

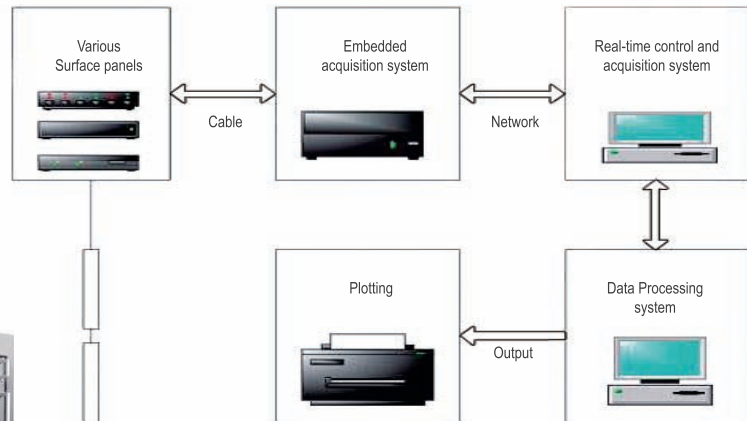
# ELIS-II

## Enhanced Logging Imaging System (II)

Enhanced Logging Imaging System (II) is mainly consisted of powerful computer (EMCU) and a data acquisition and processing unit (EDAU) for real-time acquisition and processing. The Compact PCI (CPCI) bus that is widely used in industry currently are used as its basic structure and data signal processing technology DSP being adopted. For the real-time control, high-performance Power PC single chip microcomputer, and VxWorks software design technology are adopted. The logging platform can provide to our clients with comprehensive logging services.

### Surface System (Hardware):

- (1) Powerful computer system (two computers);
- (2) Embedded data acquisition system;
- (3) Wireline signal processing system;
- (4) Depth processing system and depth interrupt generation/depth display;
- (5) Wireline configuration (Line switch panel);
- (6) Power supply for subsurface tools;
- (7) Perforating system for engineering operation;
- (8) Powerful uninterruptible power supply;
- (9) Color plotter /printer.

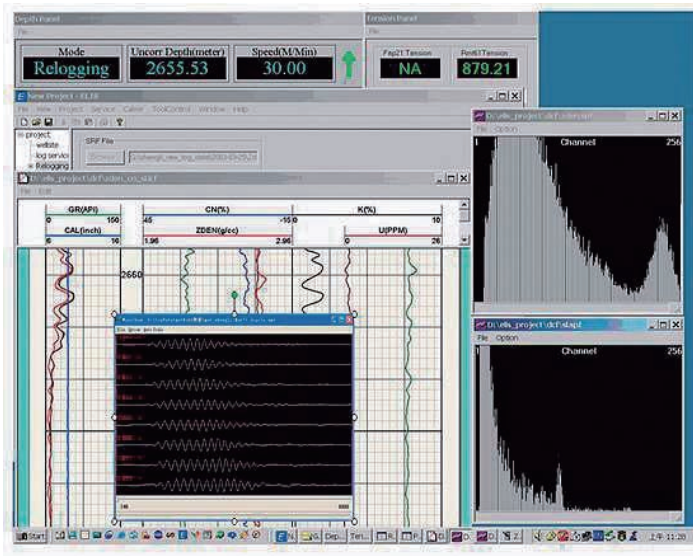


# ELIS-II

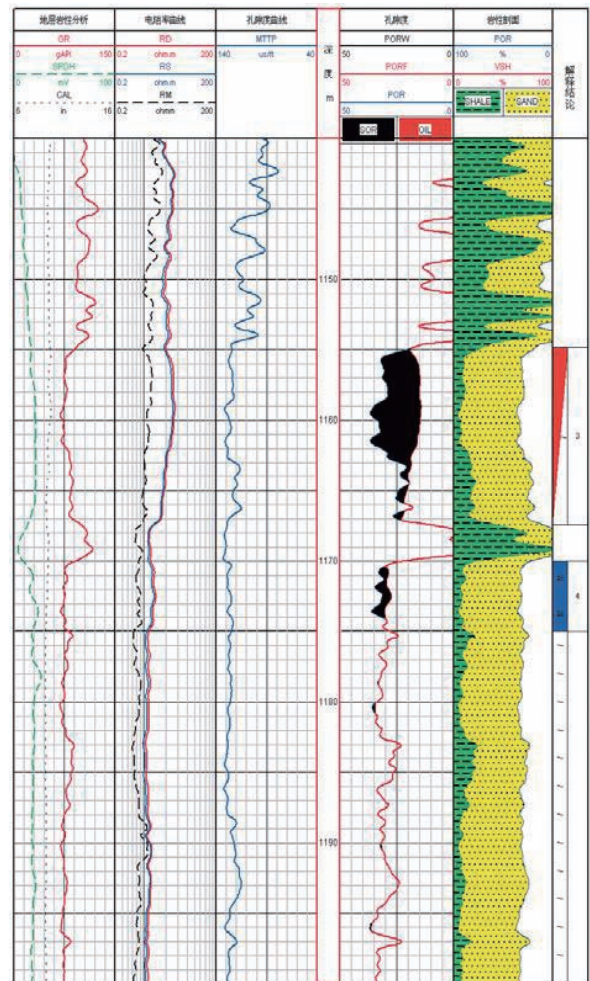
## Surface System (Software):

- (1) Logging data base based on ACCESS data base;
- (2) Real time acquisition and record, processing, display system;
- (3) Operation system based on Windows XP;
- (4) Calibration and verification system;
- (5) Instrument control system;
- (6) Embedded acquisition system;
- (7) Powerful playback and re-log system;
- (8) Logging data processing system;
- (9) FTP utilization.

## Control Window:



## Processed Log:



# ERTT

## Wireline Remote Transmitting Tool

This tool is a data transmission instrument supporting EDIB (ELIS Downhole Instrument Bus) protocol. Its main function is to complete data communication between downhole tool string and surface system. It also has some auxiliary functions, such as cable-head voltage monitor, downhole tool motor control and deal with some analog quantity such as SP, CCL, Cable Head Tension, temperature and Mud Resistance. All EDIB bus tools can be connected to the bottom of ERTT.

### Features:

- Support downhole tools bus protocol EDIB for ELIS system
- high transmission rate
- Three up-hole data transmission channels
- low error rate

### Specifications:

Maximum Temperature:	400°F (204°C ) for 10hrs
Maximum Pressure:	20,000psi (137.9Mpa)
Diameter:	3.63in. (92mm)
Length:	6ft.-3in. (1.895m)
Weight:	143.5lb (65kg)
Wireline Requirement:	7 conductor cable
Operating Power:	180VAC @ 100mA, 60Hz
Coding Mode:	Manchester Code
Cable Transmission rates:	230Kpbs
Minimum borehole diameter:	4.00 in. (101 mm)
Maximum well-logging speed:	200 ft/min (60 m/min)
Cable Head Tension	
Measurement range:	-53379 N (-12,000 lbf) (-5436 kgf) ~ +53779 N (+12000 lbf) (+5346 kgf)
Accuracy:	13.34 N (3 lbf) (1.359 kgf)
Downhole temperature	
Measurement range:	-55°C (-67°F) to +245°C (473°F)
Accuracy:	0.12°C (0.216°F)
Downhole SP	
Measurement range:	-1300 mV to +1300 mV
Accuracy:	0.15 mV
Mud Resistance	
Measurement range:	0.01 ohm-m to 10 ohm-m
Accuracy:	0.00244 ohm-m
Instrument Working Voltage and current:	180 VAC, 100-125 mA



# ESAT

## EDIB Slam Adapter Tool

This instrument is a Slam Adapter for EDIB (ELIS Downhole Instrument Bus), Its main function is to allow un-EDIB instruments to run with the EDIB tools.

### Features:

- Support EDIB bus on top and 28 pin connection tool can be connected to the bottom of tool.
- 11 Analog signal channels (12 bits ADC)
- 5 Pulse counter channels (12bits)

### Specifications:

Maximum Temperature:	350°F (175°C ) for 4 hrs.
Maximum Pressure:	20,000psi (137.9Mpa)
Diameter:	3.38in. (86mm)
Length:	5ft.-10in. (1.778m)
Weight:	112lb (50.8kg)
Wireline Requirement:	7 conductor cable
Operating Power:	180VAC @ 70mA, 60Hz
Maximum logging speed:	180m/min @ 10 samples/m
Minimum borehole diameter:	3.94in. (100mm)

#### Measuring Range and Accuracy of the Pulse Channel

Measurement Range:	0-4,095 pulses per acquisition cycle
Measurement Accuracy:	± 1 count per acquisition cycle

#### Measuring Range and Accuracy of the Analog Channel

General Analog Channel:	A1-A7
Measurement Range:	-24 mv ± 6mv to +4808mv ± 48mv
Measurement Accuracy:	(range -24 mv to 600mv) ± 0.305mv
Repeatability :	(range 600mv to 4808mv) ± 0.305mv
Repeatability:	± 2.44mv

#### Analog Channel A8 (Caliper)

Measurement Range:	-72mv ± 19mv to +14.424v ± 146mv
Measurement Accuracy:	(range-72mv to +1800mv): ± 0.930mv
Repeatability:	± 0.915mv
Measurement Accuracy:	(range1.8v to 14.424v): ± 9.766mv
Repeatability:	± 7.32mv





# ESAT

Analog Channel A9 (Flask Temperature)

Measurement Range:  $-2.4^{\circ}\text{C}$  to  $+480.8^{\circ}\text{C} \pm 16.8^{\circ}\text{C}$   
Measurement Accuracy: (range  $-2.4^{\circ}\text{C}$  to  $+60.0^{\circ}\text{C}$ ):  $\pm 1.53^{\circ}\text{C}$   
Repeatability:  $\pm 1.53^{\circ}\text{C}$   
Measurement Accuracy: (range  $60.0^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ ):  $\pm 1.953^{\circ}\text{C}$   
Repeatability:  $\pm 1.953^{\circ}\text{C}$

The output of the thermal sensor of the vacuum flask is  $10\text{mv}/^{\circ}\text{C}$ .

Analog Channel A10 (Offset of high-gain ADC, gain=16)

Measurement Range:  $-0\text{mv} \pm 6\text{mv}$  to  $+624\text{mv} \pm 6\text{mv}$   
Measurement Accuracy:  $\pm 0.305\text{mv}$   
Repeatability: Analog Channel A10

(offset of low-gain ADC, gain=2)  
Measurement Range:  $-0\text{mv} \pm 48\text{mv}$  to  $+5000\text{mv} \pm 48\text{mv}$   
Measurement Accuracy:  $\pm 2.44\text{mv}$   
Repeatability:  $\pm 2.44\text{mv}$

# ECNT

## Compensated Neutron Logging Tool

The Compensated Neutron tool is the logging tool to determine formation porosity through detecting the neutron passing through the formation. The Compensated Neutron Logging Tool is widely used in the oil and gas exploration .

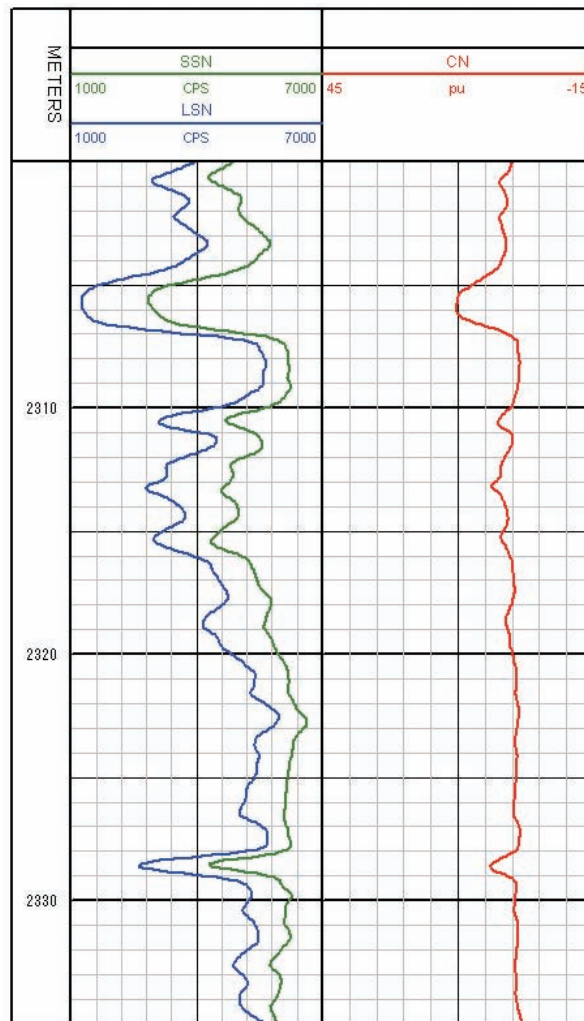
### Specifications:

Maximum Temperature:	400°F (204°C ) for 2 hr. 300°F (150°C ) for 3 hrs.
Maximum Pressure:	20,000psi (137.9Mpa)
Diameter:	3.63in. (92mm)
Length:	7ft.-7.0in. (2.31m)
Weight:	154.2lb (70kg)
Borehole Diameter:	4.75 ~ 24in. (120.7 ~ 609.6mm)
Maximum Logging Speed:	30ft./min (9m/min)
Wireline Requirement:	7 conductor cable
Operating Power:	180VAC @ 70mA, 60Hz
Measuring Range:	-3 ~ 100 Limestone Porosity Unit (p.u.)
Measuring Accuracy:	± 0.5 p.u. below 7 p.u. porosity ± 7% of recorded value above 7 p.u. porosity
Repeatability:	± 1.5 p.u. @ 15% limestone porosity
Depth of Investigation:	12in. (304.8mm), estimated for 7.88in. (200mm) water-filled borehole with nominal 15% porosity formation
Measure Point	
Short Spacing:	2 ft. - 1.0 in. (635.0 mm)
Long Spacing:	2 ft. - 6.0 in. (762.0 mm) (both measurements are from the bottom of tool)
Vertical Resolution:	26in. (660.4mm)
Detector Type:	Proportional counter
Neutron Source Type:	AmBe-18 Curie
Telemetry:	EDIB (ELIS Downhole Instrument Bus)
Maximum Tensile Force:	122,000 lbs
Maximum Compression Force:	78,000 lbs



# ECNT

Log:



# EZDT

## Litho-Density Logging Tool

This tool is used to determine formation photoelectric absorption index and density through detecting the Gamma ray from the source inside tool passing through the formation. It is widely used in oil/gas exploration today.

### Components:

Electronics(EA)+Mandrel(MA)

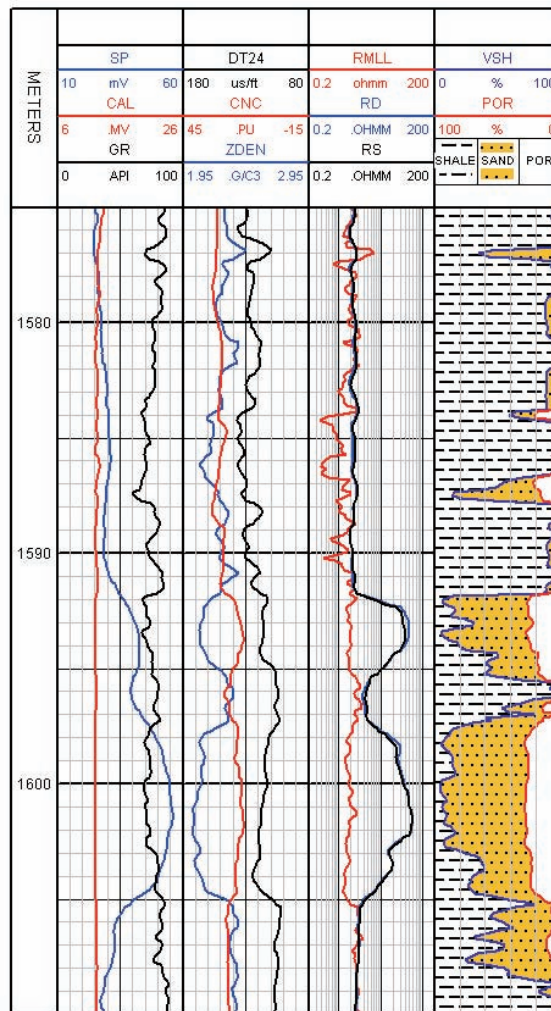
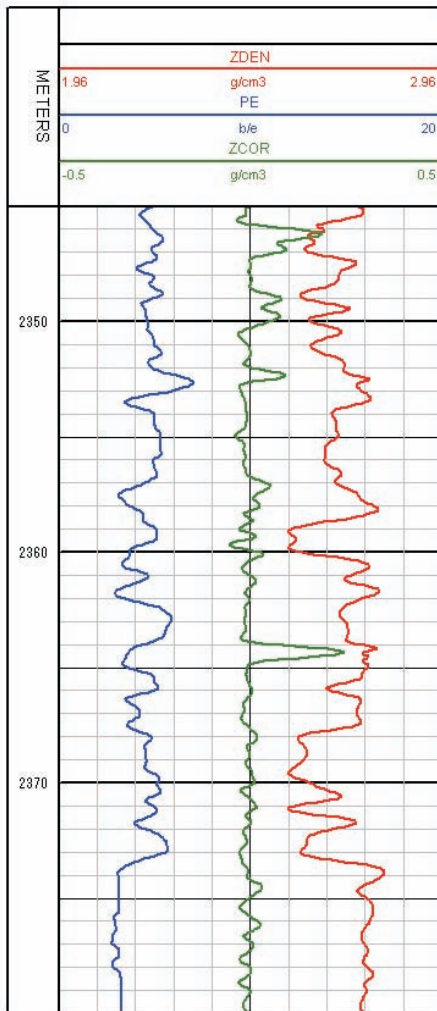
Specifications:

Maximum Temperature:	350°F (177°C ) for 0.5 hrs. 300°F (150°C ) for 3 hrs.
Maximum pressure:	20,000psi (137.9Mpa)
Diameter:	4.88in. (123.8mm)
Length:	18ft.-6.50in. (5,652mm)
Weight:	470lb (213.2kg)
Borehole Diameter:	6.0in. (152.4mm) ~ 22.0in. (558.8mm)
Maximum Logging Speed:	30ft./min (9m/min)
Wireline Requirement:	7 conductor cable
Operating Power:	180VAC @ 120mA, 60Hz
Motoring Voltage & Current:	110VDC @ 200mA
Measuring Range:	1.3 ~ 3.0 g/cc
Repeatability:	Den: $\pm 0.015$ gm/cc (from 2 to 3 gm/cc) Pe: $\pm 0.2$ B/e (absence of mud cake)
Accuracy:	Den: $\pm 0.025$ gm/cc (2.0 to 3.0 gm/cc) Pe: $\pm 0.2$ B/e (1.3 to 6.0 B/e) Caliper: 0.30in. (7.6mm) from 6.0in. (152.4mm) to 16.0in.( 406.4mm)
Depth of Investigation:	8.0in. (203.2mm) estimated for a 7.88in. (200.0mm) water filled borehole with a nominal 20% porosity formation
Vertical Resolution:	19in. (482.6mm)
Measure Point:	3 ft. - 2.30 in. (972.8 mm) from bottom of mandrel
Detector or Sensor Type:	Scintillation
Source:	2 Curie Cs137
Telemetry:	Standard EDIB
Maximum Tensile Force:	78,000 lb (35,454.5 kg) with pad retracted
Maximum Compression Force:	74,500 lb (33,793.0 kg)



# EZDT

Log:





# EGRT

## Natural Gamma Ray Logging Tool

The natural Gamma Ray Logging is a method for measuring the natural radioactivity of formations. This logging method is useful to detect and evaluate the sediment of radioactive minerals.

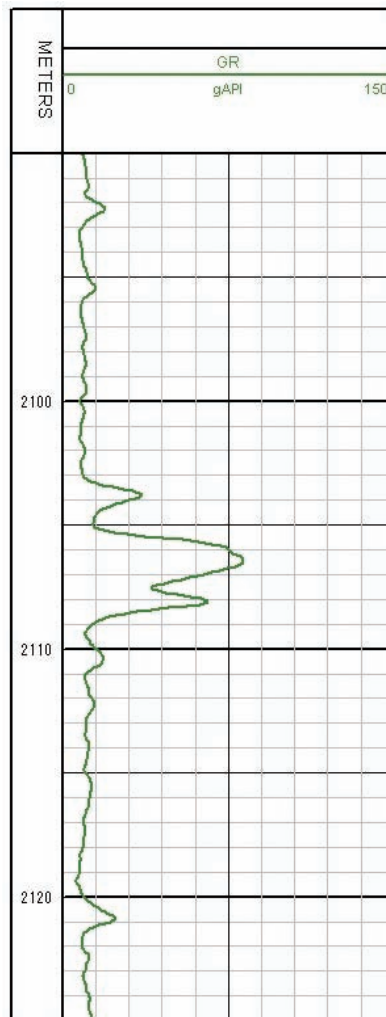
### Specifications:

Maximum Temperature:	
Normal tool:	400°F (204°C ) for 0.5 hr; 300°F (150°C ) for 3 hrs.
	Hi-temperature tool: 450°F (232°C ) for 0.5hr;
	338°F (170°C ) for 3 hrs.
Maximum Pressure:	20,000psi (137.9Mpa)
Diameter:	3.63in. (92mm)
Length:	6ft.-2in. (1.87m)
Weight:	119.05lb (54kg)
Borehole Diameter:	4.75in. (120.7mm) ~ 24in. (609.6mm)
Maximum Logging Speed:	30ft./min (9m/min)
Measuring Range:	0 ~ 1500API Unit
Accuracy:	± 5%
Repetition:	± 3%
Depth of Investigation:	12in. (304.8mm) at borehole diameter 7.88in. (200mm) filled with water and 20% porosity of formation
Vertical Resolution:	15in. (381.0mm)
Operating Power:	180VAC @ 25mA
Wireline Requirement:	Seven or Single Conductor Cable
Detector Type:	Nal (TL)
Measure Point :	0.81 ft (0.248m)from bottom of sub
Maximum Compression Force:	78,000 lb (35,381 kg)
Maximum Tensile Force:	78,000 lb (35,494 kg)



# EGRT

Log:



# EDST

## Digital Spectra Logging Tool

The digital spectral logging tool can be used in open hole or cased hole operations. By separating the gamma ray spectrum into Uranium (U), Thorium (Th), Potassium (K) components, the log analysts can identify the lithology of formations, plot out fracture zones, calculate shale content, evaluate sediment conditions, measure bed thickness, and make qualitative estimates of formation permeability. The tool can be used for depth correction.

