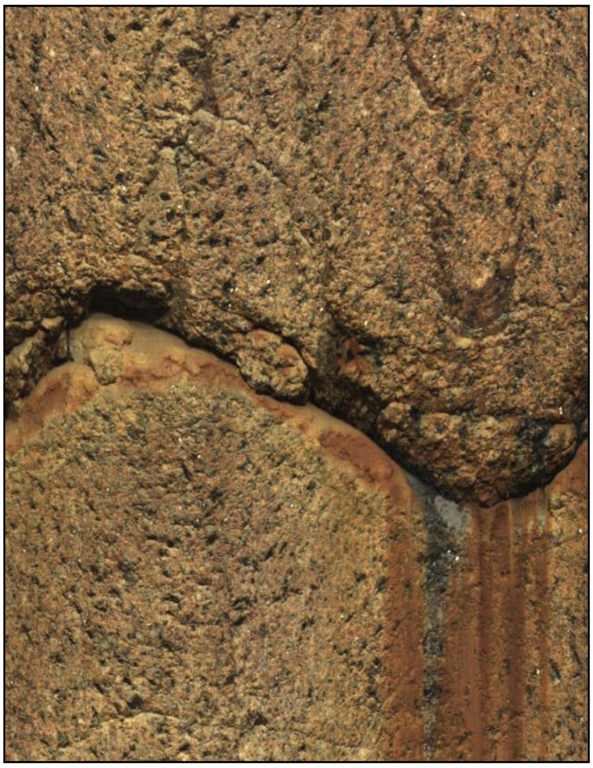


User Guide

QL40 OBI-2G Optical Borehole Imager

MOUNT SOPRIS INSTRUMENTS

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1 General Information

The QL40 OBI-2G is the new generation of slimhole Optical Borehole Imager. The new system consists of a completely redesigned optical assembly and electronics. It implements a high resolution CMOS digital image sensor combined with a fisheye lens. The tool produces an extraordinarily clear, sharp, 360° continuous - unwrapped digital picture of the borehole wall, either in air or clear water. Resolutions up to 1800 pixels over the borehole circumference can be achieved making it ideal for lithological, mineralogical and structural analyses.

A built in high precision orientation sensor incorporating a 3-axis fluxgate magnetometer and 3 accelerometers allows orientation of the images to a global reference and determination of the borehole’s azimuth and inclination.

The QL40 OBI-2G is supplied as a bottom sub of the Quick Link (QL) product line and it can either be combined with other QL40 tools to form a tool string or be run as a standalone tool.

Applications:

- *Detailed and oriented structural information*
- *Reference for core orientation*
- *Fracture detection and evaluation*
- *Breakout analysis*
- *Detection of thin beds*
- *Determination of bedding dip*
- *Lithology and mineralogical characterization*
- *Casing inspection*

Measurement features:

- *360° RGB true colors oriented image*
- *Borehole azimuth and tilt*
- *Relative bearing*
- *3 accelerometer calibrated components*
- *3 magnetometer calibrated components*
- *Temperature of CMOS image sensor*

Operating conditions:

- *Dry or clear water filled borehole*
- *Centralizers required*
- *Borehole diameter range: 2 ½" to 21"*
- *Logging speed:* function of image resolution and wireline electrical properties

  i.e: 6 m/min with 900 pixels azimuthal resolution, 2 mm vertical sampling rate @ 100 Kbps

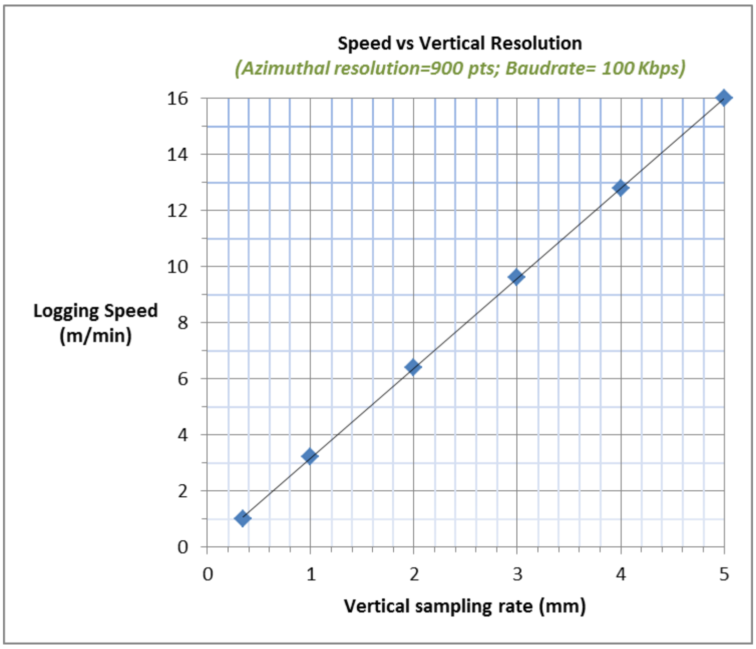


Figure 1-1-1 *Logging Speed vs Vertical Sampling Rate (900 pxls-100 Kbps)*

1.1 Dimensions

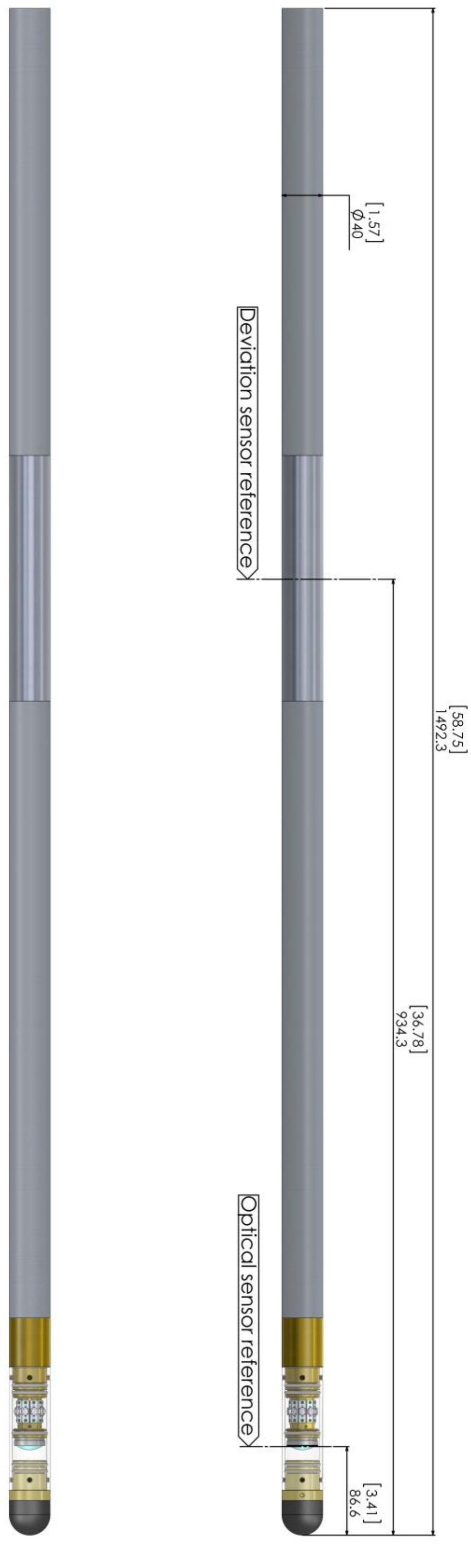


Figure 1-1 *QL40 OBI-2G overview*

1.2 Technical Specifications

Diameter:	40 mm (1.6”)
Length:	1.49 m (58.7”)
Weight:	5.3 kg (11.7 lbs)
Max. Temperature:	70°C (158°F)
Max. pressure:	200 bar (2900 PSI)

Optical system

Sensor:	1/3” high sensitivity CMOS digital image sensor
Color resolution :	24 bits RGB true colors
Responsivity :	5.48v/lux-sec
Azimuthal resolutions :	120, 180, 360, 600,900, 1800 points
Vertical resolution :	User defined. Function of depth encoder resolution

Light source

Light source:	High efficiency LEDs
Color temperature:	5000 K
Light intensity:	750 lm
Color rendering index:	90 CRI
Power max.:	5.60 W

Compatibility

Wirelines:	Multi conductor, mono or coaxial
Acquisition systems:	ALTLogger, BBOX and Matrix
Min. software configuration:	LoggerSuite 11.2 – WellCad 5.0 build 1103

Orientation sensor

Sensor:	APS544 – 3 axis magnetometer and 3 accelerometers
Azimuth accuracy:	+/- 1.2 deg
Tilt accuracy:	+/- 0.5 deg

2 Measurement Principle

The tool incorporates a 1/3-inch CMOS digital image sensor with an active pixel array of 1.2 Mp and fisheye matching optics. The digital image sensor captures the reflection of the borehole wall through the fisheye lens. The light source is provided by 10 high efficiency LEDs.
The displayed log image is derived from a single annulus extracted from the active pixel array. Azimuthal resolutions available are 120, 180, 360, 600, 900 and 1800 pixels per recorded circle. By using processed digital images in combination with deviation sensor data, the tool can generate an unwrapped 360° oriented image.

