Bently Nevada 200150

# Accelerometer


**Limited Availability**
**Used and in Excellent Condition**

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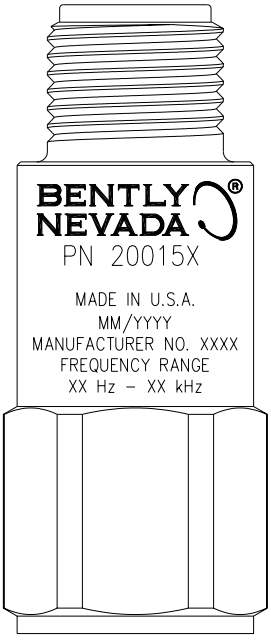
Part number 164985-01
Revision A, March 2004

# *200150, 200155 & 200157 Accelerometers*

## Information and Installation Guide

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The following ways of contacting Bently Nevada are provided for those times when you cannot contact your local Bently Nevada representative:

| | |
|---|---|
| Mailing Address | 1631 Bently Parkway South<br>Minden, NV 89423<br>USA |
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## Disposal Statement

Customers and third parties who are in control of the product at the end of its life or at the end of its use are solely responsible for the proper disposal of the product. No person, firm, corporation, association or agency that is in control of product shall dispose of it in a manner that is in violation of United States state laws, United States federal laws, or any applicable international law. Bently Nevada is not responsible for the disposal of the product at the end of its life or at the end of its use.

## For Additional Information

| | |
|---|---|
| **164986-01** | 200150, 200155 and 200157 Accelerometers Datasheet |
| **149823-01** | Trendmaster® DSM Manual |
| **149831-01** | Trendmaster® DSM Datasheet |
| **163796** | Trendmaster® DSM Field Wiring Diagram |
| **162411** | Trendmaster® Pro System Manual |
| **163986-01** | ProTIM-R Manual |
| **161934-01** | ProTIM-C Manual |
| **126709-04** | Trendmaster® 2000 Installation Guide |
| **190125-01** | 1900/25 Vibration Monitor Operation and Maintenance Manual |
| **190127-01** | 1900/27 Vibration Monitor Operation and Maintenance Manual |
| **141556-01** | Data Sheet Accel-to-Vel TIM |
| **137230-01** | flexiTIM MANUAL |

# Preface

## About the manual

This manual shows how to install the 20015x Family of Accelerometers and accessories. The 200150, 200155 and 200157 connects to the 200200 proTIM-R and 200250 proTIM-C with different Acceleration-to-Velocity channel types.

The 200150 accelerometer is also designed to operate with the Trendmaster® 2000 system. It is intended to interface with the 200100 Dual Accel to Velocity flexiTIM, the 89130-01 Accel-to-Velocity TIM (Transducer Interface Module) as well as the 1900/25 and 1900/27 monitors.

## Manual Organization

The manual is organized as follows:

The first three sections describe the hardware, with installation and operating principles.

Sections four and five describe troubleshooting techniques and how to resolve problems with EMI.

Specifications, ordering, and accessories information for the accelerometer, cables, and mounting hardware is available in the accelerometer datasheet, 164986-01.

# Contents

# 1. 20015x Operating Information


**Figure 1. 20015x Accelerometer**

## 1.1 Overview

The 200155 and 200157 Accelerometers are general purpose, wide frequency transducers designed to operate with the Trendmaster® Pro system. They are intended to interface with the 200200 proTIM-R or the 200250 proTIM-C, using the 200152 and 200151 interconnecting cables, respectively. Each proTIM must be ordered with the correct signal conditioning option.

The 200150 accelerometer is a transducer designed to also operate with the TIM, flexiTIM, proTIM or 1900 monitor. The TIM or flexiTIM or proTIM integrates this signal to velocity and sends it to the Trendmaster® 2000 system. The 1900 monitor also integrates the signal to velocity and displays the amplitude on the monitor's front panel. The 1900/25 Vibration Monitor Operation and Maintenance Manual and the 1900/27 Vibration Monitor Operation and Maintenance Manual contain detailed information about 1900 installations (Bently Nevada part numbers 190125-01 and 190127-01, respectively).

| Accelerometer | ProTIM Option | Typical Application |
|---|---|---|
| 200150 | Standard Acceleration-to-Velocity channel type (-01) | General Application |
| 200155 | Low Frequency Acceleration-to-Velocity channel type (-05) | Fin-Fan, Slow Rotating Shafts |
| 200157 | Standard Acceleration-to-Velocity with Acceleration Enveloping channel type (-06) | Roller Element Bearing and Certain types of Cavitation Effects |

The –01 and –05 options of the proTIM integrates the acceleration signal into velocity units. The –06 option of the proTIM processes the signal to acceleration enveloped. The resulting signals are then sent to the DSM where it is processed before being sent to the System 1 software.

