



# ControlFire®

Titan Division | Presentation



# Agenda

---



- Selective Switch History
- ControlFire Advanced Switch System
- Applications
- System Overview
- Safety
- Benefits and Features
- Developments
- Track Record
- Specifications
- Part Numbers
- Contact

# Selective Switch History

---



- **1960's Rotary Select-Fire Switch**
  - Negative power to switch
  - Positive power to fire
  - 10-11 guns per run
  - Dart activation to cut thru wires and seal the tandem sub
  - Skip over capability
- **1970's, Dart and Diode Switches**
  - Reduce the maintenance issues associated with Rotary Systems
  - Dart would cut thru wires and provide grounding for the detonator
  - Diodes kept the next gun in the string from firing
  - System had a history of not providing positive grounding resulting in miss-run
  - Miss-run required guns to be retrieved from the well for repair
- **1980's, EBS Pressure Activated Piston and Diode Switch**
  - System uses a pressure activated piston and diodes to provide the connection to the detonator and provide the seal between guns.
  - Switch can be used with gun of any length, size, or shot density
  - Short coming is it is a sequentially operated system, if a failure occurs in the fire sequence the gun must be retrieved from the well for repair

# Optimal Selective Switch Solution

---



- **Added level of Safety** – detonator is never electrically connected until specific software command is sent
- **Non Sequential Operation** – independent switch that does not rely on previous gun success
- **Skip over Capabilities** – provide valuable time savings as perforating operations can continue in the case of a gun misfire
- **Positive Shot Indication** – confirmation of firing, especially in deep, horizontal well conditions
- **User Friendly System** – avoid user positive/negative wiring mistakes leading to off depth perforations
- **Eliminate Premature Activation** – gun flooding causing piston activation leading to off depth perforations
- **Operational Confirmation** – gun string confirmation throughout the descent into the wellbore providing real time confirmation before critical operations commence

ControlFire® is a digital switch technology that utilizes unique logic to enable selective operations.

## Applications

- Selective Perforating
- Single Trip Plug and Perforating Operations
- Pumpdown Perforating
- Tractor Perforating
- Selective Downhole Tool Control



# ControlFire System Overview



The ControlFire system consists of four primary components:

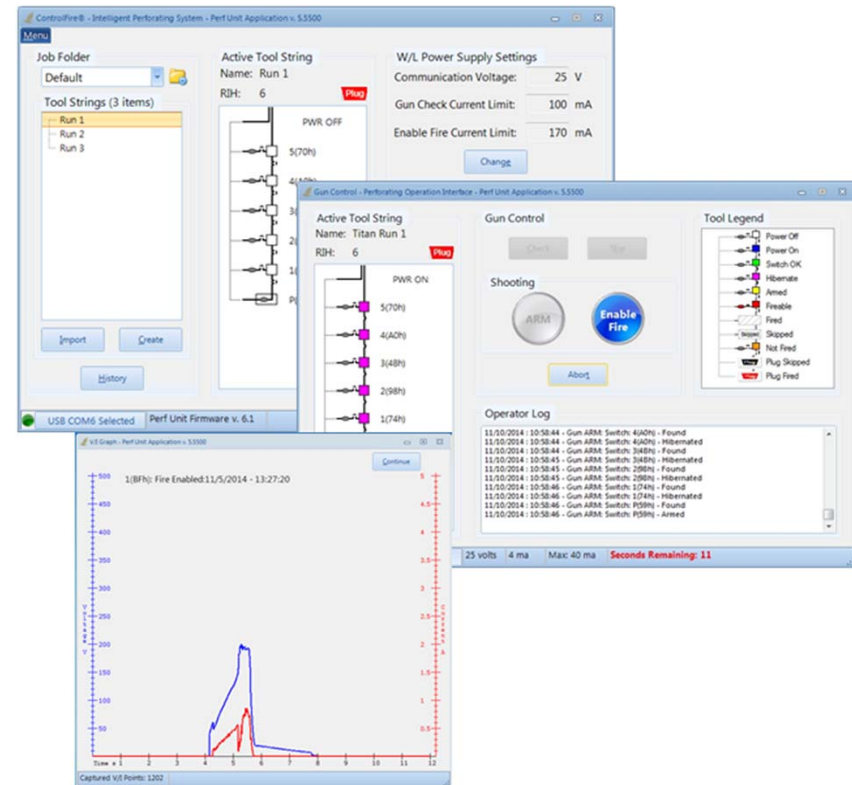
- ControlFire software
- Perforating Command and Control Panel
- ControlFire switch
- VeriFire®