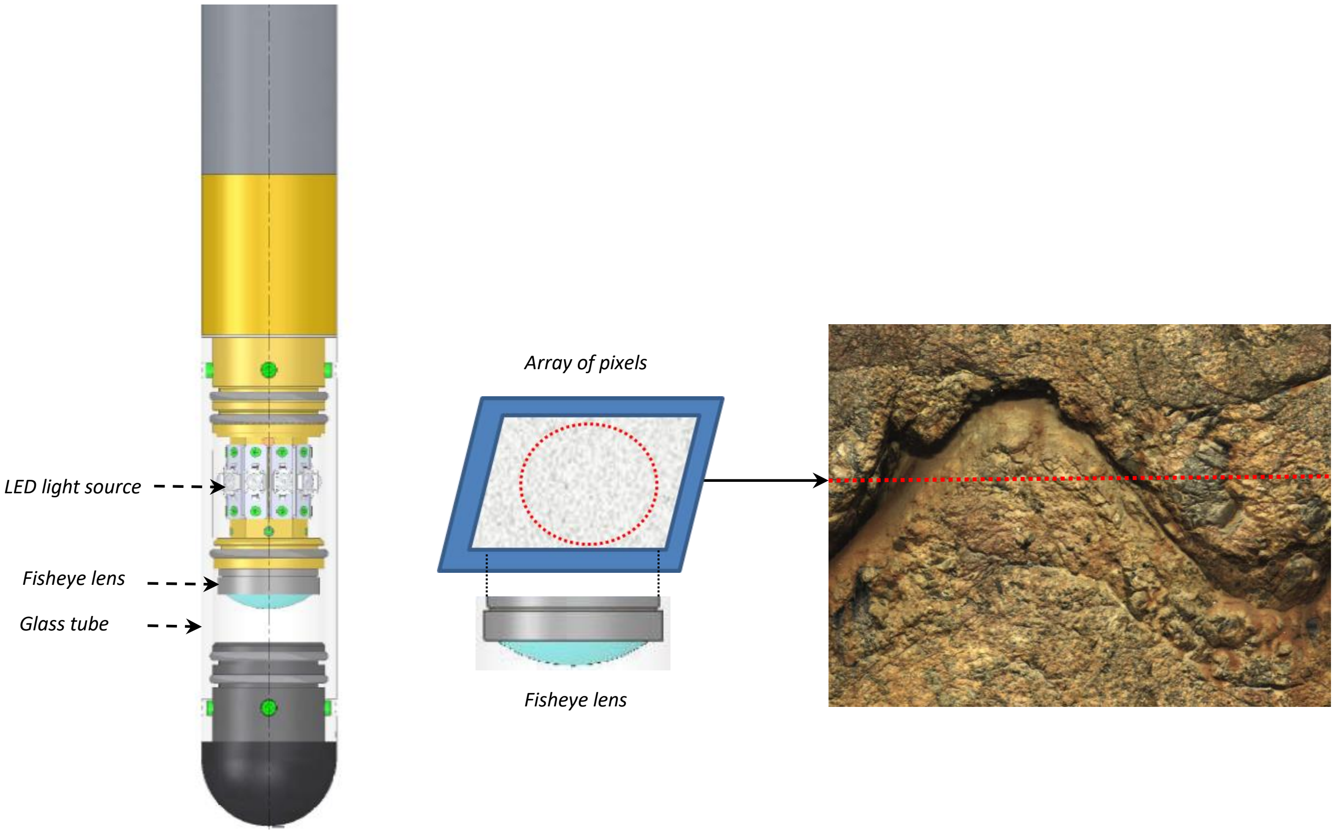


Figure 2-1 *Optical assembly and principle of measurement*

3 Notes on QL tool assembly

The following explanations are only valid for the QL40 OBI tool. OBI40 users can skip this chapter.

QL stands for **Q**uick **L**ink 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.

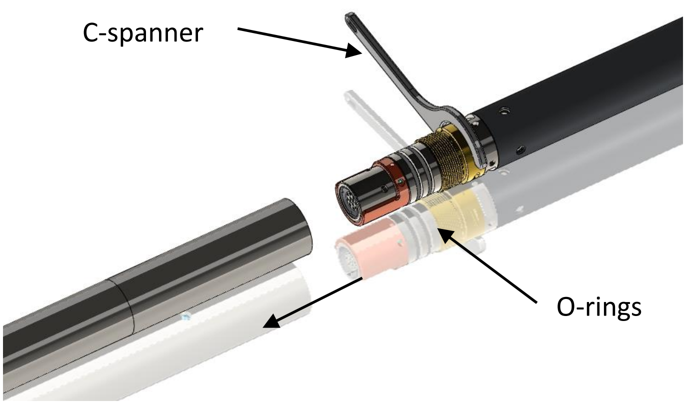


Figure 3-1 *C-spanner and O-rings of QL connection*

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

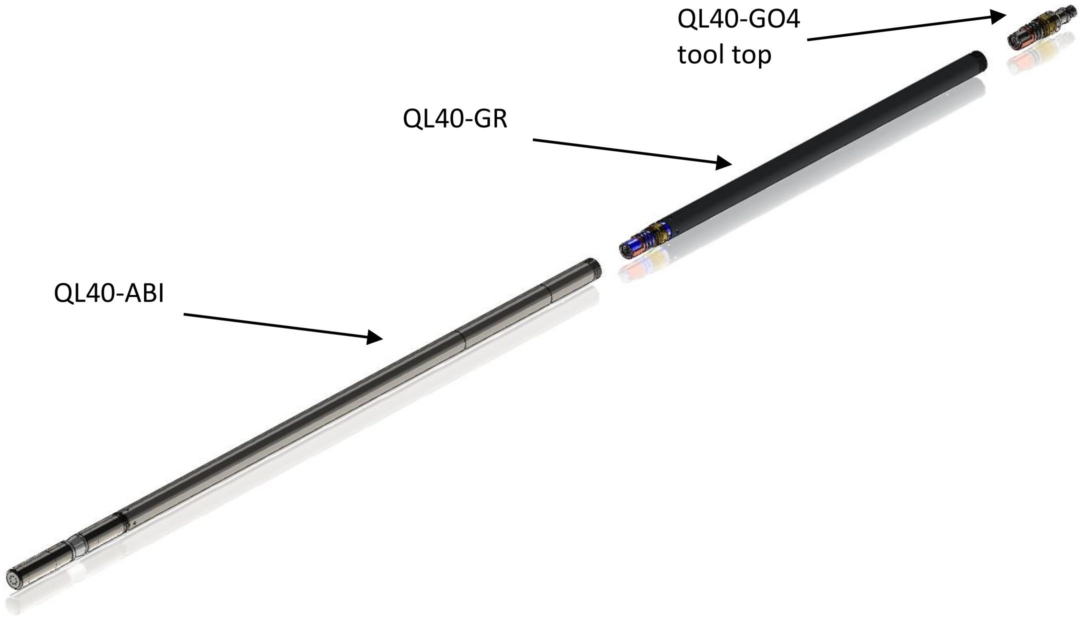


Figure 3-2 *Tool stack example*

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.

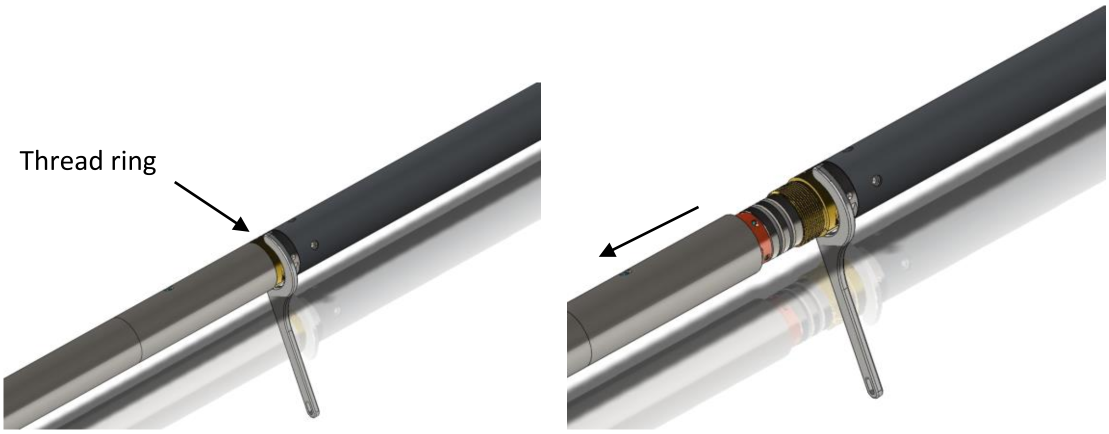


Figure 3-3 *Unscrewing the thread ring and removing the bottom sub*

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.

