Section

30

# 30 CSS Radial Bond Services

Computer Sonics produces two types of radial bond tool. One (the earlier model, though still produced) is known as the sequential tool. This tool has four modes of operation:
3 ft.- 5 ft. mode for generating the conventional dual spaced CBL radial mode for generating the eight receiver radial bond log (RBL)
calibration mode for generating the internal calibration signal open hole mode
The tool is switched from mode to mode and to acquire data for a complete log two passes must be made over the log interval, one in CBL mode and one in RBL.
The later tool model generates all the required signals simultaneously and is known as the multiplexed tool.
Both tools transmit nuclear, collar, and temperature log data in a digital form interleaved with analog sonic data. The telemetry scheme employed is not the same for the two tools, however in both cases it is detected and decoded in the Warrior system by DSP software through selection of the appropriate script command.
The sequential tool transmits acoustic signals on the wireline at their natural frequency (approximately 20 – 25 kHz). The multiplexed tool divides the downhole frequency by a factor of four before transmission to the surface, therefore the frequency of the tool signals on the line is approximately 6 kHz. Special provision must be made for this feature in the logging system in the form of a special filter / amplifier card that can be switched to accommodate conventional as well the CSS multiplexed tool.
In both tools CSS has provided an internal calibration signal which can be used for a well site calibration which does not rely on finding (assuming) free pipe in the well. For both tools the philosophy is the same, namely the tool is calibrated in a known environment (zero signal and a calibration pipe) and the internal calibrate signal evaluated. The calibrations for all the receivers and the value of the internal calibration signal are recorded by tool serial number. This procedure is termed the shop or master calibration. At the well site the receiver zero signals and internal calibration signal are re-evaluated and corrections made to reproduce the readings obtained during the shop calibration. In this way any changes in signal amplitudes due to electronic drift, differences in wireline and other factors may be minimized.
The 3 ft receiver signal curve is calibrated to industry standard values. The sector signals are normalized to a given log amplitude during the shop calibration for calibration pipe diameter. When logging casing of other diameters the sector amplitudes are adjusted to produce the same log deflection and cement map appearance.

## 30.1 SDSTIP

The gains and filters for the CSS tools should be setup as follows:
From Acquisition Window Select 'Edit/Device Configuration/SDSTIP'
For the CSSM 1 11/16" tool, with Short to medium lines the following values should be entered in the SDSTIP Panel.

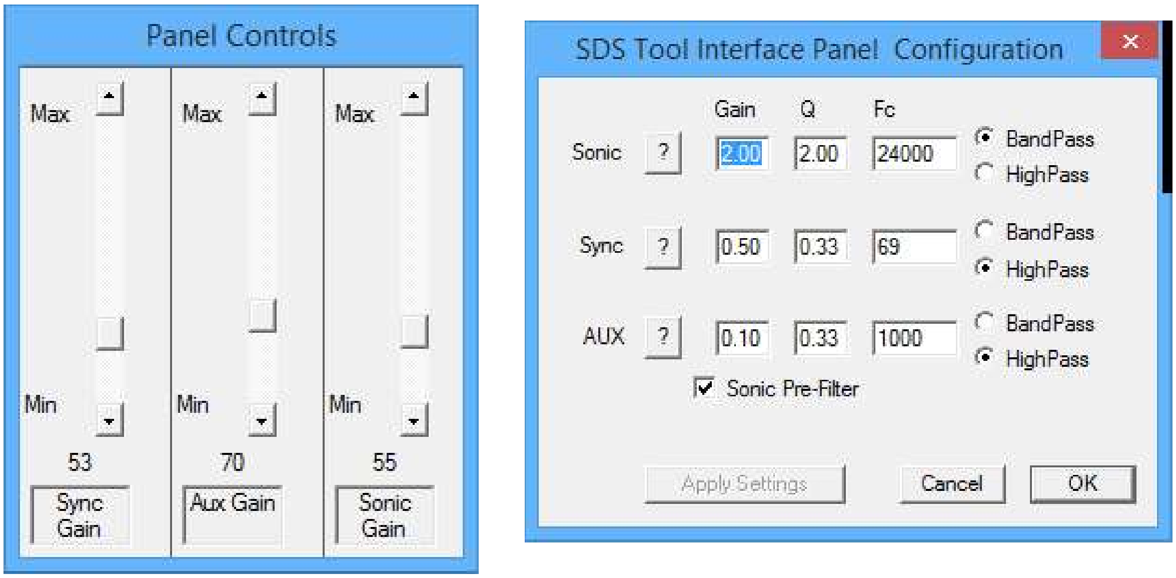


FIG: 30.1SDS Tool Interface Panel Configurations 1 11/16 Short to Medium Lines

The Gains set the maximum gain for the Panel Control Slider bars and should be set to give a usable range for the slider bars depending on line length and tool signal.
The Sonic line is for the Sonic signal.
The Sync line is for the Sync signal.
The Aux line is for the Telemetry signal.
The FC is the frequency of the signal being detected. The Q is the sharpness of the filter, the higher the Q the sharper the cutoff frequency. Band Pass or High Pass is the type filter used.
The FC for the Sonic Line should be set for the frequency of the sonic receiver crystals, with a Band Pass Filter.
The FC for the Sync Line usually works best with a low Q and Low FC, with a High Pass Filter.
The FC for the Aux Line has been tested for short to medium lines and medium to long lines, and should be entered as shown.
For the CSSM 1 11/16" tool, with medium to long lines the following values should be entered in the SDSTIP Panel.

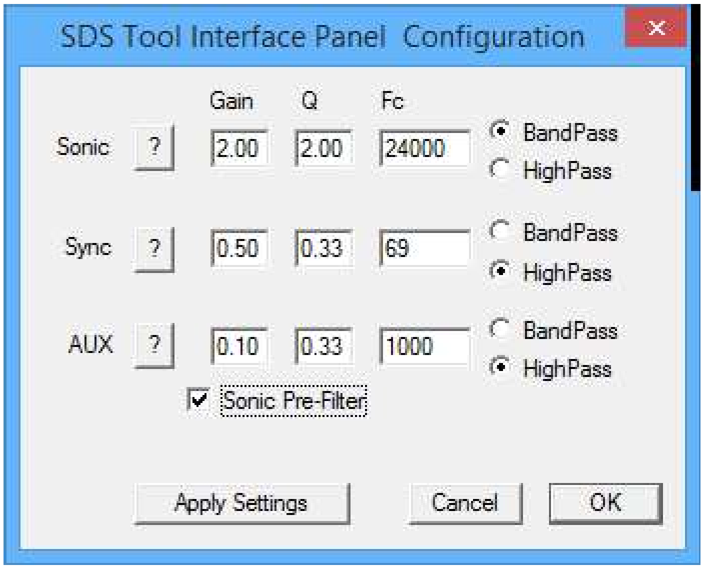


FIG: 30.2 SDS Tool Interface Panel Configurations 1 11/16 Medium to Long Lines

For the CSSM 3 1/8” tool, with short to medium lines the following values should be entered in the SDSTIP Panel.

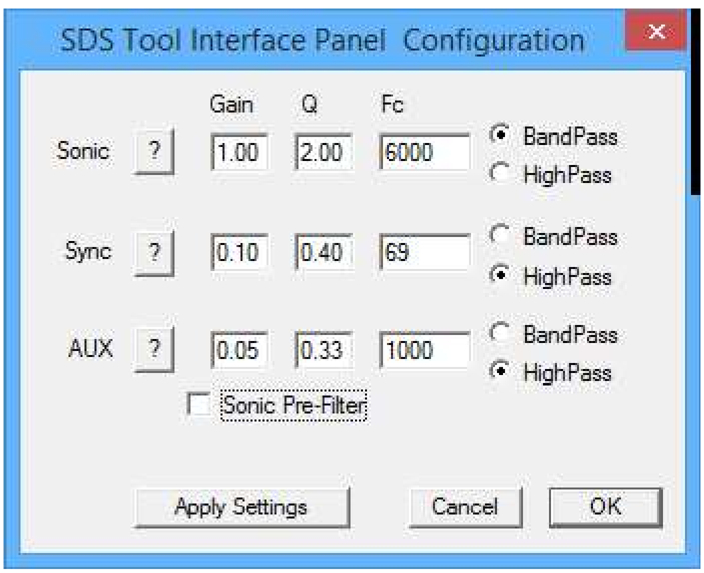


FIG: 30.3 SDS Tool Interface Panel Configurations 3 1/8 Short to Medium Lines

For the CSSM 3 1/8” tool, with medium to long lines the following values should be entered in the SDSTIP Panel.

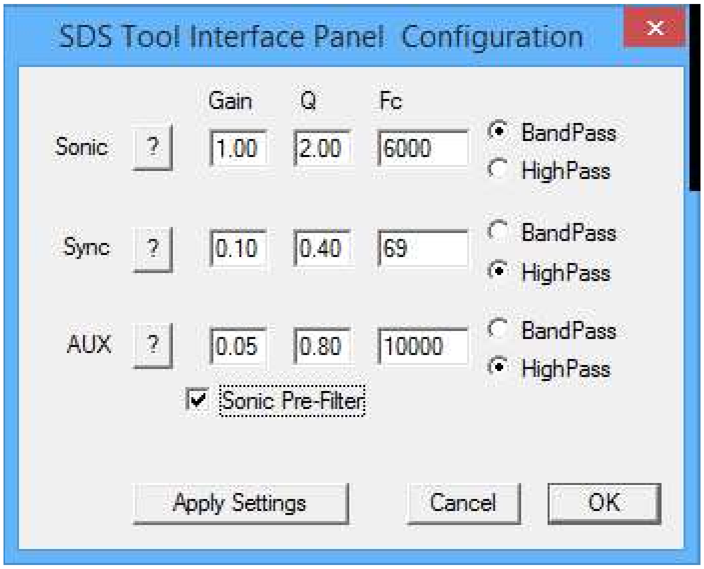

FIG: 30.4 SDS Tool Interface Panel Configurations 3 1/8 Medium to Long Lines

These values are not set and stone and may have to be tweaked for individual situations.

## 30.2 Acquisition

After starting Acquisition, the first step when running a Bond Tool of any type on Warrior will be to set the proper casing size.. This will ensure that the gates will default to the correct saved settings.

30.2.1 Edit

Click on the Edit menu box of the Warrior Logging System menu box and scroll down to and select Variables.

30.2.2 Variables

Displays the Variable (parameter) editor window, enabling depth dependent parameters associated with the selected service to be zoned and values to be set.

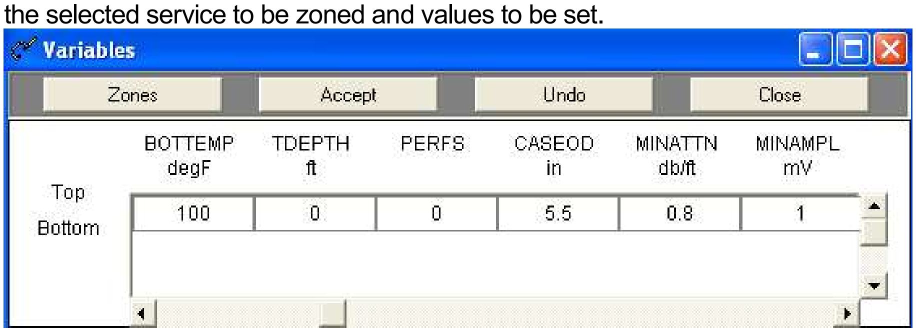

FIG: 30.5 SDS Variables

Check the proper Casing OD under CASEOD. If you are outputting a Bond Index curve, enter the Minimum and Maximum Amplitudes. Enter any other variables that may be required. Then push the Accept button.

The Minimum and Maximum Amplitude values are used for calculating the Bond Index Curve. Of these


values the MINAMPL will have the greatest impact upon the calculations. The proper values are listed in Appendix A. Also, the MINATTN value is typical for most standard casings.

30.2.3 Edit Logging Services Details

From the Warrior Logging System menu box, click on Services and select the proper service for the tool type. Tools have different telemetry schemes and the services must be set up to match the telemetry.

