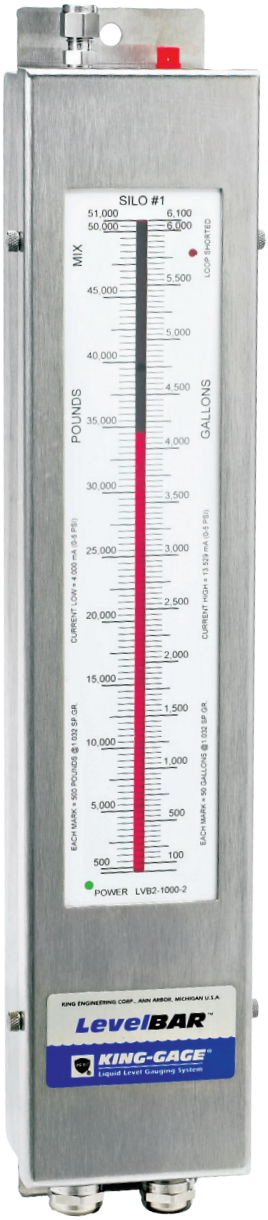
KING-GAGE®
LevelBAR v2™



Installation and Operations Manual

KING ENGINEERING CORPORATION
Since 1937

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The information contained in this manual was accurate at the time of release. Specifications are subject to change without notice.

Warranty—All King Engineering products are guaranteed to be free from defects in material and workmanship for one year from the date of purchase. Any product or part found to be defective under normal use within one year of purchase will be repaired or replaced at no charge if returned to the company at Ann Arbor, Michigan within ten days of discovery of the defect. No other warranties, whether expressed, implied, or statutory, including the warranties of fitness for a particular purpose or merchantability, are given by this agreement.

The exclusive remedy for nonconformity of these goods shall be repair and/or replacement of the nonconforming goods or parts.

Seller will not be liable for consequential damages resulting from breach of this agreement. The term "consequential damages" shall include but shall not be limited to damage to all machines, equipment and goods other than the goods sold hereby, interruption of production, loss of profits, delays of any kind, administrative expense, and overhead.

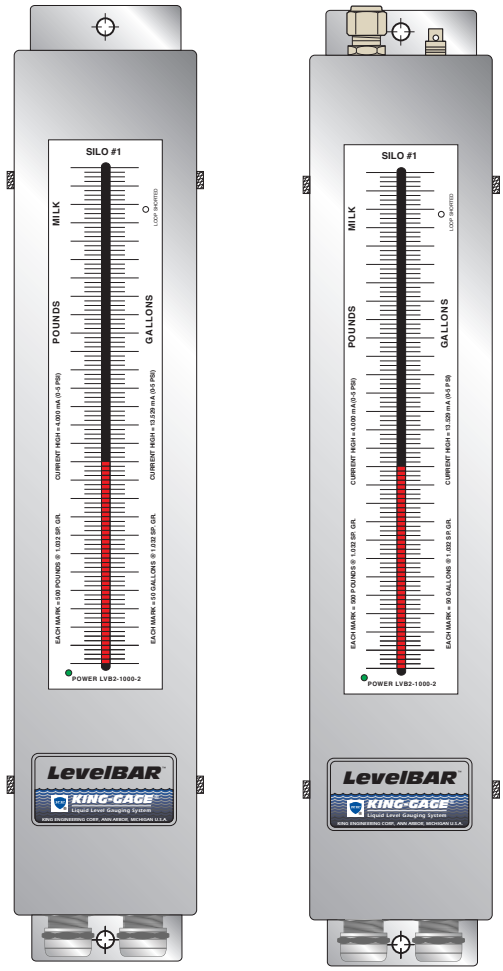
Revisions:

(A) June, 2010 – Original release
(B) August, 2010 – Input connections

Table of Contents

Model Numbers

- **5111-10**—Electronic Input (4–20 mA)



- **5111-20**—Pneumatic Input (0–5 psid)
- **5111-21**—Pneumatic Input (0–10 psid)
- **5111-22**—Pneumatic Input (0–15 psid)
- **5111-23**—Pneumatic Input (0–30 psid)
- **5111-24**—Pneumatic Input (0–50 psid)

Specifications

Display Accuracy/Resolution
1%

Display Type
100-segment LED (light emitting diode)

Display Length
10"/254 mm

Input Power
100–240 Vac, 50/60 Hz, source ground

Output Power
24 Vdc (transmitter excitation)

Input Impedance (Resistance)
150 ohm nominal (3.0 Vdc drop @ 20 mA)

Current Limiting (Overload)
70 mAdc maximum current; automatic trip/reset circuit using PTC (positive temperature coefficient) resistor limits current overload if signal loop is shorted out.