### Features:

- EDIB Bus Tool
- CsI (Na) crystal (2 × 12 inch)
- 256 channel spectrum analysis
- Automatic spectrum-drift control

### Specifications:

Maximum Temperature:	400°F (204°C ) for 0.5 hr. 300°F (150°C ) for 3 hrs.
Maximum Pressure:	20,000psi (137.9Mpa)
Diameter:	3.63in. (92mm)
Length:	8ft.-9in. (2.67m)
Weight:	145.5lb. (66Kg)
Minimum Borehole:	4.75in. (120.6mm)
Maximum Borehole:	Limited to centralizer used
Normal Logging Speed:	15ft./min (4.5m/min)
Maximum Logging Speed:	30ft./min (9m/min)
Measuring Range:	0.04 to 3.5 MeV
Wireline Requirement:	7 conductor cable
Operating Power:	180VAC @ 35mA, 60Hz
Maximum Measureable:	
Gamma Ray:	2500 API
Quantity Potassium:	100 percent
Uranium:	250 ppm
Thorium:	700 ppm
Accuracy:	
GR:	± 3% of measured value
K, U, & Th:	± 4% of measured value (accuracy compares measured values with true values)
Precision for standard shale at 10 ft/min (3 m/min) :	
GR:	100 ± 1.5 API
K:	2 ± 0.15 percent
U:	6 ± 0.51 ppm
Th:	12 ± 1.03 ppm

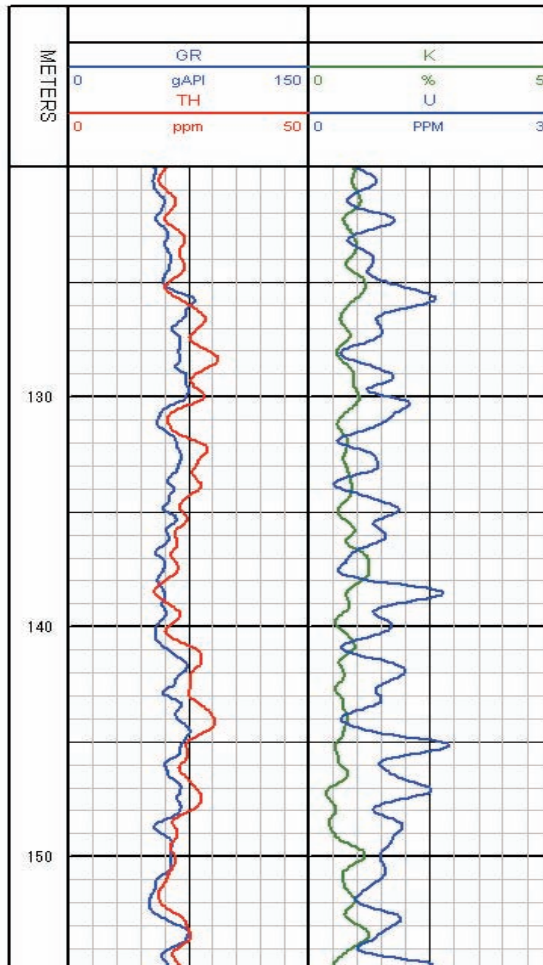


# EDST

at 30 ft/min (9 m/min):

- GR: 100 ± 2.6 API
- K: 2 ± 0.26 percent
- U: 6 ± 0.88 ppm
- Th: 12 ± 1.78 ppm
- Measure Point: 1 ft - 7.2 in (0.49m) from bottom of sub
- Resolution: ≤12 % (Cs137)
- Telemetry: EDIB (ELIS Downhole Instrument Bus)
- Maximum Compressive Force: 78,000 lb (35,381 kg)
- Maximum Tensile Force: 78,000 lb (35,494 kg)

## Log:



# EDAT

## Digital Acoustic Logging Tool

Digital Acoustic Logging tool is developed to provide high quality compression  $\Delta t$  measurement of the formation. It has the transmitting transducer to generate the firing pulses to the formation in the borehole, the acoustic signals through the formation to the receiving transducers to be picked up, and digitized. The can be run as the CBL Logging tool by selection of the service table.

### Components:

Control/acquisition electronics(EA)+Transmitting/receiving mandrel(MA)+Firing electronics(BA)

### Specification:

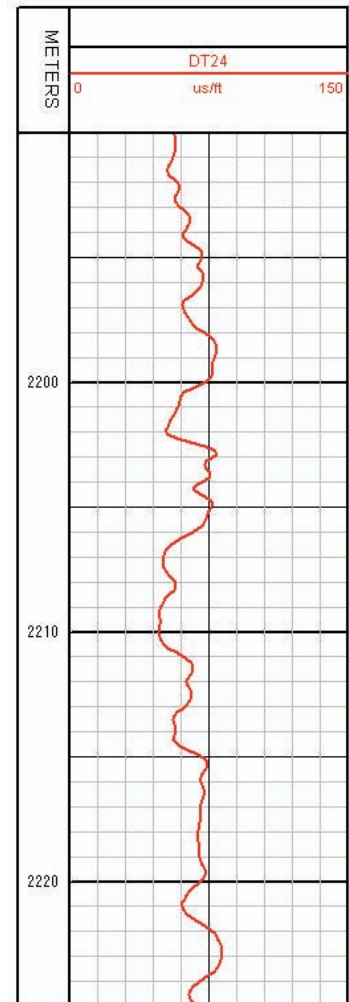
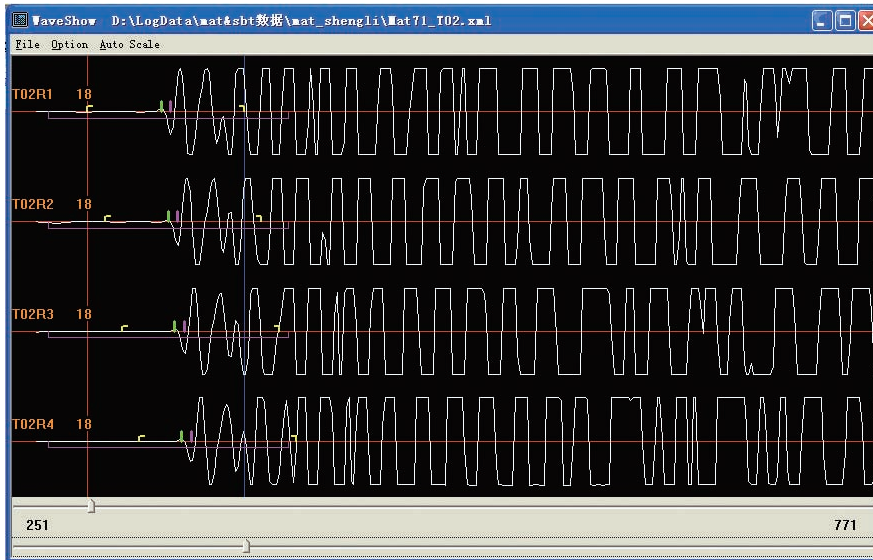
Maximum Temperature:	400°F (204°C ) for 0.5h 350°F (177°C ) for 4h
Maximum Pressure:	20,000Psi (137.9Mpa)
Minimum borehole Diameter:	4.5in.(114mm)
Tool diameter:	3.62in. (92mm)
Maker-up length:	20.0 ft.- 6.9 in. (6.26m)
Total Weight:	336 lb (153 kg)
EA:	140 lb ( 65 Kg)
MA:	198 lb ( 90 Kg)
FA:	62 lb ( 28Kg)
Maximum logging speed:	49.2 ft/min (15.0 m/min) max.
Absolute Accuracy:	$\pm 1.0\mu\text{s}/\text{ft}$ (3.3 $\mu\text{s}/\text{m}$ )
Vertical resolution:	6in (152.4mm)
Power supply:	180VAC 120mA 60Hz
Transducer:	
Receivers:	Piezoeletric transducers(1-23kHz) 5 in tool
Transmitter:	Piezoeletric transducers(1-23kHz) 1 in tool





# EDAT

Log:



# EMAT

## Multipole Array Acoustic Logging Tool

Multipole Array Acoustic Logging Tool is a logging device which evaluates the formation properties and estimates formation parameters by measuring the sonic wave propagations in formations. By combining the dipole and monopole technologies, it can effectively obtain the array signals of compressional waves, shear waves and Stone waves in formation ranging from soft sandstone to low porosity hard rocks. Thus it provides a new technique for determining geological parameters analyzing lithology, and for identifying fractures. As certain configuration, this tool can also run for cement bond quality evaluation operation.

### Components:

Transmitting mandrel(BA) +Transmitting electronics(FA)+ Isolator(PA)+ Receiver mandrel(MA)+ Electronics(EA)

### Features:

- EDIB Bus Tool;
- Four transmitting transducers (Two monopole transducers, one dipole; transducer, and one Stone wave transducer.);
- Sixteen receiving transducers (eight monopole, eight dipole);
- Eight independent receiving channels;
- Real time data acquisition control in downhole tool.

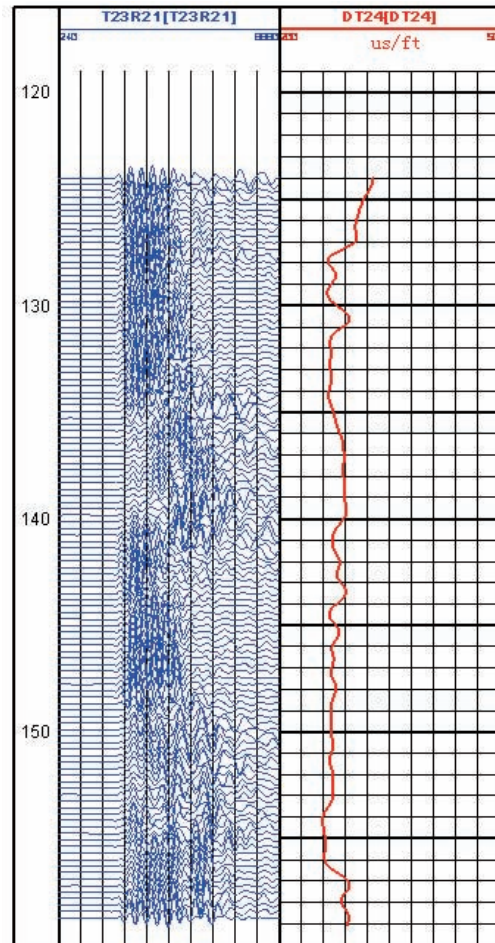
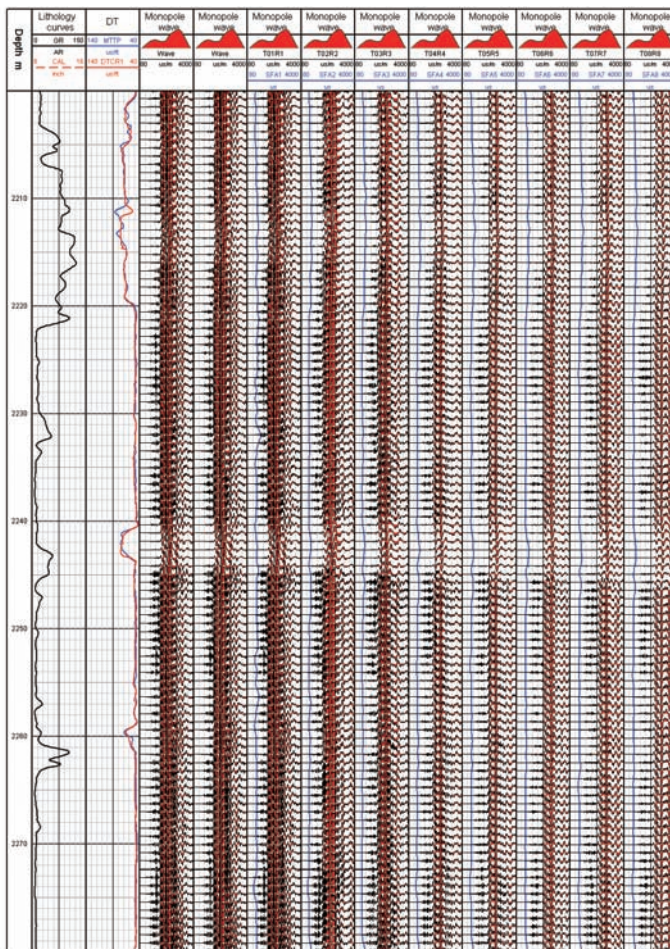
### Specifications:

Maximum Temperature:	400°F (204°C ) for 0.5hr.; 350°F (175°C ) for 3hrs.
Maximum Pressure:	20,000psi (137.9Mpa)
Instrument Diameter:	3.63in. (92mm)MAX
Maximum Logging Speed:	30ft./min (9m/min)
Wireline Requirements:	7 conductor cable
Operating Power:	180VAC @ 200mA, 60Hz
Mono/Dipole transducer:	
Monopole Transmitters:	Two, Frequency: 2-15 kHz
Dipole Transmitters:	One, Frequency: (1-3 kHz)
Transmitters Material:	Piezoelectricity Crystal
Monopole Receiver:	eight; Frequency (1-20kHz) Interval: 6in. (152.4mm)
Dipole Receiver:	eight; Frequency (0.5 - 5kHz) Interval: 6in. (152.4mm)
Receiver Material:	Piezoelectricity Crystal
Min. Offset:	MAT: 10.5ft. (3.2m)
Telemetry:	Standard EDIB instrument bus



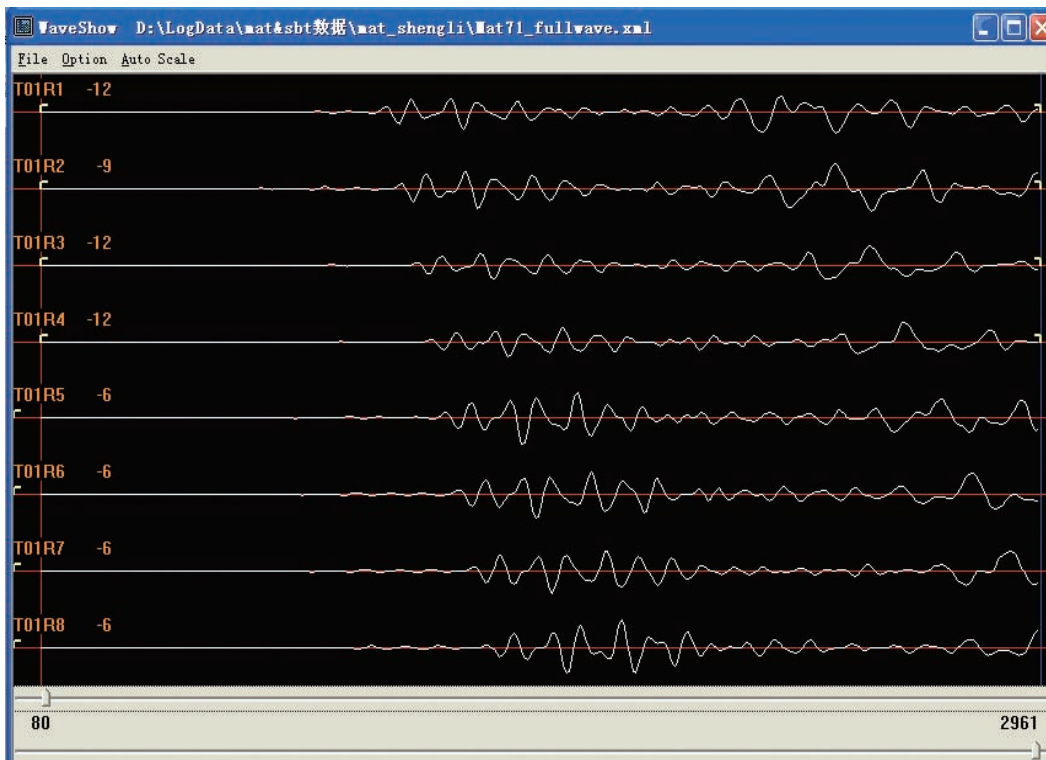
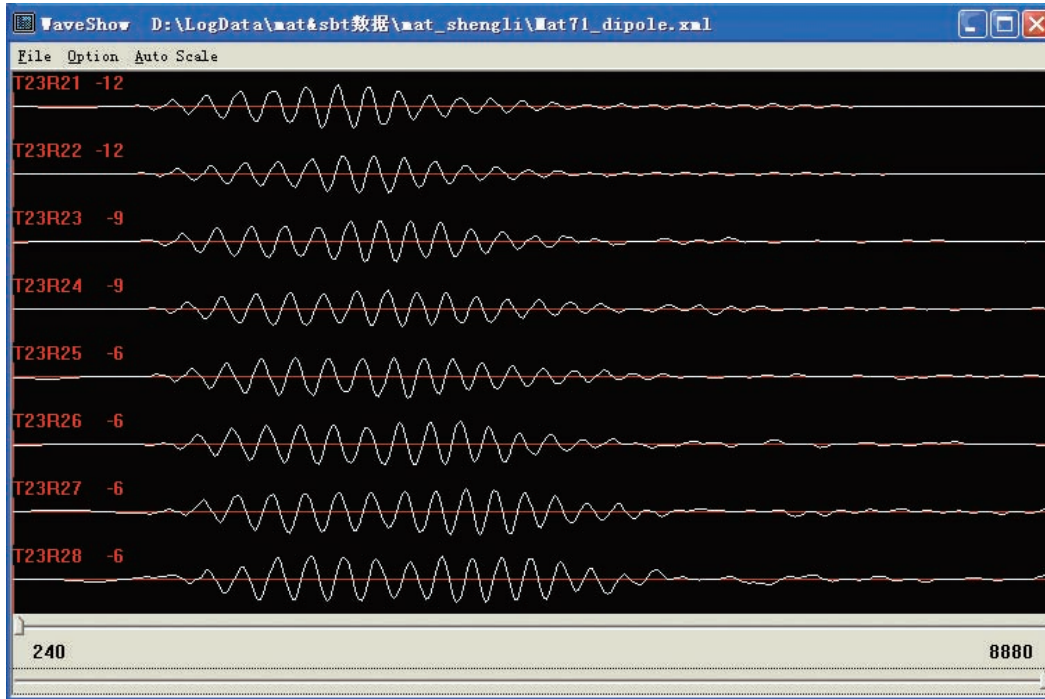
**EMAT**

**Log:**





EMAT



# CBIT™

## Circumferential Borehole Imaging Logging Tool

Circumferential borehole imaging logging tool (CBIT) is used to conduct ultrasonic scanning on wall of open hole well or cased well, thus generating detailed image. Probe of the instrument transmits high frequency acoustic pulse and measures arrival time and amplitude of echo. The magnitude is affected by characteristics of the borehole wall, while the arrival time reflects the distance from probe to the borehole wall. Ultrasonic probe is located on the rotating section of the instrument, allowing the tool to scan full 360° wellbore, and generating two images: magnitude and arrival time.

Amplitude image of echo shows borehole wall characteristics. High reflection layer is shown white in the image, while the lower reflection layer is shown black. The value between the two layers is endowed with certain gray, which is in direct proportion to the measured amplitude. The imaging is very useful when determining the low reflection layer, such as crack. Amplitude of echo is affected by mud attenuation, instrument eccentricity and wall rugosity.

### The instrument can be used to:

- Determine the orientation and depth matching of the whole core;
- Identify and measure fractures, vugs, and washouts;
- Identify position of bedding planes and fracture orientations;
- Obtain detailed geometric shape of borehole with the high-resolution acoustic measurement data;
- Locate and evaluate casing corrosion, mechanical wear, defects and perforations;
- Determine the dip.

### Composition:

Electronics (EA) + rotation transducer mandrel (MA)

### Features / Advancement:

- Working in the way of pulse-echo, a rotating transducer can generate two images: echo time and amplitude;
- The two focused transducers used have different focus length, which can be effectively used for acoustic scanning in the 5.5in-16in boreholes;
- Frequency of two focused transducers, which reduces attenuation of echo signals in drilling mud;
- Wide mud weight range;
- Acoustic scanning in full 360° range of circumferential borehole;
- Echo time data can be processed into geometric shape of the borehole ;





# CBIT™

## Specification:

Maximum Temperature : 350°F (177°C) for 4hr.  
 Maximum Pressure : 20,000Psi (137.9Mpa)  
 Borehole Diameter: 6.5in. (139mm) to 16 in. (406.4mm)  
 Instrument diameter:  
     Electronics: 3.375in (86mm)  
     Rotation transducer mandre: 3.625in (92mm)

Make-up Length  
     Electronics: 5ft -2.6in (1.59m)  
     Rotation transducer mandrel: 4ft-9.2in (1.45m)

Instrument weight  
     Electronics: 92.59lb (42Kg)  
     Rotation transducer mandrel: 110.23lb (50Kg)  
 Maximum logging speed: 12ft/min (3.66m);  
 Samples per scan: 250 points/circle  
 Scan speed: 11 circles/sec approximately

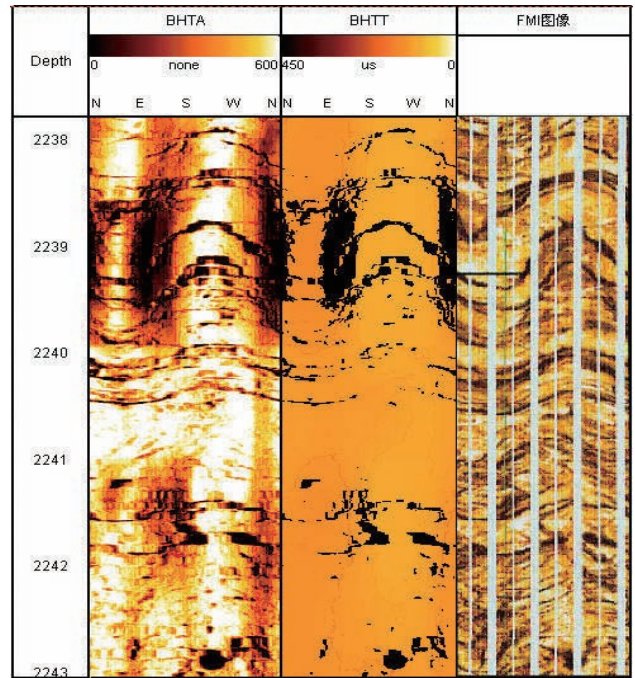
Focus probe  
     Quantity: 2  
     1.5in(38.1mm) frequency: 250kHz ± 5 kHz;  
     2.0in(50.8mm) frequency: 250kHz ± 10 kHz ;  
 Orientation device: Internal Magnetometer or  
     reference to orientation logging tool .

Fluid Velocity Reference :  
     Internal 250 kHz ± 5 kHz ceramic transducer  
 Radial resolution: 10 sampling points/ft(4 sampling points/cm) on wall  
     with a diameter of 8in(20.32cm)

vertical resolution: 66 scan/ft (2 sampling points/cm)  
 Power supply: 180Vac ± 10V 450mA ± 10mA 60Hz  
 Logging Combination: EDIB compatible

Maximum Tensile Force  
     EA: 4000lb (1814.4Kg)  
     MA: 4000lb (1814.4Kg)

Maximum Compressive Force  
     EA: 40000lb (18143.6Kg)  
     MA: 17500lb (7937.9Kg)



# EMSF

## Digital Micro Spherical Focused Laterolog Tool

EMSF (the Micro Spherical Focused Laterolog Tool) is one kind of the resistivity logging tool. It can be applied to the borehole with the water-base mud (freshwater or saline water) and formation of sandstone or limestone. EMSF is developed based on the micro-lateral and proximity well-logging methods. Due to the special structure of the micro-spherical focused pad, and designed with mud cake-corrected electrode, the effect of mud cake to measurement can be eliminated effectively, and the resistivity log of flushed zone is more accurately. The  $R^{xo}$  curve and dH curve can be recorded at the same time during one run. When combined with the EDLT, it can accurately evaluated the situation of penetrative formation and mud invasion, and therefore ascertain the nature of oil, gas and water contained in the formation. The tool is provided with the Pad Arm which is controlled by motor assembly, which enables the pad to close the borehole wall. With two optional pads, the tool can be applied to the borehole diameter 152-500mm. This tool can transmit and control digitized signal of micro resistance via EDIB Bus. Because of noncommunicating inner EDIB bus, the tool must be put in the bottom of logging array.

