

Casing Inspection & Production Logging



HUNTING

OUR VISION

Tools that are robust, combinable, and able to run in both real time and memory situations are what we provide. We design our tools to work within the proprietary WTSbus protocol so that everything is modular in nature. By doing so it allows our customers to pick and choose what sensors they want to provide for their services. It all works together and simultaneously. There are no “project” tools in our product line. We make sure that our customers maintain the flexibility to add to what they currently own.

Our telemetry is designed to be simple to use and implement in older units in the field as well as new ones. The telemetry is fully compatible with the Warrior Well Logging System and does not require any additional cards or panels to get a 50Kpbs transmission rate. If our customers need more speed, we can obtain 200Kpbs with additional hardware on surface.

When switching from running in real time to memory, you use the same sondes. Easy configuration for individual sonde sample rate(s), tool hibernation timing(s), and

merging surface-depth data to downhole tool data gives our customers the ability to quickly swap to alternative conveyance methods. Our software has easy export ability to get the data into the hands of analysts quickly.

All connectors are standard “GO” pin, so our customers can use the auxiliary equipment they already own and maintain. We also carry a wide assortment of running gear to fully prepare for difficult logging situations if a key part is missing from a customer’s inventory.



**24-HOUR
SUPPORT**

Our support team is available to help when issues arise day or night.



**CONFIDENCE IN
EXPERIENCE**

Our mechanical, electrical, and petroleum engineers have come from the wireline field.



**PARTNER NOT
SUPPLIER**

We establish relationships that go past the point of sale.



**TARGETED
TECHNOLOGY**

R&D focused on our partners' needs and requests to impact the market at a local level.

Wireline Telemetry System WTC

Description

The Wireline Telemetry System (WTC) is used when real time data acquisition is needed. The telemetry polls sondes connected below it for data and encodes the data for efficient transmission to surface. The WTC also receives commands from surface to control working mode of downhole sondes.

- WTC provides link from surface acquisition system to downhole tools
- Transmits any WTSbus protocol sonde in any configuration
- Sonde data is displayed in real time
- Bi-directional communication
- Minimum link speed of 50kbps
- Maximum link speed of 200kbps

Warrior Compatability

- No cards, panels, or additional hardware needed
- Regularly updated service
- One service covers all tool configuration options
- Tool calibrations available online 24/7
- Tools come with exported Warrior configuration file for quick integration

Specifications

PROTOCOL	WTSbus	
DIAMETER	1-3/8" (35mm)	1-11/16" (43mm)
MAX. TEMPERATURE	350°F (175°C)	
MAX. PRESSURE	15,000psi (103MPa)	
VOLTAGE	180VDC	
CURRENT RATING	1.5A	
MINIMUM UPLINK RATE	50kbps	
MAXIMUM UPLINK RATE	200kbps	
DOWNLINK RATE	300bps	
TOOL BUS RATE	500kbps	



Memory System MLP

Description

The Memory Logging System (MLP) is used when electric line conveyed realtime logging is not an available option, when using Slickline, or when using Coiled Tubing. A standard memory job consists of the following procedure:

- DMC is synced and programmed through the MCM
- TDR is connected to depth control device and records time versus depth
- Tools are lowered into hole and pre-set procedure is executed on the DMC to record time versus sonde samples
- Once back at surface, TDR and DMC data are merged in software to create a log



Conveyance

- Slickline
- Coil Tubing
- Below standard wireline
- Extended reach tractor jobs
- Drill Pipe

Specifications

PROTOCOL	WTSbus		
DIAMETER	1-3/8"(35mm)	1-11/16"(43mm)	2-7/8" (73mm)
MAX. TEMPERATURE	350°F (175°C)		
MAX. PRESSURE	15,000psi (103MPa)		
VOLTAGE	13.5-20 VDC		
CURRENT	15-30mA		
STAND-BY CURRENT	2mA		
SAMPLING RATE	20ms-24hr, 20ms increment, adjustable		
DOWNLOAD RATE	4MB/min to cpu		
MEMORY CAPACITY	512mb (1GB custom)		
COMMUNICATION RATE	500kbps		
BATTERY CAPACITY	6.2AH or 26.5AH		

Production Logging Tools PLT

Description

Production Logging Tools consist of a combination of different sensors and ancillary tools. The PLT tools can be combined with any tool in the WTSbus Suite using a Wireline Telemetry Cartridge (SRO) or Downhole Memory Cartridge (Memory). All tools can be combined in any order to facilitate well-specific requirements.

