

## FEATURES

- High-temperature electronics for demanding downhole applications
- Quartz pressure and temperature sensor
- Configurations rated for operating pressures up to 30,000 psi
- Pressure-testable, dual metal-to-metal sealing system
- Reduced-outside-diameter gauge configuration
- Multidrop capability using a single tubing-encased conductor
- Flow-measurement capability for selected applications
- Hermetically sealed, electron-beam-welded construction
- Application-specific integrated circuit technology
- FMJ connections rated for working pressures up to 30,000 psi
- Fault-protection capabilities

## BENEFITS

- Helps limit the effect of an individual gauge failure on the remaining system string
- Provides production-status data throughout the life of the asset
- Supplies information to support well-placement decisions
- Provides downhole data to support timely operational adjustments
- Supplies data for evaluating and refining reservoir models
- Measures toolhead voltage and gauge current to support diagnostics
- Supports integration and monitoring of interval control valves equipped with position sensors
- Provides continuous pressure and temperature data without routine well intervention

## INTELLIGENT COMPLETIONS | PERMANENT MONITORING

# DataSphere® ROC-X permanent downhole gauges

Real-time monitoring of downhole conditions

## Overview

Part of the DataSphere® permanent monitoring suite, ROC-X permanent downhole gauges provide real-time pressure and temperature data to support production and reservoir-management decisions throughout the life of the well. The gauges use an industry-standard resonating quartz crystal sensor and build on Halliburton ROC™ permanent downhole gauge technology. ROC-X gauges support single-zone and multizone monitoring applications.

ROC-X gauges incorporate fault-protection capabilities and provide a direct connection for interval control valve position sensors. Standard gauge configurations and dual, triple, and quadruple splitter-block assemblies are available to support multidrop installations.

ROC permanent downhole gauge systems have been installed as standalone systems and as components of SmartWell® intelligent completion systems in locations worldwide. The ROC-X gauge builds on this established technology platform with additional monitoring and diagnostic capabilities.

## Applications

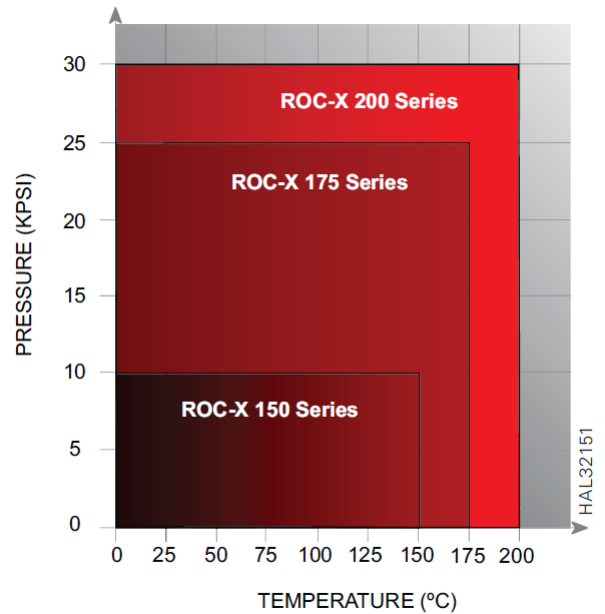
ROC-X permanent downhole gauges can be deployed in the following applications:

- Life-of-well production monitoring
- Life-of-field reservoir monitoring
- SmartWell® intelligent completion system optimization
- Artificial-lift optimization



## ROC-X gauge configurations

- Quartz transducer and hybrid electronic technology
- Operating-temperature rating up to 200°C
- Multidrop capability for up to nine dual-sensor gauges with as much as 30,000 ft of downhole cable
- Dual-sensor feedthrough capability
- Design improvements to support shock and vibration performance
- Slimline configuration with a 0.75-in. outside diameter
- Direct connection for interval control valve position sensors
- Mechanical footprint compatible with ROC gauge configurations
- Compatibility with the current-generation ROC gauge mandrel



ROC-X gauge environmental chart

## Mechanical configuration

The ROC-X gauge mechanical configuration includes connections manufactured from high-performance, corrosion-resistant alloys that are specified as NACE compliant.

