HUNTING

ControlFire® User Manual

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Safety Precautions When Using ControlFire® Perf Unit

The following precautions must be followed when using the ControlFire® Perf Unit.

1. Do NOT open the unit and try and service. If any service or repair is required the unit must be returned to the manufacturer, Hunting Titan.
2. Always use the recommended AC power cord that includes a 3rd wire safety ground that connects equipment to a grounded single phase outlet.
3. When installing into a wireline truck always position the ControlFire® Perf Unit so that the AC cord can be accessible for rapid disconnect.
4. When replacing either the AC fuse or W/L fuse always use the exact replacement P/N.
5. If equipment is not used in a manner specified by the manufacturer, safety protection may become impaired

Safety Symbol Explanation

Caution: Risk of danger, refer to user guide.

Warning: Electrical shock hazard.

1.0   ControlFire® Perforating Command & Control Panel

1.1 Equipment Overview

The minimum equipment required for running a switch system with the ControlFire® Perforating Command and Control Portable Panel is listed below.

Item	Equipment Description	P/N
1	ControlFire® Command & Control Panel	9002-013-510
2	Cable Kit	9002-013-017
[1]3	Wireline Switch Simulator Panel	9002-013-610
4	ControlFire® Perforating Switch Rev 1.8 PCB 1.0D	9002-013-120-1.8
[1]5	Wireline Switch Simulator Panel External Test Block	9002-013-320

[1]Items 3 and 5 can be used for system verification at the shop or on a job location

1.2 Perforating Command & Control Portable Panel Overview

Shown in Figure 1 is a surface perforating command & control portable panel that provides communication and control to the downhole ControlFire® switch string. This control panel interfaces with a PC or Laptop via a "USB connector", connects to a Shooting Power Supply through the "Shooting PWR IN" connector and to a wireline cable via the "Wire Line Output" connector. The Perforating Command and Control Panel is available as a portable panel, rack mount panel (BOD) or integrated into a shooting power supply as a combination rack mount panel. See Section 11 for part numbers.

Figure 1

1.3 Cable Kit

Shown in Figure 2 are the normally required cables and connectors. An itemized listing is given:

Figure 2

1. AC Input Power Cord – (PN. E6000-312011-01). Three wire power cord for connecting the Command & Control Panel to an AC power source (hot, neutral and safety ground).   The safety ground (3rd wire) within the AC receptacle must be connected to earth ground. Ground wire must be Green/Yellow.

    Cord should be:
    3-Conductor, 18AWG, 10A, 60ºC minimum, 3m length maximum

2. Shooting PWR In Cable – (PN. 9002-013-015) RG8 Coaxial Cable, 10 feet long, with Cannon Female Plug and Male UHF PL-259 connectors

3. Wire Line Output Cable – (PN. 9002-013-014) RG8 Coaxial Cable, 10 feet long, with Cannon Male Plug and Male UHF PL-259 connectors

4. Double Female UHF adaptor – (PN. E2100-83-1J) Used to convert the Male UHF of the Wire cable to a female gender

5. USB cable – (PN. E6000-USBAA-6) Male to Male cable used to interface a PC or Laptop to the Control Panel

6. BNC JACK TO DBL BANANA PLUG ADAPTER (PN: E2100-1270) – BNC to Double banana plug used to connect to the W/L Simulator (9002-013-610)

7. BNC JACK TO UHF PLUG ADAPTER (PN: E2100-27-8120) – BNC to UHF adapter.

1.4 Perforating Command & Control Portable Panel Specifications

Table 1 gives the specifications for the ControlFire® Perforating Command and Control Portable Panel.

Specification	Rating/Description		Conditions
Temperature	(-10 to +55) C (+14 to +131)F		Operating
	(-10 to +55) C (+14 to +131)F		Start Up
	(-30 to +75) C (-22 to +167)F		Storage
Humidity, RH%, Operating & Storage	10 to 95% RH		Non-Condensing
Altitude	0 – 10,000ft		Operating
	0 - 45,000ft		Storage
IEC60529 Rating	IP67 (1-meter submersion for 30 minutes)		
AC Input Voltage	120-220 VAC		0~100% load
Frequency, Range	50 – 60 Hz		0~100% load
Input Power	150W Max		
AC Power Cord	3 conductor,18AWG, 10A, 60ºC minimum, 3m length maximum		Operating
AC Entry Fuse	250V, 1.6A, 5mm X 20mm slow blow. Part# BK/GDC-1.6A		Operating
Wire Line Fuse	250V, 0.63A, 5mm X 20mm Slow blow. Part# BK/GDC-630MA		Operating

Table 1

2.0   ControlFire® Shooting Power Supply Panel

2.1 Equipment Overview

The minimum equipment required for running a switch system with a ControlFire® Shooting Power Supply is listed below.

Item	Equipment Description	Titan P/N
1	ControlFire® Shooting Power Supply	9002-013-810-1
¹2	Wireline Switch Simulator Panel	9002-013-610
3	ControlFire® Perforating Switch Rev 1.8 PCB 1.0D	9002-013-120-1.8
¹4	Wireline Switch Simulator Panel External Test Block	9002-013-320

¹Items 2 and 4 can be used for system verification at the shop or on a job location

2.2 ControlFire® Shooting Panel Overview

This is a rack mounted shooting power supply panel that provides communication and control to the downhole ControlFire® switch string. All interface cabling is done from the rear or back of the panel. This control panel interfaces with a PC or Laptop via a "USB" connector, connects to a Shooting Power Supply output through the "LOG" connector and to a dual wireline cable via the "DRUM 1" and "DRUM 2" connectors.

Front View

Rear View
Figure 3

Notes: The cable Kit that is shipped along with the ControlFire® Shooting Panel includes connectors for the 12V and Unit lights.

This ControlFire® Shooting Panel comes along with its own Cable Kit PN 9002-013-810-CBKIT. The Kit includes an A/C power cord cable and a USBAA cable and the proper connector for the 12 V and the unit lights.

2.3 Cable Requirements

An itemized listing of required cables is given:
1. LOG Cable - RG8 Coaxial Cable, 5 feet long, with UHF PL-259 connectors on both ends.
2. "Drum 1" Output Cable - RG8 Coaxial Cable, 10 feet long, with UHF PL- 259 connectors on both ends
3. "Drum 2" Output Cable - RG8 Coaxial Cable, 10 feet long, with UHF PL- 259 connectors on both ends

2.4 ControlFire® Shooting Panel Specifications

Table 2 gives the specifications for the ControlFire® Shooting Power Supply Inputs.

Specification	Rating/Description	Conditions
Temperature	(-10 to +50) C (+14 to +122)F	Operating
	(-10 to +50) C (+14 to +122)F	Start Up
	(-30 to +75) C (-22 to +167)F	Storage
Humidity, RH%, Operating & Storage	10 to 95% RH	Non-Condensing
Altitude	0 – 10,000ft	Operating
	0 - 45,000ft	Storage
AC Input Voltage	110 VAC	0~100% load
Frequency, Range	50 / 60 Hz	0~100% load
Input Power	750W Max	
AC Power Cord	3 conductor,18AWG, 10A, 60ºC minimum, 3m length maximum	Operating
AC Entry Fuse	250V, 10A, 5mm X 20mm slow blow. Part# 0326010.HXP	Operating
Wire Line Fuse	250V, 0.63A, 5mm X 20mm Slow blow. Part# BK/GDC-630MA	Operating
Truck 12V In Fuse	250V, 1A, 5mm X 20mm slow blow. Part# 0313001.MXP	Operating

Table 2

2.5 Log, Aux and CCL Operation

When the user selects Log from the front panel knob the selected Drum connector will connect to the Log connector on the back of the panel.

When the user selects Aux from the front panel knob the selected Drum connector will connect to the Aux connector on the front and back of the panel.

When the user selects CCL from the front panel the device will display the CCL signal changes on the front panel micro ammeter. The CCL Gain knob controls the gain of the CCL circuit, and the volume control knob controls the volume of the CCL signal kicks. The rear panel CCL connector is not affected by the CCL Gain knob as it has a fixed gain.

2.6 ARM Mode Operation

When the user selects ARM from the front panel, the user is able to send shooting power in either polarity down the wireline. The Dump Fire button enables the operator to Dump fire a preselected voltage.

When in Dump Fire mode the Dump Fire button LED will flash once every second.

If an over current condition occurs, then the output is disconnected and the Dump Fire LED will flash 4 times a second. Turning the knob all the way to zero or changing the mode will enable the operator to use the shooting supply again.

2.7 Select Fire Instructions (Positive / Negative)

- Turn the Voltage knob fully counter clockwise.
- Select the Polarity of voltage required by selecting Positive "POS" or Negative "NEG".
- Press the Red colored Fire Switch (spring loaded) and turn the Voltage knob clockwise till you arrive at the desired voltage.
- Once the required operation is completed release the Fire Switch and turn the voltage knob fully counter clockwise.

2.8 Dump Fire Instructions (Positive / Negative)

- Pressing the Dump Fire Switch once places the unit in Dump Fire Mode. This is indicated by a LED flashing once every second
- Turn the Voltage knob fully counter clockwise.
- Select the Polarity of voltage required by selecting Positive "POS" or Negative "NEG".
- Press the Red colored Fire Switch (spring loaded) and turn the Voltage knob clockwise till you arrive at the desired voltage.
- Press the Dump Fire switch again to dump the voltage into the connected output.
- Once the required operation is completed release the Fire Switch and turn the voltage knob fully counter clockwise.

- This removes the panel out of Dump Fire mode and places it in regular Select Fire Mode

3.0   Perf Switch and Wireline Simulator Panel

Shown in Figure 4 is a Perf Switch Simulator that allows the user to perform demonstration, training exercises, and troubleshoot/verify wireline interconnections at the well site.

Figure 4

The Simulator panel is sold with its own W/L in cable PN E6000-2BC-BNC-36

3.1 Wireline Switch Simulator Panel External Test Block

Shown in Figure 5 is a connector block with a cable that plugs into the Perf Switch Simulator, Deto I/O interface. This assembly provides the user a means to connect resistors to each of the 6 Perf Switches inside of the Perf Switch Simulator for the purpose of simulating a detonator firing. This concept can be used for demonstration, training and troubleshooting wireline problems on a job site.

DO NOT CONNECT LIVE DETONATORS!

Figure 5

3.2 ControlFire® Perf Switch Rev 1.8

Shown in Figure 6 is an expendable ControlFire® Perf Switch. Every gun/plug in a tool string must be equipped with a Perf Switch. Each switch can be verified, armed, selectively fired or skipped upon command from the surface. An RF-Safe ControlFire® Assembly is also available. See Section 11.0 for part numbers regarding the RF-Safe ControlFire® assembly options.

Note: ControlFire® switch body may be black shrink wrap or maroon plastic

Figure 6

CF SWITCH WIRE COLOR		FUNCTION
	WHITE	THROUGH WIRE TO UPPER GUN
	BLACK	GROUND WIRE (ALWAYS DOUBLE GROUND)
	BLUE	THROUGH WIRE TO LOWER GUN
	GREEN	NEGATIVE (HOT) DETONATOR/IGNITER WIRE
	RED	POSITIVE (GROUND) DETONATOR/IGNITER WIRE

3.3 ControlFire® Perf Switch Specifications

Table 3 gives the specifications for the ControlFire® switch.

