Hot Shot

DWS

INTERNATIONAL INC.

HOT SHOT

Operations Manual

Designed & manufactured by **Real Time Systems**

HSCTL-2 Version 103

Last revised: December 1, 2007

RTS Real Time Systems

RTS Real Time Systems

Our Thanks

I would like to personally thank you for choosing our HotShot Seismic Source Synchronizer for your gun controlling. We endeavored to make the HotShot a highly flexible, full-featured source controller that meets the demands of small airgun arrays.

Our Guarantee

We stand by our products 100% and engineer our controller packages to address your exploration needs. The following pages give you the information needed to know how to operate Real Time Systems' HotShot Controller. Should you experience any problems or have any questions feel free to contact us by phone 830-990-2340 (US), fax 830-990-2300, or email: support@real-time-sys.com.

Thank You.

Allen Nance,
President, Real Time Systems

Real Time Systems, Inc. contact information:

Real Time Systems
103 Industrial Loop
Fredericksburg, Texas 78624
USA

tel: 830-990-2340 US
fax: 830-990-2300 US
email: support@real-time-sys.com

Contents

1 **HotShot System Components** p4
Reviewing your HotShot Controller and what it does.

2 **Getting Started** p5
Basic configuration of HotShot System

3 **Knowing Your HotShot** p8
Controller
Front Panel Controls

4 **Pin Out Description** p9

5 **System Set-Up** p10

6 **Q/C Video Display** p12

7 **Parameter Menus** p14

8 **System Timing** p25

9 **Sensor Timing Picking and Auto Tune Algorithm** p26

10 **Shot Log** p28

11 **Statistical Information** p30

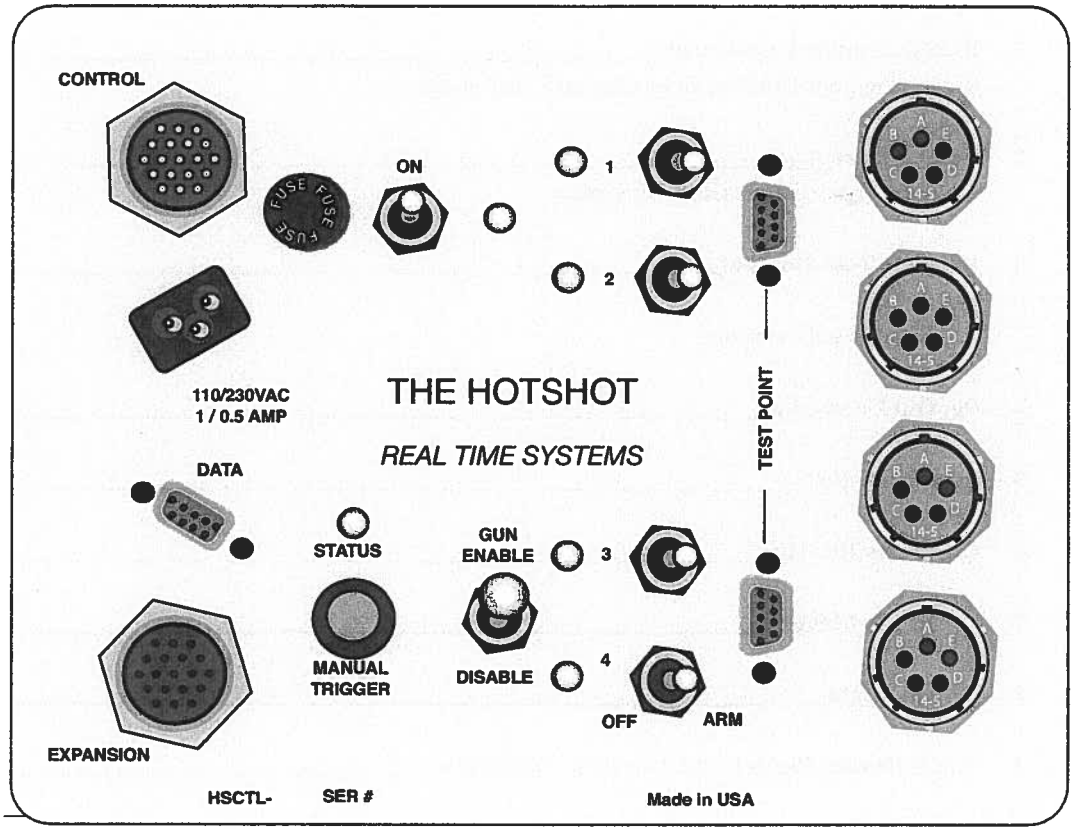
12 **Navigation Computer Notes** p32

13 **Jumper Configuration for GI Gun Usage** p33

"Real Time Systems products are solidly built and ready for the rigors of marine seismic duty."

— Allen Nance, President

1 HotShot System Components



The HotShot is a modular system of components that can be adapted to the needs of any 1 to 16 gun array.

HotShot Control Unit

This unit is a self contained 4 channel air-gun synchronizer for up to 4 guns. Up to 4 units can be daisy chained together to form a 16 gun system. Each unit contains the gun synchronization and solenoid firing electronics necessary to fire and synchronize seismic airguns. One hydrophone channel, one manifold pressure and one depth channel are standard.

External Computer / Master Controller

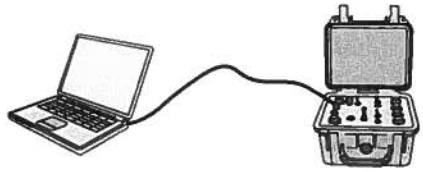
The first HotShot Controller is called the master and is connected to an external computer via a serial cable. The external computer can be a laptop or desktop running Windows 98, 2000 or XP.

Optional System

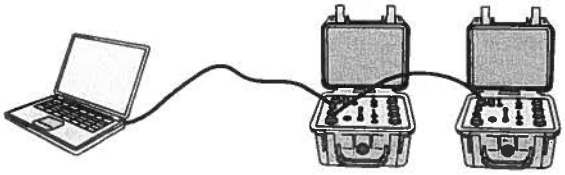
- Radio Modem

2 Getting Started: Basic Configuration & Operation

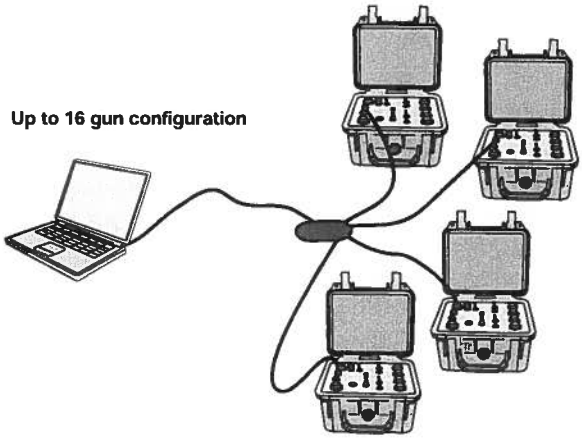
4 gun configuration



8 gun configuration



Up to 16 gun configuration



Triggering

The system can be triggered as follows:

1. External TTL trigger.
2. External Contact Closure trigger.
3. Internal Cycle
4. Manual Trigger button
5. External computer trigger via "Alt-F" keys

The HotShot Major Features

- 1 to 16 AirGun or 1-8 G.I. gun automated control and Q/C
- 0.1 msec timing resolution .
- Each HotShot has 2 channels of 16 bit hydrophone signature acquisition.
- Manifold pressure and gun depth monitoring and Q/C.
- Graphical display of hydrophone and Sensor signatures.

