

# User Guide

## QL40 SGR-2G – Spectral Gamma Ray Probe





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# Table of Contents

<b>1</b>	<b>General Information .....</b>	<b>1</b>
1.1	Dimensions .....	2
1.2	Technical Specifications.....	3
<b>2</b>	<b>Measurement Principle .....</b>	<b>6</b>
<b>3</b>	<b>Notes on QL tool assembly .....</b>	<b>7</b>
3.1	QL40 stack assembly .....	7
<b>4</b>	<b>Operating Procedure.....</b>	<b>11</b>
4.1	Quick Start .....	11
4.2	Tool Communication with OPAL/SCOUT (ALT MODEM) .....	12
4.3	Tool Communication with ALT Logger.....	12
4.4	Tool Communication with MATRIX .....	13
4.5	Tool Parameters/Details.....	14
4.6	Recorded Parameters, Processors and Browsers.....	15
4.6.1	Recorded parameters.....	15
4.6.2	SgrProc Processor – Full Spectrum Analysis.....	16
4.6.3	SgrSpectra Browser .....	18
4.6.4	MChNum Browser .....	19
4.6.5	MChCurve Browser.....	20
<b>5</b>	<b>Performance Check &amp; Calibration .....</b>	<b>21</b>
<b>6</b>	<b>Maintenance .....</b>	<b>23</b>
6.1	General Tool Maintenance .....	23
6.2	Tool Top Adapter .....	23
6.2.1	Locking Ring assembly Maintenance.....	24
<b>7</b>	<b>Troubleshooting.....</b>	<b>27</b>
<b>8</b>	<b>Appendix .....</b>	<b>28</b>
8.1	Tool Communication with OPAL/SCOUT .....	28
8.2	Parts list .....	33
8.2.1	Spare parts.....	33
8.2.2	Other parts .....	33
	<b>Index .....</b>	<b>34</b>



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# 1 General Information

The QL40 SGR-2G-2G is the new generation of slimhole Spectral Gamma Tool. The new system consists of a completely redesigned and ruggedised mechanical assembly, electronics and gamma module. It implements also the latest ALT telemetry developments to enhance tool performances on long single and multi conductor wirelines.

The QL40-SGR2G probe measures the total gamma counts in API as well as the full energy spectrum of the natural gamma radiations emitted naturally from within the formations. A Full Spectrum Analysis (FSA)<sup>1</sup> is performed on the recorded energy spectra. The FSA derives in real time the concentration of the three main radioisotopes K, Th, U and thus provides insight into the mineral composition of the formations.

The QL40 SGR-2G2G is a modular platform that can be equipped with a scintillation BGO (Bismuth Germanium Oxide) crystal or with a scintillation CeBr3 (Cerium Bromide) crystal.

The BGO crystal is characterized by a high scintillation efficiency, good energy resolution, and is mechanically strong. It is recommended for applications in sedimentary rocks.

Compared to other crystal types the CeBr3 has a very high energy resolution. The sensor dead time was reduced to less than 1µs in order to optimize the count rate computation. It makes the tool ideal for uranium exploration and ore grade analysis where a high natural radioactivity is encountered and when a high spectral resolution is required to identify radioisotopes characterized by narrow energy bands.

## ***Application (BGO)***

- . *Recognition of radioactive materials*
- . *Contamination studies*
- . *Lithology characterization*
- . *Well to well correlation*
- . *Sedimentology - differentiation of facies and depositional environment*

## ***Application (CeBr3)***

- . *Recognition of radioactive materials*
- . *Mineral composition*
- . *Uranium exploration*
- . *Ore grade analysis*

The tool is supplied as an inline sub of the Quick Link (QL) product line and can be combined with other QL40 tools to form a tool string or it can be run as a stand alone tool.

The QL40 SGR-2G operates with ALT/MSI logging systems and can be run on any standard wirelines (mono, 4 or 7 conductor, coax).

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<sup>1</sup> The Full Spectrum Analysis (FSA) is developed by Medusa Systems BV in collaboration with the Nuclear Physics Institute of the University of Groningen (Netherlands)

### 1.1 Dimensions

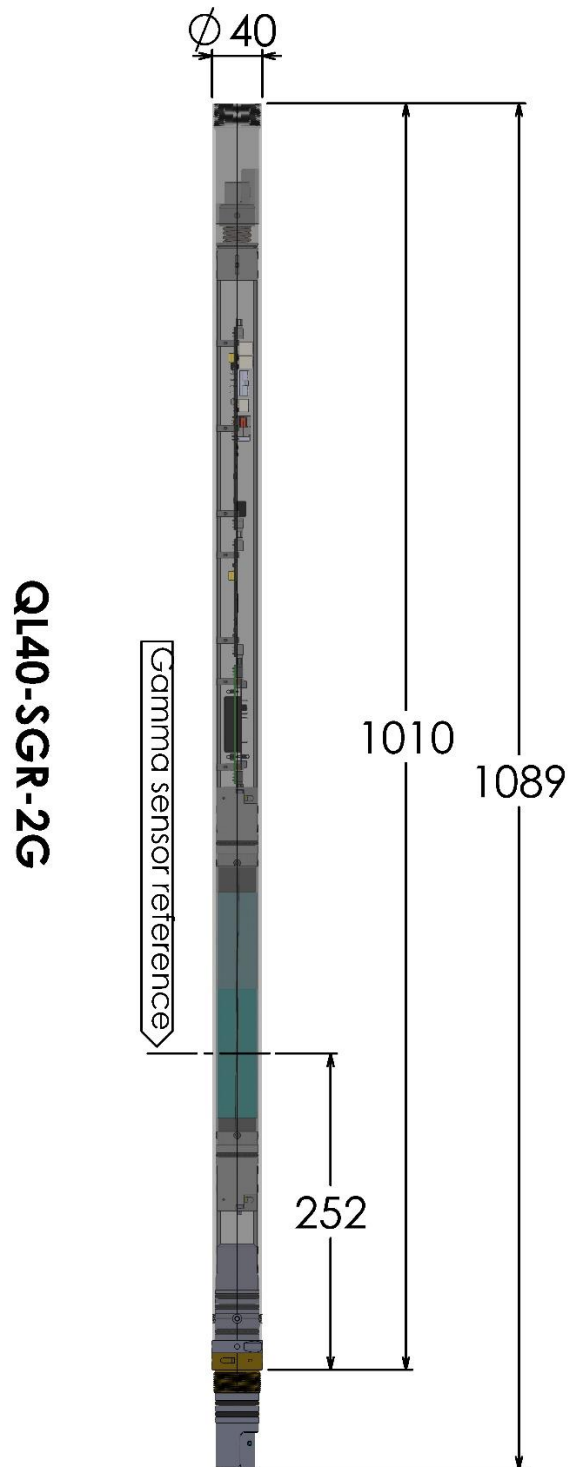


Figure 1-1 QL40 SGR-2G Dimensions

## 1.2 Technical Specifications

### Tool

Diameter:	40 mm (1.6")
Length:	1.01 m (39.4")
Measurement point:	0.25 m (9.9") from bottom
Weight:	6 kg (13 lbs)
Max. Temp:	70 °C (158 °F)
Max. Pressure:	200 bar (2900 psi)

### Measurements / Features

BGO crystal:	256 channels gamma ray energy spectrum
CeBr3 crystal:	2048 channels gamma ray energy spectrum
Stabilized spectrum:	Full Spectrum Analysis from Medusa Systems BV
Total gamma counts:	(API)
Concentration of radioisotopes :	(Bq/kg or ppm)
Concentration error :	(Bq/kg or ppm)

### Sensors:

Scintillation crystal :	BGO	CeBr3
Dimensions (mm) :	25.4 x 100.0	20.0 x 96.0
Dimensions (inch) :	1.00 x 4.00	0.79 x 3.78
Sensitivity (compared to NaI crystal) :	x 3	x 1.9
Spectral Resolution @ Cs (%) :	13.6	6.2
Dead Time (µs):	4.8	0.8

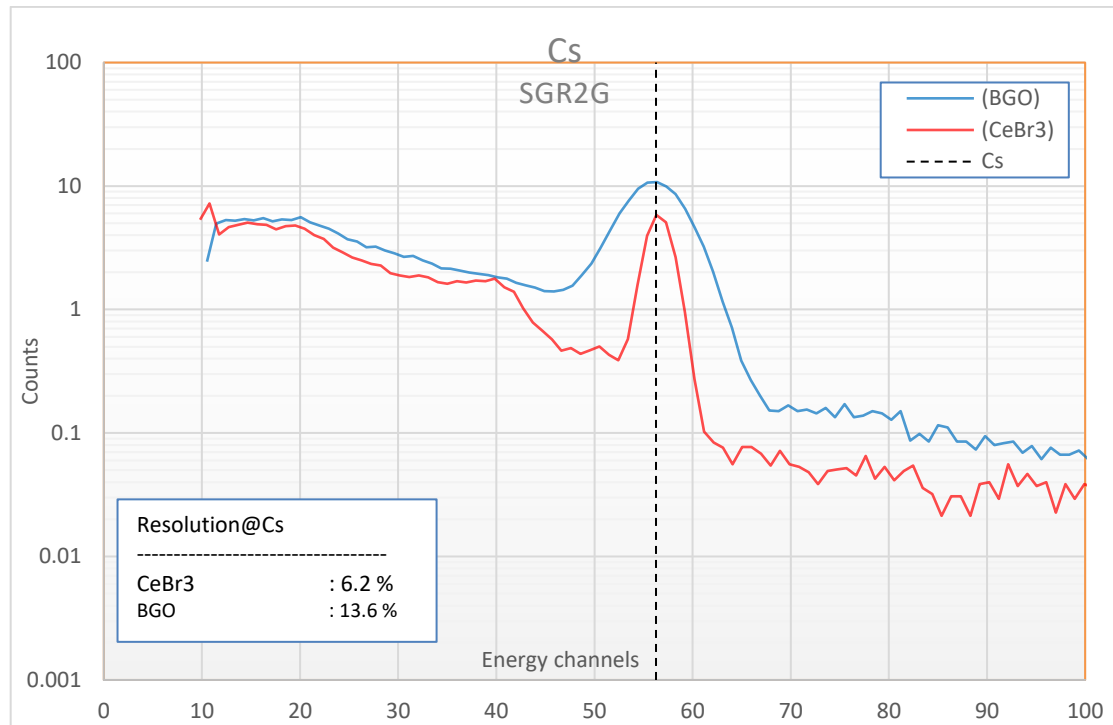
### Operating conditions:

- Open or cased boreholes
- Water filled or dry boreholes

### Cable:

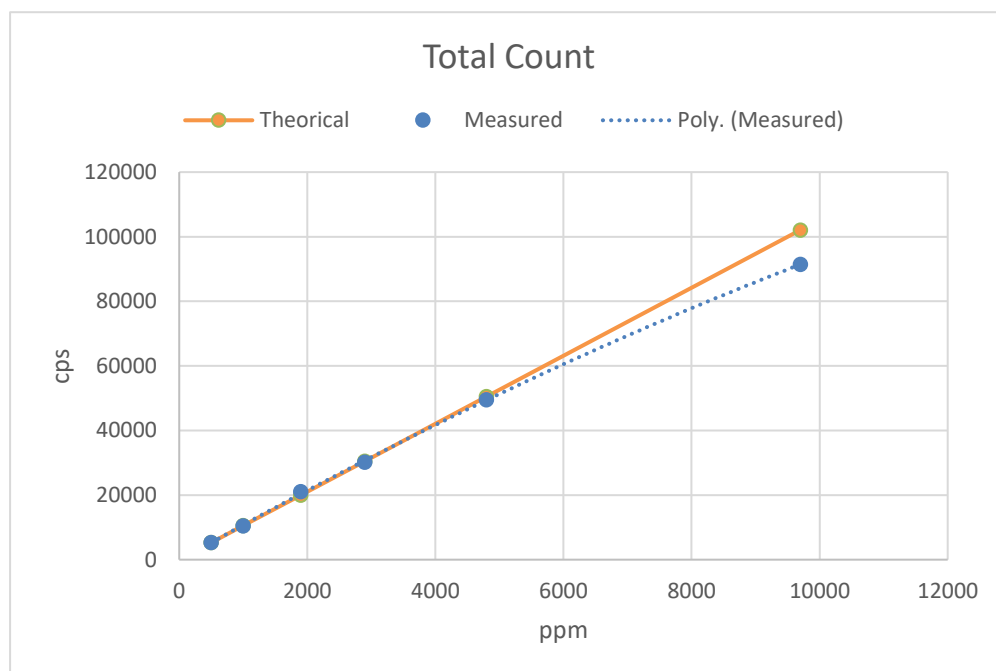
Cable type:	Mono, Coaxial, 4 or 7 conductors
Digital data transmission:	Up to 500 Kbits per second depending on wireline
Compatibility:	OPAL-SCOUT_PRO-SCOUT-BBOX-MATRIX





**Figure 1-2** BGO vs CeBr3 – Spectral resolution comparison (Cs137 isotope)

The QL40-SGR2G with the CeBr3 crystal is characterized by a very good spectral resolution (Figure 1-2). The short dead time value of the system (less than 1  $\mu$ s) combined with the latest design of the measurement electronics allows a high linearity of the total gamma count (Figure 1-3). It makes the tool ideal for ore grade analysis when a high spectral resolution is required to identify radioisotopes with narrow energy bands.



**Figure 1-3** Total Count (cps) vs Concentration (ppm)

## 2 Measurement Principle

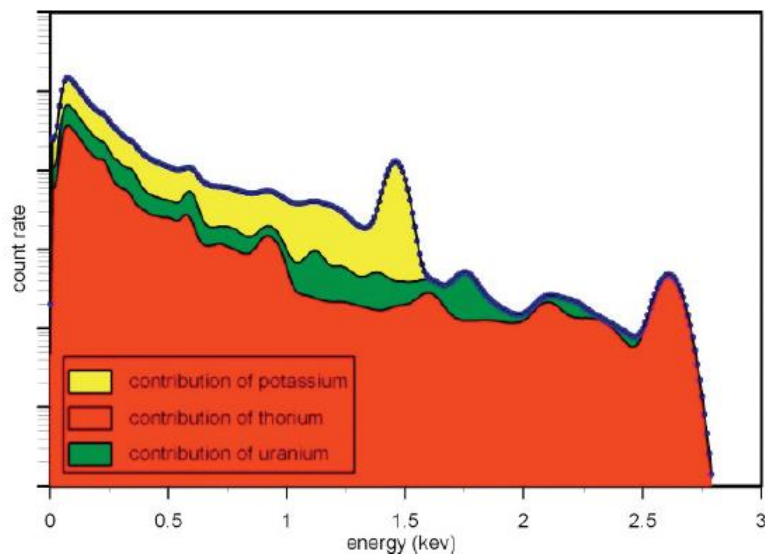
The QL40 SGR2G is equipped with a BGO or CeBr3 scintillation crystal, which, when struck by gamma rays, emits pulses of light. These pulses of light are amplified by a photo multiplier tube and are then converted into electrical pulses. The number of pulses are counted, digitized and transmitted up the wireline to the surface acquisition system.

In addition to the “total natural gamma counts” the tool records the energy spectrum of the gamma radiation emitted by the formations. A real time Full Spectrum Analysis (FSA)<sup>2</sup> method is applied to compute the concentration of the three main radioisotopes K, Th and U<sup>3</sup>.

The Full Spectrum Analysis is performed in two steps:

First spectrum stabilization will be performed. Each multichannel spectrum in the data set will be converted to a spectrum having all count peaks at the corresponding energy position. This process implies a close comparison with reference spectra obtained during the calibration process of the spectral gamma tool at the Medusa calibration facility.

In a second step the now stabilized spectrum will be convoluted into concentrations of naturally occurring radionuclides (<sup>40</sup>K, <sup>238</sup>U, <sup>232</sup>Th, or other man-made nuclides like <sup>137</sup>Cs or <sup>60</sup>Co). Corrections taking borehole diameter, rock density, casing type and thickness, tool position and borehole fluid conditions into account can be applied.



**Figure 2-1** Full Spectrum Analysis approach

<sup>2</sup> The Full Spectrum Analysis (FSA) is developed by Medusa Systems BV in collaboration with the Nuclear Physics Institute of the University of Groningen (Netherlands)

<sup>3</sup> Other nuclide concentrations can be derived on demand.

## 3 Notes on QL tool assembly

**QL** stands for **Quick Link** and describes an innovative connection between logging tools (subs) allowing to build custom tool stacks. QL40 describes a specific family of logging tools. Each sub is equipped with its own Telemetry board, Power supply element and A/D converter allowing an operation as stand-alone tool or as a stack in combination with other subs of the QL product family.

The QL40 probe line deals with two types of subs - Bottom Subs and Mid Subs.

### Bottom Sub

A bottom sub is a tool that must have one or more sensors located at the bottom. It can be operated in combination with other QL subs connected to the top but it is not possible to connect another sub below. When used in stand-alone mode the bottom sub only needs a QL40 tool top adaptor, which fits the cable head.

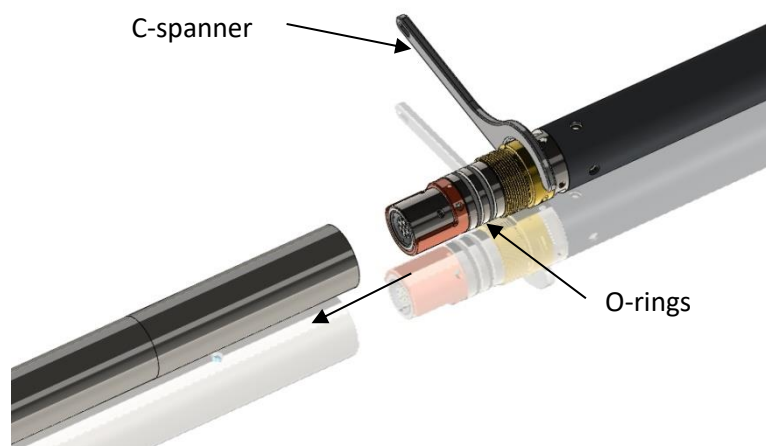
### Mid Sub

A mid sub is a tool that can be integrated anywhere within a stack of tools. When used at the bottom of a tool string a QL40 bottom plug must be used to terminate the string. If the mid sub is used as a stand-alone tool it needs a QL40 bottom plug at the lower end and a QL40 tool top adaptor at the top.

### 3.1 QL40 stack assembly

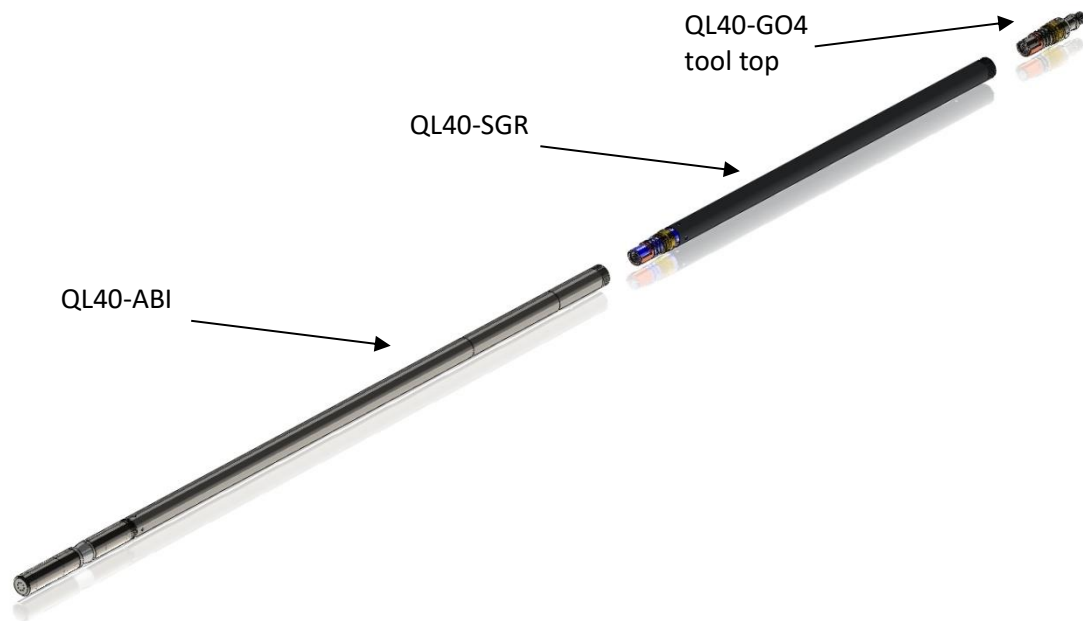
QL40 tool stacks are terminated by either a QL40 bottom sub or a QL40 bottom plug. At the top of the stack a QL40 tool top is required to connect the tool string to the cable head. Several tool tops are already available, special ones can be made on request.

To assemble and disassemble the subs the C-spanner delivered with the tool must be used (Figure 3-1). It is recommended that before each assembly the integrity of the O-rings (AS216 Viton shore 75) is verified. Prime the O-rings with the silicon grease that was supplied with the subs.



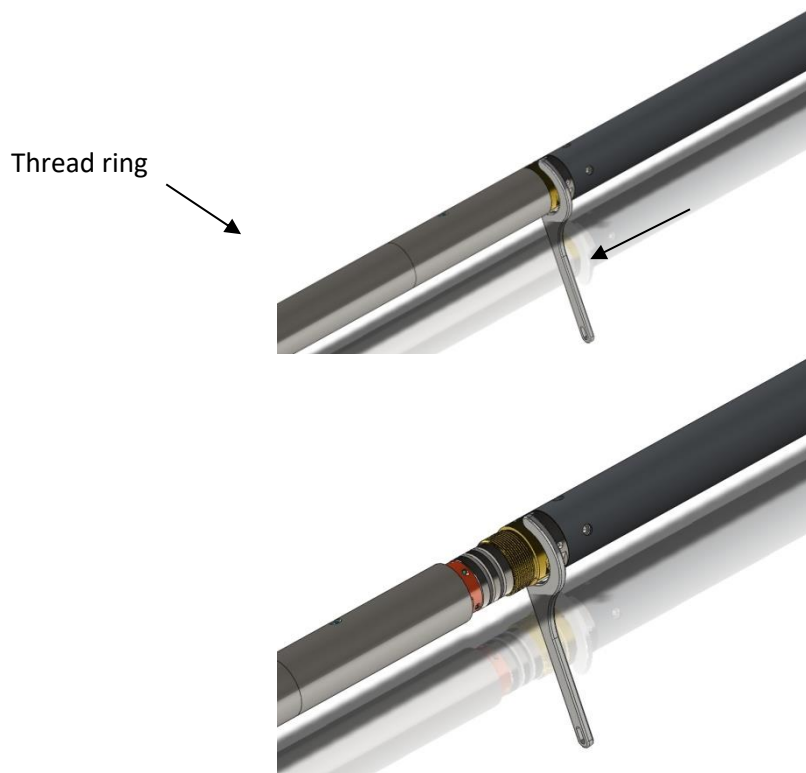
*Figure 3-1 C-spanner and O-rings of QL connection*

The following example of a QL40-ABI, QL40-SGR and QL40-GO4 (Figure 3-2) describes how to replace the QL40-ABI with a QL40-Plug in order to run the QL40-SGR sub stand-alone.