ControlFire® Switch Specifications

ENVIRONMENTAL	
Operating Temperature Range	-20 °F (-29 °C) to 347 °F (175 °C)
Survival Temperature	-58 °F (-50 °C) to 392 °F (200 °C)
Max Thermal Change	9 °F (5 °C) / Minute
Vibration Compliant	Compliant to all hollow carrier gun systems
Vibration (3 axis)	50 g RMS @ Sweep Frequency 50-1000 Hz
ELECTRICAL	
Operating Voltage Range	-5 VDC to -550 VDC
Operating Current – Standby	>1mA
Current – Communicating	10mA at Surface 30mA Downhole
Max Firing Current	1A for 12 seconds; 1.5A for 5 seconds
Bi-directional Communications	Bi-directional
COMPATABILITY	
Detonators – Hot Wire	50 ohms or higher (single or double resistor types)
Igniters – Setting Tools	50 ohms or higher
RF Safe Detonators	CFA, PX-1/EBW, RED (all versions)

Table 3

4.0   Installing the ControlFire® Software

The following procedure will provide a step-by-step guide for installing the ControlFire Perf Unit GUI and USB Virtual Com Port Driver onto a PC or laptop.

4.1 Installing GUI Program

Installation Steps:

1. Any previous versions of Titan Perf Unit must be uninstalled before attempting to install a newer version of the ControlFire® Software. Use the Add/Remove Program on the Control Panel and remove any previous ControlFire® Software version

2. Download the "Setup ControlFire V. <version>.zip" file into the folder of your choice.
3. Unzip files. A sub-folder, "Setup ControlFire v. <version>", will be created. Go to this folder.
4. Double click on "Setup ControlFire V. <version>.exe".
5. The software requires Microsoft .NET Framework 4 or higher. If it is not installed on the PC / Laptop, then a popup will appear asking to install.
6. When the "Welcome to the InstallShield Wizard for Hunting ControlFire" appears, click Next.

Figure 7

7. The License Agreement then appears. Read through the agreement and, if you agree, click the "I Agree" radio button. (Otherwise, if you do not agree, click Cancel.) Then click Next.

8. The Select Installation Folder appears next. Choose a Folder of your choice or use the default Folder. Click Next.
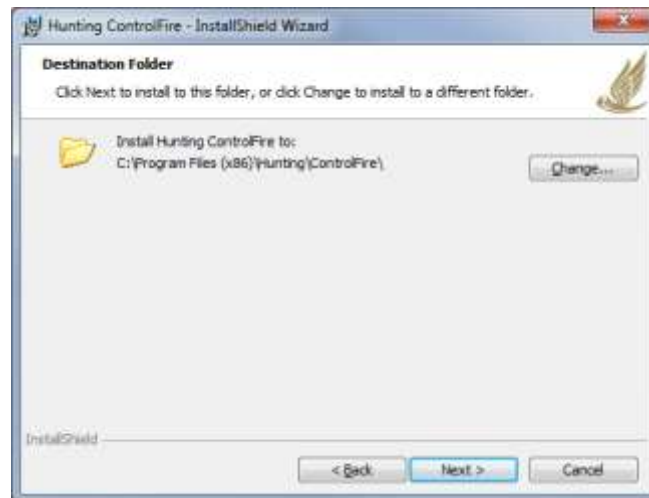
Figure 8

9. The "Ready to Install the Program" screen appears. Click Install as shown in Figure 9.

Figure 9

10. The "Installing Hunting ControlFire" screen appears, shown in Figure 10, and the program installs along with showing a progress window to completion.
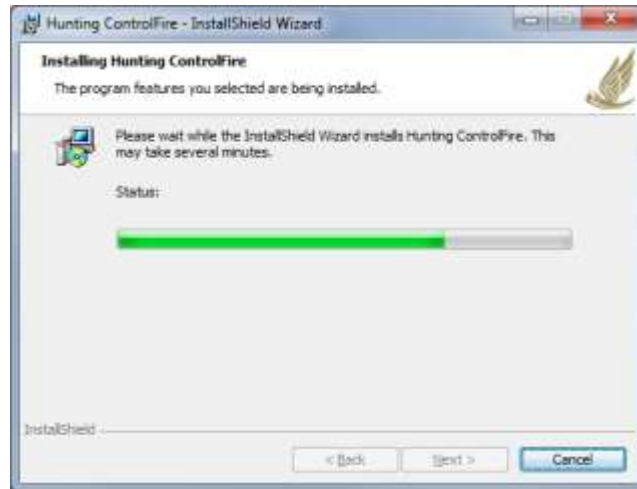
Figure 10

11. The "InstallShield Wizard Completed" window appears, shown in Figure 11, indicating a successful install. Closing the window completes the installation.

Figure 11

12. A "Hunting ControlFire" icon appears on the desktop. See image in Figure 12. Double clicking on icon initiates the ControlFire program.

Figure 12

4.2 Installing USB Virtual COM Port Driver

The USB Virtual COM Port Driver is needed to run the ControlFire® Software. The driver enables the Panel to appear as a COM port available to the PC. After a successful install in Section 4.1, click the "install CDM" button in the InstallShield Wizard to install the driver. The setup driver file is found at: C:\TitanData\CDM v<version> _Setup.exe. The driver can also be downloaded from the FTDI website: http://www.ftdichip.com/Drivers/VCP.htm. This driver supports Windows 7 and 10. Contact Hunting Support if you are running the ControlFire® Software on older Windows XP PCs and Windows Update did not install the FTDI driver automatically.

5.0 Installing ControlFire® Perforating Command & Control Panel on Logging Truck

The ControlFire® Perforating Panel would be typically installed in a logging truck as shown in Figure 13. Cabling would be installed in the order listed below:

    a. Connect the Male PL-259 connector to Shooting Power Supply output.
    b. Connect Cannon connector to the Perf Panel, Shooting PWR In.

2. Wire Line Output Cable - RG8 Coaxial Cable with Cannon Male Plug and Male UHF PL- 259 connectors:
    a. Connect Cannon connector to the Perf Panel, Wire Line Output.
    b. Install the Double Female UHF adaptor on the end of the PL-259 male connector.
    c. Connect the UHF end of the cable to the truck Wire Line Collector.

3. USB cable:
    a. Connect one end of cable to a USB input of a PC or Laptop to the Control Panel.
    b. Connect the other end of the USB cable the USB input of the Perf Panel.

4. AC Input Power Cord:
    a. Turn both the Power Entry switch and the Safety Key switch to OFF before installing the AC Power Cord.

      b. Connect the female receptacle to the Perf Panel 120/220 Power Entry connector.

      c. Plug the AC cord into an AC receptacle of the logging truck.

The Perf Panel is now ready for service. Turn the Power Entry switch to ON and the Safety Key switch to ON. The red light on the Perf Panel should turn on.

Safety: Position ControlFire Panel in truck such that power can be easily disconnected.

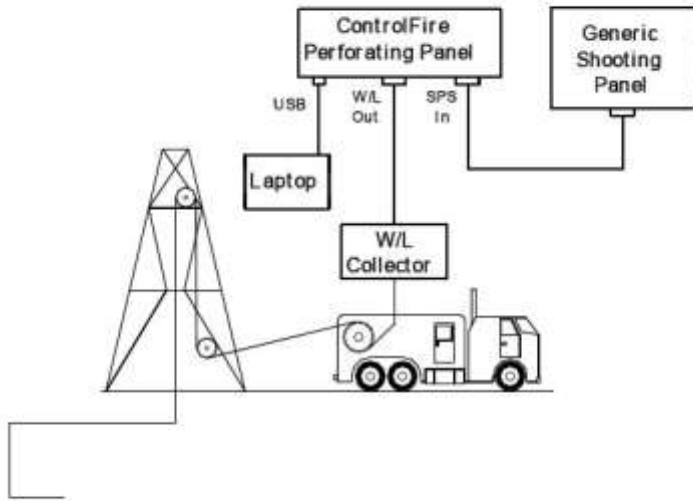
Figure 13

6.0   ControlFire® Operation

The following operation procedures for the ControlFire® are described:
1. Starting the ControlFire® Software
2. Perf Unit Setup for ControlFire® Operations

6.1 Starting the ControlFire® Software

The following steps are required to start the software
1. Double click the Hunting ControlFire® icon on your desktop. See Figure 14.

Figure 14

Figure 15

2.   If necessary, review the About, License and Help tabs on the License page. Check the **I have read and agree** box and then click **Continue**. The USB COM Port dialog will appear after selecting the Continue button as shown in Figure 16.

Figure 16

3.   Click **Auto Detect** or select the appropriate COM port to the ControlFire® Communication Board and then click **Open**. When reusing the same computer and Communication Board, the screen may not appear and instead the Set-Up screen appears as shown in Figure 17.

Figure 17

4.   The ControlFire® Software has now started and the user interface is available
with the Perf Unit Set Up screen visible.

Perf Unit Setup Screen Definitions:

Job Folder – A dropdown is used to use an existing job folder.

Import – Activates a previously saved tool string file from another file location.

Create – Generates a new tool string associated with the selected Job Folder.

Menu > Delta Current Limits – Do not change default delta current limit values.

Menu > Depth Settings – This dialog allows the user to select between "feet" or
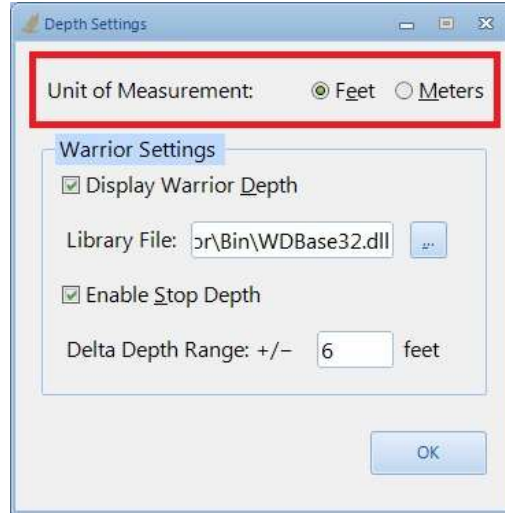"meters" as the unit of measurement for depth.

