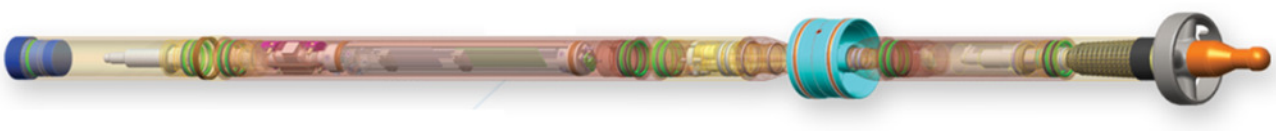


OPERATIONS MANUAL

CHAPTER 9 XEM Job Execution procedures

REV A: 2013 November 24

XFLD-0009

Table of Contents

This chapter provides guidelines on:

1. How to pick up the XEM Tool string on surface.
2. Recommended operating procedures.
3. Files to be sent at the end of the Job.
4. Basic troubleshooting.

Prior to job execution it is recommended to:

1. Complete the Surface equipment hardware setup as described in Chapter 5.
2. Prepare the XEM Tool as described in Chapter 6.
3. Program the XEM Tool as described in Chapter 7.
4. Configure the XEM Rx and perform the bank test as described in Chapter 8.

1. LIFTING ASSEMBLY

THE XEM can be picked up from the catwalk to the Gap Sub using either the

1) The T11038889 Pickup plate (this has to have the right ID)
2) A certified Web Sling rated in good condition rated for 2 Klb.

A Pickup plate assembly is used to pick up and install the XEM from the Cat walk into the Gap Sub/ NMDC on the Rig floor. It is not recommended the 03JIGS295 pickup plate assembly.

1.1. T1038889 PICKUP PLATE

The T1038889 is also referred to as the Slim Pulse Pickup plate assembly.

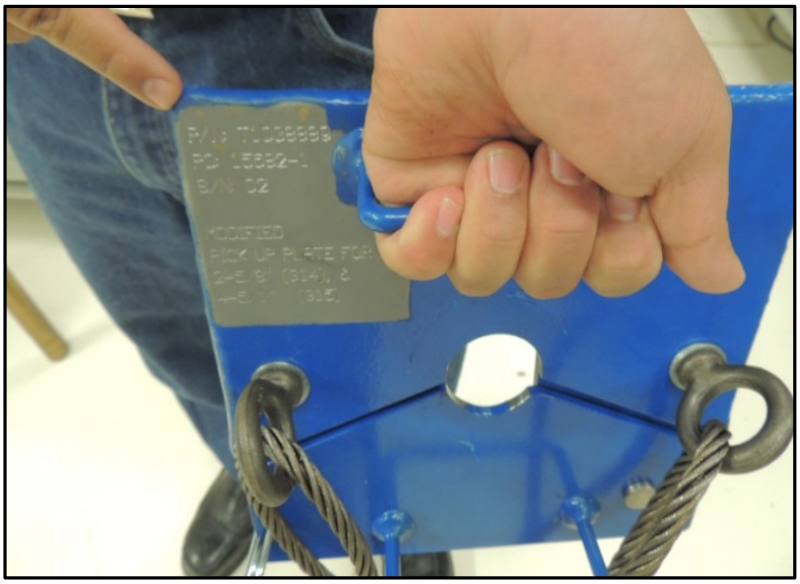


Figure 1 T1038889 Pickup plate assembly with Certification

The following sequence describes the installation procedure for the T1038889 Pickup plate on the DPG probe below the Landing spider.

1. Remove the Safety Clip from the T1038889 Pickup plate.

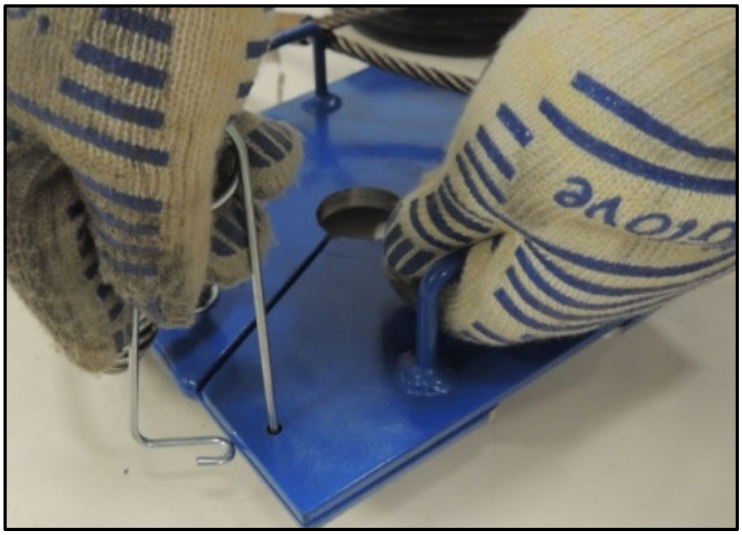


Figure 2 Remove the Safety Clip

2. Open the T1038889 Pickup plate.

Figure 3 open the pickup plate

3. Slide the T1038889 plate below the Landing Spider on the DPG probe.

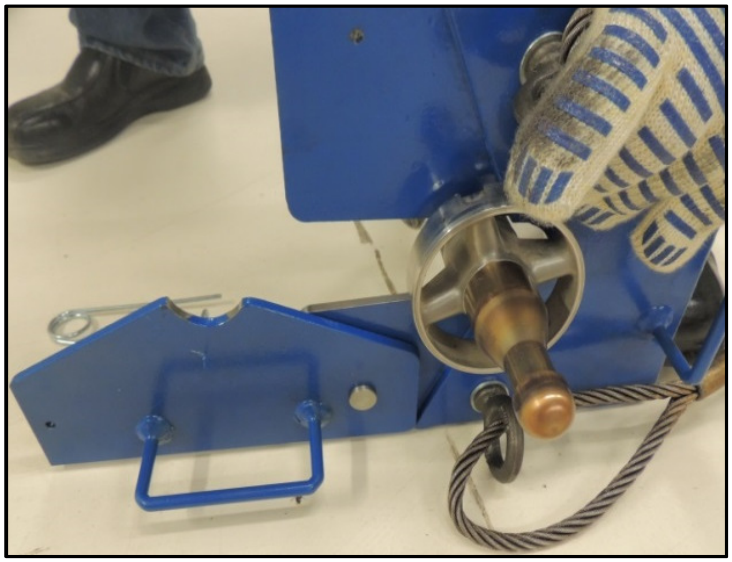


Figure 4 Slide the Plate below the Landing spider

4. Close the plate

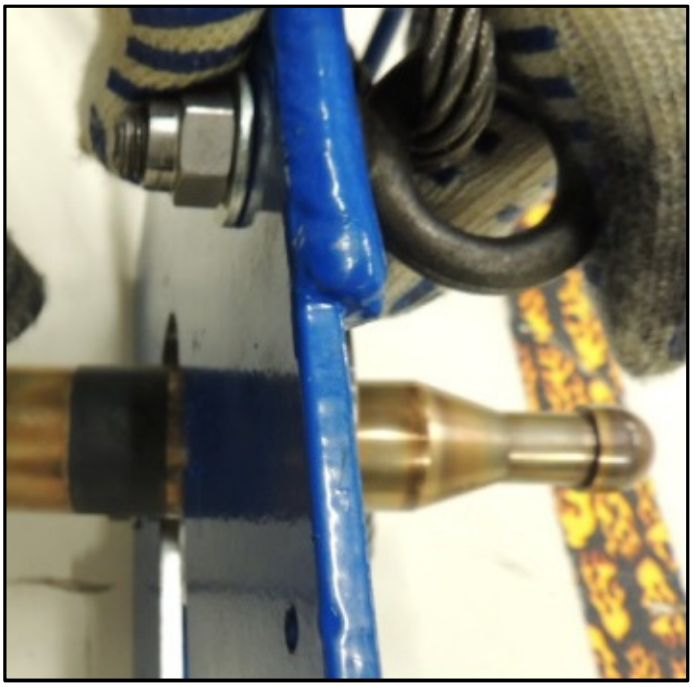


Figure 5 close the plate

5. Lock the Safety Pin

Figure 6 lock the safety Pin

The Pickup plate Assembly has been installed; the XEM tool string can now be taken to the cat Walk.

1.2. WEB SLING

If the T1038889 plate is not available it is recommended to use a certified Sling wrapped below the Landing Spider

Figure 7 Web Sling

1.3. LEGACY PICKUP PLATE

The Legacy Pickup plate **03JIGS295** is no Longer supported by Engineering and needs to be replaced with the **T1038889** pickup plate or a web Sling. The 03JIGS295 needs to be used with precaution (this has to be installed in the correct orientation).

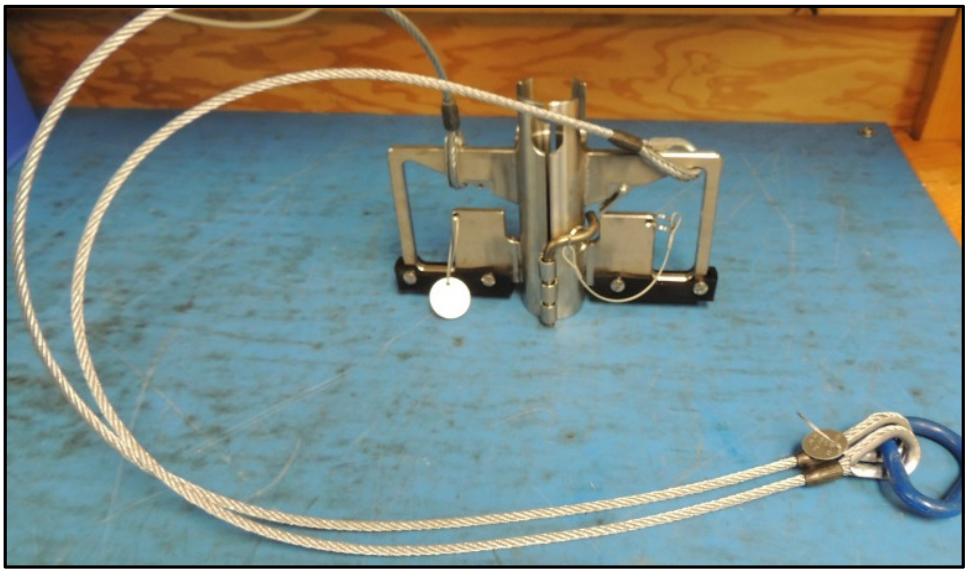


Figure 8 Legacy Lifting Plate 03JIGS0295

Check that the Pickup plate has been inspected recently and is certified for 1000lb or higher.

The Legacy pick plate **03JIGS295** has to be intalled below the Landing spider in the correct orientation as illustrated in Figure 9.

Figure 9 Legacy Pick up Plate installed correctly

If the 03JIGS295 pickup plate is installed above the Landing spider as illustrated in Figure 10 the tool can drop when picked up.

Figure 10 Legacy Pick up plate installed incorrectly

Figure 11 Pickup plate assembly installed on the DPG

2. ASSEMBLY AND PICK UP PROCEDURES

2.1. BHA ASSEMBLY

The XEM is designed to run with a Gap Sub and any standard size Drill collar below.
Typically for Directional wells an NMDC (Non Magnetic Drill collar) is used instead of a standard collar. Additional Non Magnetic Subs and collars can be used in the BHA below the (Gap Sub +NMDC) depending on specific requirements to minimize Drill string interference.

The Gap Sub and NMDC (Non Mag Drill Collar) can be made up and the XEM can be pre-loaded before picking the whole assembly to save Rig time at the floor.

The Gap Sub and the NMDC can also be made at the Rig Floor and the XEM loaded into the assembly after. The instructions below explain how to load the XEM into a Gap sub and an NMDC at the Rig floor.

