Tolteq Directional

Maintenance Manual

500768 A

April 2015

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Table of Contents

1 Welcome

Welcome to the Maintenance Manual for Tolteq Directional module.

This manual provides a list of the recommended tools, equipment, and materials needed for maintenance of this module, in addition to drawings of the tool and maintenance procedures.

This manual is written in the exact order that you should perform maintenance on your module. It will take approximately *one hour* to complete the procedures.

Before you Begin:

Before using tools or equipment. please read, understand, and observe all safety information and instructions contained within this manual and listed on safety decals located on the tool assembly and other equipment. Please wear listed protective gear when required.

All tools, materials, and equipment manufactured and supplied by Tolteq Group, LLC are designed to be used by qualified and trained personnel only.

Contact:

For general information:

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For documentation feedback and questions:

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General support: 8:00 AM – 5:00 PM CST, Monday through Friday.

Critical Issue support: 24/7, 1-512-220-1614.

2 Introduction

The Tolteq® TruCourse Directional module is a complex electromechanical assembly that includes sensor electronics that help detect and transmit the location of the wellbore position in terms of azimuth, inclination, and toolface by measuring the intensity of the magnetic and gravity fields and the dip angle.

Typically, this module is part of a tool string that includes other sensors and devices that relay the downhole data to the surface in real time. The module's main benefits include:

- Assisting the directional driller in reaching the proposed target area
- Providing data retrieval and analysis after the job is completed (using the onboard memory)
- Measuring and recording the intensity of earth's magnetic field and calculating the azimuth, using magnetometers and accelerometers

3 Tools, Parts, and Drawings

This section provides the following:

- List of tools, parts, and materials
- Directional components drawing and parts
- Centralizer components drawing and parts

Tools, Equipment, and Materials

The following tools, equipment, and materials are required to perform maintenance on the Tolteq Directional module. All items can be ordered from Tolteq.

Part #	Image	Details
900013		Tool Tracker Package 500456: Quick Start Guide 200008: Cable, Tool Tracker, Interconnect Adapter
101582		Laptop with power cord (Win 7/64 bit) *Installed with TruCourse Surface System and Tool Tracker 3 soft-ware*
600160		O-ring picks
100513		O-ring, **AS-018** (1) (*Centralizer*)

Part #	Image	Details
101541		O-ring, **AS-215** (2) (*Electronics*)
100214		O-ring, **AS-217** (10) (*Centralizer*) - 3 (*Electronics*) - 7
100124		O-ring, **AS-220** (2) (*Centralizer*) - 1 (*Dir. Housing*) - 1
100004		O-ring, **AS-318** (4) (*Electronics*)
600276		Wrench, Allen, 7/64", T-Handle (ball point hex key)
100496		Screw, SHCP, #6-32 x .50" Lg., (12)

Part #	Image	Details
100487		Thread protector cap, 1-9/16"-10
100520		Centralizer (SureMate) thread protector cap, 1.5625-10
600124		Spanner wrench, 1.875"
600122		Barrel wrench, 1.875"
600274		Vise bushing plates, 1.875"
600371 600372		600371 - Air compressor 600372 - Pneumatic accessory kit
100933		V-Block (2)

Part #	Image	Details
100389		MWD tool stand (optional) (2)
600252		Apron, industrial
600286		Clean repair trays (2)
600291		Safety glasses
600373		Gloves, chemical resistant, neo-prene, lined, med, pair
600290		Gloves, latex, medium

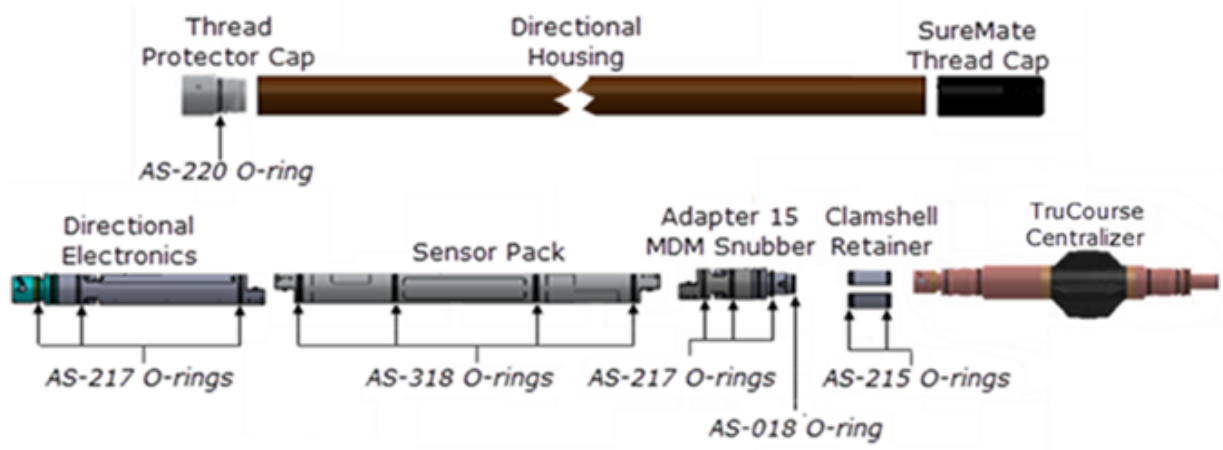
Part #	Image	Details
100392		Contact cleaner
600077		Lubricant, O-ring, sealant
100931		Loctite, #246, Blue, Thread Locker
N/A		Isopropyl Alcohol
N/A		Diagonal Pliers (snips) or Side Cutter
N/A		Pen, permanent marker

Part #	Image	Details
100419		Rags, box
N/A		Sink with dish washing liquid soap
N/A		Wire brush
600346		Solvent Parts Washer *Before use, consult operator booklet, instructions under washer lid, and Material Safety Data Sheet (MSDS) that comes with your solvent.*

Directional Components and Parts

The electronics parts of Directional module are shown in the image below highlighting the different O-rings needed for each part. The O-rings are the only item that you should replace.

