

# KING-GAGE® Marine Systems

Tank Level and Draft Indicating Systems for the Marine and Offshore Industries

## LiquiSeal™ Downpipe Purge Control

- Level Sensor for Ballast and Service Tanks or Ship's Draft
- Externally Mounted at the Tank or Remotely
- Pneumatic or Electronic (4–20 mA) Output

The downpipe level sensor is a highly refined version of a bubbler system using a precision air flow controller. A downpipe is an extremely simple yet effective method of sensing the hydrostatic pressure due to liquid depth. It can be used for tank gauging or ship's draft measurement.

LiquiSeal Purge Control is a fully integrated air purge regulator and pressure transmitter. It can be mounted directly adjacent to the tank or remotely up to 50 feet away. 3/8" air line tubing connects the LiquiSeal unit to the pipe extending downward in the tank. A supply of compressed air is required for system operation.

The rugged brass construction is especially suited to the rigors of marine service. Beneath a durable gloss epoxy finish, the machined brass body and housing resists corrosion while affording maximum protection. For explosion hazard areas, an all-pneumatic version of the LiquiSeal can be used without the need for intrinsic safety provisions.

### Pneumatic or Electronic Output

These pressure-based level transmitter provides output proportional to depth. 735 LiquiSeal generates a pneumatic 1:1 pressure signal that can be transmitted to a suitable indicator or pressure transducer. 738 D/P LiquiSeal provides a direct 4–20 mA<sub>dc</sub> electronic output compatible with most receivers or analog I/O devices.



**Model 738  
D/P LiquiSeal  
Control**

## Principles of Operation

Purging a downpipe with compressed air creates a force balance, resulting in pneumatic pressure equal to the hydrostatic pressure due to liquid depth in the tank. The LiquiSeal Purge Control works as a constant flow regulator, providing a continuous flow of air (1 cfh) into the downpipe. Pressure is created as liquid is purged from the downpipe.

This pneumatic pressure is the basis for the tank level measurement because it is equal to the hydrostatic (liquid) pressure which is directly proportional to liquid depth. For any increase or decrease of depth, there will also be a corresponding change in the pneumatic pressure.

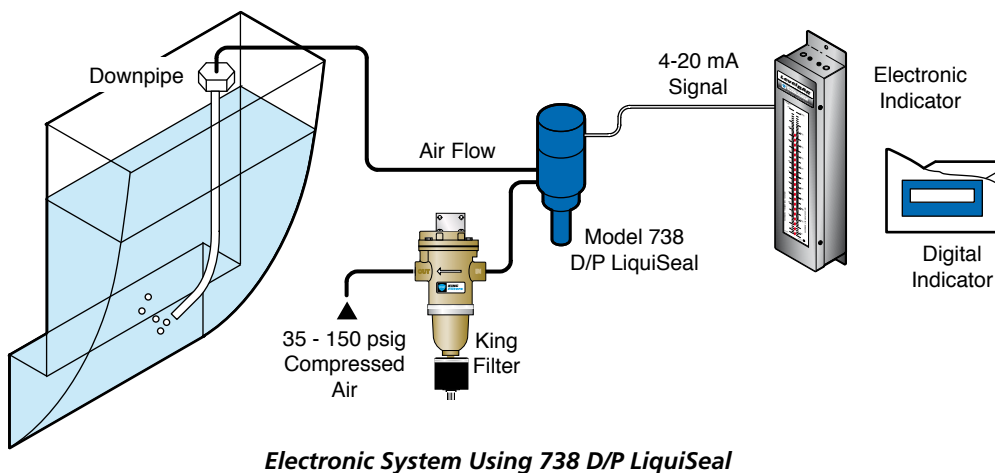
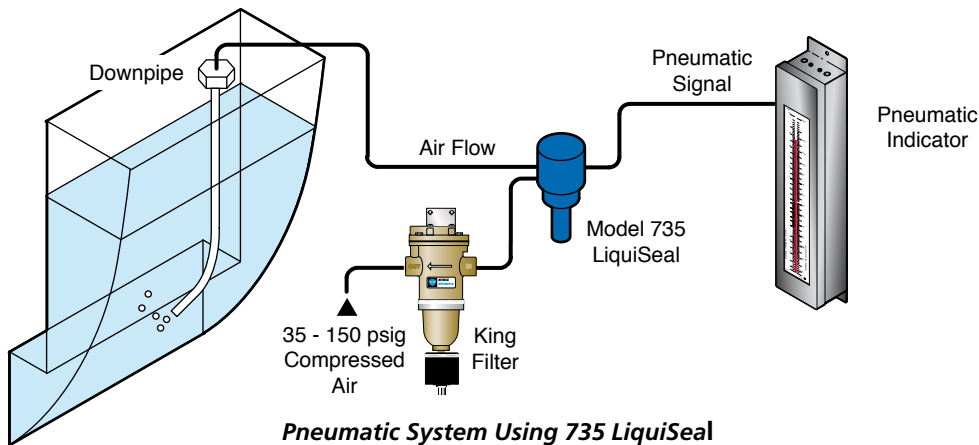
When equilibrium exists (i.e., air pressure = liquid pressure), the continuous flow of air escapes through the open end of the downpipe. This air bubbles up through the liquid hence the reason why this type of level sensing is often termed a “bubbler”.