1. Pick up the Gap sub and NMDC on the Rig Floor
2. Make up and Torque the NMDC with the Motor and BHA below.
3. Look into the Gap sub to ensure there is no debris or damage that could interfere with either the Grounding or the landing spider.
4. Apply pipe dope to the Pin end of the Gap sub and the Box end of the NMDC.
5. Raise the Gap Sub and thread it into the NMDC. Tighten together as much as possible using chain wrenches making sure to not place any clamps or tongs on the Gap Joint.
6. Assemble the BHA all the way to the Gap sub which should stick out above the Rig floor so that there is access to the Grounding set screw/ set screw port and that Tongs/ clamps are not placed on the Gap joint.
7. Torque the GAP sub and NMDC connection according to the desired values as specified in Chapter-2 Table 4.2.
   (As an example for the 4 ¾"" Gap Sub with NC38 connection the Torque needs to be made up to 9400ftlb.)

2.2. DRILL OFFSET

As illustrated in Figure 12:

8. Scribe the Motor reference Line from the Motor Bend housing all the way to the Gap sub.
9. Mark the Gap sub High side reference.
10. The **Drill offset Angle** needs to be calculated; this is the Angle measured from the MWD High side reference to the Motor Bend housing reference looking down hole in a clockwise direction.

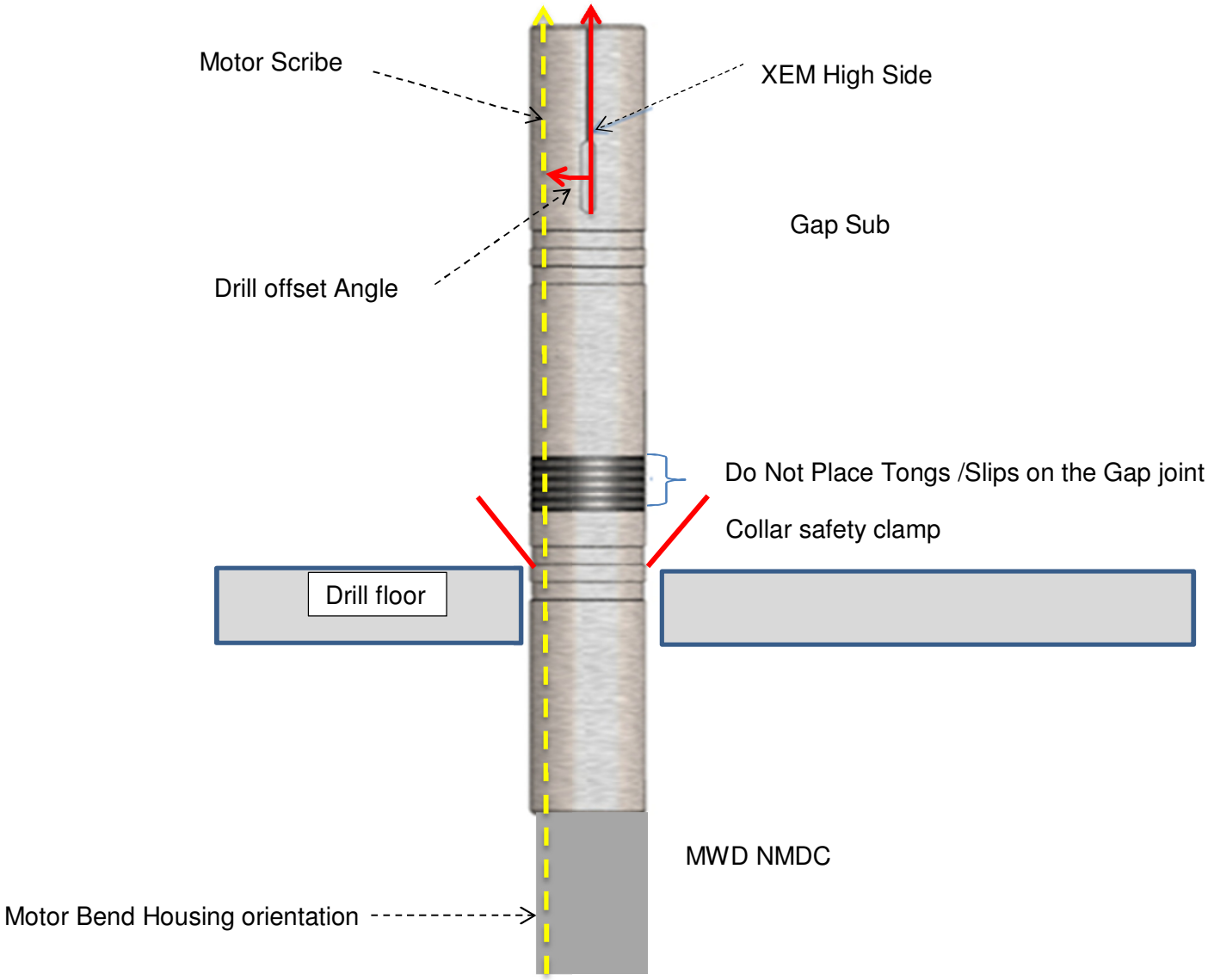


Figure 12 Drill offset Angle

11. Measure the circumference of the Gap Sub. As illustrated in the example in Figure 13 the circumference is 52 units; this corresponds to 360°.

Figure 13 Circumference of the Gap Sub

12. Measure the Drill offset arc from the Gap sub high side to the Motor scribe line looking down in a clockwise direction. The Drill offset arc illustrated for the specific example in Figure 14 is 4 units.

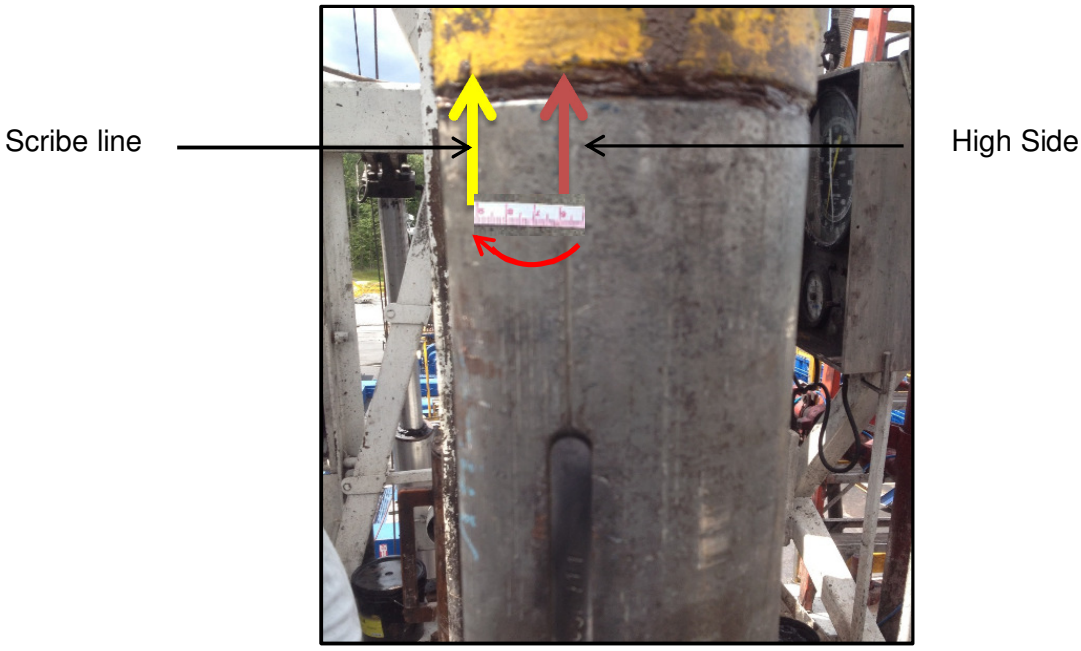


Figure 14 Drill offset Arc

13. The Drill offset Angle is calculated as:

$$Drill\ offset\ Angle = \frac{Tool\ face\ Arc\ X\ 360}{Circumference} \quad \textbf{Equation 1}$$

For the Example illustrated in Figure 14/14, the Drill offset Angle is calculated as

$$\frac{4 \times 360°}{52} = 27.7°$$

This needs to be calculated every time a connection between the Gap Sub and Motor is opened.

14. The Drill offset Angle is entered in the Tool Corrections section in the Configuration tab of the XEM Receiver as shown in Figure 15.

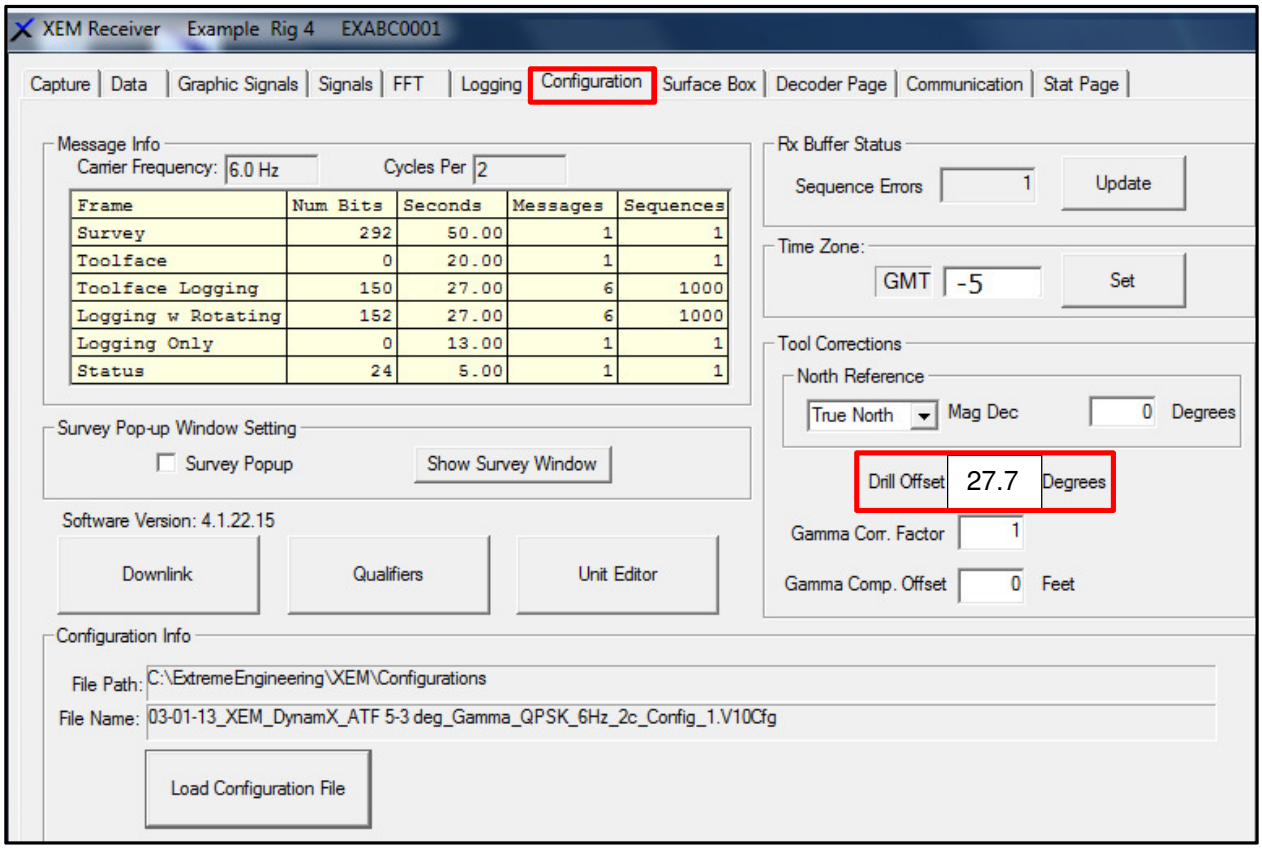


Figure 15 Drill offset Initialization in the XEM Receiver

15. Ensure that all the other corrections in in the Configuration Tab are entered; Refer to Chapter 8 for additional information.