You will not need to access the inside of these electronics parts. If the Directional electronics fail, contact Tolteq to return them for replacement.



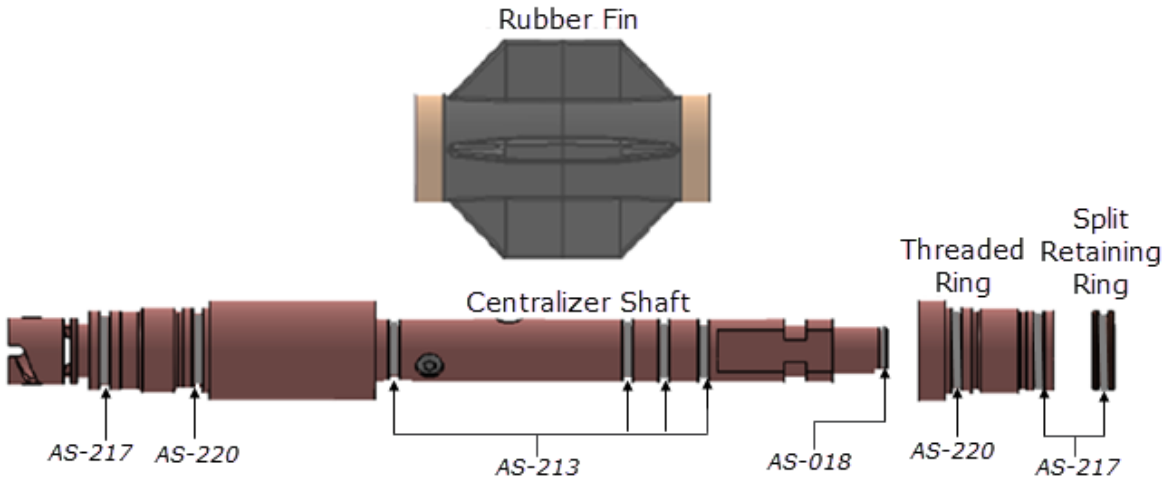
All parts are available from Tolteq:

Part #	Description	Qty
100487	Thread Protector Cap, 1-9/16"-10	1
101182	Directional Housing	1
100520	SureMate Thread Protector Cap, 1.5625-10 STUB ACME	1
900216	Directional Electronics	1
200056	Sensor Pack, NOV	1
900215	Adapter 15 MDM to Snubber	1
101379	Clamshell Retainer	2
100496	Screw, SHCP, #6-32 x .38" LG.	8
100513	AS-018 O-ring	1
101541	AS-215 O-ring	2

Part #	Description	Qty
100214	AS-217 O-ring	6
100124	AS-318 O-ring	4

Centralizer Drawing and Parts

The image below shows the components of the Centralizer, highlighting the different O-rings used.



All parts are available from Tolteq:

PART #	DESCRIPTION	QTY.
900214	TruCourse Centralizer	1
100513	O-ring, AS-018	1
100229	O-ring, AS-213	4
100214	O-ring, AS-217	3
100124	O-ring, AS-220	2

4 Maintenance Tasks

The maintenance tasks for the Tolteq Directional Module are as follows:

1. Run diagnostics check
2. Download log data
3. Erase log data and reset the odometers
4. Disassemble the Directional Module
5. Disassemble the Centralizer
6. Clean and inspect electronic components
7. Clean and inspect other components
8. Reassemble the Centralizer
9. Reassemble the Directional Module
10. Final reassembly

Run Diagnostics Check

Checking Directional diagnostics validates that the Surface System is reading from the tool, affirming that the tool is functional.

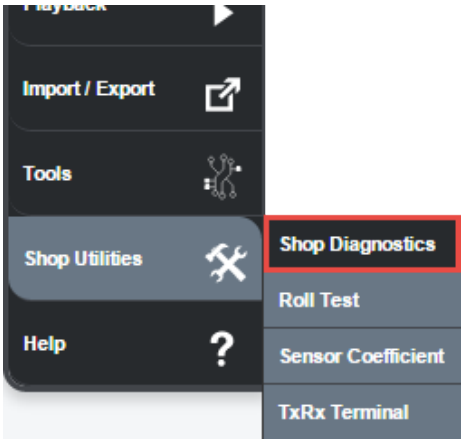
Tools/Items needed:

- Laptop installed with Surface System and Tool Tracker software
- Tool Tracker cable
- Tool uphole end concentric connector

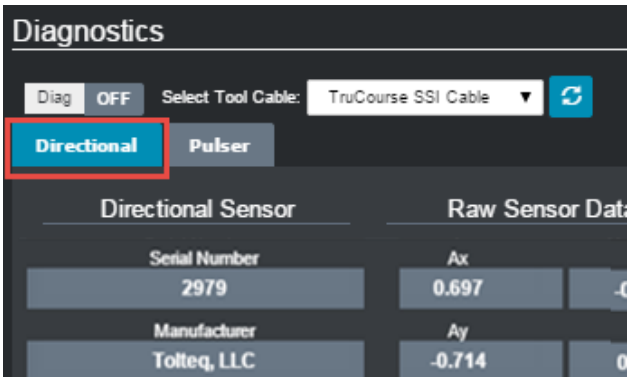
Procedure:

1. On the TruCourse laptop, connect the USB end of the Tool Tracker cable.
2. Connect the other end of the Tool Tracker cable to the concentric connector on the uphole end of the tool.