Figure 18

If you have Warrior® 8 installed, you can select the **Display Warrior Depth** box. This instructs ControlFire® to continuously acquire the real-time depth from the Warrior® service and display it in the Gun Control screen. To make use of this function both ControlFire® and Warrior® Software must be running on same PC. See Figure 19 below:
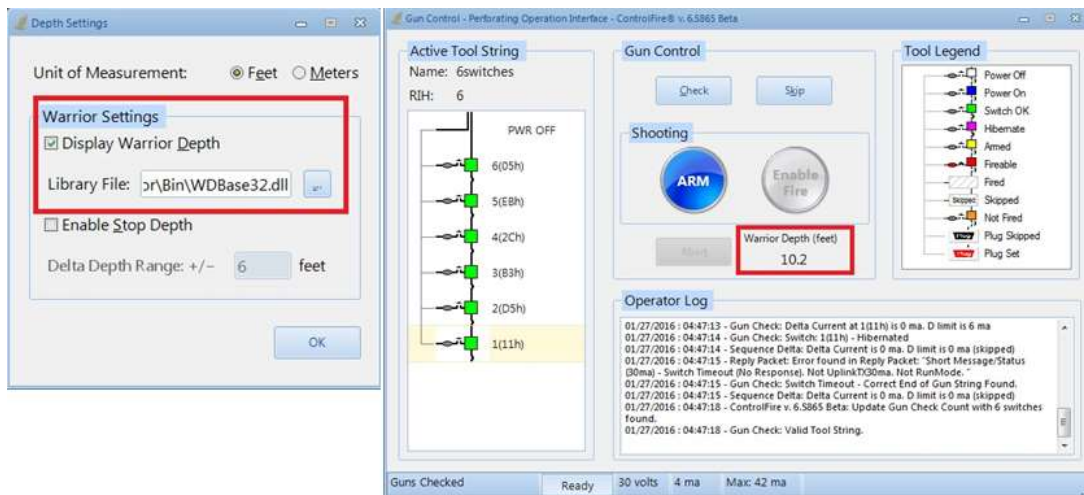

Figure 19

Additionally, the real-time depth is stored in the VI graph that is produced when a switch is fired. Select the plot of the fired switch from the History screen to view the depth values.

The **Enable Stop Depth** feature works with the Warrior® software to ensure that guns are fired within the allowed depth range. ControlFire® accomplishes this by making the Enable Fire button in Gun Control clickable only at the correct depths. A gun becomes "fireable" when the current Warrior® depth in Gun Control is within range of the gun's Stop Depth. Note that a switch can be checked and armed at any depth. Additionally, once the user has clicked Enable Fire, the user will have the ability to send voltage even if the depth of the switch goes out of range. For this reason, we recommend using the Stop Depth feature only when shooting in a stationary position. The Stop Depths are entered in the Gun Sheet as outlined in Section 6.2.4 steps 2-4. As an added safety measure, when ControlFire® detects a Shooting Power Supply (SPS) from Hunting, it disables that panel's Fire relay switch as soon as the Gun Control screen becomes active. The SPS Fire relay switch is enabled only after a gun is armed and within the tolerance range.

Menu > Downhole Temperature – This option allows the user to select the temperature unit. It is useful when the Tool String includes a temperature sensor, such as the one found in the Hunting Safety Sub.

Menu > Decrease the Armed Timer to 15 seconds – When enabled, this option decreases the time available to click the Enable Fire button once the switch is armed. The default timer is 5 minutes.

Menu > Hunting Release Tool – Electronic – This option modifies the voltage used to operate the tool.

Menu > Update ControlFire Board Firmware – When selected, the Bootloader dialog is opened for updating the Communication Board firmware.

Menu > Update Shooting PS Board Firmware – When selected, the SPS Bootloader dialog is opened for updating the Hunting Shooting Power Supply Board firmware.

Menu > Help – When selected, a ControlFire® User's Manual is opened for viewing.

Menu > Troubleshooting Guide – When selected, a ControlFire® Troubleshooting guide is opened for viewing.

History – Opens a screen to view the history of each run within the job folder. It also enables the user to export specific V/I plots within the job folder.

History > Export – Located in the History screen, it exports the job history (GSI, plots and logs) for a specified job. Select the tool string(s) you want to export or click Select All for Export. Click the Export button then select Export to Folder or Export to

ZIP file. When sending files to Hunting Support, we recommend that you submit the ZIP file.

USB COM Button – Located at the bottom left corner of the status bar, it confirms communication with the ControlFire® Board via USB cable. The round icon will be displayed in green if communication is enabled and in red if communication is not established.

W/L Power Supply Settings – Enables the user to input the Communication Voltage, the Gun Check Current Limit and the Enable Fire Current Limit.

Verify String – Establishes communication with the tool string and confirms that the tool string created in the software physically matches the actual tool string to be run into the well. Once confirmed the Gun Control button will become enabled.

Gun Control – Changes focus from the job setup screen to the perforating operation interface.

OFFLINE MODE – Also from the License Agreement screen shown in Figure 15 the offline mode can be selected by clicking on the offline mode box, after having agreed to the software usage agreement. The following actions can be done from the offline mode; Display V/I plots, Display Operator logs, Display Port Commands logs, generate gun sheets both in .pdf or Excel formats, change W/L Power Supply, Edit tool string headers and Settings and Export jobs.

6.2 Setup for ControlFire® Operations

6.2.1 Create New Job Folder

A new Job Folder in normally created for a client on every new job or well. Refer to Figure 20 for the next steps:
1. Click the yellow folder icon and then type in the new name. (For example, use **Titan Job 1**).

2. Click **OK**. This will create a new job folder, **Titan Job 1**, located in directory: **C:\TitanData\Titan Job 1**.
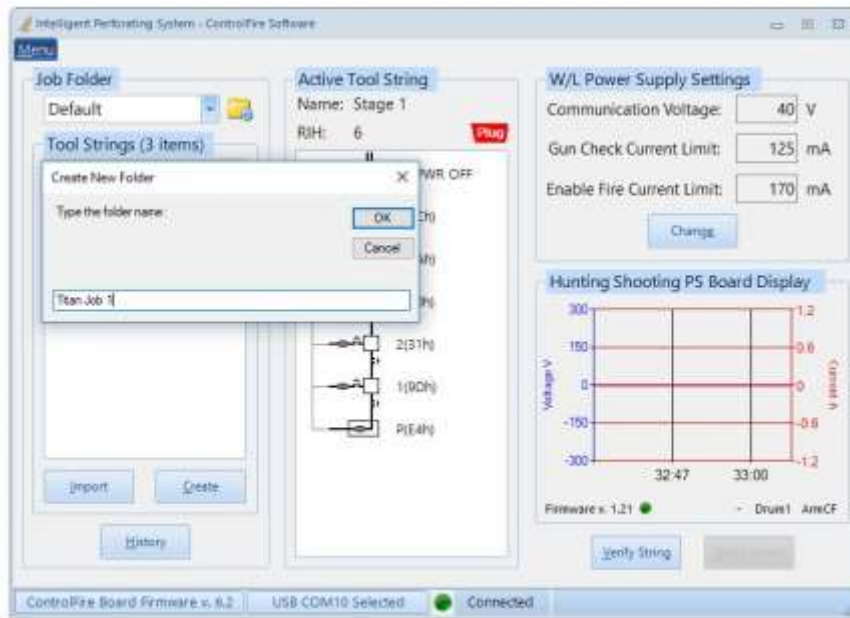

Figure 20

6.2.2 W/L Power Supply Settings

W/L Voltages and Currents settings should remain as default parameters. Default parameters should be adequate for all tools in the string. Refer to the ControlFire Troubleshooting Guide for instances when W/L parameters may need to be changed. From the setup screen in Figure 20, select the **Change** button in the **W/L Power Supply Settings** group box. This brings up the W/L Information screen shown in Figure 21.
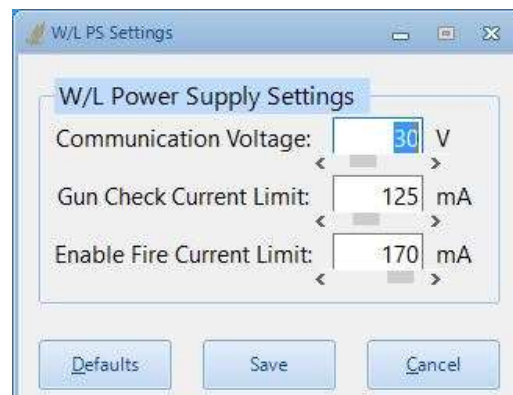

Figure 21

Input the Communication Voltage, the Gun Check Current Limit, and the Enable Fire Current Limit.

Defaults - This loads the default voltage and current values.
Save – New voltage and current values are saved in the current Job Folder.
Cancel – Discards any changes made and returns to the Setup-Up screen.

6.2.3 Create a New Tool String

Perform the following steps to create a new tool string for a specific job folder. (For this example, the Titan Job 1 folder will be used) At this point the user must have the Panel connected to the tool string in order to communicate with the Perf Switches and create a tool string file.

1. Select Titan Job 1 folder (Refer to Figure 20)
2. Click on the **Create** button to create a new tool string. This opens the Create Tool String screen.
3. In rare cases, a 30 second shooting window is required for all guns. If this is the case, then also check the **30 Sec Firing Window** box.
4. Use the **Number of Switches** dropdown to select the number of switches in the string as shown in Figure 22.
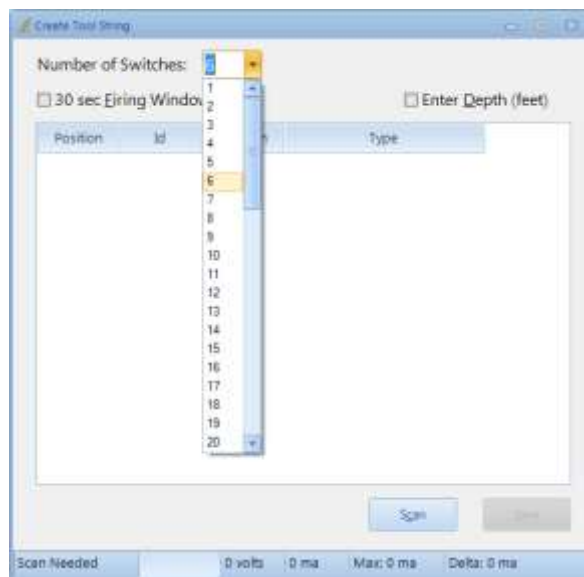

Figure 22

5. Select the **Scan** button. This action will power the wireline and send a sequence of commands from the Panel to the Perf Switches and confirm a functional string.

