



EXPRO

eXequor™ Trigger / SEL-SAS

Agenda

eXequor™ Trigger / SEL-SAS

- Introduction
- Features & Benefits
- Safety
- Qualification
- Specifications
- Detailed Overview
- Surface Equipment
- Track Record



eXequor™ Trigger / SEL-SAS

Introduction

eXequor™ Trigger

Why eXequor™? **Latin for Execute, to carry out an instruction or program**

- Expro's unique, next generation electronic trigger, the eXequor™ trigger, is a **slickline deployed**, memory-based tool capable of **initiating a multitude of explosive and non-explosive devices**
- Designed to activate a device only when a stringent series of pre-programmed parameters and conditions are met ensures the **highest possible degree of safety** and control for a memory-based tool



SEL-SAS

What is SEL-SAS? **Slick-E-Line - Safe Activation System**

- Expro's unique, next generation eXequor™ trigger, configured for **deployment on SEL** to provide a surface commanded Safe Activation System capable of **initiating a multitude of explosive and non-explosive devices**
- Designed to activate a device via a **surface command** only when a stringent series of pre-programmed parameters and conditions are met ensures the **highest possible degree of safety** and control.



- The **single use**, field replaceable electronics modules provide “new tool every time” confidence
- Both systems may be deployed fully **NON-Hazmat with Alkaline battery** pack modules available for temperatures up to 135°C
- **On board memory** logs time, status, pressure, temperature, axial and radial acceleration (tilt and shock) and output voltage for post-job analysis
- May be programmed with logging rates up to **500 samples/sec during activation period** for monitoring of fast pressure transients.

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Features and Benefits

Design features providing multiple benefits

Single-Use control module electronics

- All electronics modules are designed to be replaced after one live run in the field
- Provides “New Tool Every Run” confidence

Modular design

- Designed with sufficient modularity to allow future services to be added with little-or-no impact on the product structure
- Simple configurations for multiple device activation within a single tool

Modular power source

- Designed for activation from either Alkaline or Lithium power sources.
- Alkaline batteries are non-hazardous and can be shipped unrestricted worldwide, unlike their Lithium powered counterparts

No Single-Point failure leading to an unsafe event

- Designed with multiple redundant features in electronics and firmware to ensure that no single-point failure can cause an unsafe event

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Features and Benefits

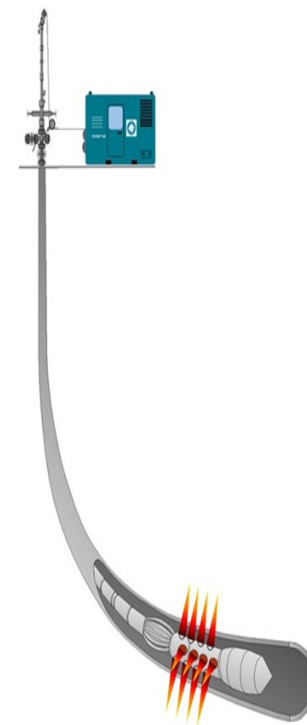
One tool activates many

Device activation capabilities

- 50 Ohm Resistorized Initiators
- Owen RF Safe Green Initiators
- JRC RF Safe Red detonators
- DynaEnergetics RF Safe Coded Initiators
- OM-1 / EBW Initiators
- NEO Products/ Bailer Solenoid
- MCR Thermal Generators
- StimStixx Coil
- Kaseum K-Set PCM

Services include:

- Perforating
- Tubing Punch
- Pipe Cutter
- Plug Setting
- Strip Gun
- String Shot
- Split Shot
- Stim Tube/ Stim Gun
- Cement Bailers
- Matrix Acidizing



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Safety

Safety in design Independently verified

Safety in design includes:

- Electronics hardware protection ensures that no single component failure can result in power being sent to the output.
- Uses of two independent CPUs which continually check each other for correct hardware and firmware functionality.
- Mechanical PT Module for dual, independent, mechanical pressure and temperature barriers used to prevent inadvertent activation at surface.

Safety Reviews include:

- Independent 3rd party FME(C)A certified.
- Radio Frequency (RF) Immunity.
- Compliance with latest API RP-67 recommendations.

