



## HIGHLY PRECISE PRESSURE TRANSMITTERS

#### FOR HAZARDOUS APPLICATIONS

# Series 33 X Ei (LV) / 35 X Ei (LV) / 36 XW Ei (LV) / PD-33 X Ei (LV)

These piezoresistive pressure transmitters are approved for use in high explosive gas and dust atmospheres of groups I (mining industry) and II (industrial applications) where there is a high risk of explosion. Optionally available are Low Voltage Versions (LV) with 3,2...8,5 V.

#### Signal processing

This series features microcontroller-based electronic evaluation to ensure maximum accuracy. Each transmitter is gauged across the entire pressure and temperature range. This measurement data is used to calculate a mathematical model that enables correction of all reproducible errors. In this way, KELLER can guarantee high accuracy as an error band within the over-all compensated pressure and temperature range. Two compensated temperature ranges are available for the transmitters, according to choice: -10...80 °C and 10...40 °C. The level probes are gauged in the 0...50 °C temperature range only. The calculated pressure value can be read via the interface, and is simultaneously processed as an analog signal.

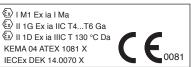
#### Interface

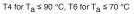
The interface is designed as a robust RS485 half-duplex for 9'600 and 115'200 baud. There is an external leadthrough for the interface on all products except the version with the DIN 43650 plug.

Communication protocol: KELLER Bus and MODBUS RTU. The transmitters can be configured and the measured values can be recorded with the CCS30 software:

- Read out current measured pressure and temperature values with maximum resolution
   Speed: at 115'200 baud, up to 330 measured values per second (depending on the converter)
- Call up information and status (pressure and temperature ranges, serial number, software version, etc.)
- Reprogram analog output (e.g. different units or pressure range)
- Calibration: zero point and amplification can be adjusted
- Special calculations, such as non-linear curve adaptation or root calculation for flow
- Possibility of adjusting the low-pass filter and the communication parameters

#### **Ex-Classification**







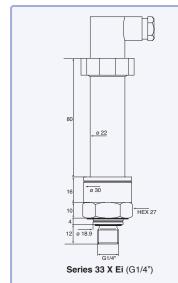


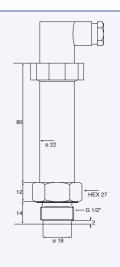
Series 33 X Ei (LV)
Industrial applications

Series 35 X Ei (LV)
Flush diaphragm

Series 36 XW Ei (LV)
Level transmitter

Series PD-33 X Ei (LV)
Differential pressure measurement





Series 35 X Ei (G1/2")

### **ELECTRICAL CONNECTIONS**

Output	Function	Binder 723	M12 A-coded	DIN 43650	MIL C-26482	Cable
2-Leiter	OUT/GND	1	1	1	С	white
Current	+Vcc	3	3	3	А	black
3-Leiter	GND	1	1	1	С	white
Voltage	OUT	2	2	2	В	red
	+Vcc	3	3	3	Α	black
Digital	RS485A	4	4	-	D	blue
	RS485B	5	5	_	F	yellow
Transmitte	er Housing			<u></u>		Shield

use shielded cable

Drawings of Series 36 XW Ei, PD-33 X Ei and mining version M available on request.



# For pricing or any further information, please contact Omni Instruments Ltd.



**Contact Details:** 

Tel: +44 1382 443000 Email: info@omni.uk.com Mailing Address: Unit 1, 14 Nobel Road, Wester Gourdie Industrial Estate, Dundee, DD2 4UH.

Website: www.omniinstruments.co.uk





#### **Specifications**

Standard Pressure Ranges (FS) and Overpressure in Bar											
PR-36 XW Ei	0,3 (1)		1		3	10	30				
PAA-36 XW Ei			0,82,3		0,84	0,811	0,831				
PR-33 X Ei, PR-35 X Ei	0,3 (1)	±0,3 <sup>(1)</sup>	1	±1	3	10	30				
PA(A)-33 X Ei, PA(A)-35 X Ei	0,81,2		1		3	10	30	100	300	700	1000
(pressure ranges Series PD-33 X Ei on request	:)										
Überdruck	2	2	2	2	5	20	60	200	400	1000	1100

PAA: Absolute. Zero at vacuum PA: Absolute. Zero at 1 bar abs. PR: Gauge pressure. Zero at atmospheric pressure PD: Differential

All intermediate ranges for the analog output are realizable with no surcharge by spreading the standard ranges. Accessing the extended area 0.1 bar Also negative and further +/- ranges

Туре	RS 485	420 mA (2-wire)	010 V (3-wire)	05 V (3-wire)	<b>0,12,5 V</b> (3-wire)
Digital Interface	RS485	RS485	RS485	RS485	RS485
Supply (U)	1030 Vcc	1030 Vcc	1530 Vcc	1030 Vcc	3,58,5 V (LV)
Accuracy <sup>(2)</sup> @ RT (digital) typ.	0,02 %FS	0,04 %FS	0,02 %FS	0,02 %FS	0,02 %FS
Total Error Band (3) (1040 °C)	0,05 %FS	0,10 %FS (5)	0,10 %FS (6)	0,10 %FS (6)	0,10 %FS
Total Error Band (3) (-1080 °C) (4)	0,10 %FS	0,15 %FS (5)	0,15 %FS (6)	0,15 %FS (6)	0,15 %FS
Power Consumption (without communication)	< 8 mA	3,222,5 mA	< 8 mA	< 8 mA	< 3 mA