## FMJ cable termination

The FMJ cable termination incorporates a pressure-testable, dual metal-to-metal ferrule seal arrangement. The design helps isolate the downhole cable's outer metal sheath from well fluids. It builds on FMJ connector technology used in Halliburton intelligent completion systems.

## Testing and quality verification

The complete ROC-X gauge assembly, including the sensor and electronic boards, undergoes an independent calibration check at a Halliburton calibration facility. A calibration certificate is supplied with each gauge before installation.

New gauge designs undergo a Highly Accelerated Life Test program. The program applies controlled environmental stresses to evaluate performance against defined criteria for thermal shock, mechanical shock, vibration, and thermal aging.

During manufacturing, each gauge also undergoes Environmental Stress Screening to help identify functional defects before wellsite installation.

ROC-X gauges undergo pressure testing at elevated temperatures as part of factory acceptance testing.

## ROC-X gauge family- temperature performance

| DESCRIPTION                    | SPECIFICATION |
|--------------------------------|---------------|
| Accuracy (°C)                  | 0.5           |
| Typical accuracy (°C)          | 0.15          |
| Achievable resolution (°C/sec) | < 0.005       |
| Repeatability (°C)             | < 0.01        |
| Drift at 177°C (°C/year)       | < 0.1         |

## ROC™ gauge family - pressure performance specifications

| Pressure range (psi/bar)                           | 0 to 10,000 /0 to 690 | 0 to 16,000 /0 to 1,100 | 0 to 20,000 /0 to 1,380 | 0 to 25,000 /0 to 1,725 | 0 to 30,000 /0 to 2,070 |
|----------------------------------------------------|-----------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Accuracy (% FS)                                    | 0.015                 | 0.02                    | 0.02                    | 0.02                    | 0.025                   |
| Typical Accuracy (% FS)                            | 0.012                 | 0.015                   | 0.015                   | 0.015                   | 0.015                   |
| Achievable resolution (psi/sec)                    | < 0.006               | < 0.008                 | < 0.008                 | < 0.010                 | < 0.010                 |
| Repeatability (% FS)                               | < 0.01                | < 0.01                  | < 0.01                  | < 0.01                  | < 0.01                  |
| Response time to FS step (for 99.5% FS)            | < 1 sec               | < 1 sec                 | < 1 sec                 | < 1 sec                 | < 1 sec                 |
| Acceleration sensitivity (psi/g – any axis)        | < 0.02                | < 0.02                  | < 0.02                  | < 0.02                  | < 0.02                  |
| Drift at 14 psi and 25°C (% FS/year)               | Negligible            | Negligible              | Negligible              | Negligible              | Negligible              |
| Drift at max. pressure and temperature (% FS/year) | 0.02                  | 0.02                    | 0.02                    | 0.02                    | 0.025                   |

## ROC™ gauge specifications

| CONFIGURATIONS                                                 | ROC-150 | ROC-175 |     |     |     |                                                                                               | ROC-200 |     |     |
|----------------------------------------------------------------|---------|---------|-----|-----|-----|-----------------------------------------------------------------------------------------------|---------|-----|-----|
|                                                                | 10K     | 16K     | 20K | 25K | 30K |                                                                                               | 20K     | 25K | 30K |
| Single pressure/ temperature sensor                            | ✓       | ✓       | ✓   | ✓   | ✓   |  HAL32155 | ✓       | ✓   |     |
| Single pressure/ temperature sensor + feedthrough              | ✓       | ✓       | ✓   | ✓   | ✓   |  HAL32156 | ✓       | ✓   |     |
| Dual pressure/temperature sensor                               | ✓       | ✓       | ✓   | ✓   | ✓   |  HAL32157 | ✓       | ✓   |     |
| Dual pressure/ temperature sensor + feedthrough                | ✓       | ✓       | ✓   | ✓   | ✓   |  HAL32158 | ✓       | ✓   |     |
| Dual pressure/ temperature sensor fully redundant              | ✓       | ✓       | ✓   | ✓   | ✓   |  HAL32159 | ✓       | ✓   | ✓   |
| Dual pressure/temperature sensor fully redundant + feedthrough | ✓       | ✓       | ✓   | ✓   | ✓   |  HAL32160 | ✓       | ✓   |     |

Special calibration available upon request

For more information, contact your local Halliburton representative or visit us on the web at [www.halliburton.com](http://www.halliburton.com)

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