Temperature Range (Environmental)
30°F to 120°F (-1°C to 49°C) operating range

Electronic Input Model Only

Signal Input
4–12 mAdc (min.) to 4–20 mAdc full scale range

D/P Option Models Only

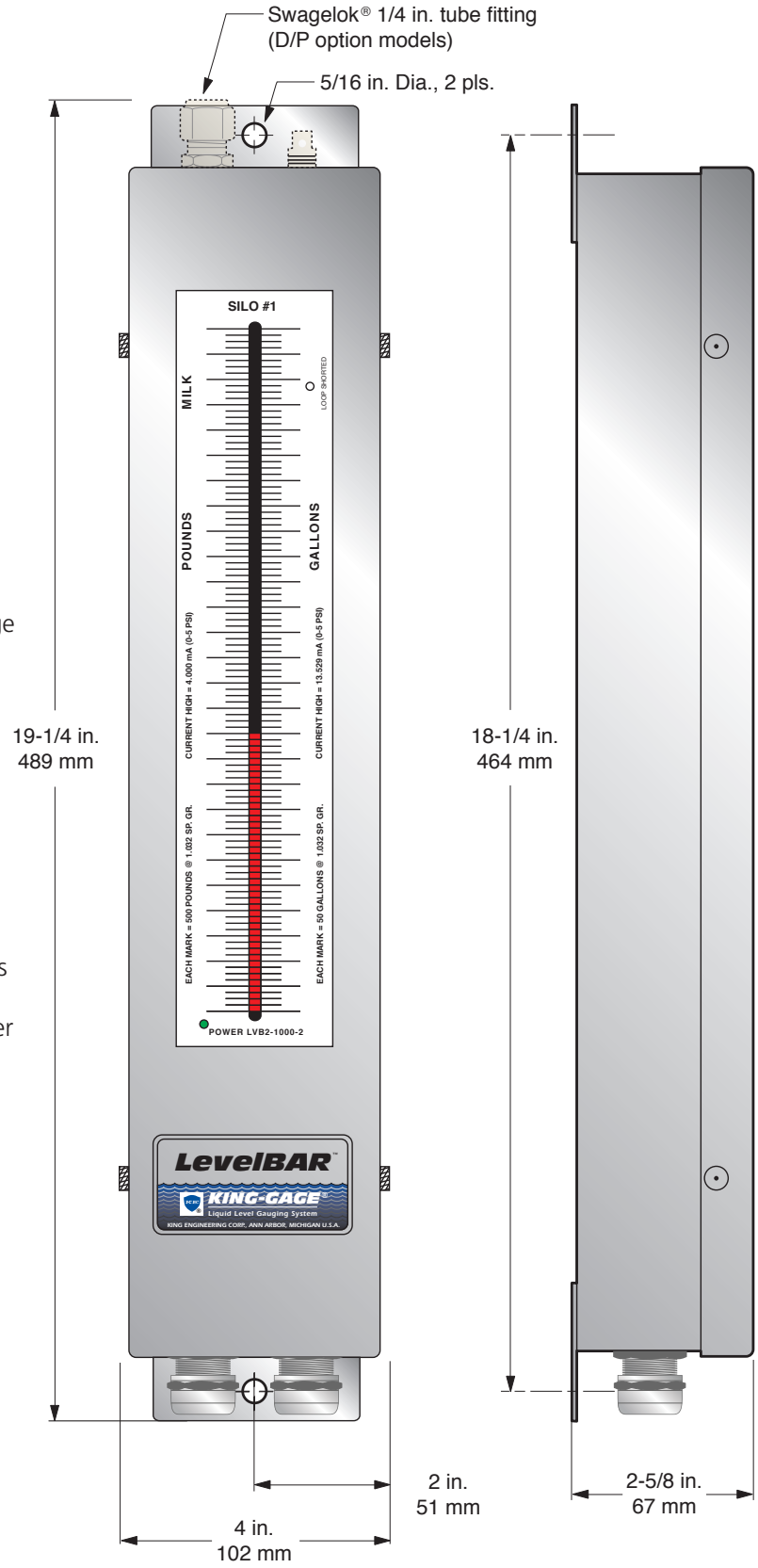
Input Pressure Ranges
0–5, –10, –15, –30, –50 psid fixed range transmitter element (accepts clean, dry air/gas pressure input). Maximum pressure rating is 300% FS. Minimum pressure range for proper operation is 50% of nominal. The lowest acceptable input pressure range is 0–2.5 psid using the 0–5 psid transducer element.

Transmitter Accuracy
0.5% FS

Output
4–20 mAdc (assumes FSO)

Power Supply Voltage (External)
14–40 Vdc (unregulated) when D/P signal loop is externally powered; required in bypass (or satellite) mode.

Maximum Load Capacity
1400 ohms @ 40 Vdc (external power); 500 ohms @ 24 Vdc (internal power)



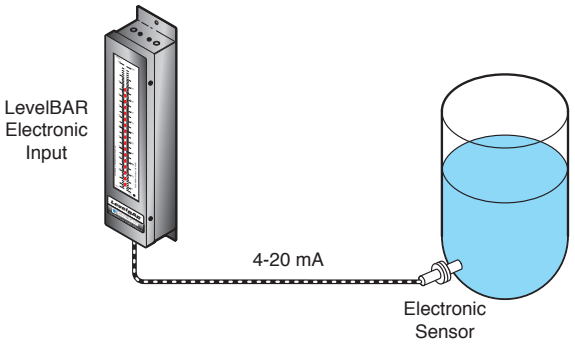
Electronic Input (4-20 mA)

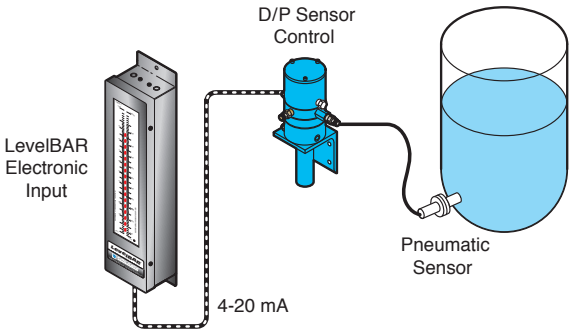
The electronic input version will accept a standard 4–20 mAdc signal from any typical two wire pressure transmitter. A full scale ranging feature allows the LevelBAR to be used with fixed range pressure devices in situations where maximum signal output would be less than 20 mA.

Model No. Description
5111-10 electronic input 4–20 mA indicator

Principle of Operation

The electronic input version (p.n. 5110-10) will accept a 4–20 mA signal from any two-wire pressure transmitter. Individual LED segments on the display column illuminate as the signal (e.g., tank depth) increases. The scale itself is custom marked for the actual tank dimensions and milliamp output of the external transmitter. (This milliamp range is a factor of the transmitter span and actual pressure created by the tank gauging application.)