Gun Firing Lines (output)
Each gun channel has a high voltage firing line which is programmable from 75 to 150 VDC. The pulse width and high voltage firing line are programmable from the TIMING menu. The output time for each gun firing line can be automatically adjusted by the HotShot or fired at a static time. This is determined by the firing mode found in the GUN menu. The fire time is determined by the "gun delay" on the GUN menu. This value is always positive and determines how many msecs before the aim-point that the high voltage pulse is sent to the gun. The aim-point is the time at which the guns are aligned. The aim-point is fixed at 100msecs.

Gun Sensor Lines (input)
Each gun produces a sensor output. The HotShot can be configured for all types of gun sensors; BOLT sensor, Sleeve shuttle, hydrophone, etc. The sensor signal is digitized starting at 55 msecs after trigger. The sample rate is 10 khertz or 100 usec intervals. The signal gain can be adjusted on the GUN menu to compensate for varying sensor amplitudes. The signal is stored for 200 msecs. After the shot is finished the software picks the firing time of the gun to determine if the gun fired on time. If the gun firing time is outside the tolerance specified in the Q/C menu a DELTA error is declared. If no sensor is detected, a NO FIRE is declared. Guns that are automatically tuned, will have their Gun Delay adjusted for the next shot.

The sensor lines are summed together to form a Summed Sensor signal. This signal can be selected as the Field Time Break (FTB). The FTB is output as an analog signal on the FTB line.
The sensor lines are also continuously monitored for auto-fire conditions. This occurs when a gun fires without being told by the system. An auto-fire is flagged by the system and recorded as an error.

Hydrophone (input)
The system can have one hydrophone. The hydrophone is digitized at 16 bit resolution at 1 msec intervals for up to 1000 msecs. The hydrophone can be selected to be the source of the FTB signal. This is done in the hydrophone menu. The hydrophone gain and inversion status can also be adjusted. This input is on the control connector.

Pressure (input)
There is one manifold input. Calibration for this is done on the TRANSDUCER menu. The pressure transducer is a 4-20ma transducer and produces an A/D value which must be scaled to display in units of PSI. This is performed using the zero and scale correction factors. The pressure is displayed on the status display. A chart is produced which shows the pressure at trigger time for the last 25 shots. This input is on the control connector.

Depth (input)
There is 1 gun depth transducer input. This is done on the TRANSDUCER menu. The depth transducer is a frequency encoded transducer and produces a count value which must be scaled to display in units of feet or meters. This is performed using the zero and scale correction factors. The depth is displayed on the status display. A chart is produced which shows the depth at trigger time for the last 25 shots. This input is on the control connector.

Clock Time Break CTB (output)
TTL pulse that is 5 msecs wide. The leading edge represents the aim-point or time when the guns should fire. This input is on the control connector.

Field Time Break FTB (output)
An analog signal that can be selected to be either the "Summed Sensor" or "Hydrophone" signal. This is set in the hydrophone menu. This input is on the control connector.

Closure (output)
This is a 200 msec closure signal that can be used to trigger a fix on a navigation system or can be used to start a recording system. It occurs at a time specified on the TIMING menu and can be output from 55 to 10,000 msecs after trigger time. This input is on the control connector.

Closure Trigger (input)
A closure across these two pins will start a firing cycle. This input is on the control connector.

TTL Trigger (input)
A TTL high going signal on these two pins will start a firing cycle. This input is on the control connector.

Serial (output)
The control connector has a serial ouput that contains an ASCII header string. This string use contains gun timing data for recording on a recording system external header. It is GCS90 format.

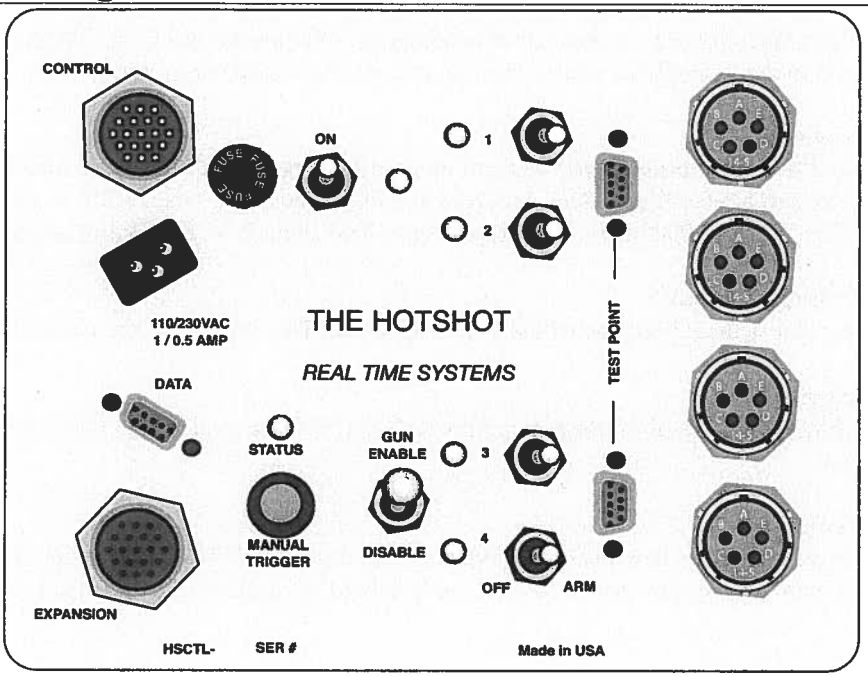
User Interface Serial port (input/output)
Serial port interface for user PC. Can use Windows based HotShot control software.

Power (110-240 VAC input)
The HotShot is normally powered by 110-240VAC.

Expansion
Up to four(4) units can be combined together to expand to 8,12 or 16 guns. The Hotshot control software supports these additional guns.

M1 - Master
S1 - 1st Slave
S2 - 2nd Slave
S3 - 3rd Slave

3 Knowing Your HotShot



Front Panel Controls

Power On/Off
When the On/Off switch is up, the LED lamp will light.

Gun Enable
In the enable position, internal, external or radio triggers firing cycles are enabled. The dissable position will disable all triggers and High Voltage to the guns is disabled.

Manual Trigger
This button fires the enabled guns in the following modes.
1. After Power On when the PC serial interface is disconnected.
2. When in External Trigger Mode

Note: the enable switch must be active in order for this button to be used.

Status LED
This is a GREEN LED that is blinking when the HotShot is enabled to Fire Guns. Therefore it is a warning that **Guns Can Be Fired** when it is blinking. It turns on for 2 seconds when the unit is triggered. When OFF the guns are disabled.

Individual Gun Enable Switches
These 4 switches disable an individual gun from Firing.

Gun Status LED
These four Red LEDS are on when a gun channel is ready to fire. They blink off when the firing voltage is below 95% of the selected firing voltage.

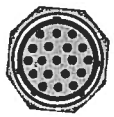
4 HotShot PinOut Descriptions

CONTROL

A - Closure Trigger In +
B - Closure Trigger In -
C - FTB Out +
D - GND (FTB)
E - GND (CTB)
F - HydroPhone 1 In + (optional)
G - Gun Depth In + (optional)
H - Gun Depth In - (optional)
J - Manifold Pressure In + (optional)
K - RS232 Control TX (Header)
L - TTL Trigger In -
M - TTL Trigger In +
N - Closure Out +
P - Closure Out -
R - CTB
S - HydroPhone 1 In -
T - Manifold Pressure In - (optional)
U - RS232 Control RX (Header)
V - GND

Note: Items noted as optional are available by adding an optional transducer I/O card.

