



Integrated Optical & Electronic Downhole Sensors

Qteq's eLiteTraq combines optical distributed sensing technology, with end-point electronic pressure gauge technology, into a common architecture. This integration of optical and electronic sensor platforms enables eLiteTraq systems to be deployed on a single hybrid optoelectrical tubing encapsulated cable.

This hybrid cable incorporates an electrical wire, single mode (SM) and/or multimode (MM) optical fibres, with number of each fibre type being freely configurable.

At surface, the hybrid cable is sealed in a novel pressure-testable hybrid splitter assembly attached to the wellhead. The electrical wire and optical fibres are terminated into separate conventional electrical and fibre optic wellhead outlets (WHO). These WHOs are mounted on each arm of the hybrid splitter assembly, with each one also being pressure-testable.

The eLiteTraq platform enables FibreTraq distributed

temperature sensing (DTS) and distributed acoustic sensing (DAS) to be combined with either a ResTraq digital pressure gauge, or a PumpTraq analogue pressure gauge. DTS and DAS use MM and SM optical fibres respectively, with an electrical wire used to power the pressure gauge.

The pressure gauge, SM fibre end terminations and MM fibre MiniBend connections are incorporated into a single downhole assembly. This assembly incorporates several pressure test ports to verify seal integrity of the electrical cable head and fibre termination/splice chamber.

The eLiteTraq architecture significantly reduces supply and installation costs, as well as operational complexity, when compared to the conventional practice of installing electronic permanent downhole pressure gauges and optical DAS/DTS on separate cables.

Features and Benefits

- Integrates FibreTraq DTS and/or DAS with a ResTraq digital pressure gauge or PumpTraq analogue pressure gauge, into a single architecture.
- Deployed on a single downhole hybrid optoelectrical cable, accommodating a single copper conductor and one or more SM and/or MM fibres.
- The copper conductor and optical fibres are terminated into a single downhole pressure-testable assembly.
- Novel, pressure-testable wellhead splitter that seal onto the hybrid cable and allows the fibres and copper conductor to be terminated into separate conventional electrical and fibre optic wellhead outlets.
- Use of a single downhole hybrid optoelectrical cable significantly reduces supply and installation costs, as well as operational complexity.

Applications

- All applications listed for FibreTraq – see separate System Specification Sheet SSS 000002.
- All applications listed for ResTraq - see separate System Specification Sheet SSS 000004.
- All applications listed for PumpTraq - see separate System Specification Sheet SSS 000008.

Key Components

Analogue Pressure Gauge

TSS 000002

Employs a monocrystalline silicon piezo-resistive sensor, with a Wheatstone bridge etched into the silicon substrate. This results in excellent measurement repeatability and optimises sensor sensitivity.

Wellhead Outlet (WHO) – Type A-6K & A-3K

TSS 000006

Designed to facilitate cable feed-through and termination of the downhole electrical TEC through the wellhead. The TEC is fed through the tubing hanger, sealed at both top and bottom sides and then wrapped around the neck of the hanger. The TEC is then routed through a port in the spool piece and into the bore of the wellhead flange.

Gauge Interface Card Type A-15

TSS 000007

Intrinsically safe circuits typically require one earthing point or complete isolation. Qteq's galvanic isolator ensures compliance with hazardous area certification requirements whilst replacing Zener barriers, ground loop isolators, DC-DC converters, and eliminates the need for a bonding conductor. This is a cost effective and viable solution for connection of our gauge systems employing single conductor TEC.

Digital Pressure Gauge

TSS 000001

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. Pressure and temperature measurements are transmitted digitally to the Surface Data Acquisition Unit for decoding and archiving.

Wellhead Outlet (WHO) – Type D-10K

TSS 000006

Designed to provide a rugged and safe means to seal onto the electrical wire exiting the Wellhead Hybrid Cable Splitter Assembly and to splice the wire to surface armoured electrical cable through a secondary pressure barrier. This secondary barrier ensures pressure control is maintained in the unlikely event of a breach in the Hybrid Optoelectrical Cable downhole.

Gauge Interface Card – Type D-G6

TSS 000007

Decodes digital signals transmitted by downhole gauges and apply calibrations files to the raw data to compute measured pressure and temperature values in the desired units. The computed values, together with diagnostics and system health data, are output through an RS485 interface using Modbus protocol to the PLC.

Pressure Gauge Protector

TSS 000036

The protector design includes a raised spine (stand-off guard) to accommodate the pressure gauge and Hybrid Cable End Termination Assembly in the hollow underneath. This shields the pressure gauge from potential impact and abrasion damage during installation and retrieval, and during well operations.

Hybrid Cable End Termination Assembly

TSS 010007

Houses SM and MM fibre splices and termination of the electrical wire to the downhole pressure gauge. Pressure sealing of the single-piece housing is achieved through use of pressure-testable cable heads at each end of the assembly that use metal-to-metal primary seals and elastomeric backup seals.

Hybrid Optoelectrical Cable

TSS 010008

Incorporates SM and MM optical fibres to acquire high performance distributed temperature and acoustic measurements from surface to well total depth. The fibres are protected using a fibre-in-metal tube (FIMT) construction. The cable also includes a separated insulated multi-stranded copper wire for transmission of measurements from the downhole pressure gauge to surface. The FIMT and copper wire cable are housed in an outer armoured tube engineered to maintain mechanical, optical and electrical integrity for the life of the well. The armoured cable is protected from damage during deployment by means of a thermoplastic encapsulation that is suited to contend with in-situ chemical and temperature conditions.

Cross Coupling Protectors

TSS 000005

Designed to secure the downhole Hybrid Optoelectrical Cable to the casing, completion tubing or coil tubing, and protect it from damage during deployment and well completion operations across all casing and pipe connections and other external upsets.

Wellhead Hybrid Cable Splitter Assembly

TSS 010009

Provides a means to create a pressure seal onto the Hybrid Optoelectrical Cable at the exit from the wellhead. The insulated copper wire and optical fibres are split out and terminated into separate conventional electrical and fibre optic wellhead outlets (WHO) attached to separate ports in the Splitter body.

Fibre Wellhead Outlet (FWHO) 10K

TSS 010003

Designed to provide a rugged and safe means to seal onto the FIMT exiting the Wellhead Hybrid Cable Splitter Assembly and to splice the FIMT to surface fibre optic cable through a secondary pressure barrier. This secondary barrier ensures pressure control is maintained in the unlikely event of a breach in the FIMT downhole.

DAS and DTS Fibre Interrogator

TSS 010005

Provides the means to sample the downhole fibres, both for temperature and acoustic profiles, with sampling frequency, spatial and signal resolution programmed to customer specific needs and requirements. The Interrogation unit can be installed onsite permanently, or be used to conduct periodic "drive-by" surveys.