30.2.4 Edit logging Tools details

When the Service is selected the Edit Toolstring Window will come up automatically. Or, select Edit and Tool String, to display the following window:

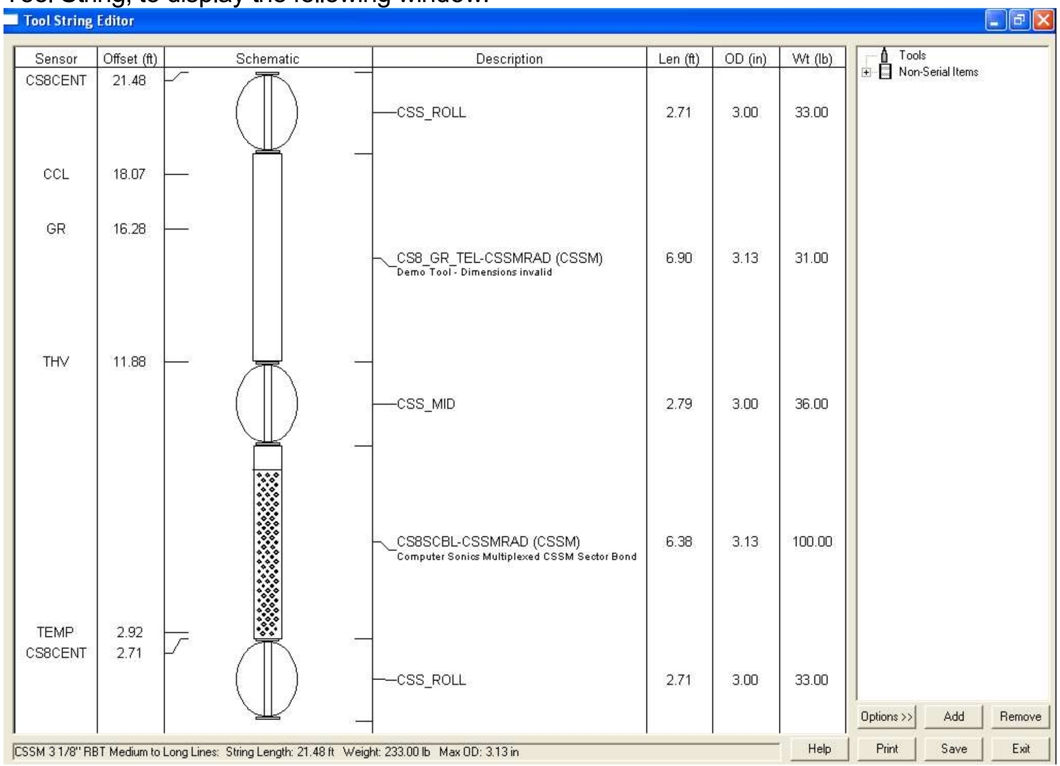

FIG: 30.6 Toolstring

From this window it is possible to change the tool being run, the order of the tools in the string, and add or delete centralizers, weight bars, knuckle joints or other tool string components. It is from the information set in this window that the calibrations, default offsets and filters settings for the log to be run are derived.

30.2.5 Tool String

Depth offsets that were derived from the Edit - Tool String step may be viewed by choosing Edit - Sensors, to display the following window:

Edit Sensors

Edit Select

| Name | Device | Chan | Offset | SPF |
|---|---|---|---|---|
| TEL | DSP | 27 | | |
| WVF3FT | DSP | 2 | 2.71 | 4 |
| WVFCAL | DSP | 5 | 2.71 | 4 |
| WVF5FT | DSP | 3 | 2.71 | 4 |
| WVFSUM | DSP | 4 | 2.71 | 4 |
| WVFS1 | DSP | 19 | 2.71 | 4 |
| WVFS2 | DSP | 23 | 2.71 | 4 |
| WVFS3 | DSP | 20 | 2.71 | 4 |
| WVFS4 | DSP | 24 | 2.71 | 4 |
| WVFS5 | DSP | 21 | 2.71 | 4 |
| WVFS6 | DSP | 25 | 2.71 | 4 |
| WVFS7 | DSP | 22 | 2.71 | 4 |
| WVFS8 | DSP | 26 | 2.71 | 4 |
| WVFSYNC | DSP | 1 | 2.71 | 4 |
| LSPD | BASE | 21 | | 4 |
| LTEN | BASE | 7 | | 4 |
| TCURR | BASE | 1 | | 2 |
| TVOLT | BASE | 2 | | 2 |
| ELTIM | BASE | 22 | | 4 |
| ADPTH | BASE | 23 | | 4 |
| MINMK | BASE | 22 | | 2 |
| TEMP | DSP | 13 | 2.92 | 4 |
| CCL | DSP | 16 | 18.07 | 20 |
| GR | DSP | 7 | 16.28 | 4 |
| THV | DSP | 12 | 11.88 | 4 |

FIG: 30.7 Edit Sensors

These offsets may be edited from this window, by double clicking on a sensor. The information in this window normally consists of the hardware source of the sensor (Device and Channel number), the depth offset of the sensor from tool zero reference, and the sampling rate.

The information contained in Edit Sensors is defaulted to the current service and current tool string information. For example, sensor depth offsets are derived from the selected tool string and the information contained in the tools database. The default sample rates and device channel assignments are derived from the services file. The default device and channel settings, and the default sample rates are contained in the services.ini file. The default depth offsets are derived from tool information contained in the tools.ini file.

Sensors can not be modified while in a record mode.


It is important to know that no permanent changes are saved from this window. If you change anything in the Edit Tool String window and save them, any changes under Edit Sensors will be deleted when the service is closed. If you have to edit offsets in the Edit Sensor window the Tool.ini file should be modified.

### 30.2.6 Power Up

Power up the tool string. (Nominally 125V at the STIP)

Adjusting the sync. Start by turning the Panel Control ‘Sync’ slider bar all the way down. Monitor the Waveform Window and slowly raise the Slider Bar. In the Waveform Window you will see the 0/s changes to typically 3/s or 4/s on the 1 11/16” tool and 7/s or 8/s for the 3 1/8” tool. At this point the waveforms are synced. The PMON Window is used to adjust the telemetry thresholds. (This window will be hidden behind the Waveform window, and must be brought to the front.) On the PMON Window the left arrow adjusts the positive threshold and the right arrow the negative threshold.

Adjusting CSS Telemetry sync. While looking at the PMON window, adjust the positive (+) and negative (-) thresholds to about 50%. Adjust the Panel Control ‘AUX’ Slider to adjust the height of the digital signal, until the pulses are just below saturation

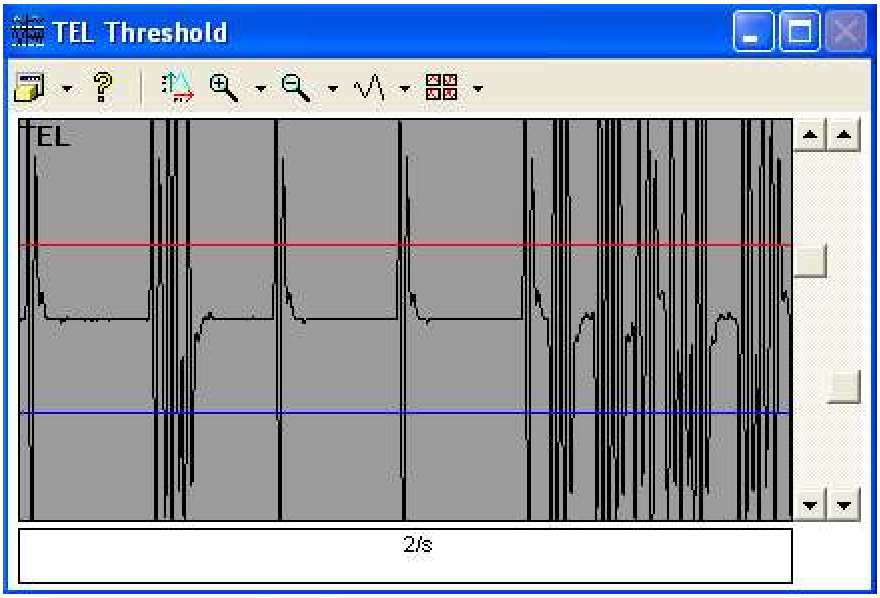

FIG: 30.8 Tel threshold


The PMON discriminator values will be what is saved in the 'Source/Save Setup' for this service. *Options - View Axis Scaling* may be used to more accurately set these values. This window is digital. The screen will not update until waveform sync is established. Select *Source/Save Setup* to retain these values for your next log.

30.2.7 Telemetry
Verifying Telemetry Data:
From Warrior Acquisition Window -Select Monitor/ Devices/ DSP:

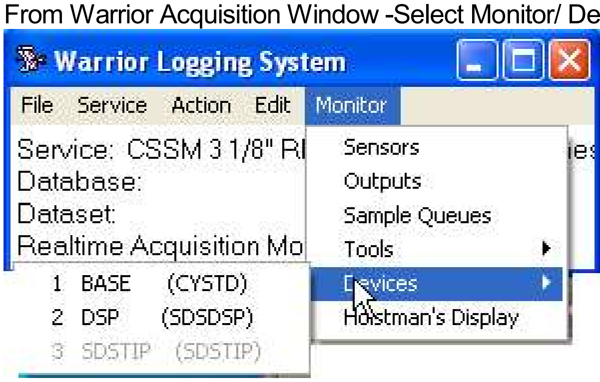

FIG: 30.9 Devices

Values for CSSM 3 1/8" Radial Bond Tool

Device: CYSTD

| Source | Name | Value | Units |
|---|---|---|---|
| BASE-1 | TCURR | 0.0656 | V |
| BASE-2 | TVOLT | 0.0095 | V |
| BASE-3 | CCL | -0.0034 | V |
| BASE-4 | | 9.9997 | V |
| BASE-5 | | 0.1865 | V |
| BASE-6 | | -0.0327 | V |
| BASE-7 | LTEN | 1.0306 | V |
| BASE-8 | | 0.0052 | V |
| BASE-9 | | -0.0095 | V |
| BASE-10 | | -0.0095 | V |
| BASE-11 | | -0.0397 | V |
| BASE-12 | | -0.0336 | V |
| BASE-13 | | -0.0354 | V |
| BASE-14 | | -0.0330 | V |
| BASE-15 | | -0.0333 | V |
| BASE-16 | | -0.0079 | V |
| BASE-17 | CTR1 | 0.0000 | cps |
| BASE-18 | CTR2 | 0.0000 | cps |
| BASE-19 | CTR3 | 0.0000 | cps |
| BASE-20 | CTR4 | 0.0000 | cps |
| BASE-21 | LSPD | -20.6300 | ft/min |
| BASE-22 | ELTIM | 523.2700 | sec |
| BASE-23 | ADPTH | 9776.6000 | ft |

FIG: 30.10 Devices List

The above values are very close to what the tool normally reads. Monitor TEL5-CCL, TEL7-Cable head voltage and TEL8-Temperature for stable readings. If necessary adjust the positive threshold in the PMON window up or down to stabilize the readings.

30.2.8 Monitoring Outputs.

From Warrior Acquisition Window select Monitor /Outputs. *An* Outputs window will appear that allows you to monitor signals such as CCL, GR, and other sensors.

**Outputs**

| Name | Source | Value | Units |
|---|---|---|---|
| AMP3FT | [CS8SCBL... | 19.8975 | mV |
| TT3FT | [CS8SCBL... | 218.9651 | usec |
| AMPCAL | [CS8SCBL... | 0.2441 | mV |
| AMP5FT | [CS8SCBL... | 0.0586 | mV |
| TT5FT | [CS8SCBL... | 327.5909 | usec |
| AMPSUM | [CS8SCBL... | 0.1807 | mV |
| AMPS1 | [CS8SCBL... | 0.2902 | |
| AMPS2 | [CS8SCBL... | 0.2308 | |
| AMPS3 | [CS8SCBL... | 0.2189 | |
| AMPS4 | [CS8SCBL... | 0.2037 | |
| AMPS5 | [CS8SCBL... | 0.2240 | |
| AMPS6 | [CS8SCBL... | 0.2733 | |
| AMPS7 | [CS8SCBL... | 0.3530 | |
| AMPS8 | [CS8SCBL... | 0.3072 | |
| AMPMIN | [CS8SCBL... | 0.2037 | |
| AMPMAX | [CS8SCBL... | 0.3530 | |
| AMPAVG | [CS8SCBL... | 0.2627 | |
| ATT3 | [CS8SCBL... | -4.5204 | db/ft |
| BONDIX | [CS8SCBL... | 0.3430 | |
| LSPD | [STD] | -20.6300 | ft/min |
| LTEN | [STD] | 1.0306 | lb |
| TCURR | [STD] | 0.0644 | mA |
| TVOLT | [STD] | 0.0089 | V |
| ELTIM | [STD] | 455.8200 | sec |
| ADPTH | [STD] | 9782.0498 | ft |
| MINMK | [STD] | 0.0000 | |
| LTENRT | [STD] | 1.0306 | lb |
| DLTENRT | [STD] | 0.0009 | lb |
| LSPDRT | [STD] | -20.6300 | ft/min |
| HVOLTA | [STD] | 0.0056 | V |
| TEMP | [CS8SCBL... | 2020.0000 | degF |
| DTMP | [CS8SCBL... | 0.0000 | degF |
| CCL | [CS8_GR_... | 7739.0000 | |
| CCLRT | [CS8_GR_... | 7739.0000 | |
| GR | [CS8_GR_... | 14.0000 | |
| THV | [CS8_GR_... | 12018.0000 | V |

FIG: 30.11 Outputs List

Continue to Shop Calibration Section.

## 30.3 Shop / Tank Calibration:

Make up the tool with the centralizers and slide it into the tank. The tool should show signals on all of the signals in the Waveform Window.

Bring the Waveform Window to the front. The gates appear on the waveforms as a white line on the section of the waveform where they are set.

The gates can be changed on this window by clicking on the waveform that needs to be adjusted (note the dark border around the selected waveform) and then using the buttons in the top right corner of the Waveform Window. To move the gate right or left on the x-axis use the buttons labeled << to move it to the left or the button labeled >> to move the gate to the right. The width of the gate can be increased by selecting the < = > button and decreased by using the > - < button.

**Note:** It is recommended that you keep all of your gate widths the same. Approximatly 30 micro-seconds works well with most tool types.

