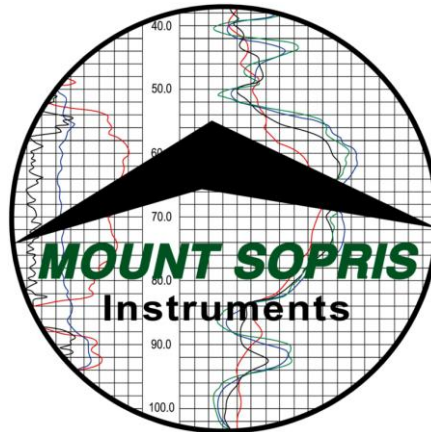


QL40-CAL

QL40 - Caliper Probe Sub



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General Information

QL40 Stackable Logging Tool Overview

QL stands for Quick Link and describes the latest line of stackable logging tools. This development is a joint venture of Mount Sopris Instruments (MSI) and Advanced Logic Technology (ALT). Innovative connections between tool elements (subs) allow users to build their own tool strings in the field.

The Tool Stack Factory – a sophisticated extension of the acquisition software – provides a convenient way to configure tool strings for operation.

Each sub has a Telemetry and Power supply element, the TelePSU, allowing them to operate individually without a separate telemetry sub. As a result all QL subs can be operated as standalone probes or in combination with other subs. The GenCPU card in each measurement handles Analog to Digital conversion and/or counting of the measurement signal and formatting of the data for transmission up hole.

When used as a standalone or stack of active subs the tool is completed by adding a Tool Top sub and where applicable a Tool Bottom sub. At present two Top subs are available, a MSI single conductor and GOI 4 conductor. Consult the factory for additional options.

The number 40 indicates a nominal OD of 40mm. Over coating and special measurements may make some subs larger in diameter than this. See their particular specifications.

Minimum requirements:

Matrix v10.3 software with appropriate Matrix Logger firmware
 See the installation instructions for Matrix software for more information.

Controls, Connectors, and Layout

Connectors for the tool are as follows. The probe top described below is a Mount Sopris standard single conductor probe top. Other variations of probe tops and wiring can be accommodated at the factory such as the GO-4 probe top listed below.

Probe Top sub connections:

MSI-1 conductor		
Pin	Signal	Origin
Probe top housing	Tool power ground	Armor
Center pin in probe top	Tool power positive	Center conductor
GOI-4 conductor		
Pin	Signal	Origin
Probe top housing	Tool power ground	Armor
1	Tool power positive	Com A&B
2, 4	No Connection	No Connection
3	Tool power positive	Com C&D

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The QL40-CAL sub provides borehole caliper measurement. The QL40-CAL can be operated as a stand-alone probe or can be stacked above or below another sub on a MATRIX logging system.

Caliper

The Q40-CAL Caliper sub measures borehole diameter with three linked arms operating a single resistive sensor. Digital control of the arm opening and closing is via the Dashboard, Tool panel, Settings/Commands button. The 3 Arm Caliper data can be scaled and calibrated in inches or in centimeters. The resistive sensor is digitized and combined with data from other subs (if present in the stack). The data is then transmitted up the wireline using a pulse coded digital data protocol.

The Q40-CAL is supplied with two sets of arms for measurements of 57 mm – 406 mm or 736 mm. The caliper arm can be unscrewed from the short pivot arm and can be replaced with one of different length. The hardened arm wear tips can be unscrewed and replace.

QL40 CAL Specifications:

Power Requirements

DC voltage at probe top: MIN. 80 VDC MAX. 160 VDC Nominal 120VDC
 Current 38 mA nominal

3 Arm Caliper

Caliper measurement: 2.25" to 16" (standard arms)
 57.2 mm to 406 mm

12" to 30" (with extended arms)
 300 mm to 736 mm

Measuring location

20 cm up from bottom of locking ring at the tip of the closed, short arms

Operating temperature range

32 to 158 degrees F 0 to 70 degrees C

Pressure rating

2900 psi 200 bars

Dimensions

Length	70.28 inches	1.785 cm
Diameter	1.67 inches	42.3 mm with neoprene heat shrink and PVC electrical tape
Weight	22 lbs	10 kg

Installation

Installing the QL40-CAL and support equipment

Before operating the QL40-CAL, Three Arm Caliper sub, determine if the sub will be used in a stand-alone configuration, or if it will be used in conjunction with another QL Series sub.

