SERIES 33X/XX Subsea Pressure Transmitter

HIGH PRECISION PRESSURE TRANSMITTERS
Accuracy Ranges: 0.1, 0.05, 0.01% FSD

DIGITALLY COMPENSATED / RANGEABLE / DIGITAL AND ANALOG OUTPUT

These pressure transmitters have conventional analogue outputs but are designed for subsea environments for pressures ranging from 50 to 1360 bar A or 1 to 600 bar DP, liquids or gas. External case pressure allowed is up to 400 bar. The series 33 sensor combines the latest technologies of both pressure sensor and electronic compensation.

The pressure sensor is a high stability piezoresistive device designed for use in transmitters where accuracy and stability are essential. The sensor is selected after severe testing under pressure and temperature. The sensing component is a micro-machined silicon chip of high sensitivity mounted in a floating arrangement. An independent temperature sensor is integrated on the surface of the silicon chip.

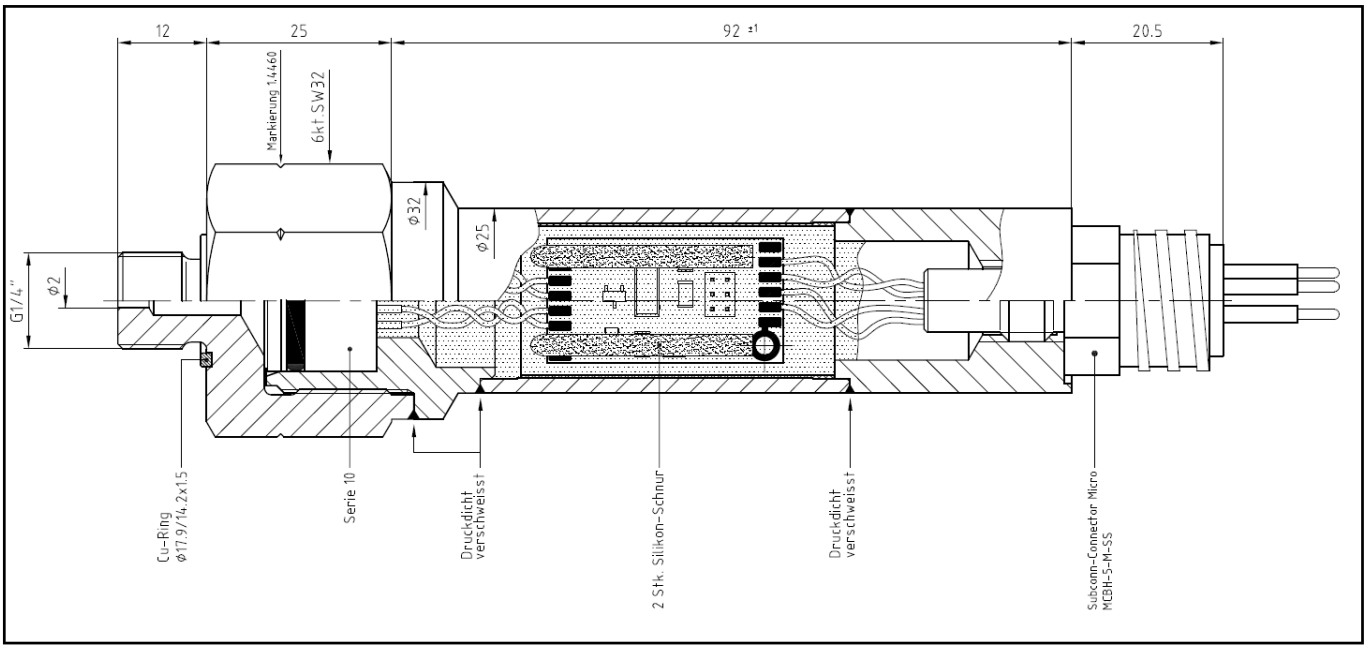
The processing electronics comprise of a microprocessor with an integral 16 bit A/D. Conversions are performed at a rate of at least 100 operations per second.

The pressure signal compensation uses a mathematical model based on polynomial approximation, which provides almost perfect compensation over the operating temperature range.

The voltage (or current) analogue output signal is generated by a 16-bit D/A converter. The output signal is updated every 10 milliseconds.

The user can, via the RS485 interface and using a KELLER adapter cable, set the zero and the gain of the transmitter by simple software programming. Standard accuracy of the serial output is 0.05% FSD, however high accuracy units can be supplied with 0.01% precision serial output.