2.3. PICKING UP THE XEM FROM THE CAT WALK

16. After Assembly move the XEM to the Catwalk.
17. Ensure that the block assembly is appropriately positioned above the Rig floor so that the XEM can be picked up from the cat walk and installed into the collar.
    In some cases it may be required to run the Tugger (Air-Hoist) line through the elevators.
18. Inspect all mechanical lifting equipment associated with the lift. Always use hooks with proper functioning safety mechanism.
19. Attach the Tugger line to the lifting sling.

Figure 16 XEM on the Cat Walk ready to be picked up

NOTE: The Legacy Pickup plate shown in Figure 16 needs to be replaced with the T1038889 Pickup plate.

20. Stand beside the tool near the end of the XTX probe as illustrated in Figure 17.
21. Establish eye contact with the Tugger line Operator. If the view is obstructed ensure there is someone on the floor who can act as a guide.
22. Ask the Tugger line Operator to pull the Tugger line.

Figure 17 Pick up the XEM from the Cat walk

23. When the tool is lifted Grab it with both hands at hip level and walk towards the V Door Ramp. Ensure maximum tension on the Line; the Spear point should not collide with the V-Door Ramp.There should be a distance of 2 feet between the Spear point and the V-Door ramp.

Figure 18 picking up the XEM from the Cat walk

24. Walk on the Catwalk towards the V door Ramp following the Tool up the V-Door.

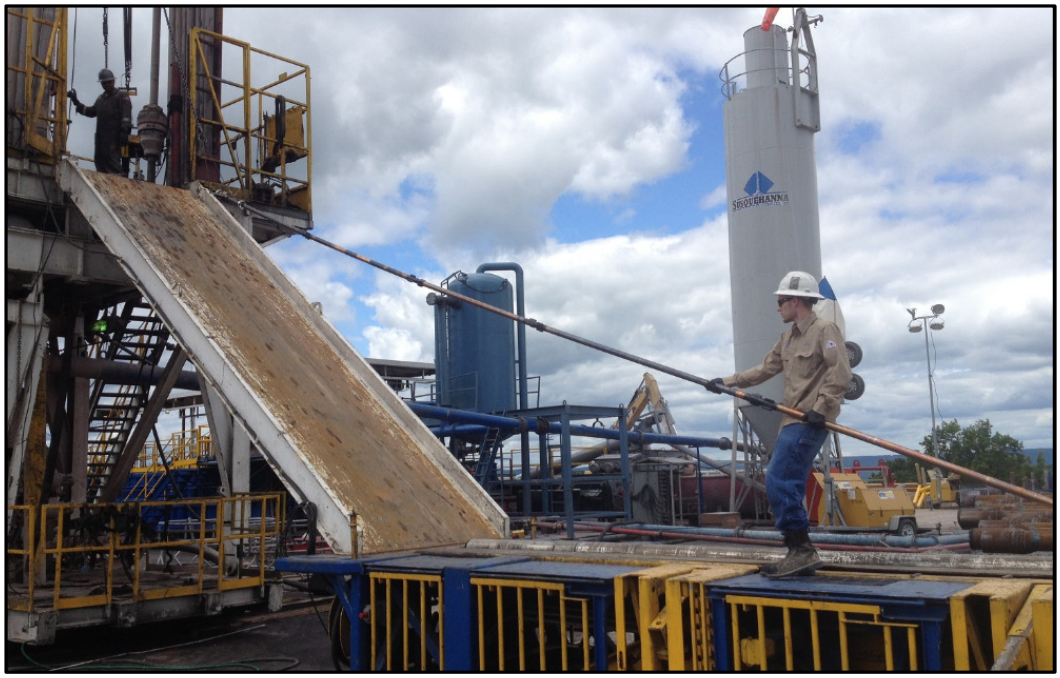


Figure 19 Walk the Tool up the V-Door

Figure 20 Walk the Tool up the V-Door

25. Walk the Tool all the way to the V-Door Ramp.

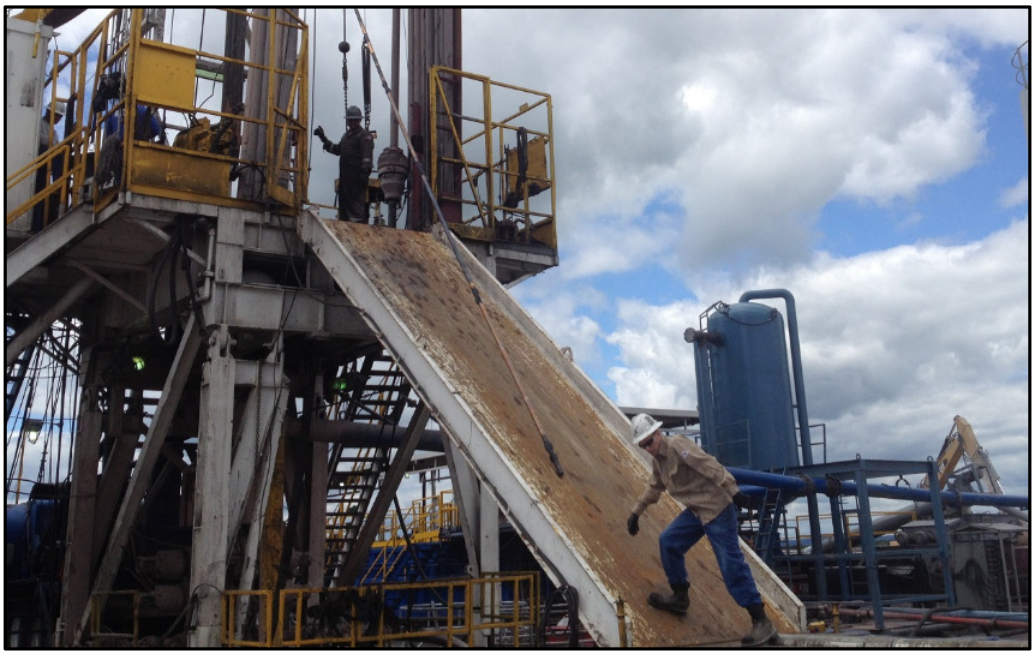


Figure 21 XEM on the V-Door ramp

When Laying down the tool at the end of the Run the steps illustrated from Figure 21 to Figure 17 have to be carried out in reverse order. It is important to follow the precautions listed in Figure 22 while laying the Tool down , excessive curvature can create stress in the Transmitter probe leading to tool failure.

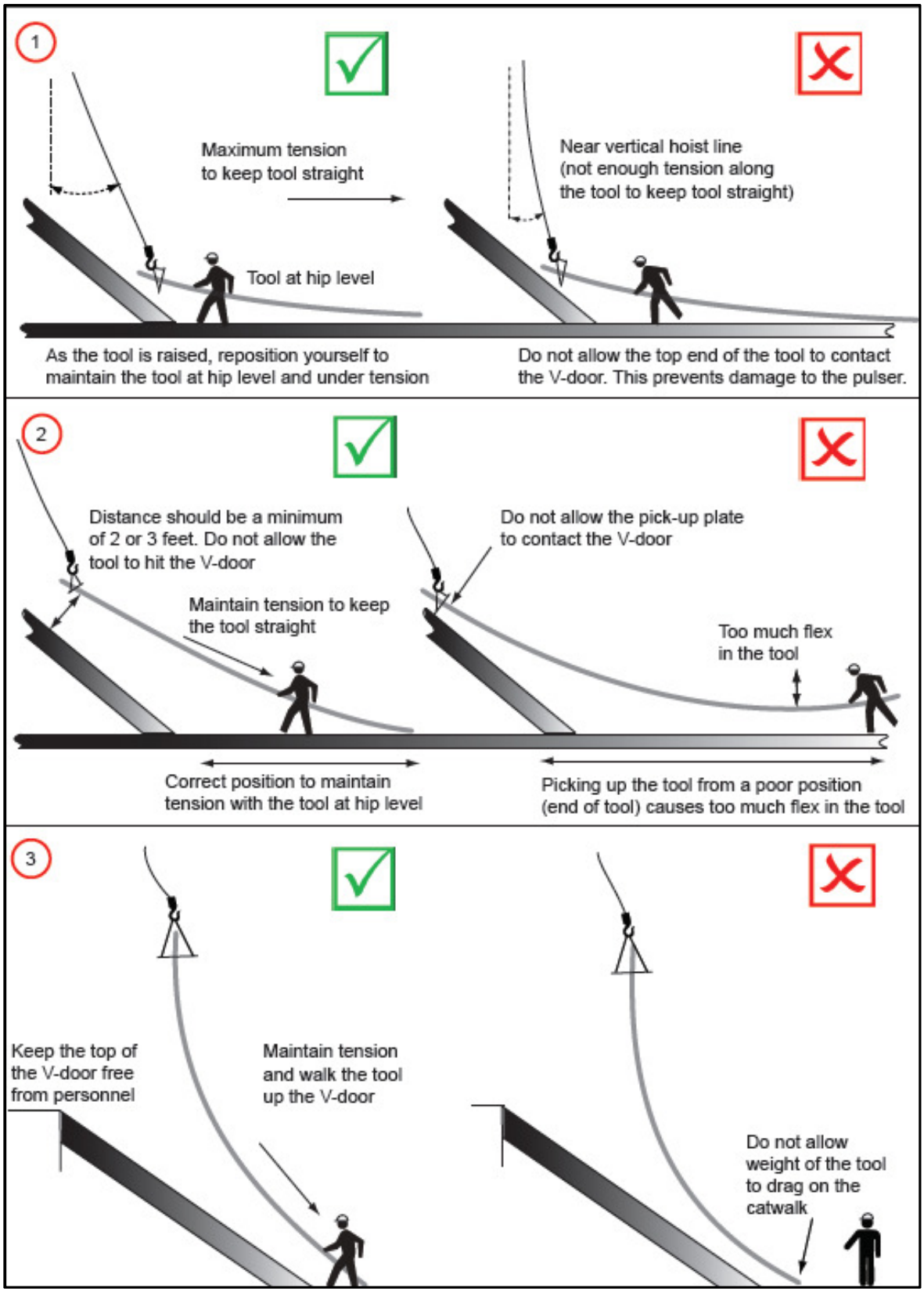


Figure 22 Precautions while picking up / laying the Tool

2.4. LOADING IN THE COLLAR

26. On the Rig floor preparations should be made to insert the XEM into the Gap sub (this should be the first assembly above the Drill floor/ Rotary table.)

Figure 23 Lower the XEM into the Gap

27. Prior to lowering the tool, ensure that the Grounding set-screw on the Gap Sub is removed. Lower the Tool gently watching for signs of slack on the Tugger line.

Figure 24 Grounding Set screw removed

28. When the Tool is all the way in and the Pickup assembly is resting on the face of the Gap sub box, detach the Pickup sling from the Tugger line.
    Only the **Spear point** and the **Landing Spider** should be visible as illustarted in Figure 25.

Figure 25 Pickup sling on the Gap sub box

29. Attach the alignment Overshot (02JIGS0052) with the Overshot rotation head assembly (02PULS0071) onto the spear point.
30. Attach the Tugger hook to the overshot.

