MSLog v.7 for the MGX II Operators Manual

Mount Sopris Instrument Co., Inc.

License Information

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1. System Overview

I. Introduction

The MGXII Logger acquisition system is based on modern electronics design in which software control techniques have been used to the best advantage. The hardware incorporates the latest electronic components with embedded systems controlled via the specially developed MSLog Windows interface program.

The software takes advantage of the Microsoft Windows ™ family of operating systems. These multi-tasking software platforms can accommodate all the tasks necessary for maximum data security and ease of operation.

The system design philosophy is unique in two respects. First, it has been built to accommodate several generations of single conductor, Mount Sopris tool types, and second, it is totally software controlled.

The basic system design criteria are as follows:

- Windows 95, 98, NT, 2000 ™ operating systems platform
- Rugged, fault tolerant electronics
- Easy to use, on-screen graphical user interface -***The Dashboard-*** with self-diagnostic features, system configurable through screen dialog boxes, with minimal technical knowledge needed by the user.
- Wire line and winch flexibility - runs on most coax, single and multi-conductor wire lines with compatible probes.
- Depth encoder flexibility - compatible with most 12V or 5V AB quadrature and pulse shaft encoders, and configurable for any combination of wheel/depth pulses per revolution.

II. Setting up the System

a) Serial Cable

The standard, nine pin, serial cable is the interface between the PC and the MGX II Logger.

b) Setup Connections

! Insure that the power supply cable is connected to the MGX II. Insure that the serial cable is connected to COM1. Connect your printer to the printer parallel port, LPT 1, checking first that the printer is turned off. *Even if you don't have a printer connected to the PC*, **MSLog log display functions will not work unless a default printer is set up on the PC**. If one is not installed (such as when starting out with a new PC, install at least one printer.) Finally, connect the PC power cable to your external power supply.

The system is now prepared for operation. Read Chapter 3, System Operation before you apply power to the system.

c) Logger Configuration

The user should read and understand details of the **MSLConfig** program, which is automatically started during MSLog software installation. The user should have information about the logger, winch, and probes to be used so that the system and software are properly configured. For details click on Help when running the MSLConfig program, which is located in \MSLog\Utils

2. Software Architecture

I. Introduction

The acquisition system software runs on the Microsoft Windows 9X ™, Windows NT™, or Windows 2000™ operating systems. The system software was developed using the Microsoft Win32™ applications programming interface (API), which allows applications to exploit the power of 32-bits on all Microsoft Windows ™ family of operating systems. The Microsoft Win 32 API can support more than one process (executable programme) concurrently. Moreover a process can consist of more than one thread, i.e. operational task, where threads are the basic entity to which the operating system allocates processor (CPU) time.

The MSLog software exploits the true pre-emptive multitasking ability of the Win 32 environment. Within the system threads are allocated a priority rating. The priority rating is designed to optimise the data security features of the system while maintaining an environment that is exceptionally responsive to the user. The multitasking environment also means that you can have more than one application running at once.

II. The Dashboard System

a) Overview

In the MSLog program the graphical screen interface used by the operator is called the Dashboard. The Dashboard system consists of multiple threads, running concurrently, that handle specific system tasks. The system currently controls the six functions listed below:

1. Data Handler
2. Depth
3. Tool Power
4. Data Display
5. Configure Tool
6. Configure Communications

Top priority is given to the thread that controls the Data Handler task. There are three tasks that are related to window panels that remain constantly available on the screen: the Depth Panel, Tool Panel and the Data Panel. Two other threads are related to tasks that interact with dialogue boxes, Configure Tool and Configure Communications. The multi-thread architecture allows the system to run different tasks concurrently, e.g. updating the depth counter at the same time as acquiring data from the tool. Items 2-6 are always available on the dashboard.

Information specific to a particular tool is contained in a unique **tool configuration file** which will have the extension name ***.TOL**. Information contained in the *.TOL file is used by different components of the system for initialising Dashboard components (tool power, data protocol etc.), as well as setting parameters for Client processes, where a “Client” process is an application handling data processing, data display or printing. Of the six operational tasks top priority is always given to the Data Handler screen, either maximised as an open window or as a minimised toolbar.

As mentioned above, **tool information** is kept in ***.TOL** files which normally reside in the \MSLog\Tol\Current directory. **Winch specific information** is held in the **MSLOG.INI** file in the \Windows or WinNT directory. The file contains information on parameters such as the depth encoder characteristics and measure wheel dimensions, cable length and type.

b) The Dashboard

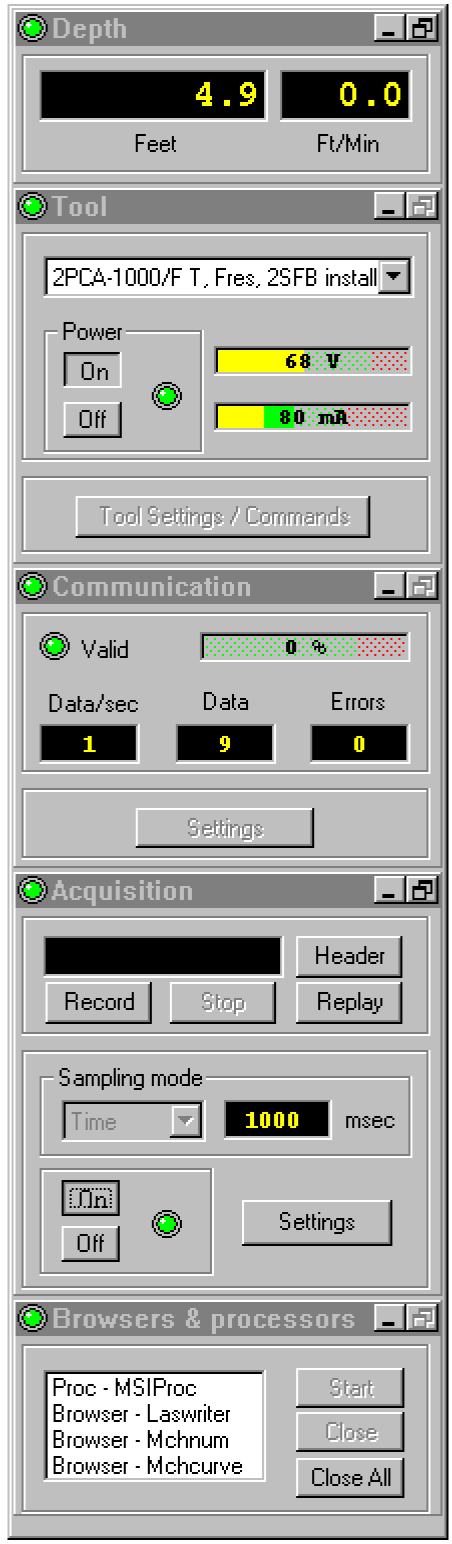
The Depth Panel displays depth information and logging speed, and allows the user to change the depth value and "zero" tool when beginning a logging run.

Tool Power Panel allows selection of and displays the currently selected tool type. The window displays the calculated up-hole voltage and current consumption and provides the means to switch tool power on and off. It also provides control of tool specific functions such as Caliper and sampler opening and closing as well as image and acoustic probe configuration settings.

The Communication Panel displays the status of the data communication between the logger and the PC. It provides information on the number of data samples already read, unique to a recording or replay session, and counts the errors or number of times the system failed to obtain data upon request, during acquisition. A button allows the user to access and modify communications settings for digital probes. The bar graph display is disabled in MSLog.

The Acquisition Panel window indicates both the current file that data is being recorded to or replayed from. It also provides the means to record, stop recording and replay data files. A second window provides the means to switch the acquisition system from time to depth recording mode. The Settings button allows the user to specify different time and depth digitise intervals, and provides the capability to save the settings

The Browsers & Processors panel controls starting and stopping of client processes, which consist of applications that support such functions as data processing, on-screen display and printing. The selection of client windows that will start up is set up in the TOL (tool configuration) file.



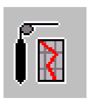
3. System Operation

I. Starting MSLog

Refer to Chapter 1 for details on how to connect the system

! After verifying that all connections are correct, turn on the power to the PC, and **allow the operating system to finish completely loading**. Turn on Power to the MGXII. You should see the MGXII depth display flash "***-8888.8***", and then display the last depth value stored in the logger. The right side "TO PC" data light should blink. If the "TO PC" is not blinking, turn the Logger power OFF then ON again.

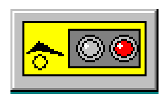
If you are unfamiliar with Windows operating system then please refer to the Windows user manual for guidance on the basics of the system's operating platform. It is assumed that the user has basic knowledge of Windows.



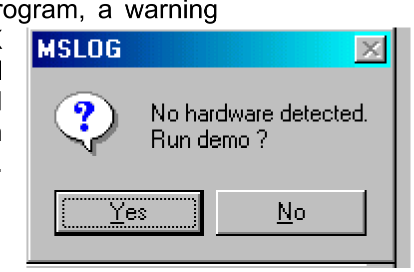
MSLog

To start the MSLog program, left click on the **Start** button on the status bar, and holding down the left mouse button, move to **Programs>MSLog>MSLog**. Release the button and the system will automatically load the MSLog operating software and present you with the control Dashboard at the left of the screen.

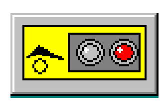
At start-up of the program, MSLog will attempt to communicate with the MGX II. A small logger replica will appear:



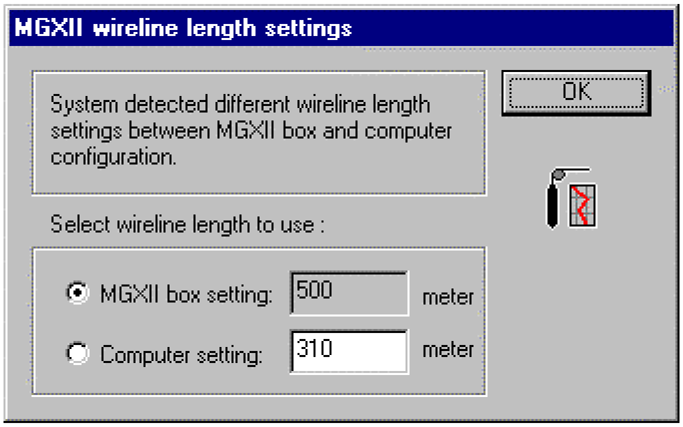
If the MGX II, logger is not detected by the MSLog program, a warning message appears. This message will appear if the MGX II is not properly connected by serial cable, or if the serial cable is bad, or if the MGX II power is not turned on and correctly initialised. Note that the program can be run in Demo Mode on any PC to replay previously logged data. For more information, refer to the section on REPLAY.



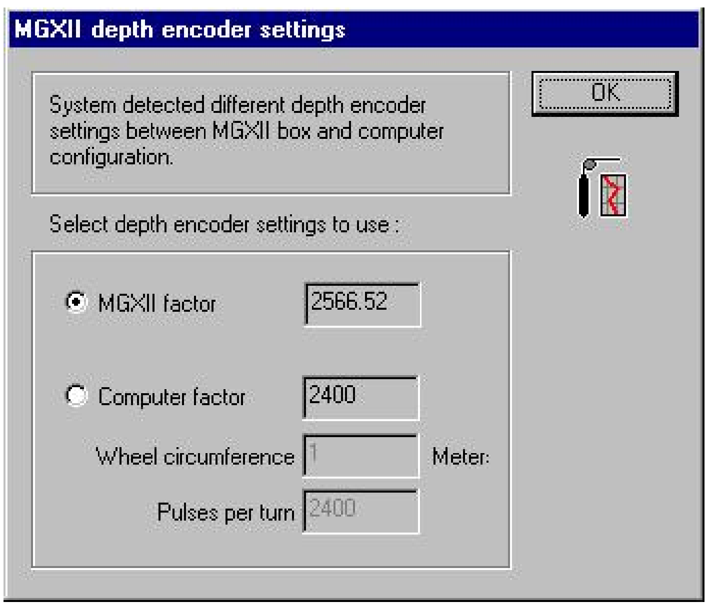
When the MGX II logger is detected, MSLog sends commands to configure the MGXII. The logger replica icon that mirrors the status LED's on the MGXII Depth display appears on the screen until the command sequence is completed. During this time MSLog will not accept further mouse clicks. The logger replica icon also appears at tool selection and again when tool power is turned on. It is displayed to show the user that the logger and PC are communicating with each other in a "SETUP" mode, The user should not press any keys or click the mouse until the box disappears.



During the initialisation sequence, if the PC and logging system have been set up at the factory, or the software has been previously installed and configured, the system will normally start up and the DASHBOARD will appear on the left hand side of the screen. If the PC has not been set up for the logger, and the initialisation settings in the MSLOG.INI file are different than those set up in the logger, the following boxes may appear:

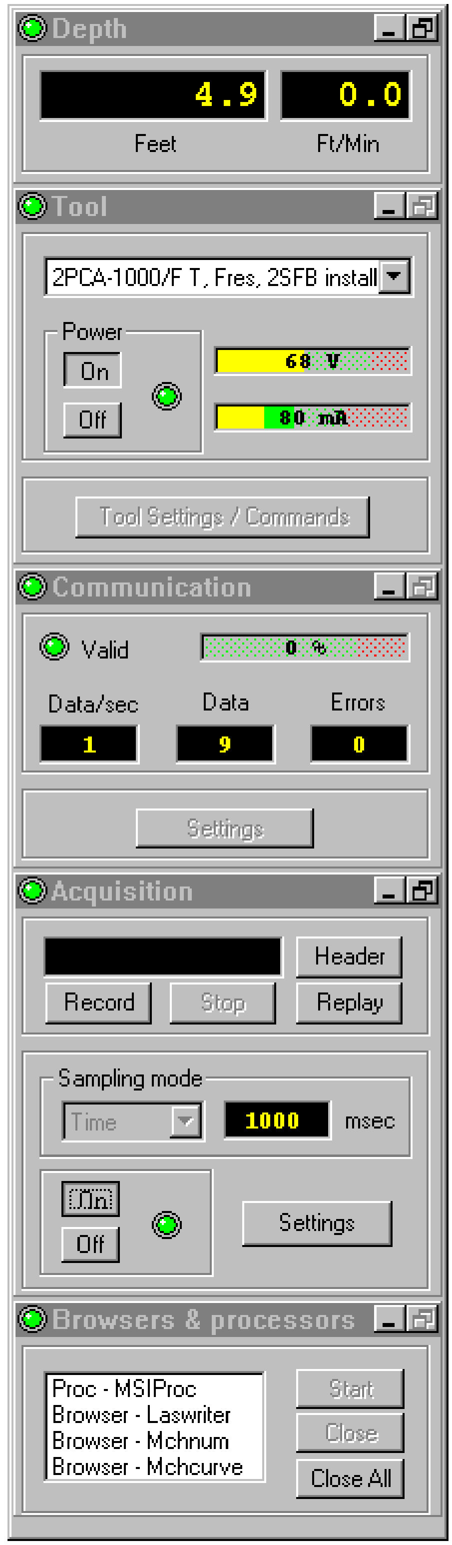


Normally, the user should allow the logger settings to be used, since they are set at the factory for the logger/winch system. These settings control the depth measuring system and power and data communications parameters for different winch and cable configurations. If in doubt, contact the factory for details.



If these windows do not appear, then the logger and PC have been initialised during an earlier session and no further action is required.

II. Dashboard Introduction



The Dashboard is the operator's control panel. It is used to select and control all system functions and to monitor acquired data. This section of the manual introduces the components of the dashboard. More details can be found in the "Dashboard Operation" section.

The main Dashboard window occupies the left of the monitor screen. The standard Windows screen icons remain active onscreen but are shifted to the right of the MSLog Dashboard, they can be accessed in the usual way.

Operators familiar with Microsoft Windows may recognise some of the controls found on the Dashboard while to others they may be new. Features used include *push buttons, radio buttons, check buttons, check boxes, text entry fields, graphically simulated switches, LED indicators and LED bar graphs*.

Whether experienced or a newcomer to the concept of virtual controls, the user will soon become confident in their use.

Right clicking with the mouse while over the Logger Dashboard opens the menu shown below:

Options are:

Always on top	Dashboard window always above other windows.
Autohide	Dashboard hidden when area outside is made active by pointer. (Dragging the pointer to the extreme left of screen re-opens the Dashboard).
Help Index...	Click to enter the help document. It is fundamentally a copy of this document with some enhancements.
About MSLog	Program and hardware set up details.
Exit	Closes MSLog (which closes open data files, and powers down MGXII if this has not already been done).

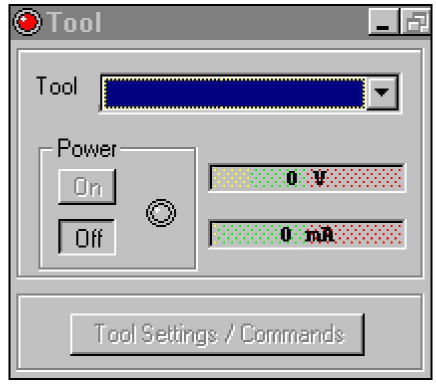
III. Dashboard Panels

The Dashboard window contains five sub windows or panels, all of which can be maximised or minimised using the top right window control buttons common to Windows applications. These windows cannot be permanently closed.

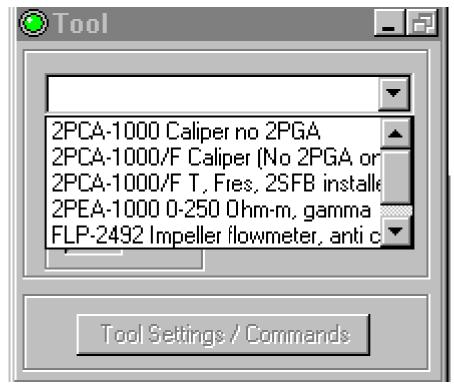
Depth	depth settings
Tool	tool configuration & power
Communication	data flow & communications controls
Acquisition	data sampling & replay controls
Browsers & Processors	data browsers & processor controls

When in an active state control buttons are sharply outlined. The user will notice that some controls are either permanently or temporarily grey. This is an indication that the function is not yet implemented or that operation of the control is not appropriate at the current state of the system. For example Replay cannot be accessed when Data Sampling is On. A display light (or LED) at the top left of the each panel indicates system status. The color green indicates a correctly functioning system, and a red color indicates a fault. This is generally true of all panels on the dashboard. Throughout this document, these display lights will be referred to as LEDs, which is an acronym for **L**ight **E**mitting **D**iode

a) Tool Panel

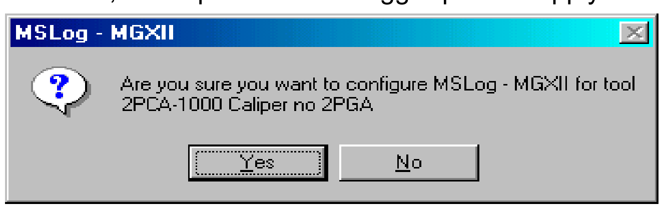


The **Tool** panel is used to select the desired probe for logging, switch tool power on and off, access tool functions such as Caliper open/close, and to modify tool configuration settings. Access to secondary windows, is provided when required, for setting additional tool parameters. Depending on the probe being used, tool power may have to be On to access Tool Settings/Commands.



The logging tool is selected from a pull down list box which displays the tools available as described by the *.TOL files loaded in the \MSLog**\tol\current** directory. After the desired tool is selected with the mouse or highlight bar, a window will pop up asking the user to confirm the selection. An example of such a window is shown below:

If the YES button is pushed, the MSLog software reads the information in the TOL file associated with this selection, sets up the MGX II logger power supply and data protocol



system, and loads the relevant "browser" clients for log data display. During this time, the logger icon will flash, indicating the system is busy. Also, the browser clients will load, based on the configuration in the TOL file. Normally, for standard logging tools, the MSIPROC, MCHNUM, MChCurve, and LASWRITER Clients will start. For image and full wave sonic tools, other Clients will start. The functions and features of these Clients are discussed later in this document. <u>If a browser fails to start within a reasonable time</u>, a "**not connected"** message will appear. The user should go to the Browser window, select and Close the browser, and "Start" it again.

Two bar meters on the Tool Panel display the tool voltage and current supplied by the MGXII logger to the probe. These values are calculated from information read in the TOL file and winch/cable information.

The current meter is active but should show 0 mA until the tool power button is pushed. These meters are not diagnostic, in that they only display the values read from the TOL file. The voltage at the logger can be measured at the red and black banana jacks on the logger, if desired.

The Power-On and Power-Off control buttons are activated by mouse-clicking. The Power LED shows green when the tool is powered correctly, and red when off. When the tool is powered on, the current meter should indicate the value programmed from the TOL file.

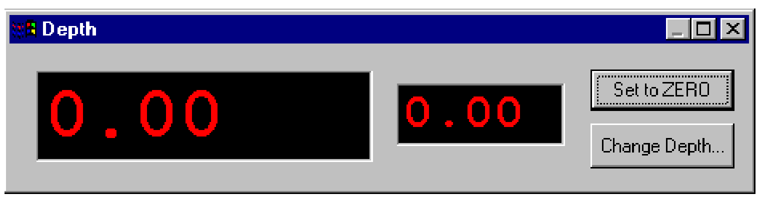
The **Tool** panel also contains a Tool Settings/Commands button. This button is only active when there are settings or commands available for the probe in use. Controls for particular tools, such as Calipers, samplers, image, and sonic tools are discussed in later sections.

b) Depth Panel

Within the **Depth** Panel there are two separate numeric displays. The left side displays the current tool depth in metric or English units (depending on user preference-see details on **Logger Configuration**). For the MSLog system, this is normally the physical bottom of the tool. The right side displays the current logging speed in depth units per minute.

