

## Instruction Manual

# Tank Level Monitor 309500 rev.G

**Part No. 119274, Series C, North America (N.A.)**  
**Part No. 120105, Series C, (Australia)**

Used to monitor tank levels for oils and anti-freeze mixtures.

The Tank Level Monitor is to be used only with Graco Matrix Software.

U.S. Patents Pending



### Important Safety Instructions

Read all warnings and instructions in this manual.  
Save these instructions.

### WARNING



Intrinsically safe Exia for use in Class I, Division 1, Group D Hazardous Locations when used with two 9-volt alkaline batteries.

Ambient temperature range -22°F to 122°F (-30°C to 50°C).

Temperature Code: T3.

**Do not** use the Tank Level Monitor with fluids having an auto ignition below 392° F (200° C).

**Do not** use the Tank Level Monitor with pressurized tanks.

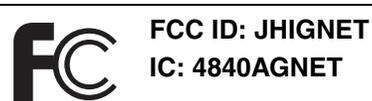
**Read warnings and instructions.**



### CAUTION

- **Do not over tighten tank level monitor into tank bung!** Over tightening can cause permanent damage and result in inaccurate readings.
- **Do not use thread sealant or adhesive!** Many of these products are chemically incompatible with the PC/ABS plastic.

The Matrix Tank Level Monitor contains an RF device with the following approvals:



### Industry Canada Statement

The term "IC" before the certification/registration number only signifies that the Industry Canada technical specifications were met.

PROVEN QUALITY. LEADING TECHNOLOGY.



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# Warnings

The following warnings include general safety information for this equipment. More specific warnings are included in the text where appropriate.

 <b>WARNING</b>	
	<p><b>FIRE AND EXPLOSION HAZARD</b></p> <p>When flammable fluids are present in the work area, such as gasoline and windshield wiper fluid, be aware that flammable fumes can ignite or explode. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> <li>• Use equipment only in well ventilated area.</li> <li>• Eliminate all ignition sources, such as cigarettes and portable electric lamps.</li> <li>• Keep work area free of debris, including rags and spilled or open containers of solvent and gasoline.</li> <li>• Do not plug or unplug power cords or turn lights on or off when flammable fumes are present.</li> <li>• Ground equipment.</li> <li>• Use only grounded hoses.</li> <li>• If there is static sparking or you feel a shock, <b>stop operation immediately</b>. Do not use equipment until you identify and correct the problem.</li> </ul>
	<p><b>BATTERY SAFETY</b></p> <p>The battery may leak, explode, cause burns, or cause an explosion if mishandled:</p> <ul style="list-style-type: none"> <li>• You must use the battery type specified for use with the equipment.</li> <li>• Sparking can occur when changing batteries. Only replace the battery in a non-hazardous location, away from flammable fluids or fumes.</li> <li>• Handle and dispose of battery properly - do not short circuit, charge, force over discharge, disassemble, crush, penetrate, incinerate, or heat the battery to a temperature exceeding 185° F (85° C).</li> </ul>
	<p><b>EQUIPMENT MISUSE HAZARD</b></p> <p>Misuse can cause death or serious injury.</p> <ul style="list-style-type: none"> <li>• Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See <b>Technical Data</b> in all equipment manuals.</li> <li>• Use fluids and solvents that are compatible with equipment wetted parts. See <b>Technical Data</b> in all equipment manuals. Read fluid and solvent manufacturer's warnings.</li> <li>• Check equipment daily. Repair or replace worn or damaged parts immediately.</li> <li>• Do not alter or modify equipment.</li> <li>• For professional use only.</li> <li>• Use equipment only for its intended purpose. Call your Graco distributor for information.</li> <li>• Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.</li> <li>• Do not use hoses to pull equipment.</li> <li>• Comply with all applicable safety regulations.</li> </ul>

# Installation

## WARNING



Installing and servicing this equipment requires access to parts which may cause fire, explosion, and serious injury if work is not performed properly. Do not install or service this equipment unless you are trained and qualified. Read warnings, page 3.

## CAUTION

- **Do not over tighten tank level monitor into tank bung!** Over tightening can cause permanent damage and result in inaccurate readings.
- **Do not use thread sealant or adhesive!** Many of these products are chemically incompatible with the PC/ABS plastic.

## TLM Dipswitch Settings

Tank Level Monitors (TLM) and Transceivers have two, 4-position dipswitches labeled S1 and S2.

- **Network ID (S1):** This is the RF identification setting assigned to a Matrix installation. All components in the system use this same Network ID. For example, if one dealership is using Network ID (A), the dealership across the street would require Network ID (B) to avoid RF interference between the two systems.
- **Transceiver ID (S2):** This is the RF identification setting assigned to a Matrix Transceiver(s). Matrix system components are then assigned to the Transceiver(s) ID's as desired for RF communication. For example, if a system required two Transceivers, some components would be assigned to one Transceiver and other components would be assigned to the second Transceiver using the Transceiver ID dipswitch.

There are (8) Network ID's and (8) Transceiver ID's possible by changing the position of the dipswitches. The eight positions are identified as A, B, C, D, E, F, G, and H.

The location of the dipswitches will change to the same settings of the Transceiver that it must communicate with. The factory default setting for all Tank Level Monitors is (AA) using a RS232 connection. The first A refers to the Network ID and the second A refers to the Transceiver ID. If multiple Transceivers are used or if RS422 connection is used, the factory default settings will require changing.