EXPANSION



A - Slave Select 1
B - Slave Select 2
C - RS485 A
D - RS485 B
M - GND
P - Sum Sensor
R - GND RS485
S - HydroPhone
V - Undefined

GUN

A - Solenoid Power Out +
B - Solenoid Power Out -
C - Sensor In +
D - Sensor In -

5 System Set-up

Check-out Procedure

1. Apply power to HotShot. Turn on unit via front panel switch. The Orange LED comes on and the Green LED should blink, if GUN ENABLE switch is in ENABLE position.

2. Turn ON/OFF each GUN switch. The RED LED next to the switch should turn OFF when in the OFF position and back ON when in the ON position.

3. With no other cable connected, put GUN ENABLE switch in DISABLE position, green LED should stop blinking and all RED gun LEDs should turn OFF. Put back in ENABLE position, green LED should start blinking and all RED gun LEDs should turn ON.

4. Push MANUAL TRIGGER button, green LED should stay on for 2 seconds and then returns to blinking.

5. Connect PC interface cable provided from HotShot to the serial port COM1 on the PC. Install the HotShot software from the supplied disk and start the HotShot application. When the HotShot is connected to the PC and the software is running, there is a time field in the status bar at the bottom of the screen. It should be updating with the current time. This is your indication that the HotShot is connected to the PC properly.

6. Go to the MODE menu and change the "System Mode" to TEST and the "Trigger Mode" to CYC. Press OK and look for the HotShot to start firing at 10 second intervals. You can change this interval on the MODE menu. The displayed waveforms should be flat and a NO FIRE status displayed for each gun.

7. In the GUN menu, change the MODE to AUTO for all guns, change the DELAY time to 1 msec for all guns and the GAIN to 6 for all guns. Press OK and wait for a cycle. In the next one or two cycles a waveform should display for each gun.

8. Now you are ready to try firing real guns. ***NOTE: DO NOT test fire real guns until you are sure that the guns are in the water or have no pressure on them.*** Connect a gun by connecting its' gun cable to the SOLENOID and SENSOR connectors. Cycle the Hotshot by Manual Trigger or by PC control. When the gun fires you will see the RED LED go out momentarily. This means that the internal gun capacitor has discharged. It will come back on within a few seconds. Do this to each gun with pressure OFF and guns on deck to see that the solenoid is connected.

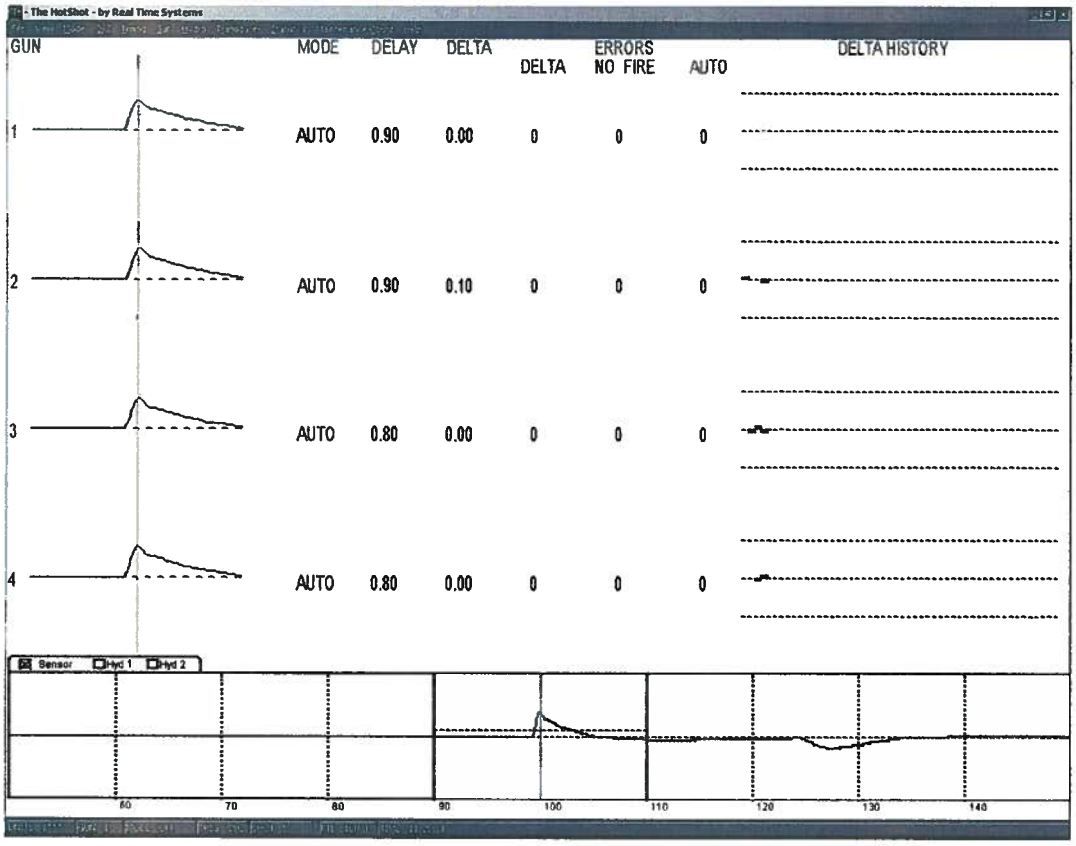
9. Now put the guns in the water and apply pressure. Edit the fields in the GUN menu and change the DELAY for each gun to 10 msecs. This is a good starting position for most guns. You may have to change the GAIN or INVERT fields but wait to do this to see what the sensor returns look like. IMPORTANT: Now go to the mode menu and change the Firing Mode to WARM.

10. Cycle the HotShot once and observe the sensor returns. The left side of the screen shows only +/- 5 msecs of sensor return. If the gun delay is very far off from the initial value of 10 msecs you may need to change the gun delay to get it closer for the sensor to fall inside the window. The lower graph shows an expanded view of one gun sensor. Select the gun you want to see by single clicking its graph. This is the monitor gun. Its graph will update on the next shot.

11. Play with the DELAY, GAIN and INVERT to get an idea how these settings affect the sensor signal.

12. In the Timing menu, select the type of gun you are using: "Sleeve" for both sleeve or G guns, "Bolt" for Bolt guns only, and "G.I." for G.I. guns only. Set Sensor Detect Method to PEAK for Bolt, LEVEL for G or G.I. guns, and ZERO CROSS for Sleeve guns.

6 Q/C Video Display



The video display has six parts:

Border status
The border status includes HotShot units on-line, Selected Gun, Firing Mode, Trigger Mode, Shot Number, Depth, Pressure, Field Time Break, and Time.

Sensor signature graphics
The middle left hand side of the screen contains a column of sensor signatures. The magenta line running down the middle of these traces is the aim point. The user can change several parameters on the selected gun directly from the main graphics screen by double clicking on sensor graph. If a gun experiences a NoFire this is indicated in the DELTA column. If an auto-fire occurs an "A" appears beside the gun sensor trace.