Also, specific waveforms can be viewed by selecting Options – Enable, and selecting the waveforms that you want displayed. Reducing the number of waveforms gives you a screen that is easier to work with. Remember to click on the waveform before adjusting the gates.
Before gating on the first arrival use the ('BHC/CBL' pot on the panel for CBL01-09 sytems) (Panel Control 'Sonic' Slider Bar on CBLDR systems) to increase/decrease the signal. Make sure that none of the signals are saturated. (If you are going to be running logs in casing that is smaller than your calibration tank, be aware that the signals will be larger in smaller casings and decrease your signal to accomodate this.)
**Note:** The signal height on the screen is not valid if you are in threshold mode.
After all of the gates are set select *Source* – *Save As*. Give this setup a name, such as 'CSSM 1 11/16" Cal Tank Amplitudes.' If there is a problem later the setting can be restored by selecting Source – Load and selcting that setup name.
**Note:** The same can be done for settings on the PMON Window.


AT THIS POINT YOU SHOULD HAVE YOUR GATE (WHITE LINE) ON ALL THE FIRST POSITVE ARRIVALS OF ALL THE SIGNALS BEING DISPLAYED. (The CAL pulse first arrival should be positive. If the first arrival is not positive, the polarity can be changed through Warrior/Utilities/Edit Logging Tool Details.)

On the Waveform Window, select Source – Threshold Mode and use the UP/DOWN Arrows (Only on the 3 ft and 5 ft display). To move the red threshold line to a suitable position where the threshold cuts the first arrival. Make sure it is far enough to avoid baseline noise (This may be above or below the baseline). Threshold Mode is only used to set the travel time thresholds.
On the Waveform Window, select Source – Normal Mode.
On the Acquisition Window select Action – Calibrate – Shop / Free Pipe Zero Cal. A window will appear to sample the base line noise.

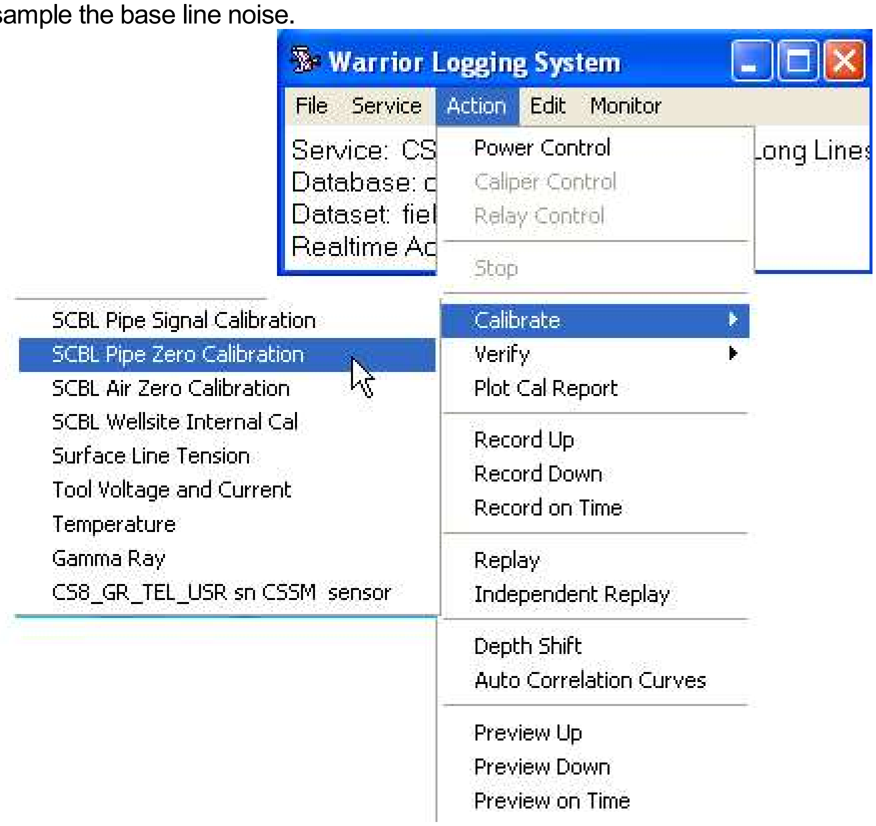


FIG: 30.12 Calibrate

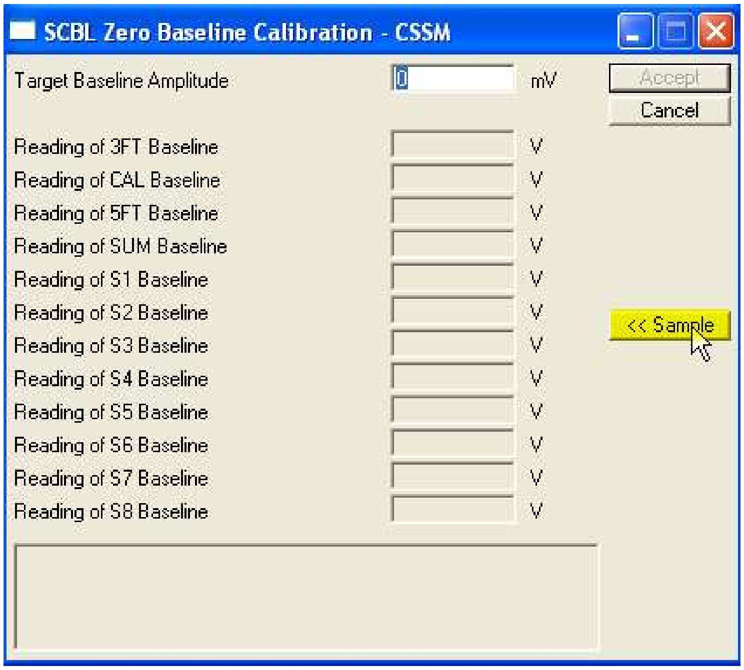


FIG: 30.13 Zero Baseline Calibration

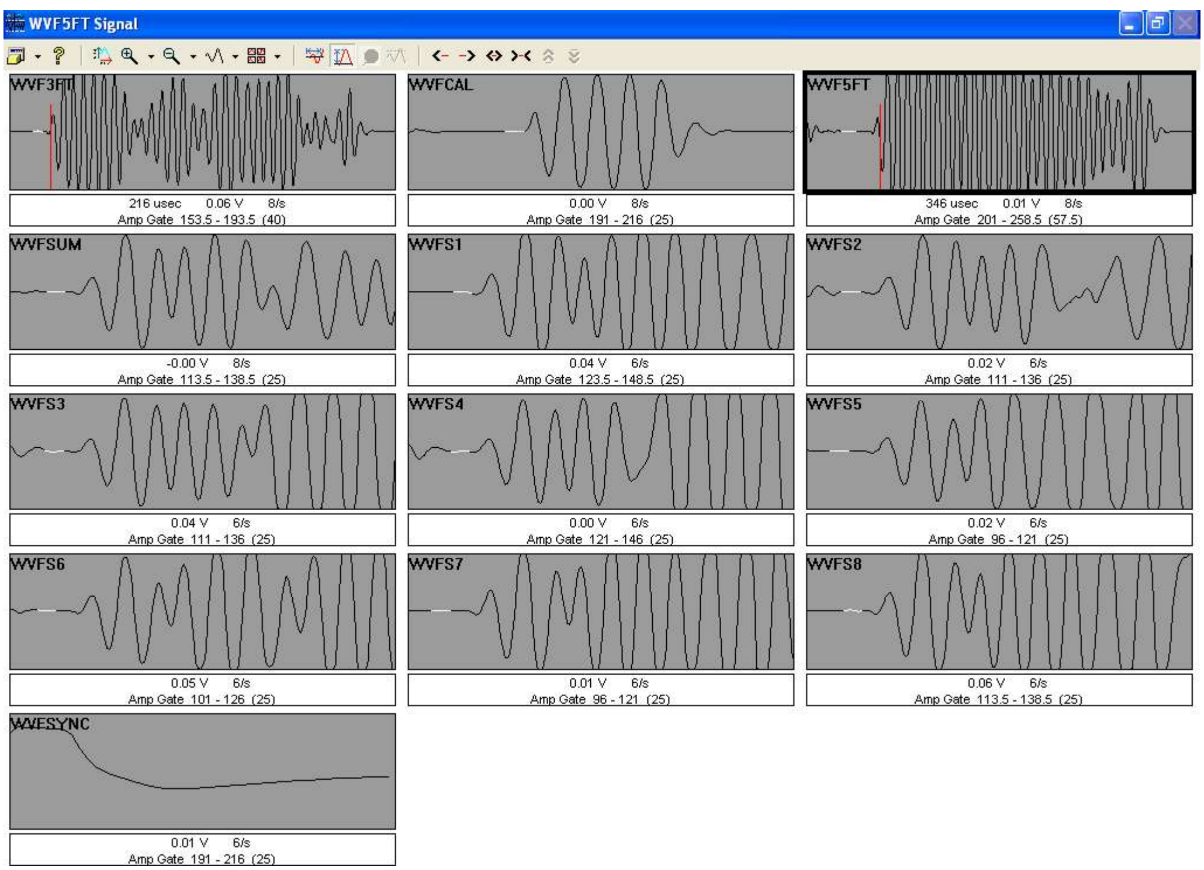


FIG: 30.14 Signals

Make sure the gates for all signals are on the flat part of baseline before the first arrival. These values will be updated when doing the well site air zero cal.
Click on the <<sample button. The Sample & Average Sensor(s) box will appear. Click on the begin button. When the sample is complete, monitor the values they should be very close to zero. If they are click the Accept button. If the values are not close to zero click the Reject button and correct the problem.

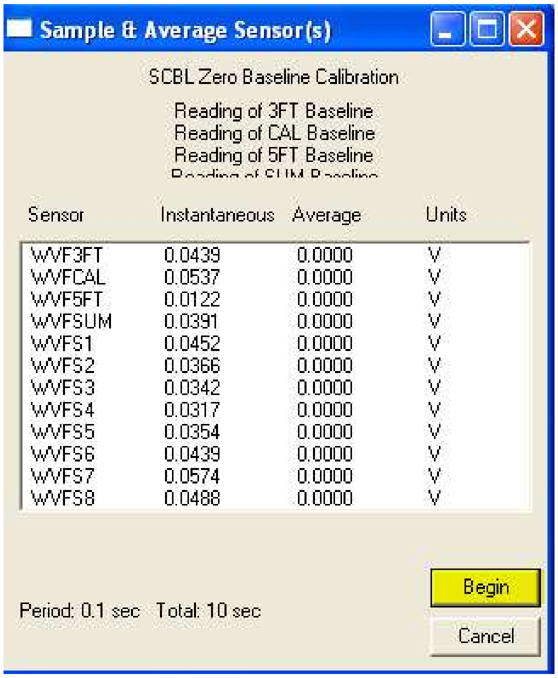

FIG: 30.15 Sensors signals

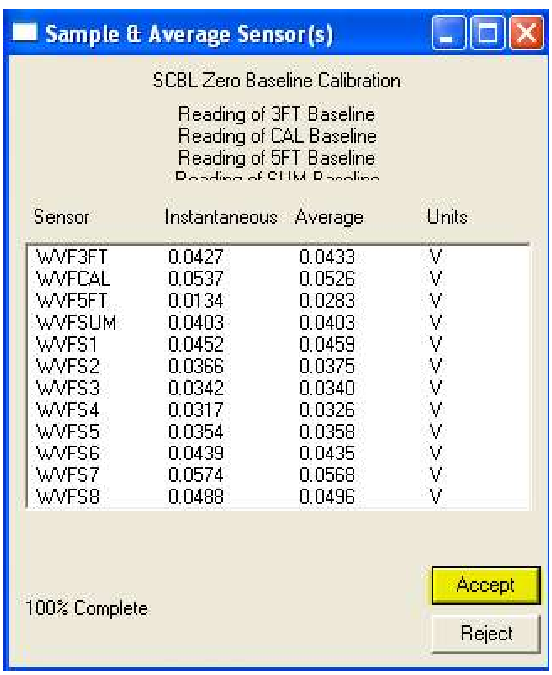

FIG: 30.16 Sensors Value signals

The SCBL Zero Baseline Calibration box will appear check that the values are all close to zero and click Accept.