## Application Alert

**Use of the 200155 and 200157 accelerometers with TIMs other than those listed in the table above, including 1900 monitors, will result in false readings.**

## Application Alert

**The wider frequency range of the 200155 and 200157 accelerometers may result in increased noise compared to the 200150. The 200155 is the recommended transducer if some frequencies of interest are below 10Hz. The 200157 should only be used if the acceleration enveloping is required. Using the 200155 or the 200157 in place of the 200150 may potentially result in faulty readings. Refer to the proTIM datasheet for proper frequency response of the system.**

## Application Alert

**Because frequencies above 1 kHz will be attenuated by the Acceleration to Velocity circuitry in the 200200 and 200250 proTIMs, using the 200155 and 200157 to get higher frequency information will be ineffective.**

Refer to the “For Additional Information” section in the front of this manual for more information on TIMs, flexiTIMs, 1900 monitors, proTIMs, the DSM, Trendmaster® 2000, and the Trendmaster® Pro system.

## 1.2 Principle of Operation

The 20015x transducers contain a piezoelectric sensing device. The device generates charge when it is subjected to vibration. This charge is then converted electronically to a differential voltage signal. The output voltage is proportional to the acceleration that is parallel to the sensitive axis of the transducer.

# 2. Receiving and Handling Instructions

Visually inspect each transducer for shipping damage when it is unpacked. If shipping damage is apparent, file a claim with the carrier and submit a copy to Bently Nevada. Include part numbers and serial numbers on all correspondence.

Store the equipment in areas that will not be exposed to potentially damaging corrosive atmosphere or high temperature. See the Datasheet for more details.

# 3. Installation

**Application Alert**

**If you protect a machine by measuring the housing vibration, evaluate the usefulness of the measurement for each application. Most common machine malfunctions such as imbalance or misalignment originate at the rotor and cause an increase or change in rotor vibration. In order for any housing measurement alone to protect a machine, significant rotor vibration must be faithfully transmitted to the location on the bearing housing or machine casing where the transducer is mounted.**

**In addition, the transducer must be installed correctly. Improper installation can decrease the transducer amplitude signal and frequency response or generate signals, which do not represent actual machine vibration.**

## 3.1 Selecting a Mounting Location

Select a mounting location for data collection that best reflects a machine's behavior. To obtain a signal that is most sensitive to vibration, mount the accelerometer as close to the bearings as possible. Also make sure the location meets the operating conditions detailed in the Datasheet. The Bently Services department can assist in locating an optimal location for mounting the accelerometer.

## 3.2 Installing a Mounting Stud

**Application Alert**

**Improper installation can result in an attenuated response of the accelerometer and/or the generation of signals which do not represent actual machine vibration. Follow the installation instructions carefully.**

**Using mounting studs other than the ones listed in this manual can damage the transducer. See the Datasheet for a complete list of available studs.**

Bently Nevada offers several types of mounting studs for the mounting of the 20015x Accelerometers: Hex and hex plate stud, quick-set mounting, adhesive stud, and mag-force mounting. Refer to the Datasheet for complete part number information.

### 3.2.1 Hex and Hex Plate Stud

The hex or hex plate stud is recommended for use with 20015x Accelerometers because it provides a flat polished surface to prevent damage to the transducer and it allows for better transmission of high frequency vibration. Hex and hex plate studs require a location with enough thickness to drill and tap to accommodate at least 1.6 mm (1/16 in) longer than the stud length. Standard drilling and tapping tools are required. The mounting hole should be perpendicular to the surface. Due to the wide frequency range of the 20015x Accelerometers, spot facing the surface is required for mounting the plate stud. See the Datasheet for the hex size of each stud. Drill and tap with the thread size of the stud used. Screw in the stud with the wrench.

