

# xBolt

## Real Time Operations

**EXTREME**™



# Objectives

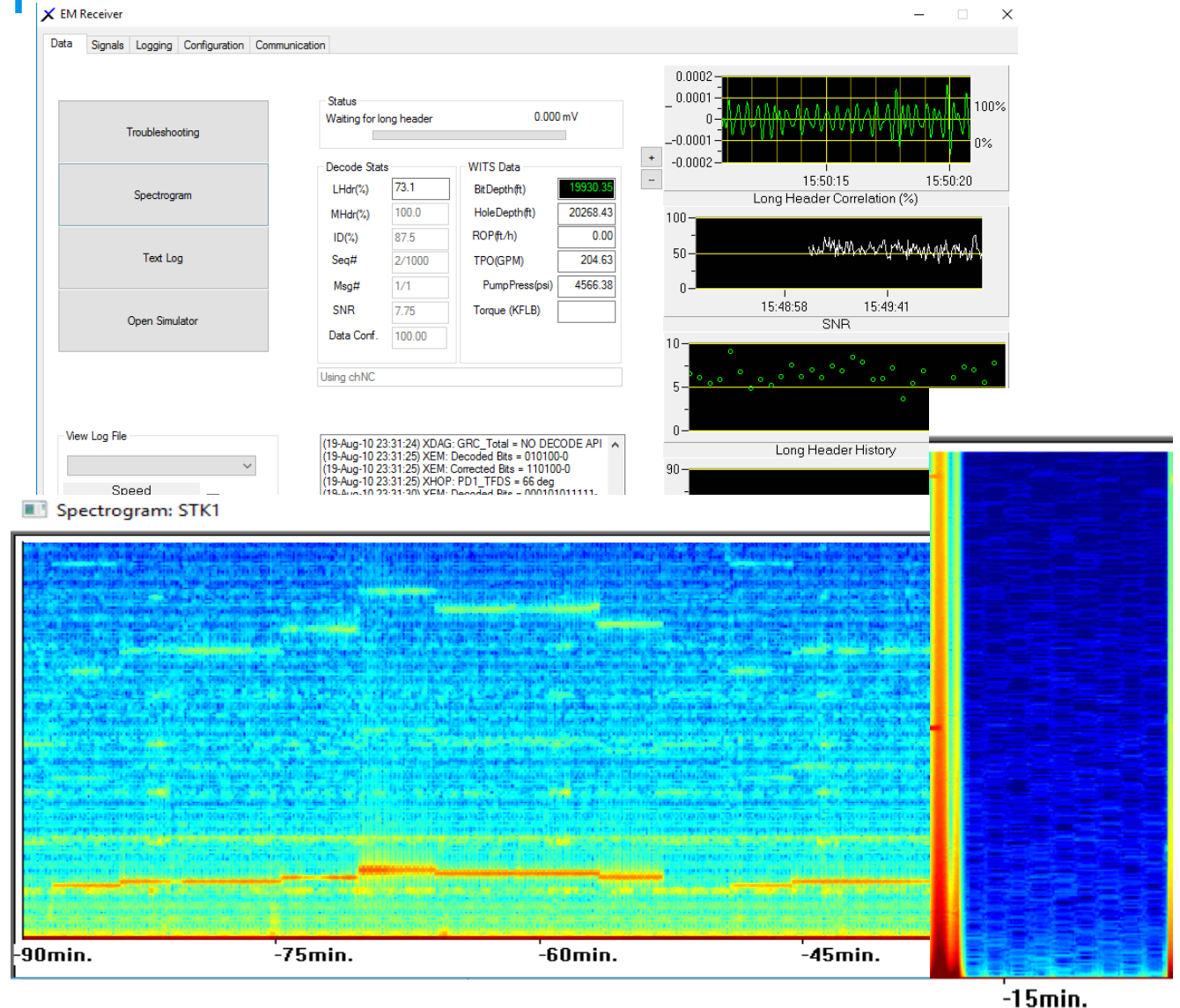
- Validate good SHT
- Use xBolt downlinking features
- Learn receiver options within Xdirect
- xBolt Basic troubleshooting
- Learn logging functions within XDirect

# xBolt Real Time Operations

Shallow Hole Test

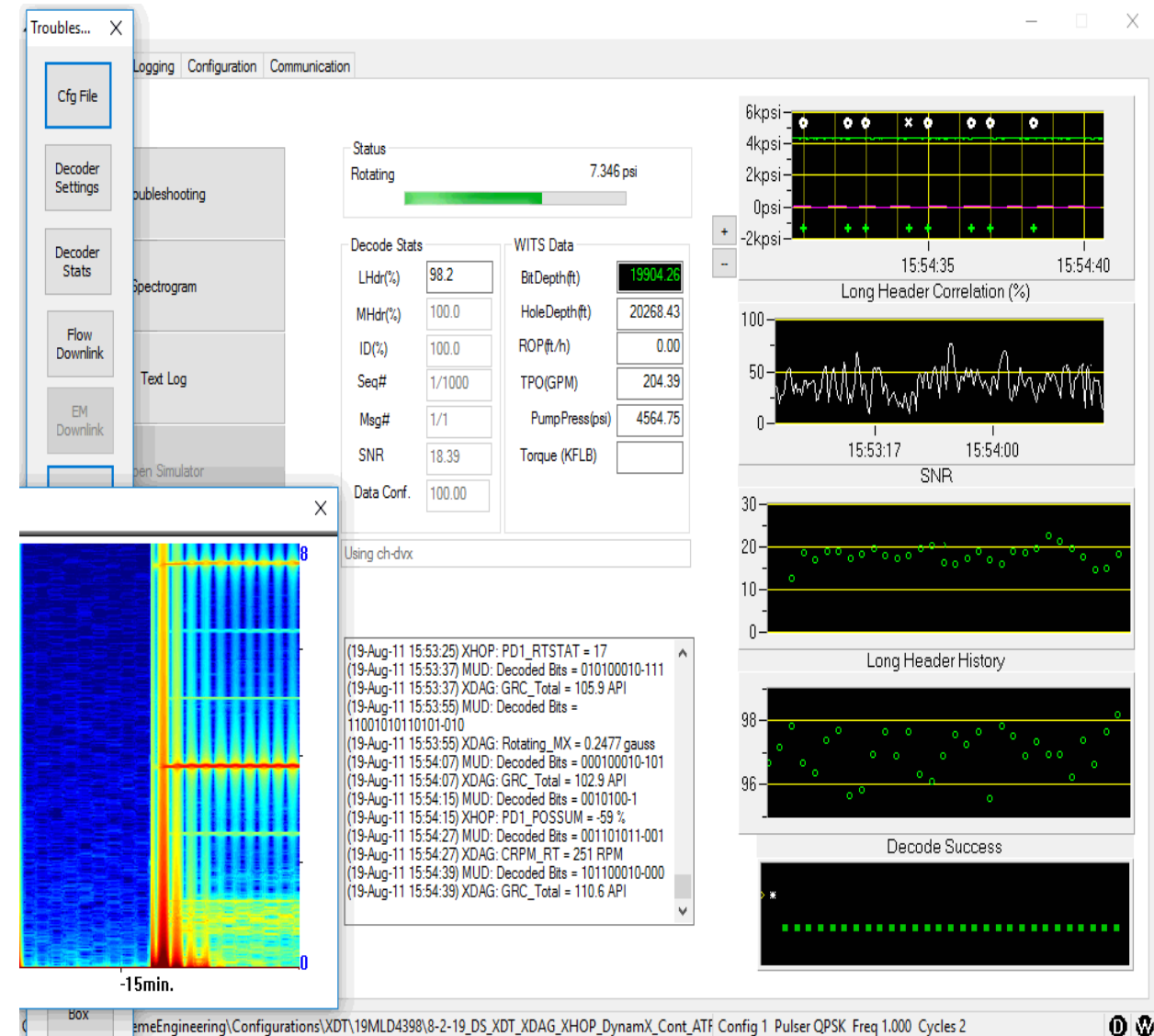
# xBolt Shallow Hole Test Preparation

- Open X-Pulse RX and verify trace is scrolling
  - Pressure reading should be close to 0 and spectrogram should show small traces of noise
  - If pressure is showing a large negative number (ie -1500 psi), check all connections first and then check sensor
- Open XM4 RX and verify trace is scrolling
  - Each channel should show traces of noise in spectrogram
  - Measure resistance with downlinker to verify connections
- Confirm “Launcher” is open
- Confirm WITS is being received into X-Pulse RX / XM4 RX



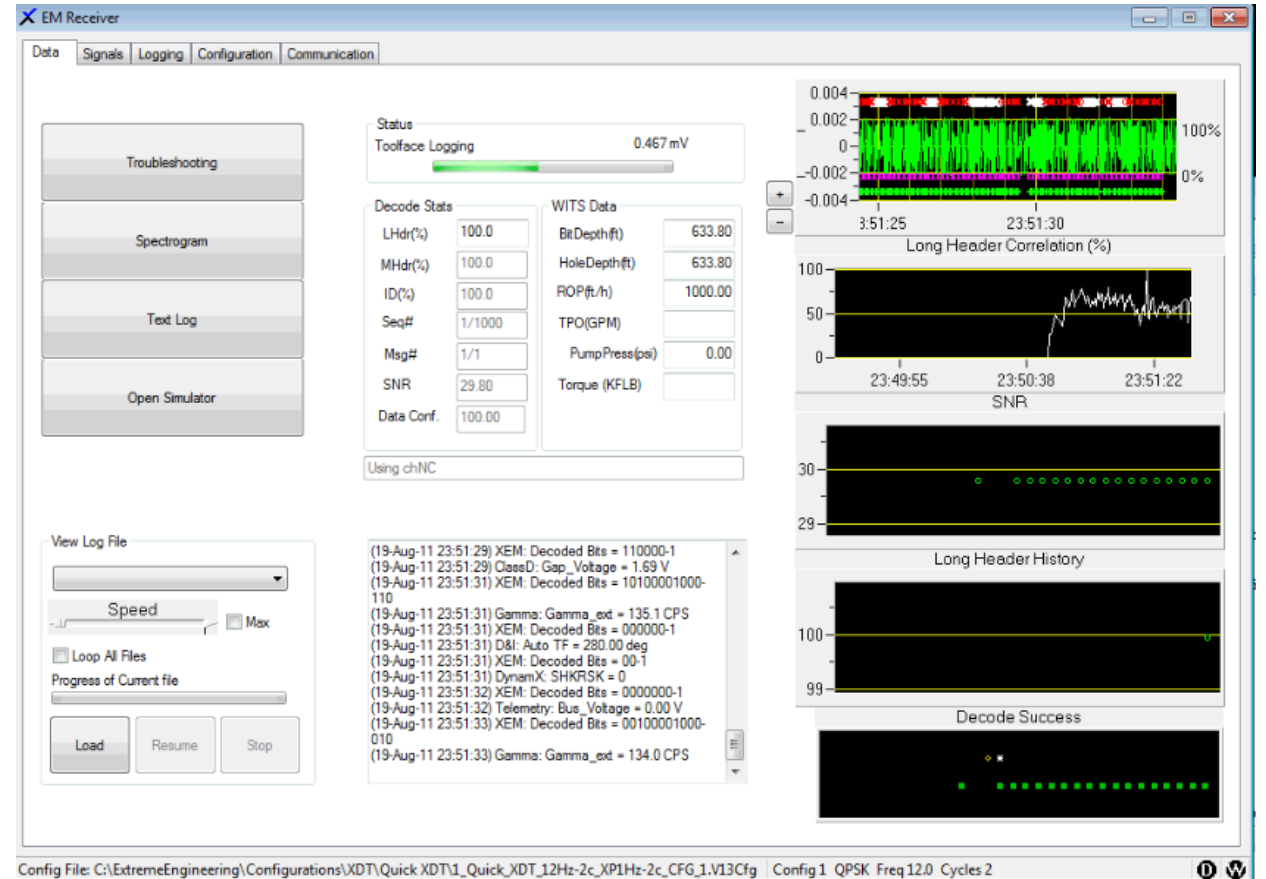
# xBolt Shallow Hole Test

- Mud Pulse SHT may be conducted after picking up BHA
- EM SHT must be conducted after tripping in beyond casing shoe
  - Recommended to have gap sub at least 30 feet outside of shoe to complete test



# xBolt Shallow Hole Test

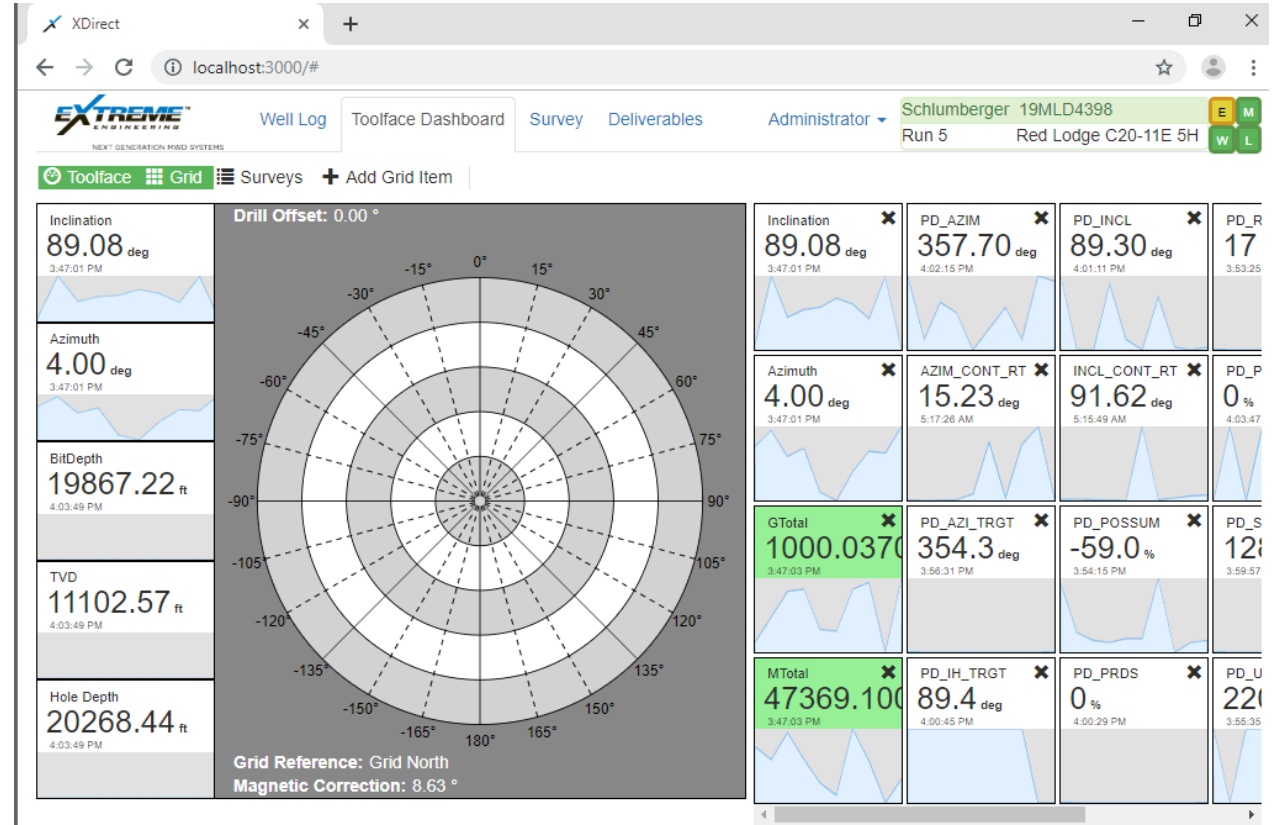
- Consult with DD and Company man for SHT parameters prior to testing. Recommended to flow 10-15% above minimum flow of all tools in BHA
- Bring flow up to planned flow rate and monitor spectrogram for signal
- Monitor the following parameters during SHT
  - Signal Strength
  - SNR
  - Decode Success
  - Pump Pressure
  - Gap Voltage (EM)
  - Gap Current (EM)
- If testing at shallow depth, safety disabled may be needed for the tool to transmit EM





# xBolt Shallow Hole Test

- Monitor real time data coming from tool
  - Total G must be in FAC
  - Total M & Mag. Dip will be out of FAC if inside casing
  - Verify gamma data is not reading 0, unexpectedly high or locked up
  - Verify continuous AX/MX are close to survey
  - Monitor all shock data and stop SHT if shocks are high
  - Verify RT comms is working as expected if not inside casing
  - Gap Voltage \* Gap Current  $\approx$  Tool Power Setting



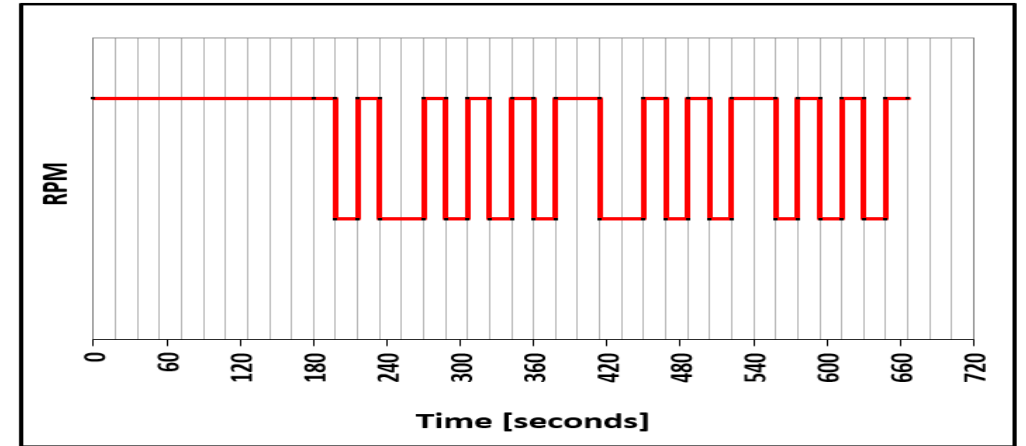
# xBolt Real Time Operations

Downlinking



# xBolt Downlinking Methods

- Flow On/Off
- EM Downlink
- Collar RPM
- Pressure



Downlink Pattern

Note: The Status Header Detection will be enabled for 30 minutes when you click the 'Start' button.

Pattern

Config Up       Power Up       Uplink Strategy Up

Config Down       Power Down       Uplink Strategy Down

Start

Status Message Detection is OFF.