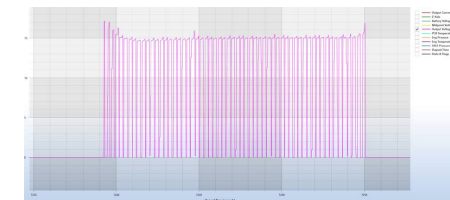
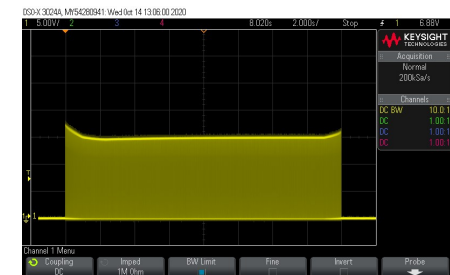


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Qualification

Extensively qualified for environments and multiple services delivery

- Tension testing (20,000lbf)
- Hydrostatic Pressure Testing per ISO13628-6 (1.1 x WP, 16,500psi)
- Temperature Testing per ISO13628-6
 - Thermal Soak Testing (24hrs at 0°C & 24hrs at 160°C)
 - Thermal Cycle Testing (10 cycles, 0°C to 160°C to 0°C)
- Shock and Vibration Testing per ISO13628-6
- Functional Testing (Ambient & Max Temp)
- Dummy Fire Testing (Ambient & Max Temp)
- Drop Survival Test, 30ft Free-Fall per API RP-67
- Live Fire Initiator Testing
- Live Fire System Testing



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Specifications

Environmental

Parameter	Quantity/Description
Maximum Operating Pressure	15,000 psi
Maximum Operating Temperature	160°C (with Lithium Battery Pack) 135°C (with Alkaline Battery Pack)
Minimum Operating Temperature	0 °C
Pressure Switch Operating Range	150psi to 2000psi
Temperature Switch Operating Range	20°C to 150°C

Mechanical

Parameter	Quantity/Description
Maximum Outside Diameter	1-11/16"
Overall Length	Varies with configuration
Tensile Capacity	20,000 lbs
Upper Head Mechanical Connection	15/16"-10 SR PIN or SEL PPU
Upper Head Electrical Connection	N/A or SEL PPU
Lower Head Mechanical Connection	1-3/16"-12 UN
Lower Head Electrical Connection	4mm Pin

Electrical

Parameter	Quantity/Description
Pressure Sensor Accuracy	+/- 0.2% of FS
Pressure Sensor Resolution	<1.0 psi
Temperature Sensor Accuracy	±1.0 °C
Temperature Sensor Resolution	<0.1°C
Operating Voltage	<9V
Operating Current	<20mA
Feed-Through Wires	1
Memory Capacity	≥1, 000,000 data sets
Sample Rate	0.1sec to 1 min (In 0.1 second increments) Fast Sampling Mode: Up to 500 samples/sec
PC Connection	USB compatible
Operational Lifetime	24 hours cumulative at 165 °C

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Detailed Overview

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only

Slickline Battery
Housing Battery Bulkhead
Module



Battery Pack Options :

Lithium – BAT09

74V Alkaline

20V Alkaline



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only

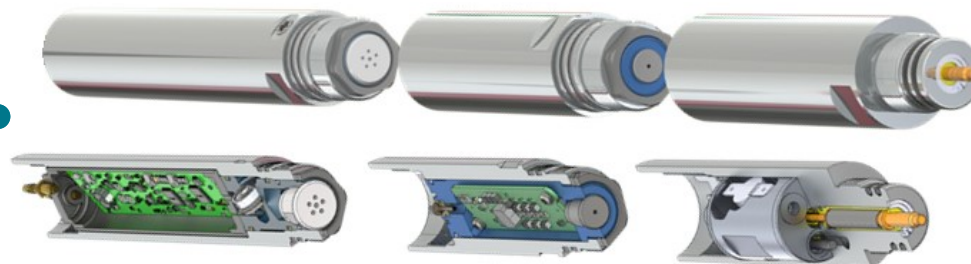


Filter & Battery Chassis Module
and Housing

Control module

Service module
(Optional)

PT Switch module



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Battery Packs

Battery Pack options

Battery module - Alkaline

- Tool will operate up to 135°C from either a 20V alkaline battery pack (Blue) or a 74V alkaline battery pack (Red) depending on the exact voltage/ power requirements of the service being deployed