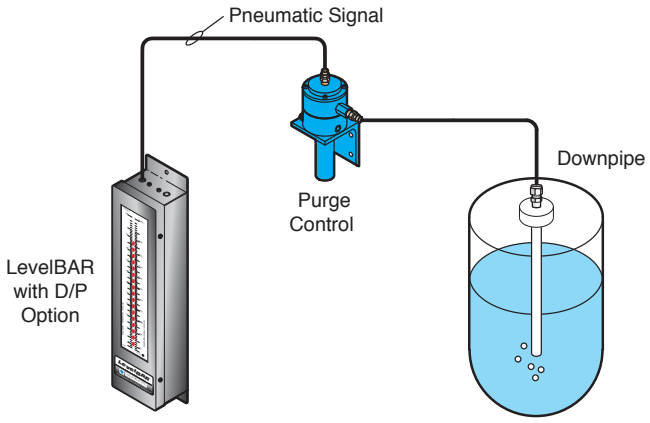
Pneumatic Input (w/ Internal D/P Transmitter)

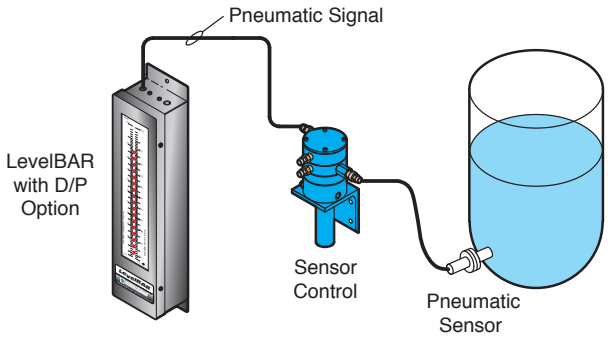
A differential pressure (D/P) option incorporates an internal fixed range electronic transmitter as part of the indicator package. This provides a 4–20 mAdc signal proportional to the pneumatic input applied. A scale ranging adjustment obtains full scale display where maximum pressure input is less than the transmitter upper pressure range.

Model No. Description
5111-20 fixed range transmitter 0–5 psid.
5111-21 fixed range transmitter 0–10 psid.
5111-22 fixed range transmitter 0–15 psid.
5111-23 fixed range transmitter 0–30 psid.
5111-24 fixed range transmitter 0–50 psid.

Principle of Operation

When used with either an air-driven diaphragm sensor or bubbler, the pressure signal is directed into the LevelBAR (with D/P option). The internal electronic transmitter generates a milliamp output in response to the applied pressure. Individual LED segments on the display column illuminate as the signal (e.g., tank depth) increases. The scale itself is custom marked for the actual tank dimensions and pressure range of the gauging application.





Indicator Scale

Scales are marked for readout in a specified unit of measurement such as weight (pounds, kilograms, tons) or volume (gallons, liters, barrels, etc.). Each scale is uniquely graduated based on pressure range, tank geometry and density (specific gravity) of the contents.

Scale Serial Number—A unique LVB2-#### serial number appears at the lower left hand of each scale.

Scaling Adjustment Setting—Refer to "CURRENT HIGH =" notation on right hand edge of scale. This notes the scaling adjustment settings and pressure range of the transmitter.

Tank Identification—The tank designation appears at the top of the scale.

Status Indicators

The LevelBAR display incorporates two LED status indicators that are useful during installation and for troubleshooting operation. In the event of a short or fault in the signal loop (4-20mA), a red LED will indicate "Loop Shorted"…refer to upper right hand corner of scale window.

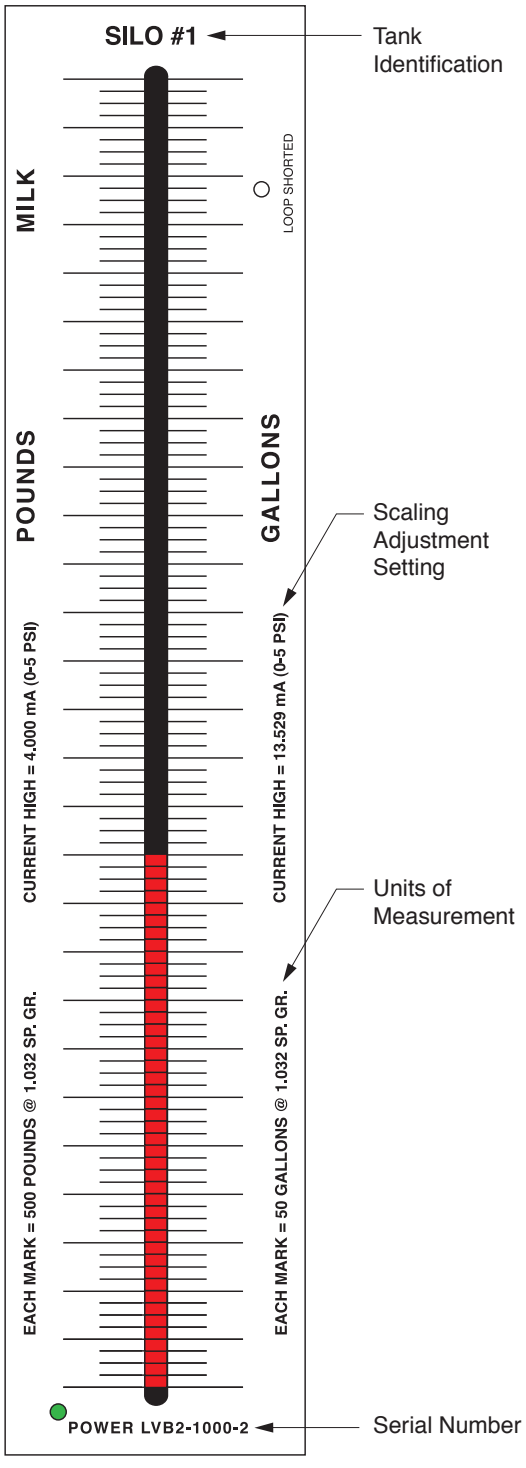
Red LED (upper right): Off—normal
On—current loop short

Green LED (lower left): Solid—normal (power on)
Flashing—open (disconnected) current loop

