

**KING-GAGE**®**Tank Liquid Level****Inventory Monitoring****Process Integration**

Liquid Level Transmitter

## TeleSensor™

- External mounting at tank
- Electronic (4–20 mA) or pneumatic output
- Unaffected by foam or vapor
- Safe for explosion hazard zones

### Rugged and Reliable Measurement

These unique pneumatic sensors detect level by sensing hydrostatic pressure created by liquid depth. Acting on the force balance principle, a sensitive diaphragm is exposed to the liquid contents of the tank. Compressed air within the sensor creates a pneumatic pressure that balances the force of the liquid acting against the diaphragm. This compensating pneumatic pressure is directly proportional to the depth of liquid in the tank.

The pneumatic force balance technique is virtually free from long term drift, hysteresis and temperature sensitivity unlike strain measurements (including load cells) since mechanical deflection of the diaphragm is not directly measured. The compensating pneumatic balance pressure which effectively isolates the sensor is converted to a proportional 4–20 mA<sub>dc</sub> signal or can be directly output to a suitable gauge. In actuality, the sensor is measuring the mass (weight) of fluid matter that can be correlated to units of standardized volume.

### Tank Flange Mounting

The basic configuration is designed for mounting to any typical outlet near the bottom of the tank. It features a pipe flange connection (2", 3", or 4" class 150 ANSI). Since the TeleSensor sensing diaphragm responds to the pressure due to the head of liquid in the tank,



the mounting location determines the starting level measurement point. Owing to the direct contact, all wetted materials should be selected based on compatibility with the tank's contents. Standard diaphragms are titanium. Flange connectors are available in various materials as well. The rugged design of the TeleSensor tank unit is remarkably easy to maintain.



Force balance diaphragm has no inherent hysteresis or bias induced by temperature (unlike strain measurement devices) and mounts completely external to the tank.

# TeleSensor ■ 4–20 mA Output Version

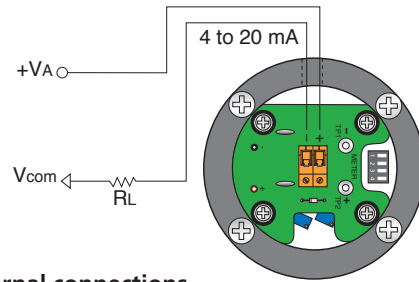
## Tank Gauging Applications

Acting on the force balance principle, a pneumatic sensor generates air pressure equivalent to the hydrostatic force created by liquid depth. This pneumatic pressure is directed into the D/P transmitter. Pressure is converted to an electronic 4–20 mA<sub>dC</sub> output proportional to liquid depth. Twisted pair cabling is used to form the signal loop through which the remote indicator receives the transmitter output. The KING-GAGE indicators shown in these system views correlate the transmitter output to total volume or weight of tank contents. This is determined by using a pressure versus capacity listing corresponding to the actual tank dimensions.

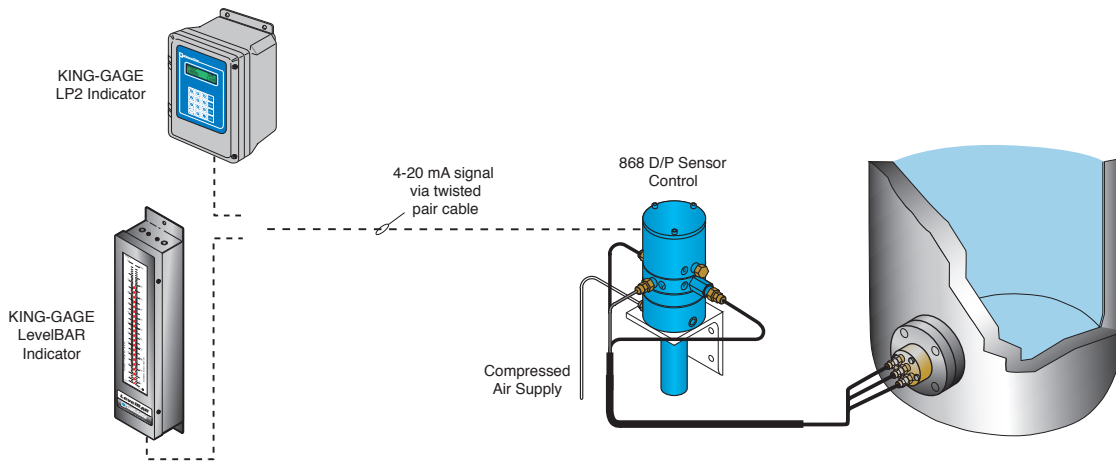
The diaphragm unit is generally paired with the 868 D/P Sensor Control with integral transmitter. This converts the pneumatic isolation pressure to a proportional 4–20 mA<sub>dC</sub> signal suitable for process control or remote level indication. The standard TeleSensor + 868 D/P package combines accuracy, rugged durability, reduced maintenance, and long term stability for liquid level tank gauging.

