TRONIC Line
Reference Manual

WIKA®

Part of your business

Pressure and Temperature Measurement

Contents

This manual should be used in conjunction with the Tronic Line data sheets. The information herein is for reference only. Final product selection should be based on the technical specifications provided on the most recent product data sheets. All technical specifications in this manual and on the data sheets are subject to change without notice. For further assistance, please contact the WIKA technical team.

1.0 Introduction

Pressure transmitters and transducers are electronic devices that measure pressure and produce an output signal that is both **linear** and **proportional** to the applied pressure.

> A **pressure transmitter** converts applied pressure to an amplified output signal such as 4-20 mA or 0-10 V.
> A **pressure transducer** converts applied pressure to an unamplified signal such as 2mV/V.

General purpose pressure sensors, transducers, and transmitters are usually referred to as pressure transducers. In this manual , the word transmitter is used to refer to both transmitters and transducers unless otherwise noted.

Typical WIKA Tronic Industrial Pressure Transmitter

Standard electrical connection: DIN 43650 cap with solderless screw terminals. Available options include 1/2" NPT female conduit, NEMA 4 flying leads with vented cable, 4 and 6 pin Mil Plug, and custom connectors.

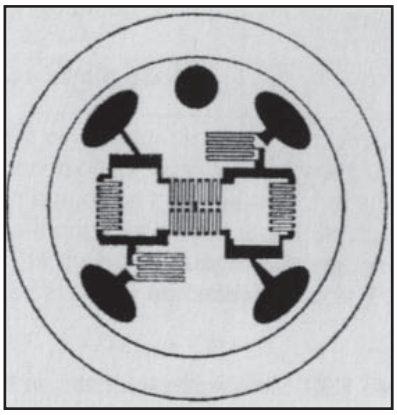
Body: 304 stainless steel. Contains circuit board for signal conditioning to produce 4-20 mA, 0-5 volt, or other high level output. The circuit board is potted in silicone gel for moisture and vibration protection.

Process connection: 316 stainless steel for corrosion resistance. 1/2 NPT male is the standard. The sensing element is located inside the process connection near the hex.

WIKA manufactures a broad range of transmitter models to meet a variety of applications and environments. These models can vary in the type of electrical connection, process connection, and electrical specifications.

1.1 The Pressure Sensor

WIKA pressure transmitters use a **strain gauge** as the primary sensing element. Strain gauge sensors feature small size, fast response, and high reliability. The strain gauge is a series of resistors arranged in a circuit called a **Wheatstone Bridge**. As the sensor is pressurized, the resistors are stretched and compressed by the pressure and their resistance changes in proportion to the amount of pressure applied.



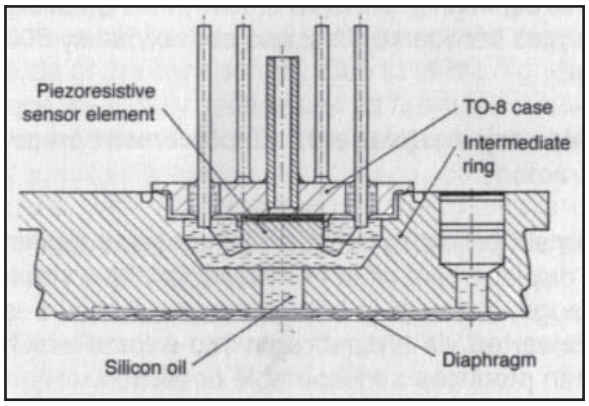
Wheatstone Bridge

Three types of strain gauge sensors are used in most WIKA pressure transmitters: **piezoresistive**, **thin film, and ceramic.**

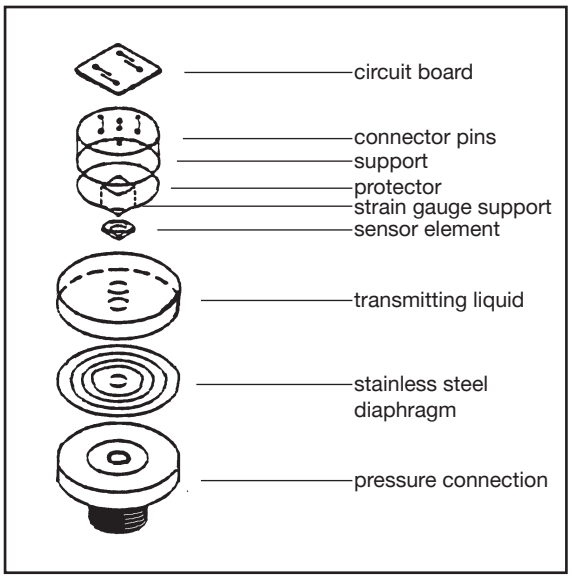
1.2 Piezoresistive Sensors

Low pressure applications to 300 psi use a diffused semiconductor **piezoresistive** strain gauge. This type of strain gauge is manufactured using integrated circuit technology. The Wheatstone Bridge is etched onto a single crystal silicon diaphragm. Since the silicon diaphragm cannot withstand corrosive media, it is isolated by a metal diaphragm. Pressure is transmitted to the silicon diaphragm by a transmitting liquid, usually a synthetic oil. Other fill fluids including halocarbon are available for special applications including paint and oxygen media.

This type of sensor, also known a *piezoresistive strain gauge*, is found in most WIKA industrial, OEM, and special purpose transmitters up to a pressure range of 300 psi.



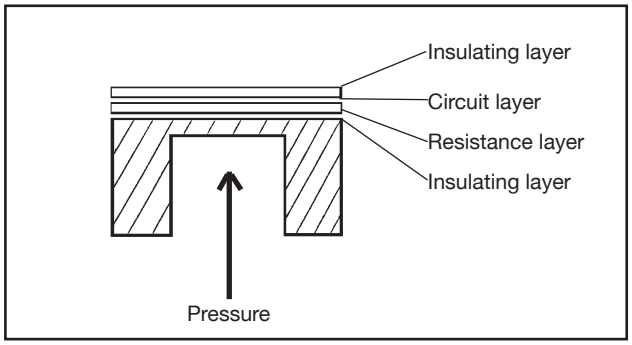
Piezoresistive sensor



Exploded view of a typical piezoresistive sensor assembly

1.3 Thin Film Sensors

Tronic pressure transmitters above 300 psi use a **Thin Film** strain gauge sensor. A Thin Film sensor has the Wheatstone Bridge deposited directly on a stainless steel diaphragm. This is applied to the diaphragm by a vacuum deposition process called sputtering. This sensor technology results in fewer components and higher reliability in high pressure applications when compared to many other sensor technologies.



Cross section of a Thin Film sensor

WIKA 7 mm Thin Film sensor

The thin film sensor is used in WIKA Tronic pressure transmitters with a range above 300 psi.

Product example:

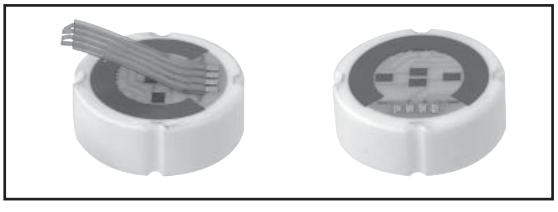
The WIKA **TTF-1** is the Thin Film sensor packaged in a 1/4" NPT male process connection and equipped with 6" color coded leads. The **low level output** is 2 millivolts per volt (**2mV/V**). Using the 0-25 bar range as an example, a circuit with a 10 volt supply will provide an output of 20 mV at 25 bar pressure. A 20 volt supply voltage (the maximum) will provide a 40 millivolt output at full pressure. The lowest available pressure range for this sensor is 0-10 bar (0-145 psi).

Model TTF-1

This sensor is designed for OEM engineers who want to provide their own regulated power supply and signal conditioning circuitry. Substantial cost savings for the user are possible when large quantities are required.

Ceramic Sensors

The WIKA monolithic ceramic thick film sensor is a one piece design. This provides high, long term stability. The ceramic substrate produces virtually no hysteresis. It is a low cost sensor with an unamplified mV per V signal for use in the automotive, pneumatics, and water industries. It is also used in the WIKA low cost PSD-10 pressure switches, DG-10 digital gauge, and MCT sensors.



WIKA monolithic ceramic sensors

Model DG-10

1.4 Other Sensor Types

Many different sensor technologies exist for pressure measurement. Many have specific advantages, depending upon the application.

Foil type strain gauges are inexpensive and flexible because they can be applied to many types of metal surfaces, including curved surfaces, by using adhesives. They are glued to the rear surface of the diaphragm. An additional plastic film is applied over the strain gauge for protection. Bonded strain gauges may show excessive temperature and stability effects because they use an adhesive to attach the foil to the metal diaphragm. Since the steel diaphragm and adhesive expand and contract at different rates with temperature changes, elaborate temperature compensation measures are required to minimize this error. The bonded foil may also "creep" (shift position on the diaphragm) when under load because the diaphragm and adhesive have different elastic properties.

Capacitive sensors use the change in distance between two metallic plates to measure pressure. They are very sensitive in low pressure and high vacuum applications. If made with ceramic diaphragms, this type of sensor can withstand very high overload pressures. However, ceramic diaphragms are brittle when compared to stainless steel, and many require a sealing gasket of Viton® or other material when installed in a stainless steel process connection.

Inductive sensors include types that use a change in magnetic resistance and LVDT (linear variable displacement transformer). These sensors require a relatively large displacement of the diaphragm and are typically used to measure static pressure. This technology has largely been replaced by other newer sensor technologies.

Microelectromechanical systems (MEMS) combines microelectronics with miniature mechanical systems such as valves or gears all on a single chip using nanotechnology for pressure measurement.

Vibrating elements (for example silicon resonance) use the change in vibration on the molecular level of different material elements caused by a change in applied pressure to measure the pressure.

Many other sensor technologies exist, including Hall effect, potentiometric, ionization, and quartz. Many are for highly specialized, nonindustrial applications.

2.0 Specifications

WIKA Tronic catalog pages and data sheets have a consistent layout of technical information that is required to select the correct transmitter.

The second page of the data sheet lists general performance characteristics for each model. The following specification descriptions uses the S-10 transmitter as an example.