 $<sup>^{(1)}</sup>$  Specified "Accuracy" and "Total error band" multiplied by a factor of 2

Compensated temperature range for Series 36 XW Ei: TEB 1 % @ 0...50 °C
Disturbance of the 4...20 mA signal occurs during communication through RS485. 3-wire types are suitable for simultaneous operation of analog output and RS485.

(6)	Without burden of the voltage output (R = 100 $\Omega$ ). With burden R = 100 k $\Omega$ the error increases by	10 1 0/ EQ
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Output Rate	400 Hz
Resolution	0,002 %FS

Range ≤ 1 bar: 1 mbar Long Term Stability typ. Range > 1 bar: 0,1 %FS

Load Resistance	<(U-10 V) / 25 mA (2-wire)	$> 100 \text{ k}\Omega \text{ (3-wire)}^{(6)}$
Electrical Connection	DIN 43650*, Binder Series 72	3*, M12, MIL-C 26482,
	Subconn BH MSS and MCBH	MSS or cable
	* Mating connector included	

Start-up Time (Supply On) < 600 ms 10 M $\Omega$  / 500 V Insulation -40...+120 °C Storage Temperature

-40... +90 °C for T4 Operating Temperature\*\* -40... +70 °C for T6

 $^{\star\star}$  Available for P  $_i$   $\leq$  640 mW, see operational manual for other options. Pressure Endurance 10 Million Pressure Cycles 0...100 %FS @ 25 °C

< 0,1 mm<sup>3</sup>

Vibration Endurance, IEC 60068-2-6 20 g (10...2000 Hz) Shock Endurance, IEC 60068-2-27 50 g (11 ms)

Protection CE-Conformity (EMC)

Material in Contact with Media Weight

Dead Volume Change

Options:

- Special calculations with pressure and temperature

- Different housing-material, oil filling, pressure thread

- Different compensated temperature and pressure ranges

- Low Voltage Version labelled with "LV" in Type Designation

- Mining Version labelled with "M" in Type Designation

Further versions: - Series PD-39 X Ei: for differential pressure measurements with

high double-sided overload resistance

IP 65 optional: IP 67 or IP 68 (with cable)

Stainless Steel 316L (DIN 1.4435) / Viton®

Series 33 X Ei ≈ 140 g; Series 35 X Ei ≈ 160 g

EN 61000-6-1 to 6-4 / EN 61326-1 / EN 61326-2-3

Series PD-33 X Ei ≈ 500 g, Series 36 XW Ei ≈ 200 g

- Series 41 X Fi: for low pressure ranges

- Series 46 X Ei: for low pressure ranges, flush diaphragm

(see separate data sheets)

Intrinsically safe in conjunction with certified intrinsically safe power circuits, with the following maximum connected loads:

 $U_i \le 30 \text{ V}, I_i \le 200 \text{ mA}, P_i \le 0.64...1.3 \text{ W}$ (depending on the application, see operating instructions)

Low Voltage Version "LV"

 $U_1 \le 8.5 \text{ V}, I_2 \le 200 \text{ mA}, P_3 \le 1.3 \text{ W}$  $L_{i} = 0 \text{ mH}, C_{i} = 6.5 \mu\text{F}$ 

#### **Polynomial Compensation**

This uses a mathematical model to derive the precise pressure value (P) from the signals measured by the pressure sensor (S) and the temperature sensor (T). The microprocessor in the transmitter calculates P using the following

## $P(S,T) = A(T)S^0 + B(T)S^1 + C(T)S^2 + D(T)S^3$

With the following coefficients A(T)...D(T)depending on the temperature:

 $A(T) = A_0 T^0 + A_1 T^1 + A_2 T^2 + A_3 T^3$  $B(T) = B_0^x T^0 + B_1^x T^1 + B_2^x T^2 + B_3^x T^3$  $C(T) = C_0^x T^0 + C_1^x T^1 + C_2^x T^2 + C_3^x T^3$  $D(T) = D_0^x T^0 + D_1^x T^1 + D_2^x T^2 + D_3^x T^3$ 

The transmitter is factory-tested at various levels of pressure and temperature. The corresponding measured values of S, together with the exact pressure and temperature values, allow the coefficients A<sub>0</sub>...D<sub>3</sub> to be calculated. These are written into the EEPROM of the microprocessor.

When the pressure transmitter is in service, the microprocessor measures the signals (S) and (T), calculates the coefficients according to the temperature and produces the exact pressure value by solving the P(S,T) equation.

Calculations and conversions are performed at least 400 times per second.

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<sup>(3)</sup> Accuracy and temperature error within the selected, compensated temperature range