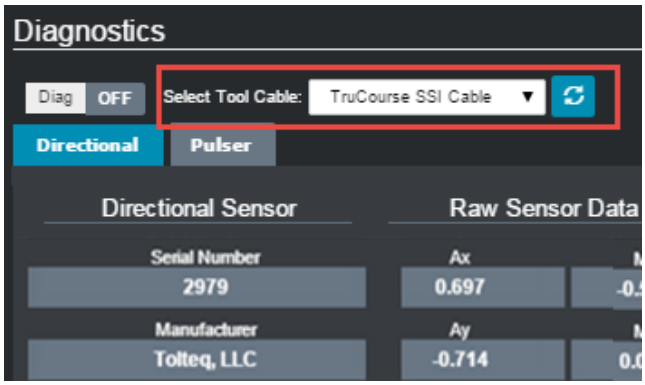
3. Open the TruCourse Surface System application.
4. From the *Menu panel*, select **Shop Utilities** > **Shop Diagnostics**.



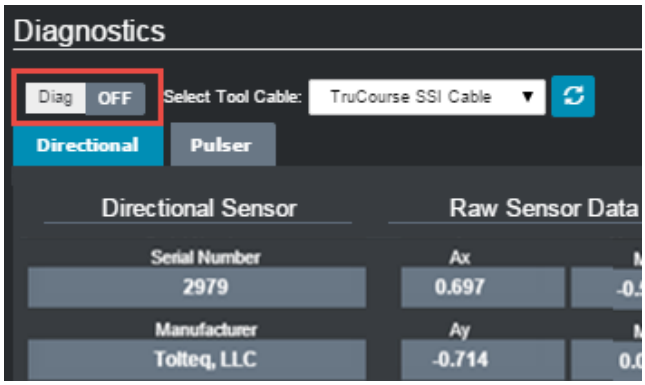
5. If not already displayed, select the **Directional tab**.



6. Select the type of cable from the *Select Tool Cable* drop-down list. If you do not see the correct cable type, click the **Refresh** button and try again.



7. Click the **Diag | OFF** button a to turn diagnostics on, and to verify that data populates in the various fields of the *Directional* diagnostics page.



8. Close the Diagnostics page in TruCourse, and leave the Tool Tracker cable connected so that you can download log data using Tool Tracker.

Download Log Data

Tolteq recommends downloading log data after every job. Downloading and analyzing job files provides a capability to assess tool performance, identify required maintenance actions, and safeguard against tool abuse and loss of data.

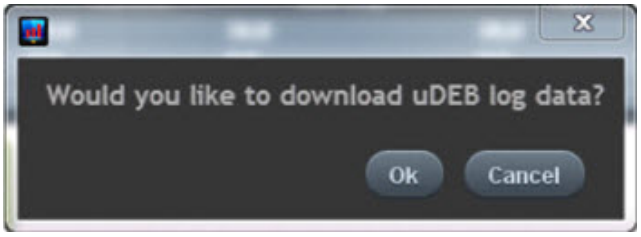
Note: Refer to the *Tool Tracker User Manual* for additional information about Tool Tracker.

Tools/Items Needed:

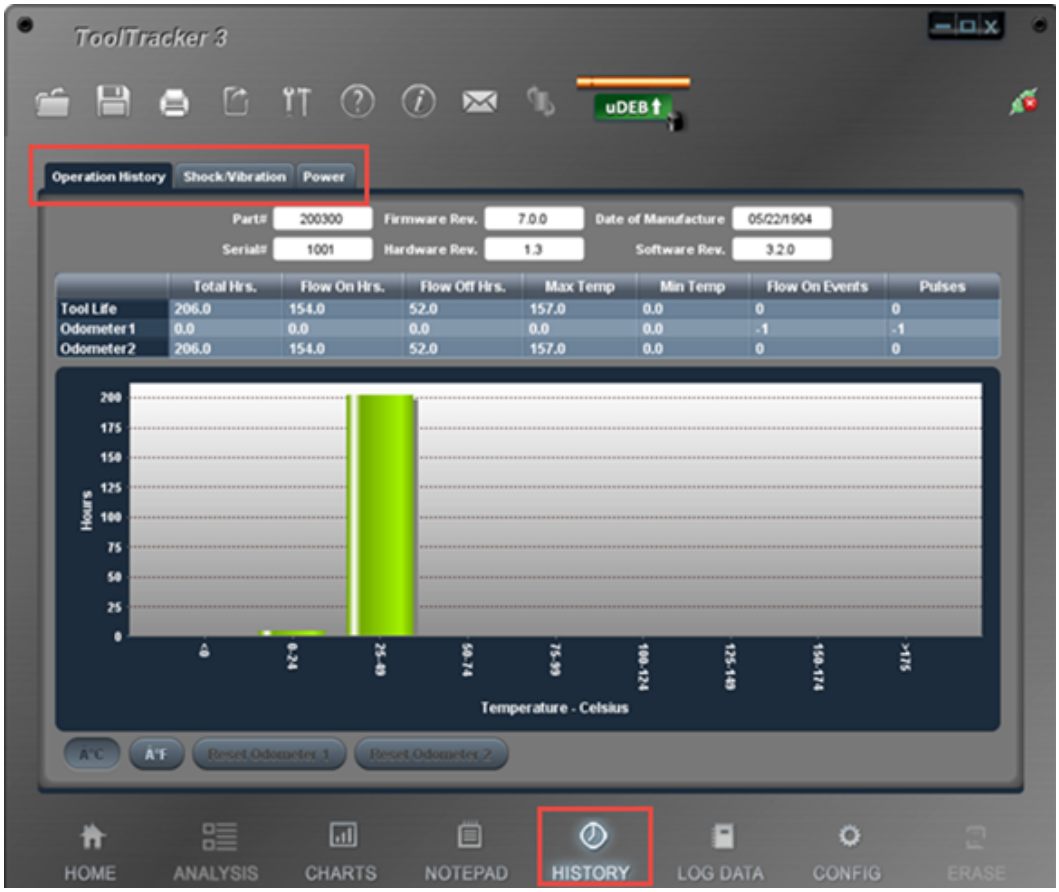
- TruCourse Tool Tracker USB cable
- Laptop installed with Tool Tracker software application

Procedures:

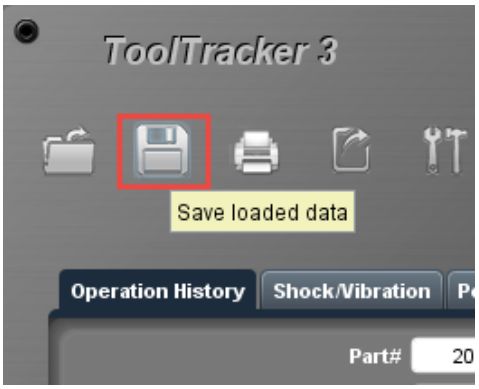
1. Connect the TruCourse *Tool Tracker cable* to the laptop and Directional module.
2. On the TruCourse laptop, open **Tool Tracker**.
3. When prompted to download log data, click **OK**.