# ControlFire Software



- Switch commands fully automated with software controlled command and control panel
- ControlFire Gun Control operation window
- Graphical display of each switch status
- ControlFire Job Setup window
- User friendly, Graphical User Interface (GUI) software
- Compatible with Windows XP/7



# Perforating Command and Control Panel



- Perforating Command and Control Panel connects the shooting panel and wireline
- Fully automated software driven panel
- Relay disconnect when switch communications are not in progress
- On/Off key for power off confirmation
- Gun Communication Limits:
  - Max Voltage: -600VDC
  - Max Current: 100mA
- Available as a portable box, rack mount or integrated into the Titan Shooting Power Supply rack



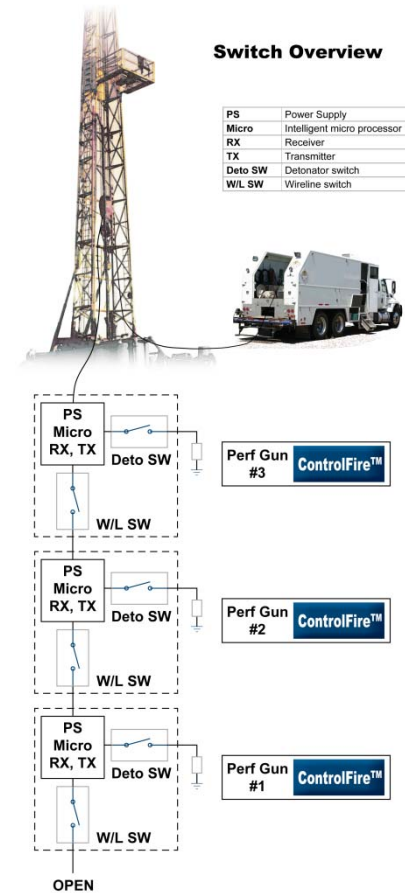


# ControlFire Switch



## ControlFire switch circuit consist of 3 primary components:

- Intelligent Micro Processor – Controls the switch position and communicates state
  - Transmitter
  - Receiver
- Detonator Switch – remains in open state until Enable Fire command is received to connect to the detonator/igniter
- Wireline Switch – remains in open state until communication is establish and command is received to close



