

## Symphony live downhole reservoir testing

For real-time control and actionable decisions

### Applications

- Downhole reservoir testing
- Deviated and deepwater wells
- Exploration and appraisal testing
- HPHT and hostile environments
- Completion operations

### How it improves reservoir testing

Symphony\* live downhole reservoir testing is a comprehensive testing solution configurable to your testing objectives. It enables you to measure pressure, position and selectively activate perforating guns, control dual-valve operation, obtain representative reservoir fluid samples, and enable zonal selective flow in your reservoir—all in a single run. United by powerful Muzic\* wireless telemetry, Symphony testing provides real-time verification of operations so you can rapidly adjust as conditions change to acquire the optimal amount of representative data from every reservoir test.

### Benefits

- Digital workflows that unlock new capabilities
- Minimized cost during testing through validation of objectives to enable ending the well test early
- Minimized operating time by using acoustic commands to operate tools
- Consistent and reliable communication in challenging environments where pressure transmissibility is difficult

- Enhanced safety through acoustic signal activation of the tubing-conveyed perforating (TCP) guns
- Contextual insights connecting data through the cloud to take informed decisions
- Increased reliability from bidirectional communication during tool operations
- Single-trip efficiency enabling selective multizone testing
- Personnel-on-board optimization through combined digital workflows
- Condensed string design
- Reduced operating pressures
- Elimination of the use of nitrogen for control of well integrity
- No drill collars or slip joints
- Multicycle flexibility
- Fewer seals and connections
- Premium connections

### Features

- Retention of rupture disc operation of tools as a contingency
- Optional pressure pulse activation of TCP firing system as a contingency
- Maintenance of high data transmission density across packers, screens, valves, jet pumps, and gravel packs, with an extensive track record
- Achievement of well test objectives with real-time data validation
- Real-time, accurate bottomhole pressure data acquisition at a high scanning rate
- Constant communication with the gauges throughout the flow period of the test
- Acquisition of critical downhole data for pressure transient analysis
- Wireless-operation reservoir testing toolstring and confirmation of command execution
- High-resolution quartz gauge measurements



*Symphony live downhole reservoir testing comprises a complete portfolio of technologies that can be configured to meet any well test requirements.*

# Symphony

## What it replaces

The Symphony testing string offers multiple advantages over conventional string configurations, including bidirectional communication, selective multizone perforating, real-time test design modification and control, selective contaminant-free representative reservoir sampling, and elimination of a wireline correlation run.

## Position wireless correlation tool

The Position tool wirelessly provides real-time depth correlation to a radioactive marker placed on the casing or to a natural formation gamma ray signature. Continuous real-time gamma ray and pressure measurements are used to position the perforating guns at the target interval with an accuracy of 1 ft [0.3 m]. A photomultiplier tube (PMT) sensor provides fast response and high signal-to-noise ratio for the gamma ray count. This correlation capability eliminates a separate intervention run to obtain a wireline gamma ray and casing correlation log for depth correlation to save rig time, reduce the number of personnel at the wellsite, and enhance safety.

## Connect wireless selective electronic firing head

The Connect firing head is used to acoustically activate the perforating guns, unlike conventional technology that requires pressure pulse commands generated from high overpressure or mechanical movement to activate. Not only does using acoustic signals enable achieving optimal underbalance conditions before perforating, but it also significantly increases the reliability and safety of perforating operations in combination with the firing head's field-proven sensors, battery power, microprocessors, and control switches. The system's flexibility enables incorporating multiple Connect firing heads in a single run and initiating them independently for commingled or selective multizone reservoir testing.

Activation of the Connect electronic firing head by the acoustic signal is reported to surface to confirm gun initiation. For contingency operations, standard fluid pulses can also be used to initiate the guns. The pressure transducer provides measurements to the electronics cartridge. When a firing command is registered, the initiator module triggers the guns.

## Measure wireless quartz gauge

Measure wireless quartz gauges are seamlessly integrated in the Symphony testing toolstring to provide real-time pressure measurements that enable seeing beyond the near-wellbore area. This wealth of information makes it possible to identify reservoir features in detail and detect seemingly minor pressure fluctuations that can have a significant affect on field development plans. The entire Symphony testing toolstring is monitored by the Measure gauges during testing, and each gauge can be independently interrogated for pressure or temperature data in either real-time or historical mode.

These gauges are powered by long-life proprietary batteries for reliable continuous acquisition of the high-quality measurements and incorporate a durable all-ceramic multichip module (MCM), securely housed in a welded steel housing to prevent contamination and safeguard the data.

## Control wireless dual valve

The Control wireless dual valve provides independent dual-valve operation controlled and verified via wireless bidirectional communication. Not only are the circulating and test valves of the Control dual valve operated independently, but multiple Control wireless dual valves can be run in a single Symphony testing string for extended operations or selective multizone testing, with each tool independently operated. The Control dual-valve hydraulic design is insensitive to pressure fluctuations and mud debris, which makes it the ideal tool in previously untestable environments, such as shallow wells or heavy muds, with control maintained going in and coming out of the well at any depth. This rugged operational flexibility is enhanced through redundancy of the wireless communication with contingency capabilities for low-pressure command sequences and mechanical override while eliminating the use of nitrogen for tool operation.

## Sample wireless selective sampling system

The Sample system obtains contamination-free, representative reservoir fluid samples and can accommodate up to eight INCONEL® samplers that can be activated at any time during the flow period. Each sampler has a small independent nitrogen gas charge to ensure that once a sampler self-closes downhole, the individual samples remain in single phase, at or above reservoir pressure. An optional Dursan® nonreactive sample chamber ensures that H<sub>2</sub>S, mercaptans, and trace elements are retained by the Sample system even at low concentration to deliver the most representative reservoir fluid samples.

The Sample wireless selective sampling system replaces pressure-activated rupture disc systems that require a large pressure window, which limits the choice of sample locations and restricts what type of fluid samples can be taken. A contingency pressure backup option ensures operational flexibility and control of sample collection with confidence.

## Select wireless isolation valve

The Select wireless isolation valve enables real-time zonal selective flow to allow single-trip selective multizone reservoir testing when it is operated below the Isolate wireless high-integrity reservoir test isolation system in the Symphony testing toolstring. Other typical operations with the Select isolation valve are commingled flow and vertical interference testing. All valve operations are confirmed to surface in real time with measured positive feedback. The sleeve's robust, highly reliable performance is enhanced through immunity to downhole pressure and temperature fluctuations and elimination of the use of nitrogen.

## What else I should know

The fully customizable Symphony string design is optimized for risk mitigation through review with technical and domain experts at the Operational Control Center. These experts monitor each test in real time and guide you every step of the way to help you meet test objectives. The logistics team ensures that your equipment arrives on time, even to the most remote locations, thanks to Schlumberger's global logistics network.

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