### 3.2.2 Quick-Set Mounting System

The Quick-Set mounting system is a hex type of adapter which does not require the use of tapping tools. The required minimum machine case thickness is 9.7 mm (0.38 in). This will allow for drilling with a #26 (0.147 in) drill to a depth of 8 mm (5/16 in). Other tools and materials include a 1 inch socket or open-end wrench and a thread locking compound. More specific instructions are included with the system.

### 3.2.3 Adhesive Stud

Adhesive studs are packaged in kits, which contain all materials needed for installation. The contents of the kits are shown in the following figure.

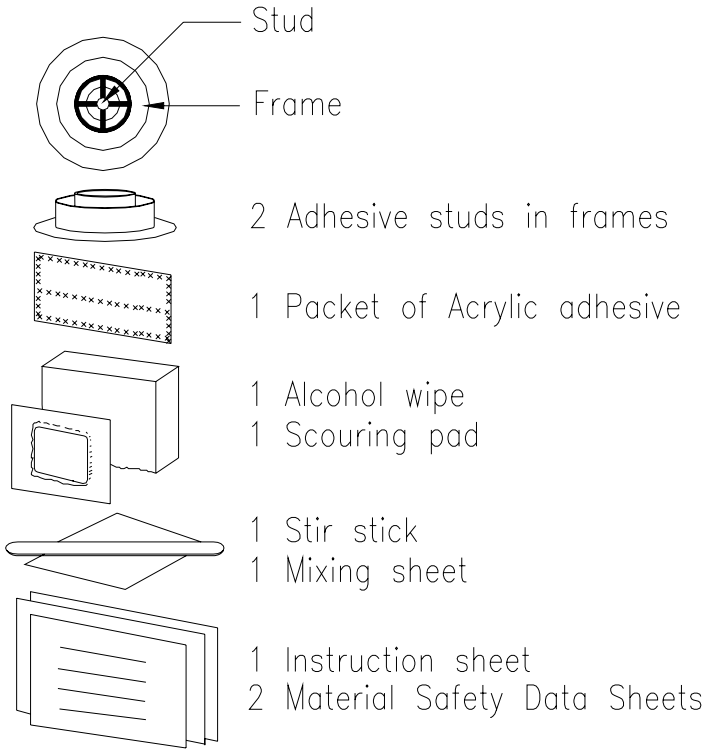



**Figure 2. Adhesive Mount Kit**

Adhesive studs require a location with a radius of curvature of 127 mm (5 in) or greater. A plastic frame on the stud temporarily holds the stud in place while the adhesive is curing. This frame requires a circular area of 51 mm (2 in) in diameter to mount. To obtain an effective bond, remove any paint, grease, and dirt from the surface and roughen it with sandpaper. A combination of solvent (such as MEK) and 100 to 180 grit sandpaper is recommended. Clean the stud base with alcohol or other solvent, taking care not to leave any residue. Prepare the adhesive and mount the stud base and frame according to the instructions included with the kits. Allow 24 hours for full cure at 24 C (75º F). Use pliers to remove the frame after the adhesive has cured. See the Datasheet for adhesive specifications.

**Application Alert**

**Applying adhesive studs on surfaces above 80 C (176º F) is not recommended.**

### 3.2.4 Mag-Force Mounting System

The Mag-Force mounting system uses a strong magnet coupled with a permanent adhesive to provide a fast and reliable method of attaching low frequency (<2 kHz) transducers to a variety of general purpose rotating machinery. The mounting surface should be prepared as described previously for adhesive mounting. The surface should be flat or have a radius of curvature of 152 mm (6 in) or greater. The mounting location must also be at least 32 mm (1.25 in) in diameter. A ½ -13 threaded rod and hex adapter 138730-01 are also recommended for installation to keep adhesive splatter to a minimum. More specific instructions are included in the system kit.

## 3.3 Mounting the Transducer

Screw the accelerometer onto the stud with a 11/16 in. deepwell socket or wrench. Torque to 6.8 N*m (5 ft*lb) Maximum.

## 3.4 Connecting and Installing the Cable

The 20015x accelerometers connect to the proTIMs, flexiTIMs or 1900 monitors with one of two interconnecting cables: 200151 (for proTIM-C, flexiTIMs, conduit cable adapters, and housing cable adapters) and 200152 (for proTIM-R and 1900 monitors). The 200151 has mating connectors on each end, while the 200152 is open on one end with blunt cut wires.