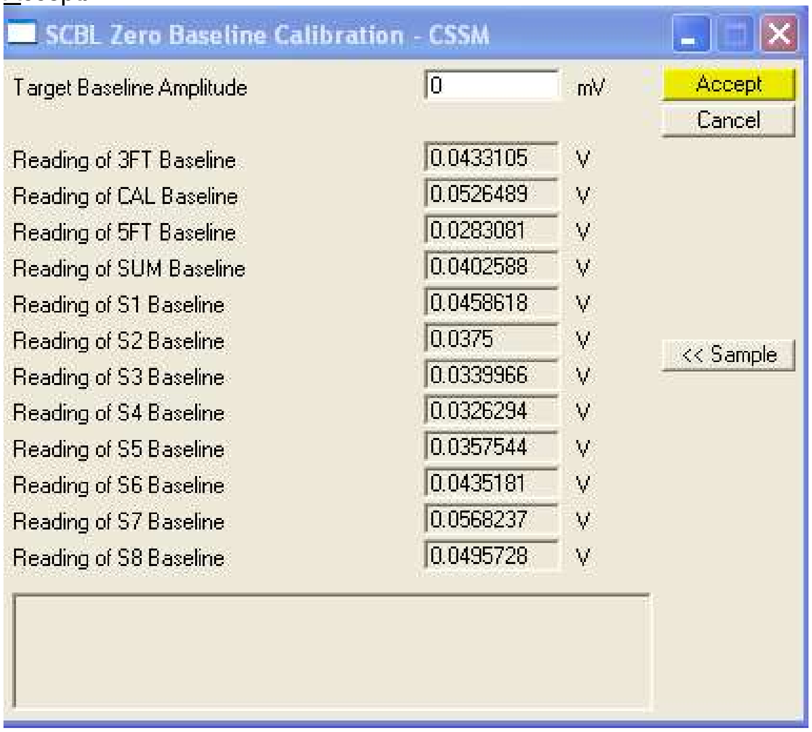

FIG: 30.17 Zero Base line

On the Acquisition Window select Action – Calibrate – Shop/Free Pipe Reference. The SCBL E1 Amplitude Calibration window will appear to sample the first arrival pipe amplitude. The Free Pipe Millvolt of the casing you are sampling is in the cells at the top of the window. The Sector E1 amplitude is normally set to 100 or made to match the 3ft E1 amplitude.

**Note:** If the value is not there or not correct check to see if the Casing OD and Maximum Amplitude were input in the Variables Window.


FIG: 30.18 Pipe signal Calibration

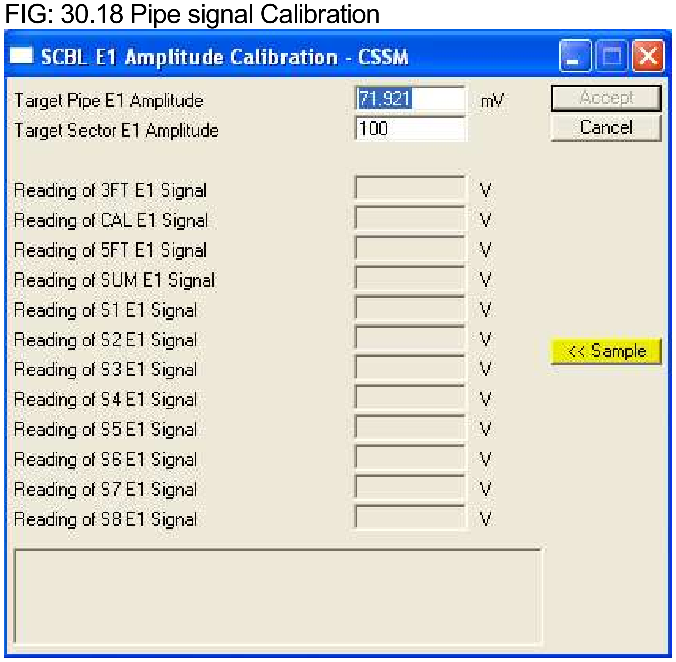


FIG: 30.19 Amplitude Calibration

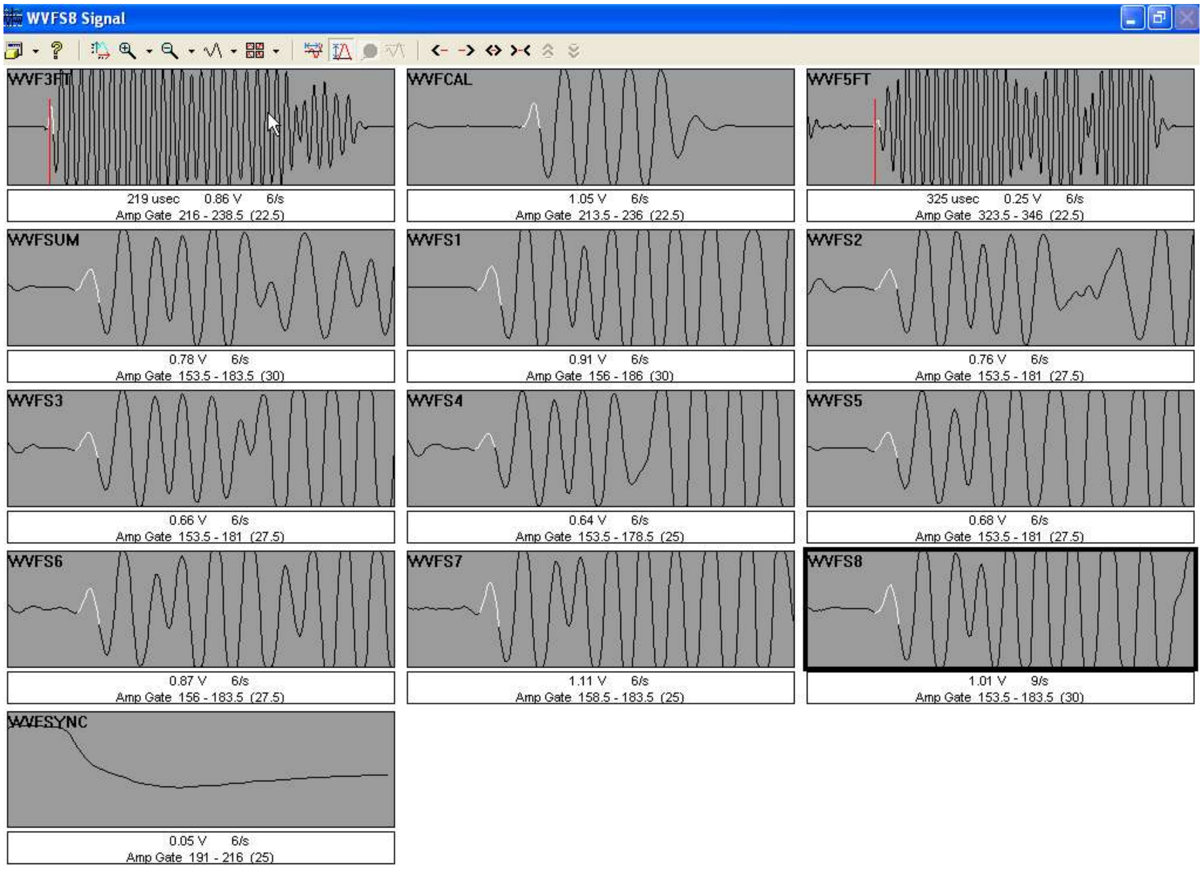

FIG: 30.20 Signals

Make sure the gates for all signals are on the positive part of the first arrival. Click on the <<sample button. The Sample & Average Sensor(s) box will appear.

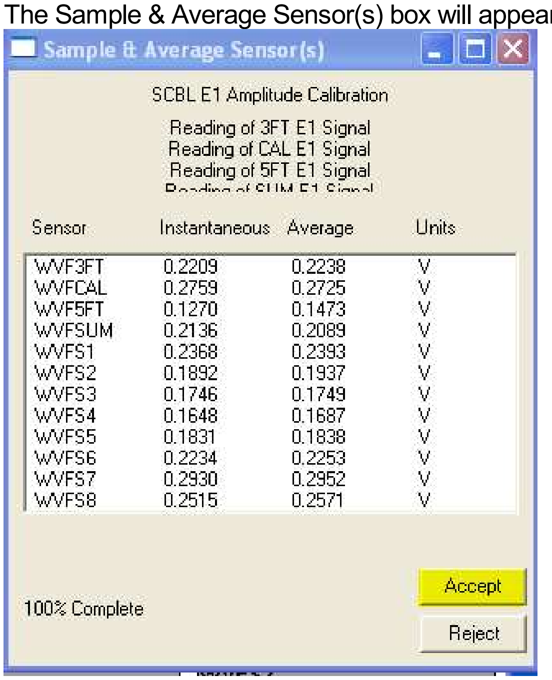

FIG: 30.21 Sample Signals

Select <<Sample. After the sampling has finished select Accept. The calibration gains and offsets for each waveform are displayed. The offsets on all waveforms should be near zero. The gains should range from 20 to150. Select OK.

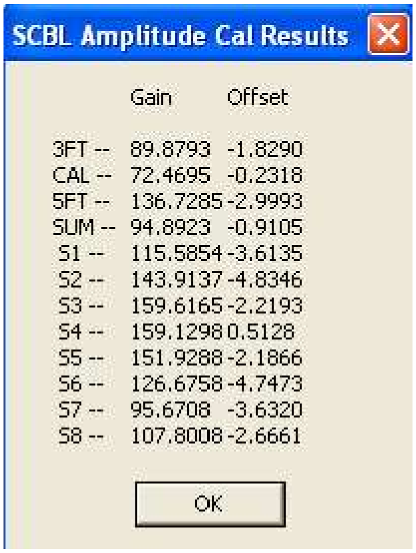


FIG: 30.22 Amplitude Calibration Results

The SCBL E1 Amplitude Calibration window will appear with the raw voltage readings displayed. Select Accept.

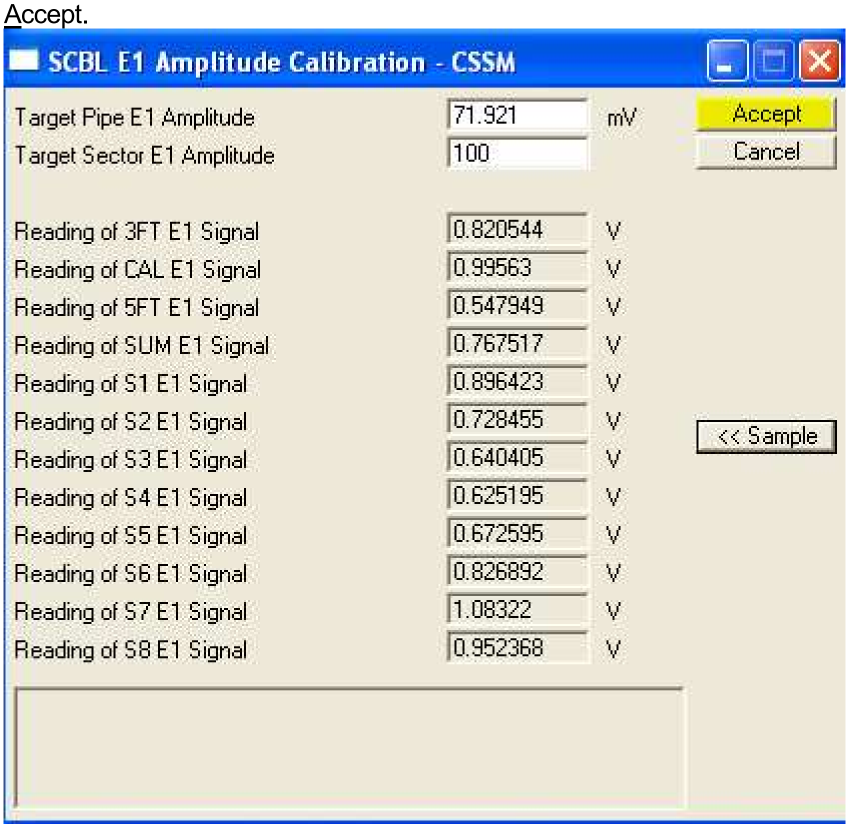


FIG: 30.23 E1 Amplitude Calibration

**Note:** If you need to make more than one calibration for each tool you must enter a different Serial Number.

**Warning!** Do not do a downhole cal with the same Serial Number because if you accept the cal and it is no good you will have over written the good shop cal, which can be utilized, if there is no Free Pipe found in the well.

**Note:** To create In the Warrior Screen select Utilities – Edit Logging Tool details then click Edit Tool. A list will come up, select SCBL and enter the “alias” Serial Number which you will use to do other cals on the same tool without over writing the original. Then Click Create – Tool. Enter a new serial number.

## 30.4 Wellsite Calibration Procedures:

The GR can be calibrated like any other GR tool. Select Action – Calibrate – Gamma Ray. Follow the onscreen menu.

### 30.4.1 SCBL Air Zero Cal.

SCBL Air Zero Cal: The following step is performed with the tool hanging in the air. On the Acquisition Window select Action/ Calibrate/SCBL Well Site Air Zero Cal. The SCBL Air Zero Cal window will appear.

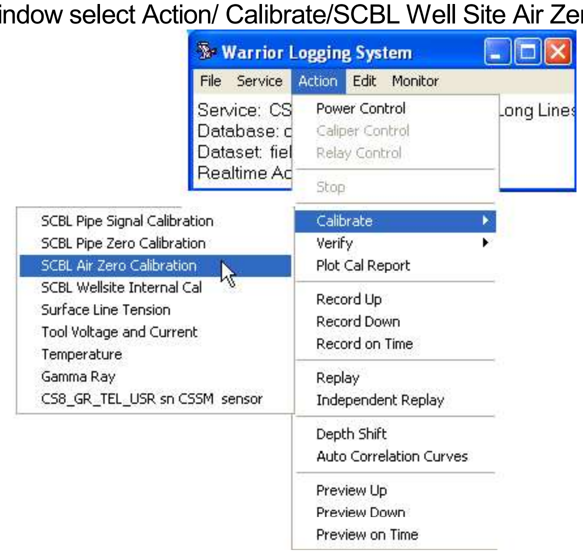


FIG: 30.24 Air Zero calibration

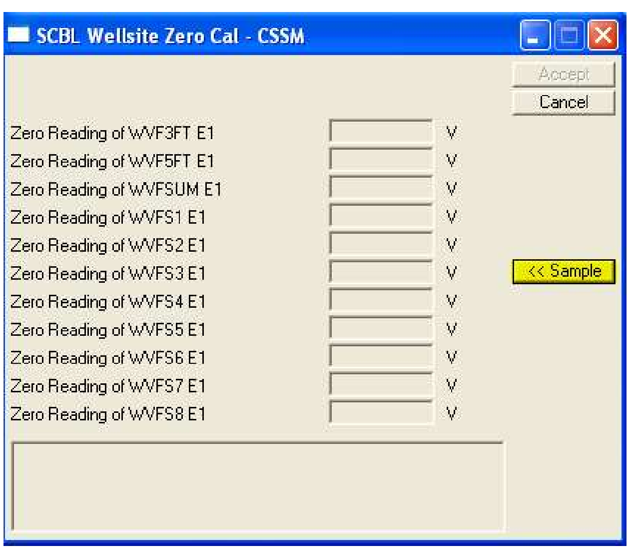


FIG: 30.25 Air Zero calibration

Ensure the gates are set in the proper position for the size pipe to be logged select <<Sample. The Sample & Average Sensor(s) box will appear. Select Begin.