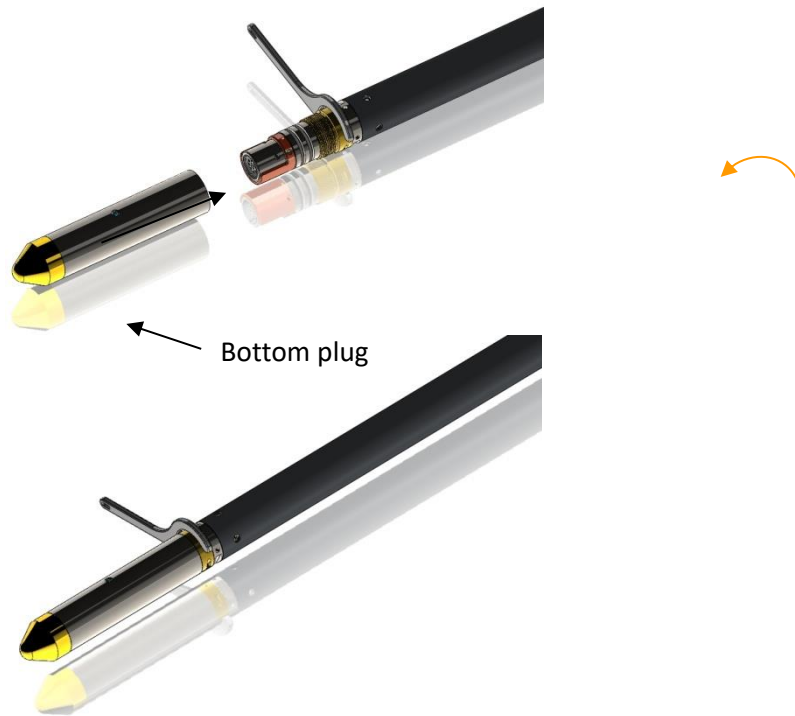
**Figure 3-2** Tool stack example

To remove the QL40-ABI bottom sub attach the C-spanner to the thread ring as shown in Figure 3-3, unscrew the thread ring and remove the QL40-ABI bottom sub.



**Figure 3-3** Unscrewing the thread ring and removing the bottom sub

After checking the O-ring integrity slip the QL40-Plug over the exposed QL connector (Figure 3-4) attach the C-spanner and screw the thread ring until the plug fits tight.



**Figure 3-4** Attaching the QL40-Plug

The QL40-SGR can now be run stand-alone (Figure 3-5).



**Figure 3-5** QL40-SGR mid sub with tool top and bottom plug



## 4 Operating Procedure

**Note:** Parts of the topics discussed in the sections below assume that the user is familiar with the data acquisition software. Refer to the corresponding operator manuals for more details. Information about assembly and configuration of tool stacks can be found in the same manuals.

### 4.1 Quick Start

1. Connect the tool to your wireline and start the data acquisition software.

2. Select the relevant QL40 SGR-2G tool from the drop down list (Figure 4-1) in the software's **Tool** panel (if your tool is not listed check that your tool configuration file is stored in the designated folder on your computer).

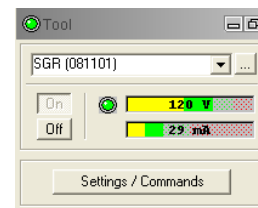


Figure 4-1 Tool panel

3. In the **Tool** panel, switch on the tool (click **On** button) and verify that the power indicator shows a valid (green) level. The system goes through a short initialization sequence which sets the default parameters and communication settings held in the tool configuration file. The configuration returned by the tool is also checked during this procedure. (Setup tool communication as explained in chapter 4.2 if error message is displayed.)

4. On the **Tool** panel (Figure 4-1) click the **Settings / Commands** button to configure your tool (see chapter 4.5 for details).

5. In the **Acquisition** panel (Figure 4-2) select the sampling mode (depth or time). Click on **Settings** and specify the corresponding sampling rate. Switch on the sampling (click the **ON** button).

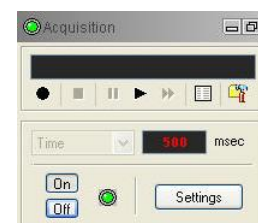


Figure 4-2 Acquisition panel

6. Press the **Record** button in the **Acquisition** panel (Figure 4-2), specify a file name and start the logging.

7. During logging observe the controls in the **Telemetry** panel (Figure 4-3):

- Status must be valid (green light);
- Bandwidth usage in green range;
- Memory buffer should be 0%;
- Number of **Data** increases and number of **Errors** negligible.

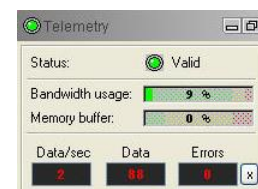


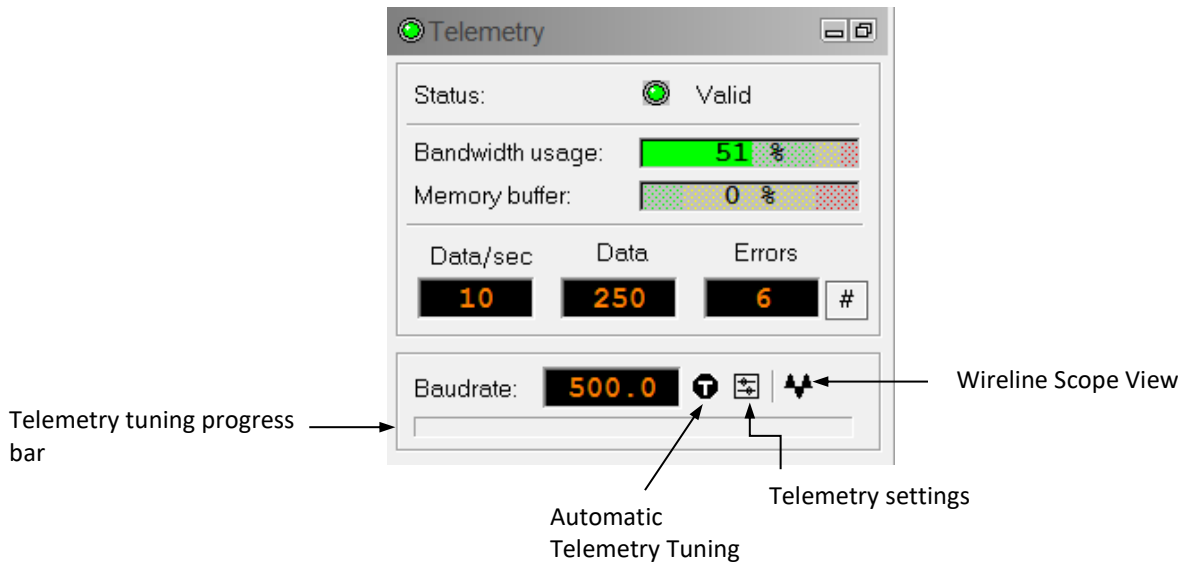
Figure 4-3 Telemetry panel

8. To end the logging procedure press the **Stop** button in the **Acquisition** panel and turn off the sampling (click **OFF** button).

9. In the **Tool** panel power off the tool.

## 4.2 Tool Communication with OPAL/SCOUT (ALT MODEM)


The telemetry provided through the **OPAL-SCOUT** systems implementing the **ALT MODEM** controls and configures **AUTOMATICALLY** the telemetry settings for any wireline. In case communication status is not valid the user has different options to adjust manually the telemetry settings from the telemetry panel of the dashboard:



### **Baud rate:**

Indicates the default baud rate or optimal baud rate in kbps found by the system for the selected winch/telemetry scheme

### **Automatic Telemetry Tuning:**

The Tune button  resets the telemetry tuning automatically. This process defines:

- the optimum baud rate for the winch configuration selected
- a transfer function and a filter to re-construct at the surface the shape of the pulse trains distorted by the wireline.

A **progress bar** at the bottom of the telemetry window shows the progression of the telemetry tuning. At the end of the process the baud rate display is refreshed with the optimal baud rate value.

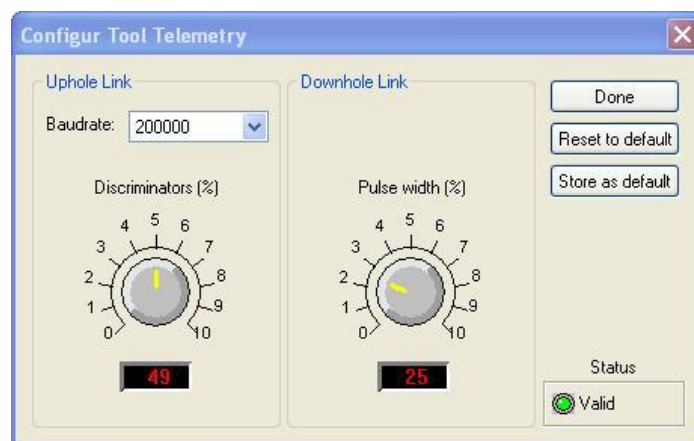
Refer to **Appendix** at the end of this manual for more information on the **advanced telemetry settings**.

## 4.3 Tool Communication with ALT Logger

The telemetry provided through the ALTLogger is self-tuning. In case communication status is not valid the user can manually adjust the settings. In the **Telemetry** panel of the dashboard click on **Settings** to display the **Configure Tool Telemetry** dialog box (Figure 4-4). A procedure to achieve valid communication is given below:

- Change the **Baudrate** to 41666 kbps.

- Verify that the **Downhole Pulse width** knob is set on 20 (default value). This value is the preferred one and is suitable for a wide range of wirelines. For long wireline (over 2000m), increasing the pulse width could help to stabilize the communication. The reverse for short wireline (less than 500m).
- Set the **Uphole** discriminators in the middle of the range for which the communication status stays valid.
- Increase the **Baudrate**, check the communication status stays valid and the **Bandwidth usage** (in **Telemetry** panel of the dashboard) is below the critical level.
- When **Uphole** discriminators are properly set, store the new configuration as default. The tool should go through the initialisation sequence the next time it is turned on.