4. When the download is complete, an analysis of the downhole job displays onscreen. Look through the tabbed options on the Tool Tracker *History screen* for indicators of potential damage to the tool from temperature, shock/vibration, and power.



5. All downloaded data is automatically saved to the default directory. To save the data to another location, click the **Save** toolbar button.



Note: Keep the Tool Tracker cable connected to your laptop and to the module for the next procedure.

Reset Odometer and Erase Log Data

As with any electronic device that stores data, the storage capacity of modules in the Tolteq tool string are not infinite. The more data stored on a tool, the longer it takes to download data after a job. Also, log data will begin to write over older log data if the storage capacity is reached.

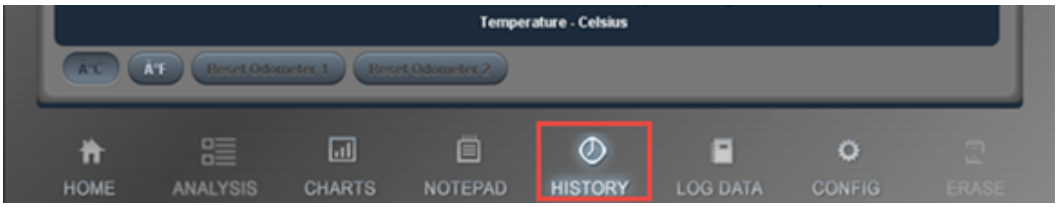
Tolteq recommends erasing log data after downloading and saving data from each job. Your company's operating procedures may also call for resetting one or both of the odometers after each job to help narrow the focus when analyzing tool wear or problems.

Tools/Items needed:

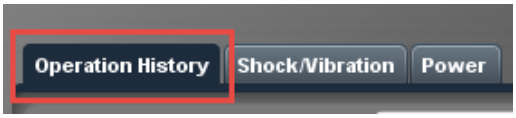
- Tool Tracker USB cable
- Laptop installed with Tool Tracker software application

Procedure - To Reset Odometer:

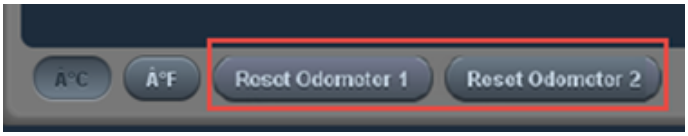
1. The *Tool Tracker cable* should still be connected to the laptop from the previous procedure. If not, connect the cable to your laptop and to the module.
2. If not already open, launch the *Tool Tracker application*.
3. From the toolbar on the bottom of the screen, select the **History** button.



4. At the top of the *History* screen, select the **Operational History** tab.



5. At the bottom of the screen, select either (**Reset Odometer 1** or **Reset Odometer 2**).



6. When the confirmation window opens, click **Yes**.

Procedure - To Erase Log Data:

Note: This procedure is highly recommended after each job to speed up download times, improve tool performance, and prevent log data from overwriting previously-recorded log data.

1. From the toolbar on the bottom of the screen, select the **Erase** button.
2. When the confirmation window opens, click **Yes.**
3. Disconnect the Tool Tracker cable from the laptop and the Directional module.

Disassemble the Directional Module

After you have checked diagnostics and downloaded data, you need to disassemble the module and inspect the *concentric connectors* on each end of the module.

Tools/Items needed:

- Vise
- Vise bushing plates
- 1.875" barrel wrench
- O-ring pick
- Diagonal pliers
- Isopropyl Alcohol
- Contact cleaner
- V-blocks
- Repair tray

Procedure:

1. Place the module on V-blocks and remove the thread protector caps.
2. Fasten the *downhole* end of the Directional module in the *vise* so that the Centralizer is completely out of the vise.

3. Using the *barrel wrench*, loosen the *Centralizer* from the Directional housing, and unscrew the Centralizer from the housing.

4. Carefully pull the *Electronics assembly* out of the Directional housing and place it on *V-blocks*.

Note: Keep the Electronics assembly on a parallel plane to the barrel when removing it from the housing, and support the Electronics so the uphole and downhole connections do not bind from the weight while moving the assembly.

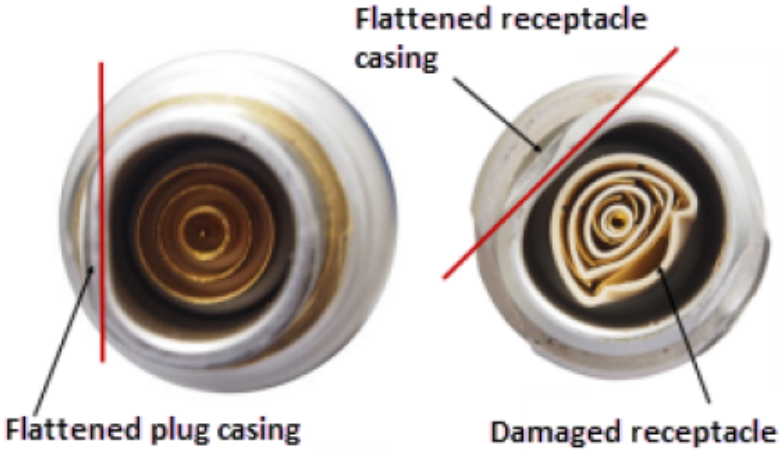
5. Using the *O-ring pick* and *diagonal pliers*, cut the *O-rings* off of the *clam shell retainers* on the Centralizer connection, and remove the retainers. Place components on a repair tray.