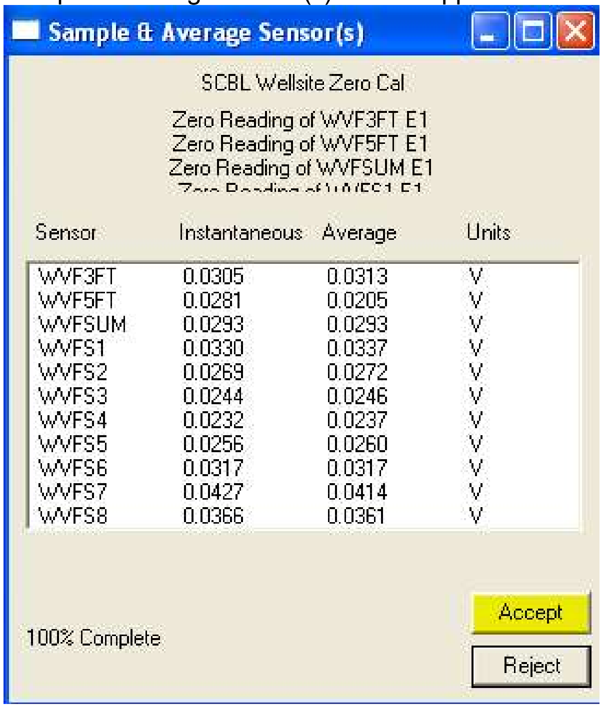


FIG: 30.26 Air Zero Values

All the values should be close to zero, and are used to establish the offset to be applied to the primary gain and offset established in the Shop Calibration. Select Accept.
Select Accept in the SCBL Air Zero Cal Window.

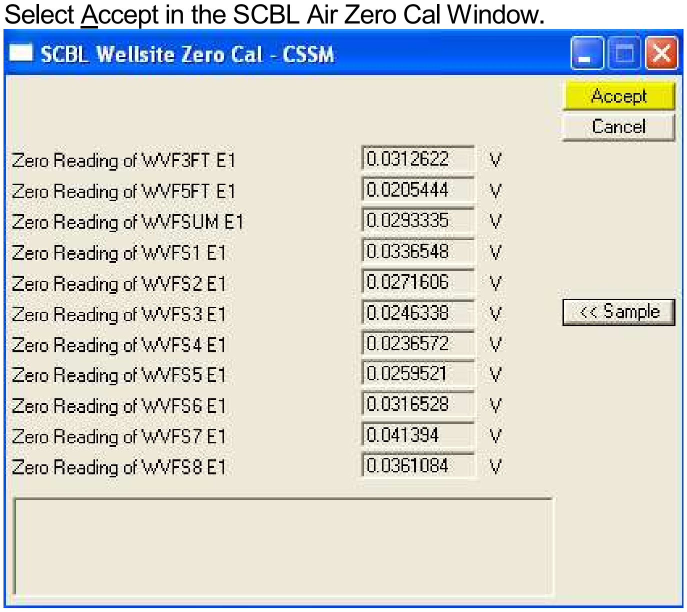


FIG: 30.27 Air Zero reading

### 30.4.2 SCBL Wellsite Internal Ref Cal

SCBL Wellsite Internal Ref Cal: The following step should be performed down hole. The CAL pulse is recalibrated to compensate for line resistance and temperature. The new values are used to normalize all waveform amplitude values back to the shop calibration.

On the Acquisition Window select Action/ Calibrate/ Well Site Internal Ref Cal. The SCBL Internal Reference Cal window will appear

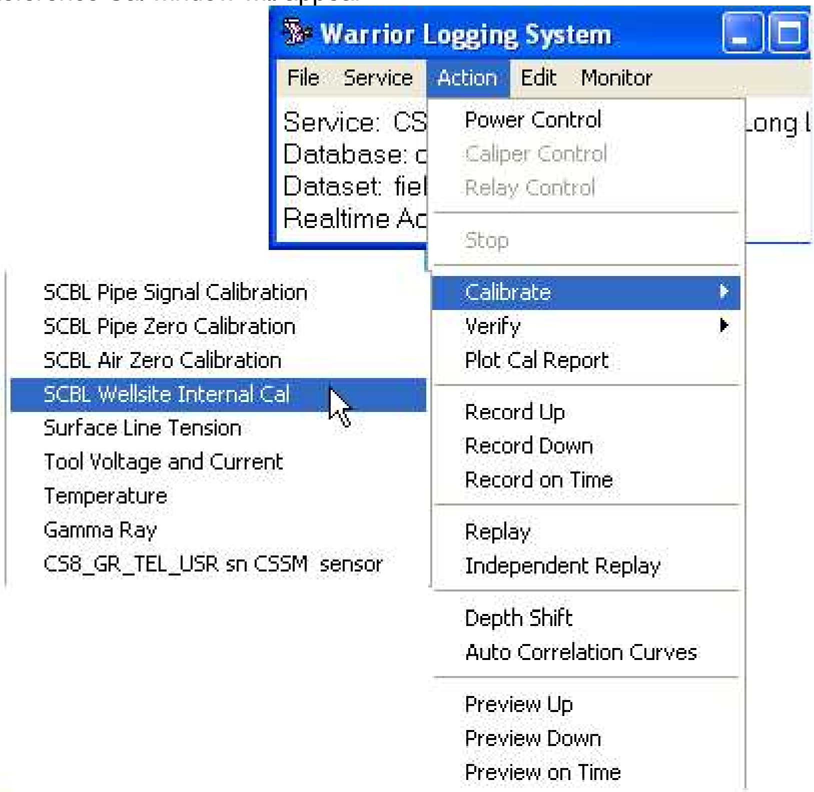


FIG: 30.28 Wellsite Internal Calibration

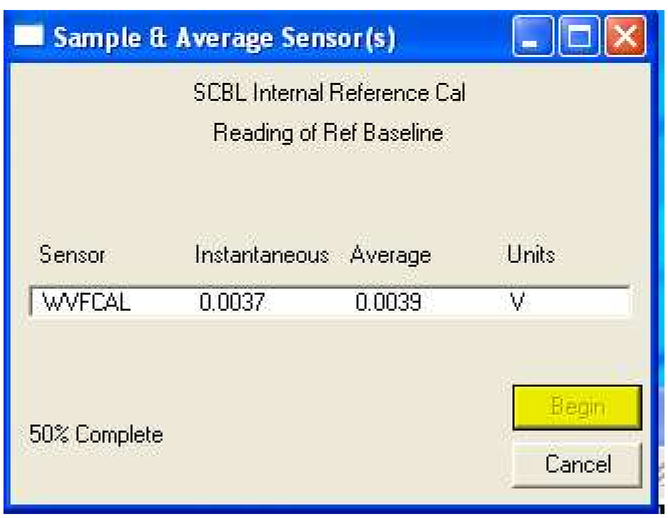


FIG: 30.29 Internal Reference Calibration

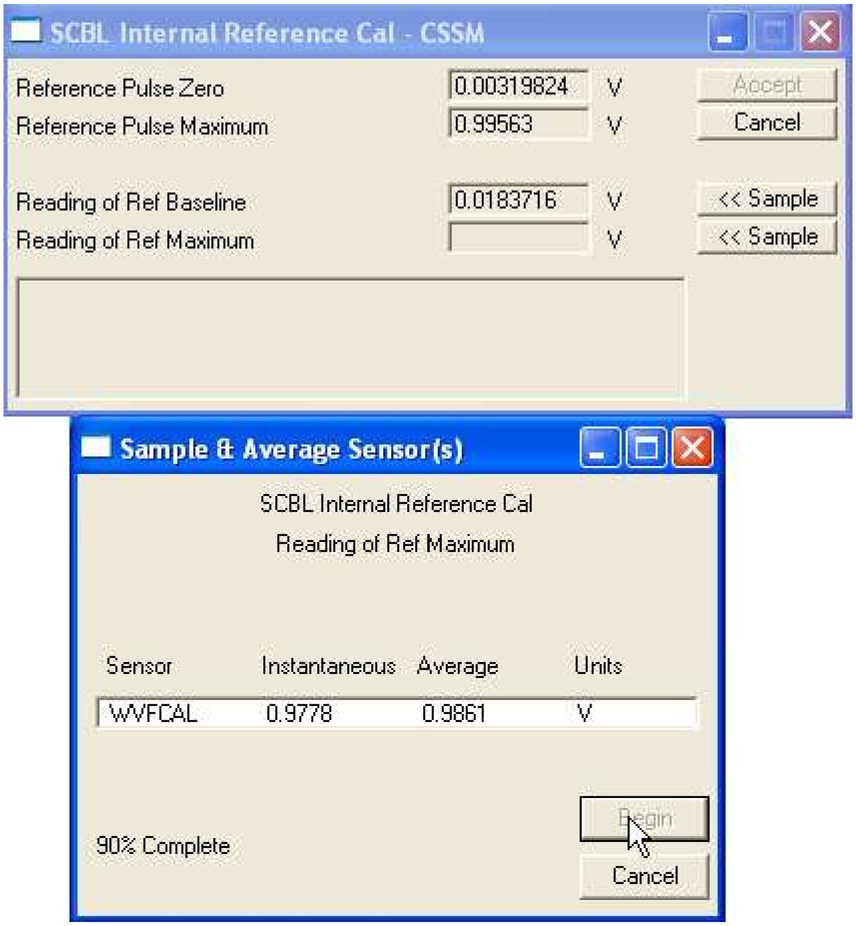


FIG: 30.30 Zero Reference

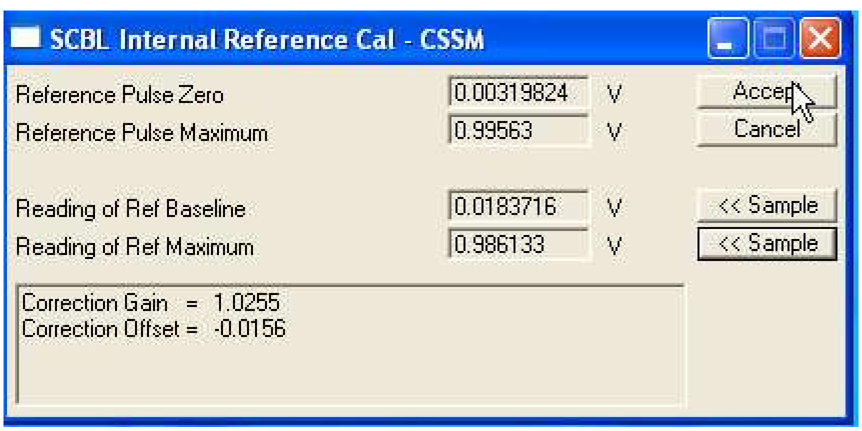


FIG: 30.31 Gain and Offset

Move the gate in the WVFCAL Signal window to the flat part of the baseline in front of the first positive arrival. Select <<Sample on the Reading of Ref Baseline. The Sample & Average Sensor(s) window will appear.