## Determining what settings to use

Tank Level Monitor dipswitches must be set to match those of the transceiver the TLM will be communicating with.

1. Remove the protective plastic cover (5) over the Tank Level Monitor display that was used for shipping and discard. See FIG. 1.
2. Remove the four screws (3) holding the tank monitor cover in place.

## WARNING



Read and follow **BATTERY SAFETY** warnings, page 3.

3. Remove the cover.
4. Remove the insulating foam (4) to access the circuit board.
5. Set the S1 and S2 settings to match those of the transceiver that this TLM will communicate with. Wait at least 30 seconds after the dipswitch settings are made before installing the batteries. If you do not wait the 30 seconds, the software will not recognize the new settings.
6. Install the (2) alkaline 9-volt batteries (1) provided. Be sure that the batteries fully engage the mounting clips by pushing on the bottom of the batteries with your thumbs.



On initial power up of the TLM, it will take about 30 seconds for the monitor to display information after pressing the blue display button. This time will decrease thereafter to a few seconds

- Replace the insulating foam (4) and reconnect the batteries.



Make sure the o-ring (2) is not damaged and is in the correct location.



Make sure the RF antenna wire (black formed wire near the center of the top PC board) is not flattened against the PC board. This can result in poor RF communication.

- Replace cover and secure it with the four screws (3).



Make sure the cover screws are tightened securely (18-22 in-lb) to avoid water leakage into the TLM electronics. If a torque wrench is not used, verify there are no gaps under the screw heads and no gaps under the cover flange. This will ensure proper compression of the o-ring for a water-tight seal.

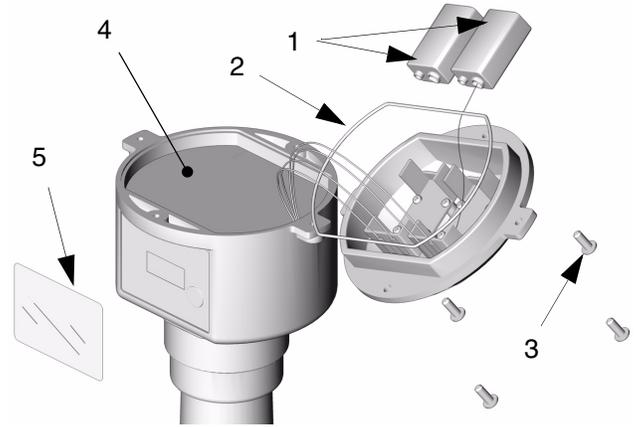


FIG. 1

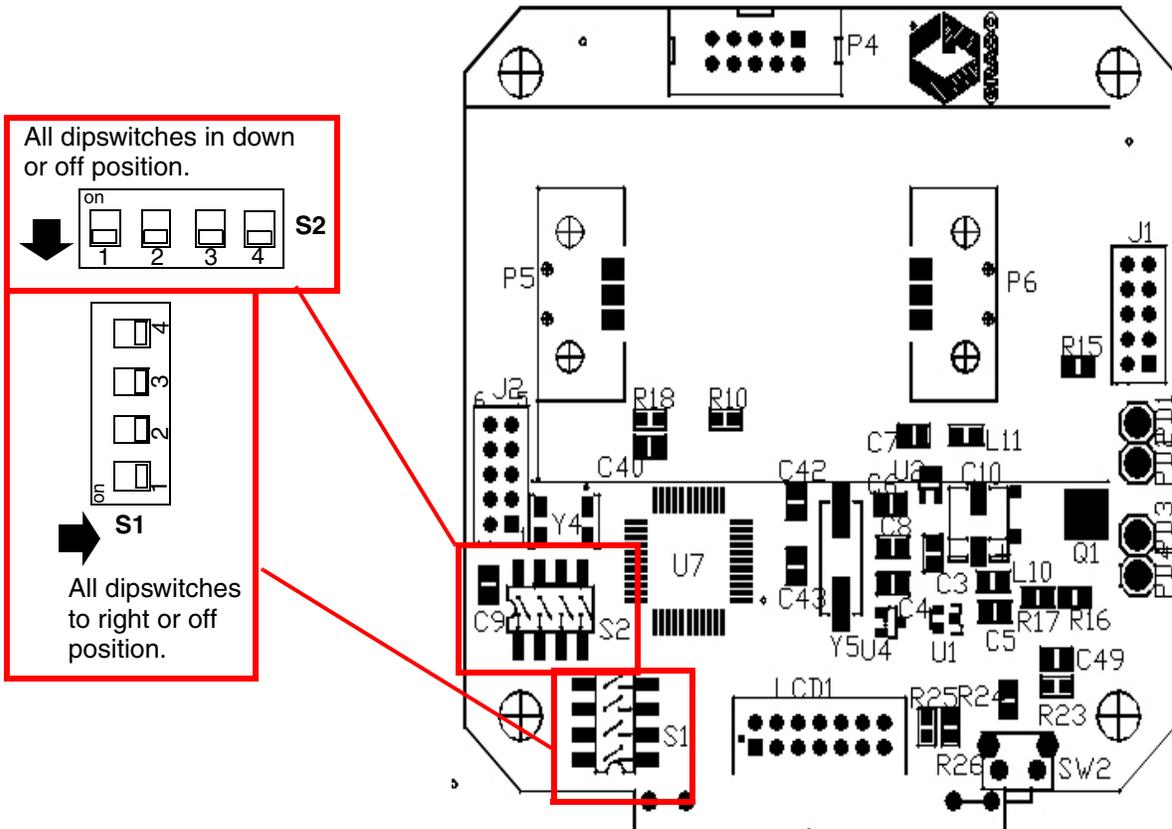


FIG. 2

# Dipswitch Setting using RS232 Connection

See FIG. 3 for dipswitch settings.