**Figure 4-4** Tool communication settings

#### 4.4 Tool Communication with MATRIX

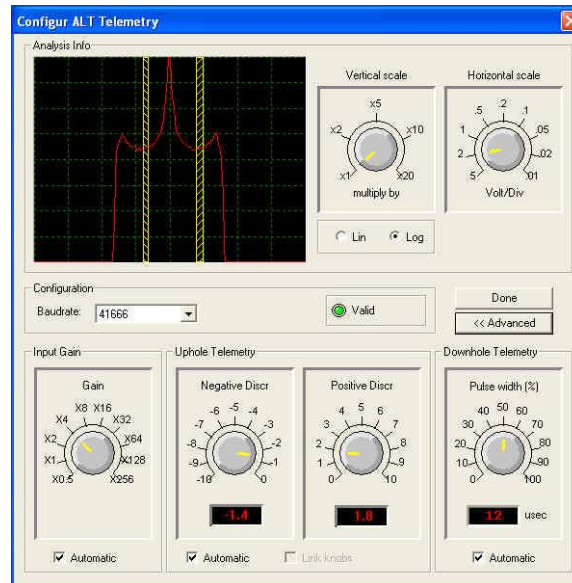
The tool telemetry can be configured through the **Telemetry** panel of the Matrix dashboard. By clicking on **Settings**, the operator has access to the **Configure ALT Telemetry** dialog box (Figure 4-5) providing various controls to adjust the telemetry settings and monitor its current status.

The **Analysis View** displays the current discriminator levels (vertical yellow lines) and a histogram of the up-hole data signal. The scales of the **Analysis View** can be adjusted using the **Vertical Scale** and **Horizontal Scale** knobs and the **linear / logarithmic** scale buttons. The status of the configuration should be flagged as Valid (indicated by the LED being green). In any other case (LED red) the telemetry should be adjusted (we assume a pulse signal is displayed in the analysis view). Click on the **Advanced** button to display additional controls to tune the telemetry.

The Automatic settings option is the preferred mode and should allow the telemetry to be configured for a wide range of wirelines without operator input. For wirelines with a more limited bandwidth, the operator might need to turn off the automatic mode and adjust the telemetry settings manually.

For each wireline configuration, the discriminators (vertical yellow lines) for the **positive** and **negative** pulses must be adjusted in order to obtain a valid communication status (see Figure 4-5) for an example of a suitable discriminator position). There is also the option to alter the **baudrate** in order to optimize the logging speed. The input **gain** can be increased

(long wirelines) or decreased (short wirelines) in order to set up the discriminator levels correctly.



**Figure 4-5** Matrix telemetry settings

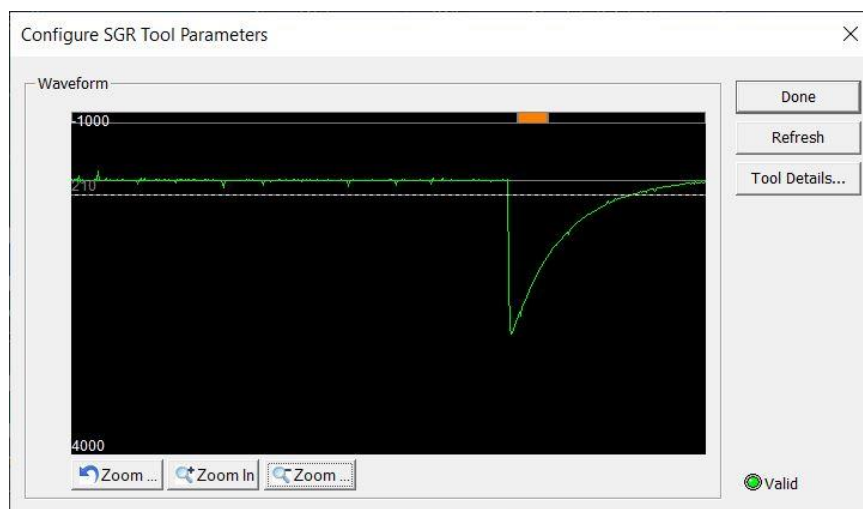
Once the telemetry is correctly set, store the new settings as default. The tool should go through the initialization sequence in “Valid” status the next time the power is turned on.

## 4.5 Tool Parameters/Details

The **Tool Parameters** dialog box (Figure 4-6) can be accessed by clicking on the **Settings / Command** button on the dashboard’s **Tool** panel or by clicking on the tool’s bitmap located in the **Tool Stack Manager** window.

The main view displays the shape of the gamma ray pulses detected by the probe.

- The green curve represents the gamma ray pulse train
- The horizontal dashed line is the detection threshold of the pulses
- The orange square is a representation of the dead time



**Figure 4-6** Gamma ray pulse

The tool details (serial number, firmware version,... ) are listed in the dialog box displayed when clicking on the “Tool Details...” button.

**Figure 4-7** Tool details

## 4.6 Recorded Parameters, Processors and Browsers

### 4.6.1 Recorded parameters

The following data channels are recorded by the QL40 SGR-2G tool.

TCPU	Temperature at CPU board in °C
Counts	Raw gamma ray counts
Time	Sampling time in seconds
Stack Counts	Stacked raw gamma ray counts
Stack Time	Stacked sampling time in seconds
EHT	High voltage [V]
Instant Spectrun	256 samples spectrum - BGO crystal 2048 samples sepctrum - CeBr3 crystal
Stacked Spectrum	Stacked 256 samples spectrum - BGO crystal Stacked 2048 samples spectrum - CeBr3 crystal

The total GR is computed by the MChProc processor

GR	Total Gamma ray in cps or API
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Additional channels are computed and produced by the SgrProc processor – See next section 4.6.2.

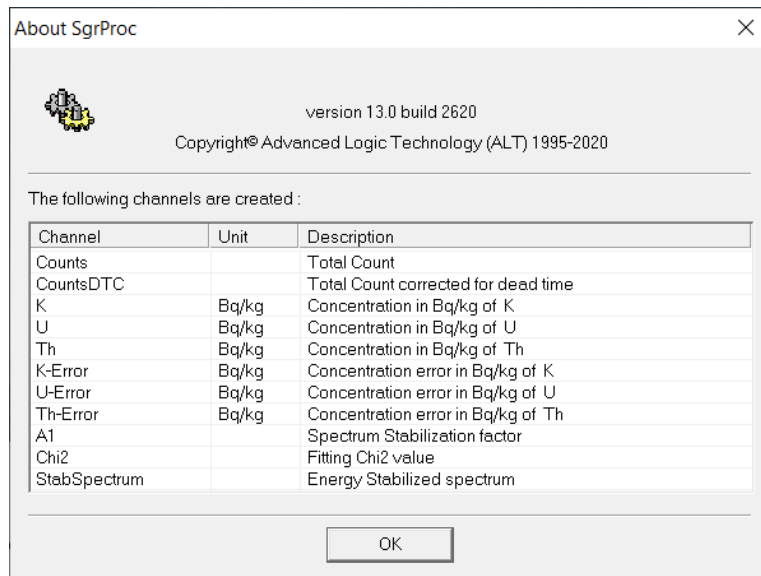
#### 4.6.2 SgrProc Processor – Full Spectrum Analysis

The SgrProc processor processes the spectra acquired by the tool using the Full Spectrum Analysis (FSA) method developed by Medusa Systems BV in collaboration with the Nuclear Physics Institute of the University of Groningen (Netherlands).

The FSA method applies the gain shift correction and a full spectrum analysis to compute the concentrations in Bq/kg of the nuclide elements. This process requires a master calibration file provided by Medusa company.

The computed parameters produced by the Sgr processor are listed in the About dialog box displayed when selecting “About SgrProc...” from the context menu.

K	Concentration of K [Bq/kg]
U	Concentration of U [Bq/kg]
Th	Concentration of Th [Bq/kg]
K-Error	Concentration Error of K [Bq/kg]
U-Error	Concentration Error of U [Bq/kg]
Th-Error	Concentration Error of Th [Bq/kg]
A1	Spectrum Stabilization factor
Chi2	Spectrum Fitting Chi2
StabSpectrum	Energy Stabilized Spectrum



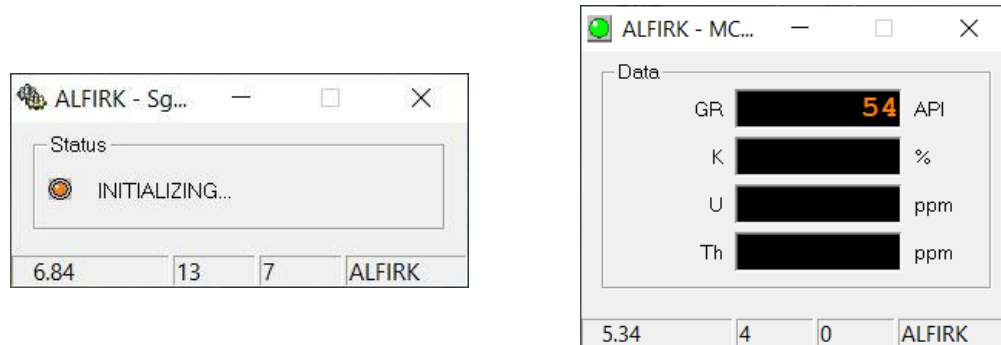
**Figure 4-11** SgrProc About dialog

The values of the computed parameters can be expressed in other units. This can be done by using the MChNum calibration pages. The following are the conversion factors (CalA) from Bq/kg to % and ppm

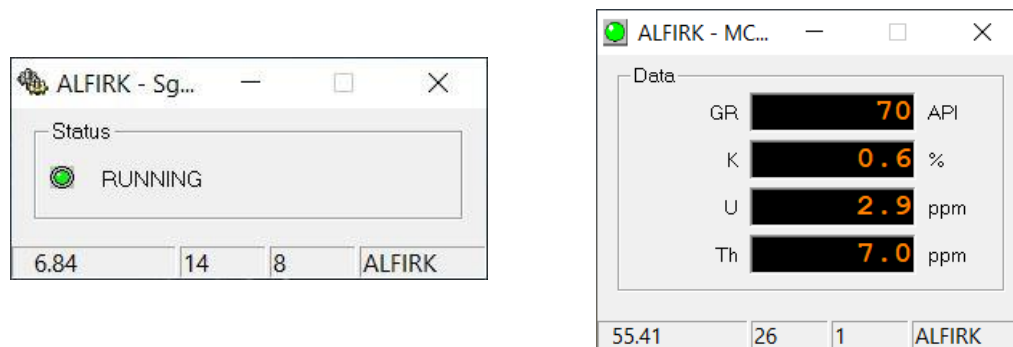
1 % K	= 315.99 Bq/kg K <sup>40</sup>	1 Bq/kg K <sup>40</sup>	= 0.0031645 %K
1 ppm U	= 12.35 Bq/kg U <sup>238</sup>	1 Bq/kg U <sup>238</sup>	= 0.081 %U
1 ppm Th	= 4.06 Bq/kg Th <sup>232</sup>	1 Bq/kg Th <sup>232</sup>	= 0.2457 % Th