# xBolt Real Time Operations

Flow On/Off Downlink

# xBolt Downlinking – Flow On/Off


- Tool recognizes “flow” through vibration
- Flow or vibration must go above/below vibration thresholds
- Flow on/off downlinks achievable via flow, rpm or pipe movement when flow is off
- Timings found in XM4/X-Pulse receivers
- When in MP, use X-Pulse RX flow downlink, when EM, use XM4 flow downlink

Downlink Pattern

Note: The Status Header Detection will be enabled for 30 minutes when you click the 'Start' button.

Pattern

Config Up       Power Up       Uplink Strategy Up  
 Config Down       Power Down       Uplink Strategy Down



Start

Status Message Detection is OFF.

# xBolt Downlinking – Flow On/Off Options


- **Config Up**
  - Increase config number by 1
  - Will wrap from config 8 to config 1
- **Config Down**
  - Decrease config number by 1
  - Will wrap from config 1 to config 8
- **Power Up**
  - Sets tool to 20W power setting
- **Power Down**
  - Sets tool to 3W power setting
- **Uplink Strategy Up\***
  - Sets uplink strategy to Mud Pulse
- **Uplink Strategy Down\***
  - Sets uplink strategy to EM

Downlink Pattern

Note: The Status Header Detection will be enabled for 30 minutes when you click the 'Start' button.

Pattern

Config Up       Power Up       Uplink Strategy Up  
 Config Down       Power Down       Uplink Strategy Down



Start

Status Message Detection is OFF.

\*Uplink strategy should not be changed using flow on/off downlink due to IP restrictions, however, this may be done via pipe translation or rotation of drill string to generate vibration

# xBolt Real Time Operations

EM Downlink

# xBolt Downlinking – EM Downlinking - Safety

- Improper use may lead to serious injury or death EM Downlinking may
- Improper installation could lead to fire
- EM downlink connections and equipment should always be outside of Zone 1 (use stakes or offset wellheads)
- Consult company representative and rig manager prior to driving stakes or connecting to wellheads
- Check cables frequently for damage
- Always verify no one is handling stake or cables when transmitting downlinks

Zone	Definition
0	<i>In which ignitable concentrations of flammable gases or vapors are:</i> <ul style="list-style-type: none"><li>• Present continuously</li><li>• Present for long periods of time</li></ul>
1	<i>In which ignitable concentrations of flammable gases or vapors are:</i> <ul style="list-style-type: none"><li>• Likely to exist under normal operating conditions</li><li>• May exist frequently because of repair, maintenance operations, or leakage</li></ul>
2	<i>In which ignitable concentrations of flammable gases or vapors are:</i> <ul style="list-style-type: none"><li>• Not likely to occur in normal operation</li><li>• Occur for only a short period of time</li><li>• Become hazardous only in case of an accident or some unusual operating condition.</li></ul>

Per NEC article 505-9, CEC Section 18, EN60079-10, IEC 60079-10





# xBolt Downlinking – EM Downlinking

- When flow is off and tool is not transmitting EM, tool “listens” for EM downlinks
- Only applicable when gap probe is in string
- Downlink power >> Uplink Power (ie. Tool can see downlinks when EM signal is too weak to see on surface)

EM Downlink ×

**Transmit Parameters**

Modulation Mode : QPSK Extreme

Carrier Frequency (Hz) : 4,000

Bit Rate (bps) : 4,000

Transmit Power (%) : 40

**Downlinker Commands**

Select Tool : XDT Tool

Select Command : Set Power

Target Power : 15,000

Auto Settings

**Transmit Power**

V rms : 74 V      V max : 106 V

I rms : 1400 mA      I max : 2041 mA

Power : 104.4 W      Resistance : 53.0 Ohm

**Resistance**

Output Resistance (Ohm) : 47

**Safety Parameters**

Over Voltage Limit (V) :

Over Current Limit (mA) :

V Mon Threshold (V) :

I Mon Threshold (mA) :

Max Load (Ohm) :

Min Load (Ohm) :

Note: The Status Header Detection will be enabled for 30 minutes when you click the 'Send Downlink Command' button.

Status Message Detection is OFF.

Downlink Status : Disconnected      COM15      Connect to PC by USB

# xBolt Downlinking – EM Downlinking – Key Factors

- For downhole operations, resistance should be ideally be less than 100 ohms
- The lower the resistance, the more power available to safely transmit downlink
- Good grounds are essential for successful downlinking (offset wellheads or ProXimity antennas make for the best downlink connections)
- Stakes should be off man-made pads as grounds are often poor, look for swampy or wet areas nearby
- Frozen ground will not provide an effective grounding source, stakes or casing must go below frozen layer to reach good ground
- If resistance measurements are high between downlinking stakes, reduce resistance by “daisy chaining” stakes together.
- Watch video for grounding tips:  
<https://www.youtube.com/watch?v=G2OtgeDkTLs>

# xBolt Downlinking – EM Downlinking – Resistance Measurement

- Resistance
  - Measures resistance between two stake connections
  - When connected to load box for bank test, resistance measurement is generally between 250-450 Ohms
  - Resistance will vary when connected to stake based on ground quality
  - Ideally, for downlinks to downhole tools, resistance should be less than 100 Ohms

Resistance

Output Resistance (Ohm) : 47

# xBolt Downlinking – EM Downlinking – Transmit Parameters

- Carrier Frequency/Bit Rate\*
  - Frequency and bit rate at which tool listens for downlinks
  - Tool only listens in one bit rate/frequency dictated during programming
  - Programmable options shown on right
- Transmit Power
  - Target power percentage output by downlinker
  - If power setting is too high, safety alarm will trigger
  - If too low, downlink may not take
  - Use 10% (default) to 20% in bank testing
- Abort Downlink / Safety Alarm
  - Downlinks may be aborted while sending
  - If safety alarm triggers, abort downlink button will change to “Safety Alarm”, Safety Alarm button must be clicked to send another downlink

Transmit Parameters

Modulation Mode : QPSK Extreme

Carrier Frequency (Hz) : 4.000

Bit Rate (bps) : 4.000

Transmit Power (%) : 10

Abort Downlink

DDR Listening Freq/BitRate

Should erase flash

Estimated time to erase

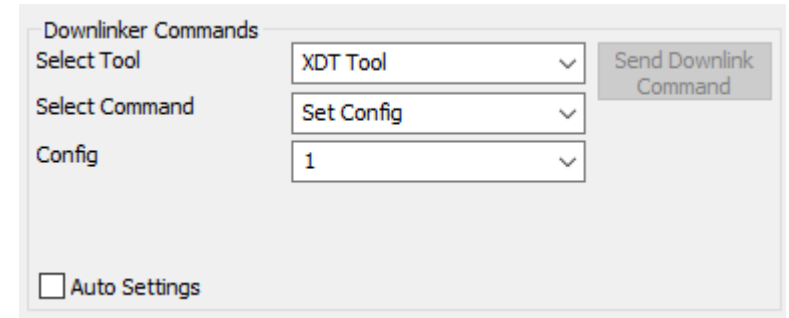
CONFIGURATIONS - PLEASE

ACTIVE	NUM	ANGLE
Yes	1	No

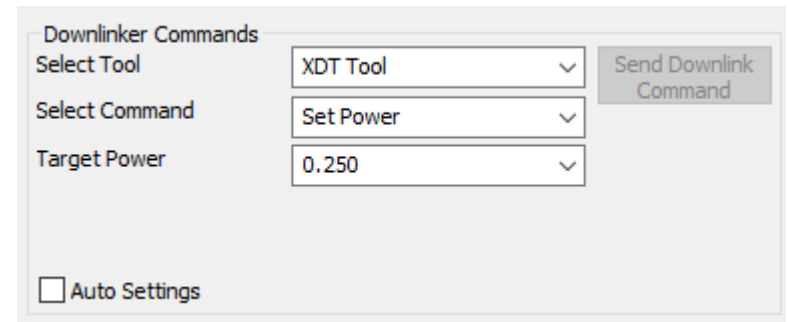
\*4Hz/4BPS is most commonly used bit rate/frequency

# xBolt Downlinking – EM Downlinking – Transmit Parameters

- Select Tool
  - Two Options: XEM or XDT
  - Use XDT when running xBolt
- Select Command
  - Set Config
    - Changes between different configs in tool
    - Tool will send status message upon receipt of config change downlink
  - Set Power
    - Changes maximum EM uplink power setting of tool
    - 42 options between 0.25W and 20W



The screenshot shows a software interface titled "Downlinker Commands". It contains three dropdown menus: "Select Tool" set to "XDT Tool", "Select Command" set to "Set Config", and "Config" set to "1". To the right of these menus is a grey button labeled "Send Downlink Command". At the bottom left, there is a checkbox labeled "Auto Settings" which is currently unchecked.



The screenshot shows the same "Downlinker Commands" interface. The "Select Tool" dropdown is still "XDT Tool". The "Select Command" dropdown is now set to "Set Power". The "Target Power" dropdown is set to "0.250". The "Send Downlink Command" button and the "Auto Settings" checkbox are also present in the same positions.

# xBolt Downlinking – EM Downlinking – Transmit Parameters (Cont.)

- Select Command (cont.)
  - Set Uplink Parameters
    - Change tool's bit rate and frequency for transmission independent of config
    - Currently only applicable for EM, soon to be supported in MP uplink
  - Set XDT Mode
    - Change between tool's 6 different telemetry strategies
  - Set Downlink Parameters\*
    - Change tool's listening bit rate/frequency
    - Requires second downlink sent in new bit rate/frequency within 150 seconds of previous downlink
  - Auto Settings
    - Automatically calculates safety parameters and transmit power

The image displays three screenshots of the 'Downlinker Commands' interface, each showing a 'Send Downlink Command' button and an 'Auto Settings' checkbox.

- Top Screenshot:** Select Tool: XDT Tool; Select Command: Set Uplink Parameters; Frequency (Hz): 12.000; Cycles Per Symbol: 6.
- Middle Screenshot:** Select Tool: XDT Tool; Select Command: Set XDT Mode; XDT Mode: EM Mode.
- Bottom Screenshot:** Select Tool: XDT Tool; Select Command: Set Downlink Parameters; Frequency (Hz): 6.000; Bit Rate (bps): 4.000.

\*It is not recommended to change downlink parameters downhole



# xBolt Downlinking – EM Downlinking – Safety Parameters

- Over Voltage Limit
  - Max allowed output voltage (ie. if output voltage is more than this, safety alarm will be triggered)
- Over Current Limit
  - Max allowed output current (ie. if output current is more than this, safety alarm will be triggered)
- V Mon Threshold
  - Monitoring minimum output voltage inside downlinker (don't change this default)
- I Mon Threshold
  - Monitoring minimum output current inside downlinker (don't change this default)
- Max Load
  - Maximum measured resistance before triggering safety
- Min Load
  - Minimum measured resistance before triggering safety

Safety Parameters		
Over Voltage Limit (V) :	<input type="text" value="50"/>	<a href="#">Get Safety Parameters</a>
Over Current Limit (mA) :	<input type="text" value="4000"/>	
V Mon Threshold (V) :	<input type="text" value="50"/>	<a href="#">Set Safety Parameters</a>
I Mon Threshold (mA) :	<input type="text" value="100"/>	
Max Load (Ohm) :	<input type="text" value="600"/>	<a href="#">Set Safety Defaults</a>
Min Load (Ohm) :	<input type="text" value="5"/>	

\*Leave values as default

# xBolt Downlinking – EM Downlinking – Safety Parameters (cont.)

- Get Safety Parameters
  - Sends request to downlinker for current safety settings
- Set Safety Parameters
  - When parameters overridden by user, set safety parameters will update downlinker's safety parameter settings
  - Must be clicked after making changes to take effect
- Set Safety Defaults
  - Sets software defaults to current values listed

Safety Parameters		
Over Voltage Limit (V) :	<input type="text" value="50"/>	<input type="button" value="Get Safety Parameters"/>
Over Current Limit (mA) :	<input type="text" value="4000"/>	
V Mon Threshold (V) :	<input type="text" value="50"/>	<input type="button" value="Set Safety Parameters"/>
I Mon Threshold (mA) :	<input type="text" value="100"/>	
Max Load (Ohm) :	<input type="text" value="600"/>	<input type="button" value="Set Safety Defaults"/>
Min Load (Ohm) :	<input type="text" value="5"/>	

# xBolt Downlinking – EM Downlinking – Safety Parameters (cont.)

## ■ Formulas for setting safety parameters

First, measure Resistance in downlinker application

- If resistance  $\leq 37.5$  Ohms
  - Over Voltage Limit = Resistance\*4.2
  - Over Current Limit = 4200
  - Transmit Power = Resistance\*2.22
- If resistance  $\geq 37.5$  Ohms
  - Over Voltage Limit = 158
  - Over Current Limit =  $157500 / \text{Resistance}$
  - Transmit Power = 84 (if safety alarm triggers, lower power by 10% until alarm no longer triggers)

Resistance

Output Resistance (Ohm) : 47 Measure

Safety Parameters

Over Voltage Limit (V) :	<input type="text" value="158"/>	<span>Get Safety Parameters</span>
Over Current Limit (mA) :	<input type="text" value="3351"/>	
V Mon Threshold (V) :	<input type="text" value="50"/>	<span>Set Safety Parameters</span>
I Mon Threshold (mA) :	<input type="text" value="100"/>	
Max Load (Ohm) :	<input type="text" value="600"/>	<span>Set Safety Defaults</span>
Min Load (Ohm) :	<input type="text" value="5"/>	

# xBolt Downlinking – EM Downlinking – Transmit Power

- Transmit Power section populates after each downlink
- V rms
  - Displays RMS voltage of last downlink
- I rms
  - Displays RMS current of last downlink
- V max
  - Displays max voltage of last downlink
- I max
  - Displays max current of last downlink
- Power\*
  - Display RMS power of last downlink
- Resistance
  - Shows resistance measurement of last downlink

Transmit Power			
V rms :	74 V	V max :	106 V
I rms :	1400 mA	I max :	2041 mA
Power :	104.4 W	Resistance :	53.0 Ohm

\*Transmit power should always be much higher than tool's power setting. If tool is transmitting at 10W and surface decode is poor, downhole downlink detection may also be poor if transmit power is 10W

# xBolt Real Time Operations

Collar RPM Downlinking

# xBolt Downlinking – Collar RPM

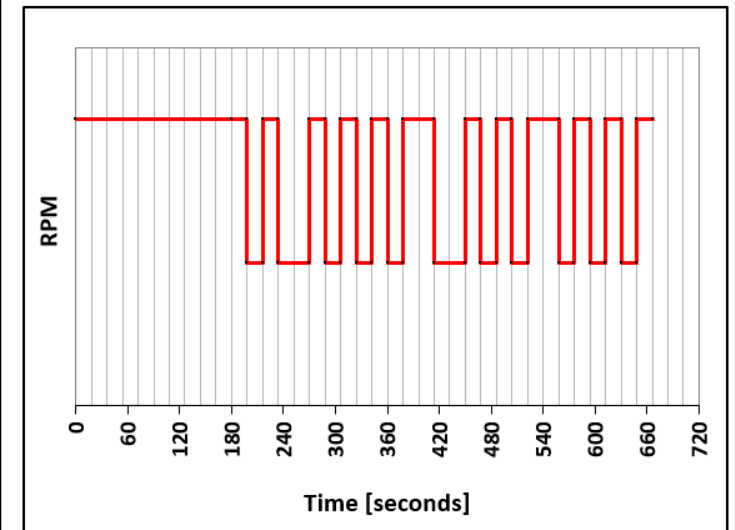
- CRPM downlink similar to PowerDrive CRPM downlinks (Hi/Lo RPM)
- RPM must vary by a minimum of 15%
- Currently only supported with XDAG (no XJDI support)
- Supported in V74 MCU firmware or greater and V38 XDAG firmware or greater

Lagun Fast Rotary Downlink Timing Sheet 2019\_05\_22

Bit Period [seconds]:	36	
Command:	EM Uplink 4 Hz / 2 bps	
Tool on > 3 mins before Downlink:	No	
Downlink Timing		Comments
At:	Go:	
0:00	H	Start of Steady Rotation before downlink
3:00	H	Start of Downlink Sequence
3:18	L	Reduce Collar Rotation
3:36	H	Increase Collar Rotation
3:54	L	Reduce Collar Rotation
4:30	H	Increase Collar Rotation
4:48	L	Reduce Collar Rotation
5:06	H	Increase Collar Rotation
5:24	L	Reduce Collar Rotation
5:42	H	Increase Collar Rotation
6:00	L	Reduce Collar Rotation
6:18	H	Increase Collar Rotation
6:54	L	Reduce Collar Rotation
7:30	H	Increase Collar Rotation
7:48	L	Reduce Collar Rotation
8:06	H	Increase Collar Rotation
8:24	L	Reduce Collar Rotation
8:42	H	Increase Collar Rotation
9:18	L	Reduce Collar Rotation
9:36	H	Increase Collar Rotation
9:54	L	Reduce Collar Rotation
10:12	H	Increase Collar Rotation
10:30	L	Reduce Collar Rotation
10:48	H	Increase Collar Rotation
11:06	H	End of downlink.
		Resume Drilling

**Note:**

- Pumps do not need to be cycled to initiate a downlink.
- A "quiet period" with a steady flow and rotation is required before downlink starts
- Rotary downlinks can typically be performed while drilling (re-try off bottom if unsuccessful)
- Vary RPM by 15% (re-try with higher % change if unsuccessful)





# xBolt Real Time Operations

Pressure Downlink

# xBolt Downlinking – Pressure

- Pressure downlink similar to PowerDrive flow downlinks (Hi/Lo Flow rate)
- Still in development, should be in testing by Q1, 2020

