Production Monitoring

Production Logging Services

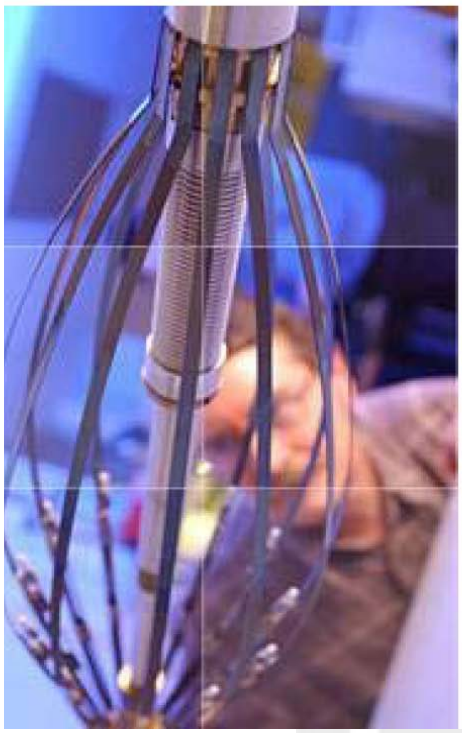
Expro has established itself as the global market leader in cost-effective memory production logging since introducing the first memory production log into the North Sea in 1985.

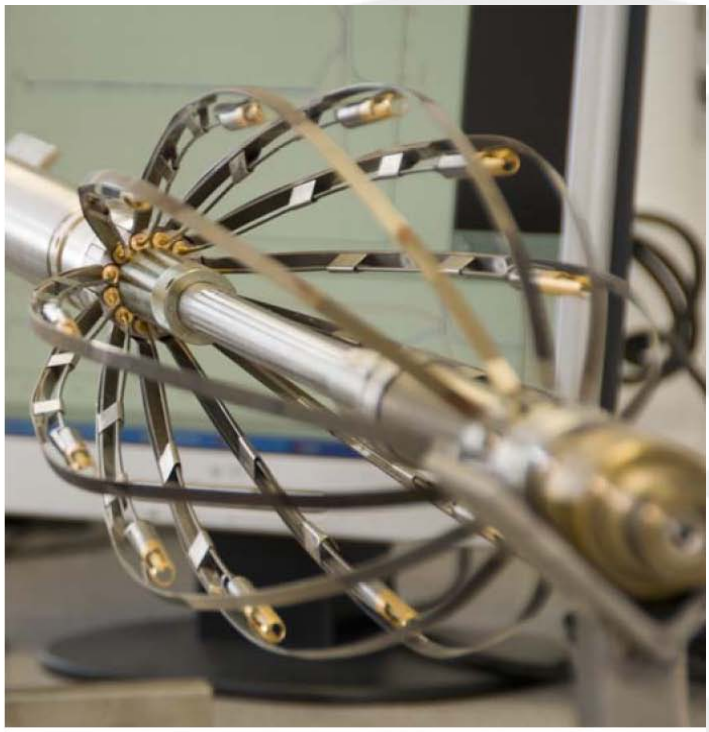
The on-site acquisition services are backed up by data analysis centres, which provide expert analysis to meet customer requirements.

Expro's production logging strings can be deployed via slickline, coil tubing, electric-line or tractor systems in vertical, deviated or horizontal wells.

A wide range of sensors are available, to optimise data recovery depending on the customer needs. Including the latest in multi-sensor array tools for logging deviated multi-phase wells.

All tools are manufactured from corrosion resistant materials with full material traceability.





Production Monitoring

EXPRO
WIRELINE INTERVENTION

In addition to providing the latest in advanced sensors, Expro has also introduced innovative tools to meet changing market needs.

The Intelligent Drift (I-Drift) which was introduced to meet the requirement to provide accurate Hold-Up Depth (HUD) measurement without the requirement for an on-site specialist or a surface depth system.