### How to log :

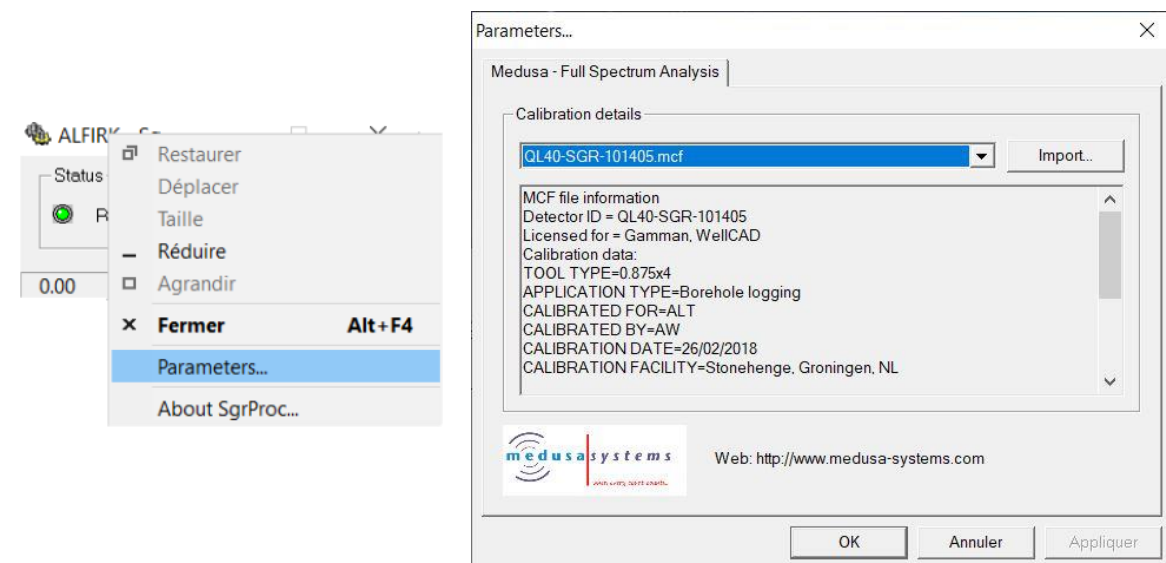
The processor should collect a certain number of spectra to initialize the stabilization process. During this period of time, no outputs are produced and the MChNum numerical displays corresponding to the nuclide concentrations remain black.



When this phase is completed, the real-time stabilization process is running and the concentration of the nuclides are computed and displayed in the MChNum browser.

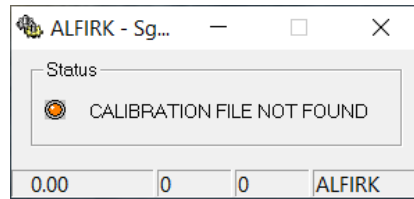


The calibration file details can be accessed from the “Parameters” entry of the menu displayed when right-clicking on the window title.

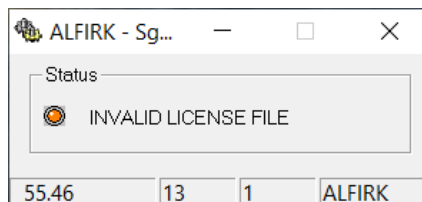


It is possible from this window to select another calibration file or to import a new one. Calibrations files are stored in *C:\Logger\Tools\Calibrations* folder and are displayed in the list.

When the calibration file indicated in the sub file is not found, the “CALIBRATION FILE NOT FOUND” message is displayed. Select the right calibration file from the “Parameters” dialog box. If a calibration file is not provided, the system still collects the spectra from the tool but does not apply any process to them.



The calibration should be tagged to be used with LoggerSuite or WellCAD. If not, the “INVALID LICENSE FILE” message is displayed.



The system still collects the spectra from the tool but does not apply any process to them.

### 4.6.3 SgrSpectra Browser

The SgrSpectra browser displays the instant spectrum acquired by the tool as well as the stacked spectra generated by the tool or by the browser itself (Settings menu entry). Windows and their related count rates, isotopes, ... can be displayed by choosing the corresponding options in the menu.

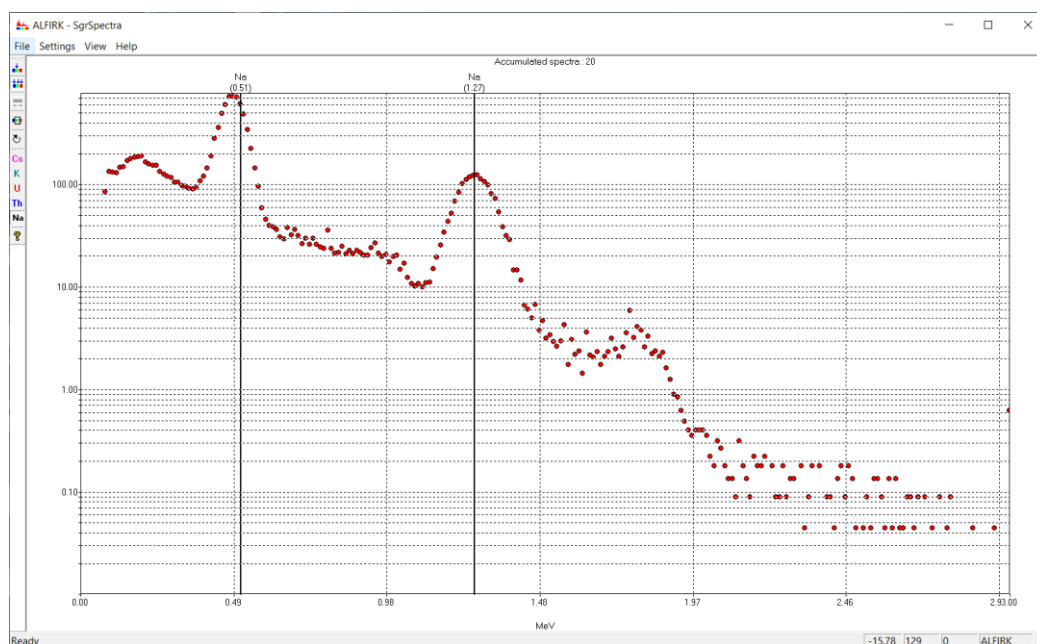







Figure 4-12 SgrSpectra browser

	Show / hide the current spectrum
	Show / hide the stacked spectrum
	Show / hide the energy stabilized spectrum (if available) – see figure below
	Show / hide windows
<b>Cs</b>	Show / hide the Cs energy peaks
<b>K</b>	Show / hide the K energy peaks
<b>U</b>	Show / hide the U energy peaks
<b>Th</b>	Show / hide the Th energy peaks
	Display the About dialog box

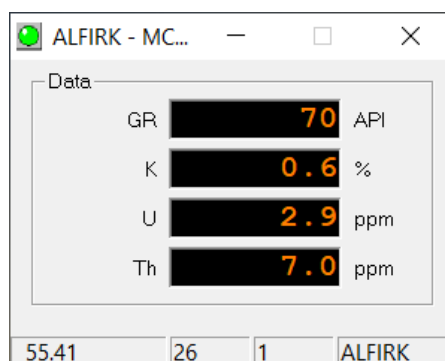
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**Note :** the “Stabilized Spectrum” button remains disabled until the processor has acquired enough spectra to stabilize the spectra.

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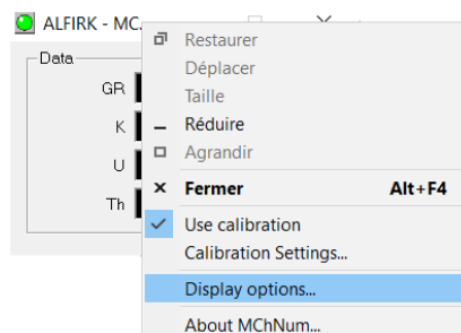
#### 4.6.4 MChNum Browser

The MChNum browser is used to display the numerical values of the channels. The list of channels that can be displayed depends on the process running with SgrProc.



**Figure 4-13** MChNum Browser during operation

Additional channels can be displayed by right-clicking on the window title and selecting “Display options...” from the context menu.



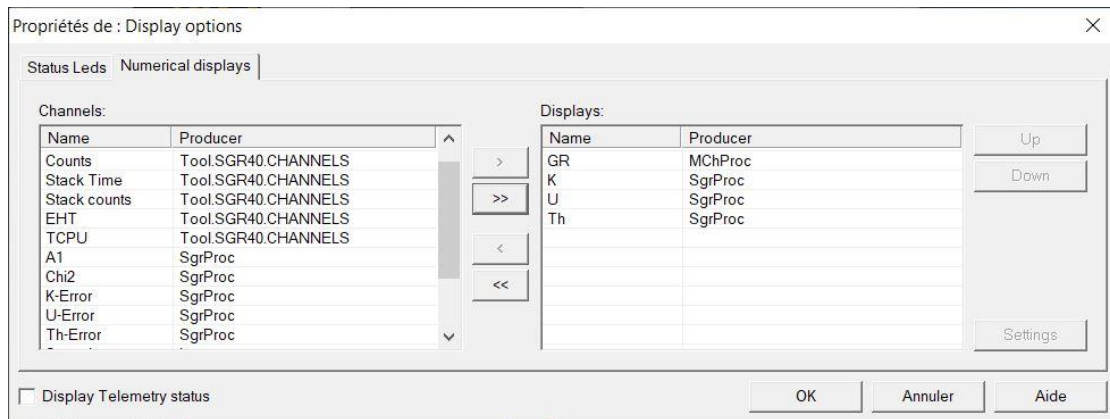


Figure 4-14 Display options

#### 4.6.5 MChCurve Browser

The MChCurve browser displays the recorded parameters by means of curves in real time (Figure 4-15).

The user is allowed to modify the curve presentation by double clicking on the log title (colours, column position, scale, filter, gridding,...)

