connection options • E.g. K-114-B with cable outlet instead of screw-type terminals for Binder series 723 (5-pin) • Various adapter cables available	• Angled socket, cable 5 m *PN 602515.0093* • Angled socket, cable 2 m *PN 602515.0094* • Female connector, cable 5 m *PN 602515.0095* • Female connector, cable 2 m *PN 602515.0096*