 All dipswitch settings must be made without power to the TLM (no batteries) or the settings will not be properly communicated to the PC software.

## RS232 Cable Settings

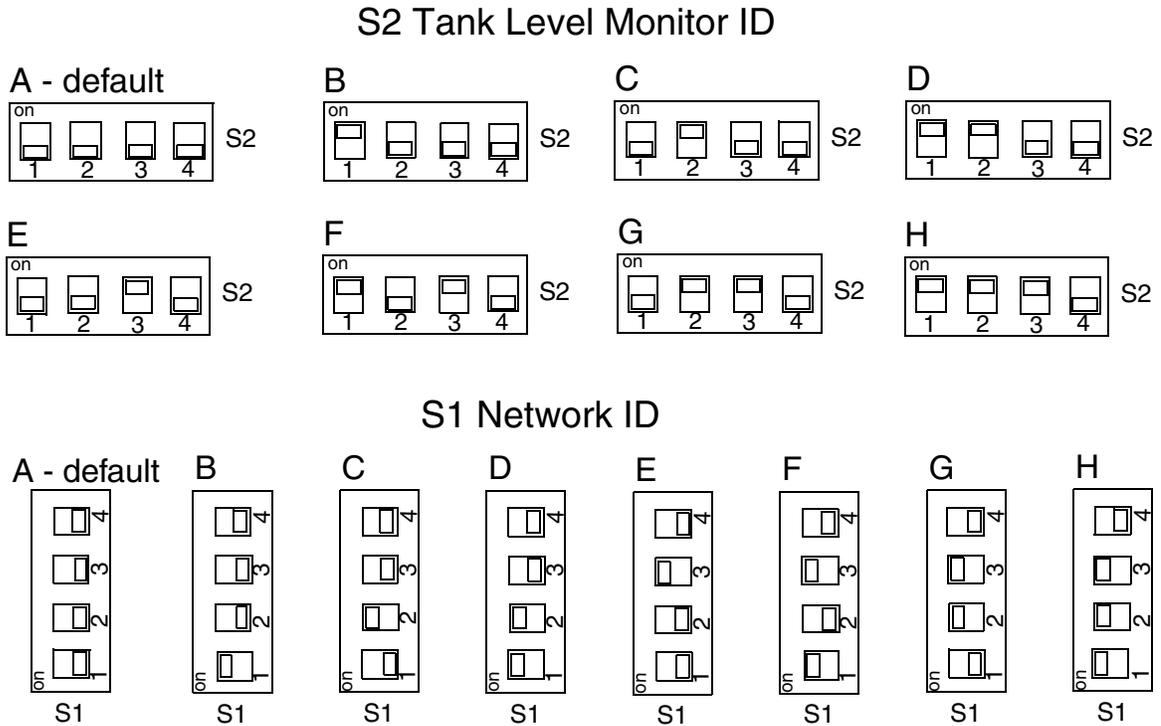


FIG. 3

# Dipswitch Setting using RS422 Connection:

See FIG. 4 for dipswitch settings.

 All dipswitch settings must be made without power to the TLM's or the settings will not be properly communicated to the PC software.

 Dipswitch setting (4) of the S1 Network ID changes position when using RS422 cable instead of RS232 cable.