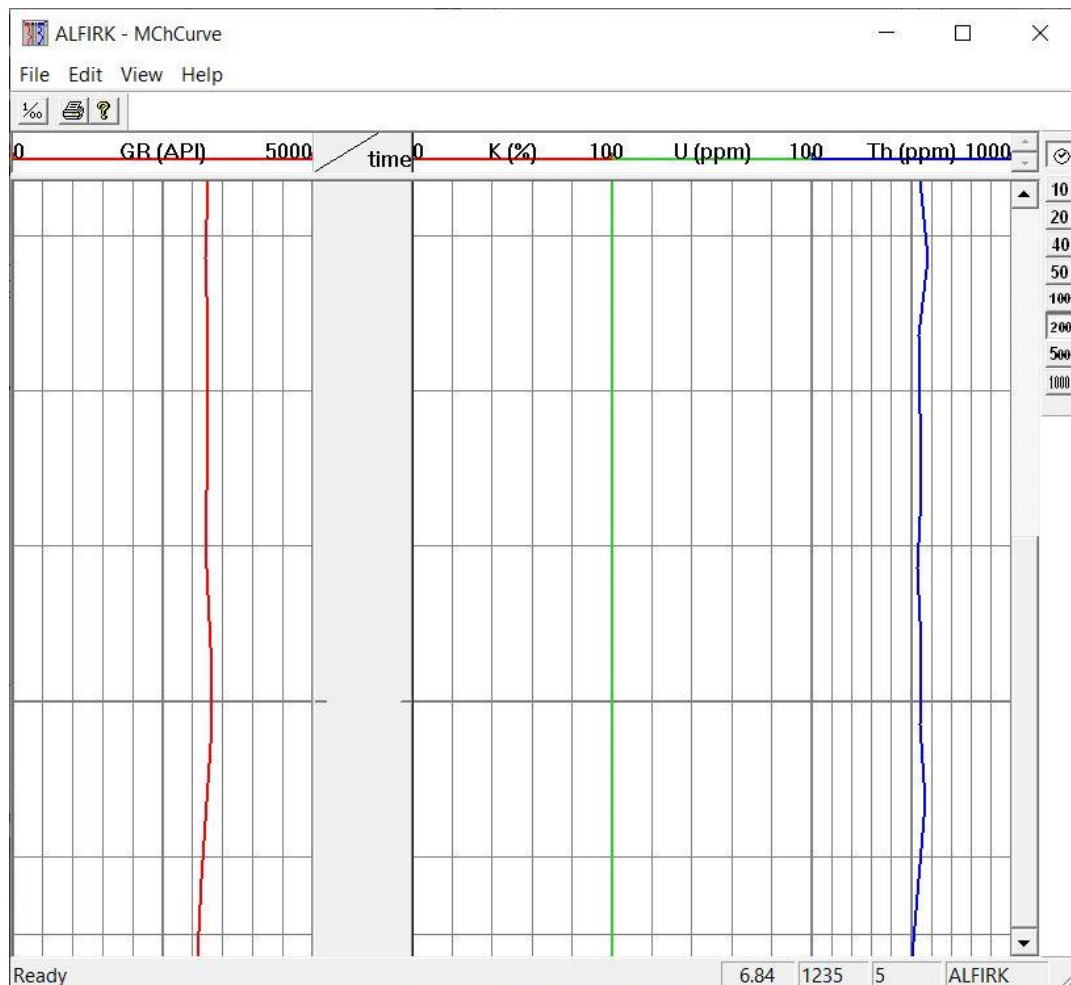


Figure 4-15 QL40 SGR-2G MChCurve Browser Window

## 5 Performance Check & Calibration

Calibrations are performed at the factory and require a basic knowledge and understanding of the tool. Performance checks for the gamma measurement can be made on the surface before logging. With the tool powered on and viewing data on the computer screen a small source of natural gamma radiation can be placed in close proximity to the detector area about 21 cm above the bottom of the probe. An increase in gamma counts will then be observed in the MChNum and MChCurve window if the tool is working properly.

### Prepare to Calibrate:

1. Assemble the tool sub(s) and connect to the wireline.
2. In the **Tool Panel**:  
Select the proper tool/stack;  
Turn tool power **On**;
3. In the **Acquisition Panel** select **Time** and turn it **On**.
4. Click the Green LED at the top left corner of the MChNum Browser window or right click the top pane to display the MChNum context menu (Figure 5-1).
5. Select **Calibration Settings**.

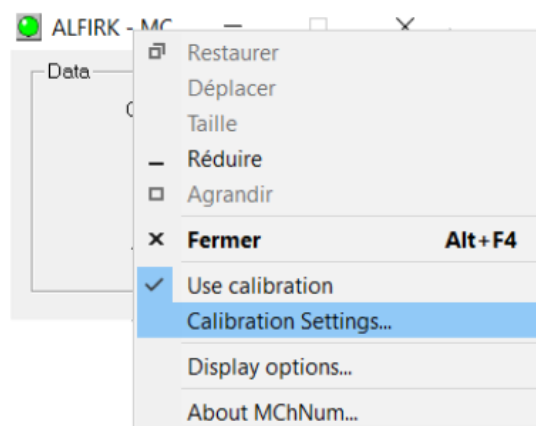
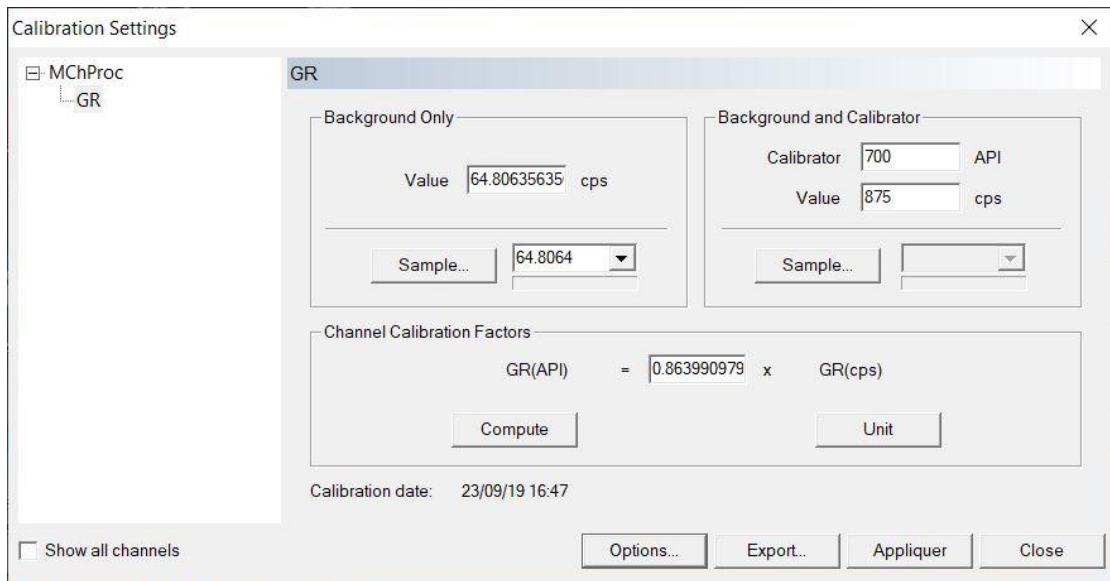


Figure 5-1 MChNum context menu

### Calibration Settings

1. In order to measure the background radiation, place the tool away from any radioactive material at least 1.5m above the ground or, if available, place the tool in a water tank.
2. In the **Tool Panel**:  
Select the proper tool/stack;  
Turn tool power **On**;
3. In the **Calibration Settings** dialog box (Figure 5-2) click on **Sample** in the **Background Only** section and wait until an average value has been determined. The corresponding **Value** will be updated automatically. (The number of samples taken can be changed under **Options**.)



**Figure 5-2** Calibration Settings dialog box

4. Place the calibrator on top of the sensor or lower the tool into the test pit.
5. Enter the known source strength into the **Calibrator** edit box. If necessary change the units by clicking on the **Unit** button.
6. Click on **Sample** in the **Background and Calibrator** section to determine an average value. The corresponding **Value** will be updated automatically. Click on **Compute** in order to compute the calibration factor.
7. **Store** the new calibration settings in the sub file by clicking on the corresponding button.

On the **Browsers & processors** panel click **Close All** then **Start All** to refresh the other Browsers and Processors. This must be done as they only read the calibration constants from the sub file once when they start.

---

## 6 Maintenance

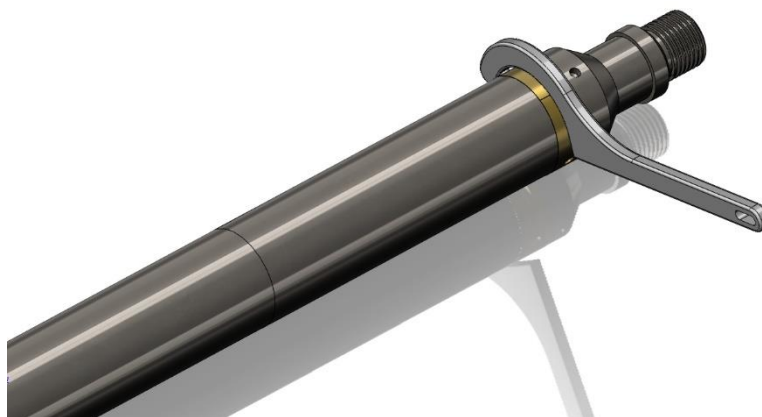
### 6.1 General Tool Maintenance

The QL40-SGR tool should require no maintenance other than a few salient points.

- Keep the probe and the tool top/bottom connectors clean.
- When the probe is transported, it needs to be contained in a vibration damped container to minimize stress on the sensors.

### 6.2 Tool Top Adapter

The tool top adapter provides the connection between wireline cable head and chassis electronics and can be provided to suit 7 conductors, 4 conductors, mono or special wireline configurations. The adapter is fixed by the means of a threaded ring screwed in the pressure housing. To remove the tool top adapter, use the correct C spanners provided with the tool - see picture below (Figure 6-1).



**Figure 6-1** Removing the tool top

The wireline cable head socket and tool top adapter connector pins should be checked for cleanliness before each use of the tool. The pin inserts, whether 4 or 7 pin, have a locating mark indicating WL1 or A that should line up with the slot mating with the cable head.

Check O-Ring seals and apply silicon grease before re-assembly. Silicon grease of a similar type to RS Components Ref 494-124 is suitable for this and other O-Ring seals.

**(Rem: O-Ring reference for tool top and for the quick link 40 is AS215 26,57 x 3,53 Viton Shore 75)**

## 6.2.1 Locking Ring assembly Maintenance

### **Tools required:**

1.5mm Allen wrench  
2 ea 40-42mm spanner wrench  
Clean rags

### **Replacement Parts:**

ALT26005, Large Threaded Ring, Qty 2  
28-174-995 M2x8 SHCS, Qty 2

### **Disassembly:**

Unscrew and remove the two M2x8 socket head cap screws and separate the two halves.

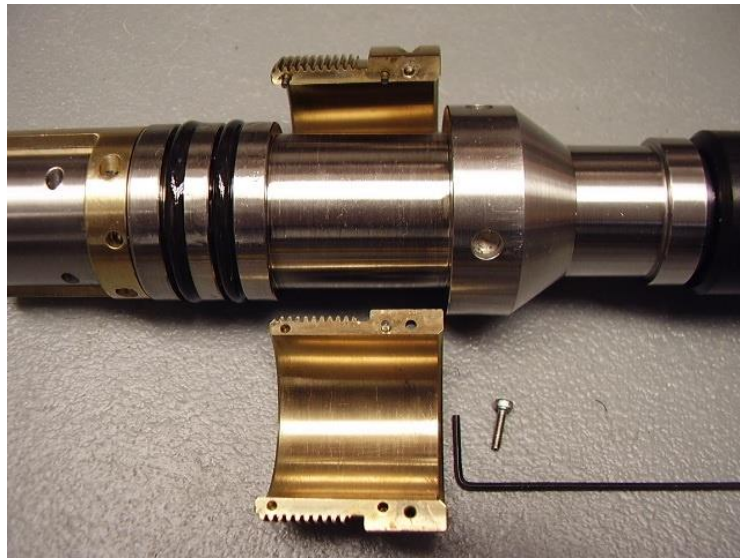
Four guide pins align the two ring halves and tend to hold them together after the screws are removed. To pry the halves apart you can use a pair of spanner wrenches inserted into the wrench holes on opposite sides of the ring mating surfaces to pull them apart slightly.

Do this carefully to prevent bending the guide pins.



**Figure 6-2** Disassembly of the locking ring –step 1

Place something small in the opening and move the spanners to the other side and pry it open slightly. This should be enough to release the two rings as below.



**Figure 6-3** *Disassembly of the locking ring –step 2*

Clean inside surfaces thoroughly and reassemble, coating the inside with a very light film of anti-seize compound. Nickel based compounds are best, to prevent any sticking between the brass and steel surfaces.