### Components:

Electronics (EA) + Mandrel (MA)

### Features:

- Special structure of electrode and measurement
- EDIB bus supported
- CALM measurement
- Flushed zone resistivity ( $R_{xo}$ ) measurement

### Specifications:

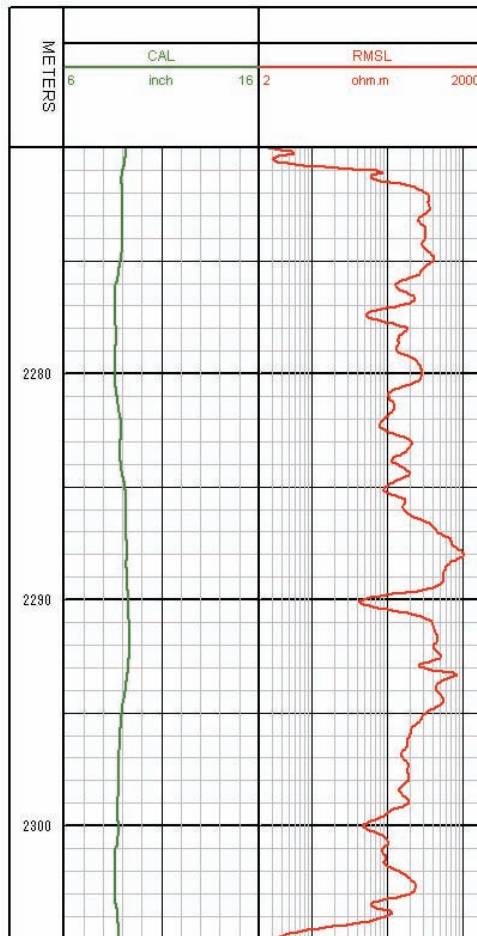
Length:	13.1ft (4m)
Diameter:	$\varnothing$ 3.6in (92mm); when Pad arm is retracted, it's less than 4.5in. (114mm); when Pad arm is spread, it's less than 19.7in (500mm)
Weight:	200lb (108Kg)
Power supply:	180Vac, 60Hz, 70mA
Maximum Temperature:	392°F (200°C) (constant temperature for 0.5h)
Maximum Pressure:	20,000Psi (137.9Mpa)
Maximum logging speed:	59ft./min (18m/min)



# EMSF

Mode: standard EDIB bus  
 RMSF Range: 0.2 ~ 2000ohm·m  
 RMSF Measurement accuracy: For the range of 2Ω·m-200Ω·m, the allowable error is ± 5%.  
 For the range of 0.2Ω·m-2Ω·m and 200Ω·m-1000Ω·m, the allowable error is ± 10%.  
 CALM Range: 5.9 ~ 19.7in. (150 ~ 500mm)  
 CALM Measurement accuracy: For the range of 5.9 ~ 19.7in. (150 ~ 500mm), the allowable error is ± 5%.  
 Vertical resolution: 7.9in (200mm)  
 Depth of detection: 5.9 ~ 19.7in (150 ~ 500mm)  
 Measure Point: 23.6in (600mm)

## Log:



# EMSF

## Micro Spherical Focused Laterolog Tool

EMSF (the Micro Spherical Focused Laterolog Tool) is one kind of the resistivity logging tool. It can be applied to the borehole with the water-base mud (freshwater or saline water) and formation of sandstone or limestone. EMSF is developed based on the micro-lateral and proximity well-logging methods. Due to the special structure of the micro-spherical focused pad, and designed with mud cake-corrected electrode, the effect of mud cake to measurement can be eliminated effectively, and the resistivity log of flushed zone is more accurately. The  $R^{xo}$  curve and dH curve can be recorded at the same time during one run. When combined with the EDLT, it can accurately evaluated the situation of penetrative formation and mud invasion, and therefore ascertain the nature of oil, gas and water contained in the formation. The tool is provided with the Pad Arm which is controlled by motor assembly, which enables the pad to close the borehole wall. With two optional pads, the tool can be applied to the borehole diameter 152-500mm.

### Components:

Electronics (EA) + Mandrel (MA)

### Features:

- Special structure of electrode and measurement
- CALM measurement
- Flushed zone resistivity ( $R_{xo}$ ) measurement

### Specifications:

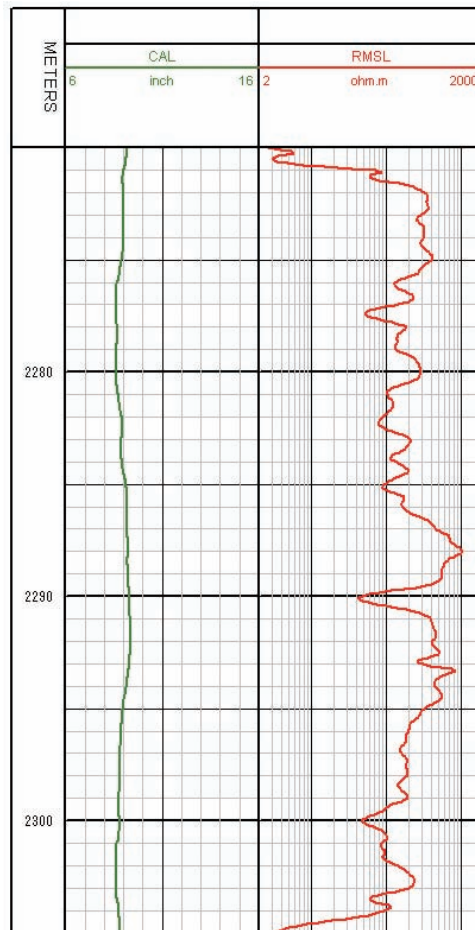
Maximum Temperature:	350°F (175°C) (constant temperature for 0.5h)
Maximum Pressure:	20,000Psi (137.9Mpa)
Power supply:	180Vac, 50mA
Diameter:	$\varphi$ 3.6in (92mm); when Pad arm is retracted, it's less than 4.5in. (114mm); when Pad arm is spread, it's less than 19.7in (500mm)
Length:	10ft. (3.05m)
Weight:	200lb (90kg)
CALM Range:	5.9 ~ 19.7in. (150 ~ 500mm)
CALM Measurement accuracy:	For the range of 5.9 ~ 19.7in. (150 ~ 500mm), the allowable error is $\pm 5\%$ .



# EMS F

Wireline Requirements: 7 Conductor Cable  
 RMSF Range: 0.2 ~ 2000ohm-m  
 RMSF Measurement accuracy:  
 For the range of 2Ω-m-200Ω-m, the allowable error is ± 5%.  
 For the range of 0.2Ω-m-2Ω-m and 200Ω-m-1000Ω-m,  
 the allowable error is ± 10%  
 Maximum logging speed: 59ft./min (18m/min)  
 Vertical resolution: 7.9in (200mm)  
 Depth of detection: 5.9 ~ 19.7in (150 ~ 500mm)  
 Measure Point: 23.6in (600mm)

## Log:





# EDLT

## Dual Laterolog Tool

The EDLT provides two resistivity measurements: a Shallow reading to investigate the formation near the borehole and a Deep reading to measure farther out where the formation is less disturbed by drilling fluid. By analyzing this information combined with other logging curves, the geologist can distinguish visually and accurately any permeable formation, locate oil and water formation.

### Components:

Electronics (EA) + Mandrel (MA)

### Features:

- High Dynamic Range
- Extended Range in Fresh Mud Systems
- Selectable Operating Modes

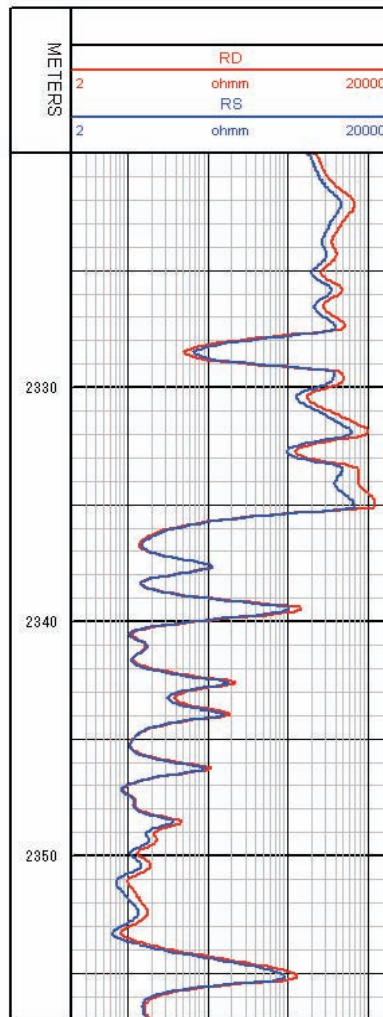
### Specifications:

Maximum Temperature:	350°F (175°C ) for 0.5hr.
Maximum Pressure:	20,000Psi (137.9Mpa)
Diameter:	EA 3.39in. (86mm); MA 3.63in. (92mm)
Weight:	EA 110.23lb (50kg); MA 165.35lb (75kg)
Maximum Tensile Force:	48000lb (21700kg)
Maximum Compressive Force:	7400lb (3350kg)
Minimum Hole Diameter:	5.5in. (140mm)
Maximum Hole Diameter:	22.6in. (575mm)
Make-up Length:	212.6in. (5.4m)
Wireline Requirements:	7 Conductor cable
Power Requirements:	180VAC, 80~95mA, 58~62Hz
Measurement Range:	0.2 ~ 40000 ohm-m
Mud Type/Range:	Water based mud 0.015 ohm-m ~ 3.0 ohm-m
Accuracy:	± 20% 0.2 ~ 1 ohm-m ± 5% 1 ~ 2000 ohm-m ± 10% 2000 ~ 5000 ohm-m ± 20% 5000 ~ 40000 ohm-m
Measure Point:	6ft. (1.83m)
Maximum Logging Speed:	60ft. /min (18m/min)
Vertical Resolution:	2ft. (0.61m)
Radius of Investigation :	Deep Standard Return Mode (SrtnDp) 55in.(1.397m) Shallow Enhanced (EnhSh) 31in. (0.787m) Shallow Standard (StdSh) 18in. (0.457m)



# EDLT

Log:



# EDLT

## Digital Dual Laterolog Tool

The EDLT provides two resistivity measurements: a Shallow reading to investigate the formation near the borehole and a Deep reading to measure farther out where the formation is less disturbed by drilling fluid. By analyzing this information combined with other logging curves, the geologist can distinguish visually and accurately any permeable formation, locate oil and water formation.

### Components:

Electronics (EA) + Mandrel (MA)

### Features:

- High Dynamic Range
- Extended Range in Fresh Mud Systems
- Selectable Operating Modes
- Standard EDIB bus

### Specifications:

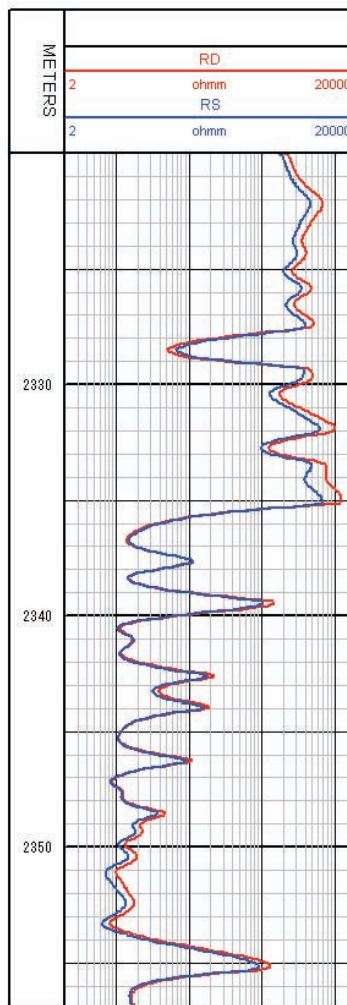
Diameter:	3.63in. (92 mm)
Length:	263.4in. (6690mm)
Total Weight of instrument:	320lb. (145kg)
Maximum Tension Force:	48000 lb. (21700 kg)
Maximum Compressive Force:	7400 lb. (3350 kg)
Measure Point:	1.96m (above matching point of black block of EDLT72XA Mandrel)
Maximum Temperature:	392°F (200°C ) for 0.5hr.
Maximum Pressure:	20,000Psi (137.9Mpa)
Minimum Hole Diameter:	4.8in. (120mm)
Mode:	standard EDIB bus
Mud Type/Range:	Water based mud 0.015 ohm ·m ~ 3.0 ohm ·m
Max. Logging Speed:	60 ft/min (18m/min)
Power supply requirement:	170 Vac ~ 190Vac, 90 mA ~ 110 mA, 58 Hz ~ 62 Hz
Measurement Range:	0.2~40000 ohm ·m
Accuracy:	± 20% 0.2 ~ 1 ohm ·m
	± 5% 1 ~ 2000 ohm ·m
	± 10% 2000 ~ 5000 ohm ·m
	± 20% 5000 ~ 40000 ohm ·m



# EDLT

Measure Point: 6ft. (1.83m)  
 Maximum Logging Speed: 60ft. /min (18m/min)  
 Vertical Resolution: 2ft. (0.61m)  
 Radius of Investigation:  
     Deep Standard Return Mode (SrtnDp ): 55in.(1.397m)  
     Shallow Enhanced (EnhSh): 31in. (0.787m)  
     Shallow Standard (StdSh): 18in. (0.457m)

## Log:



EFDT<sup>®</sup>

## Enhanced Formation Dynamic Tester

## Advanced Wireline Formation Testing System

Enhanced Formation Dynamic Tester (EFDT<sup>®</sup>) can deliver...

- Multiple, large-volume high-purity formation fluid samples with downhole fluid characterization
- Reliable formation pressure testing
- Real-time downhole fluid analyze and much more ...

The EFDT is designed to obtain formation pressures and formation fluid samples at discrete depths within a reservoir. Analyzing pressure buildup profile and the properties of fluid samples helps to a more complete description of reservoir fluids and behavior. The EFDT service provides key petrophysical information to determine the reservoir volume, producibility of a formation, type and composition of the movable fluids, and to predict reservoir behavior during production.

THE EFDT is a modular formation testing system. Clients can customize the tool for the required applications. The modularity of EFDT ensures the ability to test and sample fluids in a wide range of geological environments and borehole conditions. For basic configuration, the string includes a fully controllable Dual Probe module for fluid in taking, Flow pump module for variable-volume draw down and pumping out contamination fluids, a Fluid sensor module for dynamic properties of fluids, a PVT Carrier module for monophasic sampling and a Large Sample Carrier module for large-volume normal sampling. It can also be configured with Straddle Packer Module, Optical Analysis Module, Focus Probe Module and Multi-PVT Tank Module to meet the requirement of complex reservoir formation test, such as low permeability and crack formation.

THE EFDT enables up to five properties of fluid and formation to be monitored during testing: fluid conductivity/capacitivity, fluid density, fluid dynamic pressure, fluid NIR optical analysis and formation permeability anisotropic.

EFDT provides up to four MonoPhase Sampling Tanks (MPST) for one run, which recover high-quality pressure-compensated reservoir fluid samples during borehole formation testing operations. The new Multi-PVT module can take up to 24-48 PVT samples one run (6 × 350ml per module).

The EFDT uses standard EDIB telemetry protocol, is combinable with other EDIB logging tools, and requires the ELIS surface acquisition system.



**EFD<sup>®</sup>T**

**Applications**

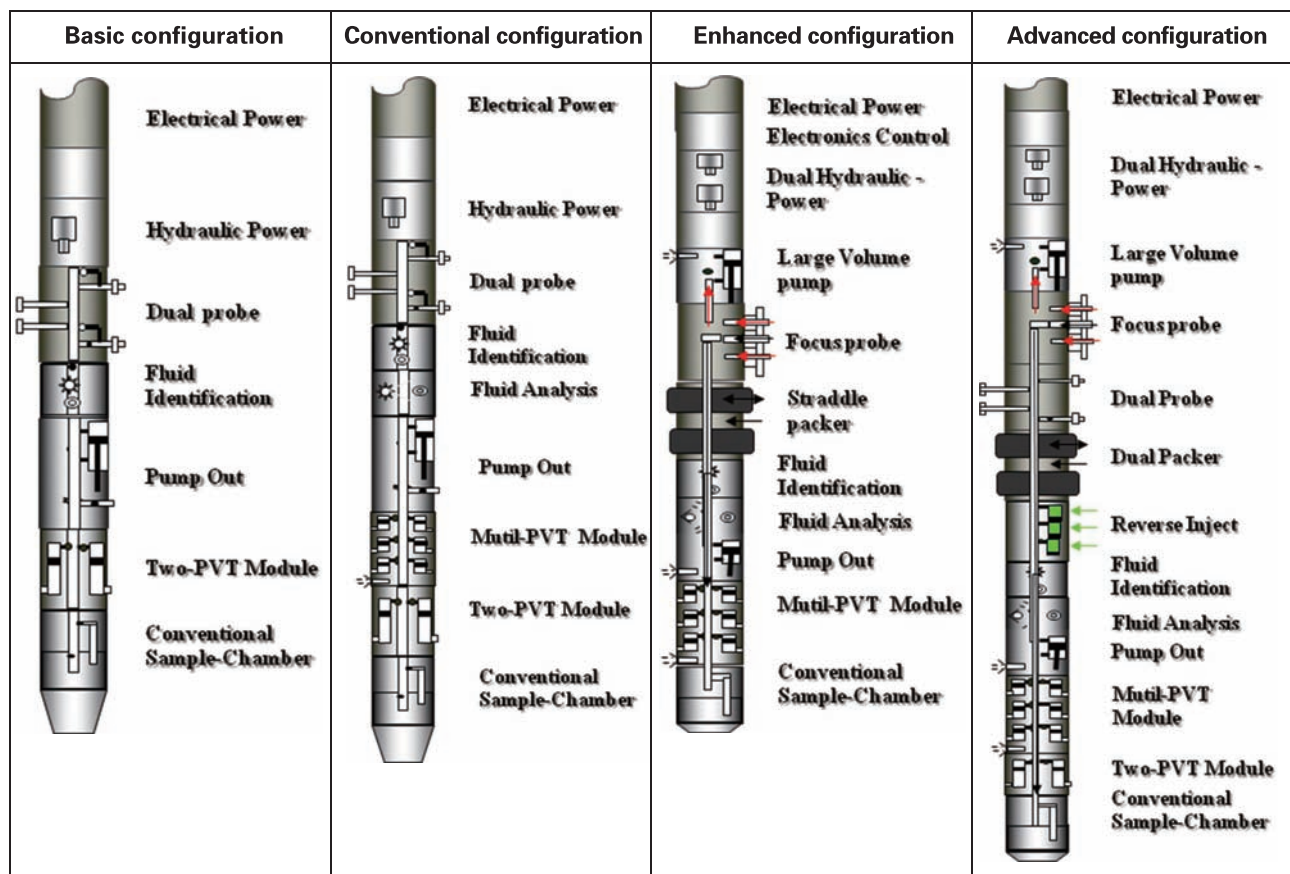
- Formation pressure measurements and fluid contact identification
- Repeatabile formation fluid sampling
- Measurement of formation permeability anisotropic
- Vertical Interference Testing
- In-situ downhole fluid analysis Features

**Benefits**

- Fast, high-accuracy pressure measurement using Quartz Pressure Gauge (QPG) with temperature compensating
- Conductivity/capacitivity, density, fluid dynamic pressure, NIR optical analysis and formation permeability anisotropic for real time reservoir evaluation
- Save 50% sample time used focus probe
- Multiple samples in one run, provides highest-quality PVT samples

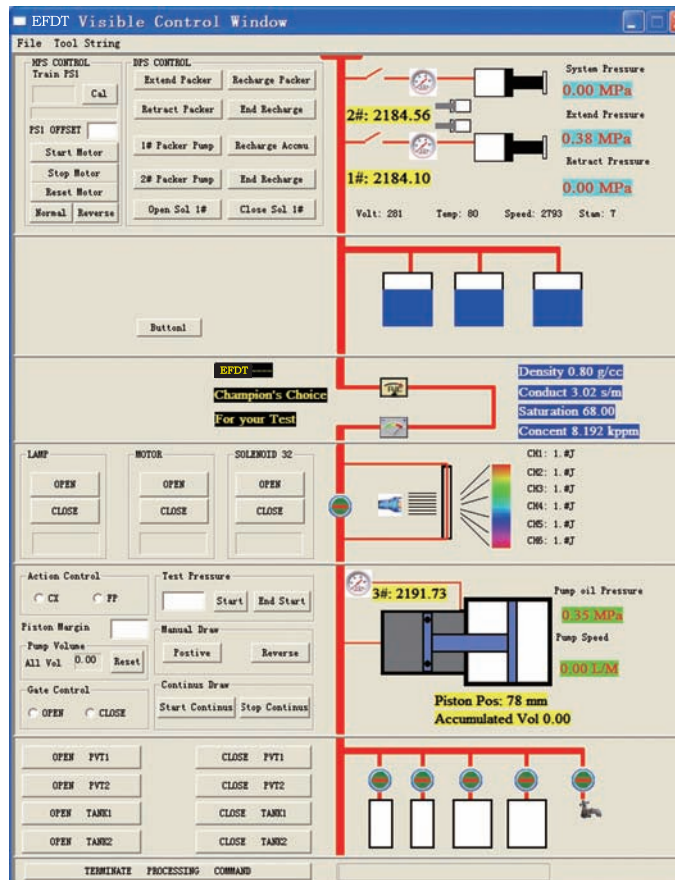
**Features**

- Modularity, offering expanded testing versatility
- Accurate pressure measurement using QPG
- Real time downhole fluid assessment
- PVT quality formation fluid samples

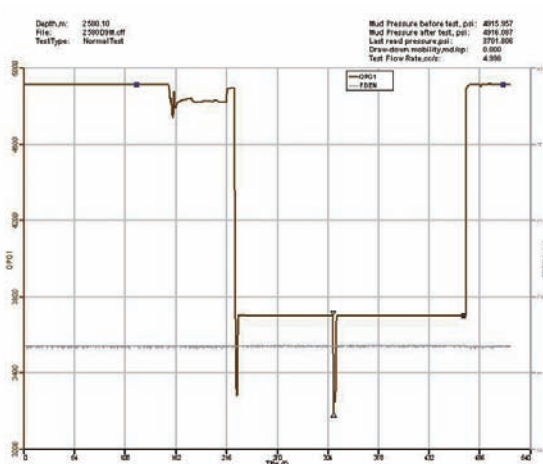




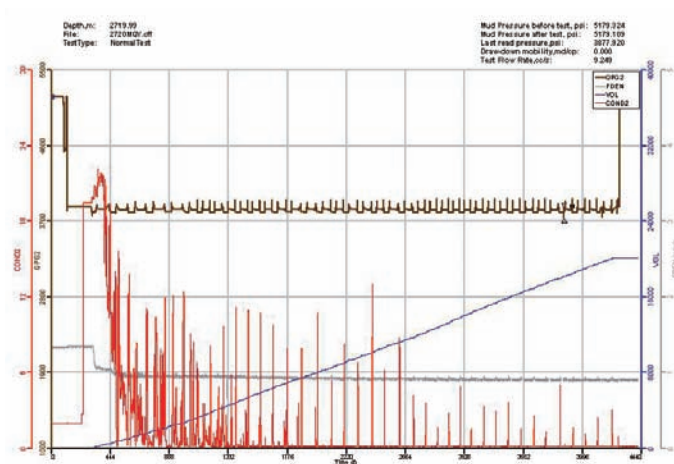
EFDT Surface Control Interface



EFDT Pressure Measurement Chart



EFDT Fluid Real-time Monitoring Chart



# EFDT<sup>®</sup>

## Enhanced Reservoir Characteristic Tool<sup>®</sup> (EFDT ) Technical Specifications

Temperature	165°C (330° F)
Nominal OD	120mm(4.7 inch) *
Min/Max Hole Size	140mm - 559mm (5.5-22 inch)
Rating pressure	137.9Mpa(20000psi)
Max. working pressure	110.3Mpa (16000psi)
Weight	770kg(1700 lbs)
Length	2285cm(ERMT+ERTT+EDST included)
Dual Probe Module	
Pretest volume	2-280ml
Pressure measurement range	0-16000psi (0-110.3Mpa)
Pressure accuracy	± 0.02% F.S.
Pressure resolution	0.01psi (0.069kpa)
QPG zero drift at 15psi, 25°C	<3psi/yr (20.63kpa/yr)
QPG temperature compensating sensor accuracy	0.28° F (0.5° C )
QPG temperature compensating sensor zero drift	<0.28° F/yr (0.5° C /yr)
Release the wire line when sampling	YES
Focus Probe Module	
Diameter of central suction	1 inch (25.4mm)
Central suction area/outside suction area	1 : 2
Release the wire line when sampling	YES
Pressure gauge is the same with Dual Probe Module	
Straddle Packer Module	
Length of the module	18ft.-0.5in.(5500mm)
Center distance of two packers	6ft.-1.6in.(1870mm)
Effective length of the sealed well	3ft.-9.3in.(1150mm)
Min/Max Hole Size	6"-14"
Charging pressure of packer	2600psi(17.9MPa)
Max. working pressure	0-16000psi(0-110.3MPa)
Bypass Pump Module	
Pump pressure	1740psi (12Mpa)
Flow rate	2.0L/min
Flow line pressure measurement range	0-15000psi (0-103.4Mpa)
Pressure sensor accuracy	± 1% F.S.
Fluid sensor Module	
Conductivity	0.01-200s/m
Conductivity accuracy	± 5%
Water cut accuracy	± 10%
Density	0-2g/ml
Density resolution	0.025g/ml
Flow Pump Module	
Pumping rate	0-1100ml/min @ 21-28Mpa pressure difference
PVT Carrier Module	
Large volume PVT Module	2 × 566ml**
Multiple PVT Module	6 × 350ml (4-8 modules one string)
Sample type	Monophase downhole fluid with PVT quality
Normal-Sample Carrier Module	
Tank Qty	2
Tank volume	1.6/1.85L
Sample type	Normal downhole fluid

\*Depending on the types of Packers used, Max. OD of EFDT varies.

