

# Tempo

## Instrumented docking perforating gun system

### APPLICATIONS

- Hollow carrier perforating gun systems
- Single or selective perforating applications with up to 40 guns in a single descent
- Advanced measurements throughout perforating
- Confirmation of dynamic underbalance and peak shock while perforating

### BENEFITS

- Radio frequency (RF) safe per API RP 67 Group 2 specifications means that wellsite operations can continue uninterrupted during perforating operations in most use cases
- RF-safe capability enables arming in advance to improve operational efficiency and save rig time
- Simplified system design significantly minimizes the potential for human error during assembly to increase reliability and eliminate perforating misfires
- Gun arming time for single and selective guns is greatly reduced in comparison with conventional gun systems
- Shorter gun lengths support deploying extreme-length gun strings
- Integrity of the system can be fully checked at surface and while running in hole
- Precise depth control is ensured by correlation using both gamma ray and casing collar locator (CCL) in standard and chrome tubulars for diameters up to 9½ in
- Fast, accurate pressure measurement verifies the dynamic underbalance for delivering clean perforations

### Plug-in system efficiency paired with full-visibility perforating

The Tempo\* instrumented docking perforating gun system is the industry's first perforating gun system to fully integrate an innovatively designed plug-in gun that significantly simplifies assembly, arming, and firing with real-time advanced downhole measurements for monitoring and confirming operations to mitigate risk while increasing safety, reliability, and efficiency.

### New gun design for improved perforating outcomes

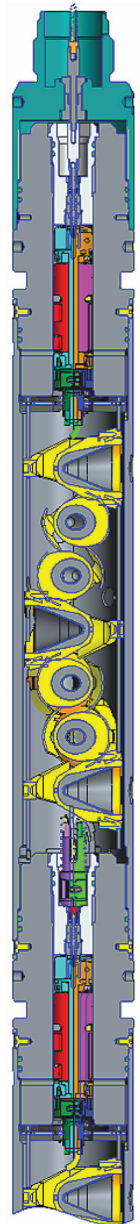
Proprietary docking components are the key element of the Tempo gun system's plug-in design. They simplify assembly and eliminate the major causes of perforating misfires: technique-sensitive crimping and wiring. Gun design is further streamlined with fewer seals and reduced lengths, which in turn maximizes the usable gun string length that can be deployed. Both single and selective guns can be armed offline in significantly less time than required for conventional systems to further improve safety and operational efficiency.

With its engineered controls and integrated measurement capabilities, the Tempo gun system provides the highest level of safety in compliance with API RP 67 Group 2 specifications, with RF protection verified by an independent third-party organization (ITPO). RF silence requirements are eliminated in almost all use cases.

### Integrated measurements for real-time insight

By incorporating advanced perforating measurements capability, the Tempo gun system delivers a complete suite of real-time, simultaneously acquired data that are critical for verifying and optimizing perforating design and execution. The ruggedized measurement technology obtains pressure, temperature, CCL, and optional gamma ray before, during, and after perforating without the need for a shock absorber in the compact design.

For PURE\* clean perforations system, P3\* postperforating treatment, and propellant treatments, the Tempo system measures the dynamic pressure and transmits the data within seconds after firing. The Tempo system also accurately records peak shock to help validate gun shock modeling and optimize future operations.



*Tempo docking perforating gun system.*

## FEATURES

- Compatible with both deep penetrating and big hole shaped charges
- Compatible with PURE clean perforations system and P3 postperforating treatment
- Ruggedized sensor and electronics package to withstand repeated gun shock
- Powered CCL measurement
- Wireline, pumpdown, e-coil, or tractor conveyance
- Applications up to 340 degF

### Tempo System: Docking Perforating Gun Mechanical Specifications

Outside diameter, in	2%	3%, 3½, 3.67	4½, 4¾, 4.72
Shot density (spf), phasing (°)	3, 120; 4, 120; 4, 180; 6, 60	4, 60; 4, 180; 5, 180; 6, 60; 6, 99; 12, 135/45	4, 180; 5, 72; 12, 135/45
Charge	PowerJet Nova* 2906 PowerJet Omega* 2906 PowerJet* 2906 CleanPACK* 38C	PowerJet Nova 4512 PowerJet Nova 3406 PowerJet 3406 PowerFlow* 3412	PowerJet Nova 4505 PowerJet Nova 4512 PowerJet Omega 4505 PowerJet Omega 4512 PowerJet 4505 PowerJet 4512 PowerFlow 4621
Temperature rating, degF	340	340	340
Pressure rating <sup>†</sup> , psi	15,000–25,000	15,000–25,000	8,000–20,000
Min. casing size, in	4½	3¾-in guns: 4½ 3½- and 3.67-in guns: 5	6¾
Max. number of selective guns	40	40	40

<sup>†</sup> Configuration dependent

### Tempo System: Measurement Module Measurement Specifications

Pressure accuracy, psi	±40 at 1 Hz
Temperature accuracy, degF	2 at 1 Hz
Peak shock measurement, g <sub>n</sub>	50,000
Dynamic pressure accuracy, psi	7 s: 40 at up to 10 kHz

### Tempo System: Measurement Module Mechanical Specifications

Outside diameter, in	2%
Temperature rating, degF	350
Pressure rating, psi	20,000
Min. casing size, in	4½
Max. casing size, in	9¾
Length, ft	4.98 Without gamma ray: 3.11
Weight, lbm	80 Without gamma ray: 55
Tension, lbf	40,000
Compression, lbf	21,000

### Exclusion Zone Comparison

Hazard	Conventional 50-ohm Detonator	Tempo Instrumented Docking Gun-System
Stray voltage, V	0.25	40
Typical no-fire voltage, V	10	600
Emergency shutdown (ESD) protection, kV	25	2
RF exclusion zone <sup>†</sup>		
Small transmitters, ft	30	0 <sup>‡</sup>
Medium transmitters, ft	30	4
Large transmitters, ft	5,280	Offshore: 40 Land: 200

<sup>†</sup> Small transmitters (handheld radios, cellular phones, Bluetooth, wifi, driving monitors, etc.): ≤5 W. Medium transmitters (truck and marine radios): >5 and <200 W. Large transmitters (TV and radio transmission towers and marine radar systems:) ≥200 W.

<sup>‡</sup> Although no RF hazard exists, it is not recommended to have any components with a lithium battery immediately next to a perforating gun in consideration of lithium battery fire hazards.



Advanced perforating measurement module with gamma ray for the Tempo system.

[slb.com/tempo](http://slb.com/tempo)

# Schlumberger