

SK-TMWD Pro+AziR LWD

SK-TMWD Pro+AziR Azimuthal resistivity Log while drilling has the functions of boundary detection, gamma imaging, compensated resistivity, annular pressure (ECD), temperature, wellbore orientation, vibration, and dynamic wellbore inclination measurement. Suitable for precise geological guidance operations in deep and ultra deep wells, it can be widely used for exploration and development of shale oil and gas, tight oil, thin layers. It is a powerful tool for real-time evaluating the properties of drilling formations and improving the drilling ratio at sweet spots.

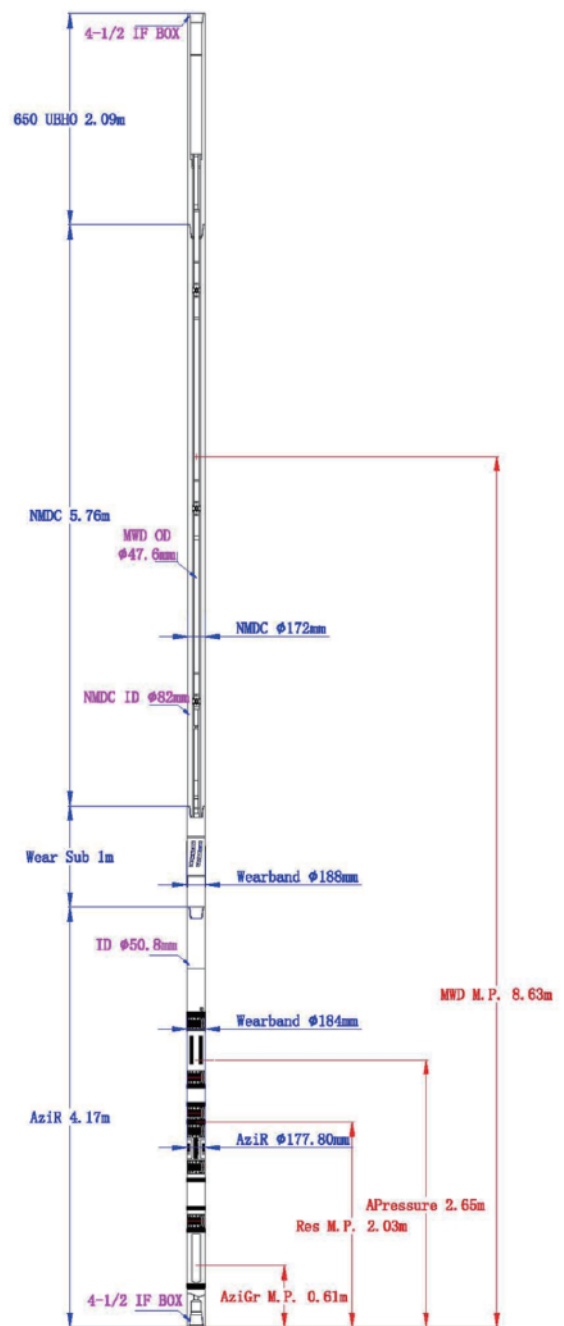
Product Features

- Real-time boundary detection and positioning to ensure precise geological guidance
- Ultra low noise ratio circuit, direct sampling technology ensures measurement speed and accuracy
- Real-time imaging function, display the distance and direction of the boundary
- Multi parameter measurement, providing stick-slip, BHA RPM, and ECD data to ensure drilling safety
- High temperature and high pressure resistance (175°C, 20000psi)
- Compatible with Tensor standards, can be customized with third-party MWD, LWD, RSS

Special Technology

- The 4 transmitter & 3 receiver vertical orthogonal antenna system structure and detection method, achieving precise detection of geological boundaries
- Unique boundary display interface, visually displaying the distance and direction of the drill bit relative to the boundary of the oil and gas layer
- The friendly visual output interface that intuitively identifies the drilling trajectory of the drill bit relative to the boundary of the oil and gas layer, facilitating timely adjustment and ensuring continuous drilling in the oil and gas layer
- Modular design, using Qbus and RS485, and matching different drilling measurement instruments according to usage conditions
- Downlink technology enables monitoring and change of working modes, improving drilling conditions applicability
- Dynamic well inclination measurement technology reduces the time required for inclination measurement
- Adaptive filtering and denoising technology to improve decoding success rate and environmental adaptability
- Automatic switching technology between sliding and rotating sequences to improve transmission efficiency