## RS422 Cable Settings

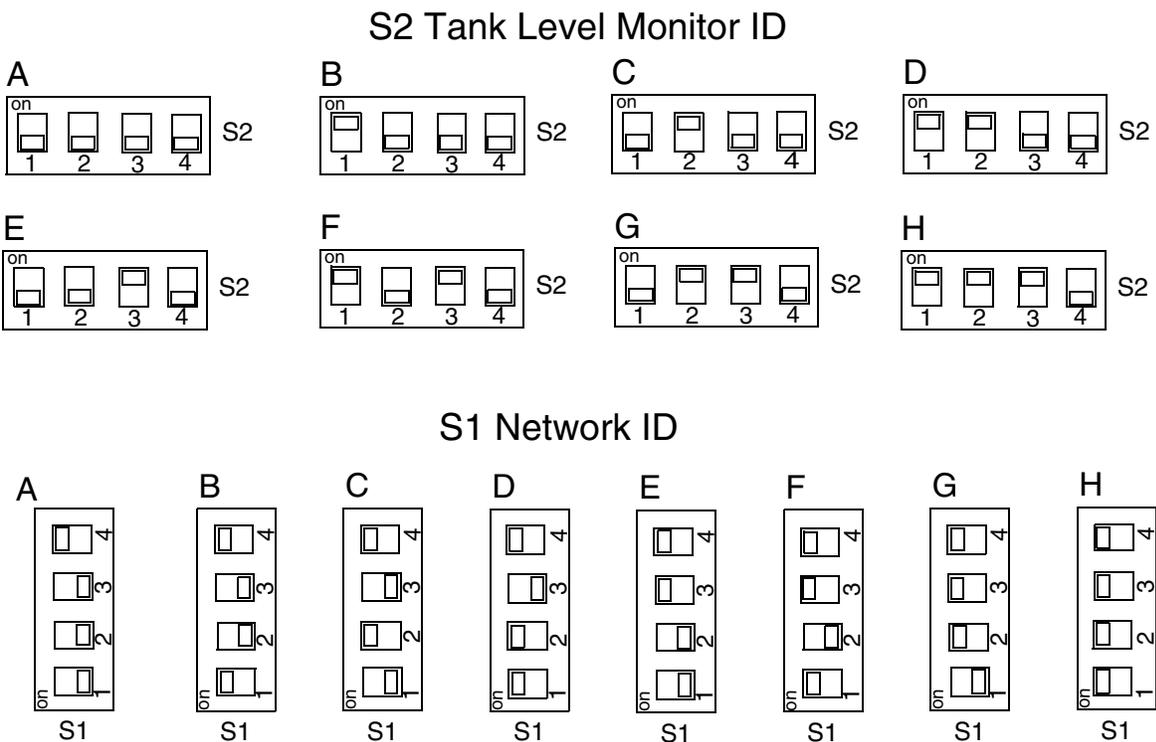


FIG. 4

## Programming Tank Level Monitors

Graco recommends that tank monitors be programmed **prior** to installation.

 The PC software allows a 5 minute period to program a Tank Level Monitor

To program the tank monitors:

- Load the Matrix software to the PC and set the Transceiver(s) dipswitches. Connect the Transceiver(s) to the PC using either RS232 or RS422 cable then supply power to the Transceiver.
  - The Matrix Tank Level Monitoring PC software must be at the Tank Monitor Setup screen and in program mode.
1. At the Matrix Setup screen on the PC, enter all the desired tank parameters and settings.
  2. After parameters are set, program each TLM in the system one at a time by clicking on the “Program” action on the Matrix Setup screen.
  3. Hold down the blue button (A) until the display (B) reads “Program Mode.” After 5 seconds the TLM will

display “Complete”. A pop-up window will appear on the PC screen indicating the TLM is programmed. See FIG. 5. Label the tank name and fluid name on the TLM. Repeat this procedure for each TLM in the system.

4. Press the blue TLM button (A) to reset the internal clock. If not done, the TLM will not read and report at the scheduled time(s). When the batteries require changing, it is not necessary to re-program the TLM, but the blue button (A) should be pushed to reset the internal TLM clock. If not done, the TLM will not report at the correct scheduled times. See *Instruction Manual 309501 PC Software Guide* or *Manual 309504 Tank Level Monitor Software Guide* for details.

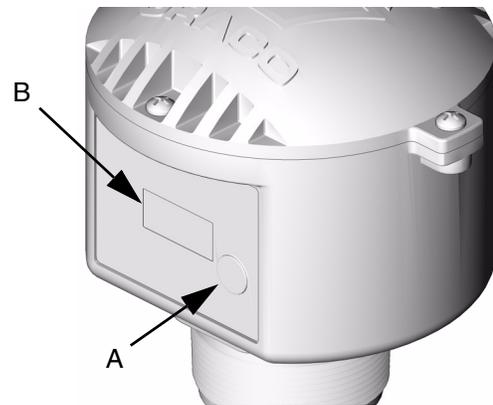


FIG. 5

## Installing Tank Level Monitor

### CAUTION

- **Do not over tighten tank level monitor into tank bung!** Over tightening can cause permanent damage and result in inaccurate readings.
- **Do not use thread sealant or adhesive!** Many of these products are chemically incompatible with the PC/ABS plastic.

1. Remove the 2 in. bung fitting and screw in the TLM hand-tight. **DO NOT** use a wrench to tighten as this may damage the TLM. Do not use thread lock adhesive as this may damage the TLM.
2. The TLM must be mounted within 2 degrees of the surface of the fluid. A level that measures degrees should be used. Place the level on the top of the pipe fitting on the tank. If outside the 2 degree specification, the fitting should be changed. Graco recommends that the height of the tank fitting should not exceed 1/2 in. (1.27 cm). The fitting height can be up to 2 in. (5.08 cm), provided the fitting is within 2 degrees of the surface of the fluid. Also, the taller the tank, the more critical the 2 degree specification becomes. See FIG. 6.

### CAUTION

The TLM will not operate correctly if tilted more than 2° from the surface of the tank liquid.

The TLM will not read properly when the fluid in the tank is agitated (i.e. filling a tank with oil or anti-freeze). Be sure to take all TLM readings when the fluid in the tank is calm.

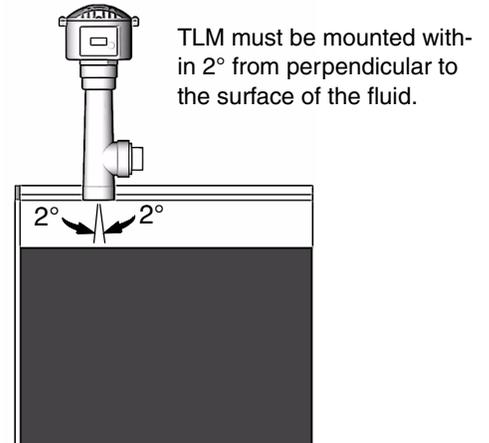


FIG. 6

### CAUTION

Do not install the TLM in the tank's fill port. Repeated removal of the TLM will damage the unit and void the warranty.