6. The Switch Unit IDs will be displayed along with the switch revision number in the Create Tool String File window as shown in

7. Figure 23. The number of Perf Switches found must match the number of switches selected. If not, a String Count Mismatch popup occurs, and the Scan Tool String must be repeated before the tool string file (file.gsi) can be saved.
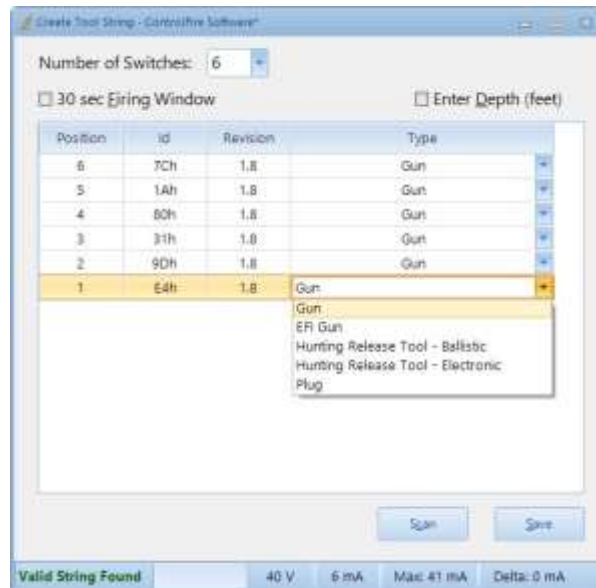

Figure 23

8. The Switch Type can be changed using the dropdown arrow to the right of each switch. For plug and shoot operations, the bottom switch should be changed to "Plug" as shown in Figure 24. When this is done the software will create a red plug icon at the top right-hand side of the active tool string section of the screen. If a ControlFire Safety Sub is in the tool string, the top two switches should be changed to "ControlFire Safety Sub" as shown in Figure 25. If a Hunting release tool is in the tool string, the switch should be changed to either "Hunting Release Tool - Ballistic" or "Hunting Release Tool - Electronic" as appropriate. See examples in Figure 26.
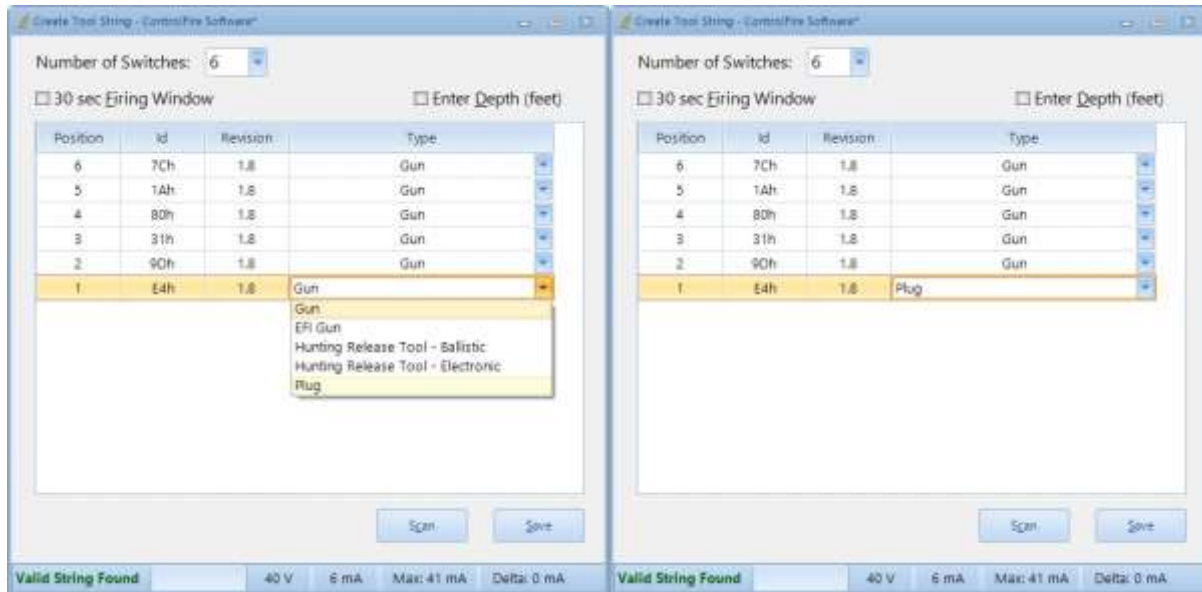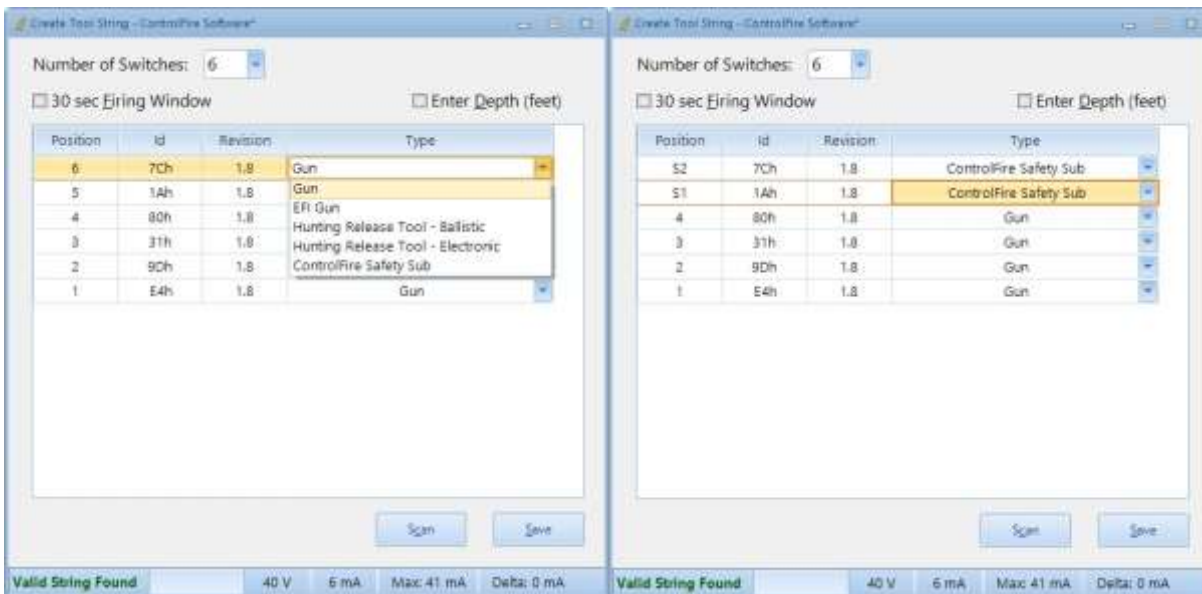
Figure 24

Figure 25

Figure 26

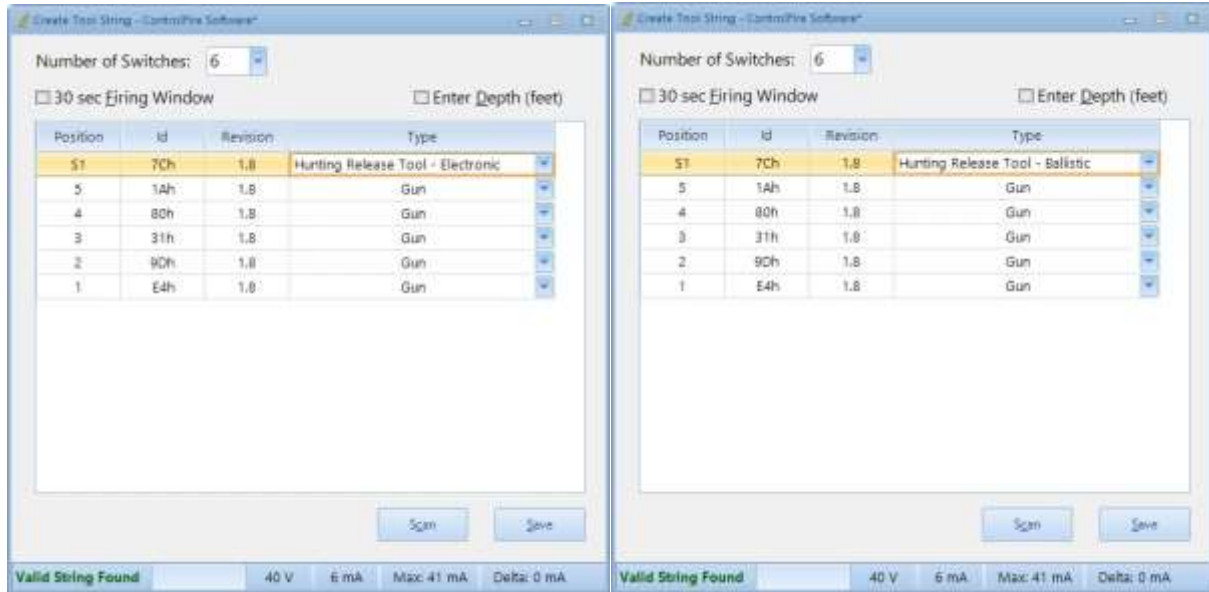9. The user can enter depth values for correlation purposes by clicking on the "Enter Depth" box. **This step is required if the Warrior Stop Depth feature is enabled**. Refer to section 6.2.4 steps 2-4.

10. Once the user input and the physical tool string match, select the **Save** button and create the new tool string file. As an example, shown in Figure 27, a Titan Run 1.gsi file was created.
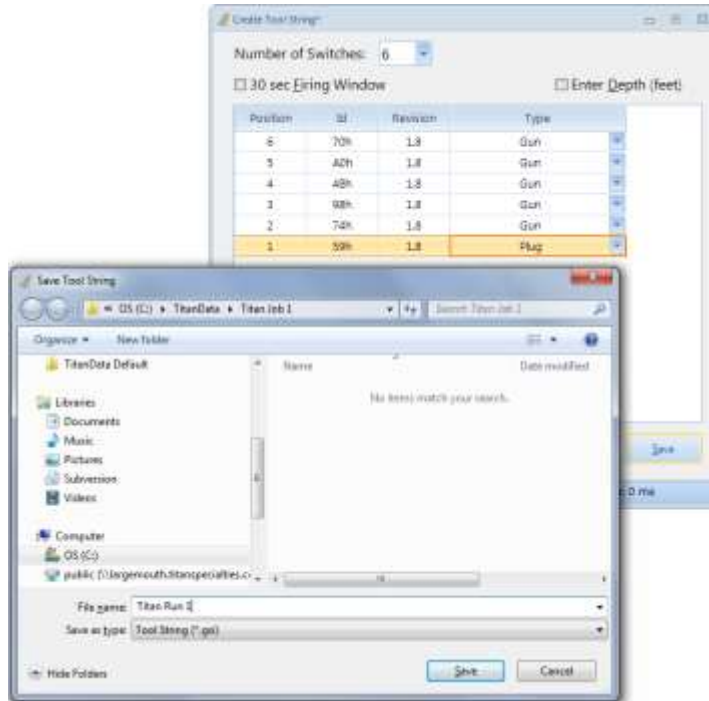
Figure 27

6.2.4   Verify a Tool String

After a Tool String File has been successfully created, it is required to verify the tool string. You can also enter depth information if desired.

