

Model 4100 Series Level Gauge Instructions

What it is

Orange Research 4100 Series Level Gauge measures the level of liquefied gas in a cryogenic tank and displays the level in 3 ways. A graphical image of the tank contents, percent full and height are all displayed, at the same time to help the user understand the liquid level. Basic components are a proven differential pressure sensor, a Hall-Effect sensor, microprocessor, and an LCD graphics module.

Five ranges are available depending on the height of the liquid in the tank. Available ranges are 0-30, 0-60, 0-80, 0-110, 0-160 inches of H₂O. Select one of these choices when ordering.

Three intuitive user buttons allow for waking up the unit, set up and backlighting.

A 4-20 mA output is an option.

Basic features:

Set Full Tank: With a new delivery of gas, the user sets the gauge to "Full". The tank image on the LCD now presents an image of a full tank, with text that states that the tank is "100% Full". As gas is withdrawn from the tank, the tank image will show a decreasing level of liquid in the tank, and the percent full changes accordingly.

Selectable Units: The user can select one of 3 pressure units in which to display differential pressure: Inches H₂O, mm H₂O or PSI.

Illuminated Display: If the user is in low light conditions, a backlight can be engaged which illuminates the display.

Power: The base model is a battery operated device, and does not require any external electrical connections. Under normal operating conditions, a user can expect to get a 2 year lifespan from the batteries. Battery replacement is easy, and does not require special tools or training.

If the 4-20 mA output option is chosen the device is powered off the loop, and an isolated 12VDC power supply is needed to engage to backlight feature.

How it Works

Our 4100 Series Level Gauge utilizes a differential pressure gauge to sense and indicate the level of liquefied gas in a cryogenic tank. As the gas is consumed from the tank, it presents the operator with a visual indication of the height of the liquid.

A diaphragm magnet sensor receives the high pressure from the bottom of the tank and the low pressure from the top of the tank, so that both are acting against the same sensor, from opposite sides. Changes in liquid level will cause this diaphragm sensor position to move in proportion to the change.

As the diaphragm magnet assembly moves with respect to pressure input, the change in position is followed by a digital Hall-Effect sensor.

The Hall-Effect signal is read by the microprocessor and is converted into a differential pressure reading. This information is then displayed on a 128 x 64 pixel LCD display.

Installation

Check maximum operating pressure listed on the instrument body label. Check the differential pressure sensor to identify *HI* and *LO* markings identifying the high and low pressure ports respectively and connect piping accordingly. The high pressure port will be piped to the bottom of the tank and the low pressure port will be piped to the top of the tank. Install NPT fittings with sealing tape or other non-migrating sealant on the threads prior to installation.

Two #8-32 threaded holes are located on the bottom of the DP sensor for mounting the unit.

Display Operation

The 4100 Series Level Gauge has 2 user settable functions; **Set Full** and **Set Units**. When the tank is newly filled the user sets the tank to full which allows the tank image to appear with liquid at the top of the tank, and 100% Full. The full scale differential pressure will also appear on the screen. After the tank is set to full the user can select the preferred units, mmH₂O, inH₂O or PSI.

After the unit is set to full the only setting recommended is Set Units, which can be changed at any time. Once the tank is filled and the 2 functions are set there is no need to reset anything until the tank is filled again.

The battery powered unit spends most of the time in a low power sleeping state. When the gauge is sleeping, power consumption is at a minimal level to maximize the gauge's battery life. With the 4-20 mA output option this sleep function does not apply.



Figure 1

Fig. 1 shows the front panel of the LCD level gauge. Three buttons positioned under the display allow the user to control and configure the unit.

The unit can be awakened (placed into an operational state) by momentarily pressing the **On/Select** button. Fig. 1 shows information presented on the operating screen. After 15 seconds, if the On/Select button is not pressed, the unit will return to sleeping state, and the display will become blank.

When the gauge is awake, the operator can activate the display backlight by pressing the button that is labeled with the **light bulb** graphic. The backlight feature enables the operator to read the LCD display under low ambient light conditions. Since the backlight consumes battery power, the use of this feature should be minimized.

The tank image allows the user to get a quick visual picture of the liquid level in the tank. If the gauge has never been set to full, the tank graphic will not appear in the operating screen. To see the image of the tank and the percent full follow the "Set Full" instructions below. These instructions also apply when batteries are replaced.

Setting Full Tank

The “Set Full” screen appears when the user momentarily presses the On/Select button while the gauge is in the operating screen. If the gauge is asleep, the user can bring up the “Set Full” screen by pressing the On/Select button twice.