Port (D) is not to be used as a fill hole for oil deliveries. See FIG. 7.

The tank's breather port might be the only available location for mounting the TLM. The horizontal 2 in. npt port (D) can be used to accommodate the breather. The breather should be mounted in an upright position using a 90° elbow fitting.

 Do not use the horizontal port for routing pressure relief return tubes. This can result in inaccurate readings.

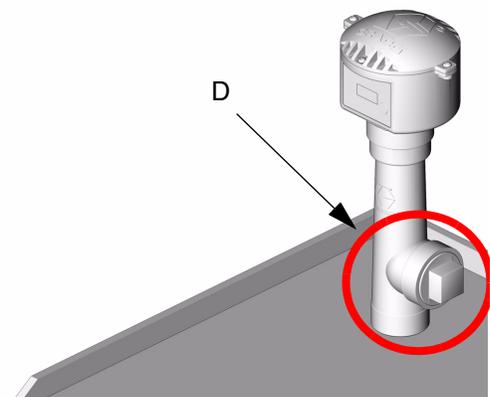


FIG. 7

# Operation

## Tank Level Data

The tank level monitor is equipped with an LCD display screen (B) and a display button (A). See FIG. 9.

The LCD display is used to view tank data. It displays:

**Battery Life** - the remaining life of the unit's batteries. Batteries should be replaced before the power remaining drops below 10%.



Battery life is dependent on the number of readings taken per day.

**Network ID and Transceiver ID** - displays the Network and Transceiver ID information for 2 seconds. This ID information relates to the dipswitch settings on the PC board of the TLM.

**Firmware** - TLM version displays current firmware revision.

**Fluid Level** - remaining inches or cm of fluid in the tank.

**Fluid Volume** - the volume of fluid remaining in the tank, based on the tank geometry defined during setup. The TLM can be programmed to display in either gallons or liters during programming of the TLM.



Vertical tanks use this capacity figure to calculate tank volume. Obround and cylindrical tanks use the tank dimensions to calculate tank volume.

**No RF Signal** - displays when the tank level monitor is **not** receiving an RF signal from the PC transceiver. If the tank monitor is receiving a signal or the signal is re-established, this screen will not appear. If "No RF Signal" appears, the fluid volume and battery life data is not being transmitted or updated at the PC. This may take up to 15 seconds to display.

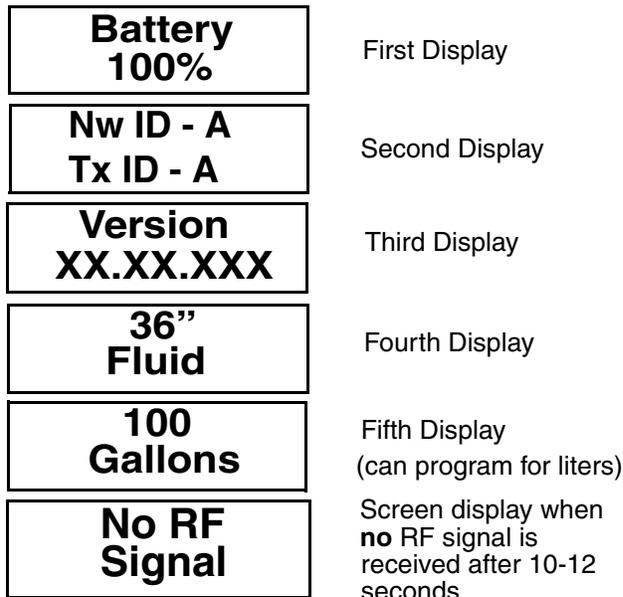


FIG. 8: Example Display



After tank re-fill from an oil distributor or waste oil tank is emptied from a waste oil service provider, press the blue button on the TLM to ensure the TLM will maintain the most current tank volume status. If button is not pushed, the TLM will automatically read correctly at the next scheduled tank reading.

## Daylight Saving Time (DST) Change

The PC software automatically changes the PC time when daylight saving time changes occur (Spring and Fall).

When this happens the Matrix software displays a pop-up screen instructing the administrator to re-boot the Matrix PC. This changes the Matrix clock to match the PC clock.

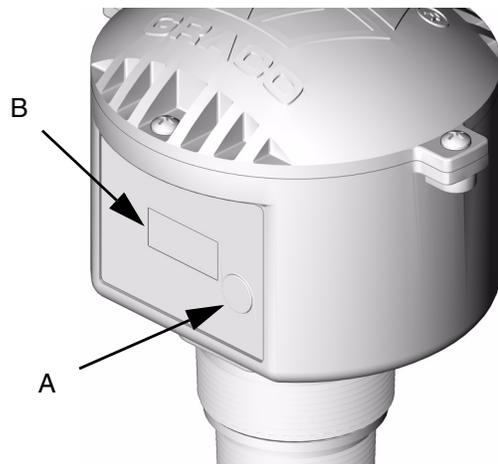


The first TLM reading will be 1 hour earlier or later (depending on the Spring or Fall daylight saving time change), but all subsequent TLM reading will be accurate.