Scale Installation/Removal

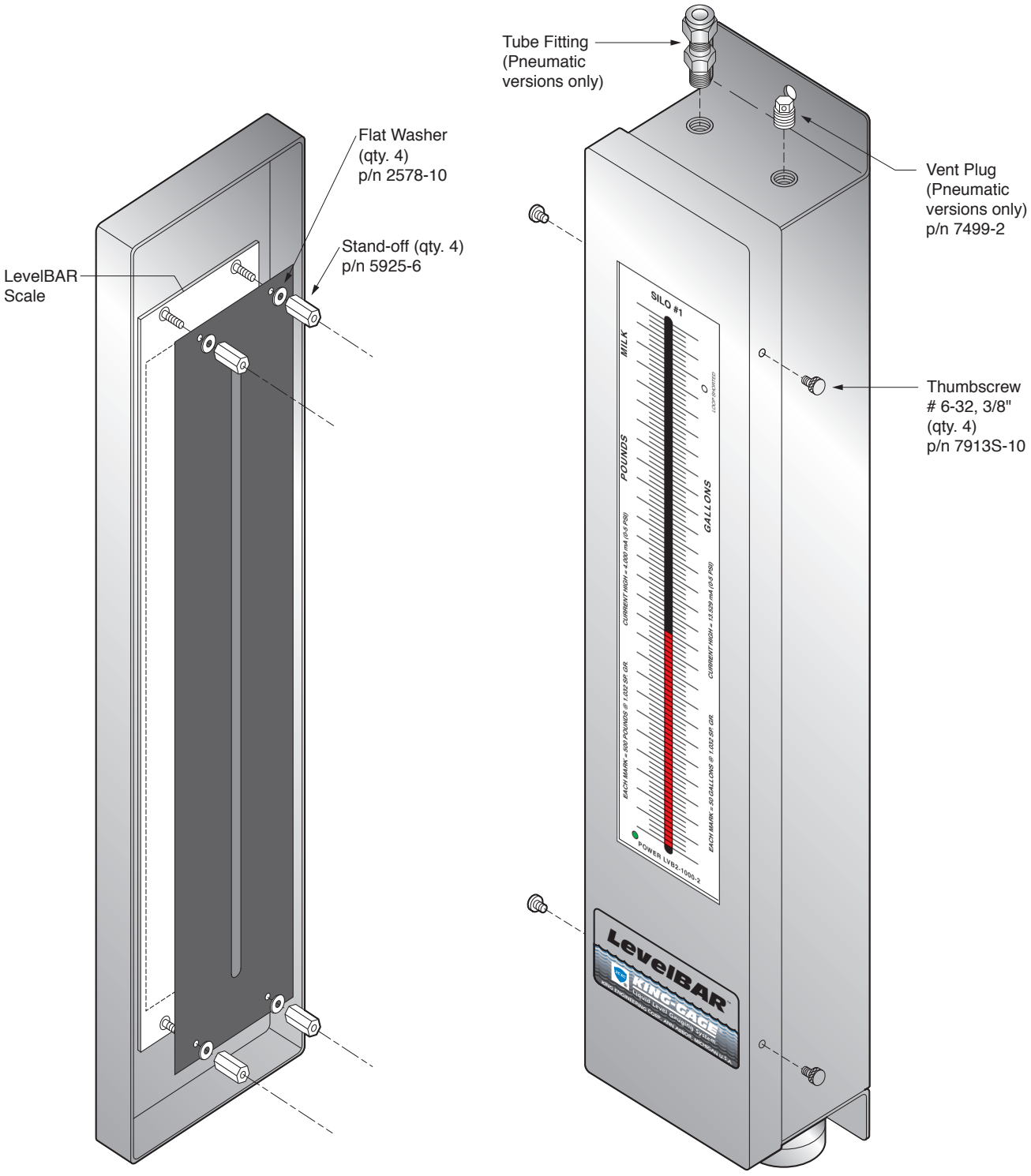
The front cover must be removed to access the indicator scale. Refer to illustrations on page 7.

1. Remove four (4) thumbscrews on sides of housing to unfasten cover.
2. Scale Removal: From backside of cover, unthread the four (4) stand-offs to access scale.
3. Scale Installation: Once properly aligned, tighten stand-offs securely. The bottom mark on the scale should be aligned with the bottom edge of the first LED segment.



LevelBAR Scales are marked for the specific tank geometry. Liquid in the tank can be measured by volume or total weight.

Scale Installation/Removal



Scaling Adjustment Settings

The multi-segment LED column is adjustable for full scale display of any milliamp value between 12-20 mAdc generated by the transmitter. A custom marked scale, graduated in any selected engineering unit (lbs, gal., liters, etc.), is mounted alongside of the display column. The LED column segments provide a clear, graphic indication of tank levels for operations personnel.

The scaling adjustments for the indicator are identified as "CURRENT LOW" and "CURRENT HIGH". When the LevelBAR is supplied with the graduated scale already installed, these scaling settings are factory preset. Field installing a graduated scale will require setting the scaling adjustments. The scaling factor is based on the upper milliamp value generated by the transmitter in response to applied pressure

If the maximum applied pressure is below full scale (FS) using the LevelBAR's fixed pressure range transmitter, the highest milliamp value will be below 20 mA. This also will be true of external transmitters used at nominal range (default) setting. The scaling adjustment required is based on the actual upper milliamp value. The minimum input value at which a full height column display can be generated is 12 mA. Maximum input is 20 mA.