Standard Tools

- Gamma Ray Tool (GRT)
- Casing Collar Locator (CCL)
- Fluid Density Radioactive (FDR)
- Fluid Density Acoustic (FDA)
- Spectral Noise Tool (NST)
- Capacitance/Temperature/Flow (HTF)
- Folding Flowmeter (CSFM)
- Continuous Flowmeter (CFJ)
- Inline Spinner Flowmeter (ILB)
- Quartz Pressure / CCL (QPC)
- Fast Response Temperature (RDT)

Applications

- Evaluate completion efficiency
- Detection of mechanical problems
- Provide guidance for workovers
- Evaluate treatment techniques
- Monitor or profiling of production
- Detect thief zones
- Determine reservoir characteristics
- Define reservoir boundaries
- Leak detect

Auxiliary Tools

- Roller Centralizer Tool (RCT)
- Knuckle Joint Tool (KJT)
- Swivel Sub (PSC)
- Downhole Tension Tool (DTT)
- Dual Roller Centralizer (DRC)
- Spring Bow Centralizer (SCT)
- Addressable Release Tool (ART)



Specifications

PROTOCOL	WTSbus	
DIAMETER	1-3/8"(35mm)	1-11/16"(43mm)
MAX. TEMPERATURE	350°F (175°C)	
MAX. PRESSURE	15,000psi (103MPa)	
VOLTAGE/CURRENT	180VDC 35mA	

Production Logging Tools PLT

Standard Tool Specifications

GAMMA RAY (GRT)	
SONDE COMPOSITION	Nal
CCL (CCL)	
SONDE CONFIGURATION	6 Oriented Magnet
FLUID DENSITY RADIOACTIVE (FDR)	
SONDE CONFIGURATION	Nal Crystal / AM241 or CS137
PRECISION	±0.01g/cc
ACCURACY	±0.03g/cc
FLUID DENSITY ACOUSTIC (FDA)	
PRECISION	±0.01g/cc
ACCURACY	±0.03g/cc
SPECTRAL NOISE TOOL (NST)	
SONDE COMPOSITION	Piezoceramic
OPERATING FREQUENCY	100Hz - 12.7KHz
OUTPUT FORMAT	MP3
CAPACITANCE / TEMPERATURE / FLOW (HTF)	
CAPACITANCE RANGE	0 - 45%
CAPACITANCE ACCURACY	±1%
TEMPERATURE PRECISION	±0.018°F (0.01°C)
TEMPERATURE ACCURACY	±3.6°F (2°C)
TEMPERATURE RESPONSE TIME	<0.5s
FLOW RESOLUTION	10 PPR
FLOW METER (CSFM / CFJ / ILB)	
SONDE COMPOSITION	Jeweled or Ball Bearing
QUARTZ PRESSURE COLLAR LOCATOR (QPC)	
SONDE COMPOSITION	QUARTZDYNE
ACCURACY	±3.2 psi
RESOLUTION	±1.6 psi
RESPONSE TIME	<1s
SONDE CONFIGURATION	6 Oriented Magnet
FAST RESPONSE TEMPERATURE (RDT)	
ACCURACY	±0.09°F (0.05°C)
RESOLUTION	±0.009°F (0.005°C)
RESPONSE TIME	<0.08 s

Cement Bond Logging Tool RBT

Description

The RBT is equipped with one transmitter and two receivers constructed out of piezoelectric crystals. The near receiver, located 3Ft from the transmitter, is constructed of an 8-sector radial sensor. The primary amplitude is constructed from radial signals at the near receiver while the Variable Density Log is constructed from the far receiver. The RBT can be deployed in deviated holes and combines easily with any of the other range of tools. The tool is comprised of H2S resistant materials throughout. All RBT tools have a built-in orientation sensor that allow for relative bearing and deviation data.

The analog waveform is completely digitized downhole and converted back to analog at surface for interpretation. By digitizing downhole, the tool is able to:

- By-pass analog calibration pulse issues on H2S line transmission
- Store and revert to a calibrated configuration upon power up. Internal memory settings for sensor pickups circumvent the need for free pipe calibration.

