Level Plus®
Loop-powered Transmitters

Loop-Powered Level Transmitter (Model C4)
Ordering Guide and Installation Manual
General Information

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1 INTRODUCTION

MTS is recognized as the pioneer, innovator, and leader in magnetostrictive sensing. The new Level Plus C4 loop-powered transmitter design represent a continuation of our on-going effort to provide effective, innovative, and reliable products to the liquid level marketplace.

This manual will provide information about the Level Plus® C4 loop-powered transmitter, to include:

• Product Description
• Dimensions
• Theory of Operation
• Wiring/Electrical Connections
• Specifications
• Model Numbers
• Mounting
• Adjustments
• Maintenance
2 PRODUCT DESCRIPTION

The Level Plus C4 is a two-wire, 4-20 mA loop-powered, proportional level transmitter. Each C4 transmitter is provided with an explosion-proof metal housing. In the standard design, the outer pipe, or sensing portion of the device, is constructed of rigid 1/2 in. diameter 316L stainless steel (standard) or Teflon®. See Figure 2.1 for C4 dimensions.

Optional sensor wells are available for use with C4 transmitters. Sensor wells are 5/8 in. tubular sleeves in a secondary containment configuration. The sensor wells are installed over the existing 1/2 in. 316L stainless steel pipe (see Figure 2-1). Two types of sensor wells are offered:

1.) Industrial Sensor Well:
   • Material of Construction: 316L stainless steel or Hastelloy® C-276
   • Process Connection: Flange (a selection of sizes and ratings) or 3/4 in. NPT adjustable fitting

2.) Sanitary Sensor Well
   • Material of Construction: Polished 316L stainless steel
   • Process Connection: Sanitary Cap (a selection of sizes)

Sensor wells permit the C4 transmitter to be easily removed and/or replaced while that tank is in service and the tank connection/seal remains intact.

NOTE - Upgrade:
The C4 transmitter is provided with an RTD installed. The RTD permits the C4 transmitter to be upgraded to a multi-functional A4 transmitter if desired. The A4 transmitter offers two 4-20 mA loops and HART communications to transmit product level, interface level, and temperature data.

To upgrade to an A4 transmitter, a new electronics module must be installed in the transmitter’s electronics housing. Upgrading from a C4 to an A4 transmitter is a simple procedure and can be done in the field by a qualified technician.
2.1 C4 Transmitter Dimensions

Figure 2-1
The Level Plus C4 Transmitter Dimensions
(Typical Configuration)
2.2 C4 Transmitter Specifications

**LEVEL OUTPUT**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured Variable:</td>
<td>Level 1</td>
</tr>
<tr>
<td>Full Range:</td>
<td>0.5 to 25 ft. (152 mm to 7.6 m) minus 3 in. (76.2 mm) inactive zone and 5 in. (127 mm) for mounting (See Figure 2.1)</td>
</tr>
<tr>
<td>Non-linearity:</td>
<td>0.035 % F.S. (Independent best straight line) or 1/32 in. (0.794 mm)*</td>
</tr>
<tr>
<td>Hysteresis:</td>
<td>0.01 % F.S. or 0.015 in. (0.381 mm)*</td>
</tr>
<tr>
<td>Repeatability:</td>
<td>0.01 % F.S. or 0.015 in. (0.381 mm)*</td>
</tr>
<tr>
<td>Time Constant:</td>
<td>180 ms</td>
</tr>
<tr>
<td>Temperature Sensitivity:</td>
<td>Zero: &lt; 0.005 % per °C (0.003% per °F)</td>
</tr>
<tr>
<td>Operating Temperature:</td>
<td>For transmitter lengths ≤ 220 in. (5588 mm): -30 to 300°F (-34 to 149°C)</td>
</tr>
<tr>
<td></td>
<td>For transmitter lengths &gt; 220 inches (5588 mm): Contact the factory</td>
</tr>
</tbody>
</table>

**CALIBRATION**

<table>
<thead>
<tr>
<th>Zero Adjust Range:</th>
<th>Anywhere within the active length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span Adjust Range:</td>
<td>FS ≥ 0.5 ft. from Zero</td>
</tr>
</tbody>
</table>

**ENVIRONMENTAL**

<table>
<thead>
<tr>
<th>Sealing:</th>
<th>Potted sensor cartridge, electronics are conformally-coated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity:</td>
<td>0 to 100 % R.H.</td>
</tr>
<tr>
<td>Operating Temperature:</td>
<td>-34 to 71°C (-30 to 160°F)</td>
</tr>
<tr>
<td>Vessel Pressure:</td>
<td>6.894 MPa (1000 psi) maximum</td>
</tr>
<tr>
<td>Materials (wetted parts):</td>
<td>316 Stainless steel standard, other material available optionally</td>
</tr>
<tr>
<td>Minimum Life Expectancy:</td>
<td>10 years</td>
</tr>
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</table>