12 mA = minimum input for full scale
20 mA = maximum input for full scale

Jumpers and Factory Default Settings

JP1 Jumper: 4–20ma loop power—
internal (default) / external

JP2 Jumper: Graph LEDs—test / **run** (default)

JP4 Jumper: Current loop—
Electric Input Model—**insert** (default) / bypass
Pneumatic Input Model—insert / **bypass** (default)

JP7 Jumper: Shield—**float** (default) / chassis

JP8 Jumper: Power supply common—**float** (default) / chassis

R79: Graph span—99.5% default (of CURRENT HIGH)

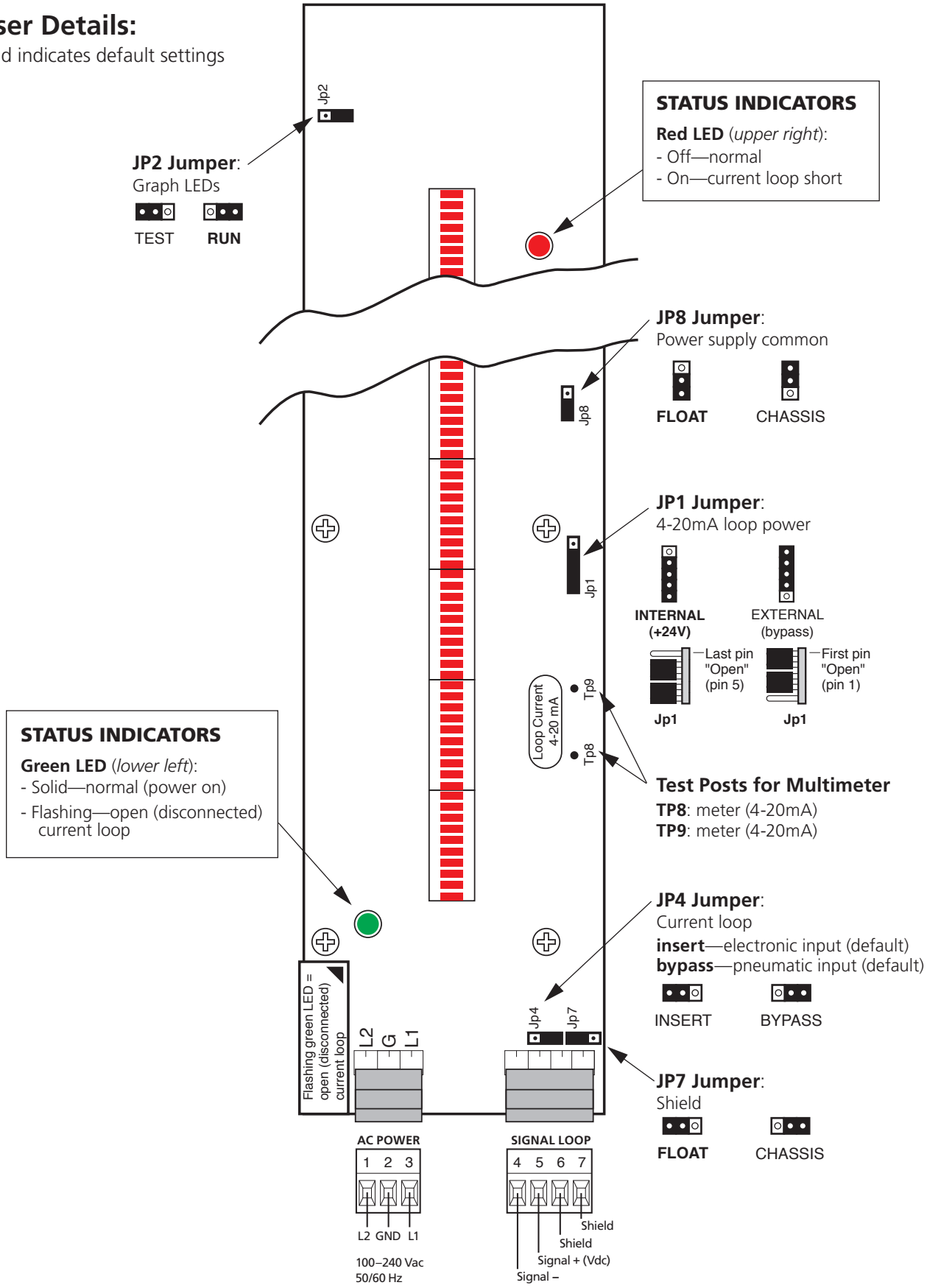
R88: Graph zero—0.5% default (of CURRENT LOW)

TP8—meter **–** test point (4–20 mA loop)

TP9—meter **+** test point (4–20 mA loop)

User Details:

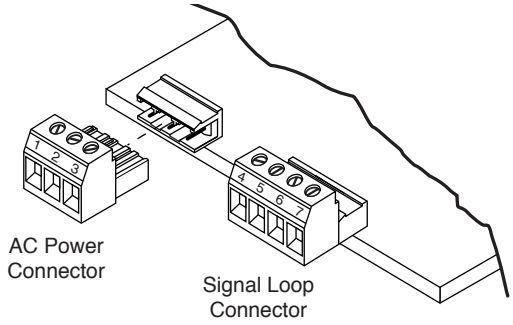
Bold indicates default settings



LevelBAR Model 5111-10 Electronic Input

When used with an external transmitter, the LevelBAR signal connections will accept any standard 4-20 mA input. An available on-board 24 Vdc power supply can be used to power the transmitter signal loop. If an external power supply will be used, the +24 Vdc output of the LevelBAR must be bypassed (see JP1 Loop Power Jumper).

Power (100–240 Vac, 50/60 Hz)
Connect the LevelBAR indicator to a grounded 100–240Vac, 50/60Hz. power source. Source ground must be connected to terminal #2 (L1/**GND**/L2) as indicated. (Note that "hot" or "neutral" power conductors may be connected to either the L1 or L2 terminals.) Use only the supplied watertight cord grips or other watertight connectors (conduit) for the power cabling.



4–20 mA Signal Input
LevelBAR indicators are designed to accept the proportional 4–20 mAdc electrical signal from typical two wire loop powered transmitters. Each LevelBAR indicator includes an onboard 24 Vdc supply that can be used to power the transmitter and signal loop. If an external power supply is used within the loop circuit, the onboard 24 Vdc must be internally bypassed within the indicator. (See *JP1*.)