Figure 2



Figure 3

Fig. 2 shows what the user will see in the display when the “Set Full” screen is selected. Press the **arrow key** to scroll the cursor symbol “=” upwards to the next position. Repeatedly pressing the arrow button will cause the cursor symbol to move upwards one position until it rolls over. If the cursor is placed next to "Yes", and the On/Select button is pressed, the gauge will be set to full. The gauge will then return to the Operating Screen which will show a full tank. If the user presses the On/Select button while the cursor is positioned next to "Home", the gauge will return home to the operating screen.

Setting Units

If the cursor is placed next to "Units" and the On/Select button is pressed, the “Pressure Units” screen is brought up (see Figure 3). In this screen the user can select one of three units to display the differential pressure, PSI, Inches of H2O, or mm of H2O. The arrow button is used to position the cursor next to the user’s choice. Pressing the On/Select button will save this setting and return to the operating screen.

4-20 mA Output

With the 4-20 mA output option the power for the instrument is provided from the loop, so no batteries are needed. A 3 foot long 4-wire input/output cable is provided. Two of these wires provide the connections for the instrument loop. The other two wires are provided so that the customer can hook up a 12VDC power supply to (1) power a heater for the LCD display at low temperature conditions and (2) provide backlight for the LCD display.

All of the functionality for the LCD display described in previous sections is available with the 4-20 mA version of this product.

Pinout for the 4-20 mA I/O cable:

Function	Color	Pin
Loop -	Black	1
Isolated ground	Green	2
Loop +	Red	3
Isolated 12 VDC	White	4

Maintenance

The 4100 Series Level Gauge is designed to be reliable and accurate in difficult environments for years of use. The magnetic coupling of the sensor to the electronics has no mechanical linkage to fail so there are no adjustments built into the unit. If there is a concern with the unit please contact Orange directly at 203-877-5657 for assistance.

The housing requires little care. To maintain an easy to read screen please wash the unit with a mild soap solution. Please take care to use non-abrasive solutions or cloth when drying the unit.

Batteries

As the battery approaches the end of its service life, a low battery indication will appear in the upper right corner of the operating screen. When the "Low Bat" indicator is present, it is time for the user to change the batteries. During this period the backlight feature is locked-out, and will not function, until new batteries are installed. This prevents the backlight from depleting the remaining battery life and causing a loss of gauge settings.

Changing the batteries

The instrument uses Two CR123A (3V Lithium battery) cells. Note that the electronic components inside the case of the gauge are sensitive to ESD (Electrostatic Discharge). The user should always ground himself to metal on the tank before reaching inside the gauge. Provided there is enough clearance it should be possible to perform the battery replacement without removal from the tank.

Loosen the 4 screws on the front panel. The screws are captive and do not need to be completely removed from the top cover.

Lift the top cover away from the housing. Support the weight of the cover to prevent damage to the internal cables; do not let the cover hang by the cables. Rotate the cover upwards so a clear view of the internal electronics becomes visible, see Figure 4.

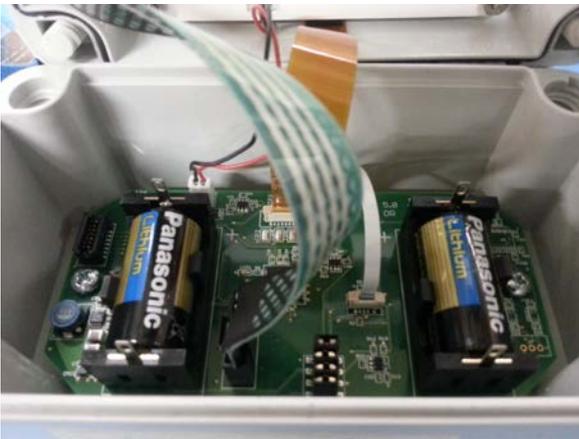


Figure 4

Remove the battery from the battery holder. If the user has difficulty maintaining a sufficient grip on the battery, it is recommended to use a pair of needle-nose pliers. Orient the new battery so that the positive post is upwards and push the replacement battery into the holder.

Rotate the cover back into position, and re-engage the cover screws with the base.

Tighten all of the screws **gently** on the first pass. Then, on a 2nd pass, perform the final tightening to restore a proper gasket seal. Since the device has been powered down, all saved settings will be lost, and it will be necessary to reconfigure the gauge.