Select the cable length to provide the shortest connection between the transducer and the necessary interface module without placing any stress on either of the connections. The available cable lengths and types are listed in the Datasheet. Routing should be free of any item or surface that could harm the cable. Use tie wraps to support the cable, if necessary, to existing conduit runs, pneumatic tubing, etc. and steer the cable clear of any hot areas exceeding the rated temperature of the cable, refer to the Datasheet for cable specifications. Coil and support excess cable in a manner to avoid placing any load on the connections.

**Application Alert**

**The maximum allowed cable length for use with the 200155 is 50 feet.**

### 3.4.1 Connecting to the Accelerometer

Attach the female end of the cable to the accelerometer by screwing it finger tight plus 1/8th of a turn using a pair of pliers.

### 3.4.2 Connecting to ProTIMs, flexiTIMs, 1900 Monitors, Housing Cable Adapters, or Conduit Cable adapters

The 200151 cable has a male connector installed on the end opposite from the transducer. This connector mates directly with the 200250 proTIM-C, 200100 flexiTIM, the housing cable adapter (142485-01), or the conduit cable adapter (141887-01 Single, 141887-02 Dual). Attach the male end of the cable to one of these units by screwing it finger tight plus 1/8th of a turn using a pair of pliers.

The 200152 cable is provided with blunt cut wires on the end opposite from the transducer. This is ideal for connecting to the proTIM-R or 1900 monitors.

Refer to the Datasheet for complete part number listings. Refer to the front of this manual in the “For Additional Information” section for more information on connecting to applicable hardware.

### 3.4.3 Connecting to TIMs

To connect to a TIM, the following tools and materials are required:

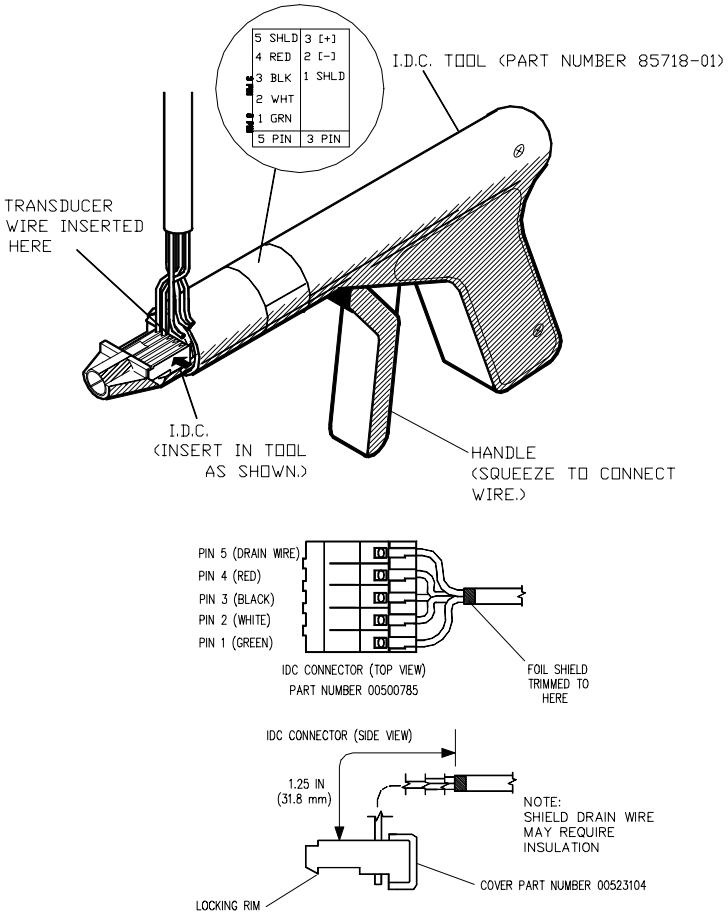
- An extension cable (catalog number 200152 - AA).
- An insulation displacement connector (IDC) and cover (Bently Nevada part numbers 00500785 and 00523104 respectively).
- An installation tool (Bently Nevada part number 85718-01).
- A wire striper to remove insulation from the cable.