SK-TMWD Pro+AziR Measurement Point Length



Technical Specification

Mechanical Specificaton	
Hole size	8 1/2" -9 1/2"
Tool OD	6.75 in
Tool ID	2 in
Upper connection	4-1/2 IF BOX
Lower connection	4-1/2 IF BOX
Antenna long spacing	38.5 in
Antenna short spacing	17.5 in
Receiving antenna spacing	7 in
Azimuth antenna spacing	28 in
Main power supply	Mud driven turbine generator

Operating norms and limitations	
Mud type	WBM/OBM
Mud pump	14.2-47.3 L/s
Max. Temperature-Operating	175°C
Max.Temperature-Survival	185 °C
Max.Pressure	20000 Psi
Mud Sand Content	<1%
Vibration	25G RMS 30-500 H
Shock	1000G/0.5millisecond
Make Up Torque	40600-44600 N²m
Max.Dogleg	18 (Sliding) 9.8 (Rotating) °/30m
Notes: The maximum wellbore dogleg degree that the tool passes through is for reference only, and the actual size varies depending on the BHA structure.	

Sensor parameter			
MWD			
Sensor type: Three-axial Fluxgate & accelerometer			
	Range	Resolution	Accuracy
Inclination	0-180°	0.05°	±0.1°
Dynamic inclination	0-180°	0.05°	±0.2°
Azimuth	0-360°	0.18°	±0.5°
Dynamic azimuth	0-360°	0.2°	±2°
Annular pressure			
Range	0-25000 Psi		
Accuracy	±24 Ps		