The Expro Water Investigation Tool (WIT) combines a downhole video camera with logging sensors to give a tool that is designed to pinpoint hydrocarbon and water entry points in high water cut wells

Applications:

- Vertical, deviated or horizontal wells
- Determination of Downhole flowrates
- Layering
- Zonal distribution
- Crossflow and leaks
- Multi-phase flow

Features:

- Expanded memory capacity
- Single pin connections with telemetry
- Quartz pressure gauges
- Flexible
- Combination logging
- On-site reporting

Benefits:

- High resolution
- Portable for fast mobilisation, minimising rental period
- Accurate and reliable
- Can be run on Slickline, Electric-Line and Coiled Tubing
- Enabling rapid decisions

Production Logging Sensors

Ultrawire Memory

Designed to acquire and store data from a string of logging sensors to non-volatile EEPROM memory chips. The UMT can log data from any combination of Ultrawire telemetry tools (i.e. Callipers, Radial Bond Tools and Production Logging tools), MPL can only log Production Logging tools that are compatible with the Ultrawire telemetry bus.

The memory tool is programmed and uploaded through a USB interface using Windows software.

Data is merged with depth recorded from a memory depth logger and processed to output standard LAS files for data analysis.

Technical Specification:

	UMT	MPL
Temperature Rating	350 °F (177 °C)	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)	15000psi (103MPa)
Tool OD	1 11/16” (43mm)	1 11/16” (43mm)
Length	25.66” (652mm)	19.7” (500mm)
Weight	10.6 lbs (4.8Kg)	7.5 lbs (3.4Kg)
Memory Size	128 Mbytes	32 Mbytes
Number of Sensors	62 tools	62 tools
Minimum Sample Rate	20 msecs	100 msecs

Production Logging Sensors

Quartz Pressure / CCL Tool

Combined Quartz Pressure sensor and CCL tool designed to minimise tool length.

Consisting of 16,000 psi rated quartz crystal pressure sensor and a temperature crystal giving a digital output. An integral bellows isolates the crystals from well fluids and a wire mesh filter prevents debris from plugging the sensor port.

CCL sensor consists of a pair of rare earth magnets and single coil is fitted around the Quartz pressure gauge.

Technical Specification

	QPC
Temperature Rating	350 °F (177 °C)
Pressure Rating	15000psi (103MPa) 1
Tool OD	1 1/16” (43mm)
Length	19” (483mm)
Weight	8.8 lbs (4.0Kg)
Pressure Accuracy	± 3.2 psi (22 KPa)
Pressure Resolution	< 0.008 psi (0.055 KPa)
Pressure Response	< 1 sec for 99.5%
Temperature Accuracy	± 0.27 °F (0.15 °C)
Temperature Resolution	< 0.009 °F (0.005 °C)

EXPRO
WIRELINE INTERVENTION

Production Logging Sensors

Gamma Ray

Consisting of a Sodium Iodide scintillating crystal and photomultiplier tube.
The detector is unshielded enabling detection of incident gamma radiation from any direction.

Technical Specification

	PGR
Temperature Rating	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)
Tool OD 1 $^{11}/_{16}$" (43mm)	Length 23.1" (586mm)
Weight	9.4 lbs (4.3Kg)
Material	Corrosion Resistant Throughout
Sensitivity Threshold	20 keV approx.
Nominal Calibration	1 count per API

EXPRO
WIRELINE INTERVENTION

Inline Spinner

Consisting of a symmetrical spinner mounted on two precision roller bearings, with rotation detection being accomplished by a zero drag Hall effect device and dual magnets attached to the spinner shaft completing the circuit.

Technical Specification

	ILS
Temperature Rating	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)
Tool OD	1 11/16" (43mm)
Shroud OD	2 ⅛" (54mm)
Length	17.3" (586mm)
Weight	6.8 lbs (3.1Kg)
Maximum Fluid Velocity	3000 ft/min (15m/sec)
Spinner Threshold	12 ft/min (0.06m/sec)
Output	10 pulses/rev (directional)
Spinner size	1.772" Spinner Pitch 7" (0.029 RPS/Ft/min)

EXPRO
WIRELINE INTERVENTION

Production Logging Sensors

Fluid Density sensors

FDI: Utilising a stainless steel vibrated tuning fork.

FDR: Utilising a low energy Americium 241 radioactive source (5.5 GBq) and a shielded scintillation gamma-ray detector and photomultiplier located at either end of the fixed volume measuring cell.

FDD: Utilising a precision differential pressure transducer with the hydrostatic pressure ports being 2 feet apart.