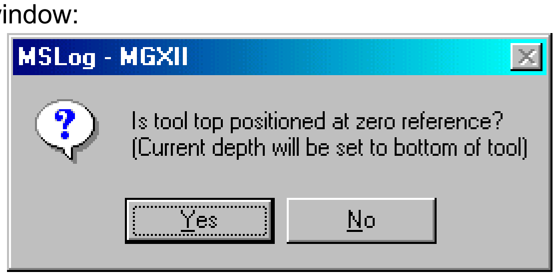
bi Setting the depth

Clicking on the link window button at the top right opens the window below:



In this window, there are two option buttons:

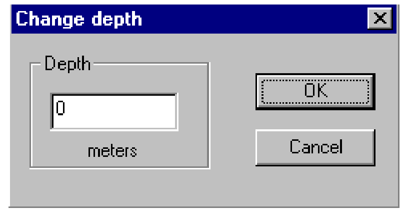
Set to Zero-resets the counter to the physical bottom of the tool. Pressing this button will bring up a new window:



This window prompts the user to position the probe top at the zero reference point to begin logging (normally ground level). After probe is positioned at zero, the user should then press the YES button, and depth system will be reset to the physical bottom of the tool. The display will then indicate the depth of the tool bottom. All other sensor positions are automatically depth corrected during logging based on values read from the *.TOL file selected for the probe being logged. Note that this feature will set the depth counter to zero if no tool has been selected.

NOTE: The standard point for the zero reference for MSLog is the **cable-head/probe top connection.**

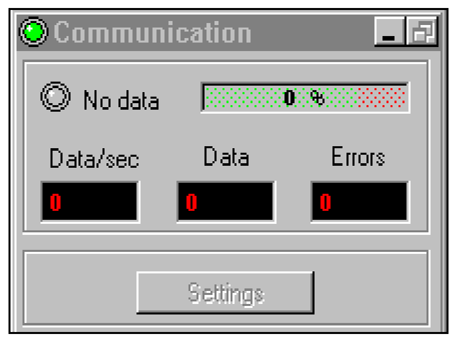
Change Depth-opens depth change window, which is activated by entering new depth and pressing **OK** button.



Note that depth data is processed as a separate task in MSLog. In the event of a power failure, the current depth information is stored in the MGX II in non-volatile memory. If the probe is kept stationary, and power is restored, the valid depth will be recovered.

! **When using an isolation bridle** (for normal resistivity logging), the user should position the bridle/cable head connection at the zero reference, and then press the “Set to Zero” control, and then after the depth has been update, press the “Change Depth” control and add the bridle length (e.g. 25 feet) to this depth and enter it into the field to set the correct depth. For example, using this method, the correct depth for a 2PEA/PGA probe would be 6.17 + 25 = 31.17 feet. The user should physically measure the bridle to insure accurate depth reference

c) Communications Panel



The communications panel shows information about the data sampling, data throughput, and provides the facility to tune communications settings as appropriate.

There are three LED panels, which display:

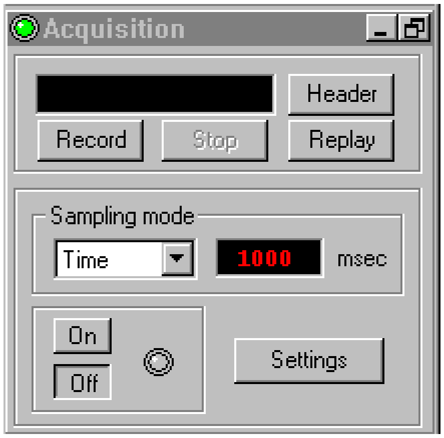
Data/sec	rate of data sampling
Data	Indicates the number of data samples read unique to a recording or in a replay session. The value is automatically reset to zero when a record or replay is terminated by the Stop control
Errors	Counts the errors or number of times during acquisition that the system failed to obtain valid data upon request.

When data is not correctly received, the **No Data** LED shows red.

The bar graph meter at the top right is **not active** in MSLog operations, and is used only with the ALTLog version of the software.

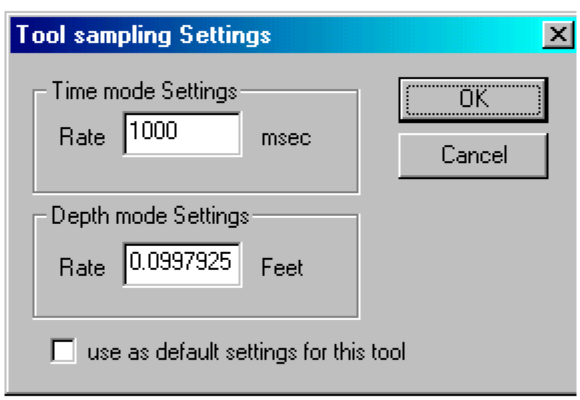
The **Settings** button options are further discussed in the Logging Procedures, and relate to the adjustment of communications parameters in the MGX II logger.

d) Acquisition Panel



The **Acquisition** panel is used to select data recording mode, set sampling rates, start and stop data recording, edit information in the log header, and replay data.

Sampling mode is selected through the combo pull down list box. Options are **Time, Depth Up,** and **Depth Down**. In depth mode sampling is directly related to the pulse inputs from the depth encoder device and the settings in the MSLog.ini file. The Settings button opens a dialogue box in which the sampling or time interval can be set by the user. Edit the values as required and confirm with OK.



To start sampling select the **On** button. The LED changes to green when sampling is active. DO NOT CHANGE DEPTH SAMPLING INTERVAL while logging, without starting a new data file.

To record a file to disk, the **Record** button is selected. This opens a file manager dialogue box in which the operator chooses the location and file name for the data recorded. Recording commences immediately after the filename has been entered and confirmed by Save. The file name is displayed in the text box at the top of the acquisition panel. MSLog automatically adds the file extension .RD to all data files, and this binary file format can be viewed/plotted again using the Replay button. If LASWRITER browser is active during logging, an LAS format data file is also created, which follows the LAS (Log ASCII Standard) v 2.0 standard. This file format can be imported into most log data processing or Windows compatible data base manipulation programs. Depth corrections are **not preserved** in LAS format files. For more details, see the section on the LASWRITER browser.

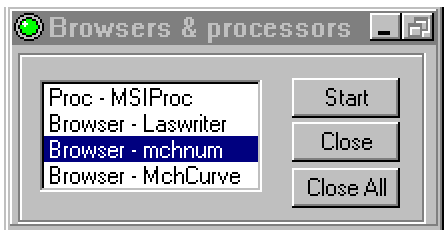
By pressing the **Header** button, the user can edit and save header information. More details are found in the Logging Procedures section. Custom headers can be created using the HeadCAD program (a WellCAD module). They should be copied to the \MSLog\Headers directory, and given the name default.wch. Currently, the header file cannot be larger than 64 Kb. This means that custom bitmaps may need to be reduced in size/resolution to fit into this limit. Otherwise the bitmap may not print or view.

To replay data (from the .RD file), first check that sampling is turned **Off**. The **Replay** button then becomes active. Clicking on the **Replay** button opens a file manager dialogue box in which the operator may choose the file to be replayed. Note that before a file can be replayed the correct image browsers and processors must be open. All browser functions can be accessed before replaying the data, including printer on/off, curve and log scaling, etc. To stop the replay at any point, click on stop. The original header recorded in the log cannot be changed, as it is a permanent part of the RD file.

If, for some reason, an LAS file was not generated during the original logging operation, a new LAS file can be created during REPLAY. See details under the LASWRITER browser section.

Sampling settings remain in place if the tool power is switched off provided that the tool is not deselected.

e) Browsers & Processors



The **Browsers and Processors** panel contains a combo list box, which shows the image and data processing drivers available for the tool selected. A **browser** is a data-viewing window. A **processor** manipulates the data for presentation of a particular type of log. Most tool calibrations Caliper, EM, etc., are made using the MCHNum browser. MSIProc is used when more than a linear calibration needs to be applied to data so it is not always used. The MSIPRoc processor **must be running if it is included in the Browser list.** Typical MSI tool options are shown above. Some of these drivers will be activated and open on screen when the tool is selected but any may be started or closed by highlighting the selection and clicking on the relevant control buttons. This facility can be useful when modifying a *.TOL file, e.g. display parameters. The parameters can be changed in a text editor e.g. Notepad, and saved to file without powering off the tool. The browser can then be closed and restarted with new parameters taking effect. Note that each TOL file contains instructions on which browsers/processors are to be used for a given probe. See the appendix for a sample TOL file description.

IV. Logging Procedures

The general procedures for logging a tool using MSLog follow. Consult the tool operators manual or the MGX II Tool Instructions.pdf for specific operating instructions covering most tools.

- Configure the system for the tool to be logged.
- Connect the tool.
- Power up the tool.
- Verify communications.
- Verify tool operation.
- Calibrate tool if necessary (**MCHNUM** Processor).
- Move tool to starting point and zero the depth.
- Set sampling parameters, and turn ON.
- Enter Header data.
- Run test log/adjust tool configuration.
- Modify image browser parameters as necessary.
- Record log.
- Process & print.

This assumes that *.TOL files with calibration factors, shifts etc., have been prepared for the tools to be run.

a) Loading a Tool Configuration File

Select the tool file from the list of available tools shown in the Tool Panel combo list box. The listed tool names are derived from the *.TOL files present in the \tol\current directory, the name being that given as the [ToolName] parameter in the file. The user may edit the [ToolName] if so desired, so that a customized name will show up in the tool name list. The default location of the active *.TOL files is set in the MSLog.ini file and are setup using the MSLConfig program.

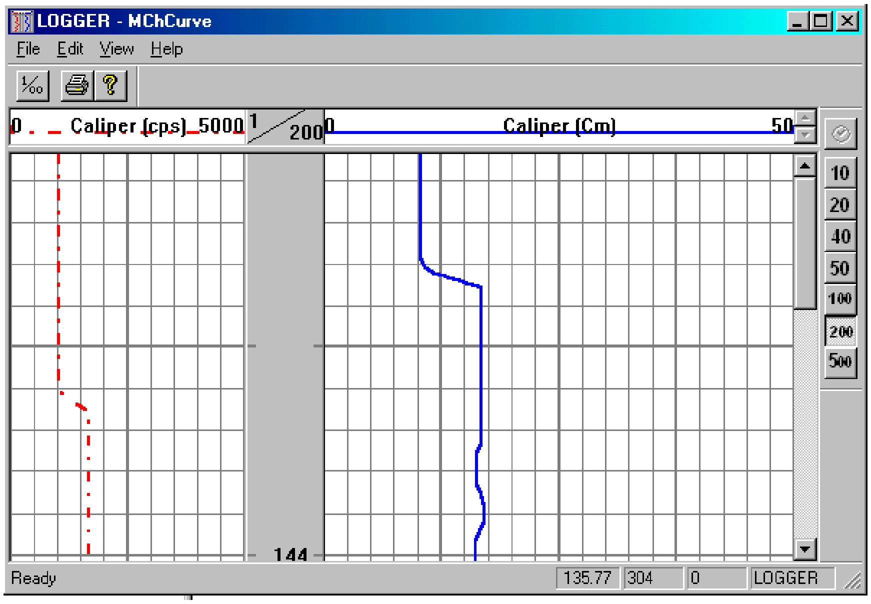
In general, only the .TOL files that correspond to the system and set of downhole probes being operated should be stored in the MSLog\tol\current directory. Depending on the version of MSLog software installed, other .TOL files may be supplied, but will be stored in the main \tol\ directory. These files may be installed at a later time, if required, using the MSLConfig.exe program. Details of the MSLConfig program are found later in this manual. **Only install TOL files using MSLConfig,** as simply copying the files may not update required information regarding tool power requirements and discriminator settings.

b) Data Viewers for Client Applications

Once a tool file has been loaded the system may, depending on the .TOL settings, automatically open the relevant data viewers specific to the tool. Any processors relevant to the tool will also be started. Both image browsers and processors are defined in the tool *.TOL file.

There are several different types of viewers and processors, all residing in their own individual windows. The windows will appear on the screen unless set to load minimised. They can all be re-sized or moved by dragging the window edges or corners, and can be maximised, or minimised to a marker on the status bar. The default position and size of each window is defined in the .TOL file and can be edited as desired.

The following figure is an example of the MChCurve browser showing a raw channel (cps) and a calibrated channel (cm) from data logged with a three-arm Caliper tool.



Detailed information on the different data browsers and processors follows in Chapter 4. Instructions for log presentation and printing, are included in the same chapter.

c) Connecting the Tool

Having loaded the correct tool file you can then proceed to connect the tool to the wire line cable. If you are in any doubt about the configuration of your system it is prudent to power on the system without a tool and to check the voltages present on the conductors of the cable head to make sure that they match the requirements of the tool. **Always check cable conductor isolation and continuity before connecting probes to the cable head.**

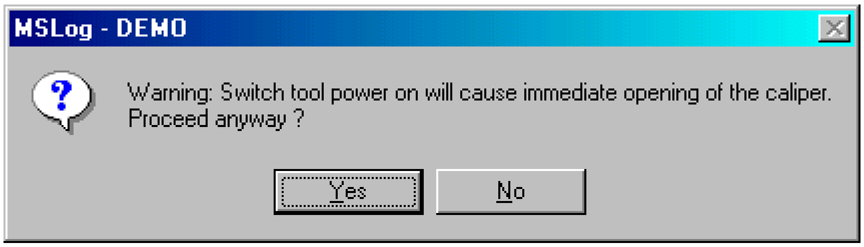
d) Powering up the Tool

! Irreparable damage may occur to the tool if powered on while an incorrect tool file has been loaded. Older tools in particular are less protected against incorrect voltages so take care. **Before powering on the tool, verify that the correct tool file has been loaded.**

The Voltage Meter on the Tool Panel will display the normal operating voltage for the tool once the tool file has been selected. Current will be zero until the power is switched to the tool. To power on the tool select the On button in the Power Panel. The LED indicator will turn green if the command has been executed correctly. There is a short initialisation period before tool communication is established. Voltage and current levels displayed on screen are the settings from the tool configuration file and do not reflect the actual voltage and current on the wire line. Refer to the tool specific instructions for further operating procedures.

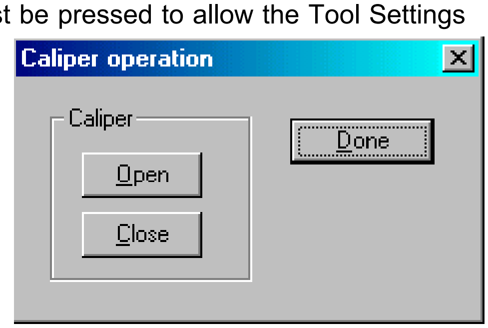
di Powering and Operating Calipers and Fluid Samplers

2CAA/2PCA Caliper Family-Caliper tools require special procedures to open and close the Caliper arms. Generally, there are two different procedures for opening Calipers with the MGX II system operating under MSLog. The procedure is specified by information loaded by the .TOL file. Mount Sopris Calipers operate and open using negative voltage. Pressing Power ON will cause a message such as the one that follows to appear for the latest 2CAA/2PCA family of Calipers.



Normally, if the Caliper is at the bottom of the hole, or the user wishes to calibrate the Caliper, the correct response is YES. However, for Calipers that operate in this mode (such as the MSI Calipers), the user should not turn power on until the Caliper is at the bottom of the hole. The normal logging sequence would be to calibrate the tool on the surface, close the arms, and then zero the tool and proceed to the bottom of the hole. The Depth System will display the correct depth even though tool power for MSI Calipers should be OFF while going in the hole. When the Caliper probe is on the bottom of the hole, the Power ON button is pressed, bringing up the window shown above. After pressing YES, the Caliper will begin to open. Press the Tool Settings button, and press OPEN, which will start the software timer. After 90 seconds has elapsed, a "Caliper Open" message will appear. To see if the Caliper is open on the bottom of the hole, the user can go to the Acquisition Panel, select Time Mode, and turn sampling ON. A reasonable value for the Caliper should appear in the MCHNUM data browser. Keep in mind that often the Caliper arms do not fully open until the probe is raised a few feet (meters) off the bottom of the hole. To close the Caliper after logging, the Tool Settings Button is pressed to bring up the Caliper Operation Button, and the Close Button is pressed.

For older Calipers, such as the CLP/CTP family, which operate on a lower voltage than the new Calipers, the Tool Power ON button must be pressed to allow the Tool Settings Button to be active. After pressing this button, the Tool OPEN/CLOSE Button will appear. Upon pressing either button, an Elapsed Time display will appear during the OPEN or CLOSE process. The user must wait until the DONE box is activated, at which time the system is returned to the logging mode. Other Calipers not manufactured by Mount Sopris (MLS, Comprobe, etc.) will generally operate in this mode. **Fluid Samplers** operate much the same as Calipers, and the user will normally turn Tool Power ON, and then use the Tool Settings Button to access the OPEN and CLOSE buttons for the sampler.

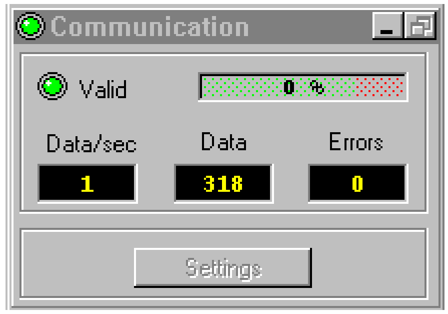


dii Image and Full Wave Sonic Tools

Probes such as the FAC40 and OBI40 imaging tools and full wave sonic tools, which have many user configurable features, are also controlled through the Tool Settings/Command Button. Detailed discussions of the settings are presented in the Operations Manuals and browser sections for the individual probes.

e) Verifying Communications

Verify correct communication between tool and surface system. A green light should appear in the upper left corner of the Communication Panel. This light should stay green when the Acquisition Panel is set to Time Mode and Sampling is turned ON. For standard probes (all MSI probes, except the high baud rate digital probes like 2SAA and Image probes from ALT) no further action is needed. The Valid Light should also be green. The **Settings** Button of the Communication Panel is only active when adjusting settings for high baud rate probes. Communication settings and options vary from tool to tool. Individual tool configuration and communications set up is described in the individual Operations Manuals for the high data rate probes.



Note that sampling should be turned off before adjusting tool or Communications settings.

f) Calibrate tool (MCHNUM Processor)

g) Zero the Depth

The MSLog program uses the connection between the cable head and the top of the probe as the zero reference. All log data is referenced to this point. Before lowering the probe in the borehole, the probe zero point should be moved to the zero depth starting point (or zero depth). After this has been done, click on the Depth Panel upper right hand corner, to reveal the next window, which has two buttons: The top button is used to set the logging system depth to the tool bottom. This is based on values that are found in the .TOL file for the selected probe. The software automatically depth corrects the individual sensor offsets referenced to the tool bottom, with no user action required. The tool length and sensor offsets in the *.TOL file are always specified in metric units, whether operating in meters or feet. These settings are also used by the browsers to depth correct the data which is displayed on screen or sent to the printer. The user can edit this number by the appropriate amount (using "Change Depth"), if an offset for the zero is required due to well-head access restrictions.

h) Setting the Sampling Rate

Prior to logging it will be necessary to set the tool sample rate. The sampling rate is set in the **Acquisition Panel**, using the settings button for either time mode, or depth mode - up/down, depending on the nature of the tool and your logging operation. Sampling rates may be altered during the course of recording a log.

Note that the sampling rate may need to be reset if a different tool is selected. Sampling rates can be set by default in the *.TOL file. Once again, the MSLOG system uses the **metric system** as a **basis for all measurement references**. This means that measure wheel circumference in the MSLog.ini file, tool and sensor lengths in the .TOL files, and default sample intervals in the .TOL files should be entered in metric units. The system then automatically converts to English units for the depth display, the sample interval display, and the browsers. In general this will be transparent to the user, unless the user operates in the English system of units, and finds it necessary to edit the INI or TOL files.

Sampling rates are related to logging speed, encoder resolution, tool sensor resolution, and data transmission rates. Since the depth data is derived directly from the encoder pulses, the sampling interval cannot be less than the distance represented by consecutive pulses. The volume of data transmitted varies from tool to tool. For high data transmission rates, logging speed should be reduced. When considering tool resolution, a density tool might have a resolution of 5cm. A sampling rate of 2cm would cause overlapping of the data points. Typical sampling rates for non-imaging probes are 5 cm or 0.10 feet.