**FIELD INSTALLATION**

<table>
<thead>
<tr>
<th>Gauge Length:</th>
<th>Up to 25 ft. (7.6 meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (electronics enclosure):</td>
<td>Refer to dimension drawing, page 3</td>
</tr>
<tr>
<td>Mounting (typical):</td>
<td>• C4 Transmitter: 1/2 in. NPT adjustable fitting</td>
</tr>
<tr>
<td></td>
<td>• Industrial Sensor Well: 3/4 in. NPT adjustable fitting or flange</td>
</tr>
<tr>
<td></td>
<td>• Sanitary Sensor Well: Sanitary process cap</td>
</tr>
<tr>
<td>Wiring:</td>
<td>2-wire connection, shielded cable or twisted pair to screw terminals through</td>
</tr>
<tr>
<td></td>
<td>a 3/4 in. NPT conduit opening</td>
</tr>
</tbody>
</table>

All specifications are subject to change without notice. Consult MTS for verification of specifications critical to your needs.

* Whichever is greater
2.3 Accuracy

The absolute accuracy of the gauge is a function of the manufacture of the waveguide. That is, any imperfections in the waveguide are reflected in the linearity of its output. The tolerances reflect a non-linearity of 0.035% full scale. Due to its high degree of repeatability, the differential accuracy is extremely high.

2.4 Theory of Operation

The magnetostrictive Level Plus transmitters precisely sense the position of an external float by applying a short (1.5 µs) interrogation pulse to a waveguide medium. This current pulse causes a magnetic field to instantly surround the waveguide. The magnet installed within the float also creates a magnetic field. Where the magnetic fields from the waveguide and float intersect, a rotational force is created (waveguide twist). This, in turn, creates a torsional sonic pulse that travels along the waveguide (Refer to Figure 2.3).

The head of the gauge houses the sensing circuit, which detects the arrival of the torsional sonic pulse and converts it to an electrical pulse. The distance from a reference point to the float is determined by measuring the time interval between the initiating current pulse and the return pulse and precisely knowing the speed of these pulses. The time interval is converted into a proportional 4 to 20 mA loop output signal.
3 ORDERING GUIDE

3.1 Model Number Generation

The following information describes the 4 fields in the Level Plus C4 model number guide (see Section 3.2). The model number describes the desired C4 transmitter configuration. This number is required when placing an order and when contacting MTS with questions regarding the transmitter after the devices are shipped to you.

At the time of order, in addition to the model number, you must also complete an Application Data Sheet (see Section 3.5). The Application Data Sheet details the parameters of the intended application and assists MTS in helping you to determine the best solution to your application demands.

1 - MODEL:

C4 = Level transmitter with a single 4-20 mA loop (Output: 1 level)

2 - UNIT OF MEASURE:

The “Unit of Measure” is a single digit code which identifies the engineering units in which you want to express the length of the transmitter.

Selection:
1 = For length: Inches (xxx.0 in.)
2 = For length: Millimeters (xxxx mm)

3 - LENGTH:

The order length of the transmitter is defined in Figure 2.1. Normal installation requirements dictate that the desired transmitter length for a vessel should be measured from the bottom of the vessel to the top of the vessel flange, plus 5 inches. This additional 5 inches allows for various mounting configurations for process vessels. The transmitter length should be accurately measured prior to ordering. Vessel or tank flexure that occurs during filling, the amount of adjustment available at the top of the vessel, and changes due to temperature fluctuations should be considered when defining the desired length. Encode the length in the model number using a 4-digit code.

Standard C4 transmitters are available in lengths from 24 inches (encode 0240) to 300 inches (encode 3000) in 12 inch increments. Custom lengths up to 300 inches are also available (price adders and extended lead times apply).

4 - WETTED PARTS:

The standard wetted parts are constructed of 316L stainless steel. Wetted parts include the adjustable fitting and the pipe as illustrated in Figure 2.1.

Selection:
0 = Standard, 316L stainless steel (1/2 in. NPT and pipe)
1 = Optional mounting configurations and pipe materials (sensor well required)
2 = Teflon

Optional sensor wells and flanges are available separately. Sensor wells can be constructed of optional materials to meet your application demands (refer to Section 3.3).
When optional mounting configurations or other pipe materials are needed, a sensor well is required. MTS offers two sensor well products:

- Industrial Sensor Wells (Section 3.3)
- Sanitary Sensor Wells (Section 3.4)

### 3.2 C4 Model Number Guide

**MODEL**

C4 = Level transmitter w/single 4-20 mA loop

**UNIT OF MEASURE**

1 = Inches and tenths (xxx.0 in.)
2 = Millimeters (xxxx mm)