Figure 26 Overshot Attached to the DPG

31. Lift the assembly with the Tugger so that the Grounding spider on the DPG can be accessed.

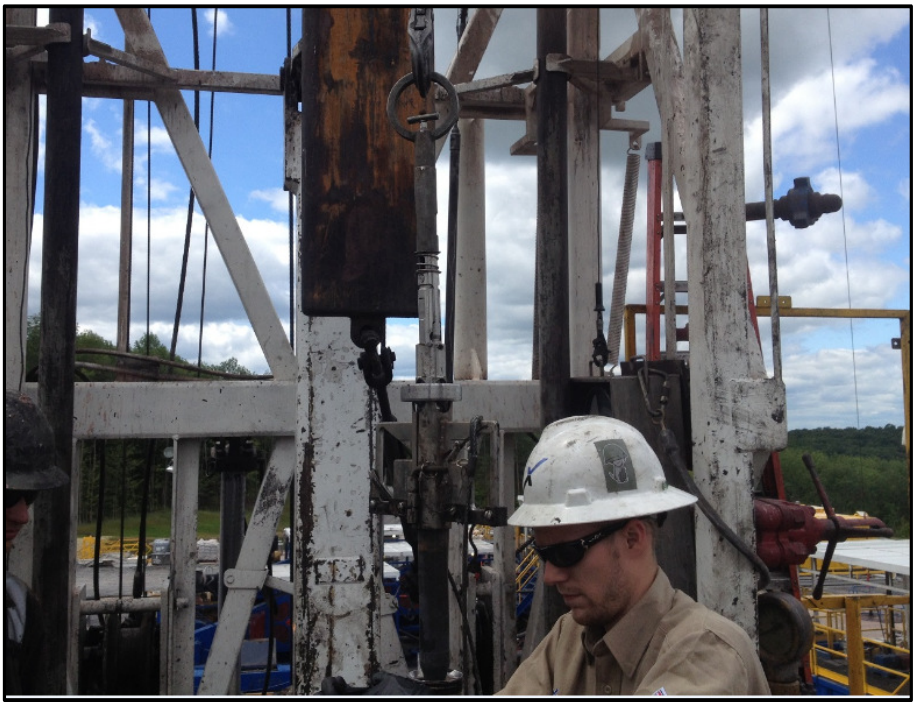


Figure 27 Overshot Pulled with the Tugger. DPG raised

32. Detach the Pickup sling assembly from the DPG probe.

NOTE: The Legacy Pickup plate shown in Figure 27 needs to be replaced with the T1038889 Pickup plate.

Figure 28 Pickup the DPG above the collar

33. Apply DC111 grease on the “O” Rings located on the Grounding spider. Identify the yellow paint or the annular pressure channel.

Figure 29 Grease the "O" Rings

34. By looking down into the Gab sub, identify the key in the Gap sub; the key will be at the same orientation as the high side scribe mark.
35. Align the key-slot on the Landing spider with key in the Gap sub by turning the overshot.
36. Lower the Overshot and Tool assembly with the Tugger line.
37. Once all the way down rotate the overshot so that the key slot on the Landing spider in the DPG probe latches with the Key on the Gap sub. The Operator will feel the key slot falling on the key; at this point the overshot has to be pushed down so that the key slot is fully engaged with the key.

Figure 30 Align the Landing spider key slot with the Gap Sub key

38. Verify that the tool is seated properly by ensuring that the annular pressure channel or paint line is visible through the Grounding port. If the Line is not visible, the tool is not seated and the previous 2 steps have to be repeated.

Figure 31 Yellow Paint/ Annular pressure channel visible on the Grounding spider

39. If the XEM is seated the Overshot can be released by pulling on the T bar handle.

40. Identify the appropriate Castle ring size as illustrated in Table-1.

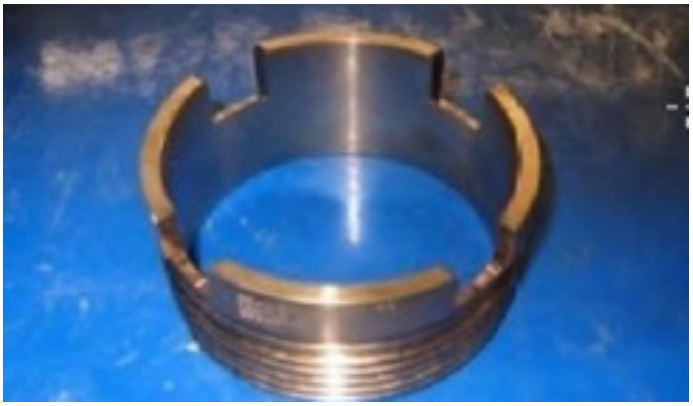


Figure 32 Castle ring

EM Castle ring	Part Number
4.75"	03X-EM2017
6.5"	03X-EM3017
8"	03X-EM5007
9"	03X-EM6007
11"	03X-EM7007

Table 1 Castle ring Sizes

41. Smear Loctite 603 on the Castle ring that will be installed.

Figure 33 Loctite on Caste Ring

42. Lower and place the Castle ring in the Gap sub. This will be threaded to secure the tool in the Gap sub and Collar assembly.

Figure 34 Castle ring installed in Gap sub

43. Identify the appropriate Castle ring tool; this is used to install the castle ring in the Gap sub.

Figure 35 Castle ring Tool

Castle ring Loading Tool Size	Part Number
4.75"	03JIGS0228
6.5"	03JIGS1228
8" and above	03JIGS5228

Table 2 Castle ring Tool size

44. Place the Castle ring tool on top of the slots in the Castle ring and turn the assembly clockwise.

Figure 36 Castle ring Tool applied on the Castle ring

45. Using a cheater bar on the Castle ring tool, torque the castle ring on to the Gap sub.

Figure 37 Torque the Castle ring

46. Look into the Gap sub from the Top. Once the castle ring is threaded all the way 6-7 threads will be visible.

Figure 38 Gap sub- castle ring threads

47. Identify the appropriate Grounding Set screw size to be installed for the required Gap sub. If annular pressure is required the Grounding set screw will be ported, otherwise the Grounding set screw will be sealed.

Grounding Plug Set screw	Part Number
4.75" Sealed	03X-EM2038 Rev 00B
4.75" Ported	03X-EM2038 RevX 00B
6.5" Ported	03X-EM3028 RevX 00B
6.5" Sealed	03X-EM3028 Rev 00B
8" Ported	03X-EM5012 RevA
8" Sealed	03X-EM5012 Rev X-A
9.5"	03X-EM6012
11"	03X-EM7012

Table 3 Grounding Plug set Screw

48. Smear the Grounding Setscrew with Loctite 243.

Figure 39 Smear Loctite 243 on the Setscrew

49. Install the Grounding set screw with a 5/16” Allen or Hex Key to 42 ft. /lbs. of torque and install the snap ring to prevent the set screw from backing out.

Figure 40 Grounding Set screw added to the Gap sub

Figure 41 Torque the Set Screw

50. Install the Snap Ring with Snap Ring Pliers.

Figure 42 Snap Ring and Snap Ring Pliers

Figure 43 Snap Ring being installed

Figure 44 Snap Ring installed

51. Apply Dope on Gap Sub Box threads and make up and torque the connection with the BHA item above.
52. The Torque values for the connection should not exceed the values listed for the gap Sub box.
53. The String is now ready to be run in Hole for the run.

3. OPERATING PROCEDURES

3.1. SHALLOW HOLE TEST

The shallow hole test for the XEM may be done at any time though it may not work while inside casing. The test can be performed as soon as the tool exits the casing. The tool needs to see a pressure of at least 100 psi before the safety switch turns ON and the tool can be woken up.
The survey is taken after a user configurable delay which is typically set at 30 seconds after the Tool stops sensing vibration when rotation is stopped and the pumps are switched off.
The survey transmission time depends on the Telemetry and the bit rate at which the tool is operated. If Tool face or gamma data is required the the tool needs to see vibration and the pumps should be switched ON, Vibration can also be induced by Rotation or pipe movement.

3.2. BENCH MARK SURVEY

It is important to get a 6 axis reference Survey after the Casing , where the survey is not affected by Magnetic Interference. This can be used as reference in case of a tool failure or if there are discripancies between different tools . The Gtotal and Mtotal, Inclination and Azimuth values should be repeatable.

3.3. GAMMA RAY

If Wire Line Logs from offset wells are available, the API reading on the offset well can be compared with logs from the XGM should read the same, if the readings are different the surface Gamma correction factor needs to be reviewed. If the Mud has Potassium a correction for potassium needs to be applied. If there are spikes on the Gamma Ray measurements while exiting casing they could be due to a Pip tag marker used for Wireline correlation.

3.4. ANNULAR PRESSURE

If Ported Grounding set screws are used Annular pressure needs to be monitored. If there are changes in Annular pressure values without any modifications to Drilling paramaters the Company Man needs to be informed.
Abnormal increase in Annular pressure values could also be due “O-rings “ on the Grounding spider washing out creating a bridge between the internal and the Annular pressure. An inspection of the Grounding spider in the DPG probe and Grounding setscrew on the Gap Plug has to be carried out when the tool is on surface.

3.5. AIR DRILLING

With air drilling it is recommended to carry out Misting preferably at 10-15 gpm (at least at a minimum of 5gpm) to improve the signal quality. The mist creates a channel for the signal into the formation in addition to reducing shock and vibration.

In air drilling conditions accelerometers are unstable at low inclination due to vibration and it is preferred to keep the MTF/ GTF switch at 15/10 degrees instead of the conventional 3/5 degrees.

3.6. DOWN LINKING

Down linking is typically carried out to:

1. Change the Power Level to improve Signal detection or conserve battery.
2. Change configuration files which may involve transmission at a lower frequency, if there are signal detection issues.
3. Change to a safety disabled configuration if there is a Pressure sensor failure and Drilling needs to continue.

   The Down linking sequence is explained in detail in Chapter8 Section 2.6. If Down linking cannot be accomplished with Pumps and conditions permit, rotation can be carried instead to simulate the Downlink high command.

3.7. SHOCK AND VIBRATION

While the XEM is adapted to work in harsh drilling environment all efforts must be carried to minimize Shock and Vibration where possible. The DynamX probe can measure Lateral and Axial Shock and Stick/ Slip and RPM. Chapter 3 provides an explanation of the user configurable Shock Levels which can be used as a reference for the Driller. Drilling parameters (RPM, WOB) can be optimized where possible to reduce Shock and vibration; this also improves the drilling efficiency.

Stick Slip%	Stick Slip Risk	Risk Level	
0-40	0	None	None
40-80	1	Low	Mitigation Recommended
80-100	2	Med	Mitigation requested
>100	3	High	30 minutes

Table 4 Stick Slip Levels

Shock Risk	Shock Risk Level	Shocks>50G's
0	None	cps≤ 2
1	Low	2≤ cps ≥30
2	Med	30≤ cps ≥100
3	High	cps ≥ 100

Table 5 Shock Risk Level

The following parameters which may be included in the configuration for the job can be monitored.

- *Shock Lateral Max* is the maximum value of lateral shocks during an interval selected in the user configuration.
- *Shock Axial Max* is the maximum value of axial shocks during an interval selected in the user configuration.
- *Stick and Slip Risk Levels* from 0-3 based on stick and slip values above the threshold value.
- *Shock Lateral Risk Levels* from 0-3 based on Lateral shock counts above the threshold value.

3.8. DOG LEG SEVERITY

If DLS > Tool specifications is expected during the run, flex-subs can be incorporated in the BHA to reduce the stress subjected on the Gap joint in the Gap sub.

3.9. HIGH VOLTAGE XTX AND XHOP

Operating procedures for the New High voltage transmitter and the X HOP assembly are provided in separate chapters.

3.10. RIG DOWN

On completion of the Job the Steps 45 to 1 are carried out in reverse order to remove the tool from the collar and to lay the tool down on the Cat Walk. The Tool can also be removed from the collar + Gap sub assembly on the pipe deck. Prior to Use for the next run the dump data needs to be sent to the command center for PTK analysis to see if the Tool needs to be recalled.

4. POST RUN FILE DUMPS

Refer to Chapter 7 which provides information on the X Connect software used to communicate with the Tool. The XTX (Telemetry), Battery and DynamX Nodes have to be dumped and the files have to be sent to the Command center for post run PTK analysis.