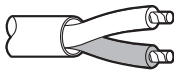
JP1 Loop Power Jumper (24 Vdc Power)
The internal 24 Vdc supply can either be used or bypassed (external), depending upon whether an external transmitter power supply is already being used.

JP1 Internal Power: +24 Vdc is applied through the + signal terminal (#5) to the transmitter.

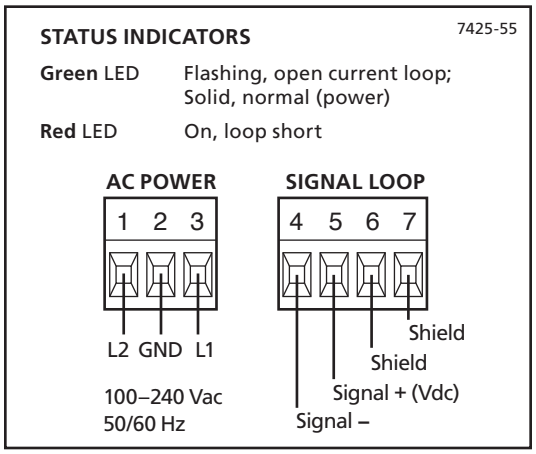
JP1 External Power: Onboard power supply is bypassed.

Signal Loop Power (14–40 Vdc)
If an external source of Vdc power to drive the signal loop is used, you must set the JP1 jumper for EXTERNAL power (see jumper illustration).

Signal Cable
Use twisted pair cable (20-22 AWG) for the signal loop between transmitter and LevelBAR indicator. For most general applications, unshielded cable can be employed to for the transmitter signal. Recommended signal cable: unshielded twisted pair cable (UTP), 20-22 AWG—Example: Belden 9407.

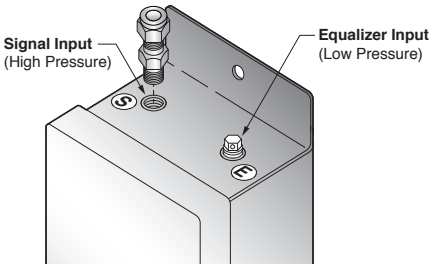


Shield Connections (Optional)
If shielded twisted pair cabling is used for the signal loop (4–20mA), note that the LevelBAR indicator factory default is for floating ground. JP7 (shield—float/chassis) and JP8 (power supply—float/chassis) are provided on the LevelBAR circuit board. Grounding the signal loop should only be attempted by a trained technician.



LevelBAR Model 5111-2x Pneumatic (Pressure) Input

Pneumatic input models (D/P option) incorporate an internal transducer to convert pressure into a level reading on the LED column. Pneumatic input models include two (2) 1/8" NPT connection ports at the top of the enclosure. These are for **Signal** (high pressure) and **Equalizer** (low pressure) input. Since a majority of applications involve gage pressure relative to atmosphere, a vent plug is provided for the low pressure input.



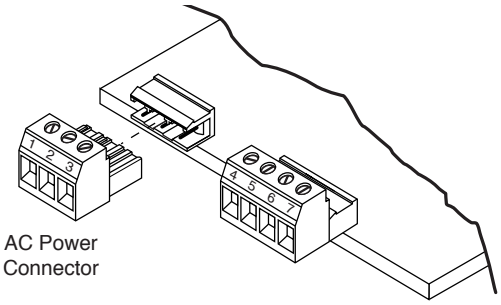
Pneumatic (Pressure) Input Connections

(S) **Signal**—pressure input from tank sensor (high pressure). On a closed or non-vented tank gauging application (i.e., differential pressure measurement), this would correspond to the lower tank sensor.

(E) **Equalizer**—In open or vented tanks, this connection is vented to atmosphere. (Steam and/or extremely wet situations may require routing vent line to a dry or protected location.) Otherwise, this connection is for low pressure input corresponding to void pressure above the liquid surface in a closed or non-vented tank.

Power (100-240Vac, 50/60Hz)

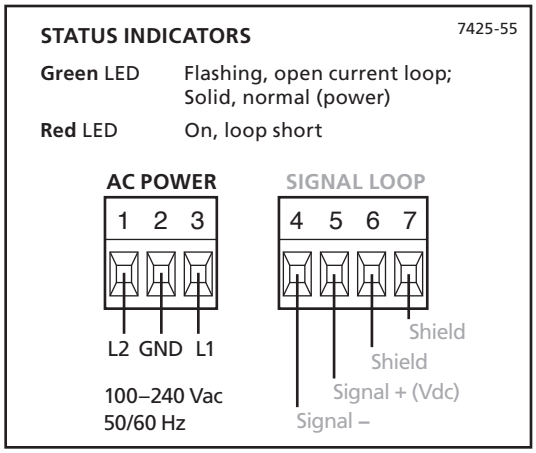
Connect the LevelBAR indicator to a grounded 100-240Vac, 50/60Hz. power source. Source ground must be connected to terminal #2 (L1/**GND**/L2) as indicated. (Note that "hot" or "neutral" power conductors may be connected to either the L1 or L2 terminals.) Use only the supplied watertight cord grips or other watertight connectors (conduit) for the power cabling.

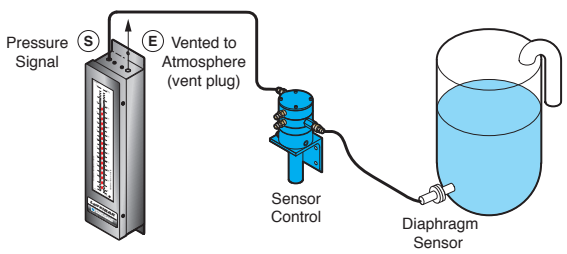


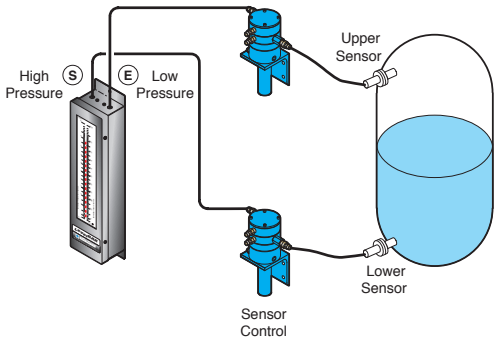
Optional Output: 4-20 mA Signal (D/P Option Models)

The pneumatic input (D/P option) LevelBAR can provide a 4-20 mA output * signal for monitoring or control use. If the 4-20 mA output will be connected by twisted loop wiring to an external device, then the JP4 jumper must be set to the "insert" position. (The LevelBAR indicator for pneumatic input is shipped with the jumper in the default "bypass" position.)