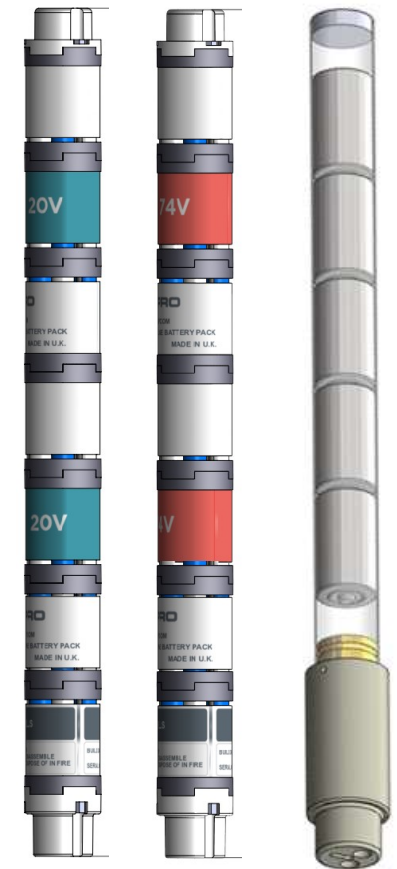
Battery module - Lithium

- Above 135°C Lithium batteries may be used.
- Tool will operate from a BAT09, 19.5V lithium battery pack. Requires Battery Adaptor.

• Optional: 70.2V lithium battery pack may also be used in place of 74V Alkaline. Extended battery housing required

Single use
Alkaline Packs

Single use
Lithium Pack w/
Adaptor



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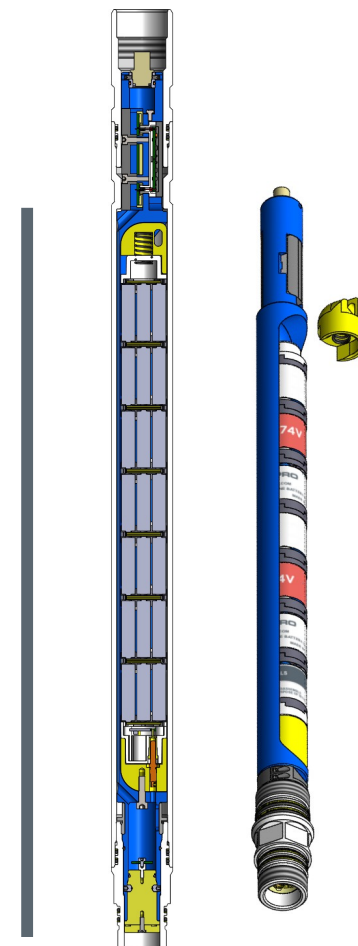
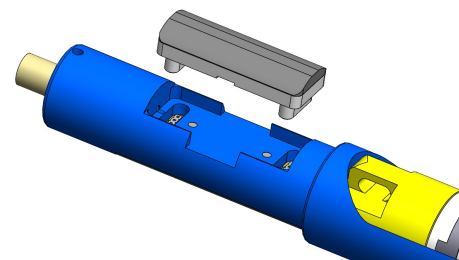
Battery Housing Module – Slick-E-line

Battery Housing and chassis with upper connections to SEL PPU

SEL-SAS only

- The SEL-SAS system battery housing has upper connections to SEL PPU and a chassis used to hold all standard battery pack options.
- The battery chassis provides bypass wiring for the bi-directional communications between the SEL system and the Control Module.

- Single use Isolator/ Filter Module is a simple push fit, field replaceable assembly.



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Battery Housing Module - Slickline

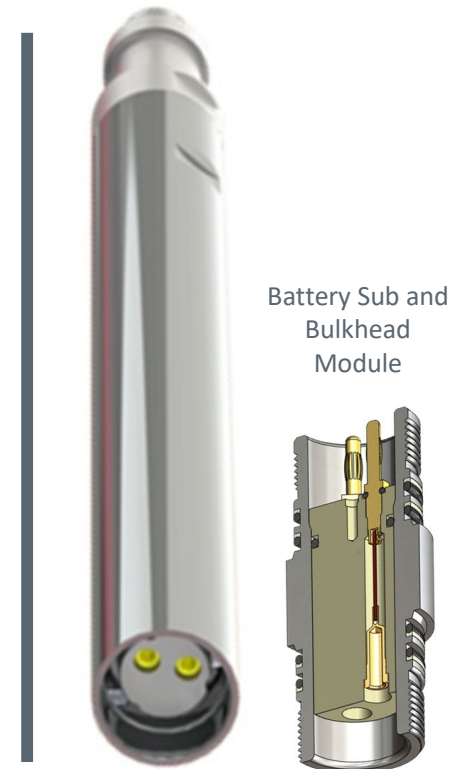
Battery Housing with SR Pin Top Sub and Battery Bulkhead Module