\*\*Depending on the downhole situations and the pressure of Nitrogen, sample capacity varies.

# BASIC-RCT™

## Basic Reservoir Characteristic Tester

BASIC-RCT(BASIC-Reservoir Characteristic Tester) is a third generation product of the formation tester family, characterized by the function of pump through. BASIC RCT is compact, convenient, safe and efficient tool. It can replace partially Drill Stem Testing (DST) operations in order to save rig time. BASIC RCT provides economical and reliable solution to formation evaluation for oil field exploration and engineering. It is a good way to reduce cost and to solve some difficult technical problems. BASIC RCT can be run on any service company logging unit. It requires only the winch, cable head and depth measurement. All services, telemetry, gamma ray recording, test recording (digital, numerical listing, screen and printer graphics) are provided in real time.

### Functions:

- Measurement formation pressure accurately.
- Taking multi-samples of formation fluids.
- Taking large samples.
- Pumping through contaminated formation fluid
- Monitoring formation fluid properties real time.
- Flowing formation fluids at controlled rates.
- Pumping through in reverse.
- Making quick wellsite sampler transfer.
- Providing real and reliable data for analyzing permeability and formation damage

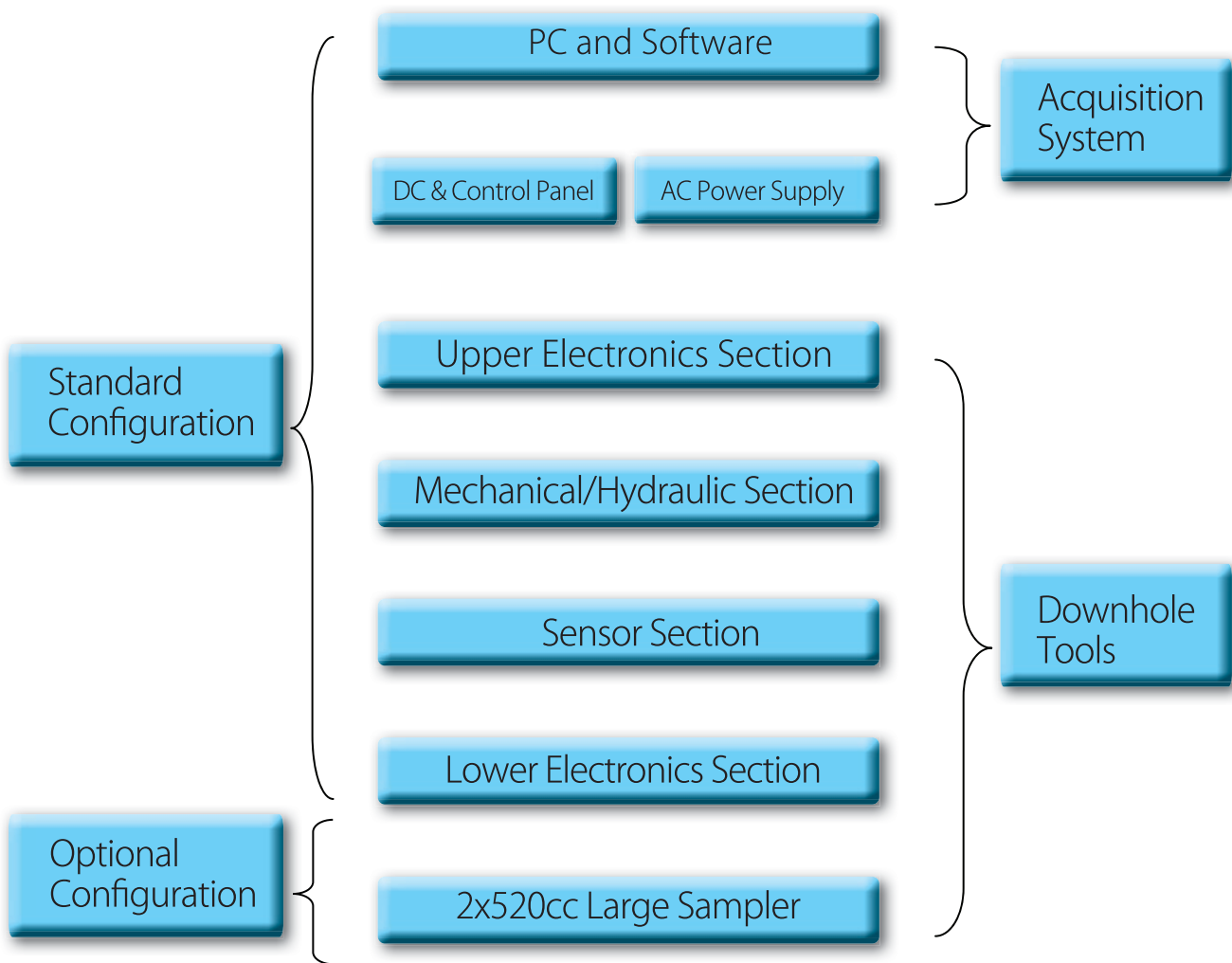
### Structure:

The BASIC RCT is composite of the surface system and the downhole tools. And the surface system includes the Acquisition and Data Process software, PC, DC control panel and AC power supply. The downhole tools include the upper electronics section, mechanical/hydraulic section, sensor section, lower electronics section with the standard configuration, and also include the 2x520cc large sampler with optional configuration (see diagram 1 and diagram 2).



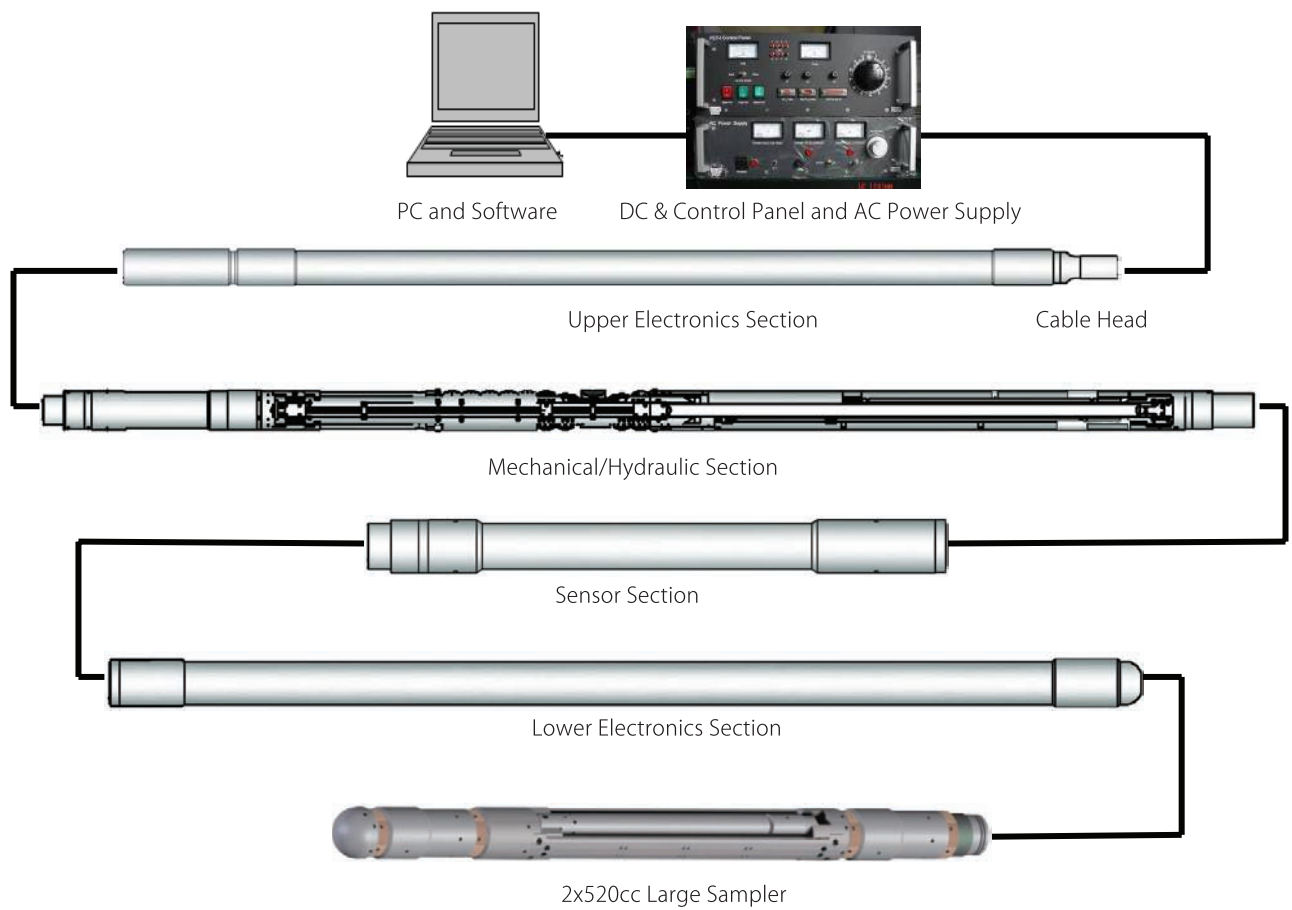
# BASIC-RCT™

Diagram 1



# BASIC-RCT™

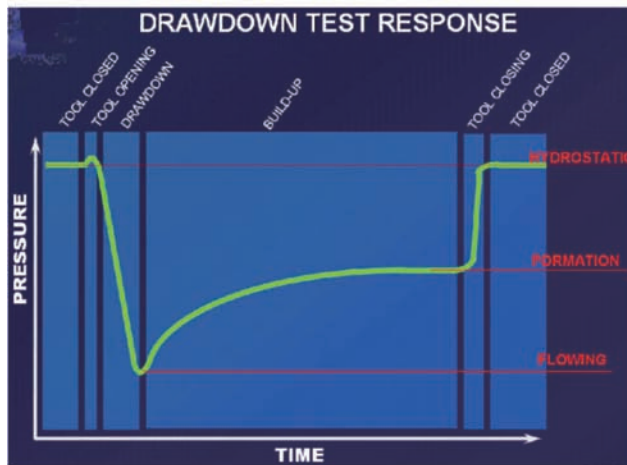
Diagram 2



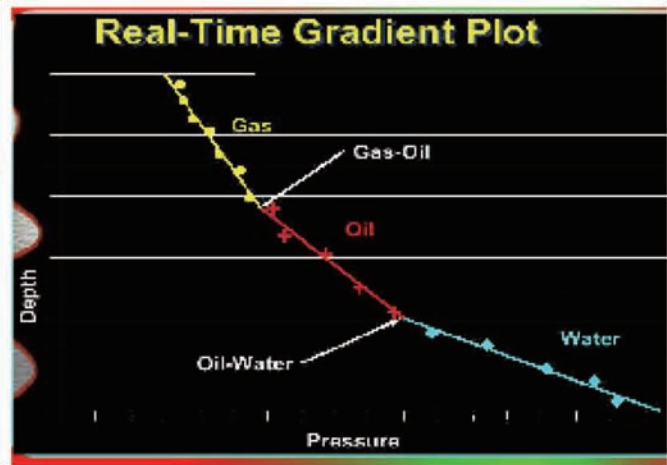
# BASIC-RCT™

## Test Curves

Drawdown Curve



Fluid Contact curve



## Specifications

Maximum Temperature Rating	302° F (150° C)
Maximum Pressure Rating	16000psi (110Mpa)
Maximum Diameter	5.5in. (140mm)
Length(with Standard Configuration)	37ft.-8.8in. (11.5m)
Weigh (with Standard Configuration)	1158lbs (525kg)
Maximum Tensile load	60000lbs
Maximum Compression load	10000lbs
Borehole Diameter Range	7" ~ 18" (177.8mm ~ 457.2mm)
Quartz pressure gauges	Range: 0 ~ 16000psi (0 ~ 110.3MPa)Accuracy: ± 0.01% F.S.
Strain pressure gauge	Range: 0 ~ 16000psi(0 ~ 110.3MPa)Accuracy: ± 0.20% F.S.
Resistivity Measurement	0.05 Ω m ~ 20.0 Ω m
Capacitance Measurement	0.05mho/m ~ 20 mho/m
Density Measurement	0.1g/cm <sup>3</sup> ~ 2.0g/cm <sup>3</sup> ;
Multi-Sampler(with Standard Configuration)	9X50cc or 4X150cc or 2x488cc or 1X1048cc
Large Sampler(with Optional Configuration)	2X520cc or 4X520cc or 6X520cc
Cable	7 Conductor
Cable Head	3-3/8" Cable head
Surface Supply Power	110VAC,60Hz



# MUIL

## Multifunction Ultrasonic Imaging Logging Tool

Multifunction Ultrasonic Imaging Logging tool (MUIL) is an ultrasonic tool designed to provide 360 degrees images with the method of detecting the echo signal. The MUIL Tool can operate in two modes: Imaging mode and Full wave mode. When operating in the image mode, the tool can provide high-resolution images and caliper measurements of the well's internal surface. When operating in the full wave mode, the MUIL provides data on the pipe thickness and cement bonding behind the casing.

The tool is composed by the electronics sub-assembly and scanner sub-assembly. The electronics sub-assembly is responsible to fire transducers and process the tool command from surface. The scanner sub-assembly contains two ultrasonic transducers: one is the mud cell transducer which is used to make the borehole fluid velocity measurements; another one is the measurement ultrasonic which is used to make the imaging measurement. Three kinds of transducer head and four kinds of transducer are offered. By replacing the transducer head can be adapted to different borehole diameter. By replacing the transducer can be adapted to different pipe thickness in the same way. The tool is fitted for the EDIB bus.

### Specifications:

Maximum Temperature:	175°C .
Maximum Pressure:	20,000PSI.
Maximum Tool Diameter:	92mm.
Overall Length:	EA: 2095mm MA:1820mm
Maximum Tool Weight:	EA: 40kg MA: 58kg
Rotating Head Dimensions:	3-5/8in、 4-3/8in、 5-5/8in、 7.0in
Tensile Strength:	2000kg
Power:	180 ± 10Vac/200mA
Full wave mode:	
Transducer Frequency:	250kHz、 350kHz、 450kHz
Firing Rate (shots/scan):	60
Vertical Scan Rate(scan/ft):	8
Circumferential Precision:	6°
Vertical Sampling:	6 in
Pipe Diameter Range(in):	5.5 -13.375
Perforation Resolution(mm):	5
Thickness Accuracy:	± 6%
Thickness Range(mm):	5-16



# MUIL

Impedance Accuracy:  $\pm 10\%$   
 Impedance Range(MRayl): 0-10  
 Logging Speed(ft/min): 10  
 Imaging mode:  
 Transducer Frequency: 380kHz (focus)  
 Firing Rate (shots/scan): 240  
 Vertical Scan Rate(scan/ft): 48  
 Circumferential Precision:  $1.8^\circ$   
 Fracture Resolution(mm): 2  
 Borehole Diameter Range(in): 4.5-12.5  
 Logging Speed(ft/min): 10

## Application:

- Surface imaging in opened hole:
- Borehole surface imaging in high resolution
  - Fracture and vug identification
  - Structural and bedding analysis
  - Borehole diameter imaging

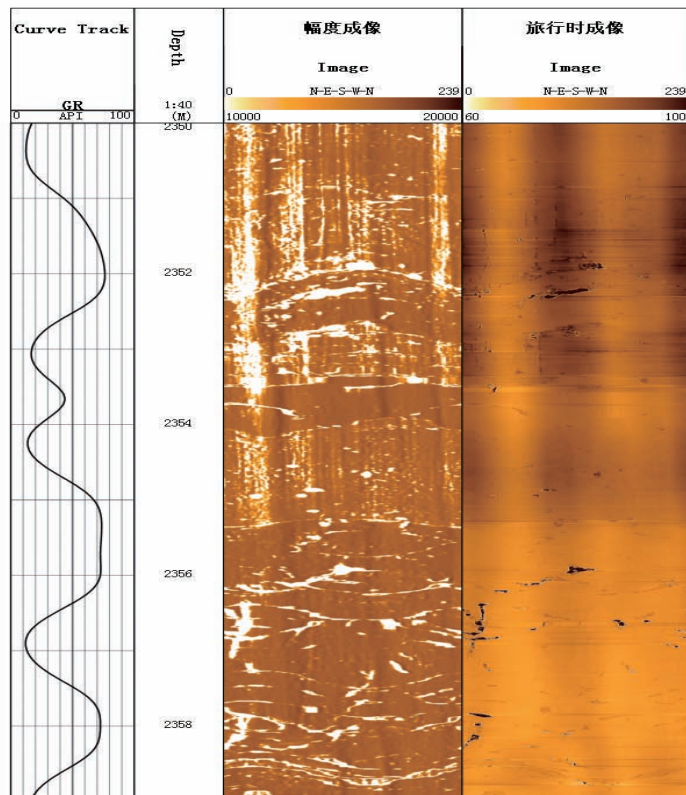


Figure 3 A map of surface imaging in the opened hole

# MUIL

Casing inspection and cement evaluation

- Casing thickness measurement
- Inner or outer diameter imaging of cased hole
- Perforation or casing deformation identification
- Cement evaluation

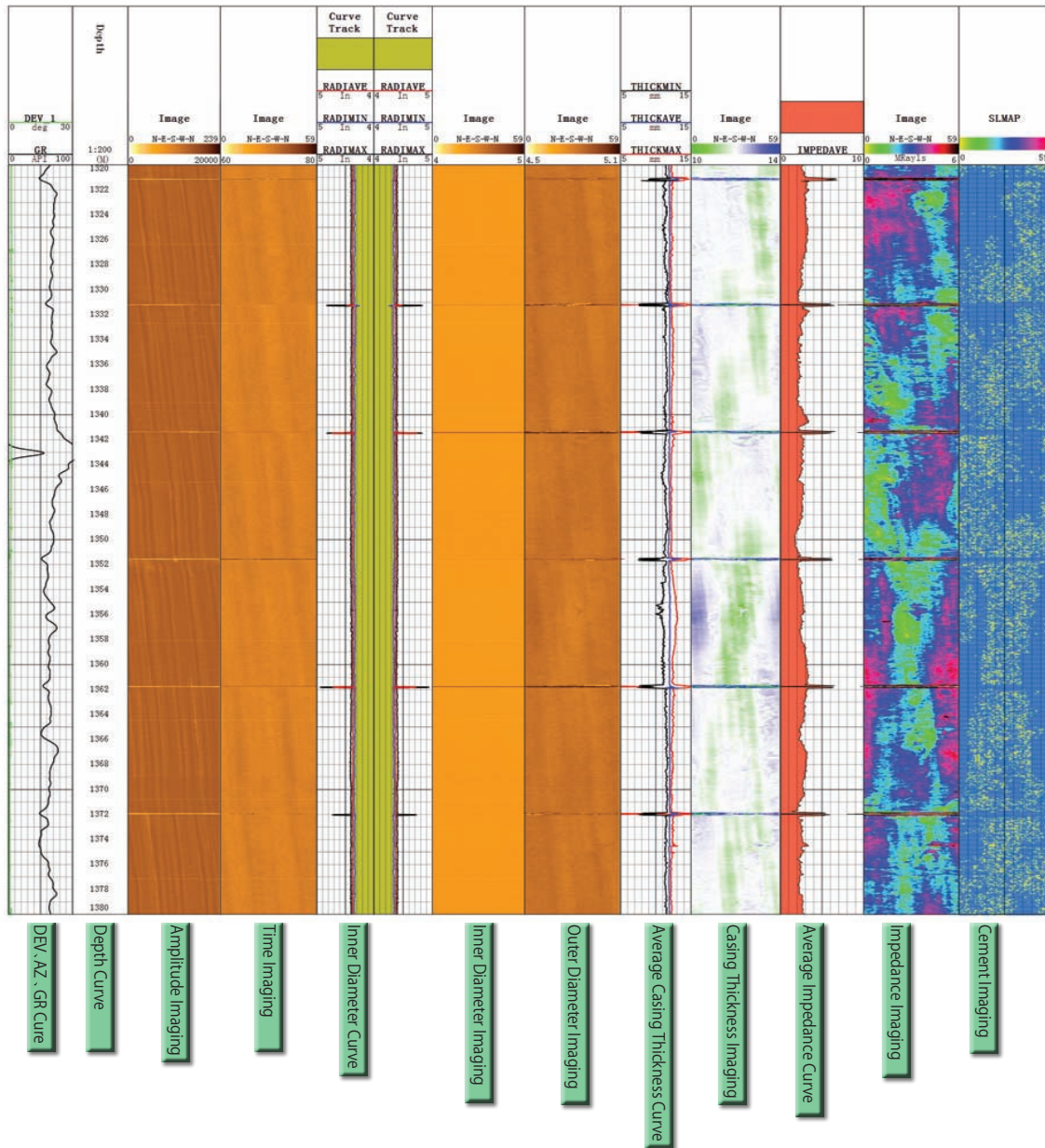
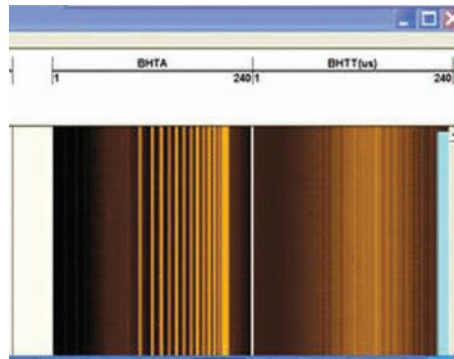