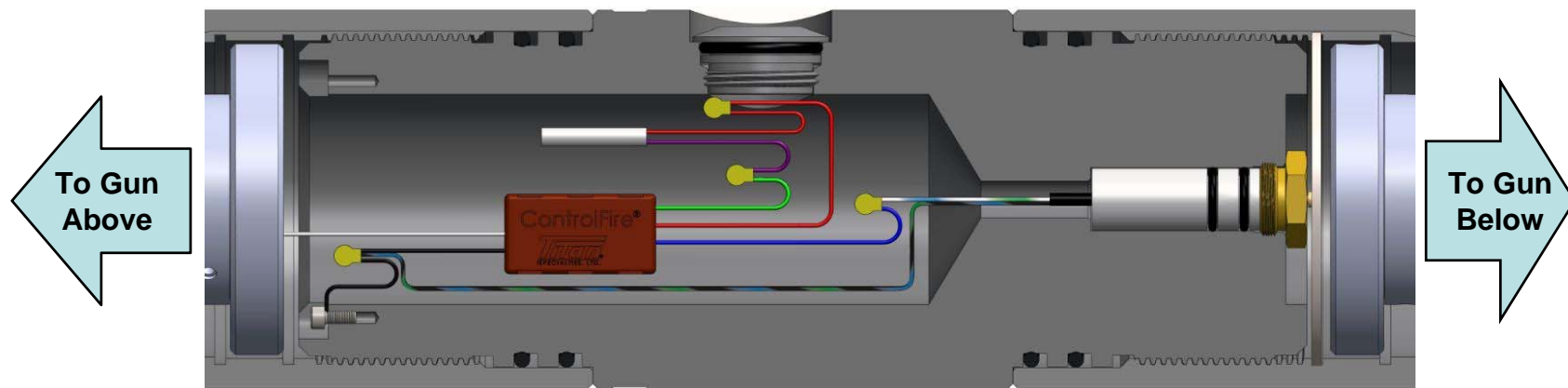
# VeriFire® Switch Tester



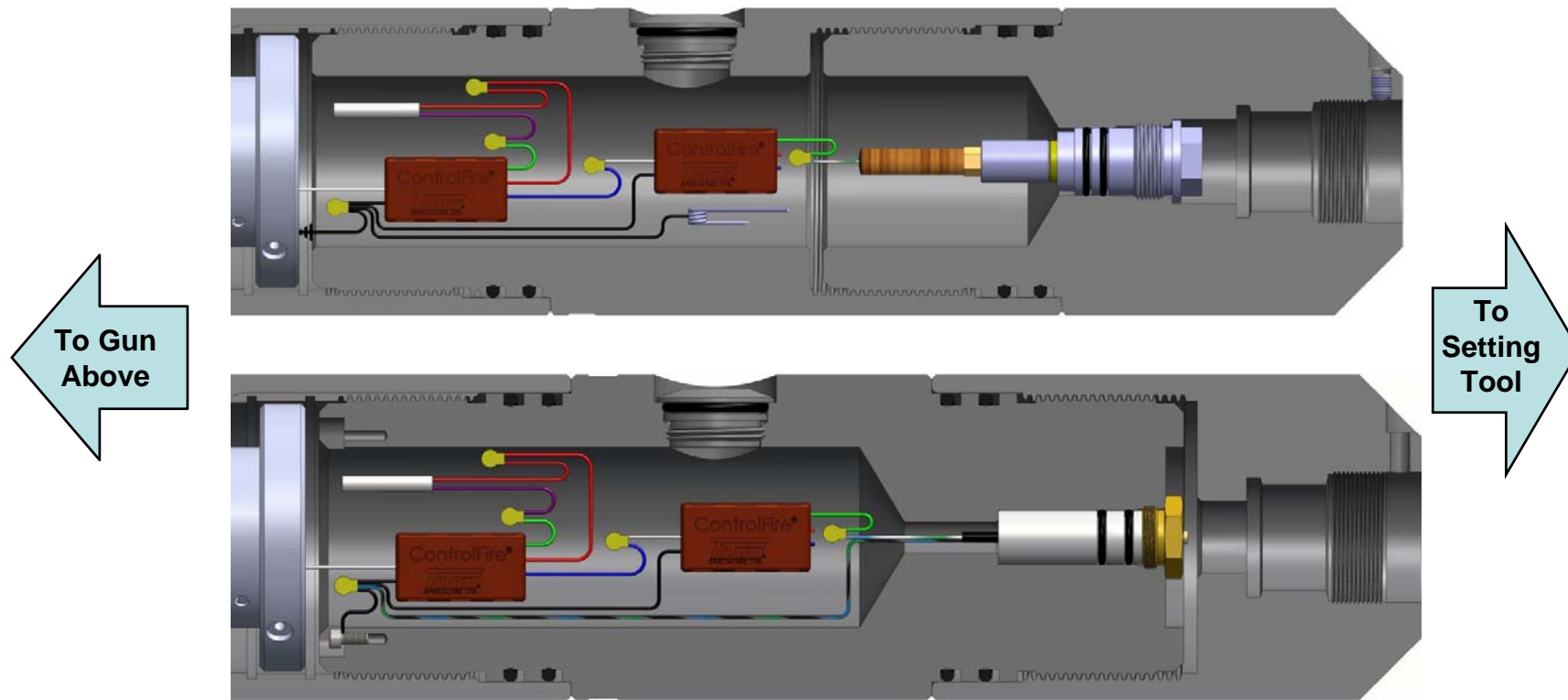
- Portable ControlFire switch tester
- Enables the surface testing of the entire gun string before attaching to the wireline (armed or unarmed)
- Performs switch safety checks and reports failed switch test
- Gun string saved to USB drive for upload into ControlFire software for gun string verification
- User friendly graphical interface
- Improved confidence before running in hole



# ControlFire Gun Wiring



# ControlFire Gun/Plug Shoot Wiring



- ControlFire switches add an additional layer of safety to perforating operations:
  - Each ControlFire switch must be activated with specific software command to establish continuity to the detonator/igniter
  - Aids in the prevention of potential surface detonation due to power remaining on the wireline
  - Automatically aborts the firing sequence and shuts down in the event a circuit fault is detected or an inappropriate command is received
  - Automatically times out, if the user does not perform require action in a given time period

