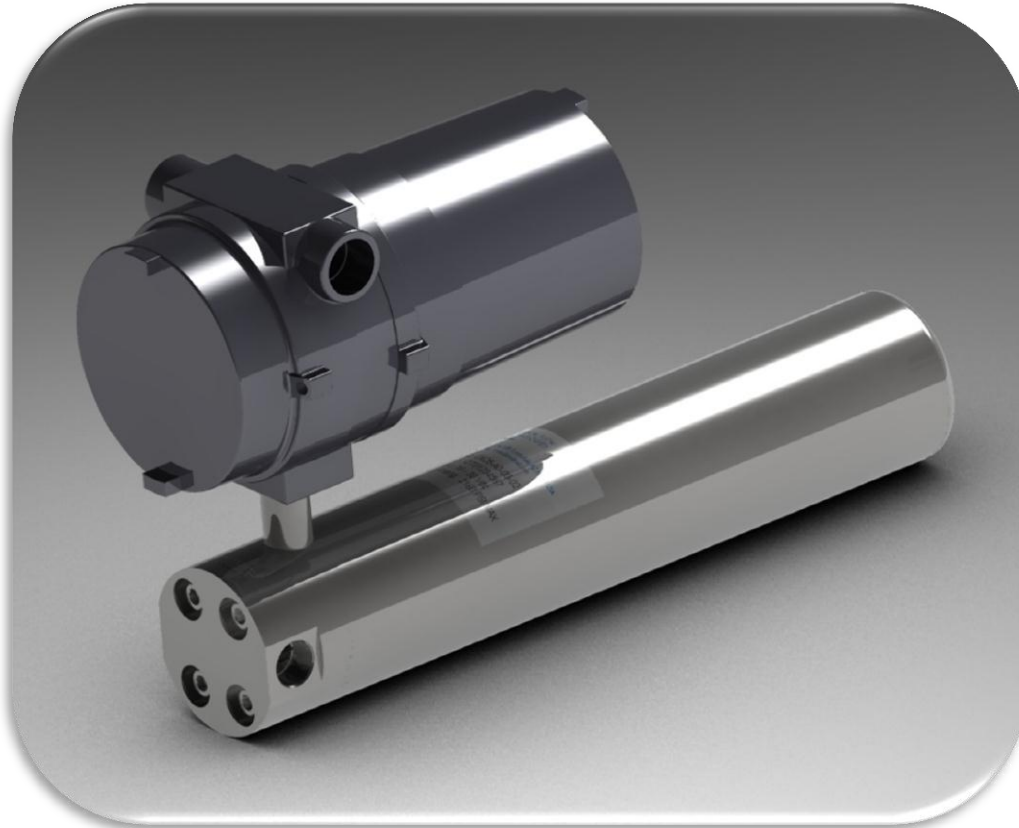


# DENSITRAK®

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## DENSITRAK® D625 OPERATION MANUAL

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*MADE AND ASSEMBLED IN THE USA*

THIS MANUAL CONTAINS VALUABLE INFORMATION - DO NOT DISCARD

**P/N 101159-REV B**



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*INTRODUCTION*

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We sincerely **THANK YOU** for your purchase of an ANALYTICAL FLOW TECHNOLOGIES DENSITRAK® D625 Density Meter (Henceforth, D625).

This manual is intended for the personnel responsible for the installation, operation and/or maintenance of the ANALYTICAL FLOW TECHNOLOGIES D625 density meter.

This manual explains the following topics:

- Safety and Precautions
- Brief History of ANALYTICAL FLOW TECHNOLOGIES
- Principle of Operation
- Specifications
- Features and Benefits
- Installation
- Operation
- Maintenance
- Field Density Output Correction (Error offset)
- Troubleshooting

Carefully read this manual prior to installation and operation of this meter to ensure safe and proper operation.

Do NOT discard this manual - Always keep it in a place where you can access it for quick reference. If you lose or require additional copies of this manual refer to the ANALYTICAL FLOW TECHNOLOGIES website ([www.densitrak.com](http://www.densitrak.com)) for a PDF version.

Carefully read ALL Safety Precautions and Important Notes prior to installation and operation of this meter.

*THE ANALYTICAL FLOW TECHNOLOGIES D625 MODEL DENSITY METER CAN BE UTILIZED IN MANY VARIOUS FLUID DENSITY MONITORING APPLICATION, SUCH AS:*

- Water and Wastewater Treatment
- Petroleum Refinery and Pipeline Applications
- Fluid Product Blending & Interface Detection
- Pulp & Paper Manufacturing
- Chemical Processing
- Power Generation
- ...and many more

## IMPORTANT SAFETY INFORMATION

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### SAFETY CAUTIONS



**SYSTEM PRESSURE:** Do NOT expose meter to pressure greater than the meter and/or flange rating – whichever is lowest.  
Do NOT pressure test meter above 1.5 x operating pressure.



**MATERIAL COMPATIBILITY:** Do NOT expose the meter wetted parts to fluids (chemicals) that are NOT COMPATIBLE with the materials of construction. Consult ANALYTICAL FLOW TECHNOLOGIES engineers with any questions regarding material compatibility.



**EXPLOSION HAZARD:** The cables and fittings provided with this meter are not certified for use in hazardous or explosive environments unless specifically noted on the meter and electronics enclosure.



**HEAVY OBJECT:** Handle the meter with care and request assistance when lifting, moving or installing.  
Dropping the meter can cause injuries and/or equipment failure.



**ELECTRICAL HAZARD:** Remove power source prior to installation or maintenance of the density meter.  
Ensure that all electrical connections and or maintenance are performed by properly qualified personnel.



**ENVIRONMENT:** DO NOT operate meter in situations where continuous line vibration is greater than 0.5g.

### IMPORTANT NOTES



**INSTALLATION:** Do not install the meter in situations where:  
 Meter is exposed to excessive vibration  
 Meter can become submerged in water or other fluids  
 Meter can come in contact with corrosive materials  
 Meter is hard to access for periodic maintenance



**PROCESS FLUIDS:** All process fluids must be compatible with the wetted parts of the meter.



**TRANSPORTATION:** NEVER transport the meter with hazardous fluids still entrapped in the meter or process connections.

Please notify ANALYTICAL FLOW TECHNOLOGIES of the process fluids utilized in the meter prior to returning to the factory for repair or service.

A CLEANING FEE applies to ALL METERS returned to ANALYTICAL FLOW TECHNOLOGIES that have not been thoroughly cleaned prior to return.

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## HISTORY OF ANALYTICAL FLOW TECHNOLOGIES

The DENSITRAK® D625 liquid density meter was ORIGINALLY designed by Calibron Systems, Inc. of Scottsdale, AZ. Calibron Systems, Inc. was eventually acquired by Honeywell Enraf. Honeywell Enraf licensed the exclusive rights for manufacture and service of the DENSITRAK® meter to Analytical Flow Technologies in March 2010.

Analytical Flow Technologies is owned and operated by Paul Heinritz, who has a long relationship with the DENSITRAK® Densitometer in which he ran the DENSITRAK® product line for Calibron Systems, Inc. and briefly for Honeywell Enraf prior to the DENSITRAK® production move to Pune, India. Analytical Flow Technologies emphasizes American-Made products, along with high quality customer service and support to differentiate itself from the large corporation alternatives.

## THEORY OF OPERATION

The liquid density meter uses the spring mass principle for measuring the fluid density. A portion of the measurement tube is energized (transmit sensor) to vibrate and to maintain its natural resonant frequency by using an electrical feedback driving system. A change in the vibrating mass, (as a result of change in the fluid density) shifts the resonant frequency which is interpreted by the receive sensor. The signal is then output to the density processing unit via the rear mount electrical connector.

An ANALYTICAL FLOW TECHNOLOGIES density processing unit uses algorithms that incorporate temperature (integrated into the meter), pressure (via an external pressure transmitter 4-20mA output) and the shift in frequency to determine the density of the measured fluid.

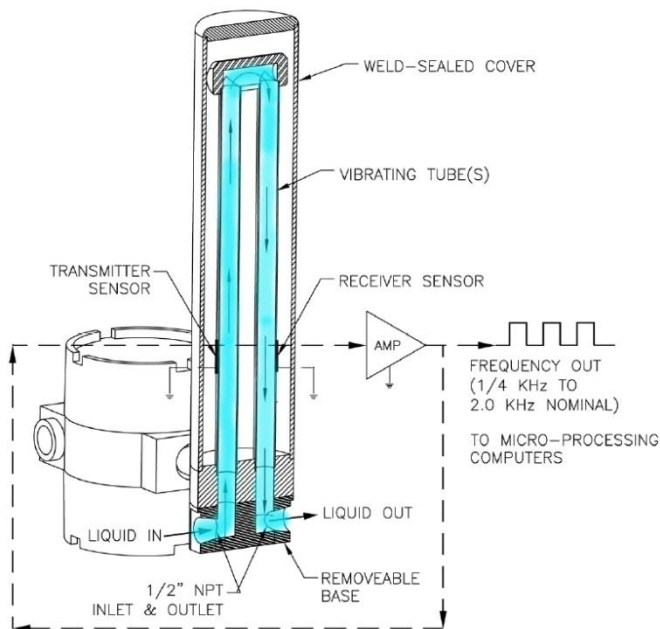


FIGURE 1: CUTAWAY VIEW - DENSITRAK D625 VIBRATING TUBE DENSITOMETER



## DENSITY EQUATIONS

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A simple definition for Density (for a homogeneous object) is the mass of the object divided by the volume of the object. Thus, common units of fluid density are grams per cubic centimeter, kilograms per cubic meter, and pounds per cubic foot.

The hydrometer is probably the most common device used to measure fluid density in which it measures the volume displaced by an object of known mass. The pycnometer is another instrument used for measuring fluid density. However, these devices are mainly restricted for use in laboratories. Another instrument used to determine the density of a liquid or a gas is the oscillating U-tube digital density meter. The U-tube digital density meter is installed in a process flow system where it continuously monitors “real-time” fluid density.

The oscillating U-tube is a method to determine the density of liquids based on an electronic measurement of the frequency of oscillation. The density value is calculated by incorporating frequency of oscillation, fluid temperature and pressure. The equations shown below are utilized by the density processor or flow computer to determine the density of the fluid flowing through the meter.

### EQUATION 1: UNCORRECTED (PERIODIC) DENSITY EQUATION

$$D_U = K_0 + (K_1 * T) + (K_2 * T^2)$$

- $D_U$  = Density of the fluid based on the periodic time (frequency of oscillation) of the meter. It is UNCORRECTED for Temperature and Pressure. Unit = grams per cubic centimeter [gr/cm<sup>3</sup>]
- $T$  = Periodic Time (frequency of Oscillation) of the density meter. Unit = microseconds [μs]
- $K_0, K_1, K_2$  = Density Coefficients. These coefficients vary for each meter and are determined at the factory during the meter calibration process. Refer to the Calibration Certificate included with your meter.