## Viewing Data

Press and release the blue display button (A). See FIG. 9. Displays appear (B), each lasting a few seconds before going on to the next screen. See FIG. 9.

 Tank Level data can be viewed remotely at the PC, using the Matrix software. See *Instruction Manual 309501 PC Software Guide* or *Manual 309504 Tank Level Monitor Software Guide* for details.



**FIG. 9**

If the TLM reading is outside of the programmed size parameters, the LCD display will show "Invalid Reading." See FIG. 10.

**Invalid  
Reading**

**FIG. 10**

# Troubleshooting

Problem	Cause	Solution
Brand new monitor's display is very dim.	Unit is shipped with protective coating over display.	Remove protective coating.
Monitor displays "Invalid Reading".	The TLM reading is outside of the programmed size parameters.	Verify the programmed parameters and re-program the TLM if necessary.
Monitor will not program.	Incorrect COM port selected for transceiver.	Ensure correct COM port is selected.
	Transceiver is not powered-up.	Verify transceiver is powered-up
	Attempt to program while red lights on transceiver are lit.	Wait until red lights on transceiver go blank before attempting to program.
	Transceiver dipswitches not set correctly.	Ensure transceiver dipswitches are set for appropriate communication cable.
	PC is not in program mode.	Ensure PC is in program mode.
	PC program window has expired.	The PC software allows a 5-minute period to program a TLM.
	TLM dipswitches settings do not match transceiver settings.	Verify settings with Transceiver (see page. 6 for dipswitch setting instructions).
	Out of RF range. RF obstruction.	Reposition Transceiver until TLM has good RF communication.
	Weak or dead batteries.	Replace batteries. See <b>Determining what settings to use</b> , page 4.
	Microprocessor not completely shut down before installing new batteries.	After you have removed old batteries, wait 30 seconds to ensure the microprocessor has completely shut down, before installing new batteries.
	RF antenna is flattened or out of position inside the TLM.	Position antenna wire to suspend above the circuit board. See 7, page 5.
Monitor has intermittent RF communication	Out of RF range. RF obstruction.	Reposition Transceiver until TLM has good RF communication.
	Two TLMs are programmed to the same address.	Verify that each TLM is correctly programmed to a unique address.
	Weak or dead batteries.	Replace batteries. See <b>Determining what settings to use</b> , page 4.

Problem	Cause	Solution
Monitor is not reporting scheduled readings.	Out of RF range. RF obstruction.	Reposition Transceiver until TLM has good RF communication.
	Two TLMs are programmed to the same address.	Verify that each TLM is correctly programmed to a unique address.
	Weak or dead batteries.	Replace batteries. See <b>Determining what settings to use</b> , page 4.
	Microprocessor not completely shut down before installing new batteries.	After you have removed old batteries, wait 30 seconds to ensure the microprocessor has completely shut down, before installing new batteries.
	Tank Level Monitor was not programmed after scheduled times were entered into software.	Reprogram Tank Level Monitor.
	Reading is scheduled when pump is operating.	Ensure readings are scheduled at times that the pump is not operating.
	Clock was changed on PC but the monitor was not reprogrammed.	The monitor's internal clock is synchronized with the PC clock upon programming. Manipulating the scheduled reporting time by changing the PC clock will cause a false indication that the monitor is not reporting at the scheduled reporting times.
Monitor will not take reading when blue button is pressed.	Weak or dead batteries.	Replace batteries. See <b>Determining what settings to use</b> , page 4.
	Batteries are not correctly seated.	Ensure the batteries fully engage the mounting clips by pushing on the bottom of each battery with your thumbs.
	Microprocessor not completely shut down before installing new batteries.	After you have removed old batteries, wait 30 seconds to ensure the microprocessor has completely shut down, before installing new batteries.
	Monitor display is cracked.	Replace monitor display.
Monitor readings are inaccurate.	Tank geometry incorrectly defined.	See <i>Instruction Manual 309504 Tank Level Monitor Software Guide</i> or <i>manual 309501 PC Software Guide</i> for details.
	Tank Level Monitor has not been reprogrammed with latest adjustments made within Tank Setup screen of the software.	Reprogram Tank Level Monitor.
	Two TLMs are programmed to the same address.	Verify that each TLM is correctly programmed to a unique address.
	Fluid surface is moving while reading is being taken.	Ensure pump is not operating and that nothing is disturbing the surface of the fluid during readings.
	Pipe adapters installed in the tank bung.	Ensure there are no adapters installed in the tank bung.
	Tank Level Monitor is not perpendicular to top of fluid.	Level tank so that it is perpendicular to top of the fluid and/or realign Tank Level Monitor.
	Inside tank obstruction.	Install in different tank bung to avoid tank obstruction.

# Service

Once the Tank Level Monitor has been installed, no additional maintenance or service is necessary, with the exception of replacing batteries.