# xBolt Real Time Operations

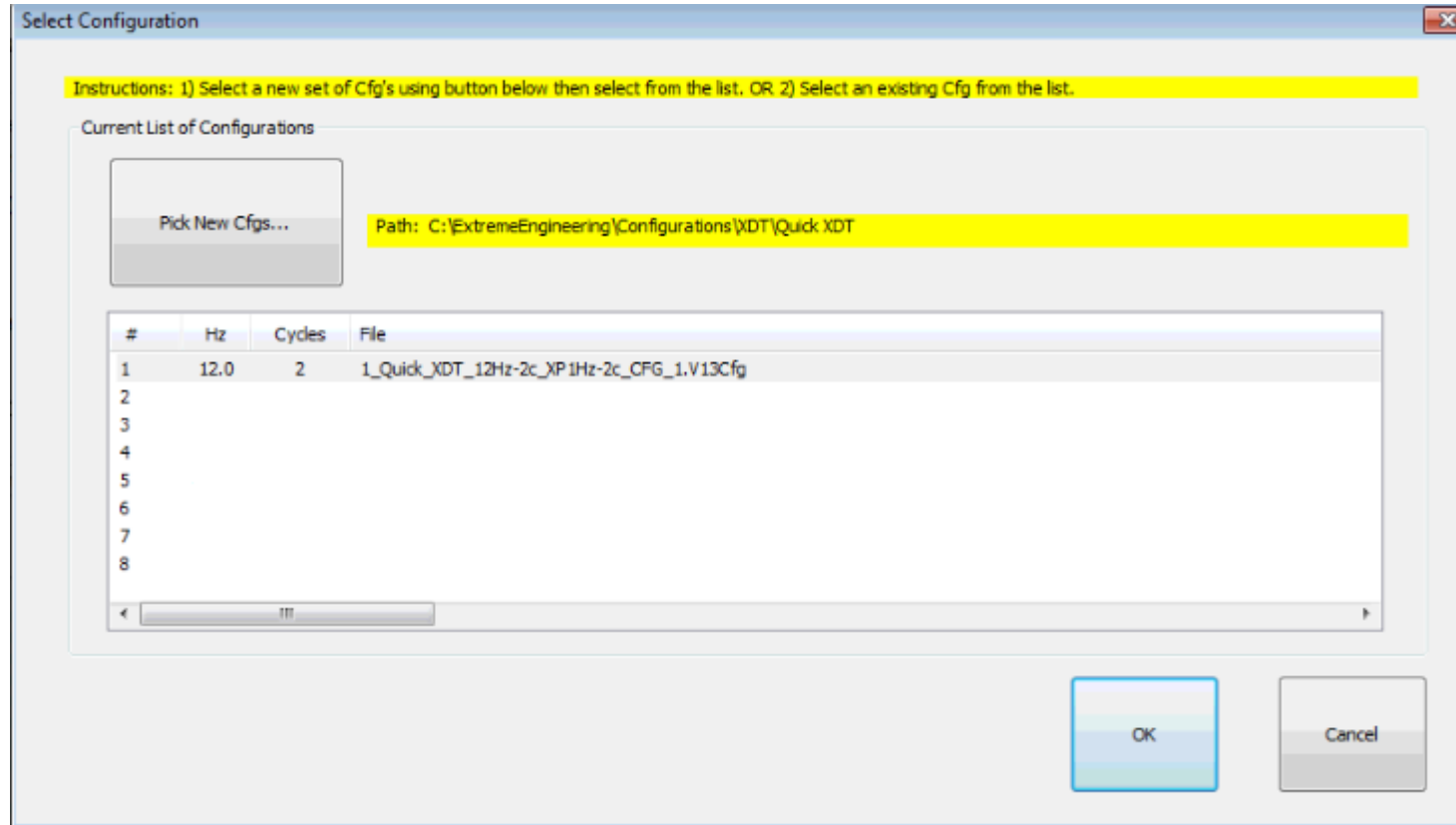
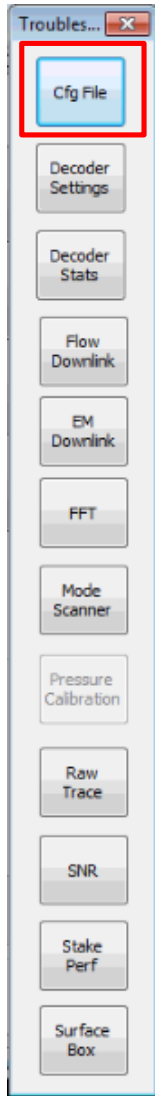
xDirect Receivers

# xDirect Receivers

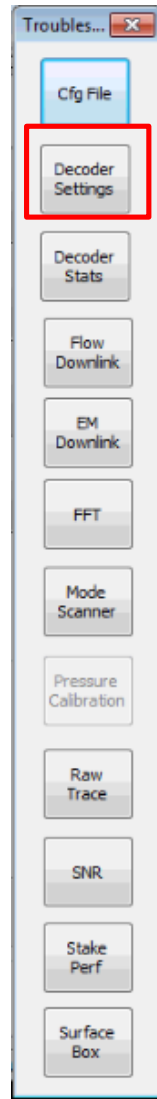
The screenshot displays the EM Receiver software interface with the following numbered callouts:

- 1**: Troubleshooting button
- 2**: Spectrogram button
- 3**: Text Log button
- 4**: Open Simulator button
- 5**: Tabbed menu (Data, Signals, Logging, Configuration, Communication)
- 6**: Decode Stats section (LHdr, MHdr, ID, Seq#, Msg#, SNR, Data Conf)
- 7**: WITS Data section (BitDepth, HoleDepth, ROP, TPO, PumpPress, Torque)
- 8**: Waveform plot showing signal amplitude over time
- 9**: Long Header Correlation (%) plot
- 10**: SNR plot
- 11**: Long Header History plot
- 12**: Decode Success plot
- 13**: Using chNC input field
- 14**: View Log File section (Speed, Loop All Files, Load/Resume/Stop buttons)
- 15**: Log file text area showing decoded data and timestamps
- 16**: Status bar (Config File, Config 1, PSK Freq 12.0 Cycles 2)
- 17**: System tray icons

# xDirect Receivers – Troubleshooting Tab

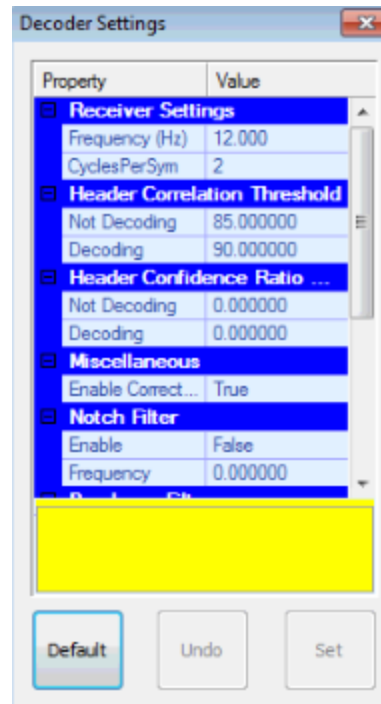


# xDirect Receivers – Troubleshooting Tab (cont)



Troubles... [X]

- Cfg File
- Decoder Settings**
- Decoder Stats
- Flow Downlink
- EM Downlink
- FFT
- Mode Scanner
- Pressure Calibration
- Raw Trace
- SNR
- Stake Perf
- Surface Box

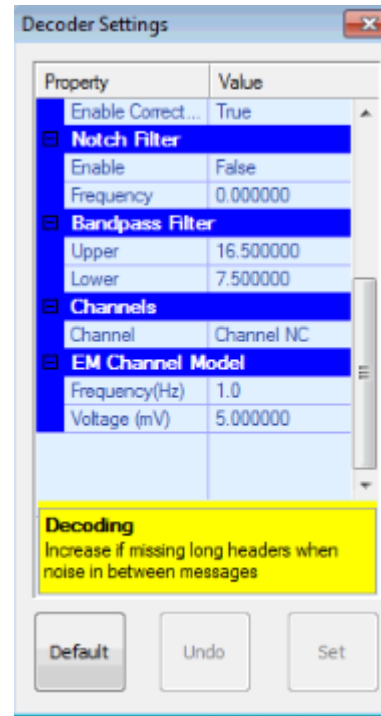


Decoder Settings [X]

Property	Value
<b>Receiver Settings</b>	
Frequency (Hz)	12.000
CyclesPerSym	2
<b>Header Correlation Threshold</b>	
Not Decoding	85.000000
Decoding	90.000000
<b>Header Confidence Ratio ...</b>	
Not Decoding	0.000000
Decoding	0.000000
<b>Miscellaneous</b>	
Enable Correct...	True
<b>Notch Filter</b>	
Enable	False
Frequency	0.000000

Decoding  
Increase if missing long headers when noise in between messages

Default Undo Set

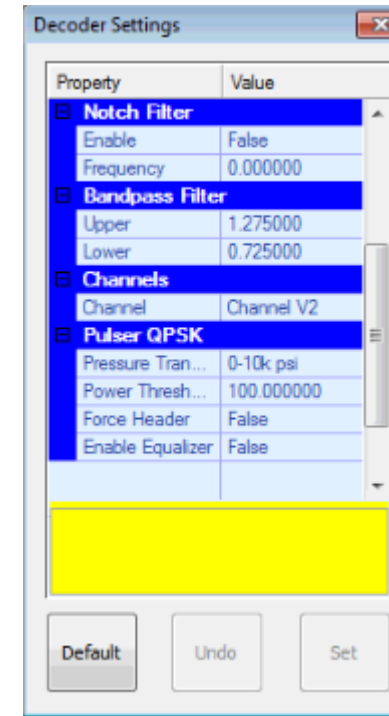


Decoder Settings [X]

Property	Value
Enable Correct...	True
<b>Notch Filter</b>	
Enable	False
Frequency	0.000000
<b>Bandpass Filter</b>	
Upper	16.500000
Lower	7.500000
<b>Channels</b>	
Channel	Channel NC
<b>EM Channel Model</b>	
Frequency(Hz)	1.0
Voltage (mV)	5.000000

Decoding  
Increase if missing long headers when noise in between messages

Default Undo Set



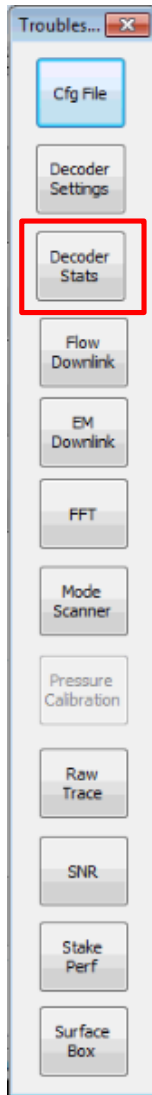
Decoder Settings [X]

Property	Value
<b>Notch Filter</b>	
Enable	False
Frequency	0.000000
<b>Bandpass Filter</b>	
Upper	1.275000
Lower	0.725000
<b>Channels</b>	
Channel	Channel V2
<b>Pulser QPSK</b>	
Pressure Tran...	0-10k psi
Power Thresh...	100.000000
Force Header	False
Enable Equalizer	False

Decoding  
Increase if missing long headers when noise in between messages

Default Undo Set

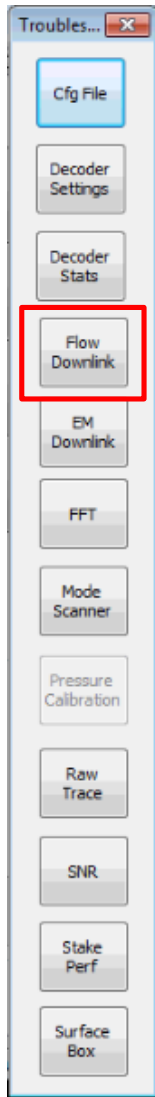
# xDirect Receivers – Troubleshooting Tab (cont)



Decoder Statistics

Channel	DC Offset	Found Hr	Chose Hr	Quick RMS	Long RMS (10 sec)
ch1	0.018127	39		0.018167	0.018166
ch2	0.018423	0		0.018424	0.018424
ch3	0.018353	0		0.018354	0.018354
ch4	0.018475	0		0.018475	0.018475
chNC		39		0.018167	0.018166

# xDirect Receivers – Troubleshooting Tab (cont)



## Downlink Pattern

Note: The Status Header Detection will be enabled for 30 minutes when you click the 'Start' button.

### Pattern

- Config Up       Power Up       Uplink Strategy Up  
 Config Down       Power Down       Uplink Strategy Down



Start

Status Message Detection is OFF.



# xDirect Receivers – Troubleshooting Tab (cont)

Troubles... [X]

- Cfg File
- Decoder Settings
- Decoder Stats
- Flow Downlink
- EM Downlink**
- FFT
- Mode Scanner
- Pressure Calibration
- Raw Trace
- SNR
- Stake Perf
- Surface Box

## EM Downlink [X]

**Transmit Parameters**

Modulation Mode : QPSK Extreme

Carrier Frequency (Hz) : 4.000

Bit Rate (bps) : 4.000

Transmit Power (%) : 40

Abort Downlink

**Downlinker Commands**

Select Tool : XDT Tool

Select Command : Set Power

Target Power : 15.000

Send Downlink Command

Auto Settings

**Transmit Power**

V rms : 74 V      V max : 106 V

I rms : 1400 mA      I max : 2041 mA

Power : 104.4 W      Resistance : 53.0 Ohm

**Resistance**

Output Resistance (Ohm) : 47      Measure

**Safety Parameters**

Over Voltage Limit (V) :       Get Safety Parameters

Over Current Limit (mA) :       Set Safety Parameters

V Mon Threshold (V) :       Set Safety Parameters

I Mon Threshold (mA) :       Set Safety Parameters

Max Load (Ohm) :       Set Safety Defaults

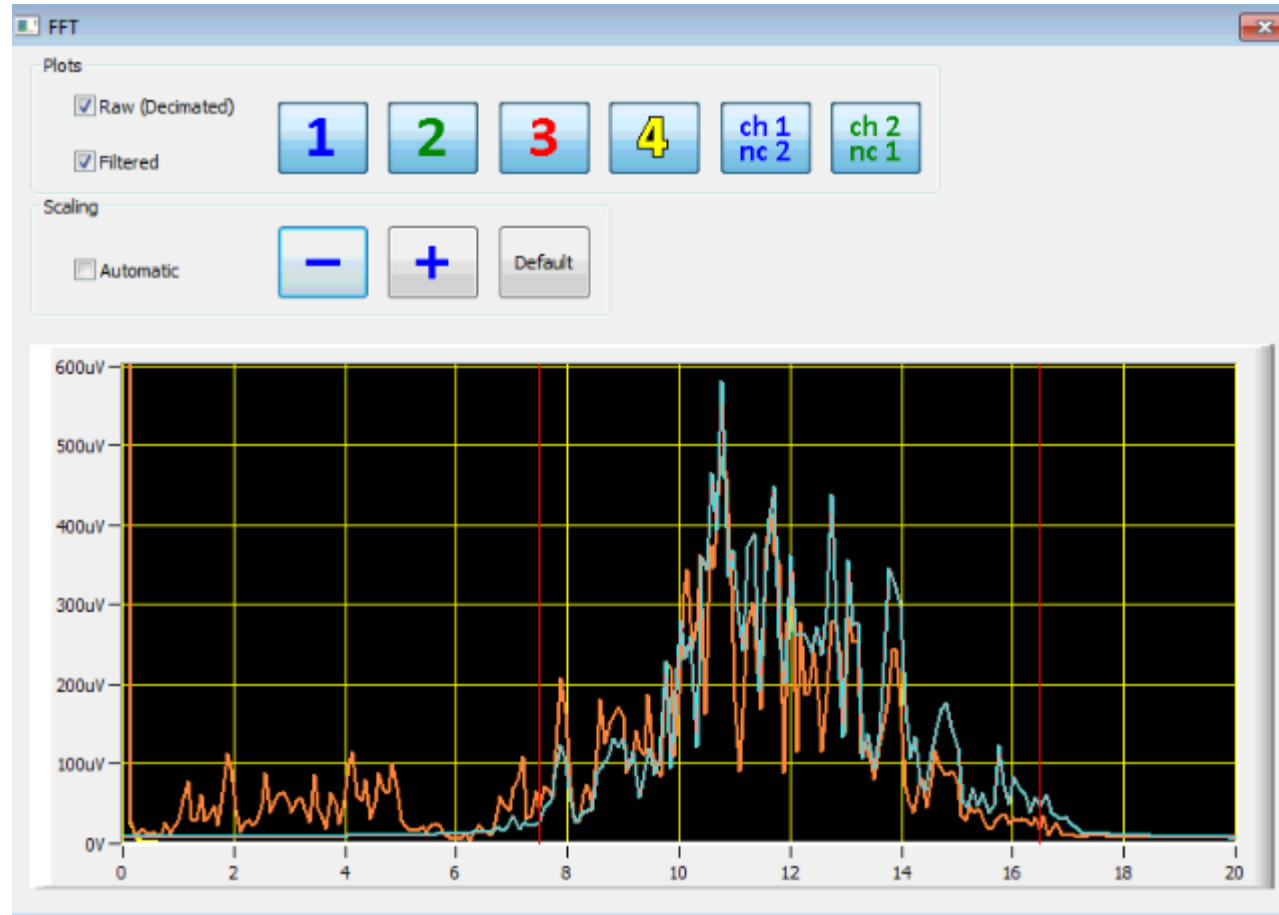
Min Load (Ohm) :       Set Safety Defaults

Note: The Status Header Detection will be enabled for 30 minutes when you click the 'Send Downlink Command' button.