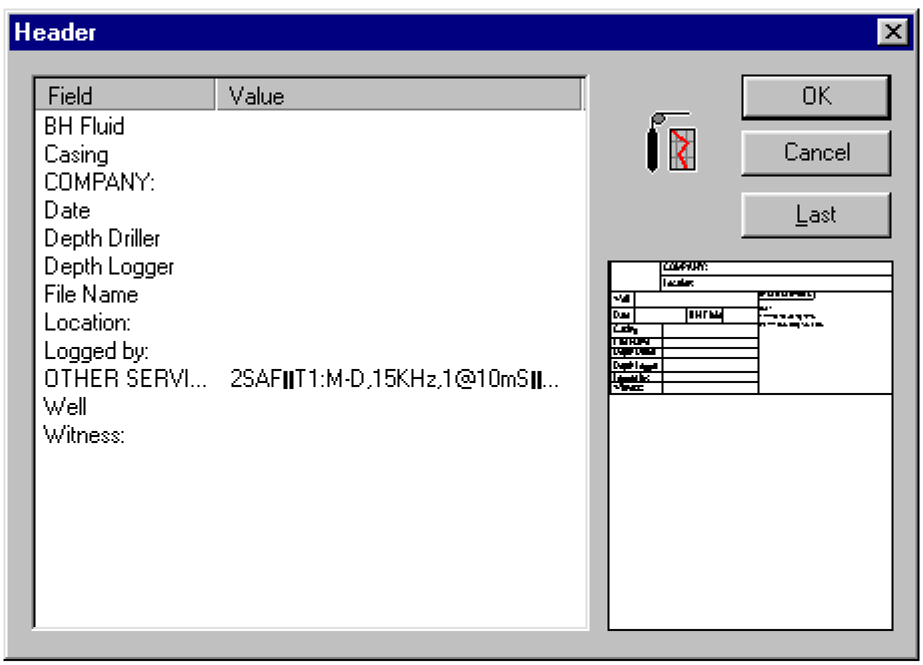
hi Time Sampling

Time sampling is normally used to verify tool operation and to carry out calibrations. It can be used when a tool is to be logged while stationary. For a tool such as the FAC40 with a high volume of data throughput a sampling rate of 500ms or greater is advised to prevent the data buffer overflowing. You will also notice that on multiple channel tools, cps values are much more stable with a longer time sampling interval.

The default time sampling rate for most tools is 1000 milliseconds (or one second). The shortest sampling interval **allowable** is probe and system dependent and is **130** milliseconds.

i) Enter Header data

Prior to recording data, fill out the header information. Press the Header button on the Acquisition panel. Once Recording is started the Header is not accessible. There are a few basic header types distributed with MSLog. Note that MchCurve printed page width is bound by the horizontal size of the header.



To edit a new field header push the button "Header" of the **Acquisition Panel**. A Header editing box will be opened together with a layout of the Header. The layout of the Header and all pre-set values are taken from a file named "default.wch" which is expected to reside in the same directory as the file "default.wchc". By clicking on the "value" field the operator can type in his information. Also, the operator can directly fill in all information from the previous logging run by clicking on the button "Last" of the Header editing box. As soon as you click on the button "OK" the values in the file "default.wchc" are overwritten or a new file "default.wchc" is created if no file of this name exists. The name of the directory where the file "default.wch" and "default.wchc" are expected can be changed in the **Tol file**. Note: The header cannot be edited in Replay mode. For custom header creation, consult Mount Sopris for more details. The HeadCAD program is available for creating custom headers, which cannot be larger than 64 Kb. HeadCAD is provided with WellCAD, or may be downloaded from www.alt.lu as part of the WellCAD evaluation software.

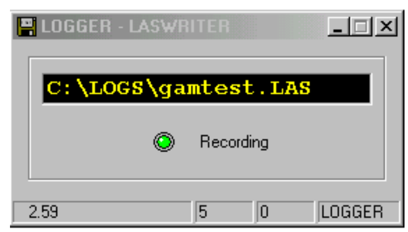
j) Recording Data

Recording data to disk is not automatic, and MUST BE STARTED by the user. To do this, click on **RECORD** in the Acquisition Panel. The system will then ask you to specify a name and location for the file. Since this is a standard Windows file selection dialog box, the user can also specify a new file folder in which to store the new data file. The file will automatically be given a **.RD** extension (Raw Data). The .RD file can be ***replayed*** with the MSLog system to provide additional copies of the log data, and can be copied to disk and replayed on an office machine. The REPLAY button is used for this function. The RD file is always created when Record is ON.

The **RD file format** is supported by the powerful **WellCAD** data processing software. WellCAD can import depth corrected RD files for all MSLog generated data quickly and easily, preserving all browser settings. Sonic data files must be processed by SONPROC before import. To import RD files into WellCAD, simply select FILE, IMPORT, SINGLE FILE, and chose RD as the type, and then navigate to the directory containing the data file. See WellCAD documentation for more details.

If the user wishes to create an LAS (Log ASCII Standard) format, version 2, file that can be imported into other data processing/presentation programs, this is done with the LASWRITER browser. The LAS format produces data that **is not depth corrected**, and the user should consult the Adobe PDF file describing each tool in detail for depth offset information.

This LASWRITER browser must be running during the logging operation if an LAS format file is needed. The user should click on this browser to verify that data is being recorded, and should see a window like this:



The LAS file is automatically turned on and off by the RECORD button, if the browser has been started.

k) Maximum Logging Speed

The maximum logging speed that the complete system can handle, given a particular type of tool, will be controlled by one of the three situations discussed below.

If the surface system requests data at a rate faster than the tool is configured to deliver, then there may either be errors in data received at the surface (tool specific), or the tool may not respond at all. In this case the tool Communications Status window gives the message " no resp" i.e., no response.

Solution: If this situation occurs it will be necessary either to re configure the tool to send data faster (i.e. in the case of a televiewer, increase the speed of rotation of the televiewer head) or reduce the rate at which data is being requested from the tool by reducing the sampling rate - (Depth/Change depth sampling). The latter can also be achieved by reducing the logging speed.

If the surface system requests more data than the tool can transmit through the wire line for the given baud rate then the tool Communications Status window will give the "overrun" message.

Solution: If this situation occurs it may be possible to diminish the amount of data requested for each sample point by changing settings in the tool configuration. See sections on image and sonic logging for details.

If the surface system requests and receives more data than the system can process in real time, data may be lost. The system manages temporary data saturation through the use of a data buffer. The buffer is a fixed size of emergency memory, which temporarily stores data while waiting for the CPU to catch up.

! Solution: To lower the demand on the surface system and thus avoid data saturation you can reduce the data transmission rate by logging more slowly or by using a bigger depth increment for data sampling. In some instances with some tools (e.g. the televiewer), the load on the CPU may be cut by reducing the number of dashboard control windows open, (minimise them), and/or by reducing the number of client data viewer windows open (similarly by minimising or closing down the windows.

l) Changing a Tool

! Before handling or disconnecting the last tool used first ensure that tool power has been turned **OFF**. Disconnect the tool. In the Tool panel select the new tool name to reconfigure the system. Note that you may have to reconfigure the communications, tool settings and sampling rates if the default values held in the tool *.TOL file have changed.

m) Replaying Data

To replay data from the Acquisition panel, it is a good idea to first go to the Sampling Mode control and select Depth Up or Depth Down. This will make it easier to change the depth scale when replaying data to a printer.

Then press the **Replay** button. The system will prompt you for a file name with the extension *.RD by displaying the file Open dialogue box. After selecting the file for replay, confirm OK. The browsers used during recording will then connect. This may take a few seconds. The system will then ask if you want to make any changes to your current browsers (such as depth scale, filters, scales, etc.) and allow you to enable printing and header style. The header cannot be edited in replay. After these final selections are made, the OK button is pressed, and Playback will begin. Logs recorded in Time Sampling Mode cannot be replayed, although the data can be read from the LAS files and imported into other programs for further processing. It is possible to create a new LAS file during replay by opening the LAS browser, and left clicking on the task bar icon, and clicking on the Save on Replay line

mi Tool selection and replaying data

Rd data files contain an imbedded copy of the tool driver (.tol) file. Rd data files may be replayed during log acquisition mode or Demo mode. In the normal log acquisition mode if you replay a RD data file recorded with the currently selected tool driver type, then the selected tool driver, not the embedded tool driver controls the settings for the replay. This means that the currently selected tool driver settings for header, calibrations, browsers running etc. are used to replay the data in the Rd data file.

This has serious implications if the calibrations of the imbedded tol file and the currently selected tol file are not the same.

This behaviour can also be used to correct a log that was run with improper calibrations. Re-calibrate the tol file and replay the RD data file after selecting the newly calibrated tool driver.

In Replay mode, if you do not select a tool from the list or select a tool of a different type, the replay uses the settings from the imbedded tol file.

If you did not enter any header information in the original data, in replay mode you can select the same tool driver, which will allow you to enter the header information. Just be sure the calibration information, if any, is the same.

Although you cannot recreate the .rd file, you can fix data recorded with a browser turned off by selecting the same tool and rewriting the .LAS file using that option on the LASWriter, browser as described above. If a needed browser is missing from a tool driver, data can be replayed with a corrected tool driver selected. You can use external tol files, with corrected conditions such as calibration changes, to import data into Wellcad.

The exact condition test for this replay behaviour is:

> On replay MSLog uses the currently selected tol file on condition that ToolName= matches (case insensitive) the imbedded one and DriverName= exactly matches the imbedded one. Otherwise the imbedded tol file values are used.

n) Exiting MSLog

To exit, the user will turn TOOL POWER OFF, and then close MSLog. Right Click over the dashboard, and select EXIT. The system will ask for verification and the user clicks on YES to complete the shutdown of MSLog. As with all processes where the PC is communicating with the logger, the **user should watch the data lights on the logger and verify that communications are complete.** The logger will return to the power-on mode (where the “TO PC” light is blinking at a steady interval.). DO NOT POWER OFF the logger until this occurs.

4. Browsers and Processors

I. Introduction

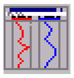
Once a tool file has been loaded the system will provide access to the relevant Data Browsers and Processors specific to the tool type. The acquired data is provided in real time to the individual clients (Browsers and Processors) window. By setting options within the clients the user can control the layout for both onscreen data display and for hard-copy printout produced as a borehole document on site, calibrate probes such as Calipers and other pulse type tools, record LAS format files, and edit and print customized API style log headers. Specific formats can be saved so that they can be called up again on the next logging job.

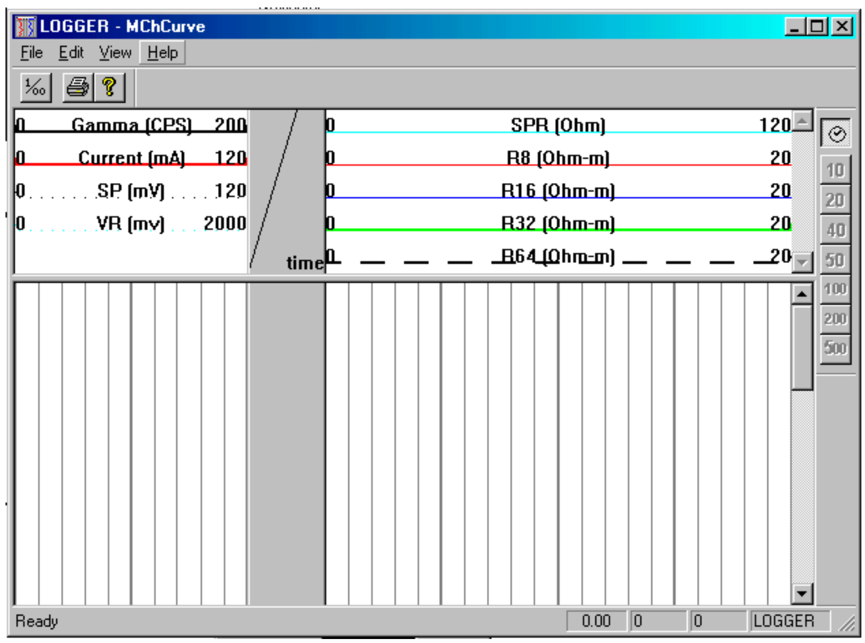
II. Multi Channel Client Data Windows

This family of display windows is a general-purpose suite that is used for logs where each trace is composed from a single data value at the sampling point.

NOTE: After performing calibrations with MCHNUM, be sure to Close and re-Start all browsers and processors. If you do not do this, calibration information will not be available to the browsers and processors, which can result in erroneous data in plots and the .las file.

a) The MChCurve Browser

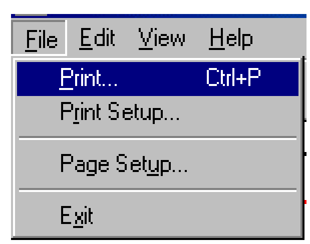




This browser has three pull down sub menus **File, Edit** and **View**

ai File

This menu contains the options **Print**, **Print Setup, Page Setup, and Exit.**



Print This selection instructs the system to send the file data to your printer.

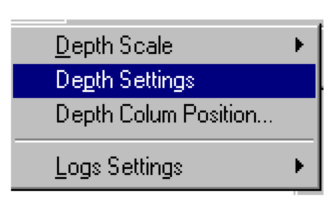
Print Setup The default choice is Windows printing. Do not select real time Printrex printing. You should select your default Windows printer, which will provide for correct scaling and resolution. Do not change this default setting, unless you have changed your default Windows printer, or the printed depth scales may not correspond to the selection made by the user.).

Page Setup The user can select whether a full header or short headers will be printed). Short headers contain only curve name and scale information.

Exit This selection always returns user to previous menu.

aii Edit

This menu contains options **Depth Scale, Depth Settings, Depth Column Position** and **Log Settings**.



Depth Scale User selects the desired depth scale.

Depth settings Allows user to specify horizontal grid settings for depth lines on log plot.

Depth Column Position User selects the position of the depth track (API standard is 30%=40%). User can change as required.

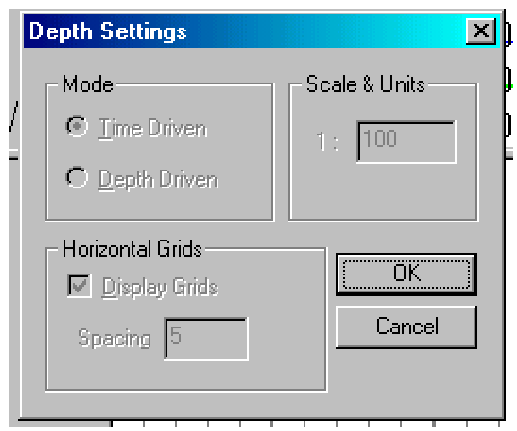
Log settings Accesses the Well-Log Settings dialogue box via the Select a Log list box. This box is more easily accessed by clicking on the log name in the header. Changes in log settings are automatically written to the \tol\current\ version of the TOL file so they are available the next time the tool is selected.

aiiiView

Tool Bar contains buttons to turn on Printer, change Depth Settings, and view Browser version number.

Status Bar shown below displays data related to Current Depth, Numbers of Data samples, Numbers of errors, and the connection status. This is useful when Auto hide is selected for the main Logger panels.

b) Depth Settings Dialogue Box



The depth settings dialogue box shown at right is used to set the depth scale and grid layout displayed in the MChCurve window.

Depth

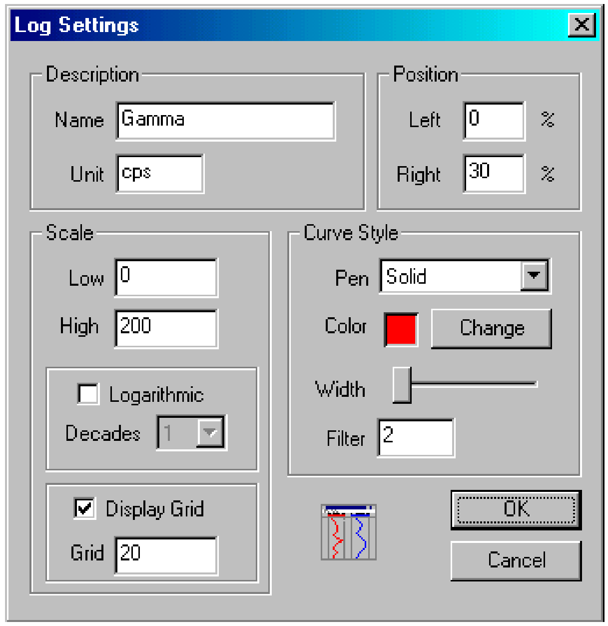
Scale - set the depth scale of the log e.g. a number 50 equals 1:50 scale, or 1 cm on screen or printer will display or print 50 cm of log. This is the scale that will be displayed and/or printed.

Horizontal Grid Spacing - sets the frequency of major and minor grid lines and corresponding depth value text display. For example, a value of 10 will produce a depth number each 10 feet or meters, a bold grid line at each 5 and 10 unit spacing, and a light grid line each unit. The user **should** **<u>not</u>** enter a value that results in a <u>minor grid line being printed at a frequency higher than the depth sample interval.</u> For this example the sample interval should be less than 1 depth unit. If in doubt, always start with a large number like 100 for depth scale, and 10 for grid spacing. Problems can occur when combining low value depth scales with low value horizontal grid spacing, when the minor grid lines are forced to try to display or print at a higher resolution than the data sampling.

c) Log Settings

The Log Settings menu option provides the user with access to the controls, which govern the display and print characteristics for individual log traces. The easiest way to reach the menu is to click on the log name in the header above the log display. The settings selection can also be made by clicking on log settings in the EDIT selection on the main menu task bar.

d) Log Settings Dialogue Box



The parameters, which can be set for each log trace follow:

Name

Enter a title of your choice using all the standard keyboard characters.

Units

Enter the units of measurement

Position

Enter the location in % full scale for the location of the curve relative to the full width of the log plot. Well Logs can occupy the same location.

Scale - Low

Select the minimum scale value. This value will appear on the top left hand corner of the log Title bar, if there is sufficient room.

Scale - High

Select the maximum scale value. This value will appear on the top right hand corner of the log Title bar, if there is sufficient room.

Logarithmic

By clicking this box, the user can select a logarithmic grid display, and enter the number of decades. If the box is unchecked, the display is linear (default).

Grid

The values in the Grid box determine the frequency between vertical grid lines. Thus a value of 10 in the Grid box means that a vertical grid line will be drawn every 10 measurement units. A value of zero will produce no vertical grid lines. This field only applies when scaling is in linear mode. Use only one grid per section of plot area when plotting multiple curves in that area.

Display Grids

Turn on or off the vertical grid lines.

Curve Styles

This selection allows the user to choose between solid and dash/dot line styles.

Color

Allows selection of the color of the log curve from the available color palette. Choose dark colors for monochrome printing, as light colors will not print on monochrome or grey scale printers. While MSLog will display all colors on screen, it will only print in monochrome in the present version of software.

Pen Width Controls the thickness of the log trace from 0.1mm up to 1.0mm.

Filter Width

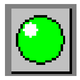
The filter width function enables you to filter your log data on a moving average basis. Thus by selecting a filter width of 5, a calculated moving average log, based upon five incremental data points, will be displayed. By using the filter, spiky data can be smoothed. Data gaps in well logs can be overcome by using an appropriate filter so long as the data missing does not exceed more than 9 incremental units. Note that the filter does not change the actual data, but is applied "on the fly" while the data is displayed only. This leaves the data untouched and allows you to later reduce your filter width if you wish to do so.

OK

Puts into operation your selected log parameters and returns you to the Multi-Channel Curve Window, and saves the current settings in the \tol\current version of the TOL file.

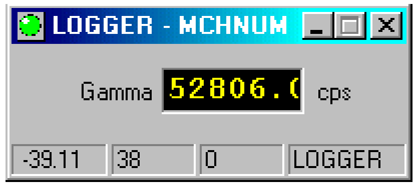
Cancel

Cancels your selection and returns you to the Multi-Channel Curve Window.



MCHNUM Processor/Calibration Procedures

This processor displays the numeric value for each tool channel, and allows calibration of data channels requiring calibration, such as EM, Caliper, etc..



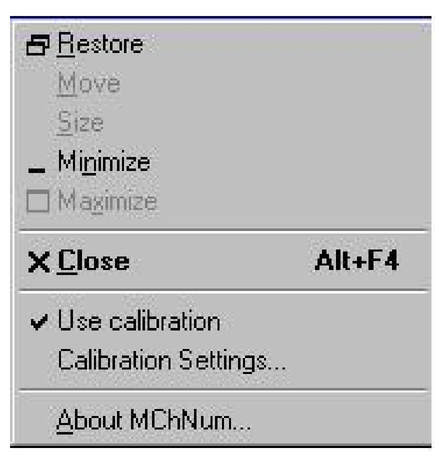
di Calibrations

By clicking on the green ball icon on the upper left corner of the MCHNUM processor, a pull down menu is provided, that allows the user to turn calibrations on and off, and further access to the calibration settings for each channel.