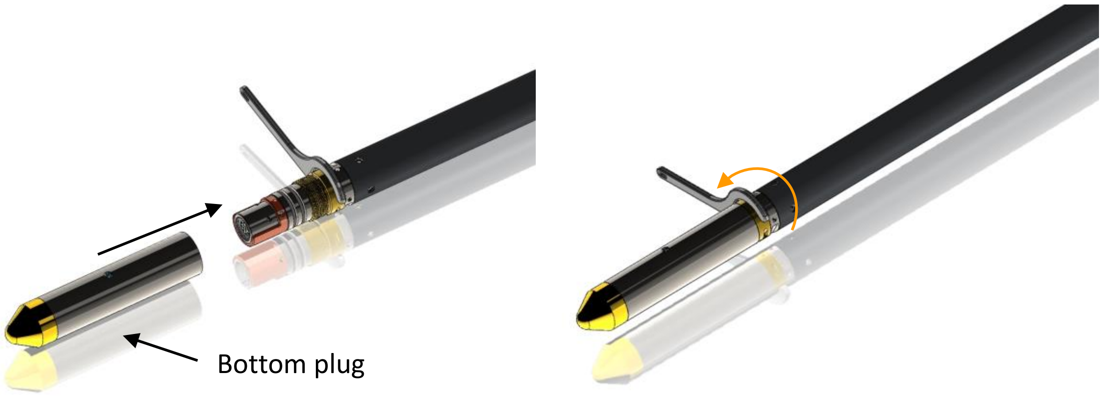


Figure 3-4 *Attaching the QL40-Plug*

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

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

4 Operating Procedure

Note: Parts of the topics discussed in these 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 OBI 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 configurations file is stored in the designated folder on your computer).

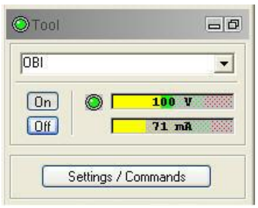


Figure 4-1 *Tool panel*

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 the tool communication as explained in section **4.2** if an 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. <u>**During logging**</u> 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.

   <u>***In the OBI40Img browser the processor "workload" and camera "frame rate" must stay below 100%***</u>

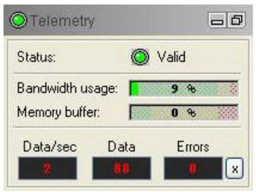


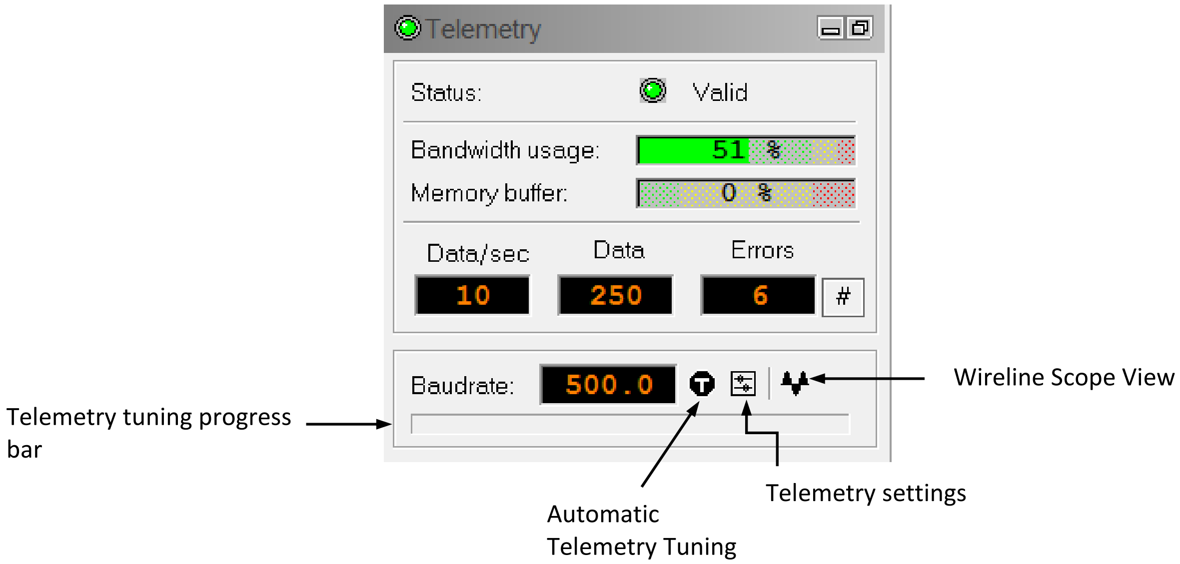
Figure 4-3 *Telemetry panel*

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.

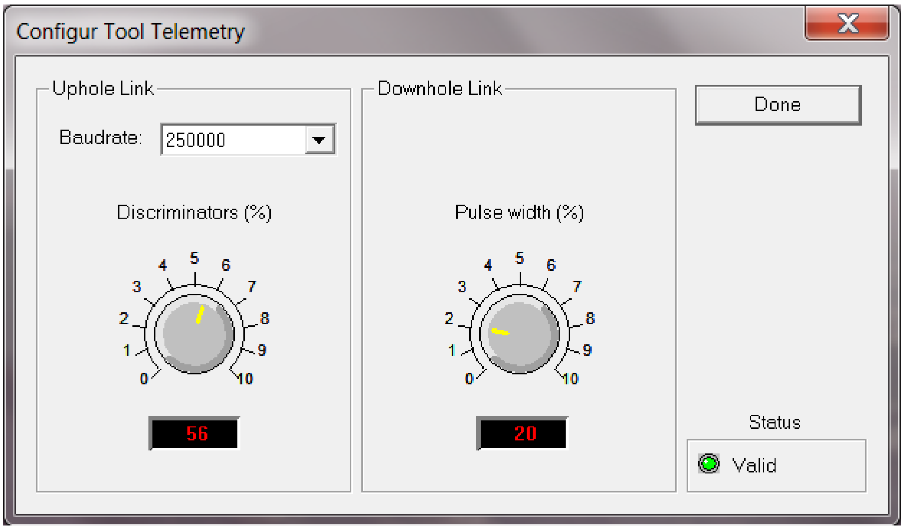


Figure 4-4 *Tool communication settings*

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 **lin**ear / **log**arithmic 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.

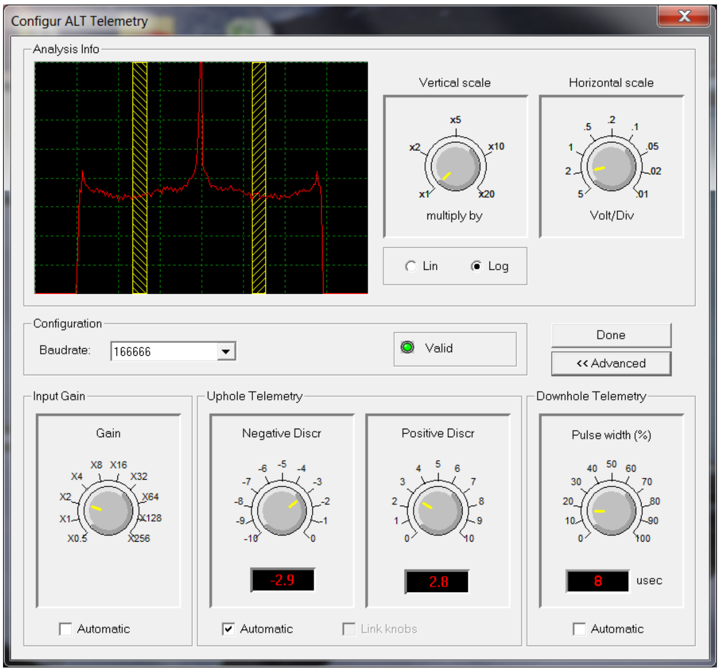


Figure 4-5 *Matrix telemetry settings*

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 Use of centralizers

Optical televiewer image quality is highly dependent upon tool centralization.
One set of centralizers is supplied with the OBI that is suitable for all tools with an external diameter of 40mm. The standard assembly comprises upper and lower mounting rings with sets of bow springs. Two C spanners are provided for tightening the locking ring. Bowsprings for other borehole diameters are available on request.
The following points relating to the use of centralizers should be considered:
The centralizers should be fitted before mating the tool with the wireline cable head and should always be fitted from the cable head end to avoid damaging the optical window. In case magnetic centralizers are used (the ALT centralizers are non magnetic) avoid mounting a centralizer over the deviation sensing point which is located in the middle of the roughened area on the pressure housing.
The "compression" ring of the centralizer, i.e. the one that is screwed tight, should always be fixed toward the **top** end of the probe. This is to avoid catching on a downhole obstruction when winching up.
Use the C spanner to fasten the fixing rings but take care not to cross thread or over tighten them as this could damage the pressure housing
(The weak point of the bowsprings is the welded bearing pin. Take care during assembly as the weld can be broken by reverse bending.)

4.6 Configuring Tool Parameters

The **Tool Parameters** dialog box for the QL40 OBI-2G is shown below (Figure 4-6). It can be accessed by clicking the **Settings / Commands** button from the **Tool Panel**. Changes and the effect of new settings on the image are displayed in real time in the **OBI image** browser.