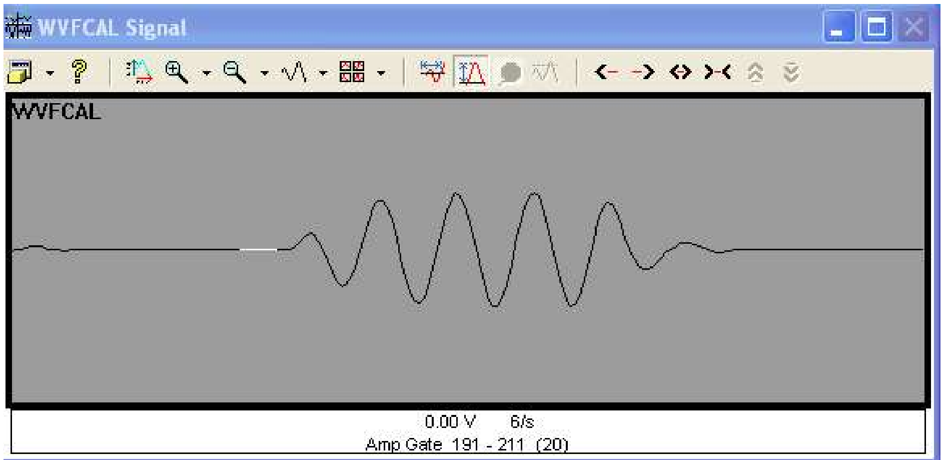

FIG: 30.32 Signal calibration reference

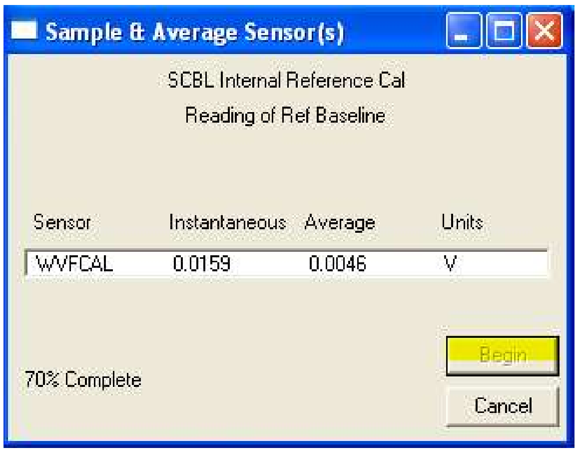

FIG: 30.33 Calibration value

Select Begin the values should be very close to zero. Select Accept.
Move the gate in the WVFCAL Signal window to gate the first positive arrival. Select <<Sample on the Reading of Ref Maximum. The Sample & Average Sensor(s) window will appear.

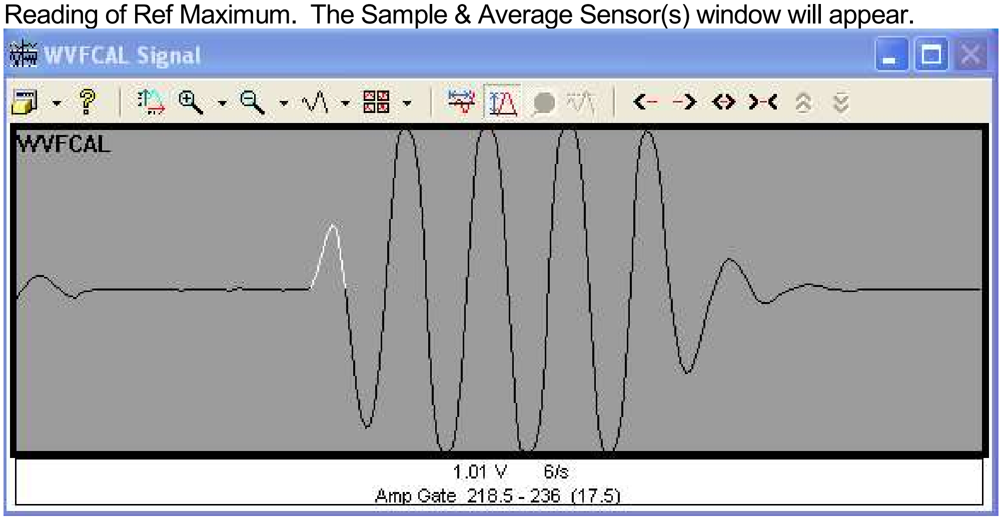

FIG: 30.34 Signal Reference Maximum value

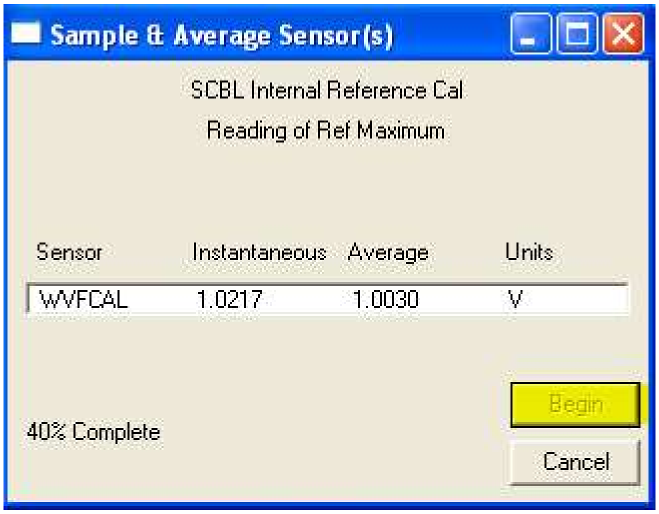


FIG: 30.35 Reference Maximum value

Select <<Begin on the Sample & Average Sensor(s). Select Accept. A gain and offset value will be shown in the SCBL Internal Reference Cal window. The gain should be very close to 1.0 and the offset value will be very close to 0. If they are not, redo your calibrations to ensure that the correct voltage is set for the WVFCAL and the gate was set in the proper position for each reading. Select Accept in the SCBL internal Reference Cal window.

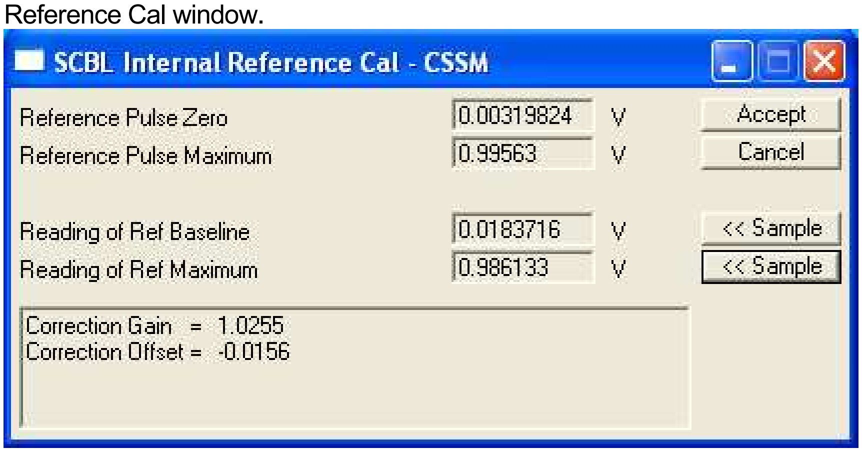


FIG: 30.36 Reference Maximum value

Go in the hole monitoring the various waveforms as shown below. Ensure that the gates are over the first positive signal and that the relative positions of the gates are correct. The gate for the 5ft receiver should be approximately 114 microseconds later in time than the 3ft. The various sector gates should be approximately 57 microseconds earlier in time than the 3ft (for a 2 foot sector spacing).

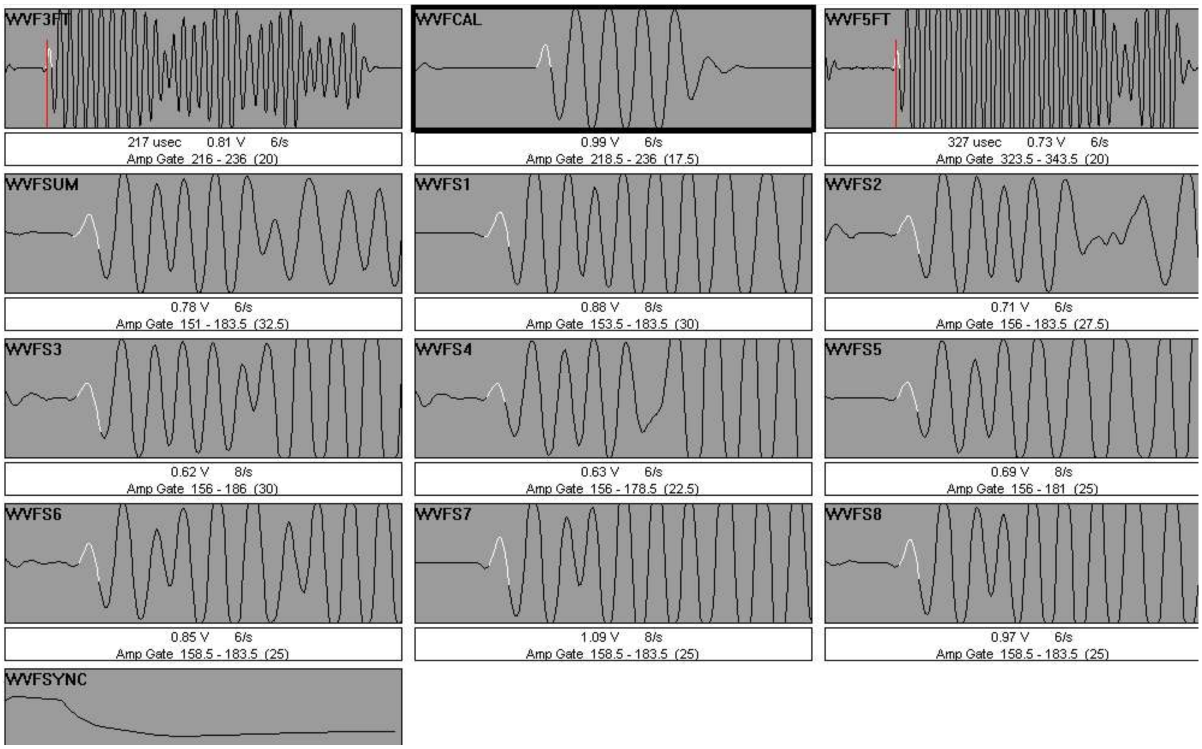

FIG: 30.37 Signals

All waveforms may be shown by selecting Options - Enable from the waveform window.
After the gates are adjusted, open the Monitor -Outputs Window and monitor the various outputs.

**Outputs**

| Name | Source | Value | Units |
|---|---|---|---|
| AMP3FT | [CS8SCBL... | 19.8975 | mV |
| TT3FT | [CS8SCBL... | 218.9651 | usec |
| AMPCAL | [CS8SCBL... | 0.2441 | mV |
| AMP5FT | [CS8SCBL... | 0.0586 | mV |
| TT5FT | [CS8SCBL... | 327.5909 | usec |
| AMPSUM | [CS8SCBL... | 0.1807 | mV |
| AMPS1 | [CS8SCBL... | 0.2902 | |
| AMPS2 | [CS8SCBL... | 0.2308 | |
| AMPS3 | [CS8SCBL... | 0.2189 | |
| AMPS4 | [CS8SCBL... | 0.2037 | |
| AMPS5 | [CS8SCBL... | 0.2240 | |
| AMPS6 | [CS8SCBL... | 0.2733 | |
| AMPS7 | [CS8SCBL... | 0.3530 | |
| AMPS8 | [CS8SCBL... | 0.3072 | |
| AMPMIN | [CS8SCBL... | 0.2037 | |
| AMPMAX | [CS8SCBL... | 0.3530 | |
| AMPAVG | [CS8SCBL... | 0.2627 | |
| ATT3 | [CS8SCBL... | -4.5204 | db/ft |
| BONDIX | [CS8SCBL... | 0.3430 | |
| LSPD | [STD] | -20.6300 | ft/min |
| LTEN | [STD] | 1.0306 | lb |
| TCURR | [STD] | 0.0644 | mA |
| TVOLT | [STD] | 0.0089 | V |
| ELTIM | [STD] | 455.8200 | sec |
| ADPTH | [STD] | 9782.0498 | ft |
| MINMK | [STD] | 0.0000 | |
| LTENRT | [STD] | 1.0306 | lb |
| DLTENRT | [STD] | 0.0009 | lb |
| LSPDRT | [STD] | -20.6300 | ft/min |
| HVOLTA | [STD] | 0.0056 | V |
| TEMP | [CS8SCBL... | 2020.0000 | degF |
| DTMP | [CS8SCBL... | 0.0000 | degF |
| CCL | [CS8_GR_... | 7739.0000 | |
| CCLRT | [CS8_GR_... | 7739.0000 | |
| GR | [CS8_GR_... | 14.0000 | |
| THV | [CS8_GR_... | 12018.0000 | V |

FIG: 30.38 Outputs

The maximum of the 3ft and sector outputs should be approximately those shown in appendix I for a given size casing. The minimum values in bonded casing should also match the indicated values. Sector values will tend to be slightly above indicated values in bonded pipe.

30.4.3 Setting Travel Time:

While monitoring the 3ft Waveform, choose Source - Threshold Setup Mode. Using the right hand scroll bar to set the Threshold Setting. The Travel Time should read within 10 microseconds of the value listed in Appendix I. This threshold should be kept as close to the baseline as possible without the threshold picking up baseline noise and triggering early.

## 30.5 Running the Log:

1 11/16" CSSM Radial Bond Tool

| | | |
|---|---|---|
| CCL Calibrations – | Gain = 0.1 | Offset = -12.8 |
| Temp Calibrations - | Gain =1.8 | Offset = 32 |

3 1/8" CSSM Radial Bond Tool

| | | |
|---|---|---|
| CCL Calibrations – | Gain = 0.0005 | Offset = -3.7 |
| Temp Calibrations - | Gain =0.02 | Offset = 0 |

An example Radial Bond presentation is shown below.