**TRANSMITTER ORDER LENGTH**

Length equals vessel height plus 5 inches (127 mm) for mounting purposes

Standard Range: 24 to 300 in. (610 to 7620 mm), encode as 0240 to 3000 (0610 to 7620)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>24 in. = 0240</td>
<td>610 mm = 0610</td>
<td>168 in. = 1680</td>
<td>4267 mm = 4267</td>
<td></td>
</tr>
<tr>
<td>36 in. = 0360</td>
<td>914 mm = 0914</td>
<td>180 in. = 1800</td>
<td>4572 mm = 4572</td>
<td></td>
</tr>
<tr>
<td>48 in. = 0480</td>
<td>1219 mm = 1219</td>
<td>192 in. = 1920</td>
<td>4877 mm = 4877</td>
<td></td>
</tr>
<tr>
<td>60 in. = 0600</td>
<td>1524 mm = 1524</td>
<td>204 in. = 2040</td>
<td>5182 mm = 5182</td>
<td></td>
</tr>
<tr>
<td>72 in. = 0720</td>
<td>1829 mm = 1829</td>
<td>216 in. = 2160</td>
<td>5486 mm = 5486</td>
<td></td>
</tr>
<tr>
<td>84 in. = 0840</td>
<td>2134 mm = 2134</td>
<td>228 in. = 2280</td>
<td>5791 mm = 5791</td>
<td></td>
</tr>
<tr>
<td>96 in. = 0960</td>
<td>2438 mm = 2438</td>
<td>240 in. = 2400</td>
<td>6096 mm = 6096</td>
<td></td>
</tr>
<tr>
<td>108 in. = 1080</td>
<td>2743 mm = 2743</td>
<td>252 in. = 2520</td>
<td>6401 mm = 6401</td>
<td></td>
</tr>
<tr>
<td>120 in. = 1200</td>
<td>3048 mm = 3048</td>
<td>264 in. = 2640</td>
<td>6706 mm = 6706</td>
<td></td>
</tr>
<tr>
<td>132 in. = 1320</td>
<td>3353 mm = 3353</td>
<td>276 in. = 2760</td>
<td>7010 mm = 7010</td>
<td></td>
</tr>
<tr>
<td>144 in. = 1440</td>
<td>3658 mm = 3658</td>
<td>288 in. = 2880</td>
<td>7315 mm = 7315</td>
<td></td>
</tr>
<tr>
<td>156 in. = 1560</td>
<td>3962 mm = 3962</td>
<td>300 in. = 3000</td>
<td>7620 mm = 7620</td>
<td></td>
</tr>
</tbody>
</table>

Note: Standard lengths from 228 in. (5791 mm) to 300 in. (7620 mm) are subject to additional lead time. Transmitters not ordered in the above standard lengths will be treated as custom orders and are subject to additional cost and lead time.

**WETTED PARTS**

0 = Standard 316L stainless steel, 1/2 in. NPT and pipe
1 = Optional pipe mounting styles/pipe materials (Sensor Well required)
2 = Teflon

**NOTE**: A completed Application Data Sheet is required before an order can be processed.
3.3 Industrial Sensor Well (Sensor Well 2)

1.) MODEL
   S2 = Industrial Sensor Well

2.) UNIT OF MEASURE
   1 = US Customary (inches and tenths)
   2 = Metric (millimeters)

3.) LENGTH
   Example: Encode 12 inches as 0120, encode 1500 millimeters as 1500
   IMPORTANT: Order Length = Transmitter order length minus 3 inches (76.2 mm)

4.) WETTED PARTS
   SS = 316L Stainless Steel (-30 to 300°F, -34 to 149°C)
   HC = Hastelloy C-276 (-30 to 300°F, -34 to 149°C)

5.) PROCESS CONNECTION
   0 = No Flange (3/4 in. adjustable fitting)
   2 = 2 in. Flange
   3 = 3 in. Flange
   4 = 4 in. Flange
   5 = 5 in. Flange
   6 = 6 in. Flange
   *Flange location (from tip of transmitter) must specified by the customer at time of order. Refer to Figure 3.1.