The transmitter has great manufacturing flexibility and can be supplied with a wide range of housings and connector types



Drawing 8601.26
Unit with Subcon MCBH5M male 5 pin connector
Stainless steel 316L body, suitable for immersion to 4000 metres

omni INSTRUMENTS
Measurement and data acquisition solutions

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Specifications

	Standard Pressure Ranges (FS) and Overpressure in bar								
PR 33 X / PD 33 X / PR 35 X		1	3	10	30				
PA(A) 33 X / PA(A) 35 X	0,8…1,2	1	3	10	30	100	300	700	1000
Overpressure	2	2	5	20	60	200	400	1000	1000
Overpr. referential pressure side PD		2	5	7	20				
PD, static line pressure* standard / high Pressure	200 bar / 600 bar								

All intermediate ranges for the analog output are realizable with no surcharge by spreading the standard ranges.
Option: Adjustment directly to intermediate ranges (below 20 pieces against surcharge).

PAA: Absolute. Zero at vacuum
PA: Sealed Gauge. Zero at atmospheric pressure (at calibration day)
PR: Vented Gauge. Zero at atm. pressure
PD: Differential

		(digital)	(analog, 2-wire)	(analog, 3-wire)		
Output		**RS 485**	**4…20 mA**	**0…10 V**	**0…2,5 V / 0…5 V**	**0,1…2,5 V**
Supply (U)		8…28 V / 3,5…12 V	8…28 V	13…28 V	6…28 V / 8…28 V	3,5…12 V
Accuracy, Error Band	(10...40 °C)	0,05 %FS	0,1 %FS	0,1 %FS	0,1 %FS	0,1 %FS
Accuracy, Error Band	(-10...80 °C)	0,1 %FS	0,15 %FS	0,15 %FS	0,15 %FS	0,15 %FS
Optional: Precision**	(10…40 °C)	**0,01 %FS**				

***** Influence static line pressure < 0,005 %FS/ba Only for Series PA(A) 33 X and for ranges ≥ 10 bar

True Output Rate	400 Hz
Resolution	0,002 %FS
Long Term Stability typ.	Gauges: 1 mbar or 0,05 %FS Absolute: 0,5 mbar or 0,025 %FS (10…40 °C)
Load Resistance (Ω)	<(U - 8 V) / 0,025 A (2-wire) > 5'000 (3-wire)
Electrical Connection	- MIL C-26482-Plug (6 pole) - Binder-Plug 723 (5 pole) - DIN 43650 Plug (4 pole)
Insulation	10 MΩ / 50 V, optional 300 V (2-wire only)
Storage-/Operating Temperature Range	-40…120 °C
Pressure Endurance	10 Million Pressure Cycles 0…100 %FS @ 25 °C
Vibration Endurance	20 g (5...2000 Hz, max. amplitude ± 3 mm), according to IEC 68-2-6
Shock Endurance	20 g (11 ms)
Protection	IP 65 optional: IP 67 or IP 68 (with cable)
CE-Conformity	EN 61000-6-1 to -6-4 / EN 61326-2-3
Material in Contact with Media	Stainless Steel AISI 316L / Viton
Weight	Series 33 X ≈ 140 g; Series 35 X ≈ 160 g; Series PD-33 X ≈ 500 g
Dead Volume Change	< 0,1 mm^3

Remarks:
- Disturbance of the 4...20 mA signal can occur during communication through RS485
- All versions are also available for use in hazardous areas (Ei-versions); see sep. data sheet
- Options: - Calculations such as density, differential pressure, flow, absolute value, etc.
  - Different housing-material, oil filling, pressure thread or connector

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 polynomial:

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

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

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

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_0...D_3 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.

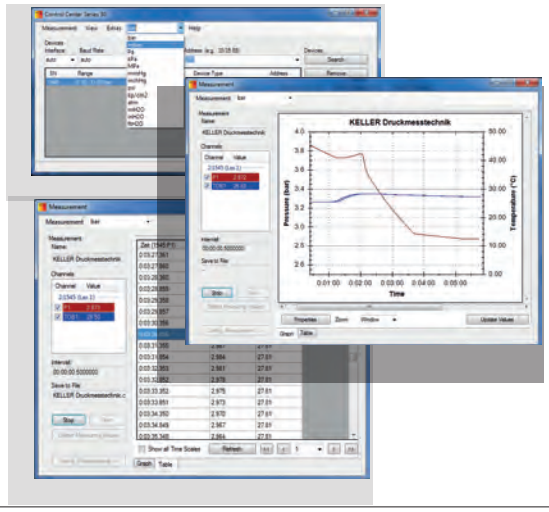
Interface

The digital interface is designed as a robust RS485 half-duplex for 9'600 and 115'200 baud. It can be used to implement bus systems with 128 subscribers and line lengths of up to 1'400 m.

Communication protocol: MODBUS RTU and KELLER Bus. The measuring channels are defined as follows: P1: differential pressure, P2: absolute pressure, TOB1, TOB2: sensor temperatures.

Details about the communication protocol are available at: www.keller-druck.com.

The transmitters can be configured and measured values can be recorded with the CCS30 software and a K-114 interface converter.



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