Figure 4 A map of MUIL logging presentation

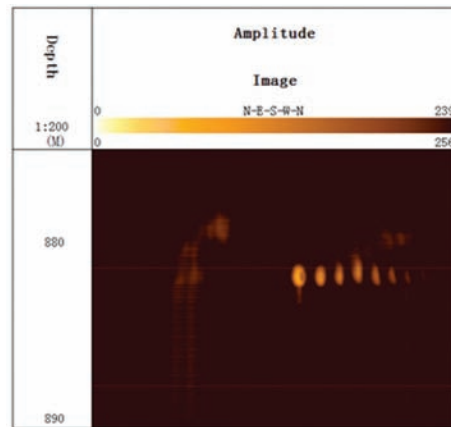
# MUIL

Illustrative example:

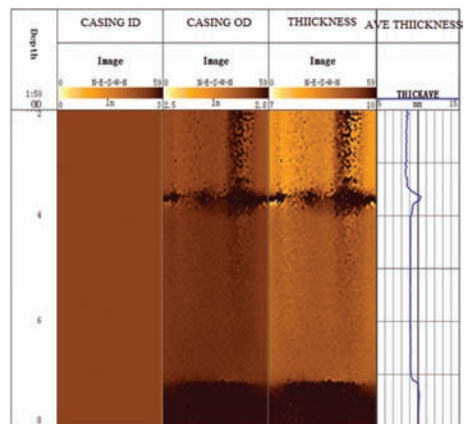
- Fracture Testing



- Perforation Testing



- Pipe Thickness Testing





# EMRT<sup>®</sup>

## Enhanced Magnetic Resonance Tool

The Nuclear Magnetic Resonance (NMR) technology is one of the most advanced technology in well logging today. The logging signals, which contain rich information about reservoir, come from the pore spaces of reservoir rocks, and can be used to analyze the key parameters such as the volume of free fluid, bound water, and permeability ,pore size distribution. During the exploration stage, the NMR logging can provide effective information of fluid properties, reservoir properties and recoverable reserves and so on for the reservoir evaluation. In the development wells, the NMR logging can provide quantitative data for evaluation and analysis of problem such as oil remaining, recovery ratio and the effects of production increase methods. It has an obvious effect with the application to the complex reservoir , the low resistivity and saturation reservoirs as well as natural gas and heavy oil reservoirs. The Nuclear Magnetic Resonance (NMR) technology has become a symbol , which can stand for the logging level of a company or even a country .

ELIS Magnet Resonance Tool(EMRT) mainly measures the hydrogen nuclei response from formation pore fluid. With static and pulsed radio frequency(RF) magnetic field , the tool can make downhole spin echo magnetic response measurements. The spin-echo train contains all important information. The initial amplitude of the spin-echo train is proportional to the number of hydrogen nuclei associated with the fluids in the pores within the sensitive volume, which can be calibrated to give porosity. The attenuation rate of the spin-echo provides information for pore size and fluid types.

### Functions:

Directly measure the density of hydrogen nuclei in reservoir pore movable fluid , which can quantitative analysis the volume of free fluid , bound water ,permeability and pore size distribution ,the mineral components of the rock rack have no effect on the porosity measurement.

The NMR technology has an obvious effect to the application of the complex reservoir, the low resistivity and saturation reservoirs, natural gas and heavy oil reservoirs. The NMR technology is irreplaceable in these reservoir.

TOOL NO : EMRT 9321;

Principle: Gradient field, Pulse-echo NMR ;

TOOL COM. : Standard EDIB Bus ;



# EMRT<sup>®</sup>

Data recorded: : control parameters TW、TE、NE、PHASE and quality control parameters etc. ; echoX、echoY,  
Each echo train is recorded in a composite curve along with calibration, acquisition and auxiliary data values ;

Logging MODE :

- |                      |           |
|----------------------|-----------|
| (1) single TWTE      | STWTE     |
| (2) fast bound water | FASTBOUND |
| (3) 3 freq poro perm | 3FMODE    |
| (4) 6 freq poro perm | 6FMODE    |
| (5) oil mode         | OIL3F     |
| (6) heavy oil mode   | HOIL6F    |
| (7) gas mode 1       | GAS6F1    |
| (8) gas mode 2       | GAS6F2    |

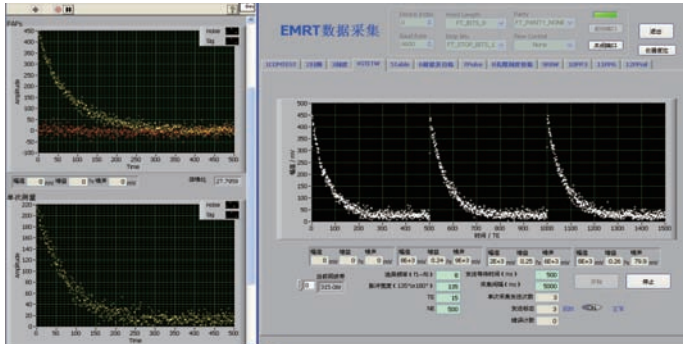
Logging Curves : clay bound water (CBW)、bulk volume irreducible (BVI)、bulk volume movable (BVM)、permeability、effective porosity (MPHE)、total porosity (MPHS)、differential T2 distributions and Fluid-type analysis curve etc.

Measurement Range :	0-100pu ;
TE :	0.4ms-10ms ;
TW :	0.02-15.0 s
MAX. NE :	1000
Measurement Accuracy :	± 2pu ;
Max Logging Speed :	11ft./min. (3.3m/min. ); spotted survey available
Number of Operating Frequencies :	8 ;
Depth of Investigation Beyond Borehole Wall :	2.17in.-4.53in.(55-115mm) ;
Static field Gradient:	12-45 gauss/cm
Min. Vertical Resolution :	23.62 in.(600mm) ;
Search Angle :	120° ;
Shell Thickness :	0.04in-0.08 in.(1.0-2.0mm) ;
Maximum Temperature :	302° F(150°C )/ 4Hours ;
Maximum Pressure :	16,000psi (110MPa) ;
Tool Operating Position :	Decentralized(telescoping ram) ;
MIN. Hole Diameter :	7.09in.(180mm) ;
MAX. Hole Diameter :	16.5in. (420mm) ;
Length: Make-up :	29ft.-5.16in.(8.97m) ;
EB: 11ft.-2.64in. (3.42m);MB :	7ft.-10.8in. (2.41m) ;
QA :	10ft.-3.6in. (3.14m) ;
Transport Length :	12ft.-5.64in.(3.8m) ;
Instrument Weight : EB :	265.7lbs (120.5kg) ; MB : 275.6lbs (125kg) ;
QA :	277.8lbs (126kg) ;
Telescoping ram :	71.7lbs (32.5kg)
Tool for Mud Ruled out :	46.7lbs (21.2kg)
Total weight :	937.4lbs (425.2kg)

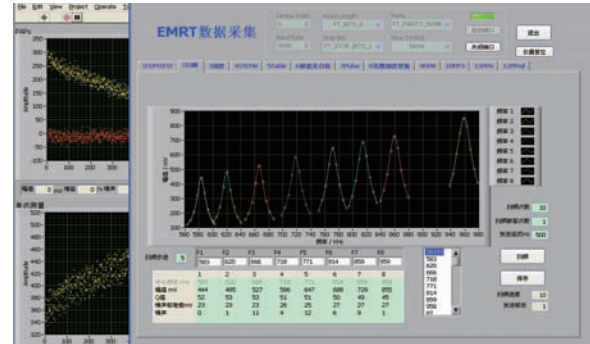


EMRT®

Echoes Acquisition

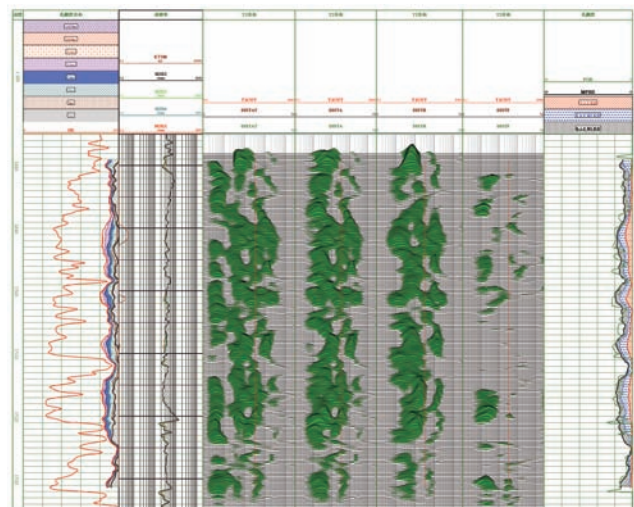
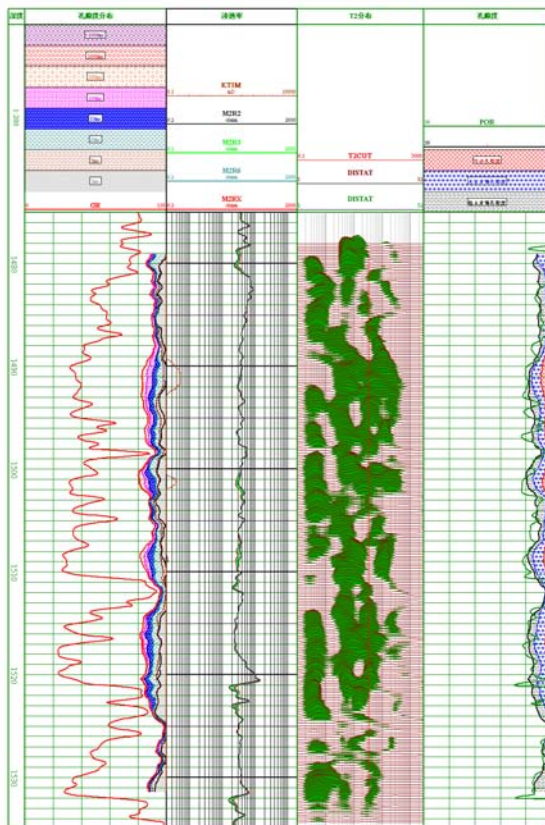


Frequency Sweep

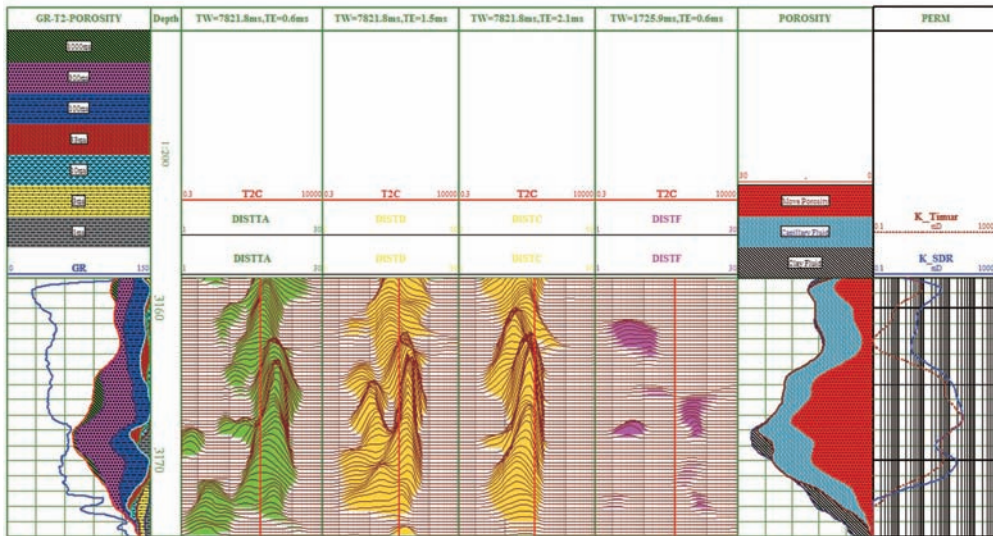


Log shows (Track 1 shows the depth ;Track 2 contains a conventional gamma ray correlation curve and T2 bin data from short-TE echo trains; Track 3 shows the calculated PERM and Rt. Track 4 displays the T2 distribution. Track 5 contains the PMT/PME/PMF curves.)

Log shows (Track 1 shows the depth ;Track 2 contains a conventional gamma ray correlation curve and T2 bin data from short-TE echo trains; Track 3 shows the calculated PERM and Rt. Track 4 displays the T2 distribution from long-TW and CBW echo trains. Track 5 displays the T2 distribution from long-TW echo trains. Track 6 displays the T2 distribution from short-TW echo trains. Track 7 displays the difference T2 distribution from long-TW and short-TW echo trains. Track 8 contains the PMT/PME/PMF curves.)



Iraq typical oil reservoir



Iraq typical water layer



# EAIL

## Array Induction Log

Array Induction Log (EAIL) , which is based on electromagnetic theory, can be used for investigation in borehole teeming with oil-based mud、 water-based mud or air. The coil array mandrel consists of 1 transmitter coils and 7 receiver coils. When works the EAIL’s transmitter coil sends the rectangular electromagnetic wave which generates eddy currents in the stratum, then eddy currents generate the inductive voltage in the receiver coils and The processed signal will be sent to the surface system where the FFT、 skin effect correction、 borehole correction、 software focusing、 adaptive filtering、 resolution matching is accomplished. The tool could simultaneously output resistivity curves of six radial depth investigations and three vertical resolutions. EAIL also uses an SP electrode for measurement of spontaneous potential.

### Components:

Electronics (EA) +Mandrel (MA)

### Specifications:

Maximum Temperature:	347°F 2 hours (175°C 2 hours)
Maximum pressure:	20,300psi (140Mpa)
Diameter:	3.64in. (92.5mm)
Length:	29ft.-4.4in. (8.95m)
Weigh:	432lb (196kg)
Cable Requirement:	7 cores cable
Electrical Supply:	180VAc/320mA, 60 ± 2Hz
Transfer Mode:	Order: Mode 2 Tool Status: Mode 2 Data: Mode 5 or Mode 7
Data Transfer Time:	140ms
Sampling Rate:	4 points/ft(Recommended) or 2 points/ft(High Speed)
Recommended logging speed:	30ft./min (9.1m/min)
Maximum logging speed:	4 points/ft: 60ft./min (18.3m/min), 2 points/ft: 100ft./min(30.8m/min),
Radial Depth of investigations:	10/20/30/60/90/120in. (0.25/0.51/0.76/1.52/2.29/3.05m)
Vertical resolution:	1/2/4ft. (0.3/0.61/1.22m)
Measuring Range:	0.2~ 2,000ohm•m





# EAIL

Precision of Measurement (Homogeneous Stratum):

- ± 1ms/m, or ± 2% of the reading, when the Radial Depth of investigations are 60in、 90in and 120in.
- ± 2ms/m, or ± 2% of the reading, when the Radial Depth of investigation is 30in.
- ± 4ms/m, or ± 2% of the reading, when the Radial Depth of investigation is 20in.
- ± 10ms/m, or ± 2% of the reading, when the Radial Depth of investigation is 10in.

Number of transmitters: 1  
 Number of receivers: 7

Limitation:

Borehole diameter: 4.5in(114mm) ~ 20in. ( 508mm)

Borehole characteristics:

Rt/Rm<7,000, when the Borehole diameter is 6in;

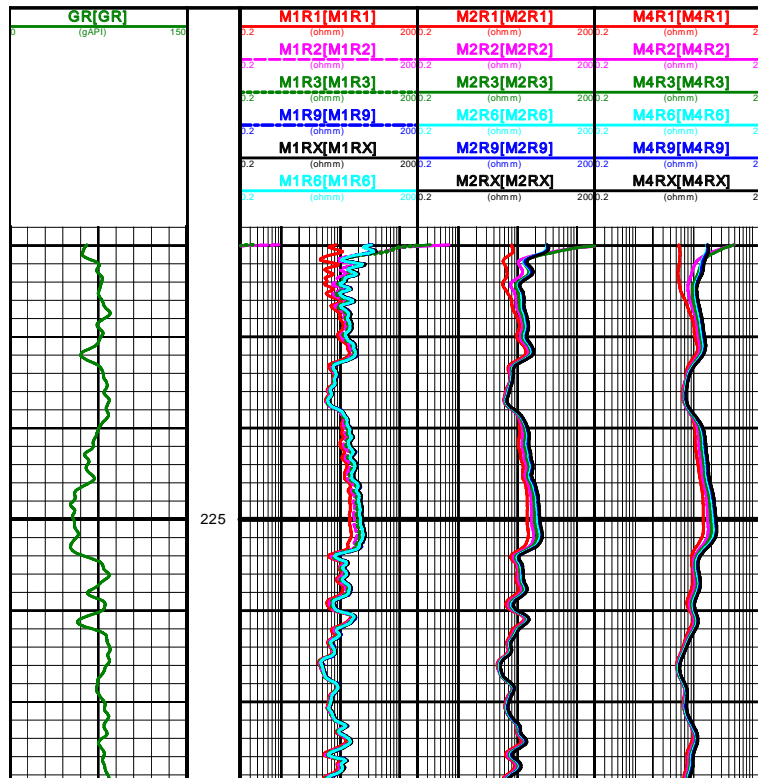
Rt/Rm<2,000, when the Borehole diameter is 8in;

Rt/Rm<1,000, when the Borehole diameter is 12in

Fluid resistivity:

≥0.2ohm·m, Oil-based mud or Water-based mud drilling fluids

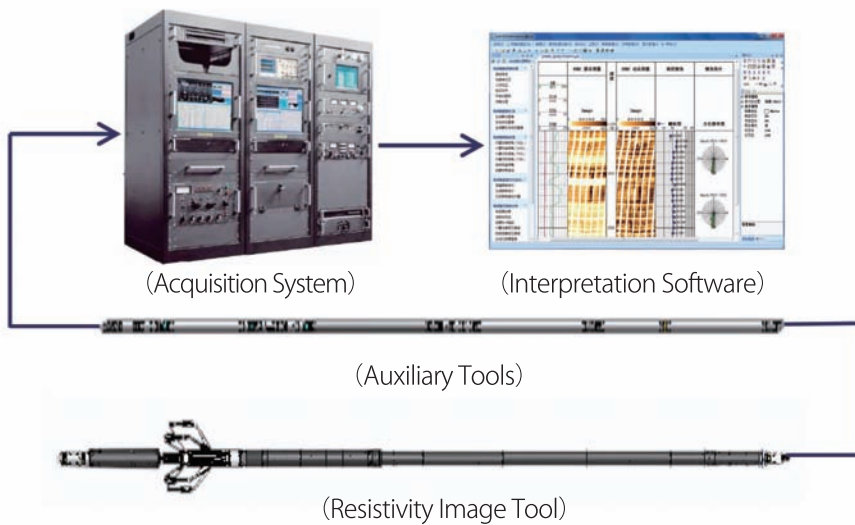
## Log:



ERMI®

Enhanced Resistivity Micro-Imager

ERMI provides micro resistivity borehole images in water-based mud well by high resolution array scanning. Special focusing circuitry ensures that the measuring currents are forced into the formation, where they are modulated in amplitude with the formation conductivities. The raw measurement currents are presented as high resolution images from which geological information is derived such as fractures, bedding, stratigraphy, dip information, depositional environments, etc.



The ERMI logging system includes resistivity image tool, auxiliary tools, data collection system, and data interpretation software. Based on the hardware platform of own ELIS collection system, software modules have been developed, including tool operation, data processing, real show, and so on. ERMI can also operate using 5700 ground system and supporting sets, with the help of the ELIS acquisition panels. By data format transformation, ERMI data also can be processed by other commercial software.