6.) FLANGE RATING
   0 = No Flange
   1 = 150#
   3 = 300#
   6 = 600#
3.3.1 Industrial Sensor Well Dimensions

Figure 3.1
Industrial Sensor Well
(Left: welded flange; right: adjustable fitting)
3.4 Sanitary Sensor Well

1.) MODEL
   SA = Sanitary Sensor Well

2.) UNIT OF MEASURE
   1 = US Customary (inches and tenths)
   2 = Metric (millimeters)

3.) LENGTH
   Example:
   Encode 36 inches as 0360, encode 1500 millimeters as 1500
   IMPORTANT: Order Length = Transmitter order length minus 2 inches

4.) END PLUG TYPE
   3A = 3A Sanitary Approved
   CP = Clean-in-Place
   DP = Drain-in-Place
   DN = Drain-in-Place (no through hole)
   MP = Drain-in-Place (w/mid clip)

5.) PROCESS CONNECTION - SANITARY CAP
   10 = 1" Cap
   15 = 1.5" Cap
   20 = 2" Cap
   25 = 2.5" Cap
   30 = 3" Cap
   40 = 4" Cap
   50 = 5" Cap
   60 = 6" Cap

3.4.1 Sanitary Sensor Well End Plugs

Figure 3.2
End Plugs for Sanitary Sensor Well

NOTE:
Sensor wells with "3A" and "DP" end plugs have permanently mounted floats—floats cannot be removed from pipe.
3.4.2 Sanitary Sensor Well Dimensions

Figure 3.3
Sanitary Sensor Well

- Standard 1/2 in. Tube
- 1/2 in. to 5/8 in. Tube Adaptor
- Sanitary Process Connection (Sanitary Cap) (Sizes: 1", 1.5", 2", 2.5", 3", 4", 5", 6")
- Sensor Well Tube (0.625 in. dia.)
  - Constructed of:
    - 316L stainless steel or
    - Hastelloy C276

Customer Defined Location of Mounting Flange
(this dimension must be provided at time of order)

Sensor Well - Order Length

Required Length = Transmitter Length Minus 2 Inches
3.5 Application Data Sheet for C4 Transmitters

The following information must be provided at the time of order to ensure that your application requirements are met.

<table>
<thead>
<tr>
<th>APPLICATION DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTS Quote/Order #:</td>
</tr>
<tr>
<td>Company Name:</td>
</tr>
<tr>
<td>Customer Reference #:</td>
</tr>
<tr>
<td>Transmitter Model #:</td>
</tr>
<tr>
<td>Sensor Well Model #: (if required):</td>
</tr>
<tr>
<td>Float P/N:</td>
</tr>
<tr>
<td>Float Dimensions:</td>
</tr>
<tr>
<td>Specific Gravity:</td>
</tr>
<tr>
<td>Sensor Pipe Material:</td>
</tr>
<tr>
<td>Flange/Process Connection:</td>
</tr>
<tr>
<td>Loop #1 Assignment: <strong>Level 1</strong></td>
</tr>
<tr>
<td>Output: <strong>4 - 20 mA</strong></td>
</tr>
<tr>
<td>Power Supply Required: <strong>24 Vdc</strong></td>
</tr>
<tr>
<td>Maximum Vessel Operating Pressure: <strong>1000 psi, 6.984 MPa</strong></td>
</tr>
<tr>
<td>Maximum Operating Temperature Range: <strong>-30 to 300°F (-34 to 149°C)</strong></td>
</tr>
</tbody>
</table>

Certified By: ___________________________ Date: _________
4 MOUNTING

The method of mounting the Level Plus C4 transmitters is dependent on the vessel or tank in which they are being used. Most applications will require one of two methods: threaded or flange mounting.

4.1 Threaded Mounting

In applications with smaller vessels and tanks, the C4 transmitters can be mounted directly to the tank via a 1/2 in NPT fitting. There must also be a tank access to allow the float to be mounted on the transmitter from inside the vessel (see Figure 4.1).

1.) Remove retaining collar or E-clip and the float from the transmitter.
2.) Insert the tip of the transmitter through the threaded vessel opening about 12 - 24 inches.
3.) Before inserting the transmitter completely to the bottom of the vessel, remount the float and the retaining collar or E-clip from inside the tank via an access hole.
4.) The tip of the transmitter can now be lowered to the bottom of the vessel and the threaded 1/2 in. NPT connection made. There must not be more than 12 inches of the transmitter's pipe extending above the vessel.

4.2 Flange Mounting

The C4 transmitters can also be mounted in threaded reducing flange as follows (refer to Fig. 4.2):

1.) Remove the float from the transmitter.
2.) Mount the transmitter in the threaded flange opening (1/2 in. NPT).
3.) Remount the float on the transmitter.
4.) To complete the installation, mount the transmitter and flange as a unit onto the tank. There must not be more than 12 inches of pipe length extending above the flange connection when installation is complete.
4.3 Sanitary Mounting

If a 3A rated sanitary C4 transmitter is required, a 316L polished stainless steel sensor well with a sanitary fitting is available as an option (See Figure 4.3 below).
The C4 transmitter designs are modular in nature. The electronics module is environmentally sealed and can be replaced in the field without the on-site support of the MTS service department. Therefore, the Level Plus single loop C4 transmitter can be upgraded to a multifunctional A4 transmitter with a bolt-in module (the C4 transmitter is equipped with an RTD for temperature measurement in the event this upgrade is desired).

