

## Wireless Fluid Level Monitoring

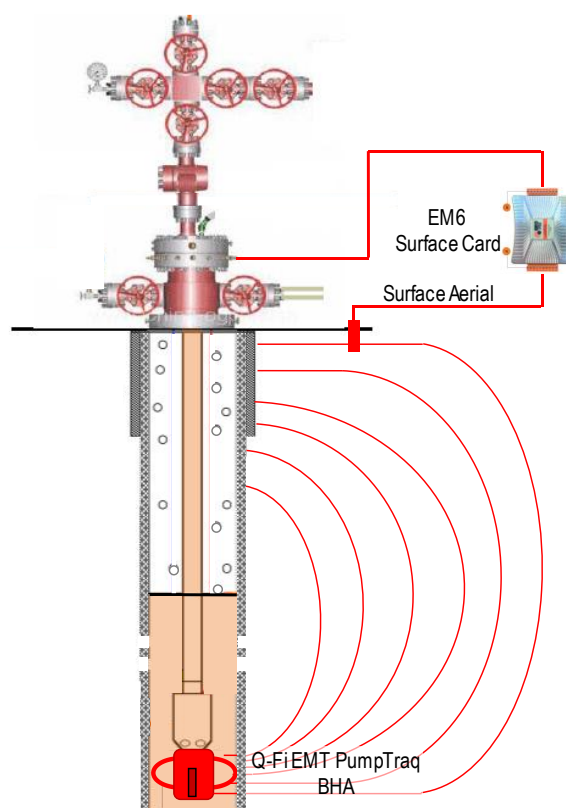
Qteq's Q-Fi EMT PumpTraq system is a breakthrough wireless permanent downhole pressure gauge (PDHG) technology. Wellbore pressure measurements are transmitted through the surrounding overburden, using electromagnetic telemetry (EMT). The EM signal is detected at surface using one or more ground antenna, connected to an EM6 Surface Receiver Card. This card decodes the EM signal and outputs extracted pressure data as either a 4-20mA signal or via a Modbus interface.

In CSG wells the pressure measurements are used to determine water level above the submersible pump inlet. This data is used to safeguard against the pump-off condition, which can cause rapid failure of submersible pumps, resulting in frequent, costly CSG well workovers.

The data is also used to prevent rapid well pumpdown during pump start-up operations, which can induce solids production. Using Q-Fi EMT PumpTraq to maintain the water level a minimum safe distance above the pump inlet also enables CSG operators to accelerate dewatering timeframes.

The signals output by the EM6 Surface Receiver Card can either be interfaced with the CSG operators' infield networked data communications ecosystem or connected directly to a third-party pump controller.

The bottomhole assembly (BHA) is available in several different configurations to suit a wide variety of well and completion designs, submersible pump types,



and to accommodate various well intervention access requirements and workover constraints. The components of Q-Fi systems are standardised across all variants, except for the gauge carrier. Descriptions of the different gauge carrier types are included under 'Key Components'.

Very extensive best practices have also been developed to ensure reliable installation and long-term performance of Q-Fi EMT PumpTraq systems.

## Features and Benefits

- Wireless telemetry eliminates need for tubing encapsulated communication cable (TEC) and cross-coupling protectors (CCP), allowing live CSG well workover operations.
- Eliminating need for TEC and CCPs enables PCP completions to be deployed more rapidly, saving rig time, and reduces amount of top-up fluid required during conventional workovers.
- Removal of TEC eliminates associated failure modes, thereby improving overall system reliability.
- Eliminating TEC and CCPs reduces HSE risks (no pinch points, no exclusion zones, no lifting ops.).
- Use of QEMT-A or QEMT-B Gauge Carriers enable the pressure sensor to be positioned below the PCP, enabling annulus water level to be set closer to the pump intake.
- Customisable, pressure-dependent, smart sampling optimises multi-year battery life.
- Carbon footprint is greatly reduced, as almost all components are recyclable, with Qteq handling reverse logistics.

## Applications

- Optimise CSG dewatering strategies.
- Prevent pump-off.
- Prevent rapid pumpdown.
- Monitor pressure transients during planned and unplanned shutdowns.

## Key Components

### QEMT-A Gauge Carrier

TSS 000045

The EMT Pressure Gauge and QBattery Pack are placed in an externally mounted instrument housing, with the eccentric carrier design providing full-bore access. This full-bore access enables QEMT-A Gauge Carriers to be positioned above rod-driven submersible pumps. The carrier can also be positioned below the submersible pump for applications where flow-through access is needed to use the entire completion string for wellbore clean-up (WBCU) operations during well workovers. The gauge carrier comprises an electronically non-conducting sleeve, sandwiched between metal top and bottom end subs, to create an EM antenna with other components of the well completion and casing strings.

### QEMT-Q Gauge Carrier

TSS 000050

The QEMT-Q Gauge Carrier is essentially a shorter, more compact, version of the QEMT-A Gauge Carrier, and is connected directly to an eccentric torque anchor for use below submersible pumps. The full-bore access again facilitates (WBCU) operations during well workovers, while the compact design is also intended to be fully compatible with live well workover operations.

### QEMT-B and -BX Gauge Carriers

TSS 000015

The EMT Pressure Gauge and QBattery Pack are placed in the bore of QEMT-B Gauge Carriers, with the longer BX version accommodating two battery packs to double operating life. The compact, concentric, pocket-less design of both gauge carriers is intended to be fully compatible with live well workover operations, using hydraulic workover units and snubbing techniques. The gauge carriers comprise an electronically non-conducting sleeve, sandwiched between metal top and bottom end subs, to create an EM antenna with other components of the well completion and casing strings. As the design has no through-bore access, QEMT-B and -BX Gauge Carriers can only be positioned below the inlet to submersible pumps.

### QEMT-S Gauge Carrier

TSS 000046

The EMT Pressure Gauge and QBattery Pack are placed in a Q-Fi Slickline Toolstring that is landed in an XN Nipple profile at top of the QEMT-S Gauge Carrier. The Q-Fi Slickline Toolstring, which can be set and retrieved on conventional slickline, consists of an XN Lock Mandrel, Shock Absorber, Q-Fi Instrument Carrier and a Mini-Belly Spring. The QEMT-S Gauge Carrier comprises an electronically non-conducting sleeve, sandwiched between perforated metal top and bottom end subs to create an EM antenna with other components of the well completion and casing strings.

### EMT Pressure Gauge

TSS 000040

The pressure gauge employs a monocrystalline silicon piezo-resistive sensor, with a wheatstone bridge etched into the silicon substrate. This results in excellent long-term stability characteristics and optimises sensor sensitivity. The gauge electronics converts raw pressure measurements into engineering units and converts the measurement into a binary data stream. An on-board EM transmitter modulates an EM signal with this binary value and injects it into the formation surrounding the well using the Q-Fi EMT PumpTraq antenna BHA.

### Completion Contact Spring

TSS 030007

This multi-purpose completion accessory forms part of the EM antenna for guiding propagation of the EM signal into the formation surrounding the well.

### Centralisers

TSS 000030

Qteq's Centralizers are strategically clamped at various locations on the completion string to provide stand-off shock protection for the Q-Fi EMT Gauge Carrier and maximise contact between the Completion Contact Spring and well casing.

### EM6 Surface Receiver Card

TSS 000033

Decodes the digital EM signal transmitted by the downhole Q-Fi EMT Pressure Gauge and detected by surface ground aeriels connected to the EM6 Receiver Card. The extracted pressure data, together with diagnostics and system health data, are output through an RS485 interface using Modbus protocol to the PLC. Pressure data can optionally be output as a 4-20 mA signal.