# ControlFire Operational Benefits

---



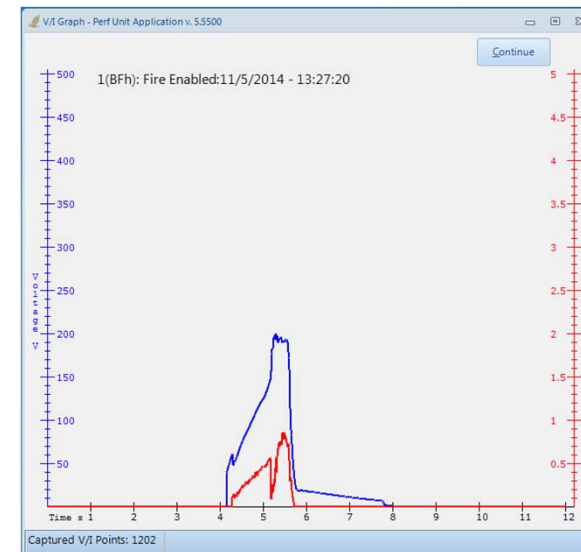
- Unique switch logic enables skip over capabilities providing valuable time savings in the case of misfire
- Eliminates potential off-depth perforating events due to improper mechanical switch wiring and/or premature activation due to gun flooding
- Increased reliability and efficiency of electronic switch over conventional mechanical components
- Switch communication verification prior to, and during, decent into the wellbore
- Improved confidence prior to pumping operations
- Reduced maintenance through fully expendable switch system

# ControlFire Features



- Real time surface shot verification with voltage/current plot
- Shoot 100+ guns in a single run
- Integrates into existing perforating gun carrier systems
- Compatible with resistorized and RF safe detonators
- Complete event log stored on file
- Compatible with long wireline cables
- Can be run in combination with perforating gamma ray tools
- Reliable operations up to 347°F (175° C)
- No need for dedicated computer at surface
- Software compatible with Windows XP/7

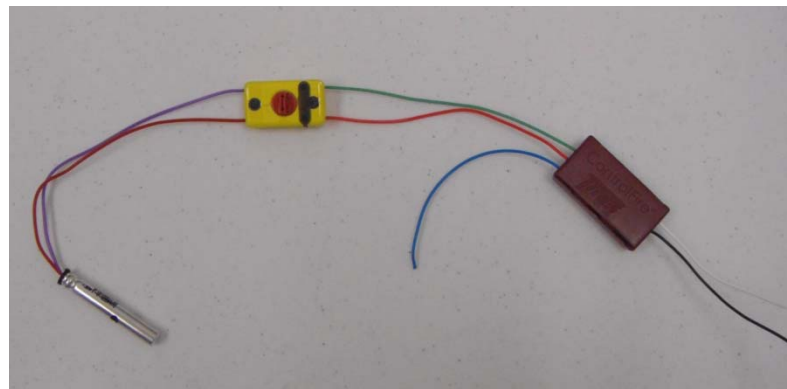
**V/I Plot  
Shot Verification**



## RF-Safe ControlFire Assembly (CFA)

ControlFire technology combined with Austin Powder resistorized detonator for completely RF Safe ControlFire Assembly (CFA)

- Added level of safety
- No need for radio silence prior to arming
- Immune to stray voltage up to 500 VDC
- Immune to human-borne electrostatic discharge energy
- No need for PX-1 or high voltage firing
- Low cost compared to EFI and EBW detonators





# Operational Summary

---



- Four year track record
  - ~750,000 switches run in wells
  - .0005% switch failure rate (better than 1 in 200,000)
- 2014 Track record:
  - ~170,000 switches run in wells including 100,000 RF-Safe Assemblies
- 2015 Track record:
  - ~170,000 switches run in wells including 100,000 RF-Safe Assemblies
- 2016 Track record:
  - ~180,000 switches run in wells including H1 and CFA

# ControlFire Specifications



## 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
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	PX-1/EBW, RED (all versions)

# ControlFire Part Numbers



## Titan Part Numbers

Description	Part Number
<b>ControlFire® Switch System</b>	
ControlFire Switch v1.8	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 w/ Ground	9400-EBTW-WG
EBFire Feed Thru	9400-EBTW
Retainer Nut – ¼” ID w/ Ground	9400-EBRN-WG
Retainer Nut – ¼” ID	9400-EBRN-250
<b>RF-Safe ControlFire® System (with Austin Powder detonator selection)</b>	
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
<b>Titan Shooting Power Supply</b>	
ControlFire Shooting Power Supply	9002-013-810-1

# Contact

---



- Website [www.hunting-intl.com/titan](http://www.hunting-intl.com/titan)
- Sales [sales.titan@hunting-intl.com](mailto:sales.titan@hunting-intl.com)
  - Houston, TX (281) 448-2200
- Corporate Office – Pampa, TX
  - (806) 665-3781
- Technical Support 24/7
  - [support.titan@hunting-intl.com](mailto:support.titan@hunting-intl.com)