A typical intrinsically safe connection for Level Plus transmitters includes protective safety barriers, a power supply, and a reading or monitoring device. Refer to Figure 6.1 below.

SPECIAL NOTE: As of November 1, 1996, Factory Mutual intrinsic safety approval is pending.

NOTES:

1. For explosion-proof installation, safety barriers are not required and wiring shall be installed in accordance with the National Electric Code ANSI/NFPA 70, Article 501-30.
2. For I.S. field installation, safety barriers are required and wiring shall be installed in accordance with the National Electric Code ANSI/NFPA 70, Article 504-30.
3. Shielded, twisted pair cable of 24 AWG or heavier should be used. Cable capacitance shall be less than 30 pF per foot.
4. Control room equipment should not use or generate more than 250 V RMS.
5. For FMRC gauges (or transmitters) Barriers must be FMRC Approved.
6. The connection between the earth ground terminal of the FM RC entity approved safety barrier and the system earth ground must be less than 1 Ω.
7. Safety barriers are FM RC entity approved safety barriers used in an approved configuration where transmitter Vmax is greater than barrier Voc or Vt and transmitter Imax is greater than barrier Isc or It.
8. Transmitter Ci plus total cable capacitance for each loop must not exceed barrier Ca. Transmitter Li plus total cable inductance for each loop must not exceed barrier La.
9. The transducer frame shall be grounded to earth ground directly or through the equipment on which it is mounted.
10. No revision shall be made without notification of approval agency(s).
11. Intrinsically safe for: Class I Division 1, Groups C & D Class II, DIV. 1, Groups E, F, & G, Class III, Division 1 with NEMA 4 (for outdoor use).
12. Explosion-proof for: Class I DIV. 1 Groups B, C, & D Class II, Division 1 Groups E, F, & G Class III, Division 1
13. Loop entity parameters: Vmax=36.1V Imax=11 BmA Ci 3 XXµF Li =XXuH
14. Temperature code is XX.
15. Approved methods for separation of each loop are:
   a.) Running loops is separate cables.
   b.) Running loops is separate shields.
   c.) Using 0.25 mm (0.01 in.) thick insulation suitable for the maximum temperature on each conductor.
NOTES:

Cables
1. Cable sets that run together must have sufficient insulation to withstand 250 RMS between sets. Electronic equipment connected to associated apparatus must not use or generate more than 250V RMS.
2. A twisted pair or shielded cable of #24 AWG or heavier gauge can be used. Cable capacitance shall be less than 30 pF per foot.
3. Cable parameters in hazardous areas must meet the requirements of the safety barrier manufacturer.
4. Maximum loop resistance vs. power supply voltage is illustrated in Figure 6.2. Maximum resistance is the sum of the cable resistance, safety barrier resistance, and load or other loop resistance.

Grounding
1. The resistance between shunt safety barrier grounds and the system earth ground must be less than 1Ω.
2. The transmitter frame shall be connected to earth ground directly or though the equipment on which it is mounted.

Figure 6.1
Two-Wire System
Figure 6.2
Two-Wire System
6.1 Safety Barriers

### HAZARDOUS AREA

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>+</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>P &amp; F (Passive)</td>
<td>Z 487/Ex</td>
<td>408 ohms equivalent</td>
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#### NON-HAZARDOUS AREA

**SHUNT BARRIERS (I.S. Ground Connection REQUIRED)**

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>+</th>
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<tbody>
<tr>
<td>MTL (Active)</td>
<td>706</td>
<td>I.S. Ground Connection</td>
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</table>

**POWER & SIGNAL COMMON**

- +24 Vdc Input
- +1 to 5 V Output

### HAZARDOUS AREA

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>+</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>P &amp; F (Active)</td>
<td>KHD J-ICR/Ex/C20 200</td>
<td></td>
</tr>
</tbody>
</table>

#### NON-HAZARDOUS AREA

**ISOLATED BARRIERS (I.S. Ground Connection NOT REQUIRED)**

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>+</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTL 3041</td>
<td>I.S. Ground Connection</td>
<td></td>
</tr>
</tbody>
</table>

**POWER & SIGNAL COMMON**

- +24 Vdc
- +1 to 5 V Output
- 1 to 5 V Return

### NOTES:

1. When selecting barrier types, the entity parameters for the A4/C4 transmitters are:
   - \( V_{max} = 36 \text{ Vdc} \)
   - \( I_{max} = 100 \text{ mA} \) (total current)
   - \( C_I = 0.0 \mu\text{F} \)
   - \( L_I = 500 \mu\text{H} \)
2. P&F - Pepperl and Fuchs (Phone: 216-425-3555); MTL = MTL Incorporated (Phone: 703-361-0111)

---

Figure 6.3

Suggested Safety Barrier Types for A4/C4 Transmitters
7 FLOATS

7.1 Standard Float

NOTE: Where magnet is not shown, magnet is positioned at centerline of float.