1. Select the **Verify String** button on the Set-Up Screen. The Verify Tool String screen appears, and the tool string is validated against the Titan Run 1.gsi file. Following a successful scan, the status bar displays "String Validated" as seen in

2. Figure 28.
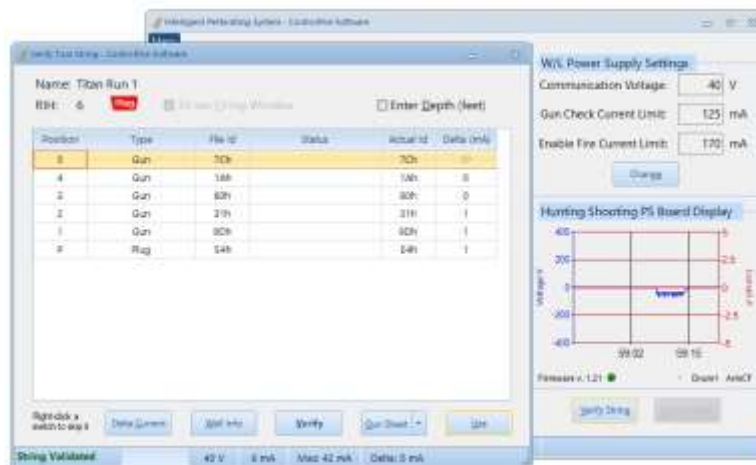
<center>**Figure 28**</center>

3. Select the "Enter Depth" check box if you need to enter the depths. Depth input columns for "Shot Depth", "CCL/GR Offset" and "Stop Depth" appear as shown in

4. Figure 29. **This step is required** if you enabled the Stop Depth feature in the Menu > Depth Settings dialog.
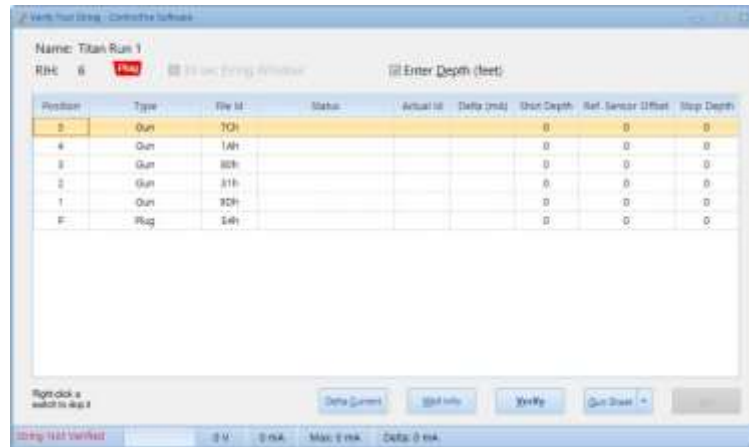
<center>**Figure 29**</center>

5. Enter Shot Depths and CCL/Depth for each item in the tool string. The Stop Depth will automatically populate as shown in Figure 30.
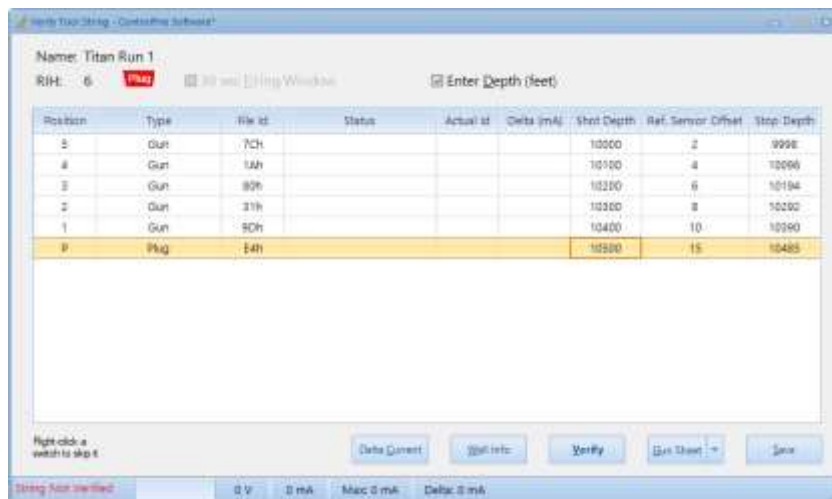
<center>**Figure 30**</center>

6. Click on the "Gun Sheet" button if you wish to print out a copy of the tool string with depths for correlation purposes. See Figure 31. After saving as

a PDF, a gun sheet will be available to view and print as shown in Figure 32. **This step is optional.**
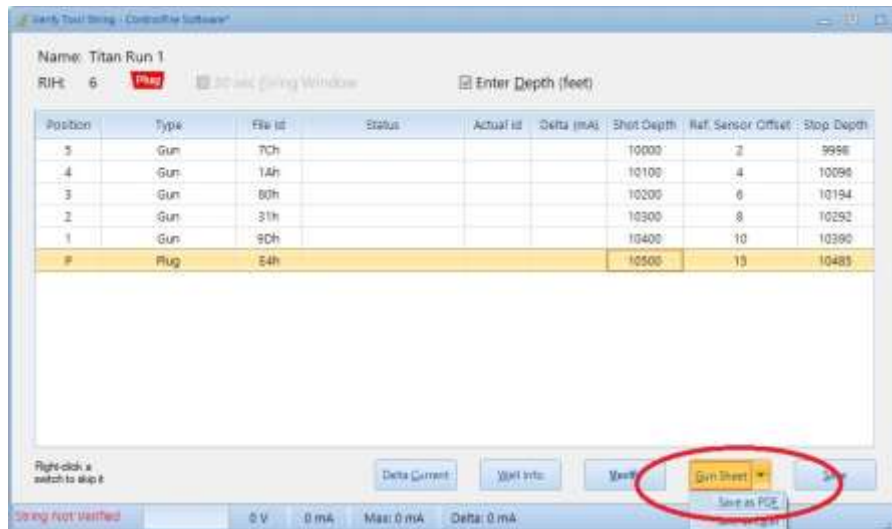
Figure 31
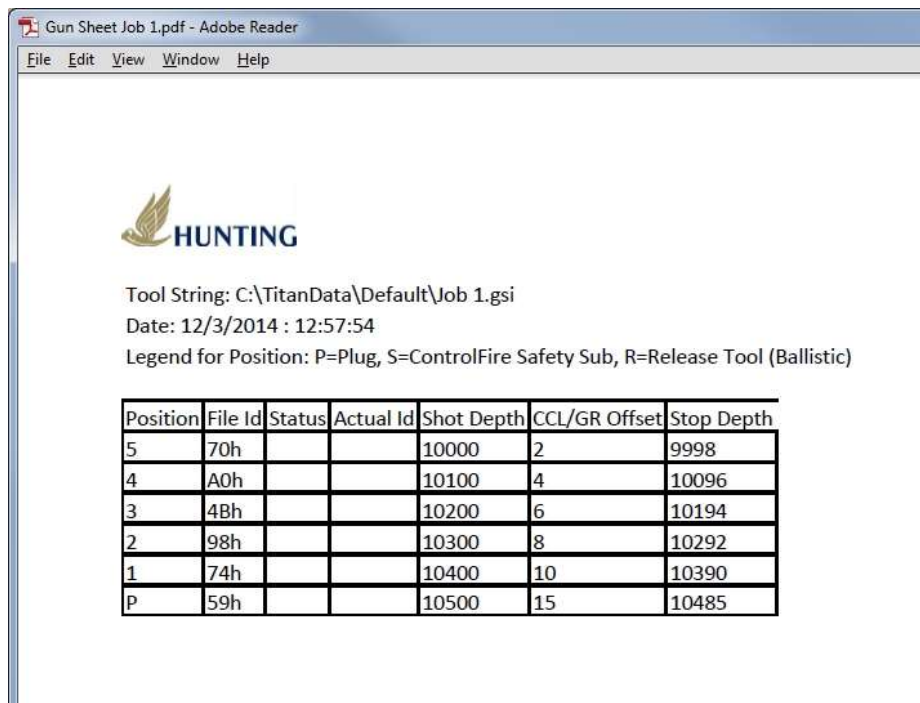
Figure 32

7. Select the **Use** button on the Verify Tool String screen. This action activates the **Gun Control** button on the Set Up screen. See Figure 33.
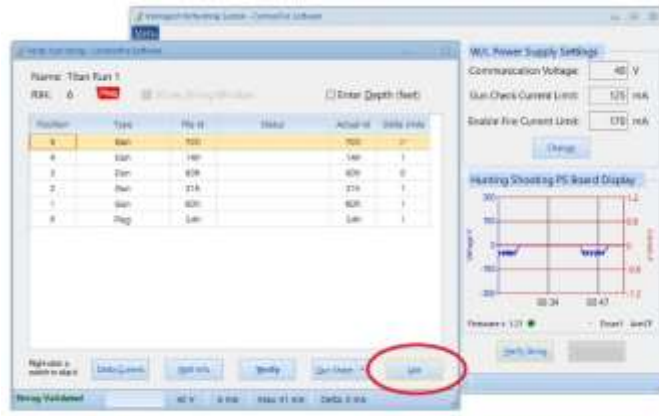
Figure 33

This completes the setup process and a given tool string is ready. The Gun Control screen is now ready for use.

6.3 Gun Check, Arming and Firing

Following a successful Verify, the tool string is ready to begin a Gun Check, Arming and Firing sequence. To start these sequences, select the Gun Control button on the Set Up screen in Figure 17. This activates the Gun Control Screen in

Figure 34.
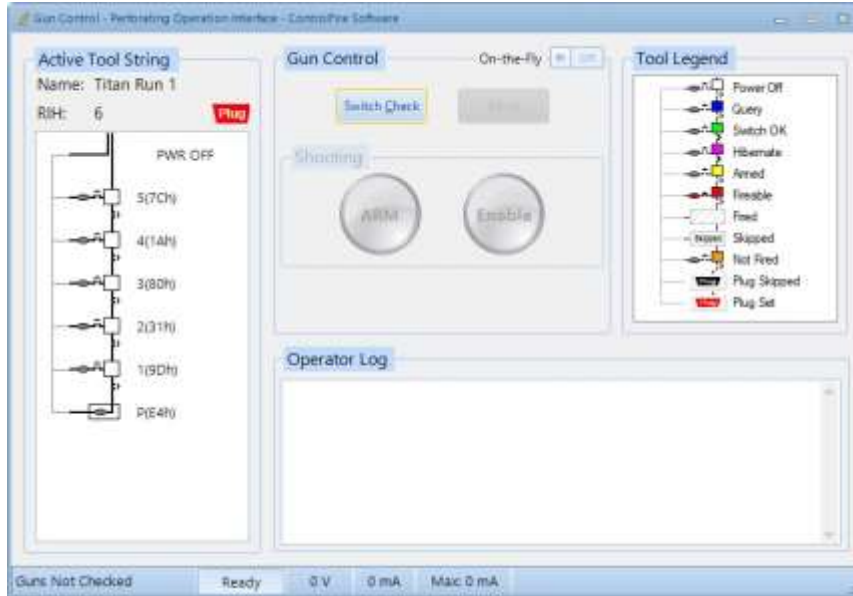
Figure 34

Gun Control Window Definitions:

Warning: All Gun Control commands must be performed in a wellbore at a depth of greater than 200 feet or according to the operator's standards.

Gun Check –The **Check** button requests the ControlFire® Board to send a set of commands to the Perf Switches and read the status of all the switches in the string. An

unlimited number of Gun Check requests can be performed on the tool string. Once the Gun Check is successfully completed, the **Arm** button is accessible to the user.

Arm – Selecting the **Arm** button sends an ARM command to the bottom most active switch. Once the selected gun is armed, the **Enable Fire** button is accessible to the user for 15 seconds or 5 minutes if the user enabled the option under Menu > Decrease Armed Timer to 15 Seconds. If an enable fire is not sent within the specified time window, the Perforating Command and Control Panel will revert back to a pre-initialized gun check screen.

Enable Fire - The **Enable Fire** button commands starts the following sequences:
1. The V/I plot appears and immediately starts recording wire line current and voltage. This Plot is used for shot detection.
2. The Enable Fire button becomes clickable, and the status bar displays "Gun Armed".