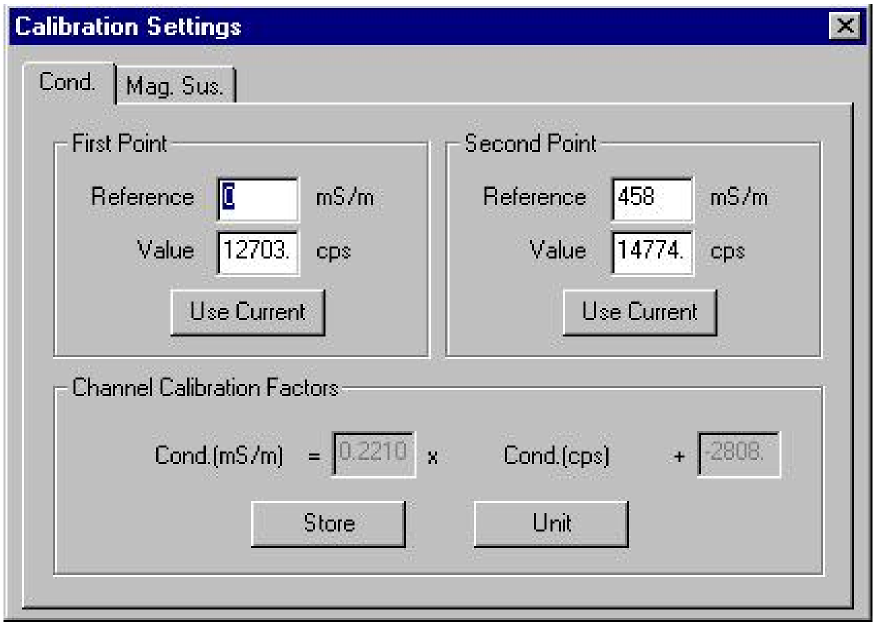
Normally, the user will leave calibrations on (with the ✓Use Calibration selected) when logging. This results in the calibrations being applied to the MCHNUM, MCHCURVE, and LASWRITER outputs. If the user wishes to watch raw data in the MCHNUM display while logging, the ✓can be unchecked.

dii Calibration Settings

Be sure that the Use Calibration ✓is OFF before proceeding! Click on the Calibration Settings line. In this dialog box, the user can select the channel to calibrate, enter the appropriate calibration values, and then store the entered values in the TOL file The example on the following page shows a screen for an EM probe calibration, where the user placed the probe in a zero conductivity medium and pressed the button marked "Use Current Value" to set one end of the calibration, and then placed the calibration ring on the probe with a 458 mS/m response and pressed the "Use Current Value" button to set the other end of the calibration. Similar calibrations can be performed for Calipers, using two different known calibration ring sizes. When finished with a channel, the user should press the Store button. After finishing the calibration, the user should close the window, and **CLICK on Use Calibration, so the ✓is checked.** If another browser, like MCHCURVE, is running, the user will have to Stop and Start the browser again to make it read the new calibrated values.



diii Sample Calibration Screen



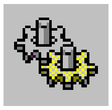
Caution: The user must follow the above procedures to the letter to ensure accurate and correct calibrations. Pay close attention to the reference to the check mark (✓) setting in front of USE Calibrations. It is OFF during calibration and ON during logging.

e) MsiProc Data Processor

The MSIPROC Processor provides data format conversion, and must be running for those probes requiring this function. This processor will automatically start when initialised by the Tool selection dialogue. The user should make sure that it is running during calibration and logging. Do not turn off MSIPROC, or incorrect data will be recorded. If it is listed in the Dashboard Panel as a processor, it must be running. Many probes, such as stand-alone gamma, image, and sonic do not require MSIPROC.

After performing calibrations with MCHNUM, be sure to Close and re-Start MSIPROC and other browsers.

f) MchProc Data Processor



The MchProc Processor is an updated version of MSIProc and will eventually replace it. It operates just like MSIProc and all comments on the operation of MSIProc apply to MchProc. Both processors are used to retain compatibility with existing and custom tol files. MchProc has additional functionality similar to Wellcad for math and logical functions including special Deviation logging algorithms.

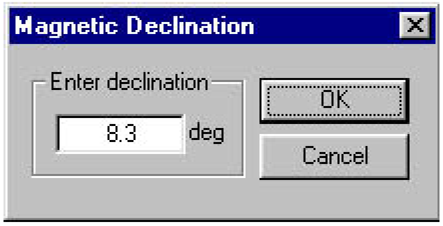
fi MchProc and Deviation Logging

Deviation tool files enable access to dialogs allowing the setting of measuring Units and Declination offset. To do this, right click the top of MchProc as shown in the following graphic.

Clicking Unit opens the following dialog:

Select the units you wish to use for the deviation TVD, Northing, Easting calculations.

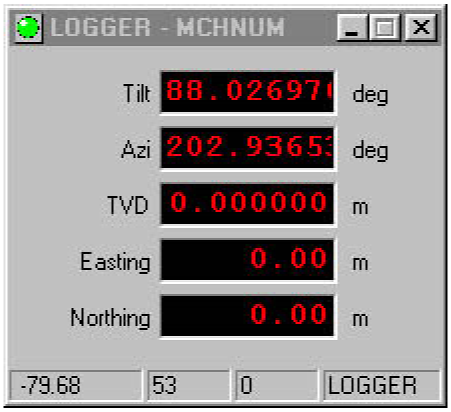
Clicking Declination opens the following dialog:



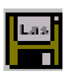
Enter the declination offset for your location.

fii MchNum and Deviation Logging

Below is MchNum display of deviation data using MCHProc. The TVD, Northing, and Easting endpoints are set to zero by either closing and restarting the browsers or reselecting the tol file at the end of a down or up run.



g) LASWRITER Browser



This browser, when active, indicates that an LAS format file is being recorded. In the present version of MSLog, this browser must be running to produce a log data file that is in an ASCII format. This format is required for import by other log processing programs. The .RD file recorded by MSLog is only used for REPLAY of logs with MSLog software or direct import into the latest version of WellCAD software.

A green light, and the name of the current file in the box, indicates that recording is taking place in the location specified. If the LASWRITER browser is closed by accident, go to the Browsers and Processors Panel, and re-select LASWRITER, and press OPEN to re-start it.

After performing calibrations with MCHNUM, be sure to Close and re-Start LASWRITER and other browsers and processors.

Note: Data recorded in the LAS format is recorded as is, with no depth offsets. The user can find depth offset information in the MGX II Tool specific operations information file (Adobe PDF format) included with the MSLog software. All depths are referenced to tool bottom, so data will need to be shifted up for depth corrections. RD playback logs are automatically depth corrected as are RD logs imported into the latest versions of WellCAD.

Replay of LAS format data

In some cases, the user may have forgotten to turn on LAS file recording during logging. If this occurs, it is possible to create a new LAS file in REPLAY. Simply start the LAS browser, and click on the upper left corner, which provides a line, which can be selected that says “Save on replay”. Click on this line to save a new LAS file in the same directory where the *.RD file was selected.

5. Image/Full Wave Sonic Tools

I. Introduction

Several types of specialty tools can be operated with the MGX II logger and MSLog software. The basic operation of these tools is covered in this section. For additional details, the user should consult the individual documentation for each probe.

II. Mount Sopris Instruments Sonic Probes

Mount Sopris currently has three, versions of Full Waveform Sonic Probe the 2SAA-1000 the 2SAA(F)-1000 and an anticipated 2SAF-1000. The 2SAA-1000 is a one transmitter multiple-receiver probe while the 2SAA(F)-1000 or 2SAF-1000 can accommodate either a second, 2STA-1000, transmitter, or the 2SNA-1000 probe section, added at the top of the probe. The 2SNA-1000 provides a natural gamma radiation measurement to the Sonic measurements.

The transmitter from a 2SAA-1000 can be upgraded, at the factory, to operate as a 2SAA(F) by replacing its microprocessor firmware. The serial number of the 2STA-1000, transmitter section will have an “F” stamped on it to indicate that it has the 2SAA(F)-1000 firmware.

In MSLog both the 2SAA(F)-1000 and 2SAF-1000 use 2SAF-1000 browsers/processors. The tol file descriptions are different because we anticipate the tool length will be different. The model number of the Sonic Tool will change to 2SAF-1000 when the new transmitter design is finished.

a) ALT FWS Sonic Probes

Mount Sopris Instruments has offered the ALT FWS 40 full wave sonic probe. Additionally the ALT FWS electronics have been used to upgrade older, analog or digital sonic probes so they are compatible with MSLog or the Altlogger

III. Mount Sopris 2SAA/2SAF Full Wave Sonic Probe

The Mount Sopris 2SAA-1000 full wave sonic probe can be configured in a variety of transmitter/receiver combinations. Each combination requires a specific TOL file, which describes the probe layout. The most basic (and most common) configuration is a single transmitter/two receiver probe, with the transmitter located on the bottom of the probe. The receivers are then located 3 feet and 4 feet above the transmitter.

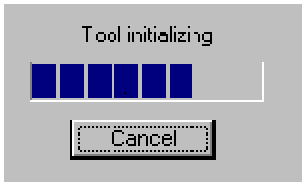
Mount Sopris supplies TOL files for each probe, as required, and the user should contact the factory for additional files as needed.

Additionally there is an upgraded version of the 2SAA-1000 designated the 2SAA(F)-1000. It has the capability to operate with one bottom transmitter or two transmitters, one above the top receiver and the other below the bottom receiver each separated from the receivers by an acoustic isolation section. Optionally a 2SNA-1000 Gamma, SP, SPR section can be inserted immediately above the top receiver in place of the top transmitter/isolator assembly. The 2SAA(F)-1000 uses a different set of browsers and processor. A newer version of the full wave sonic tool designated the 2SAF-1000 with an enhanced transmitter section is in development and will use the same browsers and processor as the 2SAA(F)-1000.

a) Operating the 2SAA Full Wave Sonic

After selecting the correct TOL file, the user should see three *sonic* specific browsers appear. These browsers are: SAA1000wave, SAA1000Image, and SAA100dt. They will be discussed later in this section.

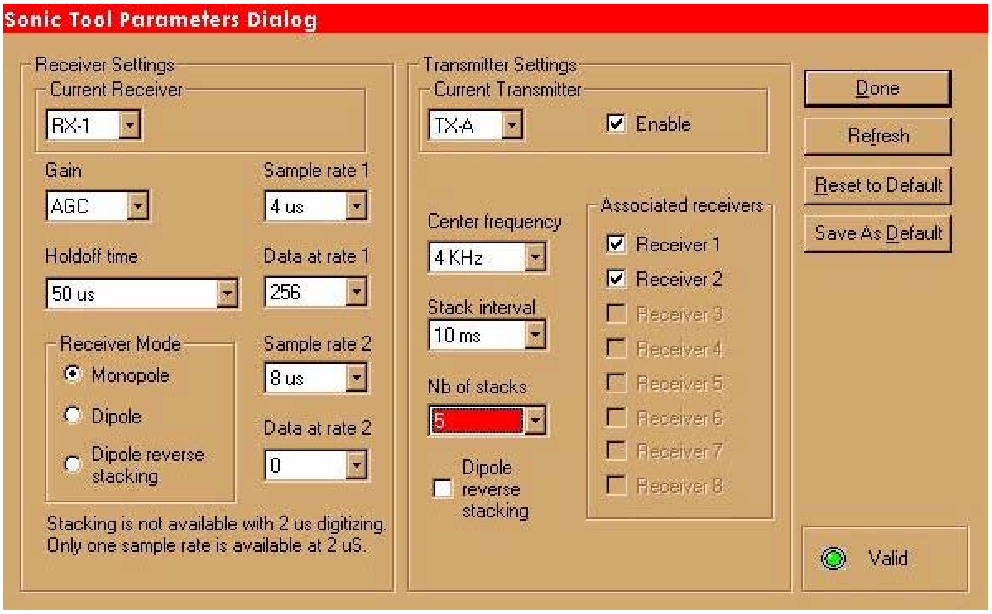
Press the Power On button, and wait for the sonic probe to initialise. A small window will appear, which will indicate when the user may proceed:



Once the window closes, the user may then review and modify the Tool Settings/Commands by pressing the button located in the Tool Window.

The TOL file contains “default” configuration settings, which include information on such items as transmitter frequency, sample rates, receiver gains, hold-off, and stacking. These settings can be modified by the user to optimise the probe for different logging scenarios. For example, for cement bond logging, a fixed receiver gain, and 20 kHz, transmitter frequency in monopole mode might be used.

More details on suggested tool configuration settings can be found in the 2SAA-1000, Full Wave Sonic Probe documentation.



ai Sonic Tool Parameters Dialog

The Sonic Tool Parameters Dialog Window is shown above. There are two basic sections, one for receivers, and the other for transmitters.

Receiver Settings

Each receiver is set-up individually. RX-1 stands for the lower most receiver in the tool string. RX-2 is the next receiver (working up the probe). In a two-receiver probe layout, RX-1 is the near receiver, and RX-2 is the far.

The user may set the following parameters for each receiver:

1. **Gain**-selectable from 1,2,4,8,16, and AGC (automatic gain control)
2. **Holdoff Time**-in 50 microsecond increments from 50-500
3. **Mode**-monopole, dipole, and reverse dipole stacking
4. **Sample rate 1-**time in microseconds per sample (4,8,16, or32 microseconds are possible settings)
5. **Data at rate 1**-number of data points at sample rate 1
6. **Sample rate 2**-time in microseconds per sample (at second rate)
7. **Data at rate 2**-number of data points at rate 2

Each receiver can be sampled using two rates. Generally, the first part of the received acoustic wave is sampled at short time intervals to provide high resolution for more accurate time picking. The second part of the wave, which usually contains lower frequencies, may then be sampled at longer time intervals. This dual mode sampling can provide a longer total record that can include accurate first arrival compressional waves as well as slower shear and tube guided wave modes. Of course, the user can also sample at a single rate if desired, by setting the second Data at Rate 2 to 0.

IMPORTANT NOTE: The highly flexible sampling capability of the Mount Sopris acoustic tool allows the user to measure waveforms over a long total sampling period. For example, for slow formations, a user might use the following settings in a dipole mode to try to measure both compressional and shear waves:

Rate 1=4 microseconds X 128 samples = 512 microseconds

Rate 2=8 microseconds X 256 samples = 2048 microseconds

Total record length = 2560 microseconds

This is a rather long record, and will require the user to consider both **logging speed** and **digitise interval.** If high vertical resolution is desired, logging speed may need to be decreased to handle the high data rates required by such a long record. Conversely, if vertical resolution is not critical, then a higher logging speed may be used if the digitise interval is increased. Digitise interval is accessed in the SETTINGS selection in the ACQUISITION Panel on the main Dashboard.

Transmitter Settings

Each transmitter can be associated with certain receivers. In a two-transmitter probe, the upper transmitter is named transmitter B, and the lower transmitter is A. For the standard two receiver, single transmitter probe, when the transmitter is below the receivers, it is called A.

Each transmitter has the following settings:

1. **Center Frequency-**user selectable transmitter frequency, between 1 and 30 kHz.
2. **Stack Interval-**time between stacks, from 10 to 250 milliseconds. This feature allows waveforms to be “*stacked”*, as in adding consecutive waveforms, such that low amplitude signals can be better viewed and processed. In many soft formations, arriving waveforms can be of very low amplitude. Also, when using long separations between Tx and Rx, such as may be done when logging Stoneley or slow shear waves, amplitude may be very low. Stacking allows the waveforms to be stacked, so that useful

information may be recorded. The time between stacks is related to logging speed and signal attenuation in the borehole. The user may need to try different logging speeds, depending on the number of stacks required to get a good, usable waveform. Also, depending on the strength and duration of later fluid waves, the stack interval will need to be adjusted to keep unwanted information out of the stacked waveform.

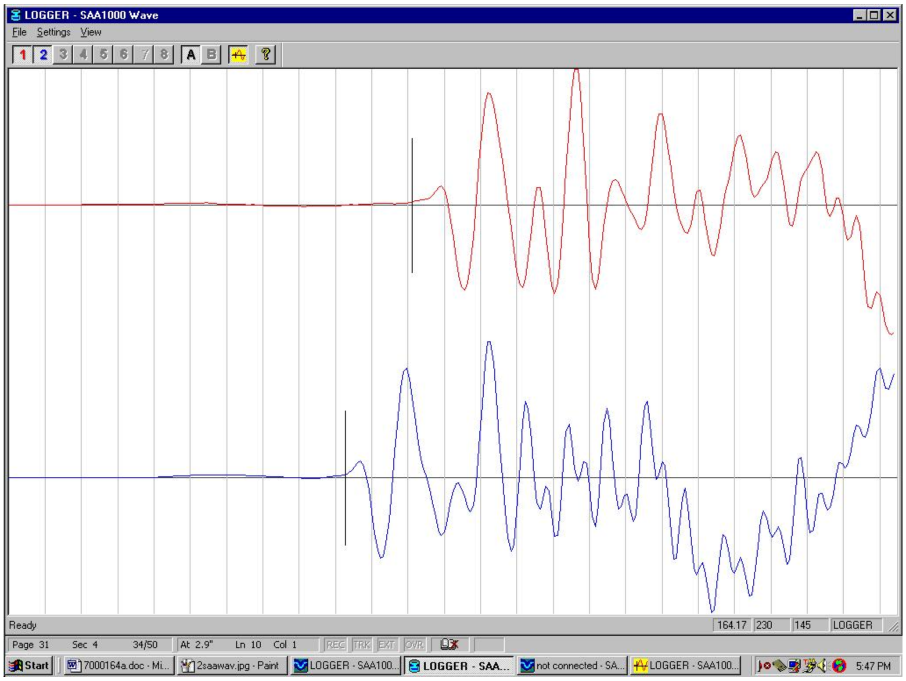
3. **Number of Stacks-**number of stacked waveforms desired, from 1-16. The number of stacks depends on how many repeated firings are required to get a good usable waveform. For most hard rock or consolidated formation logging, a single "stack" is the default. A single stack is all that is desired for Cement Bond logging. Stacking is generally only used when very low amplitude waveforms are received. Generally, the more stacks that are made, the slower the logging speed. This is because the probe should not move too far between adjacent "firings" of the transmitter, so that nearly the same borehole interval is sampled. The stack interval, discussed above, also affects sampling, and decreased logging speed will be necessary as stack interval increases.
4. **Reverse dipole stacking-**selecting this box enables reverse dipole stacking, which may be used in dipole logging. In some cases, high energy tube or Stoneley waves may overwhelm flexural (shear) waves, especially in low velocity, unconsolidated formations. By using reverse dipole stacking, the non-flexural borehole modes are effectively "cancelled", allowing the flexural waves to be more easily identified.

b) 2SAA Full Wave Sonic Browsers

The 2SAA full wave sonic probe, operating under MSLog, has 2 unique “browsers” and a unique “processor”. They are discussed below:

bi SAA1000wave

The SAA1000wave browser displays the acoustic waveforms in real-time. The user can select any number of received waveforms, from either the upper or lower transmitter. The waveforms are identified by different colors, displayed on the tool bar. An example of this browser is shown below:



In the example above, a two receiver-single transmitter probe is being logged, with vertical grid lines of 50 microseconds displayed. The browser has a lower task bar that is similar to other browsers. It displays current depth and sample number.

The top menu bar has two pull down menu selectors, Settings, and View.

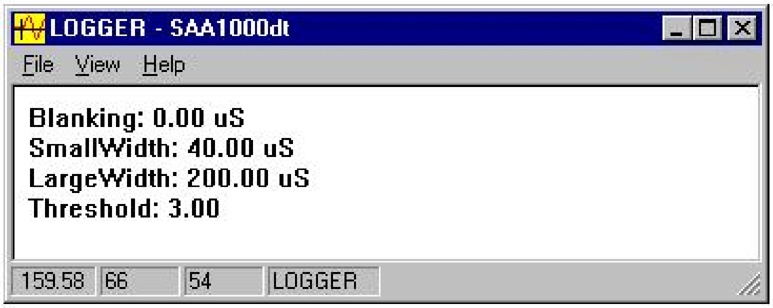
The **Settings** menu provides the user with two further choices, AMPLITUDE and TIME SCALE. TIME SCALE allows the user to display a series of vertical lines representing the time scale, and a choice of whether to display the wave forms with or without hold-off time.

AMPLITUDE allows the user to display the wave forms in Automatic or Full Scale mode. “Automatic” provides the maximum screen resolution for each wave, and the relative amplitudes of different receivers will not necessarily be equal. In the “Full Scale” mode, the true representation of each wave form is displayed, relative to the maximum sensitivity of the A/D. The “Full Scale” mode also allows the user to display horizontal grids on the browser, which allow direct comparison of amplitudes from different receivers.

The **View** menu allows the user to select which receivers will be displayed, as well as the transmitter that was fired to produce the given wave form. It also allows the user to turn off/on the transit time “picker”, which is derived from the Processor described below. The **long black vertical lines** on the wave forms indicate the time pick determined by this Processor.

bii SAA1000dt

This processor, if activated by the user, automatically picks a "first arrival" time, based on settings supplied by the user. The setting values are based on 4 required inputs for picking the arrival time (sometimes called dt or delta t). The settings are displayed by the processor, and can be changed by selecting the VIEW, SETTINGS item on the upper task bar.



The picking algorithm operates by detecting the time in the wave form that a specific set of conditions determined by the Settings are satisfied.

Blanking-this is the time, in microseconds, during which no data will be considered. It may be modified by the user to exclude portions of the wave form

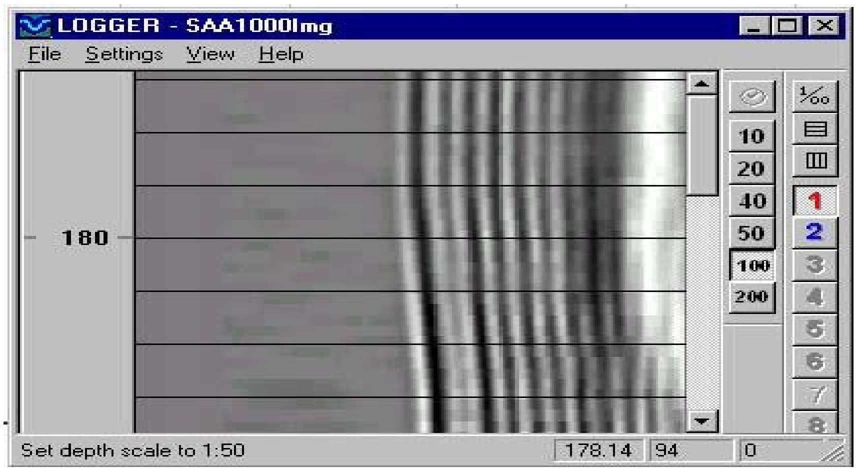
Small Width-this is the small window width, in microseconds. It is normally equal to the time for one wave length to pass. This is directly related to the transmitter frequency.