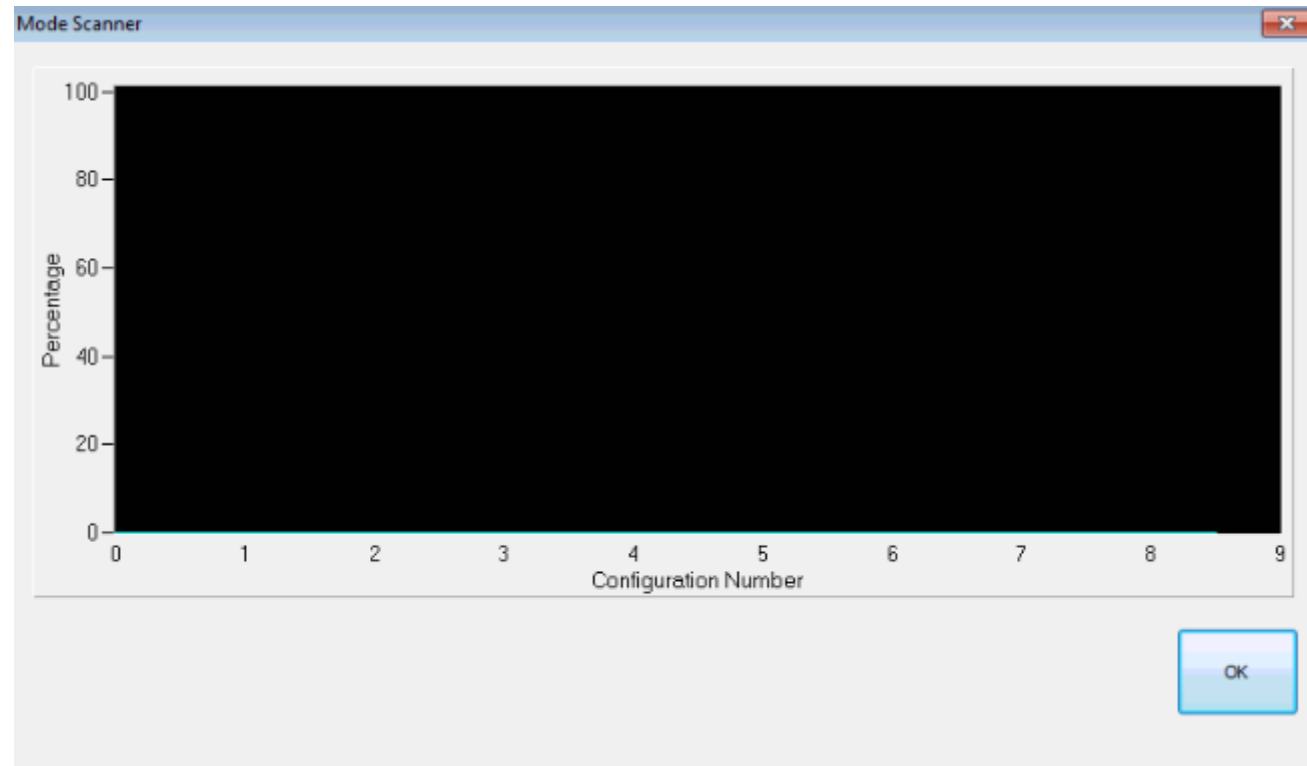
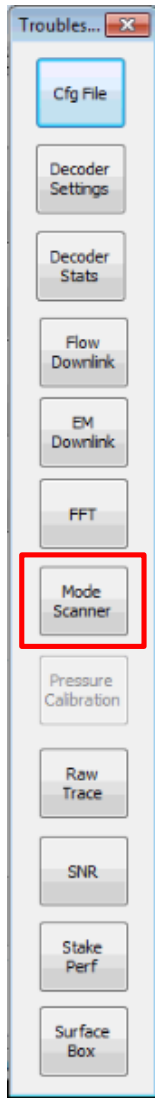
Status Message Detection is OFF.

Downlink Status : Disconnected      COM15      Connect to PC by USB      Connect

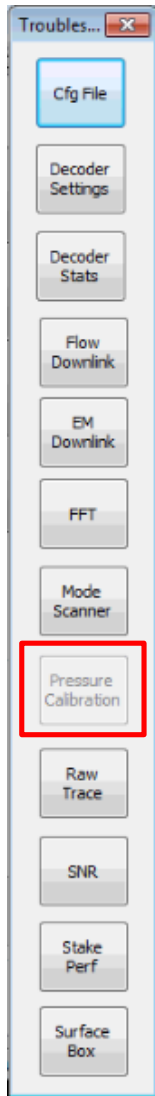
# xDirect Receivers – Troubleshooting Tab (cont)



# xDirect Receivers – Troubleshooting Tab (cont)



# xDirect Receivers – Troubleshooting Tab (cont)



### Pressure Calibration

Raw Pressure  Current Gain

Corrected Pressure  Current Offset

Calibration Input

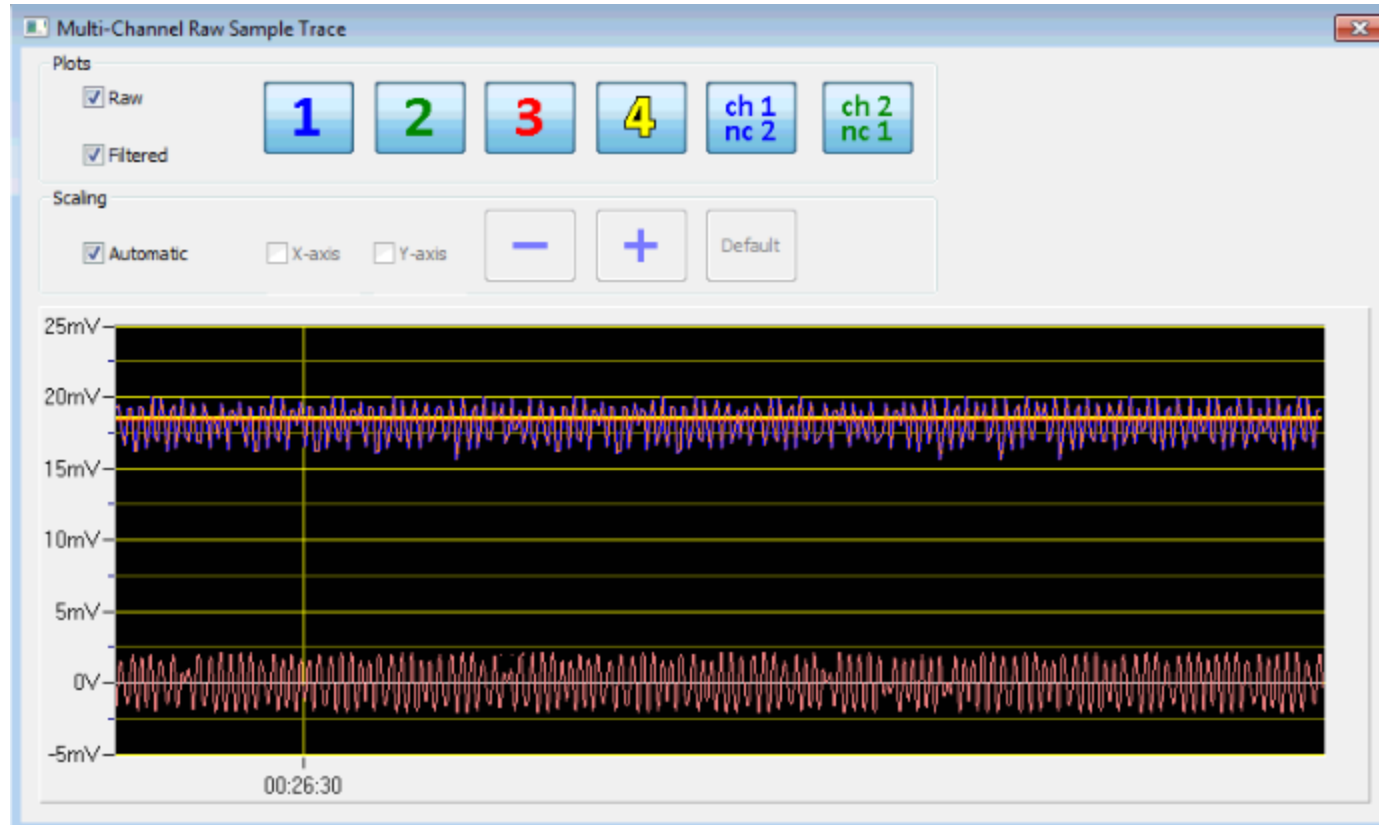
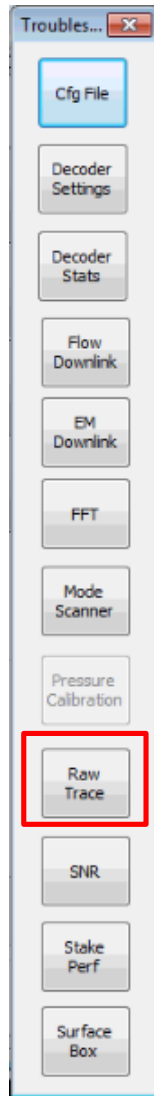
	Enter Actual Pressure	Measured Pressure	
P1	<input type="text" value="200"/>	<input type="text" value="1000.00"/>	<input type="button" value="Measurement #1"/>
P2	<input type="text" value="300"/>	<input type="text" value="1000.00"/>	<input type="button" value="Measurement #2"/>

Results

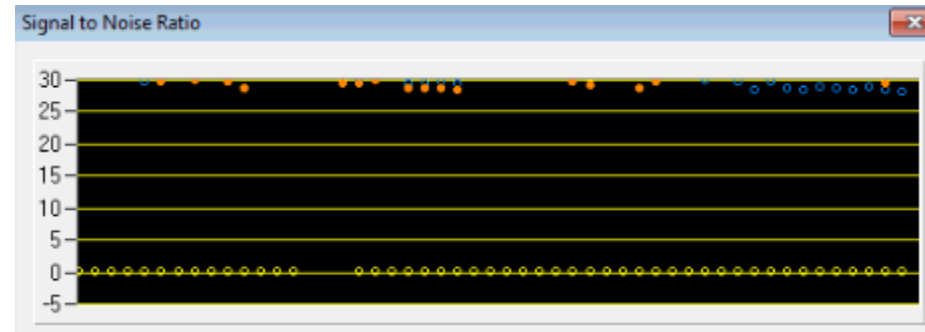
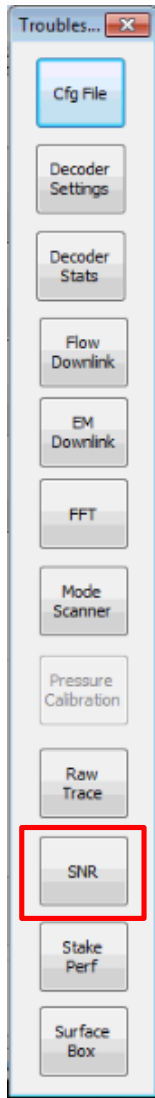
Gain   Override

Offset

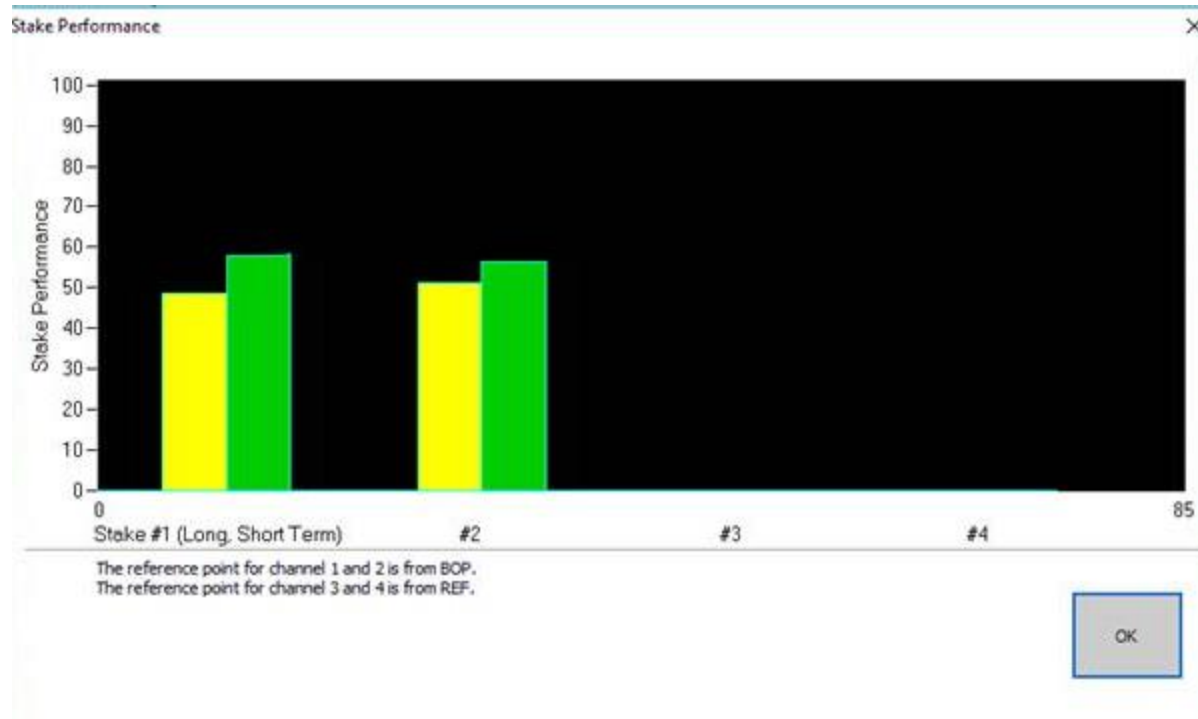
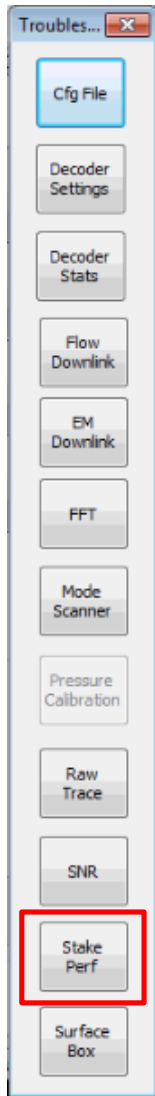
# xDirect Receivers – Troubleshooting Tab (cont)



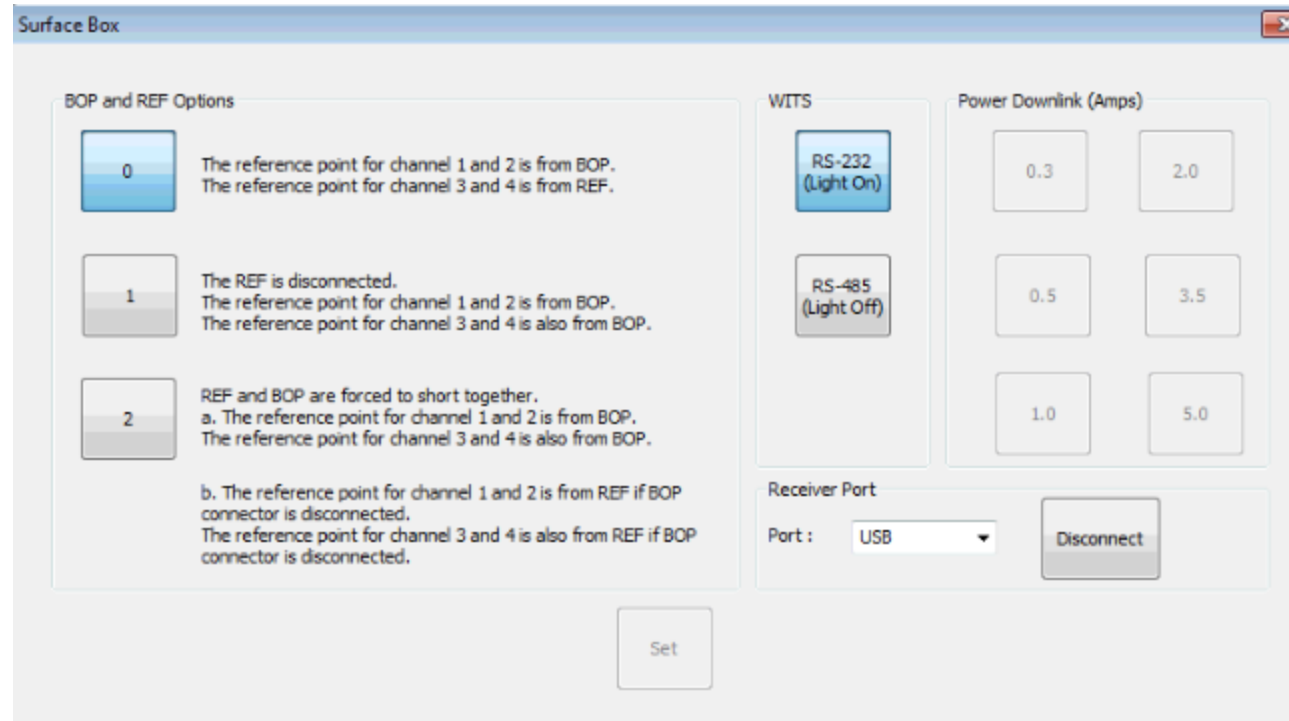
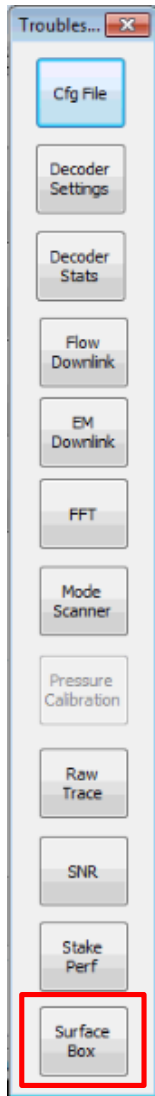
# xDirect Receivers – Troubleshooting Tab (cont)



# xDirect Receivers – Troubleshooting Tab (cont)



# xDirect Receivers – Troubleshooting Tab (cont)





# xBolt Real Time Operations

xBolt Basic Troubleshooting

# xBolt Basic Troubleshooting – Common Issues

## Downlinks Not Taking in Bank Test

- Verify Black Load Box is used
- Measure resistance in downlinker app and verify it is within normal range (250-450 Ohms for black load box)
- Verify Clamps are connected on both sides of gap probe (Connect clamps to Pulser and Bow Springs for DT or Landing Spider and Bow Springs for EM)
- Verify Downlink Transmit Parameters for bit rate and frequency match tool's programmed listening bit rate and frequency (Can be verified in pre-run report)

# xBolt Basic Troubleshooting – Common Issues (cont.)

## Erratic EM signal in bank test

- Verify Clamps are connected on both sides of gap probe (Connect clamps to Pulser and Bow Springs for DT or Landing Spider and Bow Springs for EM)
- Make sure cables are connected fully (common issue seen is between Black load box and BOP/ANT cables)
- Electrically Isolate Vibration Motor from tool
  - Connect motor on rubber centralizer
  - Wrap electrical tape around tool OD
  - Manually vibrate tool with vibration motor disconnected

# xBolt Basic Troubleshooting – Common Issues (cont.)

No communication from D&I in Bank Test (-8888.0 TF, 0.0000 for raw axis surveys and continuous AX/MX)

- Electrically Isolate Vibration Motor from tool
  - Connect motor on rubber centralizer
  - Wrap electrical tape around tool OD
  - Manually vibrate tool with vibration motor disconnected
- Move location of vibration motor away from XDT and D&I
- First survey after reset will come through with all 0s, attempt second survey
- Verify configurations match directional being used (XDAG vs Legacy)