   Note: If Stop Depth is enabled, a switch can be Armed at any depth. However, the Enable Fire button becomes clickable only when the gun is within the correct depth range. The Stop Depth feature is enabled in the Menu > Depth Settings dialog. The depths must be typed in the Verify Tool String screen.

Switch Skip – The **Skip** button provides a method to skip over malfunctioned guns. A switch skip command skips the bottom most detected gun in a string. Each additional switch skip command initiated propagates upward one gun.

Abort – The abort button stops the current operation.
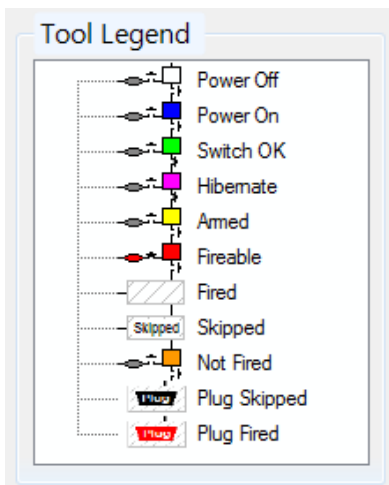
Tool Legend – This legend (Figure 35) indicates the state of the switch in the string.

Power Off – No power/communication to switch
Power On – Power applied to switch
Gun OK – Switch verified and operational
Hibernate – Switch is OFF and W/L Switch is ON
Armed – Switch is ready for detonator connection
Fireable – Switch is armed and ready for power to be applied to detonator/igniter
Fired – Enable Fire function has been performed
Skipped – Switch has been skipped and unable to be armed
Not Fired – Enable fire function has been performed but switch remains functional

Figure 35

6.3.1 Gun Check

A Gun Check is initiated by selecting the Gun Check button on the Gun Control Screen. The screen shown in

Figure 36 results from a successful gun check.

Figure 36

The following indicate a valid gun check:
1. All switch icons are green in color
2. Operator Log does not indicate any errors
3. The status bar displays "Guns Checked"

Shown in Figure 37 is the result of an invalid gun check. For this example, the wire line was not connected between switch 4(1Ah) and switch 3(80h).
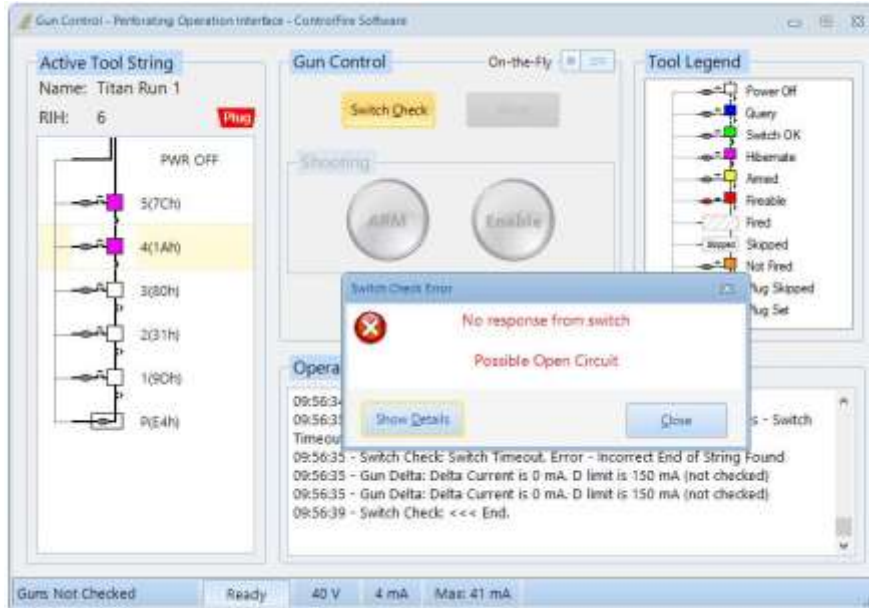
Figure 37

The following would indicate an invalid gun check:
1. Switch icons below the detected error are NOT green in color
2. Operator Log will indicate errors.

6.3.2 Arm and Fire Sequence

Note: Before arming a gun, verify that the depth correlation and tie-in on the perforating correlation software and/or company procedures have been followed.

The **ARM** button becomes active following a successful gun check, see

Figure 36. The results of selecting an active **Arm** button are shown in

Figure 38.
1. The Icon for the gun to be fired turns Yellow.
2. The Enable Fire button becomes clickable, and the status bar displays "Gun Armed".
3. A 15 second- or 5-minute countdown timer becomes visible indicating the time remaining to select the **Enable Fire** button.

Figure 38

By selecting the Enable Fire button in

Figure 38, the following results occur as indicated in Figure 39:

Figure 39

1. The Icon for the gun to be fired changes to a crosshatch image.

2. The Enable Fire button is grayed out.
3. A V/I shot plot appears.

The Shooting Power Supply voltage should be ramped up to supply enough voltage to fire the specific detonator.

An actual real time VI graph is shown in

Figure 40 and produces a voltage (blue) and current (red) plot of the applied shooting power and provides a visual aid for shot detection.
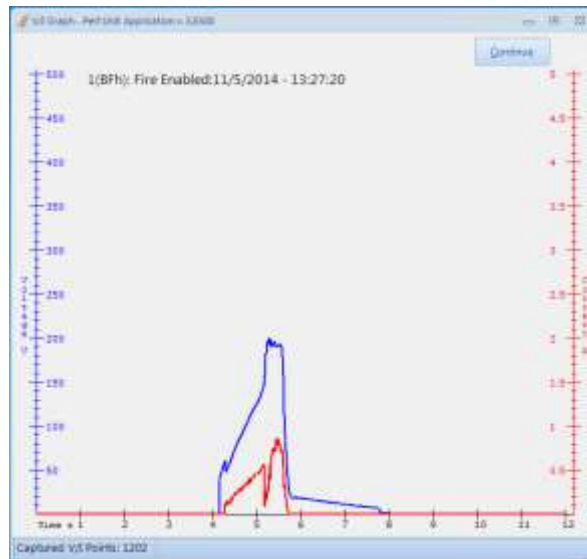
Figure 40

6.4 Gun Skipping Operations

The ControlFire® system allows the user to skip over misfired guns to continue perforating operations with the remaining good gun(s). Gun skip operations can be done from two screens:

1. Skip Button in Gun Control Window
2. Verify Tool String Window
3. Right Click in Gun Control Window

6.4.1 Gun Skip using Switch Skip button in Gun Control Window

Guns may be skipped directly from the Gun Control window for active switches in the following situations:

1. The device connected to a switch in the firing sequence is no longer needed for the operation. An example would be to skip a switch in a plug setting operation because the switch remains intact after the plug setting operation is complete provided no ControlFire® plug cartridge is used in the plug setting operation.

2. A detonator misfires and the switch remains in communication.

Shown in Figure 41 is a resulting gun Check after a Plug has been set. The software will alert user that the plug switch was found.

Figure 41

The following steps will allow skipping of the Plug so that Gun 1 is ready for arming.

1. To skip a switch, Right-click the corresponding icon in the tool string diagram as shown in Figure 42. A window will appear asking user if they wish to skip the bottom most readable switch, in this case plug switch P(E4h). Click "Yes".

Figure 42

2. A Gun Check will automatically occur resulting in the Plug switch being skipped and Gun 1 switch ready to be armed as seen in Figure 43.

Figure 43

6.4.2 Gun Skip using Verify Tool String Window

In the event that communication of a ControlFire® Switch is lost in the middle of the tool string, it will be necessary to initiate the Gun Skip using the **Verify Tool String** button on the Set Up screen in

Figure 28. This event could be caused by broken wires, shorted wires, loss of ground, bad feed-through etc.

The result of a Gun Check with a disconnected switch is shown in Figure 44 as an example (No communication below switch 4(1Ah)). To skip the Plug and Guns1 through 3, the Verify Tool String screen can be used.

Figure 44

The following steps will allow skipping of the Plug and Gun 1 through 3 to fire the top 2 guns:

1. Return to the Setup screen by clicking the ⊠ icon in the upper right corner of the Gun Control screen.
2. From the Setup screen, select the **Verify String** button. The results of this action are seen in Figure 45.
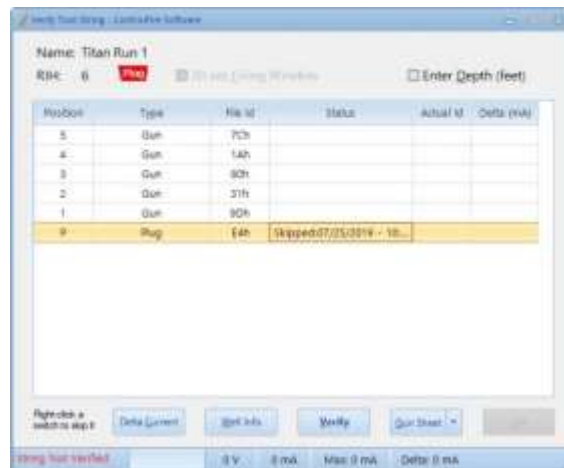
Figure 45

3. Before skipping guns, a Verify should be done to validate the failure. Select the **Verify** button and the results are shown in Figure 46.   As

seen in Figure 44, this operation confirms the same condition as found on the Gun Control Screen.
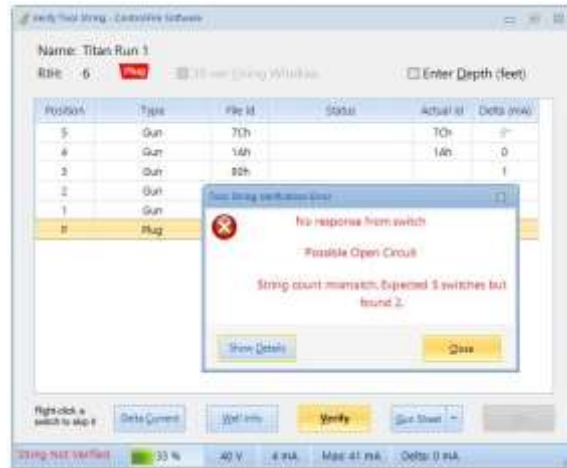
Figure 46

4. The skip operation is accomplished by right clicking in the row of the top must gun to be skipped. This action opens a dropdown window. Select Skip from the dropdown.   For this example, the Plug and Guns 1 through 3 were skipped.   The result is seen in Figure 47.
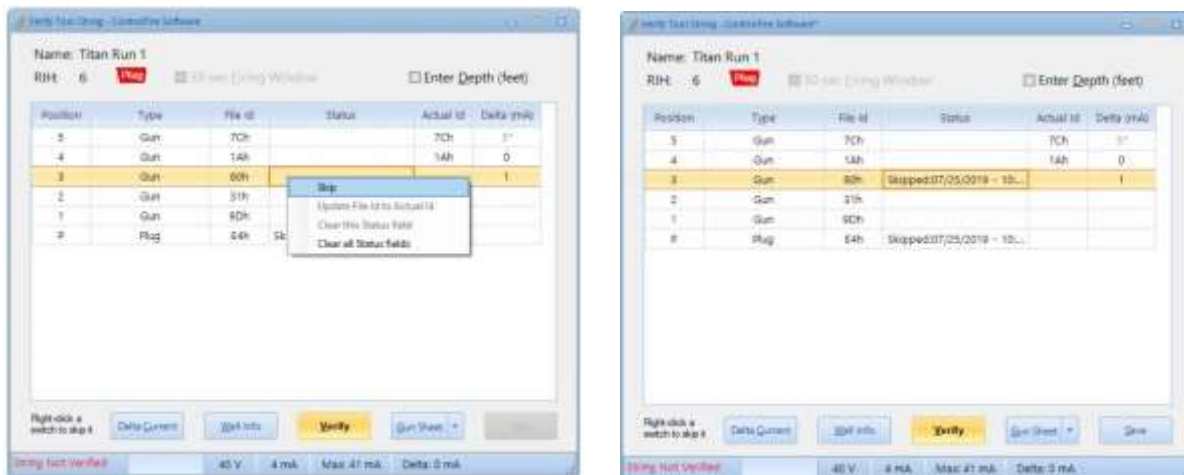
Figure 47