Gun Delta History Bar Graph
In the middle right of the screen a bar graph of delta history for each gun is displayed. Each bar represents one shot and the shot on the left is the most current. An up going bar indicates a delta to the positive side of the aim-point and down going to the negative side. The dotted line above

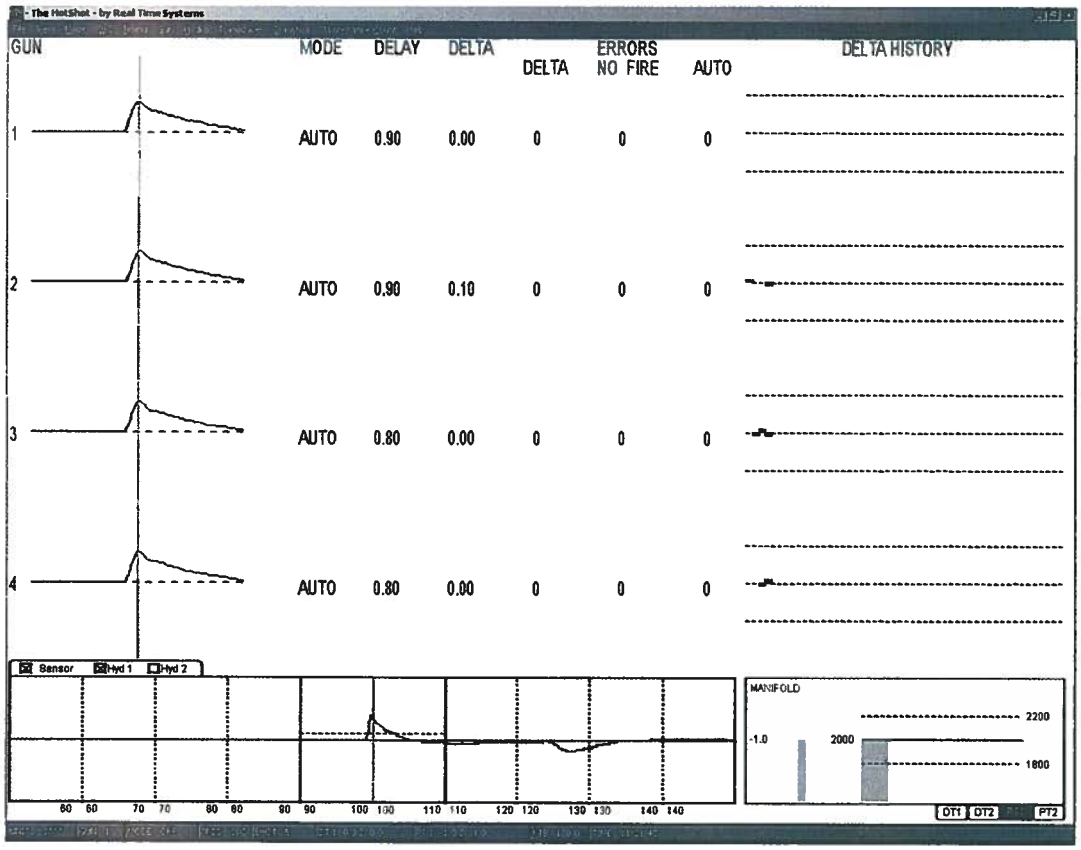
and below the bar graph represents the Q/C limits for the survey. This value is entered on the Q/C menu. If a guns' delta falls outside the Q/C limits the bar turns red and "Delta" error increments.

Gun Statistics
In the middle section of the screen the operating mode and line statistics for each are listed.

Expanded Sensor Monitor Graph
The bottom section of the screen shows an expanded (100 msecs) of sensor data for one channel. The gun to be displayed is selected by single clicking on the desired gun graph.

Hydrophone Sensor Graph
Upon receipt of a hydrophone signal, if a hydrophone has been enabled (under the Hydro menu), the signal is plotted on the 'Expanded Sensor Monitor Graph' mentioned above.

Depth & Pressure Graphs
If depth and/or pressure are enabled in the Transducer menu, the bottom right section of the screen shows the current values of depth and/or pressure as well as the values at shot time for the last 25 shots.



7 Parameter Menus

File Menu

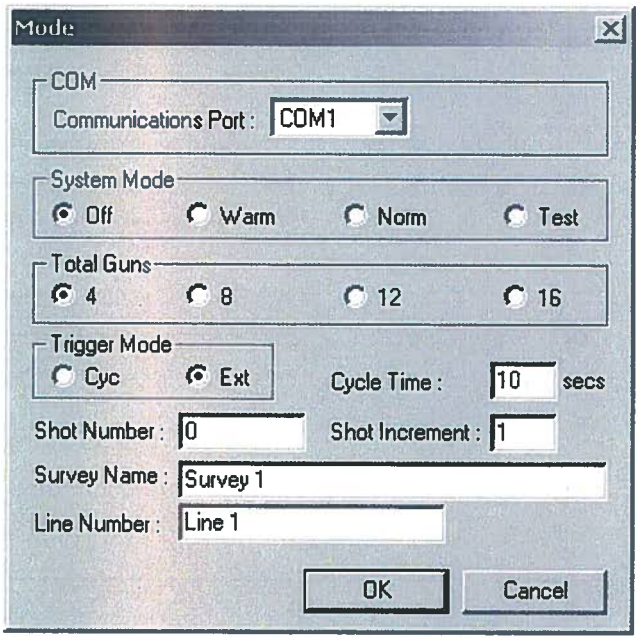
Provides access to log files and statistics (which are explained in sections 10 & 11 of this manual.)

View Menu

Provides enable/disable of:
Status bar display
FTB Error Alerts
No-Fire Error Alerts
Auto-Fire Error Alerts
Delta Error Alerts
Bubble Error Alerts (G.I. guns only)

Mode Menu (F1)

When you press F1 or click on Mode this pop-up menu will appear. Please see brief explanation of settings below. When finished with Mode Menu click "OK" or press "Enter" on the keyboard to return to the main menu.



Communications Port

1. COM1 - COM10

System Mode - Firing mode selection

1. STOP - Firing disabled
2. WARM - Fire guns in warm up mode (a fast tuning algorithm is selected and shot statistics are not recorded).

3. NORM - Fire guns in normal mode (a slow tuning algorithm is selected and shot statistics are recorded).
4. TEST - Simulate firing guns in test mode (a fast tuning algorithm is selected and shot statistics are not recorded and the Solenoid Power Supply used a loop back mode from the gun fire pulse to generate the sensor signal). Guns are not actually fired in this mode.

Total Guns
Select number of total guns 4, 8, 12, or 16 depending on how many HotShot units are used.

Trigger Mode
1. EXT - External trigger start
2. CYC - Internal cycle mode, use Cycle Time for cycle interval time.

Shot Number
Shot point number (numeric) which is incremented by the Shot Interval. Used to identify shots on the line.

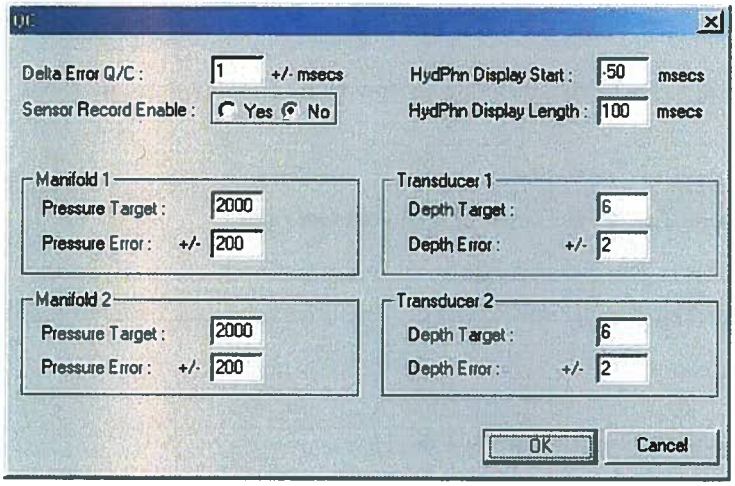
Shot Interval
Increment value for the shot point. (Typically set at 1 or -1).

Survey Name
Used to create a survey directory to store line statistics. The directory is in the directory after the HOTSHOT.EXE is stored.

Line Number
The line name is entered at the beginning of the job. The shot statistics are recorded in a file that is named with this entry. The file extension is .dat.