1. In XConnect Click on the Telemetry Node.
2. Click on “Flash”.
3. Click on “Upload” in the Telemetry Flash window.

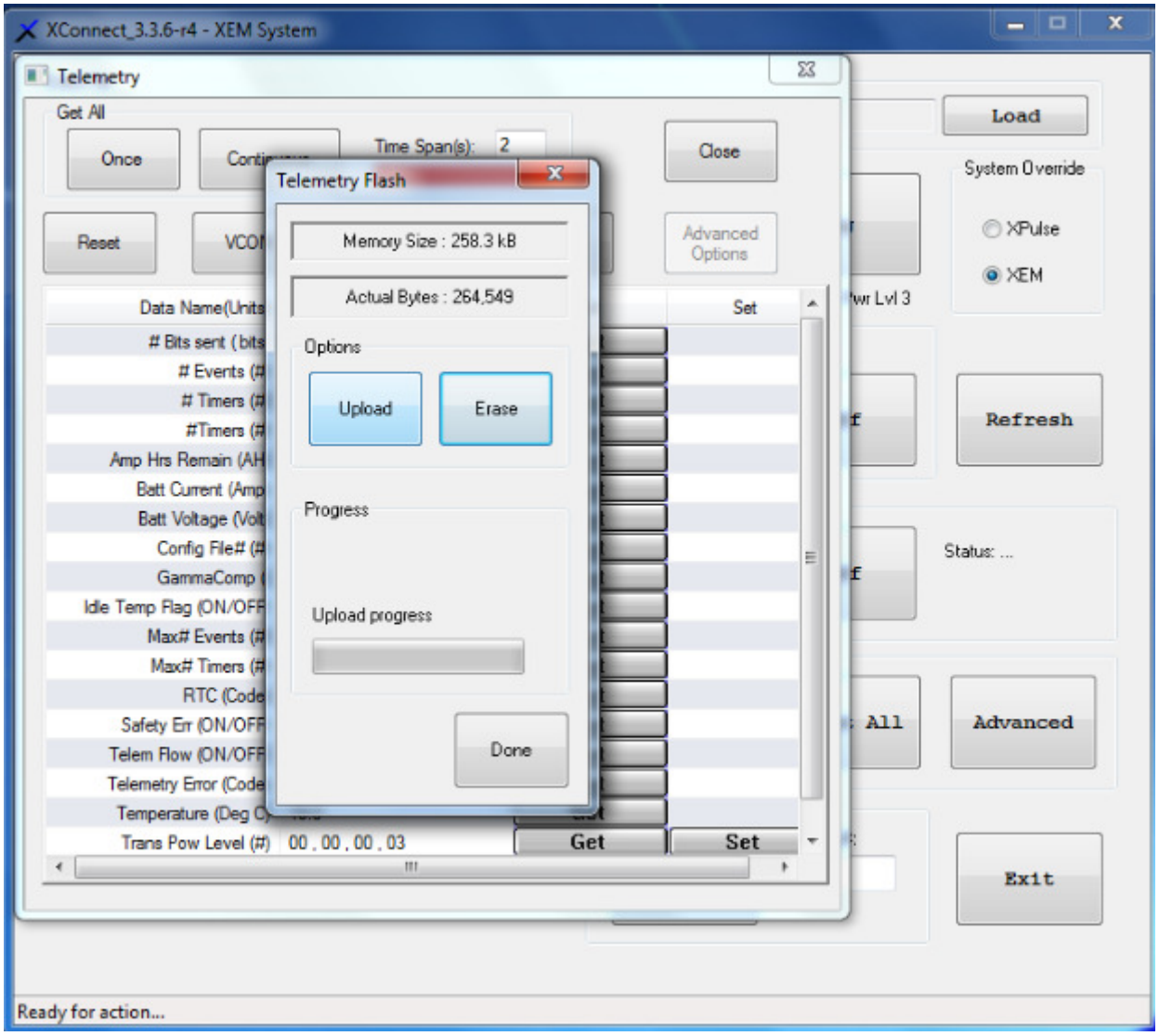


Figure 45 Telemetry Flash

5. The “Save As” window will pop up:

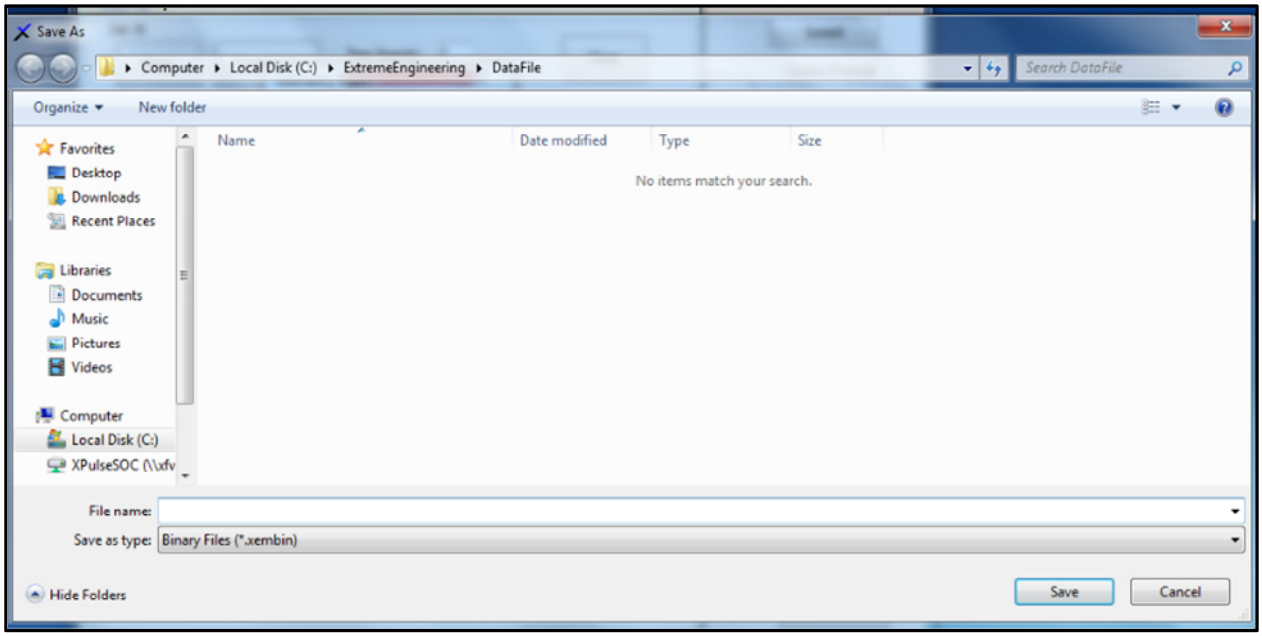
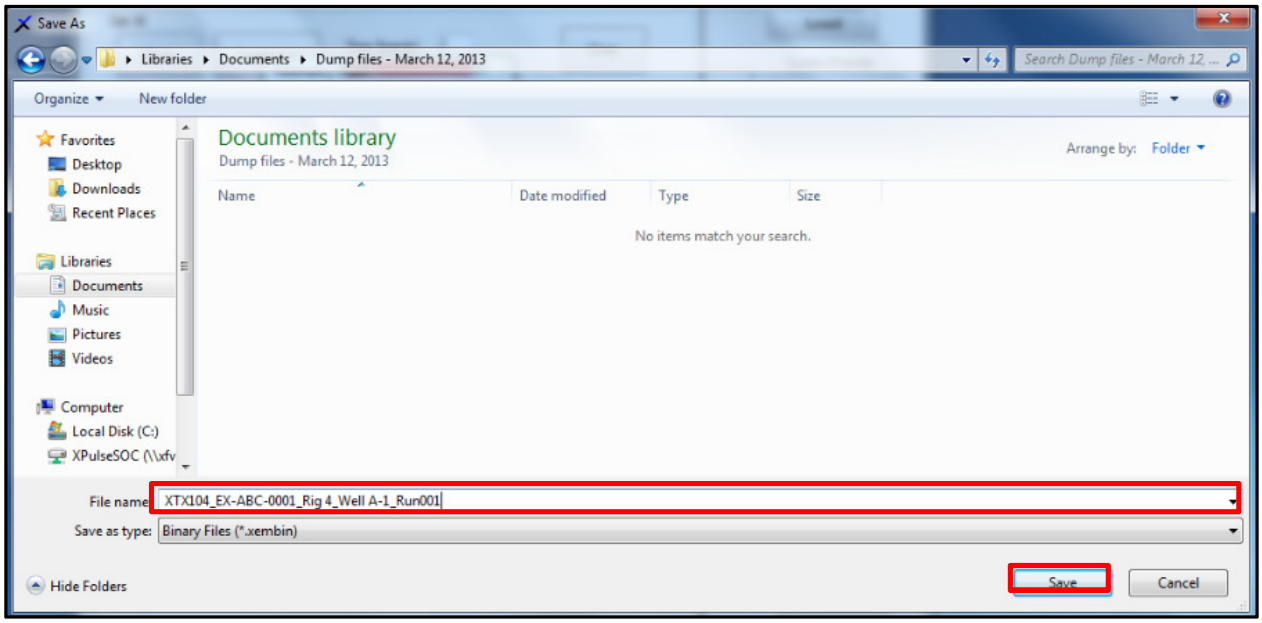


Figure 46 save Dump File

6. Change the Save Location to Libraries >Documents > Dump files- Date
7. Type the file name; the name should preferably contain the Probe Number (XTX104), Job Number, Rig Number, Well Number and Run Number.
8. Click on Save.



This will save the XTX104 XEM Binary file.

9. Monitor the progress of the Telemetry Flash dump.

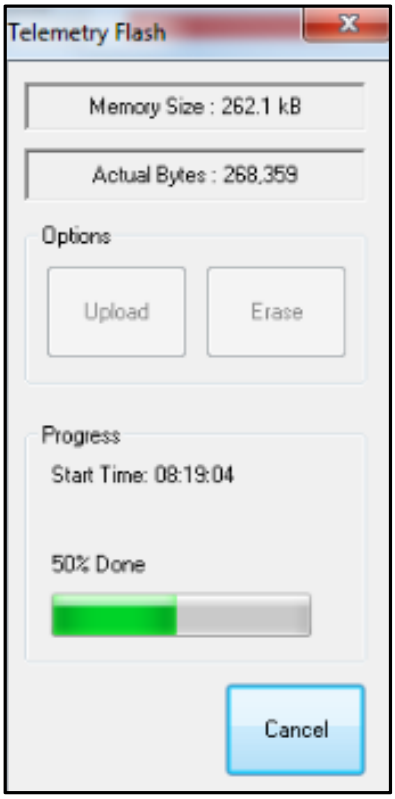


Figure 47 Upload Progress

10. When “Upload is finished” appears

    Click on “ok”.

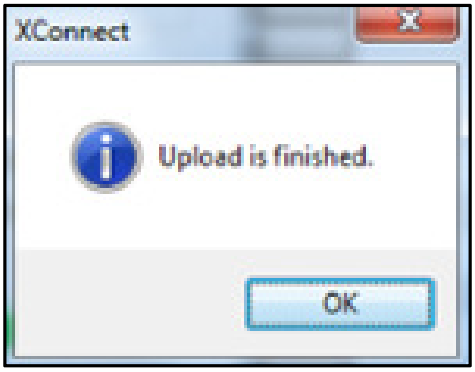


Figure 48 Upload Finished

11. Click on “Done”.

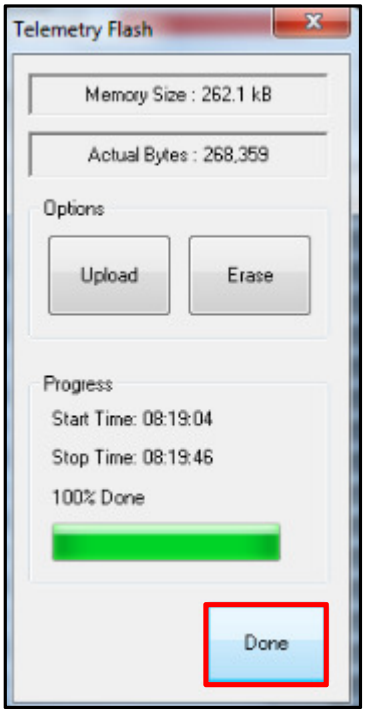


Figure 49 Done

12. Repeat Steps 1-9 for the DynamX Node (DO) and all the battery Manager Nodes. Each Battery in the XEM Tool string will have a Flash Memory.
13. With only 1 battery there should be Only 3 x Files saved with the extension xembin.