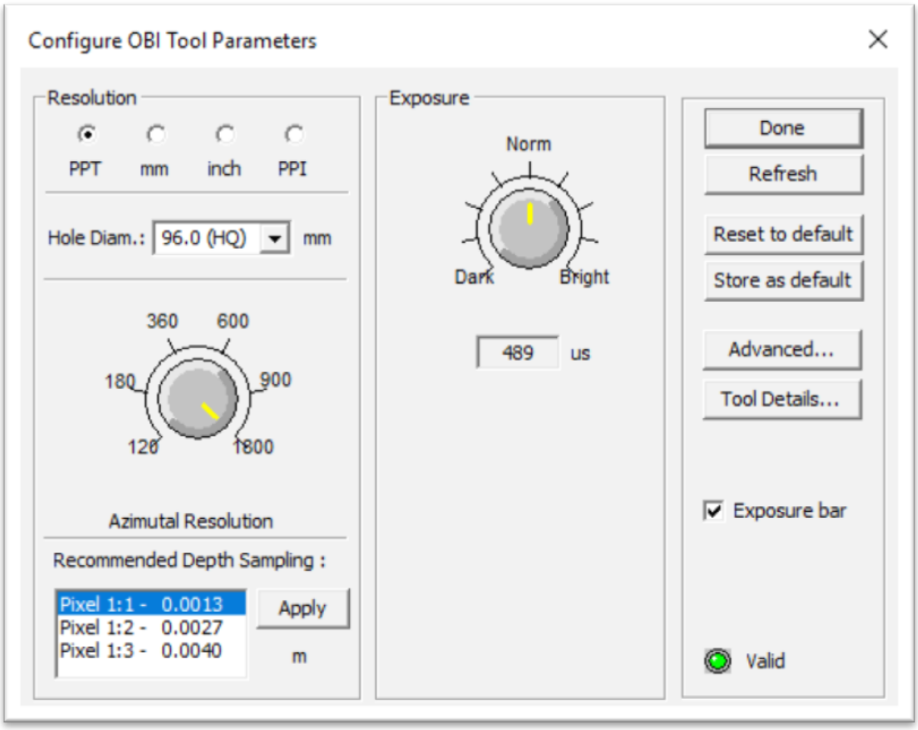


Figure 4-6 *Tool parameters dialog box*

4.6.1 Image resolution

The azimuthal resolution of the image can be defined by the operator. The choice of azimuthal resolutions is now extended to 1800 pixels over the borehole circumference.

Multiple options are possible for displaying the azimuthal resolution: points per turn (PPT), millimetres (mm), inches (inch) or points per inch (PPI).
By editing or selecting a nominal borehole diameter in the *caliper window*, the system computes automatically the azimuthal resolution values for each display options.

The system suggests in addition a *recommended vertical depth sampling rate for the selected azimuthal resolution* and offers a choice of different image ratios (ratio between horizontal and vertical resolutions). A link can be activated to apply automatically the recommended vertical sampling rate in the "*acquisition*" panel of the dashboard. Note that User is always free to edit manually the vertical depth sampling rate from the "settings" option in the "acquisition" panel of the dashboard.

Important remark:

The digital images recorded by the QL40 OBI-2G are compressed in real time to increase the transfer rate of the images to the surface acquisition system. To optimize the compression process, the tool records eight optical data frames per vertical sample. ***For***

<u>this reason, the vertical sampling value to edit must be multiplied by a factor of eight</u>. <u>I.e. in practice, if the User wants to record an image with an effective 1mm vertical depth sampling rate, a value of 8mm (8x1mm) must be manually entered in the "acquisition" window of the dashboard</u>.

4.6.2 Exposure

The "Exposure" control knob allows optimization of the exposure time set for the image sensor when capturing an image of the borehole wall under a given light level. (By default the lighting intensity is set at 100%, see Section 4.6.4). The exposure value is displayed below the knob in µsec.
Practically speaking, the exposure must be adjusted adequately for the borehole conditions: diameter, dry or water filled, rock colors.
By experience a lower exposure value is required in small diameter borehole, whitish formations and dry conditions. The reverse is applicable.

A good way to set the exposure time is to check the luminance distribution in the histogram view available with the "ObiHisto" browser (refer to chapter 4.6.3). The spectrum of the luminance should normally be centered on the luminance scale axis (Figure 4-7). A situation where the luminance spectrum is too far to the right on the luminance scale corresponds to an image saturated with light.

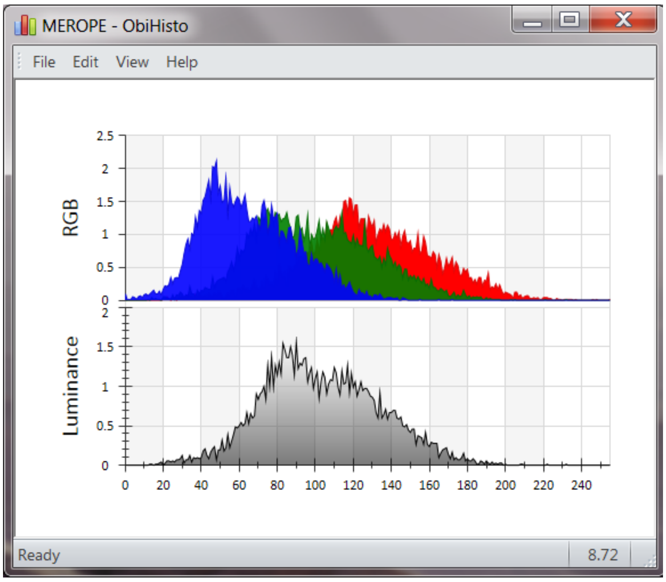


Figure 4-7 *Example of a correct luminance distribution and exposure level*

In borehole environment in which black formations are interbedded with white veins or layers it is recommended to under expose the image to avoid luminance saturation in front of the white features. The new image browser described in section 4.7.2 offers the option to re-process the image by applying a real time filtering on the raw data to enhance luminance contrast in the under exposed intervals.

By checking the "**Exposure bar**" option the "**OBI-Exposure**" box will be displayed in Logger application:

Figure 4-8 *OBI – Exposure bar*

The “OBI-Exposure” bar allows the user to adjust the camera exposure interactively while logging by the mean of a dedicated cursor. The cursor sensitivity can be switched from coarse to fine if required.

Note that the exposure value is recorded in the data acquisition file (tfd file) together with the image logs. At file import in WellCAD the “Exposure” log illustrates the exposure changes performed by the operator while logging.

Remark:
The Exposure bar option requires LoggerSuite 12.1.2356 or higher
The tool sub file must include the following key in the [Default] section :

```
…..
[Default]
…
EnableExposureBar = yes
…
```

4.6.3 Tool parameters buttons

- **Refresh**: Click to refresh the settings of the dialog box.
- **Store as default**: Selected settings can be saved as defaults in the tool’s default settings memory. The default settings are the tool settings loaded during the tool initialization sequence after the tool has been powered on.
- **Restore to default**: Load the default values from the tool’s default settings memory.

4.6.4 Advanced settings

By default the light level is always set to 100%. It is the recommended light level for most borehole conditions.
In a situation where the image is overexposed to light, first, the exposure control knob must be adjusted. If, when the lower exposure value is used the image is still too bright, the light level can be decreased.

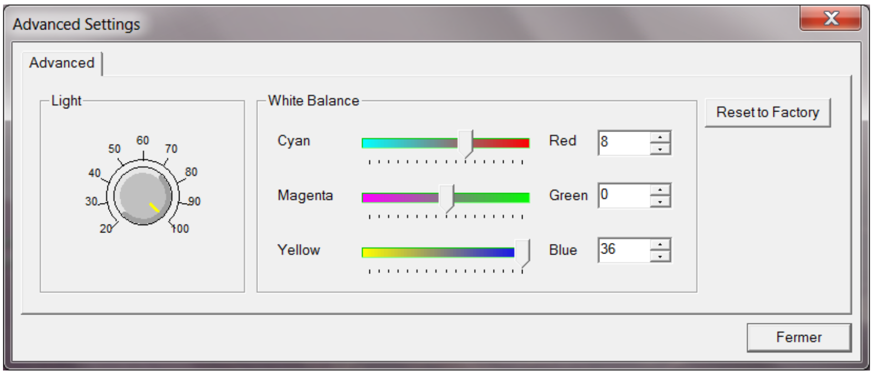


Figure 4-9 *Advanced settings dialog box*

The white balance controls the ratio between the three main colors (red, green, blue). In other words, the white balance calibrates the white color of an object or image.

The calibration of the white balance requires specific equipment and is performed at manufacturing time. No change should be applied to the white balance settings when the tool is operated under normal conditions.

- **Reset to factory:** Load the original image sensor settings stored in the tool's memory during factory calibration.

4.6.5 Tool details

The **Tool Details** window lists the tool parts serial number, firmware and hardware versions.