## Transmitter Signal Loop

As is typical of two wire transmitters, electrical power to the signal loop is supplied through twisted pair cable. Excitation voltage (+V) is provided by the receiving device or from a separate V<sub>dC</sub> power supply installed in the loop. The actual voltage necessary for operation of the system will depend upon the overall load resistance of the loop. In most applications, the KING-GAGE Digital Indicator or LevelBAR indicator provide 24 V<sub>dC</sub> excitation to power the transmitter signal loop.



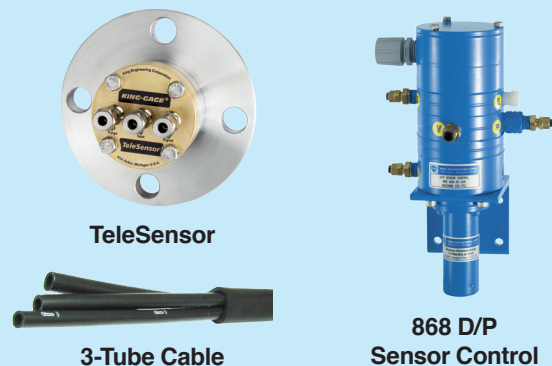
Internal connections at D/P Sensor Control



TeleSensor System Package with 868 D/P Sensor Control (4–20 mA Output)

## TeleSensor + 868 D/P Sensor Control = 4–20 mA Output

Pneumatic force balance diaphragm sensor with regulator/transmitter provides two wire 4–20 mA<sub>dC</sub> output. This system is compatible with a wide range of indicators and receivers (including PLCs).



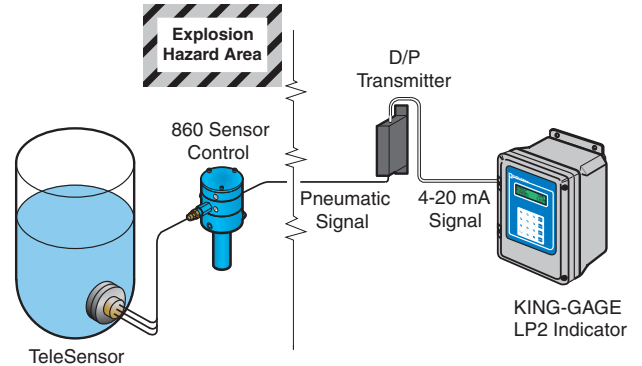
# TeleSensor ■ Pneumatic Output Version

## Pneumatic Operation

TeleSensor diaphragm unit is paired with a Sensor Control regulator to provide the continuous 1 CFH (cubic foot per hour) air flow to the underside of the diaphragm to attain pneumatic balance pressure. Constant back pressure regulation maintains linear 1:1 response throughout the entire operating range to ensure pneumatic pressure is directly equivalent to the hydrostatic head of liquid in the tank.

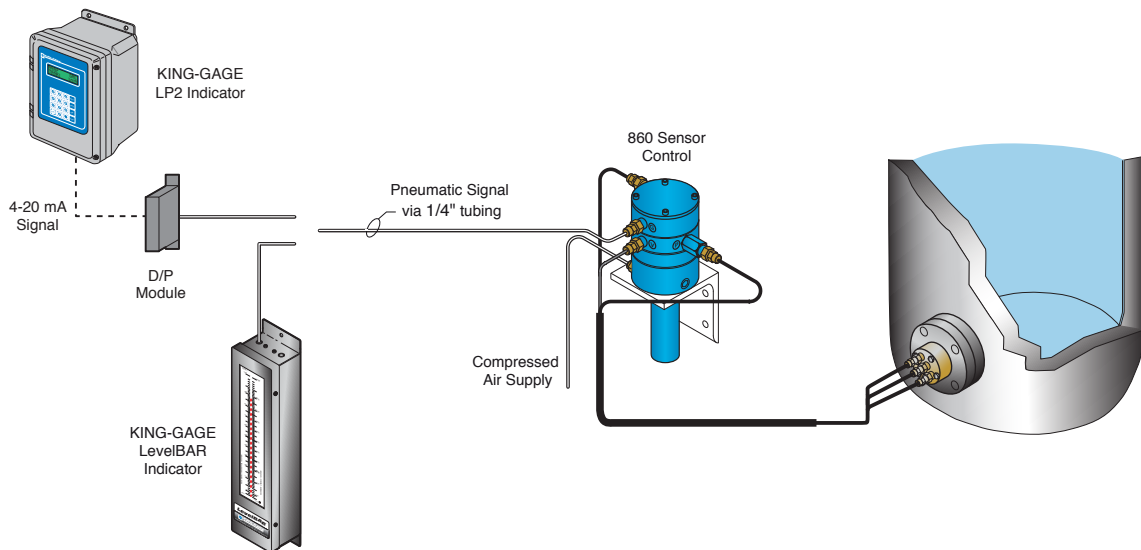
## Application Notes

Mounting flange and diaphragm are wetted surfaces requiring compatibility with process media. Location of the Sensor Control regulator should generally be no greater than 50 feet (15 m) from the TeleSensor unit. The sensor includes 15 feet (4.5 m) of bundled 3-tube cable for the pneumatic interconnections with the Sensor Control. Distances greater than 50 feet may increase response time of sensor to changes in liquid level in the tank.



### Explosion Hazard Use (Zone One or Division One)

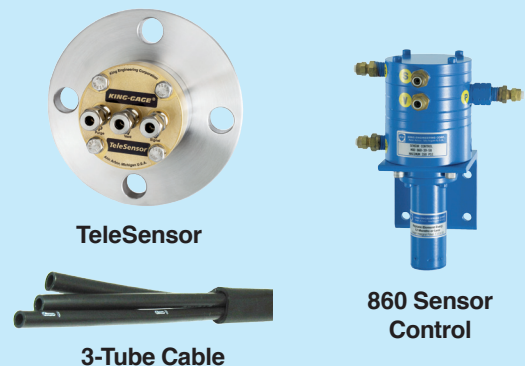
The TeleSensor requires no electrical energy for operation when using the 860 Sensor Control. It is possible to configure the tank level system without zener barriers or intrinsic safety provisions. The pneumatic signal may be routed to beyond the hazard zone (1000 feet or more) to an indicator or transmitter.



TeleSensor System Package with 860 Sensor Control (Pneumatic Output)

## TeleSensor + 860 Sensor Control = Pneumatic Output

This package comprises a complete level sensing system with specialized regulator assembly and force balance diaphragm unit. Pneumatic package has no electrical components and simply requires compressed air supply for operation.



## Specifications

### Sensitivity

Better than .001 psi ( $\pm .02$ " water/.508 mm water)

### Repeatability

Better than  $\pm .002$  psi ( $\pm .05$ " water/1.27 mm water)

### Primary Accuracy

$\pm .007$  psi ( $\pm 0.2$ " water/.508 mm water)

### Temperature Range

30°F to 300°F (0°C to 149°C)

### Pressure Range

Sensor is a 1:1 pneumatic force balance diaphragm capable of repeating hydrostatic pressure as an equivalent pneumatic output. Functional pressure limit is 130 psi (or 3598 inches @ 1.00 specific gravity) determined by supply pressure (35–150 psi) less 20 psi.

### Maximum Depth Measurement

1937 in. water (49.0 m water)

### Wetted Materials

Viton O-ring, titanium diaphragm, commercially pure.

Optional diaphragm materials: silicone rubber

Mounting flange options: 316L stainless, PVC, brewery special flange

### Air Consumption

Total air consumption of sensor package (including sensor control) is less than 10 CFH or 0.16 scfm.

### D/P Sensor Control Combined Accuracy \*

0–5 psid transmitter/control  $\pm 0.34\%$  FS

0–10 psid transmitter/control  $\pm 0.27\%$  FS

0–15 psid transmitter/control  $\pm 0.24\%$  FS

0–30 psid transmitter/control  $\pm 0.22\%$  FS

0–50 psid transmitter/control  $\pm 0.21\%$  FS

### Voltage Supply Requirements

14–40 Vdc (unregulated) to power signal loop using 868 D/P Sensor Control.

### Compressed Air Supply Requirements

35–150 psig (2.4–10.3 bar); clean, dry air (or inert gas)

\*Combined accuracy refers to the primary accuracy of the sensor in combination with the secondary accuracy of the D/P transmitter.

## Span Adjustment Range

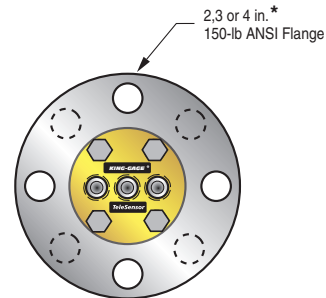
Transmitter turndown ratio is 3:1 for the 0–15, 0–30, 0–50 psid nominal ranges.

| Nominal   | Minimum   | Range of Adjustment  |
|-----------|-----------|--|
| 0–5 psid  | 0–3 psid  | 0–83 in. thru 0–138 in. water/<br>0–2.1 m thru 0–3.5 m water     |
| 0–10 psid | 0–3 psid  | 0–83 in. thru 0–277 in. water/<br>0–2.1 m thru 0–7.0 m water     |
| 0–15 psid | 0–3 psid  | 0–83 in. thru 0–415 in. water/<br>0–2.1 m thru 0–10.5 m water    |
| 0–30 psid | 0–10 psid | 0–277 in. thru 0–830 in. water/<br>0–7.0 m thru 0–21.0 m water   |
| 0–50 psid | 0–15 psid | 0–415 in. thru 0–1384 in. water/<br>0–10.5 m thru 0–35.1 m water |

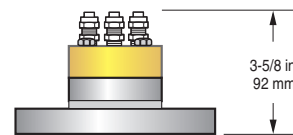
IMPORTANT! Accuracy, linearity, and non-repeatability values are based on nominal range.

## Operating Limit (Maximum Pressure)

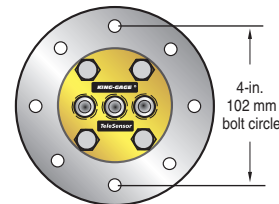
Pressure above 300% nominal range (overrange) will result in damage to the transmitter (200% may cause a shift in calibration). Burst pressure is 200 psi and will cause catastrophic and physical failure of the pressure element.



\* 4 in. Flange has 8 bolt circle, 2 and 3 in. Flange have 4 bolt circle.



TeleSensor w/ Special 3-in. Brewery Flange (304 SS)



® KING-GAGE and the KE emblem are registered trademarks and TeleSensor is a trademark of King Engineering Corp.

© 2010 King Engineering Corporation. All rights reserved.

## Compressed Air Supply

Operation of the TeleSensor requires a compressed air/gas source providing supply pressure of 35–150 psig (2.4–10.3 bar). Pneumatic components require instrumentation-grade compressed air that is clean, dry, and oil-free to ensure trouble free performance.