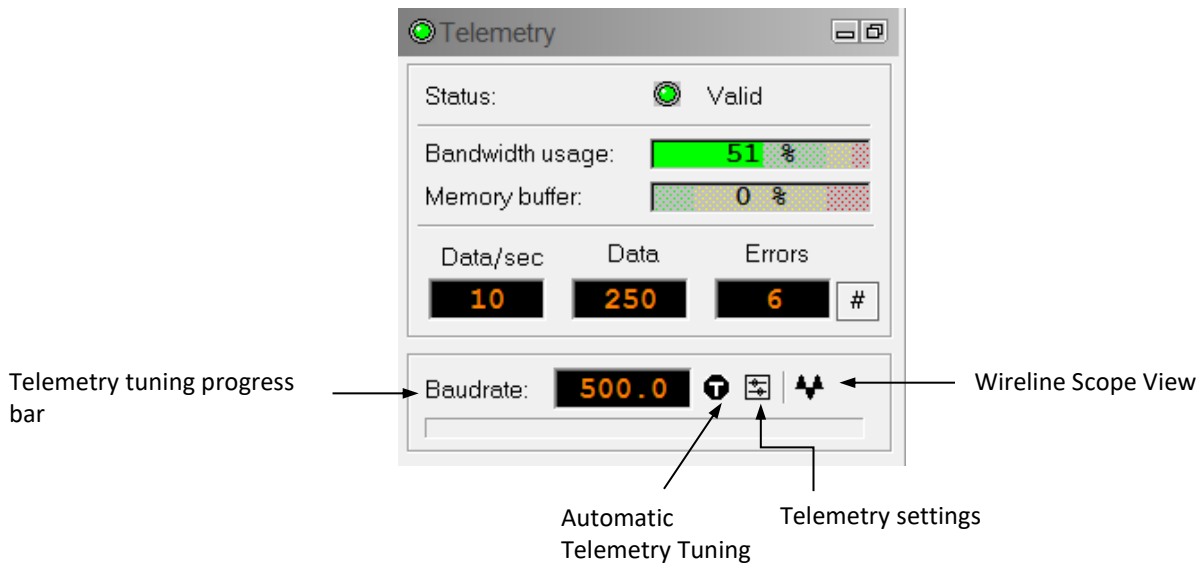
## 7 Troubleshooting

Observation	To Do
<i>Tool not listed in Tool panel drop down list.</i>	<ul style="list-style-type: none"> <li>- Do you have a tool configuration file?</li> <li>- Has the configuration file been imported using the Logger Settings application (refer to the corresponding manual )?</li> <li>- Did you configure a stack for your tool (at least top, tool body and bottom plug)?</li> </ul>
<i>Tool configuration error message when powering on the tool.</i>	<ul style="list-style-type: none"> <li>- Check all connections.</li> <li>- Adjust the telemetry settings for your wireline configuration (see chapter 4.2 or 4.3) and store the new settings as default. Apply the appropriate tool settings for your logging run (see chapter 4.5).</li> </ul>
<i>Tool panel - No current.</i>	<ul style="list-style-type: none"> <li>- Verify that the wireline armour is connected to the logging system. Test your interface cable between winch and data acquisition system.</li> <li>- Verify cable head integrity.</li> <li>- Verify voltage output at the cable head (it should be 120V).</li> </ul>
<i>Tool panel - Too much current (red area).</i>	<p><b>! Immediately switch off the tool !</b></p> <ul style="list-style-type: none"> <li>- Possible shortcut (voltage down, current up): Check for water ingress and cable head integrity - wireline continuity.</li> <li>- Verify the interface cable between winch slip ring and data acquisition system is not loose at the connectors. Check for possible source of a shortcut.</li> <li>- If the above shows no issues, use test cable provided by ALT to verify tool functionality.</li> <li>- If the problem still occurs, please contact service centre.</li> </ul>
<i>Telemetry panel - status shows red.</i>	<ul style="list-style-type: none"> <li>- Verify the telemetry settings for your wireline configuration (see chapter 4.2 or 4.3).</li> <li>- If problem cannot be resolved contact support@alt.lu .</li> </ul>
<i>Telemetry panel - memory buffer shows 100%.</i>	<ul style="list-style-type: none"> <li>- Indicates that the systems internal memory buffer is full. PC can't receive incoming data streams fast enough. Ensure your PC has enough resources available.</li> </ul>
<i>Telemetry panel – bandwidth usage shows 100%. (Ovrrun error message.)</i>	<ul style="list-style-type: none"> <li>- Set the baudrate to highest value allowed by your wireline configuration.</li> <li>- Reduce logging speed, decrease azimuthal resolution and/or increase vertical sample step.</li> </ul>
<i>Telemetry panel - large number of errors.</i>	<ul style="list-style-type: none"> <li>- Verify the telemetry settings for your wireline configuration (see chapter 4.2 or 4.3).</li> <li>- Check bandwidth usage and telemetry error status.</li> </ul>

## 8 Appendix

### 8.1 Tool Communication with OPAL/SCOUT


The telemetry provided through the OPAL-SCOUT systems implementing the ALT MODEM adapter is self-tuning. In case communication status is not valid the user has different options to adjust manually the telemetry settings from the telemetry panel of the dashboard:



#### **Baud rate:**

Indicates the default baud rate or optimal baud rate in kbps found by the system for the selected winch/telemetry scheme

#### **Automatic Telemetry Tuning:**

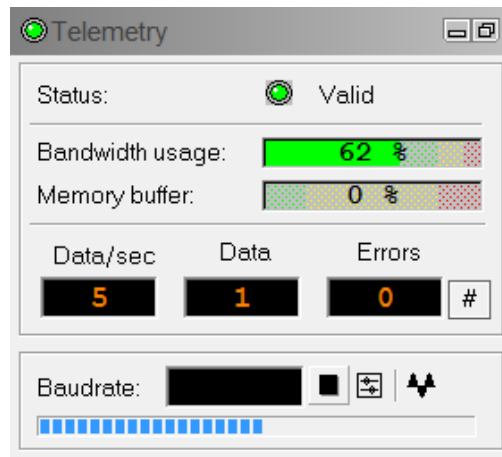
The Tune button  resets the telemetry tuning automatically. This process defines:

- the optimum baud rate for the winch configuration selected
- a transfer function and a filter to re-construct at the surface the shape of the pulse trains distorted by the wireline.<sup>4</sup> Refer to the **Equalizer** paragraph for more details.


The Automatic Tuning is very useful on wireline over 1000m length to optimize the telemetry performance and logging speed.

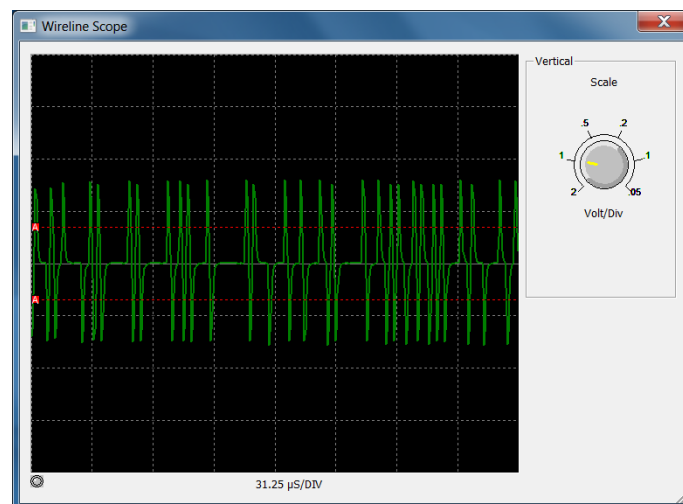
A **progress bar** at the bottom of the telemetry window shows the progression of the telemetry tuning. At the end of the process the baud rate display is refreshed with the optimal baud rate value.

<sup>4</sup> The transfer function and filter concept are only valid for tools implementing the latest generation of ALT MODEM telemetry board (i.e. QL40-ABI2G, ABI-GR-2G, QL40-OBI2G, OBI-GR-2G, QL43-ABI2G,...)



### Scope:

Pressing the scope button  on the **Telemetry Panel** brings up a **Wireline Scope** view (Figure x), which displays the pulse strings transmitted through the wireline and received by the system at the surface.



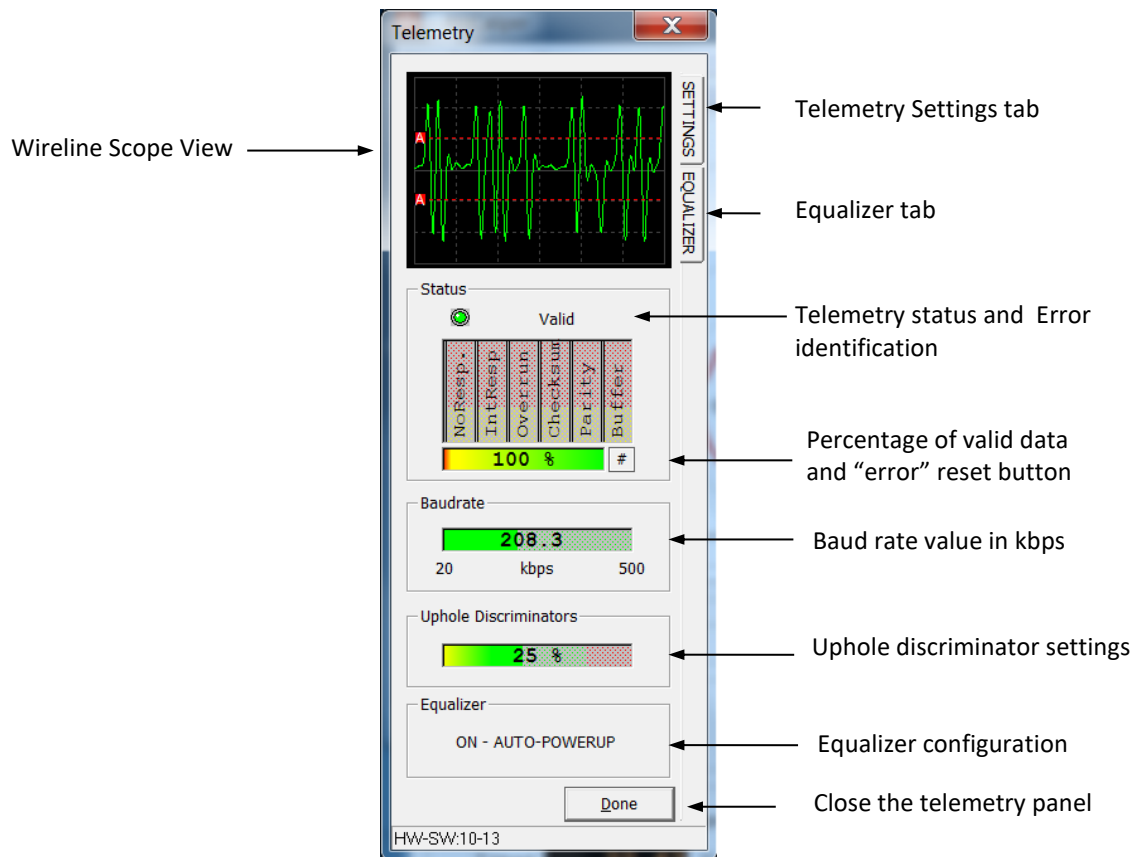
The two red-dashed horizontal lines help to visualize the position of the discriminator levels set for detecting the pulses at the surface. Discriminator levels can be tuned in the **Telemetry Settings** dialog – refer to section 3.6.1 for more information.

The Scale knob can be adjusted to show more or less vertical details. This view has no effect on the communications and is a visual aid only.

### Telemetry Settings:

The Telemetry Settings button  opens a **Telemetry** control panel summarizing the telemetry status and configuration.