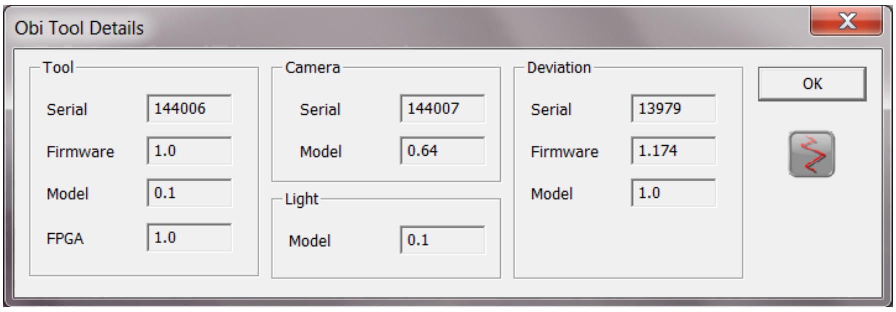


***Figure 4-10** Advanced settings*

4.7 Recorded Parameters, Processors and Browsers

4.7.1 Recorded parameters

Besides the image, the following data channels are recorded by the tool.

TCam[1]	Temperature of the image sensor - °C
FRate	Image sensor frame rate per second - fps
Workload	Percentage of the processor workload used for the image compression – %
Azimuth	Azimuth from Magnetic North – deg
Tilt	Inclination from verticality – deg
Roll	Tool relative bearing calculated from accelerometers - deg
MRoll	Tool relative bearing calculated from magnetometers - deg
MagnField	Magnetic field surrounding the borehole - µT
Gravity	Absolute value of the Earth gravity – g
TAPS	Temperature inside the deviation sensor - °C

4.7.2 "Obi40Img" Browser

Real-time 360° unwrapped images are displayed in the OBI40 image browser window (Figure 4-11). This browser has control buttons for choosing the system of orientation, time or depth mode, depth scale, grids and printing.

By clicking on "View" in the browser tool bar user has the option to display in addition to the standard OBI image a new "Processed Image". It is a real time processed image implementing some filtering algorithm to enhance the luminance distribution. The process is very powerful when the borehole wall is under exposed to light such as for instance in cavities or dark formations. It helps to emphasize the image contrast in unfavorable light conditions.

[1] *The light source of the QL40 OBI-2G is switched off automatically when TCam reaches 105°C which is the maximum operation temperature of the image sensor.*

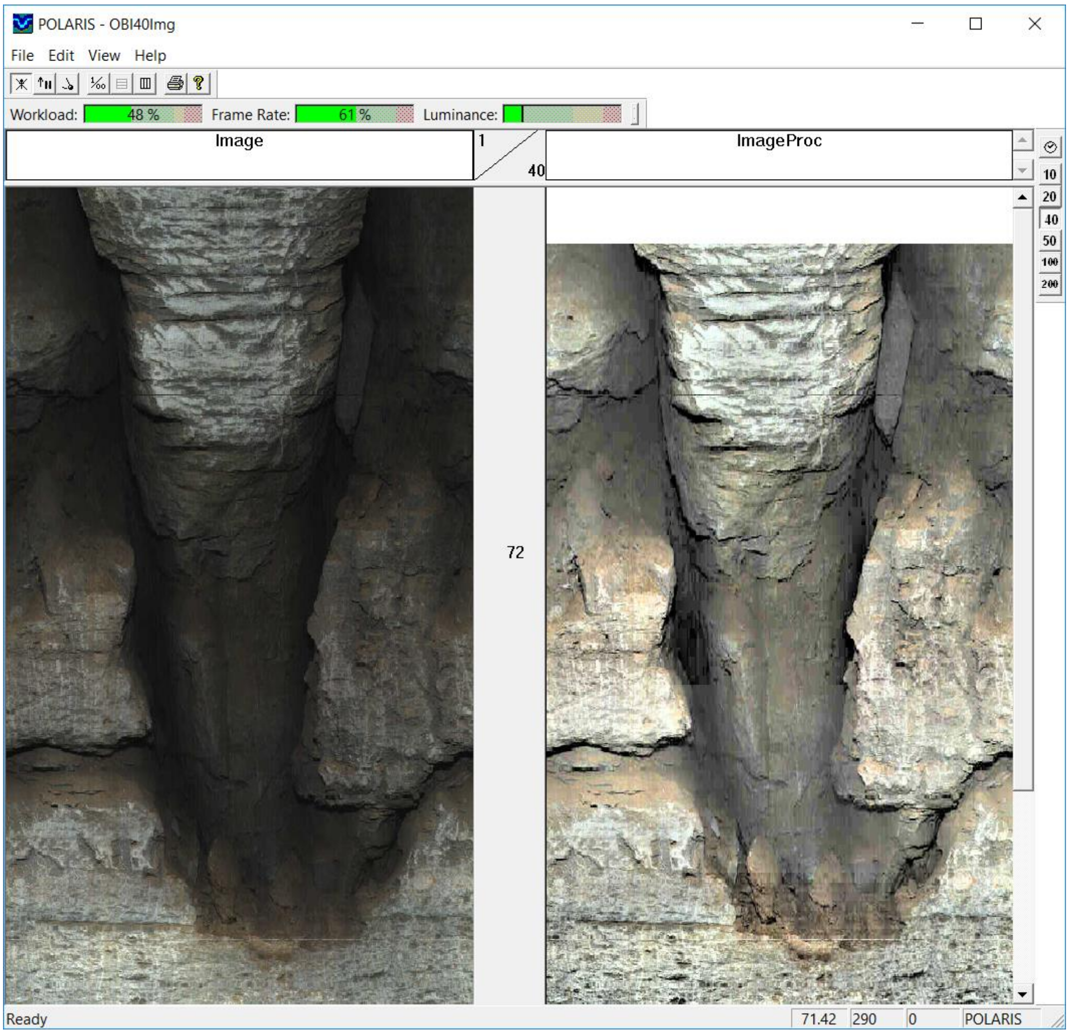
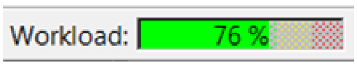


Figure 4-11 *OBI40 image browser*

At the top of the browser, two bar meters monitor in real time the camera processor workload and frame rate in percent.



The bar meters must be used to control the logging speed during a record. To avoid bad records it is recommended to keep the percentage values in the green range.

Image orientation:

 Image is non-oriented

 Orient image to magnetic North

 Orient image to High Side of the tool

There are two modes of tool data orientation: Orientation to High Side and orientation to North (Figure 4-12). Orientation to High Side is used in inclined boreholes when magnetic data is unavailable (for example in a cased hole).

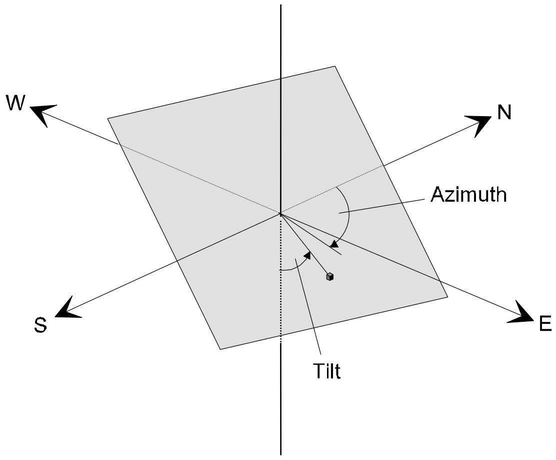
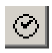


Figure 4-12 *Orientation to Magnetic North*

Vertical scales and grids:

Depth mode display and pre-defined depth scales


Operator defined depth scales, interval spacing and settings


Time mode display

4.7.3 "MChNum" Browser

Figure 4-13 shows a typical example of the numerical values displayed in the MChNum browser.

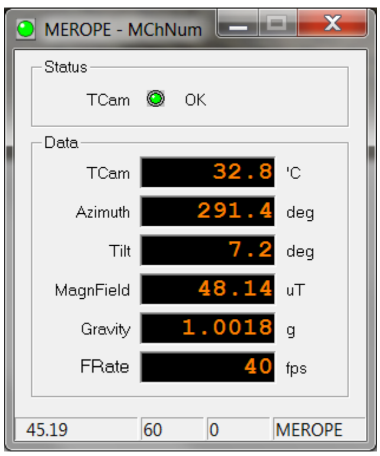


Figure 4-13 *MChNum browser*

TCam:	Temperature of image sensor - °C
Azimuth:	Azimuth from Magnetic North - deg
Tilt:	Inclination from verticality - deg
Magn.Field:	Magnetic field surrounding the borehole - µT

Gravity: Absolute value of the earth gravity - G
FRate Image sensor frame rate per second - fps

Right click on the MChNum browser title and select **Display Options to** add / remove channels.

4.7.4 "ObiHisto" browser

An histogram view is available to visualize the luminance and RGB colors distribution during the acquisition. The histogram view helps the user to set the adequate exposure level for the borehole conditions. Refer to chapter 4.5.2 to set adequately the exposure and luminance parameters.