Applications

- Provide quantitative analysis of cement bond in eight 45-degree segments for identification of channels in cement
- Identification of intervals of uniform bonding and detection of cement quality in casing sizes from 4 1/2 in to 13 3/8 in.
- Quantitative analysis of cement bond to casing
- Qualitative analysis of cement bond to formation

Specifications

PROTOCOL	WTSbus	
DIAMETER	1-11/16" (43mm)	3-1/8" (80mm)
MAX. TEMPERATURE	350°F (175°C)	
MAX. PRESSURE	20,000psi (140MPa)	
LENGTH	114.3" (2902mm)	107.0" (2718mm)
TRANSMITTER	1 Piezoelectric	
RECIEVERS	6 (60 Deg)	8 (45 Deg)
VOLTAGE	18 VDC	
CURRENT	82mA	50mA
CASING DIAMETER	1 3/4" -7" (45-177.8mm)	4 1/2" -13 3/8" (114-340mm)
LOGGING SPEED	35ft/min (11m/min)	



Multi-Finger Imaging Tool MFI

Description

The Multi-Finger Imaging Tool has been designed to provide the most accurate Pipe ID caliper measurements in the industry. The high-quality output data allows for 3-D imaging and calculation of corrosion, penetration, or scale deposition.

The MFI tool can be combined with any other tool in the WTSbus suite using a Wireline Telemetry Cartridge (SRO) or Downhole Memory Cartridge (Memory).

All MFI tools have a built-in orientation sensor that allows for relative bearing and deviation data correction. Temperature correction is hardware-based, so no software drift files are needed. The mechanical design allows for easy finger replacement in the field.

Applications

- Tubular damage analysis
- Perforation mapping
- Quantification of scale build up and corrosion
- Accurate location mapping of holes and anomalies
- Large casing (up to 21") inspection with extension kit

Specifications

PROTOCOL	WTSbus		
DIAMETER	1-11/16" (43mm)	2-7/8" (73mm)	4" (102mm)
MAX. TEMPERATURE	350°F (175°C)		
MAX. PRESSURE	15,000psi (100MPa)		
LENGTH	49.88" (1267mm)	58.2" (1479mm)	60.51" (1537mm)
FINGERS	24	40	60
VOLTAGE	18VDC		
CURRENT	25mA	30mA	30mA
MOTOR RATE	<300mA		
PIPE RANGE	1-3/4" to 7"	3" to 8.25"	4-1/2" to 9-5/8"
ACCURACY	±0.03"	±0.03"	±0.03"
VERTICAL RESOLUTION	0.082"	0.110"	0.167"
RADIAL RESOLUTION	0.003"	0.005"	0.005"
FINGER FORCE	0.75lbs-1.25lbs (.34kg-.57kg)		
INCLINOMETER	±5/6†		
LOGGING SPEED	30ft/min (10m/min)		



ElectroMagnetic Thickness Tool EMT-C

Description

The Electromagnetic Thickness Tool - Concentric (EMT-C) is designed to detect the damage of tubulars by calculating the remaining wall thickness and corrosion extent. By measuring the phase shift of an induced electromagnetic field, it can accurately indicate the column structure and location of other objects in concentric pipe.

Applications

- Measure the remaining wall thickness of concentric casing in one run
- Determination of the type(s) of damage: pits, penetrations, cracks in transverse or longitudinal plane
- Determination of inner casing penetration
- Locating inner and outer collars in concentric casing
- Wellbore temperature logging

Specifications

PROTOCOL	WTSbus
DIAMETER	1-11/16"(43mm)
MAX. TEMPERATURE	350°F (175°C)
MAX. PRESSURE	15,000psi (100MPa)
LENGTH	78.74" (2000mm)
MATERIALS	H2S Tolerant
LOGGING SPEED	20 ft/min (350/hr)
WEIGHT	20lb (9kg)
MEASUREMENT RANGE	2 1/2"-17" (63 - 432mm)
MEASUREMENT ACCURACY	0.02" (0.5mm) Single Pipe 0.06" (1.5mm) Double Pipe
MIN. AXIAL DETECTABLE LENGTH	1.5" (40mm) Single Pipe 2" (50mm) Double Pipe
MIN. TRANSVERSAL DETECTABLE LENGTH	1/6 of the perimeter
THICKNESS RANGE (MAX.)	.5" (12mm) Single Pipe 1" (25mm) Double Pipe



ElectroMagnetic Thickness Tool EMT-R

Description

The Electromagnetic Thickness Tool - Radial (EMT-R) is designed to detect the damage of tubulars by calculating the remaining wall thickness and corrosion extent. Twelve bowspring arms contain sensors that measure residual thickness based on the remote field eddy current principle.

