MWD Failure Troubleshooting Procedures

The steps below are for a reference for MWD field troubleshooting. Remain calm and use proper judgment while resolving a failure. Maintain contact with your MWD department managers/coordinators and directional driller for assistance while trying to troubleshoot.

Operator experience is the most valuable tool when troubleshooting complex systems. The following material, informed by experience and general best practices, supplements knowledge the operator may already posses.

The first series of troubleshooting materials concentrates on the most commonly experienced problems with the Tensor MWD system. It is broken down into two scenarios.

**Scenario 1** deals with a situation in which no pulses are present.

**Scenario 2** covers a situation in which pulses are present but cannot be decoded.

Troubleshooting takes place in four areas labeled Area A through D.

**Area A:** Troubleshooting procedures that the operator can accomplish inside the unit.

**Area B:** Procedures that must be accomplished outside the unit either on the drill floor, mud pits or around the pumps.

**Area C:** This Area encompasses any actions that involve the down hole tool such as working the drill string or cycling the pumps.

**Area D:** Procedures at this Area are those performed while the Bottom Hole Assembly and / or the tool are at the surface.

Follow the listed procedures in the order in which they are presented. If pulsing returns to normal, discontinue troubleshooting and try to determine if the problem is intermittent, aberrant or symptomatic of another system failing.
MWD Scenario 1: No Pulse

1.1. Determine if pulse is updating on the qMWD-PC Pulse Waveform data Window. Check to make sure that the computer has not locked up if the screen is not updating.

1.2. Is qMWDPC showing standpipe pressure on the screen? Make sure that the program or the computer has not locked up if the standpipe pressure is not showing on the qMWDPC program display.

1.3. Ensure that down hole temperature has not exceeded operating limits of the MWD. Normal operating limit is 150°C with High Temperature tools capable of performing to 175°C. Remove the tool from the drill string if normal operating limits are violated.

1.4. Ensure down hole tool vibration has not exceeded operating limits of the MWD. Remove the tool from the drill string if normal operating limits are violated.

1.5. Determine if it is possible to see pulses on the standpipe pressure gauge. Pressure fluctuations at the same time period of the pulse window indicate that the tool is pulsing. If the pressure does not fluctuate, the tool may have stopped pulsing due to operating conditions.

1.6. If pulses are still absent vary pump rate in attempt to recover pulses. Be sure to try flow rates with one pump only, two pumps, and the pump not in use when the tool failed.

1.7. Pumps and Hydraulic Check Procedure (GEHYD00001)

   1.7.1. Is the mud aerated?

   1.7.2. Is there a high level of solids?

   1.7.3. Is the suction screen or pipe screen plugged?

   1.7.4. Is LCM being mixed properly?

   1.7.5. Is the mixing pump turned on?

   1.7.6. Is there air or foam apparent in the mud tanks?
1.7.7. Is pulsation dampener pressure set to 1/3 of standpipe pressure?

1.8. Circulate off bottom and pump a sweep with a water pill or high viscosity pill if possible in order to remove solids that may be plugging off the MWD.

1.9. Work Drill String Procedure (GEWDS0001)

If it is possible that the MWD tool has become unseated out of the Muleshoe, pick off bottom (with pumps off) enough so that the drill string can be run in quickly and then stopped suddenly without hitting bottom at the same time you can also rotate the drill string. Turn the pumps on to see if the tool has seated properly and pulses are regained. You may need to repeat this process a few times to successfully seat.

1.10. Resynchronization Procedure (GERSY0001)

Try to resynchronize the tool with the surface system.

1.11. Remove Tool From Drillstring. (GEPOH0001)

If you must trip out of the hole be sure to check for any signs of washout during the trip.

Once on surface, completely inspect Muleshoe and float valve for normal condition and operation. Replace if necessary. Check that the Signal Shaft is free and operates smoothly.

Check that there is enough clearance below the MWD Muleshoe to allow laminar flow. Typically, 3 feet of unobstructed flow should be below the Muleshoe.

Perform shallow hole test. If successful continue in hole to bottom.
MWD Scenario 2: Pulse Is Present Data Not Decoded

2.1. Determine if pulse is updating on the qMWD-PC Pulse Waveform Window.

2.2. If the problem persists check the following items.

2.3. Check that the quality and confidence levels are good. Generally, they should be greater than 70% for Quality and 80% for Confidence.

2.4. Make sure that the HiPL and LoPL (High Pulse threshold and Low Pulse Threshold) values are correct. The best practice is to set the LoPL value above the noise. HiPL should be set higher than the pulse can possibly attain but lower than a torque wave created by stalling the mud motor.

2.5. Make sure that the Fbwf (Final Band Width Filter) filter is set properly. It should be set to a minimum and maximum of 60% at the high or low end of the pulse window.

2.6. Is down link enabled?

2.7. If down link is enabled perform the Mode Switch Tool and Receiver Procedure (GE Tensor Operations Manual, PN 9810004, “Downlink Controls and Procedures”).

   Down link tool to the same mode as the surface receiver if unable to decode pulses.

   If you are getting small pulses and cannot increase the flow rate, down link the tool to a wider pulse width.