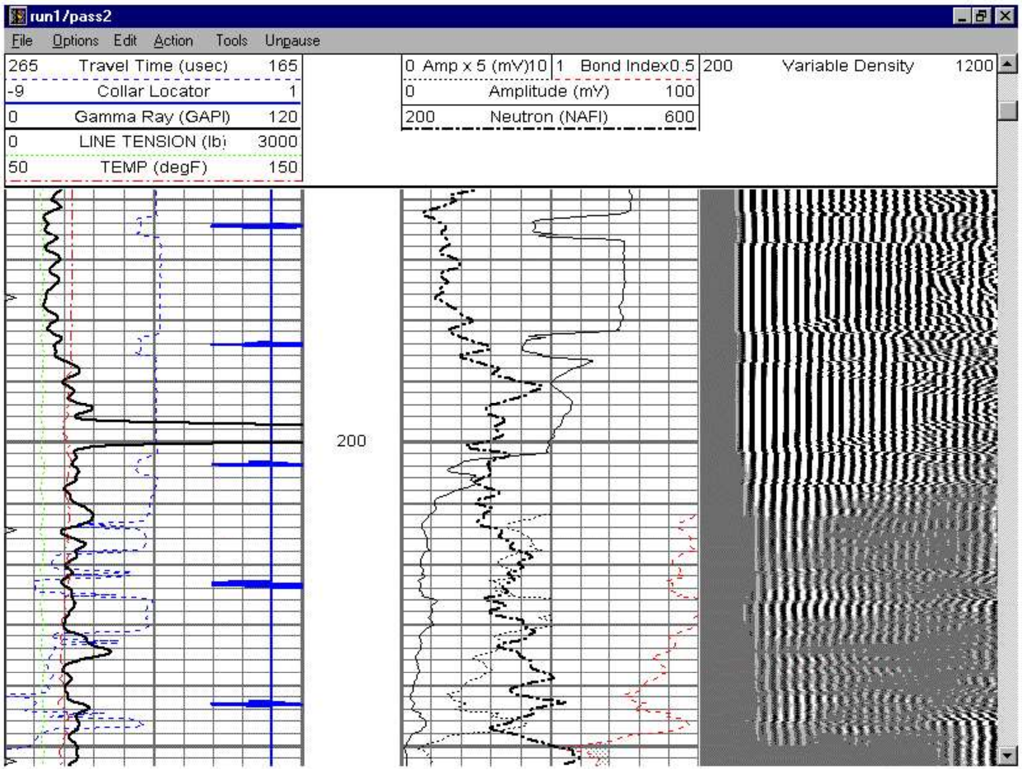


FIG: 30.39 Log

The additional Radial Bond presentation is shown below. This presentation shows the eight sector readings and the waveforms of each as a signature presentation.

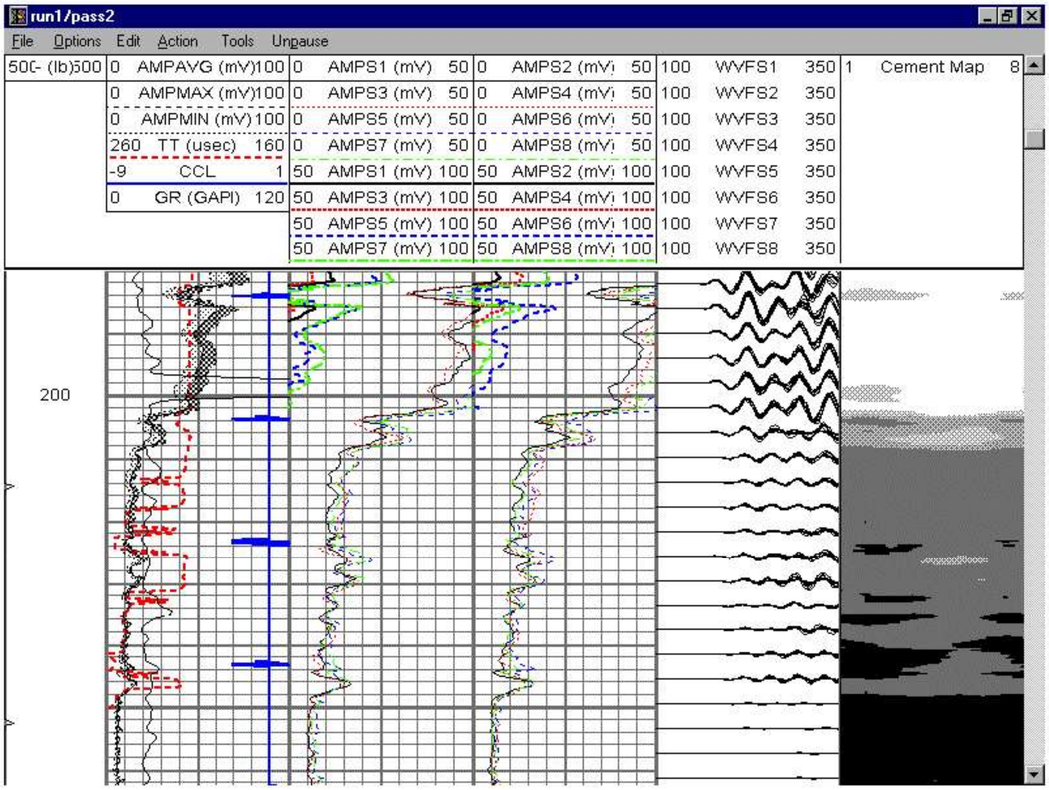


FIG: 30.40 Log Additional Radial Bond Presentation with Cement Map

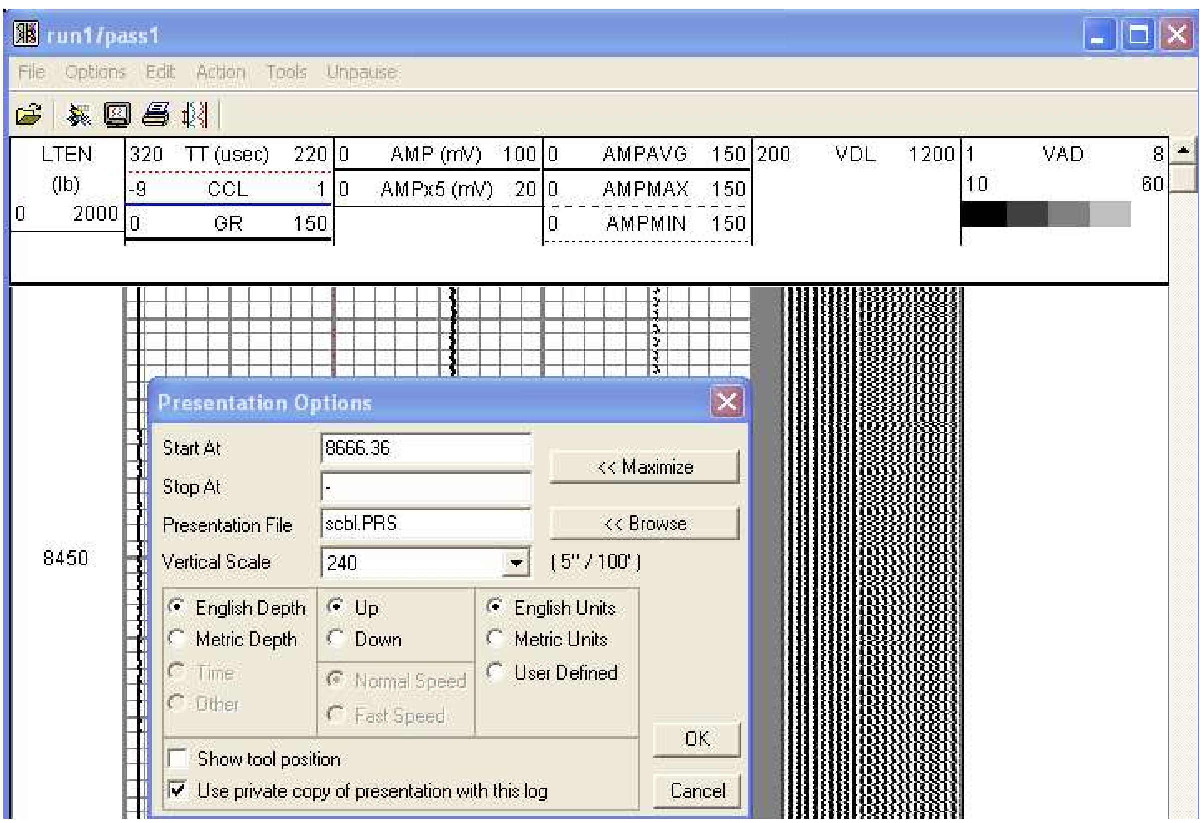


FIG: 30.41 Presentation Options

The Presentation may be changed by clicking on *Options* in the Interactive Plot Window. This brings up the window shown below. Either browse to select the presentation required, or edit the presentation name to the desired presentation.
Under Plot Job Editor, calling up Single Log pass will bring up a similar window. Editing the Format field will allow you to show the same pass, using different presentations.
**Note:** This same window allows you to show the same pass with different logging scales.
**Note:** Annotations must be made from the Interactive Replay Window for each presentation, as the annotations will not be transferred from one presentation to another.