6. Firmly grasp the *snubber* in one hand, and the *Centralizer* in the other, and disconnect the Centralizer from the electronics assembly.

7. Check each concentric connector on the electronics assembly and the centralizer for signs of excessive wear or damage.

Undamaged Concentric Connector

Damaged Concentric Connectors



Note: If any of the connectors are damaged, contact Tolteq to have the item(s) repaired.

Disassemble Centralizer

For this procedure, the Centralizer should already be disconnected from the module and resting on V-blocks.

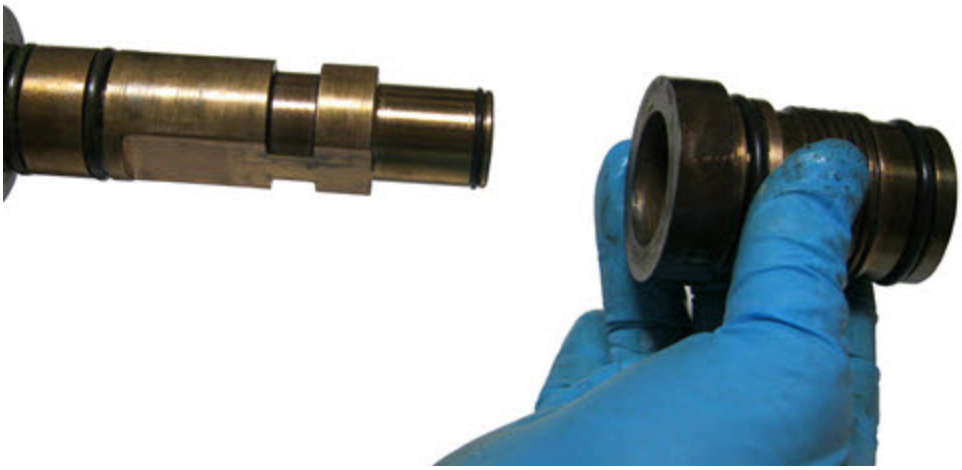
Tools/Items needed:

- O-ring pick
- Diagonal pliers
- Repair tray

Procedure:

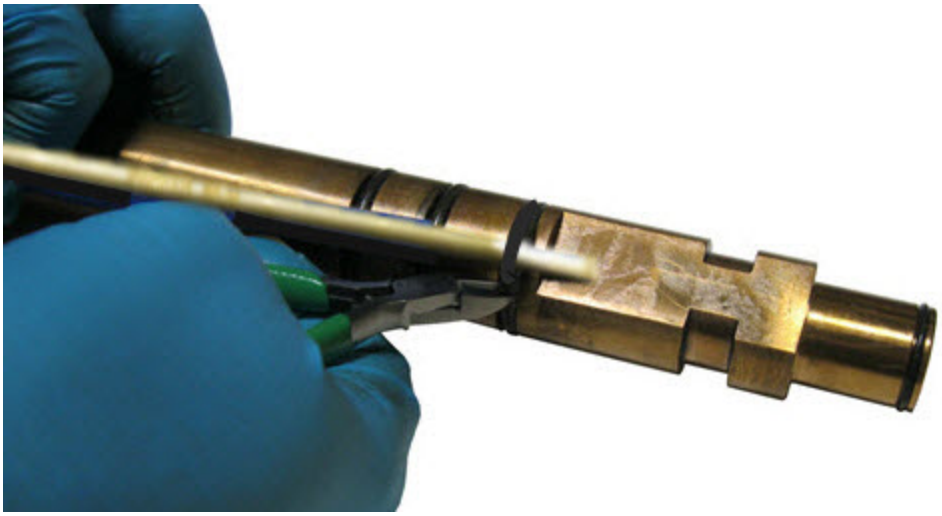
1. Using the *O-ring pick* and *diagonal pliers*, remove and discard the *AS-217 O-ring* from the split-retaining ring, then remove the *split retaining ring* from the Centralizer shaft on the downhole end. Place components on a repair tray.

2. Pull the *threaded ring* off of the Centralizer shaft, and use the *O-ring pick* and *diagonal pliers* to remove and discard the *O-rings* (**AS-220** and **AS-217**) from the threaded ring. Place components on a repair tray.



3. Pull the *rubber fin* off of the Centralizer shaft. Place components on a repair tray.

4. Using the *O-ring pick* and *diagonal pliers*, remove and discard all *O-rings* from the Centralizer shaft:
    - AS-217
    - AS-220
    - AS-213 (4)
    - AS-018



Clean/Inspect Electronic Components

The electronics assembly in the Directional module includes three primary components:

- Directional electronics
- Sensor pack
- Snubber adapter

Caution: Electronic assemblies should not be immersed in water.

