# LEX1

## Digital precision manometer

### Features

- High precision of up to 0,01 %FS
- Insulated piezoresistive pressure sensor encapsulated in an oil-filled metal housing
- RS485 bus interface for communication with up to 128 devices
- Battery-operated with up to 2000 hours of battery life
- Can be used with external power supply
- License-free KELLER software available to download
- Intrinsically safe, explosion-proof version LEX1-Ei available

### Functions

- Wide range of units of pressure to choose from
- Zero point calibration via button
- Automatic shutdown
- Min / max display
- User-defined units of pressure can be configured
- Digital calibration (zero point, end point)

### Typical applications

- Calibration
- Laboratory use
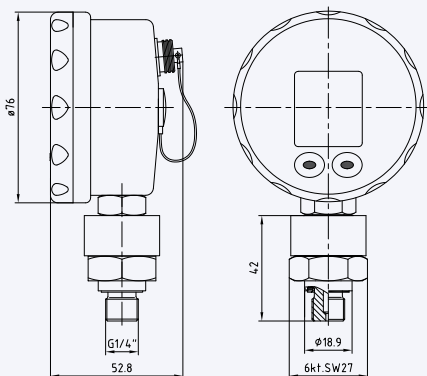- Industrial applications

**Accuracy**
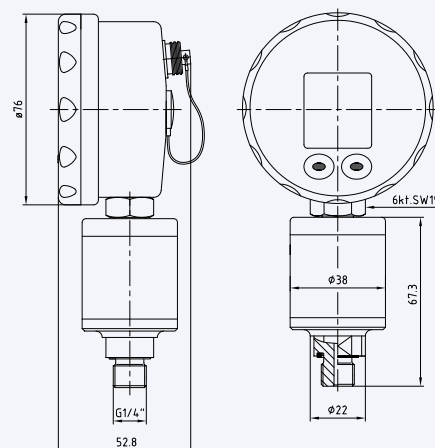± 0,05 %FS

**Total Error Band**
± 0,05 %FS

**Pressure Ranges**
0...30 mbar to 0...1000 bar

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**LEX1 with piezoresistive measuring cell**



**LEX1 with capacitive measuring cell**

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# LEX1 – Specifications

## Standard pressure ranges

LEX1 piezoresistive

| Gauge pressure, PR | -1...1 | -1...3 | -1...6 | -1...10 | -1...16 | -1...30 | | | | | | | | bar rel. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute pressure, PAA | 0...2 | 0...4 | 0...7 | 0...11 | 0...17 | 0...31 | 0...61 | 0...101 | 0...161 | | | | | bar abs. |
| Absolute pressure, PA | | | | | | | | | | 0...300 | 0...400 | 0...700 | 0...1000 | bar |
| Overload resistance | 8 | 8 | 20 | 20 | 90 | 90 | 300 | 300 | 600 | 600 | 800 | 1100 | 1100 | bar |
| Display resolution | 0,1 | 0,1 | 1 | 1 | 1 | 1 | 1 | 10 | 10 | 10 | 20 | 50 | 100 | mbar |

LEX1 capacitive

| Gauge pressure, PR | 0...30 | 0...100 | 0...300 | mbar |
|---|---|---|---|---|
| Differential pressure, PD | | | | mbar diff. |
| Overload resistance | 300 | 1000 | 1500 | mbar |
| Negative overload resistance | 30 | 100 | 300 | mbar |
| Display resolution | 0,01 | 0,01 | 0,1 | mbar |

For the PD version, a tube connection Ø 6 mm for the reference is available.

| Key | PR | Gauge pressure | Zero at atmospheric pressure |
|---|---|---|---|
| | PAA | Absolute pressure | Zero at 0 mbar abs. (vacuum) |
| | PA | Absolute pressure | Zero at 1000 mbar abs. |
| | PD | Differential | |