**Application Alert**

**The IDC connectors that come with the TIMs must be replaced by part number 00500785 when the 200152 extension cable is used to connect to a TIM. The IDC connectors that come with the TIMs will not provide an adequate connection to the 200152 cable.**

Make the connections following these steps:

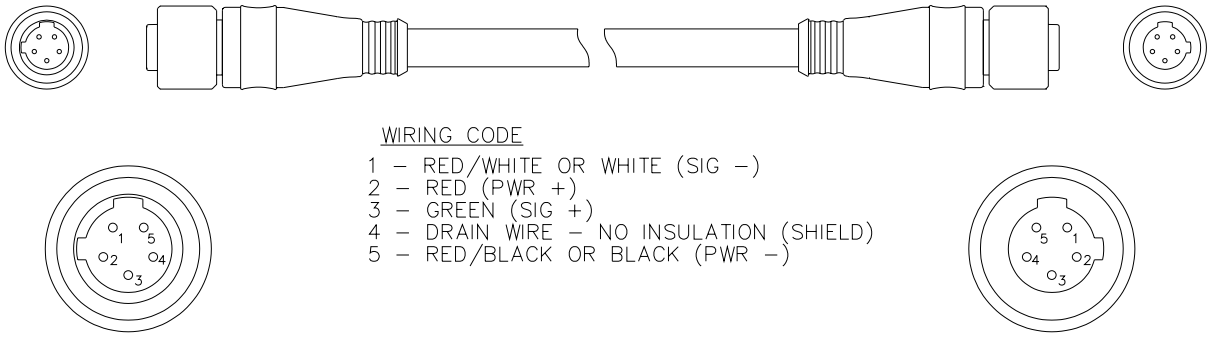
1. Cut the extension cable length to provide the shortest connection between the transducer and the TIM without placing any stress on the connections. Routing should be free of any item or surface that could harm the cable. Use tie wraps to support the cable, if necessary, to existing conduit runs, pneumatic tubing, etc. and steer the cable clear of any hot areas exceeding the rated temperature of the cable, refer to the Datasheet for cable specifications. Coil and support excess cable in a manner to avoid placing any load on the connections. Connect the extension cable to the accelerometer and tighten it finger tight plus 1/8 of a turn using a pair of pliers.
2. Strip 25 to 32 mm (1 to 1.25 in) of outer insulation and foil from the bare end of the cable but not from the individual wires in the cable.
3. Use the installation tool shown in the following figure to attach the connector to the wires as shown. Make sure the head that holds the connector is in the locked position. Load the IDC connector from the left side of the tool as viewed from the handle end.



4. After installing the wires as shown above, inspect the connections to make sure that the wires are all the way to the bottom of the pins and to the end of the IDC connector. If not, cut the wires at the IDC connector and install a new connector. Do not reconnect an IDC connector that has been previously attached to wires.
5. Install the IDC connector cover (Bently Nevada part number 00523104) to prevent the wires from coming loose.
6. Insert the IDC connector into the TIM referencing the Trendmaster® 2000 Installation Guide (Bently Nevada part number 126709-04).

### 3.4.4 Cable Pinouts

The 200151 and 200152 Cable pinouts are as follows:




## 3.5 After Installation

**Application Alert**

**Using the accelerometer as a foothold or handhold can damage it.**

# 4. Troubleshooting

This section lists some troubleshooting techniques that will help identify possible system problems.

**Symptom:** A change in the output of the accelerometer has occurred that may not be caused by a change in machine vibration.

1) **Possible Problem:** A cable connection has worked loose.
**Solution:** Check all cable connections for good contacts. Make sure the cable screw connector is finger-tight plus 1/8 turn. Make sure the connector or all conductors are fastened securely to all hardware. Replace cables if needed.

2) **Possible Problem:** The accelerometer has been damaged.
**Solution:** Return the accelerometer to Bently Nevada for possible replacement and analysis.

3) **Possible Problem:** Accelerometer has worked loose from the mounting stud.
**Solution:** Verify that the accelerometer is securely attached to the machine.

4) **Possible Problem:** The accelerometer, cable or other hardware has been exposed to EMI/RFI energy.