The subs are connected by threading the male end of the top sub into the next lower one. Note the key way.

Remove the bottom protector from the Top sub. The GOI-4 Top sub is shown below:



Locate the spanner wrenches as shown below:



Align the top sub with the key way inside the female housing of the next section. Inspect all O-rings for defects and make sure threads are clean. Threads and O-rings should be lightly greased. **Do not use silicone grease intended for O-rings on threads.** When connecting subs, it is best to balance each sub section on a tool stand so that the ends join with no load. See photo below.



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Slide the top sub in until the threads meet the mating ones inside the housing. Start turning the brass nut by hand until the threads engage. Slightly raise or lower the joint so the pieces mate evenly and the threads turn easily.

Warning: Do not force the threads! When properly aligned they should turn smoothly.

Use the spanner wrenches to tighten the threads until the brass nut is fully engaged. **Do not use cheater bars on the spanner wrenches.**

The threads should go on smoothly. If they are binding adjust the supported location top or bottom section so they are level and evenly aligned.



Measurement Caliper stand alone mode

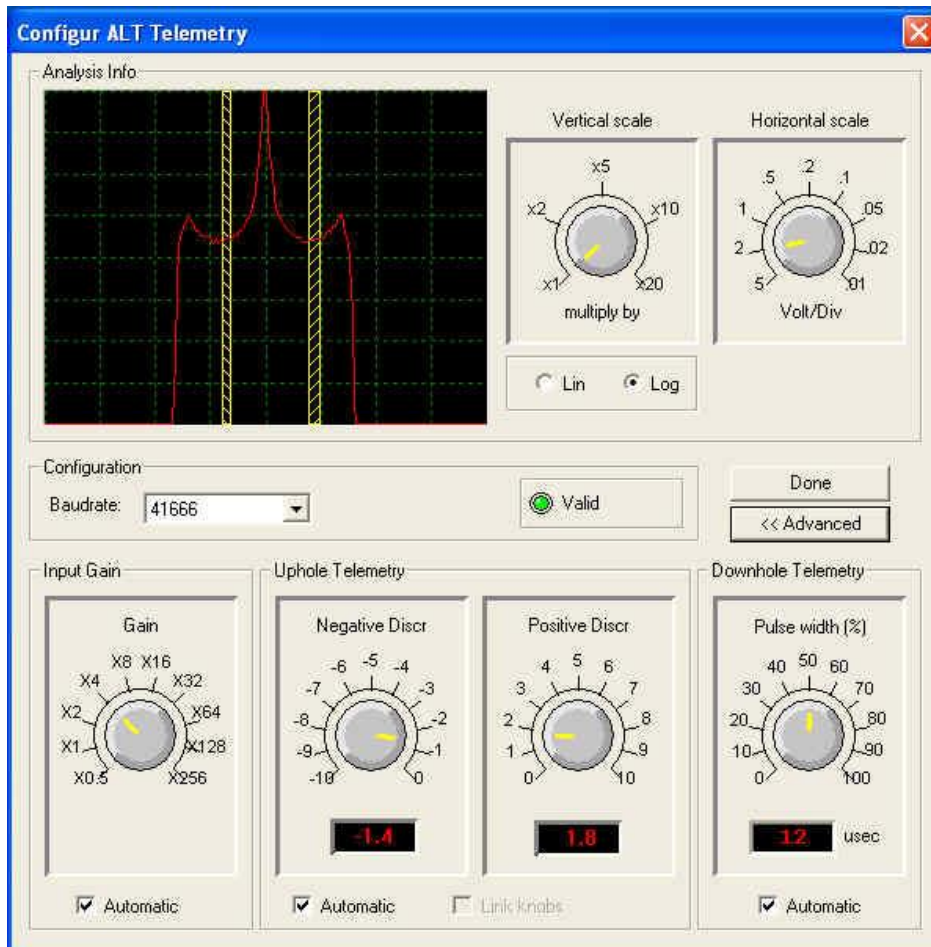
In order to operate the sub as a stand-alone probe, a top and bottom sub must be connected to the sub. Remove the probe-top thread protector from the top sub then thread the top sub onto the cablehead of the winch assembly. Inspect the o-ring on the cablehead for cuts or abrasions before each use to ensure an adequate seal. See the logging software operating instructions to configure it to log this tool.