Large Width-this is the large window width, in microseconds. It is normally equal to 5 times the small window width, but may require adjustment to a lower value, depending on the overall length of the displayed wave form.

Threshold-this is the ratio between the average amplitude in the large window, compared to the average amplitude in the small window. A continuous "sliding" large window is applied to the wave form (after the blanking time). The first time that the ratio of the average amplitude measured in a sliding small window exceeds the ratio threshold is the "pick" time. The ratio threshold value will need to be modified by the user to suit the dynamic range of the viewed wave form. In general, the ratio is higher for wave forms with large variations in amplitude, and lower for wave forms with small variations in amplitude. A more complete discussion of this procedure can be found in the WellCAD FWS documentation.

biii SAA1000Image

This browser displays a variable intensity image of the acoustic wave form as if viewed from a z-axis perspective.



The upper task bar contains a pull down **View** menu, which allows the user to select **one** receiver/transmitter pair to display.

The **Settings** menu allows the user to set the depth scale and grid line presentation. It allows the user to select the **Time** between vertical grid lines. It also allows the user to set the **Amplitude** display parameters. When “Automatic” is selected, the image is displayed with an automatic gain adjustment that maximizes the contrast between the wave amplitudes. When “Manual” is selected, the image is displayed with the amplitude range defined in the scale window, which can be modified by the user.

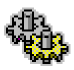
The **File** menu allows the user to turn monochrome **printing** of the image display on or off, and to select the kind of header that will be printed with the image log.

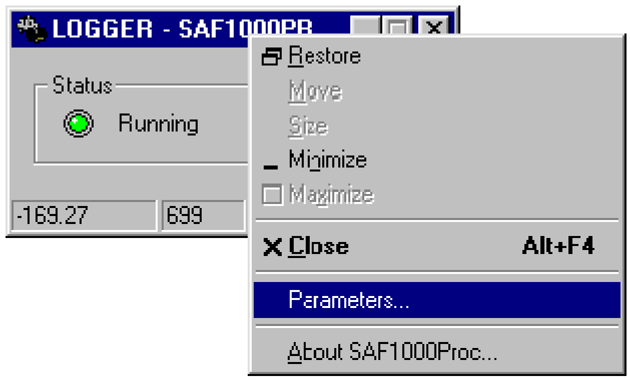
c) SAF1000 Browsers, Processor

ci Introduction

Browsers and processors for the 2SAA(F)-1000 and 2SAF-1000 sonic logging tools are SAF1000Wave, SAF1000Proc and SAF1000Img. SAF1000Wave provides a visual display of the receiver waveforms and transit time picks. SAF1000Proc allows settings for transit time and amplitude picking. For each receiver's waveform, SAF1000Img displays a VDL (variable density logs) and log traces of transit time, slowness, and amplitude.

cii SAF1000Proc Processor

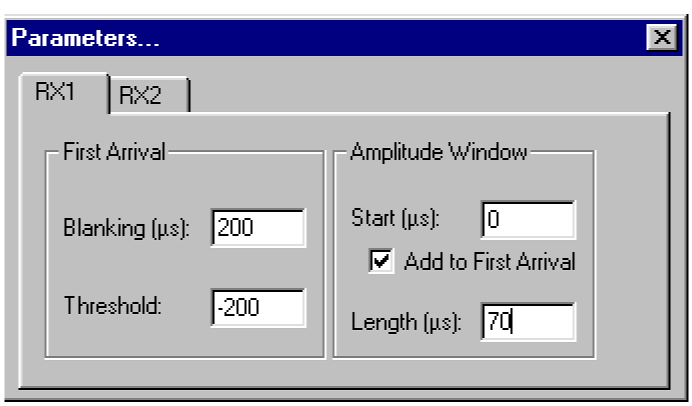




The **SAF1000Proc** processor generates Amplitude and First arrival (transit time) values, which are then used by the browsers. Control of these numbers is provided in the right click **Parameters**… menu.

First arrival is selected by finding the maximum of the waveform after the threshold and the minimum of the waveform before the threshold and extrapolating the steepest slope of the line between these two points to the zero crossing. The processor begins searching for the first arrival at the Blanking time. SAF1000Wave displays a vertical line marker at that position on the waveform.

Slowness is calculated as $(T2 - T1)$ where T2 is the transit time (in µs) for Receiver 2 and T1 is the transit time for Receiver 1. A one-foot receiver spacing is assumed. Slowness values are in µs/ft or µs/meter depending on the MSLog tol file.



The **First Arrival Window** has two text boxes for inputting values controlling the First Arrival Pick, **Blanking** and **Threshold**.

Blanking (µs) – the time to wait before picking the first arrival in microseconds. This value must include the tool holdoff time. It is not added to the tool holdoff time.

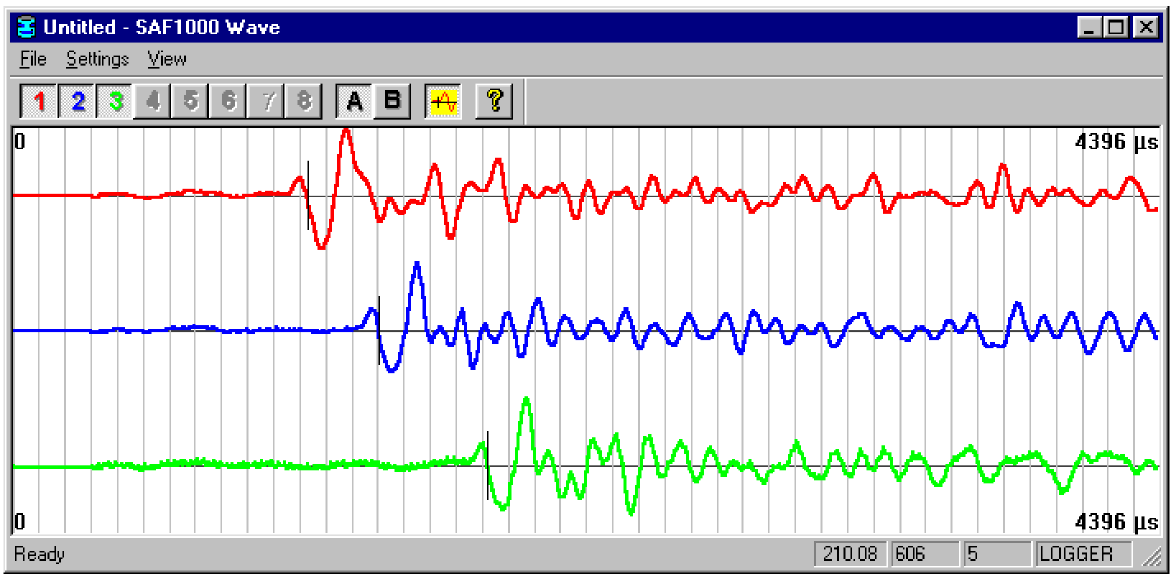
Threshold – A unit-less value that the waveform amplitude must exceed before a pick is made.

The **Amplitude Window** has two text boxes and a check box for control of the amplitude log.

Start (µs) – The amount of time to wait before beginning an amplitude pick. It may be an absolute value from the beginning of the waveform or a time after the first arrival pick if the add to first arrival box is checked.

Add to first arrival Checking this box indicates that the Start (µs) value will be added to the first arrival time.

ciii SAF1000Wave Browser



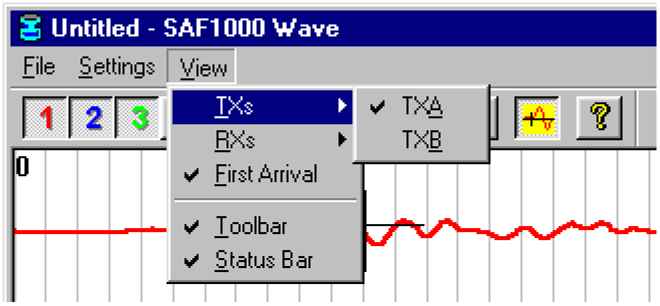
Saf1000Wave displays the receiver waveforms associated with one of the transmitters. It shows the pick point for the First Arrival, determined by SAF1000Proc, with a vertical bar, superimposed on the waveform.

{bmc saf1000Wave.bmp}

The top menu bar has three pull down menu selectors, **File**, **Settings**, and **View**.

The **File** menu provides an **Exit** function and **About SAF1000Wave** function, which displays program version number and copyright information.

The **Settings** menu provides the user with two further choices, **Amplitude** and **Time scale**. Time Scale allows the user to display a series of vertical lines representing the time scale, and a choice of whether to display the wave forms with or without hold-off time. Amplitude allows the user to select automatic scaling of the vertical scale with or without a center, line. Alternately, Manual scaling can be chosen with or without a center, line and/or horizontal grids. The horizontal grids are on 512 unit, amplitude increments.

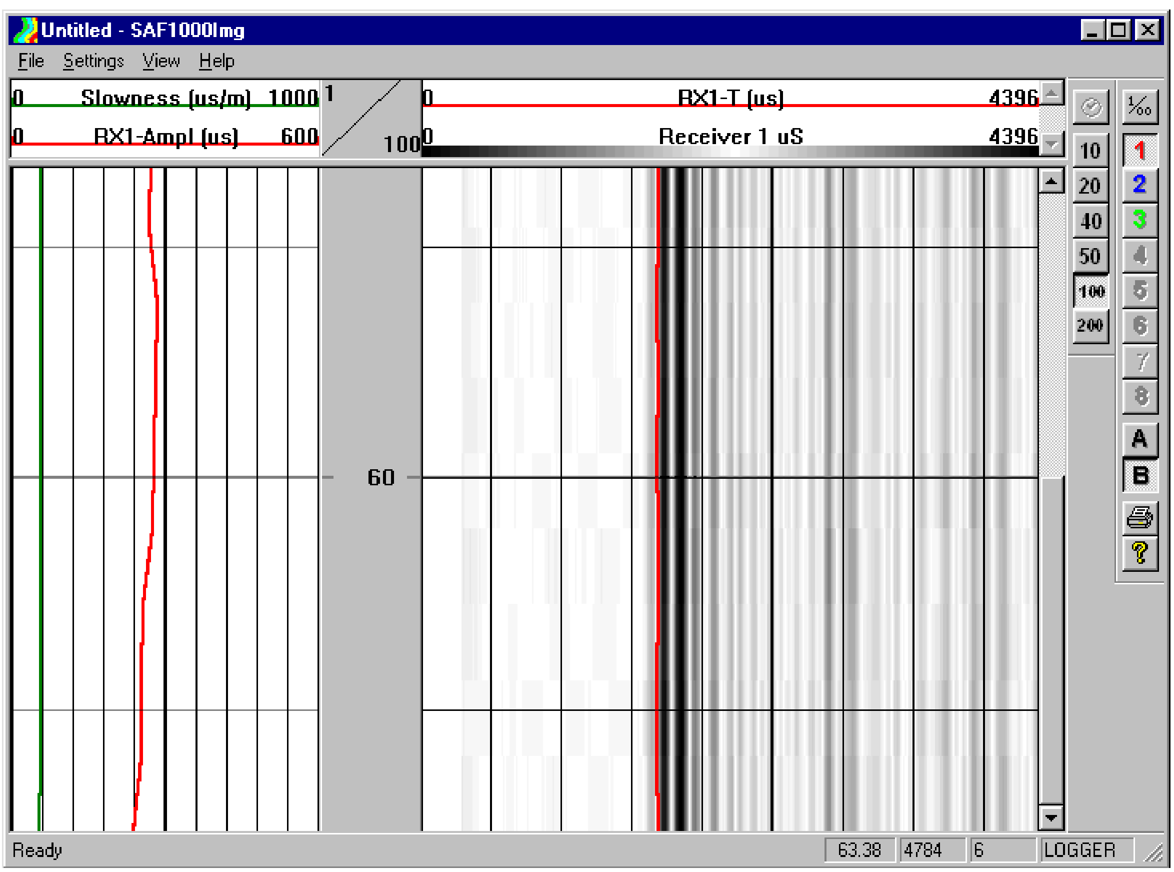


The **View** menu allows the user to select which receivers will be displayed, corresponding to a particular transmitter that was fired to produce the given wave form. It also allows the user to turn off/on the transit time "picker", which is derived from the SAF1000 Processor described above. The **long black vertical lines** on the wave forms indicate the time pick determined by this Processor. Also the **Tool bar**, and **Status Bar** can be turned on by selecting them.

Selection of the View parameters can also be accomplished by pressing the appropriate icons on the **Tool bar** when it is enabled.

The **Status Bar**, when enabled, is at the bottom of the SAF1000Wave browser. It indicates status in the lower left hand corner, and proceeding to the right, the first box is depth, the second the number of samples and the third is the number of errors and the fourth is the source of data, in the case of the example, LOGGER, which is the MSLog server name.

civ SAF1000Img Browser



This browser displays a variable intensity image of the acoustic waveform as if viewed from a z-axis perspective and log traces of First Arrival, Amplitude and Slowness.

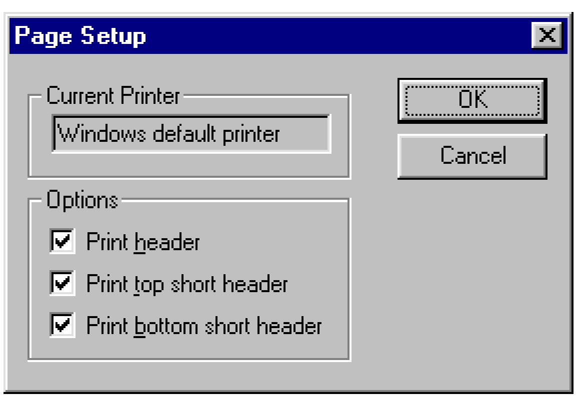
The top menu bar has four pull down menu selections, **File**, **Settings**, **View** and **Help**.

The **File** menu provides **Print, Print Setup, Page Setup** and **Exit** selections.

Clicking **File** then **Print** turns on printing to the default windows printing device. Note that you must have one printer installed in Windows for SAF1000Img Browser to operate, as it needs settings from the printer to initialise properly. Only on Receivers' data can be plotted at a time.

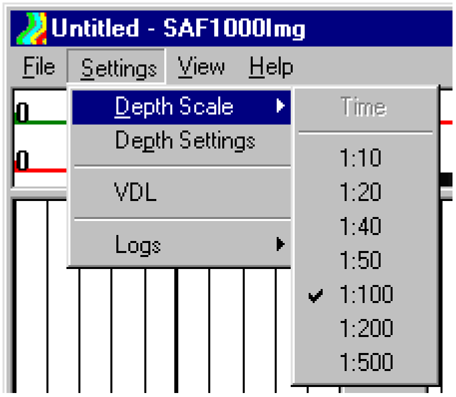
Clicking **File** then **Print Setup** will open the Windows, Printer Setup dialog.

Clicking **File** then **Page Setup** opens the following dialog:



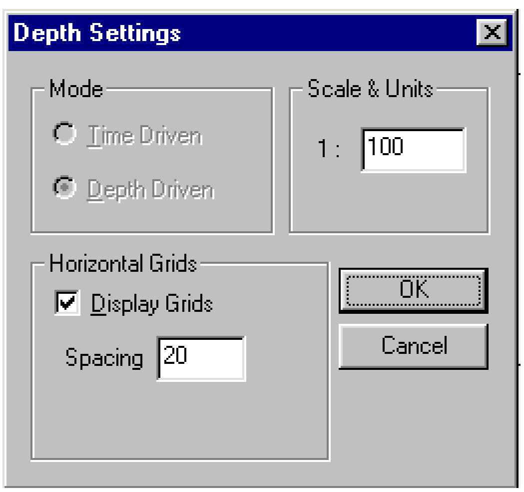
A check mark in one of the boxes enables that printing feature. The **Print header** selection enables the large, detailed header, which, when used with the proper header, details the sonic tool settings information in the OTHER SERVICES section. The **Print top short header** and **Print bottom short header** control the brief headers which detail the log name, scale and position labels at the top and bottom of the printed log, respectively.

Clicking **Settings** opens the following selection dialog:



Here **Depth Scale** is selected accessing some default depth scales. The scales such as 1:100 can be read as 1 foot of log equals 100 feet of well or 1 meter of log equals 100 meters of well.

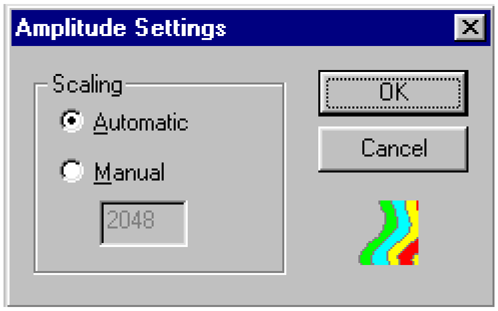
Selecting **Depth Settings** opens the following dialog:



Mode indicates the current sampling mode selected on the Dashboard, Acquisition window. Horizontal grids are enabled by a check in the **Display Grids** box**.** The desired Spacing of grids, in depth units, is entered in the **Spacing** text box. This sets the frequency of major grid lines. For example, a **Spacing** value of 10 will produce a depth number each 10 feet or meters, a bold grid line at each 5 and 10 unit spacing, and a light grid line each unit. The user should not enter a value that results in a minor grid line being printed at a frequency higher than the depth sample interval. For this example the sample interval should be less than 1 depth unit. If in doubt, always start with a large number like 100 for depth scale, and 10 for grid spacing. Problems can occur when combining low value depth scales with low value horizontal grid spacing, when the minor grid lines are forced to try to display or print at a higher resolution than the data sampling.

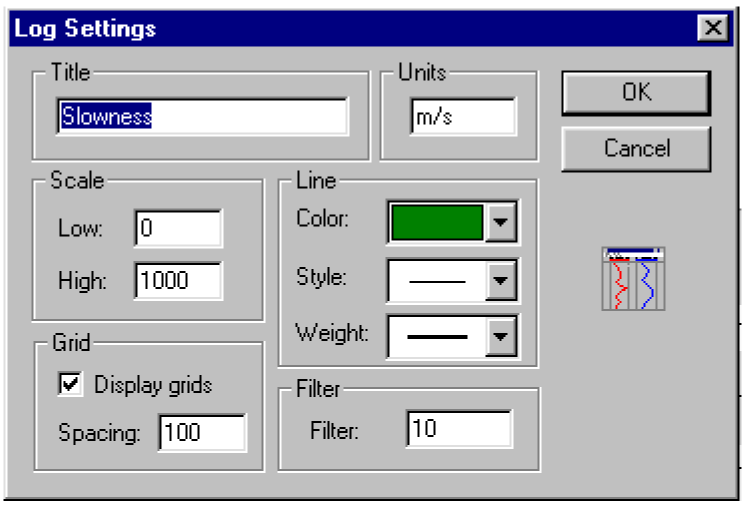
Note: Data sampling cannot be finer than the resolution of the encoder. If the encoder signal is 200 pulses per foot then the finest depth sampling is 1/200th of a foot. Internally, that is in tol files and the MSLog.ini file, all depth units are expressed in meters.

Clicking **VDL** opens the Amplitude Settings Dialog.



Two selection buttons are available, **Automatic** and **Manual**. When **Automatic** is selected, the image is displayed with an automatic gain adjustment that maximizes the contrast between the wave amplitudes. When **Manual** is selected, the image is displayed with the amplitude range defined in the scale window, which can be modified by the user.

Clicking **Logs** opens the **Log Settings** dialog for setting up the receivers transit time, amplitude or slowness log. Slowness is shown here.



This dialog allows control of the log **Title**, **Units**, **Scale**, **Line**, **Grid** and **Filter**.

Title Text entry box to change the log trace title displayed at the top of the browser and the short headers.

Units Text entry box to change the log trace units displayed at the top of the browser and in the short headers.

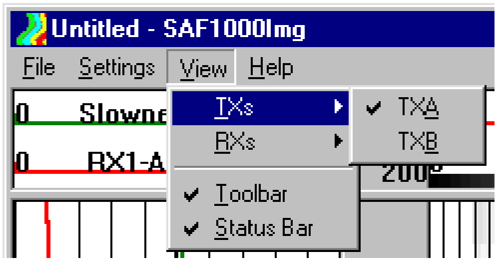
Scale Low and High values to set the minimum and maximum plot scale values, respectively, for the log. These are displayed at the top of the browser and in the short headers if there is sufficient room.

Line Color, Style and Weight (thickness) of the trace on the log.

Grid Check **Display Grid** to enable vertical grids. Enter the **Spacing** in units corresponding to the **Scale**. For each SAF1000Img column, only one log trace should have **Display Grid** checked.

Filter Enter a filter number to use a moving average filter on the displayed Log trace. Thus by selecting a filter width of 5, a calculated moving average log, based upon five incremental data points, will be displayed. By using the filter, spiky data can be smoothed. Data gaps in well logs can be overcome by using an appropriate filter so long as the data missing does not exceed more than 9 incremental units. Note that the filter does not change the actual data, but is applied "on the fly" while the data is displayed only. This leaves the data untouched and allows you to later reduce your filter width if you wish to do so.