### EQUATION 2: TEMPERATURE CORRECTED DENSITY EQUATION

$$D_T = D_U + K_{Tv}[D_U * (T_F - T_C)] + K_{T0} * (T_F - T_C) + K_{T1} * (T_F - T_C)^2$$

- $D_U$  = Uncorrected Density, [gr/cm<sup>3</sup>]
- $D_T$  = Temperature Corrected Density, [gr/cm<sup>3</sup>]
- $K_{Tv}, K_{T0}, K_{T1}$  = Temperature Correction Density Coefficients – included with Calibration Certificate.
- $T_F$  = Live fluid temperature in degrees Fahrenheit [°F]
- $T_C$  = Reference temperature in degrees Fahrenheit [°F]

### EQUATION 3: PRESSURE CORRECTED DENSITY EQUATION

$$D_{PT} = D_T + K_{Pv} * D_T * P + K_{P0} * P + K_{P1} * P^2$$

- $D_{PT}$  = Pressure & Temperature corrected Density, [gr/cm<sup>3</sup>]
- $D_T$  = Temperature Corrected Density, [gr/cm<sup>3</sup>]
- $K_{Pv}, K_{P0}, K_{P1}$  = Pressure Correction Density Coefficients – included with Calibration Certificate.
- $P$  = Live pressure in Pounds per square inch [PSI<sub>G</sub>]

## PRODUCT SPECIFICATIONS

### ANALYTICAL FLOW TECHNOLOGIES D625 Product Specifications Chart

Density Operating Range	0.40 – 2.00 grams/cubic centimeter [gr/cm <sup>3</sup> ]
Maximum Density Span	0.70 gr/cm <sup>3</sup> (range can be extended with reduction in accuracy)
Density Resolution	0.0001 gr/cm <sup>3</sup>
Meter Accuracy	0.0001 gr/cm <sup>3</sup>
Repeatability	Better than 0.01%
Operating Temperature	Standard: 50°F to 140°F [10°C - 60°C] Optional: 32°F to 203°F [0°C - 95°C]
MAX Temp. Differential	$\Delta T_{\max} = 90^{\circ}\text{F}$ [50°C]
Operating Pressure	Range: 0 to 2,220 PSI [0 – 149 bar] ANSI Flanged same as flange rating at 100°F Hydrostatic Test: 1.5 times line pressure
Flow Rate	MIN: .25 Gallons per Minute (GPM) MAX: 30 GPM
Frequency Signal Output	Nominal 0.30 kHz to 3.0 kHz
Temperature Sensor	3 Wire 100Ω Pt RTD
Power Requirement	VOLTAGE: 24 V <sub>DC</sub> CURRENT: 30 – 50 mA nom.
Materials of Construction	Standard Wetted Parts: 316/316L Stainless Steel, HASTELLOY® C276 Non-Wetted Parts: 304 Stainless Steel
Electrical Classification	Designed to meet NEC/CSA Class 1, Div. 1, Group C & D, CE Mark Housing Approved: CSA, FM, EExd, UL RoHS Compliant
Physical Dimensions	SEE APPENDIX DRAWING Shipping Weight: Approx. 16 pounds

## BENEFITS AND FEATURES

The ANALYTICAL FLOW TECHNOLOGIES D625 density meter offers a multitude of design features which greatly benefit the customer while also maintaining an affordable price.

BENEFITS	FEATURES
<ul style="list-style-type: none"> <li>• <b>Small, compact design</b></li> <li>• <b>Free draining/lower pressure drop</b></li> <li>• <b>Safe design integrity.</b></li> <li>• <b>Temperature compensated density.</b></li> <li>• <b>Detects small density changes.</b></li> <li>• <b>No radioactive source.</b></li> <li>• <b>Quick connect can be installed or moved easily.</b></li> <li>• <b>Suitable for narrow range applications.</b></li> <li>• <b>Made &amp; Assembled in the USA</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Small, compact design.</b></li> <li>• <b>No moving parts.</b></li> <li>• <b>Dynamic calibration.</b></li> <li>• <b>Outer shell pressure rated above operating pressure.</b></li> <li>• <b>Integral 3 wire RTD.</b></li> <li>• <b>High resolution.</b></li> <li>• <b>Non-nuclear.</b></li> <li>• <b>RoHS Compliant.</b></li> </ul>

## UNPACKING

Please verify that ALL of the STANDARD items listed below were included in the meter package.

Use check box to verify.

Item	Qty
<input type="checkbox"/> D625 Density Meter Housing	1
<input type="checkbox"/> Density Processor (DP) Electrical Housing	1
<input type="checkbox"/> Process Connection Flange(s)	1
<input type="checkbox"/> VITON® O-Rings	2
<input type="checkbox"/> Flange Bolts (3/8"-16 x 2)	4
<input type="checkbox"/> Anti-seize Compound (tube)	1
<input type="checkbox"/> Laminated Calibration Certificate (w/ Calibration Coefficients)	1
<input type="checkbox"/> Certificate of Conformance	1
<input type="checkbox"/> USER MANUAL / SOFTWARE <sup>1</sup>	1

<sup>1</sup> MANUAL AND SOFTWARE/FIRMWARE ARE AVAILABLE FOR DOWNLOAD AT [www.densitrak.com](http://www.densitrak.com)

## INSTALLATION

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Proper installation is crucial to the overall performance of the D625 Density Meter. The accuracy of the meter can be adversely affected by improper installation.

To ensure meter accuracy it is imperative that the items listed below be considered prior to installation of the meter into the system.

Also note that there must be some scheme present in the process flow system to induce sufficient flow through the meter. Refer to the Process Connections section for more detail.

## INSTALLATION PLANNING

---

Prior installation planning is critical for the best metering results. The table below outlines a “checklist” of important items for proper installation planning.

### PERFORMANCE - Installation Planning Checklist

<input type="checkbox"/>	All joints and couplings are airtight – GAS Bubbles in process fluid must be avoided
<input type="checkbox"/>	Meter is connected at a sufficient (> 5ft) distance from fluid pump
<input type="checkbox"/>	Pump (if applicable) is oriented so that it pushes fluid through the meter – NOT Pulls
<input type="checkbox"/>	Avoid vibration from surrounding equipment
<input type="checkbox"/>	Fluid should be at sufficient flow rate (> 1 GPM) with little or no cavitations as it enters the meter
<input type="checkbox"/>	Avoid installing in an environment with quick and extreme temperature changes. ALWAYS consider the use of an insulation jacket for OUTDOOR Installations.
<input type="checkbox"/>	Avoid mounting in direct sunlight or near surfaces with extremely high temperatures.
<input type="checkbox"/>	Refer to the meter dimensions prior to choosing a suitable location

### SAFETY - Installation Planning Checklist

<input type="checkbox"/>	Ensure SAFE & PROPER handling of the meter during installation
<input type="checkbox"/>	Do NOT drop the meter or expose to extreme impacts
<input type="checkbox"/>	Adhere to all LOCAL electrical safety regulations
<input type="checkbox"/>	Only trained personnel should be allowed to install or maintain the meter
<input type="checkbox"/>	Verify that the process fluid is compatible with the wetted material of the density meter

MAINTENANCE - Installation Planning Checklist

- Mount meter in an area that provides sufficient space for proper piping and process connections
- Installation of a BYPASS and Valves should be considered between the meter and process connections to facilitate easy removal for periodic maintenance
- Plan an adequate location for the REMOTE ELECTRONICS (if applicable) enclosure.

Once you've fully planned your installation, the next step is to unpack and assemble your D625 meter.

INSTALLATION DIMENSIONS

The diagrams below outline the overall mounting dimensions for the D625 Density Meter. Please take these dimensions into consideration. All dimensions shown are in INCHES. Weight is approximately 16 pounds empty of fluids. ALL DIMENSIONS ARE SUBJECT TO CHANGE

TOP-VIEW DIMENSIONS

All dimensions shown are in INCHES.

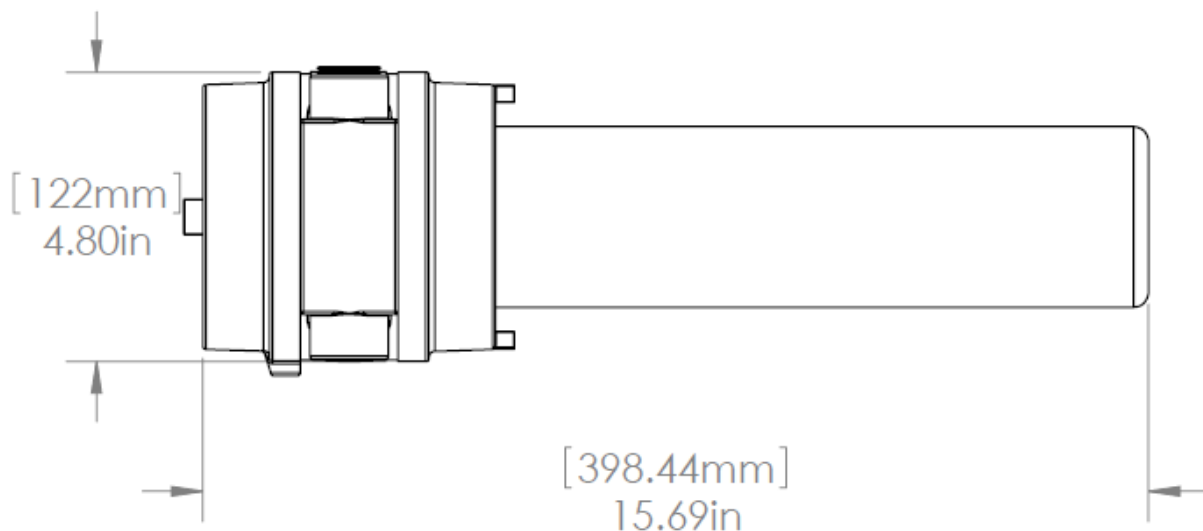


FIGURE 2: DENSITRAK D625 - TOP VIEW - DIMENSIONS

FRONT-VIEW DIMENSIONS

All dimensions shown are in INCHES.

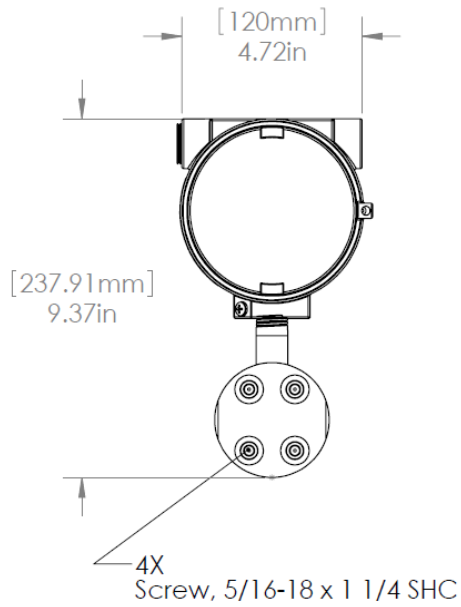


FIGURE 3: DENSITRAK D625 – FRONT VIEW - DIMENSIONS

SIDE-VIEW DIMENSIONS

All dimensions shown are in INCHES.