Technical Specification

	FDI	FDR	FDD
Temperature Rating	350 °F (177 °C)	350 °F (177 °C)	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)	15000psi (103MPa)	15000psi (103MPa)
Tool OD	1 11/16" (43mm)	1 11/16" (43mm)	1 11/16" (43mm)
Length	23" (585mm)	23" (585mm)	51.9" (1318mm)
Weight	7.8 lbs (3.55Kg)	12 lbs (5.4Kg)	22 lbs (10Kg)
Measurement	± 0.03 g/cc	± 0.03 g/cc	± 0.03 g/cc
Accuracy Measurement	0.01 gm/cc	0.01 gm/cc0.001 gm/cc	
Resolution			

EXPRO
WIRELINE INTERVENTION

Production Logging Sensors

Capacitance Temperature Flow

Capacitance: Consisting of a cylindrical insulated rod enclosed by an outer hollow tube with the gap between the rod and inner wall of the tube forming the electrode of the capacitor**.**

Temperature: Utilising a fast response Platinum resistance element housed in an Inconel low mass needle probe.

Flowmeter: Consisting of a zero drag Hall effect device with rotation detection being accomplished using dual magnets attached to the spinner shaft to complete the circuit. Various types and sizes of flow meters can be attached to the CTF to match completion design and anticipated flow rates.

Technical Specification

Pressure Rating	15000psi (103MPa)
Tool OD	1 11/16" (43mm)
Length	18.5" (470mm)
Weight	5.4 lbs (2.45Kg)
Water Holdup Accuracy	1 %
Water Holdup Resolution	± 1 % (Yw < 40%)
Temperature Accuracy	± 1 °F (0.56 °C)
Temperature Resolution	< 0.0055 °F (0.003 °C)
Temperature Response	0.5 seconds
Flow Meter Output	10 pulses/rev (directional)

Production Logging Sensors

CTF Compatible Spinner Specifications

	CFSM	CFJM	CFBM
Spinner Type	Fixed Cage	Jewelled Bearing Fixed Cage	6 arm Fullbore
Temperature Rating	350 °F (177 °C)	350 °F (177 °C)	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)	15000psi (103MPa)	15000psi (103MPa)
Tool OD	1 11/16" (43mm)	1 11/16" (43mm)	1 11/16" (43mm)
Maximum OD	1 11/16" or 2 ⅛"	1 11/16" or 2 ⅛"	4 ½" to 9 ⅝"
Length	8" (203mm)	9" (229mm)	35" (349mm)
Weight	1.7 lbs (0.77Kg)	2.2 lbs(1 Kg)	10 lbs (4.5Kg)
Maximum Fluid			
Velocity	>2500 Ft/min	>4000 ft/min	>1300 ft/min
Spinner Threshold	5 ft/min	1.5 ft/min	1.7 ft/min
			2.6" (4 ½" Casing)
Spinner Size	1.402" (1 11/16" OD) 1.772" (2 ⅛" OD)	1.402" (1 11/16" OD) 1.772" (2 ⅛" OD)	3.15" (5" Casing) 3.3" (5 ½" Casing) 4.24" (7" Casing)
			5.5" (9 ⅝" Casing)
Spinner Pitch	4"	5.6" (1 11/16" OD) 7" (2 ⅛" OD)	4"

Production Logging Sensors

CTF Compatible Spinner Specifications

	PRC001	PRC034	PSC
Centraliser Type	3 arm Roller	4 arm Roller	Bowspring
Temperature Rating	350 °F (177 °C)	350 °F (177 °C)	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)	15000psi (103MPa)	15000psi (103MPa)
Tool OD	1 11/16" (43mm)	1 11/16" (43mm	1 11/16" (43mm
Length	23"" (584mm)	32.25" (819mm)	30.2" (767mm)
Weight	8 lbs (3.6Kg)	12.5 lbs (5.7Kg)	9 lbs (4.1Kg)
Operating			
Diameter	2 7/8" to 9 5/8"	2 7/8" to 9 5/8"	2 7/8" to 9 5/8"
Centralising Force	25 or 40 lbs	110 lbs	20 – 65 lbs

	PRC001	PRC034	PSC
Centraliser Type	3 arm Roller	4 arm Roller	Bowspring
Temperature Rating	350 °F (177 °C)	350 °F (177 °C)	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)	15000psi (103MPa)	15000psi (103MPa)
Tool OD	1 11/16" (43mm)	1 11/16" (43mm	1 11/16" (43mm
Length	23"" (584mm)	32.25" (819mm)	30.2" (767mm)
Weight	8 lbs (3.6Kg)	12.5 lbs (5.7Kg)	9 lbs (4.1Kg)
Operating			
Diameter	2 7/8" to 9 5/8"	2 7/8" to 9 5/8"	2 7/8" to 9 5/8"
Centralising Force	25 or 40 lbs	110 lbs	20 – 65 lbs