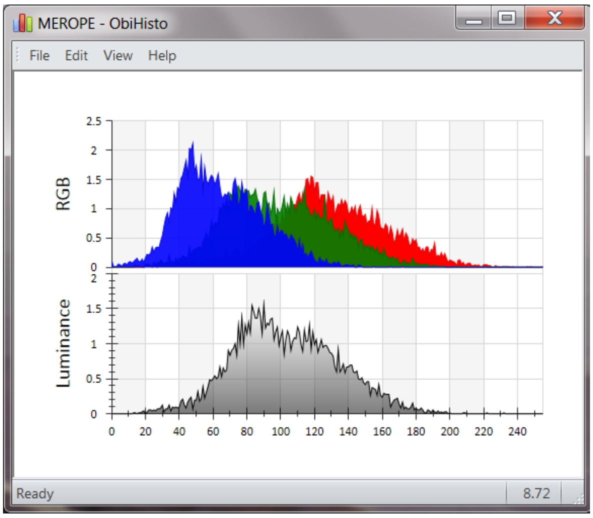


Figure 4-14 *Histogram view of the luminance and RGB colors*

The ObiHisto browser offers the option to zoom a defined area on the histogram view. To proceed left click on the histogram view and drag the mouse to highlight the area to zoom (Figure 4-15).

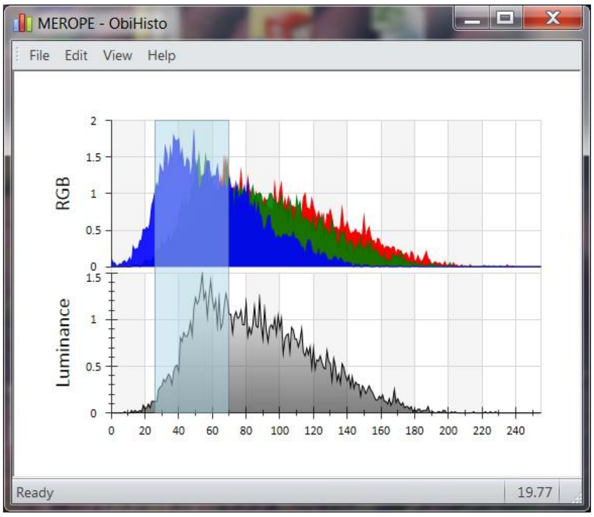


Figure 4-15 *Left click and drag the mouse to select a zoom window*

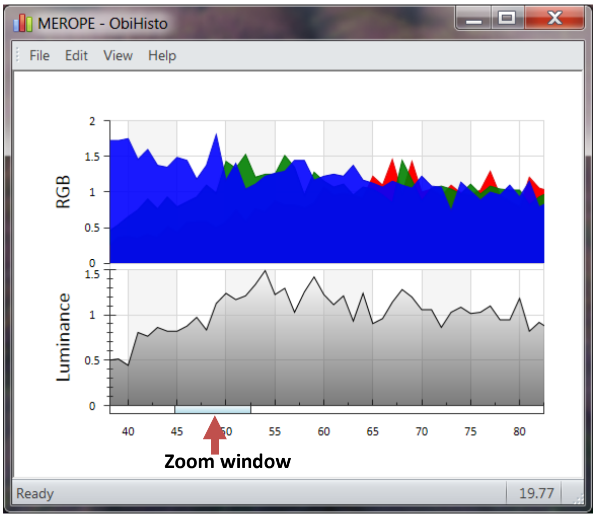


Figure 4-16 *Zoomed area in the histogram view*

The “zoom window” visible as a light blue rectangle (Figures 4-15 & 4-16) can be dragged on the horizontal axis to display the luminance and RGB colors distribution at the zoom scale.

To come back to the original histogram view right click on the ObiHisto browser.

Some additional options are available in the “File” and “Edit” menu to export (.bmp format) or copy the histogram view in a separate document.

5 Performance Check & Calibration

5.1 Testing the Deviation System

The QL40 OBI-2G deviation system is factory calibrated and does not require further calibration.

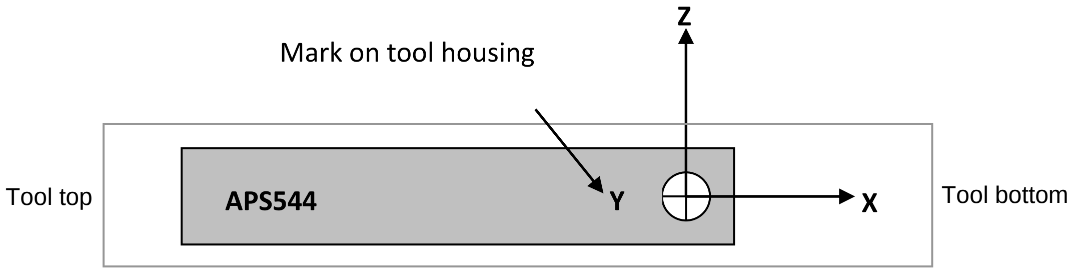


Figure 5-1 *Deviation sensor reference axis system*

The functionality test described hereafter should be executed to check that the tool is giving the correct deviation outputs:
To check Roll and Tilt outputs, place the probe on a flat surface with the Y mark engraved on the tool housing pointing up (Y axis of the coordinate system is pointing down, Figure 5-1).
Verify that the Roll and Tilt outputs are as follows:
Roll = 90° ± 0.5°
Tilt = 90° ± 0.5°
Next, roll the probe counterclockwise (looking towards the tool bottom) about its X axis in increments of 90° and verify that for each position the roll angle increments in succession to 0°, 270° and 180° while the tilt remains 90° ± 0.5°.
To verify inclination at 0° and 90°, position the probe so that the X axis is pointed down (0° inclination) and then horizontal (90°).
To verify azimuth accuracy, a good compass and an area free from magnetic materials should be used. Use a compass to orient the probe horizontal and North and verify that the azimuth reading is 0° ± 1°. Repeat the procedure for East, South and West directions.

5.2 Rolling Test – Azimuth And Tilt Check

Azimuth and tilt can be tested by rotating the tool about its long axis while maintaining both a constant inclination to the vertical, say 15°, and a fixed azimuth. The data imported into WellCAD should show a deviation of the azimuth less than the limit of ±2.5° and a deviation of the tilt less than the limit ±0.5°.

6 Maintenance

The QL40 OBI-2G optical televiewer is a delicate instrument and should be treated with care at all times. Excessive shock or temperatures should be avoided and the tool should always be carried in its transport case or a similarly cushioned enclosure. Never support the tool on its optical head that is the weakest part of the tool, and be particularly careful to avoid scratching the optical window.

6.1 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 6-2).

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)

6.1.1 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.

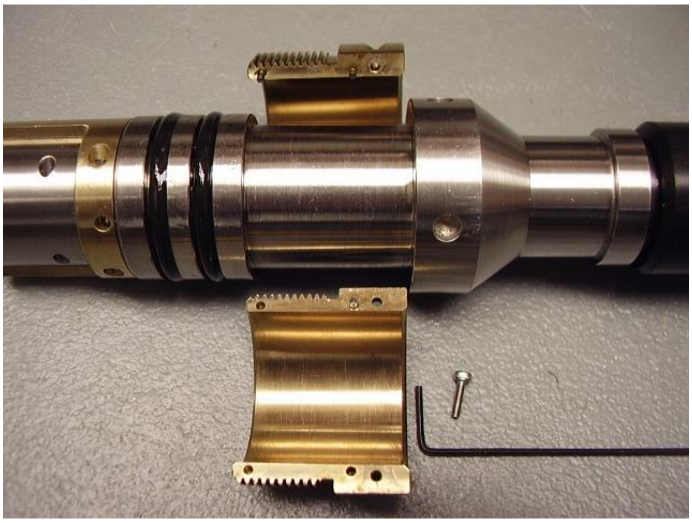


Figure 6-3 *Disassembly of the locking ring –step 2*

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

6.2 Pressure housing

<u>Warning:</u> Removing the electronic chassis from pressure housing without prior consultation with ALT will void the tool warranty.
Disassembly of the electronic chassis from the pressure housing should never be attempted in the field.

Should it become necessary to open the tool, the tool parts must be separated in the following sequence:

1. Remove the tool top adapter
2. Unscrew the pressure housing from the optical system brass interface

Before screwing back the pressure housing make sure that the threads on the brass interface are clean and properly greased with anti-seized compound. Once fully screwed on verify the correct alignment between the pressure housing and orientation key of the multi-pin Lemo connector as shown on Figure 6-4.