Specifications		Model S-10 / S-11								
Pressure range	50InWC	5psi	10psi	25psi	30psi	60psi	100psi	160psi	200psi	
Maximum pressure*	14psi	29psi	58psi	145psi	145psi	240psi	500psi	1160psi	1160psi	
Burst pressure**	29psi	35psi	69psi	170psi	170psi	290psi	600psi	1390psi	1390psi	
Pressure range	300psi	500psi	1000psi	2000psi	3000psi	5000psi	8000psi	10000psi[1]	15000psi[1]	
Maximum pressure*	1160psi	1160psi	1740psi	4600psi	7200psi	11,600psi	17,400psi	17,400psi	21,750psi	
Burst pressure**	1390psi	5800psi	7970psi	14,500psi	17,400psi	24,650psi	34,800psi	34,800psi	43,500psi	
{vacuum, gauge pressure, compound ranges, and absolute pressure references are available}										
[1] Ranges only available with Model S-10										
[2] For Model S-11 the burst pressure is limited to 21,000psi unless the pressure seal is accomplished by using the sealing ring underneath the hex.										
*Pressure applied up to the maximum rating will cause no permanent change in specifications but may lead to zero and span shifts										
**Exceeding the burst pressure may result in destruction of the transmitter and possible loss of media										
Materials										
■ Wetted parts		(other materials see WIKA diaphragm seal program)								
▸ Model S-10		Stainless steel								
▸ Model S-11		Stainless steel {Hastelloy C4}								
		O-ring: NBR [3] {Viton or EPDM}								
■ Case		Stainless steel								
Internal transmission fluid [4]		Synthetic oil {Halocarbon oil for oxygen applications} [5]								
		{Listed by FDA for food applications}}								
	[3] O-ring made of Viton or EPDM for Model S-11 with integral cooling element.									
	[4] Not available with Model S-10 in pressure ranges >300 psi.									
	[5] Media temperature for oxygen version: -22 ... 140 °F / -30 ... +60 °C. Oxygen version is not available in vacuum and absolute pressure ranges or with S-11 > 500 psi									
Power supply U_B [6]	U_B in DC V	10 < U_B ≤ 30 (14 ... 30 with signal output 0 ... 10 V)								
Signal output and maximum load R_A	R_A in Ohm	4 ... 20 mA, 2-wire	$R_A \leq (U_B - 10V) / 0.02$ A							
		0 ... 20 mA, 3-wire	$R_A \leq (U_B - 30V) / 0.02$ A							
		{0 ... 5 V, 3-wire}	$R_A > 5{,}000$							
		{0 ... 10 V, 3-wire}	$R_A > 10{,}000$	{other signal outputs available}						
Adjustability zero/span	%	± 10 using potentiometers inside the instrument								
Response time (10 ... 90 %)	ms	≤ 1 (≤ 10 ms at media temperatures below –22°F (-30°C) for ranges < 300 psi								
		or with flush diaphragm process connection)								
Isolation voltage	DC V	500								
	[6] NEC Class 02 power supply (low voltage and low current max. 100 VA even under fault conditions)									
Accuracy [7]	% of span	≤ ≤0.25 {0.125} [8] (BFSL)								
	% of span	≤ ≤0.5 {0.25} [8]} (limit point calibration)								
	[7] Including linearity, hysteresis and repeatability. Limit point calibration performed in vertical mounting position with pressure connection facing down.									
	[8] Improved accuracy is available for pressure ranges ≥ 100 InWC									
Non-repeatability	% of span	≤ ≤0.05								
1-year stability	% of span	≤ ≤0.2 (at reference conditions)								
Permissible temperature of										
■ Medium [9]		-22 ... +212 °F {-40 ... +257 °F}					-30 ... +100 °C {-40 ... +125 °C}			
		S-11 with cooling element: -4 ... +302 °F					S-11 with cooling element: -20 ... +150 °C			
■ Ambient [9]		-4 ... +176 °F					-20 ... +80 °C			
		S-11 with cooling element: -4 ... +176 °F					S-11 with cooling element: -20 ... +80 °C			
■ Storage [9]		-40 ... +212 °F					-40 ... +100 °C			
		S-11 with cooling element: -4 ... +212°F					S-11 with cooling element: -20 ... +100 °C			
	[9] Also complies with EN 50178, Tab. 7, Type C, Class 4KH Operation, 1K4 Storage, 1K3 Transport									
Compensated temperature range		32 ... +176 °F					0 ... +80 °C			
Temperature coefficients (TC) within compensated temp range:										
■ Mean TC of zero	% of span	≤ 0.2 / 10 K (< 0.4 for pressure range < 100 InWC)								
■ Mean TC of range	% of span	≤ 0.2 / 10 K								
CE - conformitiy		89/336/EWG interference emission and immunity see EN 61 326, interference								
		emission limit class A and B, 97/23/EG Pressure equipment directive (Module H)								
Shock resistance	g	1000 according to IEC 60068-2-27 (mechanical shock)								
Vibration resistance	g	20 according to IEC 60068-2-6 (vibration under resonance)								
Wiring protection		Protected against reverse polarity, overvoltage and short circuit								
Weight	lb	Approx. 0.4								

{ } Items in curved brackets { } are optional extras for additional price.

*These specifications are for layout description purposes only and are subject to change without notice.
Please contact WIKA for a copy of the most recent S-10 datasheet.

Ⓐ **Standard ranges** are listed in the first row. All Tronic transmitters except for the UniTrans are **fixed range,** so no adjustment or "turn down" of the pressure range is provided. Some models have adjustable zero and span. This feature is used to recalibrate the transmitter to original factory range should this become necessary after long term use. WIKA recommends that the adjustable zero and span not be used to change the original pressure range of the transmitter. For transmitters without zero and span adjustment, the readout device (meter or PLC) can be reprogrammed to compensate for output shifts. Other specifications are not affected by this shift.

Ⓑ **Maximum pressure** is listed in the second row. This is the maximum pressure the transmitter can be exposed to without permanent damage. The transmitters can tolerate the maximum pressure shown for brief periods, such as pressure pulsations or "spikes". Transmitters subjected to the maximum pressure may show zero and span shifts. Transmitters exposed to these pressures for long periods of time may suffer permanent damage.

Be sure to select a standard range that covers the maximum working pressure of the system. Transmitters are most accurate between 20% to 80% of their stated range.

Ⓒ Exceeding the **burst pressure** listed in the third row causes permanent, nonadjustable damage or destruction of the transmitter.

Ⓓ The **wetted parts** of WIKA industrial transmitters come in contact with the media. Piezoresistive pressure transmitters with ranges to 300 psi and all flush diaphragm transmitters have 316 *stainless steel* wetted parts. Thin Film transmitters with non-flush connections use PH17-4 *stainless steel*. This stainless steel is similar to 316 stainless for chemical resistance. It is used because it has better elastic properties than 316 stainless and results in a more accurate transmitter.

Ⓔ Power supply voltage

10-30 VDC
(14-30 VDC for 10V output signal)

All transmitters require an **input** (also referred to as *excitation or supply voltage*) in order to power the internal circuitry. This input voltage can range from 10 to 30 volts. A 0-10 volt output transducer requires a higher minimum supply of 14 volts. 24 volts is the optimal supply voltage. Since the transmitter has a built-in power regulation circuit, an unregulated power supply is acceptable. See section 2.1 for detailed wiring schematics.

Ⓕ Signal output and maximum load

4-20mA 2-wire $R_A = (V_S - 10V)/0.02\ A$
0-20mA 3-wire $R_A = (V_S - 3V)/0.02\ A$

R_A is the maximum *resistive* load permitted in the current loop that still allows the transmitter to function correctly. Meters, chart recorders, and other devices are placed in a 4-20 mA current loop to display or record the measured pressure. Each of these devices has a *resistive load* rating in their specifications. For example, a transmitter with a 24 volt power supply **(V_S)** will allow up to 700 Ohms load in the loop. If the R_A is exceeded, the transmitter will not produce the maximum 20 mA output when full pressure is applied.

For voltage output transducers:

0-5 V	**3-wire**	R_A	**> 5000 Ohms**
0-10 V	**3-wire**	R_A	**> 10,000 Ohms**

Transducers with a voltage output require a minimum resistance R_A in the three wire circuit to function properly. This minimum varies with the output voltage as shown.

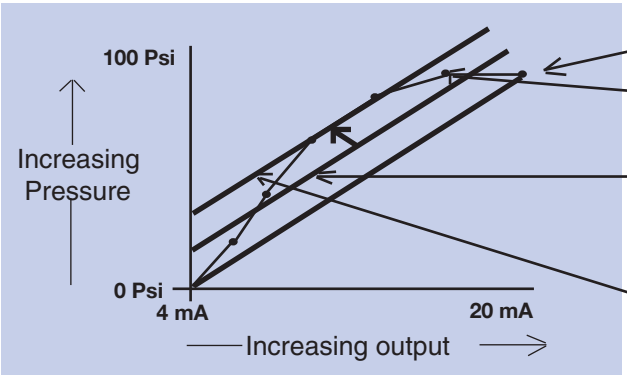
Ⓖ **Response time** is the length of time required for the transmitter output to change in response to a pressure change. WIKA industrial transmitters feature a response time of less than one millisecond (ms) or one-one thousandth of a second (0.001 sec) to pressure changes occurring within 10% to 90% of their rated pressure range.

Ⓗ **Accuracy** of a pressure transmitter is one measure of performance and includes the combined *linearity, hysteresis,* and *repeatability* errors.

Linearity (B.F.S.L) ≤ 0.25% of span (limit point: ≤ 0.5% of span)

Linearity is the error defined by the maximum deviation of a transmitter output from a best fit straight line during any one calibration cycle. In the best fit straight line (B.F.S.L.) method, a straight line is fit into a series of data points in such a way as to minimize the deviation of any one value from the ideal value.

The Limit point calibration (also called terminal based linearity) is double the B.F.S.L value since the straight line is not moved from the 0 and maximum span data points.



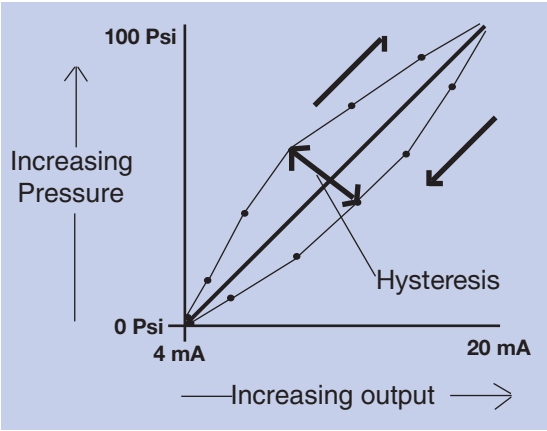
Ideal value line

Data points define the calibration curve

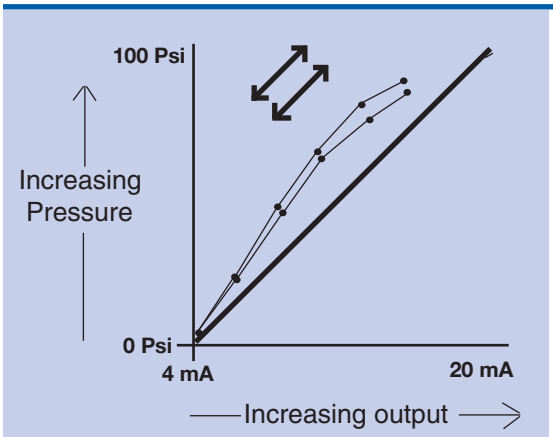
"Best fit straight line" (B.F.S.L.)
This straight line is moved to bisect the calibration curve for the "best fit". This is one half the value of the terminal based method.

"Limit point" (terminal based) line is parallel to the ideal line at the maximum error point. This is the maximum or true error.

Note: All data points in these illustrations are overstated for clarity. Actual data points are much closer to a straight line.