# ERMI<sup>®</sup>

## SPECIFICATION

### DIMENSIONS AND RATINGS :

Max Temp : 350° F(175°C)	Max Press : 20,000 psi (137.9Mpa)
Max OD : 5.0in. (127mm)	Min Hole : 6 in. (15.24cm)
Length : 27.8ft (8.46m)	Max Hole : 21in. (53.34cm)
Weight : 589.41lbs (267.35kg)	Sampling interval: 0.1in. (2.54mm)

### BOREHOLE CONDITIONS :

Borehole Fluids : Salt <input type="checkbox"/> Fresh <input type="checkbox"/> Oil <input type="checkbox"/> Air <input type="checkbox"/>
Recommended Logging Speed : 20ft/min (6m/min)
Tool Positioning : Centralized <input type="checkbox"/> Eccentralized <input type="checkbox"/>

### HARDWARE CHARACTERISTICS :

Source Type : Induced Current
Sensor Type : Micro-Resistivity Buttons
Sensor Spacing : 2 rows containing 12 & 13 sensors, respectively 0.300 in. between rows 0.200 in. between sensors on each row 0.100 in. between sensors when both rows are superimposed
Firing Rate : Continuous
Sampling Rate : 120samples/ft (394samples/m)

### MEASUREMENT :

Source Type : Induced Current
Sensor Type : Micro-Resistivity Buttons
Sensor Spacing : 2 rows containing 12 & 13 sensors, respectively 0.300 in. between rows 0.200 in. between sensors on each row 0.100 in. between sensors when both rows are superimposed
Firing Rate : Continuous
Sampling Rate : 120samples/ft (394samples/m)

### MEASUREMENT :

Principle	Resistivity	Azimuth	Rotation	Deviation	Caliper
	Micro_Resistivity	Navigation			
0-360°	0.2-10,000ohm-m 0<Rt/Rm<20,000	0-360°	0-360°	0-90°	6-21in.
Vertical Resolution	0.2in.	N/A	N/A	N/A	N/A
Depth of Investigation	Formation Dependent	N/A	N/A	N/A	N/A
Sensitivity	N/A	0.1o	0.1o	0.03o	0.1in.
Accuracy	N/A	± 5o	± 2o	± 4o	± 0.1in.
Primary Curves	Image	AZI1,HAZI	RB	DEVI	CAL1-6
Secondary Curves	Micro-Resistivity, Dip Angle, Dip AZI, Borehole Inclination				

### BOREHOLE CONDITIONS :

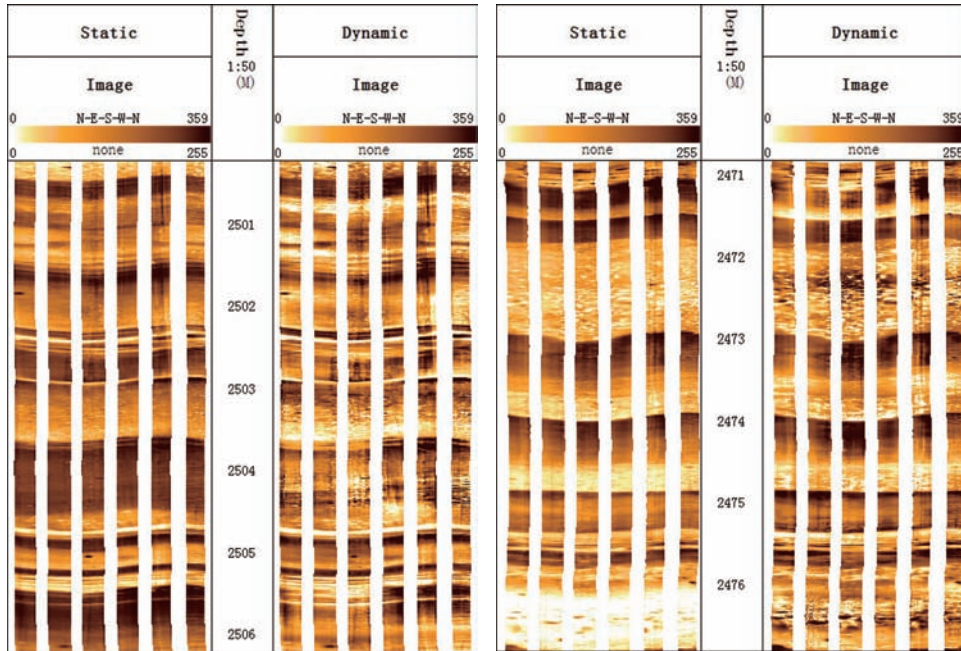
Fracture identification and characterization
Thin-bed analysis
Characterization of sedimentary bodies
Structural analysis
Secondary porosity evaluation
Orientation and substitution of cores
Valuable help for reservoir characterization





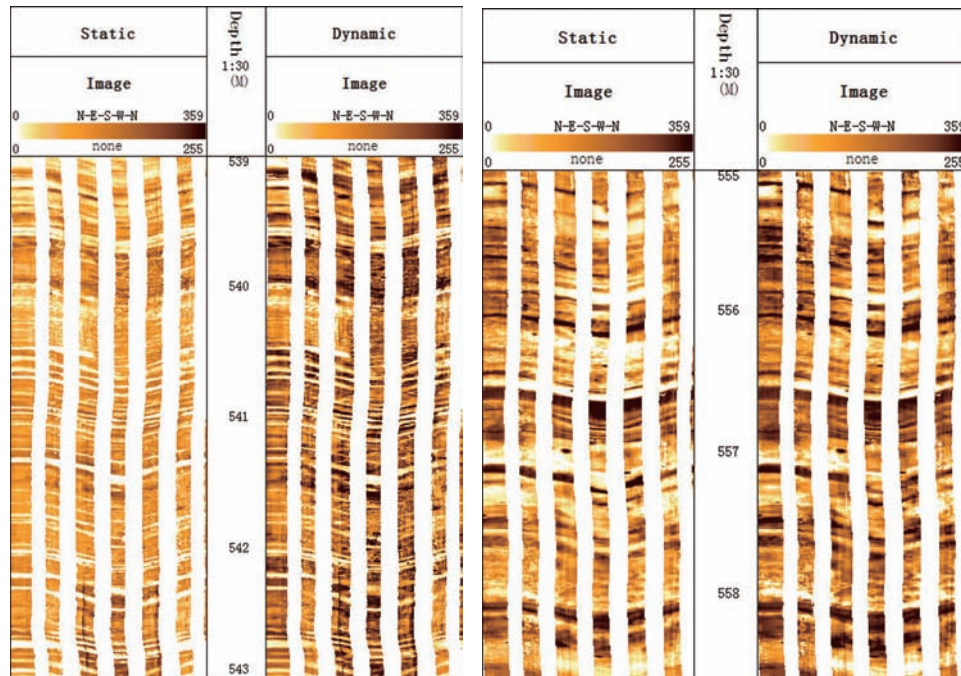
ERMI<sup>®</sup>

Images of ERMI



(Sand and Shale)

(Sand and Shale)

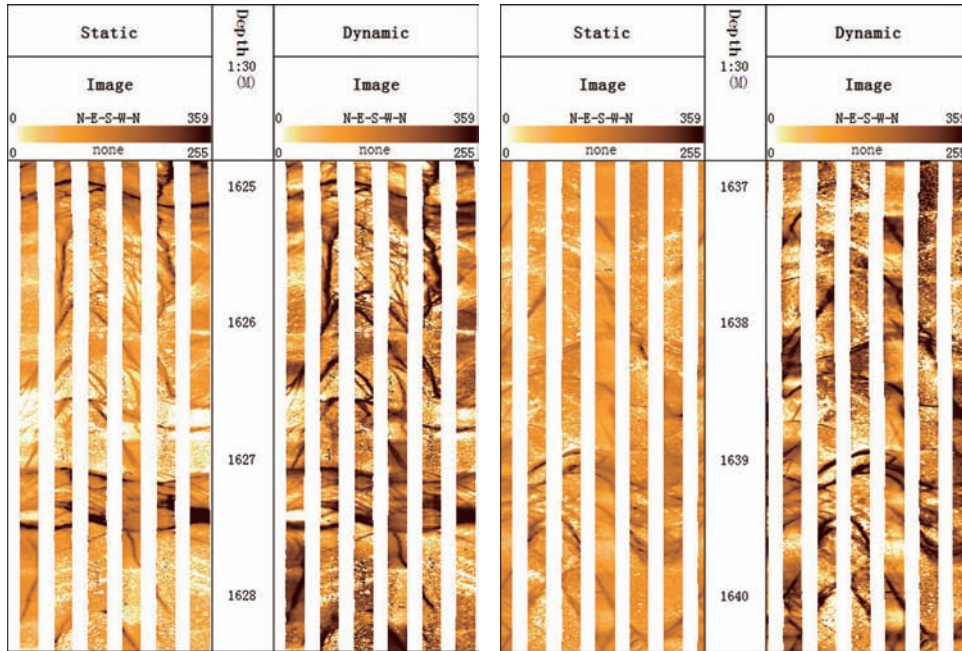


(Sand and Shale)

(Sand and Shale)

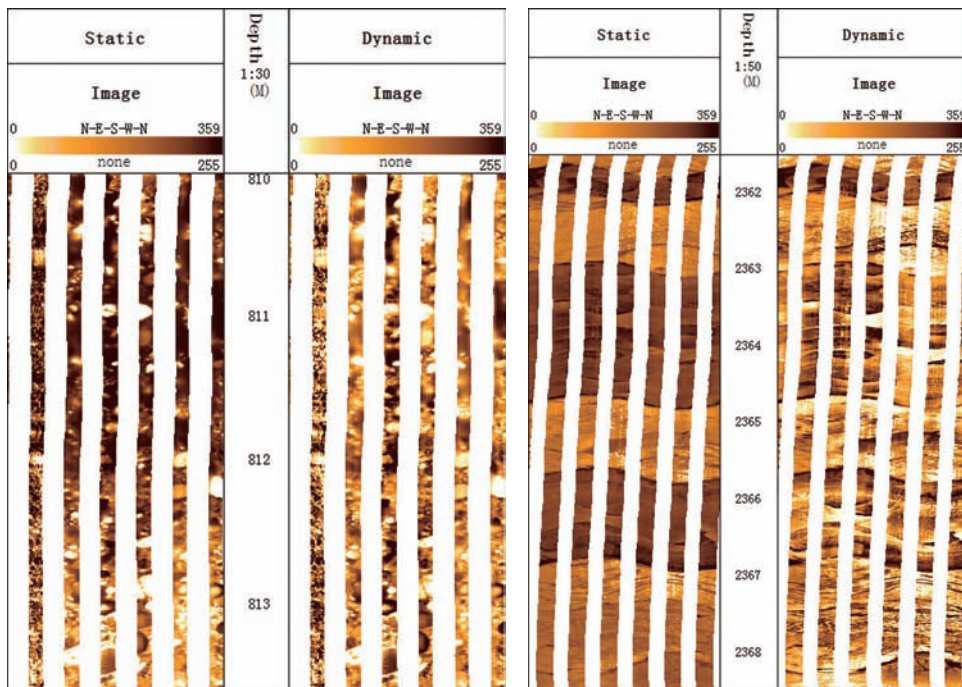
ERMI®

Images of ERMI



(Granite)

(Granite)



(Tuffaceous Conglomerate)

(Dolostone and Shale)

# ERSC<sup>®</sup>

## Enhanced Rotary Sidewall Coring Tool

Rotary Sidewall Coring Tool is a sample tool to get formation samples. It fits all kinds of formations, especially hard layers. The tool is controlled by the computer and hydraulically powered in the mandrel, with multiple samples in one run. It has Gamma ray detector inside the tool to achieve the depth correction of coring points. The coring system is composed of surface equipment and downhole tool.

### Components:

Electronics (EA) +Mandrel (MA)

### Feature:

- Digital display of downhole tool status ;
- Data transmission based on carrier wave and stable communication ;
- Large double power supply to the Motor, tool performance in stabilization ;
- Three motored arms on the tool to set the tool fastness to wall in borehole, prevent being stuck ;
- Large raw samples of the formation ;
- Flexibility of selection of sampling depth, more samples at the same depth ;

### Specifications:

Maximum Temperature:	347° F (175° C)
Maximum Pressure:	17,000psi (120Mpa)
Maximum O.D.	5.0in.(127mm)
Operating Power:	380V, 50Hz
Borehole Diameter:	6in. (152.4mm)~12.25in. (311mm)
Samples per run:	25 cores tank or 50 cores tank
Average Coring time per sample:	≤5 min
Recovery rate:	≥85%
Core Length:	1.97in. (50mm)
Core Diameter:	0.98in. (25mm)

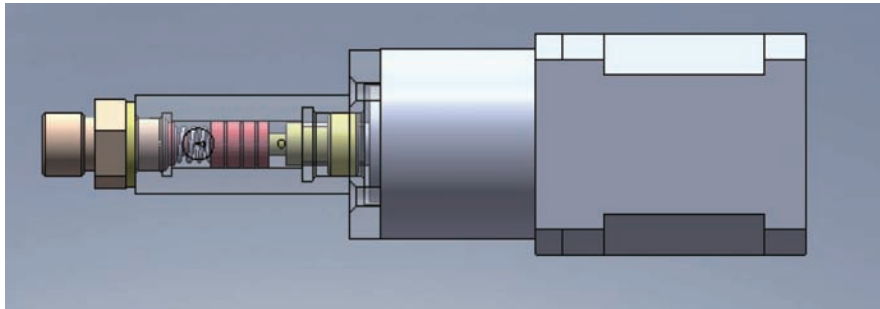




# ERSC<sup>®</sup>

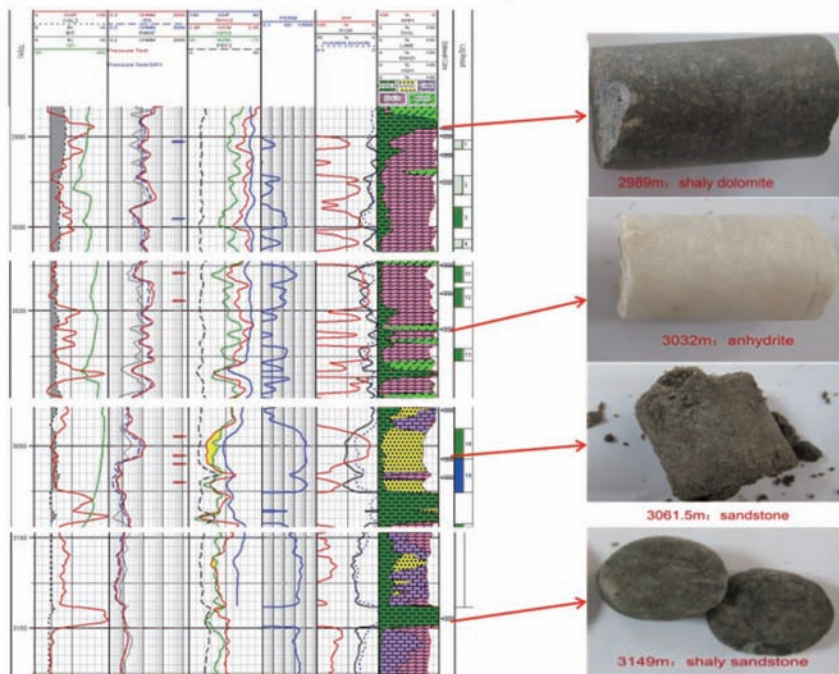
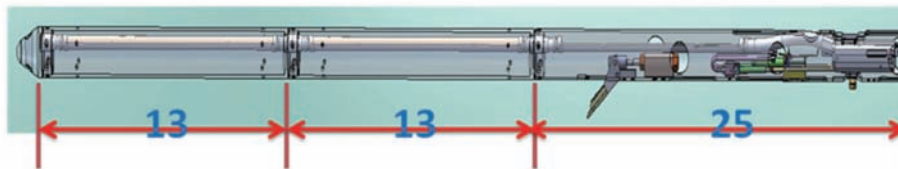
## • Real Time Coring Speed Control

Diff. Coring Speed for Hard/Soft Formation.



## • Extendable Cores Tank (13+13+25=51 Cores)

Max. 51 Cores Gotten in 1 Trip , Save the Rig Time.



RECOVERY CORES IN IRAQ OILFIELD

# EXDT™

## Cross Dipole Array Sonic Tool

This tool is designed to use a dual monopole and cross dipole sound transducers to generate the acoustic wave signals to the formation, the receiving transducers in array receive acoustic signals from formation in dual directions in 90 degrees. The time difference of longitudinal wave, full wave of longitudinal wave, full wave of dipole transverse wave and orthogonal cross dipole full wave is acquired simultaneously in one run. It is mainly applied in basic rock physical interpretation, and can be used to evaluate porosity of the formation, judge lithology, identify gas formation, analyze permeability; judge direction of strata, anisotropy of formation rock and distribution of principle stress in formation.

### Composition:

Electronics (EA) + Receiver mandrel (MA) + Sound isolator (PA) + Transmitter mandrel (FB) + Transmitter electronics (FA)

### Features / Advancement:

- (1) Multi-pole measurement.
- (2) Full wave Recorded.
- (3) Measurement of dipole wave in dual directions in 90 degrees.
- (4) Evaluate change of formation in the horizontality.
- (5) Identify geologic sedimentation changes of formation in wells.
- (6) Identify fracture of formation in wells.
- (7) Compatibility of EDIB tool.

### Specifications:

Maximum Temperature:	350°F (175°C ) for 4 hrs.
Maximum Pressure:	20,000Psi (137.9Mpa).
Minimum hole diameter:	4.5 in. (114 mm)
Maximum hole diameter:	21 in. (533.4mm)

Maximum diameter:

MA:	3.62 in (92mm)
PA:	3.62 in (92mm)
FB:	3.62 in (92mm)
FA:	3.38 in (86mm)

T-R Spacing:

Monopole T01:	126 in (3200.4mm); T02: 804.66 in (2438.4mm).
Dipole T23:	102 in (2590.8mm);



# EXDT™

Instrument length: MA: 61.02 in (4090mm)  
PA: 59.84 in (1520mm)  
FB: 94.88 in (2410mm)  
FA: 42.16 in (1070mm)

Instrument weight: 778.23 lb (353 kg)  
MA: 343.92 lb (156kg)  
PA: 116.84 lb (53kg)  
FB: 240.3 lb (109kg)  
FA: 77.16 lb (35kg)

Maximum Compressive Force: 13227.6 lb (6,000kg)

Maximum Tensile Force: 992.07 lb (450 kg)

Maximum logging speed:

inline Mode: 28ft/min (8.53m/min)

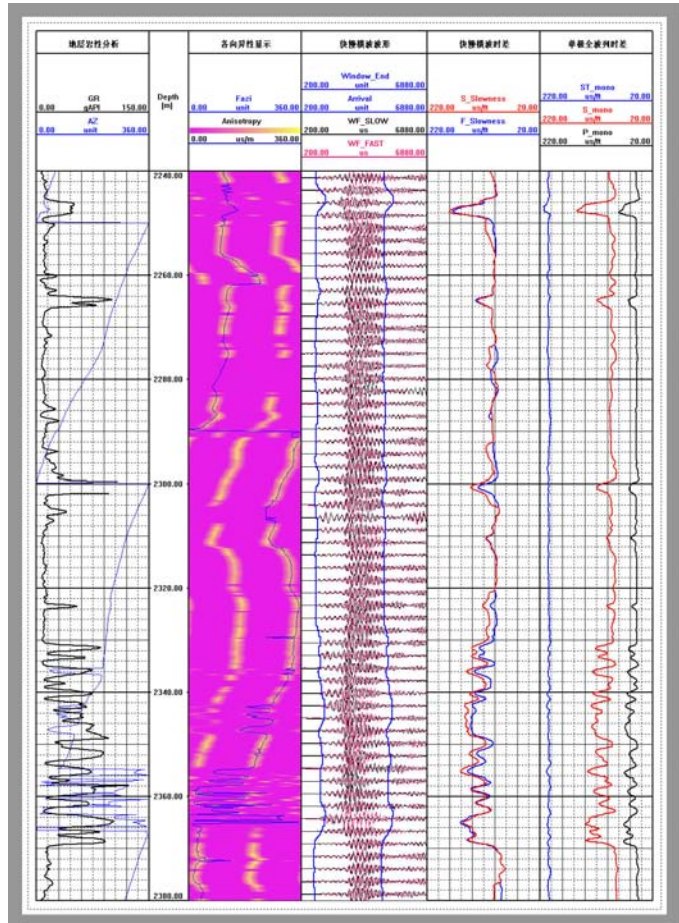
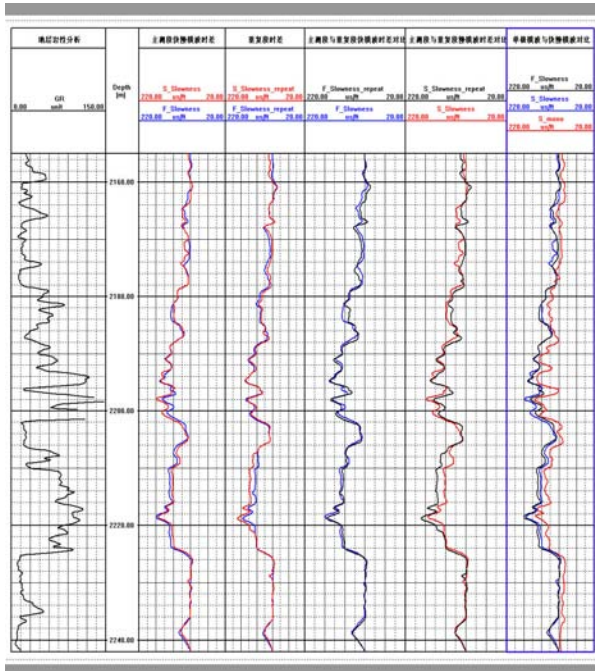
Crossline Mode: 15ft/min (4.572m/min)

Error precision: DTP<sub>wave</sub>: ± 3% ;  
DTS<sub>wave</sub>: ± 5% ;  
DTST<sub>wave</sub>: ± 5% .

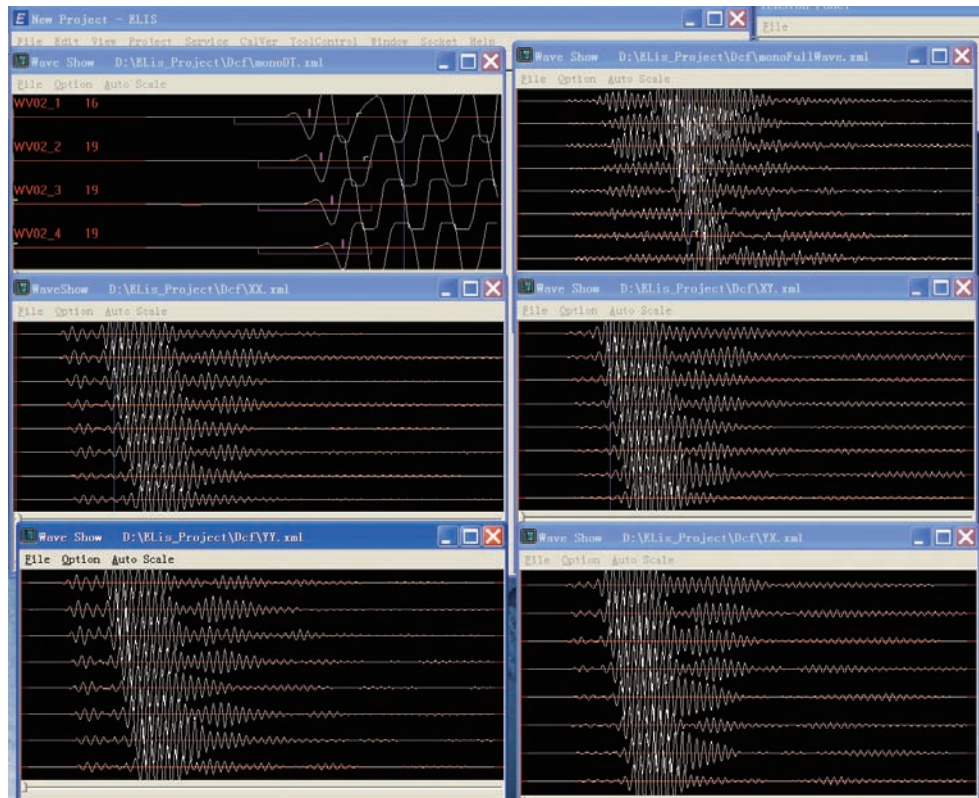
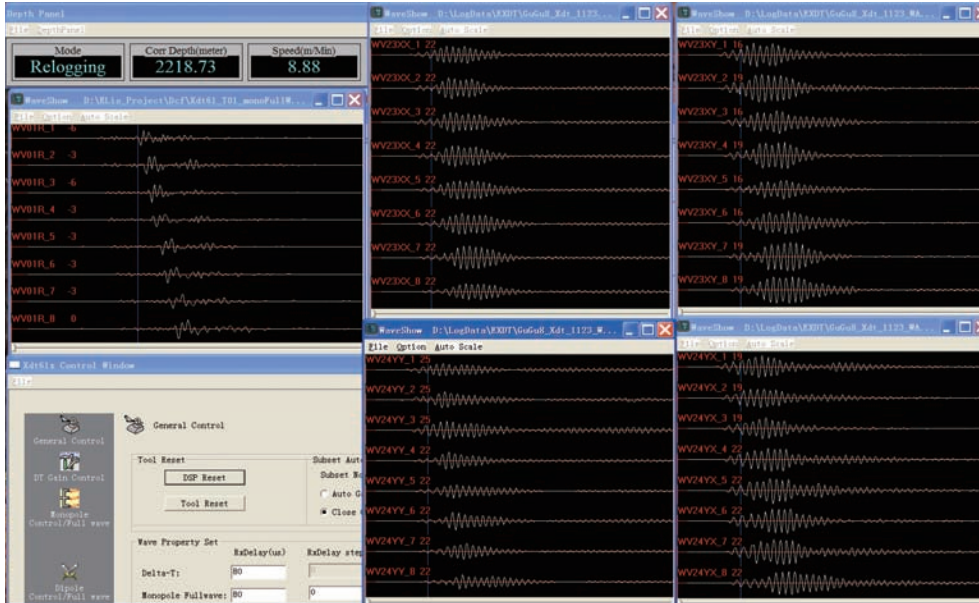


EXDT™

Log:



# EXDT™



# CBMT

## Cement Bond Imaging Logging Tool

The principle of acoustic wave attenuation is adopted to measure cement bond between casing and cement sheath, as well as formation. From the measurement data, the quality of well cementation and seal between the layers of the formation is analyzed. The tool is designed in the motored arm structure with six pads, which divides circumferential borehole into six sectors when arm is opened, and conducts compensatory measurement on such six sectors to accurately measure quality of cement bound. The pad is designed in the double transmitting probes in wave superposition when the transducers are fired in the time delay, and compensates energy loss due to acoustic scattering. The acquired signals of the pad are arranged in a crossed way to achieve compensatory measurement and minimized affect of borehole environment. The instrument combines conventional variable density measurement, casing collar locator and gamma-ray assisted measurement.