## Performance

LEX1 piezoresistive

| Accuracy @ RT (20…25 °C) | ≤ ± 0,05 %FS | Nonlinearity (BFSL), pressure hysteresis, non-repeatability, zero point, amplification |
|---|---|---|
| Total error band (0...50 °C) | ≤ ± 0,05 %FS | Max. deviation within the specified pressure and temperature range |
| Long-term stability | ≤ 0,1 %FS | > 1 bar, per year under reference conditions, yearly recalibration recommended |
| | ≤ 1,0 mbar | ≤ 1 bar, per year under reference conditions, yearly recalibration recommended |
| Degree of dependency on location | ≤ ± 1,5 mbar | Calibrated in vertical installation position with pressure connection facing downwards |
| Accuracy of temperature measurement | ± 1 °C typ. | |
| Pressure range reserve | ± 10 % | |
| Vacuum endurance | ≤ 0,2 bar abs. | Of operation ≤ 0,2 bar abs. upon request |

LEX1 capacitive

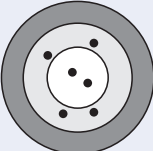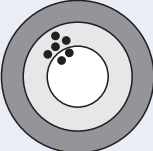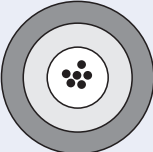| Accuracy @ RT (20…25 °C) | ≤ ± 0,1 %FS | Nonlinearity (BFSL), pressure hysteresis, non-repeatability, zero point, amplification |
|---|---|---|
| Total error band (0...50 °C) | ≤ ± 0,2 %FS | Max. deviation within the specified pressure and temperature range |
| Long-term stability | ≤ 0,1 %FS | Per year under reference conditions, yearly recalibration recommended |
| Long-term stability 30 mbar range | ≤ 0.1 mbar | Per year under reference conditions, yearly recalibration recommended |
| Degree of dependency on location | none | |
| Line pressure dependency (PD versions) | ≤ ± 0,005 %FS / bar | |
| Accuracy of temperature measurement | ± 1 °C typ. | |
| Pressure range reserve | ± 10 % | |
| Line pressure | ≤ 2 bar | |

# LEX1 – Specifications

## Performance

Optional for LEX1 piezoresistive

| Precision @ RT (20…25 °C) | ≤ ± 0,01 %FS | Nonlinearity (BFSL), pressure hysteresis, non-repeatability, with KELLER test report ex works |
| --- | --- | --- |
| | ≤ ± 0,025 %FS | |
| Accuracy @ RT | ≤ ± 0,01 %FS | With DakkS (German accreditation body) certificate issued by external calibration laboratory |

For PA / PAA ≥ 10 bar, except for flush versions.

**Accuracy ± 0,05 %FS, with KELLER test report ex works (standard)**
Keller uses pressure sources to calibrate its products that are at least four times more accurate than the product to be tested. This enables us to produce products in our factory with an absolute accuracy of up to ± 0,05 %FS.

**Precision ± 0,01 %FS / 0,025 %FS, with KELLER test report ex works**
Additional measurement work and selection of a specific pressure transducer means that optimum repeatability is guaranteed for selected pressure transmitters and digital manometers. Owing to the residual measurement uncertainty of the pressure sources used at its factory, KELLER cannot provide any verification of measurement accuracy at scales below ± 0,05 %FS for these ultra-precise devices. KELLER therefore uses the term "precision" to denote the ability of a pressure transmitter or manometer to repeat measured values within a tolerance of 0,01 %FS based on the pressure sources used at the factory.

**Accuracy ± 0,01 %FS with DakkS (German accreditation body) certificate, issued by an external accredited calibration laboratory**
By calibrating the zero point and performing amplification via the digital interface, an accredited calibration laboratory (ilac.org) can adapt ultra-precise KELLER products to their more accurate pressure sources and record the results. External calibration to an accuracy of up to ± 0,01 %FS is performed in accordance with the guidelines set out by the German Calibration Service (DKD) and is conducted under reference conditions without any consideration of long-term effects.

## Temperature Ranges

| Compensated temperature range | 0…50 °C |
| --- | --- |
| Media temperature | 0…50 °C |
| Ambient temperature | 0…50 °C |
| Storage temperature | -20…70 °C |

## Electrical Data

| Battery | 3 V, type CR2430 | LEX1-Ei only permitted for use in hazardous atmospheres when used with the Renata CR2430 |
| --- | --- | --- |
| Battery life | approx. 2000 hours | When used continuously |
| External power supply | 8...28 VDC | |
| Overvoltage protection and reverse polarity of external power supply | ± 32 VDC | LEX1-Ei devices must not be supplied with power from an external source and the RS485 interface must not be used in the Ex zone. See operating instructions for further information |
| RS485 voltage insulation | -7...12 VDC | |
| GND case insulation | > 10 MΩ @ 50 VDC | |
| External interface | RS485 half-duplex | |
| Interface measuring rate | 30 measurements per second | |
| Electrical connection | Fischer D 103 A054-130 | |
| CE conformity as per 2014/30/EU (EMC) | EN 61000-6-1 to -6-4 EN 61326-1 / EN 61326-2-3 | |

