

# SERIES 33 Subsea



## HIGH PRECISION PRESSURE TRANSMITTERS

### **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 500 bar DP, liquids or gas. External case pressure allowed is up to 1400 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 a PIC 14000 microprocessor with an integral 13...14 bit A/D converter and inputs capable of handling 5 signals. 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.

The transmitter has great manufacturing flexibility and can be produced with various types of pressure connection. Among its features are standard plates which hold the connector, enabling the same transmitter to be supplied with different electrical connectors that can be exchanged by the user as an option.

The Series 33 and 35S transmitters have an exceptional price/performance ratio.

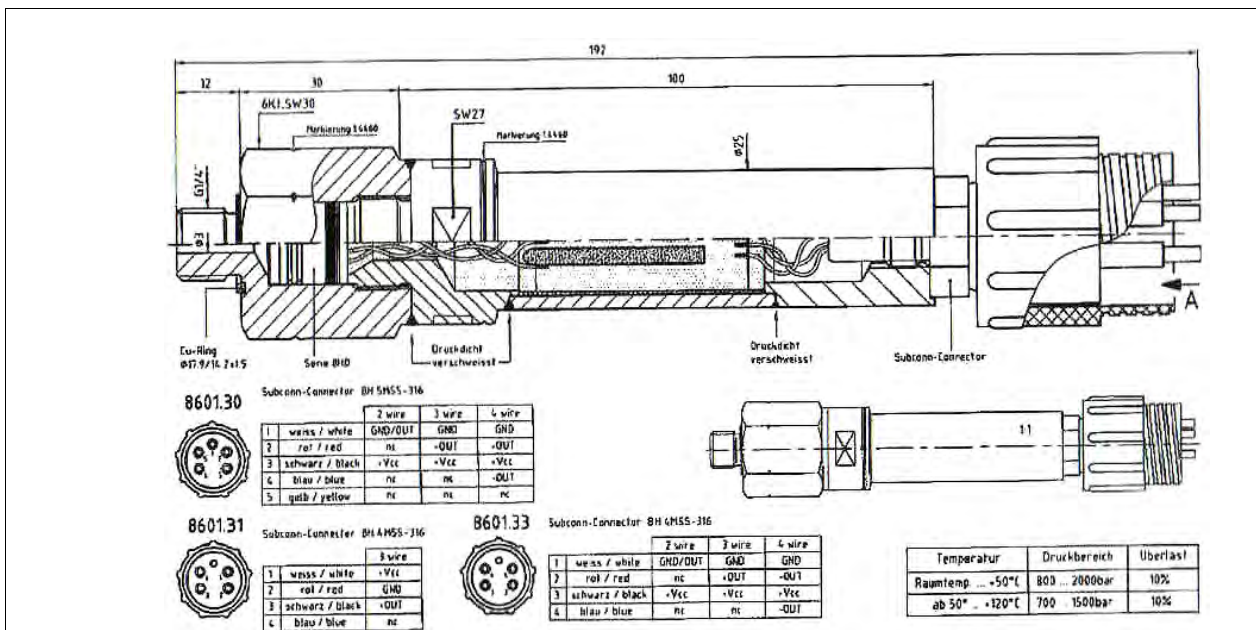
**Series 33** Male Pressure Port G1/4"  
0,05 % Total Error Band, over 10...+40 °C

**PAA-33 / 35 S** Absolute Pressure, Zero at Vacuum (0 bar abs.)

**PA-33 / 35 S** Sealed Gauge, Zero at 1 bar abs.



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## SPECIFICATIONS

### STANDARD PRESSURE RANGES (FS) AND OVERPRESSURE IN BAR

PAA-33	1	3	10	30				
PA-33	1	3	10	30	100	300	1000	1360
Overpressure	-1	3	7	20	60	200	300	1000

All intermediate ranges for the analog output are realizable with no surcharge by spreading the standard ranges.