**Solution:** Refer to section 5.0 of this manual regarding EMI/RFI issues.

**Symptom:** The accelerometer gives no signal, an intermittent signal, or a “NOT OK” indication appears in the system**.**

1) **Possible Problem:** The cable has an internal open or short.
**Solution:** Disconnect the cable at both ends and check for opens or shorts. Also, carefully check the connector to verify that it does not contain the fault. Replace the cable if a fault is found.

2) **Possible Problem:** One or more of the cable connections may be loose or contaminated.
**Solution:** Check all cable connections for good, clean contacts. Make sure the cable screw connector is finger-tight plus 1/8 turn. Make sure each connector or all conductors are fastened securely to all hardware. Replace cables if needed.

3) **Possible Problem:** The accelerometer may be damaged.
**Solution:** Remove the accelerometer and replace it with a spare. Return the unit to Bently Nevada for possible replacement and analysis.

If the response has not changed or is still not acceptable, replace the accelerometer with a working spare. Check the results with the system software. If the problem still exists, the fault may either be in the machine, cable, and/or the other Trendmaster® equipment.

# 5. Minimizing Electromagnetic Interference

This section presents technical information on ElectroMagnetic Interference (EMI) terminology and provides an installation checklist to improve transducer immunity to EMI.

## 5.1 Terminology

ElectroMagnetic Interference (EMI) is defined as "the impairment of operation of electronic equipment from any electrical source, whether natural or man-made". More specifically, Radio Frequency Interference (RFI) refers to impairment of electronic equipment from radio interference. There are two methods of interference:

- Radiated
- Conducted

Radiated interference occurs when energy propagates through space and couples into a piece of equipment. For example, a hand-held transmitter radio can radiate interference when "keyed" to transmit. Conducted interference occurs when energy propagates through a conductor or physical media other than space such as signal lines or ground paths.

The interaction between radiated or conducted interference with equipment is often referred to as **immunity** or the reciprocal terminology is **susceptibility**. Specifications for immunity or susceptibility depend on the following:

- EMI frequency
- EMI field strength
- Maximum expected equipment response
- Installation

## 5.2 Installation Guidelines

### 5.2.1 Determining an EMI/RFI Problem

Since no two industrial environments are identical, installation requirements may differ from site to site. Routing the accelerometer's interconnect cable without conduit is permissible provided the following precautions are taken:

- Do not use high-powered radio transmitters (> 3 watts) near the cables
- Maintain at least 1 meter distance when using a radio transmitter near the cable exit from conduit or housings.

An EMI/RFI problem may exist if one or more of the following has occurred:

- Alert or danger trips occurring at random and after machinery health has been verified
- Vibration readings fluctuate when a cellular phone or high-power transmitter/receiver is used near transducer case or cabling
- The DSM shows random vibration readings when machine is "off" and it has been determined that vibration is not coming from surrounding equipment

### 5.2.2 Connecting the Shield Wire

The 20015x accelerometers use a four conductor cable with a braided or foil shield. The shield helps protect the signal/power lines from EMI/RFI. The shield should be connected at one point, monitor common, to prevent possible ground loops. Ground loops occur when a common line is connected to two points of different electrical potential. If an EMI/RFI problem persists, connect the shield to the transducer's outer steel case. Be certain that whichever shielding connection you choose to use, take precautions against ground loops. If you connect the shield to the transducer case, then disconnect the shield from the monitor common.

If you find that it is necessary to have the shield connected to the transducer case and the monitor common, insert a 200 V, 0.01 μF, low loss capacitor between the shield and monitor common. This capacitor will block DC and low frequency ground currents.

### 5.2.3 Resolving an EMI/RFI Problem

If an EMI/RFI problem is detected, perform the following:

Step 1 — Check that the machinery casing is properly grounded. The impedance measurement from machinery case to monitor ground should be less than 1 Ω.

Step 2 — Correct the grounding and verify whether or not the problem persists.

Step 3 — If the problem persists, check that the shield connection is correct. Refer to *Connecting the Shield Wire* in the previous section.

Step 4 — Correct the shield connection and verify whether or not the problem persists.

Step 5 — If the problem persists, route the interconnect cable in flexible metal conduit. Use conduit fittings to connect the flexible conduit to the transducer case.

Step 6 — Verify whether or not the problem still persists.

Step 7 — If the problem persists, a metal transducer housing may be required.