NOTE: The Float-Retaining Collar is adjustable and should be installed on the transmitter such that the centerline of the float will not enter the 3 inch inactive area. Float sizes are variable so “X” indicated in Figure 9.1 is also variable.

<table>
<thead>
<tr>
<th>Part No. Ext.</th>
<th>Material</th>
<th>Offset Option?</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = 1</td>
<td>316L Stainless Steel</td>
<td>No</td>
<td>0.65</td>
</tr>
<tr>
<td>X = 2</td>
<td>316L Stainless Steel</td>
<td>Yes</td>
<td>0.67</td>
</tr>
<tr>
<td>X = 3</td>
<td>Hastelloy C-276</td>
<td>No</td>
<td>0.68</td>
</tr>
<tr>
<td>X = 4</td>
<td>Hastelloy C-276</td>
<td>Yes</td>
<td>0.71</td>
</tr>
</tbody>
</table>

PRODUCT FLOAT
Part No. 251981-X
Maximum Pressure: 500 PSI
Maximum Temperature: 300°F
Specific Gravity: See chart above

#1 INTERFACE FLOAT (<1.0 s.g.)
Part No. 251982-X
Maximum Pressure: 500 PSI
Maximum Temperature: 300°F
Specific Gravity: Sink through <0.89 specific gravity and float on 1.0 specific gravity

#2 INTERFACE FLOAT (>1.0 s.g.)
Part No. 251983-X
Maximum Pressure: 500 PSI
Maximum Temperature: 300°F
Specific Gravity: Sink through 1.0 specific gravity and float on >1.12 specific gravity
7.2 Teflon Floats

PRODUCT FLOAT
Part No. 201109
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: For use in sp. gr. > 0.87

#1 INTERFACE FLOAT (<1.0 s.g.)
Part No. 251119
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: Sink through 0.89 specific gravity and float on 1.0 specific gravity

#2 INTERFACE FLOAT (>1.0 s.g.)
Part No. 251120
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: Sink through 1.0 specific gravity and float on > 1.12 specific gravity

PRODUCT FLOAT
Part No. 201112
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: For use in sp. gr. > 0.87

#1 INTERFACE FLOAT (<1.0 s.g.)
Part No. 251115
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: Sink through < 0.89 specific gravity and float on 1.0 specific gravity

#2 INTERFACE FLOAT (>1.0 s.g.)
Part No. 251116
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: Sink through 1.0 specific gravity and float on > 1.12 specific gravity

PRODUCT FLOAT
Part No. 201109
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: For use in sp. gr. > 0.87

#1 INTERFACE FLOAT (<1.0 s.g.)
Part No. 251119
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: Sink through 0.89 specific gravity and float on 1.0 specific gravity

#2 INTERFACE FLOAT (>1.0 s.g.)
Part No. 251120
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: Sink through 1.0 specific gravity and float on > 1.12 specific gravity
PRODUCT FLOAT
Part No. 251939
Maximum Pressure: 15 PSI
Maximum Temperature: 100°F
Specific Gravity: For use in sp. gr. >0.86
7.3 Nitrophyl Floats

**Part No. 251966-X**
- Maximum Pressure: 200 PSI
- Maximum Temperature: 220°F
- Specific Gravity: For use in sp. gr. >0.48

**Part No. 251967-X**
- Maximum Pressure: 200 PSI
- Maximum Temperature: 220°F
- Specific Gravity: Sink through gasoline and float on water

**Part No. 251968-X**
- Maximum Pressure: 200 PSI
- Maximum Temperature: 220°F
- Specific Gravity: Sink through diesel and float on water

---

**Part No. Ext. Offset Option?**

<table>
<thead>
<tr>
<th>Ext. Offset</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = 1</td>
<td>No</td>
</tr>
<tr>
<td>X = 2</td>
<td>Yes</td>
</tr>
</tbody>
</table>
NOTE - Float Limitations:
Floats 200941 CANNOT be used with applications requiring 2 floats (i.e., for product and interface levels).

PRODUCT FLOAT
Part No. 200941-X
Maximum Pressure: 275 PSI
Maximum Temperature: 220°F
Specific Gravity: For use in sp. gr. >0.47

#1 INTERFACE FLOAT
Part No. 251240-X
Maximum Pressure: 275 PSI
Maximum Temperature: 220°F
Specific Gravity: Sink through gasoline and float on water

#2 INTERFACE FLOAT
Part No. 251241-X
Maximum Pressure: 275 PSI
Maximum Temperature: 220°F
Specific Gravity: Sink through diesel and float on water

NOTE - Float Limitations:
Floats 251239, 251240, and 251241 can only be used with transmitters ≤ 200 inches (5080 mm) in length.