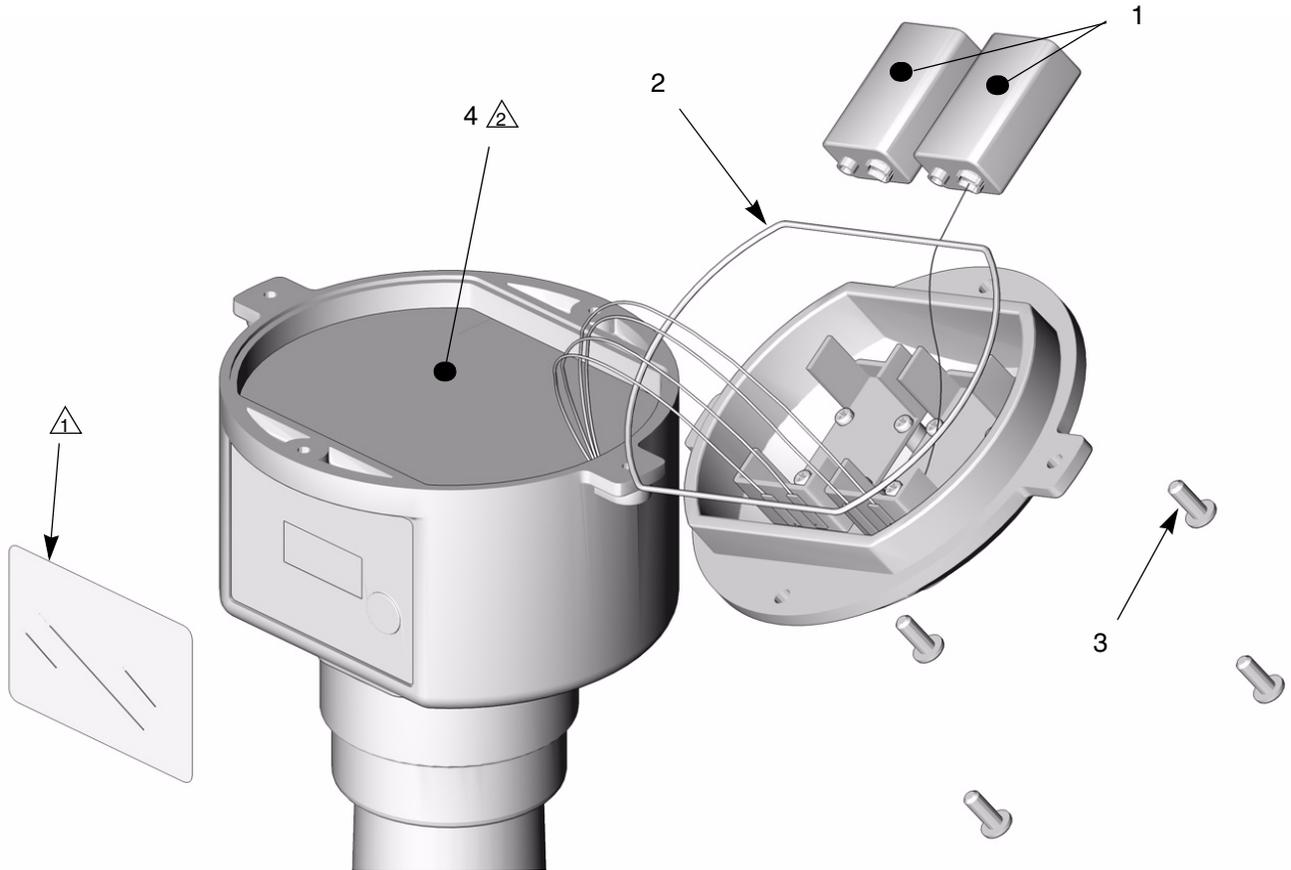
## Replacing Batteries

When the tank sensor or PC battery indicator shows that replacement of batteries is needed (before power drops below 10%), replace the TLM batteries as follows:

1. Remove the four tank monitor cover screws.
2. Replace the batteries using alkaline 9v batteries. Be sure the batteries fully engage the mounting clips by pushing on the bottom of the batteries with your thumbs.
3. Replace the cover and tighten the four cover screws.

# Parts

## 119274 (N.A.), Tank Level Monitor 120105 (Australia), Tank Level Monitor



⚠ Remove protective cover used for shipping before programming.

⚠ Do not remove. This is required to maintain intrinsic safety approval.

Ref. No.	Part No.	Description	Qty	Ref. No.	Part No.	Description	Qty
1		BATTERY, 9V (purchase locally)	2	3	117467	SCREW, self tapping, HI-LO, #10-16 x 9/16	4
2	112343	O-RING	1	4	117743	FOAM, insulator	1