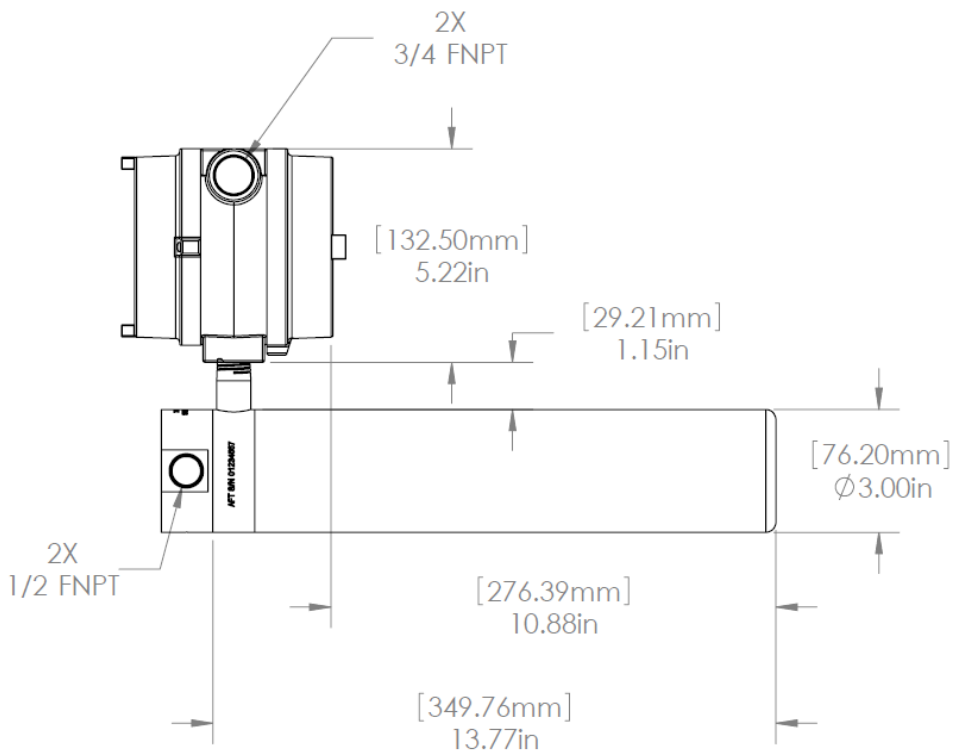


FIGURE 4: DENSITRAK D625 – SIDE VIEW - DIMENSIONS

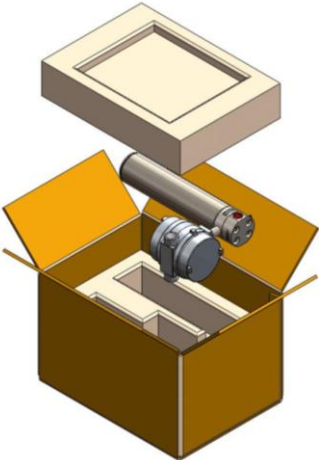
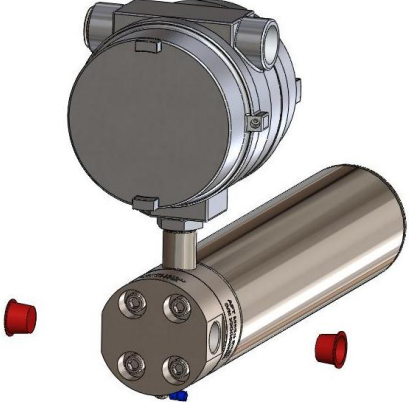
## METER ASSEMBLY

The D625 is shipped to the customer essentially fully assembled. The customer must simply attach the INLET and OUTLET flow connections and the electrical cable gland and make the proper electrical connections.



**ANTI-SEIZE LUBRICANT:** Each DENSITRAK D625 ships with a small tube of anti-seize lubricant. Ensure that all threaded connections are coated with a layer of anti-seize lubricant unless the threaded connection already utilizes Teflon tape.

The following table will guide you through the initial meter assembly and installation.

	
<p>Unpack the D625 meter from the shipping container. Determine a suitable mounting location for the meter and density processor housing before beginning assembly.</p>	<p>Remove the two protective PLUGS from the flange 0.5FNPT Fittings. Ensure the internal NPT ports are free of debris.</p>
<p>Install the meter into your Fluid Processing System:</p> <ul style="list-style-type: none"> <li>• Ensure that your piping configuration maintains a consistent flow rate</li> <li>• Try to minimize ambient vibration from the system and flow pumps – excessive vibration can adversely affect meter performance</li> </ul>	




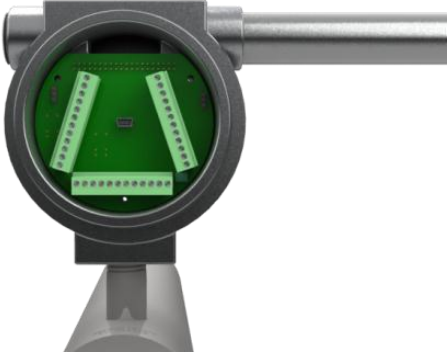
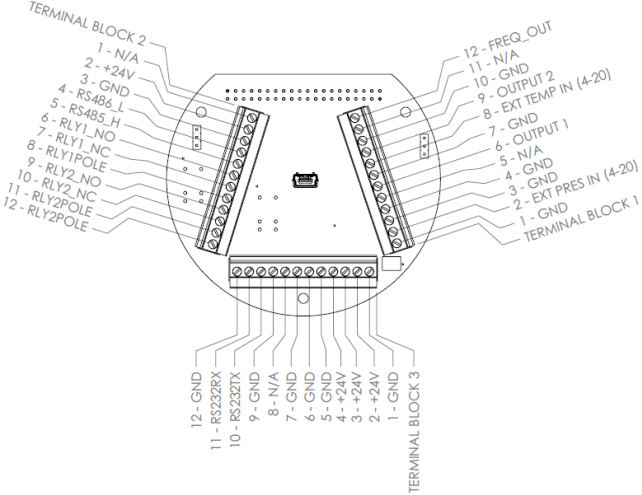
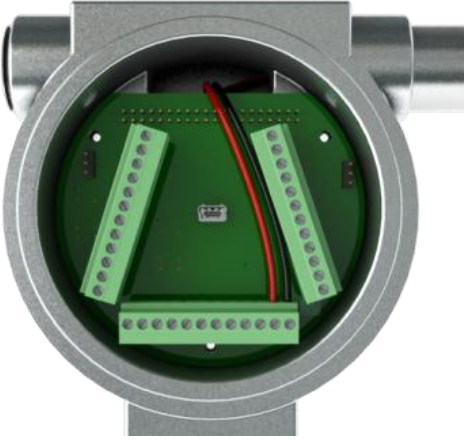
- KEEP THE PACKAGING OR PROTECTIVE CAPS IN THE EVENT THE METER NEEDS TO BE RETURNED FOR SERVICE
- DO NOT DISCARD THE LAMINATED CALIBRATION CERTIFICATE

Once the meter is securely mounted in an appropriate location the next step is to connect the electronics.

## D625 METER – ELECTRICAL CONNECTIONS




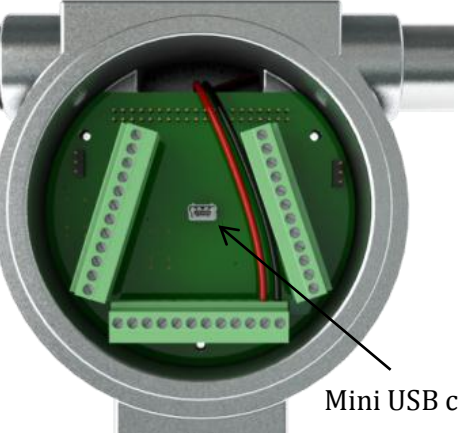
Electrical connections to the D625 meter are very simple – you simply supply DC power (+24 V<sub>DC</sub>) to the Electronics Package and connect the 4-20mA output (or Frequency output if no processor is selected) of the electronics package to your controls.

### MODEL D625 EX-PROOF ENCLOSURE ELECTRICAL CONNECTIONS



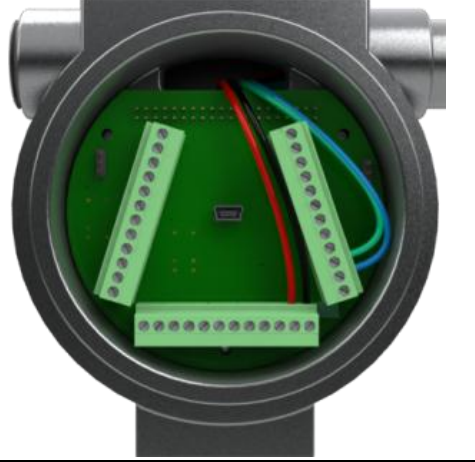

 <p>Remove the ELECTRICAL ENCLOSURE COVER, and the 3/4 "NPT PLUG from the electronics assembly.</p>	 <p>Connect your electronic cabling to the meter via cable gland to either of the 3/4 " FNPT ports located on either side of the enclosure.</p>
 <p>The customer interface board terminal block wiring locations are shown above. Each interface will be described in detail in the following steps.</p>	 <p>To power the meter, connect ground to terminal block 3 pin 1 (black) and +24 VDC to terminal block 3 pin 2 (red).</p>



MODEL D625 EX-PROOF ENCLOSURE ELECTRICAL CONNECTIONS  
COMMUNICATE WITH AND CONNECTING TO METER OUTPUTS

	
<p>To collect data from the meter make the following connections (to change output 1 and 2 refer to software manual);</p> <ol style="list-style-type: none"> <li>1. Frequency (4-20mA) to terminal block 1 pin 12 (blue)</li> <li>2. Output 1 (Density 4-20mA) to terminal block 1 pin 6 (purple)</li> <li>3. Output 2 (Fluid Temp 4-20mA) to terminal block 1 pin 9 (purple)</li> <li>4. Ground to terminal block 1 pin 10 (green)</li> </ol>	<p>To communicate with the meter through RS232 make the following connections;</p> <ol style="list-style-type: none"> <li>1. RS232RX to terminal block 3 pin 11 (blue)</li> <li>2. RS232TX to terminal block 3 pin 10 (yellow)</li> <li>3. Ground to terminal block 3 pin 12 (green)</li> </ol>
	 <p>Mini USB connector</p>
<p>To communicate with the meter through RE485 make the following connections;</p> <ol style="list-style-type: none"> <li>1. RS485_L to terminal block 2 pin 4 (blue)</li> <li>2. RS485_H to terminal block 2 pin 5 (yellow)</li> <li>3. Ground to terminal block 2 pin 3 (green)</li> </ol>	<p>To communicate with the meter through USB connections, connect directly to the mini USB connector in the center of the customer interface board.</p>

MODEL D625 EX-PROOF ENCLOSURE ELECTRICAL CONNECTIONS  
CONNECTING TO METER INPUTS

	
<p>To input external temperature (4-20mA) into the meter make the following connections;</p> <ol style="list-style-type: none"> <li>1. External TEMP(+) to terminal block 1 pin 8 (yellow).</li> <li>2. Ground to terminal block 1 pin 7 (green).</li> </ol>	<p>To input external temperature <b>Loop Type</b> (4-20mA) into the meter make the following connections;</p> <ol style="list-style-type: none"> <li>1. External temp(-) to terminal block 1 pin 6 (yellow).</li> <li>2. External temp(+) to terminal block 3 pin 3 (red).</li> </ol>
	
<p>To input external pressure (4-20mA) into the meter make the following connections;</p> <ol style="list-style-type: none"> <li>1. External PRES(+) to terminal block 1 pin 2 (blue).</li> <li>2. Ground to terminal block 1 pin 3 (green).</li> </ol>	<p>To input external pressure <b>Loop Type</b> (4-20mA) into the meter make the following connections;</p> <ol style="list-style-type: none"> <li>1. External pres(-) to terminal block 1 pin 2 (yellow).</li> <li>2. External pres(+) to terminal block 3 pin 3 (red).</li> </ol>

MODEL D625 EX-PROOF ENCLOSURE ELECTRICAL CONNECTIONS  
CLOSING THE METER ENCLOSURE

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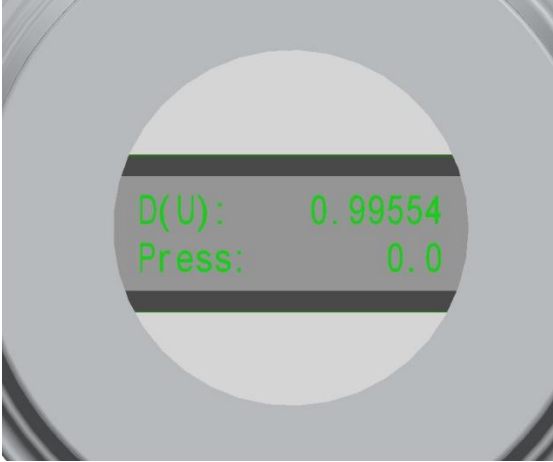
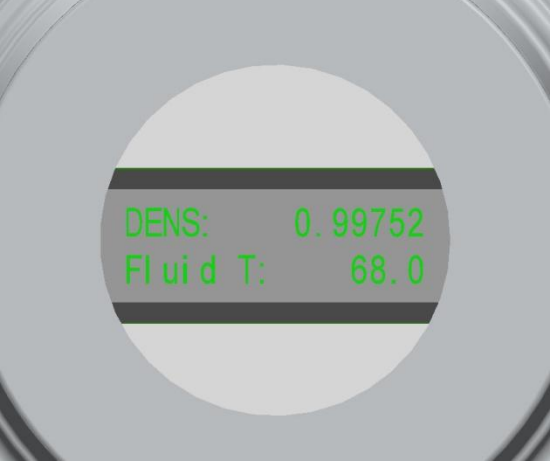
When all desired connections have been made;

1. Ensure the meter is grounded.
2. Replace the Electrical Enclosure Cover prior to supplying the meter with 16 - 32 V<sub>DC</sub>.