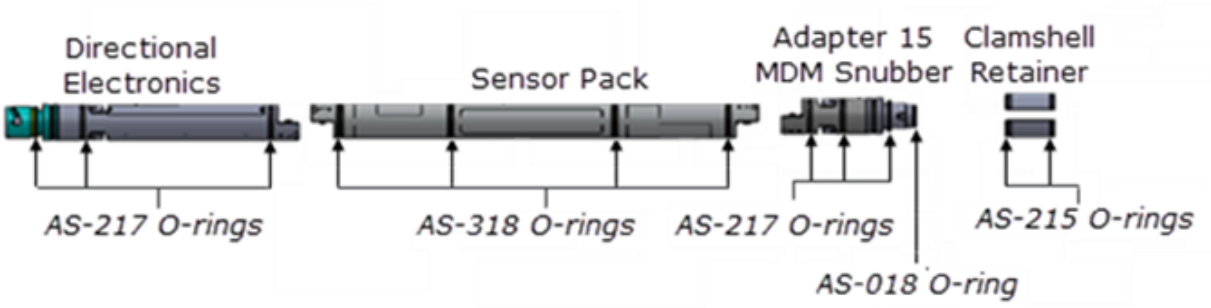
Tools/Items needed:

- AS-318 O-rings (Sensor pack)
- AS-217 O-rings (Directional electronics and MDM Adapter Snubber)
- O-ring pick
- Diagonal pliers
- Allen wrench, 7/64", T-Handle hex key
- Screws 6-32 x.50" Lg (12)
- Loctite 246
- Clean repair tray
- Contact cleaner
- Clean rags

Procedure:

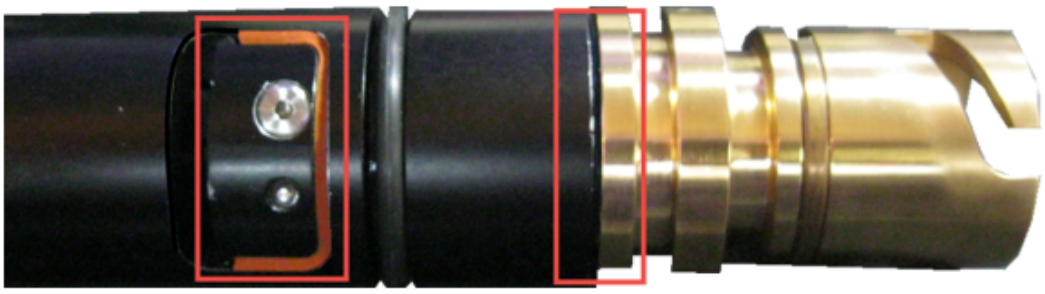
1. Spray the Electronics assembly with *contact cleaner* and wipe it down with a *clean rag*.

2. Check the O-rings on all three components for tears, excessive wear, or other damage. If any O-rings are damaged or show noticeable signs of wear, replace them with new O-rings.



3. Check the *elastomer saddles* and *cone* on both ends of the Directional electronics and Snubber adapter for tears or damage.

Note: If any of the elastomer fittings or connectors are damaged, contact Tolteq to have the item(s) repaired.

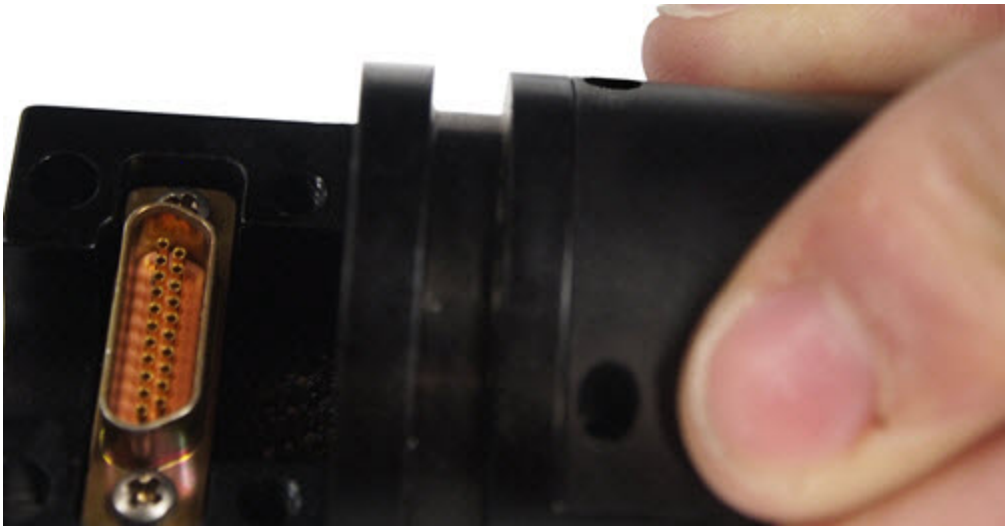


4. Verify that the *MDM connections* are still tight between the components.

If any of the connection points are loose, do the following:

a. Remove and discard the *screws* from both sides of the connections using a *7/64 in. hex key Allen Wrench*.

b. Carefully separate the components (electronics, sensor pack, or snubber), and inspect the MDM connectors for damage.



c. If the connectors are in good condition, use isopropyl alcohol and contact cleaner to clean out any Loctite residue from the screw holes.

d. Fasten the components back together using *new screws 6-32x.50" Lg* with *Loctite 246* applied to the screws.

Clean/Inspect Other Components

Cleaning module parts includes using solvent and soapy water on mechanical parts, and air pressure and clean rags for drying. If possible, use a Solvents Parts Washer so that liquid that is contaminated from cleaning the tools is disposed of properly. As parts are cleaned and dried, place them on a clean repair tray.

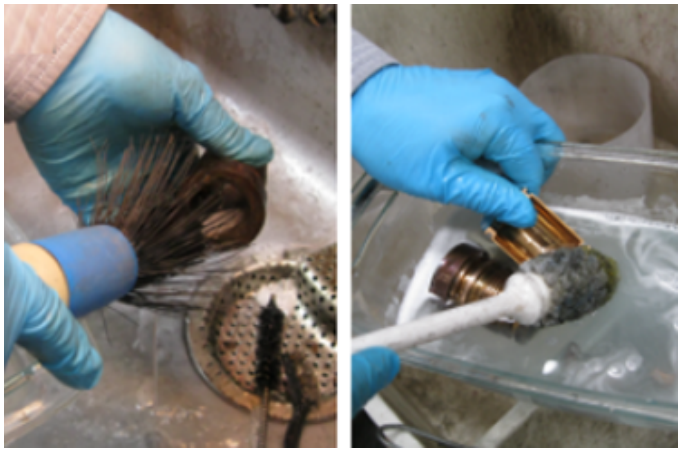
Tools/Items needed:

- Wire brush
- Latex and chemical resistant gloves
- Apron
- Solvent Parts Washer with solvent
- Sink with dish washing detergent
- Clean repair tray
- Contact cleaner
- Clean rags
- Air compressor and kit

Caution: Electronic assemblies should not be immersed in water.