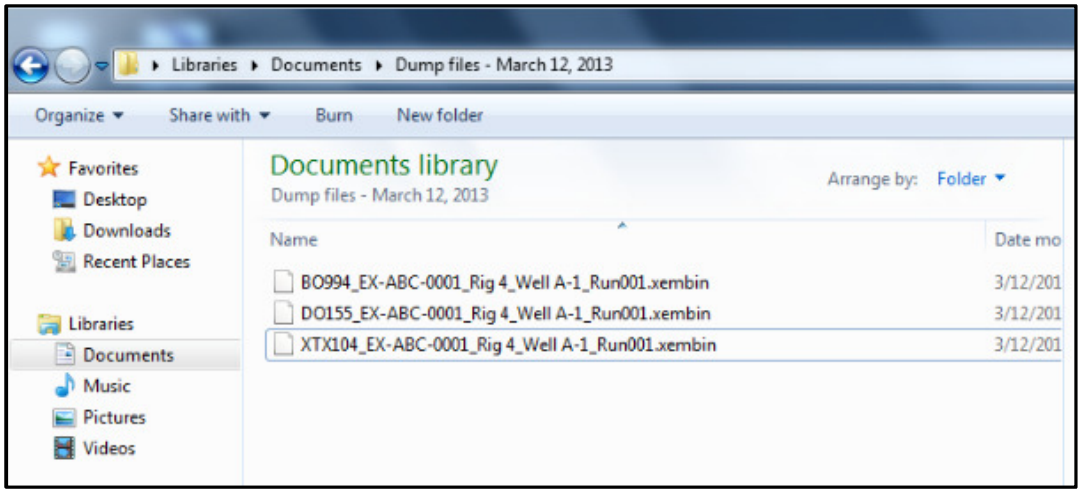


Figure 50 Dump Files

14. Navigate to the folder C > Extreme Engineering> XEM > Decoded Log Files
15. This should have Decoded data in txt format

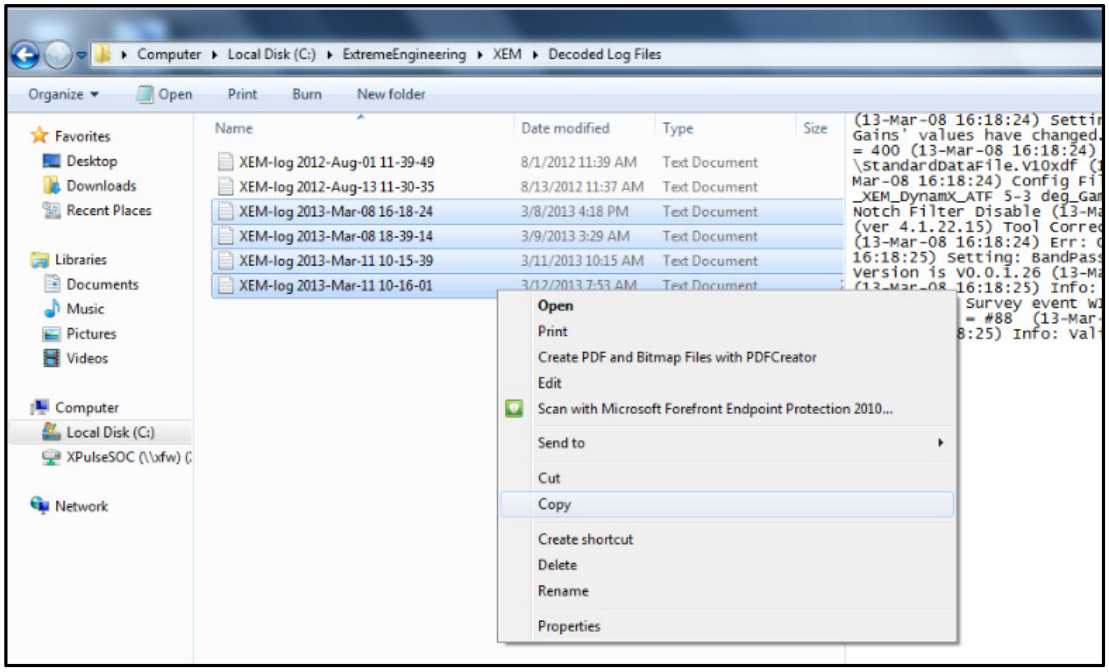


Figure 51 Decoded Log Files

16. Select and copy all the decoded txt files pertaining to the Run(s).
17. Paste the decoded txt files in the Dump directory together with the flash Dump files.