NOTE: PIPING SYSTEM NOT SHOWN ON THIS GRAPHIC

## D625 METER – ELECTRICAL CONNECTIONS

The D625 Meter display cycles through three screens, one every three seconds. Display information can also be collected from the meter using the outputs on the customer interface board, refer to DENSI-Trax Software User Manual for more detail.

 <p>D625 Meter Display</p>	
<p>The D625 display can be seen through the enclosure's display lenses. Units shown here are the default settings, they can be changed in the provided DENSI-Trax software.</p>	<p>Screen 1;</p> <ol style="list-style-type: none"> <li>1. Line 1; Period, displayed to three decimal places, units (seconds).</li> <li>2. Line 2; Frequency, displayed to whole number, units (1/seconds).</li> </ol>
	
<p>Screen 2;</p> <ol style="list-style-type: none"> <li>1. Line 1; D (U) (uncompensated density), displayed to five decimal places, units (g/cm<sup>3</sup>).</li> <li>2. Line 2; Pressure, displayed to one decimal, units (psi).</li> </ol>	<p>Screen 3;</p> <ol style="list-style-type: none"> <li>1. Line 1; DENS (fully compensated density), displayed to five decimal places, units (g/cm<sup>3</sup>).</li> <li>2. Line 2; Fluid Temperature, displayed to one decimal, units (°F).</li> </ol>

## ELECTRICAL INSTALLATION NOTES

-  **GROUNDING:** The meter should ALWAYS be grounded to an adequate earth ground
-  **POWER SUPPLY:** Voltage drops due to wiring, barriers, etc. must be considered prior to sourcing a suitable power supply.
-  **WIRE & CABLE:** Shielded cable is recommended for all field wiring between the meter and the signal processors.
-  For intrinsically safe wiring and hazardous installation, refer to National Electrical Code Article 500 and ISA-RP12.1, ISA-S12.4 & ANSI/ISA-RP12.6

## METER – PROCESS FLOW INSTALLATION

---

The ANALYTICAL FLOW TECHNOLOGIES D625 meter can be mounted in a variety of methods, however the meter should be as near to the metering point as possible.

Flow rate through the D625 meter is a critical component for performance – the flow rate should be high enough to achieve temperature stability – but not so high as to cause cavitations/vibration or severe pressure drop. The recommended flow rates are 1-3 GPM minimum, and 30 GPM maximum.

The diagrams on the following pages are examples of some typical installations. These diagrams are not intended to encompass all possible configurations for installing the D625 Density Meter. Please consult ANALYTICAL FLOW TECHNOLOGIES engineers with any questions regarding your specific installation.



ANALYTICAL FLOW TECHNOLOGIES Engineers can design a system installation tailored to your specific requirements.

It is critical that you plan your installation according to the “Installation Planning” section outlined earlier in this manual.

Important considerations for proper installation are:

- ✓ Adequate flow through the density meter – some method must be used to ensure proper flow through the meter.
- ✓ Avoid severe vibration – if the meter is to be installed in an area with severe vibration, the use of flexible hoses (tubing) is recommended.
- ✓ Allow adequate distance between the density meter and pump (if installed)
- ✓ Gas/Air bubbles must not be present in the meter during normal operation. Horizontal mounting of the meter is recommended.
- ✓ Locate the meter in a suitable location for convenient access during periodic maintenance.
- ✓ Avoid installing in areas where the temperature effects from the ambient environment are severe. The use of an insulation jacket may be required depending on your installation.



API Chapter 14, Section 6, outlines density meter and Pycnometer installation for Natural Gas Liquid applications.



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**INLINE SETUP INSTALLATION**

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The diagram below is an example of an IN-LINE INSTALLATION. The meter is simply placed in-line with customer process piping/tubing.

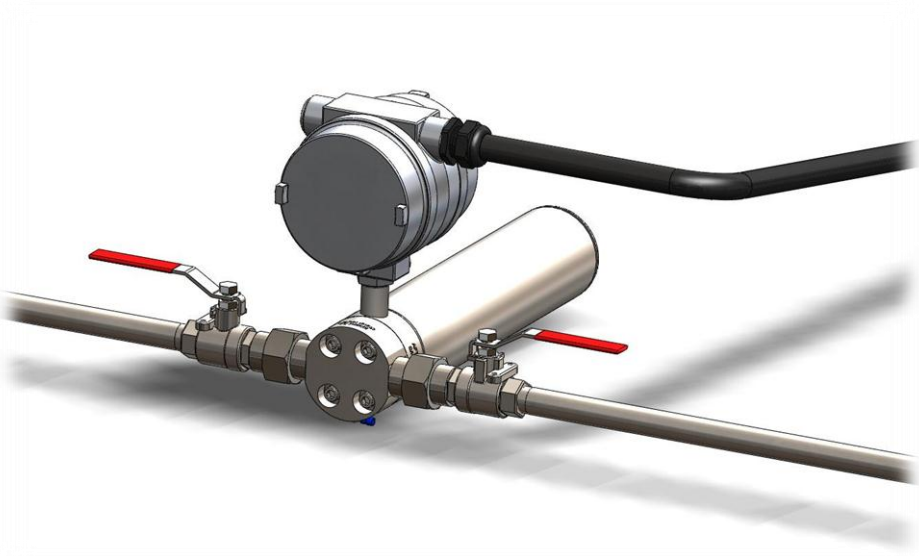


FIGURE 5: IN-LINE DENSITY METER INSTALLATION

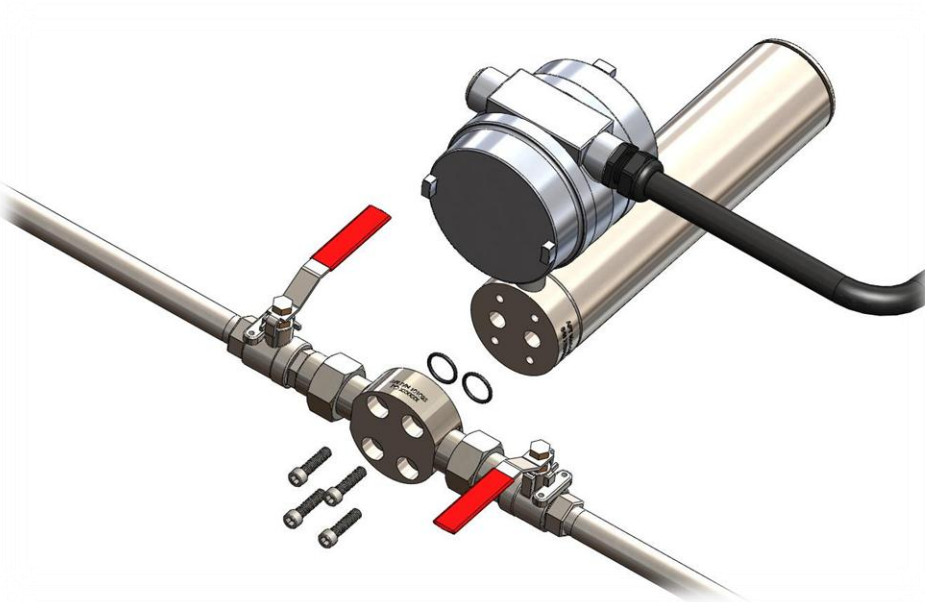


FIGURE 6: DENSITRAK D625 REMOVAL.

**EASY REMOVAL OF THE METER FOR PERIODIC CLEANING AND MAINTENANCE - SIMPLY CLOSE THE BALL VALVES, REMOVE THE 4 BOLTS AND THE METER DISENGAGES FROM THE FLANGE TAKE CARE NOT TO LOSE THE O-RING SEALS**

---

**ANSI 150#/300#/600# REMOTE MOUNT SCOOPED FLANGE INSTALLATION**

---

This installation is very popular in the OIL and GAS Pipeline Industry with large diameter pipes. Since the high flow rates inside the pipes causes excessive vibration it is recommended that the customer mount the meter off of the SCOOP FLANGE and connect via BRAIDED HOSE. This isolates the meter from the pipeline vibration. The Cutaway view below illustrates the scoop orientation inside the pipeline. The FLOW RATE through the meter is a function of the MAINLINE FLOW RATE – See Figure 9.