*Actual milliamp output may be less than 20 mA depending upon application and pressure range of the internal D/P transmitter.

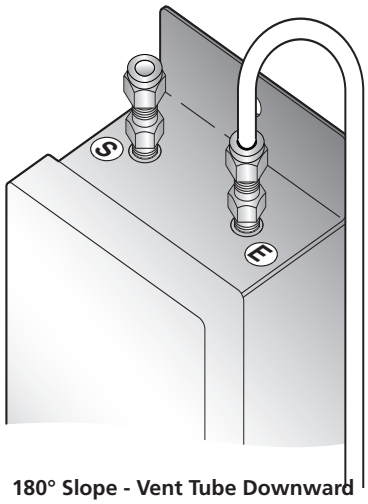




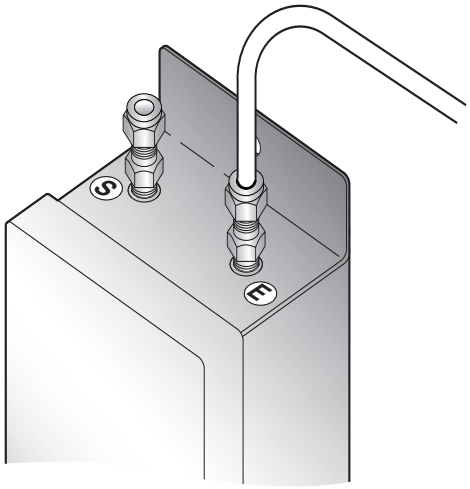


Protected Vent (Wash-Down Locations)

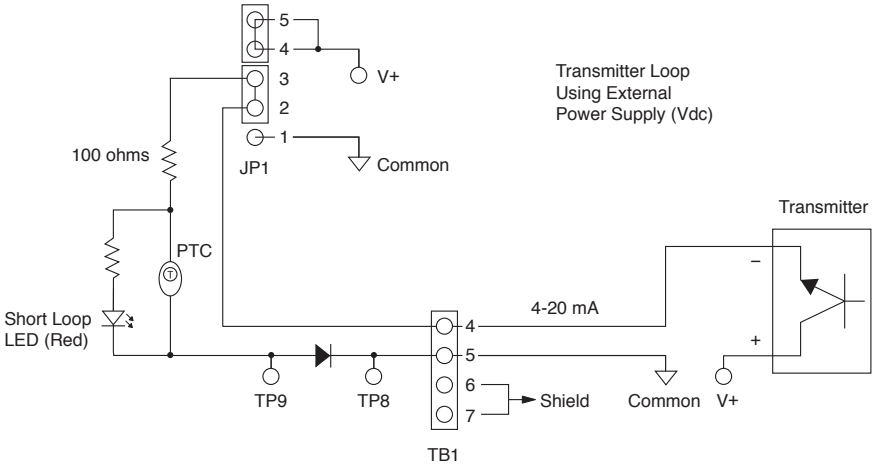
Installing a short tubing run with a downward turn can prevent water or other liquid solutions from being sprayed into the LevelBAR equalizer vent. (When steam is present, route tubing to a dry location.)