Operating Procedure

Operation


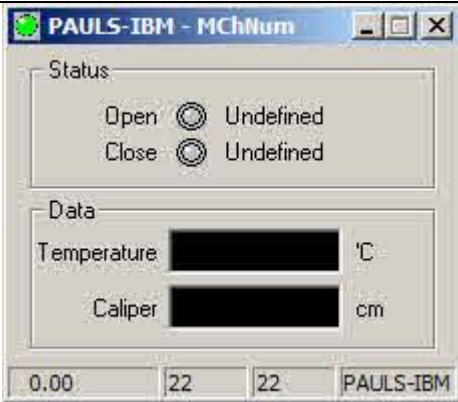
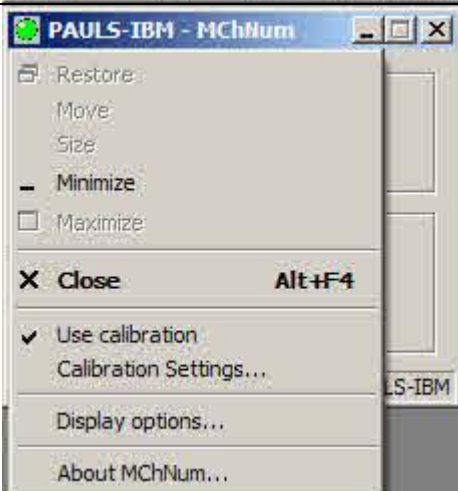
To use the QL40-CAL, Caliper sub with the MATRIX logging system, make sure the correct sub files are installed in the C:\Logger\Tools\QL40-12 directory. The files are most easily installed using **LoggerSettings.exe** utility program supplied with the software installation. QL40 sub files may be found on the installation or separate CD.

In the case of the Matrix logger, the power settings are set to default values used for all probes equipped with the QL TelePSU down-hole power supply. Different wirelines may require some adjustment to the telemetry. These settings are accessed by pressing the Settings button in the Telemetry section of the Matrix dashboard. The user may also view the pulse stream on the cable line by pressing on the Scope button. To change telemetry settings, press the properties button after the Modem Settings window appears. The user can observe the discriminator settings and make changes as necessary using the "Advanced Settings" button in the Telemetry window on the dashboard. The two discriminator bars should be placed in the middle of the displayed troughs, as shown in the following figure. When correct discriminator settings are made, SAVE the configuration, naming it as to describe the wireline configuration and the settings will be recorded for future use. In general the "factory" settings will not need adjustment.



Performance Checks and Calibrations

Calibrations are performed using calibration rings of known diameter over the opened arms.