Q/C Dialog (F2)

When you press F2 or click on "QC" this pop-up menu will appear. Please see brief explanation of settings below. When finished with Q/C Dialog click "OK" or press "Enter" on the keyboard to return to the main menu.



NOTE: Manifold #2 and Transducer #2 are only available on the HSCTL-3 version of the HotShot.

Sensor Record Enable
Used to enable recording of sensor waveforms.

Hydrophone Display Length
Display length in msecs for the hydrophone sensor display.

Delta Error Q/C
Q/C tolerance limits for delta errors. A gun with a delta outside this tolerance is flagged as having a DELTA error. (Typically set at 1.0 msecs)

Hydrophone Display Start
Determines at what point of the hydrophone signal to start the graph on the screen.

Pressure Target
Desired Manifold Pressure at time of shot.

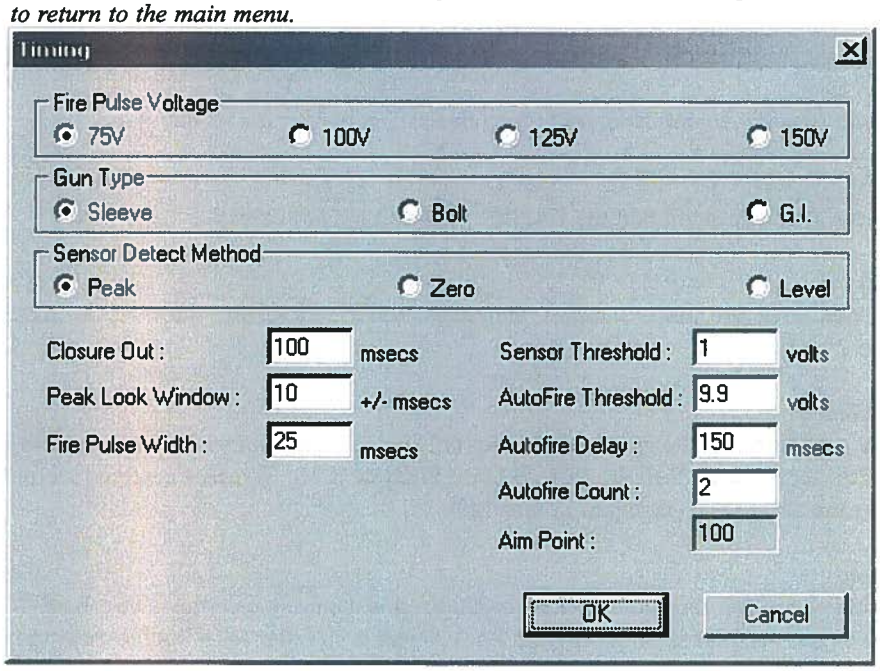
Pressure Error
Allowable pressure range around **Pressure Target.**

Depth Target
Desired Gun Depth at time of shot.

Depth Error
Allowable gun depth range around **Depth Target.**

Timing Parameter Dialog (F3)

When you press F3 or click "Timing" this pop-up menu will appear. Please see brief explanation of settings below. When finished with Timing Parameters click "OK" or press "Enter" on the keyboard to return to the main menu.



Fire Pulse Voltage

Select 75V, 100V, 125V or 150V as the solenoid firing voltage. Typically the lowest voltage is sufficient on short (less than 50 meters of cable). 150V is used for very long cables (500 meters or more). Too low of voltage will result in erratic gun firing.

Gun Type - Select SLEEVE, BOLT or G.I.

SLEEVE: One gun per channel and no sensor power. (Use for G guns also)
BOLT: One gun per channel and sensor power applied.
G.I.: One gun per two channels and no sensor power. Gun 1(odd # gun) is for the generator solenoid and Gun2(even # gun) is for the injector solenoid.

Closure Out

Start time after trigger at which the 200 msec Closure Out signal is activated. The minimum value is 55 msec. The maximum value is 10,000 msecs (10 seconds).

Peak Look Window

The window around the aim-point to look for sensor return signatures. (see sensor time picking section for full description of how this entry should be used).

Peak Detection Method

One of three methods can be selected (see sensor time picking section for full description): PEAK, ZERO or LEVEL.

Fire Pulse Width
Solenoid fire pulse width (G or GI gun = 60 msecs; BOLT = 25 msecs; Sleeve = 25 msecs)

Sensor Threshold
Voltage threshold that the sensor signal must cross before sensor signal is detected.

AutoFire Threshold
Voltage threshold sensor signal must cross before an autofire is detected on any gun.

AutoFire Delay
Number of msecs after aim-point that the HotShot will wait to start detecting Auto-Fires.

AutoFire Count
Number of consecutive 0.1 msec samples that must occur before an Auto-Fire is declared. Typically set to 2 or 3.

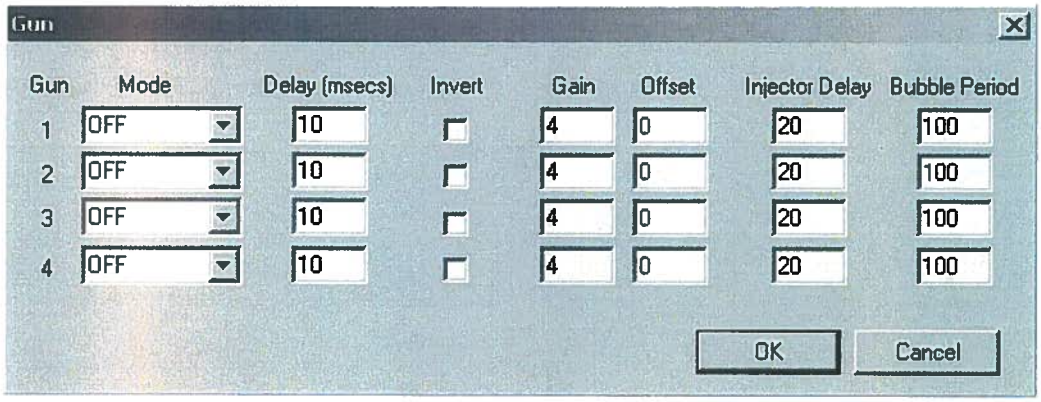
Bubble Look Window
This entry only appears when the gun type is set to G.I. It defines a window size in which to look for a bubble. If this entry is 10, then the Bubble Look Window is +/- 10 msecs centered around the Bubble Period time defined for each gun in menu F4.

Bubble Threshold
This entry is similar to Peak threshold defined earlier in this menu. It specifies a threshold over which the signal must cross in the Bubble Look Window in order for a bubble error to be declared. As with Bubble Look Window, this only appears when gun type is set to G.I.

Aim Point
The time in msecs after trigger where the guns are aligned. This value is fixed at 100 msecs until futher notice.

Gun Parameters Menu (F4)

When you press F4 or click "Gun" this pop-up menu will appear. Please see brief explanation of settings below. When finished with Gun Parameters click "OK" or press "Enter" on the keyboard to return to the main menu.



Mode - Select Gun mode from the following:

- OFF - gun will not fire or have autofire detection.
- SPARE - Gun will not fire but will have autofire detection.
- MANUAL - Gun will fire at static Gun Delay time.
- AUTO - Gun will fire and be automatically tuned to aiming point.

Delay

The time before the aim-point at which the solenoid fire pulse is activated for this gun.

Gain

Linear gain applied to sensor signal prior to digitizing.

Invert

Sensor signal inversion for reversed sensor inputs. Note: BOLT gun sensors are powered and polarity sensitive, so software inversion is not useful.

Offset

Fixed number of msecs offset from Aim-Point that is applied to this gun. Typically set to zero.

Injector Delay

This entry will only appear if the gun type (in the Timing menu) is set to G.I.