Procedure:

1. Put on *chemical-resistant gloves* and an *apron*.
2. Wash the following mechanical parts with *solvent*, then *soapy water*:
    - *Module*: clamshell retainers
    - *Centralizer*: split-ring retainer, rubber fin, and threaded ring



3. Rinse mechanical parts and dry them using *clean rags* and *compressed air*.

4. Spray the Centralizer shaft with contact cleaner and wipe it down with a *clean rag*.

5. Once all parts are clean and dry, look for indentions, deformation of profile, significant changes to the inner or outer diameters, and cracks or friction lines. Replace parts that are damaged or excessively worn.

Reassemble the Centralizer

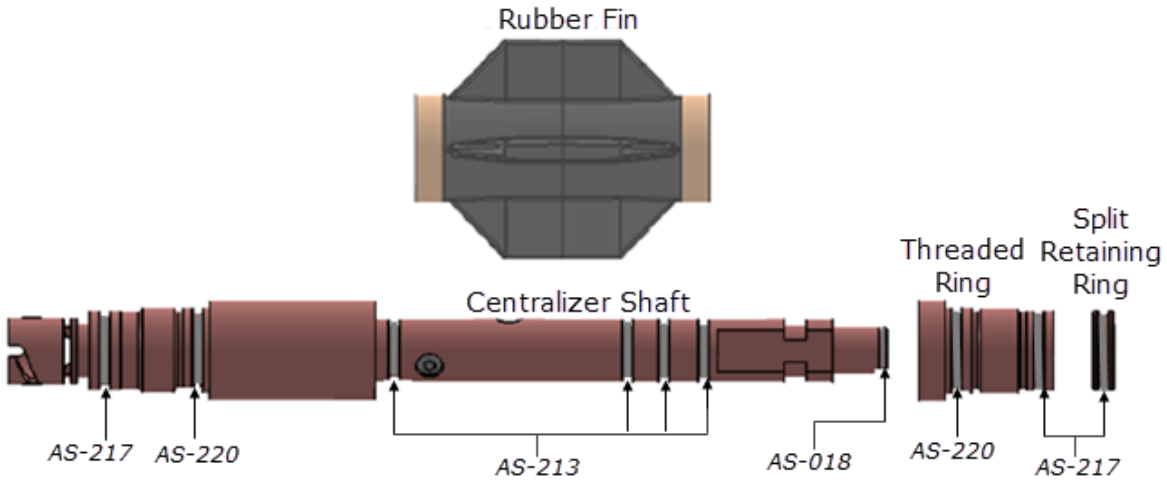
Before reassembling the Centralizer, ensure that components are clean and you have all of the required O-rings.

Tools/Items needed:

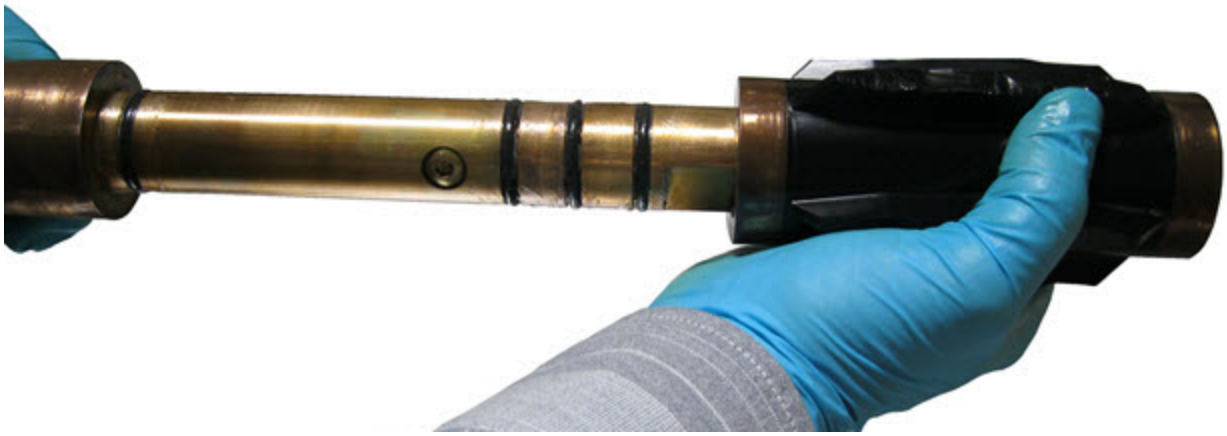
- AS-018 O-ring (1)
- AS-213 O-rings (4)
- AS-217 O-ring (3)
- AS-220 O-ring (2)
- Lubricant
- O-ring pick

Procedure:

1. Place new O-rings on the Centralizer, as shown below:



2. Lubricate the (4) *AS-213 O-rings*, and slide the rubber fin all the way onto the shaft.



3. Slide the *threaded ring* onto the shaft.

4. Place the *split-retaining ring* in the groove next to the threaded ring, and attach an *AS-217 O-ring* to lock it in place.

Reassemble Directional Module

For this procedure, you will attach the Centralizer to the Electronics assembly, then install the assembly in the Directional housing.

Tools/Items needed:

- AS-215 O-ring (2)
- O-ring pick
- Lubricant

Before procedure:

- If the directional housing is not already clamped in the *vise*, do so before installing the assembly in the Directional housing.
- The Centralizer and Electronics assembly should be supported on *V-blocks* before they are connected.

Procedure:

1. Place a clamshell retainer *AS-215 O-ring* on each *j-latch* end of the Centralizer and Snubber in preparation to secure the retainers in place.