<p>Prepare to Calibrate:</p> <ul style="list-style-type: none"> • Assemble the tool sub(s) and connect to the wireline. • In the Tool panel: • Select the proper string configuration, • Turn tool power On • Click Tool Panel Settings/Commands button and Open the Caliper arms from the dialog. • Rotate the Jig arms into place and secure with Socket Flat Head Screws. • Slide the Jig over the body of the tool from the bottom and place one arm into each of the desired small set of holes. • In the Acquisition Panel select Time and turn it On. 	 <p>3 Arm Caliper, calibration Jig shown with one arm folded for ease of packaging.</p>
<p>MchNum:</p> <ul style="list-style-type: none"> • When the arms are open the Open Status Led with turn green. Calibrated measurement will display in the Caliper box. 	
<ul style="list-style-type: none"> • Click the Green LED at the top left corner or right click the top pane to display the MCHNum fly out menu. • Click Calibration Settings 	

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- In the First Point reference enter the diameter of the small calibration value.
- Click Sample. When average sampling is complete the value read from the tool will display in the First Point Value box.
- Place the caliper arms into a large value calibration Jig hole set.
- In the Second Point reference enter the diameter of the large calibration value.
- Click Sample. When average sampling is complete the value read from the tool will display in the Second Point Value box.
- Click Compute
- Click Store
- Click Close

Calibration Settings

Caliper: []

First Point
Reference: 10.2 cm
Value: 18.55399 cps

Second Point
Reference: 30.5 cm
Value: 37.78822 cps

Channel Calibration Factors
Caliper(cm) = 1.05541 x Caliper(cps) + -9.38207

Calibration date: 18/12/09 00:36

- 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.

Preventative Maintenance

The QL40 series tools require some maintenance. Make sure the threads on the brass nut on the sub bottom are free of sand mud or other dirt. A thin layer of anti-seize is recommended. When disassembling the sub string dry the joint as it is separated to prevent fluid from entering the sub top and getting into the Lemo electrical connector inside.

After replacing top and bottom protectors it is good to wash the probe off after each use. ***Never take the probe apart. This probe is very difficult to disassemble and requires special steps to be taken in order to gain access to the inside of the probe without damaging the electronics. If you have read this after attempting to disassemble the probe chances are the probe has experienced damage and will need to be sent to the factory to be repaired.*** Inspect O-rings occasionally and keep the threads on both ends of the probe clean, to minimize problems in the future.

Caliper Mechanism Maintenance:

Before and after each usage of the probe, using a standard automotive grease gun and M6 x 1thread fittings (replacement P.N. 28-957-001), apply grease to the two grease ports. These are located immediately above and below the arm pivot point. Close the arms to apply grease to the upper fitting and open the arms to apply grease to the lower fitting. Remove the two grease fittings and install M6 X 6 SS Set Screws (replacement P.N. 28-185-549) as plugs in the holes before operating the probe in a well. After each log, when possible, clean and flush mud and or contaminants out of the caliper arm assembly. When the caliper arms are open inspect the mechanism on the arms to see if there is adequate grease for lubrication, if not re apply grease.

We recommend Dow Corning DC-111 silicone grease for use in water wells. DC-111 is approved for incidental contact with food. There are a number of other greases that will work. High resistance to water washout and temperature range being the prime considerations in their selection. Any grease used should be compatible with the Buna N o-rings. Buna N o-rings are recommended for: Petroleum oils and fluids, cold water, silicone greases and oils, Di-ester base lubricants (MIL-L-7808), Ethylene glycol base fluids (Hydrolubes). It is not recommended for: Halogenated hydrocarbons (nitrobenzene, aniline), Nitro hydrocarbons (nitorbenzene, aniline), Phosphate ester hydraulic fluids (Skydrol, Fyrquel, Pydraul), Ketones (MEK, acetone), strong acids, ozone, and automotive brake fluid.