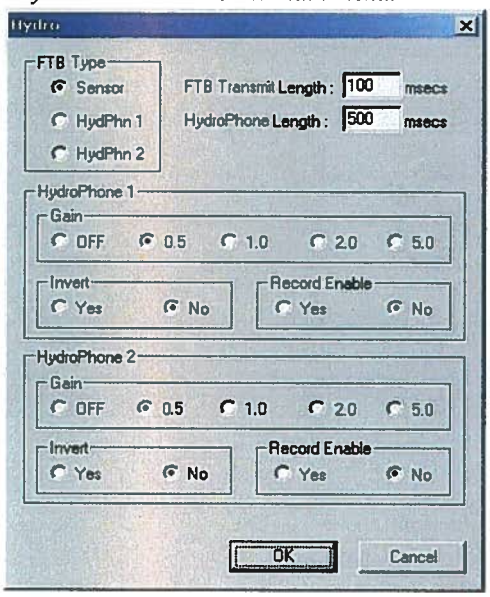
This is the injector delay time. It is the time in msecs after the generator solenoid start, at which the injector solenoid is turned on. It will have a different value for each size gun.

Bubble Period

This entry will only appear if the gun type (in the Timing menu) is set to G.I. This is the Bubble Period that was mentioned in menu F3. It defines the center point of the Bubble Look Window for this gun. It is different for each size gun. As with Injector Delay, this entry only appears if the gun type is set to G.I. It is the time after the aim-point where the Bubble window is central for this gun.

Hydrophone Parameter Menu (F5)

When you press F5 or click "Hydro" this pop-up menu will appear. Please see brief explanation of settings below. When finished with HydroPhone Parameters click "OK" or press "Enter" on the keyboard to return to the main menu.



Note: Hydrophone #2 is only available on the HSCTL-3 version of the HotShot.

FTB Type
The source of the field time break is selected to be either the hydrophone or the analog sum of the gun sensor signals.

FTB Xmit Length
This is the length of time that the FTB output signal is valid (If a value of 200 is entered from 50 msecs before the aim-point to 150 msecs after).

Hydrophone Length
Number of msecs of hydrophone signature to digitize. (up to 1000 msecs) This value must be non-zero (1 - 1000) to enable a hydrophone. A value of zero, in effect, turns off the hydrophone functionality. It starts 50 msecs before the aim-point.

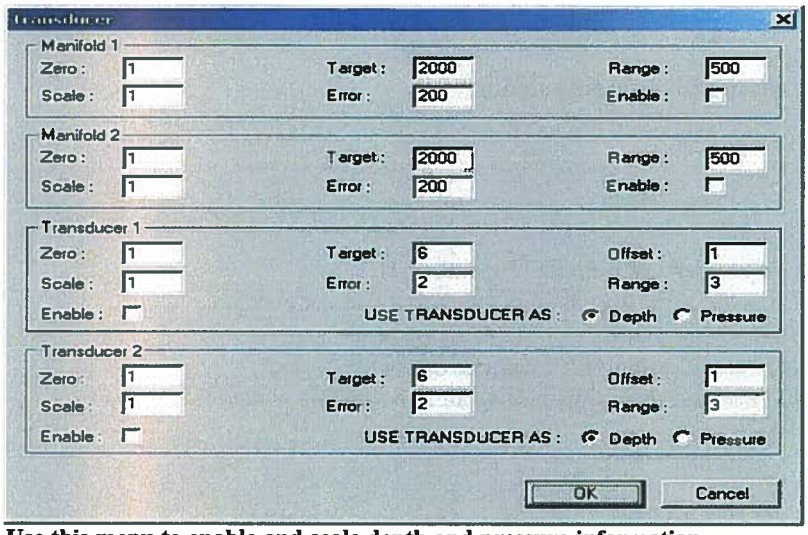
Hydrophone Invert
Selects hardware inversion of Hydrophone signal. Note: hydrophone must be positive going in order for FTB detect to be active.

Hydrophone Gain
The linear scale factor applied to the hydrophone before digitization.
times 0.5; times 1.0; times 2.0; times 5.0

Record Enable
Causes the hydrophone to be recorded on harddisk as a SEGY file.

Depth/Pressure Configuration Menu (F6)

When you press F6 or click "Depth" this pop-up menu will appear. Please see brief explanation of settings below. When finished with Depth/Pressure click "OK" or press "Enter" on the keyboard to return to the main menu.



NOTE: Manifold #2 and Transducer #2 are only available on the HSCTL-3 version of the HotShot.

Use this menu to enable and scale depth and pressure information.

NOTE: Depth channel #2 is unavailable except by special modification.

The depth transducer is powered by 24 volts and produces a signal that represents a frequency. This frequency changes depending on the depth. At zero depth the transducer manufactured by AG Geophysical or I/O outputs a frequency of approximately 2000 Hz. The Syntron transducer has a zero depth frequency of about 5000 Hz. Each 1 Hz change indicates a change of 0.01 meters.

The manifold pressure transducer is a 4-20 ma current mode transducer. There are many off the shelf transducers which will properly interface to this input channel. At 0 PSI the transducer should produce a 4 ma signal and at maximum scale it will produce 20 ma. This 4-20 ma reading is converted into a voltage which is in binary. This binary number must then be scaled to PSI units.

Transducer Chan Enable
Enables the depth transducer and associated Q/C

Transducer Zero
Enter Zero Frequency (about 2000 or 5000) or measure with transducer on board.

Transducer Offset
A static value that is added to the depth. Typically a depth transducer is mounted above the gun and a static offset must be added to compensate for this.

Transducer Scale
Typically set to .01 to display in meters (but can be changed). Set to 1.00 for pressure.

Transducer Target
Same as on Q/C dialog.

Transducer Error
Same as on Q/C dialog.

Transducer Range
Maximum display range for depth graphing.

Manifold Chan Enable
Enables pressure transducer and associated scaling.

Manifold Zero
(See Pressure Scale)

Manifold Scale
Calculate scale using slope intercept formula (P = mR - b)
Where m is the scale; b is the zero; R is the raw value and P is the pressure.
This can be done by first setting the scale to 1.000 and zero to 0.
Set pressure to zero and record reading for pressure; this is the b value.
Turn pressure up to 500 PSI and record reading again as a variable named Z.
m = 500/(Z-b)

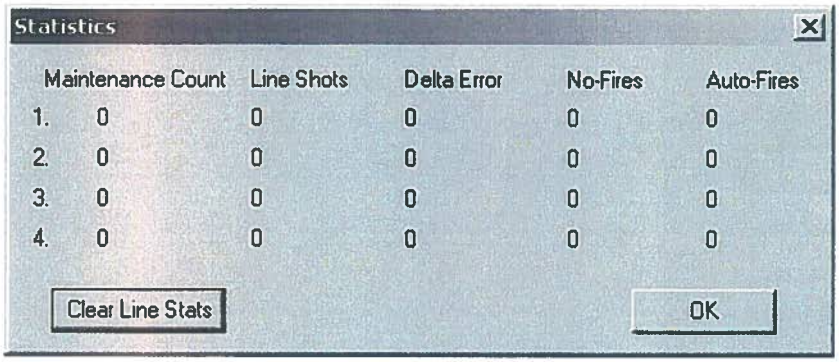
Manifold Pressure
Minimum pressure for Q/C checking.

Manifold Error
Error Range for pressure (typically 200).

Manifold Range
Maximum display range for pressure graphing.

Line Statistics Dialog (F7)

When you press F7 tor click "Statistics" this pop-up menu will appear. Please see brief explanation of settings below. When finished with Line Statistics Dialog click "OK" or press "Enter" on the keyboard to return to the main menu.