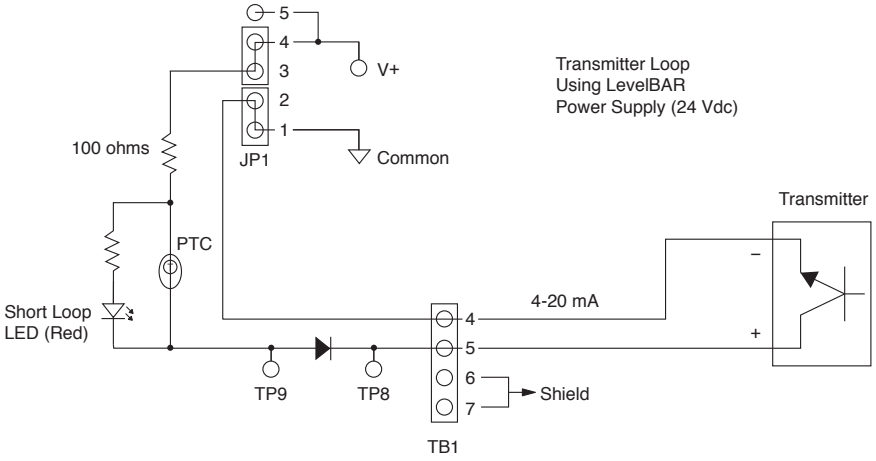


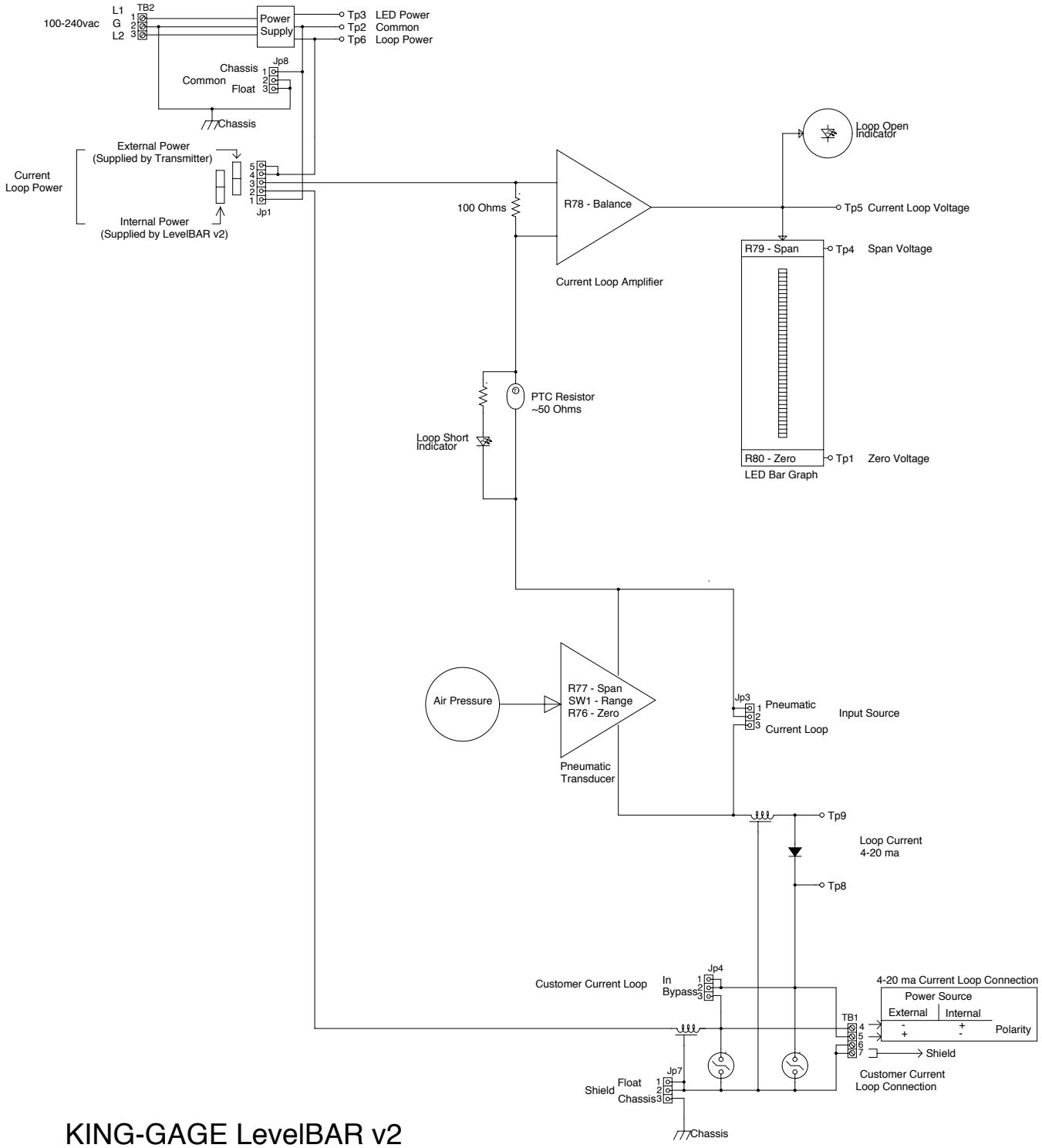
180° Slope - Vent Tube Downward



Vent Tube Routed to Alternate Location


Transmitter Loop
Using External
Power Supply (Vdc)
5
4
3
2
1
V+
Common
JP1
100 ohms
PTC
Short Loop
LED (Red)
Transmitter
–
+
4-20 mA
TP9
TP8
4
5
6
7
Shield
Common
V+
TB1


Transmitter Loop
Using LevelBAR
Power Supply (24 Vdc)
5
4
3
2
1
V+
Common
JP1
100 ohms
PTC
Short Loop
LED (Red)
Transmitter
–
+
4-20 mA
TP9
TP8
4
5
6
7
Shield
TB1



KING-GAGE LevelBAR v2
Display Board Block Diagram

Troubleshooting the LevelBAR Indicator

1. **No Display?**
   Try the following…

   Check to see if Power indicator (green LED) is illuminated. If not, check AC power connection and power source.

   Graph LEDs (Diagnostic Test Mode)
   The LevelBAR LED column can be tested to ensure all individual segments are functional using the JP2 jumper at the upper left portion of the circuit board. **NOTE: For normal operation JP2 must be in the "run" position.**

   JP2 Test: causes all LED segments to light up (test only)

   JP2 Run: normal display mode (LEDs light in response to signal input)

   (**D/P Option Models**)—Check that JP4 jumper is positioned for bypass setting. Alternatively, if 4-20 mA output of the LevelBAR is connected to external device (terminals 4 & 5), check for continuity of the signal loop. Make certain that +/- sides of the loop are not reversed. If tank is empty (or input signal is 4.10 mA or less), the LED column will not be illuminated.

2. **Display Reading Low?**
   Try the following…

   (**D/P Option Models**)—Check for leaks in pressure tubing, tube fittings and/or internal transmitter pressure connections. Note that LevelBAR cannot display full scale if maximum pressure is less than 50% of the rated pressure range of the unit.

   (**Electronic Input Model**)—Check output signal from external pressure transmitter, adjusting span when required (if applicable). Note that LevelBAR cannot display full scale if maximum input is less than 12.00 mAdc. Scale: Scale is marked based on density of tank contents. If contents has a lower specific gravity than liquid for which scale was calibrated, display will not be accurate.

3. **Display Reading High?**
   Try the following…

   (**D/P Option Models**)—Pressure input to LevelBAR may be high due to malfunction at pneumatic tank sensor. For bubblers or downpipe system, check for restriction or blockage within downpipe in tank. Also, check for excessively high flow rate or vent restriction at air control unit.

   (**Electronic Input Model**)—Check output signal from external pressure transmitter, adjusting span when required (if applicable). Scale: Scale is marked based on density of tank contents. If contents has a higher specific gravity than liquid for which scale was calibrated, display will not be accurate.

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