The **Help** menu presents the selection **About SAF1000Img…** function, which displays program version number and copyright information.



The **View** menu allows the user to select a Receiver, whose data will be displayed, corresponding to a particular transmitter. Also the **Tool bar**, and **Status Bar** can be turned on by selecting them.

Access to the **Depth Settings**, selection of the **View Parameters** turning on/off the Printer can also be accomplished by pressing the appropriate buttons on the edge of the dialog when the **Tool bar** is enabled. **Depth Scale** buttons are available when Depth Sampling is selected. The time icon is depressed when Time sampling is selected.

The **Status Bar**, when enabled, is at the bottom of the SAF1000IMG browser. It indicates status in the lower left hand corner, and proceeding to the right, the first box is depth, the second the number of samples and the third is the number of errors and the fourth is the source of data, in the case of the example, LOGGER, which is the MSLog server name.

cv MchNum Browser

Enabling sonic channels for use with MchNum interferes with the clean import of 2SAF sonic data into Wellcad so MchNum and LasWriter are not enabled in those tol files. MchNum (and LasWriter) can be used with Gamma, SP, Voltage and Current data output by the 2SNA-1000, probe when it is operated with the 2SAA(F)-1000 or 2SAF-1000.

IV. FAC40 and OBI40 Image Tools

The ALT FAC40 and OBI40 image tools operate on the MGX II logger using MSLog software. These probes operate exactly as they do with the ALTLOGGER system, which is explained in detail in the ALT documentation shipped with each probe. The only difference is in communications.

With the MGX II, the communications parameters are fixed at 57.6 Kbaud, and the user cannot change the baud rate. The communications window can be accessed to change up-hole discriminator levels, and pulse width sent downhole. Normally these settings will not need to be changed. If a different logging cable (or very different length of the same cable) is to be used, adjustments may be necessary. Consult the tool manuals for details. A data compressor board present in these probes allows for a reasonable sampling rate and logging speed, comparable to similar tools in the industry. Pentium II computers with 64 Mb + ram are recommended for logging these probes, as well as the MSI 2SAA sonic probe

a) Operating Parameters for the FAC40 and OBI40

In general, the more data sampled (per depth interval or time interval), the slower the logging speed. This is due to the limitations imposed by the logging cable. Recommended logging speeds and sampling intervals depend on tool settings.

For example, the **OBI40** can be logged with 90, 180, 360, and 720 pixels per scan. Obviously, as the number of pixels increases, the data density increases, and logging speed will need to be REDUCED. For very high-resolution data, such as 0.003 ft. (1 mm) logging speed may approach 1 ft (0.3 m/min). Very good results can usually be acquired using 360 pt/turn, and 0.01 ft sampling at 2.6 ft/min. At 0.02 ft sampling, logging speed can be increased to 5 ft./min

The **FAC40** has similar logging speed/sampling constraints. Normally, the FAC40 does not require such fine depth resolution, with .015 ft. (5mm) sampling allowing logging speeds of 3 ft./min. The scan time and measurements per revolution both affect logging speed. If the scan time is reduced, less data is sent, and logging speed can be increased. If the measurements-per-revolution setting is increased (72,144,288 are available settings), logging speed must be decreased.

The user should carefully watch the Data/Sec and Errors Display on the Communication Window in the DASHBOARD. DATA/SEC should not be allowed to go above 5/sec or errors will occur, data will be LOST, and the system may stop responding. To restart, turn tool power off and restart MSLog.

For more details and helpful information on the operation of the Image tools, consult the manuals supplied.

6. Spectral Processor / Browser

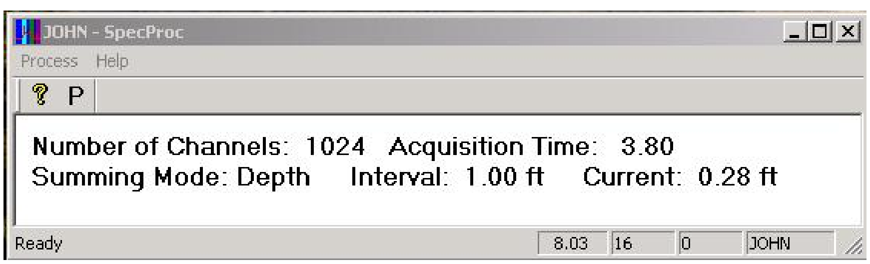
I. Introduction

The 2SNA-1000-S Spectral Gamma Tool uses two processors for spectral calibration and real-time display of the spectra and spectral stacking. The older version 2GSA-1000(IFG BSOG-01) spectral tool can also take advantage of the SpecProc processor and Gspec Browser when run with an updated .tol file that invokes them.

Data for output to other plotting/processing software is recorded in the LAS format with the LASWriter Browser. At present the RD format output using these Spectral Browsers/Processors is not supported directly by Wellcad. LAS format must be used to import this data. See the section on Reprocessing Spectral Data that follows.

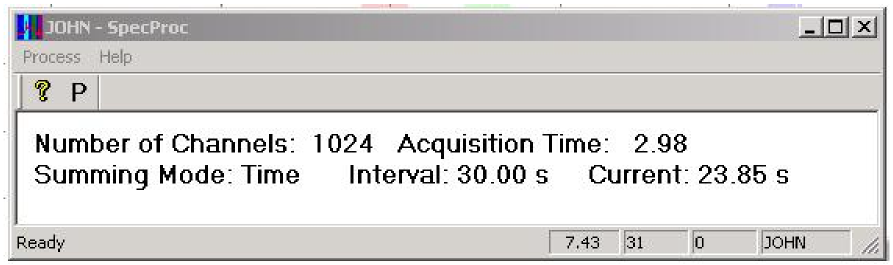
a) SpecProc Processor

The SpecProc processor generates and appends summed spectra and up to five spectral channels to the raw data stream sent by the probe. It allows the user to apply calibrations to the display of spectral data. It allows the user to specify the names and energy windows for up to five individual spectral channels. It allows the user to sum spectral data over a pre-defined time or depth interval. The SpecProc main browser window is shown below:

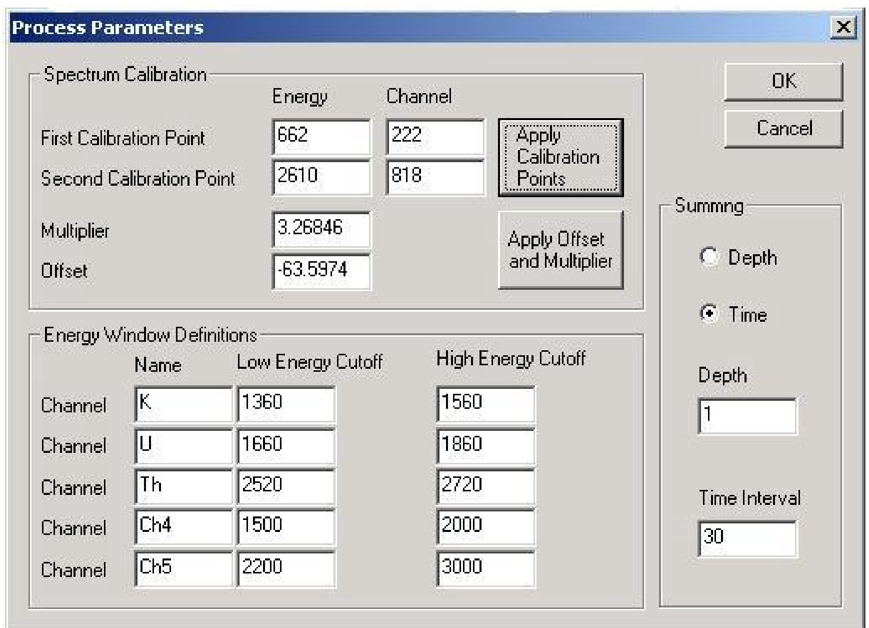


The **main** window displays the number of channels or energy bins being measured by the probe. It also indicates the summing mode, which can be based on a time or depth interval. In the example above, the summing mode is **Depth**, and the summed interval is 1 foot. The number of samples in the summed interval depends on this value and the depth digitise interval selected in the Acquisition Window in MSLog. For example, if the depth digitise interval was 0.1 feet, there would be 10 samples in each summed spectra. The Current field shows the distance the probe has travelled since the last summed interval was completed.

In the following figure, the probe is being operated in the **Time** based Summing Mode. In this example, with the probe normally stationary for such measurements, the probe will acquire data for 30 seconds. The actual number of discrete samples depends on the Acquisition Time value shown in the upper right portion of this window. Acquisition Time is the Time Digitise interval plus the time required to send a full set of data. The Current Window shows the amount of time elapsed since the last summing event.



To access the other features of the SpecProc browser, press the **P** button on the upper left hand side of the menu bar. A window called **Process Parameters** will appear:



Spectrum Calibration

The upper left window provides access to spectrum calibration. This browser uses a two point linear calibration to adjust the spectral display to fit two known source or isotope energies. To make a calibration, it is best to have two distinctly different energy levels. In the example above, ^{137}Cs and ^{208}Tl* are used. Each source is placed on the probe, and a reasonable spectrum is allowed to build in the GSpec browser. Once a good peak has been produced, the energy window or channel value from the peak source is read from the GSpec browser by moving the mouse pointer to the peak and left-clicking. A channel value of 222 was read for ^{137}Cs in the above example. Similarly, a channel value of 882 was read for ^{208}Tl. By pressing the button marked **Apply Calibration Points**, the calibration will be applied to the GSpec browser and to any other browsers, such as MchNum and LASWriter.

*^{208}Tl is the high-energy secondary decay product from ^{232}Th

IMPORTANT NOTE: All browsers must be closed and restarted to allow any changes in SpecProc to take effect. If this is not done, the changes will not be implemented.

A second window in the Spectrum Calibration section indicates the current slope and offset for the linear two-point calibration. The user may also enter these values if they are already known for a given probe.

Energy Window Definitions

The lower left hand section in the Process Parameters window allows the user to enter the name and energy range for up to 5 different Energy Windows. Each Window has a pre-set color, and depending on the settings in the GSpec browser, will be displayed as a background to the real-time spectrum. SpecProc calculates CPS (counts/sec) for each window over the summing interval.

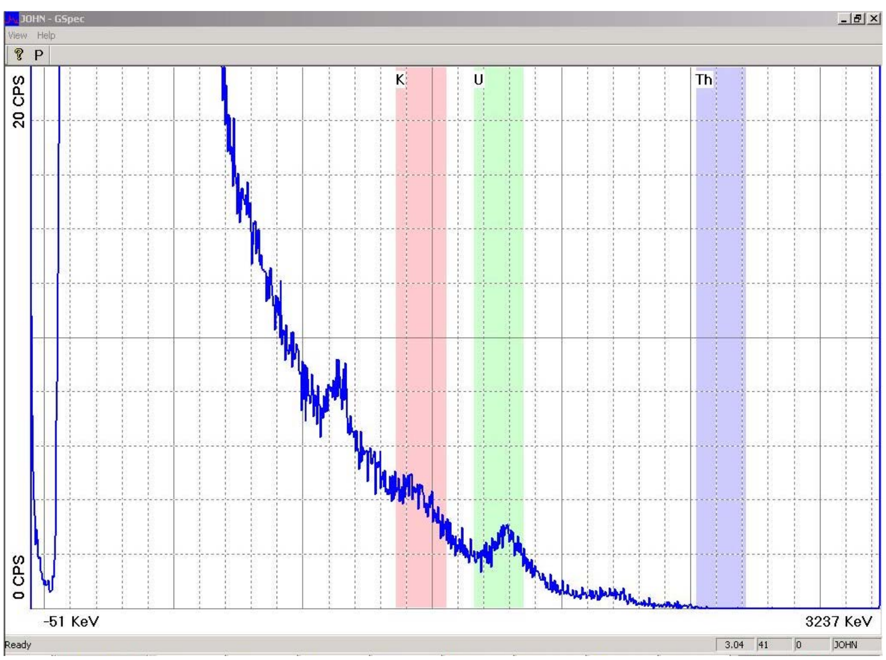
Summing Mode

The third section of the Process Parameters window allows the user to select either **Depth** or **Time** summing. If Depth is chosen, then the value in the Depth window represents the total depth interval over which data will be summed before it is displayed as a sum on the building spectrum. For example, it the value entered is 2 feet, and the depth digitise interval is 0.1 feet, 20 samples will be summed on the spectrum. This summed spectrum will be represented in GSpec by the blue spectrum curve (and will build as the green spectrum curve).

If Time is chosen, then the value in the Time window represents the total number of time samples that will be summed. For example, if the value entered is 50, and the time digitise interval is 1 second, then the summed spectrum represents 50 seconds of data. Time summing is normally used for stationary logging when high-resolution spectra are desired.

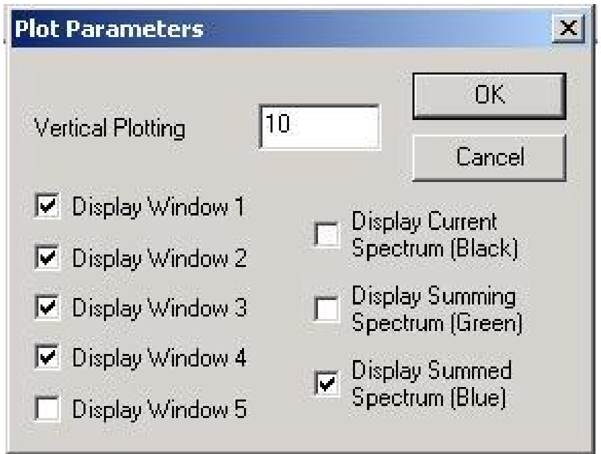
b) GSpec Browser

The **GSpec** browser provides a real-time display of spectral gamma data. GSpec is configured using the SpecProc processor, which is described above. GSpec allows the user to present and view gamma data from up to 5 user-defined energy windows on-screen during logging. An example showing a 3-channel spectrum is shown below:



Plot Parameters

A pull-down menu marked **P** is selected to configure the plotting parameters for the Gspec Browser. This menu is shown below:



The "Vertical Plotting" window is used to enter the count-rate scale (in counts per second) that is used for the spectrum. Normally, a low number, like 2 or 5 will be used. The total CPS is the integrated value of all counts per second over all channels at a given point in time.

The Display Window check boxes are selected to allow display of desired spectral channels previously defined in **SpecProc**. These windows are color-coded and have the channel name noted at the top of the display.

The Display Spectrum check boxes may be selected to represent three different possible spectra. The current spectrum (all cps from the current data sample (at a specific depth or time interval), is shown in black if the **Current Spectrum** box is checked. The summing spectrum (which shows the running total of cps from the beginning of a defined depth or time sample interval) is displayed in green if the **Summing Spectrum** box is checked. The summing spectrum is determined from parameters configured in the SpecProc browser. Finally, the summed spectrum will be displayed if the **Summed Spectrum** box is checked. The summed spectrum represents the total of all CPS in the summed depth or time interval, and is only updated after the depth or time interval has passed. This interval is determined in the SpecProc browser.

c) Reprocessing Spectral Data

At present the only output of the MSLog Spectral Processors that is useable with other applications is the LAS file format created by LASWriter. If changes to calibration or other plot parameters need to be made then you will need to use the playback features of MSLog. To change plot parameters of MCHCurve follow the normal playback procedures and change the parameters in MCHCurve. If you need to change any of the SpecProc Processor parameters then you need to do the following.

Start MSLog and select the same tool driver type as was used to make the log.

Change the parameters in the SpecProc Processor as needed. For example, new or different Spectral Energy window could be added.

Close all the Browsers & Processors and start them again.

> Note: This is necessary because the changes made in the previous step are written to the .tol file. The calibration and configuration information for the Processors and Browsers is retrieved from the .tol file only once when they are started.

Click Replay and select the proper .rd data File.

Note: If you wish to maintain a copy of the original LAS output file you will need to rename it before proceeding as the file will be rewritten by LASWriter in the following steps.

Right click on the top panel of LAS writer and click Save on Replay.

If you want to change any further MCHCurve settings change them now.

Click OK to allow the replay to proceed.

LASWriter will rewrite/create a file with the same name as the .rd file.

7. Glossary

a) Acquisition Panel

This panel allows the user to select the **Sampling Mode**, to set the **Sampling Rate**, to switch data acquisition on and off, to start and stop the recording (storage) of data (**Record Mode**), and to start and stop the replay of previously recorded data (**Replay Mode**).

b) Browser

A **Browser** is a **Client Process. Browsers** offer the operator of the **MSLog/MGX II logging system** a number of different on-line display facilities to present log data on the screen in a user-friendly, easily controllable, attractive layout. Depending on the **Tool Category,** different **Browsers** are used to display log data. Currently the following **Browsers** are available:

- **Multi-channel Tool** (**4.II**)
  - **MSIPROC** (**4.II.f**)
  - **MCHNUM** (**4.II.e**)
  - **MChCurve** (**4.II.a**)
  - **LASWRITER** (**4.II.g**)
- **Full Waveform Tool**
  - **Fws40Img**
  - **Fws40Wav**
- **DTPickup**
- **SAA-1000 Full Waveform Tool (5.II.b)**
- **SAA1000dt**
- **SAA1000Img**
- **SAA1000Wave**
- **Image Tool**
  - **OBI40Num**
  - **OBI40Img**
- **Full Waveform / Scanner Tool**
  - **Fac40Num**
  - **Fac40FwImg**
  - **Fac40FwWav**

Some **Browsers** are used by tool of different **Tool Category** as e.g. **MCHNUM** and **MChCurve**, other are very similar like **Fws40Img** and **Fac40FwImg**.

c) Browser & Processors Panel

All tool specific **Browsers** and **Processors** are defined in the **Tol file**. Normally they are automatically started during the initiation of the **MSLog Software**. If the operator prefers not to start all Browsers and Processors immediately, he can later start them individually from the Browsers & Processors Panel. The operator can also stop individual

Browsers and Processors, e.g. for the sake of increased logging speed if the computing power of the PC is not sufficient to execute simultaneously the **Data Handler**, and all Browsers and Processors. The operation of the **Dashboard** is not effected, if one of the Browsers and Processors programs crashed during execution. The program can at any time be restarted from the Browsers & Processors Panel.

d) Client Process

All **Browsers** and **Processors** are realised as Client Processes of the **Dashboard** program. Client processes add new features to the Dashboard, but the functionality of the Dashboard is not dependant on the execution of a Client Process. Under **MSLog Software,** Client Processes run normally on the same computer as the Dashboard. They can be started on another computer, if this computer is connected via a network to the computer on which the Dashboard is active. Client Processes are loosely link to the Dashboard via **Data Pipes**. Once they are started they run more or less independent from each other and from the Dashboard. Client Processes are executed with a lower priority than the Dashboard to make sure that the performance of the Dashboard is not influenced. If the operator has started several Client Processes it may happen that e.g. the display of some data is not continuous. This is not critical at all, because the data is lost only on screen. If the operator would like to have this data displayed continuously it might be necessary to stop another Client Process.

e) Communication Panel

This **Panel** monitors the performance of the **Data Handler**, the most important **Thread** of the **Dashboard**. Log data is not directly lost, if the rate of the data flow from the tool is too high. In this case the data is written into an emergency buffer. As long as this buffer is not filled up to 100% no data is lost. The filling of the buffer indicated by a horizontal bar meter in the **Communication Panel**. Therefore, this **Panel** should always be maximised during data acquisition and the operator should observe the bar meter to have enough time to react before data is lost. A reaction could be to lower the logging speed or to check the **Sampling Rate** setting of the **Depth Mode**.