This menu displays the statistics for all guns on the current line.

Maintenance Count
Cumulative count of shots fired on this gun. This value must be zeroed in the "Maintenance Count" menu.

Line Shots
Count of shots on line for this gun.

Delta Error
Count of delta errors on line for this gun.

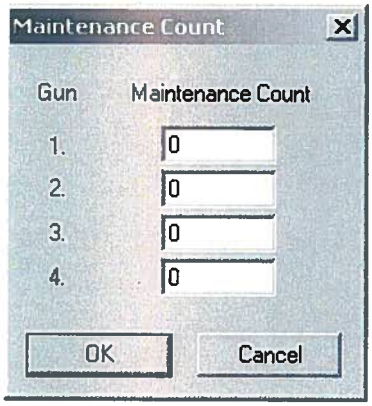
No-Fire Error
Count of No-Fire errors on line for this gun.

AutoFires
Count of auto-fire errors on line for this gun.

Use the **Clear Line Stats** button to clear these counts. This does not clear the Maintenance Count which must be edited in the Maintenance Count dialog box.

Maintenance Count Dialog (F8)

When you press F8 or click "Maintenance Count" this pop-up menu will appear. Please see brief explanation of settings below. When finished with Maintenance Count Dialog click "OK" or press "Enter" on the keyboard to return to the main menu.

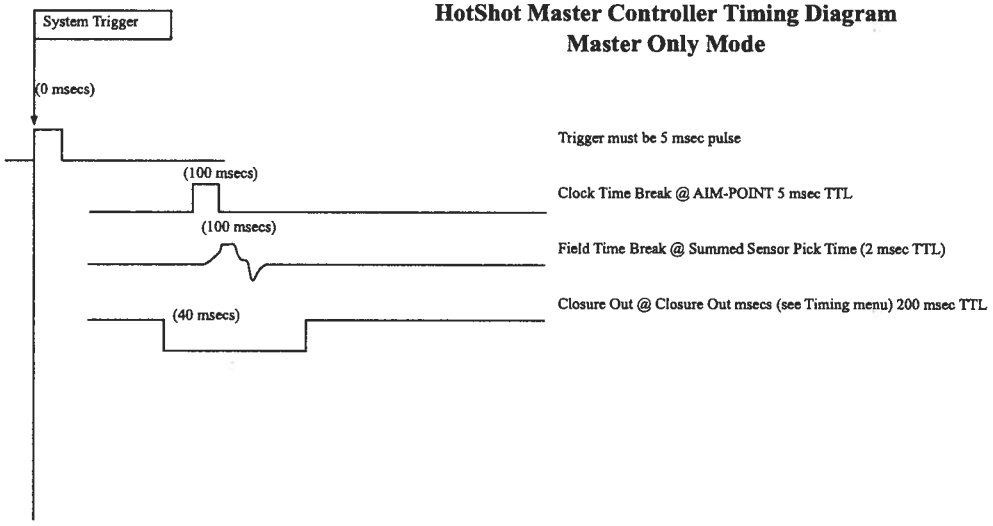


This is used to change the maintenance count statistic for each gun.
This count is used to maintain a count of the number of times a gun has been fired so that proper maintenance can be scheduled.

8 System Timing

The system is started in one of three ways:
1. External trigger from Navigation. (Note: **External trigger must be greater than 5 msecs long**)
2. Internal Cycle Mode start.
3. Manual Trigger.
4. PC Command

HotShot Master Controller Timing Diagram
Master Only Mode



9 Sensor Time Picking and Auto Tune Algorithm

Sensor Picking Diagram

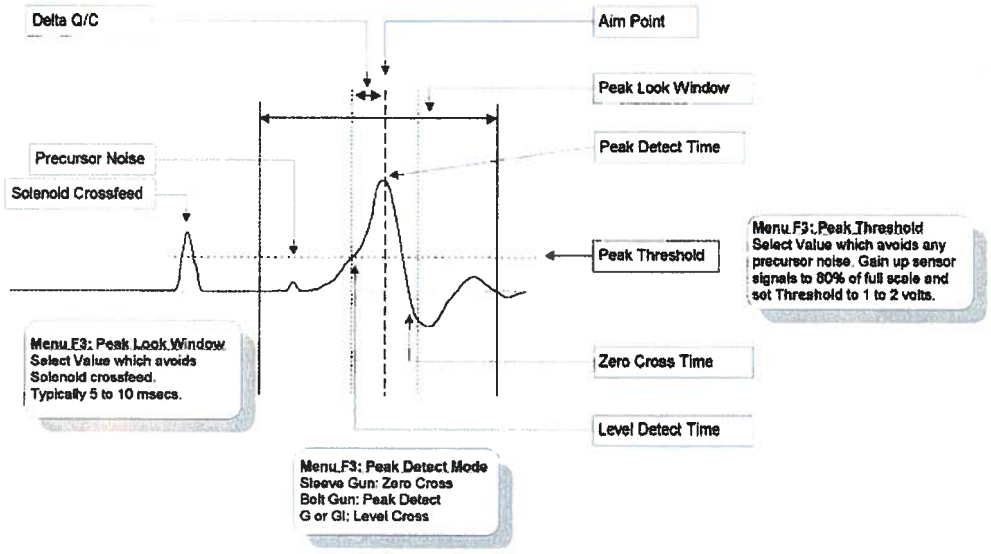


Figure 5

1. The sensor waveform is processed after the shot to determine when the gun fired. This involves the follow steps (see Figure 5):

2. The sensor signal is digitized at 0.1 msec intervals and a 100 msec window is stored.

3. Find the start of the Peak Look Window; this start time is the (Aim Point - Peak Look Window). For example, if the Aim Point is 100 msecs and the Peak Look Window is 10 msecs, then the peak look algorithm will start at 100-10 = 90 msecs.

4. Average the first 5 sample of the window. This is the DC offset and is subtracted from every sample before being processed.

5. Look for the first sample that crosses the Peak Threshold. Record this time as threshold cross time.

6. Look for the first peak that has 3 up going samples, followed by 2 down going samples. If that is found, record the time of the peak.

7. Look for the first time when the signal crossed zero after the peak.

8. TIMING Menu F3 has a parameter which selects which time to pick. Choose either the threshold level crossing time (mode **LEVL**), or the peak time (mode **PEAK**), or the zero crossing time (mode **ZERO**).