Locking Ring assembly Maintenance

Tools required:

1.5mm Allen wrench
2 ea 40-42mm spanner wrench
Paper towels or clean rags

Replacement Parts:

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

Disassembly:

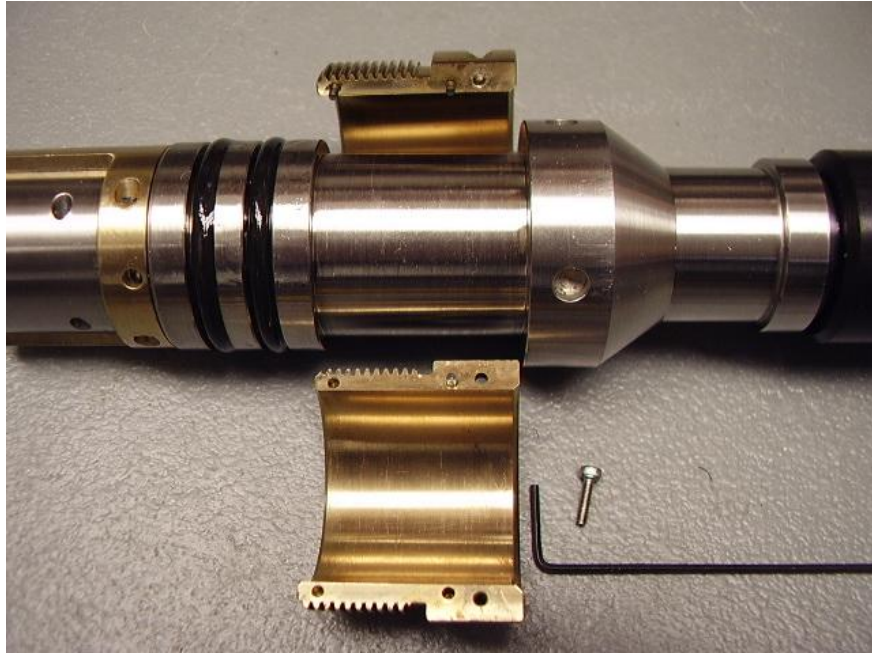
Unscrew and remove the two M2x8 socket head cap screws and separate the two halves. Four guide pins align the two ring halves and tend to hold them together after the screws are removed. To pry the halves apart you can use a pair of spanner wrenches inserted into the wrench holes on opposite sides of the ring mating surfaces to pull them apart slightly.

Do this carefully to prevent bending the guide pins.



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.

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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

Troubleshooting

Problems with the Tool

NEVER DIS-ASSEMBLE THE PROBE WITHOUT CONSULTING THE FACTORY FIRST

Disassembly Instructions

The QL40-CAL Caliper Probe should **never be disassembled** unless service is necessary. This is a very difficult probe to disassemble, and is highly recommended that any service be performed by Mount Sopris, ALT or a qualified technician.

Appendix

Suggested QA Procedure

General notes for Quality Assurance are presented here for users who need to utilize these techniques when collecting data. These users will need to periodically calibrate their equipment using equipment whose calibration is traceable to an approved standard. Details of these calibrations must be recorded.

When an instrument is calibrated, records need to be kept regarding the calibration standard(s) used and what was changed on the instrument to calibrate it. Typically, the corrections made to the instrument involve changing constants that are used to scale the raw instrument reading so that the proper value is reported. The constants must be recorded during a calibration procedure. The Mt. Sopris family of acquisition programs records the calibration constants that were used to acquire the data. This aids the QA process, but does not replace the need for recording these constants at the time of calibration. The reason for this is that the length of time since the last calibration is unknown with only this information.

The device providing the standard must be traceable to an accepted standard. Examples of organizations providing standards for measuring instrumentation are: The U. S. National Bureau of Standards; The American Petroleum Institute; and the American Society for Testing Materials. For example, if the voltmeter or the density standard used for calibration is not traceable to an approved organization, such as those listed above, the calibration should not be considered valid. Records should be kept indicating the last time that standard being used for calibration was calibrated or checked against an approved standard. The QA procedure necessary for some programs mandate that the calibration standards be periodically checked against a standard approved by a proper agency.

A QA procedure may dictate that data taken from a given locale be associated with records indicating the exact time and location that the data was collected. The data itself may have to be collected in a certain format to meet requirements. Often, QA procedure specifies that surveys must be repeated and the data from the successive surveys compared. This technique is used to eliminate poor or invalid data.