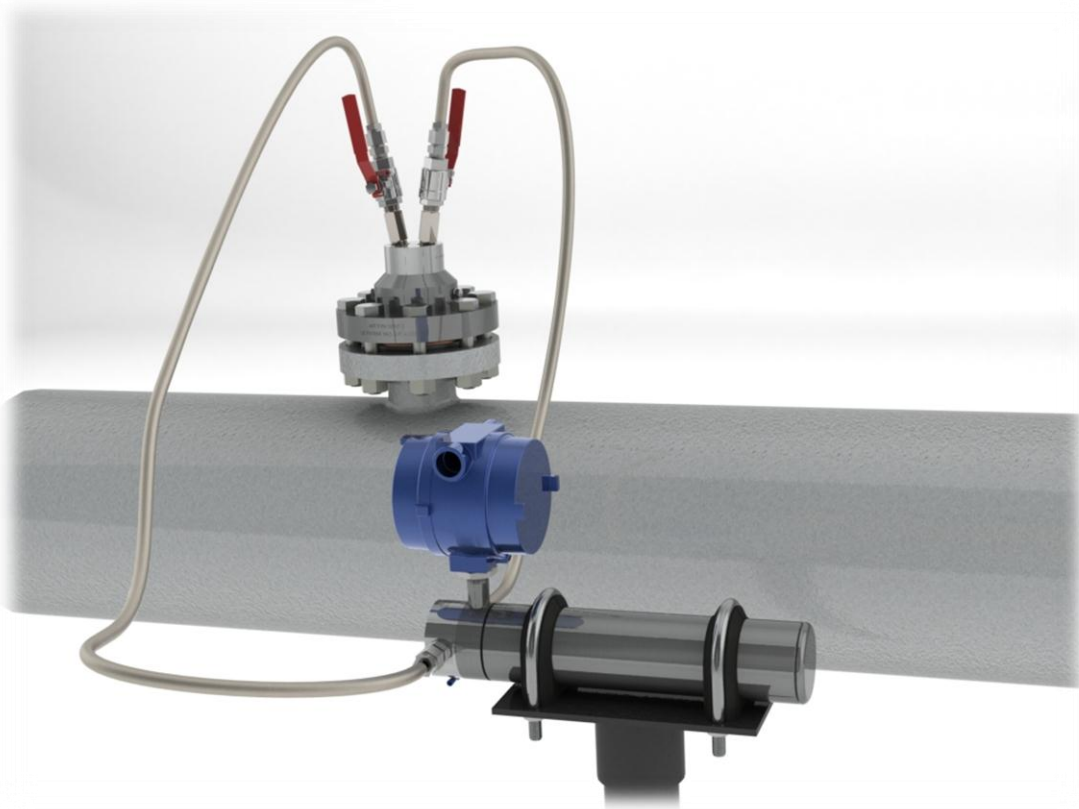


FIGURE 7: SCOOPED FLANGE ASSEMBLY

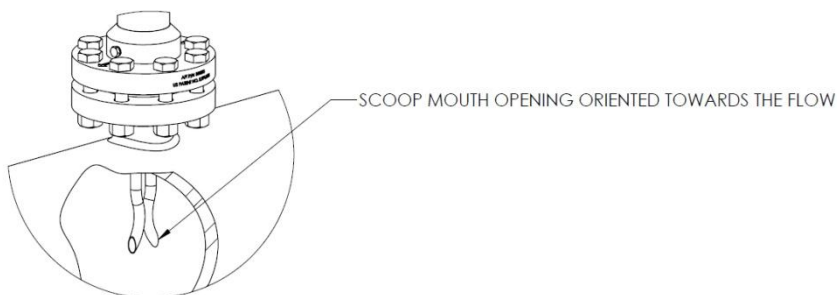


FIGURE 8: CUTAWAY VIEW OF SCOOP ORIENTATION INSIDE THE MAIN PIPELINE



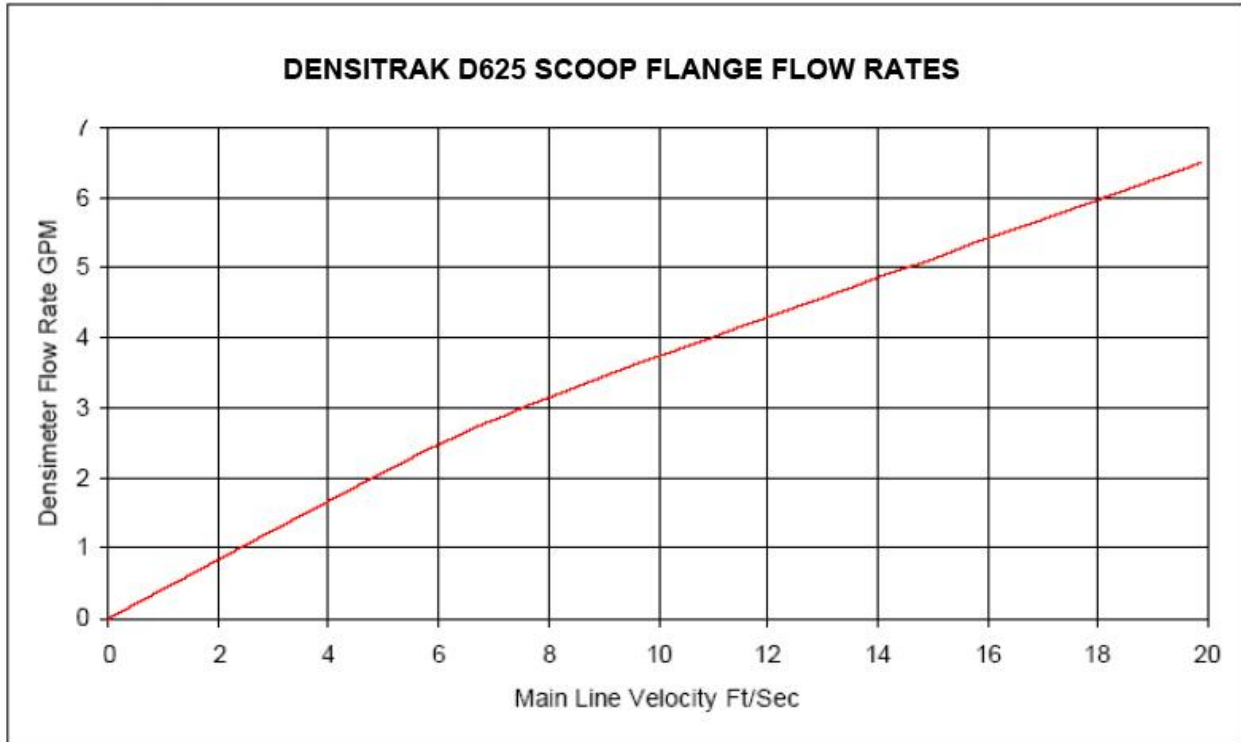


FIGURE 9: SCOOP FLANGE FLOW RATE VERSUS MAIN PIPELINE FLOW VELOCITY

**ANSI 150#/300#/600# SCOOPED FLANGE INSTALLATION**

In cases where the MAIN PIPELINE does not cause excessive vibration, the Densitrak D625 can be mounted directly to the scoop flange as shown in Figure 10 below. Refer to FIGURE 9 to determine approximate flow rates through the meter.

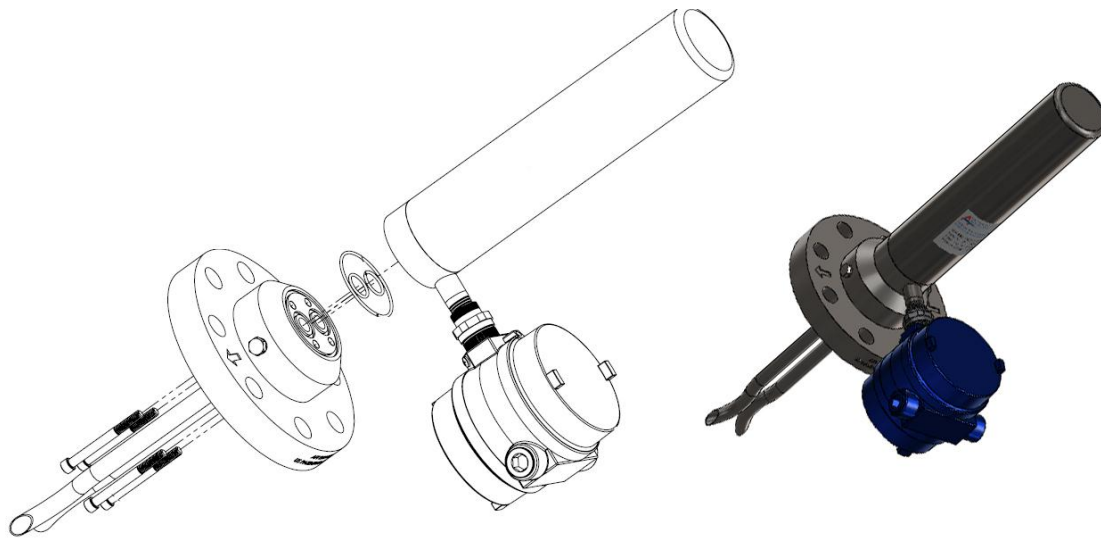


FIGURE 10: ANSI SCOOP FLANGE TO D625 MOUNTING ASSEMBLY

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**ORIFICE / BYPASS D625 INSTALLATION**

---

This installation method incorporates a bypass line. The flow in the pipeline causes flow through the tube which then runs through the meter and dumps back into the customer main-line. To induce flow through the meter it is recommended that some method be employed to create a **PRESSURE DIFFERENTIAL** between the **INLET** and **OUTLET** ports of the Densitometer. An **ORIFICE PLATE** or **VALVE** can be incorporated to create the pressure differential across the meter. **FIGURE 11** below is a typical installation – however, ball valves should be employed at the **INLET** and **OUTLET** to allow easy **REMOVAL** for periodic maintenance.

Pressure differential is defined as:

$$\Delta P = P_1 - P_2$$

$P_1$  = upstream pressure

$P_2$  = downstream pressure

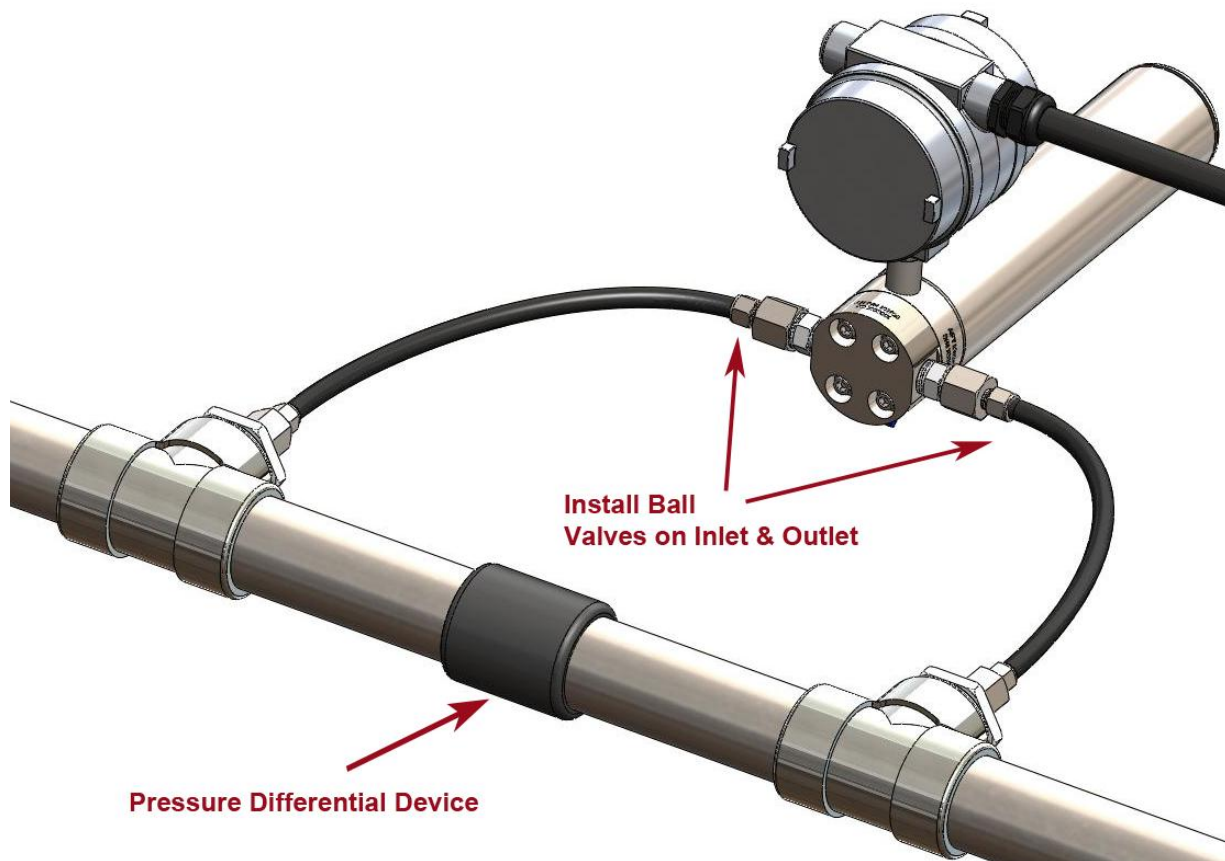


FIGURE 11: TYPICAL DENSITRAK D625 "BYPASS INSTALLATION" SETUP

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## OTHER INSTALLATION METHODS

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### MOTOR-DRIVEN PUMP

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This installation incorporates a motor driven pump to draw fluid from the customer pipeline. This installation incorporates ball valves at the inlet and outlet of the densitometer to allow for easy meter maintenance and service. The pump is installed so that the fluid is “pushed” through the meter.

### TANK INSTALLATION

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This installation involves process connections between the density meter and a fluid holding (mixer) tank. The meter can be installed so that the fluid inside the tank is run through the meter and then pumped back up into the tank.