## xBolt Basic Troubleshooting – Common Issues (cont.)

Poor decoding/missed pulses in MP mode on bank test

- Restart XDT Bank Test Receiver, over time receiver performance degrades
- Listen to pulser to see if clicking does not sound consistent
- In below freezing temps, warm pulser up inside prior to bank test to reduce viscosity in oil
- Reduce bit rate to 1 BPS or less

## xBolt Basic Troubleshooting – Common Issues (cont.)

Battery Voltage tests failing in pre-run report

- If showing ~17V, turn XM4 tool power button off

## xBolt Basic Troubleshooting – Common Issues (cont.)

No EM Signal when drilling surface hole

- Downlink tool to Safety Disabled Configuration as pressure can be too low to activate flow switch
- Verify using correct frequency/bitrate (check spectrogram)

# xBolt Basic Troubleshooting – Common Issues (cont.)

Unable to measure resistance with downlinker

- Check cables and clamps are properly connected to stakes or well heads
- Try different inputs into EL+ and EL- and measure resistance
- Measure resistance using an EGT if available
- Verify grounding rods are driven as deep into the ground as possible. If ground is frozen, a good resistance may not be achievable without connecting to well heads or grounding rods driven below frozen layer



# xBolt Basic Troubleshooting – Common Issues (cont.)

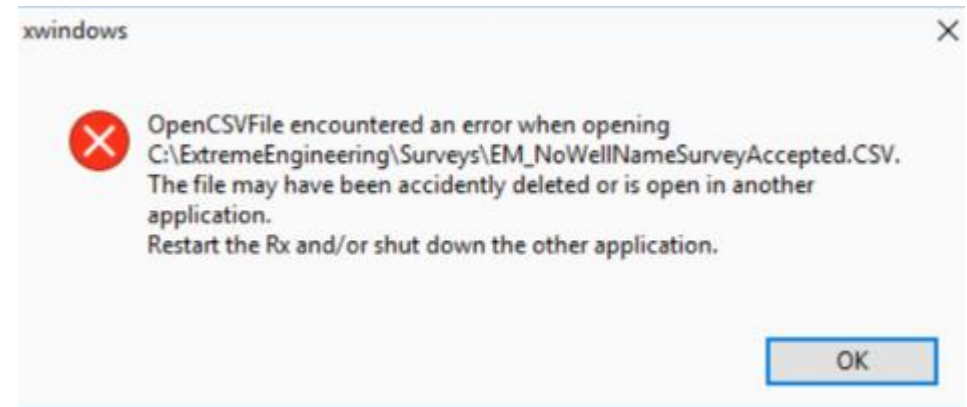
## Tool not accepting downlinks downhole

- Verify Downlink Transmit Parameters for bit rate and frequency match tool's programmed listening bit rate and frequency (Can be verified in pre-run report)
- Measure resistance in downlinker app, the lower the resistance the more power that can be pushed into formation. Anything less than 35 Ohms is ideal, anything greater than 100 Ohms may make downlinking difficult. If resistance is greater than 100 Ohms, try using different stake inputs into EL+ and EL-, drive ground stakes deeper into ground, daisy chain multiple grounding rods together using grounding wire (Grounding rods should be at least double the distance apart from each other as the depth that they are driven into the ground. Ie if a rod is driven into the ground 3 ft, the second grounding rod in the daisy chain should be at least 6 ft or more away)

# xBolt Basic Troubleshooting – Common Issues (cont.)

XM4 Receiver not opening and showing error:

- Open Task Manager > Find XEM Receiver (usually under background processes) and end task. Once task is ended, it should be possible to open XM4 receiver.
- Restart Computer

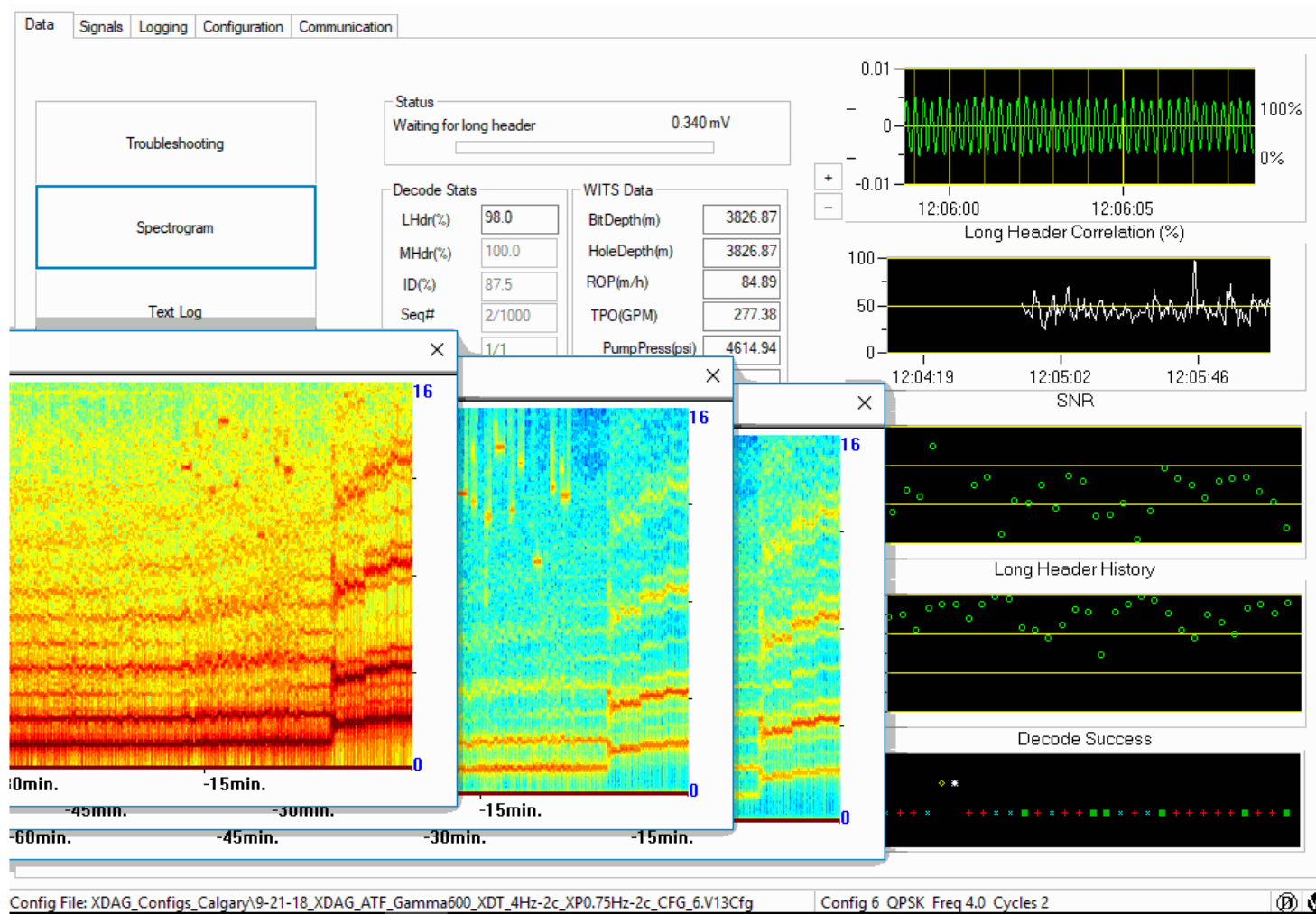


## xBolt Basic Troubleshooting – Common Issues (cont.)

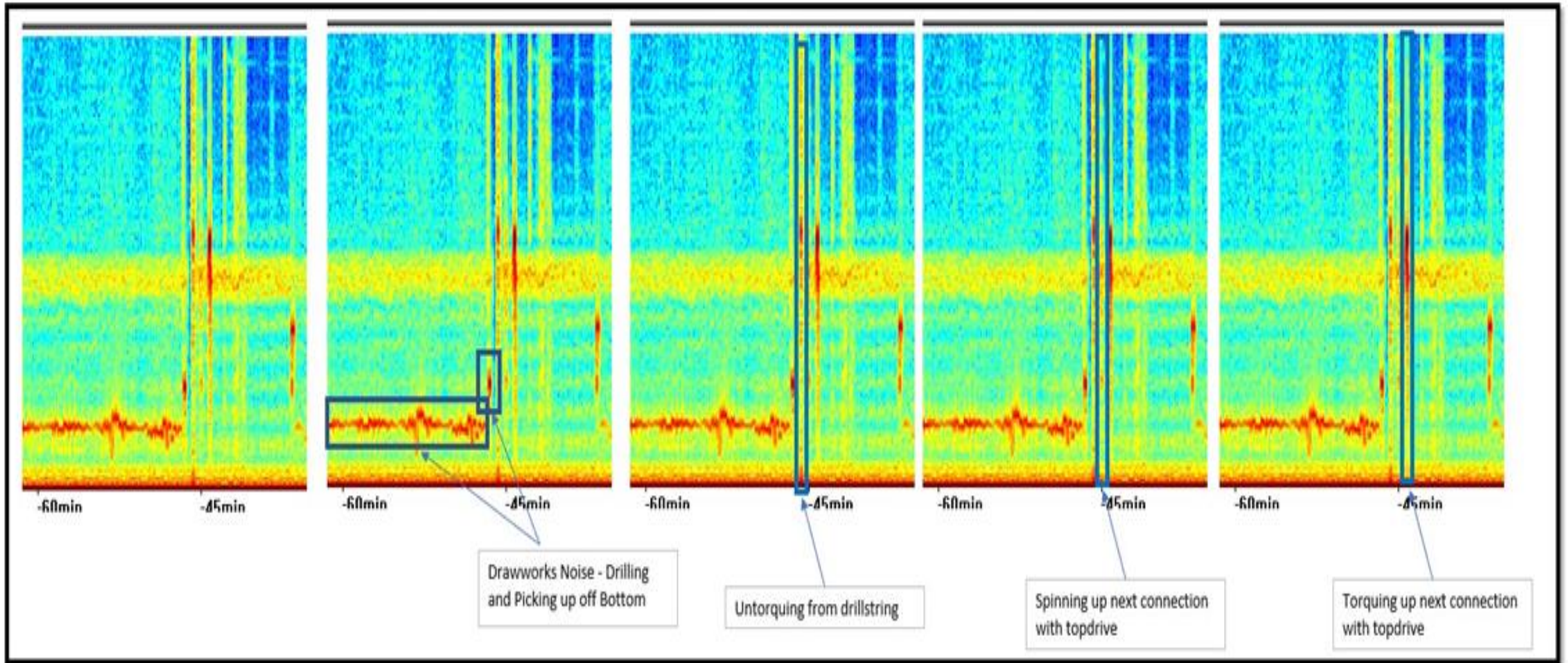
When connecting to Lagun-R tool string, PPP node doesn't appear but all other nodes are present. PPP may also show bootload version for firmware during resets pending on board revision

- Remove battery/XM4 power from string, remove R-Pulser from string, apply power back to tool string and re-communicate. PPP node will sometimes disappear if R-Pulser motor has shorted