# LEX1 – Specifications

## Display

| | |
|---|---|
| Dimensions/appearance | Width × height: 27,8 × 30,0 mm (see Dimensions and options) |
| Number of digits on LC display | 2 rows with 5 digits each |
| Display mode | Pressure + min / max |
| Measuring rate | 2 measurements per second |
| Configurable units of pressure | [bar], [mbar], [hPa], [kPa], [MPa], [PSI], [mH2O], [cmH2O], [inH2O], [ftH2O], [mmHg], [inHg], [kp/cm2] |
| Additional units of pressure | 5 user-defined units can be configured |

## Mechanical Data

Materials in contact with media

| Component | LEX1 piezoresistive | LEX1 capacitive |
|---|---|---|
| Pressure connection | Stainless steel AISI 316L | Stainless steel AISI 316L |
| Pressure transducer separating diaphragm | Stainless steel AISI 316L | Aluminium oxide 96 %, gold-plated |
| Pressure transducer seal (internal) | FKM (Viton® type A) | Nitrile |
| Pressure connection seal (external) | FKM (Viton® type A) | FKM (Viton® type A) |

Other materials

| Component | LEX1 piezoresistive | LEX1 capacitive |
|---|---|---|
| Display housing | Faradex AS-1003 | Faradex AS-1003 |
| Oil filling pressure transducer | Silicone oil | None |

Further details
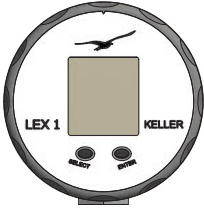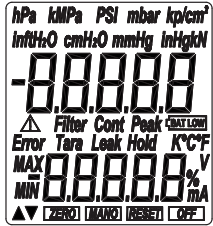
| Component | LEX1 piezoresistive | LEX1 capacitive |
|---|---|---|
| Pressure connection | G1/4, see Dimensions and Options | |
| Diameter x height x depth | 76 mm 118 mm × 55 mm | 76 mm × 148 mm × 55 mm |
| Weight | approx. 300 g | approx. 335 g |
| Protection | IP65 | |

## Explosion Protection LEX1-Ei
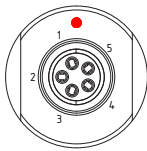
| | | |
|---|---|---|
| Intrinsically safe version in accordance with 2014/34/EU and IECEx | PTB 05 ATEX 2012 X<br>IECEx PTB 13.0028 X<br>Zone 1: Ex II 2 G Ex ia IIC T6 Gb | Permitted max. ambient temperature range -20…65 °C |

# LEX1 – Dimensions and Options
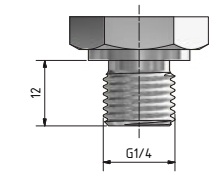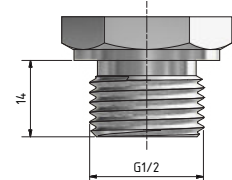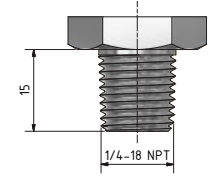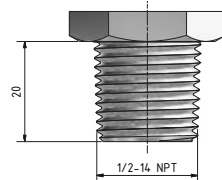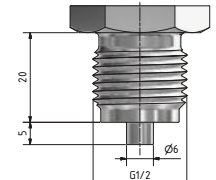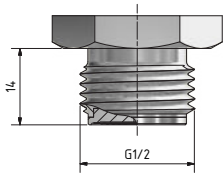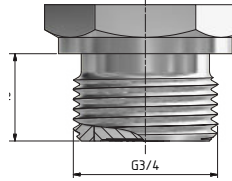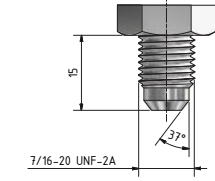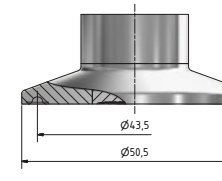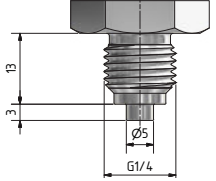
## Display