Processed data can be combined with caliper in order to generate detailed interpretation of wellbore condition along with 3D image.

Applications

- Measure the remaining wall thickness of casing
- Determination of the type(s) of damage: pits, penetrations, cracks intraverse or longitudinal plane
- Sectorized sensors allow localized identification of damage
- Inner and outer wall damage identification
- Casing collar identification

Specifications

PROTOCOL	WTSbus
DIAMETER	1-11/16"(43mm)
MAX. TEMPERATURE	350°F (175°C)
MAX. PRESSURE	15,000psi (100MPa)
LENGTH	85.86" (2181mm)
MATERIALS	H2S Tolerant
LOGGING SPEED	15ft/min (300m/hr)
WEIGHT	30lb (13.7kg)
MEASUREMENT RANGE	2"-7"
MEASUREMENT ACCURACY	15% of Casing Thickness



Spectral Noise Tool NST

Description

The Spectral Noise Tool is used to detect the incoming noises in the wellbore generated at different spectral frequencies from different sources. By analyzing the frequency spectrum, the nature of fluids may be determined and leaks can be located.

Noise logging is applicable to oil/gas/water wells. It increases the success rate of locating leaks and channeling in tubulars. When combined with temperature and flowrate measurements, extensive quantitative interpretation can be performed.

Real time monitoring combined with the ability to save the audio to digital file provides better confidence in analysis.

Applications

- Location of production interval and productivity evaluation
- Fluid identification and flow rate evaluation
- Inspection of the channeling behind casing, leaks, backflows, sand production, and effect of packers

Specifications

PROTOCOL	WTSbus
DIAMETER	1-11/16"(43mm)
MAX. TEMPERATURE	350°F (175°C)
MAX. PRESSURE	20,000psi (140MPa)
LENGTH	33.29" (846mm)
MATERIALS	H2S Tolerant
LOGGING SPEED	15ft/min (300m/hr)
WEIGHT	30lb (13.7kg)
OPERATING FREQUENCY	100Hz - 12.7KHz
FREQUENCY RESOLUTION	100Hz
AUDIO OUTPUT FORMAT	MP3



Downhole Tractor System DTS

Description

The downhole tractor is an electric motor-powered system consisting of a surface control panel and downhole assembly, which include a Tractor Control Cartridge (TCC), a Downhole Tractor Tool (DTT), and auxiliary tools.

The TracSIM software is included to enable the operator to determine the specific bottom hole assembly to control the risk before operations. The conveyance process is monitored in real time so that the operator knows where the tractor system and the passenger tool(s) are while downhole.

Applications

The downhole tractor is capable of conveying a variety of tools in highly deviated, severe doglegged, or horizontal wells:

- Well logging tools
- Perforating tools
- Completion tools

Specifications

DIAMETER		2-7/8" (73mm)	3-1/2" (89mm)
POWER SUPPLY		0-850VDC	
MAX. TEMPERATURE		311°F (155°C)	
MAX. PRESSURE		15,000psi (103MPa)	
LENGTH	DTT	145.39" (3693mm)	163.03" (4141mm)
	TCC	61.97" (1574mm)	64.21" (1631mm)
WEIGHT	DTT	154lb (70kg)	174lb (79kg)
	TCC	44lb (20kg)	49lb (22kg)
SPEED		20 ft/min (6m/min)	
MAX. PULL		880lb (400kg)	1100lb (500kg)
VOLTAGE		<850VDC	
CURRENT		<2.1 A	



Products and Services

- ▶ Hunting's mission is to innovate and manufacture quality oil/gas extraction equipment and distribute it across the largest independent global supply chain.
- ▶ Hunting's energetics division produces the greatest number of shaped charges in the world.
- ▶ Hunting's instrument division produces the most widely used addressable switch in the world.

Proprietary Technology

Hunting develops innovative technology that simplifies and improves the way oil and gas are extracted, with a full range of applications below the wellhead including mud motors, premium connections, well perforating, logging and intervention tools.

Geographic Footprint

Over 40 manufacturing and distribution locations are strategically located in the key energy producing regions of the world.



Global Business Units

OCTG and Connection Technology

Perforating Systems

Advanced Manufacturing

Drilling Tools

Intervention Tools

Subsea

Logging Instruments

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