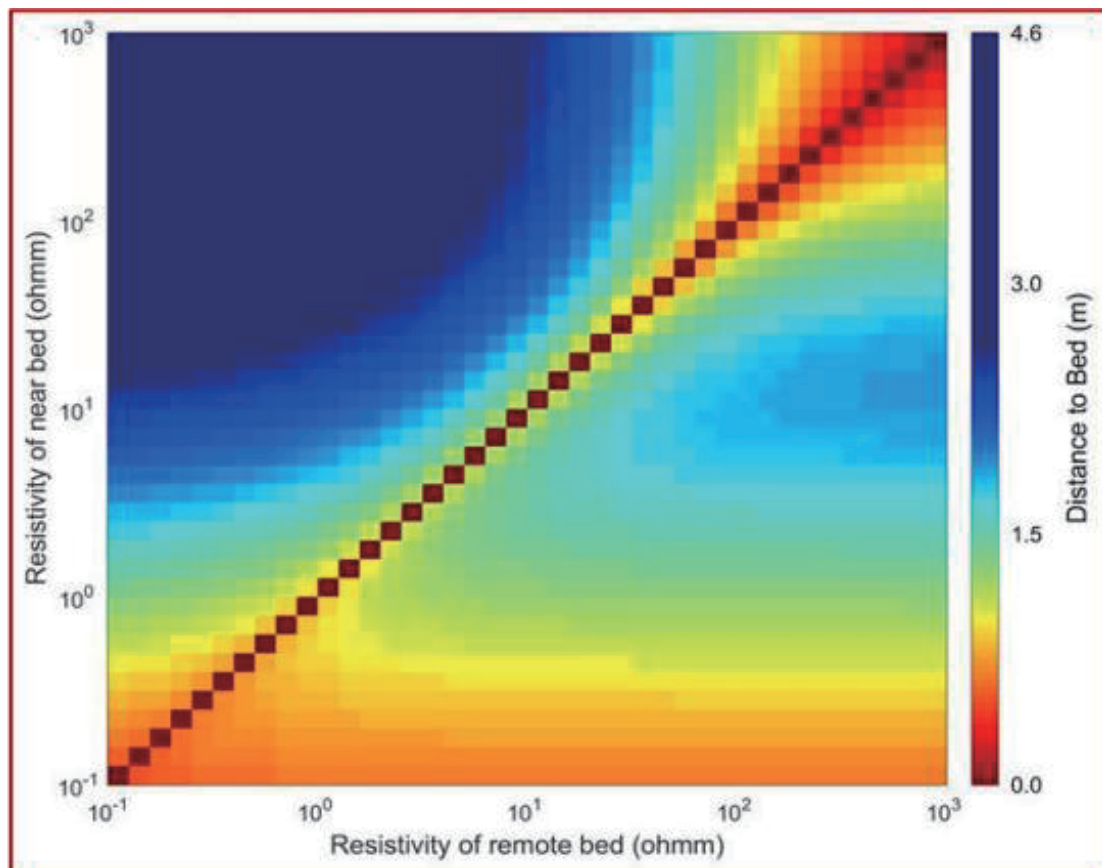
AziR measured Parameters	
2MHZ	
Phase Difference (Long Space) RPFH	Range :0.2-3000ohm-m ±2% (0.2-20ohm-m) Accuracy: ±1 mmho/m (20-3000ohm-m)
Phase Difference (Short Space) RPFH	Range :0.2-1000ohm-m ±2% (0.2-10ohm-m) Accuracy: ±1 mmho/m (10-1000ohm-m)
Attenuation (Long Space) RPFH	Range :0.2-50ohm-m ±5% (0.2-16ohm-m) Accuracy: ±3 mmho/m (16-50ohm-m)
Attenuation (Short Space) RPFH	Range :0.2-50ohm-m ±5% (0.2-8ohm-m) Accuracy: ±6 mmho/m (8-50ohm-m)
400KHZ	
Phase Difference (Long Space) RPFL	Range :0.2-500ohm-m ±2% (0.2-10ohm-m) Accuracy: ±2 mmho/m (10-500ohm-m)
Phase Difference (Short Space) RPFL	Range :0.2-250ohm-m ±3% (0.2-5ohm-m) Accuracy: ±6 mmho/m (5-250ohm-m)
Attenuation (Long Space) RPFL	Range :0.2-10ohm-m ±5% (0.2-3ohm-m) Accuracy: ±10 mmho/m (3-10ohm-m)
Attenuation (Short Space) RPFL	Range :0.2-10ohm-m ±5% (0.2-3ohm-m) Accuracy: ±15mmho/m (3-10ohm-m)

AziR and Gamma sensor specifications	
AziR	
Maximum boundary detection distance	4.6 m
Azimuthal signal	Two curves (Real-time) Sixteen curves (Memory)
Imaging	Provide real-time/memory far and near resistivity boundary detection imaging
	Provide real-time/memory resistivity imaging
AGR	
Sensor type	PMT + NaI crystal
Range	0-1000 API
Accuracy	±5%
Imaging	Sixteen sectors (Memory) Real-time gamma imaging

Investigation depth / Vertical Resolution

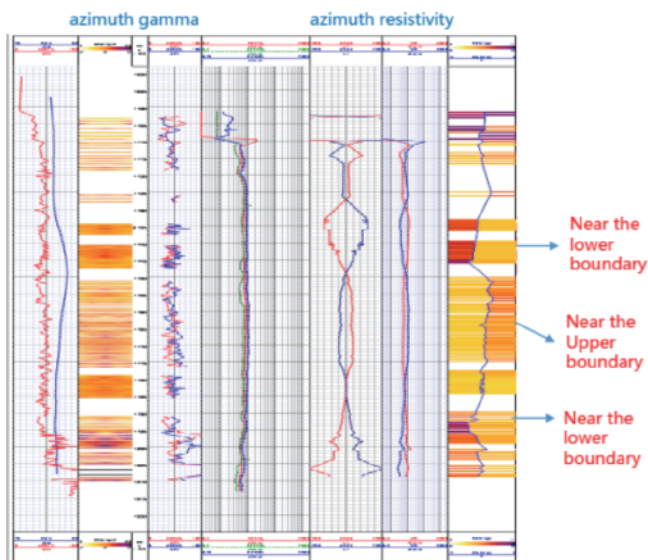
	Investigation depth (in)			Vertical Resolution (in)		
	1	10	100	1	10	100
	ohm-m	ohm-m	ohm-m	ohm-m	ohm-m	ohm-m
RPNH	11	17	23	9	13	16
RPHL	15	21	26	12	16	17
PANH	18	33	73	24	48	75
RANL	27	57	141	42	65	104
RPFH	16	27	42	9	13	22
RPFL	23	37	50	13	20	25
RAFH	26	46	91	23	63	118
RAFL	39	73	163	46	104	162