5. Verify the tool string by selecting the **Verify** button. The result of this action is seen on Figure 48.   The tool string is again verified.
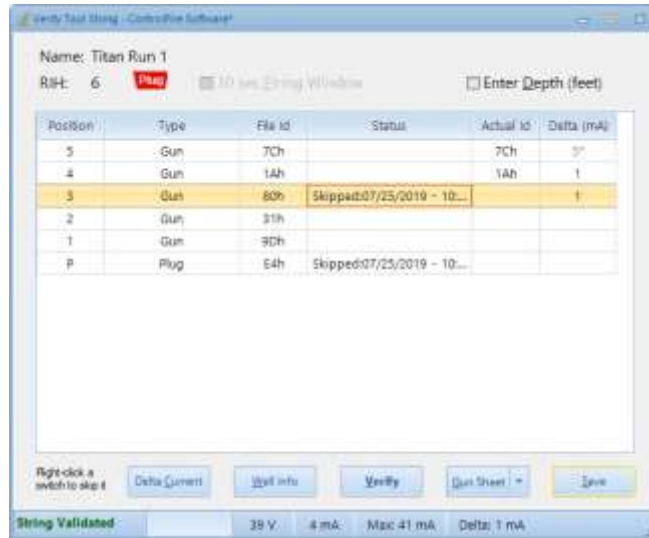
Figure 48

6. Select the **Save** button to return to the Setup screen.
7. From the Setup screen select the Gun Control button to return focus back to the Gun Control screen.
8. Shown in Figure 49 is the result of a successful Gun Check after performing a gun skip on the Plug and the Guns. The tool string can now be used.

Figure 49

6.4.3 Gun Skip using right click in Gun Control Menu

In the event that communication of a ControlFire® Switch is lost in the middle of the tool string, a Gun Skip is initiated by right-clicking the switch icon on the

tool string. This event could be caused by broken wires, shorted wires, loss of ground, bad feed-through etc.

The result of a Gun Check with a disconnected switch 2(31h) after Gun 1 was successfully fired is shown in Figure 50 as an example. User can skip the Open switch following indications given below.

Figure 50

The following steps will allow skipping of Gun 2 such that Guns 3 is ready to arm:

1. Right-click on the disconnected switch 2(31h)) in the tool   diagram and click "Yes" when the Skip Switch and All Below window appears as shown in Figure 51.

Figure 51

2. A Gun Check will automatically occur, resulting in switch 2(31h) skipped and Gun 3 ready to arm as seen in Figure 52.

Figure 52

7.0 Hunting Release Tool - Electronic

When creating a new string with this tool, change the switch type of the tool from "Gun" (the default type) to "Hunting Release Tool - Electronic". The software will automatically adjust the Position to RM1. See Figure 53 below.

Position	Id	Revision	Type
RM1	03h	2.3	Hunting Release Tool - Electronic ▾

Figure 53

The power supply voltage to run the motor can be modified from the Set-Up screen by clicking Menu > Hunting Release Tool - Electronic …
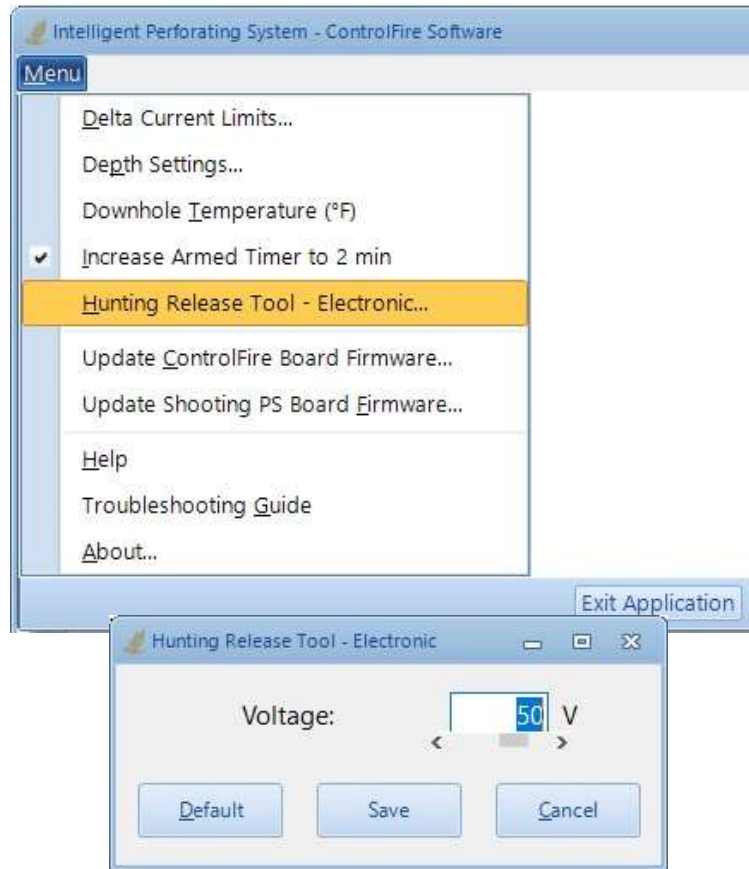
Figure 54

To operate the tool, you must verify the string and then open the Gun Control screen.

7.1 Releasing the Tool

Figure 55 shows a sample string where the top tool is a Hunting Release Tool - Electronic. To release this tool, right click the switch just below it; i.e., switch 5 (7Ch) and skip it. Perform a Gun Check then Arm the tool as you would arm a regular switch. Click Yes when you see the ARM Tool dialog shown in Figure 55.
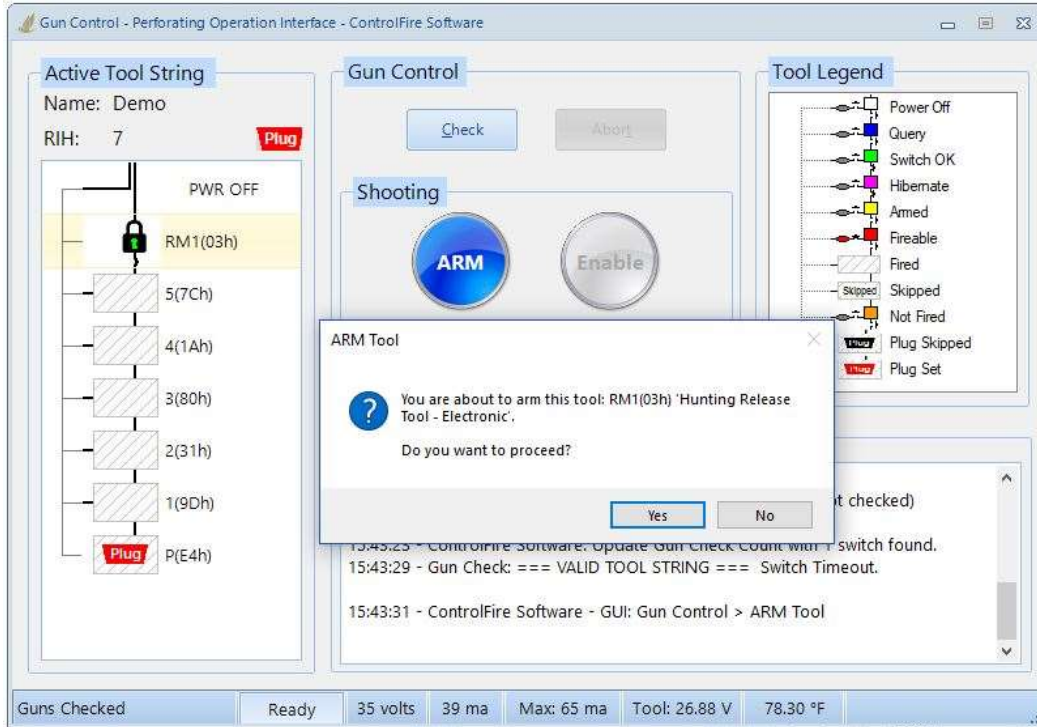
Figure 55

Following a successful Arm sequence, the **Enable Release** button in Gun Control becomes active. Click Enable Release then click Yes to proceed. See Figure 56.

Figure 56

A new window appears showing a real time V/I graph that lets you monitor the operation.
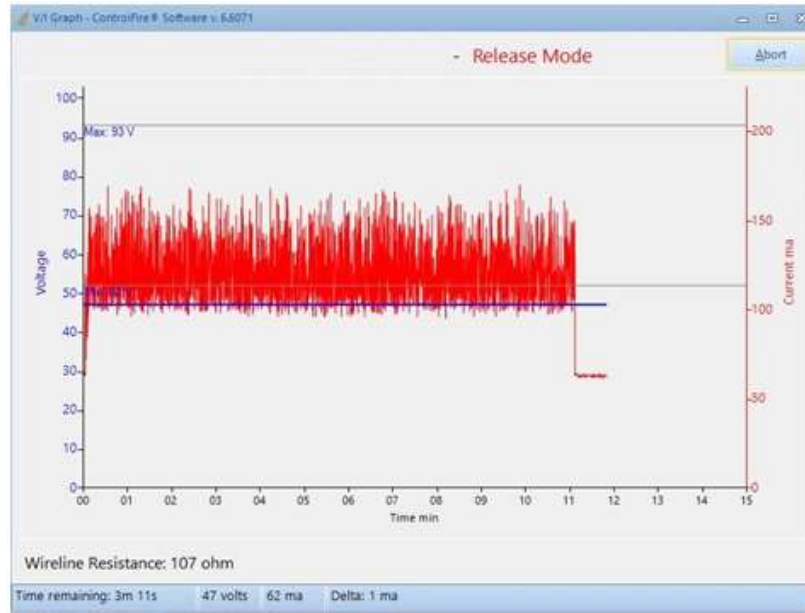
Figure 57

7.2 Attaching the Fishing Neck

Closing the tool is initiated by right-clicking the icon in the Gun Control menu then selecting the Attach fishing neck option, as shown in