PRODUCT FLOAT
Part No. 251239-X
Maximum Pressure: 275 PSI
Maximum Temperature: 220°F
Specific Gravity: For use in sp. gr. >0.38

#1 INTERFACE FLOAT
Part No. 251240-X
Maximum Pressure: 275 PSI
Maximum Temperature: 220°F
Specific Gravity: Sink through gasoline and float on water

#2 INTERFACE FLOAT
Part No. 251241-X
Maximum Pressure: 275 PSI
Maximum Temperature: 220°F
Specific Gravity: Sink through diesel and float on water

NOTE - Float Limitations:
Floats 251239, 251240, and 251241 can only be used with transmitters ≤ 200 inches (5080 mm) in length.

PRODUCT FLOAT
Part No. 200941-X
Maximum Pressure: 275 PSI
Maximum Temperature: 220°F
Specific Gravity: For use in sp. gr. >0.47

NOTE - Float Limitations:
Floats 200941 CANNOT be used with applications requiring 2 floats (i.e., for product and interface levels).
7.4 Sanitary Float

PRODUCT FLOAT
Part No. 200931-X
Maximum Pressure: 275 PSI
Maximum Temperature: 300°F
Specific Gravity: For use in sp. gr. >0.63

NOTE - 3A Rated:
Floats 200931 is rated 3A by Factory Mutual for use in sanitary applications.

7.5 Clean-in-Place/Drain-in-Place Float

PRODUCT FLOAT
Part No. 251234-X
Maximum Pressure: 275 PSI
Maximum Temperature: 300°F
Specific Gravity: For use in sp. gr. >0.74

NOTE - Clean-in-place:
Floats 251234 is suitable for use in clean-in-place and drain-in-place applications.
7.6 Special Product Floats

PRODUCT FLOAT
Part No. 251553
Maximum Pressure: 275 PSI
Maximum Temperature: 300°F
Specific Gravity: For use in sp. gr. >0.60

Note:
This float can only be used with gauges less than or equal to 200 inches. This float cannot be used in applications requiring two floats.

PRODUCT FLOAT
Part No. 200938-X
Maximum Pressure: 125 PSI
Maximum Temperature: 300°F
Specific Gravity: See chart above

Note:
This float can only be used with gauges less than or equal to 200 inches. This float cannot be used in applications requiring two floats.

<table>
<thead>
<tr>
<th>Part No. Ext.</th>
<th>Material</th>
<th>Offset Option?</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = 1</td>
<td>316L Stainless Steel No</td>
<td></td>
<td>0.74</td>
</tr>
<tr>
<td>X = 2</td>
<td>316L Stainless Steel Yes</td>
<td></td>
<td>0.77</td>
</tr>
</tbody>
</table>

PRODUCT FLOAT
Part No. 251553
Maximum Pressure: 275 PSI
Maximum Temperature: 300°F
Specific Gravity: For use in sp. gr. >0.60

Note:
This float can only be used with gauges less than or equal to 200 inches.
7.7 Long Gauge Floats

**PRODUCT FLOAT**
Part No. 250709-X
- Maximum Pressure: 500 PSI
- Maximum Temperature: 300°F
- Specific Gravity: See chart above

**#1 INTERFACE FLOAT (<1.0 s.g.)**
Part No. 250714-X
- Maximum Pressure: 500 PSI
- Maximum Temperature: 300°F
- Specific Gravity: Sink through <0.89 specific gravity and float on 1.0 specific gravity

**PRODUCT FLOAT**
Part No. 251223-X
- Maximum Pressure: 500 PSI
- Maximum Temperature: 300°F
- Specific Gravity: See chart above

**#1 INTERFACE FLOAT (<1.0 s.g.)**
Part No. 251224-X
- Maximum Pressure: 500 PSI
- Maximum Temperature: 300°F
- Specific Gravity: Sink through <0.89 specific gravity and float on 1.0 specific gravity

**PRODUCT FLOAT**
Part No. 250855-X
- Maximum Pressure: 500 PSI
- Maximum Temperature: 300°F
- Specific Gravity: See chart above

**#2 INTERFACE FLOAT (>1.0 s.g.)**
Part No. 250855-X
- Maximum Pressure: 500 PSI
- Maximum Temperature: 300°F
- Specific Gravity: Sink through >1.12 specific gravity