| Placement | Display information | |
|---|---|---|
| | hPa  kMPa  PSI  mbar  kp/cm²<br>InftH₂O  cmH₂O  mmHg  inHgkN<br>-8.8.8.8.8<br>⚠ Filter Cont Peak BAT LOW<br>Error Tara Leak Hold  K°C°F<br>MAX 8.8.8.8.8 % V<br>MIN        mA<br>▲▼ ZERO MANO RESET OFF | Width × height:<br>27,8 × 30,0 mm<br><br>Digit height:<br>8,4 pt. large<br>6,3 pt. small |

## External Connection

| Placement | Connection | | Pin assignment | |
|---|---|---|---|---|
| | Fischer connector D 103 A054-130 | | Red | Reference point |
| | | | 1 | GND |
| | | | 2 | n.c. |
| | | | 3 | +Vcc |
| | | | 4 | RS485 A |
| | | | | B |

## Available Pressure Connections

| G1/4 (standard) | G1/2 | 1/4 NPT | 1/2 NPT | G1/2 EN 837 |
|---|---|---|---|---|
| 12<br>G1/4 | 14<br>G1/2 | 15<br>1/4–18 NPT | 20<br>1/2–14 NPT | 20<br>5<br>Ø6<br>G1/2 |
| **G1/2 flush** | **G3/4 flush** | **7/16-20 UNF** | **Clamp DIN 32676 flush** | **G1/4 EN 837** |
| G1/2 | G3/4 | 15<br>7/16–20 UNF–2A<br>37° | Ø43,5<br>Ø50,5 | 13<br>3<br>Ø5<br>G1/4 |

Other pressure connections available upon request.

## Other Customer-specific Options

- Other pressure and temperature ranges
- Parts that come into contact with media made from Hastelloy, Inconel or titanium
- Customer-specific front covers
- Integration of application-specific calculations
- Customer-specific firmware
- Detached pressure transducer
- Axial pressure connection
- Other sealing materials
- Other oil fillings pressure transducer

# LEX1 – Software and Accessories

## Interface

The LEX1 manometer has a digital interface (RS485 half-duplex) which supports the KELLER bus protocol. The pressure measurement rate via the interface is up to 30 x per second. 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 to integrate the communication protocol into your own software.

## Interface Converters

The connection to a computer is established via an RS485-USB interface converter. Suitable converters are available as accessories. To ensure smooth operation, we recommend the K-114 A converter with the corresponding USB connector.

## «ManoConfig» Software

The ManoConfig program is compatible with various types of KELLER manometers and allows end customers to configure the devices.

Range of functions
- Display of online measured values
- Configuring the wait period before automatic shutdown
- Selecting standard pressure units
- Activating/deactivating pressure units
- User-defined pressure units can be programmed
- Restoring to factory settings
- Calibrating the manometer
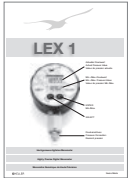
## «CCS30» Software

Recording measured values
- Live visualisation
- Adjustable measuring and storage interval
- Export function

Configuration
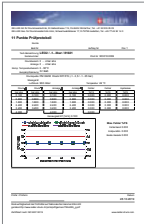- Call up of information (pressure and temperature range, firmware version, serial number etc.)

## Scope of Delivery

| Plastic case | CR2430 battery | KELLER 5-point report | Operating instructions D/E/F |
|---|---|---|---|
|  |  |  |  |

## Accessories

| Rubber cover | KELLER 11-point report | Calibration certificate | Interface converters | |
|---|---|---|---|---|
|  |  |  |  |  |
| For additional protection in harsh environments | Measurement deviation at room temperature with hysteresis | Issued by the external calibration laboratory of the German accreditation body DAkkS or the Swiss accreditation body SAS | K-114 A<br>• With Fischer plug (5-pin)<br>• Various adapter cables available | K-114 BT A<br>• with Bluetooth interface and integrated rechargeable battery<br>• Wireless connection via Serial Port Profile (SPP)<br>• 15 V measuring device supply from the converter's internal battery |