eXequor™ Trigger only

- The slickline battery housing with 15/16" SR pin top sub is used for all standard battery pack options.
- The lower battery module connection incorporates an internal seal to prevent leaks from the battery entering the Control module.
- The Battery Sub is designed to allow installation either way for simplified assembly.
- Re-useable Peek Bulkhead connects the battery to the Control Module.
- Connections are offset to ensure correct orientation of the battery pack every time.

Exception: 18 Cell Lithium pack will require Extended Battery Housing (manufactured on request)

Battery Housing
with
SR Pin Top Sub



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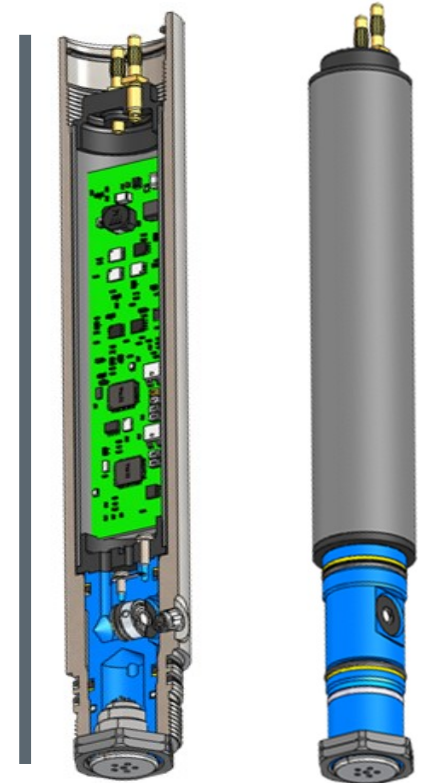
Control Module



Control Module

- Contains all programmable, safety electronics (two independent microprocessors), memory (redundant) and sensors (pressure, temperature and accelerometer).
- Operates from 15Vdc to 80Vdc input voltage to suit all anticipated battery types and inputs.
- The single use cartridges come with a fully calibrated P/T sensor which may be sampled up to 500 reading per second for pressure transient logging.
- Field serviceable and allow the operator easy change out of the Control module cartridge. Simply push fit into lower sub and retain with M25 gland nut.

Single use
Control Module



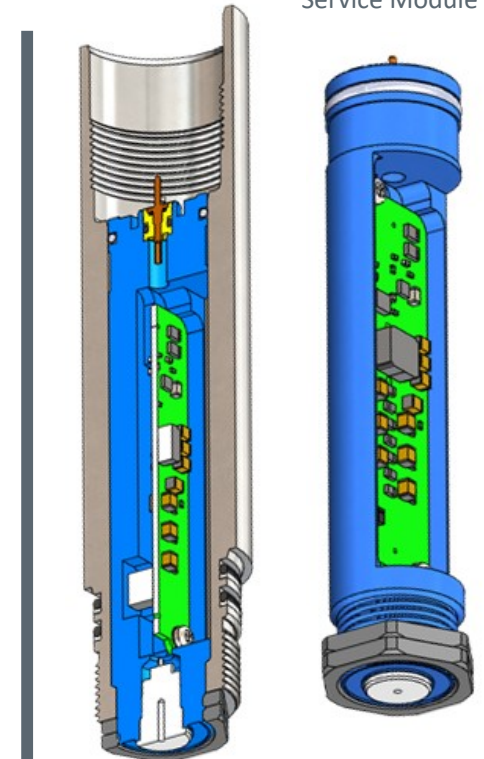
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Service Module(optional)

Optional Service Module

- For some services the devices require specific voltage, current and other power configurations which are not within the range of the control module. These require an additional Service module.
- The Service module converts it's input from the control module to the configured output for the device to be fired.
- Modules are required for:
 - 1) Owen Green & JRC Red Initiators
 - 2) OM-1 / EBW Initiators
- The Service module will be field serviceable and allow the operator easy change out of the service cartridge.