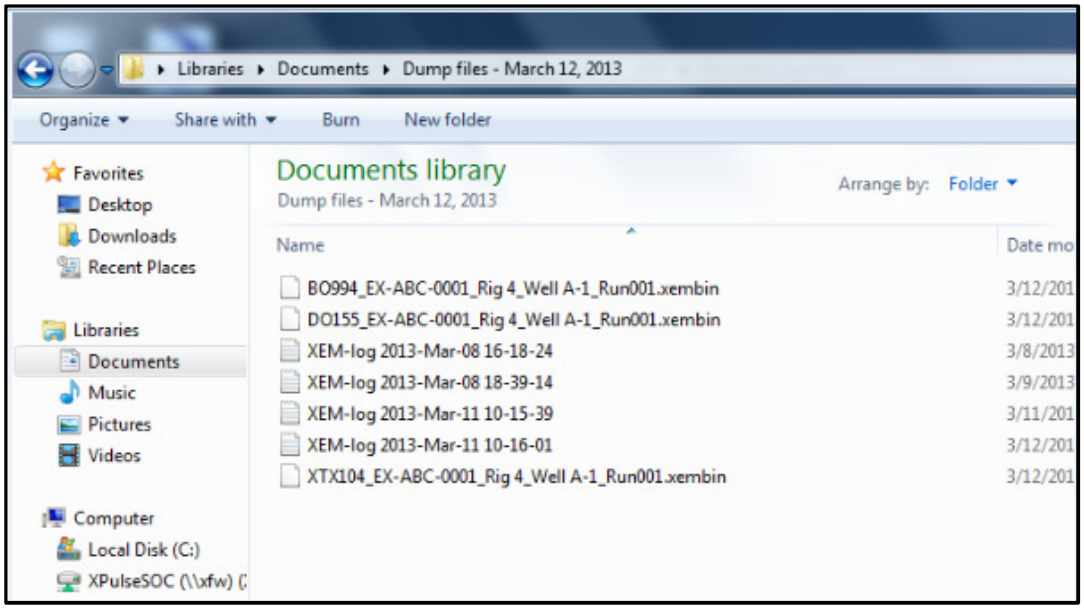


Figure 52 Dump and decoded files

18. Select the Dump Files folder and Zip it to a compressed Zip folder.

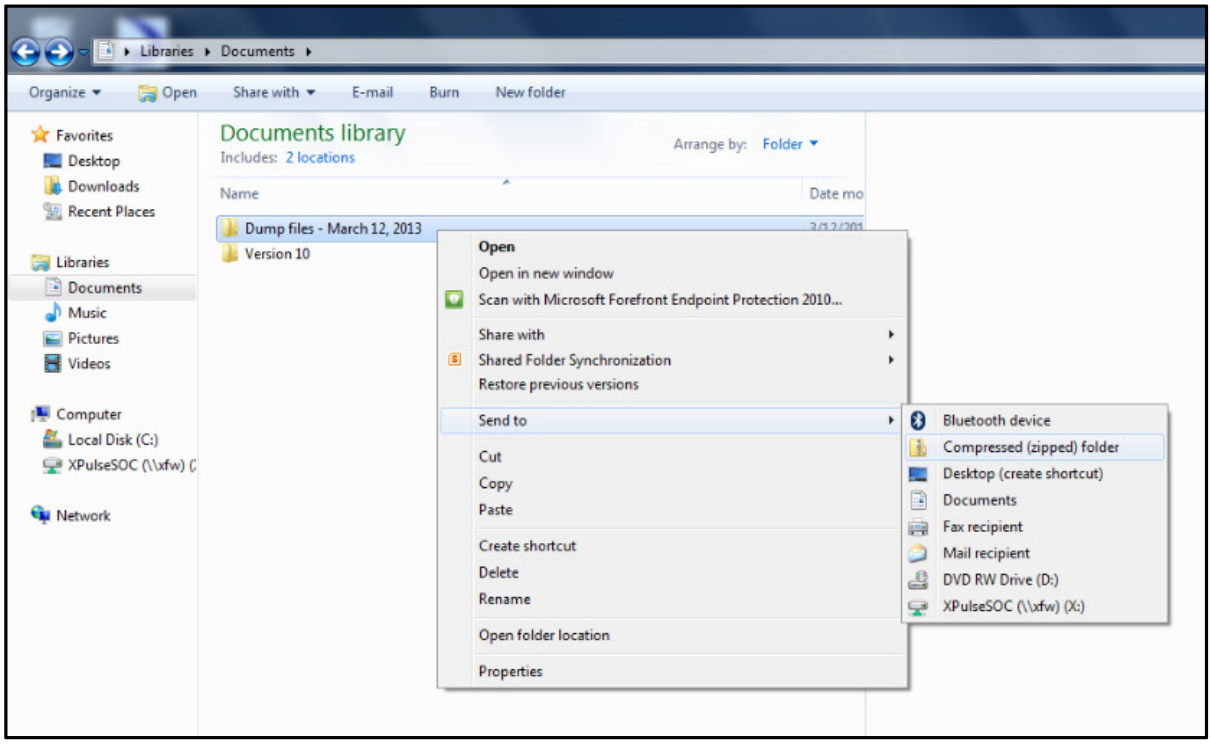


Figure 53 Zip the Dump folder

19. A Zipped Dump folder will be created.

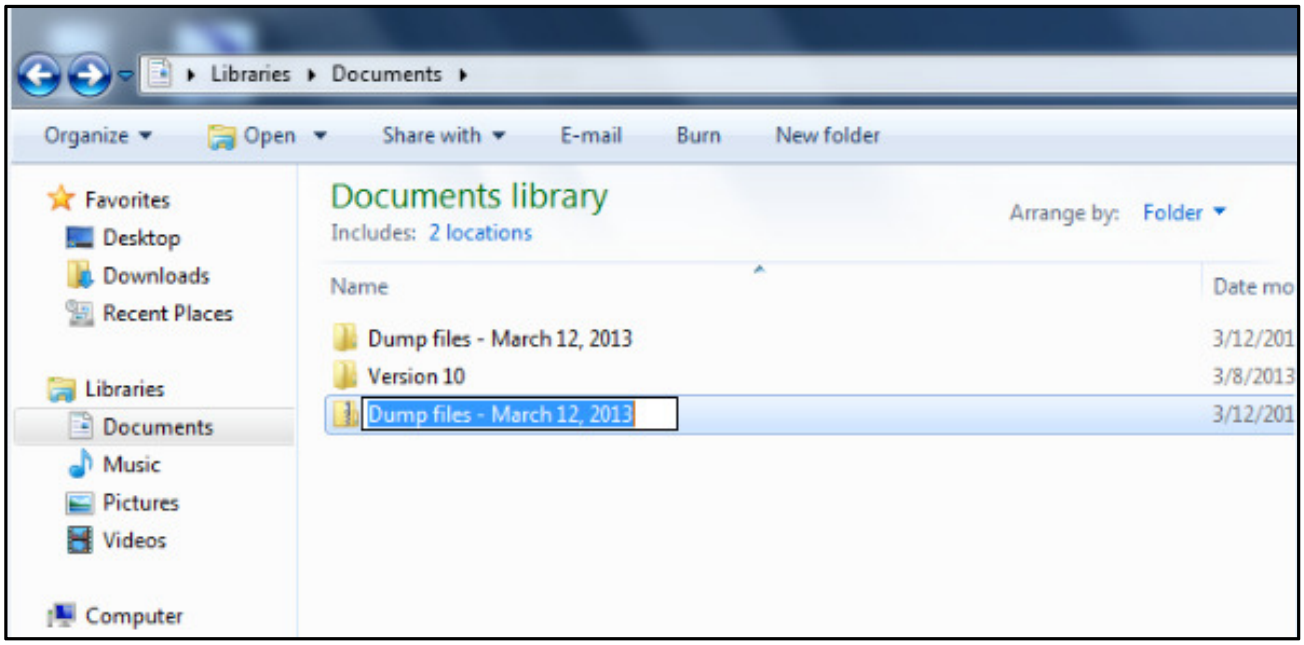


Figure 54 Dump files folder creation in progress

20. Rename the Dump folder

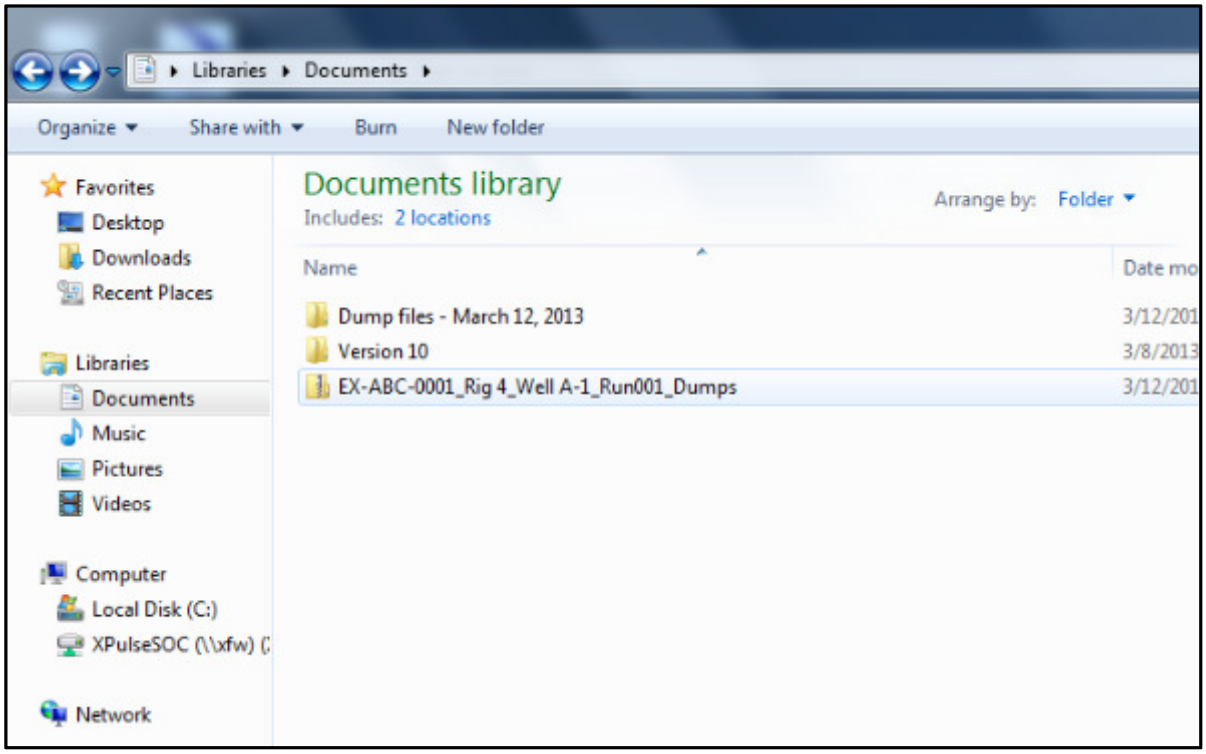


Figure 55 Dump files folder

21. Right Click on the folder and send to mail recipient.

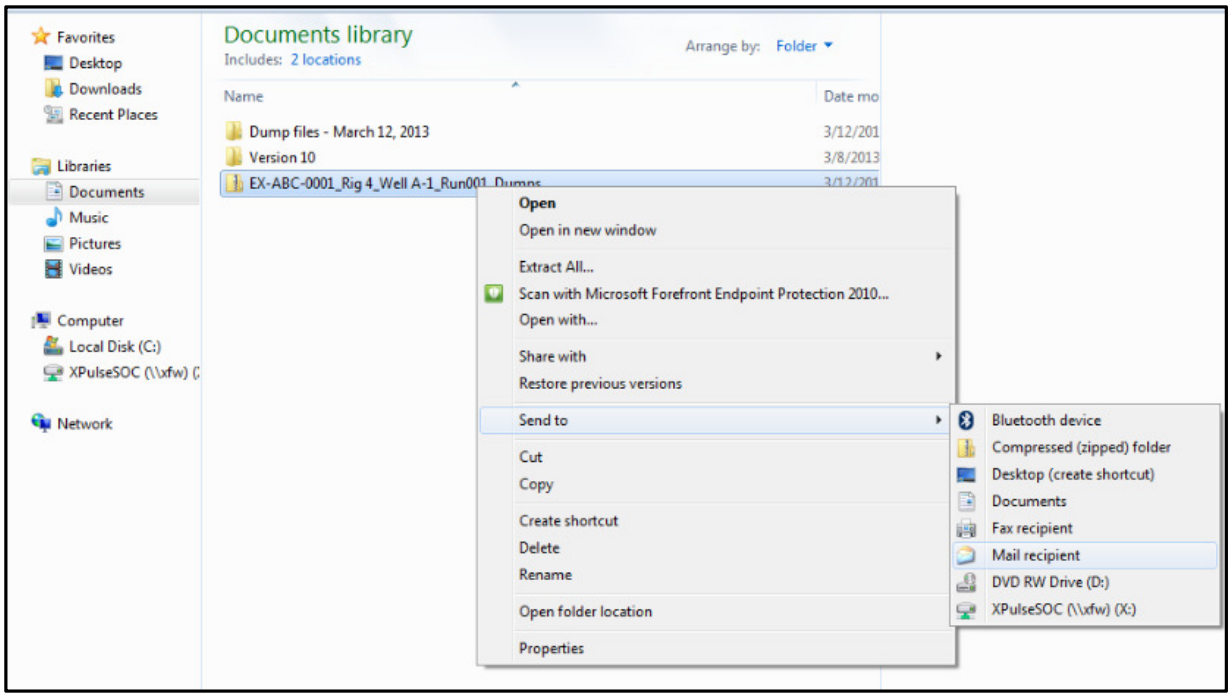


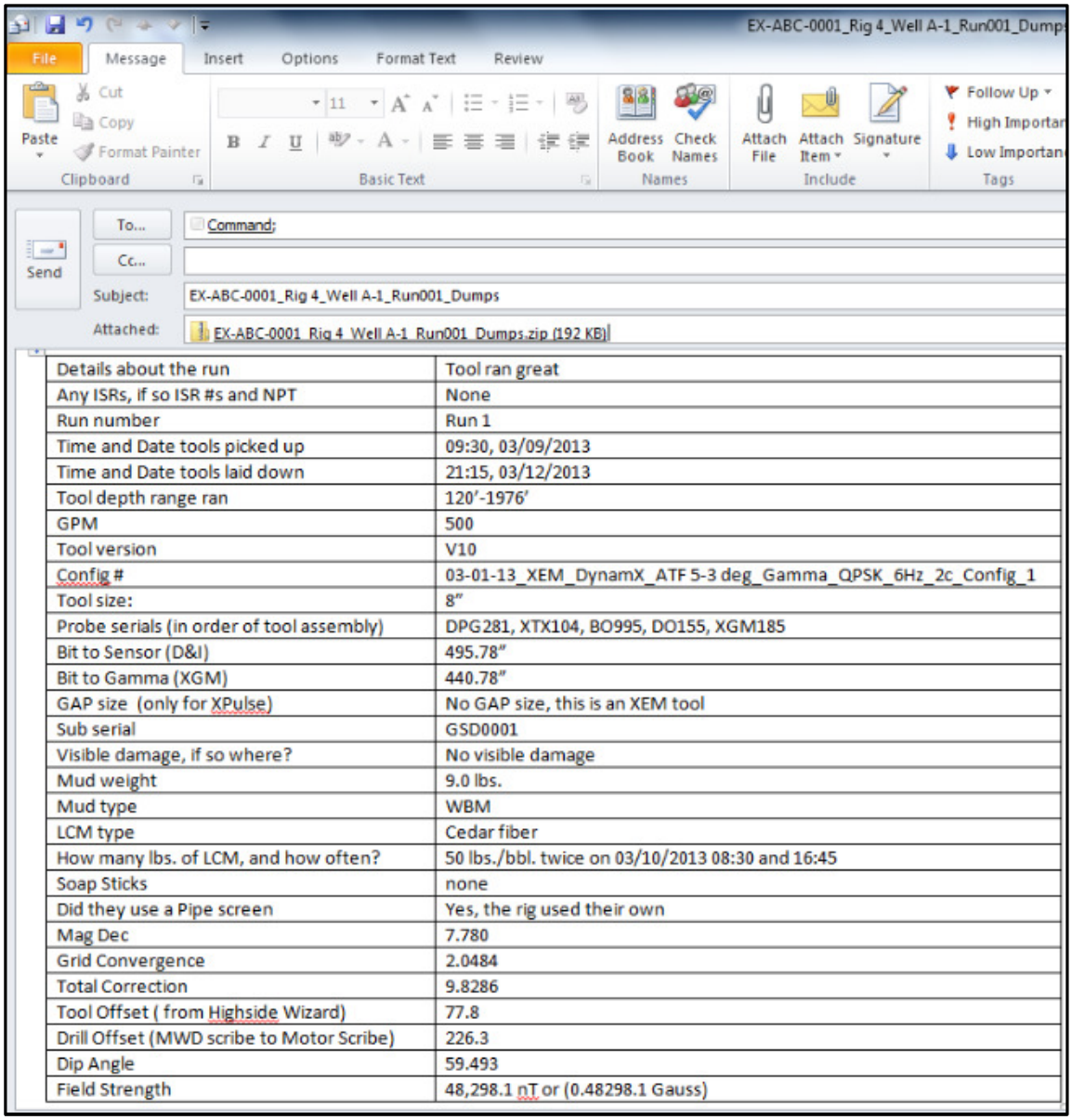
Figure 56 Dump Files to mail recipient

22. Address the Email to Command@extremeeng.com
23. Add Run Details:

Details about the Run	
Any ISRs, if so ISR #s and NPT	
Run Number	
Time and Date Tools picked up	
Time and Date Tools Laid Down	
Total depth range ran	
GPM	
Tool Version	
Config #	
Tool Size:	
Probe Serials#(in order of assembly)	
Bit to Sensor# (D&I)	
Bit to Sensor# (Gamma)	
Gap sub Serial Number	
Visible damage if so where	
Mud weight	
Mud type	
LCM type	
How many lbs. of LCM and how often?	
Soap sticks	
Did they use a pipe screen	
Mag Dec	
Grid Convergence	
Total Correction	
Tool Offset (From High Side wizard)	
Drill offset (MWD to Motor scribe)	
DIP Angle	
Reference Magnetic Field Strength	
XTR/XM4*	
Reference Tool Gravity strength*	
Misting if Air? Gpm? *	
Number of stakes used 2,3 ,4*	
Signal Conditioner*	
Maximum DLS*	
Surveys out of FAC?*	

- The information in Red is Currently Not included but is good to have

24. Send Email (with the attached Dump folders and Run Details) to the Command Center.



Details about the run	Tool ran great
Any ISRs, if so ISR #s and NPT	None
Run number	Run 1
Time and Date tools picked up	09:30, 03/09/2013
Time and Date tools laid down	21:15, 03/12/2013
Tool depth range ran	120'-1976'
GPM	500
Tool version	V10
Config #	03-01-13_XEM_DynamX_ATF 5-3 deg_Gamma_QPSK_6Hz_2c_Config_1
Tool size:	8"
Probe serials (in order of tool assembly)	DPG281, XTX104, BO995, DO155, XGM185
Bit to Sensor (D&I)	495.78"
Bit to Gamma (XGM)	440.78"
GAP size (only for XPulse)	No GAP size, this is an XEM tool
Sub serial	GSD0001
Visible damage, if so where?	No visible damage
Mud weight	9.0 lbs.
Mud type	WBM
LCM type	Cedar fiber
How many lbs. of LCM, and how often?	50 lbs./bbl. twice on 03/10/2013 08:30 and 16:45
Soap Sticks	none
Did they use a Pipe screen	Yes, the rig used their own
Mag Dec	7.780
Grid Convergence	2.0484
Total Correction	9.8286
Tool Offset (from Highside Wizard)	77.8
Drill Offset (MWD scribe to Motor Scribe)	226.3
Dip Angle	59.493
Field Strength	48,298.1 nT or (0.48298.1 Gauss)

5. TROUBLE SHOOTING

The XEM Signal Tree.xls sheet (attached as a resource for this Manual) is used by the Command center at Fort Worth to trouble shoot Signal detection issues with the XEM.