<table>
<thead>
<tr>
<th>Part No. Ext.</th>
<th>Ext. Material</th>
<th>Offset Option?</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = 1</td>
<td>316L Stainless Steel</td>
<td>No</td>
<td>0.44</td>
</tr>
<tr>
<td>X = 2</td>
<td>316L Stainless Steel</td>
<td>Yes</td>
<td>0.46</td>
</tr>
<tr>
<td>X = 3</td>
<td>Hastelloy C-276</td>
<td>No</td>
<td>0.52</td>
</tr>
<tr>
<td>X = 4</td>
<td>Hastelloy C-276</td>
<td>Yes</td>
<td>0.54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part No. Ext.</th>
<th>Ext. Material</th>
<th>Offset Option?</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = 1</td>
<td>316L Stainless Steel</td>
<td>No</td>
<td>0.54</td>
</tr>
<tr>
<td>X = 2</td>
<td>316L Stainless Steel</td>
<td>Yes</td>
<td>0.56</td>
</tr>
<tr>
<td>X = 3</td>
<td>Hastelloy C-276</td>
<td>No</td>
<td>0.67</td>
</tr>
<tr>
<td>X = 4</td>
<td>Hastelloy C-276</td>
<td>Yes</td>
<td>0.69</td>
</tr>
<tr>
<td>X = 5</td>
<td>Monel K-500</td>
<td>No</td>
<td>0.83</td>
</tr>
<tr>
<td>X = 6</td>
<td>Monel K-500</td>
<td>Yes</td>
<td>0.85</td>
</tr>
</tbody>
</table>
Replace the 4-20 mA transmitter modules as follows (reference Figure 8.1):

1. Remove any dirt or debris from the top of the electronics enclosure.

2. Remove the electronics housing cover by rotating the cover counterclockwise.

3. Remove the existing transmitter module by loosening the two screws in the base of the module assembly, then rotate the module assembly counterclockwise until it disengages.

3. Lift out the module assembly from the housing. Be sure that the internal electrical connections remain intact; the wiring to the modules is of adequate length to provide serviceability.

4. Make the appropriate electrical connections to the new transmitter module before installing it in the housing (refer to Table 8-1).

4. Install the new 4-20 mA transmitter module in the housing by aligning the slots on the module base with 2 screws in mounting area.

5. Rotate the module assembly clockwise until the screws are positioned in the slot, then tighten the screws.

<table>
<thead>
<tr>
<th>Table 8-1</th>
<th>Sensor Wire Color Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3-1</td>
<td>Red</td>
</tr>
<tr>
<td>P3-2</td>
<td>White</td>
</tr>
<tr>
<td>P3-3</td>
<td>Orange/Shield</td>
</tr>
<tr>
<td>P3-4</td>
<td>N/C</td>
</tr>
<tr>
<td>P3-5</td>
<td>Blue</td>
</tr>
<tr>
<td>P3-6</td>
<td>Green</td>
</tr>
<tr>
<td>P4-1</td>
<td>Black</td>
</tr>
<tr>
<td>P4-2</td>
<td>Brown</td>
</tr>
</tbody>
</table>

Figure 8.1
Transmitter Module Assembly (Cover removed)

CAUTION!
Ensure that all power is disconnected before making any electrical connections.
9 ADJUSTMENTS FOR LEVEL TRANSMITTER

9.1 Alarm Settings C4 Transmitter:

When a fault condition is detected by the internal microprocessor, the 4 to 20 mA current will go to the current which is selected. To select the fault current, remove the alarm jumper, and replace it in either the 4 mA or the 20 mA position (the alarm jumper is a rectangular, black plastic piece located inside of the dotted line box labeled “alarm” on the front panel).

When in the 4 mA alarm mode after a fault has been detected, the output will be continuous at 3.8 ± 0.1 mA. When in the 20 mA alarm mode after a fault has been detected, the output will be continuous at 22.0 ± 0.2 mA.

9.2 Calibration for C4 Transmitter:

1. Remove the calibration jumper from the OFF position, and replace it in the ON position. This enables the calibration mode. (The calibration jumper is a rectangular, black plastic piece located inside of the dotted line box labeled CAL” on the front panel of the transmitter module.)

2. Move the float along the probe to the desired position for 4 mA.

3. Momentarily press the ADJUST switch down (labeled 4mA) and release. Do not hold down the switch for more than 1 second.

4. Move the float along the transmitter to the desired position for 20 mA.

5. Momentarily press the ADJUST switch up (labeled 20mA) and release. Do not hold down the switch for more than 1 second.

6. Move the calibration jumper back to the OFF position. Calibration is now complete.

Non standard settings:

A non standard setting may be achieved by moving the float to a position where more than 4 mA is desired, (e.g. 4.5 mA) and holding the ADJUST switch down until the output increments up to that reading. Use a voltmeter connected across the test (TST) pins of the loop connector (as marked on the front panel) to monitor the output; 4 to 20 mA will read as 40 to 200 mV.

Likewise, for non standard 20 mA settings, hold the ADJUST switch up until the output changes to the desired current level (e.g. 19.5 mA). Monitor the reading using the voltmeter.