Hysteresis is the error defined by the maximum measured separation between the upscale and downscale indications of the measured pressure during a full range traverse from 0 to the maximum pressure. Hysteresis for WIKA industrial transmitters is equal to or less than 0.1% of span.



(I) **Non-Repeatability** is the error defined by the ability of a transmitter to reproduce an identical output signal when the same pressure is applied to it consecutively, under the same conditions, and in the same direction. *In industrial applications*, *non-repeatability is usually the most important specification*. Most WIKA industrial transmitters feature excellent non-repeatability: less than or equal to 0.05% of span.

(J) **One year stability** is the ability of a transmitter to maintain its performance specifications over time. It usually applies to calibration taken at ambient conditions and is expressed as a percentage of scale over one year. WIKA industrial transmitters feature a stability of better than 0.2% of span per year.

(K) **Permissable Temperature** changes have an effect on transmitter output. WIKA uses 70 °F as the reference temperature. This is the temperature when the initial calibration takes place. WIKA standard industrial transmitters are **temperature compensated** between 32 °F and 175 °F. This means that temperature changes between these two values will cause a change in output no greater than the **temperature error.**

The temperature effects on WIKA industrial transmitters is less than or equal to 0.2% of span for every 18 °F (10 °C) change in ambient temperature *within the compensated temperature range*.

For example, a transmitter that heats up from 70 °F to 88 °F will show a change in output no greater than 0.2% of span. If the same transmitter is heated another 18 degrees to 106 °F, it will show a total change in output no greater than 0.4% of span. Cooling the transmitter below 70 °F will also produce the same percentage effects. If the transmitter is heated above 175 °F or cooled below 32 °F, (outside the compensated temperature range!) the effects will be approximately 0.4% per 18 degree change. Extended compensated temperature ranges are available as an option.

Temperature effects occur *in addition to* linearity, hysteresis, and non-repeatability errors.

Permissible **media temperature** is -25 °F to 212 °F. Measuring media temperatures above 212 °F (for example, with steam monitoring applications) is possible by using a "pigtail", "siphon", or cooling element to isolate the transmitter from the heat. Flush diaphragm transmitters are available with an integral cooling extension for media temperatures to 300 °F. Some WIKA transmitters are available with an extended media temperature range. These transmitters use different internal components that allow them to function with higher media temperatures.

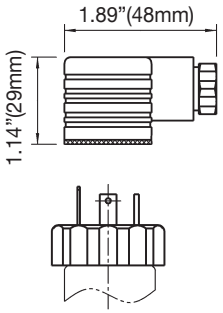
Ambient temperature is the temperature around the case of the transmitter. Whenever possible, transmitters should be mounted in an area protected from temperature extremes. This will reduce the temperature error and prolong the life of the transmitter.

The third page of the data sheet gives dimensional information for the transmitter and also information about the optional process and electrical connections.

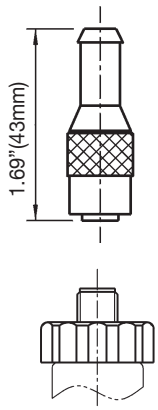
Dimensions in inches(mm)

Electrical connections (L)

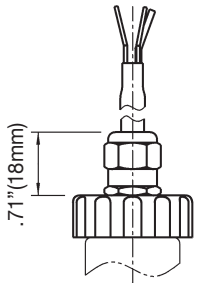
L-connector, DIN EN 175301-803, Form A (DIN 43 650) for conductor cross section up to max. 1.5 mm² , conductor outer diameter 0.3“ (6-8 mm), NEMA 5 / IP 65
Order code: A4



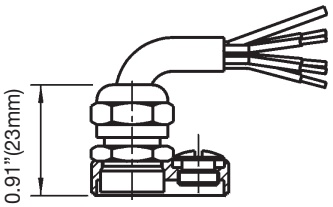
Circular connector M 12x1, 5-pin, NEMA 4 / IP 67
Order code: M5



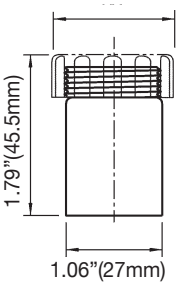
Cable with free ends conductor cross section up to max. 0.5 mm² / AWG 20 with end splices, conductor outer diameter 6.8 mm, NEMA 4 / IP 67
Order code: DL

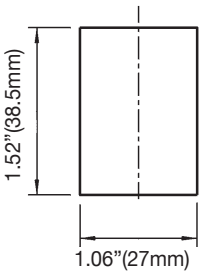


Cable with free ends adjustable zero and span conductor cross section up to max. 0.5 mm² / AWG 20 with end splices, conductor outer diameter 6.8 mm, NEMA 6 P / IP 68
Order code: XM



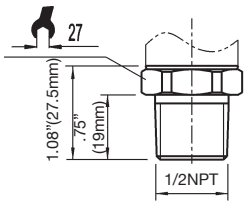
Case



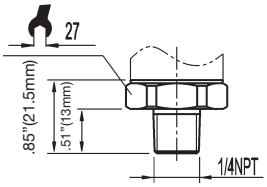


S-10 pressure connections (others available) (M)

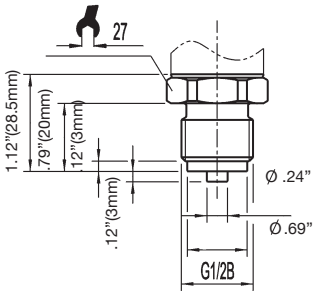
1/2 NPT male
Order code: ND



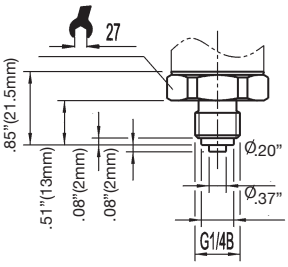
1/4 NPT male
Order code: NB



G1/2B male
Order code: GD

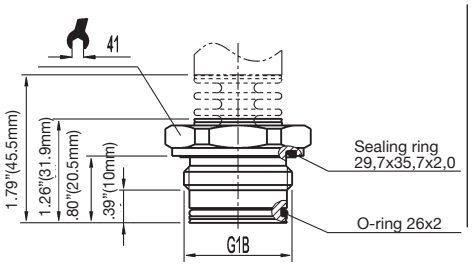


G1/4B male
Order code: GB

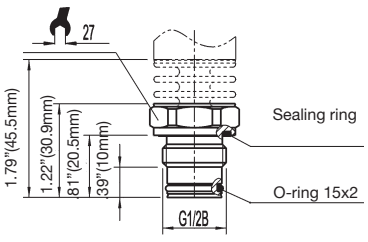


S-11 flush diaphragm pressure connections

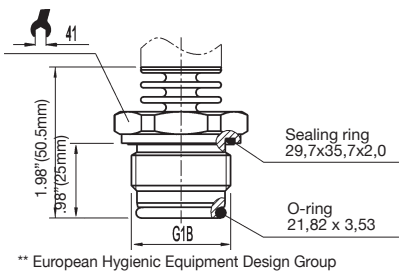
G 1B
with or without cooling element
50 InWC to 30 psi
Order code: 85



G 1/2 B
with or without cooling element
50 psi to 8000 psi
Order code: 86



G1B according to EHEDG **)
with cooling element , up to 302°F (150°C)
100 InWC to 250 psi
Order code: 84



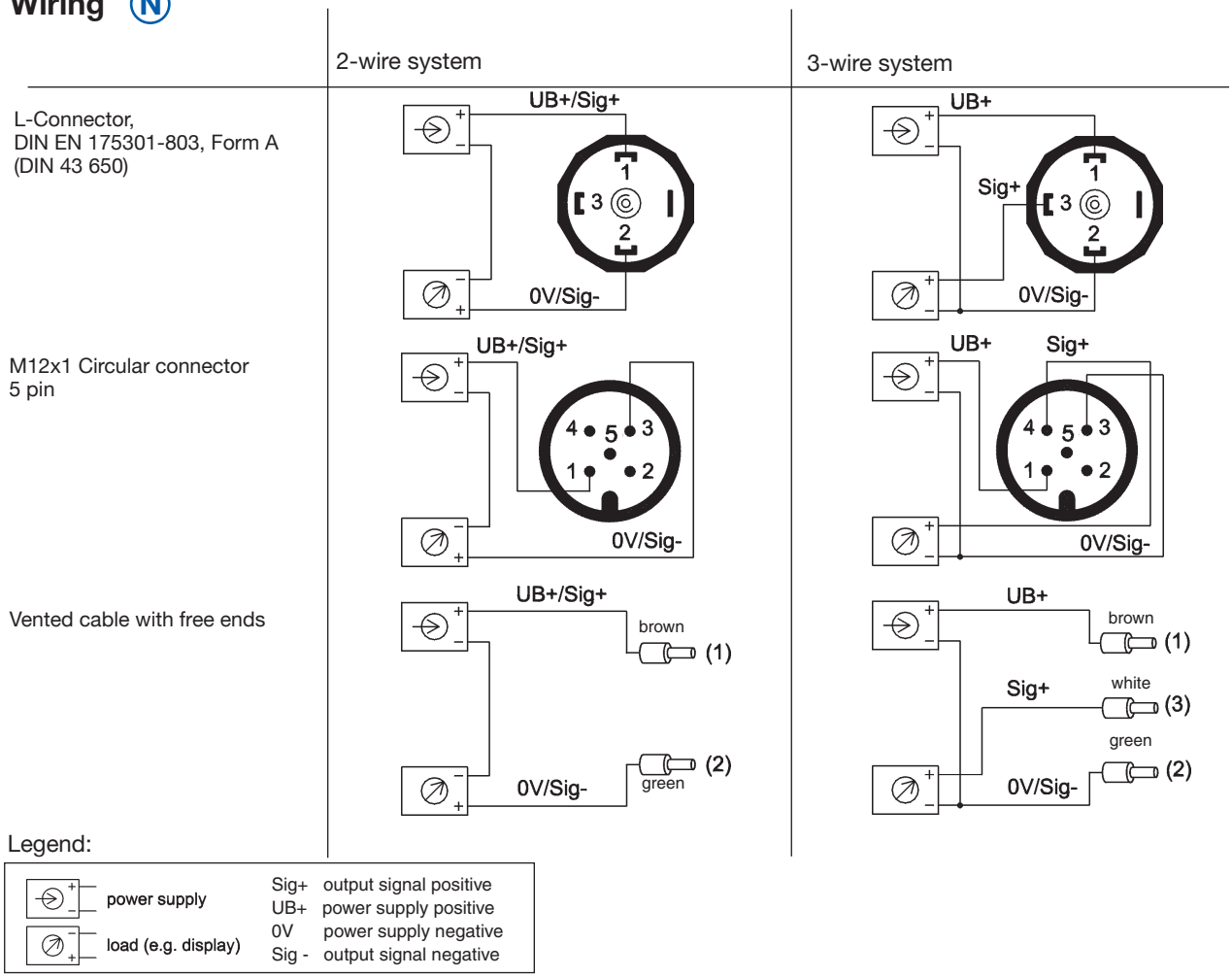
** European Hygienic Equipment Design Group

Ⓛ The standard **electrical connection** is the black L-shaped DIN 43650 cap. This is a fiber-glass reinforced plastic cap with solderless screw terminals. The standard cap is provided with a compression fitting so the user can install their own wiring. Other options include a DIN 43650 cap with a 1/2" NPT female conduit opening (rated NEMA4/IP65), 5 foot flying leads (NEMA 4/IP65) 4 or 6 pin Military style plugs, the Snap Cap with 1/2" NPT female conduit or compression fitting, and caps with flying leads already attached. Additional details are provided in section 3.5 of this manual.