A list of common issues identified during Surface and down hole drilling are given below.

5.1. COMMON ISSUES DURING SURFACE TESTS

No power to the Receiver or Telemetry Terminal:

- Ensure the Telemetry and Receiver Terminals power switches are in the ON position. The LED indicators will be lit.
- Check that there is a good power source. E.g. Power inverter, AC outlet, etc.
- Ensure that the power and communication cables are in good working condition and connected properly, (swap if necessary).
- Inspect connectors on the Terminals for any visible damage. E.g. broken pins, etc.
- Swap the Terminals.
- Confirm the voltage supply 110V/ 220.

No Signal Trace moving across the Remote Terminal:

- Turn off both Terminals for 1 minute. Restart.
- Try a new power and communication cable.
- If available, try another Telemetry Receiver.
- If available, try another Remote/ Azonix Terminal.
- Ensure the proper software, firmware, and drivers have been installed and are functioning properly on the Receiver Terminal. If you cannot, have a Support Center Specialist log onto the box and check them for you. Ensure there is internet connectivity to do so.
- Dirty power can create communication issues between the surface terminals. This can manifest by “freezing” the signal trace (timestamp in XEM Rx behind time in Windows) or having the tool light flicker on and off. Using an APS or a high quality Isolation system may be necessary to maintain connectivity between the two.

- Switching from shack to inverter power may also remedy the issue. Avoid running the vibrator on the same circuit as the surface equipment as it may lock up XEM Rx when powering on or off.

No Signal from tool string visible on Signal Trace:

- Ensure the pump is properly sealed and is delivering at least 100psi so the pressure threshold of the DPG is being met. Pressure can be confirmed in XConnect from the telemetry node by using the get command.
- Double check clamps are fully plugged into the telemetry receiver test box and the BOP and Antenna cables from the test box are connected properly to the telemetry receiver.
- Check that the test clamps are properly secured to the spear point of the DPG and the pressure fitting on the pump so isolation between the two points is established.
- Double check all connections and reboot the surface system.

D&I Roll test failures on surface

- If the Total Magnetic field keeps changing it is likely due to interference from external sources at the well site, remove sources or move the tool string away.
- If During the Roll there is an Inclination spread > 0.5 Degree, verify that the tool is level
- If there is no response OR the Sensors are out of FAC and the temperature ≤ 0 degrees C heat the Directional probe with a blanket.
- If there are issues with the G total changing, remove the Directional probe from the string on its own and see the G total spread both horizontally and vertically.

Gamma Counts on surface differs from expected values

- Count rates from Different detectors output different counts per second. Verify the Output counts with the backup Tool

5.2. COMMON ISSUES WHILE DRILLING:

No signal being detected:

- Make sure that the tool is below the casing. Check with the driller to make sure the tool is at an appropriate depth if necessary.
- If there is a sudden change in Signal Verify with the Signal prediction model that there are no expected issues with signal in the zone being drilled.
- If available use a Signal Strength generator 04FSTS, which can be connected to the BOP and Antenna stakes to simulate a signal from the Tool, this will confirm if there are any issues with the surface system.

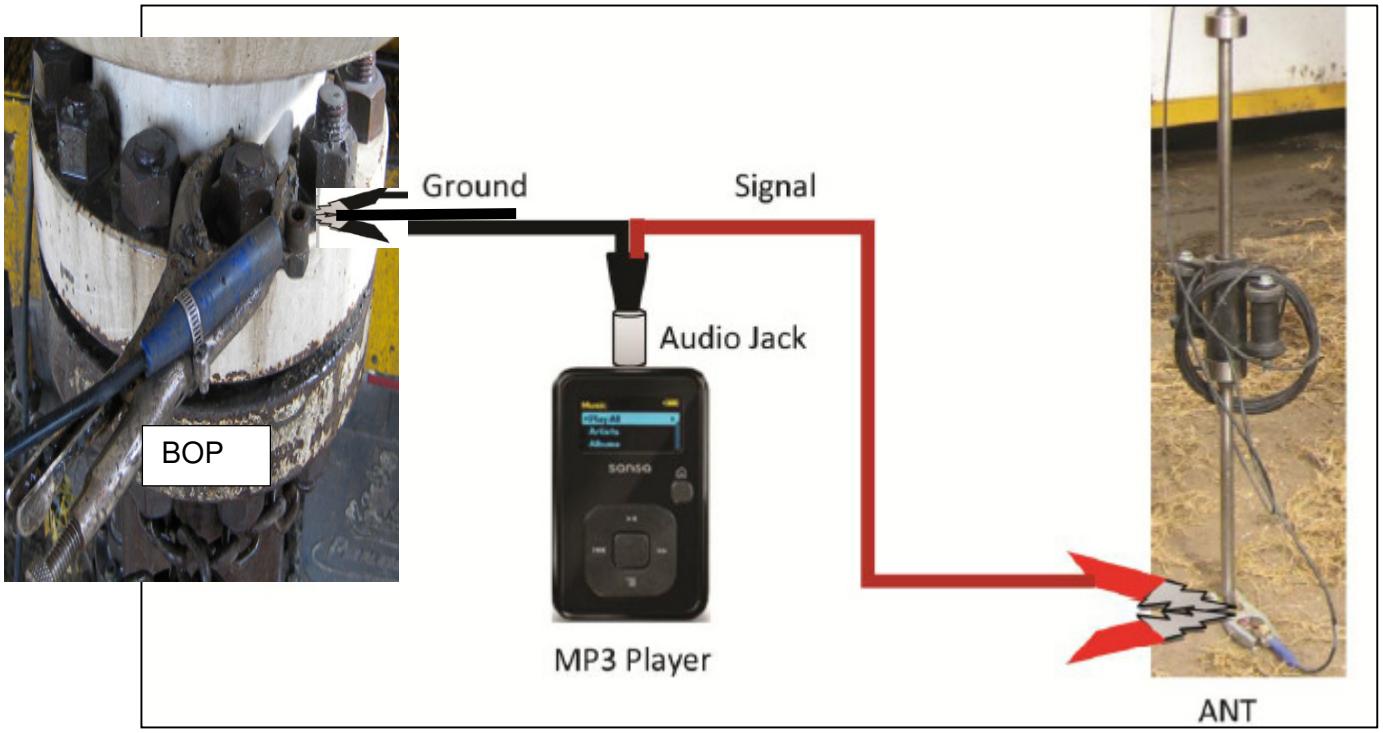


Figure 57 Signal strength generator

- If a signal strength generator is unavailable Double check connections from the Telemetry box to the Antenna and BOP.
- Ensure the BOP connection is secured to a clean surface on the BOP stack, take a file and clean a good connecting surface if necessary. Do the same for the Antenna clamp if you are using something other than the Ground Stake. E.g. Old well head, Culvert, Etc.

- NOTE: To check if the Antenna and BOP cables are functioning properly, you may disconnect them from the Telemetry Receiver and plug them back in one at a time. Watch for a spike in the signal on the Remote Terminal box. This will indicate the cables are functioning properly.
- Check the continuity of the cables with an Ohm meter.
- Ensure the signal trace is moving across the screen from right to left.
- Kick in rotary table on rig to produce vibration, as the vibration switch may not function with the flow.
- Check the Battery tracking sheet to ensure there is adequate Battery life
- Confirm the Operating specifications to ensure that the DLS/ Temperature have not been exceeded.
- There is a possibility the Pressure measurement may be affected compromising the pressure interlock, try downlinking to a safety disabled configuration.

Noisy signal: *If signal noise is causing bad detection, follow these steps.*

- Check the Rig Grounding system with the Electrician. Ensure that the TDS, Compressors, Pumps and input supply to the XTR/XRT are properly Grounded.
- If Air Drilling is in progress ensure the Rig is misting at 25-30 gpm.
- Double check the connection to the BOP. Ensure that the connecting surface is free from mud and dirt to ensure good contact, use a file to make a clean contact if necessary.
- Try repositioning the ground stake, making sure it is at least 25 feet from rig structures, and as far away from the BOP stack as possible. Alternatively, connect the Antenna cable clamp to a nearby wellhead, culvert or any other metal fixture that is buried in the ground.

  NOTE: On some rigs outside interference from various unspecific sources can be quite strong and may eradicate the signal. In this case moving the ground stake right off the lease may be necessary. Make sure the cables are run in a manner that trucks won't drive over them. Using cable elevators or running the cable through pipe may be necessary to avoid damage.
- Try using the isolation transformer to remove any bad ground from the rig.
- Ensure that all cables are as far away from rig power lines as possible, as this will cause interference.

- Try downlinking to a higher power configuration, while also making sure the configuration on the remote terminal is the same as down hole upon completion.
- Try Downlinking to a lower frequency configuration.
- Run the Spectrogram to determine if there is a consistent source of noise that can be removed by a Notch filter.

Clean signal but no decode:

- Ensure that the configuration in Remote Terminal matches the configuration in the tool. There is a possibility that the tool has been accidentally downlinked. It may be necessary to try each configuration independently. Keep in mind that the tool readings will not come up until a header is decoded. If the tool signal is visible but the software is not decoding it, you are most likely in the wrong configuration. Note that if configuration frequencies vary, you will need to open the band pass frequency range to cover all possibilities. An alternative is to download .xem files and replay with each configuration file loaded into the tool. It should be noted that the band pass filter cannot be changed when replaying .xem files, only in real-time.

Remote Terminal (XRT) Connectivity: *If you are having troubles connecting to the XRT remotely via on-site or offsite, follow these steps.*

- Ensure the antenna is connected outside the doghouse, horizontally pointing upwards.
- Install a satellite kit to achieve connectivity.
- Use air card's dynamic IP address to gain connectivity.

Direction and Inclination out of FAC

- If the Total G is out of the Field Acceptance criteria repeat the Survey, work the pipes to remove trapped torque in the string and retake the Survey. If the Repeat Survey has the same issue, retake the Surveys at 4 different Tool face orientations, The G total spread should be the same, Gx should remain constant, Gy and Gz total should keep changing.
  Confirm the temperature when the Survey is out of the Field acceptance criteria.
  Confirm that the Tool signal is clean.
  Move the String to the Bench Mark or reference Survey location.
- If the Total M is out of the Field acceptance criteria
  Check estimates for Drill String interference (This increases with Inclination and Azimuth orientation towards the East/West)

Confirm there is no nearby Well or Source of External interference
Confirm there is no Pyrite in the formation.

Gamma Logs

- If there are spikes in the gamma Log, confirm that the signal is clean and the decoded values are “Green”
- Retake the Log in a zone where the Gamma Log was clean to confirm repeatability. Confirm with the Company Man that there are no specific formation features which may cause the spikes.
- If the Logs read different from expected values, confirm the Surface correction factors. And confirm the thickness of the collar, in flex collars the thickness of the collar in front of the Gamma module may differ from the nominal OD. Confirm there is no Potassium in the Mud which needs to be corrected.

6. REFERENCES

1. Well site Pictures courtesy Jack Rader Extreme Engineering
2. FST Training Material courtesy Dan Bukovec Extreme Engineering
3. Trouble shooting references courtesy Command Center/ Dave Dexter/ Ryan Kirby
4. Slimpulse Operations Manual EMS UID

7. REVIEWS

1. Erwann Lemenager