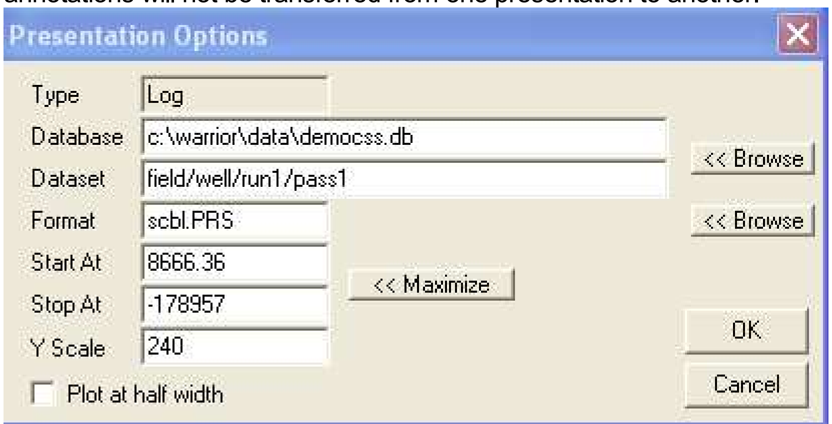


FIG: 30.42 Presentation Options Type

# APPENDIX A

| PIPE | | | 1 11/16" RCBS | | | 3 1/8" RCBL | | |
|---|---|---|---|---|---|---|---|---|
| OD | WEIGHT | ID | RADIAL | 3 FT | 5 FT | RADIAL | 3 FT | 5 FT |
| 2.875 | 6.500 | 2.441 | 128 | 204 | 318 | | | |
| | 7.900 | 2.323 | 126 | 202 | 316 | | | |
| | 8.700 | 2.259 | 125 | 201 | 315 | | | |
| | 9.500 | 2.195 | 123 | 199 | 313 | | | |
| | 10.700 | 2.091 | 121 | 197 | 311 | | | |
| | 11.000 | 2.065 | 121 | 197 | 311 | | | |
| 3.500 | 9.300 | 2.992 | 139 | 215 | 329 | | | |
| | 10.300 | 2.922 | 138 | 214 | 328 | | | |
| | 12.800 | 2.764 | 135 | 211 | 325 | | | |
| | 12.950 | 2.750 | 134 | 210 | 324 | | | |
| | 15.800 | 2.548 | 130 | 206 | 320 | | | |
| | 16.700 | 2.480 | 129 | 205 | 319 | | | |
| 4.000 | 11.850 | 3.476 | 149 | 225 | 339 | | | |
| | 14.000 | 3.340 | 146 | 222 | 336 | | | |
| 4.500 | 9.500 | 4.090 | 161 | 237 | 351 | 151 | 208 | 322 |
| | 10.500 | 4.052 | 160 | 236 | 350 | 150 | 207 | 321 |
| | 11.600 | 4.000 | 159 | 235 | 349 | 149 | 206 | 320 |
| | 13.500 | 3.920 | 157 | 233 | 347 | 148 | 205 | 319 |
| | 15.100 | 3.826 | 155 | 231 | 345 | 146 | 203 | 317 |
| 5.000 | 11.500 | 4.560 | 170 | 246 | 360 | 160 | 217 | 331 |
| | 13.000 | 4.494 | 169 | 245 | 359 | 159 | 216 | 330 |
| | 15.000 | 4.408 | 167 | 243 | 357 | 157 | 214 | 328 |
| | 18.000 | 4.276 | 164 | 240 | 354 | 155 | 212 | 326 |
| | 20.300 | 4.184 | 162 | 238 | 352 | 153 | 210 | 324 |
| | 23.200 | 4.044 | 160 | 236 | 350 | 150 | 207 | 321 |
| | 24.200 | 4.000 | 159 | 235 | 349 | 149 | 206 | 320 |
| 5.500 | 13.000 | 5.044 | 179 | 255 | 369 | 170 | 227 | 341 |
| | 14.000 | 5.012 | 179 | 255 | 369 | 169 | 226 | 340 |
| | 15.500 | 4.950 | 177 | 253 | 367 | 168 | 225 | 339 |
| | 17.000 | 4.892 | 176 | 252 | 366 | 167 | 224 | 338 |
| | 20.000 | 4.778 | 174 | 250 | 364 | 165 | 222 | 336 |
| | 23.000 | 4.670 | 172 | 248 | 362 | 163 | 220 | 334 |
| | 26.000 | 4.548 | 170 | 246 | 360 | 160 | 217 | 331 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6.000 | 15.000 | 5.524 | 189 | 265 | 379 | 179 | 236 | 350 |
| | 18.000 | 5.424 | 187 | 263 | 377 | 177 | 234 | 348 |
| | 20.000 | 5.352 | 185 | 261 | 375 | 176 | 233 | 347 |
| | 23.000 | 5.240 | 183 | 259 | 373 | 174 | 231 | 345 |
| | 26.000 | 5.132 | 181 | 257 | 371 | 172 | 229 | 343 |
| 6.625 | 17.000 | 6.135 | 201 | 277 | 391 | 191 | 248 | 362 |
| | 20.000 | 6.047 | 199 | 275 | 389 | 190 | 247 | 361 |
| | 24.000 | 5.921 | 197 | 273 | 387 | 187 | 244 | 358 |
| | 28.000 | 5.791 | 194 | 270 | 384 | 185 | 242 | 356 |
| | 32.000 | 5.675 | 192 | 268 | 382 | 182 | 239 | 353 |
| 7.000 | 17.000 | 6.538 | 209 | 285 | 399 | 199 | 256 | 370 |
| | 20.000 | 6.456 | 207 | 283 | 397 | 198 | 255 | 369 |
| | 23.000 | 6.366 | 205 | 281 | 395 | 196 | 253 | 367 |
| | 26.000 | 6.276 | 203 | 279 | 393 | 194 | 251 | 365 |
| | 29.000 | 6.184 | 202 | 278 | 392 | 192 | 249 | 363 |
| | 32.000 | 6.094 | 200 | 276 | 390 | 190 | 247 | 361 |
| | 35.000 | 6.004 | 198 | 274 | 388 | 189 | 246 | 360 |
| | 38.000 | 5.920 | 196 | 272 | 386 | 187 | 244 | 358 |
| 7.625 | 20.000 | 7.125 | | | | 211 | 268 | 382 |
| | 24.000 | 7.025 | | | | 209 | 266 | 380 |
| | 26.400 | 6.969 | | | | 208 | 265 | 379 |
| | 29.700 | 6.875 | | | | 206 | 263 | 377 |
| | 33.700 | 6.765 | | | | 204 | 261 | 375 |
| | 39.000 | 6.625 | | | | 201 | 258 | 372 |
| | 45.300 | 6.435 | | | | 197 | 254 | 368 |
| 8.625 | 24.000 | 8.097 | | | | 230 | 287 | 401 |
| | 28.000 | 8.017 | | | | 228 | 285 | 399 |
| | 32.000 | 7.921 | | | | 226 | 283 | 397 |
| | 36.000 | 7.825 | | | | 224 | 281 | 395 |
| | 40.000 | 7.725 | | | | 222 | 279 | 393 |
| | 44.000 | 7.625 | | | | 220 | 277 | 391 |
| | 49.000 | 7.511 | | | | 218 | 275 | 389 |
| 9.625 | 29.300 | 9.063 | | | | 249 | 306 | 420 |
| | 32.300 | 9.001 | | | | 247 | 304 | 418 |
| | 36.000 | 8.921 | | | | 246 | 303 | 417 |
| | 40.000 | 8.835 | | | | 244 | 301 | 415 |
| | 43.500 | 8.755 | | | | 243 | 300 | 414 |
| | 47.000 | 8.681 | | | | 241 | 298 | 412 |
| | 53.500 | 8.535 | | | | 238 | 295 | 409 |
| | 58.400 | 8.435 | | | | 236 | 293 | 407 |
| | 61.100 | 8.375 | | | | 235 | 292 | 406 |
| | 71.800 | 8.125 | | | | 230 | 287 | 401 |

# APPENDIX B

## 30.6 Map

### 30.6.1 Introduction

The heart of the Radial Bond Tool is the segmented crystal found below the transmitter. This crystal is cylindrical in shape. It is divided into 6 or 8 segments, each of which covers a section of the well bore.

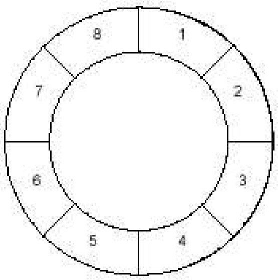


FIG: 30.39 Sector Map

### 30.6.2 The Calibration Procedure

When the Radial Bond Tool is calibrated, the sonde section is rigidly centralized in a 5-1/2” calibration chamber and the chamber is pressured up to 500 lbs of water pressure. The tool is powered up and the calibration signal is set to a reference voltage, using pots within the electronics section of the tool. Gates are then set over E1 of the 3ft, 5ft, and each of the segmented crystals. Each of these signals is then set to 1 Volt, again using pots within the electronics section.

Using the SCBL Shop/Free Pipe Calibration routine, the tool is then calibrated so that each of the signals reads 100 millivolts within the test chamber. Then, the test chamber is depressurized, and the tool is rotated 180 degrees. The test chamber is again pressurized and the calibrations are checked again to assure that the tool was properly centralized during the calibration procedure.

**NOTE:** While it is true that the expected amplitude reading for the 3ft receiver in 5-1/2” casing is 72 millivolts, that is the expected reading with pressurized water on the backside of the casing. The presence of air on the backside allows the test chamber to vibrate more freely than 5-1/2” casing. The expected readings of the 3ft in various sizes of pipe, are based upon a tool calibrated to 100 millivolts in a 5-1/2” test chamber with air on the backside.

### 30.6.3 The Radial Readings

Edit Calibrations

Edit Select

| Name | Type | Gain | Hi Read | Hi Ref | Lo Read | Lo Ref | Offset |
|---|---|---|---|---|---|---|---|
| AMP3FT | Lin2Pt | 97.649 | 1.009 | 100.000 | -0.015 | 0.000 | 3.004 |
| WS_3FT | Lin2Pt | 1.008 | 0.000 | 0.000 | 0.005 | 0.000 | -0.021 |
| AMPCAL | Lin2Pt | 66.102 | 1.503 | 100.000 | -0.009 | 0.000 | 0.625 |
| WS_CAL | Lin2Pt | 1.008 | 1.493 | 1.503 | -0.008 | -0.009 | -0.001 |
| AMP5FT | Lin2Pt | 98.521 | 1.000 | 100.000 | -0.015 | 0.000 | 1.491 |
| WS_5FT | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.006 | 0.000 | -0.009 |
| AMPSUM | Lin2Pt | 99.273 | 0.993 | 100.000 | -0.014 | 0.000 | 1.403 |
| WS_SUM | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.008 | 0.000 | -0.006 |
| AMPS1 | Lin2Pt | 97.452 | 1.011 | 100.000 | -0.015 | 0.000 | 1.482 |
| WS_S1 | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.008 | 0.000 | -0.007 |
| AMPS2 | Lin2Pt | 98.770 | 0.997 | 100.000 | -0.015 | 0.000 | 1.505 |
| WS_S2 | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.006 | 0.000 | -0.009 |
| AMPS3 | Lin2Pt | 98.485 | 1.002 | 100.000 | -0.014 | 0.000 | 1.366 |
| WS_S3 | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.008 | 0.000 | -0.006 |
| AMPS4 | Lin2Pt | 97.953 | 1.008 | 100.000 | -0.013 | 0.000 | 1.296 |
| WS_S4 | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.007 | 0.000 | -0.006 |
| AMPS5 | Lin2Pt | 97.091 | 1.016 | 100.000 | -0.014 | 0.000 | 1.337 |
| WS_S5 | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.003 | 0.000 | -0.011 |
| AMPS6 | Lin2Pt | 98.266 | 1.004 | 100.000 | -0.014 | 0.000 | 1.346 |
| WS_S6 | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.008 | 0.000 | -0.006 |
| AMPS7 | Lin2Pt | 99.237 | 0.994 | 100.000 | -0.013 | 0.000 | 1.325 |
| WS_S7 | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.008 | 0.000 | -0.006 |
| AMPS8 | Lin2Pt | 99.230 | 0.995 | 100.000 | -0.013 | 0.000 | 1.308 |
| WS_S8 | Lin2Pt | 1.008 | 0.000 | 0.000 | -0.007 | 0.000 | -0.006 |

FIG: 30.43 Radial Readings

With the Shop Calibration recorded in the Tools.ini file, all that is left for the Engineer to do at the well site, is to perform the SCBL Wellsite Internal Reference Cal and the SCBL Air Zero Cal. These calibrations generate a secondary Gain and Offset that are applied to readings from the SCBL outputs before they are plotted and recorded. These secondary calibrations are identified by WS_ and are listed directly under the curve to which they are applied.

When the SCBL Internal Reference Calibration is performed, the High and Lo Read of the AMPCAL from the Shop Calibration are used as the Hi and Lo Ref for the WS_CAL and the Calibration Signal is calibrated back to the readings taken during the Shop Calibration. The Gain derived from this calibration is then applied to ALL of the Bond curves. This calibration adjusts the Warrior Logging System for differences in line length and variations in CBL/BHC Signal gains.

When the SCBL Air Zero Cal is performed, the gates of all the bond signals are set to their approximate values for the casing size anticipated by choosing the appropriate Setup (under *Load Setu*p), while to tool is in air. This calibration generates the secondary calibration offset, which is applied to each of the Bond curves individually.

When using Shop Calibrations for logging, both of these calibrations must be done before going in the hole. If, for some reason a Wellsite Calibration is performed, there is no need to perform these two additional calibrations. Wellsite calibrations are not recommended except under unusual situations.

### 30.6.4 The Cement Map

The Cement Map is a graphical representation of the response of the sector measurements. The shading of the cement map is purely representative of the recorded amplitude readings from the various sectors. Look back to the representation of the segmented crystal shown at the beginning of this bulletin, and visualize the sectors laid out horizontally.

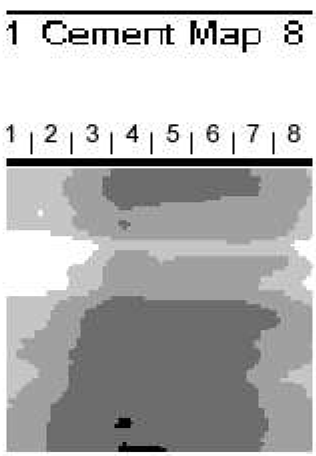


FIG: 30.44 Cement Map

Each of the individual sectors is represented by a section of the cement map, as shown below. The shade applied to each section of the map is a function of the amplitude of that sector as recorded.

The Warrior Logging System uses an algorithm to determine the shading associated with the amplitude recorded, based on several factors. These factors include:

The number of grayscales and the density of the grayscales in the Cement Map, as applied in the screen and printer setup within the Warrior.ini file.

The Filter level associated with each of the Sector Curves.

The amplitude reading of adjacent sectors.

The High Reference recorded in the Shop Calibration associated with each Sector Curve.

The Black and White values set in the presentation file.

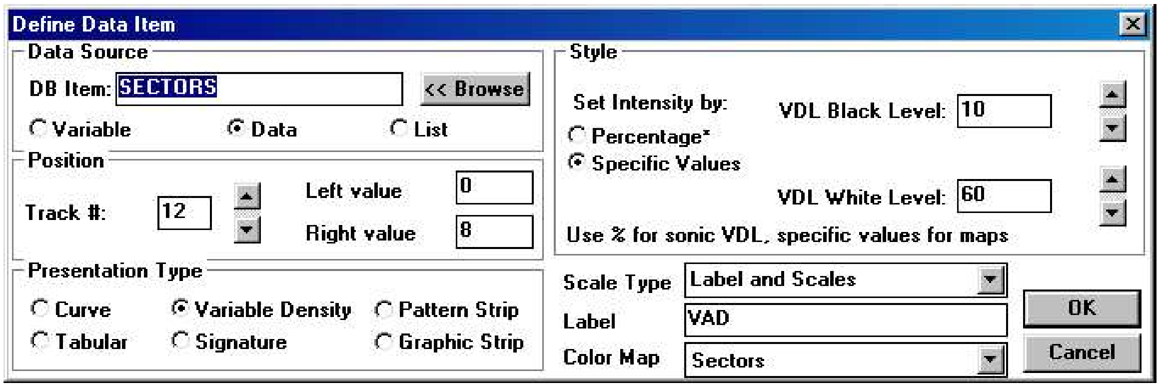

FIG: 30.45 Sectors

The only factor under control of the engineer is the Black and White values within the presentation file. The purpose of the Cement Map is to graphically illustrate small channels that may pose a problem. With that end in mind, the following is the proscribed setup for the Cement Map.
With the Black and White Levels set as above, the grays scales of the Cement Map will change as follows:

1. Amplitudes less than 10mv — Black
2. Amplitudes greater than 10.0mv and less than 26.7mv — Dark Gray
3. Amplitudes greater than 26.7mv and less than 43.3mv — Medium Gray
4. Amplitudes greater than 43.3mv and less than 60.0mv — Light Gray
5. Amplitudes greater than 60.0mv — White

If different gray scales are needed for a particular application, contact Technical Support.

### 30.6.5 Logging Conditions

The Cement Map is a visual representation of the cement conditions behind the pipe. The Sector Crystal is not free to rotate within the tool, and the cement and casing are not free to rotate. However, the tool itself is free to rotate with the well, and it is expected that it will. For this reason, apparent “channels” may rotate within the cement map while running repeats, and that the Cement Map may not repeat exactly.
The Cement Map also becomes an important aid to quickly identify problems in tool setup or logging procedures.