# xBolt Basic Troubleshooting – EM Noise

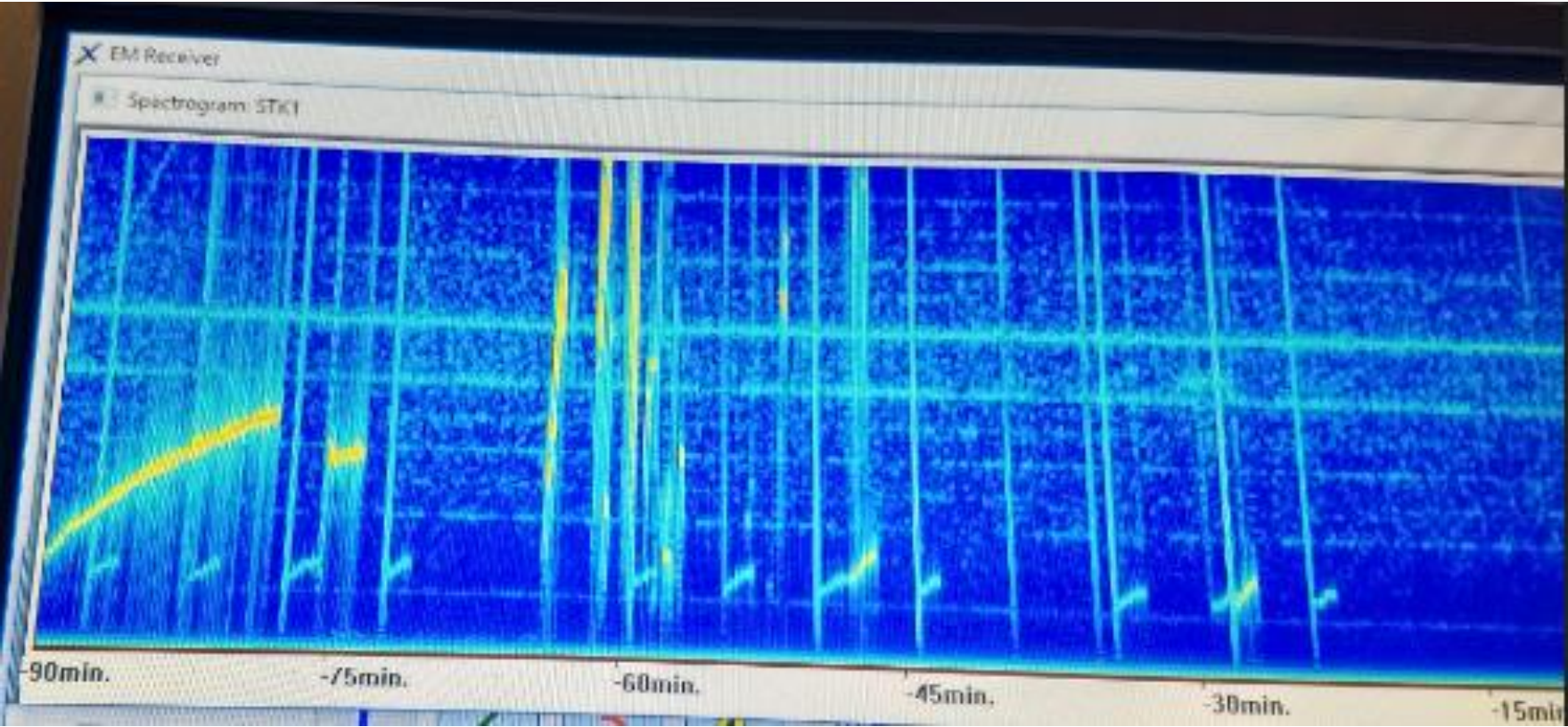


# xBolt Basic Troubleshooting – EM Noise (cont.)





# xBolt Basic Troubleshooting – EM Noise (cont.)

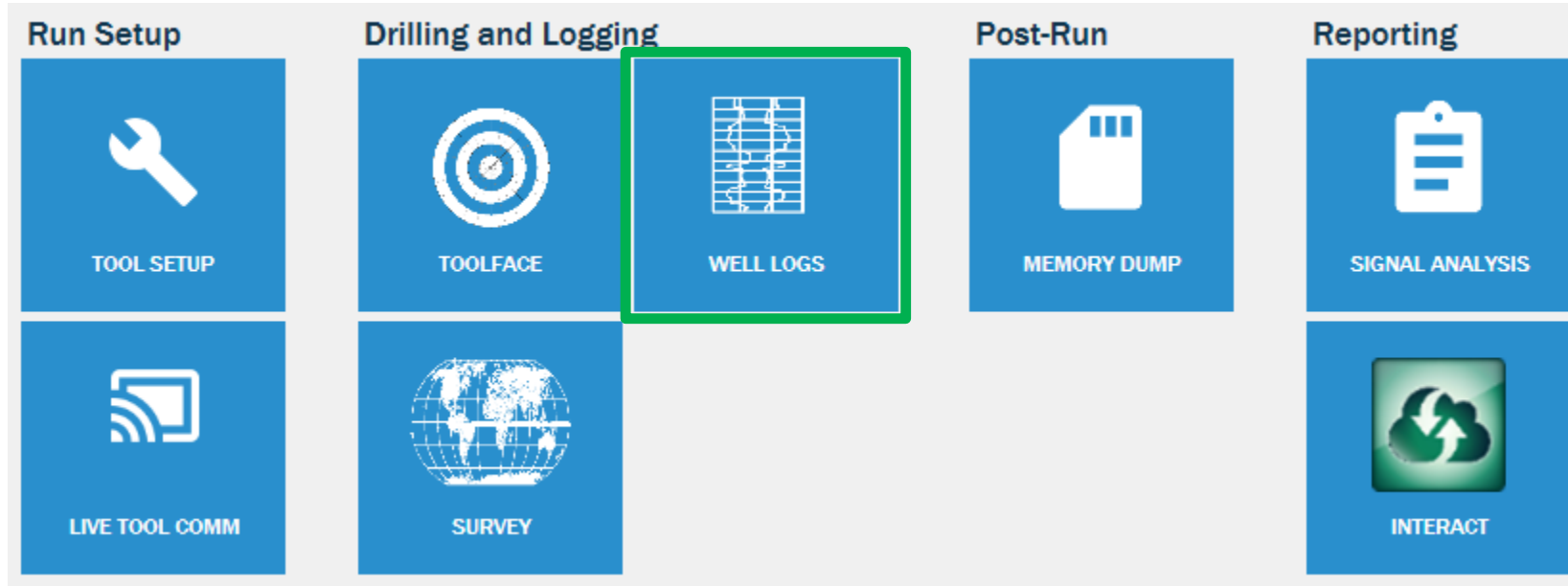


# xBolt Real Time Operations

xDirect Logging

# xDirect Logging

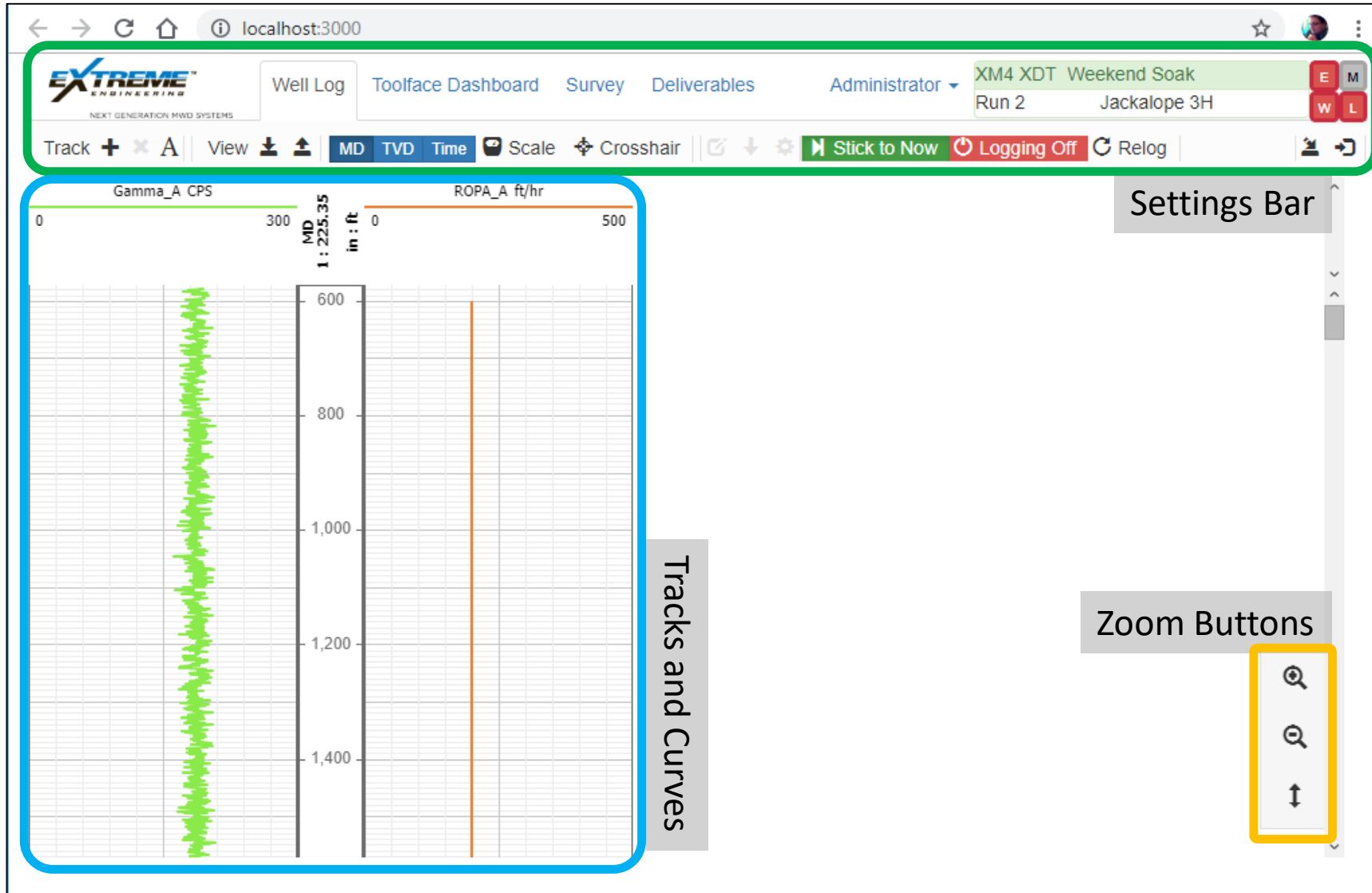
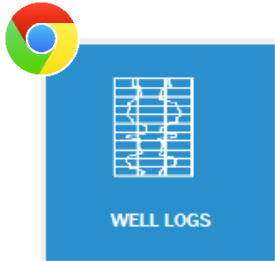
XDirect has many features available to its users.  
This presentation focuses on Well Logs



When **Well Logs** is selected from the main menu, a  Google Chrome tab will open.



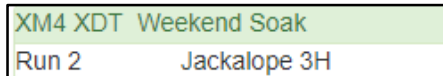
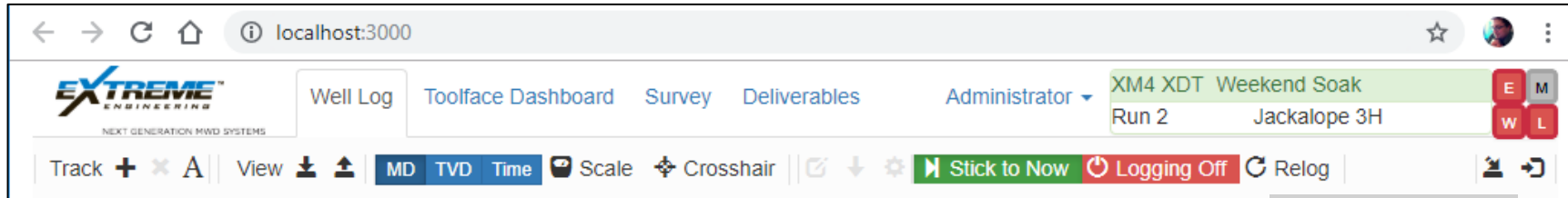
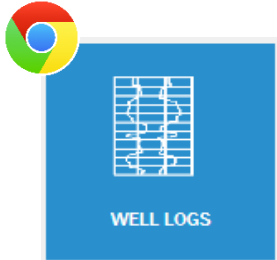
# xDirect Logging



Tracks and Curves

Zoom Buttons

# xDirect Logging



Job and Run Information

Settings Bar



EM/Mud/WITS/Logging indicators



Add/remove Tracks and Annotations



Save and Load Logging Templates



Toggle Measured Depth, Total Vertical Depth, or Time index



Toggle Scale presets



Toggle crosshair display for cursor



Edit Curve, Depth Shift, and Curve Properties



Toggle Stick to Now and Logging ON/OFF

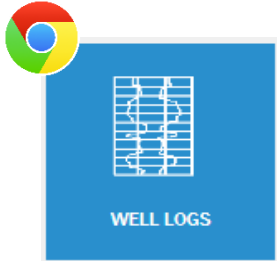


Toggle Relog ON/OFF



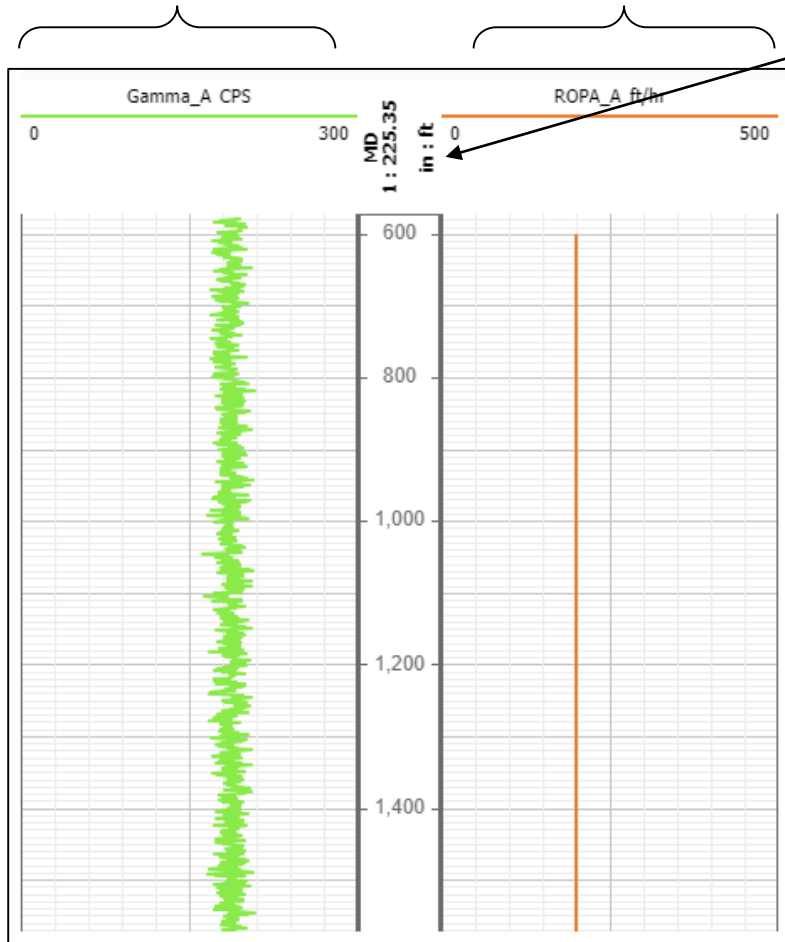
Import/Export log files

# xDirect Logging



**Tracks:** Linear and Logarithmic tracks can contain multiple curves

**Index Track:** MD, TVD, or Time scale.

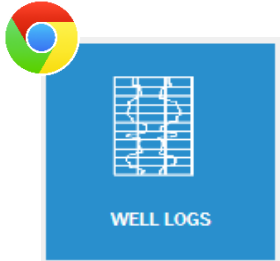


**Curves:** Each curve represents a datapoint chosen from the Curve menu. Each track can contain multiple curves.

Zoom Buttons

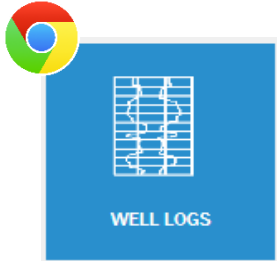
- Zoom IN
- Zoom OUT
- Show ALL

# xDirect Logging



## XDirect Curve Basics

# xDirect Logging



## Understanding Curves

Curves are split into three main categories

- Original Signals  
Curves cannot be edited by the user
- Edited Signals  
Curves can be edited by user
- Auto Generated Signals  
Curves combine multiple runs, relogs, realtime and recorded mode.



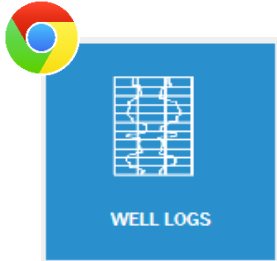
The Original and Edited categories are then grouped by Run number and Surface/Downhole indicators.



Curve suffixes help to easily identify which category they came from

- \_R = ORIGINAL Real Time Surface Data
- \_M = ORIGINAL Memory Downhole Recorded Data
- \_E = EDITED Curve Data
- \_A = Auto Generated Combined Data
- # = A number in the suffix represents a RUN and/or RELOG number

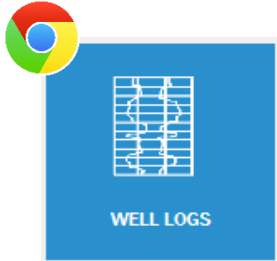
# xDirect Logging



Common Task

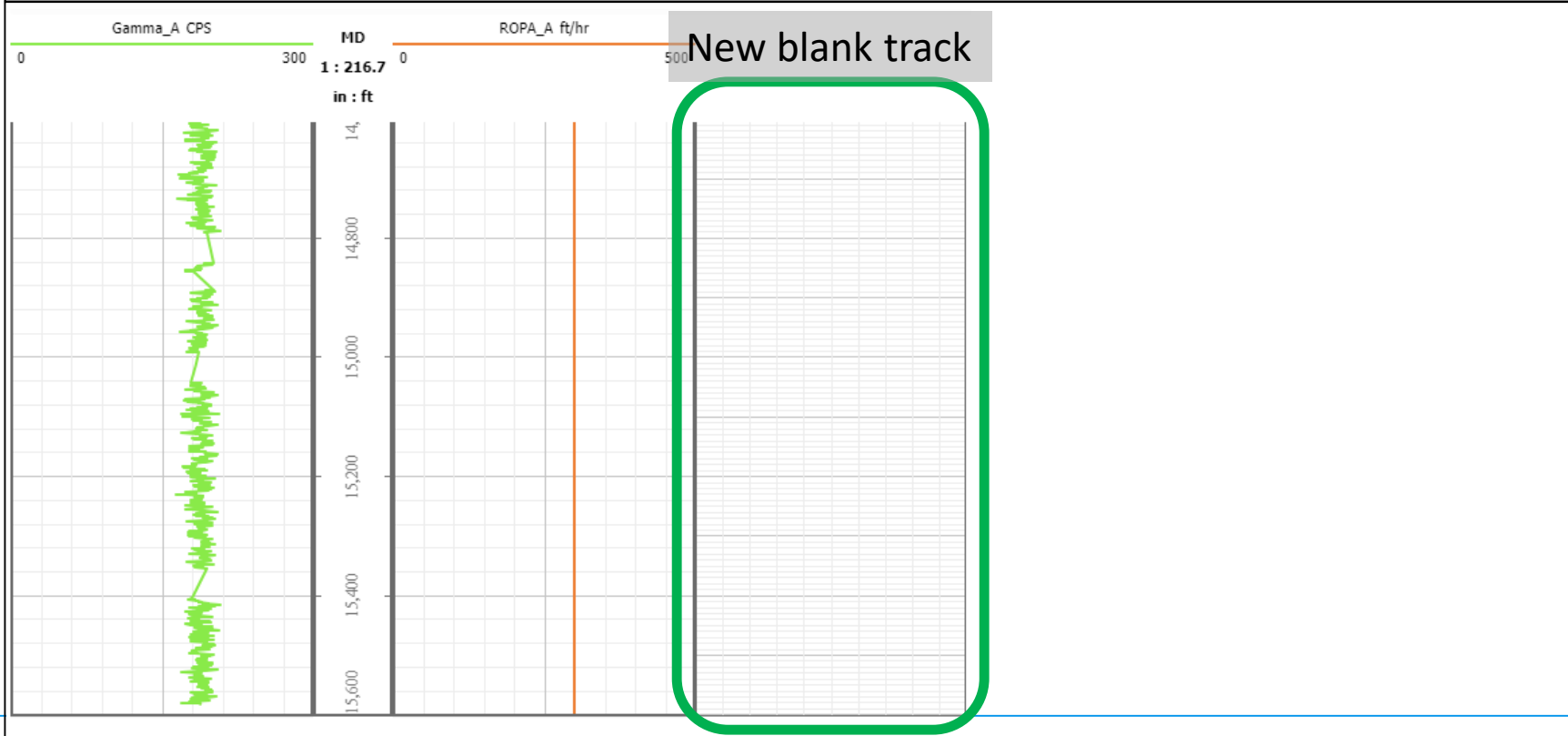
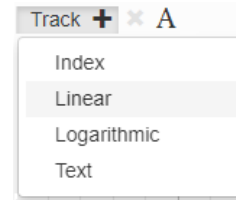
**Add Tracks and Curves**

# xDirect Logging

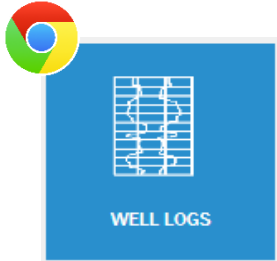


## Common Task #1 - Add a new Track

Select the **Add Track** button, then choose a Track Type.  
Note: In this example, we will add a linear track.

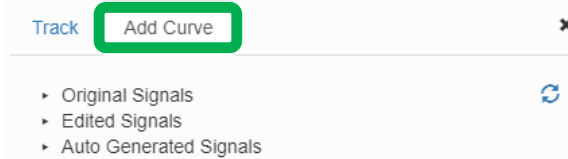


# xDirect Logging



## Common Task #2 - Add a new Curve to a Track

Double-click the desired track, then choose **Add Curve**.



Use the menu to select a desired curve.

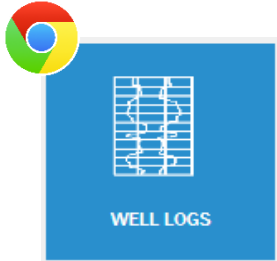


- Original Signals
  - Run 1
    - Surface Signals
      - First Pass
        - COLORMAP
        - MWD
        - CALCULATED SURVEY VALUES
        - RECORD # 1 : GENERAL TIME-BASED
        - RECORD # 7 : SURVEY / DIRECTIONAL
        - RECORD # 8 : MWD FORMATION EVALUATION
          - DEPTGR1M\_1R (ft)
          - Gamma\_1R (API)**
  - Downhole Signals
- Run 2
- Edited Signals
- Auto Generated Signals





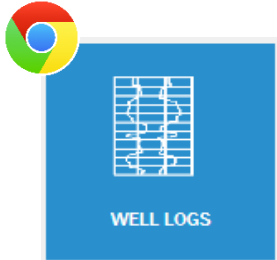
# xDirect Logging



Common Task

**Relogs**

# xDirect Logging



## Common Task #3 - Re-log a section

1. Identify the section that needs to be relogged.

In this example, the section is ~550 feet to 590 feet.

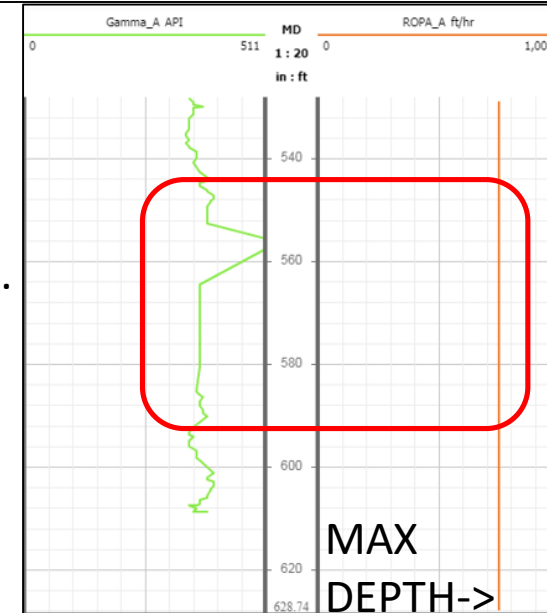
2. At the rig, pull up to the start of the desired relog section.

3. On the Logging screen, select Realog 

4. Confirm that you want Relogging to begin.

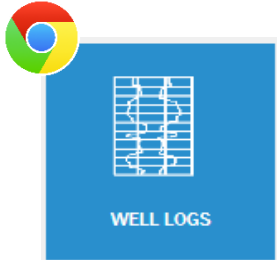
Set Relog

Do you want to set Relog On?  
Relog will automatically turn Off as bit depth reaches value 628.74 ft



5. Continue as normal, acquiring logging data and/or surveys from the tool.

# xDirect Logging



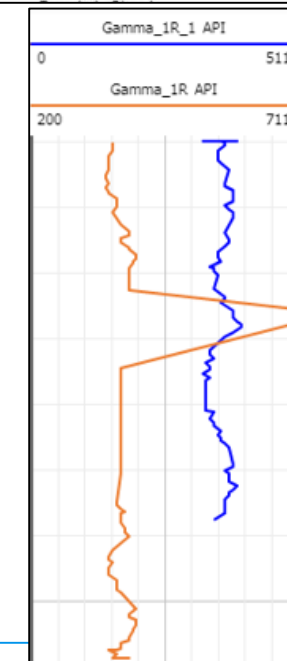
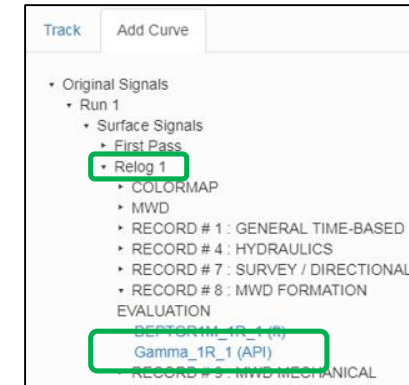
## Common Task #3 - Monitor the Re-log section (optional)

Add a new Track and add the Re-log curve if you want to monitor the curve separately. This data will also carry over into the Auto Generated curve as it gets updated.