	PKJ	PSJ
Temperature Rating	350 °F (177 °C)	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)	15000psi (103MPa)
Tool OD	1 11/16" (43mm)	1 11/16" (43mm)
Length	6.5" (165mm)	10.87" (264mm)
Weight	3.7 lbs (1.7Kg)	6.2 lbs (2.6Kg)
Maximum Tension	15400 lbs	7100 lbs

Production Logging Sensors

PLT Battery Housing

The battery housing contains the lithium battery pack to power the memory tools during the logging survey.

Two sizes are available to accommodate different battery packs, with the 5 cell pack being used for standard Production logging surveys. The 10 cell pack is used were a longer duration is required or a higher current consumption toolstring is utilised (i.e. additional sensors such as array tools or with Calliper tools).

Battery housing has an industry standard sucker rod thread at and fish neck at the top.

Technical Specification

	5 cell Battery Housing	10 cell Battery Housing
Temperature Rating	350 °F (177 °C)	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)	15000psi (103MPa) T
OD 1	1 11/16" (43mm)	1 11/16" (43mm)
Length	16.6 " (421mm)	28" (711mm)
Weight	8 lbs (3.6Kg)	9.7 lbs (4.4Kg)

Production Logging Sensors

Centralisers

Various types of centralisers are available depending on well trajectory with the 4 arm centraliser being better suited for horizontal wells or with array tools that require accurate centralisation in the well.

The 6 arm bowspring centraliser is best suited for Open Hole sections.

Technical Specification

PRC001		PRC034	PSC
Centraliser Type	3 arm Roller	4 arm Roller	Bowspring
Temperature Rating	350 °F (177 °C)	350 °F (177 °C)	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)	15000psi (103MPa)	15000psi (103MPa)
Tool OD	1 11/16" (43mm)	1 11/16" (43mm	1 11/16" (43mm
Length	23"" (584mm)	32.25" (819mm)	30.2" (767mm)
Weight	8 lbs (3.6Kg)	12.5 lbs (5.7Kg)	9 lbs (4.1Kg)
Operating Diameter	2 7/8" to 9 5/8"	2 7/8" to 9 5/8"	2 7/8" to 9 5/8"
Centralising Force	25 or 40 lbs	110 lbs	20 – 65 lbs

EXPRO
WIRELINE INTERVENTION

Production Logging Sensors

Knuckle Joint

The Knuckle Joint has a universal ball joint, which allows a maximum of 10 degrees deflection in any direction.

Swivel Joint

The Swivel Joint is pressure balanced and oil filled to avoid any increase in seal friction at high ambient pressures and temperatures. The top and bottom sub-assemblies are linked by a shaft. This shaft is free to rotate on a set of bearings which accommodate both vertical and lateral forces, minimising rotational resistance.

Technical Specification

Temperature Rating	350 °F (177 °C)	350 °F (177 °C)
Pressure Rating	15000psi (103MPa)	15000psi (103MPa)
Tool OD	1 11/16" (43mm)	1 11/16" (43mm)
Length	6.5" (165mm)	10.87" (264mm)
Weight	3.7 lbs (1.7Kg)	6.2 lbs (2.6Kg)
Maximum Tension	15400 lbs	7100 lbs

Production Logging Sensors

Depth logger

Suitable for logging with either Slickline or Coil Tubing.

Records data from high resolution optical encoder to non-volatile memory and displays on backlit monochrome LCD display..

Intrinsically safe powered by user replaceable internal D cell batteries with.

Uploaded and merged with memory tool data using Windows based software.

Technical Specification

Technical Specification	DTR
Height	3.93” (100mm)
Pressure Rating	9.44” (240mm)
Tool OD	7.48” (190mm)
Length	10.9 lbs (4.95Kg)
Weight	8 MByte
Display	240 x 128 pixels
Internal Power	4 x D size battery
Duration	100+ hours
Memory Size	8 MBytes
Memory Capacity	460 hrs
Environment	IP65
Encoder Interface	Bi-phase, 5-12V and DIN 19234 type
Sample Rate	1 second