Ⓜ The standard **process connection** is 1/2" NPT male for the industrial pressure transmitters. Other available connections include 1/4" NPT male, SAE straight threads, and G1/2B or G1B flush diaphragm connections. The standard pressure connection is indicated on the data sheets. These items are maintained in inventory (subject to prior sale). Non-standard connections add to delivery lead time. Additional information is supplied in section 3.4 of this manual.

The last page of the data sheet contains information about **wiring** the most common electrical outputs for the transmitter, as well as information about calibration, if applicable.

Wiring (N)



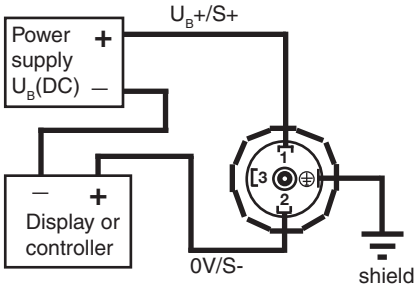
2.1 Wiring

(N) A pressure transmitter requires an external voltage supply to power the electronic amplifier and signal conditioning board. A third component to interpret the signal is also needed. This can be a digital panel meter, PLC (programmable logic controller), chart recorder, or computer. Pressure transmitters use 2-, 3-, or 4-wire systems, depending on the specific type of signal and circuit

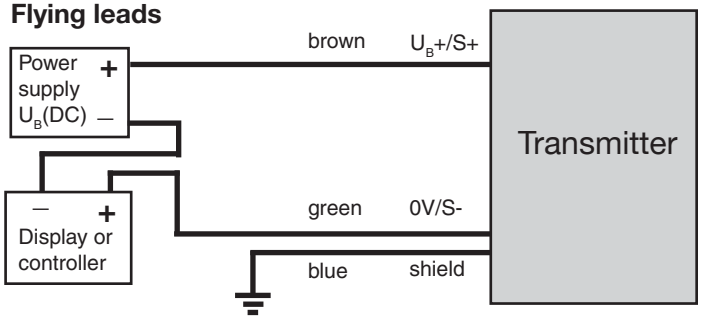
2-wire system: 4-20mA

The 2-wire system connects the power supply, transmitter, and indicating/recording instrument in a series circuit. This creates a "current loop" with the transmitter functioning as a current regulating device.

DIN connector



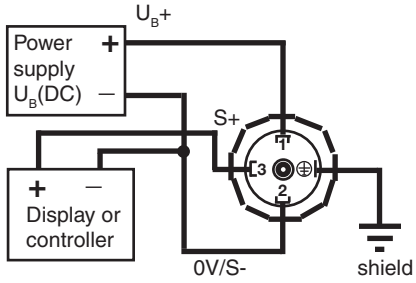
Flying leads



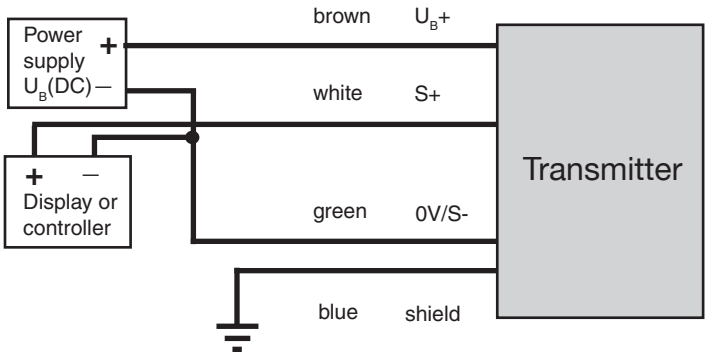
3-wire system: 0-5V, 0-10V, 0-20mA, 4-20mA

The 3-wire system features separate leads for the signal and power supply. The third lead is common minus for both devices. The signal source and indicating/recording instrument are connected in series, the power supply in parallel.

DIN connector



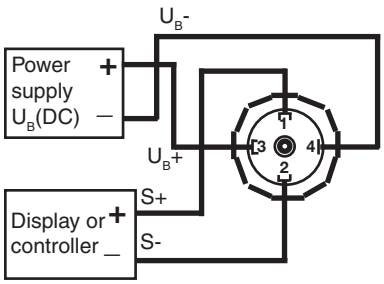
Flying leads



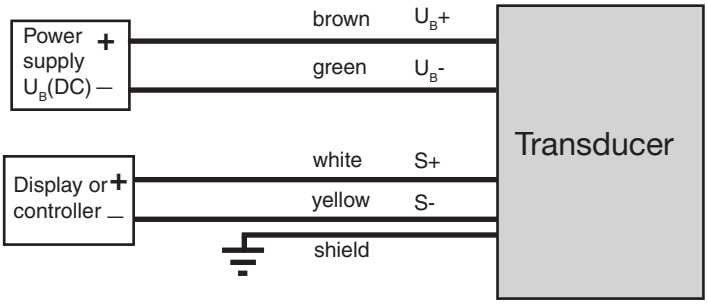
4-wire system: 0-100mV, 2 mV per Volt

In 4-wire systems each lead is a separate connection. Care must be taken that the minus leads do not come into contact with each other, as this will damage the circuitry.

DIN connector



Flying leads



Terminal coding:

U_B + Plus power supply
0V Minus power supply (common, ground)
S + Plus output signal
S - Minus output signal (common, ground)
Shield Cable shield / transmitter body

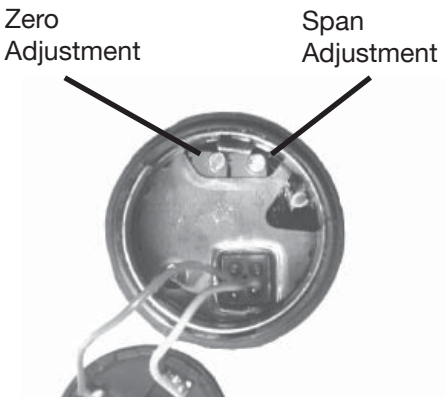
2.2 Calibration

Calibration is required for all WIKA transmitters with accessible zero and span potentiometers. Models without this feature are calibrated by changing the scaling of the digital panel meter or PLC to compensate for changes in transmitter output caused by overpressurization or long term drift.

WIKA industrial grade transmitters feature adjustable zero and span potentiometers located inside the transmitter body. These can adjust the output signal up to +/- 10% of the pressure range. These adjustments should only be used to return the transmitter to the original specifications as shown on the label. They should not be used to "re-range" the transmitter to a different span, as this may adversely affect linearity specifications. If the application requires "re-ranging" or a turn down, the UT-10 and UT-11 have a 20:1 turndown capability.

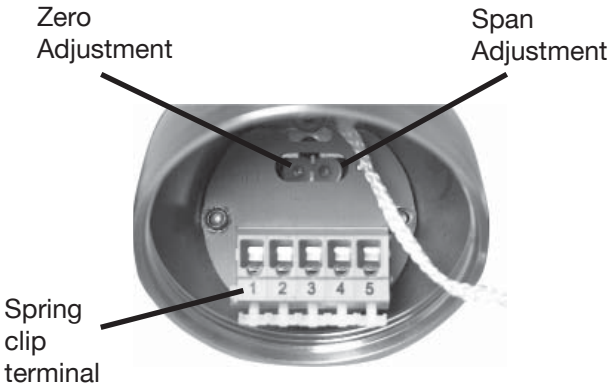
To calibrate these transmitters, access the zero and span potentiometers inside the transmitter body by removing the electrical connection (access will depend on the specific model), and retaining ring. Orient the transmitters so the potentiometers are above the four pin wiring connector (see pictures below). The zero potentiometer is below left (sometimes marked Z or O), the span potentiometer is on the right. For gauge (psi) and sealed gauge (psis) ranges, the transmitter zero potentiometer can be adjusted to produce a null output when no pressure is applied. Adjustment of the span potentiometer requires the use of a dead weight tester or other pressure reference instrument. To calibrate compound and absolute transmitters, a reference vacuum and pressure source is required to complete the calibration procedure.

Zero and span adjustments allow recalibration of the transmitter pressure range to original specifications due to changes caused by overpressure, excessive temperature, or drift over time. WIKA industrial transmitters allow for adjustment of approximately +/- 5% of the pressure range. Zero and span adjustments should be used for recalibration purposes only, not to change the transmitter's original pressure range.



View inside transmitter with connector and retaining ring removed.

Type S-10 calibration access



View inside transmitter with cover removed.

Type F-20 calibration access

3.0 Pressure Transmitter Selection

Each Tronic Line pressure transmitter has different features to meet specific performance, environmental, and price requirements. It is not possible to describe every possible condition that would require a specific model transmitter because there are an infinite number of possibilities. However, a systematic approach to selecting transmitters can assist in identifying which transmitter would best fit a specific application.

When selecting a pressure transmitter, the following information must be specified:

- **Model number**
- **Pressure range and reference**
- **Signal output**
- **Process connection**
- **Electrical connection**
- **Special options**

3.1 The **Model Number** is selected by matching the application requirements to the transmitter design capabilities. The application requirements are defined by parameters supplied by the user. The most important aspects of the application include:

-Performance requirements - accuracy
-Temperature ranges - media and ambient
-Media compatibility
-Shock and vibration resistance
-Moisture resistance
-EMI (electromagnetic interference) resistance

3.2 Pressure Range

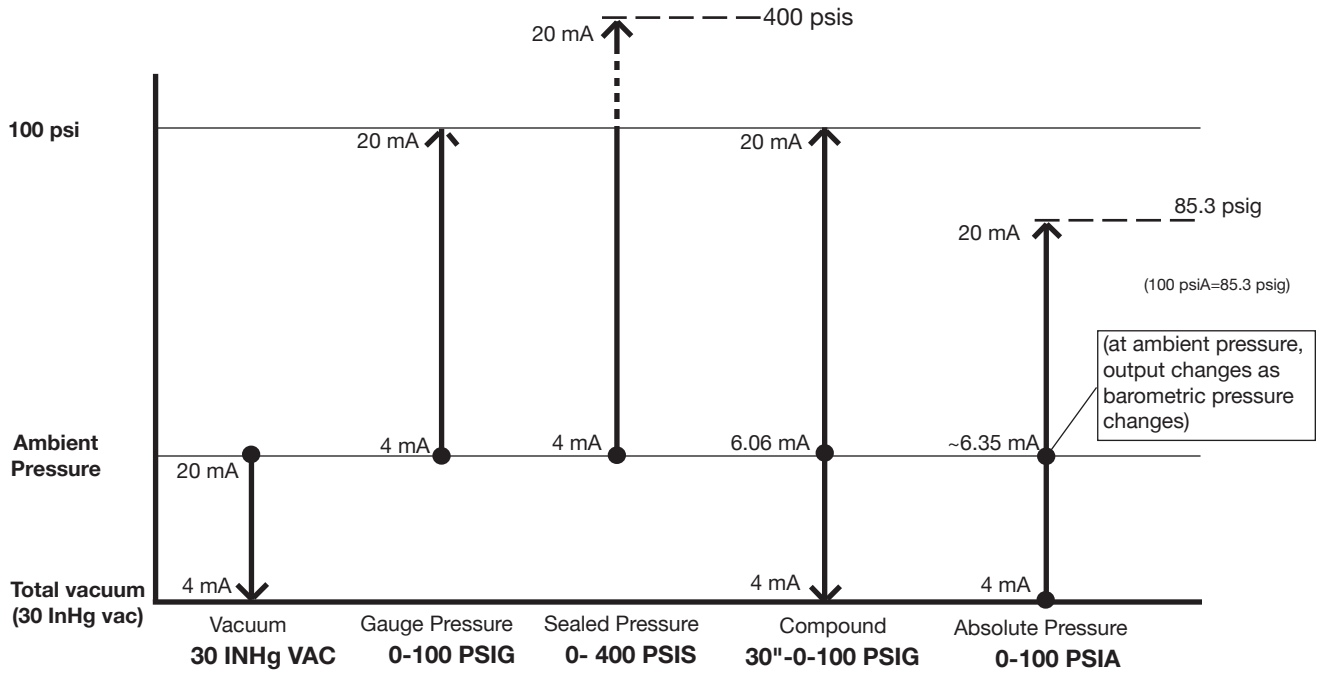
All WIKA transmitters, except for the UT-10 and UT-11, are fixed range. The range selected is determined by the application requirements. The **standard pressure range** of the transmitter should be equal to or greater than the highest expected working pressure generated by the application. The **maximum pressure** column on the data sheet defines the safety margin of pressure the transmitter can tolerate for short periods of time without damage. For example, a hydraulic system may normally generate 3000 psi. In unusual circumstances, pressure spikes lasting less than a millisecond may occur that are much higher than the normal working pressure. A 5000 psi S-10 transmitter can withstand overpressures of 11,600 psi for short periods. Exposure to pressure spikes 25,000 psi or greater will destroy the transmitter.

In liquid level applications, overpressure of a transmitter is unlikely. The transmitter range selected is the maximum pressure range of the transmitter that is as close as possible to the head pressure generated by the maximum liquid level. In the majority of applications, a standard range will meet or exceed performance requirements. For example, a tank holding 80 inches of water would use a standard range 0-100 inch water column (InWC) transmitter. Building a special range transmitter of 0-80 inches water column is possible, but the negligible increase in performance of this smaller span will usually not offset the additional cost and manufacturing lead time required to produce the special range. For example, a 100 InWC transmitter with 0.25% accuracy provides a reading of +/- 0.25 inches. The 80 InWC span provides +/- 0.20 inches or an improvement of only 0.05 inches.

After defining the pressure range, the **pressure reference** must be determined.

3.3 Pressure References

WIKA pressure transmitters and transducers are available in three references: *gauge, sealed, and absolute*. Gauge transmitters are referenced to atmospheric pressure and also include vacuum and compound ranges. The chart below shows the relationship between the types and the milliampere output at the various pressure ranges:



For transmitters with standard output signals, the rule "*the higher the pressure, the higher the output signal*" applies for all pressure references, compound, and vacuum ranges. Transmitters with reverse output (such as 20-4 mA) are available for special requirements.

Vacuum transmitters are vented to atmosphere and produce a 20 mA output when no vacuum is applied. The output decreases as the applied vacuum increases.

Gauge pressure transmitters are referenced to atmospheric pressure. With no pressure applied, the output is 4 mA. In WIKA low pressure piezoresistive industrial transmitters, including Model S-10, a vent tube inside the transmitter transfers the ambient pressure to the back of the diaphragm. There is enough clearance between the DIN connector retainer ring and transmitter body to allow ambient air pressure inside the transmitter. In OEM models, low pressure piezoresistive transmitters have a small vent hole in the case that is protected by a Teflon® or Gore-Tex® filter.

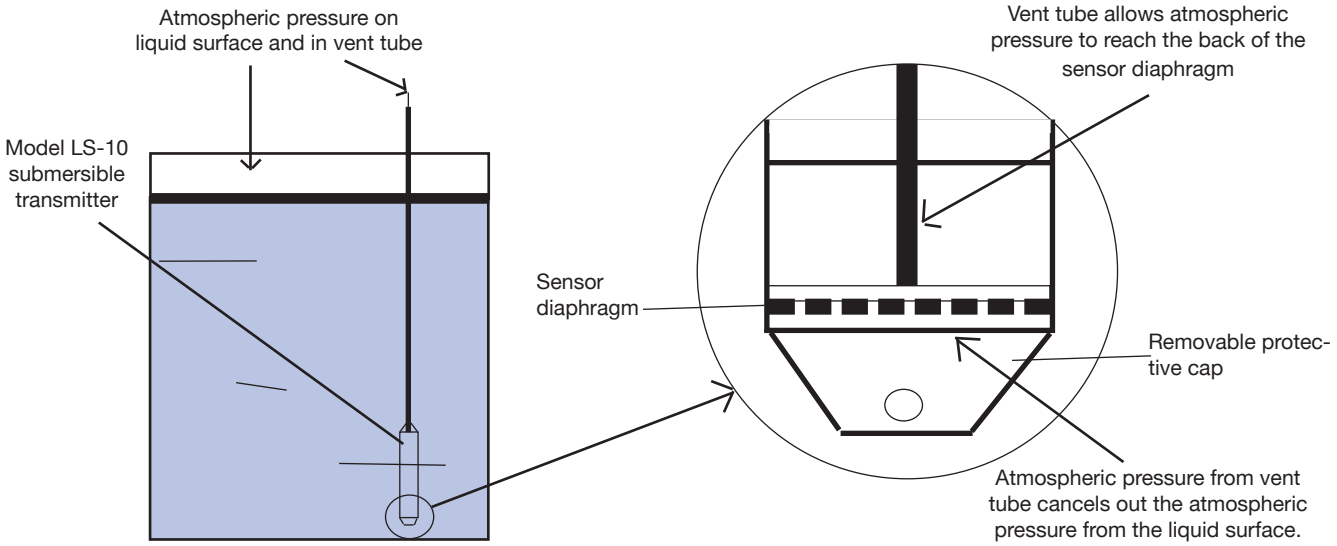
Sealed pressure transmitters are referenced to a sealed chamber behind the sensor at 14.7 psi. They are not vented directly to the atmosphere. WIKA transmitters with pressure ranges greater than 1000 psi use a sealed pressure reference. In higher pressure ranges, the output and performance of psig and psis types are virtually identical, because changes in barometric pressure are not large enough to introduce significant error. See page 18 for additional information about venting.

Compound ranges are vented to atmosphere, and measure both vacuum and pressure. They are used to measure the degree of vacuum or pressure relative to atmospheric pressure. Note that by convention, compound ranges are usually labeled with different engineering units across zero (30InHgVAC - 0 -100 psi). When programming a controller, the entire compound range should be considered as the same engineering units (-14.7psi - 0 - 100 psi).

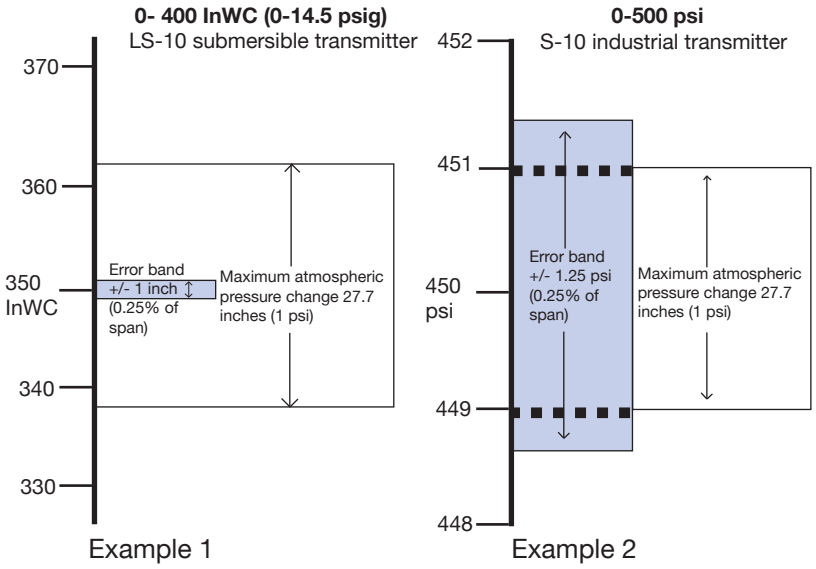
Absolute pressure transmitters are referenced to a sealed vacuum chamber located behind the sensor element. These transmitters sense changes in barometric pressure as the applied pressure is compared to a known vacuum. Absolute transmitters are used in applications where barometric pressure changes affect the operation of the system being measured. "False absolute" transmitters do not use a vacuum chamber behind the sensor but instead rely on an electronic offset of the output signal. They are less expensive but also less accurate than true absolute transmitters.

Product Example - venting transmitters to atmosphere

Atmospheric pressure can vary up to one psi depending upon weather conditions. Submersible transmitters are equipped with special vented cable containing a hollow capillary tube. This tube allows the transmitter to compensate for changes in ambient pressure. The vent tube equalizes the pressure behind the diaphragm so any changes in atmospheric pressure are cancelled from the output signal.



The error band is calculated by multiplying the transmitter span by its accuracy. The graphs below compare the error bands of a vented low pressure submersible and a sealed high pressure transmitter to the maximum possible atmospheric pressure change.



Industrial transmitters less than 400 psi span must be vented, since atmospheric pressure changes can be greater than the error band produced by the transmitter accuracy. *All WIKA Tronic piezoresistive transmitters with gauge, compound, or vacuum pressure ranges* are vented to atmosphere.

3.4 Signal Output

The 4-20 mA 2-wire analog system is in widespread use in industrial and process industries. The advantages of the 4-20 mA current loop include:

- High immunity to interference from electrical noise when compared to voltage signals.
- Low installation cost - only two wires are needed.
- Distances up to 10,000 feet are possible without additional amplification of the signal.
- The majority of existing meters, programmable logic controllers, and chart recorders accept this signal.
- The 4-20 mA signal provides built-in diagnostic capability. If a 0-5 volt transducer circuit produces a zero signal, it means either no pressure is applied to the system or the transmitter is disconnected or not functioning. If a 4-20 mA circuit fails, the output falls to 0 mA, which can be identified as an error signal by the controller instead of 0 pressure.

WIKA transmitters are available from stock in 4-20 mA 2-wire configurations. 0-20 mA 3-wire signals are available as a special order option. Pressure transducers with 3-wire voltage outputs are available with 0-5 volt, 0-10 volt, and 1-5 volt signals. Other voltage signals are available on special order.

Digital output signals with RS-232 communications are available in Models D-10 and the high accuracy P-10. The RS-232 signal is compatible with personal computers and provides high flexibility in monitoring and calibrating the transmitter. WIKA has PC-based software available to monitor, control, calibrate, and run diagnostic tests on RS-232 output transmitters.

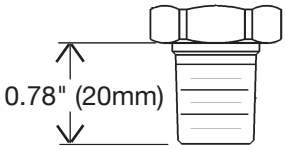
The digital and UniTrans transmitters are available with Fieldbus protocols. The digital transmitter is available for CANbus and its higher level protocols (CANopen, DeviceNet, SPS, J1939 etc.), and also for PROFIBUS DP and PA. The UniTrans is available with HART Protocol, which is a process industry standard.

Many custom output signals can be designed and manufactured by WIKA. Special signals are usually only cost effective in large quantities.

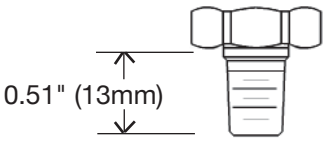
Refer to the specific data sheets or contact the factory for details regarding the availability of optional output signals for each model.

3.5 Process Connections

WIKA transmitters are available in a wide variety of process connections to meet specific applications. Standard industrial transmitters are stocked with a **1/2" NPT** (National Pipe Thread) male connection. The OEM and ECO-Tronic are available as standard in **1/4" NPT male.**



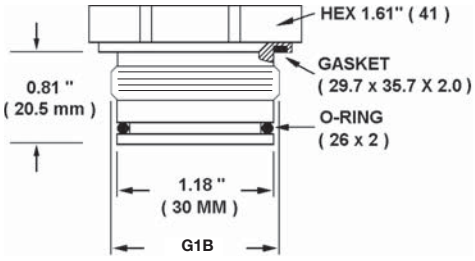
1/2" NPT male



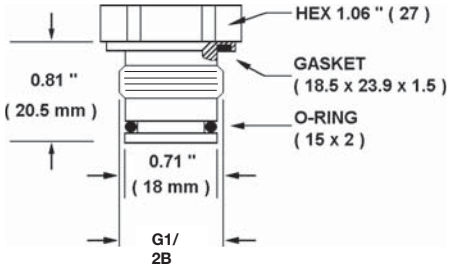
1/4" NPT male

All NPT male process connections have a 1/8" orifice leading up through the process connection to the sensing element. A **restrictor** can be installed in this orifice to protect the diaphragm from pressure spikes that sometimes occur in hydraulic systems. A restrictor can also be used to protect against damage by "water hammer" when measuring water pressure. Water hammer is a sudden increase in water pressure when the water momentum is instantaneously converted to pressure. Using a restrictor in WIKA industrial transmitters protects the sensor, but slows the response time from 1 millisecond to about 5 milliseconds. Another option that protects against water hammer and pressure spikes is an **arc eroded pressure port**. This is done using a process called "electric discharge drilling" and can produce a pressure port from 0.1mm to 1mm in diameter.

When measuring media that is viscous, crystallizing, or contains particulates, the NPT connection is not acceptable because the orifice may clog, producing errors in the signal or transmitter failure. For these applications, a WIKA transmitter with a **flush diaphragm** and straight thread is available. WIKA model numbers ending in X1 (S-11, F-21, etc.) feature the flush diaphragm. Transmitters in pressure ranges from 50 InWC (1.8 psi) to 30 psi are provided with a G1B straight thread. Pressure ranges from 50 psi to 8000 psi feature a G1/2B thread. Both sizes rely on an O-ring and gasket for sealing the connection. Buna-N O-rings are provided as standard, with Viton® O-rings available as an option if required for media compatibility.



G1B flush connection



G1/2B flush connection

Many other process connections are available. These include 1/8" NPT, female NPT, BSP (British Standard Pipe), SAE male or female, and VCR connections for high purity applications. High pressure industrial transmitters over 15,000 psi are equipped with an F-250-C (9/16-18) female autoclave connection. Other high pressure connections like the F-375-C are also available. Sanitary 3A transmitters feature a Tri-clamp® process connection which will be reviewed in a later section.

3.6 Electrical Connections

The standard electrical connection on industrial transmitters is the DIN EN 175301-803 (DIN 43650) connector. This connector features an internal connection block with solderless screw terminals, and a compression fitting to act as a strain relief for the cable entry point. Wiring is simplified, and the connector is easily removed from the transmitter by removing the center retaining screw in the top of the connector. The same connector is available with a 1/2" female conduit opening. This facilitates the use of flex-cable conduit to protect the wiring leading to the transmitter. Both of these connectors are rated IP 65. See page 25 for additional information about ingress protection (IP) ratings.

An additional level of protection is available by using a cable. The cable contains a vent tube to allow compensation for barometric pressure changes. This cable provides IP 67 protection.

The F-20 and F-21 transmitters with stainless steel junction boxes provide a high level of protection for industrial transmitters. They are rated IP 67 - NEMA 4X (both washdown and corrosion resistant). The F-2X series are available with a 1/2" female conduit or PG 13 cable compression fitting.

The maximum moisture protection is provided by IP 68 (NEMA 6P) rated submersible transmitters. The submersible electrical connection is designed to withstand permanent submersion and is provided on the LS-10, LH-10, and IL-10 submersible level transmitters.

Four or six pin military style plugs are available on Tronic industrial transmitters. These connectors do not provide any additional weather protection when compared to the standard DIN plug, but are popular due to their compact size and quick connect bayonet mount design.

Many other electrical connection options are available for all WIKA transmitters. Some are available on a custom order basis and may not be cost effective for small quantity orders. Please contact the factory for any electrical connectors not listed in the catalog.

3.7 Performance

Most users think of accuracy when they consider performance requirements. Industrial transmitter applications require anywhere from 0.05% to 1% accuracy class transmitters. Most industrial applications require 0.25% accuracy transmitters while OEM applications usually call for 0.5%. It *is important to consider repeatability, which in many industrial applications is more important than considering "accuracy" that matches a traceable standard*. The majority of WIKA transmitters fall into the 0.25% accuracy class. 0.1% or 0.05% is sometimes required for industrial laboratory applications where performance must match a traceable standard; for example, when calibrating other high accuracy pressure measurement devices.

Model Performance Comparison

Type	Vacuum	Compound	Absolute	Zero and span adjustment	Linearity	Repeatability	Temperature effect on zero per degree F
S-10	Yes	Yes	Yes	Yes	<0.25%	<0.05%	<0.012%
C-10	No	No	Yes	No	0.5%	0.05%	0.017%
P-10 accuracy digital	Yes	Yes	Yes	Yes, using RS-232 interface	0.1 or 0.05%	0.03%	0.005%
MH-1	No	No	No	No	≤0.5%	≤0.1%	≤0.017%
M-10	No	No	No	No	<0.25%	<0.05%	<0.012%
HP-1	No	No	No	Yes	<0.25%	<0.05%	<0.012
Special	See datasheets						

4.0 Model Number Selection

The environment where the transmitter is installed has a major impact on its performance and longevity. The primary environmental factors include *ambient temperature, media temperature, media compatibility, vibration, moisture*, and the presence of RFI (radio frequency interference). **Model numbers** apply to the specific requirements of these environmental factors.

4.1 Ambient Temperature

All transmitters have defined temperature limits as indicated on the specific data sheet. Exceeding these limits will cause the transmitter to not function or be permanently damaged. Two sets of temperature limits must be considered:

The **operating temperature range** is the temperature range within which a transmitter can function without damage.

The **compensated temperature range** (see page 10 for specification definitions) is usually more limited than the corresponding operating temperature range. For a transmitter to operate within specification, the ambient temperature must be maintained within the compensated temperature range. Extended compensated temperature range is available on most models at additional cost.

Example: A user wants to install an S-10 industrial transmitter where temperatures can sometimes drop to as low as 0 °F in winter. Since these transmitters are rated to -5 °F, the transmitter will function at this temperature. However, since 0 °F is 32 degrees below the minimum compensated temperature range, the temperature-induced error in these conditions will increase to approximately 0.4% per 18 °F Since the low temperature occurs infrequently, the user determines this transmitter is suitable for his application.

Steps can be taken to provide additional protection in environments where the ambient temperature exceeds the design limits of the transmitter. These can include heat tracing the transmitter in cold environments, or insulating the transmitter from excessive heat.

Media Temperature

The media temperature must fall within the limits defined by the specifications for each model. Standard industrial transmitters have a permissible media temperature range of -25 °F (-20 °C) to 212 °F (100 °C). Exceeding the media temperature specification will cause readings outside the rated accuracy or may permanently damage the transmitter. Many applications have high temperature requirements. The following options are available to protect transmitters from high media temperatures:

Media Temperature Range

Transmitter process connection	-25 °F to 212 °F. (-20 °C to 100 °C)	212 °F. to 300 °F. (100 °C to 150 °C)	Over 300 °F. (over 150 °C).
NPT	Industrial or OEM	Standard or OEM model with siphon or pigtail extension	
Flush diaphragm	Industrial only	Flush diaphragm with integral cooling extension	Use standard transmitter with diaphragm-type chemical seal and capillary line

Many custom transmitter diaphragm seal combinations are available for special applications.

Application example: Pressurized steam can reach extremely high temperatures. Since steam is a non-clogging media, a standard NPT transmitter is used with a pigtail or siphon to protect the transmitter. To allow for maximum convection cooling, the transmitter should not be mounted in a direct vertical position over the steam line.

4.2 Media Compatibility

The media being measured must be compatible with the wetted parts of the transmitter in order to provide a long, reliable service life. Most Tronic transmitters feature stainless steel wetted parts. Piezoresistive transmitters and all flush diaphragm transmitters are 316 stainless. Thin film transmitters use PH17-4 stainless. Stainless steel is acceptable for the vast majority of industrial and OEM applications. The user must determine chemical compatibility of the media with stainless steel. If stainless steel is not acceptable, several options are available.

NPT transmitters can be mounted to a diaphragm seal made of special materials including Hastelloy®, titanium, tantalum, or PFA (Teflon®) coating. Diaphragm seal selection depends upon the specific application.

Flush diaphragm transmitters can be provided with Hastelloy® C or Teflon®-coated wetted parts, along with Viton® O-rings and seals. All flush diaphragm transmitters use a silicone liquid fill behind the diaphragm to transmit the pressure to the sensing element. This silicone is isolated from the media by the diaphragm. In the unlikely event the diaphragm ruptures, the silicone would be released into the process media. If silicone is incompatible with the media, alternate fill liquids are available, including vegetable oil for food applications, and Halocarbon® for non-silicone-based paint applications and oxygen applications.

There are important exceptions for specific model numbers:

The model **SL-1** low pressure industrial transmitter and the **DP-10** low/differential transmitter are only suitable for *dry, inert gases*. This is because stainless steel isolation is not possible in extremely low pressure ranges. The media comes into direct contact with the sensor. The materials coming into contact with the media include aluminum, silicon, gold, silicone rubber, brass, and copper.

Since the entire **LH-10** and **LS-10** submersible transmitters are submerged in the media, the wetted parts include 316 and 304 stainless steel, polyurethane cable, polyolefin shrink tubing, and polyamide protective cap. The user must be sure that all these materials are compatible with the media.

SL-1 Low pressure industrial

DP-10 Low and differential pressure

LH-10 Submersible

4.3 Vibration

Excessive vibration can damage or significantly reduce the life span of pressure transmitters. The nature of the vibration is important. Vibration can occur with low or high frequency and amplitude, and can occur in one or many different directions. Whenever possible, the user should always try to install the transmitter in an area that minimizes vibration.

WIKA manufactures some of the most vibration resistant industrial and OEM transmitters available. The OEM transmitter Model C-10 and MH-1 are found on off-road equipment transmissions and hydraulic systems worldwide. The use of the cable option increases vibration resistance. Extremely severe vibration applications may require testing by the user to determine suitability.

Model	Shock	Vibration
S-10, S-11	1000 g	50 g
C-10	1000 g	50 g
MH-1	1000 g	50 g
M-10	1000 g	30 g
UT-10, UT-11	100 g	5 g

Test results per DIN IEC 770

4.4 Moisture

Moisture can have a major impact on the function and longevity of pressure transmitters. Environments can range from "condensing" moisture to washdown with water under pressure to total, permanent submersion. WIKA manufactures a wide range of transmitters to meet specific moisture protection requirements.

The degree of protection of an enclosure from environmental elements is defined by two types of enclosure classification rating systems. One is the **NEMA rating** (National Electronic Manufacturers Association). The other is the **IP** system (Ingress Protection), which is in common use in Europe and is increasingly being used in the U.S. These systems include defining protection from solids and liquids entering an enclosure. The two systems use different test parameters; therefore, they are not directly comparable. The most common NEMA/IP ratings for transmitters are as follows.

NEMA Ratings

NEMA 3 - Windblown dust, rain, sleet
NEMA 4 - Washdown
NEMA 4X- Washdown and corrosion resistant
NEMA 5 - Dust tight
NEMA 6 - Temporary submersion
NEMA 6P- Permanent submersion

IP Ratings

IP 65 - Dust tight; water sprayed from any direction shall have no harmful effect
IP 67 - Designed to withstand temporary submersion
IP 68 - Designed to withstand permanent submersion
IP 69K - Designed to withstand high pressure steam

IP 65 ⟶ IP 67 ⟶ IP 68 ⟶ IP 69K

S-10 with DIN connection

S-10 with cable or F-20

Submersible LH-10 or LS-10

MH-1 with IP 69K cable output

Increasing Moisture Protection ⟶

4.5 RF (EMI) Interference

Radio frequency or electromagnetic interference is produced by motors, solenoids, portable radios, and many other sources in industrial environments. As industrial controls increase in complexity, the problem of RFI causing unwanted fluctuations in pressure transmitter output signals is becoming more common. Several steps can be taken to reduce or eliminate RFI problems.

• Relocate the transmitter as far as possible from the RFI source.

• Use shielded cable when wiring the transmitter. Use the shield wire as a "floating ground" by attaching it to the transmitter shield lead but not to the controller/indicator. The shield lead can also be connected to the controller or indicator, but not to the transmitter. Test the output to see which connection provides the best RFI protection.

• Use a 4-20 mA signal. 4-20 mA output signals are inherently less susceptible to interference than voltage signals.

• Where applicable, the DIN 43650 cap is available with a built-in RFI filter. This cap replaces the standard electrical connector found on Model S-10 and S-11.

• Use a transmitter with the ***CE*** mark on the label. The CE mark indicates the transmitter meets stringent RFI protection and emission requirements. The CE mark is standard on all WIKA transmitters.

CE Mark

5.0 Special Purpose Transmitters

WIKA manufactures a variety of pressure transmitters for use in special applications.

5.1 3-A Sanitary Transmitters

Many pressure measurement applications in food processing, dairy, and pharmaceutical industries require pressure transmitters that meet "3-A" criteria as defined by the 3-A Sanitary Standards Administrative Council. These extensive criteria include the following:

3A Symbol

- There shall be no threads on product contact surfaces.
- All product contact surfaces can be sterilized by saturated steam or water at 250 °F.
- Product contact surfaces must be self draining.
- Product contact surfaces must be free of pits, folds, and crevices.
- Any pressure transmitting fill fluid must be edible.

The goal of 3-A criteria is to minimize areas where bacterial growth and contamination can occur, and allow for high temperature clean-in-place (CIP) procedures in order to maintain the highest possible standard of product quality.

WIKA 3-A pressure transmitters use Tri-clamp® quick release process connections with vegetable oil fill in industry standard 1.5" or 2.0" connection sizes. (Note the actual diameter of the 1.5" size is 1.984", and the 2" size is 2.490".) Other sizes and designs are available. These include 2.5 or 3" Tri-clamp connections and INLINE SEAL™ sanitary seals for Tri-clamp piping systems. Two models are available: the S-10-3A and the S-11-3A/S-11-3A-C for more critical low pressure applications. The differences are outlined below.

Specifications:	**S-10-3A**	**SA-11**
Accuracy (% of span):	0.5%	0.25%
Pressure ranges:	15 to 1000 psi	Vacuum, compound, and gauge ranges 50 InWC and up
Media Temperature Range:	14 °F to 248 °F	-40 °F to 257 °F (S-11-3A) -40 °F to 300 °F (S-11-3A-C)

NEMA 4 (IP 67) cable lead is available on both models for washdown protection
Part # 9744479

S-10-3A Sanitary

S-11-3A-C Sanitary with integral cooling extension

UT-10 on **981.22** INLINE SEAL™ for sanitary applications

5.2 Hazardous Area Pressure Transmitters

Hazardous area pressure transmitters are designed for use in potentially explosive, hazardous environments. WIKA offers explosion proof, non-incendive, and intrinsically safe pressure transmitters for hazardous environments. The type and degree of hazardous area protection and approval level is dependent on the application and installation requirements.

Hazardous environments may contain flammable or explosive gases, liquids, combustible dust, or ignitable fibers. These hazardous environments are defined in detail by the *National Electric Code* and are divided into **Class, Division**, and **Group:**

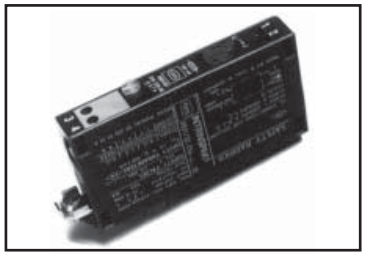
Class (type of fuel)	Division (possibility of fuel being present)	Group (specific type of fuel)
Class I gases and vapor	**Division 1** present or likely to be present in normal operation	**Group A** Acetylene **Group B** Hydrogen **Group C** Acetaldehyde, ethylene, methyl ether **Group D** Acetone, gasoline, methanol, propane **Group E** Metal dust **Group F** Carbon dust **Group G** Grain dust
Class II combustible dust	**Division 2** not present in normal operation	
Class III fibers		

Intrinsically Safe Pressure Transmitters

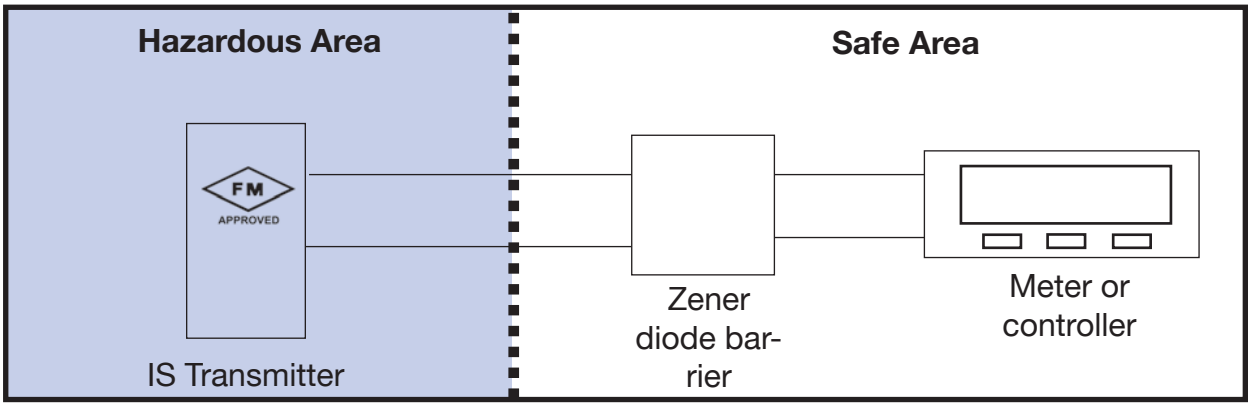
Factory Mutual (FM) is an independent testing organization that provides approvals for select industrial electronic equipment in hazardous environments. **ATEX and CSA** are similar organizations in Europe and Canada These organizations provide the **EX and CSA** approval marks. The IS-20 intrinsically safe transmitters are *entity approved* by Factory Mutual for use in the following locations:

Class I, Division 1, Groups A, B, C, D
Class II, Division 1, Groups E, F, G
Class III Division 1
Nonincendive for Class I, Division 2, Groups A,B,C,D

All intrinsically safe transmitters *must* be used with a **zener diode barrier** when used in hazardous locations. The barrier acts to limit the current going to the transmitter using current limiting resistors. Zener diodes in the barrier protect the hazardous area from any possible high voltages. Since WIKA transmitters are entity approved, they can be used with any other entity-approved component, such as barriers, power supplies, or controllers from other manufacturers. WIKA intrinsically safe transmitters are listed in the FM handbook by **model number**. Therefore, a barrier manufacturer can look up the specifications and match the transmitter with a barrier appropriate to the application and wiring requirements.



Typical intrinsically safe barrier



Typical intrinsically safe installation

Intrinsically Safe vs Explosion Proof

Intrinsically safe transmitters, by their design, limit the thermal and electrical energy to a point where ignition is not possible. In contrast, "explosion proof" transmitters work on the principle of containment, where the transmitter is enclosed in a housing that is designed to contain, control, cool and then vent any possible ignition. The housing does not prevent but instead controls internal combustion. This is accomplished by specially designed flanges, or more commonly with threaded joints. The hot gases must travel a specific distance along the threads before they are cool enough to be safe. Care must be taken not to cross thread the joints during assembly. In addition, conduit and sealoffs are needed to install and maintain an explosion proof system.

There are several advantages in using intrinsically safe transmitters. Intrinsically safe transmitters often feature a smaller design. Servicing explosion proof transmitters may require opening the housing and exposing the high energy levels to the hazardous environment. Opening an explosion proof housing requires a "hot permit" from the plant operator, indicating when it is safe to open the housing for maintenance. Intrinsically safe transmitters do not require a hot permit and can be tested or serviced when needed. This is an important consideration as the data circuit leading to the PLC are difficult to troubleshoot without power applied. Intrinsically safe circuits can be worked on while hot.

IS-20
Intrinsically
safe

IS-20-F
NEMA 4X
Intrinsically safe

5.3 Explosion-Proof Pressure Transmitters

Explosion proof transmitters work on the principle of containment, where the transmitter is enclosed in a housing that is designed to contain, control, cool and then vent any possible ignition. WIKA E-10 and E-11 explosion-proof transmitters are designed for applications in the oil and gas industry including wellhead monitoring, refining, pipelines, and natural gas compressors. The E-11 features a flush diaphragm process connection for use with viscous or crystallizing media that may clog the 1/8" pressure port in the standard NPT connection.

The wetted parts are NACE MR-01-75 compliant to provide additional resistance against sulfide stress cracking in gas applications where sulphur is present. They are FM-approved for Class I Division 1 locations. Installation requires using conduit and seal offs within 18" of the transmitter. A factory sealed-flying lead version that does not require an external conduit seal is available to allow simplified installation.

These transmitters must be installed to NEC and local codes in order to maintain the explosion proof rating.

E-10 and E-11 Explosion-Proof Ratings:

Factory Mutual (FM/CSA) Explosion-proof for:
Class I Division 1, Groups A, B, C and D
Dust ignition proof for:
Class II/III, Division 1, Groups E, F and G

FM standards according to Class numbers 3600, 3615, and 3810

E-10 NPT pressure transmitter with cable

E-11 flush diaphragm pressure transmitter with optional flying leads

5.4 Non-Incendive Pressure Transmitters

Non-incendive pressure transmitters also work on the principle of containment. WIKA N-10 and N-11 non-incendive transmitters are designed for applications in the oil and gas industry including wellhead monitoring, refining, pipelines, natural gas compressors, and general industrial applications.

While the E-10 and E-11 transmitters are rated for Class I Division 1 locations, the N-10 and N-11 are rated for Class I Division 2 non-incendive locations. As outlined on page 28, in a Division 1 location the fuel is normally present or likely to be present in normal operation. The fuel is not present in normal operation in a Division 2 location.

The N-11 features a flush diaphragm process connection for use with viscous or crystallizing media that may clog the 1/8" pressure port in the standard NPT connection.

The wetted parts of the N-10 and N-11 are NACE compliant to provide additional resistance against sulfide stress cracking in gas applications where sulphur is present.

N-10 and N-11 Non-Incendive Ratings:

Factory Mutual (FM) Non-incendive for:
Class I Division 2, Groups A, B, C and D
Dust ignition proof for:
Class II and III, Division 1, Groups E, F and G

FM standards according to FMRC Class numbers 3600, 3611, and 3810

N-10 NPT pressure transmitter with cable

6.0 Digital Panel Meters and Attachable Indicators

The 907.50.900 digital panel meters are designed to accept a 4-20 mA 2-wire signal. These meters are available with several options.

-The **built-in excitation** provides an 18VDC 60 mA supply source to power the transmitter. This option eliminates the need for a separate power supply in the 4-20 mA current loop. It also simplifies wiring as only two wires are required to connect the transmitter to the meter.

-The **peak/valley** option commits the highest and lowest measured pressures to memory for later recall by the operator.

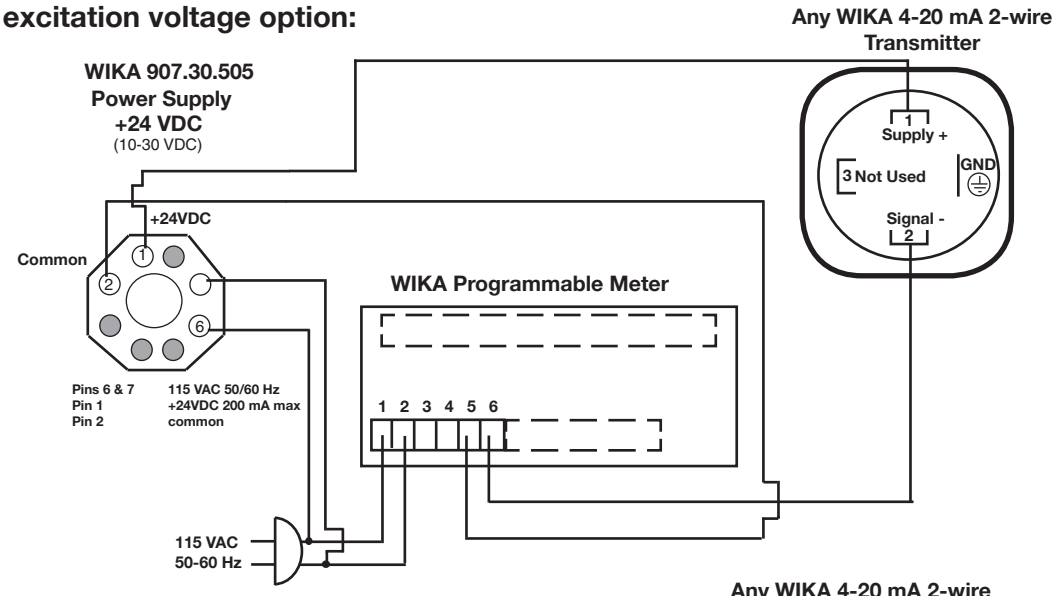
-Dual relays can be independently programmed by the user to activate warning lights or audible alerts or to start and stop pumps to maintain a predetermined pressure.

-The **serial communications** option allow for connection to computers for remote control, changing meter programs, and other functions. The meters are addressable, allowing up to 99 meters to be connected to an RS-232 port.

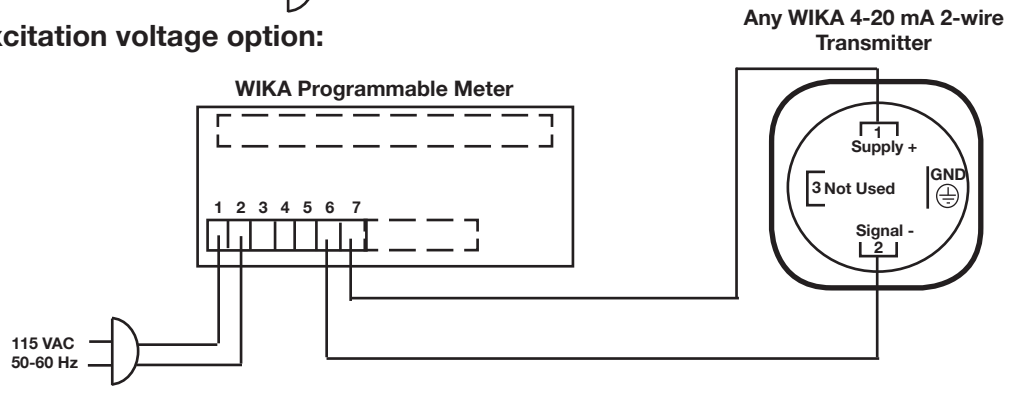
-A **retransmitted analog 4-20 mA output** can be used to provide a signal to chart recorders or other controllers. It is fully user programmable and can be set for reverse output where the maximum pressure = 4 mA and zero pressure = 20 mA.

Wiring for the meters with and without the built-in excitation voltage option is shown below:

Without excitation voltage option:



With excitation voltage option:



Attachable Loop Powered Digital Indicator

Specifications

Display
Type: 0.4" high LCD
Programmable display range: -1999 to +1999

Accuracy
≤ 0.2% of span

Programmable Range
4-20 mA can be assigned any display value within the display range. Both scaling points are individually adjustable using push buttons inside the case.

Power
Loop powered - no additional power supply required
Voltage drop: 3 VDC
Maximum current rating: 60 mA

Environmental
Operating temperature: +32 to +122^{0}F (0 to +50^{0}C)
Storage temperature: -22 to +176^{0}F (-30 to +80^{0}C)
Temperature effects: 0.1% of span per 18^{0}F (10^{0}C)
Humidity: 90%, non-condensing

CE Conformity
Interference emission per EN 50 081-1
Interference immunity per EN 50 082-2

Construction
Case ABS plastic
Viewing window: polycarbonate

Dimensions (inches)
1.9 x 1.9 x 1.4 deep

Weight
Approx. 3 oz.

Programming Instructions

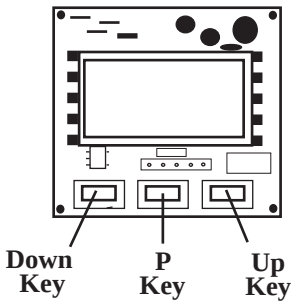
1.) Remove four cover screws and remove cover
2.) Press the "P" key. Display shows "dP".
3.) Press the "Up" or "Down" key to select the desired decimal place position.
4.) Press the "P" key twice. Display shows "An 4".
5.) Press the "Up" or "Down" key to set display to zero or other 4mA display point.
6.) Press the "P" key twice. Display shows "An 20".
7.) Press the "Up" or "Down" key to set the maximum range of the transmitter.
8.) Press the "P" key twice. Display shows "L1".
9.) Press the "Up" key to activate the error code display (display shows "1") or the "Down" key to disable error codes (display shows "0")

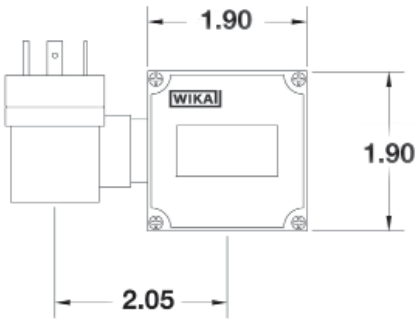
Error Codes: under range: Display shows "F1"
over range: Display shows "F2"

10.) Press the "P" key. Display shows"FILt". A digital filter is available to improve the readability of the display for applications undergoing rapid pressure changes. To set the digital filtering, press the "Up" or "Down" key to adjust the update rate of the display.

Display	Time delay
" 0"	0.2 s
" 1"	0.5 s
" 2"	1.0 s
" 3"	1.5 s

11.) Press the "P" key to return to the display mode





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For over 60 years, WIKA Instrument Corporation (WIKA) has continued to globally advance pressure gauge, sensor and temperature instrumentation technology and applications. In the United States, WIKA's operation utilizes state-of-the-art manufacturing technology and highly automated proprietary production equipment in its nearly quarter-million-square-foot facility in the metro Atlanta suburb of Lawrenceville, Georgia.

PSD-30
Pressure Transmiter

S-10 Industrial
Pressure Transmitter

As the industry leader in lean manufacturing, WIKA offers a wide variety of stock and customized instrumentation solutions for critical applications that often are distributed within days. The WIKA customer service department recently earned the Operational Excellence Award for Leadership from one of North America's leading distributors of industrial maintenance, repair and operation replacement parts. Producing over 30 million gauges, diaphragm seals, transmitters, and thermometers worldwide annually, WIKA has the most extensive product line in the industry.

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TM001-1000 Rev 1 09/09

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Pressure and Temperature Measurement