There are numerous other methods in which the meter can be installed into your system. Proper planning of your installation is essential to consistent, accurate, repeatable performance.

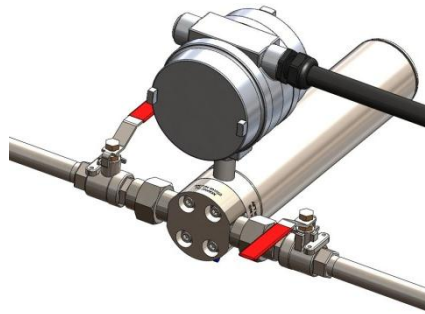
## METER MAINTENANCE

It is normal for the D625 to accumulate deposits or corrosion after extended use. These deposits adversely influence the natural resonant frequency of the meter and should be removed. The procedure for removing these deposits is fast and easy to perform – and in most cases does not require the meter to be completely removed from the system.

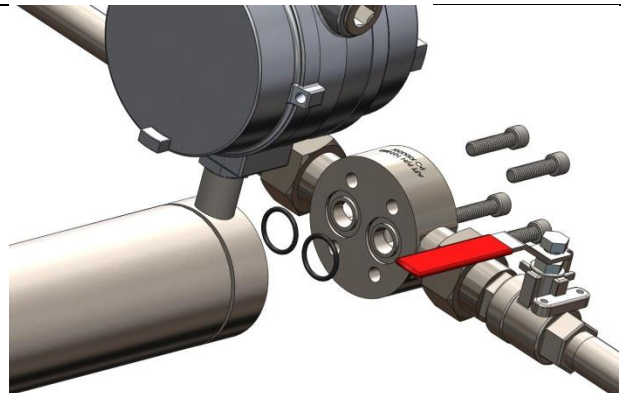
If the meter ever requires a return to the factory for recalibration or repair, the following procedure must be completed prior to shipment to ANALYTICAL FLOW TECHNOLOGIES.

### METER CLEANING PROCEDURE

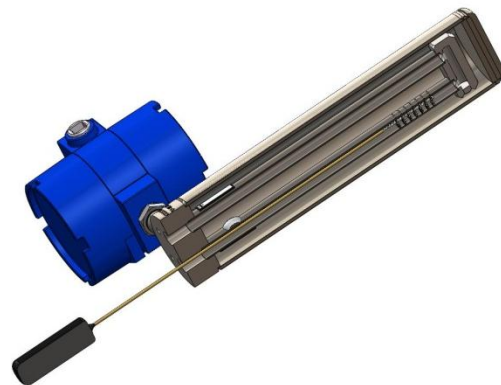
1. Shutdown flow to the D625 Meter – or Shut down pump (if necessary)
2. Close all bypass valves
3. Alleviate any residual pressure in the system



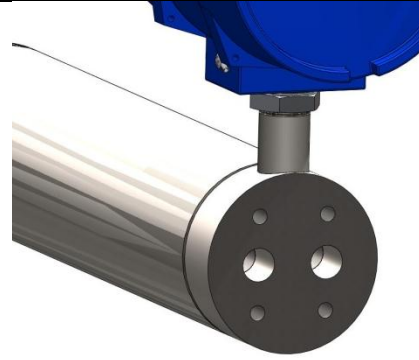
4. Remove the 5/16" -18 x 1 1/4 Socket Head CAP bolts (4) from the density meter
5. Clean the bolts to remove the old anti-seize compound.
6. Clean the flange and inspect the flange face for any debris prior to reassembly
7. Remove the O-Rings
8. Clean the O-Rings and inspect for any damage prior to reassembly



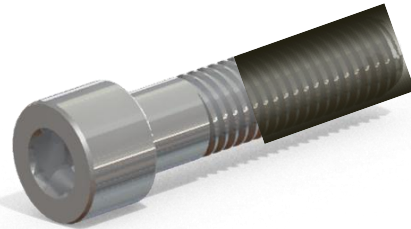
9. Clean the inside of the resonant tubes:
10. Use a 5/8" 3/4" Diameter Bore Brush with a mild cleaner/detergent or Isopropyl alcohol
11. Gently brush the interior of each tube with a back and forth motion
12. DO NOT DAMAGE the resonant tube by inserting hard metallic objects inside the resonant tubes
13. Thoroughly rinse the resonant tube interiors with clean water
14. Repeat Process until rinse water is clear



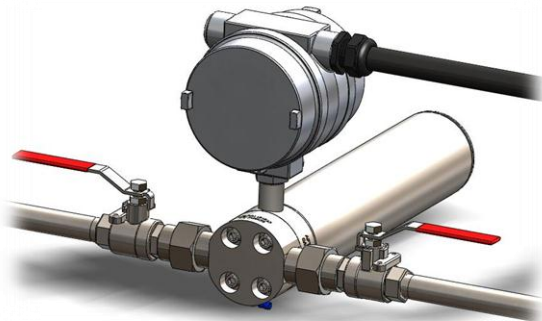
15. Clean the D625 Meter flange face with mild cleaner/detergent and rinse with water
16. Inspect the D625 Meter flange face for any damage prior to reassembly.
17. Blow out the resonant tube orifice with compressed air



18. Prepare the hardware for reinstallation
19. Coat each of the 5/16" -18 x 1 1/4" Socket Head CAP bolts with a small amount of anti-seize compound



20. Reassemble the meter and install back into the system.
21. Ensure all fittings are tightened with NO LEAKS
22. Ensure the electrical connection between the meter and density processor is securely connected
23. Contact ANALYTICAL FLOW TECHNOLOGIES with any questions or concerns.



D625 METER MUST BE CLEANED AND RINSED PRIOR TO ANY FACTORY RETURN

## DENSITY OUTPUT – FIELD CALIBRATION

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The ANALYTICAL FLOW TECHNOLOGIES D625 meter is calibrated at the factory with many various fluids and various flow rates – however, there may be occasions where field calibration (adjustment of the **K<sub>0</sub>** density coefficient) is required. Many factors influence whether an adjustment of the **K<sub>0</sub>** density coefficient is required, such as:

- ✓ Process pipeline flow rates
- ✓ Noise or vibration in the process pipeline
- ✓ Temperature differential

### WHEN TO FIELD CALIBRATE...

---

If the density meter is CONSISTENTLY displaying a density output reading that is above or below the ACTUAL density of the fluid flowing through the pipe a simple adjustment of the **K<sub>0</sub>** density coefficient can be performed so that the meter is calibrated to the actual fluid.



When comparing density readings of any fluids – the temperature (and pressure) of the fluid must be consistent (the same) for each device measuring density.

The **K<sub>0</sub>** density coefficient can be found on the Calibration Certificate that was included with your density meter. The **K<sub>0</sub>** density coefficient can also be read (and displayed) by the included Windows® Software that shipped with your meter. The Windows® software is also required when making adjustments to **K<sub>0</sub>**.

### FIELD CALIBRATION EXAMPLE:

---

An example of a **K<sub>0</sub>** adjustment might be as follows:

Distilled Water at 68°F (and minimal pressure) flowing through the meter reads (outputs) 0.99865 gr/cm<sup>3</sup> on the meter, but we know (from tables, or hydrometer, pycnometer, etc) that distilled water has a density of 0.99740 gr/cm<sup>3</sup> at 68°F. This means that the meter has an *error offset of +0.00125 gr/cm<sup>3</sup>* at 68°F.

We can correct that error by simply adjusting the **K<sub>0</sub>** density coefficient by the amount of the error offset, and then entering the new **K<sub>0</sub>** density coefficient into the density processor or flow computer.

EQUATION 4: **K<sub>0</sub>** DENSITY OFFSET EQUATION

$$K_{0(NEW)} = K_{0(OLD)} + error_{offset}$$

The table below guides you through the **K<sub>0</sub>** Coefficient adjustment for the above Example.

*CONTACT ANALYTICAL FLOW TECHNOLOGIES ENGINEERS WITH ANY QUESTIONS CONCERNING YOUR SPECIFIC APPLICATION.*

EXAMPLE: Field Calibration - $K_0$ Density Coefficient Offset Adjustment	
Original $K_0$ Value	$K_{0(\text{old})} = -0.433394018$
Meter fluid Temperature	$T_{\text{fluid}} = 68 \text{ } ^\circ\text{F}$
Density Reading from D625 Meter	$D_{\text{meter}} = 0.99865 \text{ gr/cm}^3$
Actual Fluid Density <sup>1,2</sup>	$D_{\text{actual}} = 0.99740 \text{ gr/cm}^3$
Density Error Offset ( $E_{\text{offset}}$ )	$E_{\text{offset}} = D_{\text{actual}} - D_{\text{meter}} \rightarrow E_{\text{offset}} = .99740 - .99865 \rightarrow E_{\text{offset}} = -.00125$
Compute New $K_0$ Value	$K_{0(\text{new})} = K_{0(\text{old})} + E_{\text{offset}} \rightarrow K_{0(\text{new})} = (-.433394018) + (-.00125)$
	$K_{0(\text{new})} = -0.434644018$
<b>Enter <math>K_{0(\text{new})}</math> into the Density processor or flow computer.</b>	

FIELD CALIBRATION WORK TABLE

Field Calibration: $K_0$ Density Coefficient Offset Work Table	
Original $K_0$ Value	$K_{0(\text{old})} =$
Meter fluid Temperature	$T_{\text{fluid}} = \text{ } ^\circ\text{F}$
Density Reading from D625 Meter	$D_{\text{meter}} = \text{ } \text{gr/cm}^3$
Actual Fluid Density <sup>1,2</sup>	$D_{\text{actual}} = \text{ } \text{gr/cm}^3$
Density Error Offset ( $E_{\text{offset}}$ )	$E_{\text{offset}} = D_{\text{actual}} - D_{\text{meter}} \rightarrow E_{\text{offset}} = \text{ } - \text{ }$
	$E_{\text{offset}} =$
Compute New $K_0$ Value	$K_{0(\text{new})} = K_{0(\text{old})} + E_{\text{offset}} \rightarrow K_{0(\text{new})} = \text{ } + \text{ }$
	$K_{0(\text{new})} =$
<b>Enter <math>K_{0(\text{new})}</math> into the Density processor or flow computer.</b>	



## METER TROUBLESHOOTING

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Refer to the table below for basic troubleshooting of the D625 Meter

<b>Troubleshooting checklist</b>	
<b>Meter fails to turn on (No audible noise heard)</b>	<ul style="list-style-type: none"> <li>✓ Verify the +18-32 VDC power supply is properly connected</li> <li>✓ Verify the cables are secured to the meter properly</li> <li>✓ Verify customer wiring is connected to the correct pins</li> <li>✓ INSPECT each terminal connection for broken wires or loose connections</li> </ul>
<b>Display fails to function (No LCD Output)</b>	<ul style="list-style-type: none"> <li>✓ Verify the cables are secured to the meter properly</li> <li>✓ Verify the electronics enclosure is not damaged (i.e. no obvious cracks, breaks, etc.)</li> </ul>
<b>Meter Density output becomes erratic or inconsistent</b>	<ul style="list-style-type: none"> <li>✓ Corrosion or debris buildup inside the resonant tubes</li> <li>✓ Clean per the cleaning procedure outlined earlier in this manual</li> </ul>
<b>Inconsistent Density Output Readings</b>	<ul style="list-style-type: none"> <li>✓ Air or gas bubbles are trapped in the system</li> <li>✓ Purge air from the system</li> <li>✓ Tighten all flanges, fittings and hoses</li> <li>✓ Re-orient meter position to alleviate air in tubes</li> </ul>
<b>Inconsistent Density Output Readings</b>	<ul style="list-style-type: none"> <li>✓ Excessive Vibration present in the installation</li> <li>✓ Install flexible tubing/hoses to the meter to reduce the amount of vibration felt by the meter</li> </ul>
<b>Inconsistent Density Output Readings</b>	<ul style="list-style-type: none"> <li>✓ Verify that the 4-20mA density output range is programmed correctly into the density processor</li> <li>✓ Verify that your fluid is within the 4-20mA density output range</li> </ul>
<b>Incorrect Density Readings</b>	<ul style="list-style-type: none"> <li>✓ Verify that ALL CALIBRATION COEFFICIENTS are entered into the density processor or flow computer correctly (according to the Calibration Certificate)</li> </ul>



Always handle the meter with care during unpacking, installation, service/maintenance, and shipping.