Also, from the **Communication Panel** the **Configure Communication Box** is opened.

f) Configure Communication Settings Box

- This **MSLog Box** is currently not used for the MGX II system.

g) Configure Tool Settings Box

This **MSLog Box** is opened from the **Tool Panel**. This box is used to set the tool specific logging parameters. The layout of the **Configure Tool Box** depends on the type of logging tool, which has selected by the **Tol file**. The layout is defined in the **Tool Driver**. At the moment the following **Configure Tool Boxes** are available:

- **Multi Channel**
- **FAC40/OBI40**
- **Full Wave Sonic**

h) Dashboard

The **Dashboard** is the visual, on-screen realisation of the interactive user platform of the **MSLog/MGX II logging system**. All basic functions of the MSLog/MGX II logging system to control the hardware and to run a logging operation are realised by a number of **Panels**. According to the MSLog/MGX II logging system concept Panels can be considered to be equivalent to hardware control modules in an old logging system. Panels are displayed with a fixed width, lined up along the left side of the screen. Primary dashboard panels are always displayed as the top layer in the Windows hierarchy. In *HIDE* mode the Panels can be removed from screen, but they will immediately appear on the screen when the cursor is moved to the left side of the screen. To put the dashboard in HIDE mode, right click over the dashboard and click on the HIDE selection. Additional functions of the Dashboard can be activated through the Dashboard menu. Menu boxes (**MSLog system Boxes**) can be opened to check the system performance, to tune the system performance, and to supply parameters for logging operations. Throughout all Dashboard windows all kinds of *push buttons, radio buttons, check buttons, check boxes, test entry fields, graphically simulated switches, LED indicators, and LED bar graphs* are used to create a clear, self-explanatory, virtual control system for borehole logging operations.

i) Data Handler

The Data Handler is a special **Thread,** which controls the smooth and error-free execution of all tasks that are involved in the management of the log data flow from the tool to the final storage of the data on a mass storage device. The Data Handler is the most important Thread, because a logging operation is only successful if high quality log data is acquired and stored. Therefore, the Data Handler which executed with highest priority can be considered has the heart of the **Dashboard**. The main tasks of the Data Handler are sampling and retrieving data from the tool, packaging of data, saving data onto hard disk, and distributing data into various currently opened **Data Pipes** connected to **Browser** and **Processors**.

j) Data Pipe

A Data Pipe can be seen as a buffer memory, which can be accessed from two sides. At one side the **Dashboard** writes data into the Data Pipe, on the other side a **Client Process** reads the data out of the Data Pipe. If the Client Process is too slow reading the data, the Data Pipe will overflow. In this case the **Dashboard** overwrites the oldest data and this data is then no longer available for the Client Process.

k) Depth Mode

Log data acquisition can be made in three different **Sampling Modes**, the **Time Mode** or the **Depth Mode** with the two options “up” or “down”.. The Sampling Mode is selected with a pull-down menu of the **Acquisition Panel**. In Depth Mode data is requested by the **Data Handler,** at fixed depth intervals, called **Sampling Rate**. In case “Depth down” is selected from the **Sampling Mode** menu, data will only be requested from the logging tool if the depth is increasing (tool is moved down). If the tool is moved up under this setting no data is acquired until again a greater depth is reached. The reverse is true in case “Depth up” is chosen. The **Sampling Rates,** which can be chosen in Depth Mode

depends on the depth encoder of the winch. The smallest **Sampling Rate** depends on the resolution of the depth encoder. Any attempt to input a Sampling Rate below this or a Sampling Rate that is not divisible by the smallest Sampling Rate will cause the **MSLog/MGX II logging system** to round the number to the nearest allowable number.
Data acquisition in **Depth Mode** must be used for normal log data acquisition where the tool is moved inside a borehole.

l) Depth Panel

This **Panel** displays and controls the depth supplied by the depth encoder. The actual depth of the bottom of the logging tool is shown if the tool zeroing procedure has been correctly followed, Tool length and sensor offset positions are specified in metric units, in each TOL file. The user can change the depth at any time but not during **Replay Mode** where the displayed depth is taken from the **RD-File**. The actual depth is not lost in case of power failure. After restart of the **MSLog Software** the latest depth value is displayed.

m) Depth Reference

For the MSLog/MGXII logging system, the depth reference is the connection between the cable-head and the probe top

n) Encoder Pulses Per Turn

The movement of the depth measurement wheel of the winch is recorded by a depth encoder that gives as output a certain number of pulses per one turn of the depth measurement wheel. How many pulses are counted and passed to the **MSLog program** depends on the **Encoder Type**. The correct value of the Encoder Pulses Per Turn has to be written into the **MSLog.ini File** to make sure that correct depth values are written into the logged data file (**RD-File**) and correct values are displayed in the **Depth Panel** of the **Dashboard.** Normally, this number is set-up during configuration of the logger and will not change, unless the logger is moved to a different winch system.

o) Encoder Type

The depth encoder records the movement of the depth measurement wheel by supplying a specific number of “**Encoder Pulses Per Turn”.** There are a number of different Encoder Types on the market, which have different supply voltage (typically 5V or 12V), which give at their output pulses of different height and width, and positive and negative pulses. It is important that the encoder can distinguish between up and down movement of the logging tool.

p) Full Wave Form Tool

Tools of this **Tool Category** record one or several traces per depth step, as e.g. the Full Wave Sonic tool. The **Browsers** named **FWS40Img** and **FWS40Wav** are used to display data from **Full Wave Form Tools**.

q) Header

Field header information is stored together with the recorded log data into a **RD-File**. The field header information is always taken from the actual file with the name “default.wchc” which along with the .wch, header file, is expected to reside in the directory \MSLog\Headers\.

r) Image Tool

Tools of this **Tool Category** create an image of the borehole wall (or of the surrounding of the borehole) by making measurement into different direction perpendicular to the borehole axis, as e.g. **ALT** FAC40 (Televiewer) or **ALT OBI40 (**optical borehole scanner) The **Browsers** named **FAC40Num, FAC40Cal, FAC40Img, OBI40Num,** and **OBI40Img**

s) LAS file

LAS (Log ASCII Standard) files can be generated during logging. The standard binary format data file for MSLog is called *.RD. However, some users prefer the LAS format for data exchange. These files contain all data, but are not depth corrected, so the user will need to manually apply these, using offsets provided in the TOL file or in the .PDF document provided.

t) MSLog.ini File

This file effects the execution of the **MSLog Software**. It holds general information about the configuration of the **MSLog/MGX II logging system**. Without this file the **MSLog Software** cannot be started. The **MSLog.ini File** resides in the “systemdisk”\Windows\ directory. An example MSLog.ini file is shown in the appendix

u) Multi-channel Tool

Tools of this **Tool Category** record one or several values per depth step, as e.g. density tool or induction tool. The **Browsers** named **MCHNUM** and **MChCurve** are used to display data of Multi-channel Tools**.**

v) Panels

Panels are fixed windows in a fixed position, which are automatically started when the **Dashboard** is started. There are six Panels simultaneously active:

- **Depth Panel**
- **Tool Panel**
- **Communication Panel**
- **Acquisition Panel**
- **Browsers & Processors Panel**

All non-tool specific control, operation, and display of the **MSLog/MGX II logging system** is made via these Panels.

w) Processor

A Processor is a **Client Process.** Processors offer to the operator of the **MSLog/MGX II logging system** on-line data processing facilities to improve data presentation or to derive new logs from the measured log data. Depending on the **Tool Category** different Processors are used to process log data. Currently the following Processors are available:

- MSIPROC
- Full Waveform Tool DtPickup

x) RD-File

During data acquisition (**Time Mode** or **Depth Mode** is switched on) the incoming log data is stored on disk, if the **Record Mode** is active. Log data is stored on disk as RD-File. The format of a RD-File depends on the tool, because the data is stored into the RD-File in the same format as it transferred from the tool to the **MSLog/MGX II logging system**. In the **Replay Mode** only data stored in an RD-File can be displayed and it browsers and processors which were operating during logging will be activated._Together with the log data, the **Header** is stored in the RD-File. **ALT** log processing software **WellCAD** will import data in the RD format and preserve all depth corrections. LAS files generated using the **MSLog Software** can also be imported, but depth corrections <u>are not</u> preserved. The user must make these corrections manually

y) Replay Mode

During **Depth Mode** or **Time Mode** acquisition data can be stored into a disk file (**Record Mode**). Such a file is called **RD-File**. If in the **Acquisition Panel** the Replay Mode is chosen a **RD-File** can be selected from a list. As soon as the selection is made the **Dashboard** will start to display the previously recorded data in the same way as during data acquisition. But as during data acquisition the operator can close or open **Browsers**, and he can change the display parameter settings of the Browsers. The replay can be stopped at any time. If replay is restarted it will always start at the beginning of the file. LAS files cannot be replayed.

z) Record Mode

During data acquisition (T**ime Mode** or **Depth Mode** is switched on) the incoming log data is stored on disk, if the Record Mode is active. The Record Mode is activated by pushing the “Record” button on the **Acquisition Panel**. This will cause a dialog box to be opened, where the operator can select the directory and the name of the **RD-File**.

If **Time Mode** or **Depth Mode** is already switched on, recording of data onto disk will immediately start as soon as the dialog box is closed.

If **Time Mode** or **Depth Mode** is not yet switched on and Record Mode has been activated, storage of data on disk will start as soon as either **Time Mode** or **Depth Mode** is switched on. To finish the recording of log data the “Stop” button of the **Acquisition Panel** has to be pushed. Recording of log data will also stop if during an active Record Mode the **Time Mode** or **Depth Mode** is switched off. But recording into the same **RD-File** will immediately continue as soon as **Time Mode** or **Depth Mode** are switched on again. This might make sense under **Time Mode** but normally it does not. If the recording was stopped by switching either **Time Mode** or **Depth Mode** Off, the user should then push the “Stop” button to properly close the **RD-File**.

aa) Sampling Mode

Basically there are two different Sampling Modes: the **Depth Mode** and the **Time Mode**. The **Depth Mode** has two options, “up” or “down”. The term “up” means that the logging tool is moved upwards and the depth in the **Depth Panel** decreases.

The term "down" means that the logging tool is move downwards and the depth in the **Depth Panel** increases.

bb) Sampling Rate

The meaning of Sampling Rate depends on the **Sampling Mode** selected in the **Acquisition Panel** of the **Dashboard**. In **Time Mode** the Sampling Rate is the time interval in milliseconds between two successive data samples. In **Depth Mode** the Sampling Rate is the depth interval between to successive data samples.

cc) Serial (RS232) Cable

Cable to connect the **MGX II Logging Unit** via **PC Connector** to the **PC.**

dd) Thread

A Thread is a part of a program code, which runs concurrently with other Threads under the **Dashboard** of the **MSLog Software**. Each Thread executes one or several defined tasks. All tasks together establish the Dashboard with all its functions. Some tasks are continuously active others are evoked from **Panels** of the Dashboard. A simple task would be to check the actual voltage supplied at the cable head. The most important Thread of the Dashboard is the storage of incoming log data onto a hard disk (see **Data Handler**).

ee) Time Mode

Log data acquisition can be made in two different **Sampling Modes**, the Time Mode or the **Depth Mode**. The Sampling Mode is selected with a pull-down menu of the **Acquisition Panel**. In Time Mode, the **Data Handler** requests data at fixed time intervals, called the **Sampling Rate**. Data acquisition in Time Mode is used for laboratory test, tool check and tool calibration where the tool is not moved.

The smallest **Sampling Rate** allowed by the **MSLog/MGX II logging system** is 10 milliseconds. Any attempt to input a Sampling Rate below this or a Sampling Rate that is not divisible by 10 milliseconds will cause the **MSLog/MGX II logging system** to round the number to the nearest allowable number.

Time Mode should not be used for normal log data acquisition where the tool is moved inside a borehole.

ff) TOL file

Operation of a specific borehole logging tool under the **MSLog/MGX II logging system** is initiated by starting a tool specific Tol File. The Tol File is selected from a list, which is accessed through a pull down menu of the **Dashboard** (**Tool Panel**). The Tol file passes all information about the specific tool to the **MSLog Software** such that automatically all tool specific **Browsers** and **Processors** are started, the proper voltage and current is set for the tool (in the MGX II logger), and the correct data protocol is set. The Tol file list is generated from a directory, which is defined in the **MSLog.ini File**. The operation of the logging tool is governed only by the actual version of the Tol file in that directory. The user should be aware that the Tol file can be changed at any time from the **Dashboard**, e.g. when new values are supplied within the **Configure Tool Box** or if the layout of a **Browser** is changed.

Tol files offer the operator the possibility to switch immediately to the operating environment he needs for a specific tool, a specific winch, a specific customer, or a specific logging job. The **MSLog Software** always operates with the Tol file directory, which is defined in the **MSLog.ini File**. Therefore, if new settings are made which should be saved the actual Tol file should be moved to another directory (see also Chapter "Directory Structure"). If you change the name of the Tol file you should use an editor to change the name in the first line of the Tol file, because it is this name, which will be displayed in the Tol file list of the **Tool Panel**. A sample Tol file is shown in the appendix

gg) Tool Category

Logging tools are sorted into different Tool Categories according to the way they collect data in the borehole. It is a design philosophy of the **MSLog/MGX II logging system** to use the same or very similar **Browsers** for all tools of one Tool Category. The following Tool categories are supported by **MSLog Software**:

- **Multi-channel Tool**
- **Full Wave Form Tool**
- **Image Tool**
- **Full Wave Form / Scanner Tool**

For non-digital pulse tools operating with the MGXII logger, the proper discriminator settings should be maintained if the user changes winch/cable types. See details in the MSLConfig.exe documentation.

hh) Tool Panel

This **Panel** allows the user to select the tool specific **Tol file**, to power on and off the tool, to monitor the tool power consumption, and to open the **Configure Tool Box**.

ii) Wheel Circumference

The circumference of the depth measurement wheel (see also **Depth Encoder Adapter**) of a winch is given in units set forth by the **MSLog.ini File**. The circumference cannot be calculated just from the diameter of the wheel, because the influence of the thickness of the logging cable has to be considered. A calibration can be made if an exact measured distance of the logging cable is spooled off. The wheel circumference is always given in metric units.

jj) Well Log

A record, of one or more physical measurements as a function of depth in a borehole. Also called a borehole log

kk) Logging cable

Steel armored, electrical cable, capable of passing signals from and physically supporting, logging tools. The most common cable has steel armored outer strands and one or more electrically insulated inner conductors. Steel armored Single conductor cable has an outer steel stranded wire and an insulated inner copper wire, which is the "single" conductor. Also known as a wireline.

ll) Cable Head

This is the physical and electrical termination at the down-hole end of the logging cable. It provides a means of both physical and electrical attachment of the logging cable to the logging tool.

mm) Rehead

The act of re-building (electrically and mechanically re-terminating) the cable head to wireline connection.

nn) Sonde

Well log sonde- A logging tool such as is lowered into a borehole to record resistivity, sonic, radioactivity, or other types of logs. Also known as a Probe, Logging Probe, Logging Function (down-hole), logging tool or, simply, tool.

oo) Mud Plug

An electrode placed at the surface in a conductive "mud" pit. The ‘B’, electrode, of a normal-resistivity, array. Also known as Mud Fish, or Surface Electrode.

pp) Slip Rings

An assembly, containing contacts for each conductor, that can rotate with respect to the wireline drum maintaining the electrical connection between the surface logging instrumentation and the borehole probe.

qq) Winch

Wireline winch. - A rotating drum on which is spooled the logging cable. It is used to raise and lower the sonde attached to the end of the logging cable. Also known as a Wireline Winch, Logging Winch, Hoist, Draw-works.

rr) Measuring Head

An assembly, that measures the distance traveled by the wireline by means of a (measuring) wheel in contact with the logging cable.

ss) Bulkhead

Bulkhead,(pressure). In Mount Sopris cable heads, the bulkhead is the mechanical and electrical joint between the probe and the logging cable. It is part of the Cable Head. It provides a means for the wireline conductor to leave the cable head and electrically connect to the probe. The bulkhead must seal the probe from the borehole fluid and isolate the conductor from it as well. It must provide positive electrical contact of the wireline armor to the probe top.

tt) Probe Top

That part of a probe that connects to the Cable Head.

uu) Armor

Wireline armor. The outside, body, of the wireline made up of steel strands.

vv) Conductor

Wireline conductor. The inner wire or wires of that make up the logging cable.

ww) Mecca Connector

A gold plated, crimp, (female) connector applied to the conductor and connected to the Mecca Bulkhead male pin.

xx) Mecca Pressure seal

A pressure seal that is a rubber molded terminal pin providing half of the seal between the borehole fluid and the wireline conductor and the electrical pass through for a conductor. It installs in the Cable Head Bulkhead. In single conductor systems, the threaded end has the cable head contact attached. It is sometimes referred to as a Mecca Pin or Mecca Bulkhead.

yy) Mecca Boot

A rubber molded boot that fits over the conductor insulation, on one end, and over the Mecca Bulkhead on the other. It provides the seal for the wireline conductor. It is exposed to borehole fluid pressure.

zz) O-ring

Any number of sizes of rubber, ring seals used to seal probe, components from the borehole environment.

aaa) Continuity

From the word continuous, an electrical term indicating a "continuous" connection between any two points in a wire or circuit. Not necessarily a zero ohm connection. Conductors or wires have a resistance associated with their length and diameter. Mount Sopris 0.1", 0.125" diameter single conductor and 3/16" 4 conductor have approximately 25 ohms of resistance per thousand feet of cable length.

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8. Appendix

I. MSLog.ini file example

The following MSILog.ini file is an example of the file that is read by Windows when MSLog.exe is executed. The comments in **bold** indicate functions of selected lines. Most, if not all, of the lines in this file are set-up by **MSLConfig.exe**, and the user will not need to make any changes to the file. This file resides in the \Windows directory.

In general, the MSLConfig program takes care of most winch and wireline types offered with the MGX II logger operating with MSLog. When the correct winch type, cable length, and cable type are entered in the MSLog entry screens, the MSLog.ini is automatically updated.

A notable exception is non-MSI winches. If a non-MSI winch is to be used, the user should run the MSLConfig program. In this program, the user can enter cable length, wire line type, and then set up a “Custom Winch” in the winch selection menu, using the MODIFY button. MSLConfig allows the user with an entry screen that can be filled in with the shaft encoder information for the non-MSI winch.

MSLog.ini file:

[System]

PipeMethod=AutoDetect

PipeSize=32

PipeTimeOut=15000

ServerName=LOGGER

ServerAddress=127.0.0.1

[Depth]

; winch details

WheelCircumference=1 **(always specified in meters!)**

EncoderPulsePerTurn=2400 **(depends on shaft encoder specifications)**

; depth display settings

DepthUnit=0.3048 **(use 1.00 for metric, 0.3048 for English system)**

DepthUnitString=Feet **(this is the units name that is displayed on dashboard)**

DepthFormat=%7.1f

; speed display settings

SpeedTimeUnit=60 **(units of speed per minute)**

SpeedFormat=%7.1f

SpeedUnitString=Ft/Min **(units name displayed on dashboard)**

SpeedFilter=4

EncoderPredivisor=1

EncoderInversed=no

WinchType=4MXA-1000 top mount electronics **(this line corresponds to a specific selection in the MSLConfig program)**

[Tol Files]

RootDir=C:\MSLog\TOL\Current **(path to the *.TOL files for this installation)**

[Browsers]
RootDir=C:\MSLog **(root directory for MSLog)**

[Dashboard Panels] **(lists all panels that will start when program starts)**
Browsers & processors=yes
Acquisition=yes
Communication=yes
Status=no
Depth=yes
Tool=yes
AutoHide=no
AlwaysOnTop=yes
HelpEnable=yes

[Serial**] (shows range of serial communication ports that will be searched for connection to logger, set with MSLConfig)**
CommMin=1
CommMax=4

[Wireline] **(shows winch wire line characteristics, set by MSLConfig)**
Resistivity=82 **(conductor resistance in ohms/1000 meters)**
Length=488 **(total wire line length-this value is always in meters!!!)**
WireLineType=1/10 Single Conductor **(wire line type-used to set data communication parameters)**

[Printer]
HeaderForm=C:\MSLog\Headers\default.wch **(path to default header, change with MSLConfig)**
HeaderContent=C:\MSLog\Headers\default.wchc
PrinterType=System
PrinterPort=LPT1
ReplayDelay=50 (may need to be a larger number e.g. 250 on slow PCs)

[MChCurve]
RefreshRate=500

[MChNum]
WarnOnStoreCalibration=yes

II. Sample TOL file

A sample Tol file appears below, with comments in **bold:**

aiIMPORTANT WARNING!!!!!

<u>In general, TOL files should only be modified in the fields where comments are made below</u>. Modification of the other fields may result in a non-functioning logger, and could lead to damage to the probe. TOL files supplied by Mount Sopris are tested extensively before release. If custom TOL files are required, consult Mount Sopris for assistance. Most of the relevant fields, which may require modification in the TOL file are more easily modified in the Log Settings screen which is called up by clicking on the log name in the header of the MChCurve browser. See details in the main body of this document.

Note: Browsers and processors read information from the tol file only once when they start. For this reason you must close and re-start browsers and processors after changing calibrations and saving them with MCHNum.