9. Record the pick time and calculate the Delta Time = Pick Time - Aim Point.

10. Record the Delta time and flag delta error if value is greater than menu F4 **Delta Q/C**.

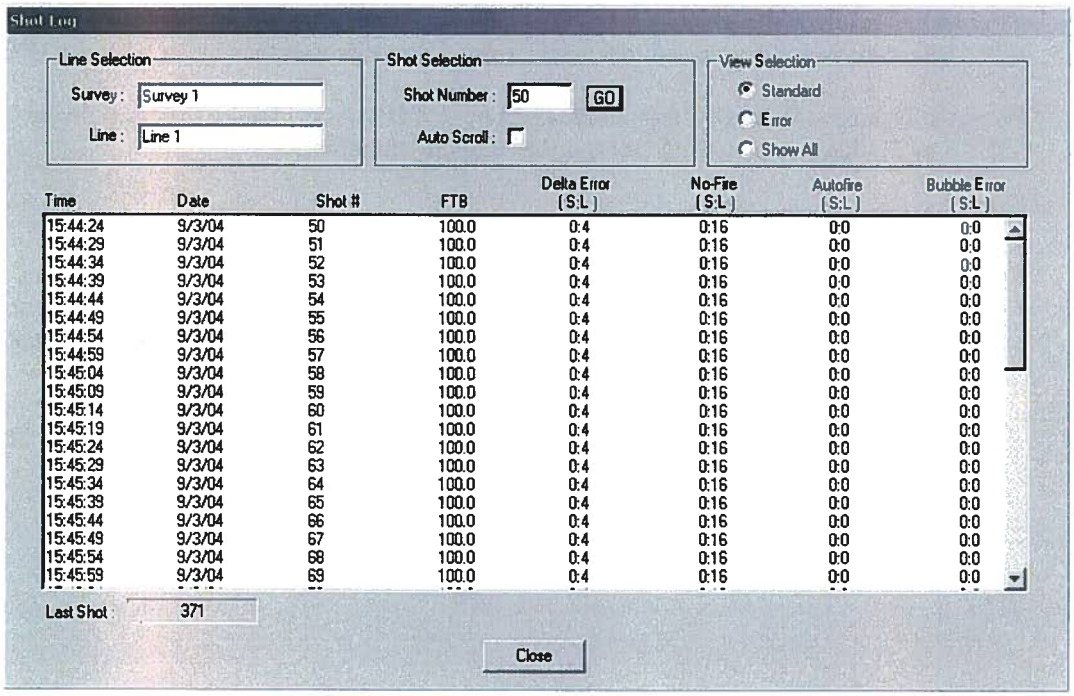
11. If Delta is > **Delta Q/C** then divide Delta by 2; if Delta is > 2***Delta Q/C** then divide Delta by 3. (this is done to filter out spurious outlying fire times).

12. Average the last 2 Delta Times.

13. Adjust next gun delay according to menu F4 **Gun Mode** and menu F1 **Cycle Mode.**
    a) If Gun Mode is Manual, DO NOT adjust **Gun Delay**.
    b) If Cycle Mode is WARM or TEST, Adjust Gun Delay by 1/2 the Delta Error. For example: Gun Delay = 15.2 before shot; Delta Error = .4; so Gun Delay = 15.4 after shot.
    c) If Cycle Mode is NORM, Adjust the Gun Delay by 1/2 the Average Delta Error. Program Solenoid Power Supplies with new fire time.

10 Shot Log (File:View Logs)

When you select View Logs under File menu this pop-up menu will appear. Please see brief explanation of settings below. When finished with View Logs click "OK" or press "Enter" on the keyboard to return to the main menu.



The log functionality uses the Survey Name that was entered under the Mode menu to create a directory on the PC in the same directory that the executable resides. The line data is recorded inside this directory in ASCII format to a file with a .dat extension. The filename is the value entered for Line Number under the Mode menu. Therefore each time data is received, it is either appended to the existing line's log file, or (if the file has not yet been created) a directory and/or line log file is created for that data. The Shot Log dialog displays this data in increments of fifty beginning with the value entered for the Shot Number parameter. To generate a readable text file of the entire line's shot data, select Print Log to File under the File menu. Select the log file to be used, and a .rtf file will be generated with the same name inside the same directory. This file may then be opened, saved, printed, etc. with a text editor such as Word Pad, Microsoft Word, or even Notepad. (Word Pad is recommended as it has been used in developmental testing.) As of this writing, hydrophone data signals are recorded in the same directory as line data with the same filename but with a .HYD extension. The format of those files is SEG-Y format.

Survey

The data displayed inside the dialog belongs to the survey name entered in this text box. The default value that appears when this dialog opens is the current survey name (entered in the Mode menu).

Line
The value entered here determines which line's data to display in the dialog. The default value is the current line number (the value in the Mode menu).

Shot Number
This is the line's shot number at which to begin the display. Up to 50 shots will be displayed beginning this one. If less than 50 shots have been recorded beyond this value, only those shots will be displayed.

GO
This button will update the dialog when clicked.

Auto Scroll
If selected, the display of the last 50 shots will automatically update as data is received/recorded for the current line.

Standard View
This is the default view of the data. It shows only those items identified in the heading. Shots that contain errors are displayed in red.

Error View
This view shows everything Standard View does as well as any errors that occurred on each shot per gun. If no errors occurred in the range being viewed, it will appear identical to Standard View.

Show All
This view shows everything displayed in Error View plus system and individual gun settings for every shot.

Last Shot
This is the last shot recorded in the specified line.

NOTE: In the heading, you will notice "(S:L)." The 'S' refers to shot and the 'L' refers to line as in the number of errors that occurred on the shot and cumulatively on the line up to that point."

Go
Click this button to recalculate the statistics based on the other parameters entered.

Last Shot
As in the Log dialog, this is the last recorded shot for the specified line.

Print
Click this button to print the statistics display.

12 Navigation Computer Notes

When the HotShot is hooked up to a navigation computer through the 'Control' port (on the rear panel), a Navigation Computer Header String is sent by the HotShot through that port to the Navigation Computer. This occurs every time a shot is fired.

This Header String is composed of ASCII characters and contains all the pertinent information for the shot that fired in the GCS90 format:

Parameter	**# of characters**	**Note(s)**
Syntron header	6	always = "*GCS90"
Status Block Size	4	ASCII NUMERIC
Line Number	8	ASCII NUMERIC
Shot Point	10	ASCII NUMERIC
Trigger Mode	1	'I'=internal, 'E'=external
Time	17	format = YY/MM/DD HH:MM:SS
Sequence Number	1	ASCII NUMERIC
Number of Guns	2	ASCII NUMERIC
Number of Active Guns	2	ASCII NUMERIC
Number of Delta Errors	2	ASCII NUMERIC
Number of Autofires	2	ASCII NUMERIC
Number of Miss-fires	2	ASCII NUMERIC
Delta spread	3	In 1/10 msecs
Total Volume Fired	5	ASCII NUMERIC
Spare	14	not used (placeholder)
Manifold Pressure	4	ASCII NUMERIC in PSI
Depth	4	ASCII NUMERIC in meters

The next portion of the string can vary in length depending on the number of guns (determined above). If Number of Guns is '4' the following is repeated 4 times ('8' means 8 times, '1','2' means 12 times, and '1','6' means 16 times):

Gun Number	2	ASCII NUMERIC
Gun Mode	1	[A]uto,[M]anual,[S]pare,[O]ff
Detect	1	[P]eak, [Z]ero
Sequence Number	1	ASCII NUMERIC
Auto Fire	1	Y/N
Spare	1	
Offset	3	Static offset in 1/10 msecs
Delay	3	Gun delay in 1/10 msecs
Fire time	3	Gun fire time in 1/10 msecs
Delta	3	Delta in 1/10 msecs
Depth	3	Depth in 1/10 meters

The last 2 characters appear after the previous section has been repeated for all the guns. Those two characters are an ASCII carriage return and line feed.

13 Jumpering HotShot 1 or 2 for GI Gun

You need 2 Berg Stick 1/10th inch jumpers for each GI gun you are configuring.

Remove outer perimeter screws from panel. Lift front panel out of plastic box. It is a tight fit--pull carefully.

Remove 8 screws that secure metal plate with power supply and optional Hydrophone Board. Unplug connectors as necessary. P.C. Board under this plate is shown on the drawing on the next page. Add jumpers where shown.

Replace plate and reconnect all interal wiring. Put panel back into plastic case BEING VERY CARFUL TO NOT PINCH WIRES! Reinstall panel screws.

JP1 is for Gun #1
JP3 is for Gun #2

Gun Connector 1, 3	A G Sol +
Gernerator	B G Sol -
Connections	C Hyd+
	D Hyd-
	E N.C.

Gun Connector 2, 4	A I Sol +
Injector	B I Sol -
Connections	C N.C.
	D N.C.
	E N.C.

HotShot Fire Control Board Jumper Setting Diagram