Single use
Service Module

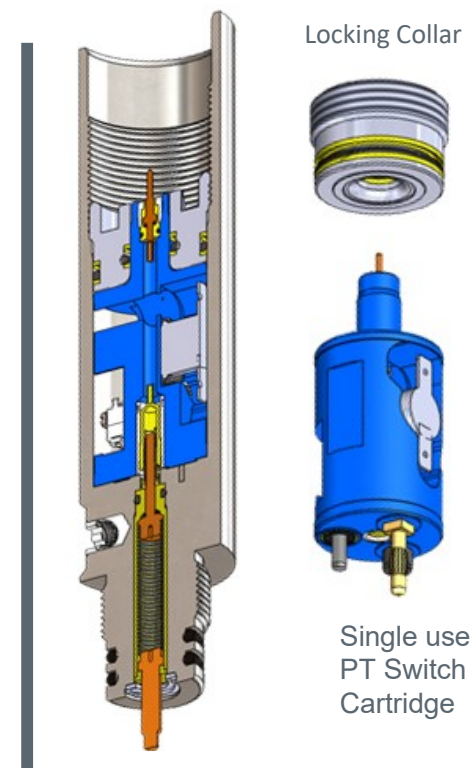


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PT Switch Module

Mechanical Pressure & Temperature Safety Switch Module

- Simple, dual mechanical barrier used to prevent inadvertent activation at surface.
- Uses two switches, one based on a mechanical pressure switch and the other based on a bi-metallic temperature switch.
- Two separate versions are available to meet the low switching point of 150 psi and the 165°C/15,000 psi maximum operating environment.
- Field serviceable and allow the operator easy change out of the PT Switch cartridge.