Tol file example:

[Description]

ToolName=2PGA-1000 Gamma **(this is the name that shows up in the Tool List Pull Down Menu-the user can edit this line to display a customised name for the tool, or use a different language if desired)**

DriverName=MGXIISCRIPT

;9-11-00 pls new browsers

;logged 9-14-00 pls

[Protocol]

LengthMode=Fixed

Length=24

LengthMax=24

UpholeBaudRateDiv=50

DownholeBaudRateDiv=50

Parity=even

DataBits=8

SamplingCmdLength=0

TimeOut2=400

[Default]

TimeSamplingRate=1000

DepthSamplingRate=.05

TimeSamplingRateMin=100

TimeSamplingRateMax=2000

[ToolAdapter]

Name=MGXII

Address=64

FramingByte=69

ToolScriptFile=scripts\TwoPulse.scp

ToolControlledCaliper=no

ToolType=2PGA

DiscLengthFactor1=-0.550 **(Updated by MSLog for different wireline types)**

DiscLevel1=700 **(same as above)**

DiscLengthFactor2=0.550 **(same as above)**

DiscLevel2=-700 **(same as above)**

[PowerSupply]

Voltage=75

Current=35

VoltMeterLabel=50

VoltMeterYellow=70

VoltMeterGreen=90

VoltMeterRed=110

AmpMeterLabel=50

AmpMeterYellow=25

AmpMeterGreen=45

AmpMeterRed=65

[Caliper]

Caliper=no

CaliperWaitTime=0

[MultiCh]

NbCh=2

NbRawCh=2

NbProcessedCh=0

ToolLength=0.79 **(tool length from probe top to bottom of tool, in meters)**

TimeAvailable=no

TimeDataType=word

EnableSpeedCh=yes

[Ch1]

DisplayEnable=no **(This is a hidden channel that is accessible only in Wellcad)**

CalibrationEnable=no

Name=Speed **(log name, which may be changed by user in MCHCurve)**

ChShift=0.135 **(length from bottom of tool to measure point, in meters)**

Unit=m/min **(log units, which may be changed by user in MCHNum/MCHCurve)**

Offset=0

DataType=float

CalA=1

CalB=0

Reference1=0

Reference2=1

NumberFormat=%6.2f

PenColor=ff0000

PenStyle=Solid

PenWidth=1

Left=30

Right=100

Low=15000

High=20000

GridEnable=yes

Grid=500

NbDecade=1

ReverseScale=no

Mode=Linear

Filter=0

[Ch2]

DisplayEnable=yes

CalibrationEnable=yes

Name=Gamma **(log name, which may be changed by u ser)**

ChShift=0.135 **(length from bottom of tool to measure point, in meters)**

Unit=cps **(log units, which may be changed by user)**

Offset=4

DataType=MGXIIFloat

CalA=1

CalB=0

Reference1=0

Reference2=100

NumberFormat=%6.2f

PenColor=ff

PenStyle=solid

PenWidth=2

Left=0

Right=30

Low=0

High=200

GridEnable=yes

Grid=20

NbDecade=1

ReverseScale=no

Mode=Linear

Filter=3

[Process] **(Browsers and Processors available for this probe**

Process1=mch\mchnum.exe

Process2=mch\Laswriter.exe

Process3=mch\MchCurve.exe

[Process Info] **(Browsers and Processors which will start automatically)**

Process1=Browser,Start

Process2=Browser,Start

Process3=Browser,Start

[MChNum]
Minimized=no
XOffset=269
YOffset=42
XSize=222
YSize=90

[LASWriter]
XOffset=7
YOffset=569
XSize=284
YSize=155
Minimized=no

[MChCurve]
DepthScale=120
ForceTimeMode=no
DepthSpacing=10
Grid=yes
GridSpacing=1
XOffset=12
YOffset=10
XSize=580
YSize=467
Minimized=no
RefreshRate=100
DepthColLeft=0.3
DepthColRight=0.4

[MSIProc]
XOffset=64
YOffset=88
XSize=228
YSize=115
Minimized=no
[RecDebug]
XOffset=0
YOffset=0
XSize=570
YSize=496
Minimized=yes

III. Pulse Discriminator Settings for the MGX II

a) Overview

The two basic types of tool communications that are supported by the MGX II are Digital and Analog Pulse. Digital tools (probes) communicate by means a digital communications protocol employing specific modem types similar in design to the modems employed by Personal Computers to communicate over the Internet. Analog Pulse tools communicate to the MGX II by means of a stream of positive or negative going discreet voltage pulses at some amplitude and width (duration). The frequency of this pulse stream is then associated with some measurement such as natural gamma in CPS, Counts Per Second.

Standard Mount Sopris Instruments Analog Pulse tools have been characterized, by wireline type, on at least two line lengths to determine two numbers that are used to set a discriminator voltage the tool pulse amplitude must exceed to be counted. MSLog applies this pulse characterization automatically when the tool type is selected. There are times when these numbers may need to be manipulated by the operator because the tool in use has no characterization available for the wireline type or the length of cable is outside of the tested range for the tool and the characterization fails. The purpose of this document is to detail methods to manually set such a fixed discriminator level.

Note: The characterization is not strictly linear and may fail at long lengths such as beyond the guaranteed 800 meters.

b) Theory of Operation

At the surface the pulse input circuit must discriminate the actual pulse from noise or secondary ringing or an opposite polarity pulse in order to correctly count the frequency of the incoming data. To do this the MGX II uses an electronic circuit that has a digitally controlled, variable discriminator level that is set so that this level must be exceeded by the tool pulse amplitude in order to be counted.

Pulse logging tools are characterized on each type of wireline as each has a different response to the pulse.

Each tools is tested at a short and long wireline length. At each length measurements are made of:

- Minimum pulse-height of the desired polarity.
- Maximum Overshoot in the direction of the desired pulse polarity.

  Note Overshoot is the ringing from the same pulse or from a pulse of opposite polarity.

  These values are graphed and two numbers are derived which define a slope and offset of a line on which the discriminator values will be set for various cable lengths.

One number is for the threshold at zero cable length and the other is a multiplier value that adjusts that level per meter of cable line length. These values are then used to automatically calculate the threshold setting based on constants in the MGX II firmware and the length and type of cable selected by the operator.

c) Tol files and Discriminator settings

TOL files are ASCII text files containing the configuration information needed by MSLog to setup for the particular probe in use. They use the Windows .INI data format scheme where there are section headings in brackets and parameters under those headings. They can be opened and edited with a text editor such as Notepad.exe and Wordpad.exe. Be sure to save as raw text. Notepad is the safest to use as that is the only format it can use.

The slope and offset values determined above are then placed in the tol file. There are two discriminator circuits in the MGX II normally one is set for Positive pulses and the other for Negative pulses therefore there need to be two sets of parameters, one for each discriminator. Discriminator 1 is normally set for positive pulses and Discriminator 2 for negative.

Here is an example from the TOL file for the 2PGA-1000 gamma operating with 1/10", 1/8" Single Conductor Wireline. Comments are in italics.

[ToolAdapter] *section heading*
Name=MGXII *tool adapter type*
Address=64 *tool type*
FramingByte=69
ToolScriptFile=scripts\TwoPulse.scp *necessary script file for additional initialisation*
ToolControlledCaliper=no *enable caliper control yes/no*
ToolType=2PGA *Used by MSLConfig to change the following by WirelineType*

DiscLengthFactor1=-0.550 ***Amount to change the discriminator per meter***
DiscLevel1=700 *Zero cable length discriminator voltage level*
DiscLengthFactor2=0.550 *Same as above for second discriminator*

DiscLevel2=-700 ***Same as above for second discriminator***
WirelineType=1/10", 1/8" Single Conductor *label indicating the wireline type for the current Disc settings.*

ciDiscriminator parameters explanation

ToolType=2PGA…MSLConfig reads the tol file when it installs it in the MSLog\Tol\Current folder. If it finds the 2PGA in the CableTypes.msl file in a WirelineType which is the same as is currently selected the it takes the values it finds and writes them into the following Parameters:

- DiscLengthFactor1= The amount to decrease the threshold per meter of logging cable.
- DiscLevel1= The voltage level of the discriminator at zero cable length.
- DiscLengthFactor2= The amount to decrease the threshold per meter of logging cable.
- DiscLevel2= The amount to decrease the threshold per meter of logging cable.

In the example above, the 1st discriminator is set to700 milli-volts at zero cable length and the voltage changes by -0.550 (note the negative sign) per meter of logging cable.
The 2nd discriminator is set to –700 milli-volts (note the negative sign) at zero cable length and the voltage changes by 0.550 (note the sign is assumed to be positive) per meter of logging cable.

d) Manual Discriminator Settings

Using the above information we can modify a tol file to have a fixed discriminator in all cases of wireline. To do this the following parameters need to be set.

- ToolType= Must be blank or a type which does not exist in CableTypes.msl
- DiscLengthFactor1=-0.0 Must be set to 0.0. This indicates that the value will not change per meter of logging cable.
- DiscLevel1= Set to some value determined by testing with an oscilloscope or by changing from a maximum value of 1300 to a minimum of100.
- DiscLengthFactor2=0.0 Must be set to 0.0. This indicates that the value will not change per meter of logging cable.
- DiscLevel2= Set to some value determined by testing with an oscilloscope or by changing from a maximum value of -1300 to a minimum of -100.

The numbers above are based around the mean value of the voltage on the MGX II main board at TP41 and TP44. This value is about 5.3 volts so that negative pulses do not drive the inputs of U39 pins 5 and 6 below ground. One of the things to watch out for is that some tools send wide, negative pulses up the cable line which do drive TP41 and TP44 below ground. This causes the outputs of U39 to output twice the number of pulses as are present at the input. The tool may need to be changed electrically so this does not happen.

e) Procedure for determining Manual Discriminator Settings

eiEquipment needed

Dual channel Oscilloscope
2.5mm Allen Wrench

f) Discriminator pulse testing for positive discriminator

- Remove the cover from the MGX II.
- Connect both channels of the oscilloscope to TP 41.
- Connect the oscilloscope ground lead to TP 49.
- Set the vertical scale for both oscilloscope channels to 2 volts per division.
- Set the time scale for the oscilloscope to 50 microseconds per division.
    - Note the above two settings are a good starting point in most cases. You may need to adjust them depending on the pulse duration and height and the trigger sensitivity of the oscilloscope.
- Turn the MGX II On, Start MSLog and run the tol file you intend to use.
- Turn tool power on.
- Adjust the vertical position of the channels so the signals are on top of each other.
- Move one test probe to TP 43.
    - Notice whether the pulse exceeds the dc level of the probe on TP 43.
    - Notice if any overshoot exceeds the dc level of the probe on TP 43
    - If the pulse exceeds the dc level and the overshoot does not then the discriminator is okay. Increase the frequency of the tool output to its maximum and verify the previous observation is still true. If so no adjustment is needed.
    - If the pulse does not exceed the dc level.
        - Change the value of DiscLevel1= to a lower value.
        - Save the file and reselect the tool.
        - Turn tool power on and observe the oscilloscope.
        - Iterate until the dc level at TP 43 is below the pulse peak but higher than the overshoot.

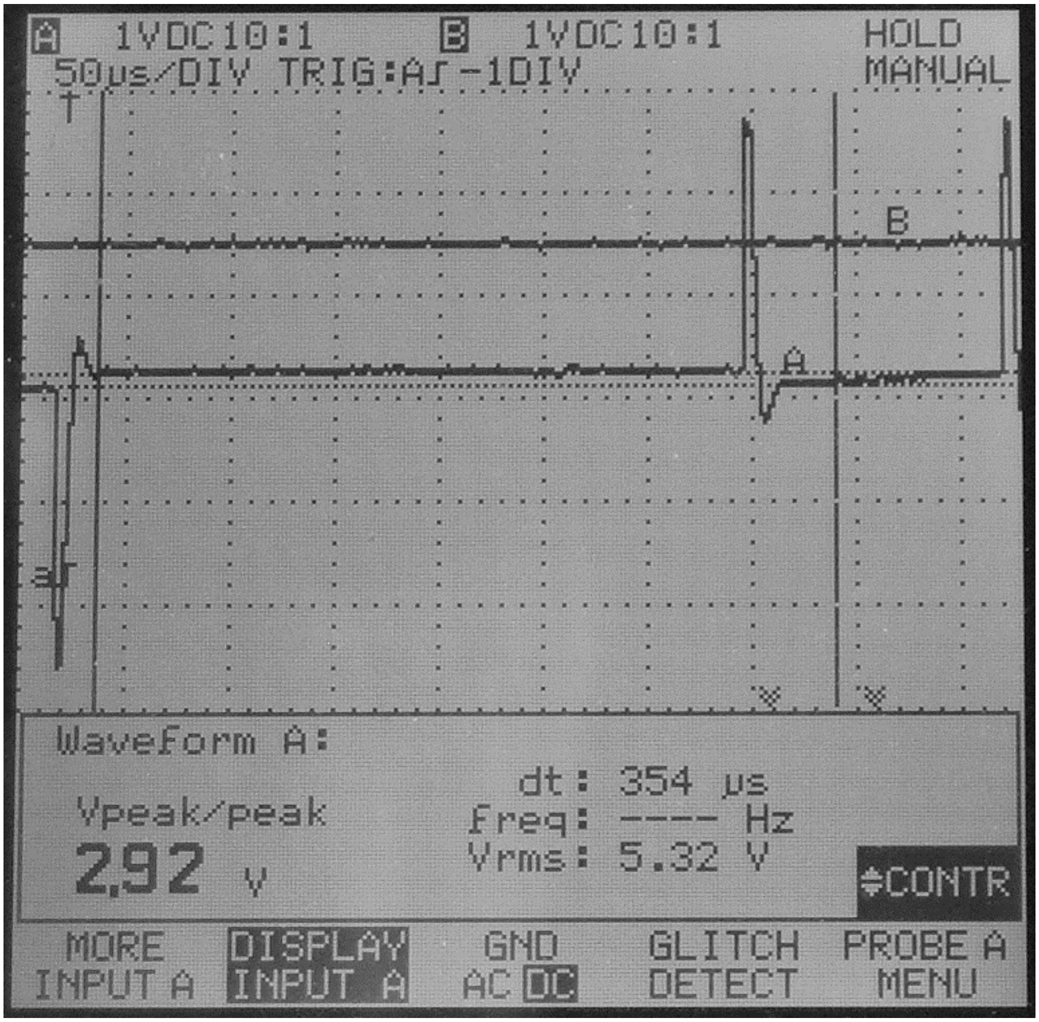

Figure 1 Positive discriminator pulses

In Figure 1 there are displayed from left to right a negative pulse and two positive pulses. These are on the trace with the label A at TP 41. The trace with label B is the DC level at TP 43. Note the small positive peak after the first, large negative peak. That small positive peak is the overshoot caused by the larger, negative pulse that is the actual signal. For the next, positive peak there is a trailing negative peak that is the overshoot caused by the larger, positive pulse peak.

The TP 43 threshold indicated by the B trace is at a good level. It is higher than the positive overshoot of the first negative pulse peak and it is lower than the positive peak pulse and is about half the distance between the overshoot and minimum positive peak pulse.

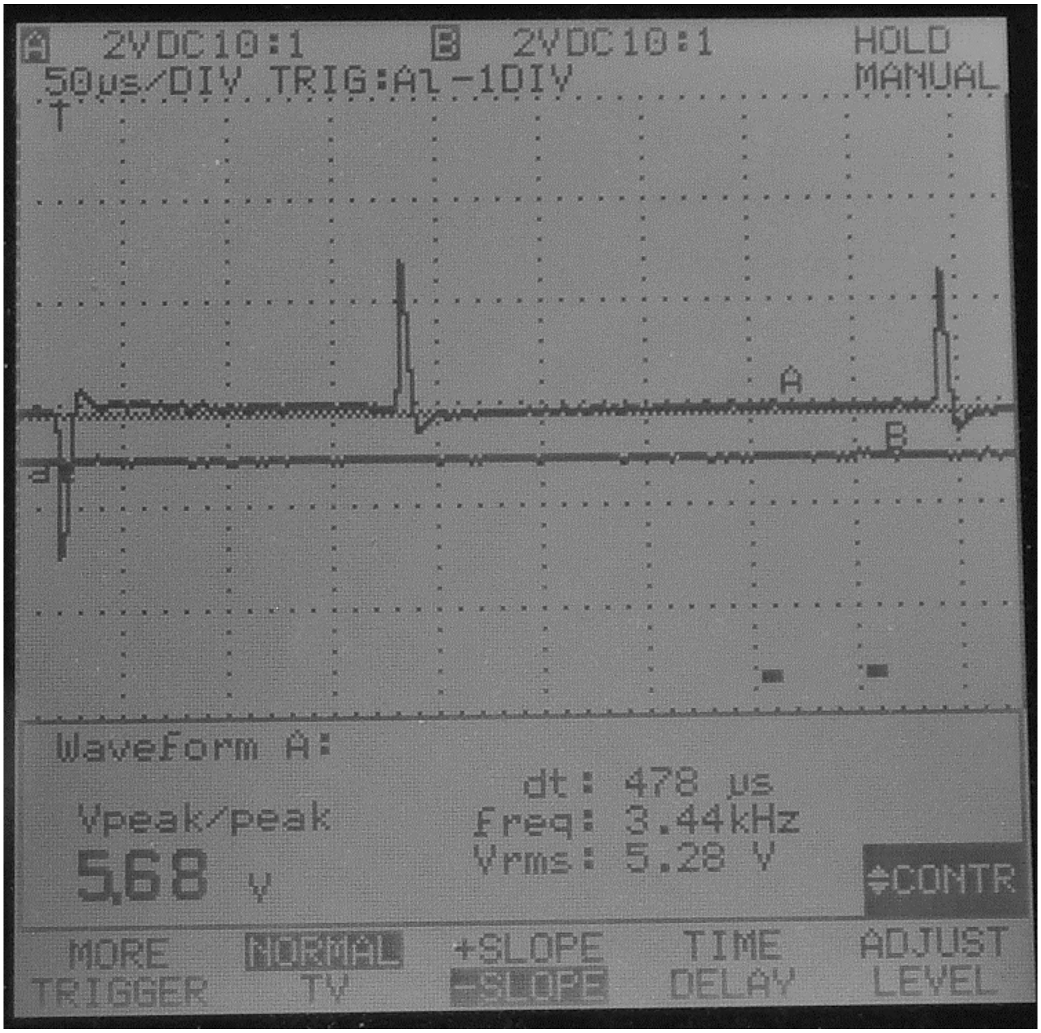

Figure 2 Negative discriminator pulses

In Figure 2 the oscilloscope leads for channel A are on TP 44 for channel B on TP 46 to monitor the negative discriminator inputs.

The oscilloscope vertical scale has been changed to 2 volts per division and is displaying pulses from the same source as Figure 1. Note that the DC level on scope lead channel B at TP 46 is properly positioned across the first negative pulse. It is below the negative overshoot of the first large positive pulse.

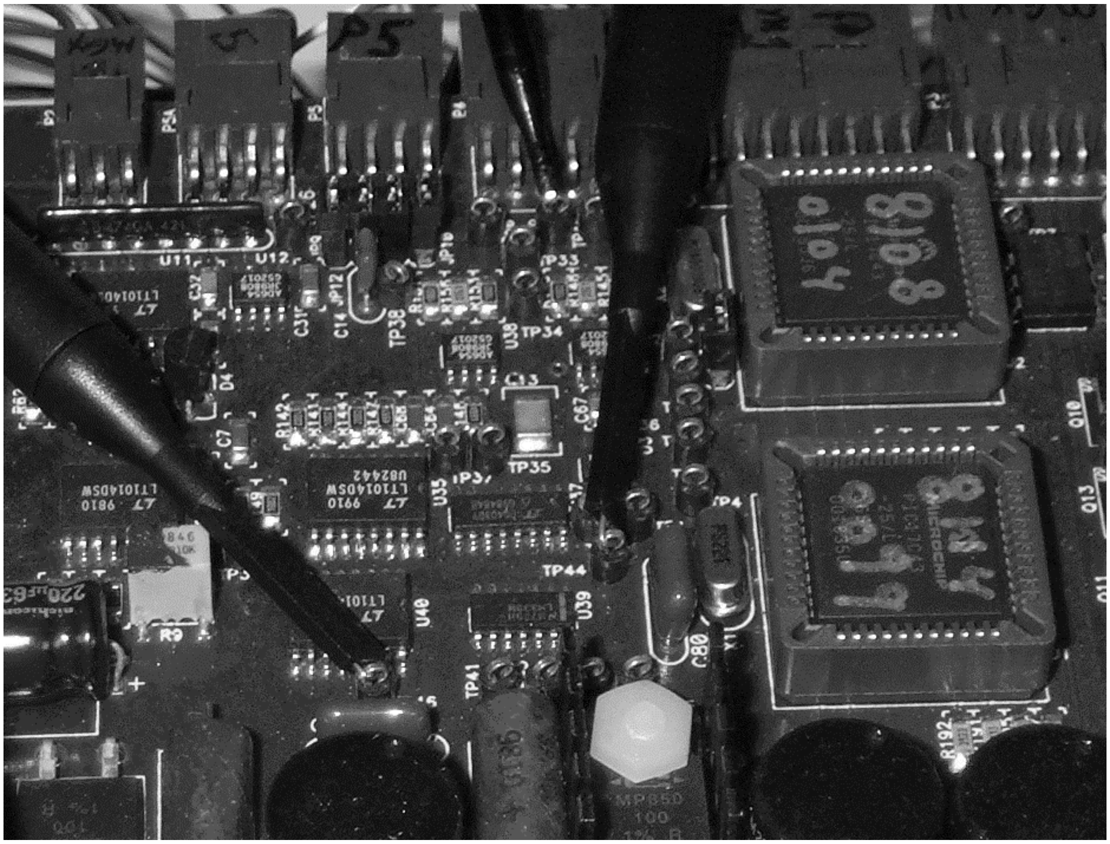

Figure 3: Oscilloscope Lead Placement

Figure 3 shows the placement of oscilloscope leads on TP 44 and TP 46. The oscilloscope ground is on TP 49 in the top center of the picture. TP 41 can be seen near the bottom center and TP 43 is immediately to its right.

IV. Depth Offset Control in Tol Files

a) Introduction

In real time plotting and in import of data with Wellcad, depth offsetting of the data traces is controlled by settings in the Tol file. For standard tools these values are preset in the distributed tol files. For modified tol files these numbers may need to be revisited.

b) Tol file configuration

There are two sections in the tol file that control depth plotting of the data channels. The first is the **[MultiCh]** section. In this section the required parameter that determines the tool length is: **ToolLength=0.79**.The value, in this case 0.79 meters, is the total length of the tool from the bottom of the tool to the joint of the tool at the cablehead. The value must be in meters and is always positive.

Then for each data channel there is a section in the tol file with a section heading similar to the following fragment:

[Ch2]
Name=Gamma Data Label
ChShift=0.135 Offset Distance
Unit=cps Data Units Label

The Offset Distance value is the distance from the bottom of the probe up to the measuring point in this case 0.135 meters. The value must be in meters and is always positive. The Data Label, and Data Units Label, can be changed manually or by dialogs within either MchCurve or MchNum browsers.

After changing any of these settings, save the file and restart all processors and browsers.