Figure 58. Click Yes to start the sequence.
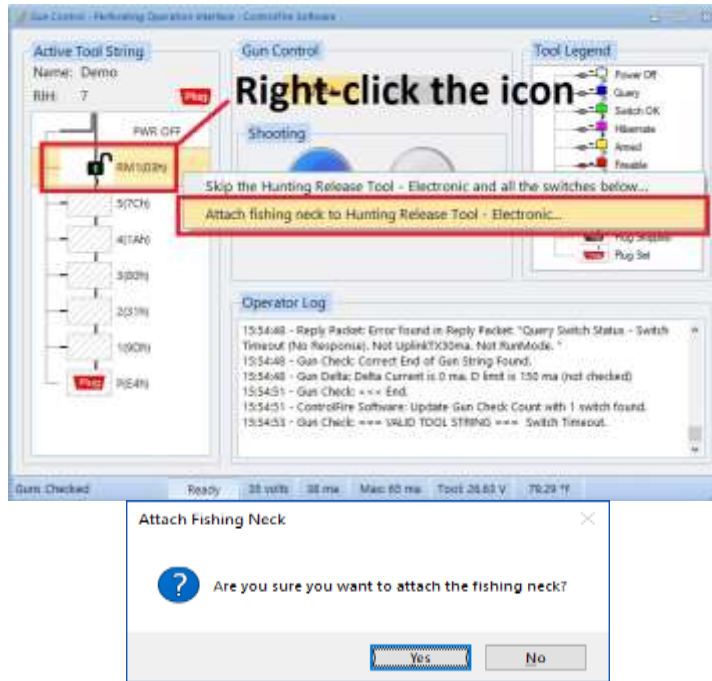
Figure 58

A new window appears showing a real time V/I graph.
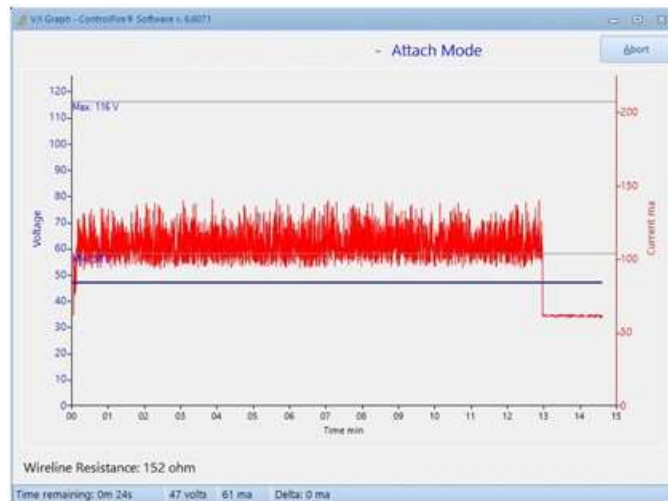
Figure 59

8.0   Shooting PS Board Display

The ControlFire® Software provides users of the Hunting Shooting Power Supply a graphical control that shows voltage and current and provides other monitoring information

about the panel in real time. Start the ControlFire® Software using the steps outlined in Section 6.1 and go to the Set-Up screen.

 shows the Shooting PS Board Display highlighted in red. Note that the graphical control will appear grayed out to users of the ControlFire® Perforating Command and Control Portable Panel to indicate that the feature is not available.
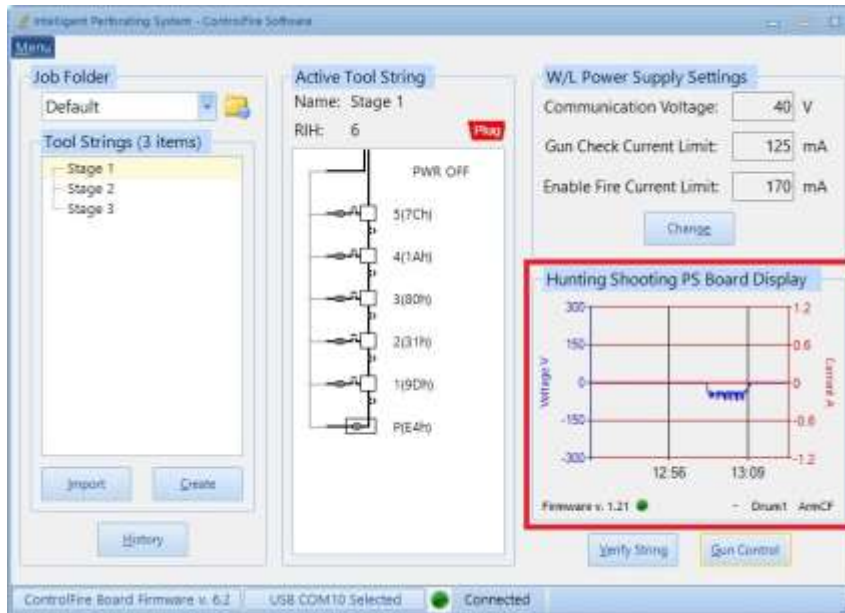
Figure 60

Right-clicking on any area within the Board Display brings up a menu that allows you to control several settings.

Figure 61

Disconnect/Connect – This option tells the software to connect to the Shooting Panel and acquire real-time data or to disconnect from the Shooting Panel.

Set Max Volts… – Sets the maximum voltage value in the plot.

Set Max Amps… – Sets the maximum current value in the plot.

Audio while Shooting… – This option turns the Audio while Shooting feature on or off.

Update Shooting PS Board Firmware … – When selected, the SPS Bootloader dialog is opened for updating the Hunting Shooting Power Supply Board firmware.

Record V/I Data while Shooting… – This feature is especially useful to EBFire users who want an option to store V/I data acquired while shooting. You can plot the data from the History screen. First select the tab called Shooting PS V/I Plots and then click the Folder icon as shown in Figure 62. Note that each file uses a timestamp as the file name so you can identify a shooting event. For instance, the filename "01-27-2017_17-21-01.297.csv" was recorded on January 27, 2017 at 5:21 PM.

Figure 62

The shooting data is recorded when the Fire switch on the ControlFire® Shooting Panel is pressed.

9.0   Cleaning Instructions

There are no user serviceable parts inside the box and the unit does not require any preventive maintenance.

If the unit requires service, it must be returned to Hunting Titan.

The unit may be cleaned using a damp cloth to remove and dust and dirt form the case and the metallic faceplate on the inside.

10.0 VeriFire®

The panel shown in Figure 63 is a VeriFire® ControlFire® Switch Tester. The purpose of the VeriFire® panel is to test and confirm the proper operation of ControlFire® switches contained in an armed or unarmed perforating gun while on surface. This unit is self-contained and equipped with a rechargeable battery, built-in touch keys and a sunlight visible LCD. A USB input is also available that supports saving new tool string files and comparing tool strings to existing stored files. It is highly recommended to check the tool string after gun loading, after gun arming and before running in hole using the VeriFire® panel (PN: 9002-013-210). Refer to the *VeriFire® User Manual* for instructions and safe use.

Figure 63

11.0 ControlFire® Part Numbers

Description	Part Number
ControlFire® Switch System	
V1.8 ControlFire® Switch	9002-013-120-1.8
Command and Control Panel (portable)	9002-013-510
Command and Control Panel (rack mount)	9002-013-550
VeriFire Panel	9002-013-210
Wireline Switch Simulator Panel	9002-013-610
Panel External Test Block	9002-013-320
Cable Kit	9002-013-017
EBFire® Feed Thru	9400-EBTW
EBFire® Feed Thru w/ Ground	9400-EBTW-WG
Retainer Nut – ¼" ID	9400-EBRN-250
Retainer Nut – ¼" ID w/ Ground	9400-EBRN-WG
RF-Safe ControlFire® System (with Austin Powder detonator selection)	
RF-Safe Switch with A-85 Detonator	DETO-CFA-A85-T
RF-Safe Switch with A-96L Detonator	DETO-CFA-A96L-T
RF-Safe Switch with A-105 Detonator	DETO-CFA-A105-T
RF-Safe Switch with A-105-100 Detonator	DETO-CFA-A105100-T
RF-Safe Switch with A-140 Detonator	DETO-CFA-A140-T
RF-Safe Switch with A- 140F Detonator	DETO-CFA-A140F-T
RF-Safe Switch with A- 140S Detonator	DETO-CFA-A140S-T
Shooting Power Supply	
ControlFire Shooting Power Supply (SPS)	9002-013-810-1

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Appendix

A. EBS Down Hole Pin Wire Attachment

Place a length (1/2" or longer) of white silicone tubing (9400-EBWST) on wire to be attached to switch pin

Strip ¾" insulation off wire

Start with wire at 90 degrees to downhole pin

Place bare wire in the groove at end of pin, with the end of the insulation touching the pin.

Wrap bare wire around groove in pin one full turn, crossing standing end (the long body) of wire away from the switch body. (downhole side)

Rotate wire 90 degrees such that the long-insulated body of the wire is pointing straight downhole and the short bare wire is lying along the length of the pin, pointing at the switch body. Make sure that the bare wire is not long enough to reach the body of the switch and cause a short circuit.

Slide a length (1/2" or longer) of white silicone tubing (9400-EBWST) over the pin and wire, pinning the short bare wire down to the pin.

Done properly, this knot gives the smallest possible profile and is very reliable. Pulled to breaking, it typically breaks below the tie point

A touch of grease on the tubing will help the retainer slide over the tubing if needed

Strip wire & make half-hitch at outer groove

Caution, Be sure this end does not touch the body of the switch.

wire

Silicone Tubing ¾ to 1 in. piece. Slides snugly over connector to retain wire.

Tighten half-hitch and secure with the tubing.

wire
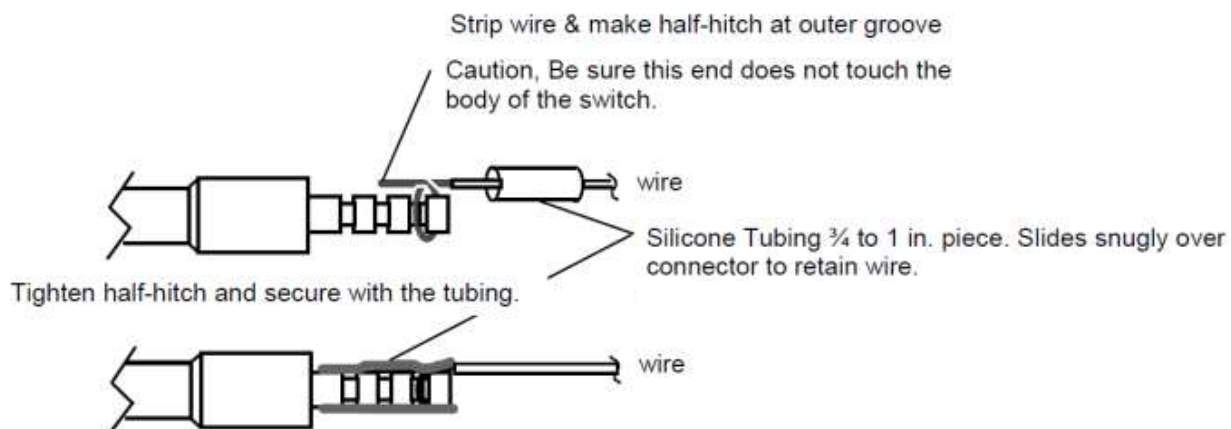
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