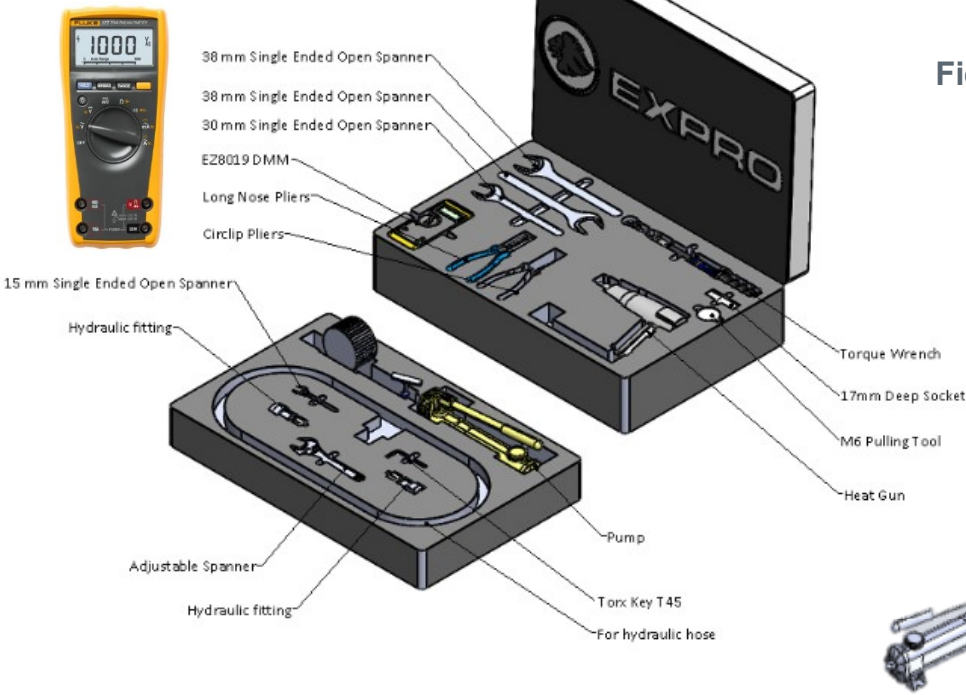


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Surface Equipment



Surface Test Kit



Field Accessory Kit



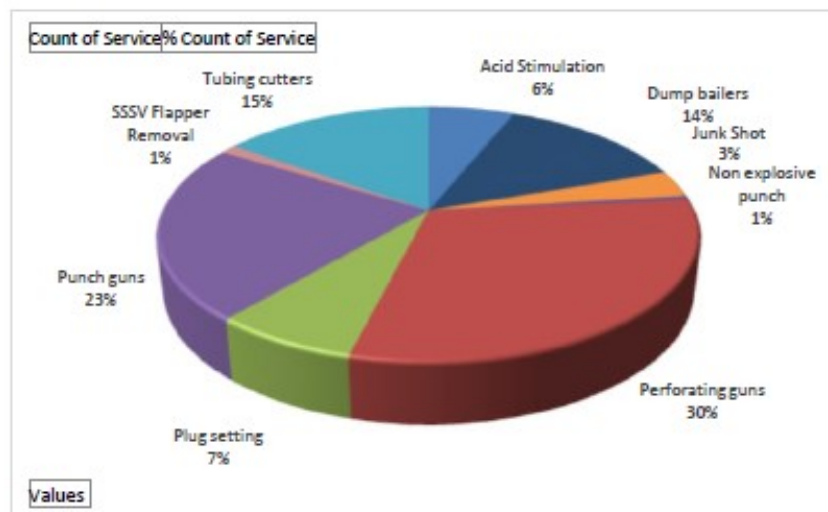
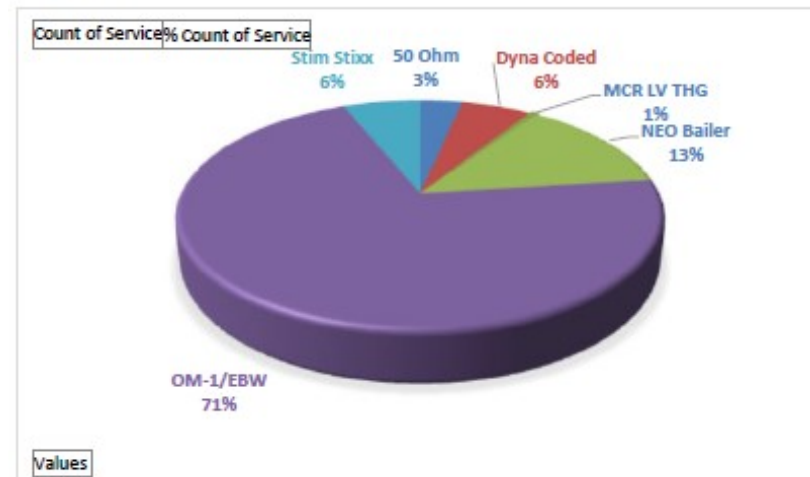
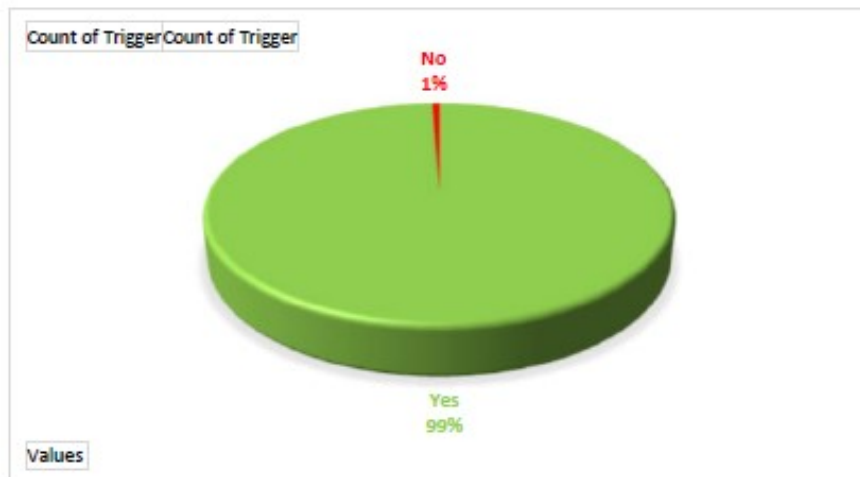
Output Test Box



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Track Record – 200+ runs



Presentation end

Any questions?

Presentation end

Thank you