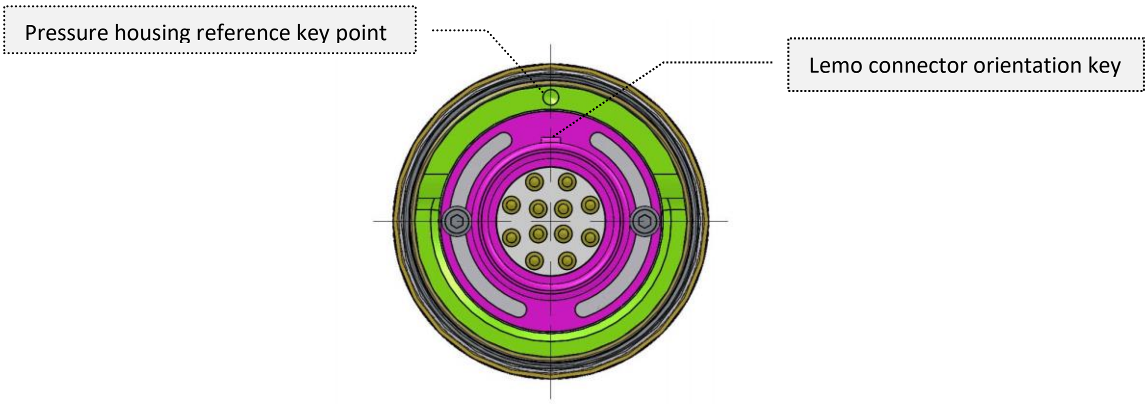


Figure 6-4 *Pressure housing top view* - *Correct orientation of the pressure housing and Lemo connector*

6.3 Optical system

<u>It is strongly recommended to inspect the integrity of the glass sleeve before each run</u>. **<u>Never immerse the tool in a borehole if any defect or crack is visible in order to avoid irreversible damage to the tool.</u>** Replace the sleeve with a spare one if necessary.

<u>Always use the ALT standard screws DIN912-M2.5x3 to fix the glass sleeve on the tool</u>. The size and shape of the screws are specifically designed for this purpose. Spare screws are usually provided with the tool spare kit.
<u>Note that the use of a different screw model may damage the glass sleeve when exposed to pressure and will void the tool warranty.</u>

7 Troubleshooting

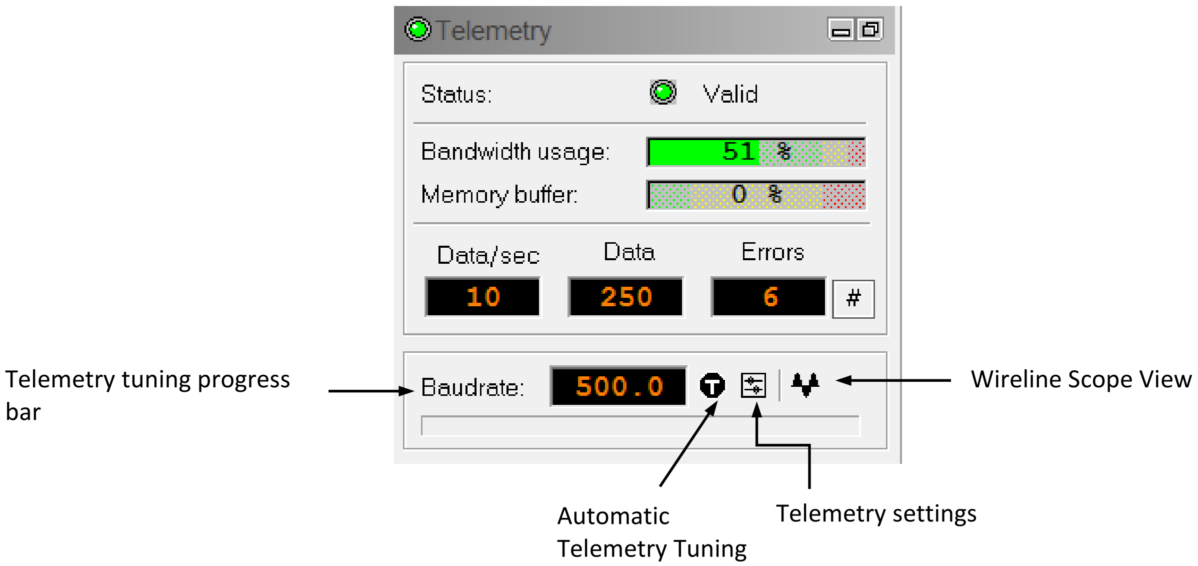
Observation	To Do
Tool not listed in Tool panel drop down list.	- Do you have a configuration file? - Has the configuration file been copied into the …/Tools folder (refer to logger manual about details of the directory structure)?
Tool configuration error message when powering on the tool.	- Check all connections. - 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).
Tool panel - No current.	- Verify that the wireline armour is connected to the logging system. Test your interface cable between winch and data acquisition system. - Verify cable head integrity. - Verify voltage output at the cable head (it should be 120V).
Tool panel - Too much current (red area).	**! Immediately switch off the tool !** **-**Possible short circuit (voltage down, current up): Check for water ingress and cable head integrity - wireline continuity. - 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. - If the above shows no issues, use test cable (provided by ALT/MSI as an option) to verify tool functionality. - If the problem still occurs, please contact service centre.
Telemetry panel - status shows red.	- Verify the telemetry settings for your wireline configuration (see chapter 4.2 or 4.3). - If problem cannot be resolved contact support@alt.lu or tech.support@mountsopris.com
Telemetry panel - memory buffer shows 100%.	- 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.
Telemetry panel – bandwidth usage shows 100%. *(Overrun error message.)*	- Set the baudrate to highest value allowed by your wireline configuration. - Reduce logging speed, decrease azimuthal resolution and/or increase vertical sample step.
Telemetry panel - large number of errors.	- Verify the telemetry settings for your wireline configuration (see chapter 4.2 or 4.3). - Check bandwidth usage and telemetry error status.

Black image – the light source stopped working.	Verify the temperature of the image sensor in the MCHNUM browser. The light source is automatically switched off when the temperature of the image sensor reaches 105°C. Cool down the tool.

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:

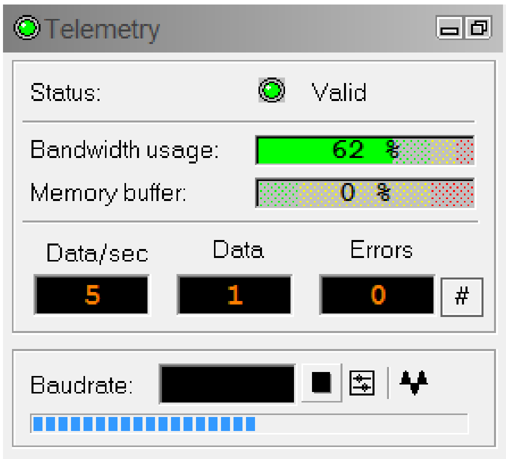
The Tune button  resets the telemetry tuning automatically. This process defines:

- 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.[2] 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.

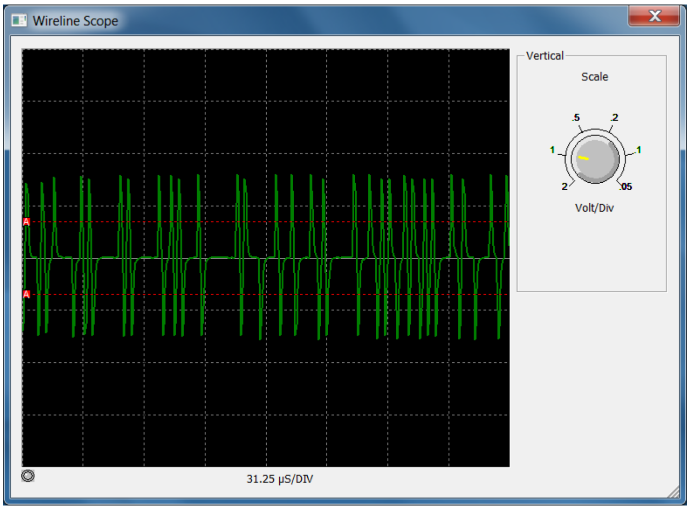
A **progress bar** at the bottom of the telemetry window shows the progression of the telemetry tuning. At the end of the process the baud rate display is refreshed with the optimal baud rate value.

[2] 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.