## CONTACT INFORMATION

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### **ANALYTICAL FLOW TECHNOLOGIES LLC**

8341 E. Evans Road, Suite 108

Scottsdale, AZ 85260

United States of America

Phone: 480-443-0168

Fax: 888-774-8321

Web: [www.densitrak.com](http://www.densitrak.com)



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## APPENDIX I: CONVERSION FACTORS

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### DENSITY

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Convert From	Convert To	Unit	Multiplication Factor
<b>Grams per Cubic Centimeter</b> gr/cm <sup>3</sup>	Kilograms per cubic meter	kg/m <sup>3</sup>	1000.00
	Ounces per gallon	oz/gal	133.5265
	Pounds per cubic foot	lb/ft <sup>3</sup>	62.42796
	Pounds per cubic inch	lb/in <sup>3</sup>	0.03612729
<b>Pounds per cubic foot</b> lb/ft <sup>3</sup>	Grams per Cubic Centimeter	gr/cm <sup>3</sup>	0.01601846
	Kilograms per Cubic meter	kg/m <sup>3</sup>	16.01846
	Ounces per gallon	oz/gal	2.138889
	Pounds per cubic inch	lb/in <sup>3</sup>	0.0005787037

### PRESSURE

---

Convert From	Convert To	Unit	Multiplication Factor
<b>Bar</b>	Pounds per square inch	PSI	14.50377
	Atmosphere	atm	0.9869233
	Kilopascal	kPa	100
	Megapascal	MPa	0.1
	Inches of Mercury		29.52999
<b>Pounds per square inch</b> PSI	Atmosphere	atm	0.06804596
	Kilopascal	kPa	6.894757
	Megapascal	MPa	0.006894757
	Inches of Mercury		2.036021
	Bar		0.06894757

### FLOW RATE

---

Convert From	Convert To	Unit	Multiplication Factor
<b>Gallons per minute</b> GPM	Gallons per hour	GPH	60
	Liters per hour	l/hr	227.1247
	Liters per Minute	l/min	3.785412
	Cubic meters per hour	m <sup>3</sup> /hr	0.2271247
	Cubic meters per minute	m <sup>3</sup> /min	0.003785412
	Barrels (US) per minute	BPM	0.0317460
	Barrels (US) per hour	BPH	1.90476
	<b>Barrels per hour</b> BPH	Gallons per hour	GPH
Liters per hour		l/hr	119.240
Liters per Minute		l/min	1.98734
Cubic meters per hour		m <sup>3</sup> /hr	0.119240
Cubic meters per minute		m <sup>3</sup> /min	0.00198734
Barrels (US) per minute		BPM	0.0166667

	Gallons per minute	GPM	0.525000
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TEMPERATURE

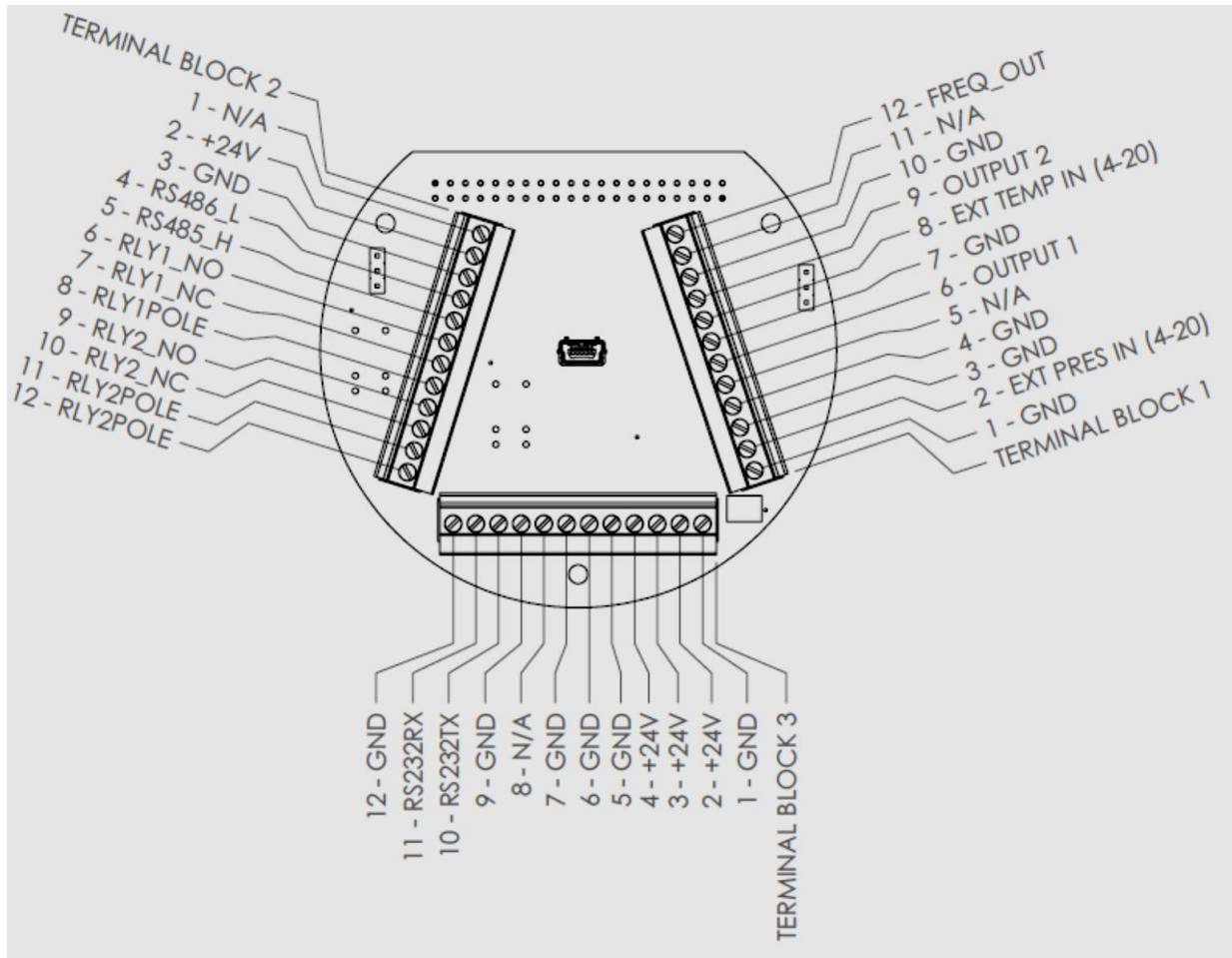
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$$^{\circ}\text{F} = (^{\circ}\text{C} * 1.8) + 32$$

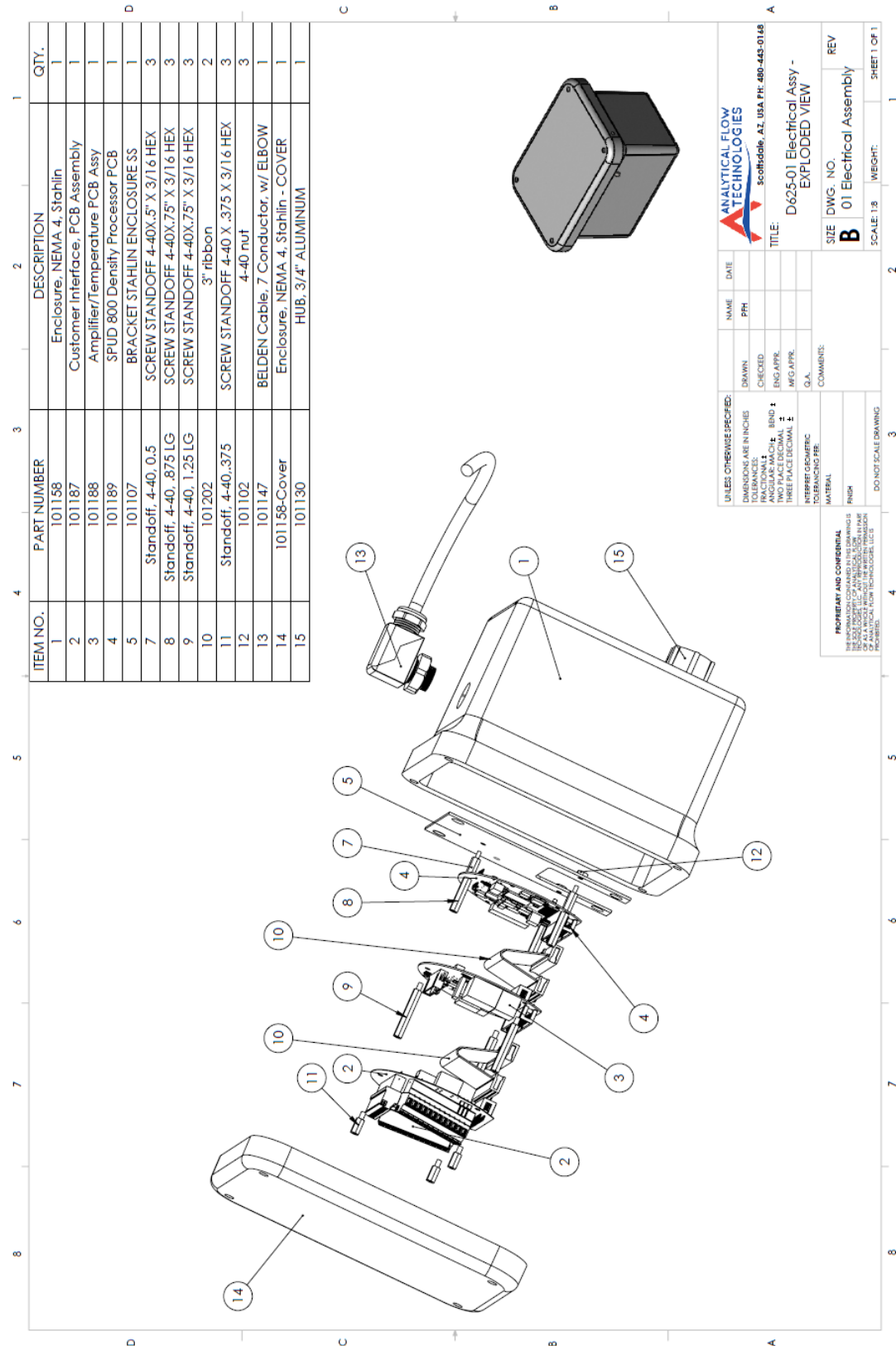
$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$$