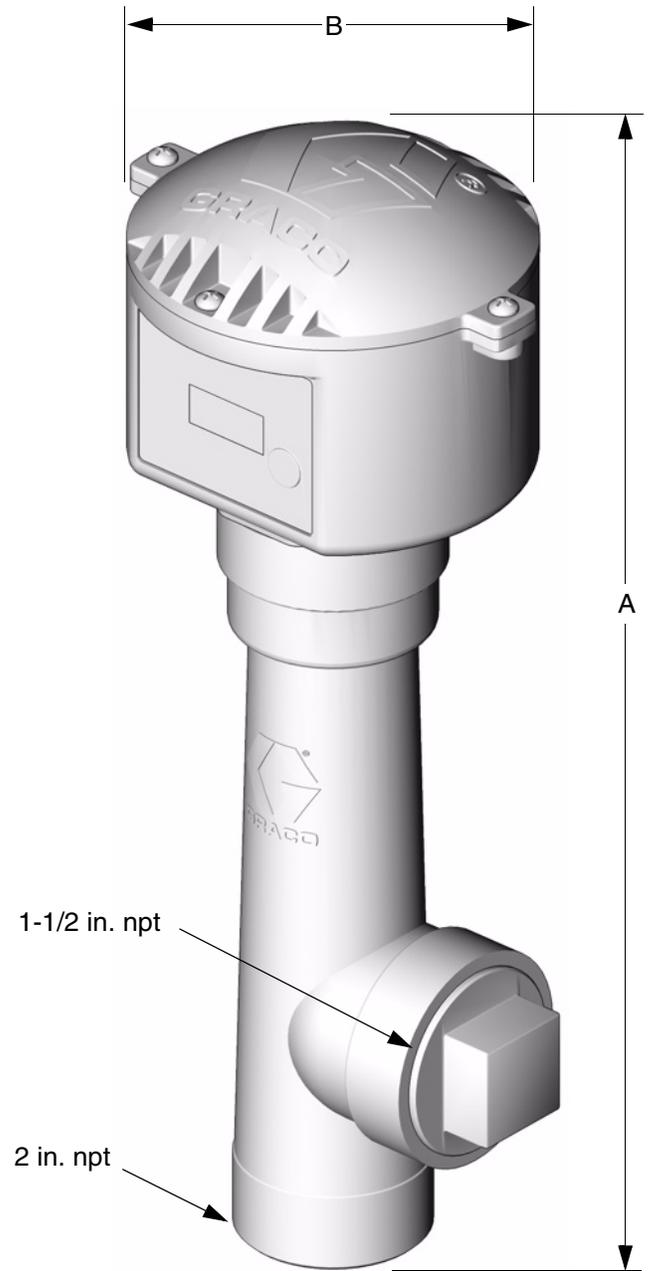
# Technical Data

Ultrasonic Tank Depth Measurement range	0 - 30 ft. (0 - 9 m) Not for use in pressurized tanks.
Fluid Level Measurement Accuracy	+/- 0.5%
Mounting	Standard 2 in. (npt) bung.
Height above tank for TLM and tube mounting	15 in. (30.48 cm).
TLM Mounting Tube and Tank Vent	Graco recommends venting the tank separately from the TLM. If not possible, the TLM mounting and vent function can be combined if required for tanks with one hole in tank.
Weight (with batteries installed)	2.34lb. (1.06 g)
Operating Temperature Range	-22° F to 185° F (- 30° C to 85° C) Note: Display will not function below 32°F (0°C).
RF Operating Temperature Range	-40°F to 185°F (-40°C to 85°C)
Storage Temperature Range	-40°F to 185°F (-40°C to 85°C)
Batteries	Two 9V alkaline
Battery Life	1.5 years
Enclosure	IP65
Intrinsic Safety	<p>Intrinsically safe Exia for use in Class I, Division 1, Group D Hazardous Locations when used with (2) 9-volt alkaline batteries.</p> <ul style="list-style-type: none"> <li>• Ambient temperature range -22°F to 122°F (-30°C to 50°C).</li> <li>• Temperature Code: T3.</li> </ul> <p> The Matrix TLM is not to be used with materials with an auto ignition below 392°F (200°C).</p>
RF Communication	902-928 MHz frequency hopping, spread-spectrum (N.A.). 915-928 MHz frequency hopping, spread-spectrum (Australia).
Totally Unobstructed RF Communication Range (based on TLM and Transceiver mounting and RF environment)	1/4 mile / 1320 ft (.4 km / 402.3 m)
Unobstructed RF Communication Range (based on building construction and RF environment)	300-500ft (91.0-152.0)
Obstructed RF Communication Range (based on building construction and RF environment)	250-300ft (76.2-91.0 m)
Tank Geometry	<p>Vertical walled tanks, cylindrical tanks, and obround tanks.</p> <ul style="list-style-type: none"> <li>•Vertical Tanks <ul style="list-style-type: none"> <li>Maximum Volume 999,999 gallons or liters</li> <li>Maximum Height 30ft. (360 in.)</li> </ul> </li> <li>•Cylindrical Tanks <ul style="list-style-type: none"> <li>Maximum Volume 999,999 gallons or liters</li> <li>Maximum Diameter 30ft. (360 in.)</li> <li>Maximum Length Unlimited</li> </ul> </li> </ul>
Approvals	FCC, Industry Canada (IC), UL, cUL
Conformity (For 120105)	ACMA (Australia)

**NOTE:** FCC and IC approvals are for the RF device contained in the Matrix Tank Level Monitor (TLM).

# Dimensions

- A** 9.1 in (231 mm)
- B** 4.9 in. (124 mm)



# Graco Standard Warranty

Graco warrants all equipment manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twenty-four months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

**THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale Graco makes no warranty, and disclaims all implied warranties of merchantability and fitness for a particular purpose in connection with accessories, equipment, materials or components sold but not manufactured by Graco. These items sold, but not manufactured by Graco (such as electric motors, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

In no event will Graco be liable for indirect, incidental, special or consequential damages resulting from Graco supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of Graco, or otherwise.

## **FOR GRACO CANADA CUSTOMERS**

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# Graco Phone Numbers

**TO PLACE AN ORDER**, contact your Graco distributor or call to identify the nearest distributor.

**Phone:** 612-623-6928 **or Toll Free:** 1-800-533-9655, **Fax:** 612-378-3590

*All written and visual data contained in this document reflects the latest product information available at the time of publication.  
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This manual contains English. MM 309500

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