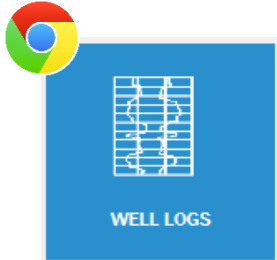
1. Create a new Track, then add a new Curve.  
In this example, the Re-log 1 Gamma curve is chosen from the Run 1 Surface Signals category.

2. Add the First Pass Gamma curve (optional) to compare them on the same track. In this example, First Pass is orange and Re-log 1 is blue.

When the tool reaches the maximum recorded depth, Re-log will turn off automatically. The user can also turn Re-log off manually in advance if they do not want to relog to max depth.



# xDirect Logging



## Common Task #3 - Multiple Re-logs

1. Identify the second section that needs to be relogged.

In this example, the section starts at ~680 feet.

2. At the rig, pull up to the start of the desired relog section.

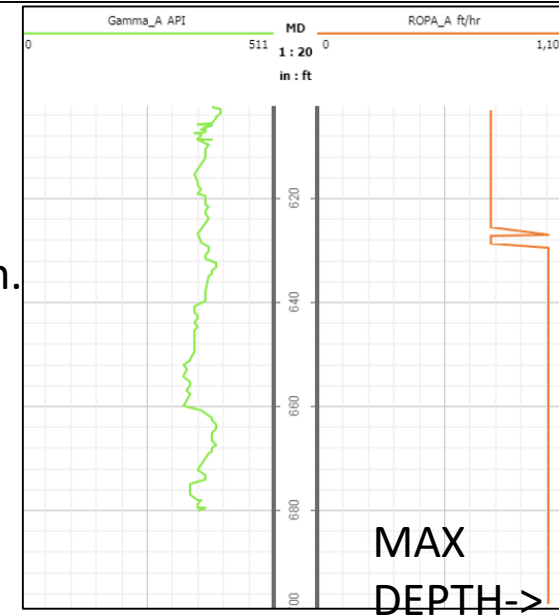
3. On the Logging screen, select Realog 

4. Confirm that you want Relogging to begin.

Set Relog

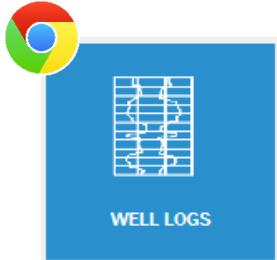
Do you want to set Relog On?  
Relog will automatically turn Off as bit depth reaches value 700.74 ft

5. Note that each Relog is numbered in the order they were created.



- Original Signals
  - Run 1
    - Surface Signals
      - First Pass
      - Relog 1
      - Relog 2
      - COLORMAP

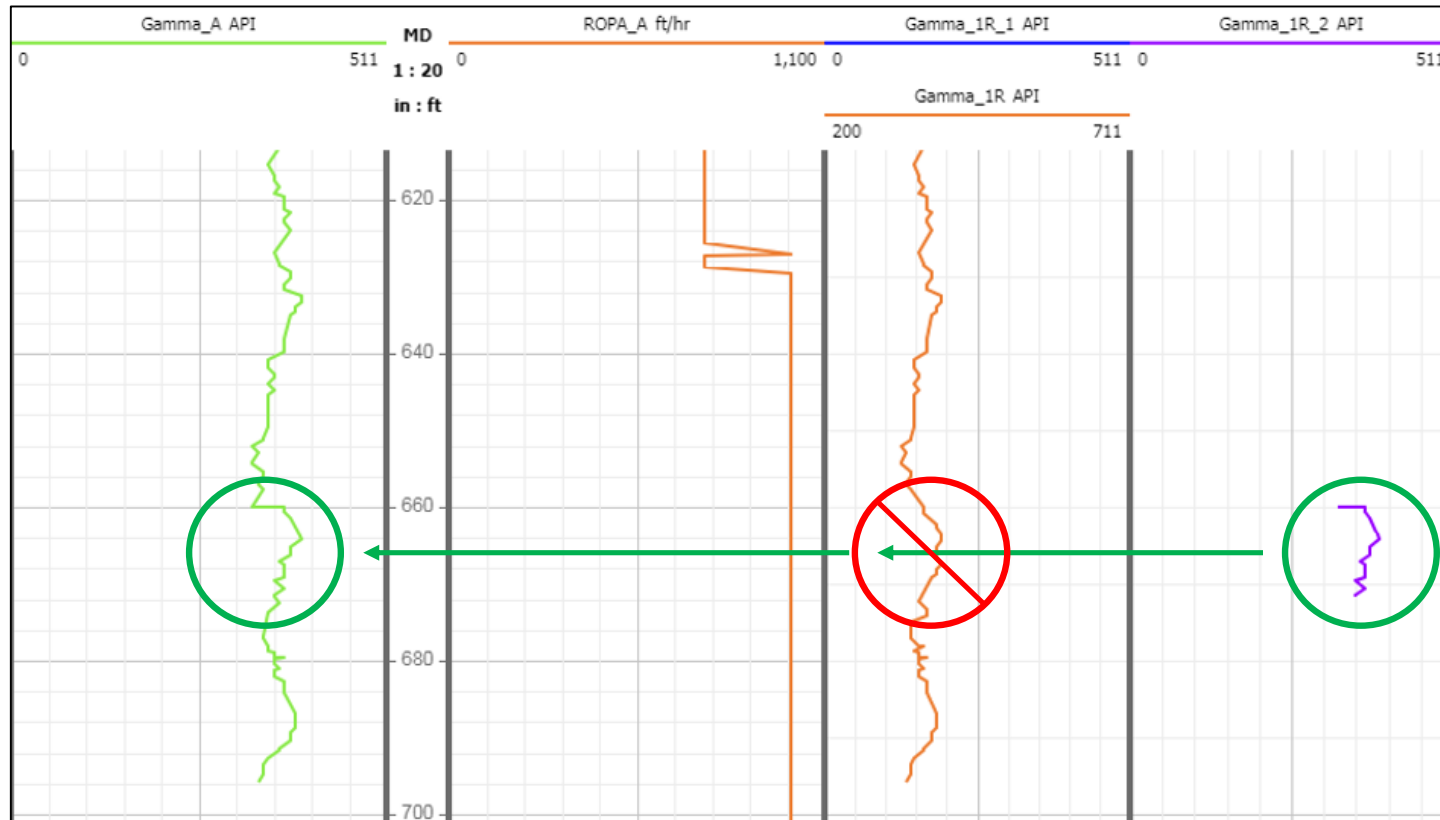
# xDirect Logging

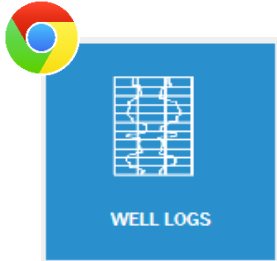


## Common Task #3 - Monitor second Re-log section (optional)

Same process as adding a relog curve to the track.

Note how Gamma\_A (Auto Curve) updates with the latest relog information.

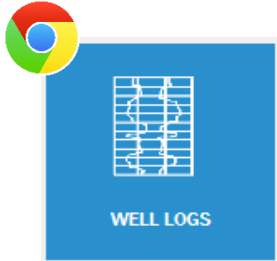





## Common Task

# Remove Section of Curve Data

# xDirect Logging



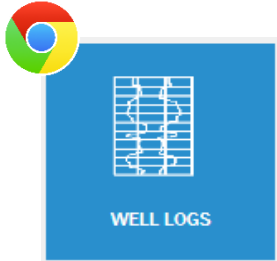
## Common Task #4 - Remove a section of data (optional)

1. Select the header of the desired curve, then select Edit 
2. Use the left-mouse button and make a box around the area you want to remove.
3. Select **Remove Selection**, change the ranges as desired, then select **Apply**.  
Note: Ensure the Max. Value is high enough to remove the highest peaks.

The screenshot illustrates the process of removing a section of data from a well log. It is divided into three main sections:

- Left Panel:** A well log plot showing two curves: "Gamma\_1ME CPS" (top, blue) and "Gamma\_1RE API" (bottom, yellow). A green circle highlights a vertical selection box around the curves between approximately 600 and 700 depth.
- Middle Panel:** A configuration dialog box for the "Gamma\_1RE (API)" curve. It contains the following fields:
  - Curve: Gamma\_1RE (API)
  - Min (depth): 601.0375
  - Max (depth): 701.3125
  - Min. Value (API): 151.69
  - Max. Value (API): 219.49
  - Buttons: "Remove Selection" and "Revert Selection" (at the bottom left of the dialog).
  - Button: "Apply" (at the bottom center of the dialog).
- Right Panel:** The same well log plot as the left panel, but with the selected section removed. The "Gamma\_1RE API" curve now has a gap between 600 and 700 depth, and the "Gamma\_1ME CPS" curve is also missing in that section. A green circle highlights the gap.

# xDirect Logging

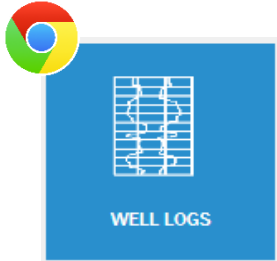


Common Task

**Clip Spikes From  
Curve Data**



# xDirect Logging

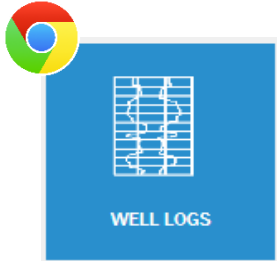


## Common Task #5 - **Clip spikes from a section of data** (optional)

1. Select the header of the desired curve, then select Edit.
2. Use the left-mouse button and make a box around the area you want to keep, leaving the spikes *out* of the selection.
3. Select **Apply Clip**, then select **Apply**.

The screenshot illustrates the 'Apply Clip' process in three stages:

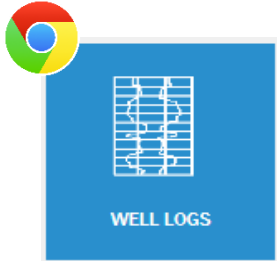
- Left Panel:** A well log plot for the 'Gamma\_2RE (API)' curve. A green circle highlights a section of the curve with a sharp spike. A context menu is open over this section, with 'Apply Clip' selected. Other options include 'Remove Offset', 'Apply Factor', and 'Remove Factor'.
- Middle Panel:** A configuration dialog box for the 'Gamma\_2RE (API)' curve. It contains the following fields:
  - Min. Depth (ft): 15570.25
  - Max. Depth (ft): 15583.85
  - Apply to entire depth range:
  - Min. Value (API): 128.13
  - Max. Value (API): 223.44
  - Apply:
- Right Panel:** The same well log plot as the left panel, but the spike has been removed, and the curve is smoothed in the selected area. A green circle highlights this smoothed section.



## Common Task

# Add Multiplication Factor To Curve Data

# xDirect Logging



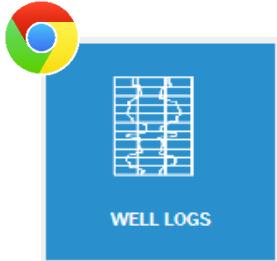
## Common Task #6 - Add multiplication factor to a section of data (optional)

1. Select the header of the desired curve, then select Edit.
2. Use the left-mouse button and make a box around the area you want to edit.
3. Select **Apply Factor**, confirm the depth range, input a multiplier, then select **Apply**.  
Note: The user may need to refresh the page to see the changes.

The screenshot illustrates the process of applying a multiplication factor to a section of data in the xDirect Logging application. It is divided into three main sections:

- Left Panel:** Shows a well log interface with two curves: "Gamma\_1ME CPS" (yellow) and "Gamma\_1RE API" (blue). A green circle highlights a section of the yellow curve between 607.74 and 680.72 feet depth.
- Middle Panel:** A modal dialog box titled "Gamma\_1ME (CPS)" is open. It contains input fields for "From (ft)" (607.74), "To (ft)" (680.72), and "Factor" (1.1). The "Factor" field is circled in green. Below the fields is an "Apply" button.
- Bottom Panel:** A menu is open with two options: "Apply Factor" and "Remove Factor". A green arrow points from the "Apply Factor" option to the "Apply" button in the modal dialog.
- Right Panel:** Shows the well log interface after the operation. The yellow curve now shows a change in amplitude within the selected depth range, which is circled in green.

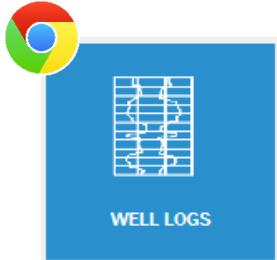
# xDirect Logging



## Common Task

# Add Depth Offset To Curve Data

# xDirect Logging



## Common Task #7 - Add offset to a section of data (optional)

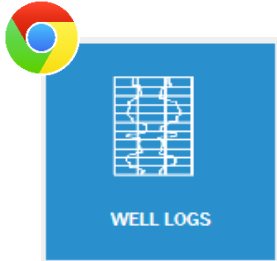
1. Select the header of the desired curve, then select Edit.
2. Use the left-mouse button to select the section of the data to offset.
3. Select **Apply Offset**, change the ranges as desired, then select **Apply**.

The screenshot illustrates the process of applying an offset to a section of data in the xDirect Logging software. It is divided into three parts:

- Left Panel:** A well log plot showing two curves: 'Gamma\_1ME 181.41 CPS' (top, blue) and 'Gamma\_1RE 182.68 API' (bottom, yellow). A section of the yellow curve between 50 and 300 feet is selected, indicated by a green circle.
- Middle Panel:** A context menu is open over the selected section, listing options: 'Remove Selection', 'Revert Selection', 'Add Splice', 'Remove Splice', and 'Apply Offset'. The 'Apply Offset' option is highlighted in grey.
- Right Panel:** A dialog box titled 'Gamma\_1RE (API)' is open, showing the following fields:
  - Curve: Gamma\_1RE (API)
  - From (ft): 647.59
  - To (ft): 647.59
  - Offset (ft): 50
  - Apply button (highlighted in grey)

The rightmost part of the image shows the final result: the selected section of the yellow curve has been shifted upwards by 50 feet, as indicated by a green circle around the new position of the data.

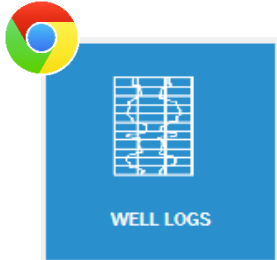
# xDirect Logging



## Common Task

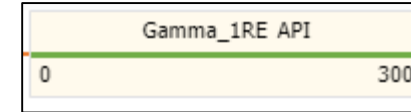
# **View/Remove Curve Edits**

# xDirect Logging



## Common Task #8 - View or Remove any or all edits to curves (optional)

1. Select the header of the desired curve or track.



2. Open the EDITS tab.

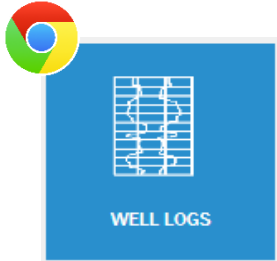
3. To remove, select

- UNDO ALL to remove all edits, or
- UNDO for each specific edit.

NOTE: Edits are automatically applied to the edited curves *and* the Auto curves.

A screenshot of the 'Edits' tab in the software interface. The tab is highlighted with a green box. Below the tab, the curve 'Gamma\_2RE (API)' is selected. The interface shows four edit options, each with an 'UNDO' button highlighted in green: 'Remove Selection' (Depth: 14677.42ft - 14772.66ft), 'Offset' (Depth: 15085.29ft - 15143.26ft), 'Factor' (Depth: 15174.31ft - 15281.97ft), and 'Clip' (Depth: 15327.52ft - 15358.58ft). At the bottom, there is a 'UNDO ALL' button also highlighted in green.

# xDirect Logging

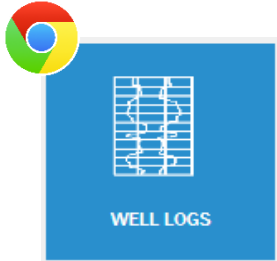


Common Task

**Changing Standard Scales**



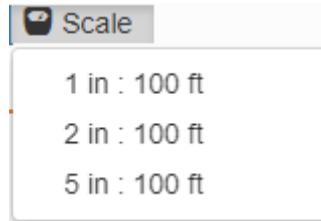
# xDirect Logging



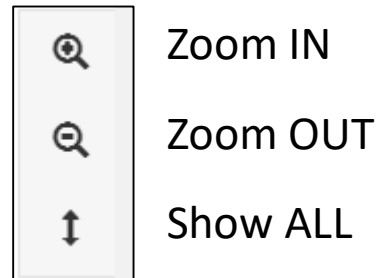
## Common Task #9 - Changing standard scales

1. Select the Scale button. 

2. Select the scale option from the list.

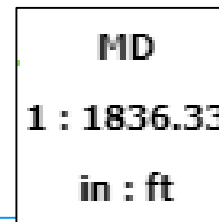


3. Alternatively, use the Zoom buttons to manually adjust the scale:

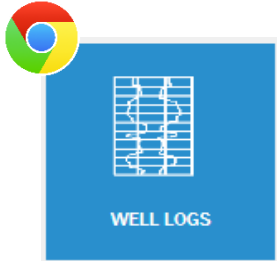


Note:

- The **Index** track will show the current scale.
- Only the Zoom buttons work for Time scaling.