Option: Adjustment directly to intermediate ranges

Storage-/Operating Temperature Range	-40...80 °C
Compensated Temperature Range	10...40 °C (-10...80 °C opt.)
Accuracy (10...40 °C) (1) (2) (3)	0,05 %FS
Accuracy (-10...80 °C) (1) (2) (3)	0,1 %FS
True Output Rate	100 Hz
Resolution	≤0,01 %FS
Long Term Stability typ.	Range ≤ 2 bar: 0,5 mbar Range > 2 bar: 0,05 %FS

- (1) Linearity + Hysteresis + Repeatability + Temperature Coefficients + Zero + Span Tolerance
- (2) Accuracy and Resolution are valid for Basic Pressure Range
- (3) Linearity: Best Straight Line

Output Signal	4...20 mA, 2 Wire 0...10 V, 3 Wire
Supply (U)	8...28 Vcc 13...28 Vcc
Load Resistance (Ω)	(U-5V) / 0,02A > 5 000
Electrical Connection	Subcon BH series or MC series
Programming	RS485 (2 Wire) / option. PROG30, K106 data cable
Insulation	100 MΩ/ 50 V

Pressure Endurance	10 Million Pressure Cycles 0...100 %FS at 25 °C
Vibration Endurance	20 g, 20 to 5 000 Hz
Shock Endurance	20 g sinus 11 msec.
Protection	IP68 external case pressure up to 600 bar ( 1400 bar on 1360 bar sensors )
CE-Conformity	EN 50081-2, EN 50082-2
Material in Contact with Media	Stainless Steel 316L (DIN 1.4435) / Viton
Dead Volume Change	< 0,1 mm <sup>3</sup>

### Options

Any Pressure Ranges between 0,5 and 1000 bar / Other Compensated Temperature Ranges / Supply 32 V / Electrical Cable Output / Oil Filling: Fluorized Oil (O2 -compatible), Olive Oil, Low Temperature Oil / Other Pressure Connections / Other Plug Connections / Other Materials

### 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 micro-processor 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:

$$A(T) = A0 \cdot T^0 + A1 \cdot T^1 + A2 \cdot T^2 + A3 \cdot T^3$$

$$B(T) = B0 \cdot T^0 + B1 \cdot T^1 + B2 \cdot T^2 + B3 \cdot T^3$$

$$C(T) = C0 \cdot T^0 + C1 \cdot T^1 + C2 \cdot T^2 + C3 \cdot T^3$$

$$D(T) = D0 \cdot T^0 + D1 \cdot T^1 + D2 \cdot T^2 + D3 \cdot T^3$$

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 A0...D3 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 100 times per second depending on the format of the signals. The theoretic resolution is 0.01 to 0.005%. In practice, however, accuracy is limited to 0.05% by the calibration equipment.

## ACCESSORIES SERIES 30

Each Series 30 transmitter also integrates a digital interface (RS485 half duplex) which you can make use of: Connect the transmitter to a PC or Laptop via the converter K106 (RS232-RS485). Two programmes are offered:

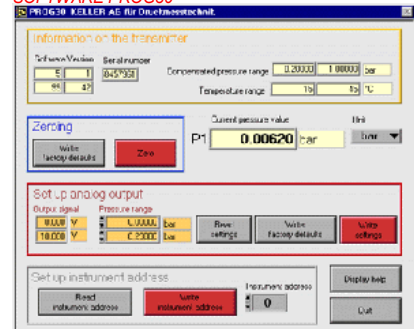
- |                                                                                    |                                                                                           |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| <b>PROG30:</b>                                                                     | <b>READ30:</b> Data collection with up to ten Series 30 pressure transmitters with graphs |
| Instrument Settings                                                                | Fast read-out and viewing of the pressure signals in a graph                              |
| Call up of information (pressure- and Temperature range, version of software etc.) | Documentation of dynamic measurements                                                     |
| Indication of actual pressure value                                                | Up to 10 transmitters on one serial connection (Bus-operation)                            |
| Selection of the units                                                             | Setting of a new zero for the transmitter                                                 |
| Setting of a new zero for the transmitter                                          | Reprogramming of the analog output (i.e. different unit, other pressure range)            |
| Reprogramming of the analog output                                                 | Setting of the instrument address (for Bus-operation)                                     |

You can also tie up the transmitters into your own software. You have then a documentation, a DLL and LabView VI's at your disposal.

### CHANGING THE PLUG CONNECTOR (optional)

Laboratory applications require the same transmitter to be used at different measurement points with different electrical connection arrangements. To accommodate such applications, KELLER can supply different connectors matching with the internal standard plug.

### SOFTWARE PROG30



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