The relationship between azimuth resistivity boundary detection distance and nearbed and remote resistivity



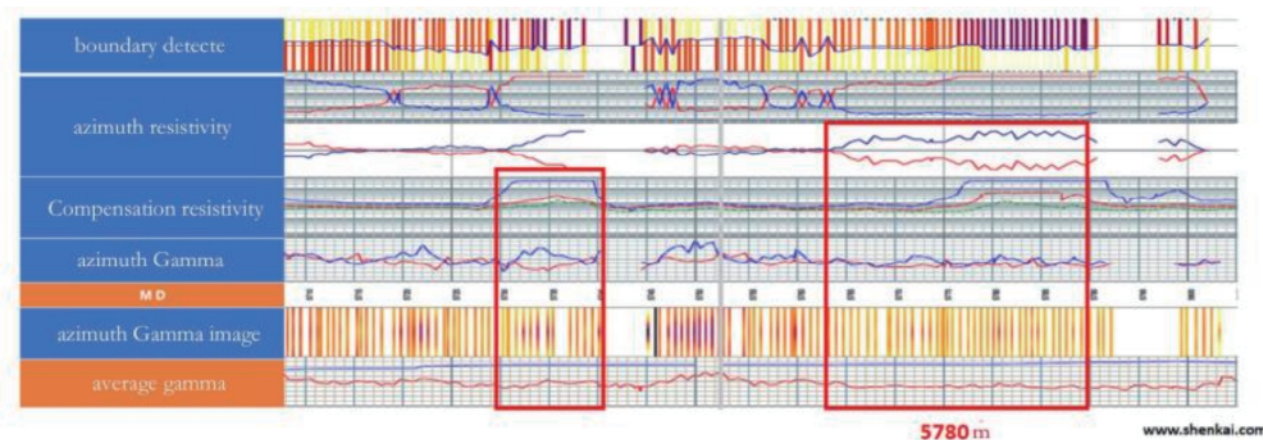
Application of SK-TMWD Pro+AziR

SK-AziR Azimuthal resistivity logging tool while drilling adopts advanced data compression algorithms to extract the characteristics of the 16 sector formation response signals collected during rotation and compress them. Real-time transmission is carried out through MWD, and the powerful analysis and mapping software for high-quality data recovery makes real-time images almost as excellent as in memory data images, fully meeting the key and challenging tasks of reservoir navigation and formation evaluation.



Max INC 88.52°, horizontal displacement 752.72m, reservoir thickness ~3m

- Using Aziexpress® to geological guidance of a horizontal well in a tight oil block in a eastern oilfield.
- The main geological objective of this well is to arrange the trajectory 1 meter away from the upper boundary, in a sweet part of the oil layer, avoiding the water layer.
- During drilling, measured the resistivity of the upper covering layer was 2.8 ohm meters, and made the trajectory about 0.8 meter away from the upper boundary, which met the requirements of design.



- During geological guidance, Aziexpress® measured the wellbore near the lower boundary twice at a depth of 5740 meters and 5780 meters, and the reservoir will drill out downwards according to the trend. After the geologist's comprehensive assessment of various information, they recognized the azimuth resistivity curve, and then decision was made to increase the inclination.
- Curve shows, at 5770 m, the azimuth resistivity was responded 10 meters in advance, and the wellbore will be drilling out downwards of the reservoir. At 5780 m, polarization occurs in the compensated resistivity, further approaching the boundary. At 5785 m, inclination increase to 93 degrees. At 5805 m, the wellbore returns to the middle position of the reservoir.
- The final evaluation shows that, the wellbore passes through 100% in the reservoir and receiving praise from Party A.