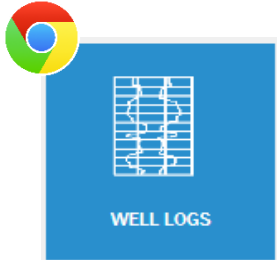
# xDirect Logging



Common Task

**Importing Curves**

# xDirect Logging

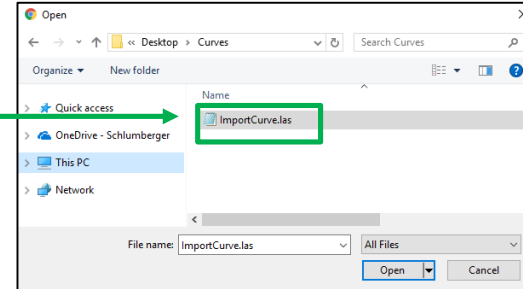
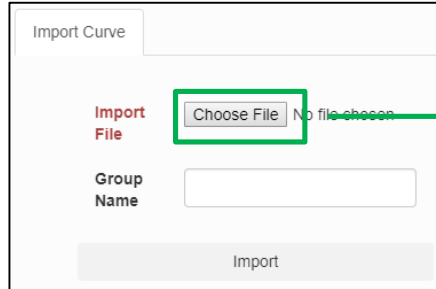


## Common Task #10 - Importing curves (part 1)

1. Select the **Import** button.

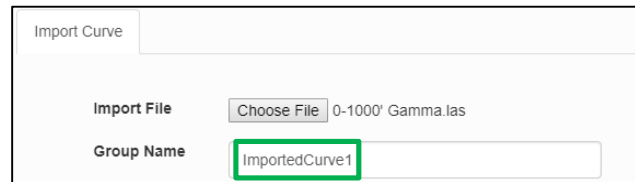
A screenshot of the software toolbar. The "Import" button, represented by a person icon, is highlighted with a green box. A green arrow points from the text "Select the Import button." to this button. Other toolbar items include "Track", "View", "MD", "TVD", "Time", "Scale", "Crosshair", "Stick to Now", "Logging On", and "Relog".

2. Select **Choose File**, select a valid .LAS log file (with DEPTBITM mapping):



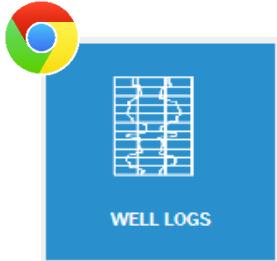
3. Give the .LAS file a group name.

This is how you will find it in the **Add Curve** menu later.



(continued...)

# xDirect Logging



## Common Task #10 - Importing curves (part 2)

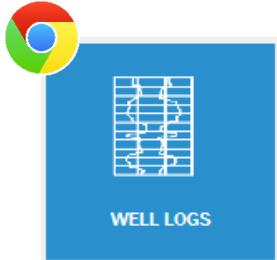
4. Select the desired data points to import from the selected .LAS log file by selecting/deselecting the checkboxes.
5. If “Select WITS Item” appears, you must use the drop-down menu to select the appropriate datapoint based on the name (ie: VSEC = Vertical Section)
6. Select the appropriate unit of measurement where required.

DEPT	<input checked="" type="checkbox"/>	DEPTBITM	Foot
Gamma	<input checked="" type="checkbox"/>		
ROPA	<input checked="" type="checkbox"/>		foot/hour
VSEC	<input checked="" type="checkbox"/>	Select WITS Item	Foot

Import

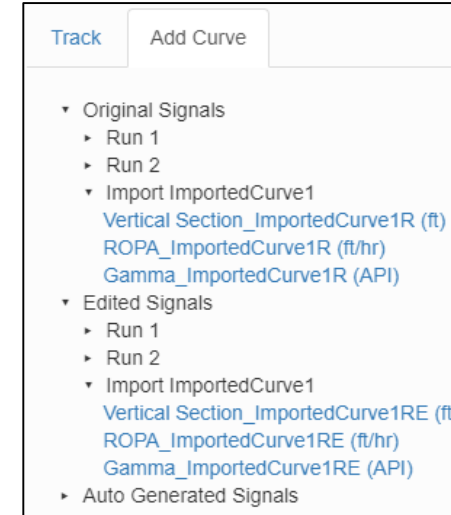
7. Select **Import**.

# xDirect Logging

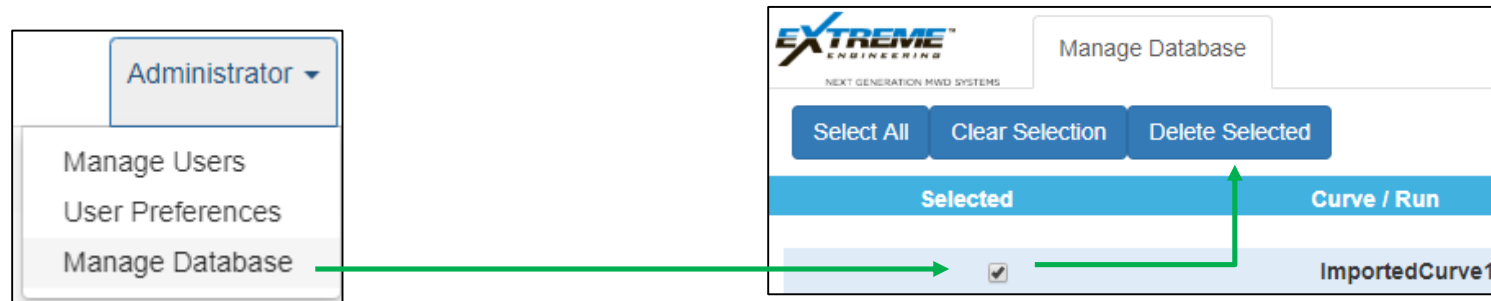


## Common Task #10 - Importing curves (part 3)

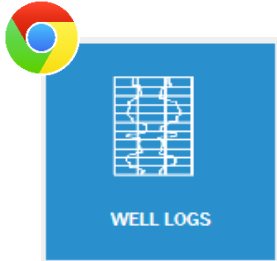
8. The imported curve will now appear in the Add Curve menu under both **Original Signals** and **Edited Signals** as new runs.



NOTE: Imported curves can be removed from the database by using the Manage Database menu from the Administrator tab.



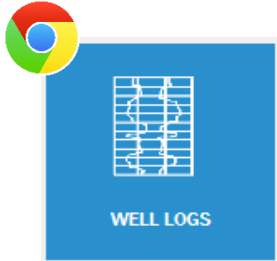
# xDirect Logging




Common Task

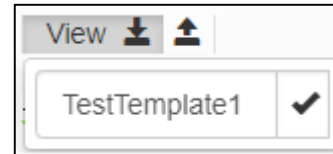
**Save and Load  
Well Log Templates**


# xDirect Logging

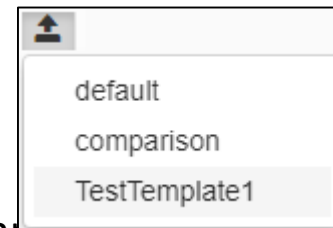


## Common Task #11 - Save and Load Well Log Templates

1. Select the **View**  button.
2. Type in a name to save the current Well Log layout as a template. Then select the checkmark to save it.

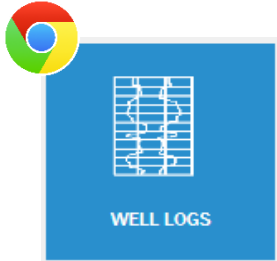


3. Select the **Load**  button to display a list of available templates. Select the desired template from the list, and it will automatically load.



Note: Templates will store layout and settings for all tracks, curves, scales, and log type

# xDirect Logging

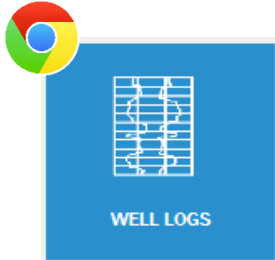


Common Task

**Hole Depth Resets**



# xDirect Logging



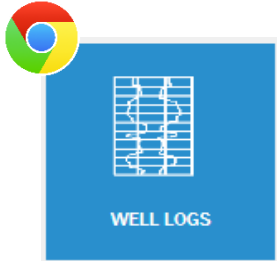
## Common Task #12 - **Validate/Ignore Hole Depth Resets**

A “Validate Hole Depth Reset” dialog will appear any time a negative depth change is detected (ie: depth goes from 500ft to 450ft)

1. Confirm that the new depth is expected and accurate. This may require discussion with the rig crew. Check for multiple resets: In some cases, the depth reset may have been done in error.
2. Select the reset message, then select **Ignore** or **Validate**. You can also ignore/validate every reset by selecting **Ignore All** or **Validate All** respectively.

A screenshot of a software dialog box titled "Validate Hole Depth Reset". The dialog has a "Do it Later" button in the top right corner. The main content area contains two messages, each asking if the user wants to remove log data from a specific depth interval and time interval. The first message is highlighted with a green border: "Hole depth reset detected at 1:55:29 PM, do you want to remove log data from 639.99ft to 661.98ft in time interval from 1:52:23 PM to 1:55:29 PM?". The second message is: "Hole depth reset detected at 1:56:51 PM, do you want to remove log data from 629.99ft to 639.99ft in time interval from 1:51:11 PM to 1:56:51 PM?". At the bottom of the dialog, there are four buttons: "Ignore All", "Validate All", "Ignore Selected", and "Validate Selected". The "Ignore Selected" and "Validate Selected" buttons are highlighted with a green border.

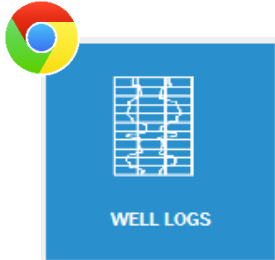
# xDirect Logging



Common Task

**Curve Splicing**

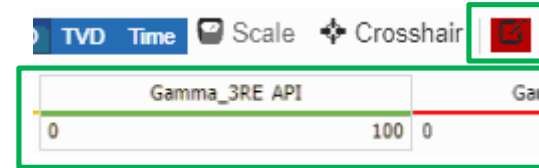
# xDirect Logging



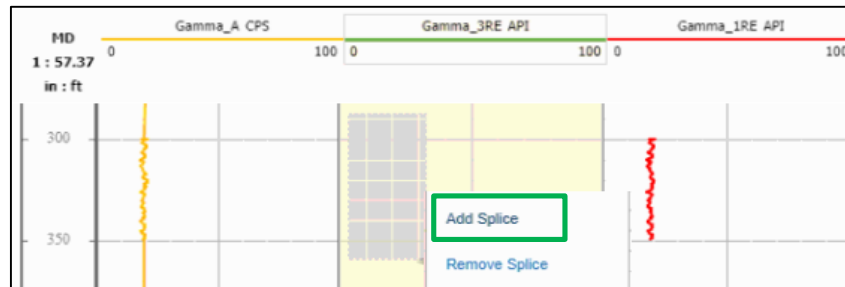
## Common Task #13 – Splicing into Edited Curves - Part 1

Edited curves – identified by "E" in the curve name – can be spliced, or combined, to add data into a single curve. In this example, we will splice data from RUN 1 into RUN 3, so RUN 3 contains the spliced data.

1. Select the RUN 3 Gamma Edited curve, then select **Edit**.



2. Use the left-mouse button to select an area of the RUN 3 curve in which to splice data in from another curve, then select Add Splice.



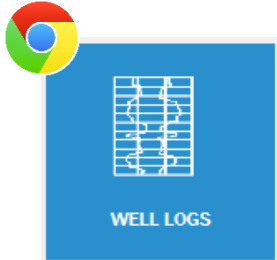
3. Confirm the details then select **Apply**.

Note: Selected Run Number is the run to import FROM.

In this case, we are importing 285' to 360' from Run 1 to Run 3.

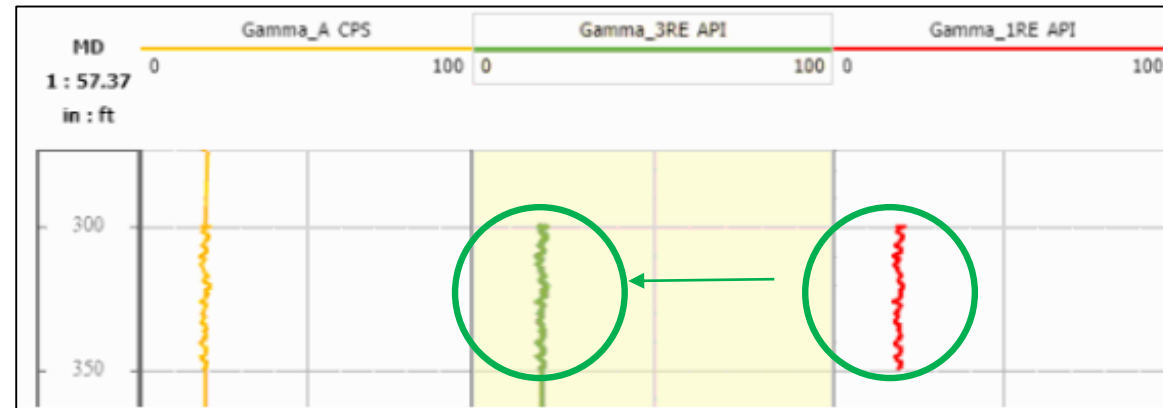
A screenshot of the "Curve Splicing" dialog box. It contains the following fields: "From (ft)" with value 285.00, "To (ft)" with value 360.00, "Run Number" with value 1, "Type" with value Surface, "Relog" with value Off, and "Splice Curve" with value Gamma. A green box highlights the "Apply" button at the bottom.

# xDirect Logging

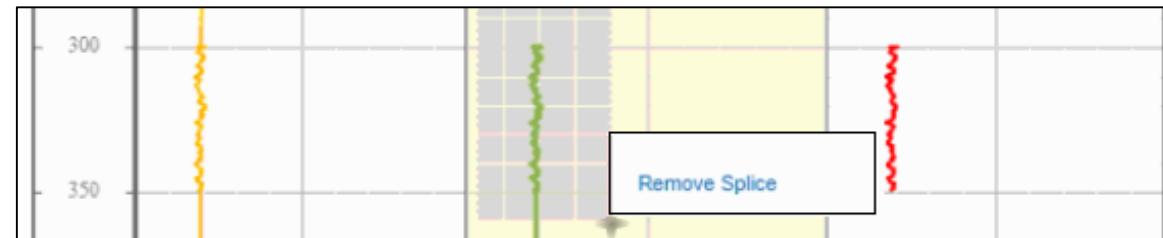


## Common Task #13 – Splicing into Edited Curves - Part 2

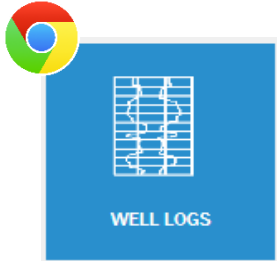
4. Confirm that the splice has taken effect.  
The user may need to refresh the screen for the changes to take effect.



5. The splice can be removed by highlighting the same area on the curve, then selecting **Remove Splice**.



# xDirect Logging



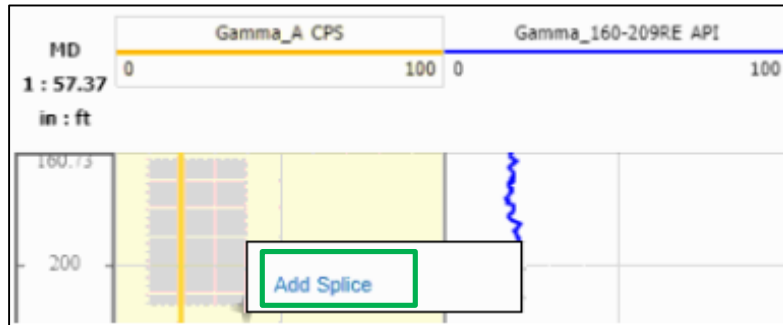
## Common Task #14 – Splicing into Auto Curves - Part 1

Auto curves – identified by "A" in the curve name – already contain data from existing curves *except* for Imported Curves. Therefore, **ONLY** Imported Curves can be spliced into Auto curves.

1. Select the Auto Gamma curve, then select **Edit**.



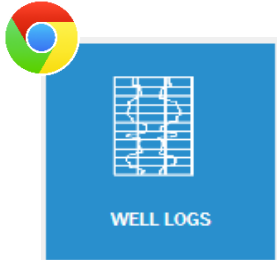
2. Use the left-mouse button to select an area of the Auto curve in which to splice data in from another curve, then select Add Splice.

A dialog box titled "Curve Splicing". It has three input fields: "From (ft)" with value 160, "To (ft)" with value 210, and "Splice Curve" with a dropdown menu showing "Gamma". A green box highlights an "Apply" button at the bottom.

3. Confirm the details then select **Apply**.

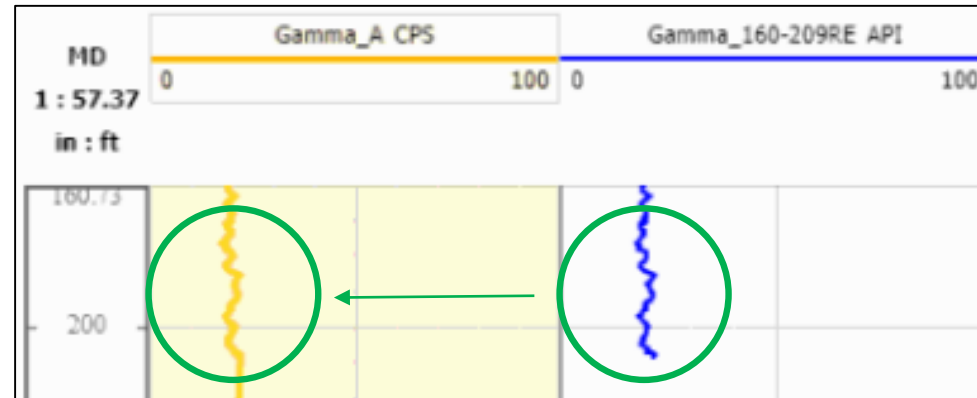
Note: When splicing into an Auto curve, XDirect does not allow the user to choose which curve to splice from, as it can only be the Imported curve.

# xDirect Logging



## Common Task #14 – Splicing into Auto Curves - Part 2

4. Confirm that the splice has taken effect.  
The user may need to refresh the screen for the changes to take effect.



5. The splice can be removed by highlighting the same area on the Auto curve, then selecting **Remove Splice**.



# Summary

- Validate good SHT
- Use xBolt downlinking features
- Learn receiver options within Xdirect
- xBolt Basic troubleshooting
- Learn logging functions within XDirect