2.8. Cycle power to the receiver. If the problem persists then continue troubleshooting.

2.9. Change out the Safe Area Interface or Safe Area Power Supply.

2.10. If data still cannot be decoded inspect and clean cable connections.

2.11. Inspect cables for damage. Replace if necessary.

2.12. Check the Transducer Procedure (GEXDR0001)

2.13. Perform Pumps and Hydraulics system check (GEHYD0001)
2.14. Remove tool from drillstring. (GEPOH0001)

If you must trip out of the hole be sure to check for any signs of washout during the trip.

Once on surface, completely inspect Muleshoe and float valve for normal condition and operation. Replace if necessary. Check that the Signal Shaft is free and operates smoothly.

Check that there is enough clearance below the MWD Muleshoe to allow laminar flow. Typically, 3 feet of unobstructed flow should be below the Muleshoe.

Perform shallow hole test. If successful continue in hole to bottom.
MWD Procedure GEPOH001: Remove Tool from Drillinging

1. Remove Tool From Drilling Procedure See GEPOH001
2. Tapping Out of Hole? Yes → 3, No → Go To Step 6
3. Check to Washout During Tap Out
4. With Tool On Surface, Inspect Make Sure, Flow Vane, Signal Shaft, and Ropeway as Necessary
5. Confirm 3 Feet of Undisturbed Lander Flow Make Sure
6. Replace Failed MWD Yokes & Backup
7. Perform Flow Test
8. Pusles Answer
   - Yes → Return to Start of Previous Flow Chart
   - No → Continue Is Hole to Bottom
9. Other Problems?
   - Yes → Refer to Other Troubleshooting Flow Charts
   - No → Problem Solved
10. Refer to Other Troubleshooting Flow Charts
11. No
Procedure GEHYD0001

Procedure to Inspect the Hydraulic System

If any parameter is incorrect notify the person in charge. Do not hesitate to recommend a change of procedure, process or quality if necessary.

1. Is Standpipe pressure consistent? If not there are a number of things that can cause the pressure to be inconsistent. Consider the following as possible reasons why the pressure is not constant.

2. Air or foam in the mud system. Introduction of air into the mud system will distort pulses to the point that they become undetectable. Check the mud pits for foaming or bubbling. If present inform the person in charge.

3. Check pipe screens for solids. Pipe screens, as well as in line screens for the pumps, when packed with solids will distort pulses or even prevent pulses from appearing on the standpipe or Pulse Waveform data screen. Make sure that these screens are clean and free of debris.

4. Pulsation dampers set to the wrong setting will cause pulses to become distorted or make pulses disappear. Normal setting for pulsation dampers is one third of system pressure. Make sure the pulsation dampers are set correctly.

5. During the drilling process monitor the procedures and quantities with which Lost Circulation Material (LCM) is mixed. The LCM should be well mixed in the system and does not exceed GE Tensor recommendations. (Refer to Tensor MWD Operating Specifications). The mixing pump should be on and all material mixed thoroughly.
Procedure GERSY0001

Procedure to Resynchronize the down hole tool with the surface receiver

The procedure listed below is only one method of obtaining a resynchronization between the down hole tool and the surface receiver. It is, however, the most certain method.

1. Remove the drill string from bottom
2. Shut down the mud pumps.
3. Wait at least one minute without moving the drill string.
4. Rapidly bring up the mud pumps until correct operating pressure is obtained.
5. Check for synchronization pulses for at least five (5) minutes.
6. If synchronization pulses are absent as well as other pulses, continue trouble shooting with Trouble Shooting Chart Scenario A, Level 3.
7. If pulses are present but it is impossible to decode data, continue trouble shooting with Trouble Shooting Chart Scenario B.
Procedure GEWDS0001

Procedure to Work the Drill String

Working the drill string as recommended should only be carried out in consultation with the person in charge. Be absolutely certain to follow all necessary precautions to prevent the drill string from abruptly returning to bottom.

1. Pick up off bottom 7-10 meters (20 – 30 feet).
2. Open Kill line
3. Vigorously work pipe up and down. Do not allow the bit to collide with the bottom of the hole.

A. If pulses are absent: check the Pulse Waveform data screen while working the pipe. Moving the drill string should create pseudo pulses on the Pulse Waveform data screen. If pseudo pulses appear the transducer and transducer cable should be good. If normal pulsing does not return continue to B.

B. Tool may be unseated: Perform steps 1 – 3 above.

4. Rotate at a minimum of 60 RPM
5. Return to step 1 and repeat this procedure several times.
6. Rapidly bring up the pumps and check for a pulse for at least five minutes.

C. Pulses are still absent: return to the troubleshooting chart.
Checking the pressure transducer on the standpipe is an important troubleshooting procedure, because it is the primary means by which the mechanical pressure pulse is transformed into an electrical signal.

1. Remove pressure transducer from standpipe
2. Check to determine if the diaphragm is damaged.

3. Make sure that the diaphragm area is clear of debris such as mud, LCM and, in cold climates, ice. Also check the area inside the transducer mounting area on the standpipe and make sure this area is also free of debris. If debris is present, thoroughly clean the area.
4. Replace the standpipe pressure transducer and bring the pumps up to normal operating range.
5. If a pressure signal is now present on the Driller’s Remote Terminal or the Pulse Waveform data screen, make sure that the pulses are being
detected. If not, continue trouble shooting on Trouble Shooting Chart Scenario B.

6. If pulses are not present continue trouble shooting on Trouble Shooting Chart Scenario A.