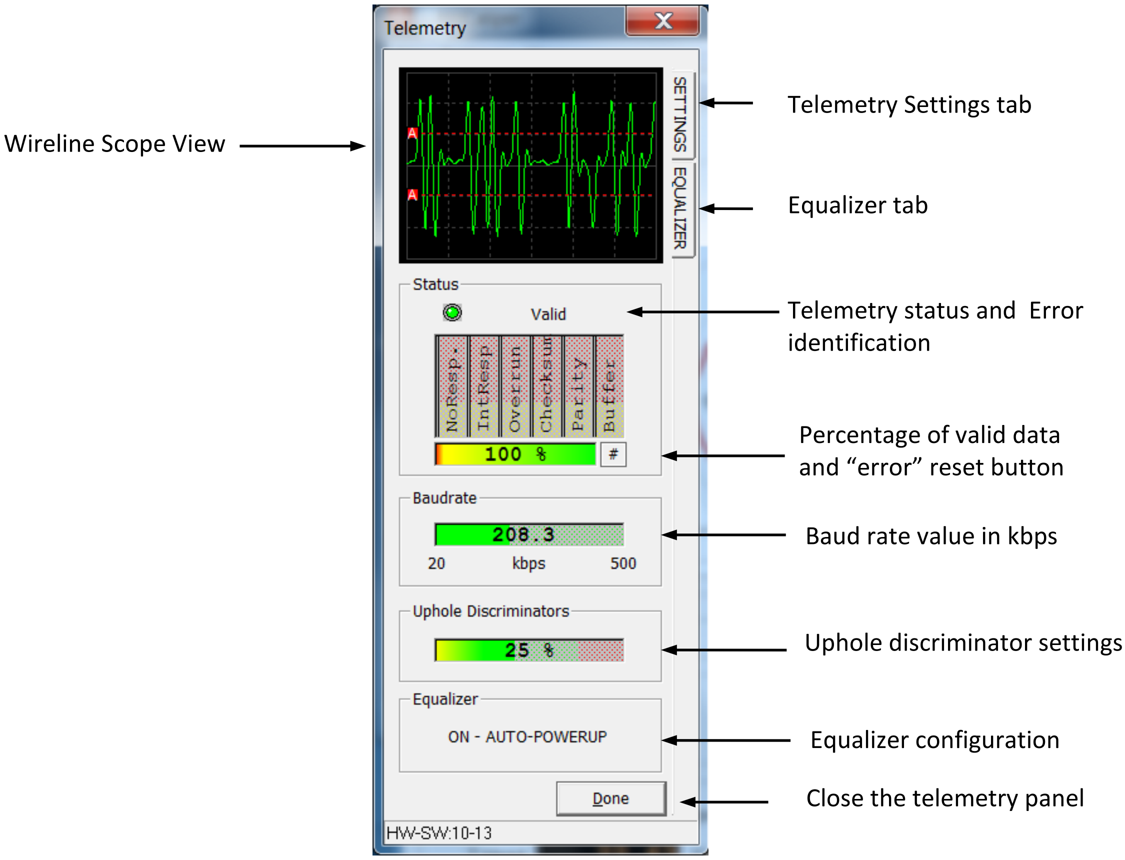
The two red-dashed horizontal lines help to visualize the position of the discriminator levels set for detecting the pulses at the surface. Discriminator levels can be tuned in the **Telemetry Settings** dialog – refer to section 3.6.1 for more information.

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.

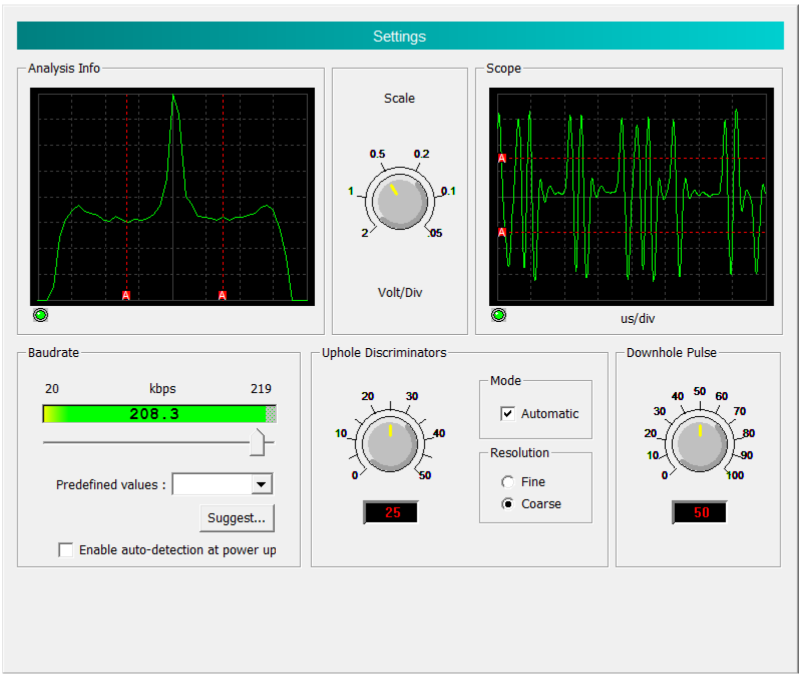
In Automatic mode the uphole discriminators are set automatically to detect the pulse strings.

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.

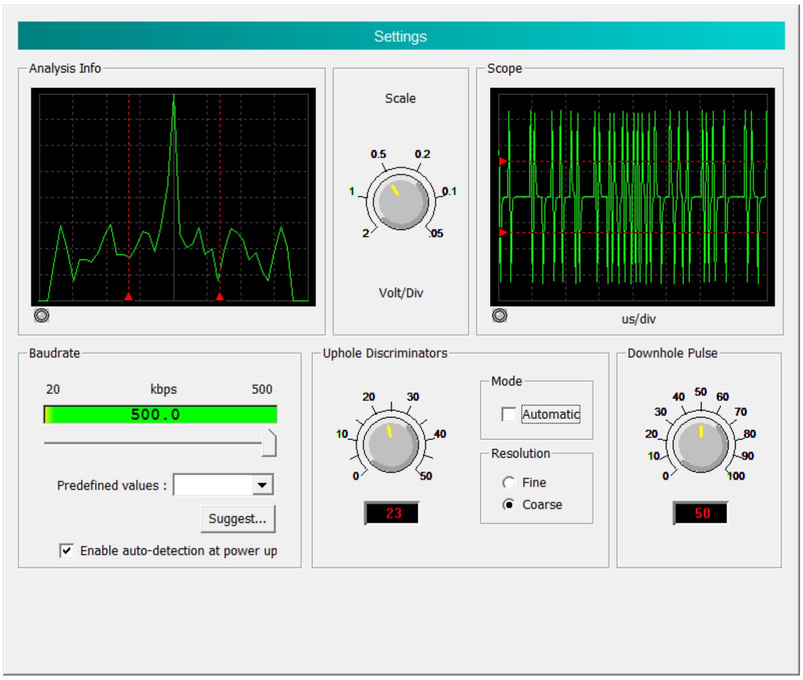
The "A" letter on the red square means that the discriminators are set in automatic mode.

The **Scale knob** controls the scale for the Analysis and Scope displays.

<u>Position of the discriminator lines should be set as illustrated below.</u>



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.



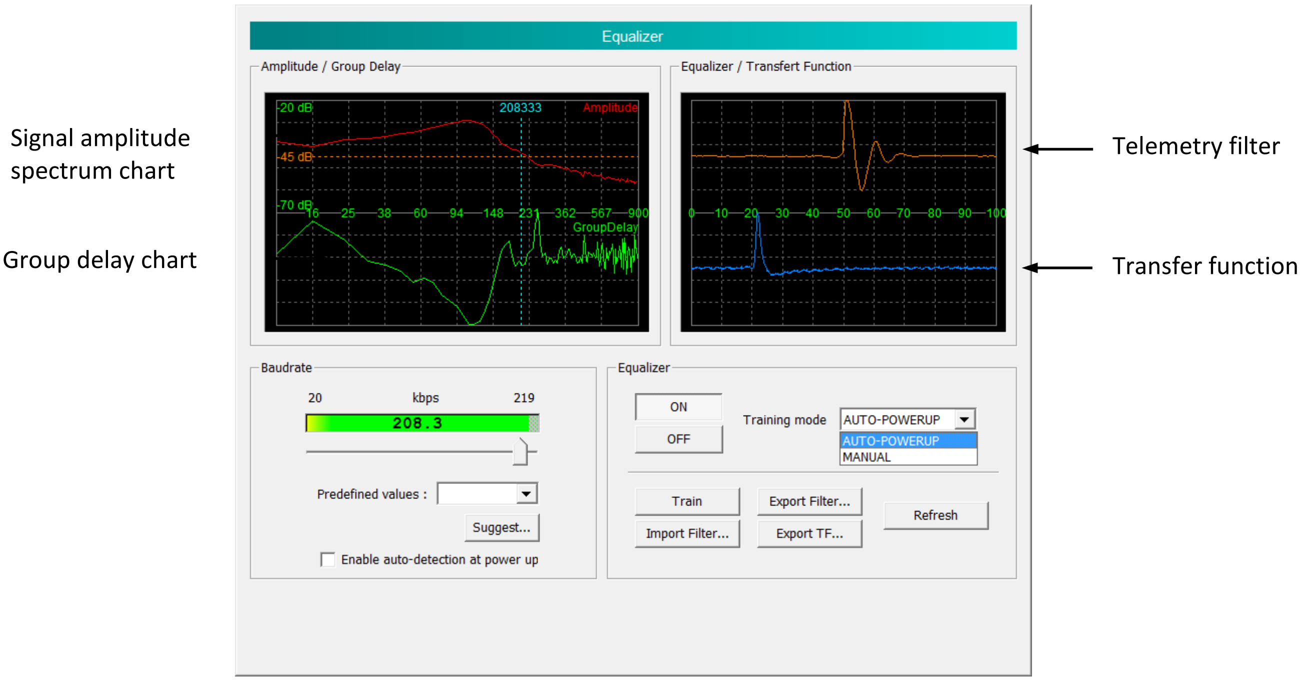
The **Downhole Pulse knob** controls the width of the pulse commands sent to the tool. It is set on 50 as a default value. This value is the preferred one and is suitable for a wide range of wirelines. For long wireline increasing the pulse width could help to stabilize the communication. The reverse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

Detailed part numbers and descriptions are available for tool delivery and spare part kits. Please contact support@alt.lu or tec.support@mountsopris.com for further details.

8.3 Technical drawings

The following technical drawings are available on request:

- Wiring Diagram.

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