If the system cannot establish a stable communication with the tool, the **Settings and Equalizer tabs** allow the user to modify the telemetry settings and to apply a telemetry filter (Equalizer option)



### ***Adjusting the Telemetry Settings:***

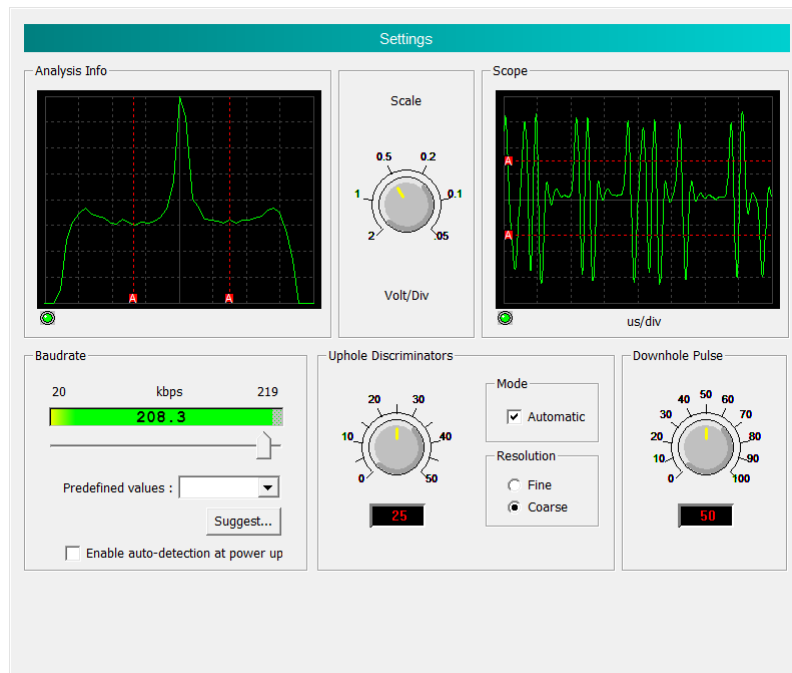
By default the telemetry settings are set to Automatic mode and should stay in this configuration. When more advanced tuning is required (i.e. long wirelines having a limited bandwidth) the manual mode can be activated.

In Automatic mode the uphole discriminators are set automatically to detect the pulse strings.

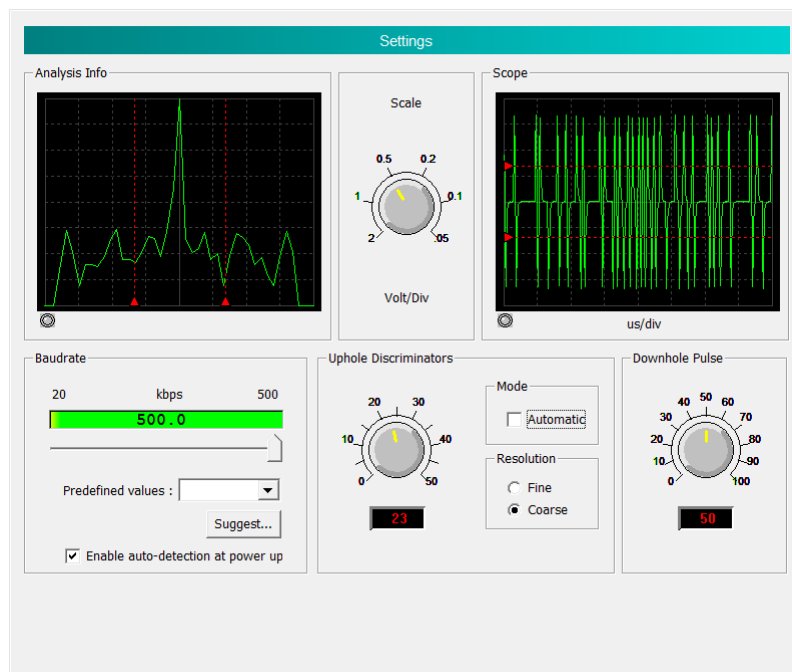
The position of the discriminator levels are visible on the Scope and Analysis views and are represented by two red dashed lines – one for the positive pulses and the other for the negative pulses.

The “A” letter on the red square means that the discriminators are set in automatic mode. The **Scale knob** controls the scale for the Analysis and Scope displays.

*Position of the discriminator lines should be set as illustrated below.*



When the automatic mode is unchecked user has the option to adjust manually the uphole discriminators using either the discriminator knob or by moving interactively the red dashed lines in the Analysis and Scope displays. The red triangles located at the extremities of the red dashed lines refer to manual mode. For fine tuning of the discriminators the **Fine resolution** can be chosen.



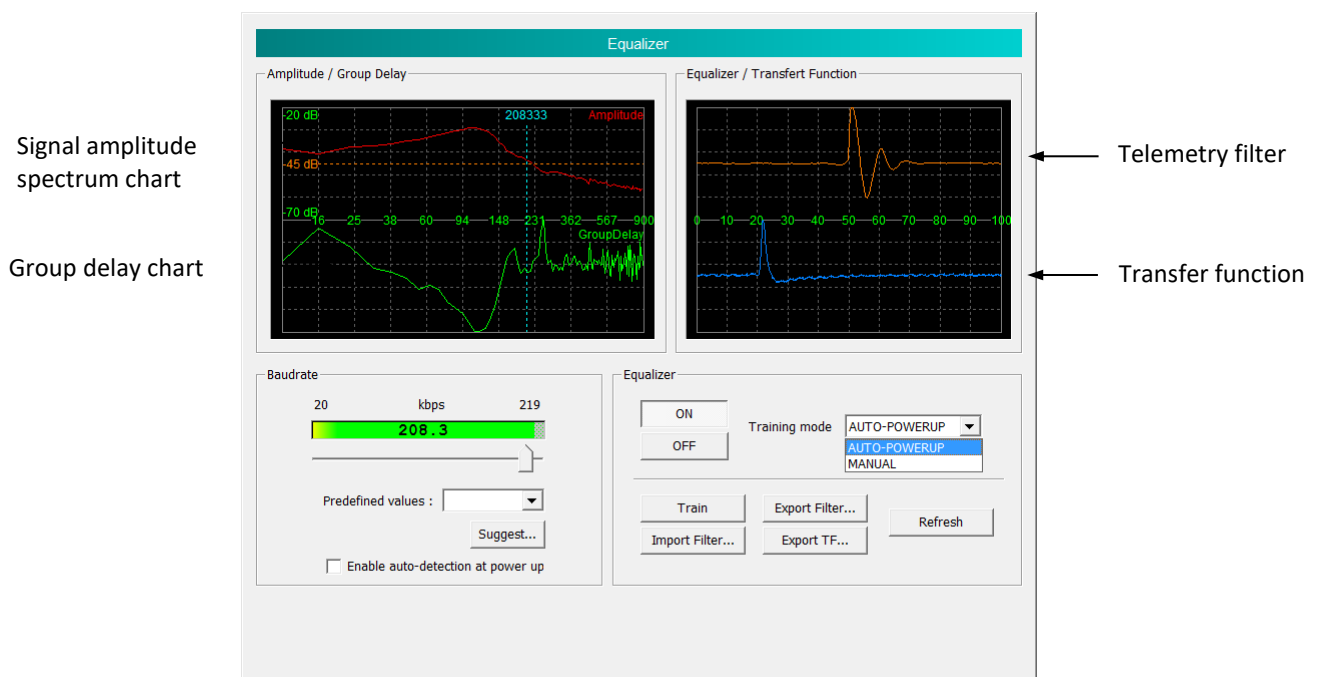
The **Downhole Pulse knob** controls the width of the pulse commands sent to the tool. It is set on 50 as a default value. This value is the preferred one and is suitable for a wide range of wirelines. For long wireline increasing the pulse width could help to stabilize the communication. The reverse for short wireline.

The **Baudrate** is generally set to the maximum value for which the communication status stays valid in order to optimize the logging speed for the wireline configuration. The baudrate can be adjusted by moving the cursor below the baudrate bar meter or by selecting a predefined baudrate value from the select box.

When clicking the **Suggest** button the system is searching for the optimum baudrate value and keeps this value for the data transmission.

The **Enable auto-detection at power-up** configures the system such a way that the baudrate is reset to its optimum value each time a tool is powered up.

### Applying the Equalizer



The **Equalizer** dialog provides some advanced telemetry settings described hereafter.

- The **Train** button computes the transfer function of a wireline - refer to the blue signal. When clicking on Train the tool sends a pilot pulse frame to the surface. The received signal at the surface is compared with the original pilot pulse frame to measure the distortion of the signal through the wireline. The result of this process is the definition of a transfer function specific to the wireline used.

A filter is then derived from the transfer function - refer to the orange signal. The filter will be applied on the telemetry signal to counteract the distortion of the pulse strings through the wireline.

**Applying the filter will thus improve the telemetry performance of the system and logging speed on wirelines with unfavorable band width.**

- The **Equalizer ON/OFF** buttons enables or disables the filter. The activation of the equalizer can be configured to **MANUAL** mode or to **AUTO-POWERUP**.

The AUTO-POWERUP feature applies the telemetry filter upon tool power-up.

- The **Export TF** option exports the **Transfer Function** defined by the wireline training process in a ASCII file format
- The **Export Filter** option exports the **Filter** derived from the transfer function in a ASCII format
- The **Import Filter** option loads a saved filter configuration
- The **refresh** button is refreshing the Equalizer/transfer function display

The **Amplitude/Group Delay** charts are mostly used by ALT developers for telemetry signal and performance analysis.

The Equalizer dialog repeats the **Baudrate** settings already discussed in the previous paragraph "Adjusting telemetry settings".

## 8.2 Parts list

### 8.2.1 Spare parts

Item No.	Qty	Part No.	Description
1	1	1673840	Molykote 111 compound
2	2	55459	DIN1810B 40-42 Hook wrench w.pin
3	6	AS215-V-75	O-ring Viton 51414 26.57X3.53 -75°
4	1	L0034-086	Grease Lubriplate

### 8.2.2 Other parts

Item No.	Part No.	Description
1	QL40GO1	QL40-GO1 tool top
2	QL40GO4	QL40-GO4 tool top
3	QL40GO7	QL40-GO7 tool top
4	QL40MS1	QL40-MSI tool top
5	QL40BOT	QL40 bottom plug

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## Index

ALT Logger, 12  
**Baudrate**, 12  
bottom sub, 7  
Diameter, 3  
Dimensions, 2  
discriminators, 13  
**Downhole Pulse width**, 13  
General Information, 1  
Length, 3  
Maintenance, 23  
MATRIX, 13  
Max. Temp, 3  
Max.Pressure, 3  
MChCurve Browser Window, 20  
Measurement point, 3  
Measurement Principle, 6  
mid sub, 7  
Operating Procedure, 11  
Parts list, 33  
Performance Check & Calibration, 21  
**QL**, 7  
QL tool, 7  
Quick Start, 11  
Recorded Parameters and Browsers, 15  
stack assembly, 7  
Technical Specification, 3  
Telemetry, 12, 13  
Tool Communication with ALT Logger, 12  
Tool Communication with MATRIX, 13  
Tool Head Adapter, 23  
Tool Maintenance, 23  
Trouble Shooting, 27  
Weight, 3