2. Grasp the shank of the *Centralizer* in one hand, and the *Snubber* on the *Sensor Pack* in the other hand, and connect the two components together with the *j-latch*.

3. Attach the *clamshell retainers* over the j-latch, and move the two *AS-215 O-rings* into place to secure them.

4. Lubricate all *O-rings* on the electronics assembly and the *AS-217 O-rings* on the uphole end of the Centralizer.

5. Carefully lift and slide the electronics into the Directional housing until the threads of the centralizer meet the threads of the housing.

Note: The internal components need to be on an even plane with the housing when installing them so that the Centralizer O-rings do not hang up on the housing

threads and roll off their positions. Do not force the components through the housing. If you feel resistance during the installation, back the Centralizer off a little and adjust the plane before going forward again.

6. Turn the Centralizer shank by hand until it is inserted all the way in the Directional housing.

Final Reassembly

Before tightening the Centralizer connection and attaching the thread protector caps, check the system once again for proper functionality.

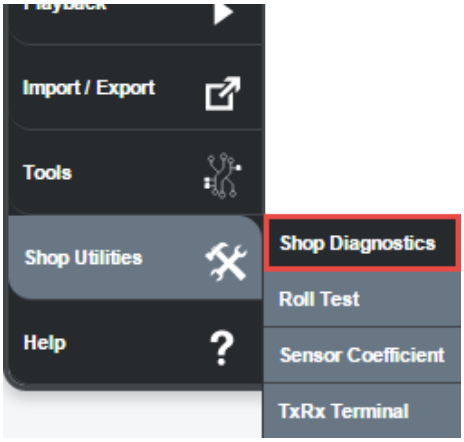
Tools/Items needed:

- Laptop installed with TruCourse Surface System and Tool Tracker software
- Tool Tracker cable
- Barrel wrench
- Permanent marker
- Uphole and downhole thread protector caps

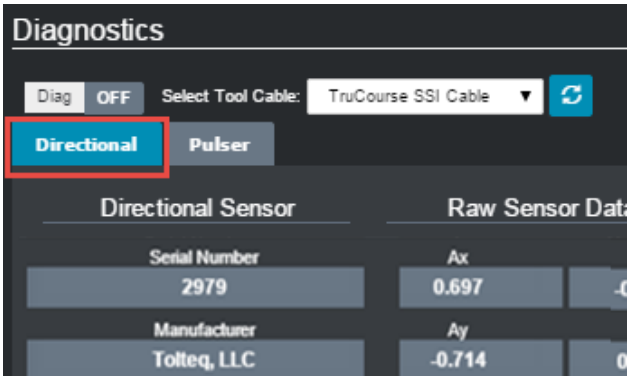
Procedure - Diagnostics Check

1. On the TruCourse laptop, connect the *USB* end of the *Tool Tracker cable*.
2. Connect the other end of the Tool Tracker cable to the *concentric connector* on the uphole end of the tool.

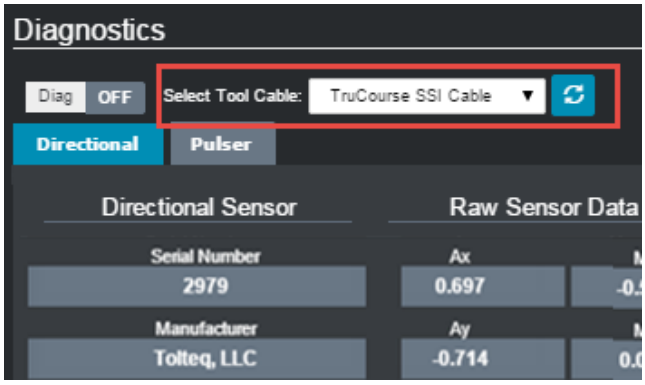
3. Open the *TruCourse Surface System application*.
4. From the *Menu panel*, select **Shop Utilities>Shop Diagnostics**.



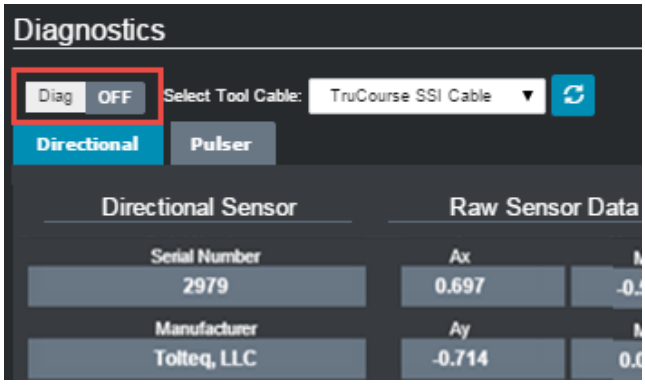
5. If not already displayed, select the **Directional tab**.



6. Select the type of cable from the *Select Tool Cable* drop-down list. If you do not see the correct cable type, click the **Refresh** button and try again.



7. Click the **Diag | OFF** button a to turn diagnostics on, and to verify that data populates in the various fields of the *Directional* diagnostics page.



8. When done with the diagnostics, close the program.

Procedure - Final reassembly

1. Disconnect the *Tool Tracker cable*, and tighten the Centralizer connection to **350 ft-lbs of torque** using the *barrel wrench*.

2. Use a *permanent marker* to draw a line perpendicular to, and across, the Centralizer connection on the downhole end of the module.
3. Write the letter "**T**" next to the line indicating the module was torqued.

4. Attach, then hand-tighten, the uphole and downhole *thread protector caps* on the module.

Note: Before the module is fully ready for the field, you need to do a **flow test** with the Directional module using the TruCourse Surface System software. Since this requires Surface System hardware, you will do this as part of the Surface System maintenance. However, the maintenance done on the Directional module in this section must be completed before doing the flow test.

This completes the maintenance of the Tolteq Directional module.