APPENDIX II – AFT DENSITRAK DOCUMENTS

AFT CUSTOMER INTERFACE BOARD PINOUT



AFT DENSI TRAK D625-XX-XX-01 ELECTRONICS EXPLODED VIEW



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	101158	Enclosure, NEMA 4, Stahlin	1
2	101187	Customer Interface, PCB Assembly	1
3	101188	Amplifier/Temperature PCB Assy	1
4	101189	SPUD, 800 Density Processor PCB	1
5	101107	BRACKET STAHLIN ENCLOSURE SS	1
7	Standoff, 4-40, 0.5	SCREW STANDOFF 4-40X.5\" X 3/16 HEX	3
8	Standoff, 4-40, .875 LG	SCREW STANDOFF 4-40X.75\" X 3/16 HEX	3
9	Standoff, 4-40, 1.25 LG	SCREW STANDOFF 4-40X.75\" X 3/16 HEX	3
10	101202	3\" ribbon	2
11	Standoff, 4-40,.375	SCREW STANDOFF 4-40 X .375 X 3/16 HEX	3
12	101102	4-40 nut	3
13	101147	BELDEN Cable, 7 Conductor, w/ ELBOW	1
14	101158-Cover	Enclosure, NEMA 4, Stahlin - COVER	1
15	101130	HUB, 3/4\" ALUMINUM	1

**ANALYTICAL FLOW TECHNOLOGIES**  
 Scottsdale, AZ, USA PH: 480-443-0148

**TITLE:** D625-01 Electrical Assy - EXPLODED VIEW

**SIZE:** DWG. NO. B 01 Electrical Assembly

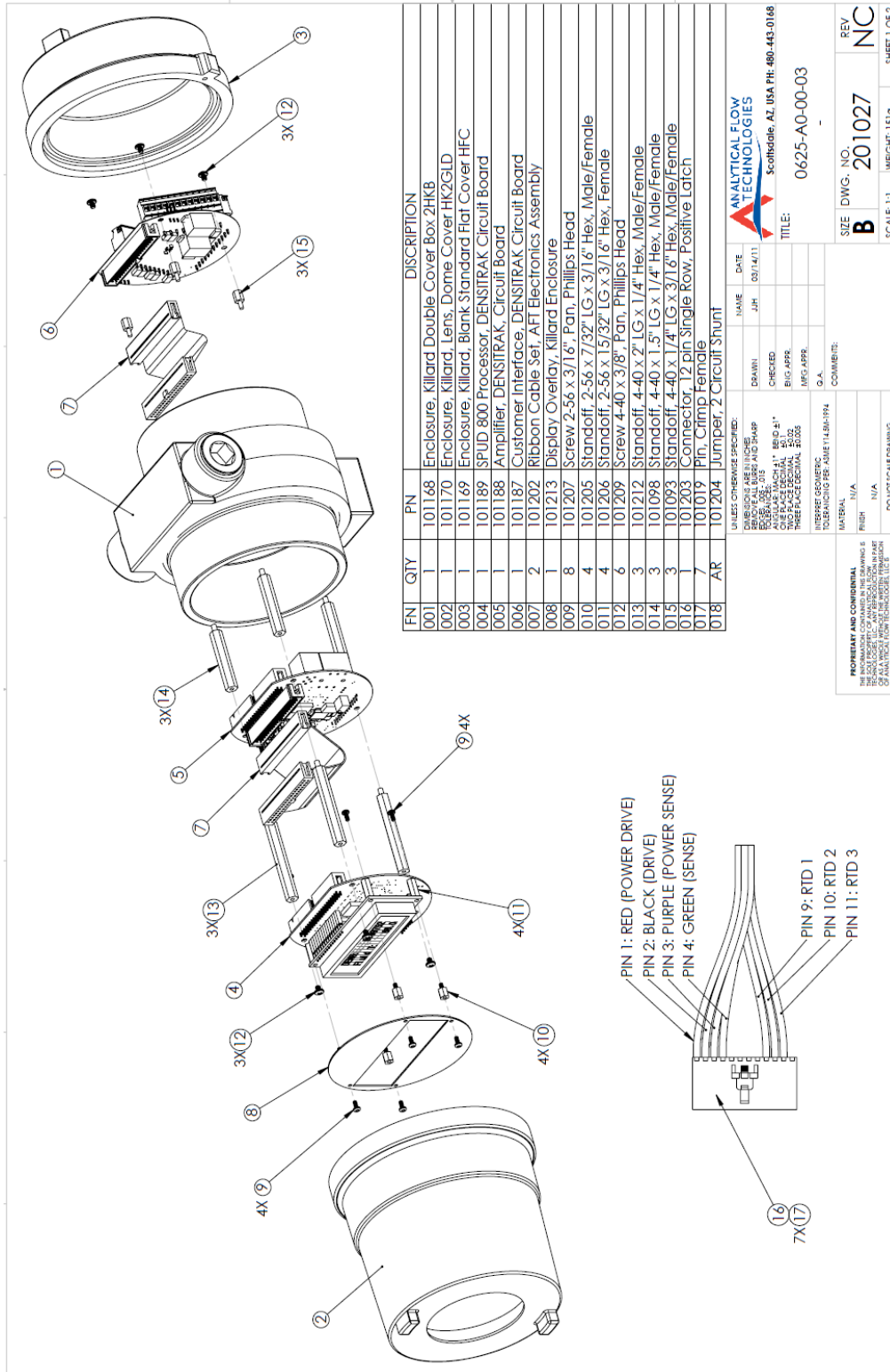
**REV:** 01

**SCALE:** 1:8

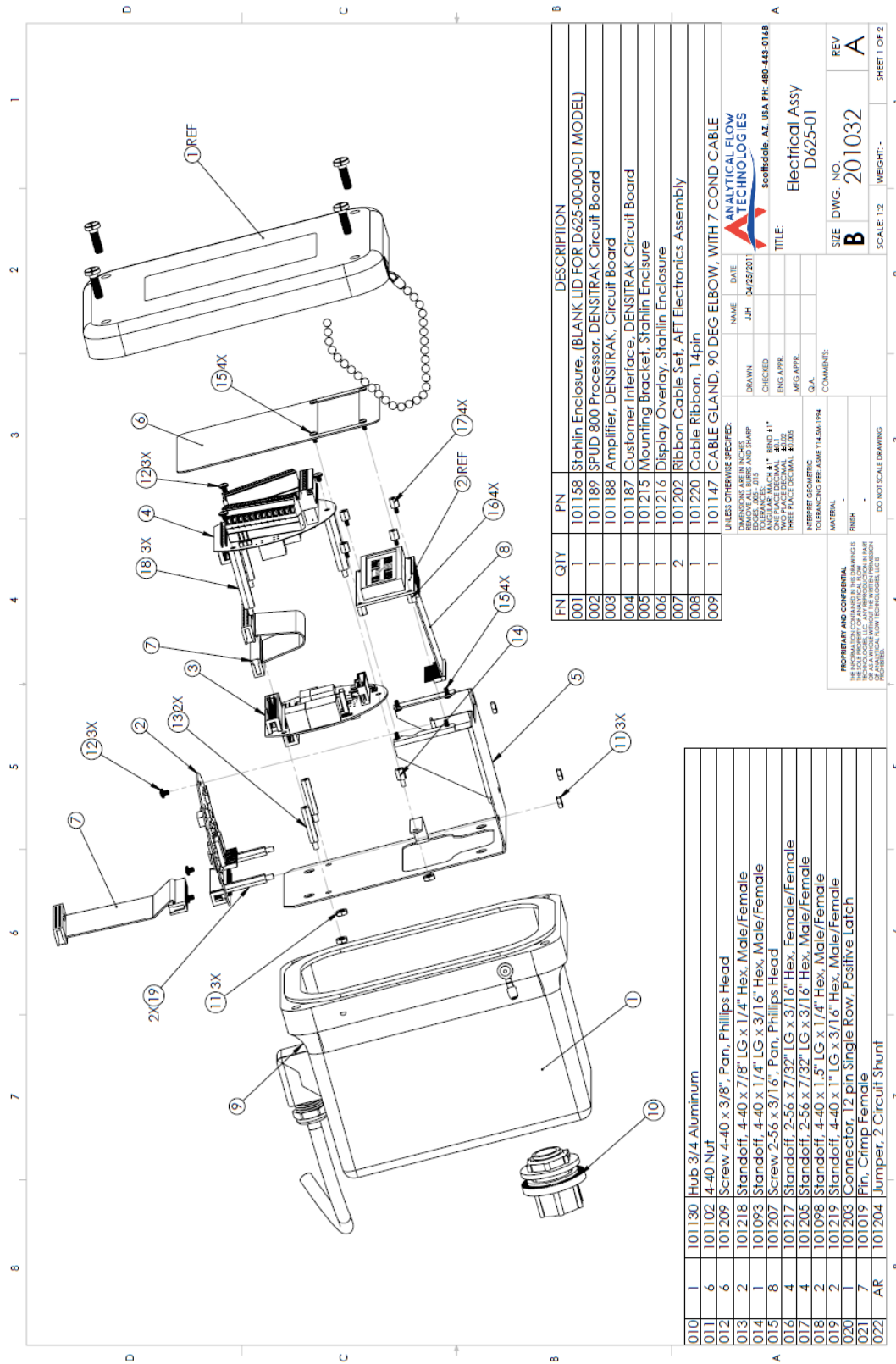
**WEIGHT:** 1

**SHEET 1 OF 1**

AFT DENSI TRAK D625-XX-XX-03 ELECTRONICS EXPLODED VIEW



AFT DENSITRAK D625-00-00-04 ENCLOSURE EXPLODED VIEW



FN	QTY	PN	DESCRIPTION
001	1	101198	Stahlin Enclosure, (BLANK LID FOR D625-00-00-01 MODEL)
002	1	101189	SPUD 8000 Processor, DENSI TRAK Circuit Board
003	1	101188	Amplifier, DENSI TRAK, Circuit Board
004	1	101187	Customer Interface, DENSI TRAK Circuit Board
005	1	101215	Mounting Bracket, Stahlin Enclosure
006	1	101216	Display Overlay, Stahlin Enclosure
007	2	101202	Ribbon Cable Set, AFT Electronics Assembly
008	1	101220	Cable Ribbon, 14pin
009	1	101147	CABLE GLAND, 90 DEG ELBOW, WITH 7 COND CABLE

UNLESS OTHERWISE SPECIFIED:		NAME	DATE
DIMENSIONS ARE IN INCHES		JH	04/28/2011
EXCEPT AS NOTED		DRAWN	
ALL DIMENSIONS ARE TO CENTER UNLESS NOTED OTHERWISE		CHECKED	
ANGULAR TOLERANCES UNLESS OTHERWISE SPECIFIED:		ENG APPR.	
ASSEMBLY MACH 41" BING 11"		WFG APPR.	
TWO PLACE DECIMAL #1/32		Q.A.	
THREE PLACE DECIMAL #1/64		COMMENTS:	
TOLERANCING PER ASME Y14.5M-1994			
INTERFEREOMETRIC			
MATERIAL			
FINISH			
DO NOT SCALE DRAWING			

010	1	101130	Hub 3/4 Aluminum
011	6	101102	4-40 Nut
012	6	101209	Screw 4-40 x 3/8", Pan, Phillips Head
013	2	101218	Standoff, 4-40 x 7/8", LG x 1/4", Hex, Male/Female
014	1	101093	Standoff, 4-40 x 1/4", LG x 3/16", Hex, Male/Female
015	8	101207	Screw 2-56 x 3/16", Pan, Phillips Head
016	4	101217	Standoff, 2-56 x 7/32", LG x 3/16", Hex, Female/Female
017	4	101205	Standoff, 2-56 x 7/32", LG x 3/16", Hex, Male/Female
018	2	101098	Standoff, 4-40 x 1.5", LG x 1/4", Hex, Male/Female
019	2	101219	Standoff, 4-40 x 1", LG x 3/16", Hex, Male/Female
020	1	101203	Connector, 12 pin Single Row, Positive Latch
021	7	101019	Pin, Crimp Female
022	AR	101204	Jumper, 2 Circuit Shunt

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TITLE: Electrical Assy  
D625-01

SIZE DWG. NO. B 201032  
REV A

SCALE: 1:12 WEIGHT:- SHEET 1 OF 2









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