### Composition:

Data acquisition and data and transmission sub (CBMT61EA 9242)+ Pad section (CBMT61XA 9243) + VDL section (CBMT61PA 9244)

### Features / Advantage:

- 360° sectored measurement, ensuring accurate measurement;
- Motored Pad design, with high accuracy;
- Capable of identifying channel and hole;
- Can be used in highly-deviated well or horizontal well;
- Minimization affected by borehole environment;
- Visual cement map;
- Real-time quality monitoring;
- The variable density measurement is integrated in logging tool string.

### Specification:

Maximum Temperature: 350°F (175°C) 2 hour;  
 Maximum Pressure: 20,300psi (140Mpa);  
 Weight: 480.61lb (218kg);  
 measuring point (from connector of bottom): 179.133in (4550 mm);  
 Minimum casing: 4.01in (102 mm);  
 Maximum casing: 15.4in (393 mm);  
 Diameter: 3.38in (85.8 mm);





# CBMT

Make-up length:  
 Acquisition/transmission: 7ft-11.6in. (2.43m)  
 PAD section: 17 ft-4.0 in. (5.28 m)  
 VDL section: 7 ft-8.0 in. (2.34 m)

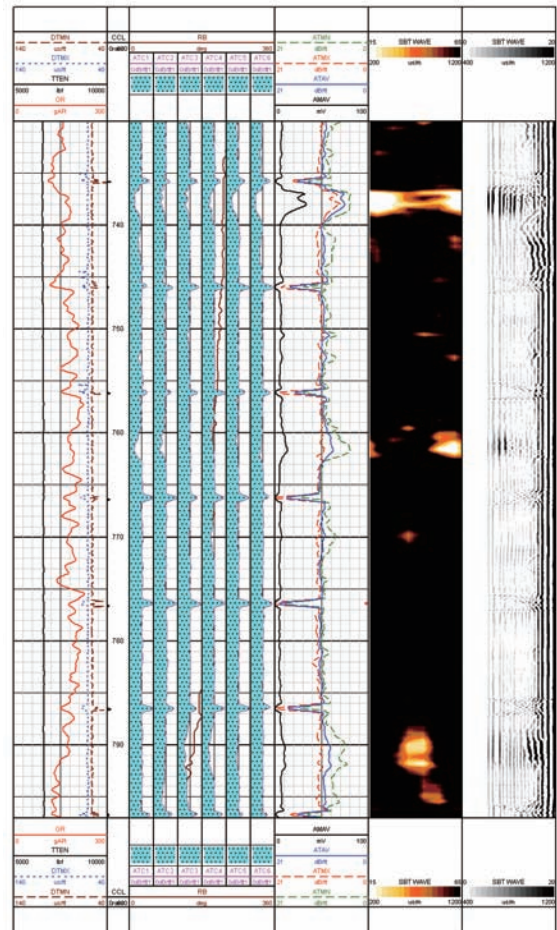
Instrument weight:  
 Acquisition/transmission : 133lbs (60.3kg)  
 PAD section: 240 lbs (108 kg)  
 VDL section: 108 lbs (49 kg)

Maximum logging speed: 1092 m/h  
 Measurement range: 0-22dB/ft compensation attenuation  
 Measurement accuracy:  $\pm 1.0$  dB/ft or 10% of logging value  
 Repeatability:  $\pm 1.0$  dB/ft or 10% of logging value  
 Cable Head vottage Measurement accuracy :  $\pm 1V$  ;  
 Flask temperature Measurement accuracy :  $\pm 1^{\circ}C$  ;  
 Vertical resolution : 0.25 ft (7.62 cm) ;  
 Radial resolution:  $60^{\circ}$   
 Depth of investigation: 2 in. (5.08 cm)

Operating frequency of transducer:  
 Variable density measurement transducer: 20KHz ;  
 Pad transducer: 100KHz ;  
 Pad force: 51lb (23 kg) ;  
 Requirement for power supply: 150Vdc@25mA  
 Maximum Current of open moter : 300mA ;  
 Maximum Current of close moter : 400mA ;  
 Type of detector :  
 100 kHz Multilayer piezoelectric ceramic stack ;  
 20 kHz Multilayer piezoelectric ceramic cylinder.

Cable requirement:  
 single- or multi-conductor cable,  
 with a maximum length of 30,000ft.

## Log:



# CORT

## Casing Orientation Tool

Casing Orientation Tool with high precision optical fiber gyroscope can provide the precise measurements of the deviation, deviation azimuth and relative bearing in both cased and open boreholes. The tool is all solid and It has the advantages of high precision, long lifetime and logging without the interference of the casing.

### Features:

- Support EDIB Bus protocol;
- Azimuth measurement in casing;
- High precision;

### Technical specifications:

Maximum Temperature:	350°F (175°C ) for 4 hours;
Maximum Pressure:	20000psi (140MPa);
Minimum Casing ID:	4.5 in.(114 mm);
Maximum Casing ID:	21 in.(533 mm);
Tool Diameter:	3.62 in.(92 mm);
Tool Make-up Length:	10ft-0.27in.(3055m);
Tool Shipping Length:	11ft-4.26in.(3461mm);
Maximum Logging Speed :	82ft/min(25m/min);
Work Voltage Requirement:	180Vac ± 10V,58-62Hz;
Work Current:	220mA ± 10mA;
Telemetry Protocol:	EDIB;
Telemetry Speed:	41.6kbit/s;
Deviation Range:	0° ~ 90° ;
Deviation Precision:	± 0.05° ;
Deviation Azimuth Range:	0° ~ 360° ;
Deviation Azimuth Precision:	± 3° (3° ≤ Deviation ≤ 60° ); ± 4° (0° ≤ Deviation < 3° , 60° < Deviation ≤ 90° );
Relative Bearing Range:	0° ~ 360° ;
Relative Bearing Precision:	± 1° (10° ≤ Deviation ≤ 90° ); ± 2° (5° ≤ Deviation < 10° );
1# Pad Azimuth Range:	0° ~ 360° ;
1# Pad Azimuth Precision:	± 4° (0° ≤ Deviation ≤ 5° , 10° ≤ Deviation ≤ 60° ); ± 5° (5° < Deviation < 10° , 60° < Deviation ≤ 90° ).



# ECAL

## Three Arm Caliper Logging Tool

Three Arm Caliper Logging Tool is used to log the borehole diameter through the three arms to drive the POT inside the tool, and transfer the change of borehole diameter to electric signal. In the ELIS logging system, the electric signal can be calculated to the digital borehole diameter with factors from the calibration process.

### Specifications:

Maximum Temperature:	350°F (175°C ) 2 hours ;
Maximum Pressure:	20,305Psi (140MPa) ;
Diameter:	4.41in.(112mm)
Make-up length:	7ft-6.6in.(2.3m)
Measurement Range:	6in.(152.4mm) ~ 16in.(406.4mm)
Measurement Accuracy:	0.41in.
Power Requirement:	180VAC@20mA 60Hz
Logging combination:	ERTT combination
Wireline Requirement:	7 conductor cable





# FCAL

## Four-arm Caliper Tool

Four-arm Caliper Logging Tool, bases on the EDIB Bus, is a Caliper tool. The tool accurately measures the hole's radius in four angles with 90° each angle, and the tool's axis is the center of the radius. Two diameter curves or for radius curves will be obtained in logging process. When logging in the opening hole, the degree of irregularity of the hole can be obtained. When logging in the casing hole, the position of the casing damaged and deformation condition can be obtained.

### Characteristic:

- (1) Support EDIB Bus protocol ;
- (2) Four radius curves ;
- (3) High precision ;

### Specifications:

Maximum Temperature:	350°F (175°C ) for 2 hours;
Maximum Pressure:	20,000psi (140MPa);
Minimum Casing ID:	5.5 in. (140.00 mm);
Maximum Casing ID:	21in. (530 mm);
Tool Diameter:	3.5in. (91mm);
Tool weight:	141 lb (64.5 kg);
Tool Make-up Length:	6ft 1 in. (1.86 m);
Maximum Logging Speed:	60 ft/min (18.3 m/min);
Work power supply:	180VAC@25mA, 58-62Hz;
Accuracy:	0.2 in (5 mm);
Detector:	Draw bar potentiometer



# HCAL

## Six-arm Caliper Tool

Six-arm Caliper Logging Tool, bases on the EDIB Bus, is a Caliper tool. The tool accurately measures the hole's radius in six angles with 60° each angle, and the tool's axis is the center of the radius. Three diameter curves or six radius curves will be obtained in logging process. When logging in the opening hole, the degree of irregularity of the hole can be obtained. When logging in the casing hole, the position of the casing damaged and deformation condition can be obtained.

### Characteristic:

- (1) Support EDIB Bus protocol ;
- (2) Six radius curves ;
- (3) High precision ;

### specifications:

Maximum Temperature:	350°F (175°C ) for 2 hours;
Maximum Pressure:	20,000psi (140MPa);
Minimum Casing ID:	5.5 in. (140.00 mm);
Maximum Casing ID:	26 in. (660.4 mm);
Tool Diameter:	3.63in. (92mm);
Tool Weight:	115 lb (52.2 kg);
Tool Make-up Length:	7 ft 7 in. (2.31 m);
Maximum Logging Speed:	60 ft/min (18.3 m/min);
Line requirement:	7 core line;
Work power supply:	180VAC@75mA, 58-62Hz;
Accuracy:	0.1 in (2.5 mm);
Measuring Point:	33.5 in (0.85 m) from bottom sub;
Telemetry Speed:	41.6kbit/s;
Detector:	Magnetic Resistance



# ECCL

## Collar Locate Tool

ECCL instrument measurement is based upon the principle that a changing magnetic flux within the tool sensor coil generates a voltage signal across the output of the sensor coil. The magnetic field of a ECCL magnet is affected by any magnetically sensitive material close to it, such as the casing in a borehole. A collar or joint in the casing changes the magnetic flux field including the flux passing through the sensor coil ends adjacent to the magnets, causing an electric voltage signal to be generated. The voltage signal is sent to surface system after processed by the downhole tool.

### Specification:

Maximum Temperature:	350°F (175°C) 2 hours ;
Maximum Pressure:	20,305Psi (140MPa) ;
Diameter:	3.78in.(85.8mm)
Tool Length:	8ft-2.58in.(2.5m)
Measurement Range:	3.94in(100mm) ~ 16.3in.(414mm)
Detector:	Magnet and coil
Logging combination:	CBMT combination or CBL combination
Wireline requirement:	Single or 7 conductors cable



# EOCH

## Oil Filled Cable Head

Oil-filled bridle is designed for ELIS, 3700, 5700 series of instruments. In the working condition of high voltage, large current and high temperature and high pressure wells, it can guarantee good insulation. 1-7 core of cable is corresponding with 1-7 core of bridle, 8-10 core of bridle is for grounding.

### Technical Parameters:

Maximum Temperature:	350° F (175°C )
Maximum Pressure:	20000psi (140MPa)
Diameter:	33.8in. (86mm)
Length:	49.4in. (1.254m)
Weight:	80Lbs (36.3kg)
Insulation:	>1000 M Ω
Weak Point Tension:	Depend on the selection of 6K, 8K or 10K Tensile bar,
Maximum Fishing Tension:	48T



# ECTL

## Centralizer Instrument

ECTL is optional, but is intended to be run in conjunction with instruments such as the Acoustic logging to provide centralization in the borehole.

The centralizer instrument consists of a central mandrel with integral upper tool joint, four bow spring arms with replaceable wear plates, adjustable tension springs, and a lower sub.

The centralizer mandrel is fabricated from 17-4 P.H. Stainless Steel. At the upper end the tool joint incorporates a SPLIT COLLAR fabricated from Aluminum Bronze. Four BOW spring arms and four wear plates are required. The standard bow spring arm is 1.25" wide x .125" thick with a medium spring force of 22lbs.

The optional BOW SPRING ARM is 1.25" wide x .093" thick, with a light spring force of 9lbs, and the optional bow spring arm is 1.25" wide x .187" thick, with a heavy spring force of 75lbs.

Lower sub is fabricated from 17-4 P.H. Stainless Steel and incorporates a 32-PIN bulkhead connector.

### Specification:

Maximum Temperature:	400°F (204°C)
Maximum Pressure :	20,000Psi (140MPa)
Minimum Hole Diameter	4.50 in. (114.5 mm)
Maximum Hole Diameter	16.0 in. (407.1 mm)
Make-up Length :	1.68m (66.14 in)
Shipping Length:	1.26m (49.6in)
Weight :	83lb (37.65kg)
Maximum Tension :	40,000lbf
Maximum Compressive Force :	10,000lbf



# EIST

## Insulation Sub

EIST insulation sub includes an insulating sleeve made of ceramics Peek material, which provides insulation between the top module and bottom module.

### Specification:

Maximum Temperature:	400°F (204°C ) 3 hours
Maximum Pressure:	20,305Psi (140MPa)
Diameter:	3.63 in. (91.9mm)
Tool Length:	2 ft.-1.0 in. (0.66 m)
Make-up Weight:	41lb. (18.6 kg)
Shipping Weight:	50 lb. (22.7 kg)
Maximum Tensile Force:	78,000lb (35,381 kg)
Maximum Compressive Force:	78,000lb (35,381 kg)





# EKJT

## Knuckle Joint Tool

Knuckle Joint is the tool which one for flexibility between tools in high deviation wells.

### Specifications:

Maximum Temperature:	347°F (175°C), for 1.5 hours
Maximum Pressure:	20,305 psi. (140 Mpa)
Tool Diameter:	3.54in. (90mm)
Make-up Length:	43.4in. (1.10 m)
Shipping Length:	5 ft. 1 in. (1.55 m)
Weight:	88.18lb (40 kg)
Bending angle:	≥10°



# EPAT

## Downhole Power Adapter Sub

EPAT is designed to provide large power supply (current) to the downhole instrument string. EPAT can reduce damages to the cable by large currents, as well as reduce the loss of the current over the cable. It can provide 180VAC, and provides a current of about 1.8A to the electric imaging instrument in the bottom instrument string. It can also be used in regular instrument strings which need 180VAC and operate at a maximum current of 2.3A.

### Specification:

Maximum Temperature:	400°F (200°C ) 6 hours
Maximum Pressure:	20,305Psi (140MPa)
Make-up Length :	1.60m (62.9in)
Shipping Length:	2.01m (79.1in)
Weight:	120lb (54.4kg)
Maximum Tension:	40,000lbf
Maximum Compressive Force:	10,000lbf
Voltage Requirements:	420VAC, 60Hz
Voltage Output Rating:	180VAC, 60Hz
Maximum Power Output Rating:	2.3A (180VAC)



# EPLT

## Swivel Instrument

The EPLT Swivel Assembly allows different portions of the tool string to rotate independently. It allows unrestricted 360° rotation by means of an internal slipping ring assembly.

A swivel isolates an instrument from the normal torque induced as the spiral-wound wireline is lowered into and pulled out of the well. This torque causes the tool string to rotate typically one or two rotations per 100 ft. (30 m) of depth for a seasoned line. Typically, this rotation does not cause any problems.

However, excessive rotation may degrade some well log data, such as the data from Diplog-type tools. In addition, some instruments (notably the Density and Z-Density tools) feature a powerful motorized caliper arm that causes the tool to "seek" and hold orientation across the widest axis of the borehole. Other tools have positioner to force this orientation or to hold another specific orientation. This forced orientation prevents wireline torque from rotating the string.

The built-up torque can cause the tool to break loose suddenly and spin, resulting in an interval of reduced log quality. In severe cases, the built-up torque can actually damage the wireline by causing the armor wires to unlay, resulting in high strands or "birdcages." The use of a swivel in these situations allows the top portion of the string to rotate, relieving wireline torque, while the bottom portion (below the swivel) is able to maintain the preferred orientation.

## Specification:

Maximum Temperature:	400°F (204°C ) 3 hours
Maximum Pressure:	20,305Psi (140MPa)
Diameter:	3.38in. (85.9mm)
Swivel Shaft Diameter:	1.25 in. (31.8mm)
Maximum Allowable Bending Force:	2476ft-lb. (3357N.m)
Make-up Length:	3 ft. 4.0 in. (1.02 m)
Shipping Length:	4 ft. 3.0 in. (1.30 m)
Make-up Weight:	40lb. (18.6 kg)
Shipping Weight:	50lb. (22.7kg)
Maximum Tensile Force:	-73,000lb (33,113kg)
Maximum Compressive Force:	73,000lb (33,113kg)



# ERMT

## Temperature/Tension/Fluid Resistivity Sub

The ERMT is a 3-5/8" diameter sub containing three types of transducers for measurement of cablehead tension/compression force, borehole temperature, and mud resistivity. This tool must be used on top of the ERTT tool.

### Specifications:

Maximum temperature:	400°F (204°C ) for 0.5hrs.; 300°F (150°C ) for 3hrs.
Maximum pressure:	20,000psi (137.9 Mpa)
Borehole diameter:	4.5in. (114.5mm) ~ N.A.
Tool diameter:	3.63in. (92mm)
Make-up Length:	43.8in. (1.11m)
Shipping Length:	60in. (1.52m)
Weight:	80lb (36.3kg)

Measurement Range	
Cablehead Tension:	0 ~ 12,000 lbs Tension 0 ~ 10,000 lbs Compression
Borehole Temperature:	32°F ~ 446°F (0°C ~ 230°C )
Mud Resistivity:	0.01 ~ 10 Ω -m

Absolute Accuracy	
Cablehead Tension:	± 800 lbs Tension ± 5% ± 800 lbs Compression ± 5%
Differential Cablehead Tension:	± 100 lbs Tension ± 100 lbs Compression
Borehole Temperature:	± 4°F ± 5% ( ± 2 °C ± 5%)
Mud Resistivity:	0.01 Ω -m ± 5%

Repeatability	
Cablehead Tension:	± 100 lbs Tension ± 100 lbs Compression
Borehole Temperature:	4°F ( ± 2°C )
Mud Resistivity:	± 0.01 Ω -m ± 5%
Maximum Tensile Force:	37,000 lb
Maximum Compressive Force:	174,000 lb



# EAOT

## Adjust Orientation Tool

EAOT has a transmission line that connects top and bottom connectors to connect top and bottom logging instrument. It allows adjusting EMSF & EZDT tool's pad in same direction that positioned under EAOT at surface. When logging in highly deviated wells in order to obtain good logging results.

### Specifications:

Maximum Temperature:	400°F (204°C)
Maximum Pressure:	20,000Psi (140MPa)
Make-up Length:	0.35m (13.78 in)
Shipping Length:	0.7m (27.55in)
Weight:	33lb (15kg)
Maximum Tension:	40,000lbf
Maximum Compressive Force:	10,000lbf





# EORT

## Orientation Tool

This tool is a borehole orientation logging device compatible with any EDIB service. It continuously measures borehole inclination and azimuth. It acquires digital signals of tri-ax accelerometers, tri-ax magnetometers, and temperature, which is comprised into the sensor package.

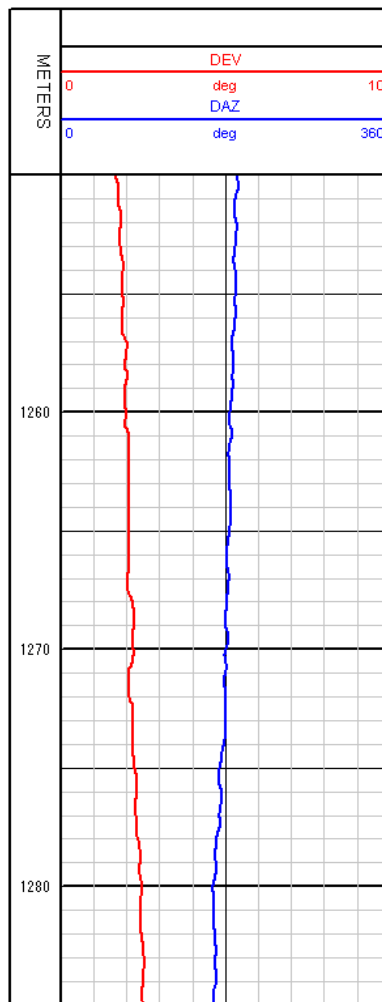
### Specifications:

Diameter of Instrument:	3.37 in (86mm)
Length of Instrument:	10.83 ft (330.2cm)
Weight of Instrument:	118 lb (53.6Kg)
Maximum Temperature:	350°F /2Hour (175°C /2Hour)
Maximum Pressure:	20,300 psi (140Mpa)
Minimum Hole Diameter:	4.72 in (120mm)
Maximum Logging Speed:	125 ft/min (38m/min)
Typical Logging Speed:	32.8 ft/m (10m/min)
Measure Point :	5.42 ft (1651 mm)
	(both measurements are from the bottom of tool)
Baud Rate:	20.83/41.66kbit/s
Operating Power:	180VAC@40 mA ~ 60 mA , 58Hz - 62Hz
Sensor Accuracy:	
Drift Azimuth:	± 1.5°
Deviation:	± 0.3°
Drift Azimuth:	
DEV 10° ~ 90° :	DAZ ± 1.5° ;
DEV 5° ~ 10° :	DAZ ± 6.0° ;
DEV 1° ~ 5° :	DAZ ± 10.0° ;
DEV < 1° :	DAZ N.A;
Telemetry:	Standard EDIB (ELIS Downhole Instrument Bus) Bus



# EORT

Log:



# ECNT70

## Compensated Neutron Logging Tool

The Compensated Neutron Logging is a method of radioactivity log. This logging method is used to measure the formation porosity of open hole or cased hole.