## Gauging System

A complete tank gauging system can be configured using pneumatic components or can include electronic transmitters and indicators. Pneumatic sensors and indicators are inherently safe and explosion proof since there are no electrical components involved. A pneumatic system transmits a pressure signal through small bore tubing (typically 1/4" OD) to the pneumatic indicator. The location of the indicator may be up to several hundred feet from the LiquiSeal control.

An electronic system using the D/P LiquiSeal generates a 4–20 mA signal to the indicator. This electronic signal can be transmitted over several thousand feet using twisted pair (2-wire) cable. The indicator can be either an analog column display or digital readout, depending upon preference.

Since the primary element of either system is merely an open-ended pipe, the variety of material selections assures compatibility with tank contents. It may also be readily replaced by the user from any conveniently available source.



### Tank Level and Draft Applications

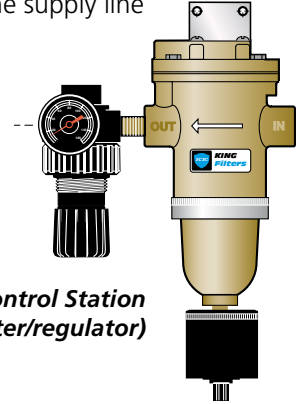
The LiquiSeal Purge Control can be used to sense tank levels or measure ship's draft. The output signal (pneumatic or electronic 4–20 mA dc) can be transmitted to KING-GAGE indicators in the engine room, control center or ship's bridge.

#### Applications Include:

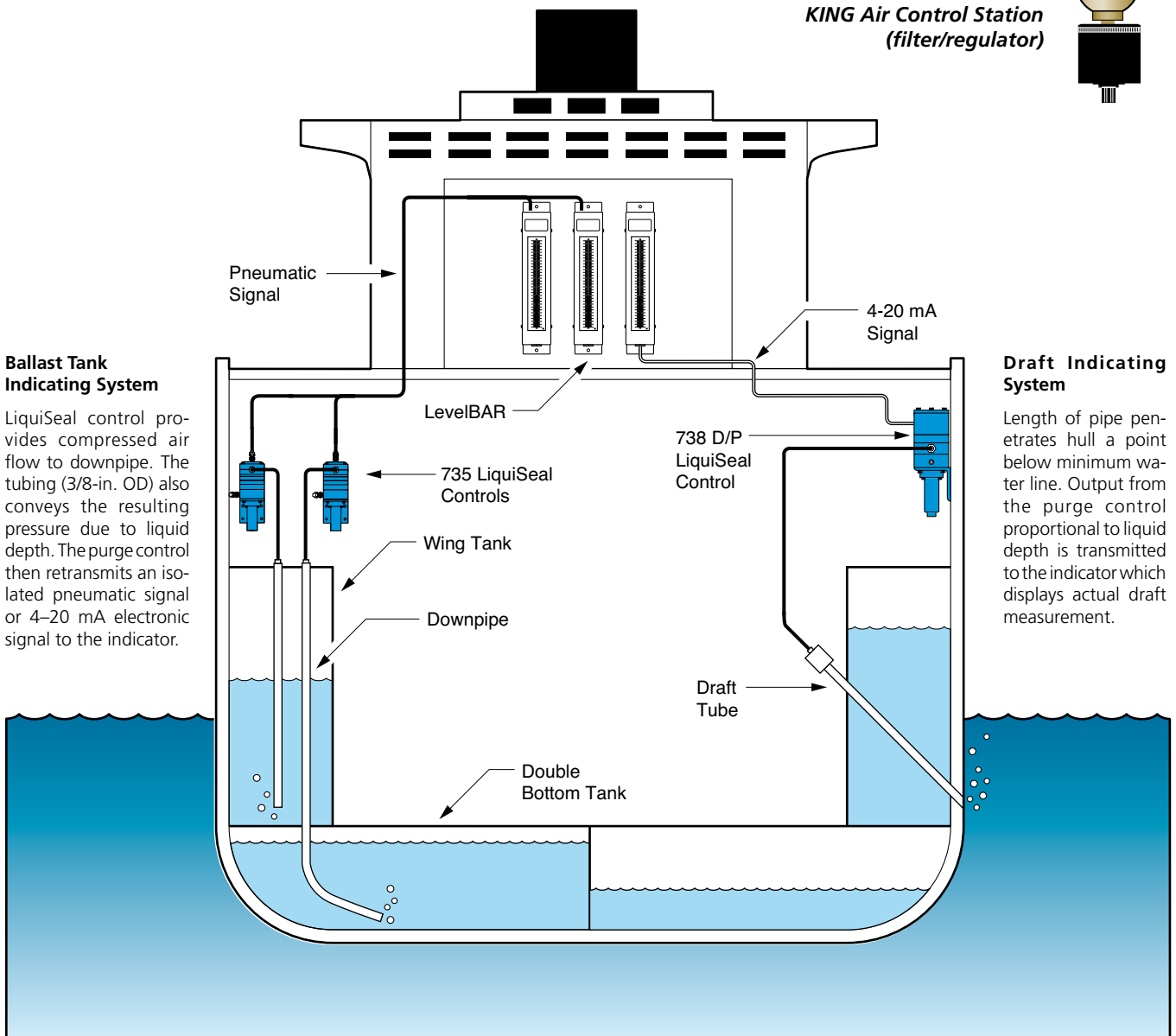
- Ballast water tanks
- Fuel oil tanks
- Day tanks
- Bunker oil tanks
- Liquid cargo tanks

### Compressed Air Requirements

All pneumatic instrumentation requires extremely clean, dry and oil-free compressed air. It must be noted that failure to use adequately filtered compressed air will result in unsatisfactory performance. Use of a compressed air coalescing filter (such as the King Air-Guard or King Air Control Station) upstream in the supply line is expressly recommended.



**KING Air Control Station (filter/regulator)**



#### Ballast Tank Indicating System

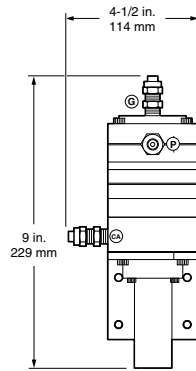
LiquiSeal control provides compressed air flow to downpipe. The tubing (3/8-in. OD) also conveys the resulting pressure due to liquid depth. The purge control then retransmits an isolated pneumatic signal or 4–20 mA electronic signal to the indicator.

#### Draft Indicating System

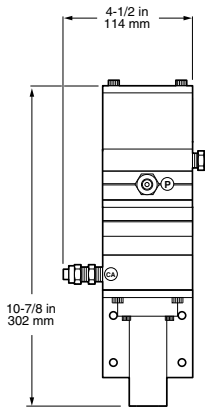
Length of pipe penetrates hull a point below minimum water line. Output from the purge control proportional to liquid depth is transmitted to the indicator which displays actual draft measurement.

**Model 735/738 Tank Level and Draft Indicating Systems**

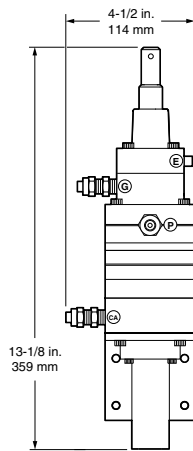
# KING-GAGE® Marine Systems



**Model 735  
LiquiSeal Control**



**Model 738 D/P  
LiquiSeal Control**



**Model 735 LiquiSeal  
Control with SafeGard**

## Span Adjustments

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 / 0–2.1 m thru 0–3.5 m water
0–10 psid	0–3 psid	0–83 in. thru 0–277 in. water / 0–2.1 m thru 0–7.0 m water
0–15 psid	0–3 psid	0–83 in. thru 0–415 in. water / 0–2.1 m thru 0–10.5 m water
0–30 psid	0–10 psid	0–277 in. thru 0–830 in. water / 0–7.0 m thru 0–21.0 m water
0–50 psid	0–15 psid	0–415 in. thru 0–1384 in. water / 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.

## Specifications

### Accuracy

0–5 psid trans./control	±0.34% FS
0–10 psid trans./control	±0.27% FS
0–15 psid trans./control	±0.24% FS
0–30 psid trans./control	±0.22% FS
0–50 psid trans./control	±0.21% FS

### Repeatability

±0.20% of calibrated span

### Temperature Range

0 to 120°F / -16 to 54°C

### Burst Pressure

200 psig

### Power Supply Voltage

14–40 Vdc (unregulated)

### Compressed Air Requirement

35–150 psig supply pressure at control inlet. (Minimum supply pressure should be at least 20 psig greater than anticipated maximum liquid head pressure.)

### Maximum Depth Measurement

1,937 in. water (49.0 m)

### 735 LiquiSeal Purge Control

Unit incorporates differential air flow regulator with flow control orifice, backpressure regulator and pneumatic transmitter with titanium diaphragm (1 mil) isolation barrier. Fixed differential set to nominal 10 psid. Output is 1:1 pneumatic pressure (hydrostatic force equivalent).

### 738 D/P LiquiSeal Purge Control

Same as the above model but adds an integral differential pressure (D/P) transmitter converting pneumatic pressure into 4–20 mAdc electronic output. Ranges available: 0–5, –10, –30, –50 psid

### Flow Rate (Air Purge)

Nominal 1 cfh (cubic feet per hour) at specified differential. Maximum air consumption under 5 cfh.

### Material of Construction

Machined brass body with acrylic semi-gloss enamel finish; integral filter element is aluminum with acrylic semi-gloss enamel finish.

### SafeGard Option (735 LiquiSeal)

An adjustable pressure-limiting control that permits pre-setting a maximum value for pressure output from the Purge Control. SafeGard range available as 25" to 650" water or 650" to 1750" water.



8019 Ohio River Blvd. Newell, WV 26050 U.S.A.  
Phone: 304-387-1200 • 800-242-8871  
Fax: 304-387-4417  
marshbellofram.com • king-gage.com



[www.king-gage.com](http://www.king-gage.com)

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