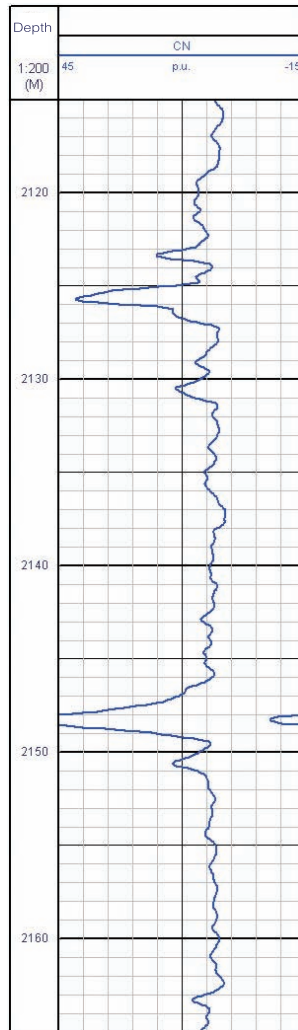
### Specifications:

Maximum Temperature:	311°F (155°C ) for 2 hrs.
Maximum Pressure:	20,000psi (137.9MPa)
Diameter:	2.87in (73mm)
Minimum Hole Size:	3.75 in (92.5mm)
Maximum Hole Size:	12 in (304.8mm)
Make-up Length:	6.30ft (1921mm)
Shipping Length:	7.82 fts (2386mm)
Weight:	92.6 lbs (42 kg)
Maximum Logging Speed:	30ft/min (9m/min)
Measuring Range:	0 ~ 70pu (limestone)
Accuracy:	por<7pu, ± 0.5pu Por>7pu, ± 7%
Repeatability:	15% , ± 2pu
Depth of Investigation:	12in(304.8mm) estimated for a 7.88in (200.0 mm) water-filled borehole with nominal 15% porosity formation
Vertical Resolution:	15in.(381.0mm)Measure Point
Short Spacing:	2 ft - 1.0 in (635.0 mm)
Long Spacing:	2 ft - 6.0 in (762.0 mm)
Operating Power:	180VAC, 65mA
Transmission Mode:	CAN bus
Detector Type:	Proportional counter
Neutron Source Type:	Am241-Be,18 curie



# ECNT70

## Log:



# ERMT70

## Temperature/Tension/Fluid Resistivity Sub

The ERMT70 sub contains three types of transducers for measurement of cable head tension/compression force, borehole temperature, and mud resistivity. This tool must be used on top of the ERTT70 tool.

### Specifications:

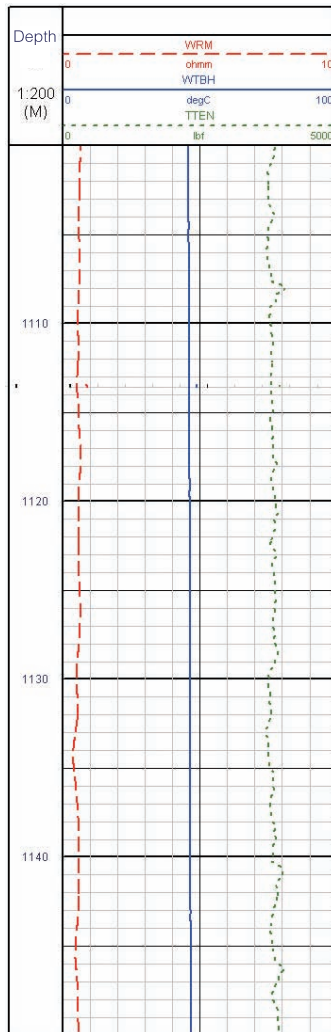
Maximum Temperature:	311°F (155°C ) for 2 hrs.
Maximum Pressure:	20,000psi (137.9MPa)
Diameter:	2.87in (73mm)
Minimum Hole Size:	3.75in (95.2mm)
Maximum Hole Size:	N/A
Make-up Length:	3.61ft (1100mm)
Shipping Length:	4.95 ft (1510mm)
Weight:	55.1 lbs (25 kg)
Maximum Logging Speed:	100ft/min (30m/min)
Measurement Range	
Cablehead Tension	0 to 12,000 lbs Tension 0 to 10,000 lbs Compression
Borehole Temperature	2°F to 392°F (0°C to 200°C )
Mud Resistivity	0.01 Ω •m to 10 Ω •m
Absolute Accuracy	
Cablehead Tension	± 800 lbs Tension ± 5% ± 800 lbs Compression ± 5%
Borehole Temperature	± 4°F ± 5% (2°C ± 5%)
Mud Resistivity	0.01 Ω •m ± 5%





# ERMT70

## Log:



# EGRT70

## Natural Gamma Ray Logging Tool

The Natural Gamma Ray Logging is a method for measuring the natural radioactivity of formations. This logging method is useful to detect and evaluate the sediment of radioactive minerals.

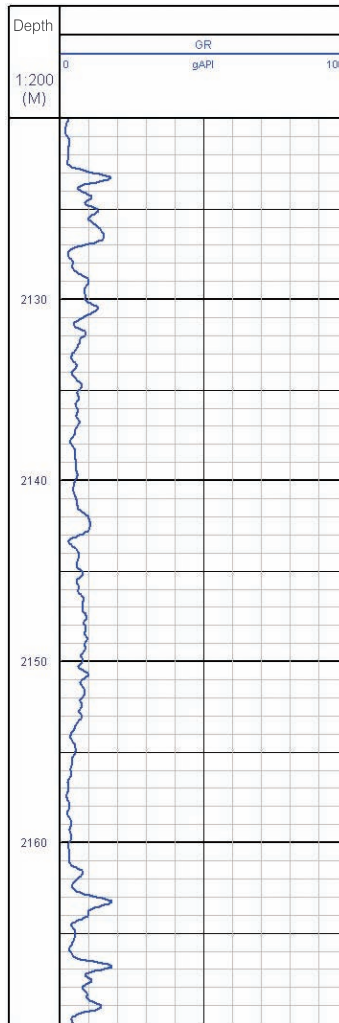
### Specifications:

Maximum Temperature:	311°F (155°C ) for 2 hrs.
Maximum Pressure:	20,000psi (137.9MPa)
Diameter:	2.87in (73mm)
Minimum Hole Size:	3.75 in (95.2mm)
Maximum Hole Size:	N/A
Make-up Length:	3.40ft (1.035m)
Shipping Length:	4.74ft (1.445m)
Weight:	36 lbs (16.5kg)
Maximum Logging Speed:	30ft/min (9m/min)
Measuring Range:	0-1500API
Repeatability:	± 7%
Operating Voltage & Current:	180VAC, 50mA@cablehead
Detector Type:	Nal Scintillation(45 × 200mm)
Tool Bus:	CAN



# EGRT70

## Log:



# EDAT70

## Digital Acoustic Logging Tool

Digital Acoustic Logging is a method for measuring the acoustic slowness of formations. This logging method is useful to calculate formation porosity, detect gas, research lithologic character and so on. It can be run as CBL/VDL Logging tool by selection of the service table.

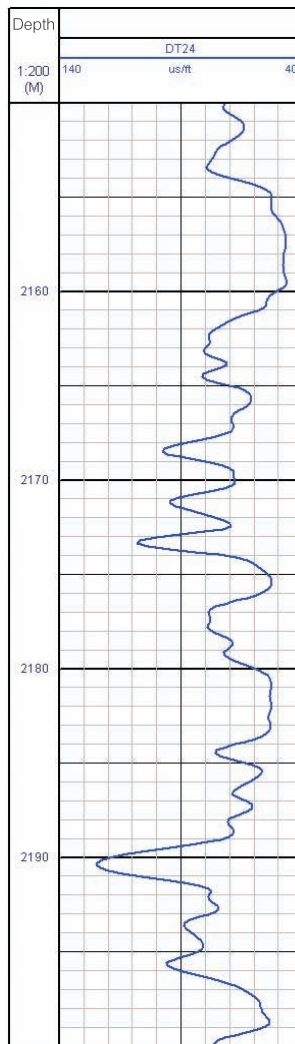
### Specifications:

Maximum Temperature:	311°F (155°C ) for 2 hrs.
Maximum Pressure:	20,000psi (137.9Mpa)
Diameter:	2.87in (73mm)
Minimum Hole Size:	3.75 in (95.2mm)
Maximum Hole Size:	10 in (254mm)
Make-up Length:	11.91ft (3629mm)
Shipping Length:	14.59 ft (4449mm)
Total Weight:	148.8 lbs (67.5kg)
Maximum Logging Speed:	60ft/min (18m/min)
Measurement Range:	40 us/ft to 200us/ft (130us/m ~ 650 us/m)
Absolute Accuracy:	± 2μs/ft.
Vertical Resolution:	0.5ft (152.4mm)
Spacing:	6.0in (152.4mm)
Transducer Type:	Piezoelectric,1 Transmitter, 5 Receivers,
Operating Voltage and Current:	180 VAC, 100 mA
Communication Mode:	CAN bus



# EDAT70

## Log:



# EDLT70

## Dual Laterolog Logging Tool

EDLT70 provides two resistivity measurement: a Shallow reading to investigate the formation near the borehole and a Deep reading to measure farther out where the formation is less disturbed by drilling fluid. By analyzing this information combined with other logging curves, the geologist can distinguish visually and accurately any permeable formation, locate oil and water formation.

### Specifications:

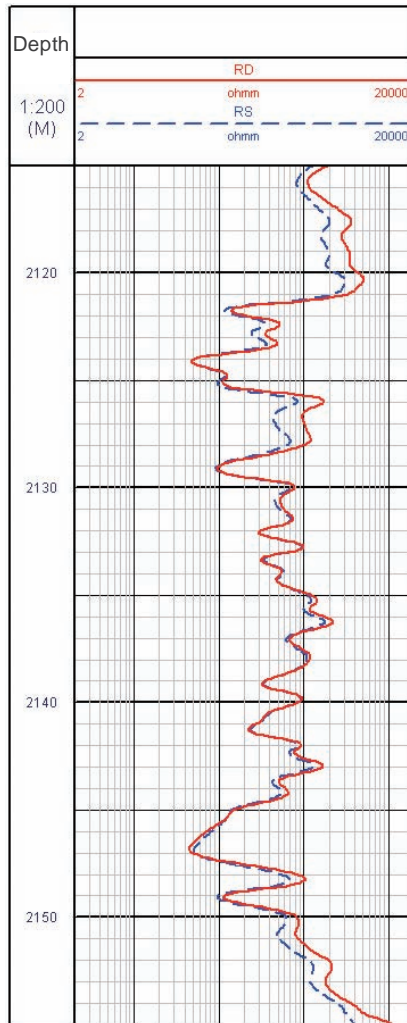
Maximum Temperature:	311°F (155°C ) for 2 hrs.	
Maximum Pressure:	20,000psi (137.9Mpa)	
Diameter:	3.07in (78mm)	
Minimum Hole Size :	4 in (101.6mm)	
Maximum Hole Size:	16in (406mm)	
Make-up Length:	12.65 ft (3854.5mm)	
Shipping Length :	13.99 ft (4264.5mm)	
Weight:	167 lbs (76kg)	
Maximum Logging Speed:	60ft/min(18m/min)	
Mud Type/Range:	Water based mud, 0.015 Ω •m ~ 3.0 Ω •m	
Measuring Range:	0.2 Ω •m ~ 40,000 Ω •m	
Accuracy:	0.2 Ω •m ~ 1.0 Ω •m	± 20%
	1 Ω •m ~ 2000 Ω •m	± 5%
	2000 Ω •m ~ 20000 Ω •m	± 10%
	20000 Ω •m ~ 40000 Ω •m	± 20%
Operating Voltage & Current:	180VAC, 80mA@cablehead	
Communication Type:	CAN	





# EDLT70

## Log:



# EDIF70

## Dual Induction Laterolog-8 Logging Tool

Dual Induction-Laterolog-8 Logging can measure uninvaded formation resistivity, flushed zone resistivity and invading zone resistivity. This logging method is useful to calculate permeability, water saturation and other parameters.

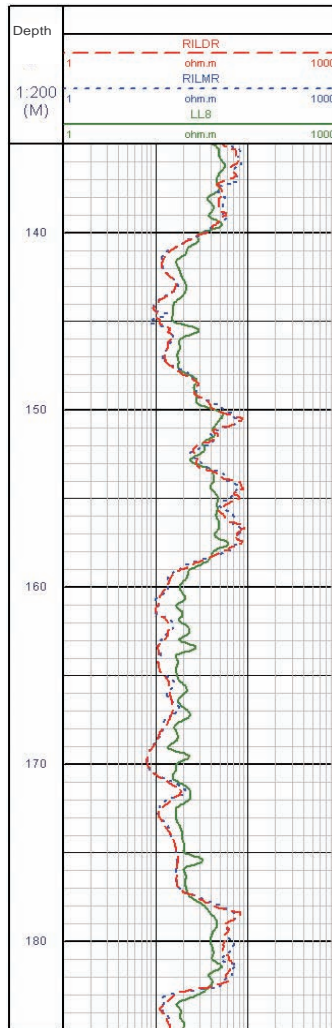
### Specifications:

Maximum Temperature:	311°F (155°C ) for 2 hrs
Maximum Pressure:	20,000psi (137.9MPa)
Diameter:	2.87 in (73mm)
Minimum Hole Size:	4 in (101.6mm)
Maximum Hole Size:	N/A
Make-up Length:	
EA:	4.55 ft (1386mm)
MA:	18.27 ft (5570mm)
Shipping Length:	
EA:	5.89 ft (1796mm)
MA:	19.16 ft (5840mm)
Weight:	
EA:	63 lbs (29kg)
MA:	134.5 lbs (61kg)
Maximum Logging Speed:	82ft/min (25m/min)
Measuring Range:	
Deep induction:	0.2 ~ 2000 $\Omega \cdot m$ ;
Medium induction:	0.2 ~ 2000 $\Omega \cdot m$ ;
Laterolog-8:	1.0 ~ 1000 $\Omega \cdot m$ ;
formation resistivity Range:	0.2-100 $\Omega \cdot m$
Mud Type/Range:	>0.2 $\Omega \cdot m$
Accuracy:	$\pm$ 3%
Operating Power:	180VAC, 65mA
Transmission Mode:	CAN bus



# EDIF70

## Log:



# ECAL70

## Four-arm Caliper Logging Tool

Four-arm caliper logging tool is used to log the borehole radius through the four arms to drive the pot inside the tool, and transfer the change of borehole radius to electric signal. Its circuit is integrated in the EAMT70 sub, and must be on the top of the EAMT70.

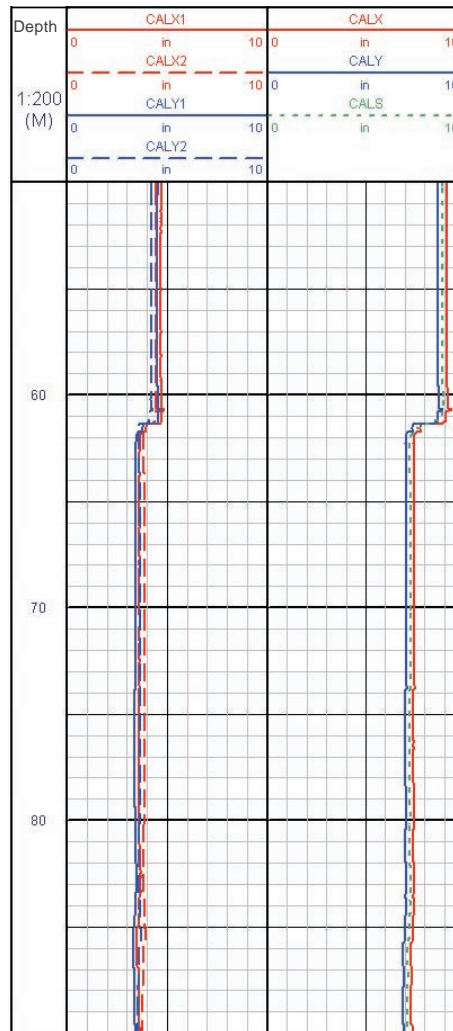
### Specifications:

Maximum Temperature:	311°F (155°C ) for 2 hrs
Maximum Pressure:	20,000psi (137.9MPa)
Diameter:	2.87 in (73mm)
Minimum Hole Size :	3.75 in (95.2mm)
Maximum Hole Size:	10 in (254mm)
Make-up Length:	5.41 ft (1650mm)
Shipping Length :	6.76 ft (2060mm)
Weight:	92.6 lbs (39.5Kg)
Measure range:	4in ~ 11.8in (100mm ~ 300mm)
Accuracy:	± 5%
Motoring Power:	110VDC , 600mA@maximum



# ECAL70

## Log:



# EMSF70

## Micro spherical Focused Logging Tool

EMSF70 is a current focused micro resistivity well logging tool with mud cake compensation. The invaded zone resistivity value measured by EMSF70 minimized the influence of mud cake because the instrument has a specially designed electrode configuration and a particular measurement method. EMSF70 can provide the borehole caliper log.

### Specifications:

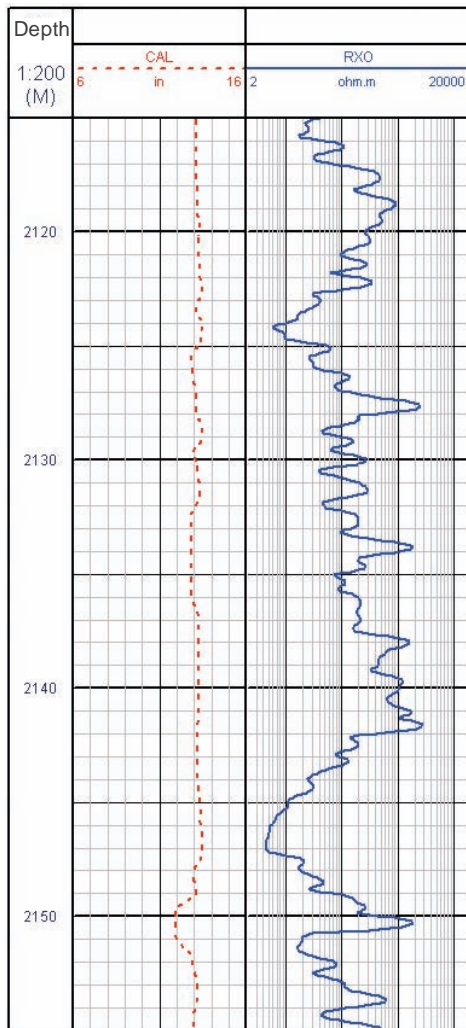
Maximum Temperature:	311°F (155°C ) for 2 hrs		
Maximum Pressure:	20,000psi (137.9MPa)		
Diameter:	4.21in (107mm)		
Minimum Hole Size:	5.5 in (139.7mm)		
Maximum Hole Size:	10 in (254mm)		
Make-up Length:	7.37 ft (2247mm)		
Shipping Length:	8.72 ft (2657mm)		
Weight:	127.9 lbs (58Kg)		
Measuring Range:			
Rxo:	0.2 $\Omega$ .m ~ 2000 $\Omega$ .m		
CAL:	4.3in ~ 13.78in ( 110mm ~ 350mm)		
Accuracy:			
Rxo:	0.2 $\Omega$ .m ~ 2 $\Omega$ .m	$\pm$ 20%	
	1 $\Omega$ .m ~ 2000 $\Omega$ .m	$\pm$ 5%	
	2000 $\Omega$ .m $\leq$ R < 5000 $\Omega$ .m	$\pm$ 10%	
CAL:	$\pm$ 5%		





# EMS F70

**Log:**



# EZDT70

## Litho-Density Logging Tool

The EZDT70 is used to determine formation photoelectric absorption index and density through detecting the Gamma ray from the source inside tool passing through the formation. It also provides the borehole caliper log.

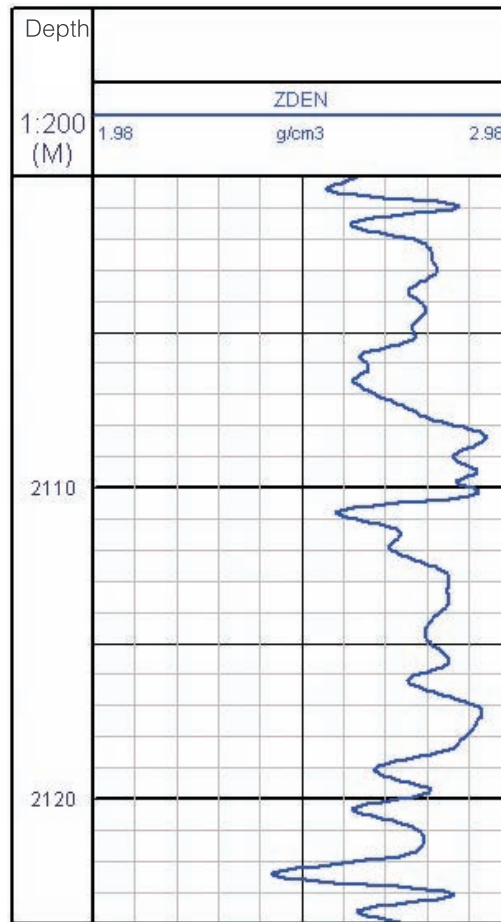
### Specifications:

Maximum Temperature:	311°F (155°C ) for 2 hrs
Maximum Pressure:	20,000psi (137.9MPa)
Diameter:	3.50in (89mm)
Minimum Hole Size:	4.75in (120.6mm)
Maximum Hole Size:	10 in (254 mm)
Make-up Length:	8.97 ft (2735mm)
Shipping Length:	10.13 ft (3087mm)
Weight:	215.8 lbs (98Kg)
Maximum Logging Speed:	30ft/min (9.1 m/min)
Operating Voltage:	180VAC, 40mA@cablehead
Motoring Current:	110VDC, 600mA@maximum
Measuring Range:	
Den:	1.3 ~ 3.0g/cm <sup>3</sup>
Pe:	1.3 b/e ~ 6.0b/e
Absolute Accuracy:	
Den:	± 0.025g/cm <sup>3</sup> (2.0 ~ 3.0 g/cm <sup>3</sup> )
Pe:	± 0.2 b/e(1.3 ~ 6.0b/e)
Detector Type:	Scintillation
Source Type:	2 Curie Cs137



# EZDT70

**Log:**



# ERTT70

## Wireline Remote Transmitting Tool

ERTT70 is the downhole telemetry interface for ELIS70 tools. It includes three orthogonal accelerometers, three orthogonal magnetometers, and temperature which comprises the sensor package. It continuously establishes the position of the tool string with respect to vertical and magnetic north. It also has some auxiliary function, such as cablehead voltage monitor, temperature measurement, downhole tool motor control.

### Specifications:

Maximum Temperature:	311°F (155°C ) for 2 hrs.
Maximum Pressure:	20,000psi (137.9MPa)
Diameter:	2.87in (73mm)
Minimum Hole Size:	3.75 in (95.2mm)
Maximum Hole Size:	N/A
Make-up Length:	4.71ft (1434mm)
Shipping Length:	6.05 ft (1844mm)
Weight:	59.5 lbs (27Kg)
Maximum Logging Speed:	60ft/min (18 m/min)
Measuring Range:	
Declination Angle:	0° ~ 120°
Azimuth:	0° ~ 360°
Accuracy:	
Declination Angle:	± 0.2°
Azimuth:	± 2° (declination angle≥3°)
Operating Voltage & Current	180VAC, 65mA
Wireline Requirements.	7 conductor
Downhole Tool Bus:	CAN



# ERTT70

## Log:

