

DOWNHOLE



GeoChain



GeoChain SLIM



GeoChain EHP



BOSS



GAMMA



PERMASEIS



SPARKER



TCU



Ancillaries

SURFACE



GSP-GPP-DCP



RSS



Software



Ancillaries

*Geochain™ Advanced
Seismic Receiver*



*Downhole Advanced
Sparker Source*

*High gain downhole
electronics and high-
speed telemetry systems*

*GeochainSlim™
Receiver*

LAST UPDATED 17/11/2025

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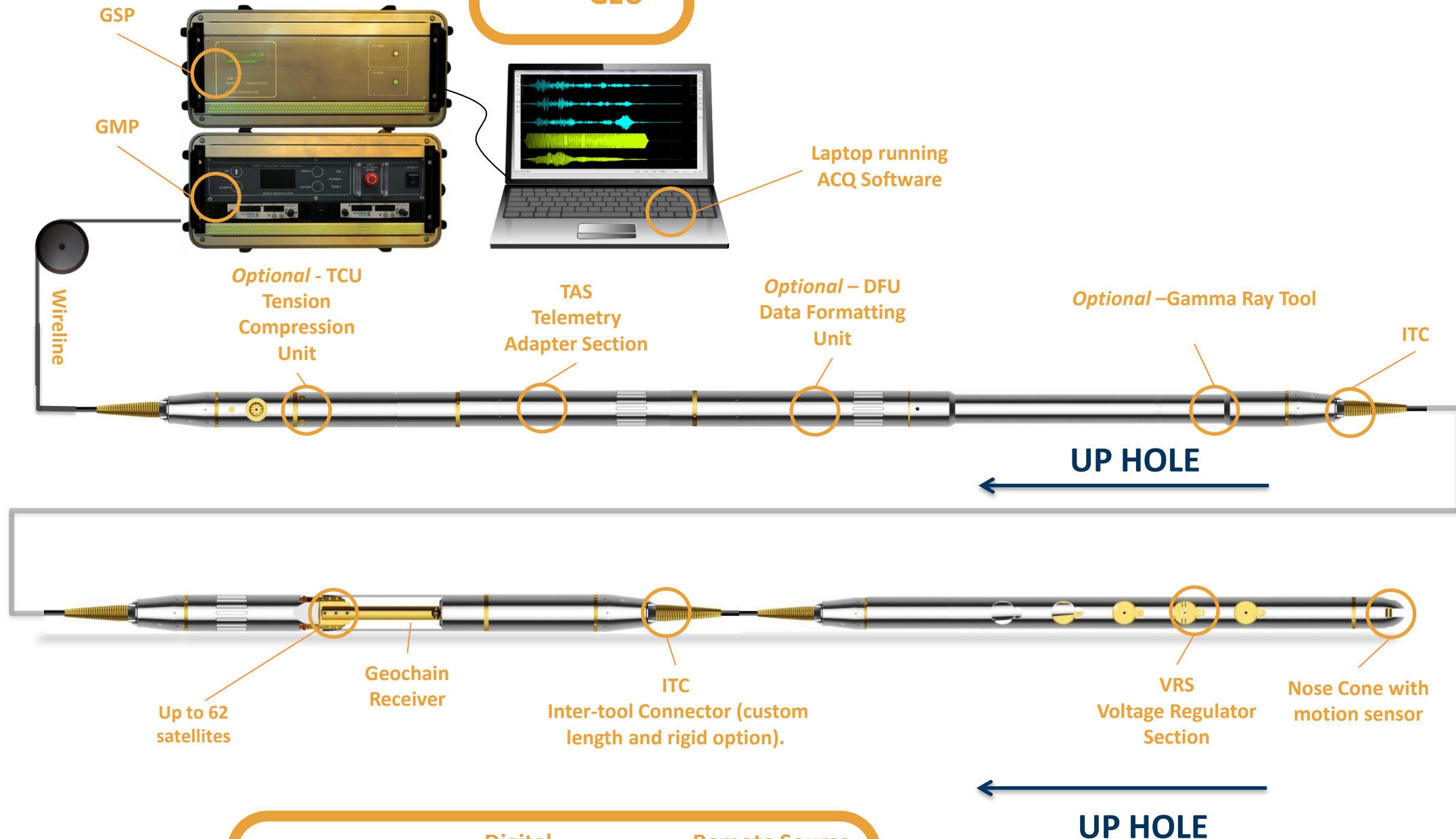
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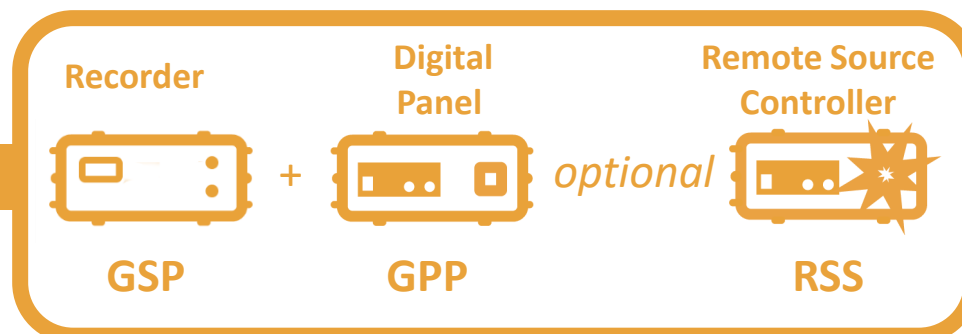
GEO

GEOCHAIN

DOWNHOLE STRING ASSEMBLY



SURFACE PANELS



ASR-1 (HP) Digital and Analog Geophone



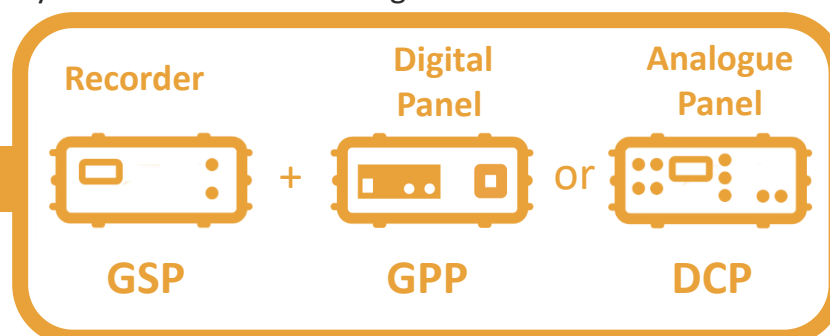
Main Features

- Ideal for **VSP & Microseismic** surveys.
- Up to 62 satellites.
- 3" Outside Diameter Tool.
- Standard 7 conductor wireline.
- Real time data transmission.
- Multiple 3 component sensor options.
- 24-bit delta sigma convertors.
- Unique Active Cooling System for continuous operation at 385°F (195°C).
- 25,000psi (1700 bar) high pressure rating.
- Up to >600' (200m) between satellites.
- Gapless recording for passive monitoring surveys.
- Quick and easy conversion from Analogue to Digital operation.
- Tractor Deployable
- New: Integrated high side indicator in every receiver.

Functionality

- The Geochain™ VSP array has been designed for use in open and cased holes using standard 7 conductor wireline. The array is based on the well proven ASR-1 downhole geophone and can be used in wells up to 25,000 psi (1,750 bar) and hole sizes from 3 1/2"-22" (89 to 559mm).
- The modular nature of the ASR-1 tool allows quick optimisation for various surveys ranging from high temperature deep well check shot to complex high sensitivity microseismic monitoring.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

ASR-1 (HP) Satellite Specifications

Length	35" (884mm)
Diameter	3" (76mm) without nodes
Weight	41lbs (19kg)
Max locking range	12" (305mm) Standard or 22" (559mm) with an arm extender
Max locking force	300 lbs (Standard Arm)
Temperature	400°F (204°C) Analogue / 437 °F (225°C) EHT / 385°F (195°C) Digital (XSeries)
Pressure	HP - 25,000psi (1750 bar) – 30,000 psi EHP version available.
Sensors	3 Component Gimbal – Sensor SM-4 HT 10Hz 3 Component Fixed – SMC 2400 15Hz Omni- Dual/Quad
Well Deviation Control	0°-95°
Panels	GPP or GMP & GSP-1 (Digital) DCP-2 & GSP-1 (Analogue)

Downhole Specifications

Max. No. of Satellites	62			
X-TAS Telemetry	Sample interval	Bandwidth Hz	ASR's	ASR's with DFU
	1/4ms	1600	8	15
	1/2ms	800	16	30
	1ms	400	32	60
	1.5ms	266	48	
	2ms	200	62	
Dynamic Range	>112dB @ 0dB pre-gain (minimum)			
A/D convertor	24 bit Delta-Sigma			
Downhole Gain	42-54dB			
Distortion	<0.02%			
DC offset	Self-calibrating			
Max data rate	4 Mbit/second			
Min. data rate	256kbit/second			
Wireline	7 Conductor (Heptacable)			

Surface Specifications

Recording panel	GPP or GMP & GSP-1 (Digital) DCP-2 and GSP-1 (Analogue)
Software	ASL Acquisition Suite and Copy of VSProwess® Processing Software
Cable equalisation	Fully automatic using internal DSP chip
Airgun firing pulse	60 V, 30ms
Test system	Fully automatic with comprehensive report generation
PC Interface	USB
Power Requirements	100/230 V AC, 47-63 Hz universal input, 30 watts
Operating Temp	32-104°F (0-40°C)
Enclosure	Standard 19" rack mounting

TAS-X-HP – Telemetry Adaptor Section HP



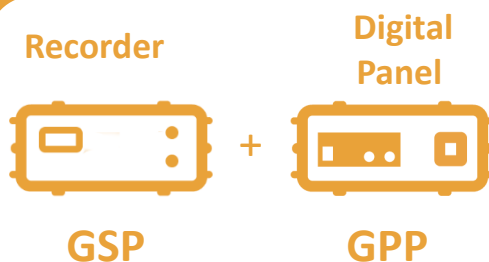
Main Features

- Interfaces digital Geochain string to wireline cable.
- Equal wireline power distribution.
- Separates downlink power and uplink telemetry.
- Unique Active Cooling System for continuous operation at 385°F (195°C).
- 25,000psi (1700 bar) pressure rating (TAS-2 HP).

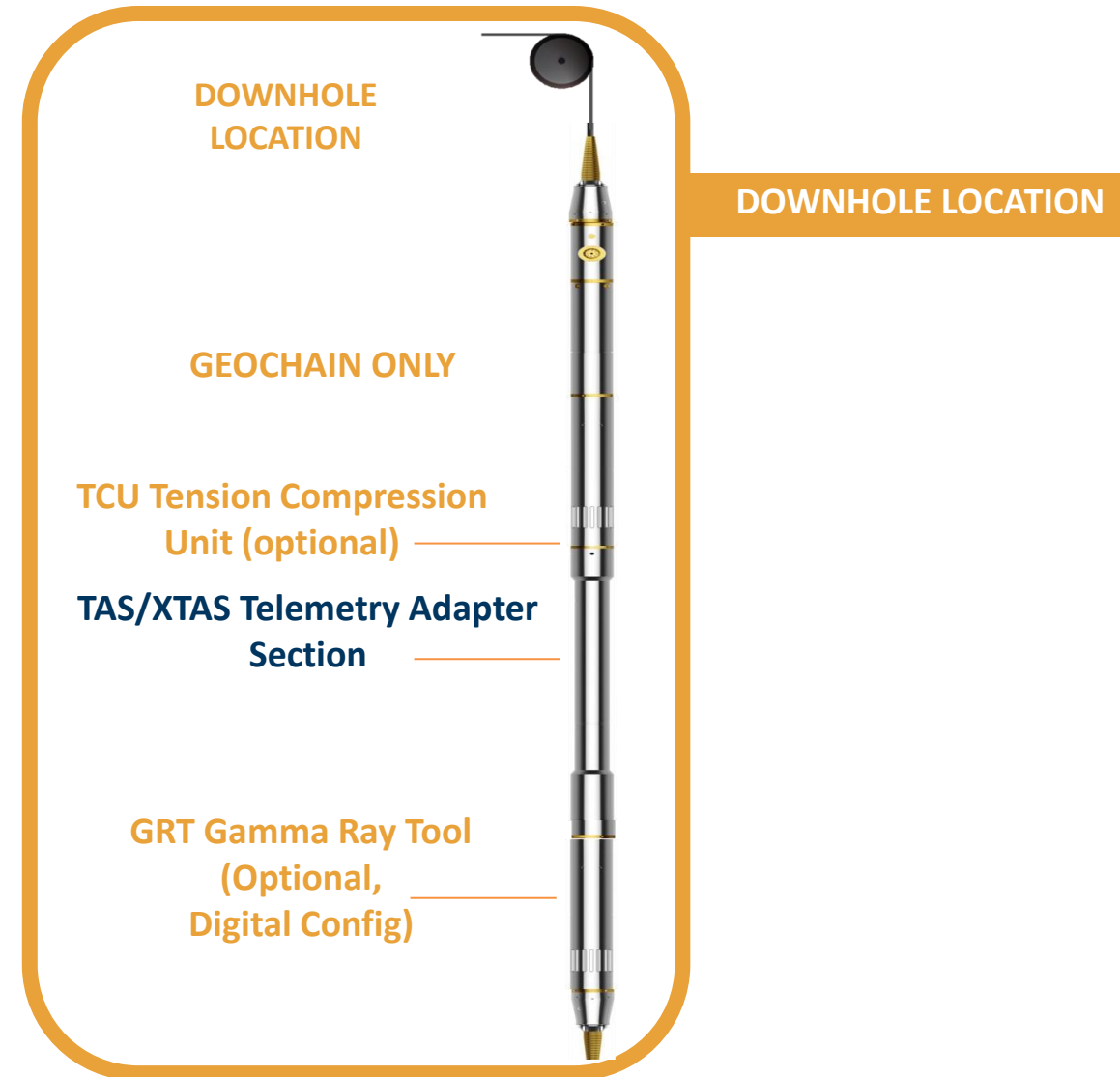
Functionality

- The TAS serves to interface the Geochain tool-string to the main wireline cable. System power from the surface is distributed equally over six wireline conductors. Transformers in the TAS separate this power from the downlink and uplink data signals.
- The TAS receives the data from the Geochain tool-string and re-transmits this to the surface, in a coded and modulated form.
- The TAS also receives synchronisation and command information from the surface and relays this down to all ASRs in the tool-string.
- The TAS may be connected directly to the top ASR using a special coupler, but is often separated by a short ITC to avoid any possible degradation of the seismic response of the ASR.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



TAS-2 (HP) Specifications

Length	AS283 18.7" (476mm)
Diameter	3" (76mm)
Weight	21.6lb (9.8kg)
Temperature	385°F (195°C) *Digital Only
Pressure	25,000psi (1750 bar) HP version
Max Telemetry Data Rate	4Mbit/second
Min Telemetry Data Rate	256kbit/second
Panels	GPP or GMP & GSP-1 (Digital)

DFU Compatible*

Yes – Firmware upgrade required to all previous 2015 TAS-2

Wireline

7 Conductor Heptacable

ASR-HP Advanced Seismic Receiver



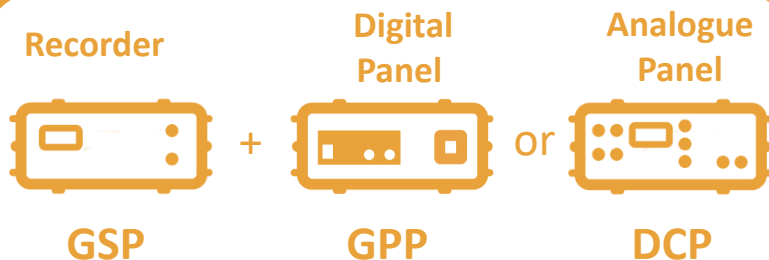
Main Features

- Ideal for **VSP** & **Microseismic** surveys.
- High strength motorized locking arm
- 3" Outside Diameter Tool.
- Standard 7 conductor wireline.
- Real time data transmission.
- Multiple 3 component sensor options.
- Quick and easy conversion from Analogue to Digital operation.
- Accepts various digital and analogue digitiser modules (up to 225°C)
- Accepts various sensor pack modules for survey customization
- 25,000psi (1700 bar) high pressure rating (30,000 psi EHP available).

Functionality

- ASR-1 downhole geophone and can be used in wells up to 25,000 psi (1,750 bar) and hole sizes from 3 1/2"-22" (89 to 559mm).
- The modular nature of the ASR-1 tool allows quick optimisation for various surveys ranging from high temperature deep well check shot to complex high sensitivity microseismic monitoring.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

TAS/DFU Telemetry Adaptor
Section/Data Formatting Unit

ITC Inter Tool Cable

ASR-1 Advanced Seismic
Receiver

ITC Inter Tool Cable

ASR-1 Advanced Seismic
Receiver

DOWNHOLE LOCATION



ASR-1 (HP) Satellite Specifications

Length	35" (884mm)
Diameter	3" (76mm) without nodes
Weight	41lbs (19kg)
Max locking range & Force	12" (305mm) Standard or 22" (559mm) with an arm extender. 300lbs force Standard Arm.
Temperature	400°F (204°C) Analogue / 437 °F (225°C) EHT / 385°F (195°C) Digital (XSeries)
Pressure	HP - 25,000psi (1750 bar) – 30,000 psi EHP version available.
Electronic Modules	Digital Modules - AS270, AS271, AS272 (X-Series), AS273 Analogue Modules – DHA-53 205C, EHT-19 225C
Sensors	3 Component Gimbal – Sensor SM-4 HT 10Hz 3 Component Fixed – SMC 2400 15Hz Omni- Dual ASR-223/232 and Quad ASR-227
Well Deviation Control	0°-95°
Panels	GPP or GMP & GSP-1 (Digital) DCP-2 & GSP-1 (Analogue)
Wireline	7 Conductor Wireline, Connects to ITC-HP/ITC-EHP, Male Coupler/Avalon wireline head.

VRS-HP – Voltage Regulator Section



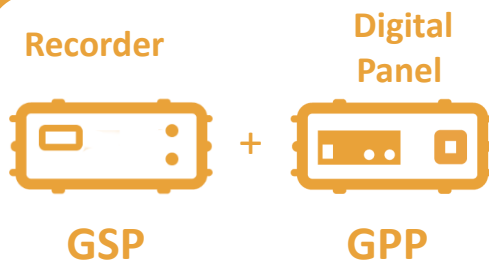
Main Features

- Voltage Regulation.
- Sinker Bar.
- Motion Sensor.
- Standard 7 conductor wireline.
- High Pressure.
- High Temperature.

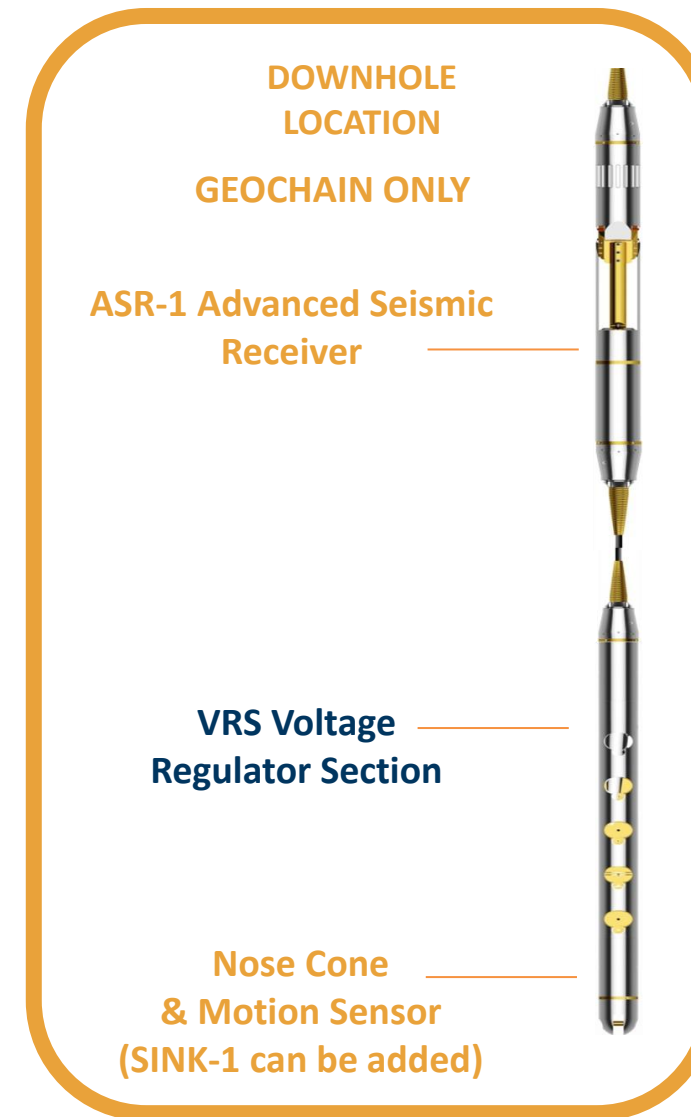
Functionality

- The VRS (Voltage Regulator Section) is located at the bottom end of the GeoChain digital receiver array and serves the dual-purpose as a voltage regulator to establish the 110 volt ASR arm operating motor voltage. The second function is to act as a sinker weight and is equipped with a motion sensor assisting with the lowering of AST tools down the borehole.
- A portion of the current, through the VRS, is diverted to operate the ASR arm control motors. The GeoChain™ software is able to resolve any current demands required by the ASR arm motors by automatically suspending one or more motors until more current is available.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



DOWNHOLE LOCATION

VRS (HP) Specifications

Length	52" (1320mm) with nose cone
Diameter	3" (76mm)
Weight	95 lbs (43kg) with nose cone
Temperature	385°F (195°C) *Digital Only
Pressure	25,000psi (1750 bar) HP version
Panels	GPP or GMP & GSP-1 (Digital)
Max number of ASR's	62
Wireline	7 Conductor Heptacable

DFU – Data Formatting Unit

Main Features

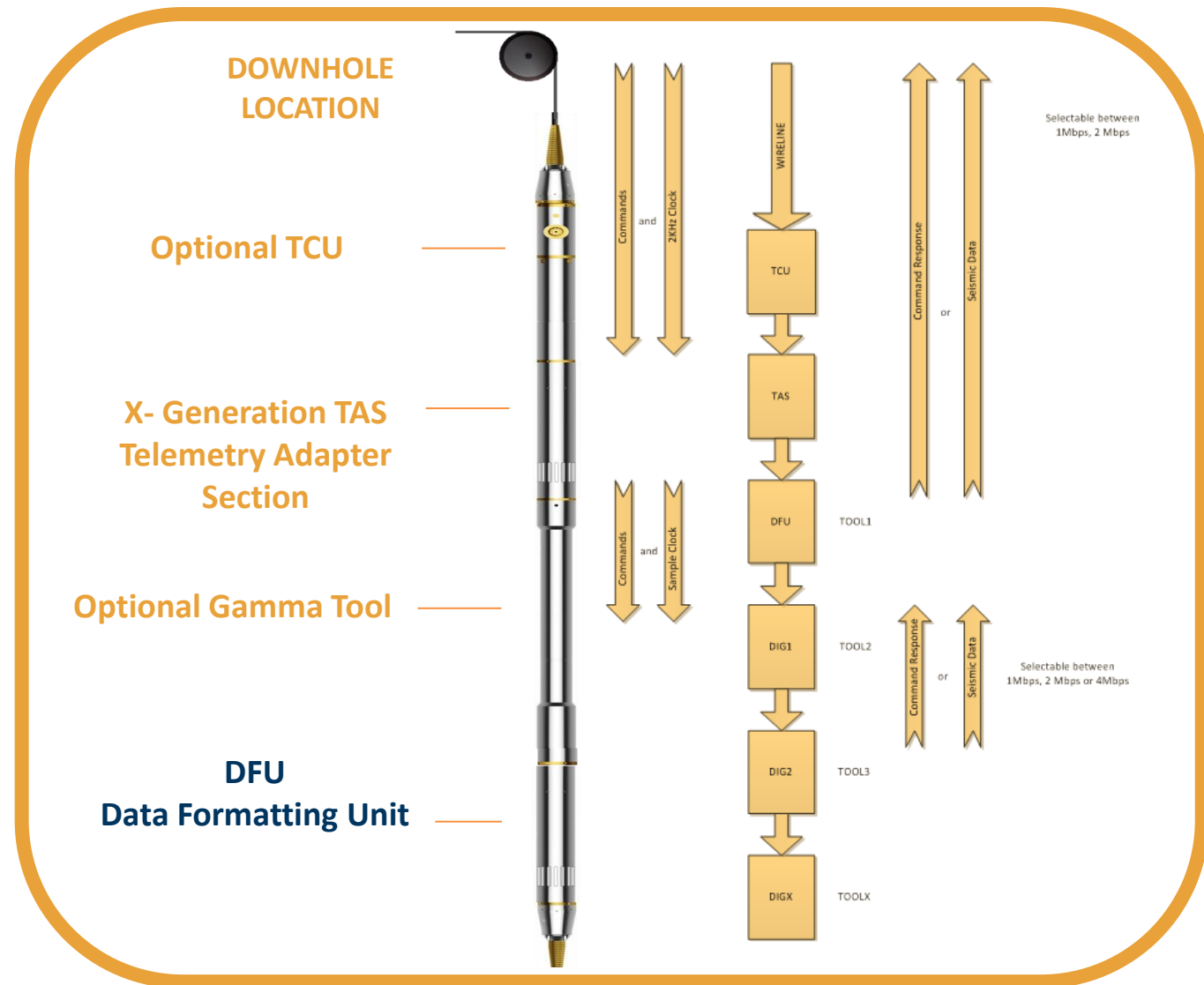
- Enables **Gapless Microseismic Operation** of Geochain system.
- **Compatible with all Geochain digitiser modules**
- Doubles the number of tools available for a given sample rate when running microseismic mode.
- Unique Active Cooling System for continuous operation at 195°C
- 25,000psi (1700 bar) pressure rating.

Functionality

- The DFU is a downhole sonde that allows the user gapless operation when used with an X Generation TAS (Telemetry Adapter Section).
- It is located in between the X-TAS and the digitisers.
- The DFU contains memory that stores digitiser data whilst the TAS has stopped, enabling the data to be continuous without gaps.



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



To perform gapless recording you will need:

1. **DFU (AS-262),**
2. **X-TAS (AS-261),**
3. **GSP with a LRX 2B card.**
4. **ACQ Software v.3.X+**

Recommended:

4. **Networked storage system in place (NAS).**
5. **Geochain Monitor Panel (GMP)**

DFU Specifications

Length	9.75" (250 mm) From M-Rotating nut to Female end.
Diameter	3" (76mm)
Weight	9.5 lb (4.3kg)
Temperature	195°C (Digital Only)
Pressure	25,000psi (1700 bar)
Panels	GMP or GPP & GSP-1 (Digital)
Wireline	7 Conductor Heptacable

Compatibility requirements

AS272 'X-Series' Digitizer

Main Features

- Low noise, High gain Geochain digitizer module.
- Robust operating temperature 385°F (195°C)
- Doubles existing Geochain system data rate, allowing 60 tools at 1ms sample rate*
- Enables continuous recording for microseismic monitoring*
- New flasking, hermetic seal employment and upgraded active cooling.
- Upgraded high temperature power supply.
- Upgraded electronics
- Integrated High Side Indicator
- Selectable Damping and Gain

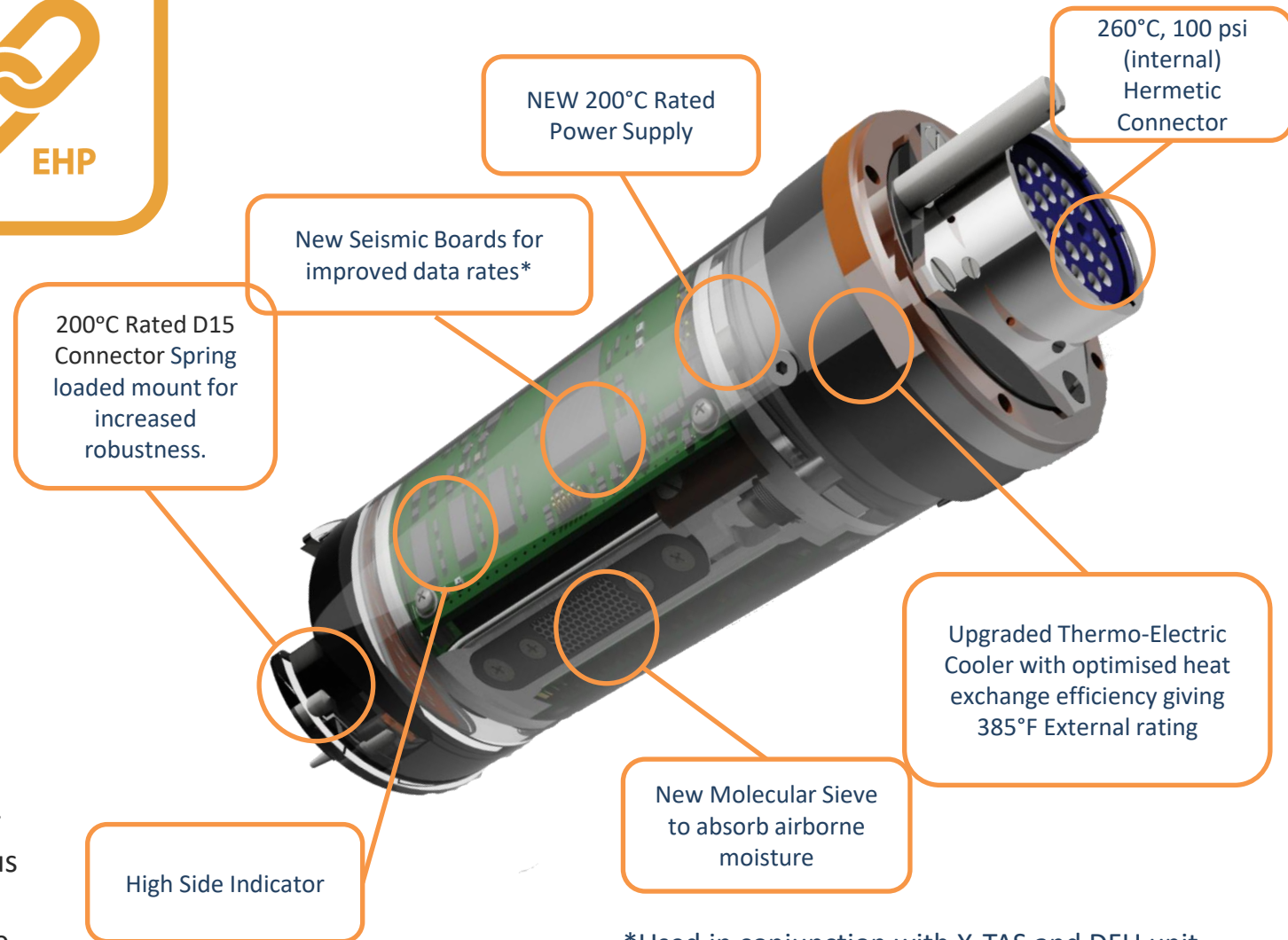
Functionality

- The X-series digitizer upgrade for the Geochain system, provides higher operating temperatures and higher telemetry rates, allowing continuous monitoring in the most hostile well conditions.
- This is the next development of the industry acclaimed AS271 low noise high gain digital module, which now introduces upgraded active cooling technology and thermal insulation components for increased robustness in addition to facilitating new operational functionality of your Geochain string.
- Compatible with all Geochain and Geochain EHP tools (Slim variant available).
- Facilitates 'Mix & Match' compatibility with Geochain Slim tools in the same string.

COMPATABLE WITH



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



*Used in conjunction with X-TAS and DFU unit.

Downhole Specifications AS272				
	X Generation			
Max. No. of Satellites	62			
Telemetry	Sample interval	Bandwidth Hz	ASR's	ASR's with DFU
	1/4ms	1600	8	15
	1/2ms	800	16	30
	1ms	400	32	60
	1.5ms	266	48	62
Dynamic Range	>112dB @ 0dB pre-gain (minimum)			
A/D convertor	24 bit Delta-Sigma			
Downhole Gain	42-54dB			
Distortion	<0.02%			
DC offset	Self-calibrating			
Max data rate	4 Mbit/second			
Min. data rate	256kbit/second			
Wireline	7 Conductor (Heptacable)			

AS271 '54dB Gain' Digitizer (Superseded)

Main Features

- Low noise, High gain Geochain digitizer module.
- Long term operating temperature 356°F (180°C)
- Plug-in 180°C Digital module for ASR
- Downhole Cooling
- 24bit A/D Conversion
- Run with 3 component Omni-directional 15Hz fixed sensor pack
- 52dB downhole gain
- Optimised for VSP work
- Standard & Extra High Pressure (EHP) compatibility
- Compatible with latest XTAS and DFU modules for both VSP and Gapless monitoring operation

Functionality

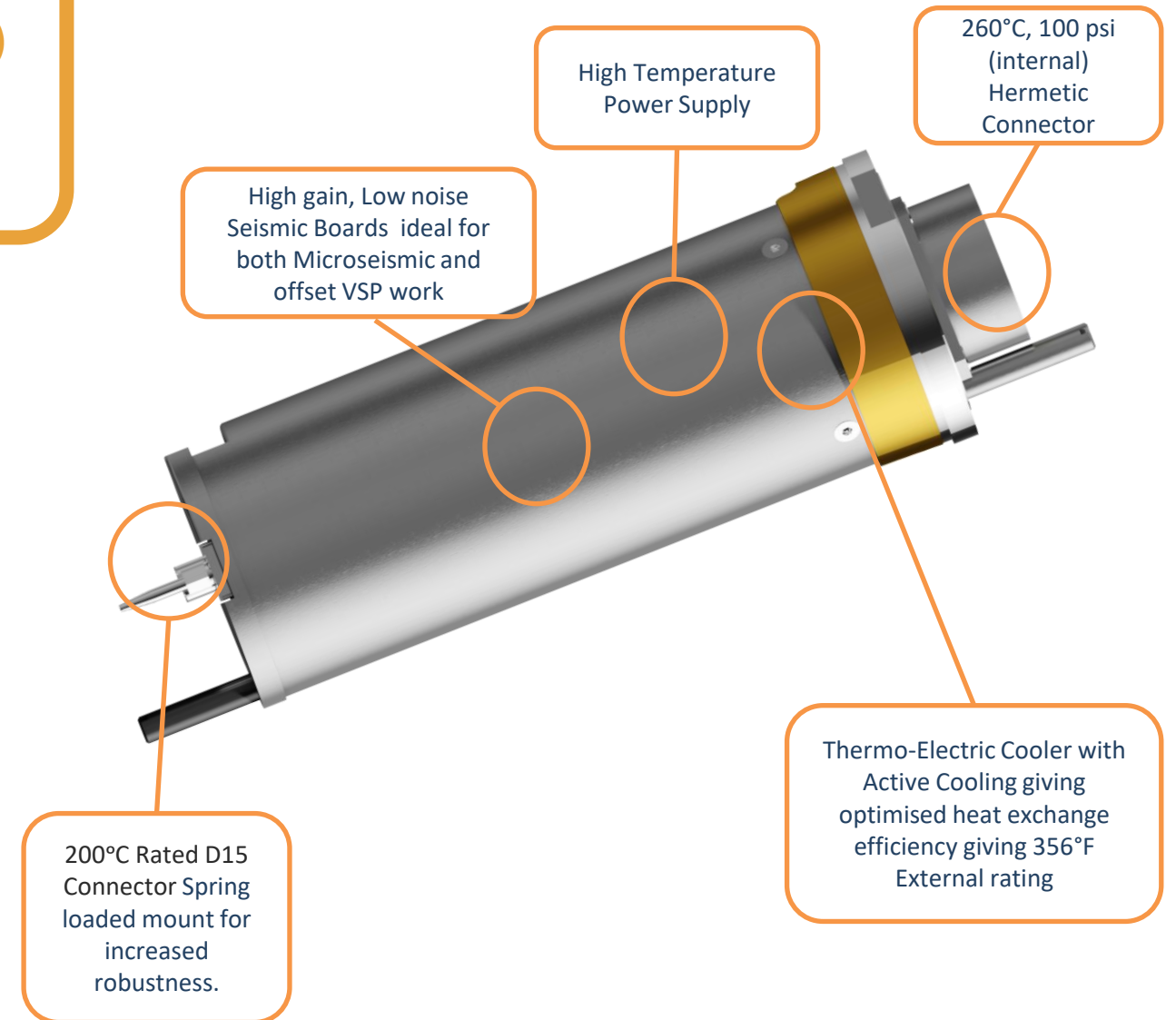
- The AS271 digitizer upgrade for the Geochain system, provides greater S/M downhole digitisation along with tool communication to TAS, even at higher operating temperatures. When combined with the 'Quad' sensor pack, this is the ideal choice for high sensitivity borehole seismic acquisition.
- This is the next development of the industry acclaimed AS270 low noise high gain digital module, which now introduces upgraded low noise/high gain seismic boards and thermal insulation components for increased robustness in addition to facilitating new operational functionality of your Geochain string.
- Compatible with all Geochain and Geochain EHP tools (Slim variant available).
- Compatible with DFU and XTAS to deliver Gapless monitoring.



COMPATABLE WITH



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Downhole Specifications AS271				
Superseded by AS272 but still compatible.				
Max. No. of Satellites	62			
Telemetry	Sample interval	Bandwidth Hz	Receivers (AS271)	ASR's (AS272 + DFU)
	1/4ms	1600	8	15
	1/2ms	800	16	30
	1ms	400	32	60
	1.5ms	266	48	62
Dynamic Range	>112dB @ 0dB pre-gain (minimum)			
A/D convertor	24 bit Delta-Sigma			
Downhole Gain	54dB			
Distortion	<0.02%			
DC offset	Self-calibrating			
Max data rate	1.5 Mbit/second (X Series AS272 can deliver 4Mbit/second).			
Min. data rate	256kbit/second			
Wireline	7 Conductor (Heptacable)			

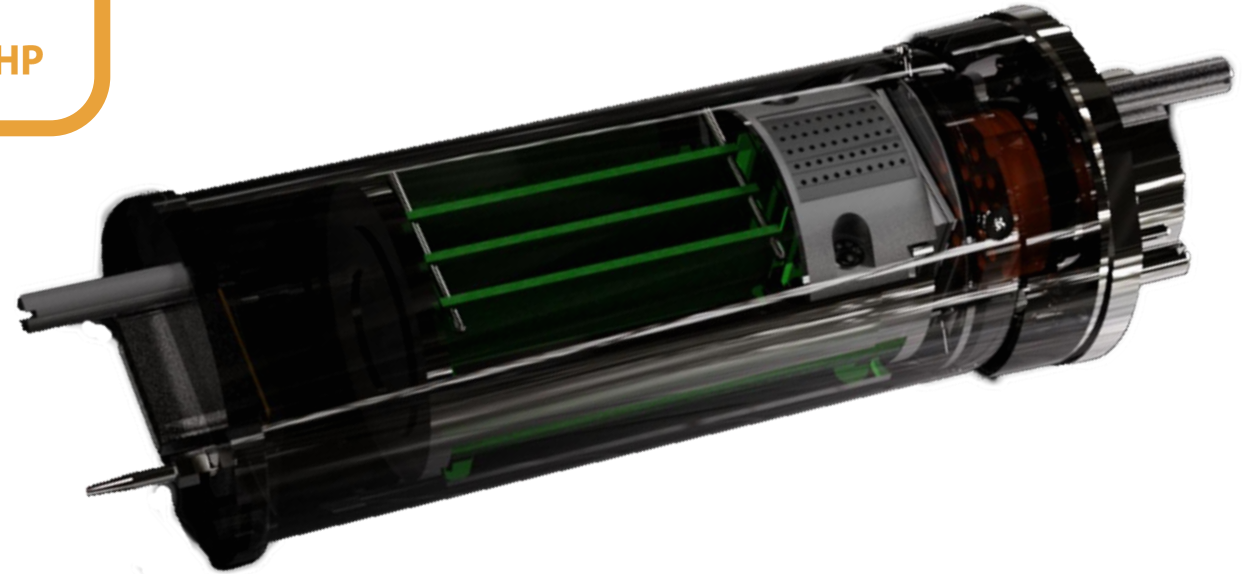
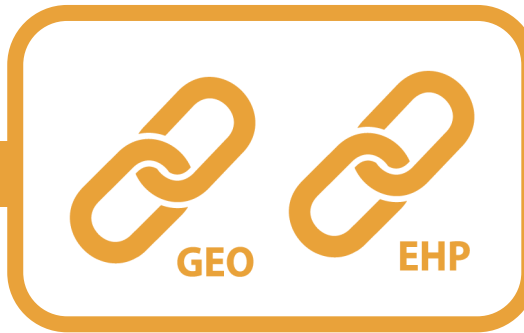
ASR-270 42dB digitiser (Superseded)

Main Features

- Plug-in 180°C Digital module for ASR
- Downhole Cooling
- 24bit A/D Conversion
- Run with 3 component Omni-directional 15Hz fixed sensor pack
- Standard 7 conductor wireline (heptacable)
- 42dB downhole gain
- Optimised for VSP work
- Standard & Extra High Pressure (EHP) compatibility

Functionality

- Downhole Digital module for Geochain ASR/ASR-HP/ASH-EHP
- Provides digitization of ASR geophones, sampling down to 250us.
- Contains tool arm motor switch control board.
- Monitors internal tool status, acoustic response & internal tool temperature (within electronics module).
- Contains active cooling.

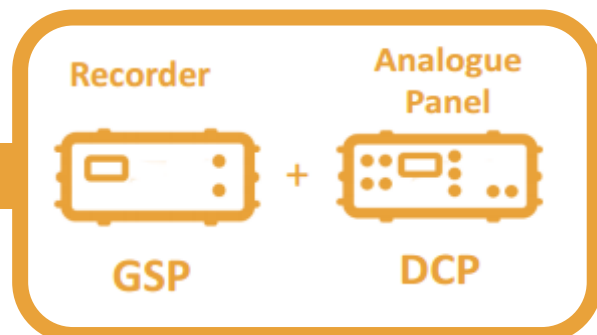


Specifications

ASR-270

<i>Downhole Specifications</i> AS270			
Superseded by AS272 but still compatible.			
Max. No. of Satellites	48		
Telemetry	Sample interval	Bandwidth Hz	ASR's
	1/4ms	1600	8
	1/2ms	800	16
	1ms	400	32
	1.5ms	266	48
Dynamic Range	>112dB @ 0dB pre-gain (minimum)		
A/D convertor	24 bit Delta-Sigma		
Downhole Gain	42dB		
Distortion	<0.02%		
DC offset	Self-calibrating		
Max data rate	2 Mbit/second		
Min. data rate	256kbit/second		
Wireline	7 Conductor (Heptacable)		

Surface Panels

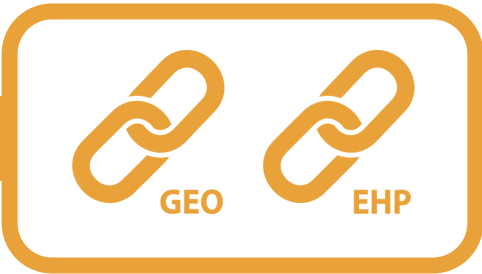


Compatible with



AS273 Geochain Digitizer (Superseded)

Plug-in high temperature digital module for ASR



Main Features

- Low noise, High gain (54dB) Geochain digitizer module.
- Increased operating temperature (180°C/356°F).
- Enables gapless recording for microseismic monitoring
- New flasking, hermetic seal employment and upgraded active cooling.
- Upgraded high temperature power supply.
- Upgraded electronics
- Selectable Damping and Gain
- Bypass mode capability

Functionality

- The AS273 digitizer for the Geochain system allows gapless monitoring in the most hostile well conditions.
- This is a development of the industry acclaimed AS271 low noise high gain digital module, which now introduces upgraded active cooling technology and thermal insulation components for increased robustness in addition to facilitating new operational functionality of your Geochain string.
- Compatible with all Geochain and Geochain EHP tools.
- Bypass mode capability limits system damage in the event of a tool failure.



COMPATABLE WITH



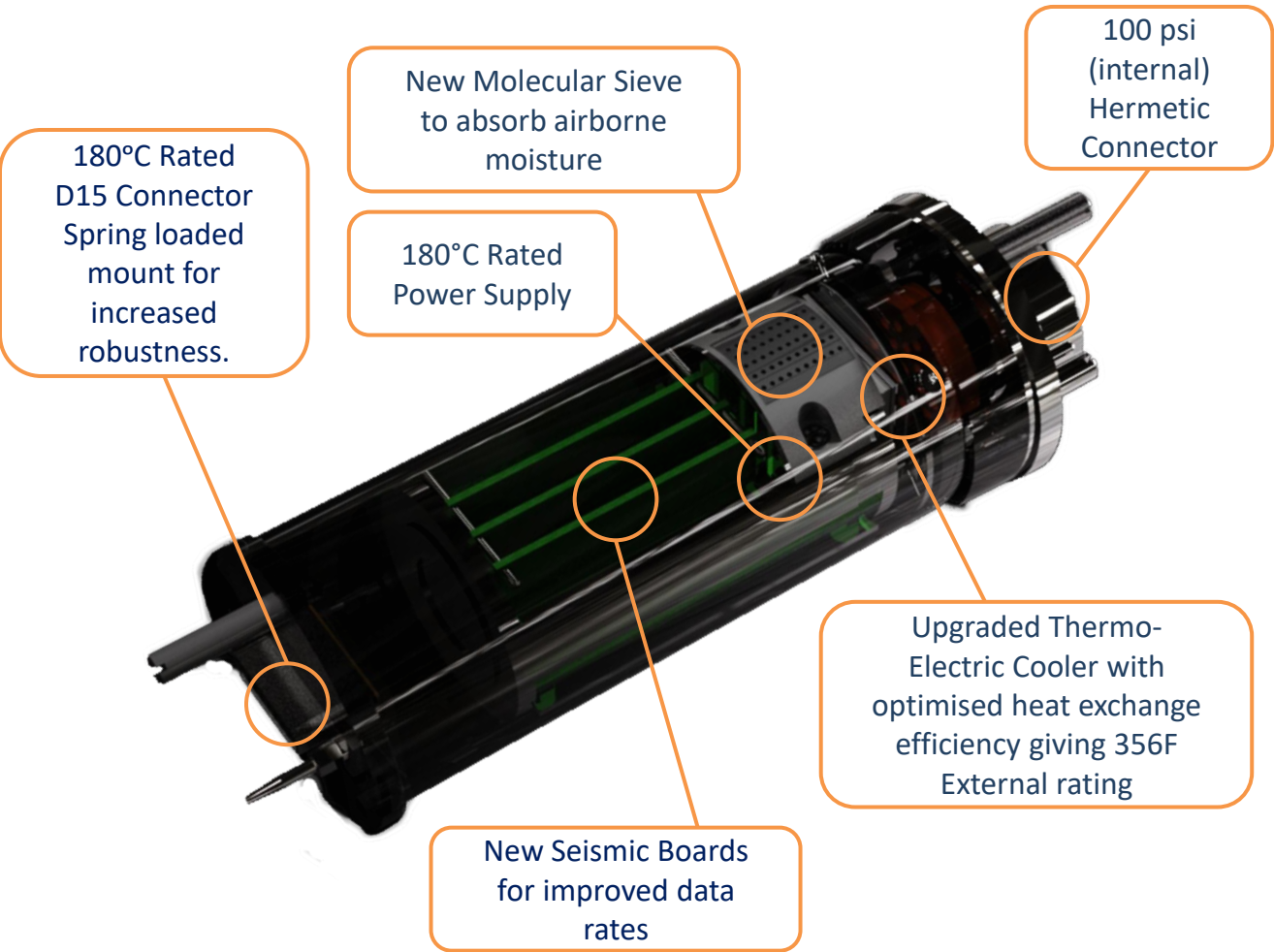
and



Geochain Digital

Geochain EHP Digital

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Downhole Specifications

TAS Telemetry	Sample interval	Bandwidth Hz	ASR's
	1/4ms	1600	8
	1/2ms	800	16
	1ms	400	32
	1.5ms	266	48
Dynamic Range	>112dB @ 0dB pre-gain (minimum)		
A/D convertor	24 bit Delta-Sigma		
Downhole Gain	42-54dB		
Distortion	<0.02%		
DC offset	Self-calibrating		
Max data rate	1.5 Mbit/second		
Min. data rate	256kbit/second		
Wireline	7 Conductor (Heptacable)		

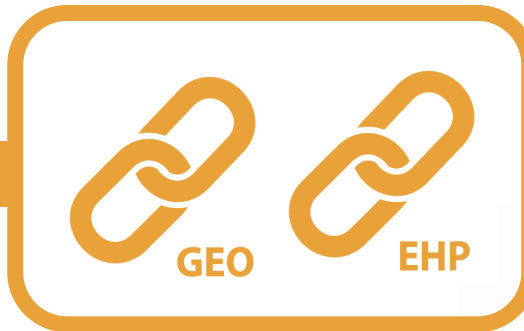
ASR-53 Downhole Analog Amplifier (DHA)

Main Features

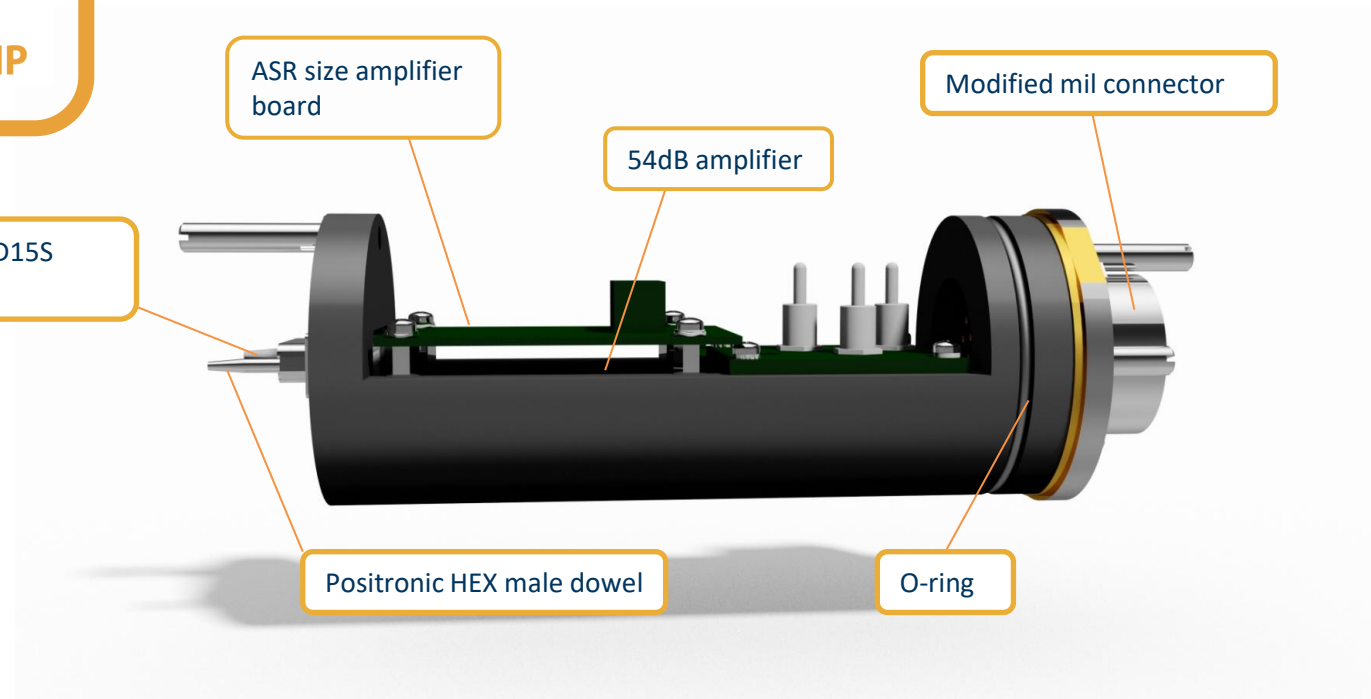
- Plug-in **200°C** (225°C EHT) analog module for ASR
- EHT module specified to 225°C
- 25,000psi pressure rating
- Single or dual
- Run with 3 component Omni-directional 15Hz fixed sensor pack
- Standard 7 conductor wireline (heptacable)
- Gamma or CCL operation
- Optimised for both VSP and hydraulic fracture monitoring work
- Standard & Extra High Pressure (EHP) compatibility

Functionality

- Replacement of the electronic module with an ASR-53 Downhole Amplifier enables a single or dual level string to be deployed in very hot wells up to 200°C.
- The DHA and sensor pack can be upgraded to ASR-1 Extra High Temperature (EHT) to provide 225°C operational temperature.
- Unlike conventional EHT tools that rely on thermal shielding the ASR-EHT uses 230°C electronics to allow for several days use at elevated temperatures.
- The modular construction of the ASR-53 DHA allows it to be easily converted with an ASR-1 electronic module.



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

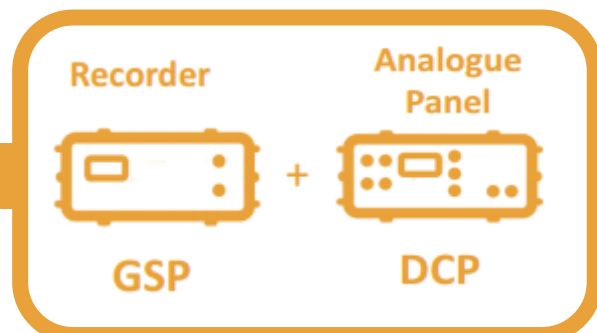


Specifications

ASR-53

Downhole gain:	54dB
Well Deviation:	0-90°
Temperature:	200°C
Temperature (EHT):	225°C
Pressure:	25,000psi
Surface converter:	24bit
Sample rate:	250us maximum
Frequency response:	10-1600Hz
Control panel:	DCP-2
Recording system:	GSP-1

Surface Panels



Compatible with



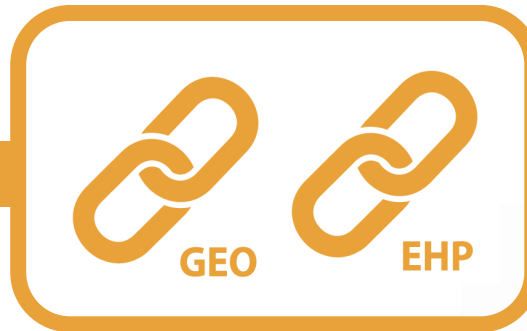
EHT-19 Downhole Analog Amplifier (DHA-EHT)

Main Features

- Plug-in **225°C EHT** analog module for ASR
- EHT module specified to 225°C
- 25,000psi pressure rating
- Single or dual
- Run with 3 component Omni-directional 15Hz fixed sensor pack
- Standard 7 conductor wireline (heptacable)
- Gamma or CCL operation
- Optimised for both VSP and hydraulic fracture monitoring work
- Standard & Extra High Pressure (EHP) compatibility

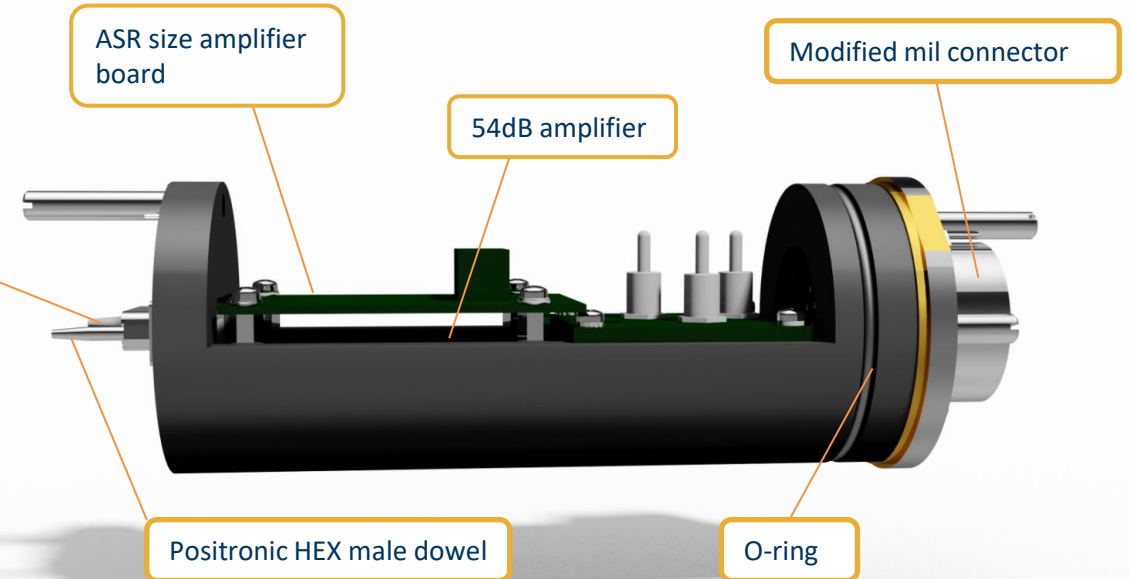
Functionality

- Replacement of the electronic module with an EHT-19 Downhole Amplifier enables a single or dual level string to be deployed in very hot wells up to 225°C.
- Unlike conventional EHT tools that rely on thermal shielding the ASR-EHT uses 230°C electronics to allow for several days use at elevated temperatures.
- The modular construction of the ASR-53 DHA allows it to be easily converted with an ASR-1 electronic module.



High Temperature D15S crimp connector

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

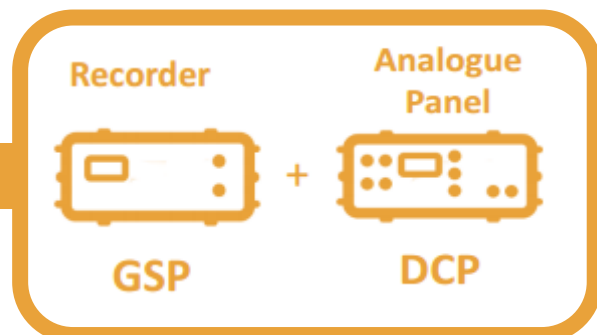


Specifications

EHT-19

Downhole gain:	54dB
Well Deviation:	0-90°
Temperature:	225°C
Pressure:	25,000psi (in ASR-HP Housing)
Surface converter:	24bit
Sample rate:	250us maximum
Frequency response:	10-1600Hz
Control panel:	DCP-2
Recording system:	GSP-1

Surface Panels



Compatible with



UHT-06 Downhole Analog Amplifier (DHA)



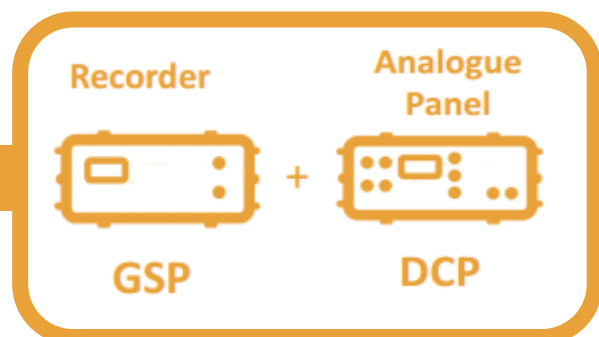
Main Features

- Plug-in **240°C UHT** analog module for ASR-UHT
- Run with 3 component Omni-directional 15Hz UHT fixed sensor pack
- Standard 7 conductor wireline (heptacable)
- Compatible with Gamma or CCL operation
- Optimised for both Extreme Hostile well VSP and hydraulic fracture monitoring work
- Standard & Extra High Pressure (EHP) compatibility

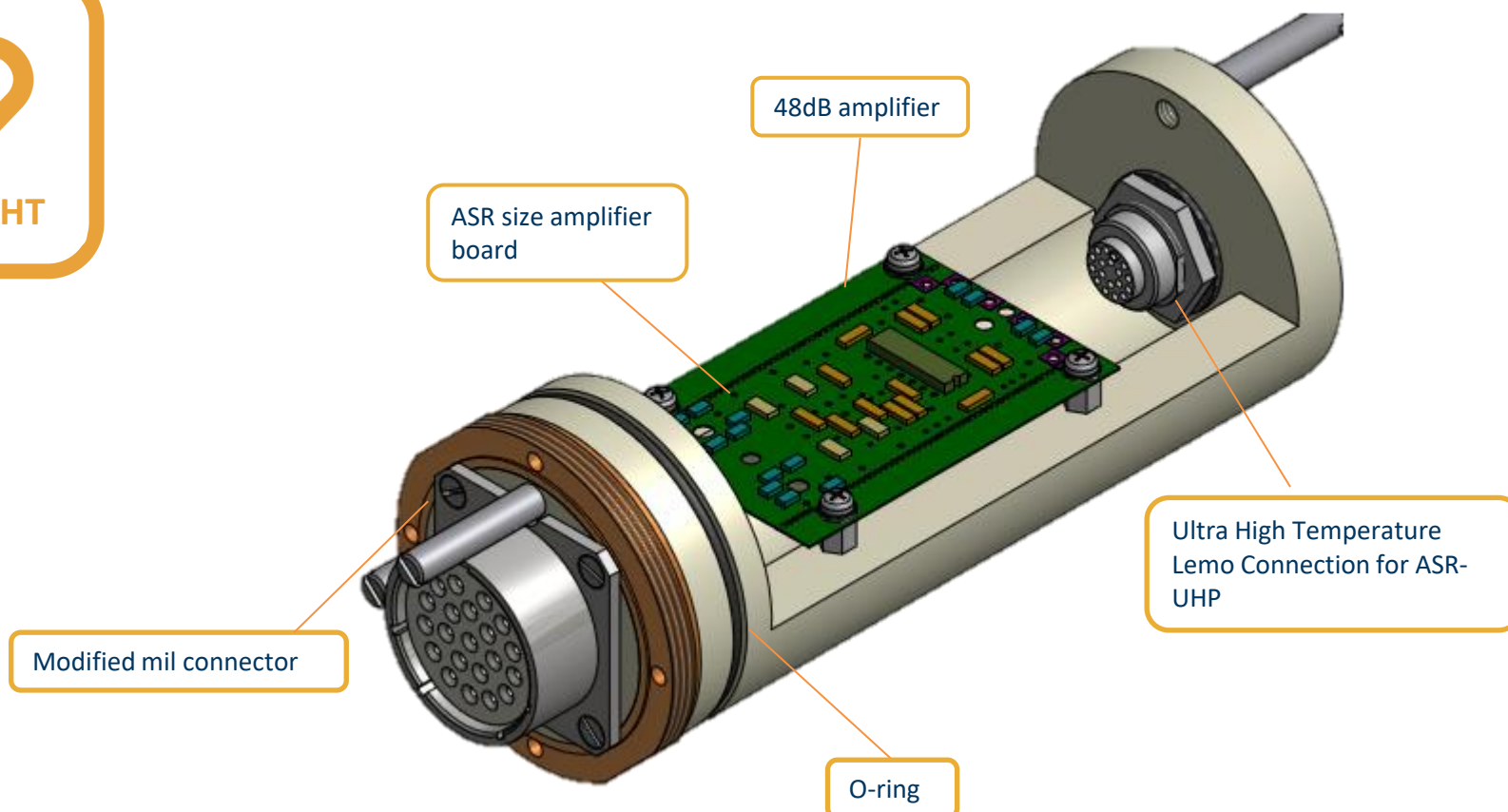
Functionality

- Corresponding downhole amplifier for ASR-UHT Tool for extremely high temperature analog operation in wells up to 240°C/464°F.
- Unlike conventional EHT tools that rely on thermal shielding the ASR-EHT uses 240°C electronics to allow for several days use at elevated temperatures

Surface Panels



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Specifications

UHT-06 DHA

Downhole gain:	48dB
Electronics	Analog
Well Deviation:	0-90°
Temperature:	464°F/240°C
Compatible Tool Body	ASR-UHT
Pressure:	25,000psi (in ASR-UHT Housing)/30,000 psi in ASR-UHP UHT Housing.
Surface converter:	24bit
Sample rate:	250us maximum
Frequency response:	10-1600Hz
Control panel:	DCP-2
Recording system:	GSP-1

Compatible with



ASR-227 – Quad Sensor Pack



Main Features

- Ideal for **VSP** & **Microseismic** surveys.
- Four geophones per axis.
- Fits standard and high-pressure ASR's.
- Greater signal to noise ratio.
- Modular for quick and easy customisation.

Functionality

- Ideal for use with high gain 54dB digitisers.
- Overall sensitivity up to 115,564 V/m/s at 48°F (20°C)
- Ideal for use with standard, HP and EHP Geochain systems.
- Operating temperature up to 437°F (225°C).*

Quad vs Dual Overall Sensitivity @ 20°C						
Sensor Pack	Electronics	Damping Resistors	Downhole Gain*	Sensitivity undamped V/m/s	Sensitivity damped V/m/s	Overall Sensitivity V/m/s*
Gimbal Mono	AS272 VSP Mode	10.29 KΩ	44dB	80	60	9490
Dual	AS271	47KΩ	54dB	104	94.4	47200
Quad	AS271	47KΩ	54dB	208	173	86350
Quad	AS272/AS251 VSP Mode	10.29KΩ	44dB	208	108	17013
Quad	AS272/AS251 uSeismic Mode	48.13KΩ	56.5dB	208	173	115564

*back calculation to correct digitiser gain is applied in acquisition software to provide true sensor amplitude.

COMPATABLE WITH



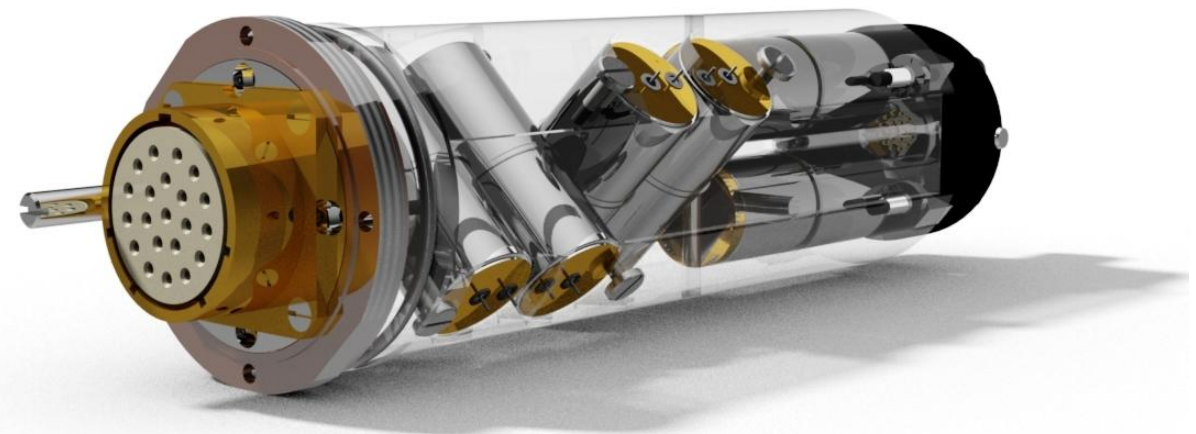
or



ASR-1 HP
& ASR-1
EHP
& ASR-1
UHP

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

<i>Omni 2400Ω Geophone</i>	Per Element
Optimum Orientation	Horizontal
Operational Range	0°to 180°(Omni)
<i>Natural Frequency (Fn)</i>	
Optimum Orientation	15 Hz +/- 5%
Operational Range	15 Hz - 5% to +15%
<i>Coil Excursion P-P</i>	
Optimum Orientation	>0.120 in, >.306 cm
Operational Range	>0.022 in, >.051 cm
<i>Spurious Frequency</i>	250 Hz
<i>Resistance</i>	2400Ω +/-5% per transducer
<i>Sensitivity</i>	
At Optimum Orientation	52 V/m/s +/- 5% * Quad Pack = x4 elements in series = 208 V/m/s)
At Operational Range	52 V/m/s -15% to +5% at 20°C Quad Pack = x4 elements in series = 208 V/m/s)
<i>Open Circuit Damping</i>	
Optimum orientation	0.57 +/-15%
Operational Range	0.57 -20% to +10%
<i>Moving Coil Mass</i>	7.6 gr
<i>Distortion</i>	
Optimum Orientation	<0.20%
Operational Range	<0.70%
<i>Storage Temperature</i>	-40°F to 212 °F (-40 to +100°C)
<i>Operating Temperature</i>	-40°F to 400+°F (-40 to +205°C)*
<i>Geophone Dimensions:</i>	
Weight	49 gr
Diameter	2.22 cm
Height	2.70 cm (3.00 cm Including Terminals)



ASR-38 – Gimbal Sensor Pack



Main Features

- Ideal for **Deviated Well VSP**.
- 10Hz Geophone.
- Fits standard and high pressure ASR's.
- Self orientating 3C Orthogonal Unit
- Single Geophone Per Axis
- Modular for quick and easy customisation.

Functionality

- Ideal for use with standard gain mode digitisers.
- Overall sensitivity up to 663 V/m/s at 48°F (20°C)
- Ideal for use with standard, HP and EHP Geochain systems.
- Operating temperature up to 400°F (204°C).

Quad vs Dual Overall Sensitivity @ 20°C						
Sensor Pack	Electronics	Damping Resistors	Downhole Gain*	Sensitivity undamped V/m/s	Sensitivity damped V/m/s	Overall Sensitivity V/m/s*
Gimbal Mono	AS272 VSP Mode	10.29 KΩ	44dB	80	60	9490
Dual	AS271	47KΩ	54dB	104	94.4	47200
Quad	AS271	47KΩ	54dB	208	173	86350
Quad	AS272/AS251 VSP Mode	10.29KΩ	44dB	208	108	17013
Quad	AS272/AS251 uSeismic Mode	48.13KΩ	56.5dB	208	173	115564

*back calculation to correct digitiser gain is applied in acquisition software to provide true sensor amplitude.

COMPATABLE WITH



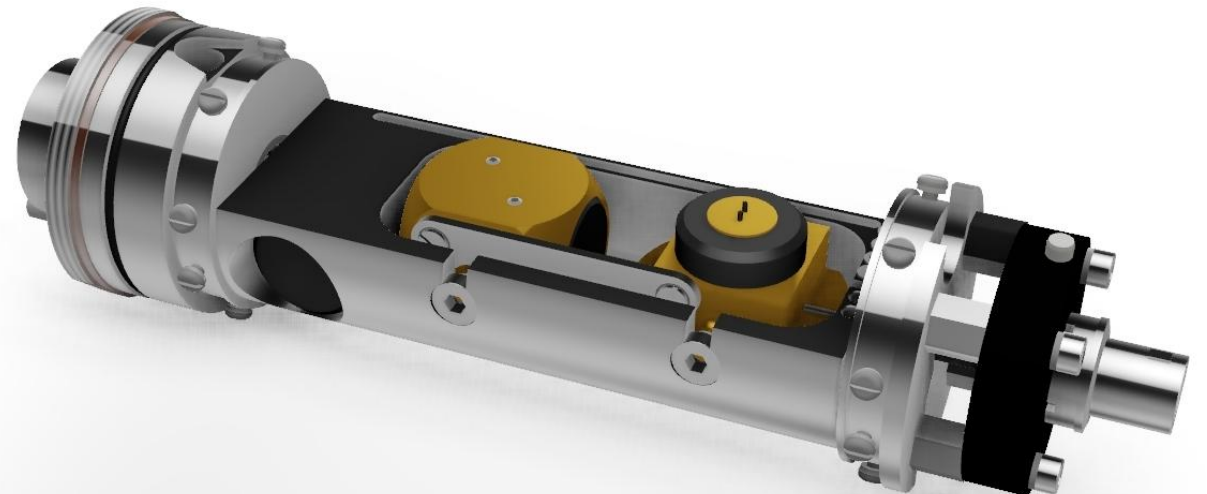
or



ASR-1 HP
& ASR-1
EHP
& ASR-1
UHP

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

<i>Gimbal 3500Ω Geophone</i>	Per Element
Optimum Orientation	Dedicated to either Horizontal/Vertical
Operational Range	0°to +-45° (Mono)
<i>Natural Frequency (Fn)</i>	
Optimum Orientation	10 Hz +/- 5%
Operational Range	10 Hz - 5% to +15%
<i>Coil Excursion P-P</i>	
Optimum Orientation	>0.2 cm
Operational Range	>0.5 cm
<i>Spurious Frequency</i>	250 Hz
<i>Resistance</i>	3500Ω +/-5% per transducer
<i>Sensitivity</i>	
At Optimum Orientation	80 V/m/s +/- 5%
At Operational Range	80 V/m/s -15% to +5% at 20°C
<i>Open Circuit Damping</i>	
Optimum orientation	0.356 +/-15%
Operational Range	0.356 -20% to +10%
<i>Moving Coil Mass</i>	9.6 gr
<i>Distortion</i>	
Optimum Orientation	<0.20%
Operational Range	<0.70%
<i>Storage Temperature</i>	--30°F to 140 °F (-40 to +60°C)
<i>Operating Temperature</i>	-22°F to 400+°F (-40 to +205°C)*
<i>Geophone Dimensions:</i>	
Weight	74 gr
Diameter	2.54 cm
Height	3.2 cm



QUAD vs GIMBAL - SUMMARY

SPECIFICATION	GIMBAL	QUAD	Comments
Date of Sensor Pack Release (for ASR)	2002	2010	
No. of Geophone Elements per axis	1	4	Quad wired in series to increase sensitivity.
Max Tool Sensitivity @20C (44dB VSP Mode)	9,490 V/m/s	17,013 V/m/s	Using X Series Electronics AS272
Max Tool Sensitivity @20C (56.5 dB uSeismic Mode)	49,817 V/m/s	115,839 V/m/s	Using X Series Electronics AS272
Resonant Frequency	10 Hz	15Hz	
Peak Operating Temp	205°C	225°C	
Well Deployment Suitability	Deviated Wells*	All Wells	*Free rotation of Gimbal – X and Y alignment will be random in vertical wells
Can be used with X-Series HSI (digitiser High Side Indicator)	No	Yes	Quad orientations are fixed with digitiser HSI roll and inclination sensors. This gives access to true tool roll and inclination values. Gimbal elements freely rotate in tool body and so cannot make use of digitiser HSI.
Maintenance Requirement	Moderate	None (just routing checks)	Gimbal bearings need to be checked. Appropriate transport locking nuts fixed. Bearing wear over time, not an issue on fixed Quad sensors.
Sensor Element Replacement Build Time	1 Day	½ Day	

*back calculation to correct digitiser gain is applied in acquisition software to provide true sensor amplitude.

COMPATABLE WITH

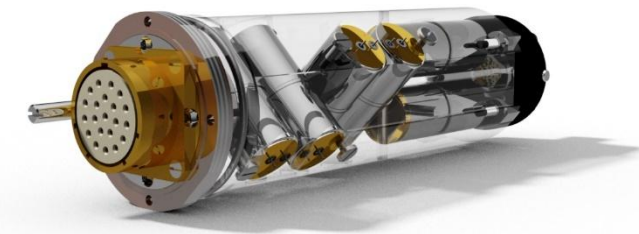


or



ASR-1 HP
& ASR-1
EHP
& ASR-1
UHP

ASR-28 Gimbal Sensor Pack



ASR-227 Fixed QUAD Sensor Pack

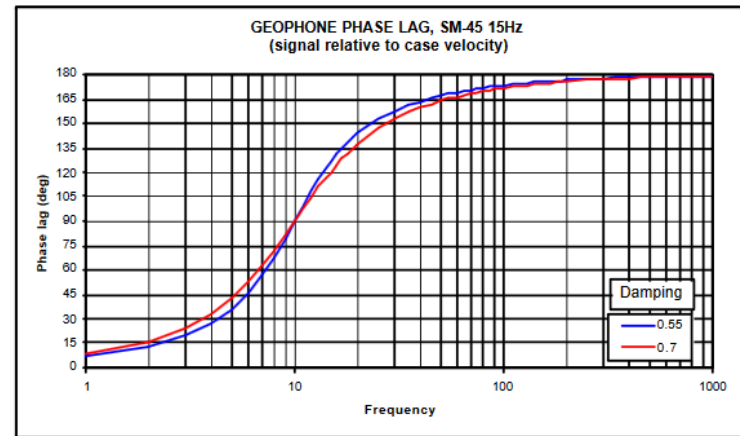
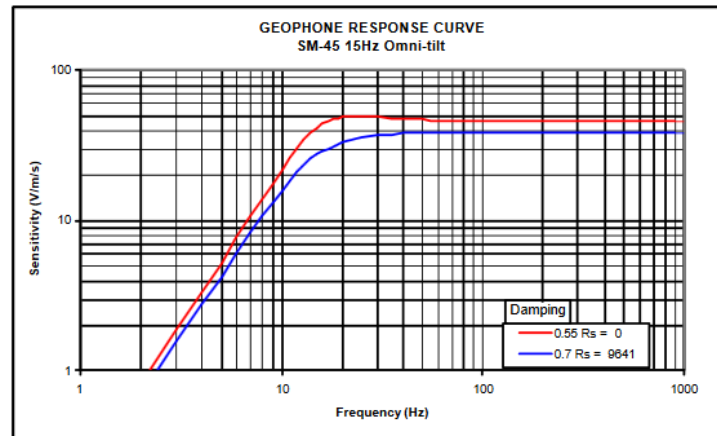
ASR-EHT11 – Extra High Temp Sensor Pack

Main Features

- Ideal for **hostile well borehole seismic**.
- 3 Component geophones. Single, Dual and Quad options.
- Plug-in 225°C EHT Sensor Pack for ASR-EHT
- Fits standard, high pressure and Extra High Pressure ASR's.
- Robust for high temperature well deployment
- Modular for quick and easy customisation.
- Operating temperature up to 437°F (225°C).

Functionality

- Replacement of the sensor module with an EHT-11 Omni Sensor Pack enables a single or dual level string to be deployed in very hot wells up to 225°C.
- Unlike conventional EHT tools that rely on thermal shielding the ASR-EHT uses 230°C electronics to allow for several days use at elevated temperatures.
- The modular construction of the ASR allows this sensor to be easy exchanged for other Geochain Sensor packs with minimal effort.



COMPATABLE WITH



or



ASR-1 HP
& ASR-1
EHP

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

SM-45 VHT Geophone	Per Element
Optimum Orientation	Omni tilt
Operational Range	0° to 180° (Omni)
Natural Frequency (Fn)	
Optimum Orientation	15 Hz +/- 5%
Operational Range	15 Hz - 5% to +10%
Coil Excursion P-P	
Optimum Orientation	>0.120 in, >.306 cm
Operational Range	>0.022 in, >.051 cm
Spurious Frequency	175 Hz
Resistance	1800Ω +/-5% per transducer RtBoFn = 25,750 Hz
Sensitivity	
At Optimum Orientation	45.5 V/m/s +/- 5%
At Operational Range	52 V/m/s -15% to +5% at 20°C
Open Circuit Damping	
Optimum orientation	0.57 +/-15%
Operational Range	0.57 -20% to +10%
Moving Coil Mass	7.6 gr +/- 5%
Distortion	
Optimum Orientation	<0.20%
Operational Range	<0.90%
Storage Temperature	-40°F to 212 °F (-40 to +100°C)
Operating Temperature	-40°F to 500+°F (-40 to +260°C)
Geophone Dimensions:	
Weight	53.3 gr
Diameter	24.1 mm
Height	30.0 mm Including Terminals

- New! 2022 Option for Dual and Quad stacked geophones per component, increasing sensitivity whilst minimising thermal noise floor.
- Option to use 2021+ Avalon Omni – 2400 15Hz sensors rated to 225C.



ASR-1 (UHT) Advanced Seismic Receiver

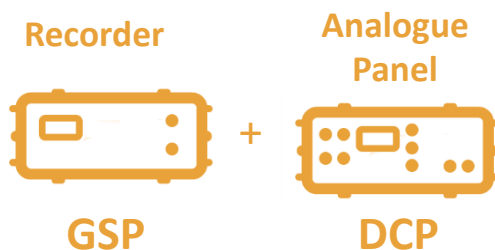
Main Features

- Optimised for the most hostile of borehole seismic **VSP** & **Microseismic** surveys.
- Ultra High Temperature** adaption of ASR-1 Geophone with operation up to 240°C
- High strength motorized locking arm
- 3" Outside Diameter Tool.
- Standard 7 conductor wireline. **Analog Operation** up to 2 geophone satellites.
- Multiple 3 component sensor options.
- 25,000psi (1700 bar) high pressure rating (30,000 psi EHP available).

Functionality

- The ASR-UHT downhole geophone is a development of the tried and tested ASR-1 tool and provides a unique solution to the high temperature VSP market. Unlike conventional HT tools that rely on thermal shielding the ASR-UHT uses 240°C electronics to allow for several days use at elevated temperatures.
- The tool has a 3C component omni-directional fixed sensor pack and line 7 can be used to run a separate (flasked) gamma or CCL tool for depth correlation.
- A standard DCP control panel is used to run the tool and recording can be done on our GSP system or any analogue recorder.
- ASR-1 downhole geophone and can be used in wells up to 25,000 psi (1,750 bar) and hole sizes from 31/2"-22" (89 to 559mm).
- This Ultra high temperature ASR variant employs a special lemo connection hardwire throughout and so requires a specific corresponding UHT amplifier, tool body and sensor pack.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

DOWNHOLE LOCATION

How is an Analog system different to Geochain?

An analogue sonde consists of a tool body with motor driven arm, fitted with a DHA and Geophone sensor cartridge. An analogue system consists of a maximum of two sondes with inter-tool cable, a hepta-core wireline, and on the surface a Dual Control Panel (DCP), a Geochain System Panel (GSP) and a PC running ACQ software. Where as in a digital system the digitisation of the seismic signal is done down-hole, in an analogue system the digitisation is done on the surface by the GSP. The digitised data is supplied to a PC running ACQ software over a USB interface. The ACQ software can be used to quality check the data and to save it for later processing.

The UHT DHA is the latest in a series of HT DHAs, the design aim is for operation from Ambient to 240°C.

Wireline Head ASR-UHT
Lower

UHT-06 Downhole Amplifier

ASR-1 UHT Analog
Advanced Seismic Receiver

UHT-39 UHT Sensor Pack

ITC UHT
Inter Tool Cable

UHT-06 Downhole Amplifier

ASR-1 UHT Analog
Advanced Seismic Receiver

UHT-39 UHT Sensor Pack

UHT-89 Nose Cone



ASR-1 (HP) Satellite Specifications

Length	35" (884mm)
Diameter	3" (76mm) without nodes
Weight	41lbs (19kg)
Max locking range & Force	12" (305mm) Standard or 22" (559mm) with an arm extender. 300lbs force Standard Arm.
Temperature	464°F (240°C) Analogue
Pressure	HP - 25,000psi (1750 bar) – 30,000 psi EHP version available.
Electronic Modules	Analogue Modules – UHT-06 Downhole Amplifier
Sensors	3 Component Fixed – ASR-UHT39 Sensor Pack (Mono, Dual Quad option).
Well Deviation Control	0°-95°
Panels	GSP-1 or 3 rd party Recorder DCP-2 (Analogue Dual Power Supply)
Wireline	7 Conductor Wireline, Connects to ITC-HP/ITC-EHP, Male Coupler/Avalon wireline head.

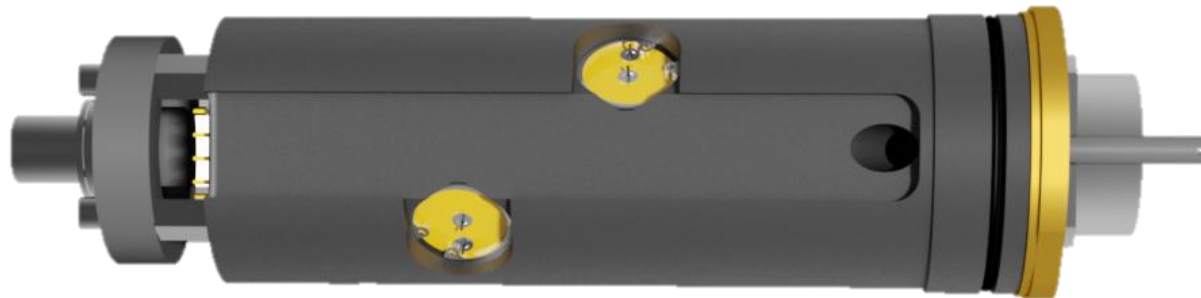
ASR-UHT39 – Ultra High Temp Sensor Pack

Main Features

- Ideal for **EXTREME** hostile well borehole seismic.
- 3 Component geophones. Single, Dual and Quad Option.
- Plug-in 240°C UHT Sensor Pack for ASR-UHT
- Modular for quick and easy customisation.
- Operating temperature up to 464°F (240°C).

Functionality

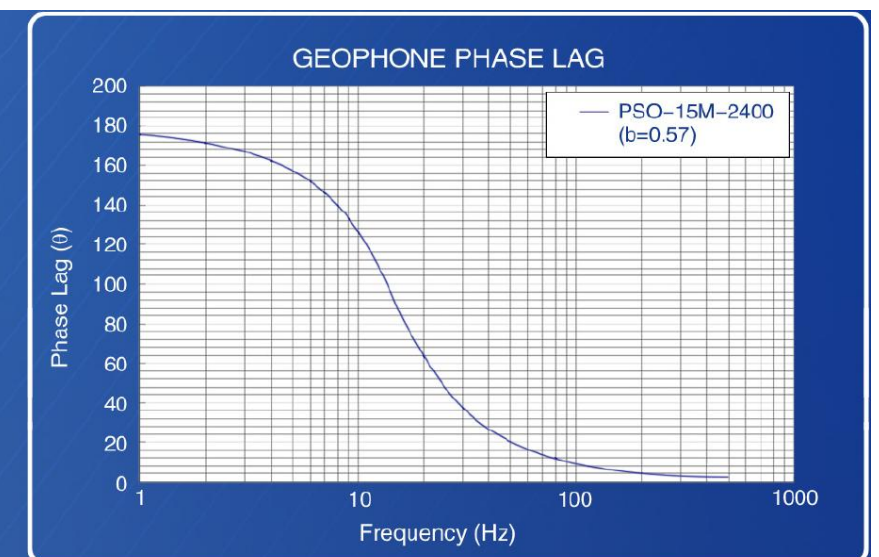
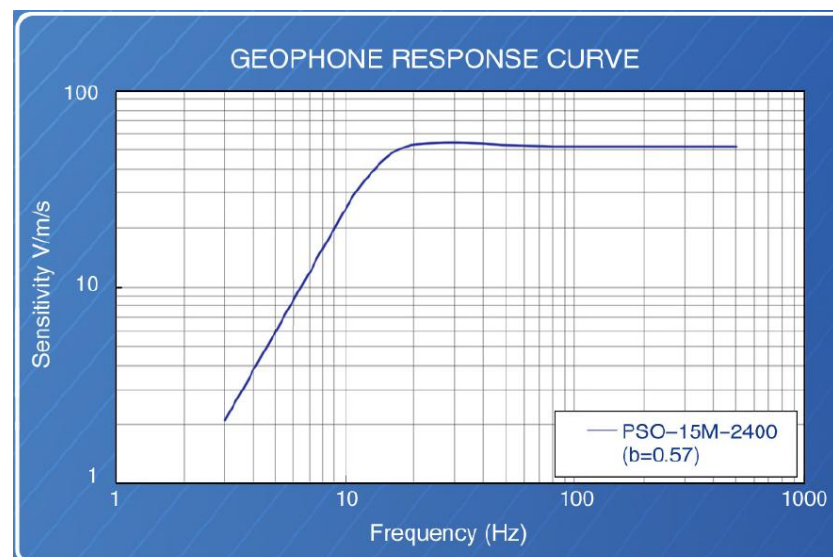
- Corresponding sensor module for ASR-UHT Tool for extremely high temperature analog operation in wells up to 464°C/240°F.
- Unlike conventional HT tools that rely on thermal shielding the ASR-UHT uses 240°C electronics to allow for several days use at elevated temperatures.



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

<i>PSO-15 Omni 2400 Geophone</i>	Per Element
Optimum Orientation	Omni tilt
Operational Range	0° to 180° (Omni)
<i>Natural Frequency (Fn)</i>	
Optimum Orientation	15 Hz +/- 5%
Operational Range	15 Hz - 5% to +10%
<i>Coil Excursion P-P</i>	
Optimum Orientation	>0.120 in, >.306 cm
Operational Range	>0.022 in, >.051 cm
<i>Spurious Frequency</i>	250 Hz
<i>Resistance</i>	1800Ω +/-5% per transducer RtBoFn = 25,750 Hz
<i>Sensitivity</i>	
At Optimum Orientation	45.5 V/m/s +/- 5%
At Operational Range	52 V/m/s -15% to +5% at 20°C
<i>Open Circuit Damping</i>	
Optimum orientation	0.57 +/-15%
Operational Range	0.57 -20% to +10%
<i>Moving Coil Mass</i>	7.6 gr +/- 5%
<i>Distortion @ 15Hz Driving Velocity 1.8 cm/sec P-P</i>	
Optimum Orientation	<0.20%
Operational Range	<0.70%
<i>Storage Temperature</i>	-40°F to 212 °F (-40 to +100°C)
<i>Operating Temperature</i>	-40°F to 464+°F (-40 to +240°C)
<i>Geophone Dimensions:</i>	
Weight	49 gr
Diameter	22.2 mm
Height	26.8 mm Including Terminals

COMPATABLE WITH





SLIM

GEOCHAIN SLIM

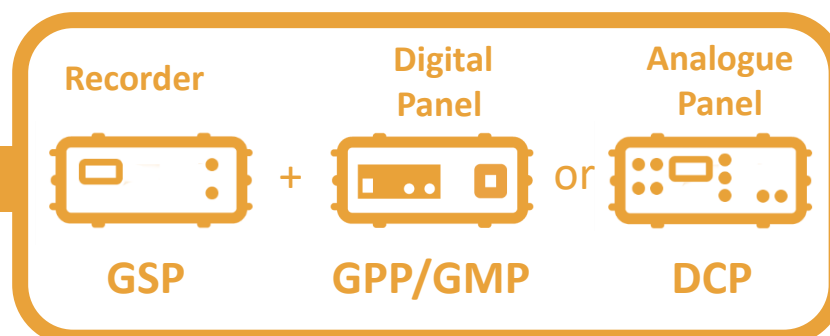
Main Features

- Ideal for **VSP & Microseismic** surveys.
- Up to 62 satellites.
- Slim 1 11/16" (43mm) Outside Diameter Tool.
- Unique Active Cooling System for continuous operation at 385°F (195°C) .
- 20,000psi (1400 bar) pressure rating.
- Standard 7 conductor wireline with GO7 connection.
- Real time data transmission.
- Extra sensitive QUAD 3 component sensor.
- 24-bit delta sigma convertors.
- Up to >600' (200m) between satellites.
- Operates with all standard ASL surface panels.
- Gapless recording for passive monitoring surveys.
- Tractor deployment capability.

Functionality

- The GeochainSlim™ is the next development of the field proven VSP and hydraulic fracture monitoring Geochain System. This system has been designed for use in open and cased holes with all locking arms opening simultaneously to reduce survey time. A max bandwidth of 1600Hz, very low electronic noise levels and slim size make the system ideal for hydraulic fracture surveys.
- The established extra high sensitivity Quad geophone sensor pack is now available as a standard configuration. The system also benefits from the new gapless recording functionality which is ideal for the continuous requirements of passive monitoring.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

GSR-1 Satellite Specifications

Length	44" (1135mm)
Diameter	1 11/16" (43mm)
Weight	19.5lbs (8.85kg)
Max locking range	7" (178mm) Standard or 13" (330mm) with long arm
Max locking force	300 lbs (Standard Arm)
Temperature	400°F (204°C) Analogue / 385°F (195°C) Digital
Pressure	20,000psi (1400 bar)
Sensors	3 Component Fixed – SMC 2400 15Hz Omni- Quad/Dual
Well Deviation	0°-95°
Control Panels	GPP or GMP & GSP-1 (Digital) DCP-2 & GSP-1 (Analogue)



Downhole Specifications

Max. No. of Satellites	62		
Telemetry	Sample interval	Bandwidth Hz	GSR's (DFU)
	1/4ms	1600	8 (15)
	1/2ms	800	16 (30)
	1ms	400	32 (60)
	1.5ms	266	48 (80)
Dynamic Range	>112dB @ 0dB pre-gain (minimum)		
A/D convertor	24 bit Delta-Sigma		
Distortion	<0.02%		
DC offset	Self-calibrating		
Wireline	7 Conductor Heptacable		

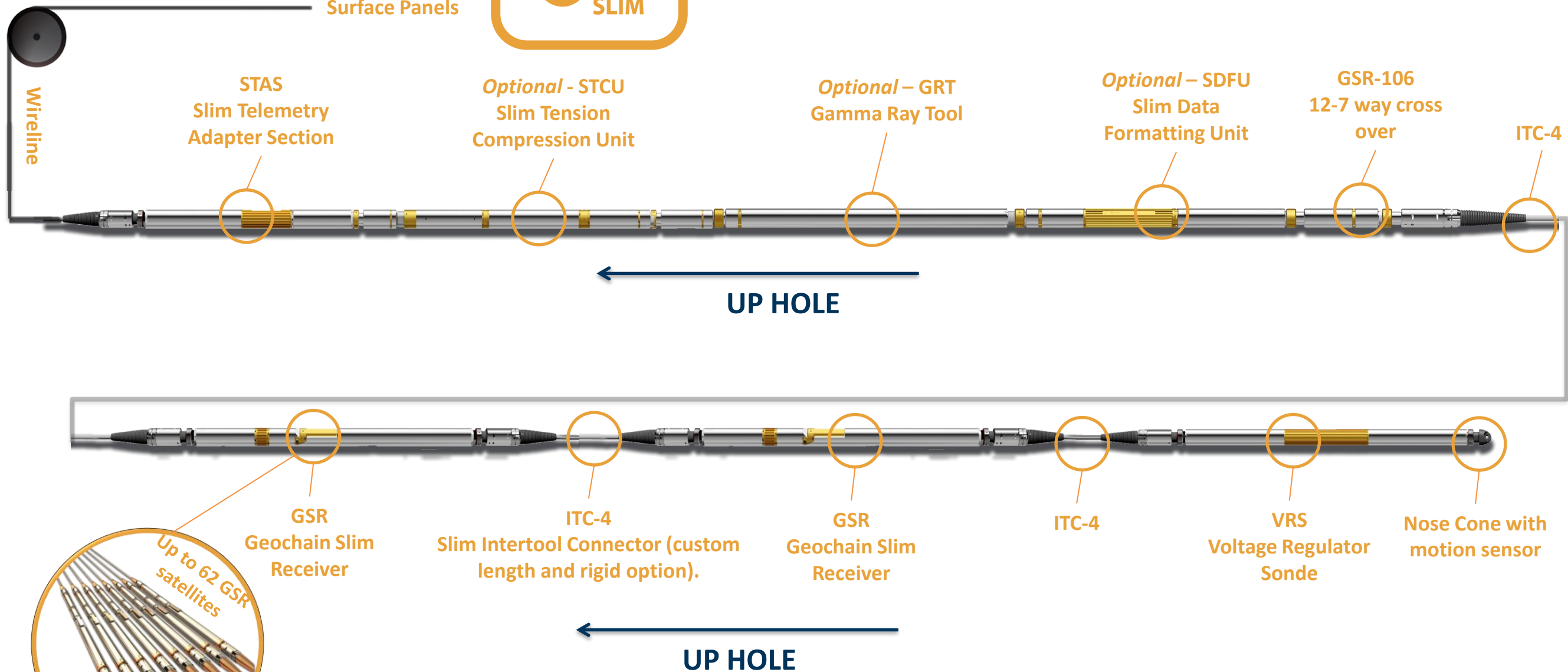
Surface Specifications

Recording panel	GPP and GSP-1 (Digital) DCP-2 and GSP-1 (Analogue)
Software	ACQ Acquisition Suite & Copy of VSProwess© Processing Software
Cable equalisation	Fully automatic using internal DSP chip
Airgun firing pulse	60 V, 30ms
Test system	Fully automatic with comprehensive report generation
PC Interface	USB
Power Requirements	100/230 V AC, 47-63 Hz universal input, 30 watts
Operating Temp	32-104°F (0-40°C)
Enclosure	Standard 19" rack mounting

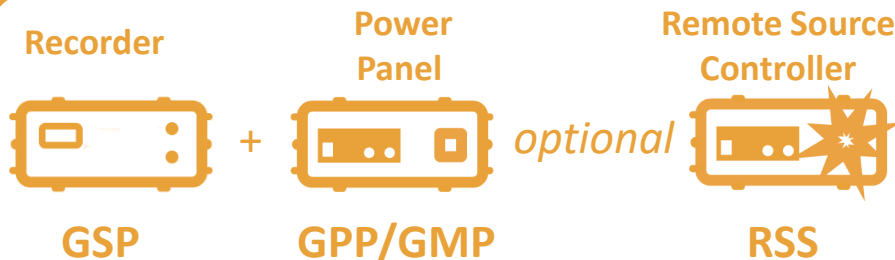
GeochainSlim™ – Slim Well Seismic



DOWNHOLE STRING ASSEMBLY



SURFACE PANELS



AS251 'X-Series' Slim Digitizer



Main Features

- Low noise, High gain Geochain Slim digitizer module.
- Increased operating temperature 385°F (195°C)
- Doubles existing Geochain system data rate, allowing 60 tools at 1ms sample rate*
- Enables continuous recording for microseismic monitoring*
- New flasking, hermetic seal employment and upgraded active cooling.
- Upgraded high temperature power supply.
- Upgraded electronics
- Integrated High Side Indicator
- Selectable Damping and Gain

Functionality

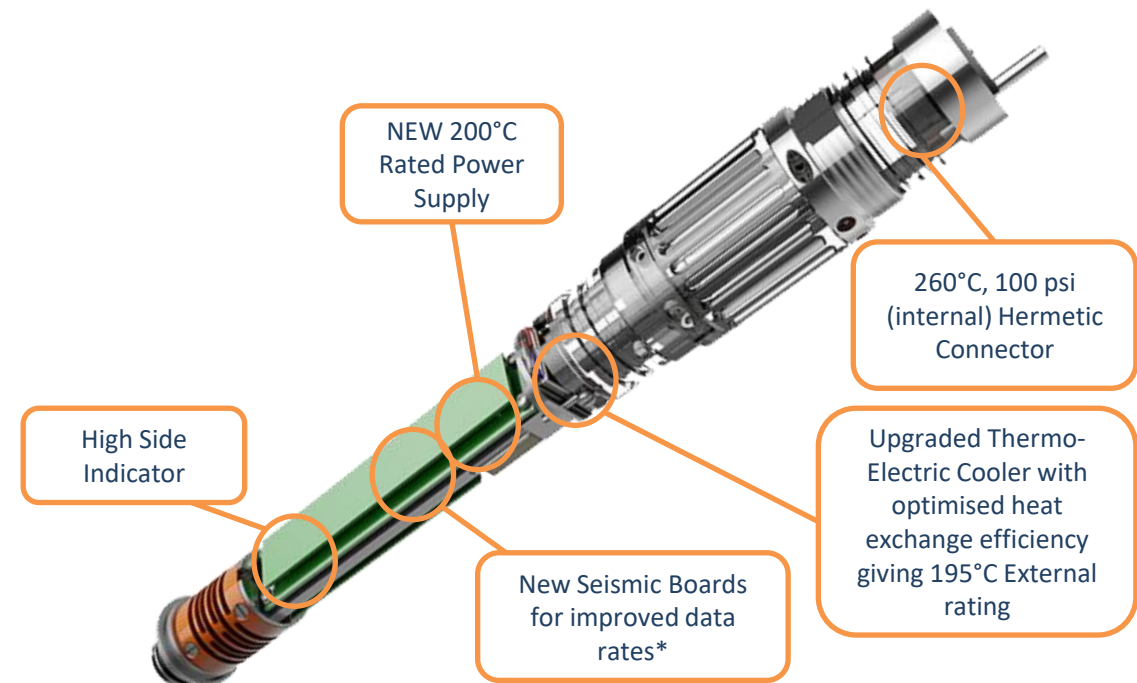
- The X-series digitizer upgrade for the Geochain Slim system, provides higher operating temperatures and higher telemetry rates, allowing continuous monitoring in the most hostile well conditions.
- This is the next development of the industry acclaimed AS251 low noise high gain digital module, which now introduces upgraded active cooling technology and thermal insulation components for increased robustness in addition to facilitating new operational functionality of your Geochain Slim string.
- Compatible with Geochain Slim systems.
- Facilitates 'Mix & Match' compatibility with Geochain and Geochain EHP tools in the same string.

COMPATABLE WITH



Geochain Slim Digital

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



*Used in conjunction with X-STAS and SDFU unit.

Downhole Specifications	AS251			
	X Generation			
Max. No. of Satellites	62			
Telemetry	Sample interval	Bandwidth Hz	GSR's	GSR's with DFU
	1/4ms	1600	8	15
	1/2ms	800	16	30
	1ms	400	32	60
	1.5ms	266	48	62
Dynamic Range	>112dB @ 0dB pre-gain (minimum)			
A/D convertor	24 bit Delta-Sigma			
Downhole Gain	42-54dB			
Distortion	<0.02%			
DC offset	Self-calibrating			
Max data rate	4 Mbit/second			
Min. data rate	256kbit/second			
Temperature	385°F (195°C)			

S-XTAS – Slim Telemetry Adaptor Section



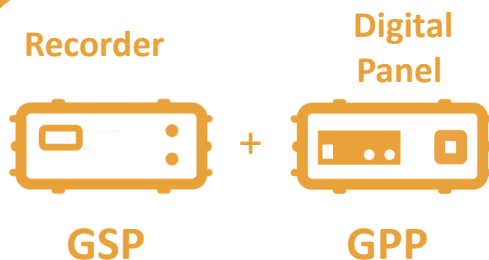
Main Features

- Interfaces digital GeochainSlim string to wireline cable.
- Equal wireline power distribution.
- Separates downlink power and uplink telemetry.
- Compatible with latest Slim DFU module for gapless Microseismic recording and increased tool operation at 250us sample rate.
- Unique Active Cooling System for continuous operation at 385°F (195°C)
- 20,000psi (1700 bar) pressure rating.

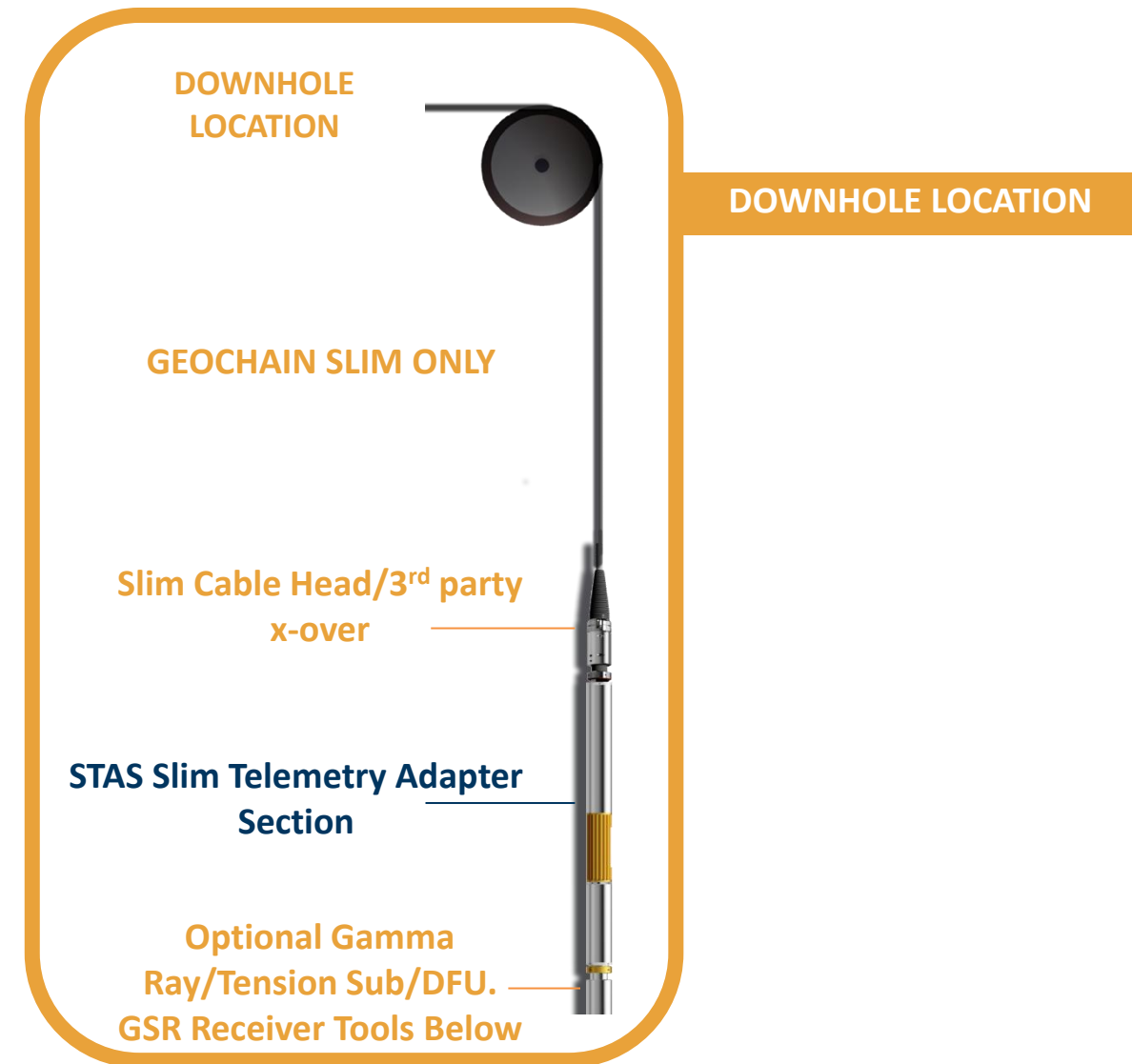
Functionality

- The STAS serves to interface the Geochain tool-string to the main wireline cable. System power from the surface is distributed equally over six wireline conductors. Transformers in the STAS separate this power from the downlink and uplink data signals.
- The STAS receives the data from the Geochain tool-string and re-transmits this to the surface, in a coded and modulated form.
- The STAS also receives synchronisation and command information from the surface and relays this down to all ASRs in the tool-string.
- The STAS may be connected directly to the top ASR using a special coupler, but is often separated by a short ITC to avoid any possible degradation of the seismic response of the GSR.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



<i>STAS Specifications</i>	AS261 GSR-330
Length	33.7" (857mm)
Diameter	1 11/16" (43mm)
Weight	12.4 lb (5.7kg)
Temperature	385°F (195°C) *Digital Only
Pressure	20,000psi (1400 bar)
Panels	GPP or GMP & GSP-1 (Digital)
DFU Compatible*	Yes – Firmware upgrade required to all previous 2015 TAS-2/STAS Units
Wireline	7 Conductor Heptacable



Main Features

- Enables **Gapless Microseismic Operation** of GeochainSlim system
- Facilitates **Discrete Buffering & Formatted** Gapless Recording to increase the number of tools a for a given sample rate*
- Unique Active Cooling System for continuous operation at 195°C
- 20,000psi (1400 bar) pressure rating.

*When used in conjunction with x-series AS251 Digitisers

Functionality

- The DFU is a downhole sonde that allows the user gapless operation when used with an X Generation STAS.
- It is located in-between the X-STAS and the digitisers.
- The DFU contains memory that stores digitiser data whilst the STAS has stopped, enabling the data to be continuous without gaps.

To perform gapless recording you will need:

1. **SDFU (AS-262),**
2. **SX-TAS (AS-261),**
3. **GSP with a USB 2B card.**
4. **ACQ Software v.3.X+**

+ Recommended:

4. **Networked storage system in place (NAS).**
5. **Geochain Monitor Panel (GMP)**

Compatibility requirements

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



SDFU Specifications

Length	33.7" (857mm)
Diameter	1 11/16" (43mm)
Weight	12.4 lb (5.7kg)
Temperature	195°C (Digital Only)
Pressure	20,000psi (1400 bar)
Panels	GMP or GPP & GSP-1 (Digital)
Wireline	7 Conductor Heptacable

SVRS – Voltage Regulator Section



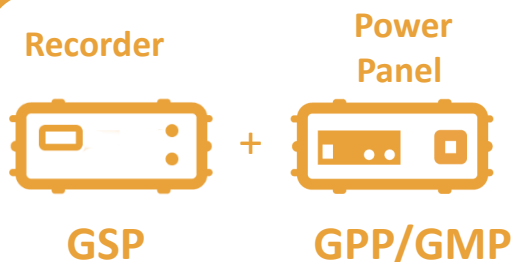
Main Features

- Voltage Regulation.
- Sinker Bar.
- Motion Sensor.
- Standard 7 conductor wireline.
- Extra Slim 1 11/16" compatible with GeochainSlim™ digital system.
- High Temperature 385°F (195°C).

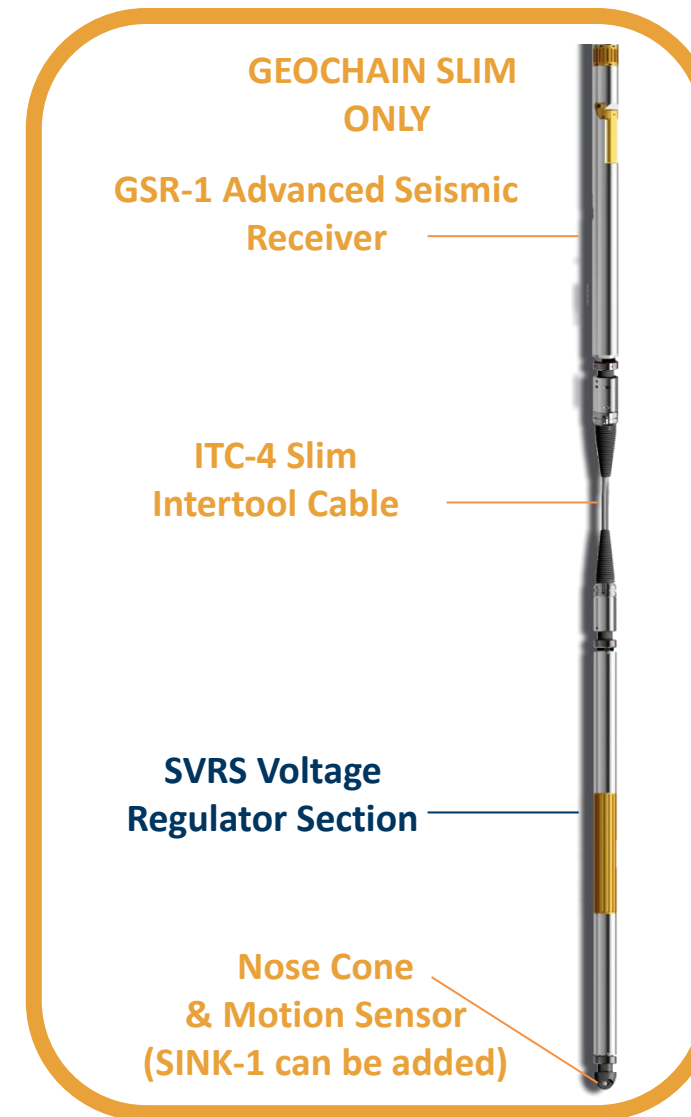
Functionality

- The Slim VRS (Voltage Regulator Section) is located at the bottom end of the Geochain™ digital receiver array and serves the dual-purpose as a voltage regulator to establish the 110 volt ASR arm operating motor power voltage. The second function is to act as a sinker weight and is equipped with a motion sensor assisting with the lowering of AST tools down the borehole.
- A portion of the current through the SVRS is diverted to operate the ASR arm control motors. The Geochain™ software is able to resolve any current demands required by the GSR arm motors by automatically suspending one or more motors until more current is available.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



DOWNHOLE LOCATION

SVRS Specifications

Length	44.6" (1330mm)
Diameter	1 11/16" (43mm)
Weight	21.6lb (10.5 kg)
Temperature	385°F (195°C) *Digital Only
Pressure	20,000psi (1,400 bar) HP version
Panels	GPP & GSP-1 (Digital) GMP
Max number of ASR's	62
Wireline	7 Conductor Heptacable



Main Features

- Ideal for **VSP** & **Microseismic** surveys.
- Four geophones per axis.
- Fits GSR Tools.
- Greater signal to noise ratio.
- Modular for quick and easy customisation.

Functionality

- Ideal for use with high gain X-Series digitizers.
- Sensitivities up to 116359 V/m/s at 48°F (20°C).
- Ideal for use with standard, HP and EHP Geochain systems.
- Operating temperature up to 400°F (204°C).

Quad vs Dual Overall Sensitivity @ 20°C

Sensor Pack	Electronics	Damping Resistors	Downhole Gain*	Sensitivity undamped V/m/s	Sensitivity damped V/m/s	Overall Sensitivity V/m/s*
Dual	AS271	47KΩ	54dB	104	94.4	47200
Quad	AS271	47KΩ	54dB	208	173	86350
Quad	AS272/50/51 VSP Mode	10.29KΩ	44dB	208	108	17013
Quad	AS272/50/51 uSeismic Mode	48.13KΩ	56.5dB	208	173	115564

*back calculation to correct digitiser gain is applied in acquisition software to provide true sensor amplitude.

Omni 2400Ω Geophone

Optimum Orientation	Horizontal
Operational Range	0°to 180°(Omni)
<i>Natural Frequency (Fn)</i>	
Optimum Orientation	15 Hz +/- 5%
Operational Range	15 Hz - 5% to +15%
<i>Coil Excursion P-P</i>	
Optimum Orientation	>0.120 in, >.306 cm
Operational Range	>0.022 in, >.051 cm
<i>Spurious Frequency</i>	250 Hz
<i>Resistance</i>	2400Ω +/-5% per transducer
<i>Sensitivity</i>	
At Optimum Orientation	52 V/m/s +/- 5% Per Element
At Operational Range	52 V/m/s -15% to +5% at 20°C
<i>Open Circuit Damping</i>	
Optimum orientation	0.57 +/-15%
Operational Range	0.57 -20% to +10%
<i>Moving Coil Mass</i>	7.6 gr +/- 5%
<i>Distortion</i>	
Optimum Orientation	<0.20%
Operational Range	<0.70%
<i>Storage Temperature</i>	-40°F to 212 °F (-40 to +100°C)
<i>Operating Temperature</i>	-40°F to 392+°F (-40 to +200+°C)
<i>Geophone Dimensions:</i>	
Weight	49 gr
Diameter	2.22 cm
Height	2.70 cm (3.00 cm Including Terminals)



Analog GSR (Formally ESR)

Main Features

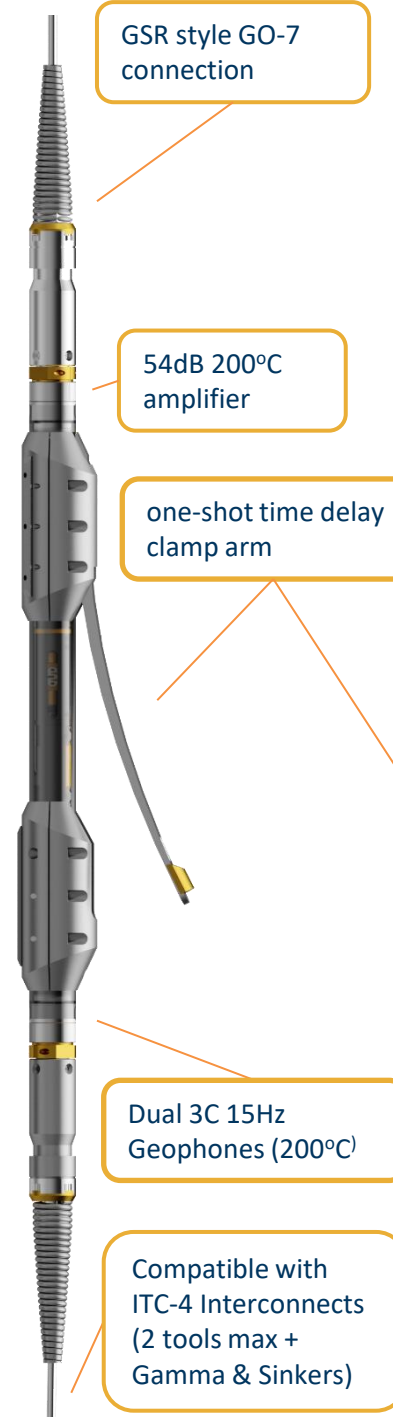
- **200°C SLIM** Analog Borehole Seismic Receiver
- 20,000 psi pressure rating
- Single or dual
- Run with 3 component Omni-directional 15Hz fixed sensor pack
- Mortised or passive time delay clamp arm options*
- Standard 7 conductor wireline (heptacable)
- Compatible with Analog Gamma or CCL operation + sinker bar(s)
- Can be used with Avalon GSP or 3rd party analog recorders
- Optimised for both VSP and hydraulic fracture monitoring work
- GO-7 Uphole Connection

Functionality

- The GSR Analog provides a ruggedised yet low-cost borehole seismic tool. Very quick and easy to use with minimal maintenance, this system has been designed for use in open and cased holes.
- A max bandwidth of 1600Hz**, very low electronic noise levels and slim size make the system ideal for long term passive monitoring surveys or slim well check shot VSP.
- The established extra high sensitivity dual geophone (ZXY) sensor pack is now available as a standard configuration.
- The system also benefits from the new gapless recording functionality which is ideal for the continuous requirements of passive monitoring.
- The tool can be provided wither with standard GSR style motorised clamp arm, or for long term/semi-permanent operations can make use of our new patented passive delayed clamp arm (tool still retrievable) or even come with no arm for cemented-in permanent operation.
- Up to 2 tools can be run in a string on 7C wireline along with an analogue gamma tool.
- The downhole amplifier and geophones allow operation in very hot wells up to 200°C.

*or sealed barrel no arm option for cemented operations

** If using ASL recorder with 250us sample interval



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

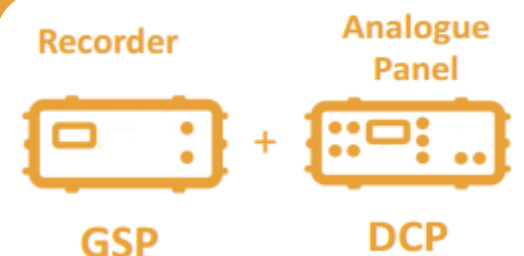
GSR-1 Analogue Satellite Specifications

Length	44" (1135mm)
Diameter	1 11/16" (43mm) No Arm. 3" (102mm) if using one shot delayed clamp arm (3" collar OD).
Weight	19.5lbs (8.85kg) or 10Kg with delayed clamp arm
Max locking range	Motor Arm - 7" (178mm) Standard or 13" (330mm) with long arm For One shot delayed clamp arm – client to specify well ID. Min well ID for clamping 4.5"
Max locking force	300 lbs (Standard Arm)
Temperature	490°F (200°C) Analogue
Pressure	20,000psi (1400 bar)
Sensors	3 Component Fixed – SMC 2400 15Hz Omni - Single/Dual
Well Deviation	0°-95°
Control Panels	DCP-2
Electronics	GSP-1 /GSP-2 (Optional) or 3 rd Party Recorder 54dB Downhole Amplifier



Motorised arm clamp option

Surface Panels





EHP

GEOCHAIN Extra High Pressure

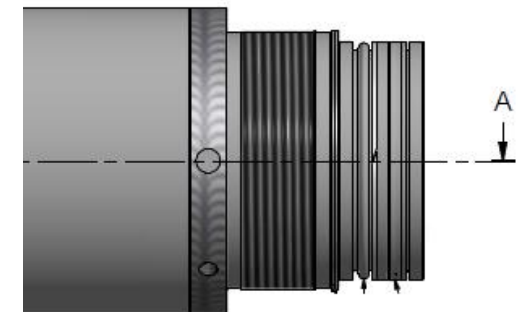
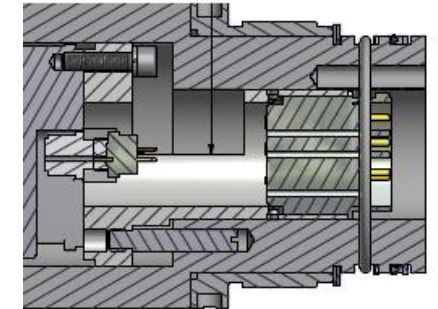


SURVIVAL UNDER PRESSURE

Main Features

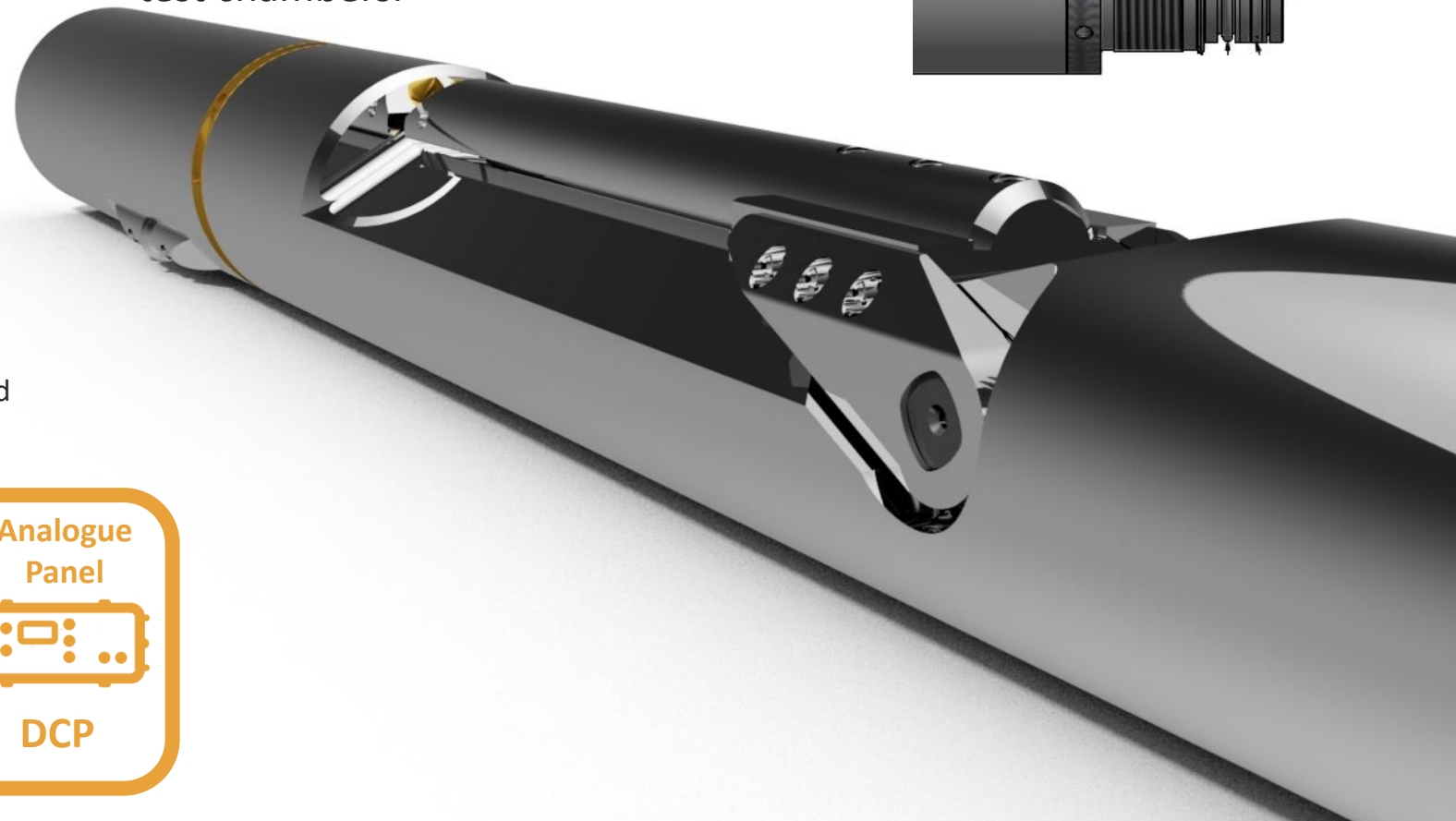
- Ideal for **VSP** & **Microseismic** surveys in the most hostile wells.
- Up to 32 satellites.
- **30,000psi (2100 Bar) pressure rating.**
- **Compatible with all legacy and new X-series Geochain modules.**
- 3-C Sensor Options
- Standard 7 conductor wireline.
- Real time data transmission.
- 24-bit delta sigma converters.
- Unique Active Cooling System for continuous operation at 392°F (200°C).
- Up to 600' (200m) between satellites.
- Gapless recording for passive monitoring surveys.
- Quick and easy conversion from Analogue to Digital operation.
- Tractor Deployment.

- FEA analysis and redesign of the 25,000 psi ASR-HP body work, connectors and seals, to deliver improved pressure specification to **30,000 psi ASR-EHP** performance.
- 3.25" (82.5mm) External Diameter
- Proven in state of the art high pressure test chambers.

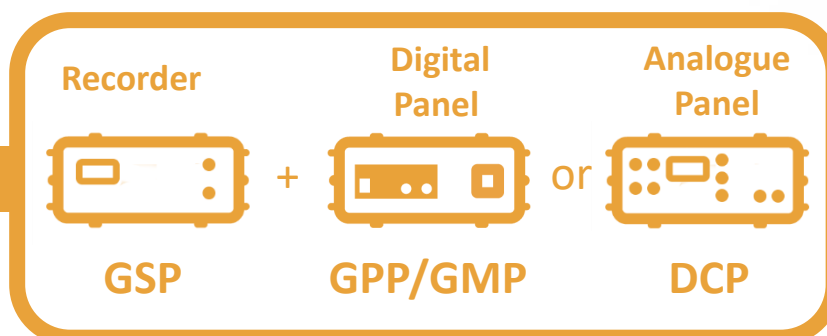


Functionality

- Geochain EHP is one of the latest advances of the Geochain™ VSP digital seismic system, for maximum logging and recording efficiency within the most hostile of high pressure well environments.
- The Geochain EHP system is fully compatible with all standard Geochain™ electronics and sensor modules in addition to all standard surface control panels.



SURFACE PANELS





Main Features

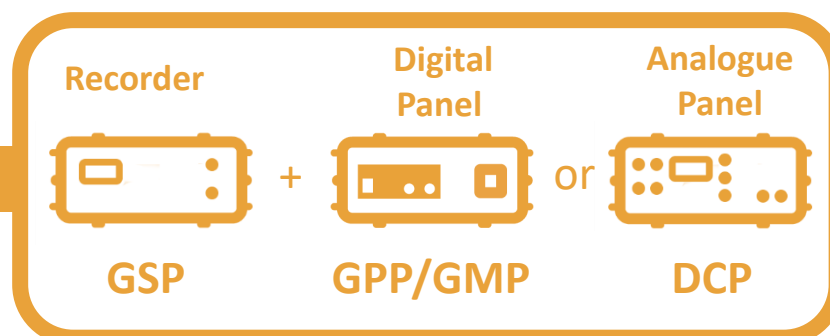
- Ideal for **VSP & Microseismic** surveys in the most hostile wells.
- Up to 62 satellites.
- **30,000psi (2100 bar) pressure rating.**
- 3.25" (82.5mm) Outside Diameter Tool.
- Standard 7 conductor wireline.
- Real time data transmission.
- Multiple 3 component sensor options.
- 24-bit delta sigma converters.
- Unique Active Cooling System for continuous operation at 385°F (195°C).
- Up to 600' (200m) between satellites.
- Gapless recording for passive monitoring surveys.
- Quick and easy conversion from Analogue to Digital operation.
- Tractor Deployment.

Functionality

- Geochain EHP is one of the latest evolutionary branches of the established Geochain™ VSP digital seismic system, operating with up to 62 satellites for maximum logging and recording efficiency within the most hostile of high pressure environments.
- The Geochain EHP system is fully compatible with all standard Geochain™ electronics and sensor modules in addition to all standard surface control panels.



SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

ASR-1 (EHP) Satellite Specifications

Length	35" (884mm)
Diameter	3.25" (82.5mm) without nodes
Weight	44 lbs (19.8kg)
Max locking range	12" (305mm) Standard or 22" (559mm) with an arm extender
Max locking force	300 lbs (Standard Arm)
Temperature	400°F (204°C) Analogue / 385°F (195°C) Digital
Pressure	30,000psi (2100 bar)
Sensors	3 Component Gimbal – Sensor SM-4 HT 10Hz 3 Component Fixed – SMC 2400 15Hz Omni- Dual/Quad
Well Deviation Control	0°-95°
Panels	GPP & GSP-1 (Digital) DCP-2 & GSP-1 (Analogue) GMP

Downhole Specifications

Max. No. of Satellites	62			
X-TAS Telemetry	Sample interval	Bandwidth Hz	ASR's	ASR's with DFU
	1/4ms	1600	8	15
	1/2ms	800	16	30
	1ms	400	32	60
	1.5ms	266	48	
	2ms	200	62	
Dynamic Range	>112dB @ 0dB pre-gain (minimum)			
A/D convertor	24 bit Delta-Sigma			
Downhole Gain	42-54dB			
Distortion	<0.02%			
DC offset	Self-calibrating			
Max data rate	4 Mbit/second			
Min. data rate	256kbit/second			
Wireline	7 Conductor (Heptacable)			

Surface Specifications

Recording panel	GPP or GMP & GSP-1 (Digital) DCP-2 and GSP-1 (Analogue)
Software	ASL Acquisition Suite and VSProwess® Processing Software
Cable equalisation	Fully automatic using internal DSP chip
Airgun firing pulse	60 V, 30ms
Test system	Fully automatic with comprehensive report generation
PC Interface	USB
Power Requirements	100/230 V AC, 47-63 Hz universal input, 30 watts
Operating Temp	32-104°F (0-40°C)
Enclosure	Standard 19" rack mounting



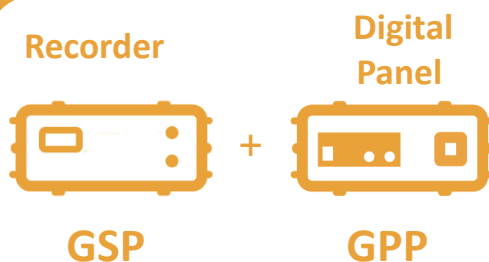
Main Features

- Interfaces digital Geochain string to wireline cable.
- Equal wireline power distribution.
- Separates downlink commands and power from uplink telemetry.
- Compatible with latest DFU module for gapless Microseismic recording
- Unique Active Cooling System for continuous operation at 385°F (195°C).
- 30,000psi (2100 bar) pressure rating (TAS-2 EHP).

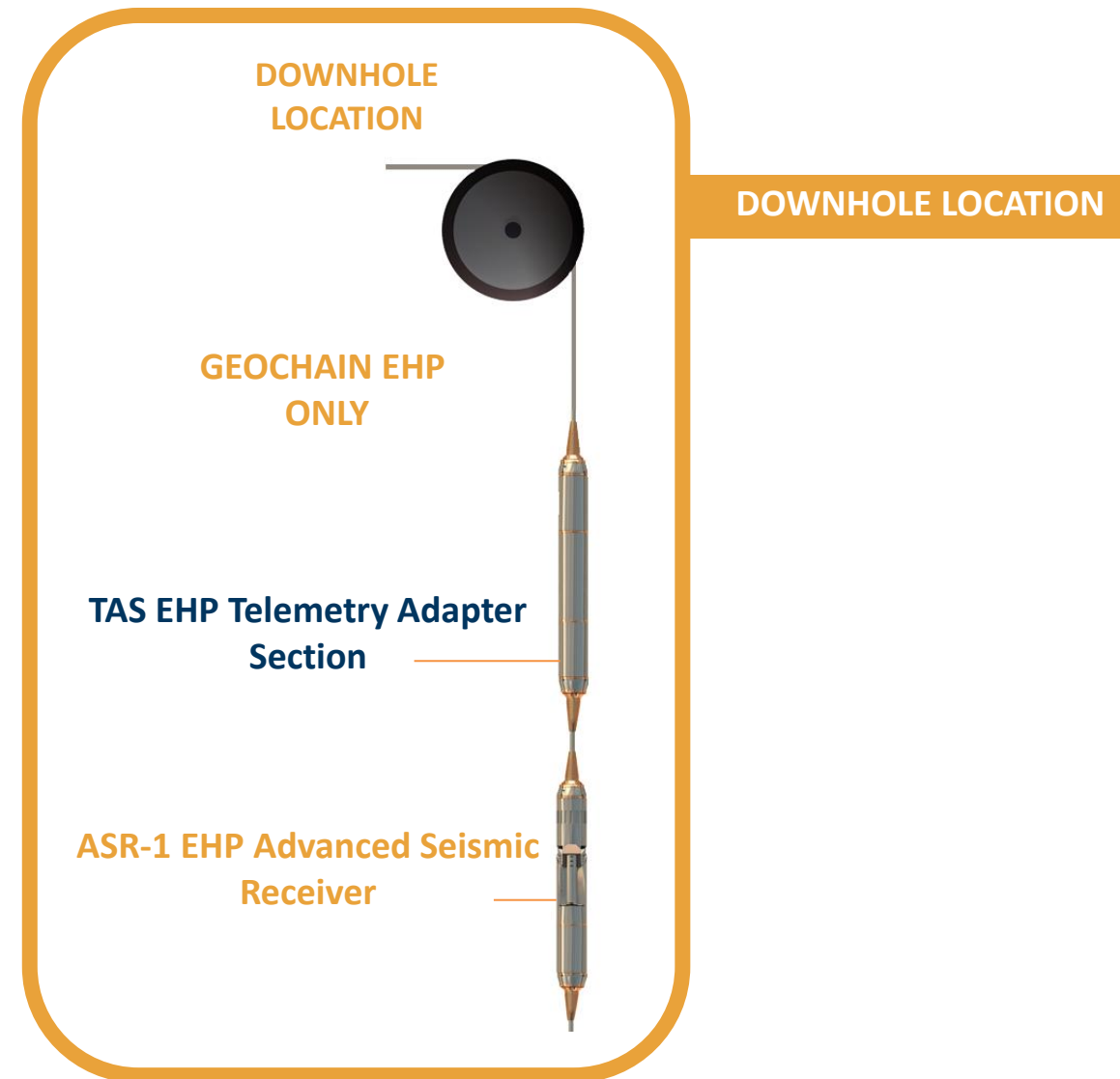
Functionality

- The TAS serves to interface the Geochain tool-string to the main wireline cable. System power from the surface is distributed equally over six wireline conductors. Transformers in the TAS separate this power from the downlink and uplink data signals.
- The TAS receives the data from the Geochain tool-string and re-transmits this to the surface, in a coded and modulated form.
- The TAS also receives synchronisation and command information from the surface and relays this down to all ASRs in the tool-string.
- The TAS may be connected directly to the top ASR using a special coupler, but is often separated by a short ITC to avoid any possible degradation of the seismic response of the ASR.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



<i>TAS (EHP) Specifications</i>	<i>AS-283 (X-Generation)</i>
Length	18.7" (475mm)
Diameter	3.25" (82.5mm)
Weight	27.6lb (12.5kg)
Temperature	385°F (195°C) *Digital Only
Pressure	30,000psi (2100 bar) EHP version
Max Telemetry Data Rate	4Mbit/second
Min Telemetry Data Rate	256kbit/second (Microseismic Mode)
Configuration Board	4/6 wire telemetry options.
Panels	GPP or GMP & GSP-1
DFU Compatible*	Yes – Firmware upgrade required to all previous 2015 TAS-2
Wireline	7 Conductor Heptacable

VRS EHP – Voltage Regulator Section



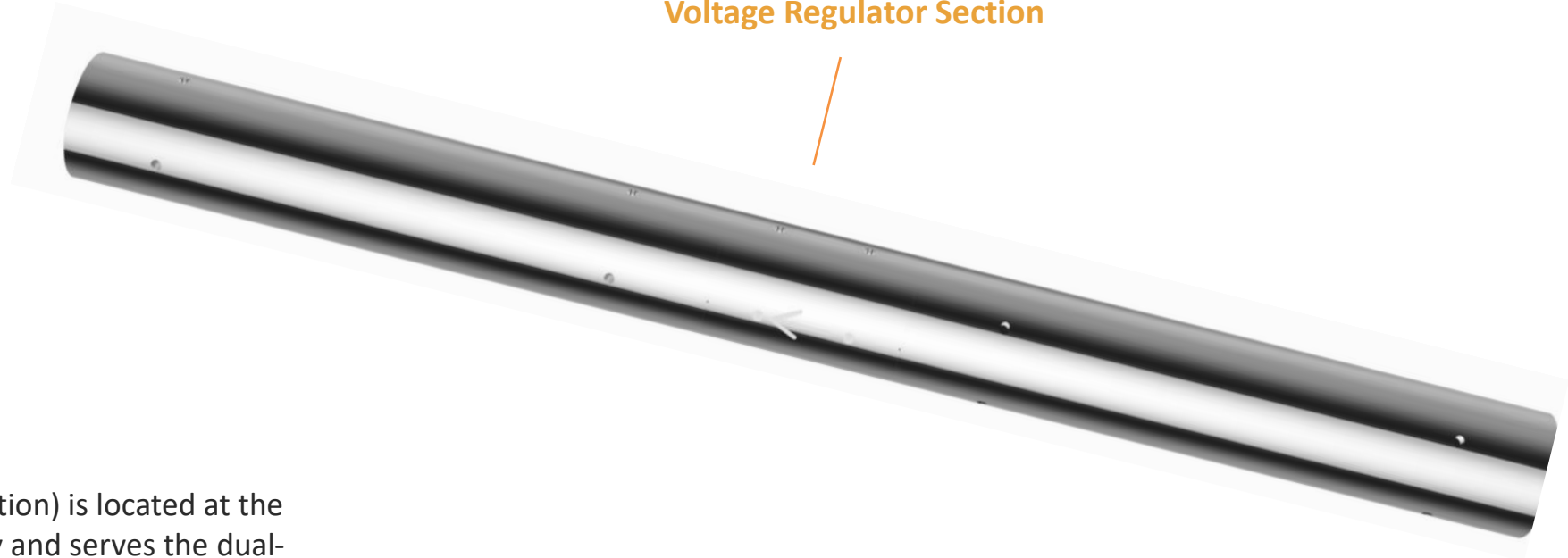
Main Features

- Voltage Regulation.
- Sinker Bar.
- Motion Sensor.
- Standard 7 conductor wireline.
- EXTRA High Pressure 30,000 psi (2100 bar).
- High Temperature.
- All new VRS design, eliminating 9 seals .

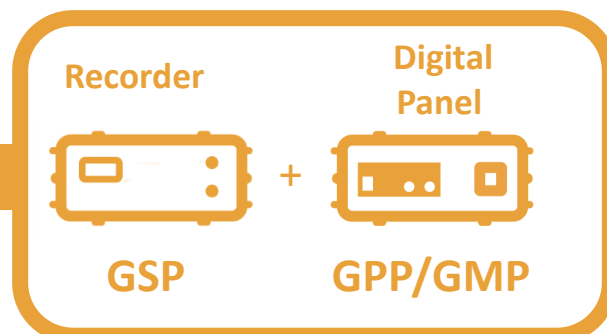
Functionality

- The VRS Extra High Pressure (Voltage Regulator Section) is located at the bottom end of the Geochain™ digital receiver array and serves the dual-purpose as a voltage regulator to establish the 110 volt ASR arm operating motor voltage. The second function is to act as a sinker weight and is equipped with a motion sensor assisting with the lowering of AST tools down the borehole.
- A portion of the current through the VRS is diverted to operate the ASR arm control motors. The Geochain™ software is able to resolve any current demands required by the ASR arm motors by automatically suspending one or more motors until more current is available.

**VRS EHP
Voltage Regulator Section**



SURFACE PANELS



VRS (EHP) Specifications

Length	50" (1270mm) with nose cone
Diameter	3.25" (82.5mm)
Weight	130lbs (46.5 kg) with nose cone
Temperature	385°F (195°C) (Digital Only)
Pressure	30,000psi (2100 bar) EHP version
Panels	GPP or GMP & GSP-1 (Digital)
Max number of ASR's	62
Wireline	7 Conductor Heptacable

DFU EHP – Data Formatting Unit

Main Features

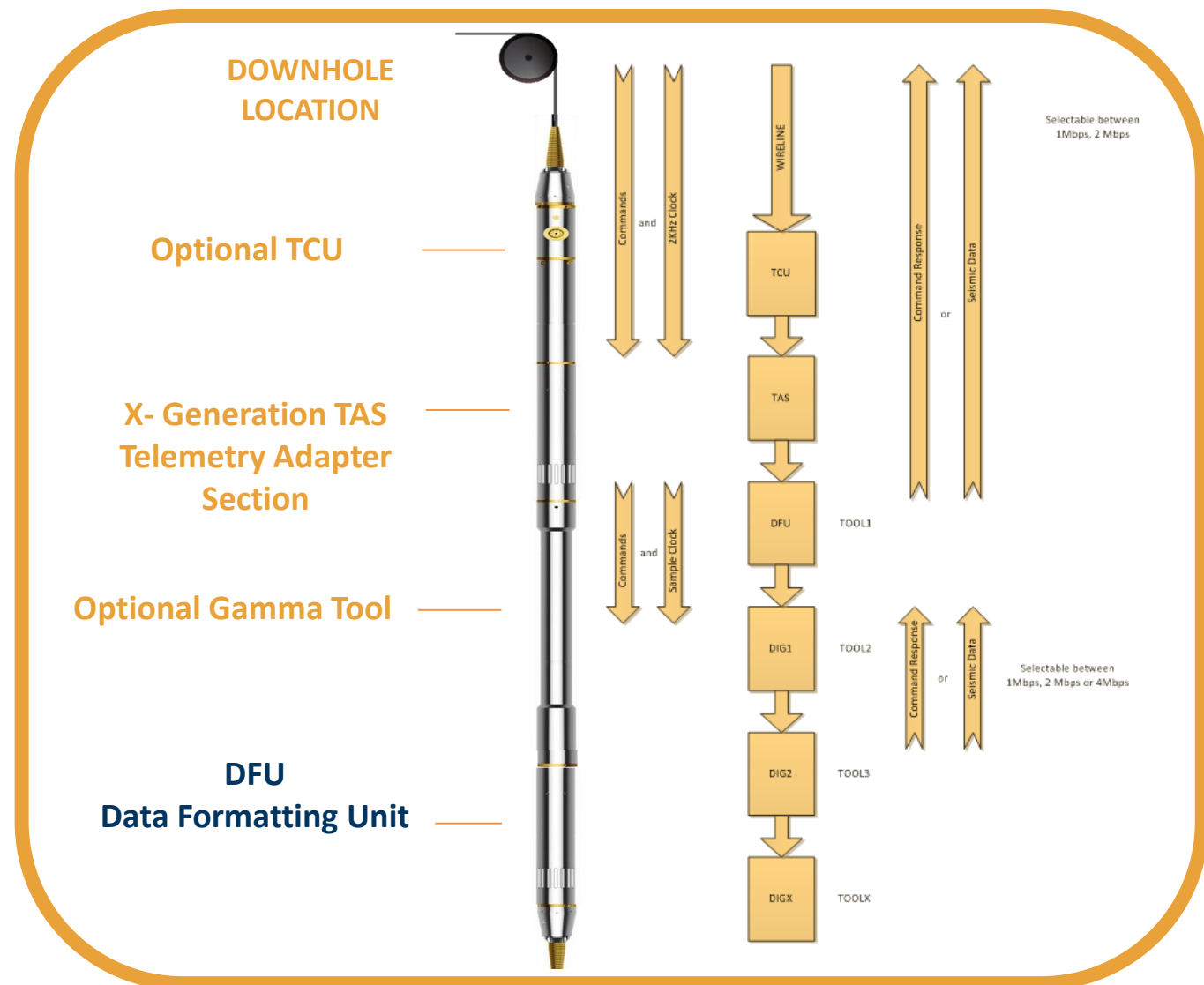
- Enables **Gapless Microseismic Operation** of Geochain system.
- **Compatible with all Geochain digitiser modules**
- Doubles the number of tools available for a given sample rate when running microseismic mode.
- Unique Active Cooling System for continuous operation at 195°C
- 30,000psi (2000 bar) pressure rating.

Functionality

- The DFU is a downhole sonde that allows the user gapless operation when used with an X Generation TAS (Telemetry Adapter Section).
- It is located in between the X-TAS and the digitisers.
- The DFU contains memory that stores digitiser data whilst the TAS has stopped, enabling the data to be continuous without gaps.



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



To perform gapless recording you will need:

1. **DFU (AS-262),**
2. **X-TAS (AS-261),**
3. **GSP with a LRX 2B card.**
4. **ACQ Software v.3.X+**

Recommended:

4. **Networked storage system in place (NAS).**
5. **Geochain Monitor Panel (GMP)**

DFU Specifications

Length	9.75" (250 mm) From M-Rotating nut to Female end.
Diameter	3.25" (82.5mm)
Weight	10.5 lb (4.8kg)
Temperature	195°C (Digital Only)
Pressure	30,000psi (2000 bar)
Panels	GMP or GPP & GSP-1 (Digital)
Wireline	7 Conductor Heptacable

Compatibility requirements

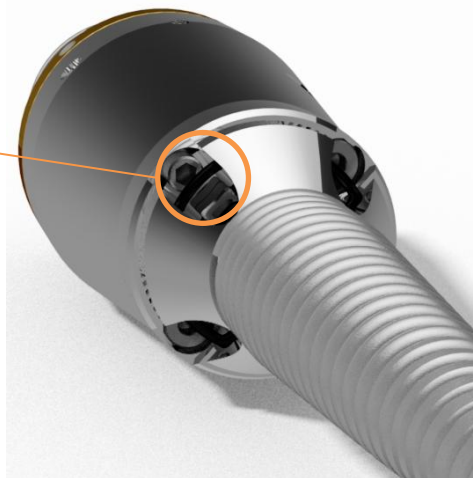
Main Features

- Standard 7 conductor wireline
- Up to 600' (200m) tool separation
- 30,000psi (2100 bar) pressure rating
- Max weak link setting 15,492 lbs

Functionality

- The ITC modular connecting system allows the deployment of multiple Geochain EHP tools in a deviated or vertical well.
- The cable is flexible such that the Geochain EHP tools can be deployed into a deviated well.
- Weaklinks screws are located on the lower head of the ITC. In the event of a stuck string, the weak links can be pulled such that the system can be easily fished.

Weak link
screws



Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	ITC-EHP
Separation Length	Up to 600ft (200m) per section
Cable Head Diameter	3.25" (83mm)
Temperature	400°F (205°C)
Pressure	30,000 psi (2100 bar)

Cable Specifications	
Cable Type	Slammer
Cable Weight	392lbs/kft (583kg/km)
Outer Diameter	0.475" (12.04mm)
Breaking Strength	24,500 lbf (109kN)

Weak Link Specifications	
Weak Link Screw size	A to W
Load	Up to 17.228 N (3,873lbf)

Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)	Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)
A	3.5	6.8	1,531	6124 (27)	L	4.6	12	2,695	10780 (48)
B	3.6	7.2	1,629	6516 (29)	M	4.7	12.8	2,883	11532 (51)
C	3.7	7.8	1,754	7016 (31)	N	4.8	12.9	2,899	11596 (52)
D	3.8	8.1	1,831	7324 (32)	O	4.9	13.4	3,010	12040 (54)
E	3.9	8.3	1,883	7532 (33)	P	5	13.9	3,119	12476 (56)
F	4	8.9	2,003	8012 (36)	R	5.1	14.6	3,288	13152 (58)
G	4.1	9.3	2,084	8336 (37)	S	5.2	15.6	3,506	14024 (62)
H	4.2	9.9	2,229	8916 (40)	T	5.3	15.8	3,546	14184 (63)
I	4.3	10.3	2,311	9244 (41)	U	5.4	16.1	3,637	14548 (64)
J	4.4	10.7	2,405	9620 (43)	V	5.5	16.7	3,756	15024 (67)
K	4.5	11.7	2,620	10480 (47)	W	5.6	17.2	3,873	15492 (69)

SURVIVAL UNDER PRESSURE



UHP

GEOCHAIN ULTRA HIGH PRESSURE

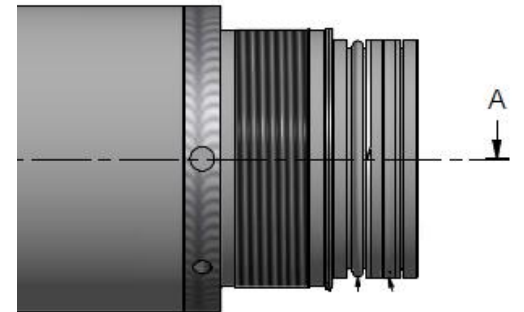
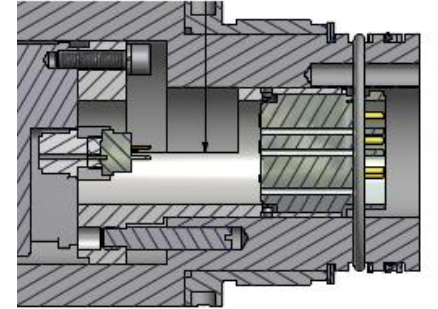


SURVIVAL UNDER PRESSURE

Main Features

- Ideal for **VSP** & **Microseismic** surveys in the most hostile wells.
- Up to 32 satellites.
- **35,000psi (2400 Bar) pressure rating.**
- **Compatible with all legacy and new X-series Geochain modules.**
- 3-C Sensor Options
- Standard 7 conductor wireline.
- Real time data transmission.
- 24-bit delta sigma converters.
- Unique Active Cooling System for continuous operation at 392°F (200°C).
- Up to 600' (200m) between satellites.
- Gapless recording for passive monitoring surveys.
- Quick and easy conversion from Analogue to Digital operation.
- Tractor Deployment.

- FEA analysis and redesign of the 30,000 psi ASR-EHP body work, connectors and seals, to deliver improved pressure specification to **35,000 psi ASR-UHP** performance.
- 3.25" (82.5mm) External Diameter
- Proven in state of the art high pressure test chambers.

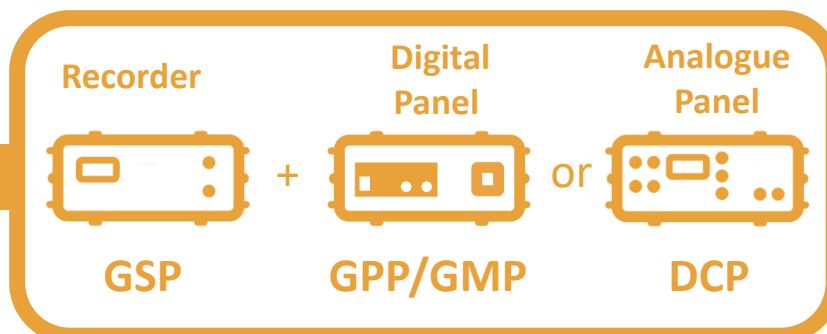


Functionality

- Geochain UHP is one of the latest advances of the Geochain™ VSP digital seismic system, for maximum logging and recording efficiency within the most hostile of high pressure well environments.
- The Geochain UHP system is fully compatible with all standard Geochain™ electronics and sensor modules in addition to all standard surface control panels.



SURFACE PANELS



Geochain UHP – Ultra High Pressure



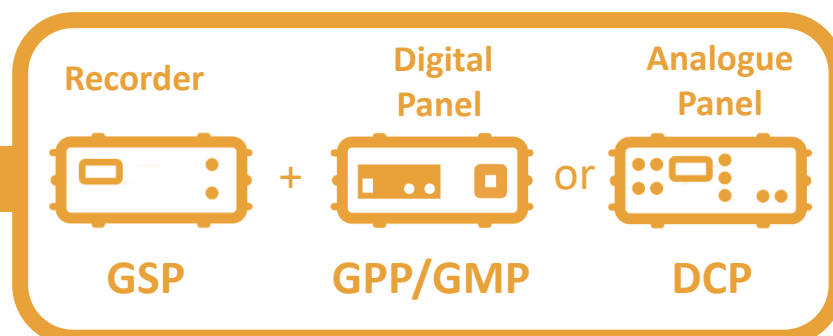
Main Features

- Ideal for **VSP** & **Microseismic** surveys in the most hostile wells.
- Up to 32 satellites.
- **35,000psi (2400 Bar) pressure rating.**
- **Compatible with all legacy and new X-series Geochain modules.**
- 3-C Sensor Options
- Standard 7 conductor wireline.
- Real time data transmission.
- 24-bit delta sigma converters.
- Unique Active Cooling System for continuous operation at 392°F (200°C).
- Up to 600' (200m) between satellites.
- Gapless recording for passive monitoring surveys.
- Quick and easy conversion from Analogue to Digital operation.
- Tractor Deployment.

Functionality

- Geochain UHP is one of the latest advances of the Geochain™ VSP digital seismic system, for maximum logging and recording efficiency within the most hostile of high pressure well environments.
- The Geochain UHP system is fully compatible with all standard Geochain™ electronics and sensor modules in addition to all standard surface control panels.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

ASR-1 (UHP) Satellite Specifications

Length	35" (884mm)
Diameter	3.25" (82.5mm) without nodes
Weight	45 lbs (19.8kg)
Max locking range	12" (305mm) Standard or 22" (559mm) with an arm extender
Max locking force	300 lbs (Standard Arm)
Temperature	400°F (204°C) Analogue / 392°F (200°C) Digital
Pressure	35,000psi (2400 bar)
Sensors	3 Component Gimbal – Sensor SM-4 HT 10Hz 3 Component Fixed – SMC 2400 15Hz Omni- Dual/Quad
Well Deviation Control	0°-95°
Panels	GPP & GSP-1 (Digital) DCP-2 & GSP-1 (Analogue) GMP

Downhole Specifications

Max. No. of Satellites	32			
X-TAS Telemetry	Sample interval	Bandwidth Hz	ASR's	ASR's with DFU
	1/4ms	1600	8	15
	1/2ms	800	16	30
	1ms	400	32	32

Dynamic Range	>112dB @ 0dB pre-gain (minimum)
A/D convertor	24 bit Delta-Sigma
Downhole Gain	42-54dB
Distortion	<0.02%
DC offset	Self-calibrating
Max data rate	4 Mbit/second
Min. data rate	256kbit/second
Wireline	7 Conductor (Heptacable)

Surface Specifications

Recording panel	GPP or GMP & GSP-1 (Digital) DCP-2 and GSP-1 (Analogue)
Software	ASL Acquisition Suite and VSProwess® Processing Software
Cable equalisation	Fully automatic using internal DSP chip
Airgun firing pulse	60 V, 30ms
Test system	Fully automatic with comprehensive report generation
PC Interface	USB
Power Requirements	100/230 V AC, 47-63 Hz universal input, 30 watts
Operating Temp	32-104°F (0-40°C)
Enclosure	Standard 19" rack mounting



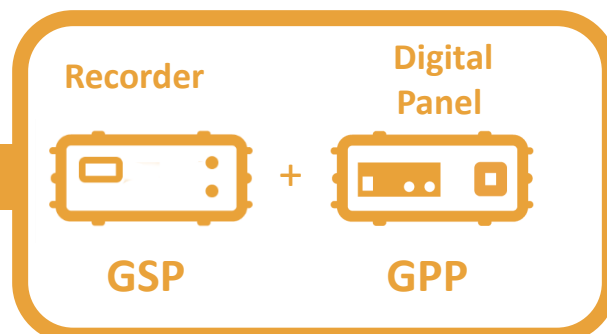
Main Features

- Interfaces digital Geochain string to wireline cable.
- Equal wireline power distribution.
- Separates downlink commands and power from uplink telemetry.
- Compatible with latest DFU module for gapless Microseismic recording
- Unique Active Cooling System for continuous operation at 392°F (200°C).
- 35,000psi (2400 bar) pressure rating (TAS-2 UHP).

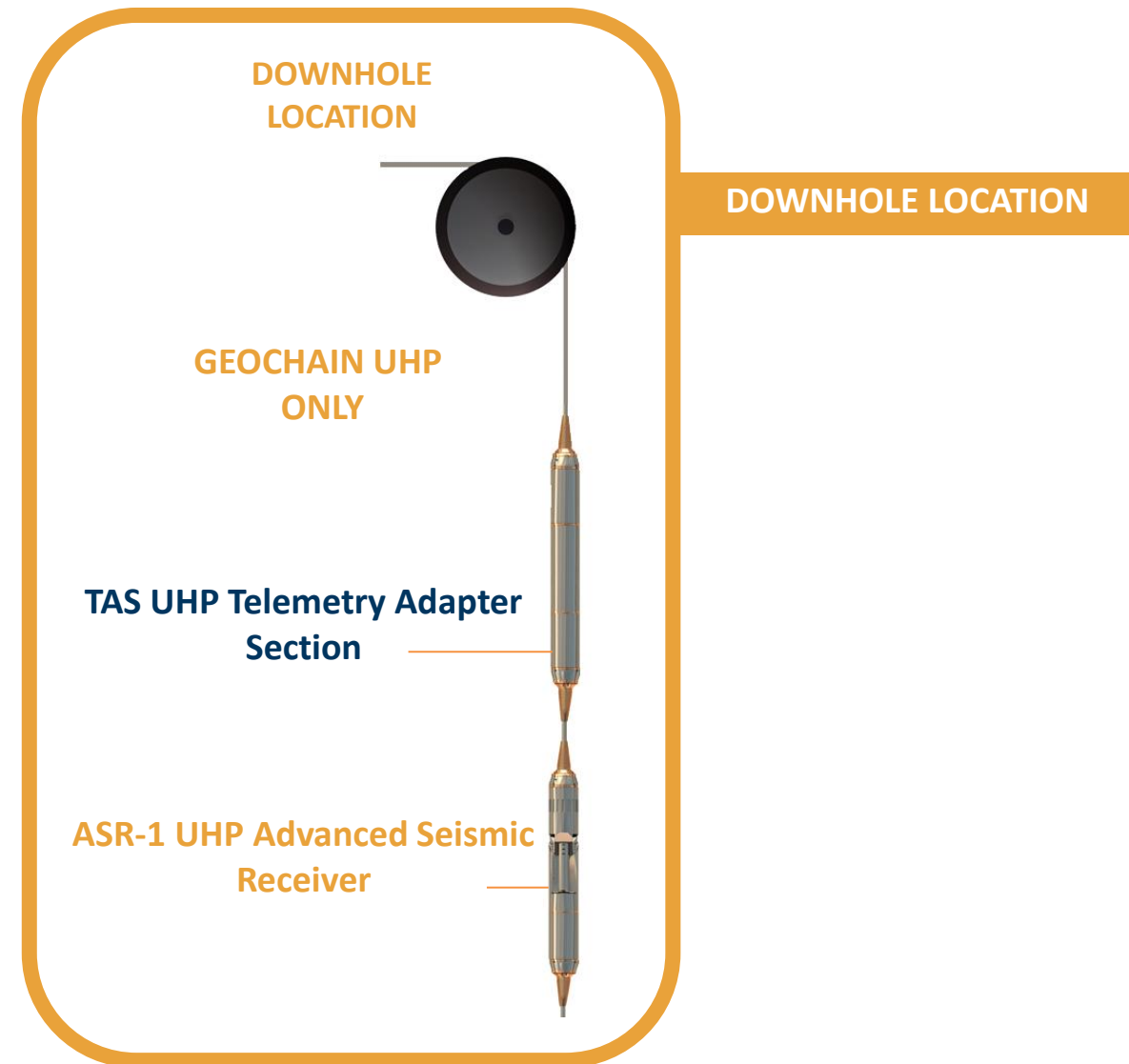
Functionality

- The TAS serves to interface the Geochain tool-string to the main wireline cable. System power from the surface is distributed equally over six wireline conductors. Transformers in the TAS separate this power from the downlink and uplink data signals.
- The TAS receives the data from the Geochain tool-string and re-transmits this to the surface, in a coded and modulated form.
- The TAS also receives synchronisation and command information from the surface and relays this down to all ASRs in the tool-string.
- The TAS may be connected directly to the top ASR using a special coupler, but is often separated by a short ITC to avoid any possible degradation of the seismic response of the ASR.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



<i>TAS (UHP) Specifications</i>	<i>AS-283 (X-Generation)</i>
Length	18.7" (475mm)
Diameter	3.25" (82.5mm)
Weight	27.6lb (12.5kg)
Temperature	392°F (200°C) *Digital Only
Pressure	35,000psi (2400 bar) EHP version
Max Telemetry Data Rate	4Mbit/second
Min Telemetry Data Rate	256kbit/second (Microseismic Mode)
Configuration Board	4/6 wire telemetry options.
Panels	GPP or GMP & GSP-1
DFU Compatible*	Yes – Firmware upgrade required to all previous 2015 TAS-2
Wireline	7 Conductor Heptacable

VRS UHP – Voltage Regulator Section



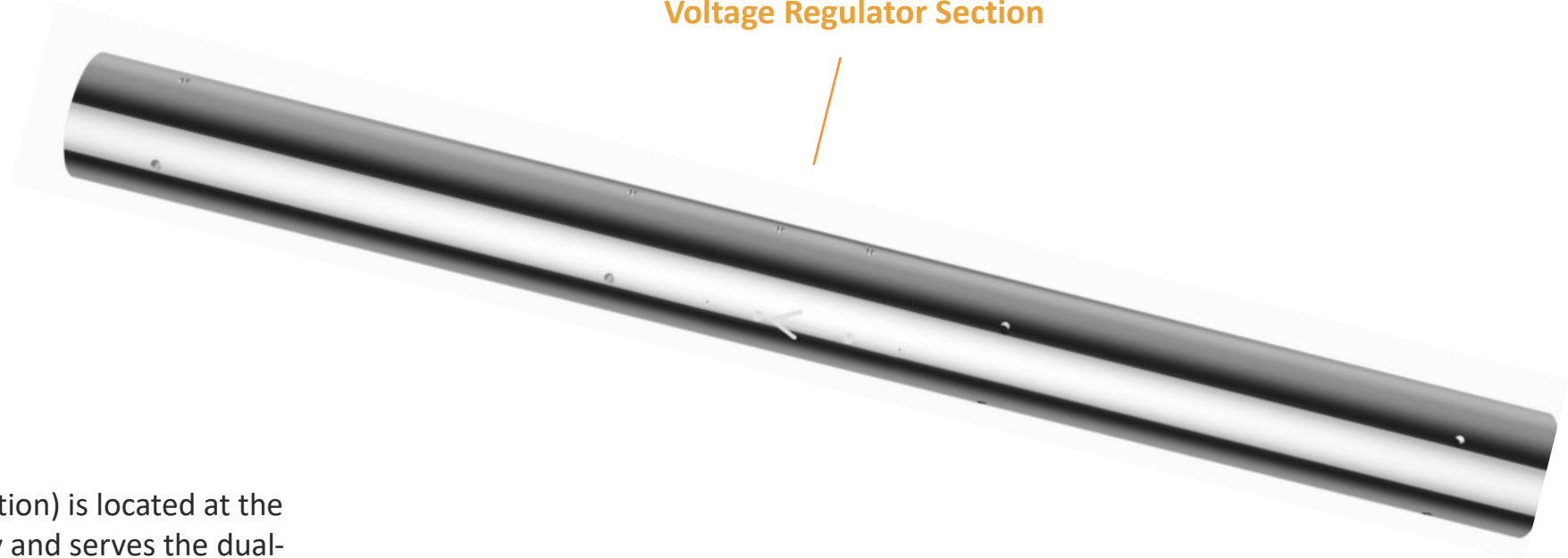
Main Features

- Voltage Regulation.
- Sinker Bar.
- Motion Sensor.
- Standard 7 conductor wireline.
- EXTRA High Pressure 35,000 psi (2400 bar).
- High Temperature.
- All new VRS design, eliminating 9 seals .

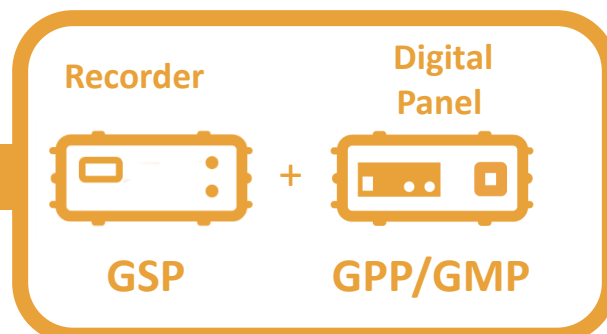
Functionality

- The VRS Extra High Pressure (Voltage Regulator Section) is located at the bottom end of the Geochain™ digital receiver array and serves the dual-purpose as a voltage regulator to establish the 110 volt ASR arm operating motor voltage. The second function is to act as a sinker weight and is equipped with a motion sensor assisting with the lowering of AST tools down the borehole.
- A portion of the current through the VRS is diverted to operate the ASR arm control motors. The Geochain™ software is able to resolve any current demands required by the ASR arm motors by automatically suspending one or more motors until more current is available.

VRS UHP
Voltage Regulator Section



SURFACE PANELS



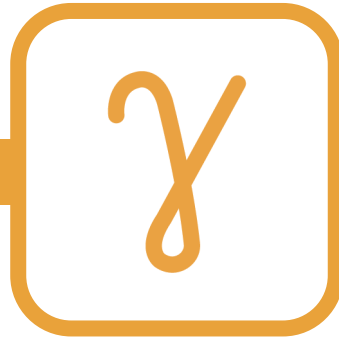
VRS (UHP) Specifications

Length	50" (1270mm) with nose cone
Diameter	3.25" (82.5mm)
Weight	130lbs (46.5 kg) with nose cone
Temperature	392°F (200°C) (Digital Only)
Pressure	35,000psi (2400 bar) EHP version
Panels	GPP or GMP & GSP-1 (Digital)
Max number of ASR's	32
Wireline	7 Conductor Heptacable



Gamma Logging Tools

Gamma Logging Tools



Main Features

- **GRT-2 HP** The GRT-2 HP Gamma Ray Tool is a standard scintillation detector type production gamma ray tool housed within an in line ASR-1 body. This arrangement allows the GRT-2 to be inserted anywhere within an analogue ASR tool string or between the wireline adapter and TAS section within a Geochain™ string.
- **GRT-2 EHP** An additional variation has been built and tested for 30,000 psi operation. This variation offers a heavier weight, 3 1/4" diameter and is optimised for the Geochain EHP system.
- **GRT-5** This tool is housed within an in line GSR compatible body. The GRT-5 is run in "digital" gamma mode. In this mode the GRT-5 is connected immediately below the STAS. The STAS provides the gamma power and reads the gamma count via pin 3. The STAS transmits the gamma information to the surface digitally with all other status information in Geochain Slim's Monitor mode.
- **GRT-100** This gamma ray tool is housed within an in line GO body. The GRT-100 has been designed to run on the end of a GeochainSlim™ tool string. However as the tool is through wired it can also be used in conjunction with any compatible monocable tool string.
- **GRT- HP109** This UHT Gamma Ray Tool is a flasked scintillation detector type production gamma ray tool housed within an in line ASR-1 body. This arrangement allows the GRT-HP109 to operate for 10 hours at temperatures up to 500°F.

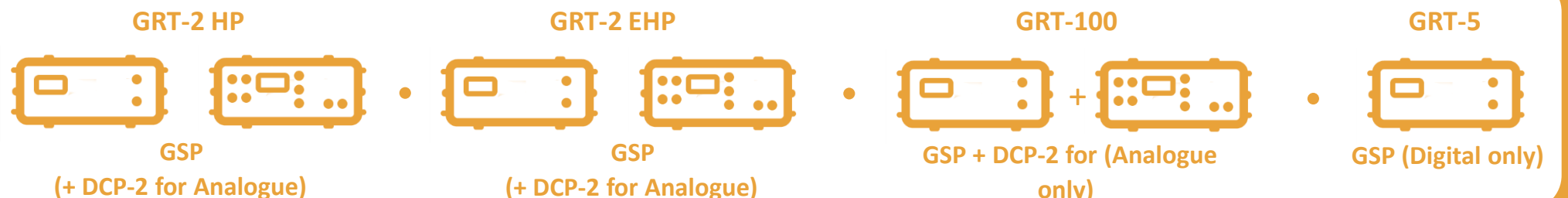
Functionality

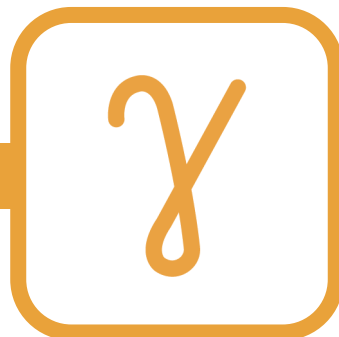
- ASL gamma tools consist of a robust pressure housing, containing a sensitive scintillation detector and high temperature electronics which sends pulses representing detected gamma radiation to surface. Our gamma instruments can be fitted quickly and easily to both digital and analogue tool systems.
- Gamma ray tools are highly useful within borehole characterisation. Gamma ray tools measure the relative naturally occurring radiation adjacent to the well bore providing a tool for depth correlation and lithological identification.

Avalon Gamma Logging Tool specification comparison table

Specifications	GRT-2 HP	GRT-2 EHP	GRT-5	GRT-100	GRT-HP109
Length	33.5"(853mm)	33.5"(853mm)	28" (720mm)	24" (618mm)	72" (1828mm)
Diameter	3" (76mm)	3" (76mm)	1-11/16th" (43mm)	1-11/16th" (43mm)	3" (76mm)
Weight	26lb (12kg)	38lb (17kg)	9lb (4.1kg)	8.4lb (3.8kg)	52lbs (24kg)
Temperature	350°F (180°C)	350°F (180°C)	350°F (180°C)	350°F (180°C)	500°F (260°C)
Pressure	25,000 psi (1750 bar)	30,000 psi (2070 bar)	20,000 psi (1375 bar)	20,000psi (1375 bar)	20,000psi (1375 bar)
Connection	ASR	ASR	STAS	GO 1 Monocable	ASR
Operating Voltage	+60V DC	+60V DC	+60V DC	+60V DC	+60V DC

SURFACE PANELS





Main Features

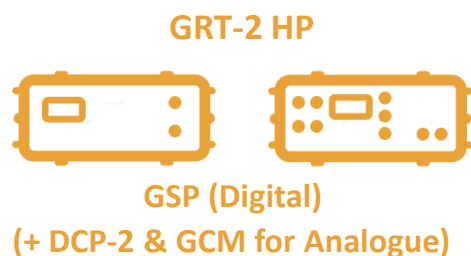
- GRT-2 HP** The GRT-2 HP Gamma Ray Tool is a standard scintillation detector type production gamma ray tool housed within an in line ASR-1 body. This arrangement allows the GRT-2 to be inserted anywhere within an analogue ASR tool string or between the wireline adapter and TAS section within a Geochain™ string.



Functionality

- ASL gamma tools consist of a robust pressure housing, containing a sensitive scintillation detector and high temperature electronics which sends pulses representing detected gamma radiation to surface. Our gamma instruments can be fitted quickly and easily to both digital and analogue tool systems.
- Gamma ray tools are highly useful within borehole characterisation. Gamma ray tools measure the relative naturally occurring radiation adjacent to the well bore providing a tool for depth correlation and lithological identification.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Avalon Gamma Logging Tool specification comparison table

Specifications	GRT-2 HP	GRT-2 EHP	GRT-5	GRT-100	GRT-HP109
Length	33.5"(853mm)	33.5"(853m m)	28" (720mm)	24" (618mm)	72" (1828mm)
Diameter	3" (76mm)	3" (76mm)	1-11/16th" (43mm)	1-11/16th" (43mm)	3" (76mm)
Weight	26lb (12kg)	38lb (17kg)	9lb (4.1kg)	8.4lb (3.8kg)	52lbs (24kg)
Temperature	350°F (180°C)	350°F (180°C)	350°F (180°C)	350°F (180°C)	500°F (260°C)
Pressure	25,000 psi (1750 bar)	30,000 psi (2070 bar)	20,000 psi (1375 bar)	20,000psi (1375 bar)	20,000psi (1375 bar)
Connection	ASR	ASR	STAS	GO 1 Monocable	ASR
Operating Voltage	+60V DC	+60V DC	+60V DC	+60V DC	+60V DC



Advanced Sparker Tool

AST – Advanced Sparker Tool

Main Features

- Peak Power 1000 Joules/Shot.
- 20s Firing Interval.
- Output Signal 10 – 4000Hz-Omni Directional.
- 3" (76.2mm) Diameter.
- Automatic or Triggered Firing.
- 302°F (150°C) Temperature Rating.
- 10,000 PSI Pressure Rating.
- Monocable or 7 conductor wireline.
- Deployed with Geochain™ System or standalone operation.
- Repeatable energy pulse.
- Firing T/B transmitted to surface.
- Operation in any type of conductive well fluid.
- Built in safety protection.

Functionality

- The Advanced Sparker Tool (AST) has been developed to provide a high energy and a repeatable downhole seismic source. Primary use of the AST would be with seismic sensors deployed in an adjacent well or wells to provide cross well imaging or sensor orientation of fracture monitoring instrumentation.
- When the AST is deployed with the Geochain™ system it will be possible to provide single well imaging. With a low power requirement of a 100W and high energy output of 1000J the AST is a versatile downhole seismic source which can be deployed in various configurations.

SURFACE PANELS

Power



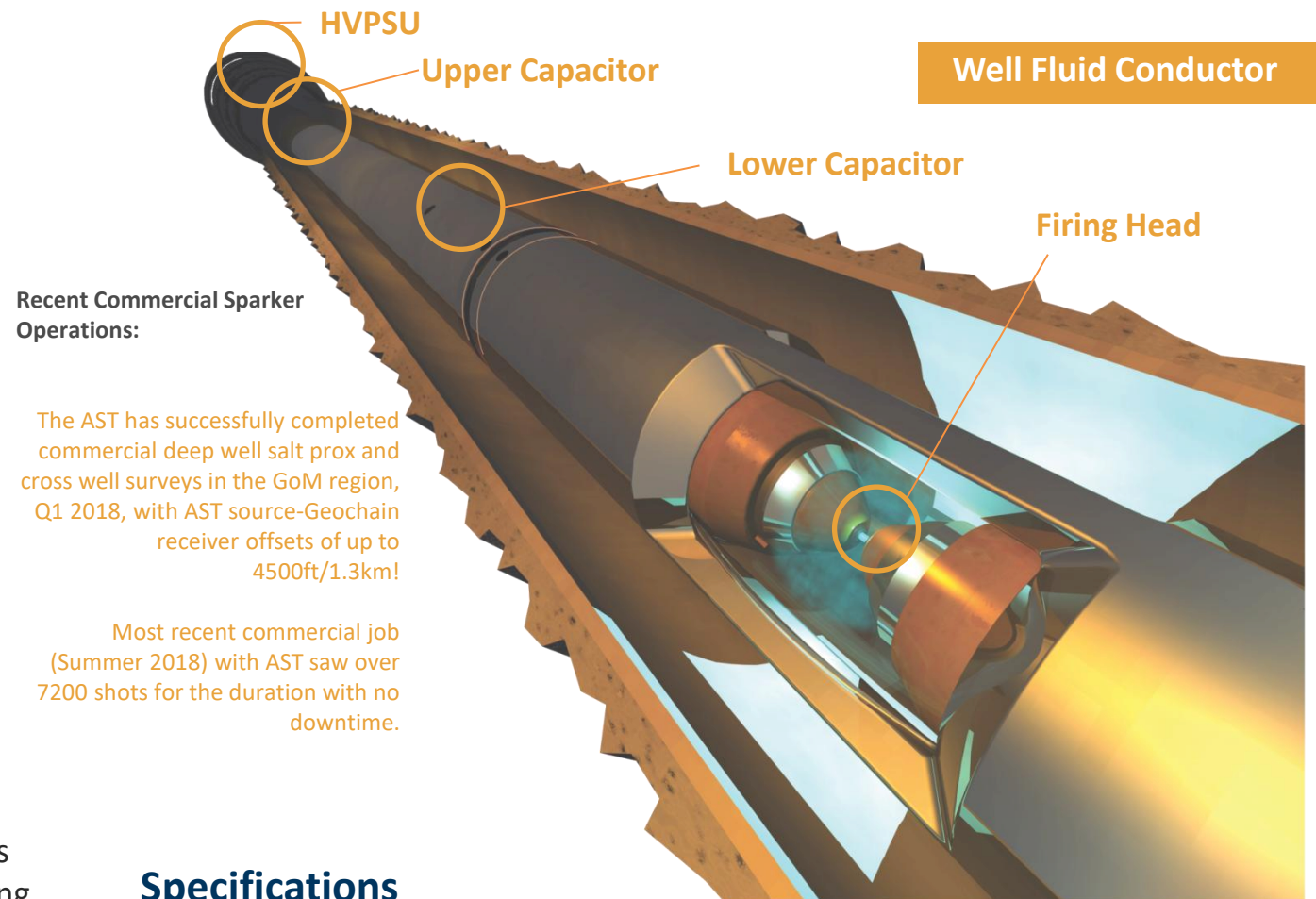
Recorder



GPP + AST Controller + GSP

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Borehole Seismic Source



Recent Commercial Sparker Operations:

The AST has successfully completed commercial deep well salt prox and cross well surveys in the GoM region, Q1 2018, with AST source-Geochain receiver offsets of up to 4500ft/1.3km!

Most recent commercial job (Summer 2018) with AST saw over 7200 shots for the duration with no downtime.

Specifications

AST Specification

Power:	1000 Joules/shot
Output Bandwidth:	10-4000Hz
Power consumption:	100 watts
Electrode life:	>5000 shots
Diameter:	3" (76mm)
Length:	29.9ft (9.1m)
Pressure:	10,000 psi (700 bar)
Temperature:	356°F (150°C)
Firing interval:	20 seconds
Wireline:	Mono or hepta



Tension Compression Unit

TCU – Tension Compression Unit

Main Features

- 3" Diameter Tool compatible with Geochain™.
- Tension and Compression measure on wireline.
- Real time surface read out.
- Ready out display with ACQ software.
- High Accuracy.
- Operation with hostile well conditions.

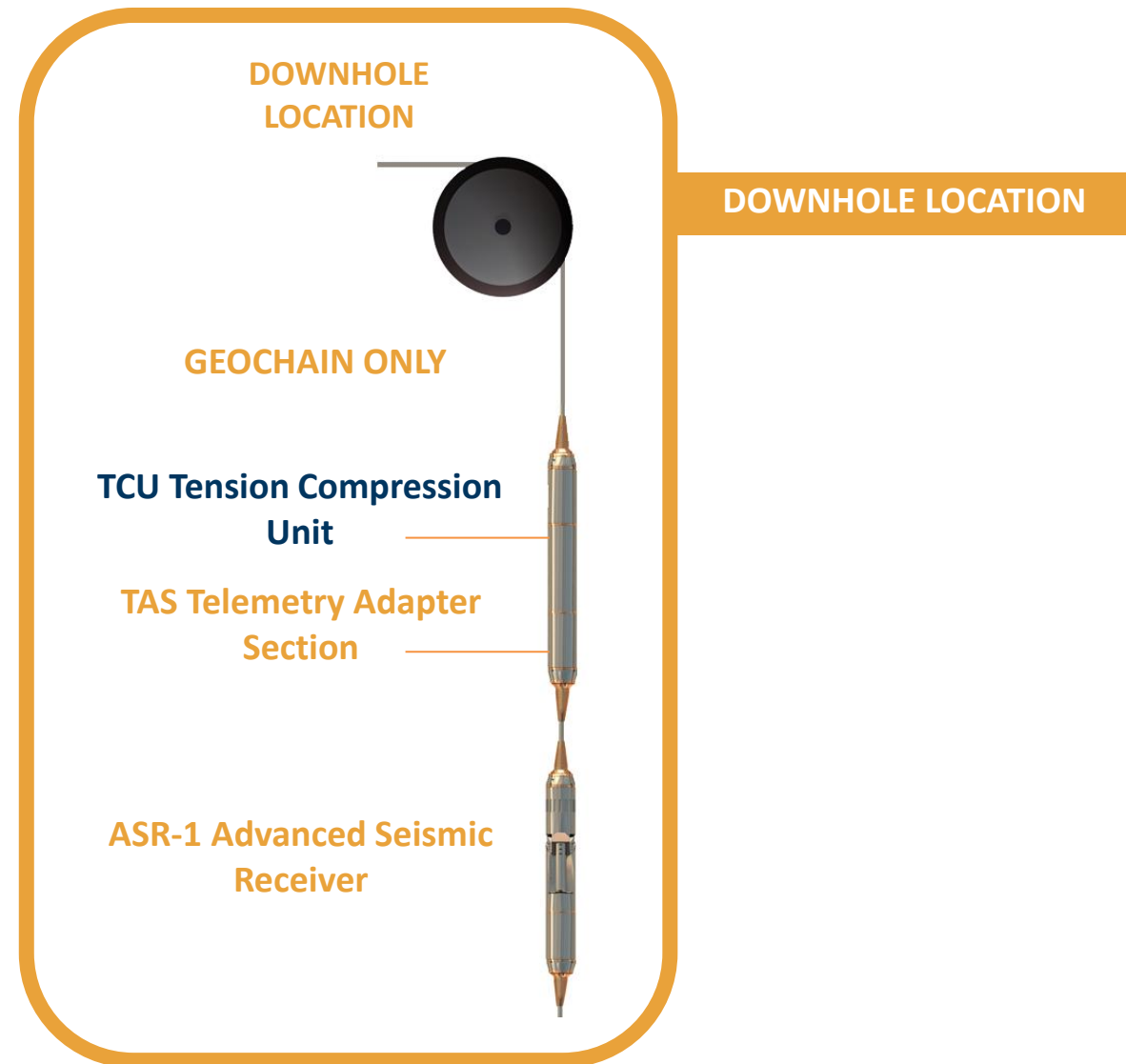
Functionality

- The TCU-2 Tension Compression Unit is a device designed to accurately measure the load on the wire line at the top of the Geochain™ string.
- This product records during receiver deployment with real time surface read out, providing the seismic engineer with an invaluable tool to detect and prevent receiver hang up.
- This new unit has refined pressure compensation capability with the load measurement achieved by means of strain gauges situated within the housing. Mounted directly above the telemetry adapter section (TAS) of the tool string, the TCU measured output voltage is digitised and transmitted by the TAS and displayed at surface within the ACQ software.
- All TCU-2 components in contact with borehole fluid are corrosion resistant, and not sensitive to hydrogen embrittlement. Any items requiring service can be easily replaced with the minimum of disassembly.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



TCU Specifications

Loading:	The unit can measure tension or compression load in the range -5 to +5 tonnes, with a damage free load limit of +/-20 tonnes
Accuracy:	Better than 2% of full scale across the range of temperature and pressure.
Length:	26" (660mm)
Weight:	40 lb (18 kg)
Diameter:	3" (76mm)
Max Operational Temperature:	400°F (205°C)
Max Operational Pressure:	25,000 psi (1720 bar)

STCU – Slim Tension Compression Unit

Main Features

- Slim 1 11/16" (43mm) Outside Diameter Tool compatible with GeochainSlim Systems.
- Tension and Compression measure on wireline.
- Real time surface read out with ACQ software.
- High Accuracy.
- Operation in hostile well conditions.

Functionality

- The STCU Tension Compression Unit is a device designed to accurately measure the load on the wire line at the top of the GeochainSlim™ string.
- The unit operates throughout the survey with real time surface read out, providing the seismic engineer with an invaluable tool to detect and prevent receiver hang up.
- The load measurement is achieved by means of a spring balance situated within the housing. Mounted directly below the telemetry adapter section (STAS) of the tool string, the STCU output voltage is digitised and transmitted by the STAS and displayed at surface within the ACQ software.
- All STCU components in contact with borehole fluid are corrosion resistant, and not sensitive to hydrogen embrittlement. Any items requiring service can be easily replaced with the minimum of disassembly.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

STCU Specifications

Loading: The unit can measure tension or compression load in the range –
Compression: Up to 2500lbs
Tension: Up to 5000lbs,
Damage free load limit: 20,000lbs

Accuracy: Better than 2% of full scale across the range of temperature and pressure.

Length: 44.7" (1160mm)

Weight: 20.5 lbs (9.3kg)

Diameter: 1 11/16" (43mm)

Max Operational Temperature: 392°F (200°C)

Max Operational Pressure: 20,000psi (1380 bar)





Permaseis

Permaseis – Permanent Seismic Receiver



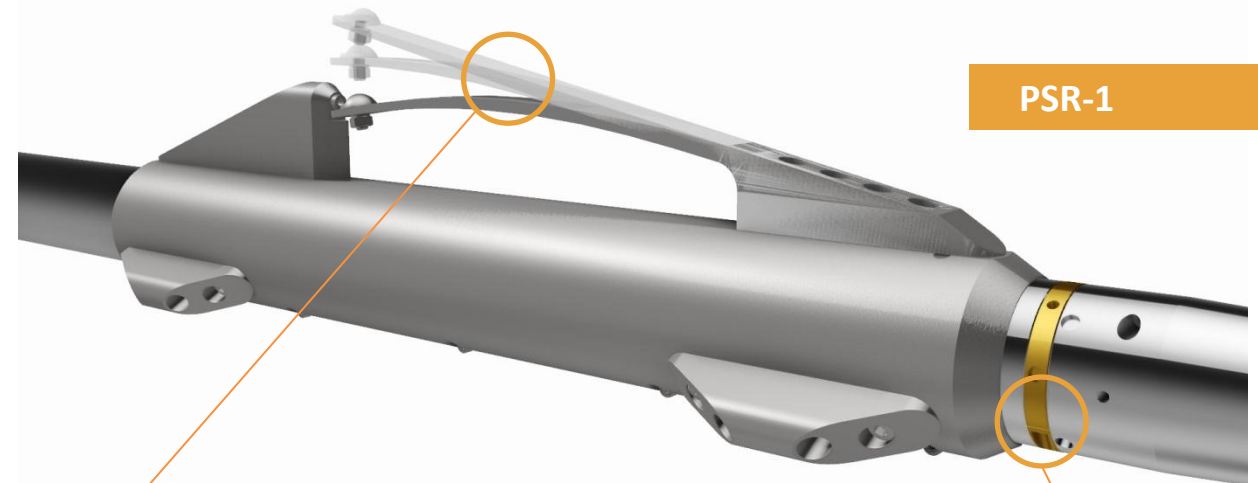
Main Features

- Metal to metal seals.
- 20,000 psi (1400 bar) pressure rating.
- 385°F (195°C) temperature rating.
- Simple conversion to analogue mode for use up to 437°F (225°C).
- ACS cooling system (Digital).
- 3 component geophones.
- Patented Time delay fluid activated sprung arm
- Uses standard Avalon surface control panels.
- Selectable Damping and Gain
- Integrated High Side Indicator (Digital system)
- X-series electronic upgrades

Functionality

- The Permaseis™ digital array is one of the latest adaptations of our highly regarded Geochain™ array. The system utilises the new PSR-1 downhole receivers along with the standard GSP and GPP surface panels from our Geochain™ system.
- The high continuous temperature rating and the robust telemetry system will ensure semi/permanent operation in the harshest of well environments.
- The tool is developed from the tried and tested Geochain Slim Receiver (GSR) tools and has been designed to provide years of reliable service by utilising metal to metal C-rings throughout. Deployment of the tool is via a standard hepta cable and uses a double booted cable head with a Krytox oil fill to ensure long term integrity.
- In digital mode the tools can be combined to a maximum of 60 levels with 328 ft (100m) spacing between levels. The tool utilises Avalon's unique Active Cooling System (ACS), this maintains a constant 113°F (45°C) differential between the borehole fluid and the tool's electronic system. This dramatically improves not only long term reliability but also allows operation to 385°F (195°C) for weeks at a time.
- The PSR can also be provided in single or dual tool analogue mode to allow even higher operating temperatures. Analogue tools are available in 392°F/437°F (200°C/225°C) versions. In this mode they operate with GSP & DCP-2 surface panels.

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



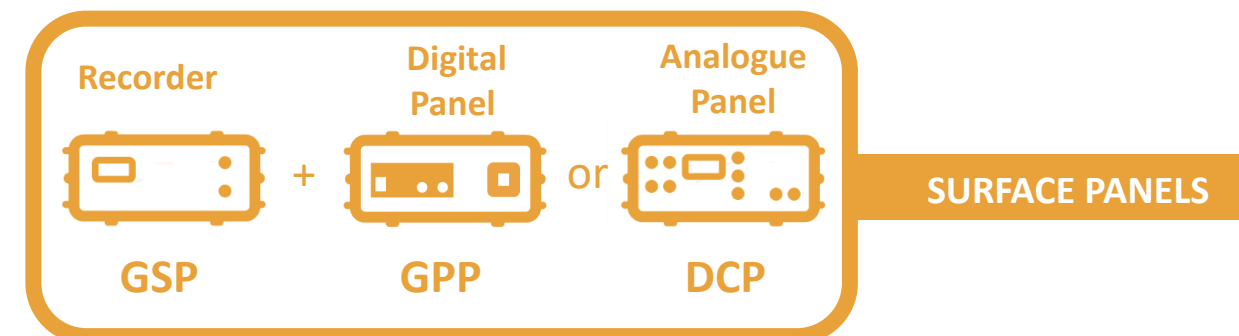
PSR-1

Time delay fluid
activated sprung
arm

Metal-Metal Seals

Permaseis Specifications

• Max number of tools:	• 60 (Digital) 2 (Analogue) HT & EHT
• Max Tool OD	• 102mm (Long Arm) 90mm (Short Arm)
• Dimensions & Weight	• L-1000mm W-60mm Weight 10kg
• Dynamic Range:	• >100db
• Noise Floor:	• <75 nV
• Distortion:	• <0.02%
• Bandwidth:	• 10-1,600 Hz
• Sensors:	• 15Hz Omnidirectional Geophone Dual or Quad
• Max Temp:	• 385°F (195°C) Digital / 392°F (200°C) HT / 437°F (225°C) EHT (Analogue)
• Max Pressure:	• 20,000 psi (1400 bar)
• Projected lifespan:	• 10 years at 302°F (150°C)
• Control Panels:	• GSP and GMP/GPP (Digital) or GSP and DCP-2 (Analogue)



Slim Permaseis – Permanent Seismic Receiver



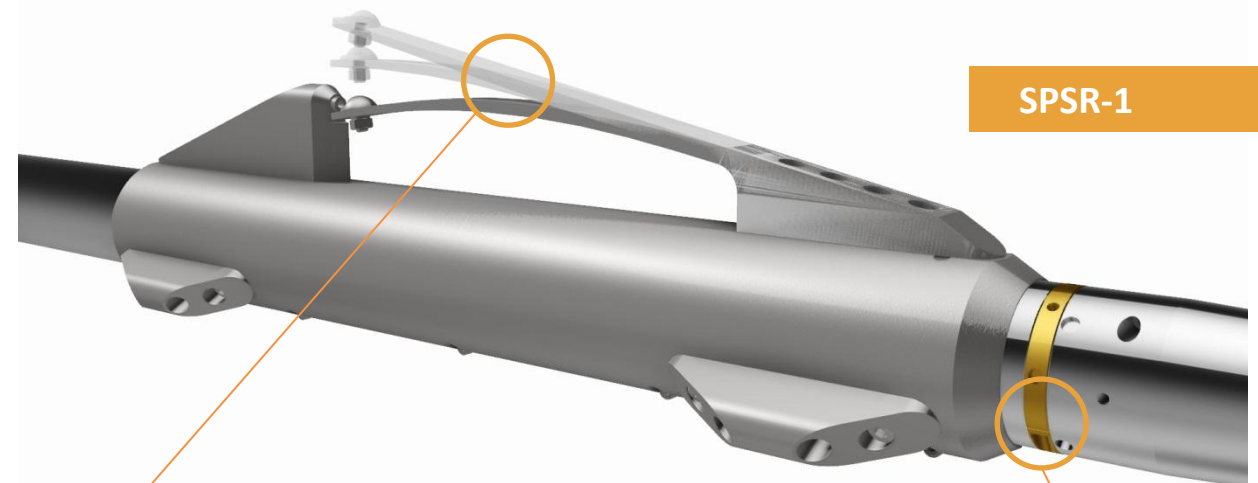
Main Features

- Metal to metal seals.
- 20,000 psi (1400 bar) pressure rating.
- 385°F (195°C) temperature rating.
- Simple conversion to analogue mode for use up to 437°F (225°C).
- ACS cooling system (Digital).
- 3 component geophones.
- Patented Time delay fluid activated sprung arm
- Uses standard Avalon surface control panels.
- Selectable Damping and Gain
- Integrated High Side Indicator (Digital system)
- X-series electronic upgrades

Functionality

- The Permaseis™ digital array is one of the latest adaptations of our highly regarded Geochain™ array. The system utilises the new PSR-1 downhole receivers along with the standard GSP and GPP surface panels from our Geochain™ system.
- The high continuous temperature rating and the robust telemetry system will ensure semi/permanent operation in the harshest of well environments.
- The tool is developed from the tried and tested Geochain Slim Receiver (GSR) tools and has been designed to provide years of reliable service by utilising metal to metal C-rings throughout. Deployment of the tool is via a standard hepta cable and uses a double booted cable head with a Krytox oil fill to ensure long term integrity.
- In digital mode the tools can be combined to a maximum of 60 levels with 328 ft (100m) spacing between levels. The tool utilises Avalon's unique Active Cooling System (ACS), this maintains a constant 113°F (45°C) differential between the borehole fluid and the tool's electronic system. This dramatically improves not only long term reliability, but also allows operation to 385°F (195°C) for weeks at a time.
- The PSR can also be provided in single or dual tool analogue mode to allow even higher operating temperatures. Analogue tools are available in 392°F/437°F (200°C/225°C) versions. In this mode they operate with GSP & DCP-2 surface panels.

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



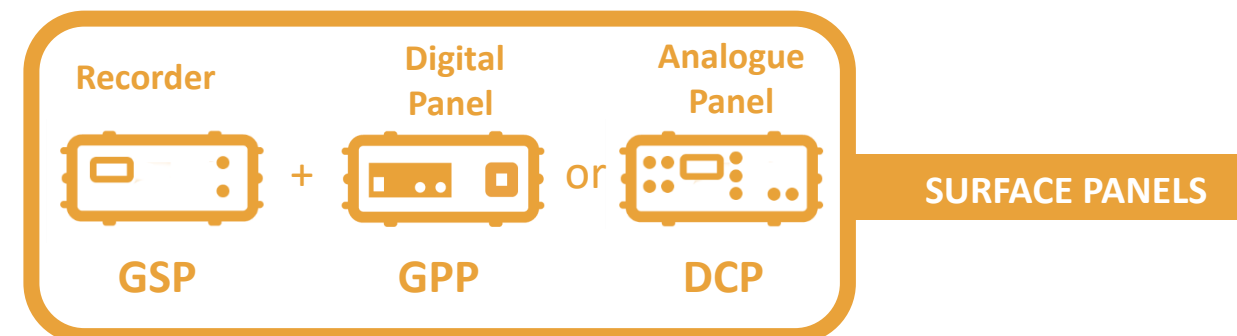
SPSR-1

Time delay fluid
activated sprung
arm

Metal-Metal Seals

Permaseis Specifications

• Max number of tools:	• 60 (Digital) 2 (Analogue) HT & EHT
• Max Tool OD	• 76mm (Slim Passive Arm Collar) 43mm (no arm collar)
• Dimensions & Weight	• L-1000mm W-60mm Weight 10kg
• Dynamic Range:	• >100db
• Noise Floor:	• <75 nV
• Distortion:	• <0.02%
• Bandwidth:	• 10-1,600 Hz
• Sensors:	• 15Hz Omnidirectional Geophone Dual or Quad
• Max Temp:	• 385°F (195°C) Digital / 392°F (200°C) HT / 437°F (225°C) EHT (Analogue)
• Max Pressure:	• 20,000 psi (1400 bar)
• Projected lifespan:	• 10 years at 302°F (150°C)
• Control Panels:	• GSP and GMP/GPP (Digital) or GSP and DCP-2 (Analogue)



Tubing Deployed PSR – General Procedure



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

PSR

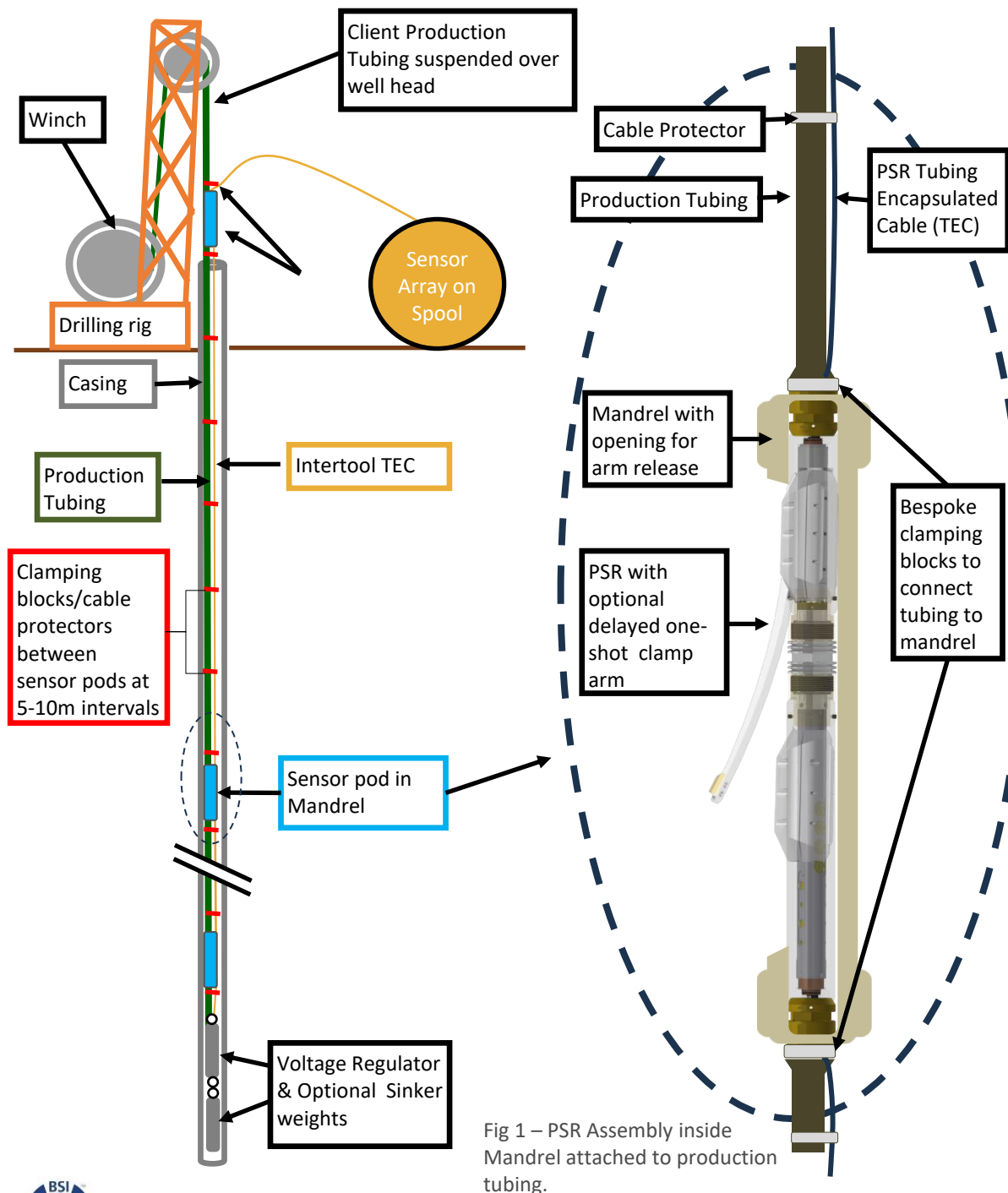
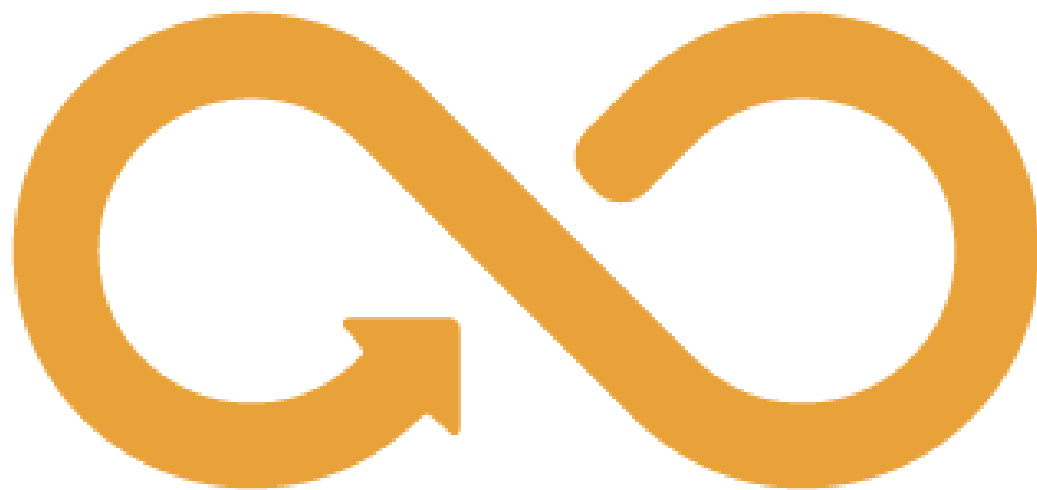


Fig 1 – PSR Assembly inside Mandrel attached to production tubing.

- The sensor array consists of a string of preassembled receivers.
- Each PSR sonde is located inside a mandrel housing (fig.1).
- The PSR is then connected through the mandrel and into the inter-tool Tubing Encapsulated Cable (TEC).
- The PSR-Mandrel-Intertool TEC connection is achieved by metal-to-metal C-rings. This robust connection is performed in advance by the manufacture using DO17796 Assembly fixture.
- The string is delivered to well head on a large spool. There will be a second cable drum carrying the lead in TEC cable to run from the top telemetry housing at depth to the surface tree.
- A drilling rig will be set up adjacent to the well to deploy the production tubing and the preconnected array.
- Each receiver will be disengaged from the spool and manhandled to the client production tubing at the rig (tubing section secured in wellhead makeup flange).
- If passive clamp arms are used, then these will be added at this point. The mandrel housing has an opening to allow the one-shot arm to spring out and couple the sensor pod to the formation/casing (*full PPE for installation/arming of delayed arm clamps*).
- The mandrel section with the (PSR & TEC inter-receiver cable inside) assembly is then connected to the client production tubing and secured using bespoke clamping blocks (supplied by Avalon Sciences).
- The free movement of the sensor is then checked and the clamping blocks adjusted, as necessary. The intertool TEC will also be coupled to the client production tubing every 5-10m using clamping blocks or cable protectors.
- When all receivers and telemetry pod is in the well, the top connection pod can be made onto the lead in cable at the wellhead (using metal to metal sealing assembly fixture).
- The TEC cable is then spooled as the tubing/drill pipe is lowered and is strapped using the cable protectors to the tubing at set intervals (typically every 5-10m) until the tools are at desired depth.
- At surface, the downhole TEC and surface lead in cable is then connected to recorder panel and functional tests of the array will be carried out.
- The TEC cable is then disconnected from the lead in cable and either fed out of the open well head or (for more permanent well configurations) made onto the surface tree penetrator. The tree can then be pressure tested. The lead in cable will be connected to the surface side of the penetrator.
- Another functional test of the system is made. If delayed clamp arms are used, this would then be repeated after arms have opened. It is advised to be continuously recording whilst waiting for arms to open to log arm opening event(s). Once arms are open and diagnostics complete, begin survey.



Passive and Shallow Buried Arrays

PSS-08 - Passive Seismic Sonde

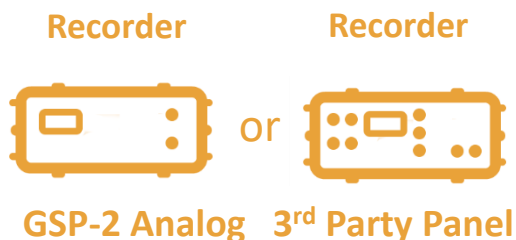
Main Features

- Over-moulded cable head.
- 70°C or 120°C Options
- 2,900psi (20MPa) pressure rating.
- 3 component sensor pack.
- Up to 4 geophones per component.
- Optimised for both VSP and hydraulic fracture monitoring work.
- Bow spring Centraliser or time delay clamp arm options.
- 10+ years lifespan @ 50°C

Functionality

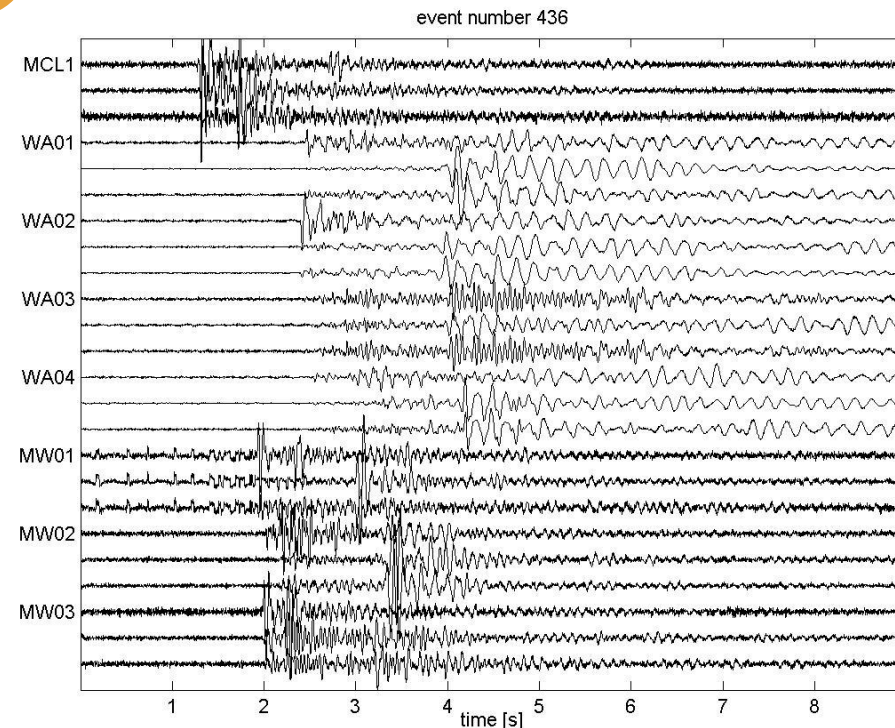
- The PSS-08 Passive Seismic Sonde is a completely passive analogue tool designed for long term downhole deployment.
 - The tool uses a combination elastomer seal and over-moulding to ensure long term compatibility with common borehole fluids.
 - 52mm diameter without arm, 108mm with arm.
- PSS tools have been installed for continuous seismic monitoring with a range of applications. An array was recently used to successfully monitor a real time massive hydraulic fracture operation.

SURFACE PANELS

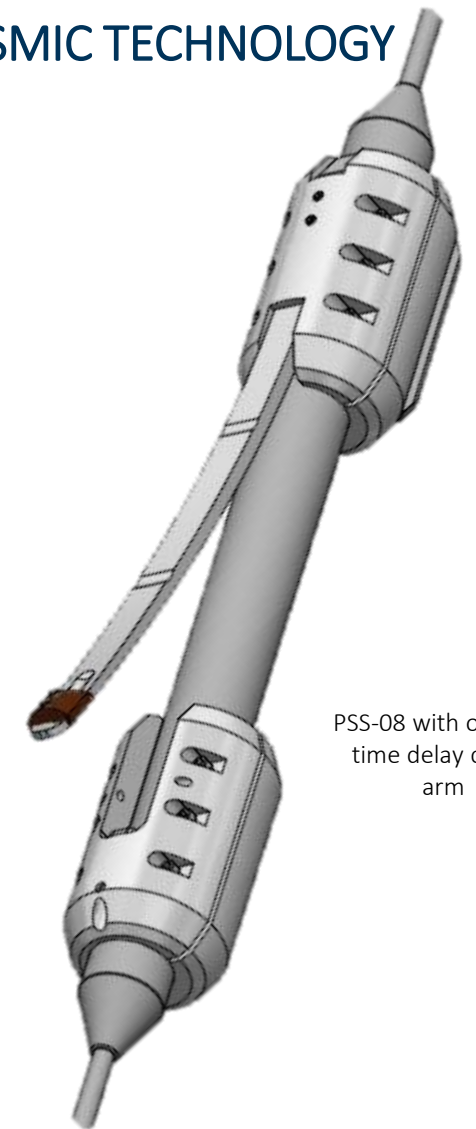


LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

PSS-SBA-08 tool complete with 1000m cable (no arm assembly),



Detected events from four tools deployed in wells WA01-WA04



PSS-08 with optional time delay clamp arm

PSS-SBA-08 Specifications	
Max number of tools:	Up to 48 Analog Channels
Max Tool OD	52mm/2.05" (No Arm) or 108mm/4 1/4" (With Arm Collar)
Dimensions & Weight	L - 596mm/23.5" D - 52mm /2.05"(No arm) Weight - 5kg
Dynamic Range:	>100db
Noise Floor:	<75 nV
Distortion:	<0.2%
Bandwidth:	4-1,600 Hz
Sensors:	• HG6 4.5, 10, 14Hz (Mono Directional) geophone options 375 Ohm Z/X/Y Phone or 15Hz Omnidirectional 2400 Ohm Geophone Option. • Sensitivity depends on number of sensors in series per channel. Typically, >200 V/m/s. Individual elements 52 V/m/s
Max Temp Max Pressure	120°C / 212°F 20Mpa (2900 psi)
Cable	Over-moulded with strength member
Projected lifespan:	10 years+ at 122°F (50°C)
Control Panels:	GSP-2 * or 3 rd Party Analog Recorder (GSP-2 offers up to 48 analog Channels)

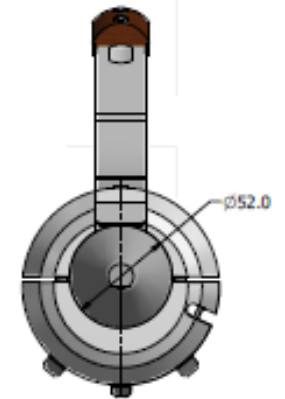
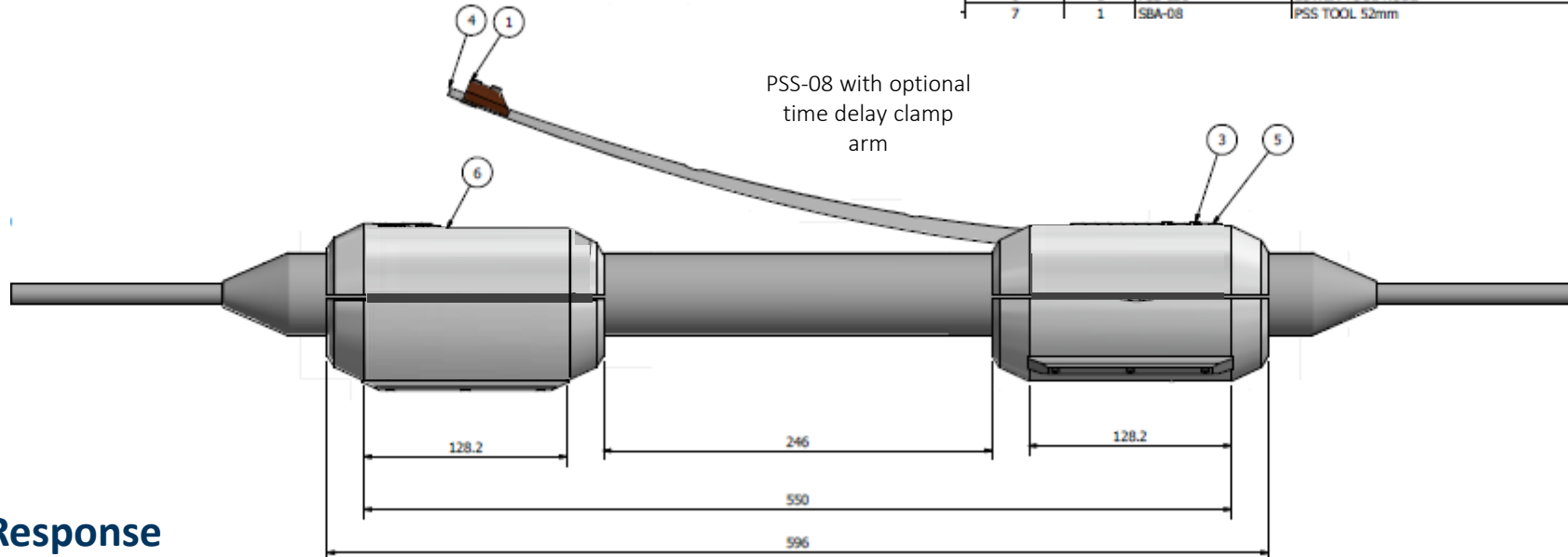
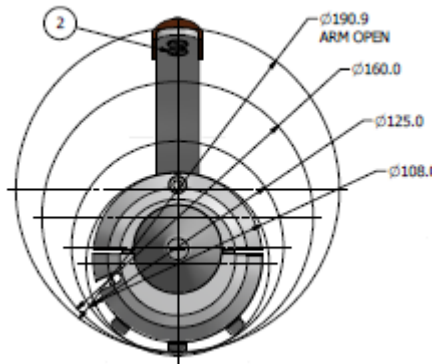


Deployment of string in the Australian outback

PSS-SBA-08- Passive Seismic Sonde



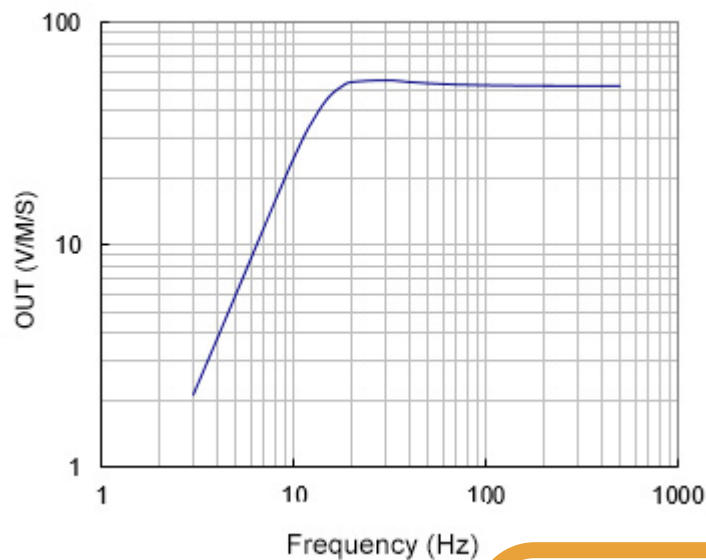
Dimensions



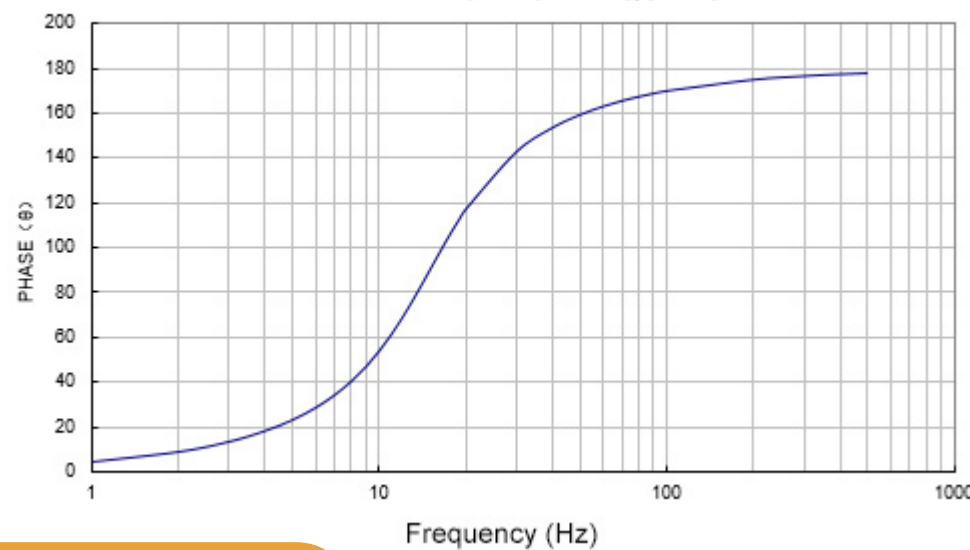
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	ACS-277	CONTACT PAD
2	2	AVF000250	M6x1 x 16 LG SLOTTED CSK SCREW A2 ST STL
3	2	AVF006349	M6x1 x 16 LG HEX SOCKET SET SCREW (CUP POINT) A2 ST STL
4	1	ACS-242	SPRING ARM
5	1	PSS-123	UPPER NODE ASSY
6	1	PSS-121	LOWER TOOL NODE
7	1	SBA-08	PSS TOOL 52mm

Single Sensor Element Response

OUT VS FREQUENCY



PHASE VS FREQUENCY

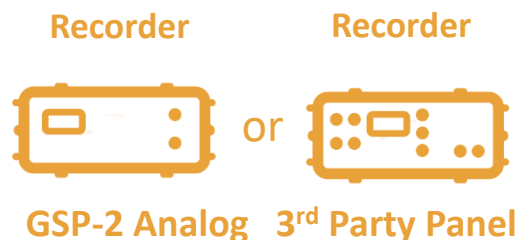


— PSO-15M1-HT-2400 (20°C)

PSS-SBA-08 Specifications

- Max number of tools:**
 - Up to 48 Analog Channels
- Max Tool OD**
 - 52mm/2.05" (No Arm) or 108mm/4 1/4" (With Arm Collar)
- Dimensions & Weight**
 - L - 596mm/23.5" D - 52mm /2.05"(No arm)
 - Weight – 5kg
- Dynamic Range:**
 - >100db
- Noise Floor:**
 - <75 nV
- Distortion:**
 - <0.2%
- Bandwidth:**
 - 4-1,600 Hz
- Sensors:**
 - HG6 4.5, 10, 14Hz (Mono Directional) geophone options 375 Ohm Z/X/Y Phone or 15Hz Omnidirectional 2400 Ohm Geophone Option.
 - Sensitivity depends on number of sensors in series per channel. Typically, ~200 V/m/s. Individual elements 52 V/m/s
- Max Temp/Pressure**
 - 120°C /248°F 20Mpa (2900 psi)
- Cable**
 - Over-moulded with strength member
- Projected lifespan:**
 - 10 years+ at 122°F (50°C)
- Control Panels:**
 - GSP-2 * or 3rd Party Analog Recorder (GSP-2 offers up to 48 analog Channels)

SURFACE PANELS





Main Features

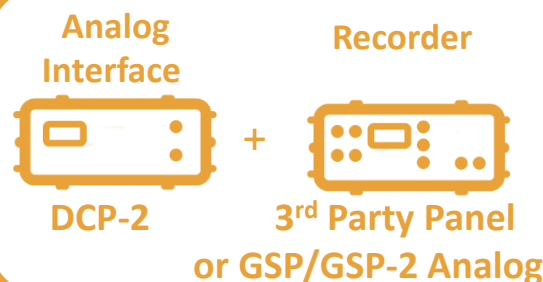
- ASR style coupling using 7-way connector
- 392°F/200°C (standard) or 464°F/240°C (UHT)
- 15,000psi pressure rating
- Omni-2400 Omni geophones
- Optimised for passive/hydraulic fracture/geothermal stimulation monitoring
- Bespoke configurations available

Functionality

- The PSS-114 Passive Seismic node is a completely passive analogue tool designed for long term downhole deployment.
- The tool uses the industry acclaimed ASR-EHT style seal arrangement to ensure long term compatibility with common borehole fluids.
- In addition, we have specialised compounds available for use in more hostile boreholes.

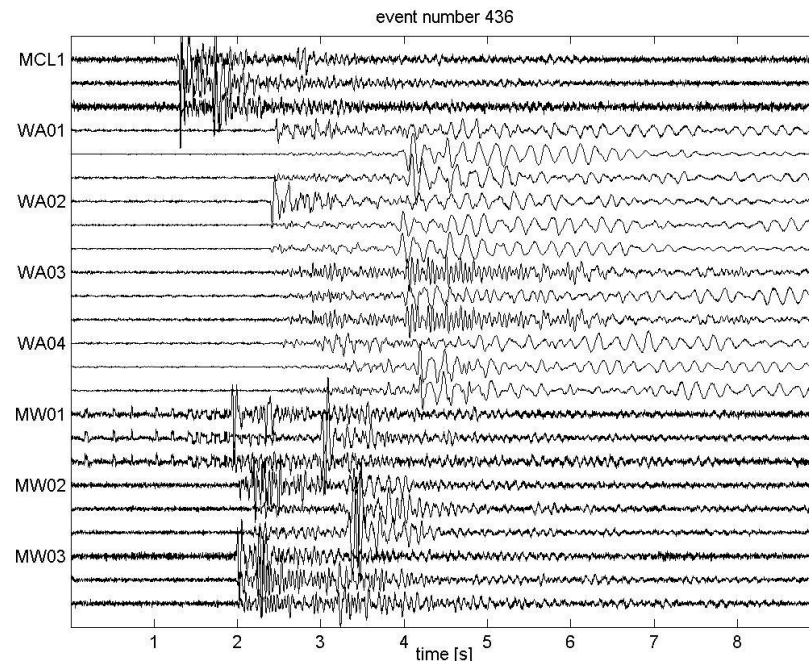
The PSS tools have been installed for continuous seismic monitoring with a range of applications. The array was recently used to successfully monitor a real time massive hydraulic fracture operation and Geothermal work.

SURFACE PANELS



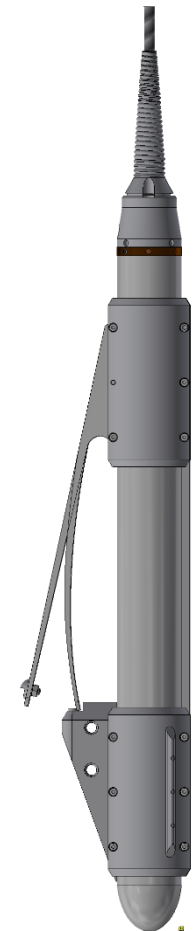
LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Two PSS tools complete with 200m cables, quick release cable clamp and T-bars in a custom transit basket.



Detected events from four PSS tools deployed in wells
PSS 114 Specifications WA01-WA04

Length	23.62" (600mm) + nose cone and cable head
Diameter	3" (76mm) – No Arm
Well ID Options for Arms*	4.75" (120mm)- 6.69" (170mm) using PSS-90 Arm 5.9" (150mm)- 8.26" (210mm) using PSS-80 Arm
Weight	44lb (20kg)
Temperature	392°F (200°C) or 464°F (240°C) option
Pressure	15,000psi (1034 bar) HP Connection
Maximum sample rate	250us
Panels	DCP & GSP/GSP-2 Analog/3 rd party recorder
Sensor	Omni 2400 Ohm (ZXY – Omni) 200/240C rated phones
Frequency Response	10-1600Hz 15Hz Resonant frequency +-3dB
Sensitivity (@20C)	52 V/m/s
Wireline	7 Conductor Heptacable. For High Temperature wells we recommend Camesa 7Q49RTZZ-EEH8 wireline.



PSS-114 TD with time delay clamp arm
Hole size 121 – 210mm (4.75" – 8.26")*
(OD 76mm no arm)

*Bespoke stand off's can be added for use in larger ID wells.



Deployment of PSS in the Australian outback

PSS 24 - Passive Seismic Sonde

Main Features

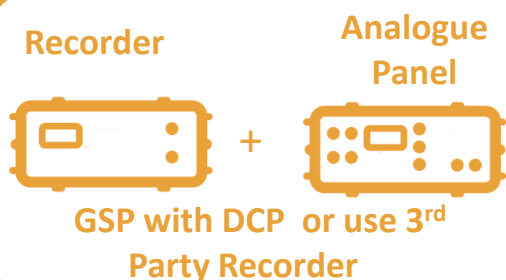
- ASR style coupling using 7 way connector
- 400°F (204°C)
- 20,000psi pressure rating
- 3 Component Geophones
- X4 SM4-3500 10Hz geophones per ZXY
- Optional time-delayed clamp arm
- Optimised for both VSP and hydraulic fracture monitoring work

Functionality

- The PSS-24 Passive Seismic Sonde is a completely passive analogue tool designed for long term downhole deployment.
- The tool uses a combination elastomer seal arrangement to ensure long term compatibility with common borehole fluids.
- The tool has access to an optional time-delayed one-shot clamp arm to allow secure coupling to the casing/formation. The tool can still be retrieved from the well even after arm deployment.

The PSS tools have been installed for continuous seismic monitoring with a range of applications. The array was recently used to successfully monitor a real time massive hydraulic fracture operation.

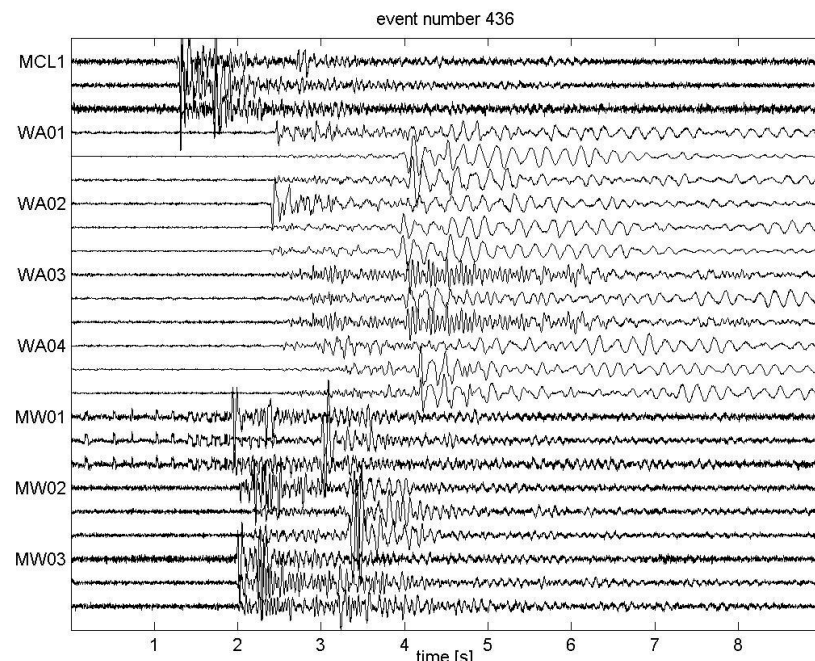
SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



PSS-24 Sonde fitted with Quad 10Hz 3C sensor and time delayed clamp arm (with removable arming jig (red))



Detected events from four PSS tools deployed in wells WA01-WA04

PSS-24 Specifications

Length	31.5" (800mm)
Diameter	3" (76mm) 6.06" 154mm with clamp arm
Weight	44lb (20kg) 25kg with clamp arm
Temperature	400°F (204°C)
Pressure	20,000psi (1400 bar) HP version
Maximum sample rate	250us
Panels	Option 1: DCP & GSP or Option 2: 3 rd party analog recorder
Frequency Response	3-1600Hz (10Hz Natural Frequency <20° from vertical)
Undamped Sensitivity	320 V/m/s (4 x 80 v/m/s elements in series) Assumes Vertical Well @20C
Wireline	7 Conductor Heptacable. Max wireline length <5000ft (assuming <50 pF/ft wireline).



Deployment of PSS in the Australian outback



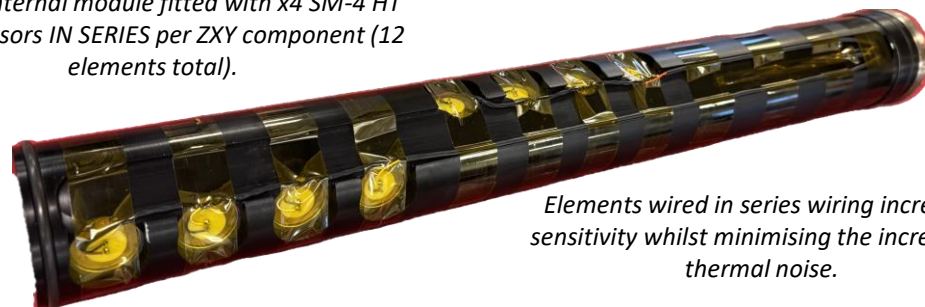
Two PSS tools complete with 200m cables, quick release cable clamp and T-bars in a custom transit basket.



Element Specification

SM4 HT 10 HZ 3500Ω Geophone	Per Element
Optimum Orientation	Dedicated to either Horizontal/Vertical
Operational Range	<20° from vertical (VZ) or in Horizontal (HX/HY)
Natural Frequency (Fn)	
Optimum Orientation	10 Hz +/- 5%
Operational Range	10 Hz - 5% to +5%
Coil Excursion P-P	
Optimum Orientation	0.2 cm
Operational Range	0.2 cm
Spurious Frequency	250 Hz
Resistance	3500Ω +/-5% per transducer (14,000 Ohm per Quad Pack ZXY channel)
Sensitivity	
At Optimum Orientation	80 V/m/s +/- 5% (320V/m/s per Quad Pack ZXY Channel)
At Operational Range	80 V/m/s -15% to +5% at 20°C
Open Circuit Damping	
Optimum orientation	0.356 +/-15%
Operational Range	0.356 -20% to +10%
Moving Coil Mass	9.6 gr
Distortion	
Optimum Orientation	<0.20%
Operational Range	<0.70%
Storage Temperature	-30°F to 140 °F (-40 to +60°C)
Operating Temperature	-22°F to 400+°F (-40 to +205°C)*
Geophone Dimensions:	
Weight	74 gr
Diameter	2.54 cm
Height	3.2 cm

PSS-24 internal module fitted with x4 SM-4 HT 10HZ sensors IN SERIES per ZXY component (12 elements total).

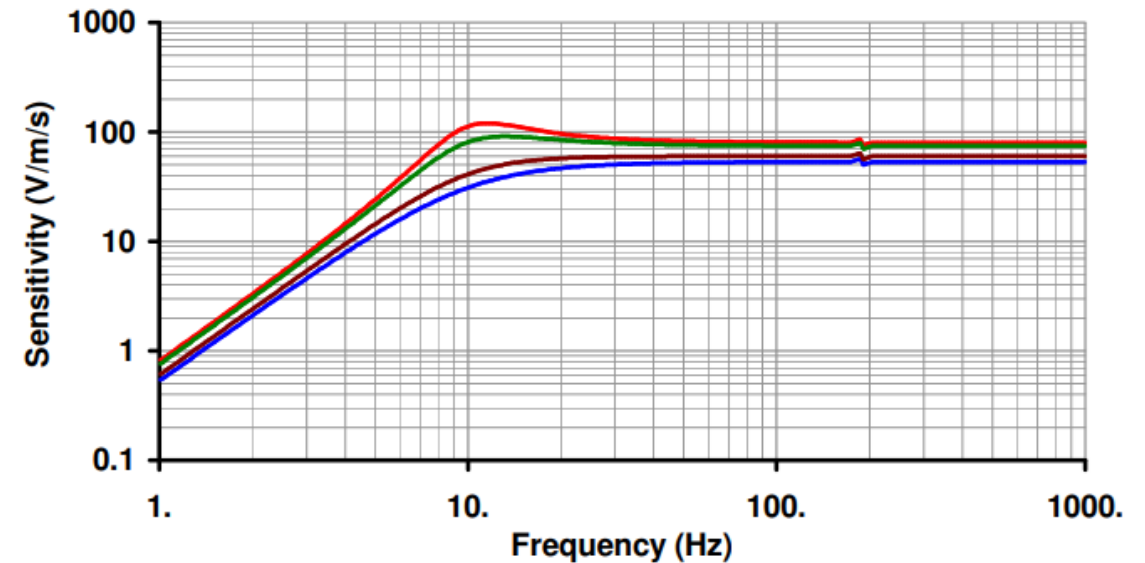


Elements wired in series wiring increases sensitivity whilst minimising the increase in thermal noise.

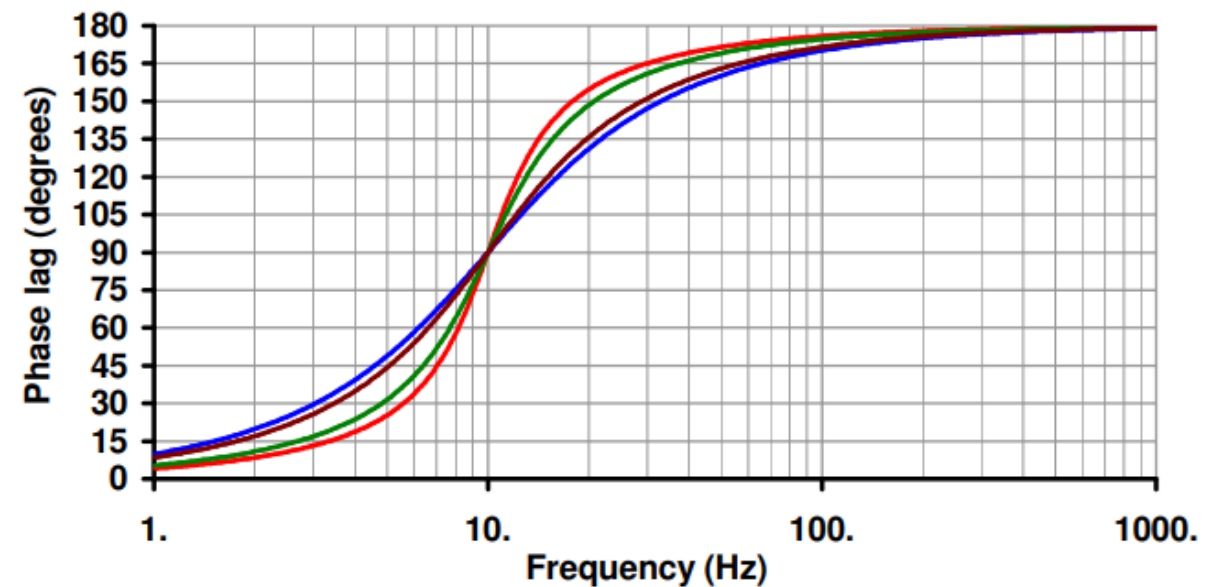
LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Geophone Response Curve Single Element (sensitivity value x4 to get in series response)

			Shunt (ohm)	Damping	Sensitivity V/m/s	
Frequency :	10.	Hz	Curve 1	O.C.	0.356	80.00
Moving Mass :	9.6	g	Curve 2	47,000	0.461	74.46
of geophones in series:	1.		Curve 3	7,000	0.861	53.33
Nr of paralel branches:	1.		Curve 4	10,600	0.732	60.14



Geophone Phase Lag (signal relative to case velocity)



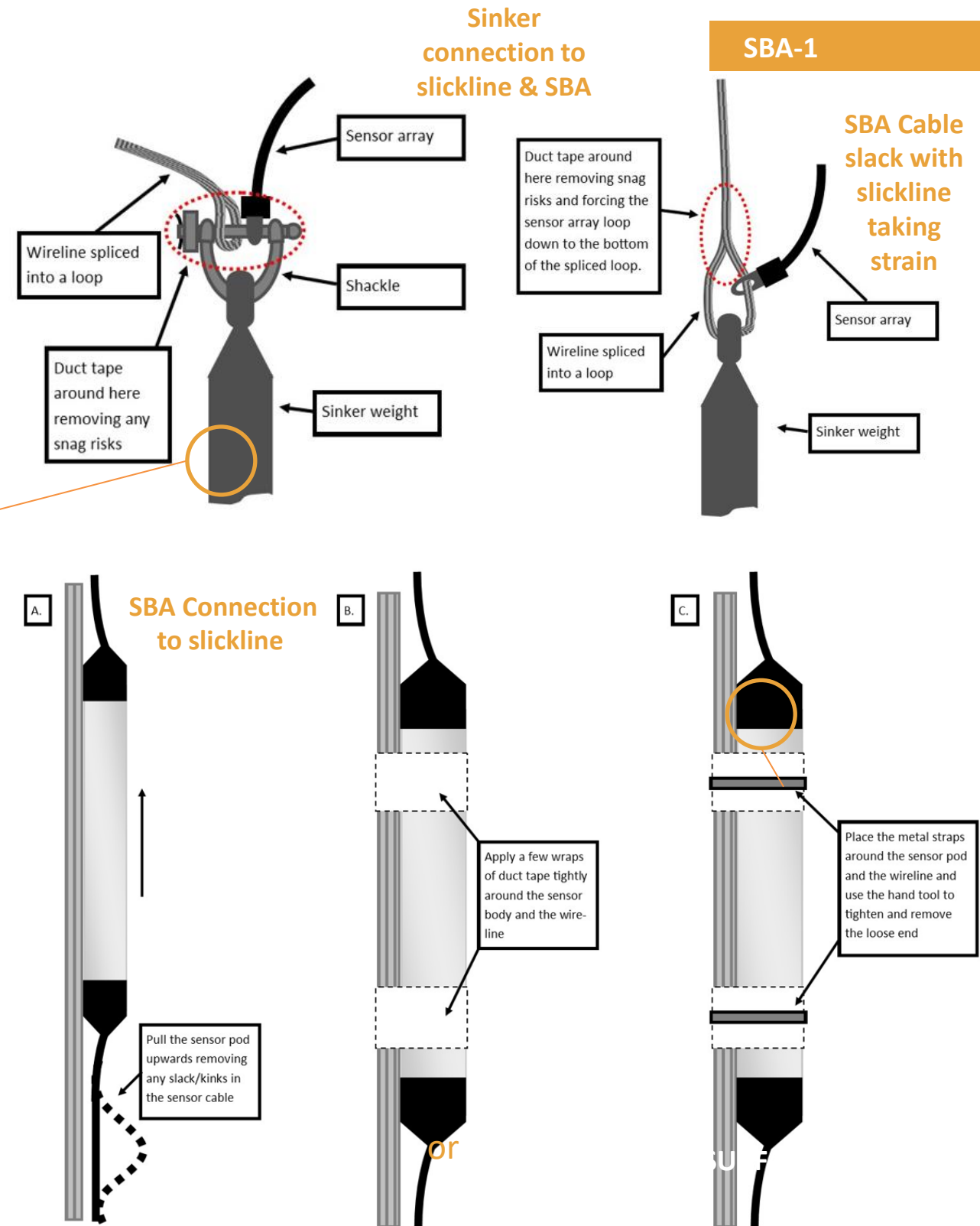
Shallow Buried Arrays (SBA)

Part 1 - Coupling SBA to Slickline/Tubing/Drill pipe

- Deployment typically involves slickline wireline installation, with a cement/glass bead coupling medium.
- Analog cabling coupled to the wireline/slick-line/tubing with the sensors pods located within individual pressure housings can be achieved by using the steps below.
- Parts used: Parts used:
 - 7.6mm x 200m plastic cable ties
 - Stainless Steel Cable Tie Gun,
 - 4.5 x 250mm Stainless Steel Cable Ties
 - Slickline/wireline with sinker weight
- 1. Deploy wireline with sinker or tubing
- 2. Align sensor to cable allowing some slack on sensor cable (Picture A). Attach the first Sonde to the wireline/tubing using duct tape at the top, Centre and bottom of the Sonde (Picture B)
- 3. Using metal cable ties attach over the duct tape and tighten with the appropriate cable tie gun (C).
- 4. Attach plastic cable ties evenly around SBA inter-tool cable and wireline/tubing evenly spaced about every 2-3 meters between the Sonde
- 5. Repeat until deployed
- 6. During deployment ensure that the tubing/wireline is taking the lift strain and not the SBA inter-tool cable.
- The SBA can also be provided with an **optional patented delayed clamp arm** to provide borehole coupling. The mechanism uses no electronics and still allows for tool retrieval for semi-permanent applications.

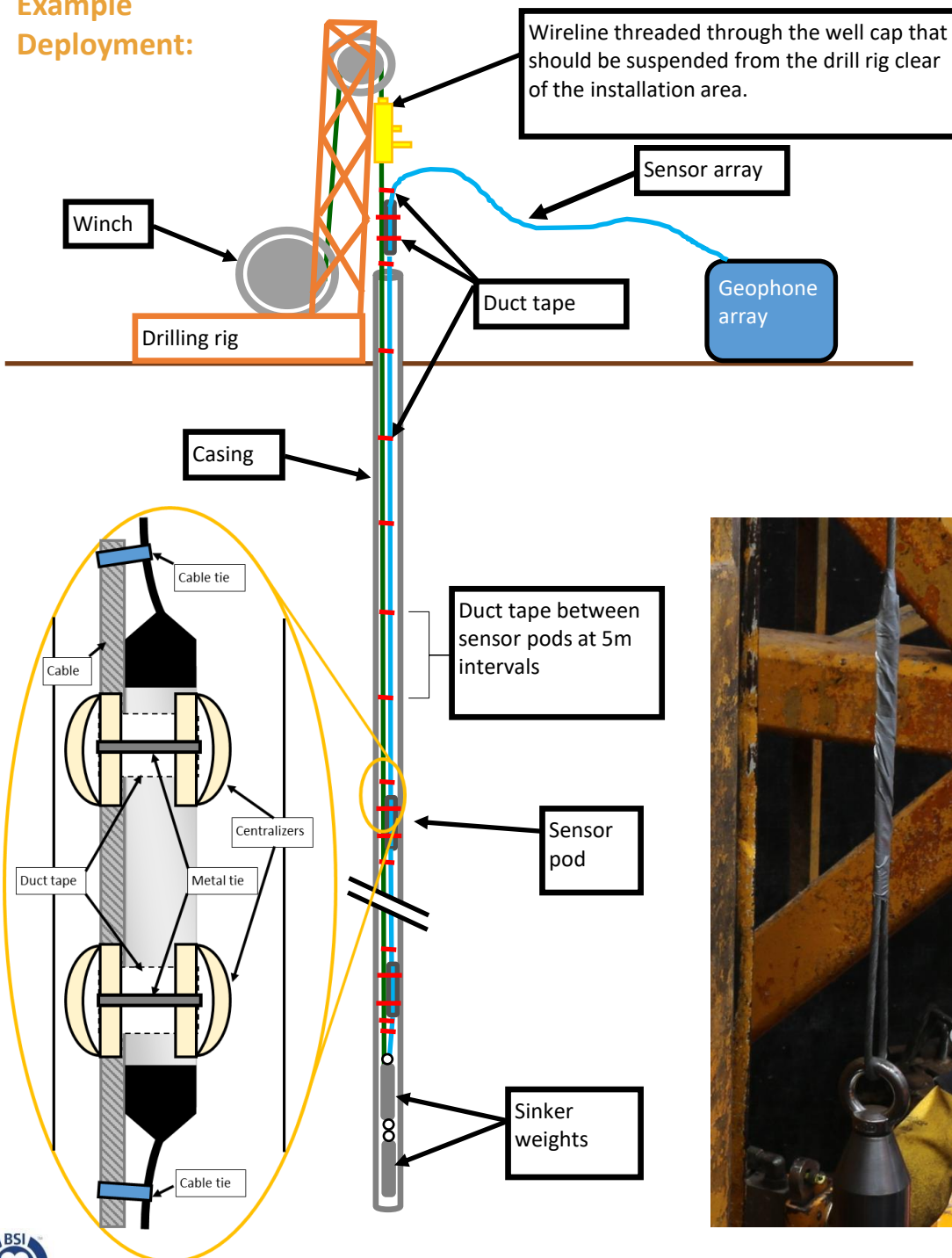


LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Part 2 – Lowering SBA coupled to slickline in well

Example Deployment:

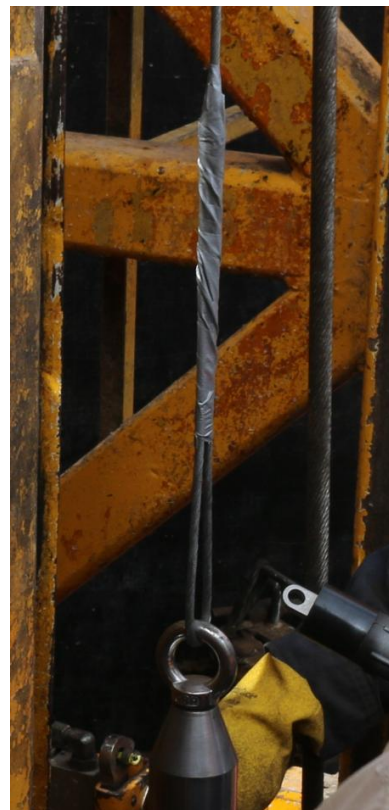


LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

SBA/PSS

- The geophone array should be manually fed into the bore-hole with periodic strapping to the cable.
- Great care should be taken during this process not to damage or stress the geophone array cable. Good winch control and communication will be necessary for this.
- The sinker weight will be lowered into the hole first, it will be connected using 3 part shackles to the cable and to the geophone array. The shackles should be taped up to reduce the risk of snagging in the hole. As the weight moves into the hole the first geophone pod will be strapped to the cable using a cable tie immediately above and below the pod on just the two cables, tape will then be strapped around the pod and cable before the centralisers are placed over the top and secured using metal strapping.
- In between the pods the cable ties will be placed around both the geophone cable and the winch cable at intervals of roughly 10 metres. This can be dictated by the winch operator.
- It is important to maintain some tension on the geophone array to reduce the risk of slippage and birds nesting.

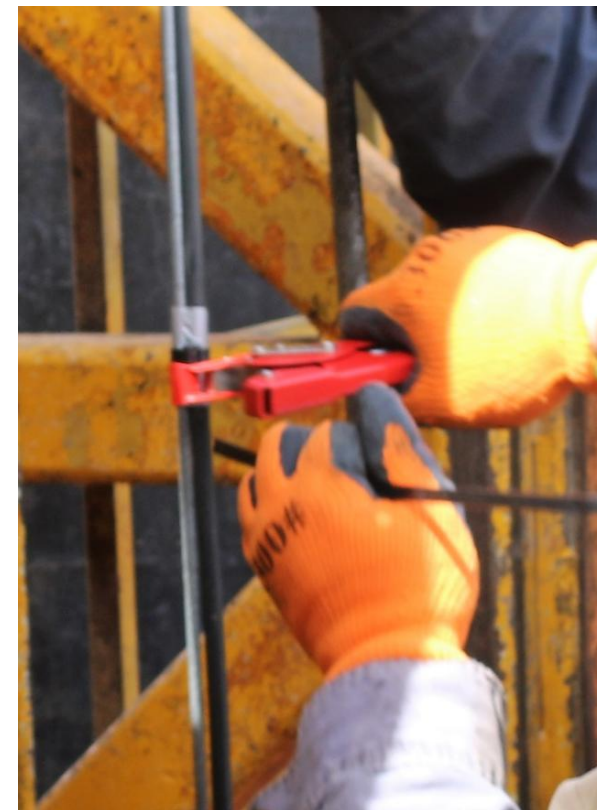
Left:
Example of
sinker
connection
to slick line

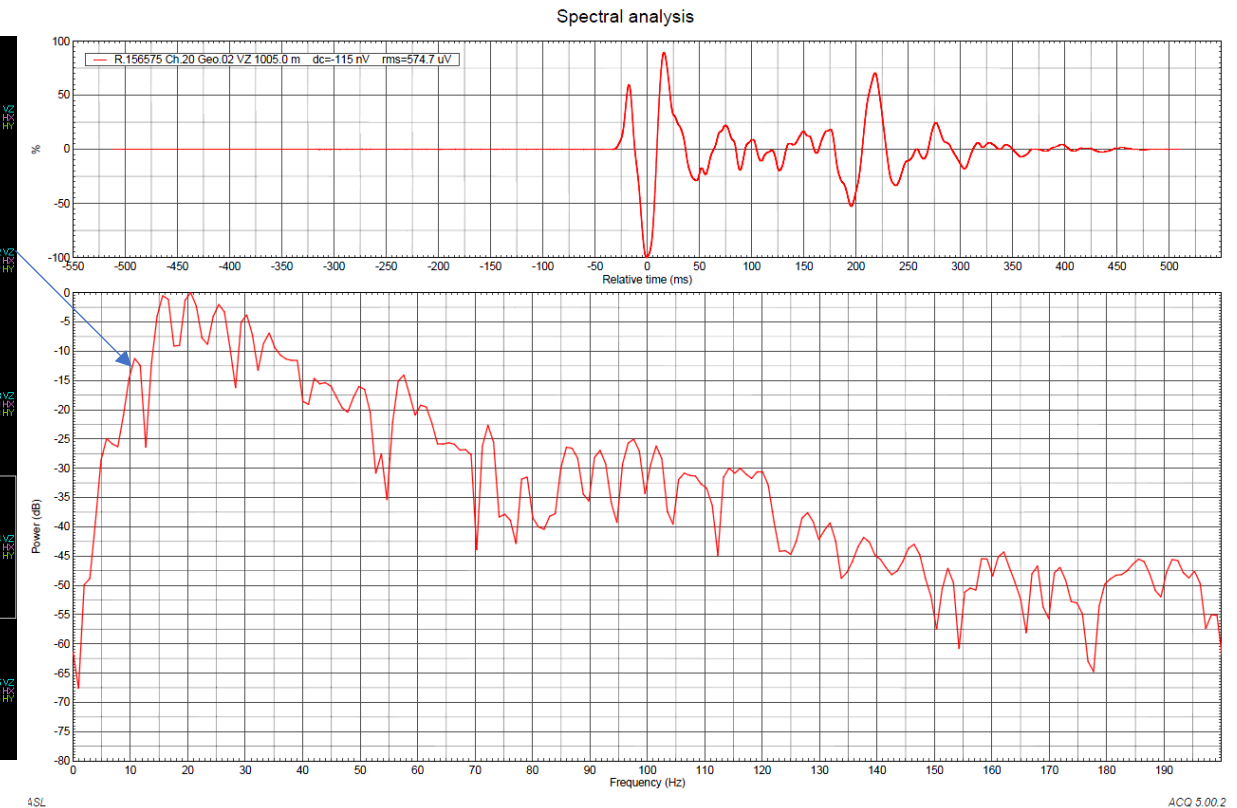
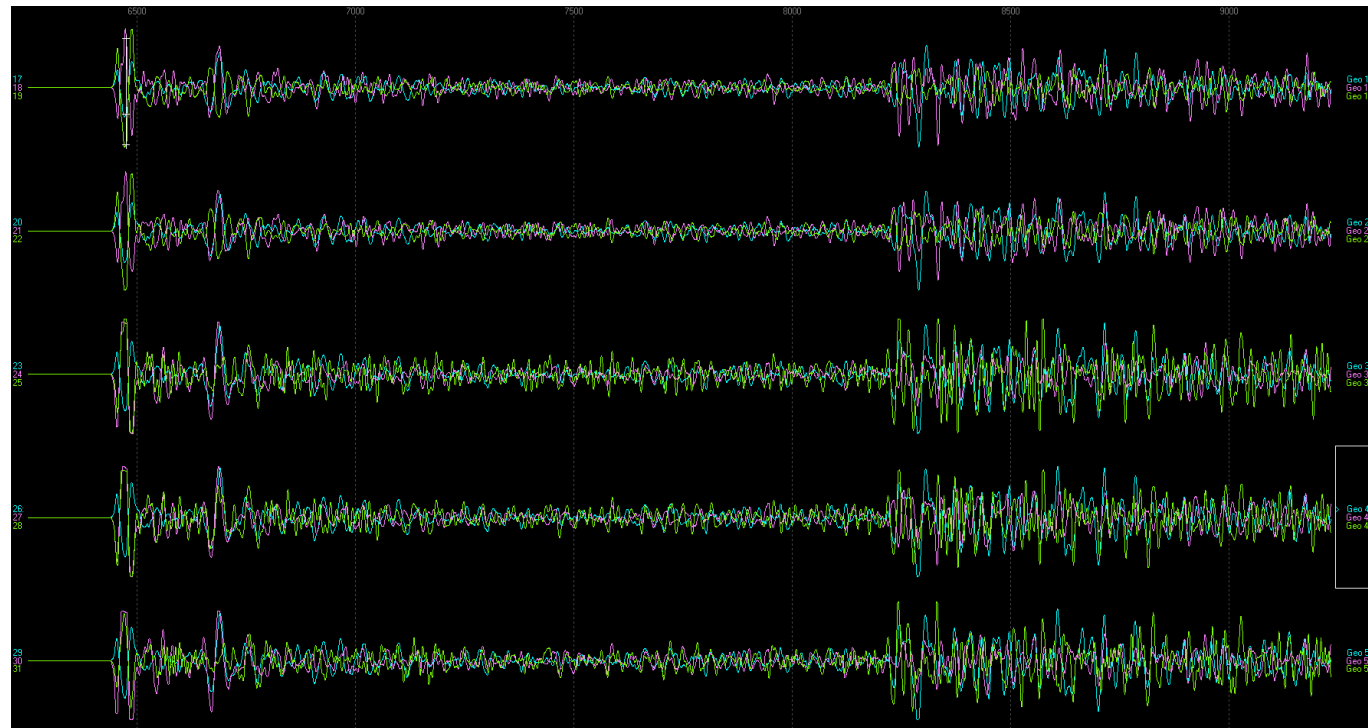


Right: SBA
Geophone
being
attached to
wireline.
Metal
straps
being
attached.



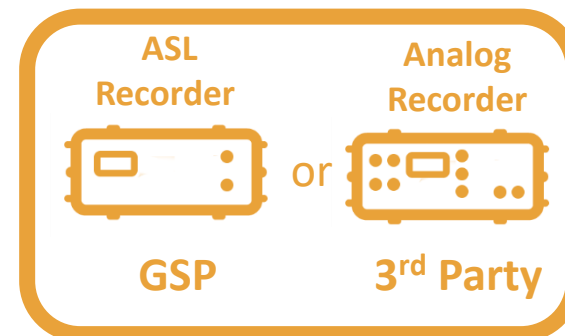
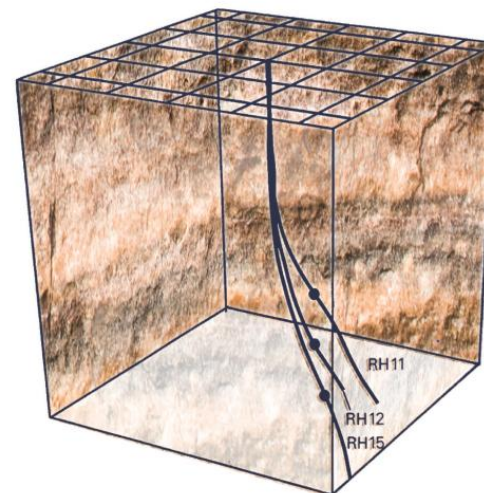
Right:
Application of
tape and cable
ties to attach
SBA cable to
tensioned slick
line. In this
example every
10m





uSeismic Data - Passive Gapless. Helston Seismicity from Rosemanowes well passive monitoring. Tools at ~1000m MD. Five level string, time domain plot.

Frequency domain response plot for tool 2 VZ vertical component



SURFACE PANELS



Borehole Optical Seismic System

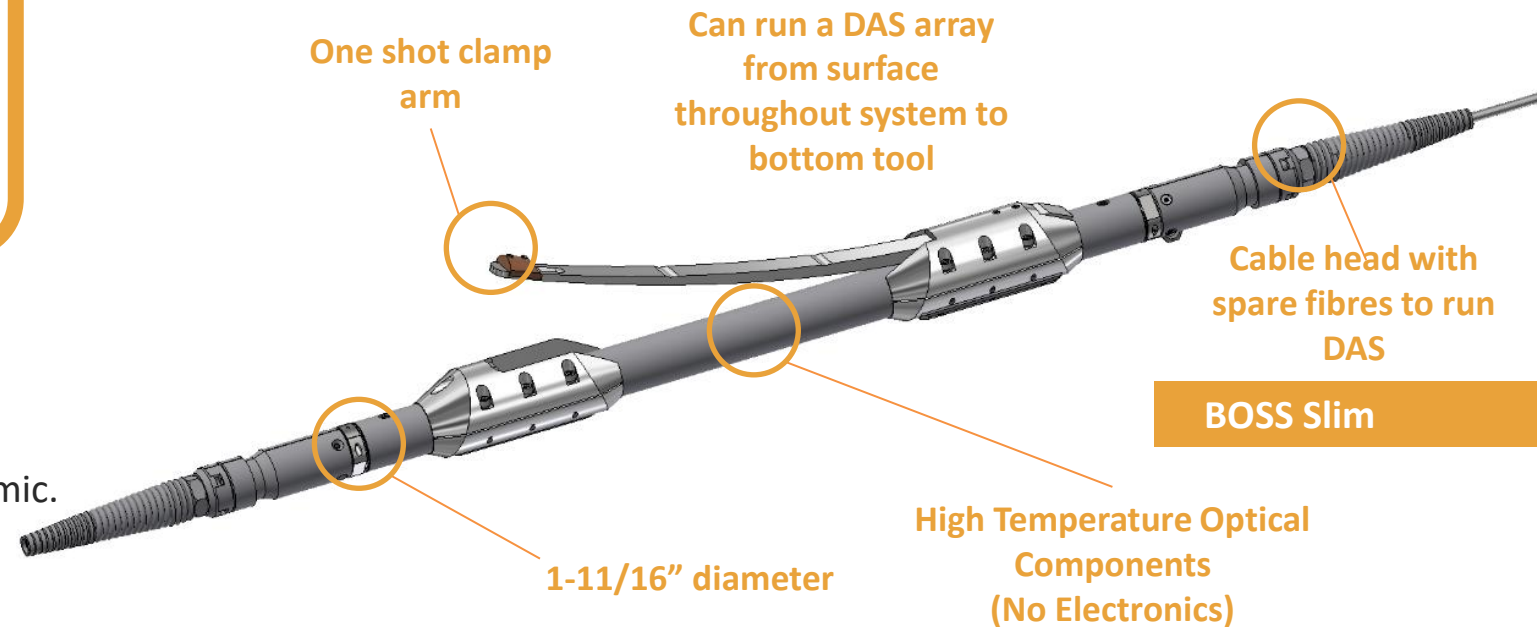
Main Features

- No Downhole Electronics.
- Passive Fibreoptic Borehole System.
- 260°C (500°F) Operation.
- 20,000 psi (1400 bar) Pressure Rated.
- Compatible with DAS from surface to deepest 3C receiver.
- High Sensitivity and recording bandwidth ideal for microseismic.
- Low Noise.
- Fibre optic/Geochain™ Hybrid variants available.

Details

- BOSS™ is an innovation for Avalon Sciences. The system is entirely passive downhole with sophisticated electronics remaining at the surface in a controlled environment.
- The high continuous operational temperature rating (260°C (500°F)) and solid mechanical coupling system will deliver a long term deployment solution, ideal for deep-well subsalt 4D VSP and high resolution fracture monitoring surveys.
- The array utilises 3 component optical omni-directional geophones especially developed by Avalon to cope with hostile deep well conditions. These broadband sensors are low noise, extremely sensitive and will work in any orientation from vertical through to horizontal. A DAS component scan also be run from surface down to the top receiver and then throughout the 3C satellites and connecting cables down to the bottom receiver.
- The system is fully expandable from a small microseismic 5 level system up to 100 stations for large 3D VSPs. The fibreoptic system is ideal for permanent deployment due to metal to metal C-rings throughout and can be considered for life-of field installations.
- The stations can be deployed on jointed or coiled tubing as standard or with optical wireline. The array can be spaced at just a few meters or at several hundred meters for total well coverage.

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



• BOSS Specifications

• Max number of tools:	• Optical Architecture allows up to 100 satellites
• Dynamic Range:	• >100db
• Noise Floor:	• <50 ng/VHz
• Distortion:	• <0.01%
• Bandwidth:	• 1-1200 Hz
• Sensors:	• Omni Directional Fibreoptic Accelerometer
• Max Temp:	• 260°C (500°F) Design lifespan 20+ years @ 200°C
• Max Pressure:	• 20,000 psi (1400 bar)
• Wireline:	• Optical or Hybridized Optical/Electronic Wireline
• Control Panels:	• BOSS Interrogator
• BOSS Tool Dimensions (No arm)	• 905mm/35.6" (L) 43mm/ 1 11/16" (W)
• BOSS Tool Weight (No Arm)	• 6.14 kg / 13.5 lbs
• Passive Arm Specs	• Suitable for wells up to • Locking Force of up to 130kg

**Fibreoptic
Interrogator**



SURFACE PANELS



GeoDAS – Combined Geochain-Distributed Acoustic Sensors



Main Features

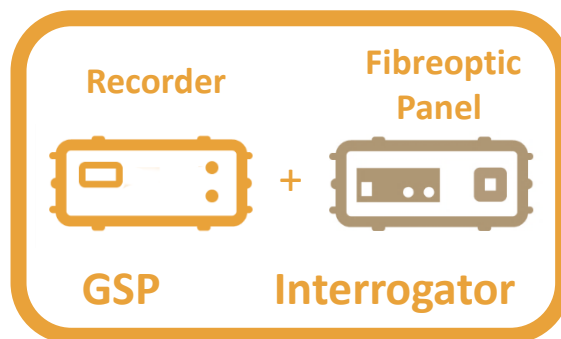
- Combined 7-conductor/fibre wireline enabling DAS from surface down to top 3-C Geochain™ receiver
- Expands VSP 3-dimensional aperture without compromising depth calibration and resolution
- Retrievable system for short term or semi/permanent operation
- Compatible with existing Geochain downhole tools
- Reduced rig time for instant full well check shot
- Migrate large offset VSP multiples for 3D VSP imaging

Functionality

- GeoDAS is the next evolutionary application for the versatile Geochain™ borehole seismic system.
- When deployed using a combined fibre/conductor wireline, the Geochain-DAS establishes a complete VSP digital seismic solution offering total well coverage from surface without the conventional standalone DAS attributed uncertainties of depth calibration, directionality and noise.
- The system is made up of individual satellites of our tried and tested 3-C ASR/GSR borehole geophones arranged below the DAS integrated wireline. The GeoDAS arrangement has already been deployed commercially in the Gulf of Mexico to acquire full 3DVSP well coverage with minimal rig time.

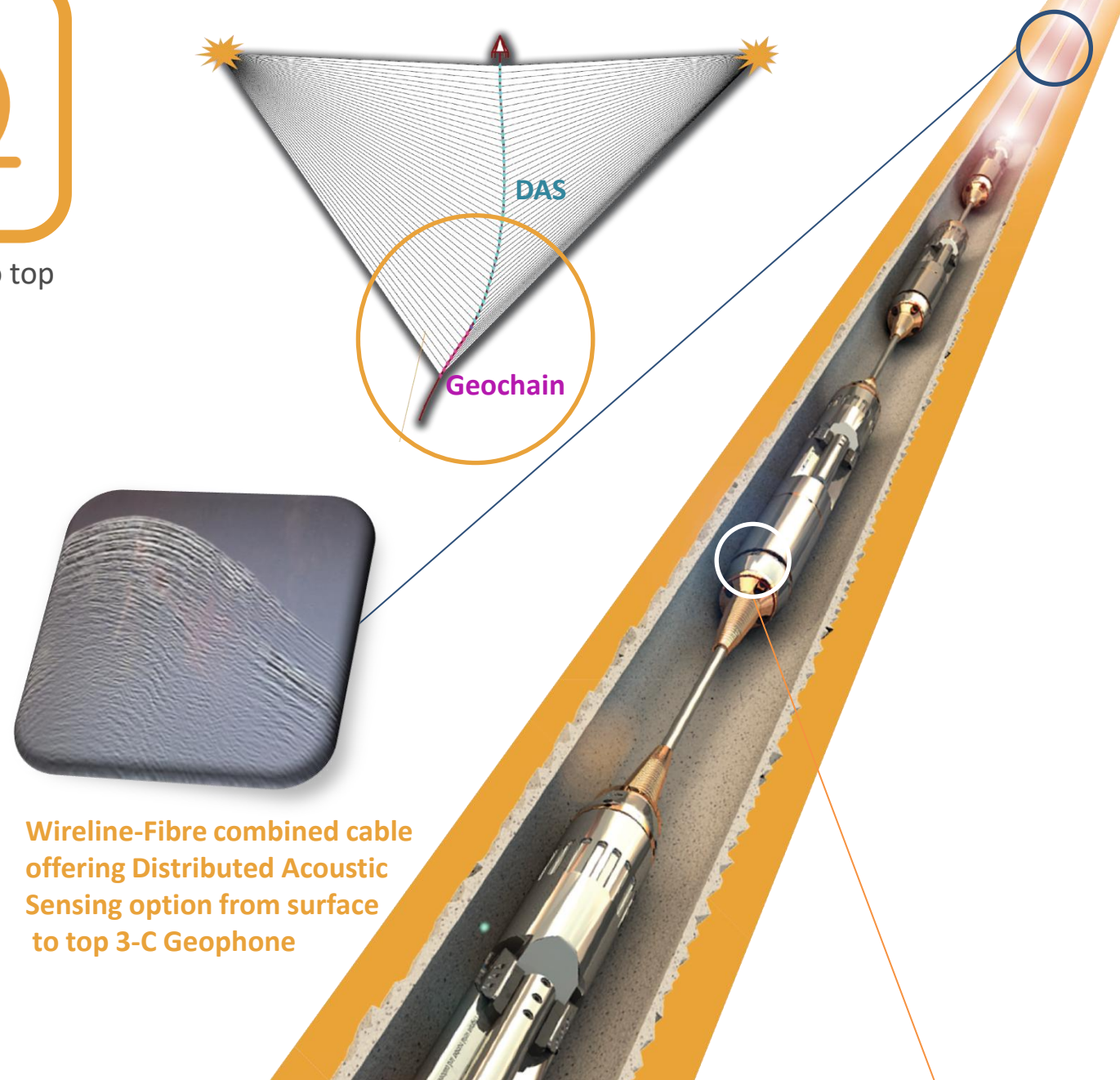
GeoDAS Specifications

- | | |
|-------------------------------|-------------------------------|
| • Max number of tools: | • 62 3C Tools below DAS Array |
| • DAS Cable Length: | • >10km |
| • Gauge Length | • 1-10m |
| • Max Bandwidth: | • 1-1,600 Hz |
| • Max Temp: | • 195°C |
| • Max Pressure: | • 35,000 psi |
| • Control Panels: | • GSP & Interrogator |



SURFACE PANELS

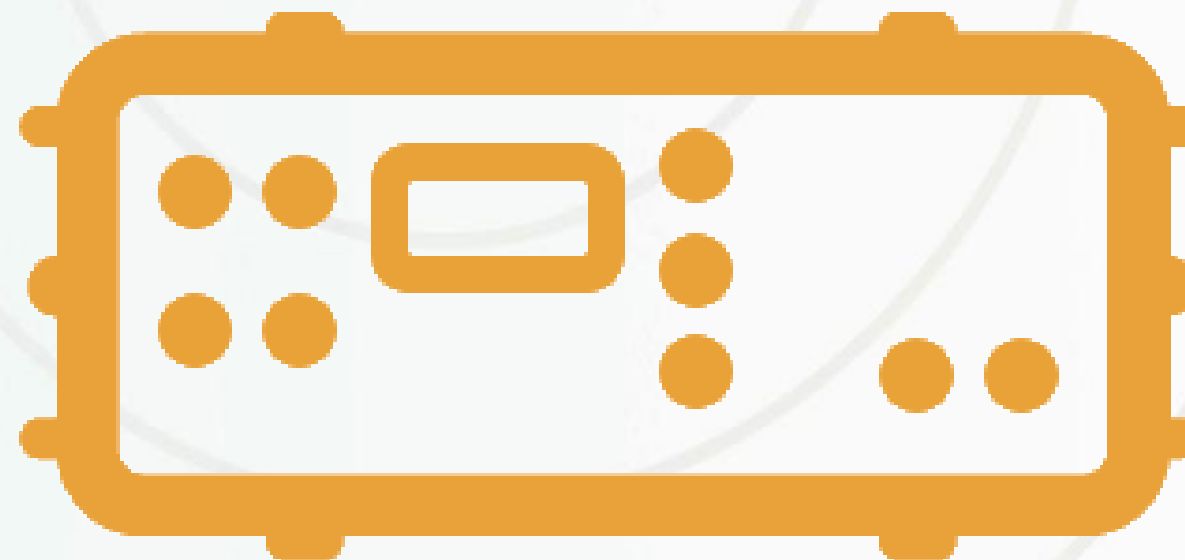
LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Wireline-Fibre combined cable offering Distributed Acoustic Sensing option from surface to top 3-C Geophone



Geochain™ 3-C X-Series 195°C-rated borehole seismic receiver system with inbuilt high side indicator deployed in lower/ lateral well section below DAS wireline cable.



Surface Panels

GSP-1 – Geochain System Panel

Main Features

- Surface Recorder and PC interface.
- Up to 16 analogue channels.
- 24 bit delta sigma convertors.
- Built in firing circuit.
- Optional GPS time stamp.
- Full instrument tests function.
- USB interface.
- Use standard PC running ACQ software.

Functionality

- This surface recording panel can have a maximum of sixteen analogue seismic channels along with the standard digital input section. The panel can therefore be used with any analogue borehole seismic tools or with our latest Geochain™ digital string.
- **Firing Circuit (FC)** allows GSP to trigger a single air gun without any additional equipment.
- **GSPIO** module includes: external source control interface, power control circuitry and controls the FC.
- **Dual seismic interface (DSI)** allows between 2-16 Analogue channels.
- **CPU2** offers both a GPS time stamp and depth encoded interface.
- **Test signal generator (TSG)** able to generate either precision sine wave signals or single sample impulses.

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



GSP-1 General

Airgun firing pulse:	Isolated 60V, 30ms pulse
Source control outputs:	4, opto-isolated
Timebreak inputs:	3, opto-isolated
Remote start inputs:	1, opto-isolated
Test system:	Fully automatic with comprehensive report generation
PC Interface:	USB
Power requirements:	95-260V ac. 50/60 Hz universal input, 50 watts
Enclosure:	Standard 19" rack mounting

GSP-1 Digital section

Interface:	RS422 (As 2065 DIF module option)
Cable equalisation:	Fully automatic using internal DSP chip
Format:	Software configured to match system

GSP-1 Analogue section

No. of channels:	2-16
Sample intervals:	0.25, 0.5, 1.0, 1.25, 2.0, 2.5, 4.0ms
A/D convertor:	24 bit Delta-Sigma
Dynamic Range:	<112dB @ 0dB pre-gain (minimum)
Distortion:	<0.01% (0.003% typical) @31.25 Hz, 15V pp signal
Noise:	<10uV rms @ 1ms, 0dB pre-gain
Input:	Differential, 20V pp max
Inter-channel skew:	Zero
Timing Accuracy:	10ppm

Control Panel for



GSP-1 – Geochain System Panel

Main Features

- Surface Recorder and PC interface.
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LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



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Cable equalisation:	Fully automatic using internal DSP chip
Format:	Software configured to match system

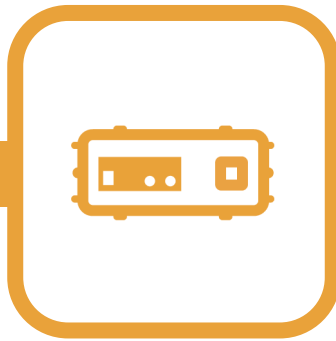
GSP-1 Analogue section

No. of channels:	2-16
Sample intervals:	0.25, 0.5, 1.0, 1.25, 2.0, 2.5, 4.0ms
A/D convertor:	24 bit Delta-Sigma
Dynamic Range:	<112dB @ 0dB pre-gain (minimum)
Distortion:	<0.01% (0.003% typical) @31.25 Hz, 15V pp signal
Noise:	<10uV rms @ 1ms, 0dB pre-gain
Input:	Differential, 20V pp max
Inter-channel skew:	Zero
Timing Accuracy:	10ppm

Control Panel for



GPP Geochain Power Panel



Main Features

- Enables DC Power and AC data transmission over same wireline.
- Operates from all standard mains power supply.
- Interface directly with GSP-1.
- Operates with all digital Geochain™/Slim™/EHP systems.
- In built safety protection.

Functionality

- The digital Geochain™ product ranges are all supplied operating current at surface via a Geochain Power Panel (GPP) which features a Wireline Interface Box (WIB) enabling both DC power and AC data to be transmitted over same wireline cable.
- The GPP has inbuilt safety features to maximise user protection during Geochain operation.
- The GPP unit also incorporates the WIB (Wireline Interface Box). The WIB contains transformers to enable both DC power and AC data to be transmitted over the same wireline cable. Note that the early GPPs do not have an integrated WIB, but instead may connect to a separate WIB via a short interface cable.

Power Panel for



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



GPP-1 Specifications

Electrical

Output Voltage:	0 – 600 Vdc
Output Current:	0 – 1.7 A
Output Power:	1020 W
Rated AC Input Voltage:	100/120/200/220/230/240 Vac (nominal)
	Derate maximum output power to 900 W for AC input less than 95 V.

Maximum Input Power:	1250 VA
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Maximum Input Current:	13 A maximum at 100 Vac, 11 A max at 120 Vac, 6 A maximum at 220 Vac
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Input Frequency Range:	47-63 Hz
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Power Factor:	0.99 minimum for full load and 120 Vac input
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Input Harmonic Distortion:	EN61000-3-2 compliant
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Switching Frequency:	62.5 KHz nominal (125 KHz output ripple)
-----------------------------	--

Isolation Voltage:	Input to output: 1350 Vac
---------------------------	---------------------------

Efficiency:	85%, full power at 115 Vac input
--------------------	----------------------------------

Operating Temp Range:	32 to 104°F (0 to 40°C)
------------------------------	-------------------------

Storage Temperature Range:	-40° to 140°F (-40° to 60°C)
-----------------------------------	------------------------------

Humidity Range:	10% to 80% RH, non-condensing
------------------------	-------------------------------

Physical

Format:	19" rack mountable case
----------------	-------------------------

Width:	450 mm (480mm inc. ears)
---------------	--------------------------

Height:	4U (180 mm)
----------------	-------------

Depth:	385 mm behind mount ears plus 45 mm in front of ears
---------------	--

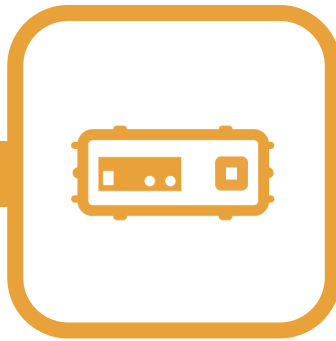
Weight:	25lbs (11.5 Kg)
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AC Input Connector Type:	IEC320
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Fuses:	20 A, 250 V, 5 x 20 mm slow
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Cooling:	Fan cooled. Air exhausts at right hand side, front and rear. Over-temperature shutdown
-----------------	--

GMP - Geochain Monitor Panel



Main Features

- The GMP is the latest surface panel which controls power supply for a Geochain System
- Single and Dual power supply options.
- The GMP can accommodate two power supplies, necessary for very long Geochain systems.
- The GMP monitors the current balance in both the MTX (downlink) conductors and LRX (uplink) conductors
- Inbuilt wireline simulator
- In built safety features

Functionality

- The new Geochain Monitor Panel (GMP) combines the full functionality and safety features of its predecessor (GPP) with an integrated wireline interface box, wireline simulator and monitor viewer to fully QC the wireline performance.
- The GMP uses one or two of the new Glassman LPC600 supplies. They are more compact than the old units and offer much better noise performance.
- The unit can be configured for 4 or 6 wire telemetry and single or dual Glassman supplies (longer string operation). It offers a considerable cost saving in comparison to purchasing the four old panels.

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



GMP Specifications

Electrical

Power Supply	X1 (Single) or x2 (Dual) Glassman LPC600-1.4
Output Voltage:	600V
Output Current:	1.42A
Output Power:	850 W
Rated AC Input Voltage:	90-240 Vac (nominal)
Input Harmonic Distortion:	EN61000-3-2 compliant
Efficiency:	

Operating Temp Range:	32 to 104°F (0 to 40°C)
Storage Temperature Range:	-20° to 140°F (-20° to 60°C)
Humidity Range:	30% to 90% RH, non-condensing

Physical

Format:	19" rack mountable case
Width:	450 mm (480mm inc. ears)
Height:	4U (180 mm)
Depth:	385 mm behind mount ears plus 45 mm in front of ears
Weight:	27kg
AC Input Connector Type:	IEC320
Fuses:	20 A, 250 V, 5 x 20 mm slow

Power Panel for



GEO
Geochain Digital



SLIM
GeochainSlim Digital



EHP
Geochain EHP Digital



GRT-2, GRT-5



Permaseis



AST

DCP Dual Control Panel



Main Features

- Control of up to 2 Analogue Geochain/Slim/EHP/EHT downhole receivers.
- Very simple operation.
- Responsive 6 channel noise display and alarmed motion sensor function.
- Can be controlled via ACQ software when interfaced with GSP-1 panel.
- Modular and rugged construction.
- 4U air-flow case provides much better cooling.
- Accepts mains 110 or 230V ac at 50/60Hz.
- Also accepts 12Vdc power.
- Allows for ancillary use of line 7 for gamma logging tools.
- Maximum cable length increased to over 50,000ft.
- Partial arm closure.
- Muting for channels 4-6 in single-tool mode.
- Reduced DHCC supply in single-tool mode.

Functionality

- A low noise universal power supply and arm control panel used to operate up to 2 ASR -1 downhole receivers in analogue mode, including the Extra High Temperature ASR-1 EHT (up to 225°C Rated), GSR-1 and ASR-EHP sondes.
- The DCP-2 provides a low-noise negative constant-current power supply to drive the downhole amplifiers. The 96V compliance voltage allows a maximum wireline resistance (conductor 7) of at least 500 ohms.

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



DCP-2 Specifications

Maximum Input Power:	1250 VA
Maximum Input Current:	13 A maximum at 100 Vac, 11 A max at 120 Vac, 6 A maximum at 220 Vac
Operating Temp Range:	32-104°F (0-40°C)
Storage Temperature Range:	-40 to 60 degrees Centigrade
Humidity Range:	10% to 80% RH, non-condensing

Physical

Format:	19" rack mountable case
Width:	450 mm (480mm inc. ears)
Height:	4U (180 mm)
Depth:	385 mm behind mount ears plus 45 mm in front of ears
Weight:	32.2 lbs (14.6 Kg)
Cooling:	Fan cooled. Air exhausts at right hand side, front and rear. Over-temperature shutdown

Compatible with



GEO

Geochain Analogue



SLIM

GeochainSlim Analogue



EHP

Geochain EHP Analogue



GRT-2, GRT-3



Permaseis



GSP-1

GTB - Geochain Test Box

Main Features

- Geochain Simulation Box
- Provides quick and easy setup of large tool strings
- Assists with software and hardware fault diagnosis
- Can test real tools/modules connected to box to check functionality
- Inbuilt tool simulator for up to 62 Tools
- Inbuilt real X-ASR* digitiser
- Inbuilt real X-TAS*
- Inbuilt DFU*
- Inbuilt VRS*
- Works with standard Avalon ACQ acquisition software and GSP/GMP/GPP panels.

Functionality

- The box enables the virtual configuration of an 'n' level Geochain string.
- The box can be utilised for testing and fault finding any element of the string in a modular fashion; ASR/GSR, TAS, DFU & VRS without the requirement to source all usual downhole equipment to set up a complete system.
- The GTB or 'Geobox' comprises all the electronic modules in a standard Geochain mounted on Eurocard in a backplane.
- The modules mounted on can be bypassed using standard Geochain connectors allowing testing of existing Geochain components with a 'Control' system.
- USB interface module for interrogation of internal modules.

*GTB electronics suitable only for surface use

Power Panel for



GEO
Geochain Digital



SLIM
GeochainSlim



EHP
Geochain EHP

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Tool Sim for up to 64 Tools

Integrated DFU

Integrated VRS

Integrated ASR 272 Digitiser

Integrated XTAS



GTB Specifications

Internal Geochain Modules	AS282 XTAS
	AS1086 TAS TxFM
	AS283 XDFU
	AS272 XASR
	AS272 TSIM
	VRS
	AS1087 USB interface module

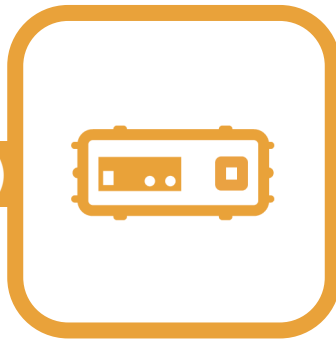
Electrical

Power Supply	External (USB 5V or GMP/GPP surface panel)
Operating Temp Range:	32 to 104°F (0 to 40°C)
Storage Temperature Range:	-20° to 140°F (-20° to 60°C)
Humidity Range:	30% to 90% RH, non-condensing

Physical

Format:	19" rack mountable case
Width:	450 mm (480mm inc. ears)
Height:	4U (180 mm)
Depth:	385 mm behind mount ears plus 45 mm in front of ears
Weight:	12kg

BSP – BOSS™ Surface Panel ('Excalibur' Version)



Main Features

- Surface Recorder and PC interface for BOSS™ system.
- Up to 288 optical channels (96 x 3 - Z/X/Y).
- 250us sample interval.
- In built GPS.
- Full instrument test function.
- USB interface.
- Integrated Windows PC and QC software.
- Real time (time domain) displays of all ZXY downhole optical channels.
- QC tools (pick, frequency domain, spectral plot).
- MIRF Export compatible for viewing in ACQ software (also supplied) for advanced QC utilities.



BSP Specifications

Electrical

Power Requirements 95-260V ac. 50/60 Hz universal input, 50 watts

Rated AC Input Voltage: 90-240 Vac (nominal)

Input Harmonic Distortion: EN61000-3-2 compliant

Power Consumption: < 1 kW

Operating Temp Range: 32 to 104°F (0 to 40°C)

Storage Temperature Range: -20° to 140°F (-20° to 60°C)

Humidity Range: 30% to 90% RH, non-condensing

Physical

Format: 19" rack mountable case

Width: 450 mm (480mm inc. ears)

Height: 4U (180 mm)

Depth: 385 mm behind mount ears plus 45 mm in front of ears

Weight: 27kg

AC Input Connector Type: IEC320

OPTICAL

Laser Hazard Class 3B

Fibre type Single Mode

No. Optical Channels 288 (3 x 96 channels)

PERFORMANCE

Measured Parameter Strain / s²

Measurement Distortion (THD) (%) <0.1%

Frequency Response (Hz) 0.5-1kHz

Sensitivity (dB re 1 rad VHz) <-63 @ 3.7km

OUTPUT

Output sample rate (Hz) 4000 (0.25 ms sample interval)

Recording Continuous

Max on-board Storage (TB) 1

Time Stamp GPS clocked

Output format HDF5 (with MIRF Export option)

Display Real time/amplitude seismic trace display

Functionality

- BOSS™ is an innovation for Avalon Sciences. The system is entirely passive downhole with sophisticated electronics remaining at the surface in a controlled environment.
- The BOSS™ Surface Panel provides the recording interface for the downhole 3C optical array. The panel has an integrated PC, GPS and display for accurate time locked records.
- Each panel comes with recording software and can output files compatible with our industry leading 'ACQ' QC software.



BOSS™ Optical



Software



Main Features

- Easy use.
- PC Control, diagnostics and acquisition of all ASL downhole receivers and logging tools.
- VSP and Passive Monitoring Operation.
- Configurable multiple source location and survey design with automated report generation.
- Dynamic Pick and Stack parameters.
- Record replay.
- Flexible trace display.
- Comparative Spectral Analysis.
- 3 Component Hodogram.
- Raw/Stack plotting.
- Depth Profile Display.
- Automated job journal.
- Simulator Mode for training.
- Tool High Side Indicator readout and QC (Xseries downhole electronics)

Functionality

- The Avalon Software Suite is a generic VSP data acquisition program that is used with any of the DCP or GSP controllers manufactured by Avalon Sciences.
- ACQ has had many years of continuous development, has acquired many hundreds of VSP and fracture monitoring surveys and is a mature, stable and powerful package.
- **Microseismic Mode** – 2014+ Digital Geochain™ systems can now be upgraded for long term passive monitoring operation. The 'X-series' system can record continuously at the highest sample rate for maximum picking accuracy and recording bandwidth.

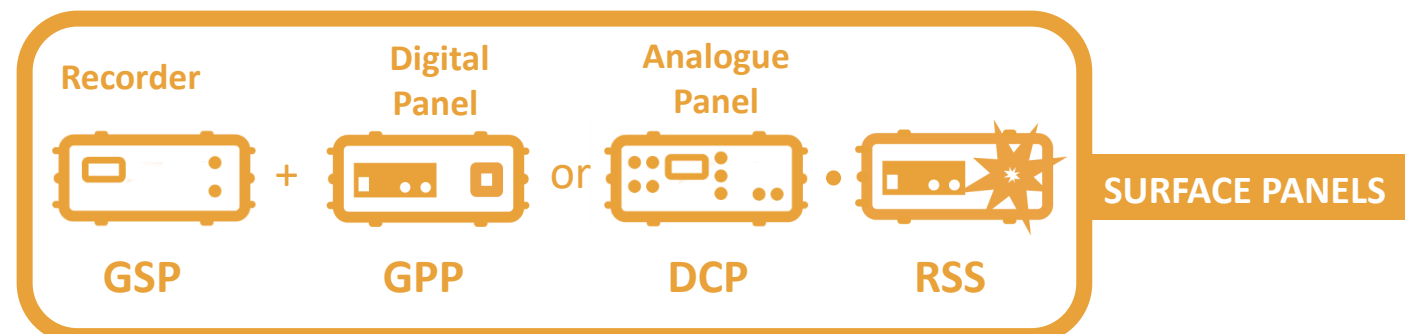
LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Additional Utilities

- **MIRFcopy** - A utility program that copies record files from the acquisition PC to another PC, or perhaps to a second drive on the same PC. Designed for use during the acquisition of a walk-away VSP, MIRFcopy imposes only a minimal overhead on the acquisition PC.
- **MIRFview** - A utility program designed to allow the monitoring of both data quality and shot point coordinates during a walk-away VSP survey. However, its flexible display options make this program a useful tool for examining any MIRF dataset.
- **WellTrak** - This programme allows well geometries to be plotted dynamically with source and receiver shot point locations.
- **RSS-2 Software** - ACQ compatible user interface designed for source synchronisation, reference and timing signals when using multiple sources remote to the well head. (Now standalone from version 5.01+).

ACQ Specifications

Version:	5.x
Operating System:	Windows 7, 8, 10 (Recommended)
Interface:	PC via USB port
Size:	Encoded multiple tone sequence
Compatible Tools:	All Geochain™ Product Range, Permaseis, Gamma, TCU-2, Downhole and Surface Analogue Trace Display.
Data Type Output	MIRF-6 Easily convertible to SEG-Y





On this Memory Stick

Memory Stick Includes

Inspected:

Date:

- In this memory stick you will find a digital copy of the following.
- Software: ACQ Acquisition software suite V.
- Software: RSS Remote Source Controller V.
- Software: VSProwess Infield Processing Software v.
Please email sales@avalonsciences.com to access UID and password. UID: Password:
- Technical Datasheets for all ASL products*
- Technical Manuals for Tool Servicing*
- Technical User Manuals for Tool/Software/Panel Operation*
- Fishing & Safe retrieval Manual and Diagrams*
- Product Marketing Brochures

**Note product line regularly updates. Please see ASL FTP for latest manuals, datasheets and software version.*

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



On this Memory Stick

Memory Stick Includes

Inspected:

Date:

- In this memory stick you will find a digital copy of the following.
- Software: ACQ Acquisition software suite V.
- Software: RSS Remote Source Controller V.
- Software: VSProwess Infield Processing Software v.2.05.
Please email sales@avalonsciences.com to access UID and password. UID: Password:
- Technical Datasheets for all ASL products*
- Technical Manuals for Tool Servicing*
- Technical User Manuals for Tool/Software/Panel Operation*
- Fishing & Safe retrieval Manual and Diagrams*
- Product Marketing Brochures

**Note product line regularly updates. Please see ASL FTP for latest manuals, datasheets and software version.*

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

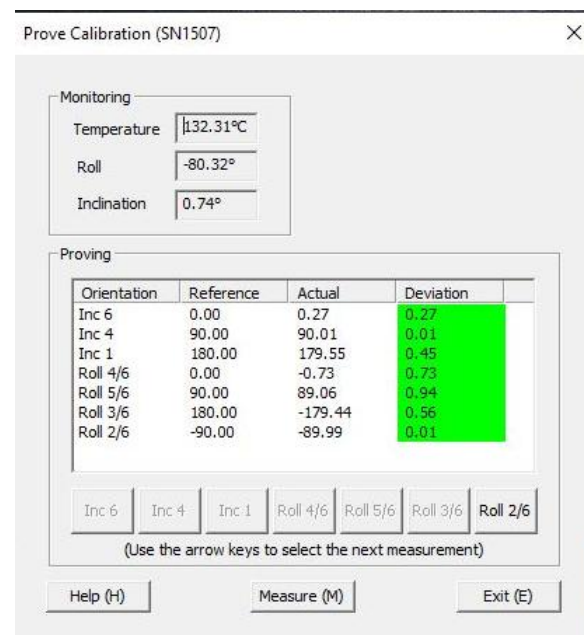


Main Features

- User friendly calibration of digitiser High Side Indicator.
- Advanced QC of tool High Side Roll and Inclination values
- Sets various temperature compensations for increased accuracy
- Critical for specialist electronic maintenance engineers who regularly perform digitiser deflask/reflask.
- Service can be offered by ASL support bases.

Functionality

- A major new feature in the ASL X series is the ability to provide High Side Indication (HSI), that is, it is possible to determine the orientation of the tool and hence the geophone orientation in X, Y and Z planes.
- In order to meet the product HSI accuracy specification, the MEMS accelerometers need to be accurately calibrated for inherent gain and offset errors.
- A calibration algorithm within the digitizer microcontroller requires HSI calibration data from measurements made at 3 temperatures which are obtained from the procedure detailed below. As the accelerometer is progressively aligned closer to the gravitational axis, its accuracy reduces. It is for this reason that the digitizer has to be manipulated into various planes and temperatures during the calibration to ensure the sensors are perpendicular to the gravitational axis while the gain and offset errors are measured.



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

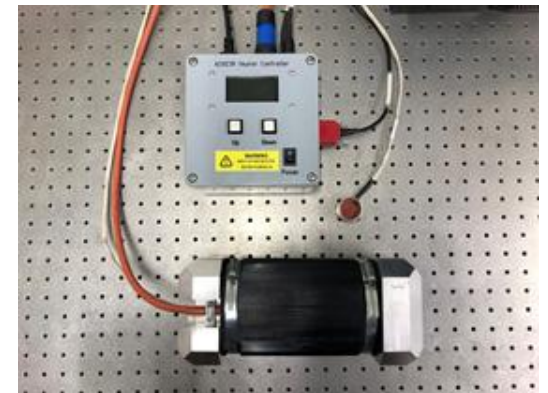
Equipment Required

Generic Equipment Required

- AS9239 Control Box (firmware ver. 0.4 or later)
- PC with ToolCam Software installed
- TL-099 Serial to USB Cable
- A calibrated spirit level with an accuracy of better than 0.1° and a firm, flat, and level bench with heat proof surface

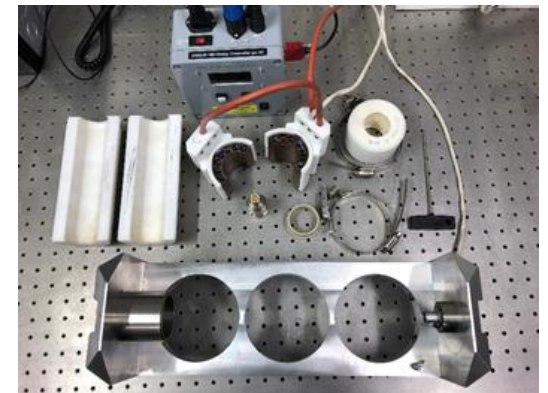
Equipment Required for ASR

- HSIJ-200 ASR HSI Calibration Jig and integral cable
- TL-101 Control Box to XASR cable
- ASR-94 Extractor Tool



Equipment Required for GSR

- GCJ-030-GSR HSI Calibration Jiggeobox
- , consisting of:
- GCJ-003 Insert
- GCJ-023 2x PTFE half-shells
- GCJ-024 Insulator
- GCJ-012 Heater Assembly and integral cable (AS9237)
- TL-102 Link Plug (ESR-88)
- 2x Jubilee Clamps



- The calibration procedure is required as any mechanical misalignment has major impact on the HSI accuracy. It is very important that the mechanical integrity of the item under test is assured.
- It is recommended that the HSI be recalibrated every time the digitiser is re-flasked. Instruction of this is included as part ATC-5 Electronic maintenance.



DOWNHOLE

Downhole Ancillaries

SINK-1 – Roller Sinker Bar (Ancillary)

Main Features

- Robust Sinker Bar.
- Compatible use with VRS.
- Motion Sensor.
- Can be used with both Digital and Analogue.
- Geochain configurations.
- Multiple Sinker Bars can be joined together.
- Very Low Maintenance.
- High Pressure.
- High Temperature.

Functionality

- The SINK-1 Roller Sinker Bar is located at the bottom end of the Geochain™ digital/ASR-1 Analogue receiver array and serves as a sinker weight.
- When used with the digital Geochain™ system the sinker is able to couple directly below the VRS motion sensor ensuring full string monitoring functionality when lowering receivers into the well. Multiple sinker bars can be joined together to give a greater sink weight.
- Containing no additional internal electronics the SINK-1 is a very low maintenance device and can perform within the harshest of well environments.

Compatible with

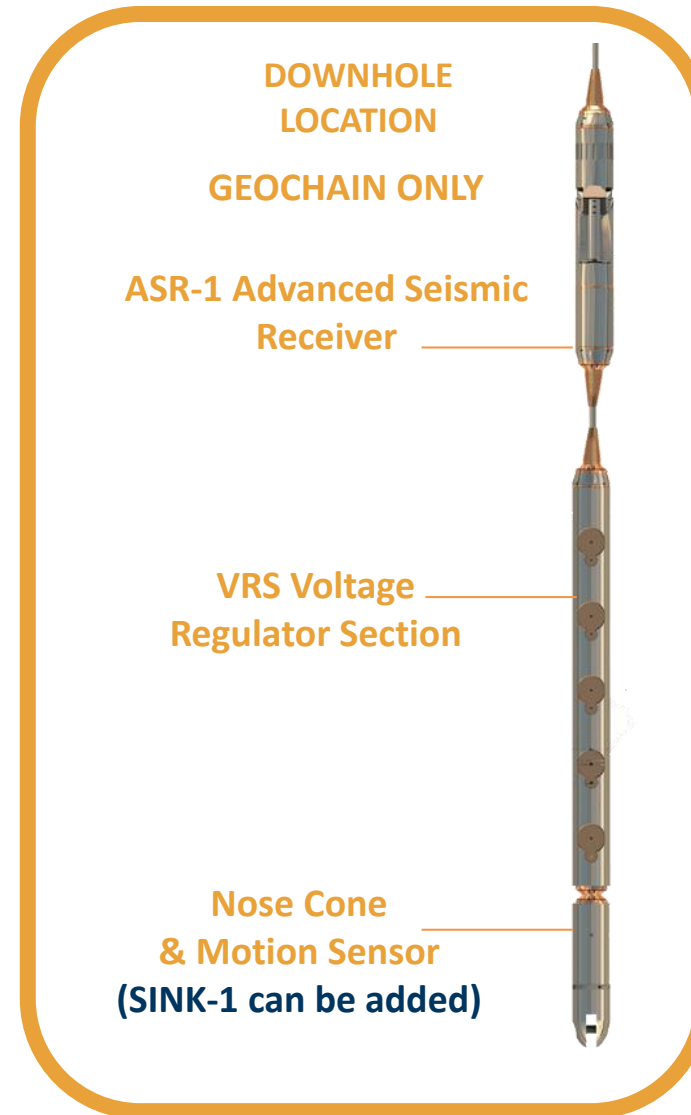


GEO

Geochain
Analogue
and Digital

DOWNHOLE

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



DOWNHOLE LOCATION

SINK-1 Satellite Specifications

Length	53.6" (1363mm)
Diameter	3" (76mm)
Weight	88lbs (40kg)
Temperature	401°F (205°C) *Digital Only
Pressure	25,000psi (1750 bar) version
Interface	VRS/ASR-1/ASR-1 EHP
Nose Cone	ASR 89

Compatible with Geochain EHP but limits system to 25,000 PSI operation

SINK-1-L – Slim Articulated Roller Sinker Bar

Main Features

- Robust sinker bar
- Fitted rollers & articulated joint to assist deployment in deviated wells
- Compatible use with Geochain SVRS.
- Can be used with both digital and analogue systems.
- Multiple Sinker bars can be joined together
- Very low maintenance.
- High pressure.
- High temperature.

Functionality

- The SINK-1-L slim roller sinker Bar is located at the bottom end of the Geochain Slim digital/GSR/ESR-1 Analogue receiver array and serves as a sinker weight
- When used with the digital GeochainSlim™ system the sinker is able to couple directly below the SVRS motion sensor ensuring full string monitoring functionality when lowering receivers into the well. Multiple sinker bars can be joined together to give a greater sink weight.
- Fitted rollers & articulated joint assist tool deployment in deviated wells
- Containing no additional internal electronics the SINK-1 is a very low maintenance device and can perform within the harshest of well environments.

DOWNHOLE

GSR-265 Nose cone

Sinker Bar Half Assembly

Articulated joint

Sinker Bar Half Assembly

Connection to GSR/SVRS

GSR-265 Nose cone

Assembly

Compatible with



**Geochain
Slim
Analogue
& Digital**

SLIM

SINK-1-L Satellite Specifications (GSR-260)

Length	96" (2438.4mm) Per half section
Diameter	1 11/16" (43 mm)
Weight	60.5 lbs (27.5kg) Per Half section
Temperature	225 °C
Pressure	20,000psi (1400 bar) version
Interface	ESR, GSR, SVRS, Additional Sink-1-L
Nose Cone	GSR-265

Compatible with Geochain Slim/ESR/GSR Analog Systems

PLT-1 Production Logging Tool

Main Features

- Multipurpose Production Logging Tool
- MRO & SRO Operation
- Compact and easy deployment
- Slim Diameter
- Quick and easy wellsite interpretation



Functionality

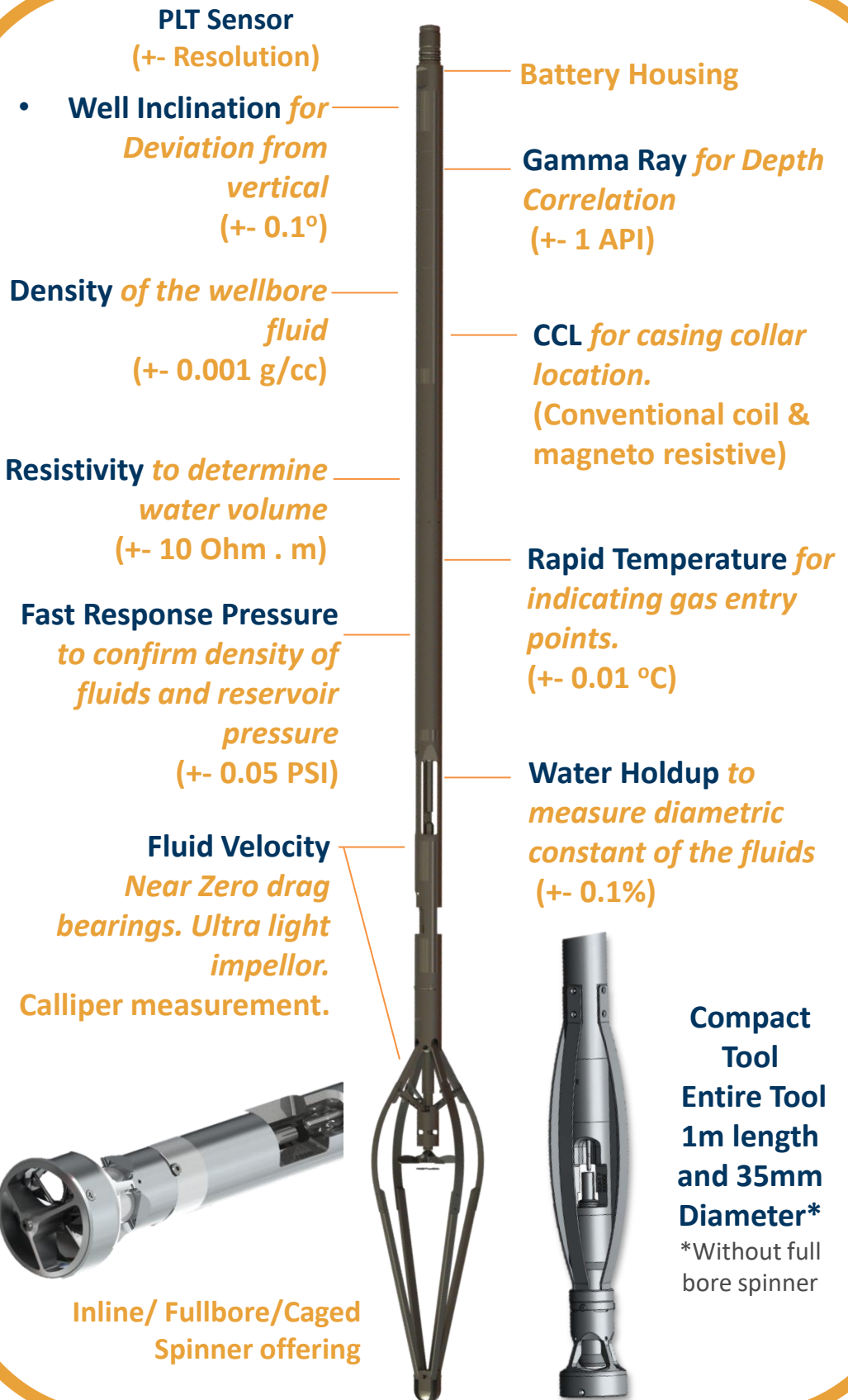
- Production logging services use a range of combinable sensors to provide advanced measurements of downhole fluid flow properties.
- The Avalon PLT offers a slim and easy to use logging tool solution which provides various real time and memory operational measurements to evaluate production and injection performance of a well.
- Our tools stand apart in the market for providing the largest range of measurement types as well as being compact and portable. Software is free and comes included with product.

Standalone System



Real Time
Surface Read Out
and Memory
Readout
operation

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

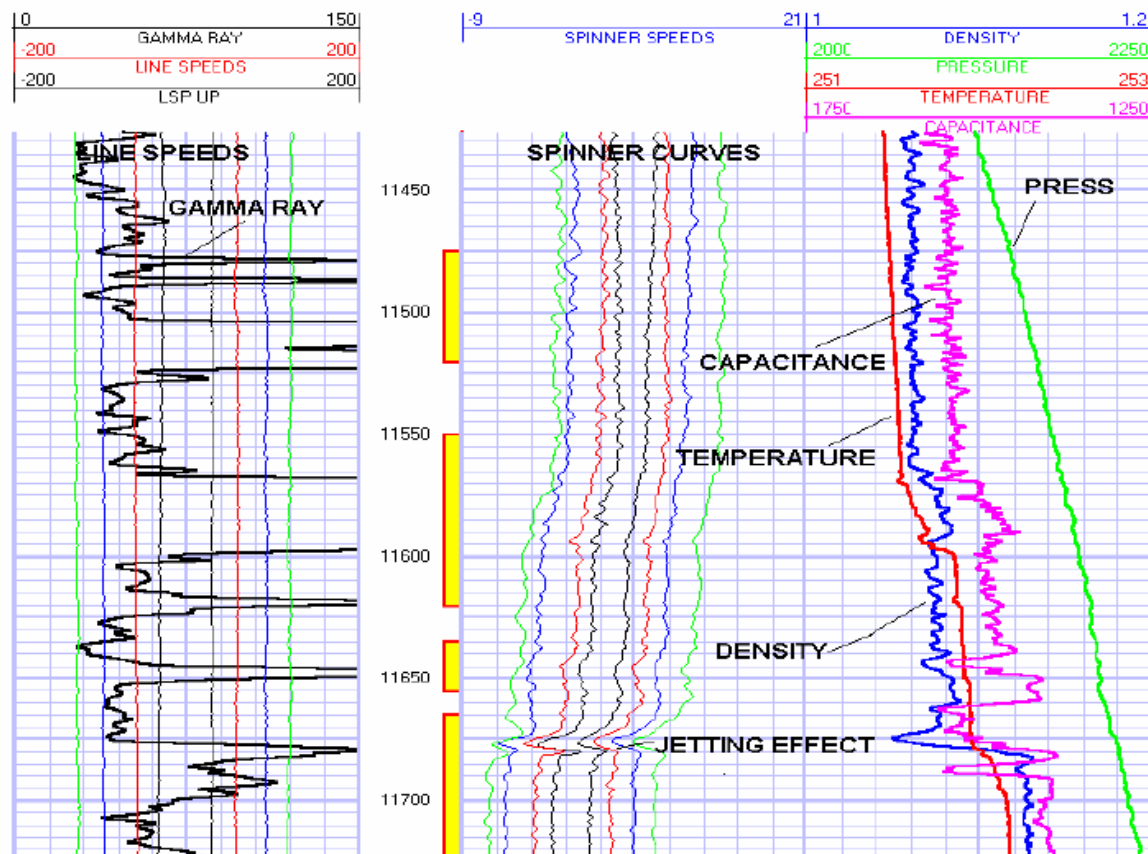


PLT-1

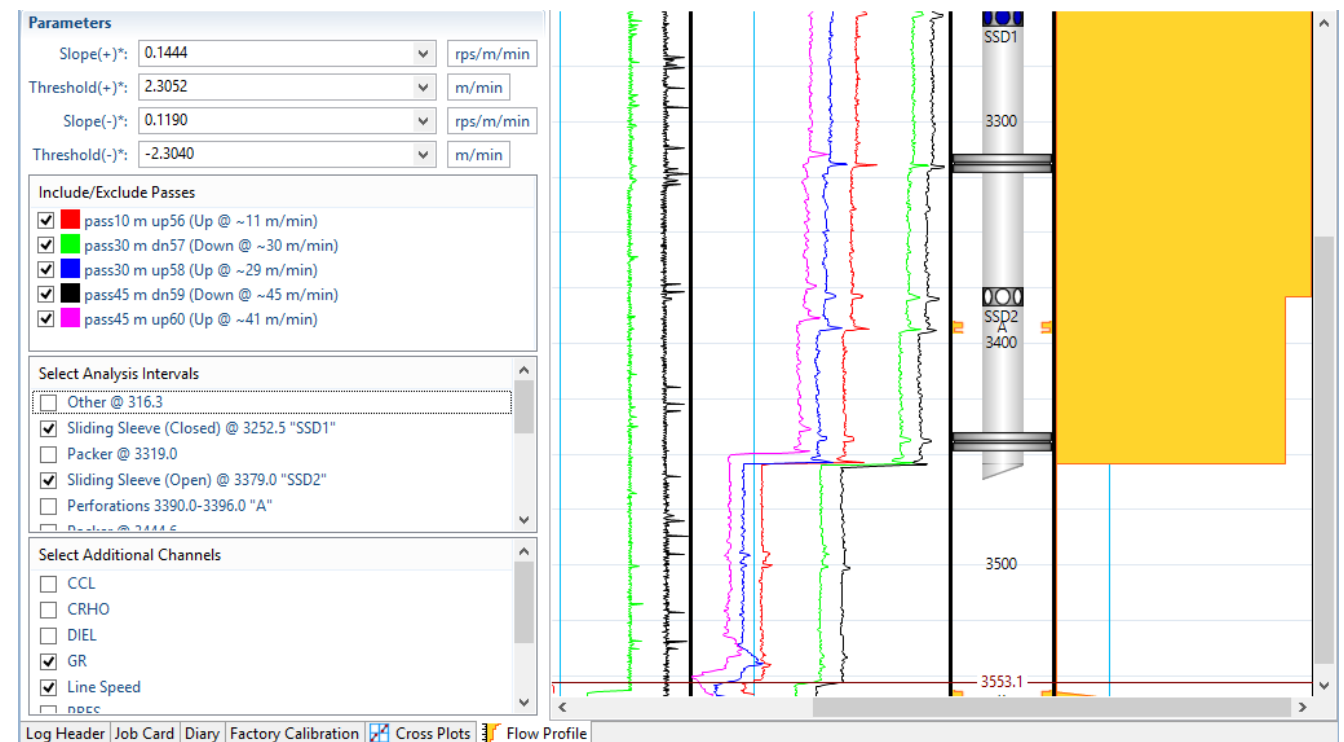


Production Logging Software

- Log data presentation report generation
- Automatic cross plots with simple to add intervals
- Offers summary field reports with quick interpretation 3-phase analysis.



Below – Real Examples of typical PLY log of merged curves



Comes with



Included with
every PLT
Tool.
Windows PC
USB.

PLT-1 Production Logging Tool

Logging Tool Accessories

Depth Encoder

- Small lightweight, portable unit
- Connects shaft encoder to laptop for live depth
- USB PC Interface
- No batteries or power supply required



Depth Encoder (Stand alone version)

- Records memory depth log, 10 samples/sec, 1024 ppr
- Setup & recovery via USB
- Displays live depth and speed
- Intrinsically safe unit
- Rechargeable internal batteries
- 50 hour log time

Surface Interface Unit

- Merges depth with tool data in real time
- USB PC interface
- No manual setup or adjustment required



Test Interface Unit

- De-passivates Lithium Batteries
- Interfaces PLT to laptop for setup and data recovery via USB
- Supports PLT field calibration & verification operations

Everything you need for logging, all included in one box!

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

PLT-1	428 C Specification		
Temperature rating	329 Deg F (165 Deg C).		
Pressure rating	15,000 psi		
Overall Length	39"		
Min Diameter	1 3/8" (35mm)		
Power requirements	7.2v @ 180mA (of which 140mA is the gamma)		
Battery requirements	2 x Lithium C cells		
Samples rate	10 s/s	ccl sampled at 40 s/s	
Logging Speed	20 m/m logging	RIH speed 75 m/m	
MRO & SRO	Tool operates MRO or SRO mode	SRO mode requires IDSI Cable Interface Box	
Sensors		Accuracy	Resolution
	Cage Flowmeter options		max fluid flow 180 m/m
	1 3/8", 1 11/16", 2 1/8" available	0.2 m/m threshold	12 pulses per rev
	Deviation	1 Deg	0.5 Deg
	Dielectric	1DC	0.01 DC
	Resistivity (range 0.1 through 5000 ohm-m)	4%	0.1%
	Fast response Temperature	1 Deg F	0.01 Deg F
	Fast Response Pressure	0.1 Psi	0.001 psi
	Density (acoustic) Collar Locator	0.02 g/cc	0.005 g/cc
Tool Material	Inconel 718	H2S CO2	
Depth Measurement	Stand Alone Encoder (50 hrs standby followed by 50hrs log)		1024 pulses per rev
Job duration	30 hours, Battery dependant		
Memory capacity	64Mbyte	57 hours	40 samples/second

ITC-1-HP Geochain Inter-Tool Cable HP

DOWNHOLE

Main Features

- Standard 7 conductor wireline.
- Up to >600ft (200m) tool separation.
- 25,000psi (1750 bar) pressure rating.
- Max weaklink setting 15,492 lbs (69 kN).

Functionality

- The ITC modular connecting system allows the deployment of multiple Geochain™ tools in a deviated or vertical well.
- The cable is flexible such that the Geochain tools can be deployed into a deviated well.
- Weaklink screws are located on the lower head of the ITC. In the event of a stuck string, the weak links can be pulled such that the system can be easily fished.



Compatible with



Geochain
Analogue
and Digital

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	ITC-1-HP
Separation Length	Up to 600 ft (200m) per section
Cable Head Diameter	3" (76mm)
Temperature	400°F (205°C)
Pressure	25,000 psi (1750 bar)

Weight 50ft-39lbs 100ft-58lbs

Cable Specifications

Cable Type	Slammer
Cable Weight	392 lb/kft (583 kg/km)
Outer Diameter	0.475" (12.04mm)
Breaking Strength	109kN (24,500 lbf)

Weak Link Specifications

Weak Link Screw size	A to W
Load	Up to 17.228 N (3,873lbf)

Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)	Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)
A	3.5	6.8	1531	6124 (27)	L	4.6	12	2695	10780 (48)
B	3.6	7.2	1629	6516 (29)	M	4.7	12.8	2883	11532 (51)
C	3.7	7.8	1754	7016 (31)	N	4.8	12.9	2899	11596 (52)
D	3.8	8.1	1831	7324 (32)	O	4.9	13.4	3010	12040 (54)
E	3.9	8.3	1883	7532 (33)	P	5	13.9	3119	12476 (56)
F	4	8.9	2003	8012 (36)	R	5.1	14.6	3288	13152 (58)
G	4.1	9.3	2084	8336 (37)	S	5.2	15.6	3506	14024 (62)
H	4.2	9.9	2229	8916 (40)	T	5.3	15.8	3546	14184 (63)
I	4.3	10.3	2311	9244 (41)	U	5.4	16.1	3637	14548 (64)
J	4.4	10.7	2405	9620 (43)	V	5.5	16.7	3756	15024 (67)
K	4.5	11.7	2620	10480 (47)	W	5.6	17.2	3873	15492 (69)

Geochain 'Anti-Kink' Inter-Tool Cable HP

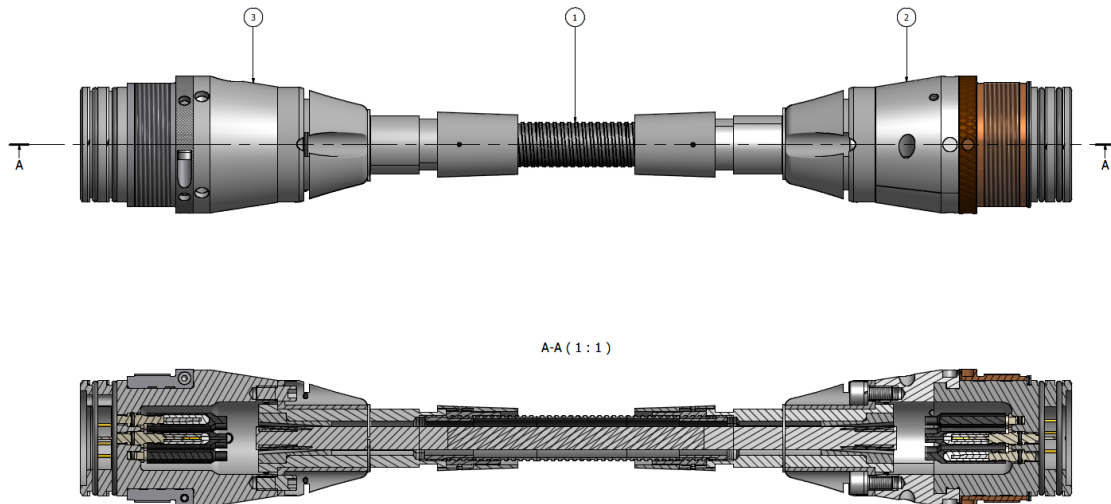
DOWNHOLE

Main Features

- Standard ITC wireline with protective 'Anti-Kink' flexible steel shroud
- Standard 7 conductor wireline.
- Up to >600ft (200m) tool separation.
- 25,000psi (1750 bar) pressure rating.
- Max weaklink setting 15,492 lbs (69 kN).

Functionality

- The ITC modular connecting system allows the deployment of multiple Geochain™ tools in a deviated or vertical well.
- Stainless anti-kink shroud reduces risk of cable knot and kink events.
- The cable is flexible such that the Geochain tools can be deployed into a deviated well.
- Weaklink screws are located on the lower head of the ITC. In the event of a stuck string, the weak links can be pulled such that the system can be easily fished.



Compatible with



Geochain
Analogue
and Digital

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	ITC-HP 265 Anti Kink Cable
Separation Length	Up to 600 ft (200m) per section
Cable Head Diameter	3" (76mm)
Temperature	400°F (205°C)
Pressure	25,000 psi (1750 bar)

Weight 50ft-50lbs 100ft-78lbs

Cable Specifications

Cable Type	Slammer with type S flexible steel shroud
Cable Weight	392 lb/kft (583 kg/km)
Outer Diameter	0.475" (12.04mm)
Breaking Strength	109kN (24,500 lbf)

Weak Link Specifications

Weak Link Screw size	A to W
Load	Up to 17.228 N (3,873lbf)

Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)	Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)
A	3.5	6.8	1531	6124 (27)	L	4.6	12	2695	10780 (48)
B	3.6	7.2	1629	6516 (29)	M	4.7	12.8	2883	11532 (51)
C	3.7	7.8	1754	7016 (31)	N	4.8	12.9	2899	11596 (52)
D	3.8	8.1	1831	7324 (32)	O	4.9	13.4	3010	12040 (54)
E	3.9	8.3	1883	7532 (33)	P	5	13.9	3119	12476 (56)
F	4	8.9	2003	8012 (36)	R	5.1	14.6	3288	13152 (58)
G	4.1	9.3	2084	8336 (37)	S	5.2	15.6	3506	14024 (62)
H	4.2	9.9	2229	8916 (40)	T	5.3	15.8	3546	14184 (63)
I	4.3	10.3	2311	9244 (41)	U	5.4	16.1	3637	14548 (64)
J	4.4	10.7	2405	9620 (43)	V	5.5	16.7	3756	15024 (67)
K	4.5	11.7	2620	10480 (47)	W	5.6	17.2	3873	15492 (69)

Geochain Rigid Inter-Tool Cable - RITC

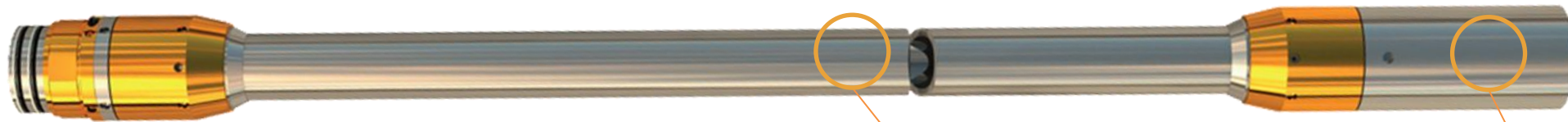
DOWNHOLE

Main Features

- Rigid connection between satellites
- Preserves receiver orientation
- The wiring between cable heads is enclosed in an armour casing, designed for hostile well environments.
- Standard 7 conductor
- Up to >50' (15m) tool separation (25ft per RITC).
- 20,000psi (1400 bar) pressure rating.
- Capable of holding up to 10,000 lbf (44482 N)
- Knuckle joints available for well deviation.

Functionality

- The RITC is a modular rigid connecting system for use with analogue or digital Geochain tools. It allows the tools to be deployed in highly deviated or horizontal wells with precise alignment of all the locking arms.
- The connection can be totally rigid by using just male to female RITC sections or knuckle joints can be used to provide flexibility. A single knuckle joint can be used or a pair fitted above and below the rigid section. The RITC-05 has an in line connection allowing stacking to increase the tool separation.



- Larger spacing can be achieved by connecting multiple RITC 31 with a long female to female coupler (RITC 47) in the between each RITC 31.
- Alternative Female/Male connections available.



GEO

**Geochain
Analogue and
Digital
(EHP & Slim
variant available)**

Compatible with

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	RITC-31	RITC -47 (F-F Coupler)
Separation Length	Up to 25 ft per section	Female-Female Coupler gives 50ft spacing with x2 RITC 31
	Multiple RITC coupled to give max 200' separation.	
Cable Head Diameter	3" (76mm)	3" (76mm)
Temperature	400°F (205°C)	400F (205°C)
Pressure	20,000 psi / 1400 bar	20,000 psi / 1400 bar
Cable Specifications		
Cable Type	7-conductor within pressure housing	
RITC Weight - 25ft	133 lbs (60.4 kg)	35.3 lbs (16 kg)
Load	Up to 10,000 lbf (44482 N)	
Weak Link Specifications		
	No Weak Links	

**Male-Male 25ft ASR-1 &
ASR-1 HP Interconnect
7-conductor**

**Female-Female (RITC-47)
coupler to connect x2 25ft
RITC to give 50ft receiver
spacing**

Geochain Rigid Inter-Tool Cable - RITC



Main Features

- Rigid connection between satellites
- Preserves receiver orientation
- The wiring between cable heads is enclosed in an armour casing, designed for hostile well environments.
- Geochain, Geochain Slim and Geochain EHP versions available.
- Standard 7 conductor
- Up to >50' (15m) tool separation (25ft per RITC).
- Capable of holding up to 10,000 lbf (44482 N)
- Knuckle joints available for well deviation.

Functionality

- The RITC is a modular rigid connecting system for use with analogue or digital Geochain tools. It allows the tools to be deployed in highly deviated or horizontal wells with precise alignment of all the locking arms.
- The connection can be totally rigid by using just male to female RITC sections or knuckle joints can be used to provide flexibility. A single knuckle joint can be used or a pair fitted above and below the rigid section.
- Larger spacing can be achieved by connecting multiple sections with a long female to female coupler in the between each RITC.
- Alternative Female/Male connections available.

Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	RITC-31	RITC-37	RITC-EHP 72
Separation Length	25ft per section	25ft per section	25ft per section
Cable Head Diameter	3" (76mm)	1 11/16" (43mm)	3 1/4" (83mm)
Temperature	400°F (205°C)		
Pressure	20,000psi (1400 bar)	20,000psi (1400 bar)	30,000psi (2100bar)
RITC Weight	133lbs (60.4 kg)		
Load	10,000lbf (44482N)		
Cable Type	7 Conductor within pressure housing		
Weak Link Specifications	No Weak links		

Male-Male 25ft ASR-1 & ASR-1 HP Interconnect 7-conductor

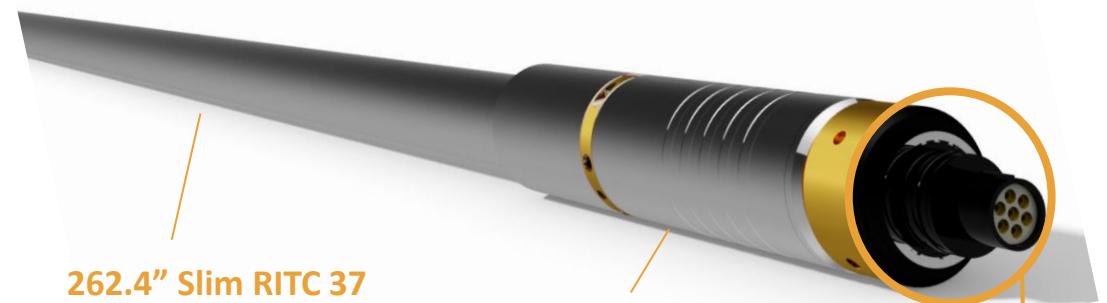
Female-Female (RITC-47) coupler to connect x2 25ft RITC to give 50ft receiver spacing



262.4" Slim RITC 37

RITC 40 coupler

GO7 Connection





Main Features

- Standard 7 conductor wireline with GO7 connection.
- Up to >600' (200m) tool separation.
- 20,000psi (1400 bar) pressure rating.
- Capable of holding up to 8108 lbf (36 kN) load.

Functionality

- The ITC modular connecting system allows the deployment of multiple Geochain Slim tools in a deviated or vertical well.
- The cable is flexible such that the Geochain Slim tools can be deployed into a deviated well.
- Weaklinks screws are located on the lower head of the Slim ITC. In the event of a stuck string, the weak links can be pulled such that the system can be easily fished.



Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

<i>Specifications</i>	<i>ITC-4</i>
Separation Length	Up to 200 ft (61m) per section
Cable Head Diameter	1 11/16" (43mm)
Temperature	400°F (205°C)
Pressure	20,000 psi (1400 bar)

Cable Specifications	
Cable Type	Slammer Wireline
Cable Weight	392 lb/kft (583 kg/km)
Outer Diameter	0.475" (12.04mm)
Breaking Strength	109kN (24,500 lbf)

Weak Link Specifications	
Weak Link Screw size	3.0 to 3.5 mm
Load	Up to 2,027 lbf (9016 N)

Screw Size (mm)	Load (N)	Load (lbf)	Lbf 2x screws	Lbf 3x screws	Lbf 4x screws
3	5936	1334	2669	4003	5337
3.1	6860	1549	3098	4646	6195
3.2	7402	1664	3328	4992	6656
3.3	7749	1742	3484	5226	6968
3.4	8425	1894	3788	5982	7576
3.5	9016	2027	4054	6081	8108

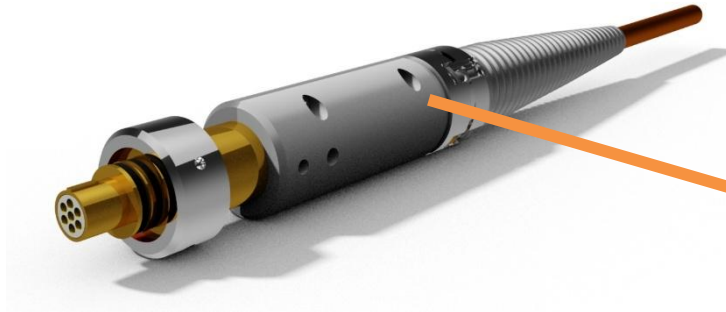


Main Features

- K15 7-pin Boot and Contact for Lower cable head - Standard 7 conductor wireline with GO7 connection.
- 20,000psi (1400 bar) pressure rating.

Functionality

- For rebuilding ITC-4 GSR interconnect cable.
- High pressure feedthrough connection (20 kpsi)



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	GSR-58 Lower
Cable Head Diameter	1 11/16" (43mm)
Temperature	400°F (205°C)
Pressure	20,000 psi (1400 bar)
Weight	<5g
Cable Specifications	
Compatible Cable Type	Slammer Wireline . Rochester A276464
Country of Origin	UK/USA



Compatible with



GSR-58 Geochain Slim Inter-Tool Cable Head



Main Features

- Lower Cable head for connection to standard Hepta conductor wireline with GO7 connection.
- Used For rebuilding ITC-4 GSR interconnect cable.
- 20,000psi (1400 bar) pressure rating.

Functionality

- Lower head for either rebuild of damaged ITC, or on to main 7 conductor winch wireline so to connect direct to GO-7 tools without need of a cross over adaptor.
- Compatible with Rochester A276464 (0.462”) wireline.
- Weaklinks screws are located on the lower head of the Slim ITC. In the event of a stuck string, the weak links can be pulled such that the system can be easily fished.



Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	GSR-58 Lower
----------------	--------------

Cable Head Diameter	1 11/16” (43mm)
Temperature	400°F (205°C)
Pressure	20,000 psi (1400 bar)

Cable Specifications	
Compatible Cable Type	Slammer Wireline . Rochester A276464

Weak Link Specifications	
Weak Link Screw size	3.0 to 3.5 mm
Load	Up to 2,027 lbf (9016 N)

Screw Size (mm)	Load (N)	Load (lbf)	Lbf 2x screws	Lbf 3x screws	Lbf 4x screws
3	5936	1334	2669	4003	5337
3.1	6860	1549	3098	4646	6195
3.2	7402	1664	3328	4992	6656
3.3	7749	1742	3484	5226	6968
3.4	8425	1894	3788	5982	7576
3.5	9016	2027	4054	6081	8108

Geochain Slim Rigid Inter-Tool Cable

DOWNHOLE

Main Features

- Standard 7 conductor wireline with GO7 connection.
- The wiring between cable heads is enclosed in an Armour casing, designed for hostile well environments.
- Larger spacing can be achieved by connecting multiple RITC 31 with a long female to female coupler (RITC 40) in between each RITC 31.
- Up to >50' (15m) tool separation (25ft per RITC).

Functionality

- The SRITC is a modular rigid connecting system for use with analogue or digital Geochain tools. It allows the tools to be deployed in highly deviated or horizontal wells with precise alignment of all the locking arms.
- A knuckle joints can be used to provide flexibility. A single knuckle joint can be used or a pair fitted above and below the rigid section.

Compatible with

SLIM
GeochainSlim

262.4" Slim RITC 37

RITC 40 coupler

GO7 Connection

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	RITC 37	RITC 40 (Coupler)
Length	262.4" (6664mm)	34.96" (888mm)
Cable Head Diameter	1 11/16" (43mm)	1 11/16" (43mm)
Temperature	400°F (205°C)	400°F (205°C)
Pressure	20,000 psi (1400 bar)	20,000 psi (1400 bar)
Weight		

Weak Link Specifications

No Weak Links



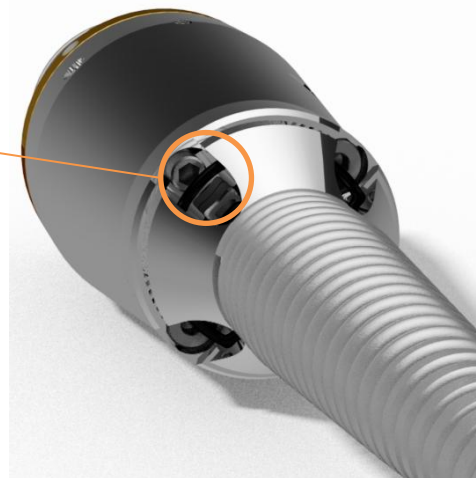
Main Features

- Standard 7 conductor wireline
- Up to 600' (200m) tool separation
- 30,000psi (2100 bar) pressure rating
- Max weak link setting 15,492 lbs

Functionality

- The ITC modular connecting system allows the deployment of multiple Geochain EHP tools in a deviated or vertical well.
- The cable is flexible such that the Geochain EHP tools can be deployed into a deviated well.
- Weaklinks screws are located on the lower head of the ITC. In the event of a stuck string, the weak links can be pulled such that the system can be easily fished.

Weak link
screws



Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	ITC-EHP
Separation Length	Up to 600ft (200m) per section
Cable Head Diameter	3.25" (83mm)
Temperature	400°F (205°C)
Pressure	30,000 psi (2100 bar)

Cable Specifications	
Cable Type	Slammer
Cable Weight	392lbs/kft (583kg/km)
Outer Diameter	0.475" (12.04mm)
Breaking Strength	24,500 lbf (109kN)

Weak Link Specifications	
Weak Link Screw size	A to W
Load	Up to 17.228 N (3,873lbf)

Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)	Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)
A	3.5	6.8	1,531	6124 (27)	L	4.6	12	2,695	10780 (48)
B	3.6	7.2	1,629	6516 (29)	M	4.7	12.8	2,883	11532 (51)
C	3.7	7.8	1,754	7016 (31)	N	4.8	12.9	2,899	11596 (52)
D	3.8	8.1	1,831	7324 (32)	O	4.9	13.4	3,010	12040 (54)
E	3.9	8.3	1,883	7532 (33)	P	5	13.9	3,119	12476 (56)
F	4	8.9	2,003	8012 (36)	R	5.1	14.6	3,288	13152 (58)
G	4.1	9.3	2,084	8336 (37)	S	5.2	15.6	3,506	14024 (62)
H	4.2	9.9	2,229	8916 (40)	T	5.3	15.8	3,546	14184 (63)
I	4.3	10.3	2,311	9244 (41)	U	5.4	16.1	3,637	14548 (64)
J	4.4	10.7	2,405	9620 (43)	V	5.5	16.7	3,756	15024 (67)
K	4.5	11.7	2,620	10480 (47)	W	5.6	17.2	3,873	15492 (69)

Main Features

- Standard 7 conductor wireline
- Up to 600' (200m) tool separation
- 35,000psi (2400 bar) pressure rating
- Max weak link setting 15,492 lbs

Functionality

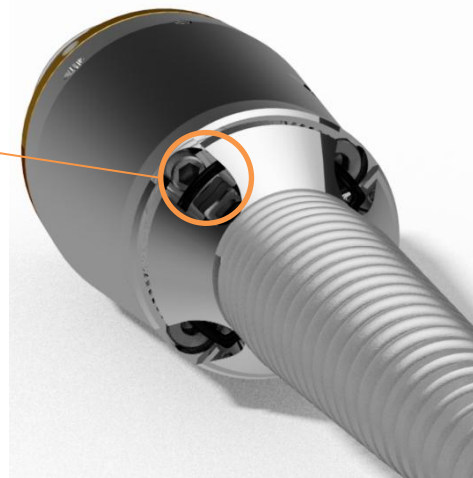
- The ITC modular connecting system allows the deployment of multiple Geochain UHP tools in a deviated or vertical well.
- The cable is flexible such that the Geochain EHP tools can be deployed into a deviated well.
- Weaklinks screws are located on the lower head of the ITC. In the event of a stuck string, the weak links can be pulled such that the system can be easily fished.

Specifications	ITC-UHP
Separation Length	Up to 600ft (200m) per section
Cable Head Diameter	3.25" (83mm)
Temperature	400°F (205°C)
Pressure	35,000 psi (2400 bar)

Cable Specifications	
Cable Type	Slammer
Cable Weight	392lbs/kft (583kg/km)
Outer Diameter	0.475" (12.04mm)
Breaking Strength	24,500 lbf (109kN)

Weak Link Specifications	
Weak Link Screw size	A to W
Load	Up to 17.228 N (3,873lbf)

Weak link screws



Compatible with



Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)	Weak Link Screw Size	Diameter (mm)	Load (kN)	Load (lbf)	Load Capacity of cable head lbs (kN)
A	3.5	6.8	1,531	6124 (27)	L	4.6	12	2,695	10780 (48)
B	3.6	7.2	1,629	6516 (29)	M	4.7	12.8	2,883	11532 (51)
C	3.7	7.8	1,754	7016 (31)	N	4.8	12.9	2,899	11596 (52)
D	3.8	8.1	1,831	7324 (32)	O	4.9	13.4	3,010	12040 (54)
E	3.9	8.3	1,883	7532 (33)	P	5	13.9	3,119	12476 (56)
F	4	8.9	2,003	8012 (36)	R	5.1	14.6	3,288	13152 (58)
G	4.1	9.3	2,084	8336 (37)	S	5.2	15.6	3,506	14024 (62)
H	4.2	9.9	2,229	8916 (40)	T	5.3	15.8	3,546	14184 (63)
I	4.3	10.3	2,311	9244 (41)	U	5.4	16.1	3,637	14548 (64)
J	4.4	10.7	2,405	9620 (43)	V	5.5	16.7	3,756	15024 (67)
K	4.5	11.7	2,620	10480 (47)	W	5.6	17.2	3,873	15492 (69)

SHT-1 Downhole Swivel Tool



Main Features

- Allows rotation of a Geochain system to prevent induced torque into the system
- Rotates when exposed to >5 N/m imposed torque
- 25,000 psi pressure rating
- 225°C maximum operating temperature.

Functionality

- Designed to be positioned at the top of a Geochain System, the swivel tool allows rotation and prevents torque in the Geochain system
- The swivel tool is compatible with standard and rigid ITCs and capable of withstanding compression/ extension forces up to 5 tons.

Swivel Tool Specifications

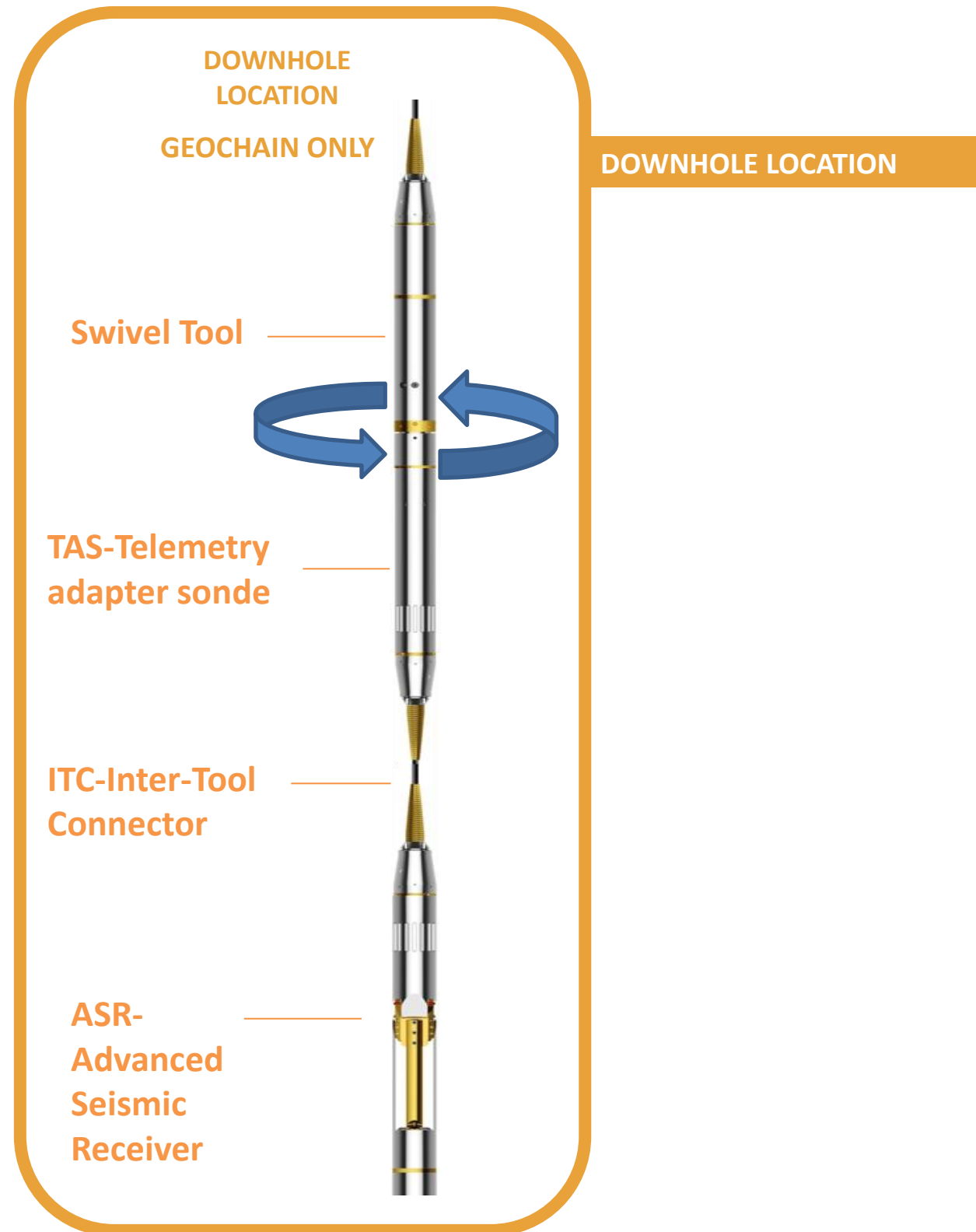
Length	25.9" (657mm)
Diameter	3" (76mm)
Weight	5.7lbs (2.6kg)
Temperature	437°F (225°C)
Pressure	25000 psi (1724 bar)

Compatible with



Geochain
Analogue
and Digital

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY





Pass Through Tool (AS270,AS271,AS273 Digitizers)

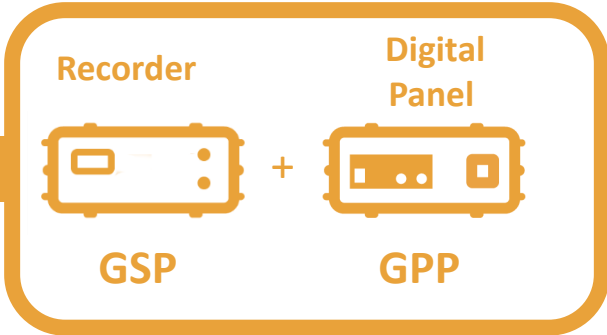
Main Features

- Enables increased tool separation (Up to >1600' (500m) between satellites.)
- Does not impact sample rates
- Allows deployment of separate arrays in the same well
- 356°F (180°C) Temperature Rating
- 25,000psi Pressure Rating
- 3" Outside Diameter Tool.
- Standard 7 conductor wireline.
- Real time data transmission.
- Tractor Deployable

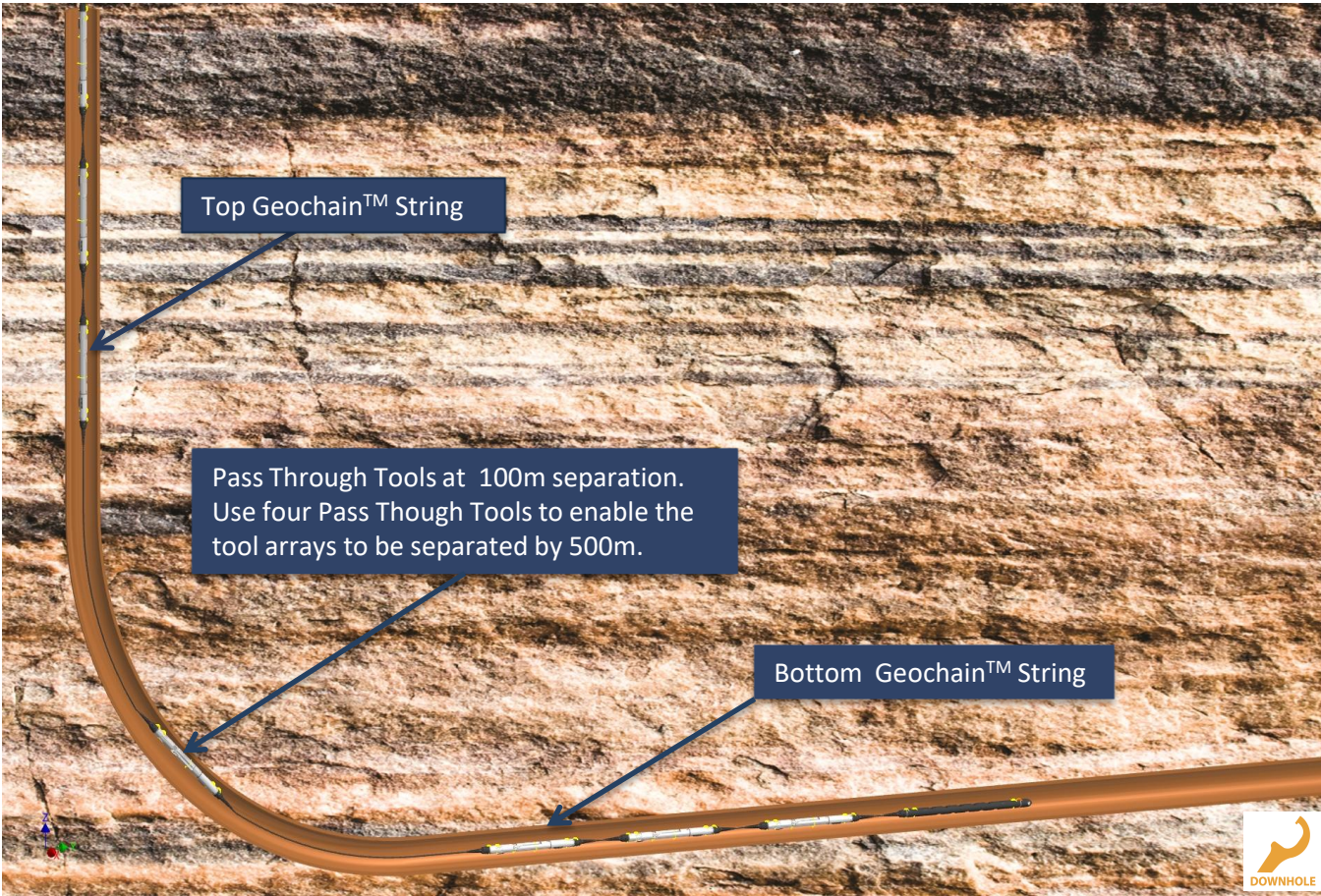
Functionality

- The Pass Through Tool allows increased separation between active receivers without the need to data-disable a tool.
- The Pass Through Tool is ideal for applications where a large tool separation is needed allowing separate arrays in the same well- e.g. in the horizontal and vertical sections of a well.

SURFACE PANELS



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Pass Through Tool	
Length	18.7" (476mm)
Diameter	3" (76mm)
Weight	21.6lb (9.8kg)
Temperature	356°F (180°C) *Digital Only
Pressure	25,000psi
Panels	GPP or GMP & GSP-1 (Digital)
Wireline	7 Conductor Heptacable

GSR-38 - GO-7 male to GO-4 female X-Over

DOWNHOLE

Main Features

- X-Over for Geochain slim tools to connect to third party GO-4 tools below.
- 205C Temperature Rated
- 20,000psi (1400 bar) pressure rating.

Functionality

- Special Adaptor to go beneath GSR or Slim VRS connection with female GO-4 below.
- Allows connection to GO-4 male devices.



Specifications

GSR-38

Separation Length in string 233mm

Cable Head Diameter 1 11/16" (43mm)

Temperature 400°F (205°C)

Pressure 20,000 psi (1400 bar)

Xover Specifications

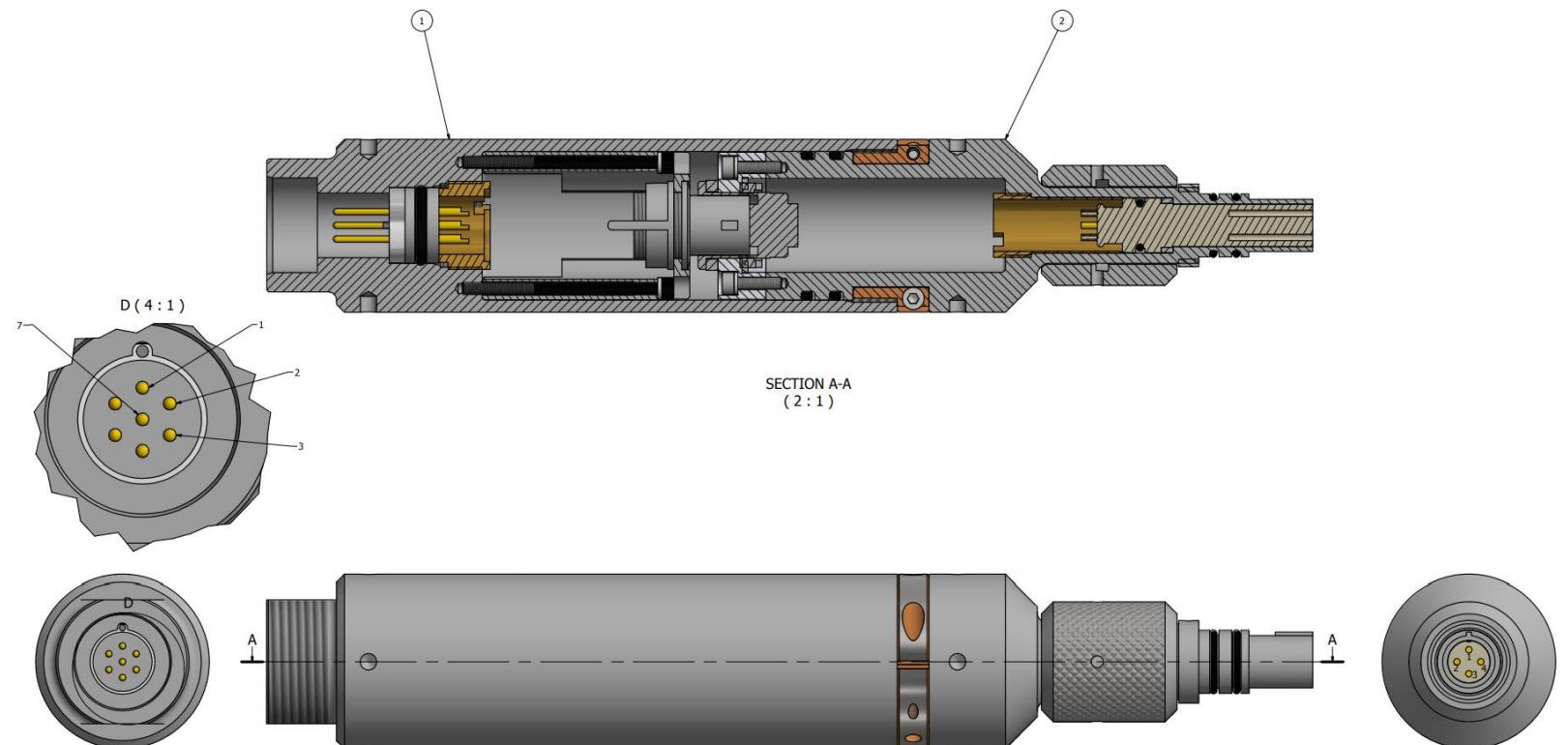
Uphole GO-7 Male

Downhole GO-4 Female

Compatible with



SLIM
GeochainSlim



Pressure – Temperature Nose Cone

DOWNHOLE

Main Features

- Accurate downhole pressure and temperature readout
- Nose cone pressure housing compatible with ASR-1 downhole tool
- Ideal for pressure transient analysis
- Easy interface to ASR-1 tool
- Large memory capacity and low power consumption for long term deployment.
- Plug and play USB interface.

Functionality

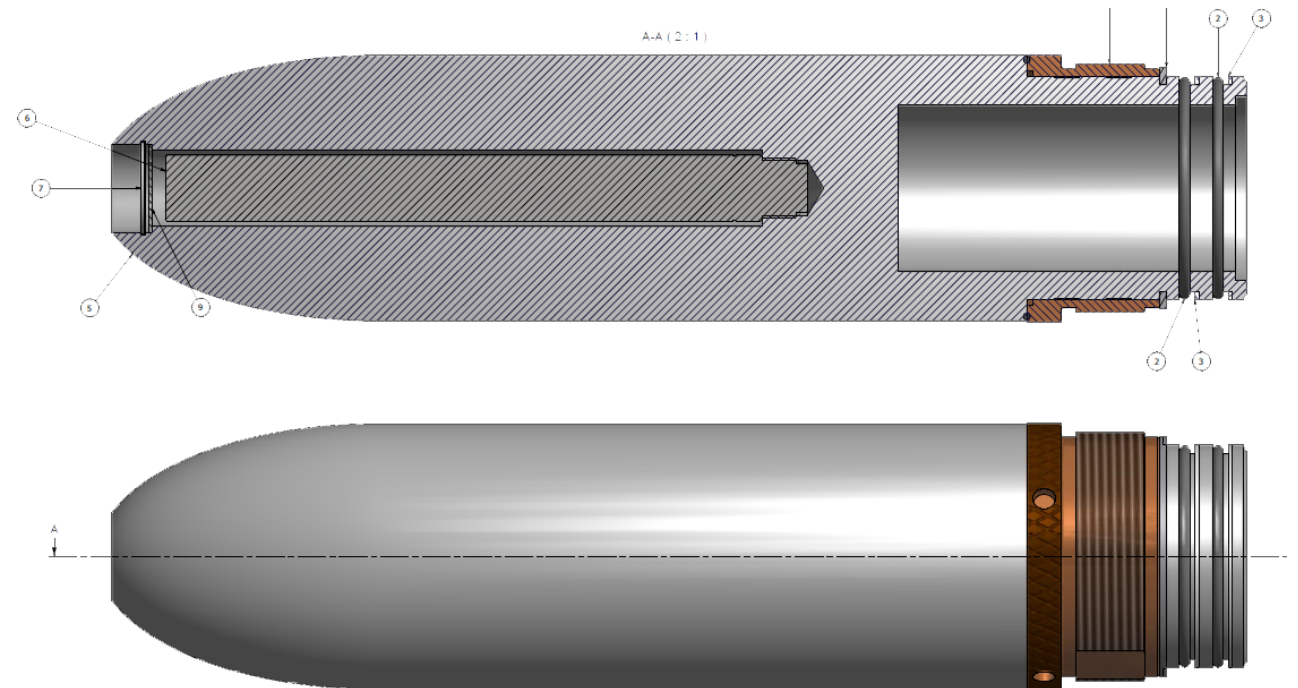
- Combining mono-crystal micro sensing elements with corrosion and HPHT resistant ASR nose cone housing, the HPHT sensor cone is a unique addition to the Geochain™ downhole ancillary range, providing well operators with superior data on downhole pressure and temperature.
- Thanks to its extremely fast settling time, the integrated MEMS technology drastically improves dynamic data acquisition and interpretation during Well Test operations.
- Low power consumption provides scope for up to 24 months of downhole monitoring.

Compatible with



**Geochain
Analogue
and Digital**

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Specifications	ASR-HP-197 PT Cone
Tool system	ASR-1-HP
Diameter	3" (76 mm)
Battery	1 single AA lithium battery
Memory	1.4 million samples (Time Pressure Temperature)
Temperature	338°F (170°C)
Pressure	25 kpsi
Pressure Accuracy	+/- 0.01% FS
Pressure Resolution	20dB
Temperature Resolution	1 mK at 1 Hz
Measurement period	From 128Hz to 1 data every 64 sec
Deployment	C Spanner to nose cone. Probe sits within nose cone housing.
Interface	Plug and Play USB

Pressure-Temperature Nose Cone Specifications

USB



PC

SURFACE PANELS

PTS Pressure Temperature Sonde

Main Features

- Accurate real time downhole pressure and temperature readout Lower Barrel pressure housing compatible with ASR-1/PSS-17 downhole tool or ITC .
- Ideal for pressure transient analysis
- Easy interface to ASR-1 tool
- Large surface memory capacity with Bluetooth streaming & low power consumption for long term deployment.

Functionality

- Combining mono-crystal micro sensing elements with a corrosion and HPHT resistant ASR pressure housing, the PTS sensor module is a unique addition to the Geochain™ downhole ancillary range, providing well operators with superior data on downhole pressure and temperature.
- Thanks to its extremely fast settling time, the integrated sensor technology drastically improves dynamic data acquisition and interpretation during well test operations.
- Low power consumption and large surface memory also means the tool provides scope for continuous downhole monitoring, especially when combined with our permanent seismic tool range.

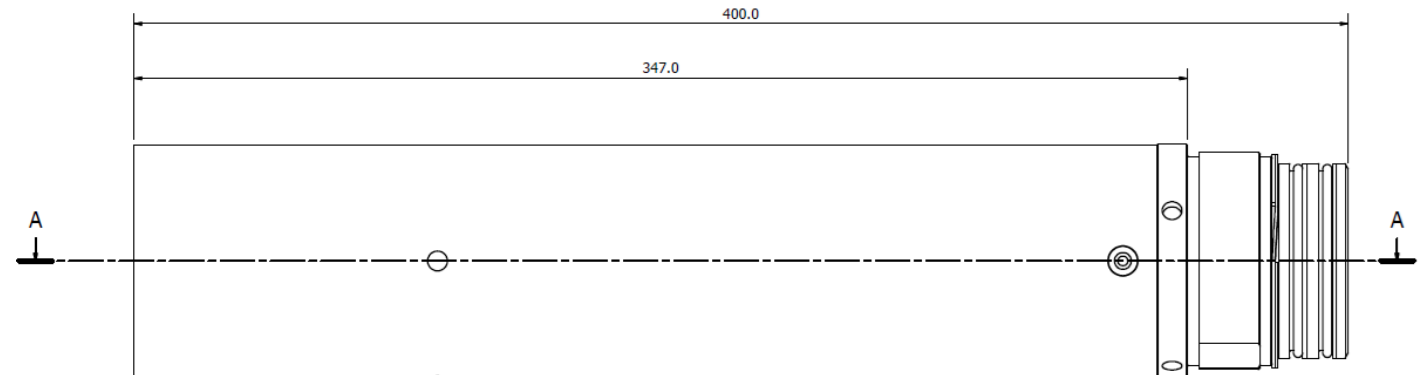
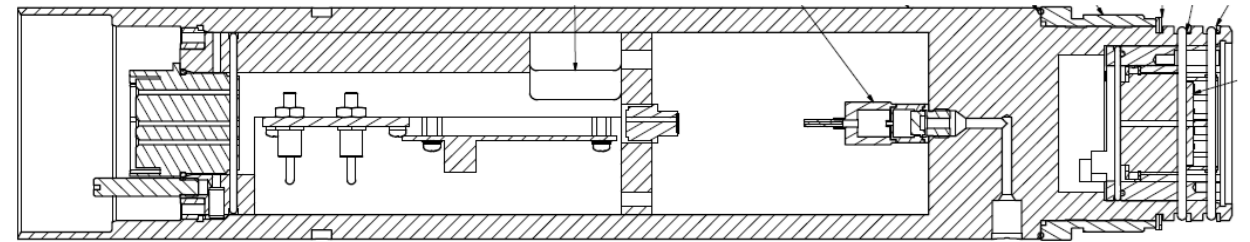
Compatible with



ASR
Analogue
and Geochain

DOWNHOLE

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Specifications	PTS-04 Sensor Specs
Full Scale Pressure Range	0 to 10,000 PSIG
Static Overpressure	150% FS
Burst Pressure	17,400 PSIG
Span	4.75mV/V
Zero Offset	0 +/- 1.2 mV/V
Supply Voltage	15 VDC MAX
Input Resistance	2000-9000 Ohms
Output Resistance	200-9000 Ohms
Insulation Resistance	> 50 MOhms @ 500 V DC
Frequency Response	> 50 kHz
Linearity	+/- 0.20 % FS (BFSL)
Hysteresis	< 0.10 % FS
Repeatability	+/- 0.10 % FS
RTD Temperature Accuracy	+/- 3.5 degree F
Thermal Zero Shift	< 0.018 % FS / degree F
Thermal Span Shift	< 0.018 % FS / degree F

Specifications	PTS-04 Housing Specs
Tool system	ASR-1-HP
Diameter	3" (76 mm)
Length	347mm / 13.65" (in string)
Weight	5 kg / 11 lbs
Max Temperature/Pressure	338°F (170°C) / 25 kpsi
Measurement period	Continuous Real Time to Surface
Deployment	C Spanner to mate lower barrel to ASR/VRS, or can be connected to ITC (above or below) tool using coupler.
Surface Interface	Hobo Datalogger (Analogue) via DCP breakout connector Used with single Analog ASR/GSR – feeds signal onto 2 nd Tool Vz channel Used with Geochain – (7C cable) Line 7 Analog
Channels	

Analogue



MX1105 Data Logger

SURFACE PANELS

Data Logger for PTS Tool



Main Features

- Bluetooth communication for wireless data offload
- 16-bit resolution for highly-accurate measurements
- Stores 1.9 million measurements for longer deployments between offloads
- New Self-Describing sensors with intelligent configuration for fast deployment
- Compatible with existing sensors for a wide range of indoor monitoring
- Audible and visual LCD-screen alarms notify you if a sensor becomes unplugged or a reading exceeds set thresholds

Functionality

- The HOBO MX1105 multi-channel data logger, with four-channel inputs, measures and transmits data wirelessly from a variety of sensors to your mobile device via Bluetooth technology.
- This self-contained wireless data logger lets you use your mobile device or Windows computer and Onset's free HOBO connect app to access data, at any time, over a 100-foot range via Bluetooth.
- You can configure the logger, read out data, view data in graphs, check the operational status of loggers, configure alarm notifications, and share data files - all with no dedicated equipment beyond a mobile device.

Compatible with



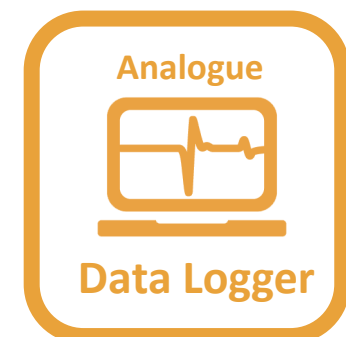
LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Specifications	MX1105 Data Logger
Operating Range	0 to 10,000 PSIG
Radio Power /Transmission Range	150% FS
Wireless Data Standard	17,400 PSIG
Logging Rate	4.75mV/V
Start / Stop Mode(s)	0 +/- 1.2 mV/V
Time Accuracy	15 VDC MAX
Battery Type	2000-9000 Ohms
Battery Life	200-9000 Ohms
Memory	> 50 MOhms @ 500 V DC
Size	> 50 kHz
Weight	+/- 0.20 % FS (BFSL)
Environmental Rating	< 0.10 % FS
ASL Surface Interface	Breakout box from DCP

Specifications	MX1105 Data Logger
Measurement Range*	0-24 V
Accuracy*	±1.0 mV ±0.3% of reading
Resolution *	384 µV

* Values if using Volt-24 cable adaptor (provided). Other cables interfaces available to offer greater resolution over smaller measurement range.



SURFACE PANELS

DHH-1 Downhole Hydrophone



Main Features

- PEH upper Coupling
- Standard 7 conductor wireline
- Direct connection to ASR-1
- Optimised for both VSP and hydraulic fracture monitoring work
- ASR lower coupling
- Built in amplifier
- Gamma compatible

Functionality

- The DHH-1 downhole hydrophone is an analogue tool designed to fit directly above an ASR-1 downhole geophone.
- In addition a gamma tool can be used to provide depth correlation.
- The upper coupling is a PEH type which makes it ideal for tractor or pipe conveyed logging operations.

Compatible with



Geochain
Analogue
and Digital

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Avalon Downhole hydrophone specification table

Specifications	DHH-1
Tool system	ASR
Length	17" (432 mm)
Diameter	3 3/8" (86 mm)
Weight	18lbs (8 kg)
Temperature	400°F (205°C)
Pressure	10,000 psi
Sensitivity	71 V/bar
Downhole Gain	20dB
Element	8.9 V/Bar
Frequency Response	10-1600Hz
Max Sample Rate	250 us
Coupling Type	PEH

Recorder



GSP

Analogue
Panel



DCP

SURFACE PANELS

DHH-2 Downhole Hydrophone



Main Features

- The DHH-2 downhole hydrophone is part of the GeochainSlim system. The DHH-2 is designed to fit anywhere within an analogue system. The tool utilises an inline GO-7 style coupling and can be used in conjunction with a gamma tool to provide depth correlation. The DHH-2 system can be modified to be tractor compatible.

Functionality

- Downhole hydrophones measure the acoustic noise of the fluid within the well. They can be used in a tool string to receive signals transmitted from the surface, to monitor seismic signals that create pressure waves in the well, or other such downhole monitoring.
- The DHH-2 is commonly used in Analogue tool strings and a digital version of the DHH-2 is in development. The DHH-2 uses up an equivalent GSR sensor pack VZ/HX/HY channel, thus allowing Gamma tools to be run in parallel using line 7.

Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Avalon Downhole hydrophone specification table

Specifications	DHH-2
Tool system	GSR
Length	25" (635mm)
Diameter	1 11/16" (43mm)
Weight	18lbs (8 kg)
Temperature	400°F (205°C)
Pressure	10,000 psi
Sensitivity	71 V/bar
Downhole Gain	20dB
Element	8.9 V/Bar
Frequency Response	10-1600Hz
Max Sample Rate	250 us
Coupling Type	Go-7

Recorder



GSP

Analogue
Panel



DCP

SURFACE PANELS



Main Features

- The switching sub allows the six outer conductors to be combined downhole to minimise voltage drop when deploying a tractor at the bottom of a Geochain™ Slim string.
- Dedicated high current wiring then routes the tractor power along the central line 7 conductor through the entire string.
- Wired to failsafe into either tractor mode or Geochain mode.
- The six outer conductors to be combined downhole to minimise voltage drop when deploying a tractor at the bottom of a GeochainSlim™ string.

Functionality

- The GSR-193 is an in-line tractor switching sub for use with the GeochainSlim™ system. It is designed to sit directly below the wireline x-over unit and above the TAS in the Geochain Slim string.
- Dedicated high current wiring then routes the tractor power along the central line 7 conductor through the entire string. The sub can be wired to failsafe into either tractor mode or Geochain mode.

Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications

Length	18.5" (444mm)
Diameter	1 11/16" (42.9mm)
Weight	7.1lb (3.2kg)
Temperature	400°F (205°C)
Pressure	25,000 psi (1750 bar)
Voltage	400V Max
Current	7 amp Max



Main Features

- The switching sub allows the six outer conductors to be combined downhole to minimise voltage drop when deploying a tractor at the bottom of a Geochain™ Slim string.
- Dedicated high current wiring then routes the tractor power along the central line 7 conductor through the entire string.
- Wired to failsafe into either tractor mode or Geochain mode.
- The six outer conductors to be combined downhole to minimise voltage drop when deploying a tractor at the bottom of a Geochain™ Slim string.
- New configuration pin board: allows configuration for 4 wire or 6 wire wireline telemetry

Functionality

- The GCN-10 is an in-line tractor switching sub for use with the Geochain™ system. It is designed to sit directly below the wireline x-over unit and above the TAS in the Geochain string.
- Dedicated high current wiring then routes the tractor power along the central line 7 conductor through the entire string. The sub can be wired to failsafe into either tractor mode or Geochain mode.

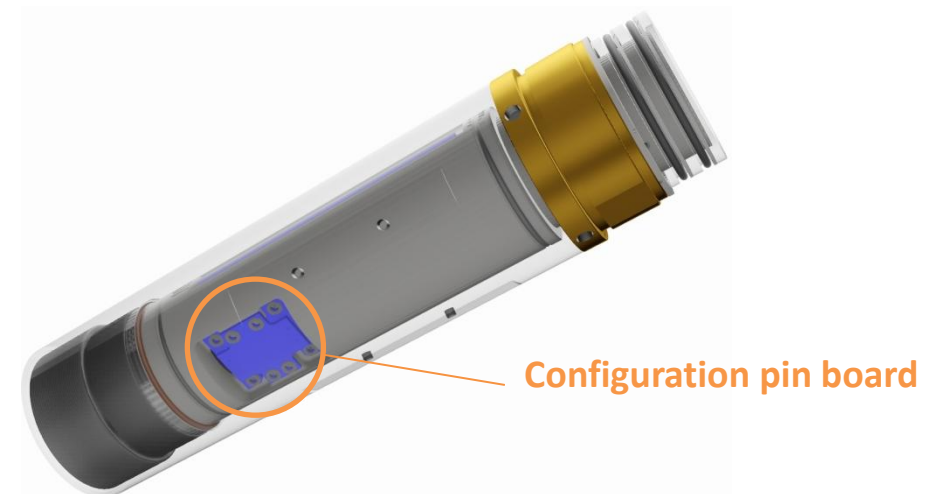
Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications

Length	15" (381mm)
Diameter	3" (76.2mm)
Weight	5.5 lb (2.5kg)
Temperature	400°F (205°C)
Pressure	25,000 psi (1750 bar)
Voltage	400V Max
Current	7 amp Max





Functionality

- Avalon provide a range of cross over tools that allow the Geochain systems to be utilised with third party equipment. If you cannot identify a cross over compatible with your cable head we can provide a bespoke interface upon request.

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Main Features

- Quick and easy fitting.
- Compatible with all ASR equipment.
- Temperature rating of 401°F (205°C)
- Pressure rating of 25,000psi.

Specifications	HAL-7	HAL-1	HAL DITS	HAL RWCH	LEHQ	BAS-1/BAS-2	HAL-HETS
Cross over type	Go7 to 21/22 connector	Go1 to line 7 on Female 21/22 connector	DITS to 21/22 connector	DITS 19 way to 21/22 connector	LEHQ to 21/22 connector	10 pin to 21/22 connector (BAS-2 = 10 pin socket)	HETS (H4TG) to 21/22 ASR connector
Length	5.5" (140mm)	6" (152mm)	12.5" (318mm)	12.5" (318mm)	13" (330mm)	9" (229mm)	10.91" (277mm)
Outer Diameter	3.1" (78mm)	3.1" (78mm)	3.6" (92mm)	3.6" (92mm)	3.4" (86mm)	3.6" (92mm)	3.0" (76mm)
Weight	3kg (6.6lbs)	3kg (6.6lbs)	8.3kg (18.3lbs)	8.6kg (19lbs)	8.5kg (18.7lbs)	6kg (13.2lbs)	4.5kg (10lbs)
Temperature	401°F (205°C)	401°F (205°C)	401°F (205°C)	401°F (205°C)	401°F (205°C)	401°F (205°C)	401°F (205°C)
Pressure	25,000 psi (1750 bar)	25,000 psi (1750 bar)	25,000 psi (1750 bar)	25,000 psi (1750 bar)	25,000 psi (1750 bar)	25,000 psi (1750 bar)	25,000 psi (1750 bar)

Compatible with



Downhole End

21/22 ASR connection



Uphole End

Go7 connection



RWCH connection



DITS connection



LEHQ connection



HETS connection



Male-Male Coupler– ASR 43



Main Features

- High Pressure (25000psi) Male-Male coupler
- Compatible with Geochain system connectors.
- High temperature capability (401°F (205°C))
- Extremely quick and easy fitting.
- 21/22 ASR Connection

Functionality

- The Male-Male coupler allows easy coupling of two female Geochain connectors, using feed through connections.



Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

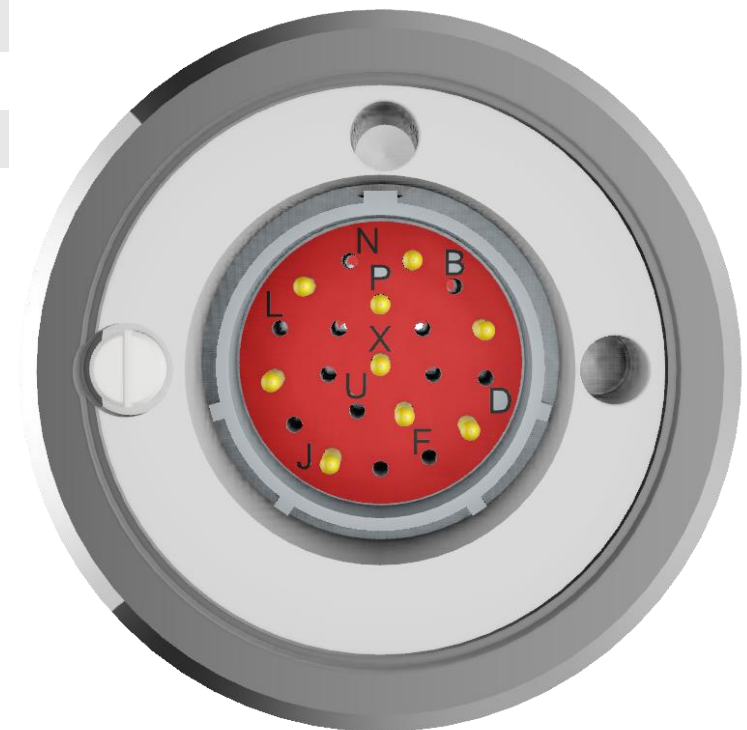
Specifications

Length	7.1" (80mm)
Diameter	3" (76.2mm)
Weight	5.1 lb (2.3kg)
Temperature	400°F (205°C)
Pressure	25,000 psi (1750 bar)

Connector Idents

Lower	Upper
B	B
D	D
F	F
J	J
L	L
N	N
X	X
P	P
U	U

21/22 ASR connection



Geochain Maintenance Summary Datasheet

DOWNHOLE

ASR-HP Maintenance

Minor Maintenance frequency	After <i>every survey</i> .
Overview	Clean the tool, check nodes and arm spike for excessive wear
	Remove and replace all O rings
	Carry out a continuity and resistance test.
Major Maintenance frequency	- Once per year or once per 10 surveys whichever comes first - Whenever the tools have been run in a well with aggressive borehole fluid or high gas levels - Whenever the tools have been exposed to temperatures >150°C for >10 hours
Overview	Remove and replace all O rings
	Clean and inspect
	Continuity and resistance test.

TAS Maintenance

Minor Maintenance frequency	After <i>every survey</i> .
Overview	Clean underneath barrel.
Major Maintenance frequency	Once per year or once per 10 surveys whichever comes first
Overview	Replace O rings
	Clean inside barrel and heatsink

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

ITC-HP Maintenance

Minor Maintenance frequency	After <i>every survey</i> .
Overview	Check insulation and continuity. (conduct major maintenance if test fails)
	Clean head and replace O rings.
Major Maintenance frequency	- Once per year or once per 10 surveys whichever comes first - Whenever the cable have been run in a well with aggressive borehole fluid or high gas levels - Whenever the cable have been exposed to temperatures >150C for >10 hours
Overview	Disassemble head and clean out grease
	Clean and check connectors
	Fill cable head with fresh silicone grease.

VRS-HP Maintenance

Minor Maintenance frequency	After <i>every survey</i> .
Overview	Replace all O rings
Major Maintenance frequency	- Once per year or once per 10 surveys whichever comes first - Whenever the tools have been run in a well with aggressive borehole fluid or high gas levels - Whenever the tools have been exposed to temperatures >150°C for >10 hours
Overview (includes minor maintenance)	Replace all O rings
	Inspect all the regulators and the through wiring.

GSP Maintenance

Instrument Testing	Automatically record a series of test files, testing the power distribution and open circuit tests. Should be carried out at the <i>start of every survey</i> .
--------------------	---

GPP Maintenance

Testing	Check WIB induction, should be tested before <i>every survey</i> . Carry out a telemetry test within ACQ, before <i>every survey</i> .
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DCP-2 Maintenance

Self-Test	When turned on system performs a sequence that quickly checks for correct operation of the motor power and DHCC circuits.
Workshop testing	DCP-2 self-test is not exhaustive because there are no internal means to check the analogue signal circuits. Periodic workshop testing is required to fully check that your DCP-2 is working properly (<i>after every job</i>).

Disclaimer – This is not to be used as a manual for tool maintenance, please refer to the **Geochain Maintenance Manual** and **Geochain Preparation and Testing Manual** for all maintenance and testing procedures.



SURFACE

Surface Ancillaries & Tool Kits (Geo/Slim/EHP)



Main Features

- **GSP to Sercel VE432 DPG Vibrator Controller**
- Connects GSP I/O Card to 3rd Party Controller (SERCEL VE432 Type)
- Includes Analog DSI Lemo Connection for return signal



Compatible with

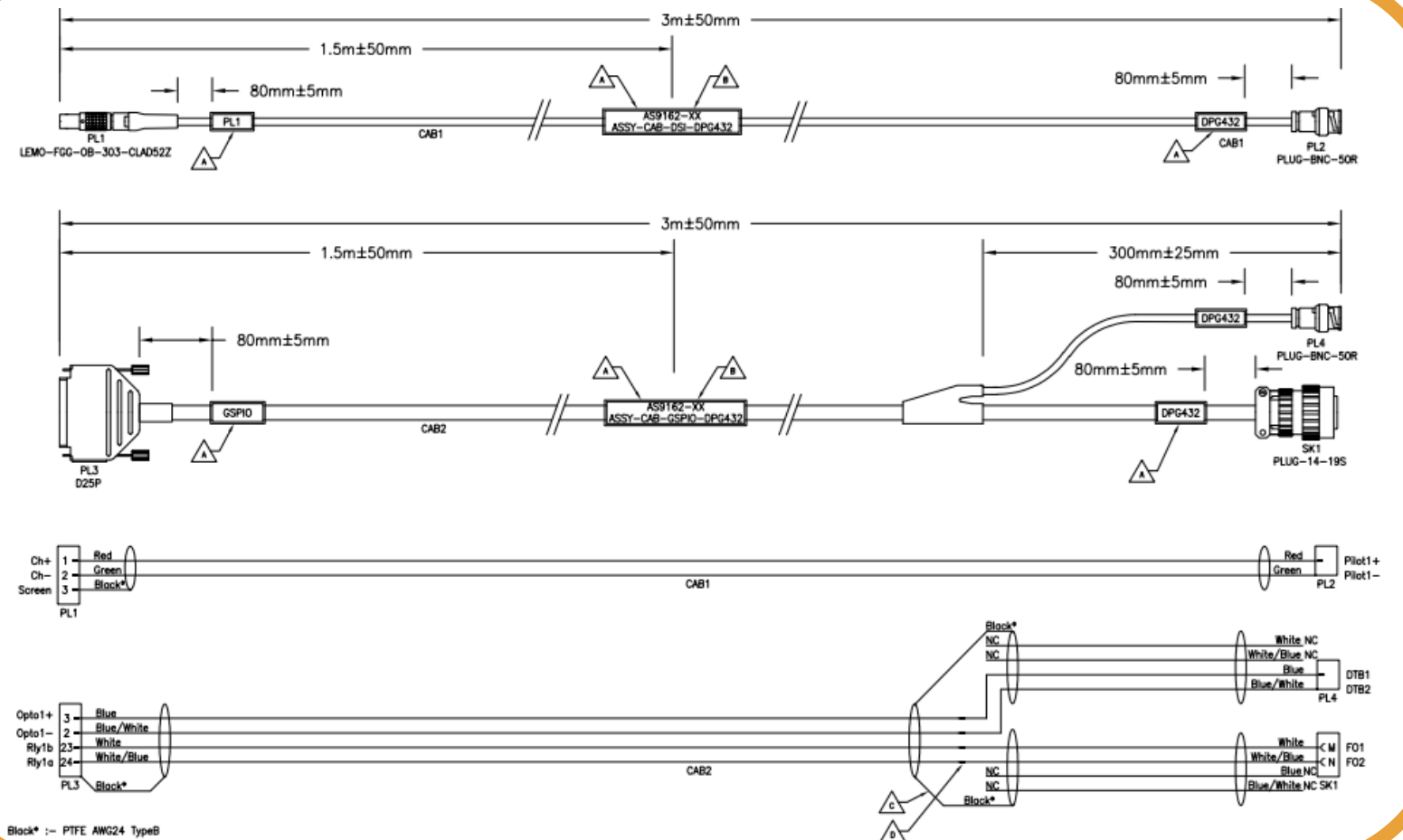


GSP Recorder

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Parts Included

Part Number	Description	Quantity
AS9162 CAB-GSPIO-432DPG	3m Surface Cable to connect ASL Recorder GSP IO to SERCEL 432 Vib Controller	1
AS9162 CAB-GSPDSI-432DPG	3m Surface Cable to connect ASL Recorder GSP DSI to SERCEL 432 Vib Controller	1



Above: **AS9162 CAB-GSP-SERCEL432DPG** (Closing Contract Fire Command) wiring diagram (Top GSP DSI to DGP432, Bottom GSPIO to DPG432)

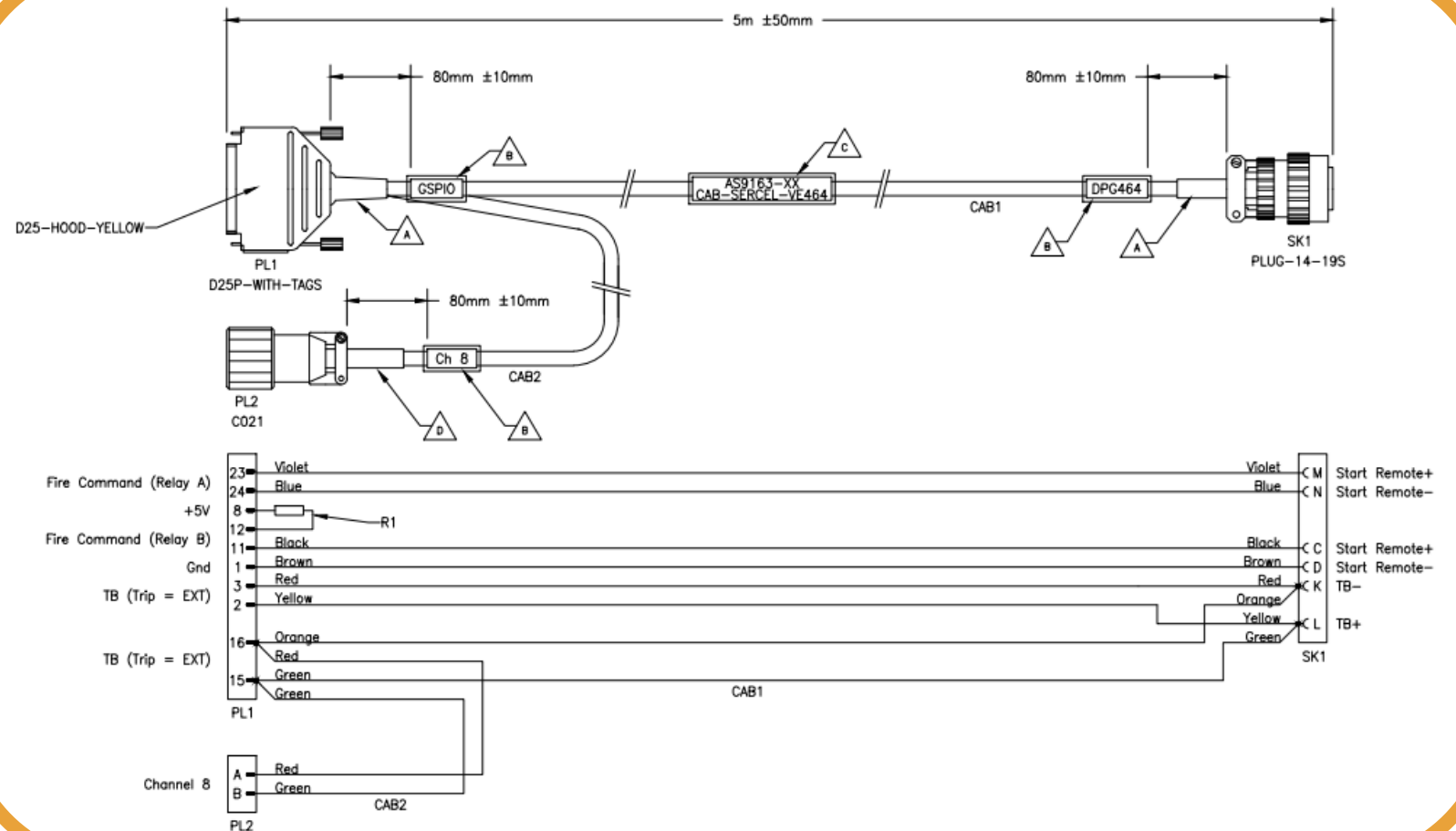
- **GSP to Sercel VE464 DPG Vibrator Controller**
- Connects GSP I/O Card to 3rd Party Controller (SERCEL VE464 Type)
- Usually sold with AS9164 Cable



GSP Recorder

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Part Number	Description	Quantity
AS9163 CAB-GSPIO-464DPG	5m Surface Cable to connect ASL Recorder GSP IO & CH8 to SERCEL 464 Vib Controller*	1
	*Should be sold with x1 AS9164 Cable	



Above: **AS9163** CAB-SERCEL-464DPG-GSP wiring diagram (D25 GSP I/O and CH8 AUX (Left) to DPG464 (Right)).

AS9164 GSP-VIBE Controller Interface Cable



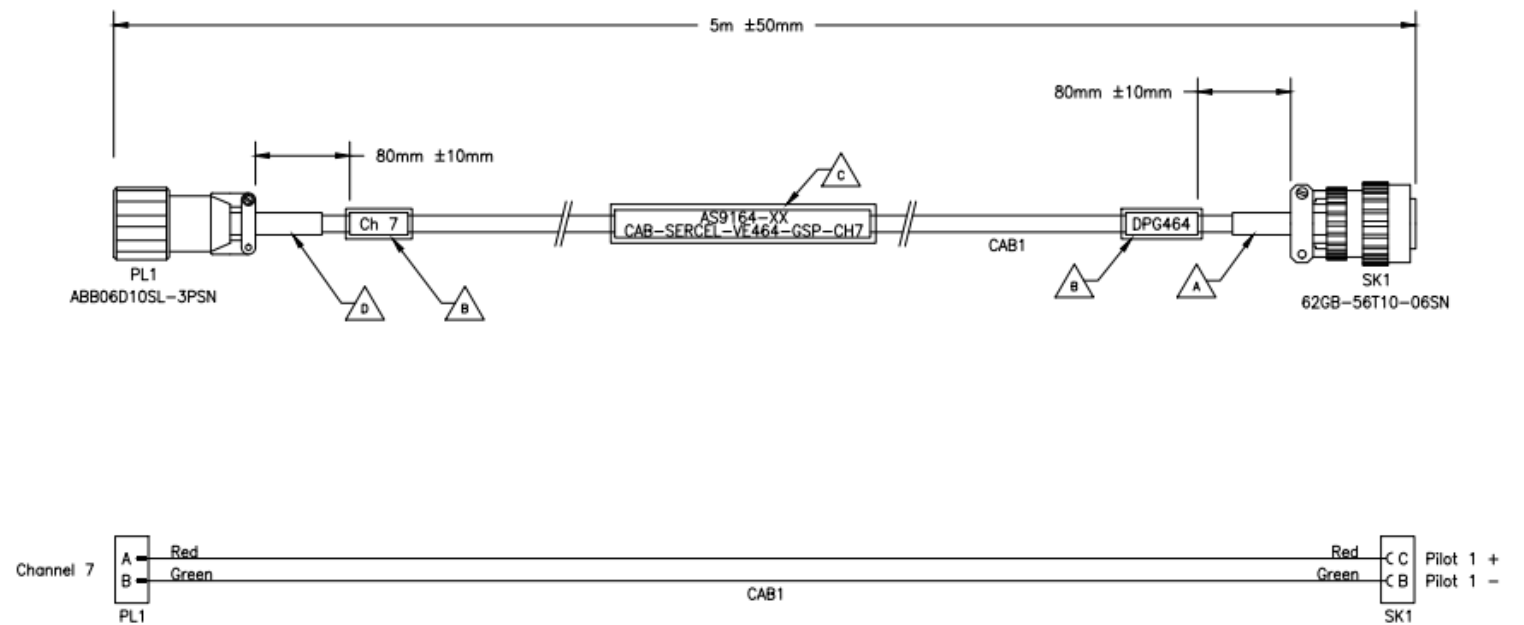
Main Features

- **GSP to Sercel VE464 DPG Vibrator Controller**
- Connects GSP I/O Card to 3rd Party Controller (SERCEL VE464 Type)
- Usually sold with AS9163 Cable



Parts Included

Part Number	Description	Quantity
AS9164 CAB-GSPIO-464DPG	5m Surface Cable to connect ASL Recorder CH7 to SERCEL 464 Vib Controller*	1
	*Should be sold with x1 AS9163 Cable	



Above: **AS9164** CAB-SERCEL-VE464-GSP-CH7 wiring diagram (GSP CH7 REF (Left) to DPG464 (Right)).

Compatible with



GSP Recorder



Main Features

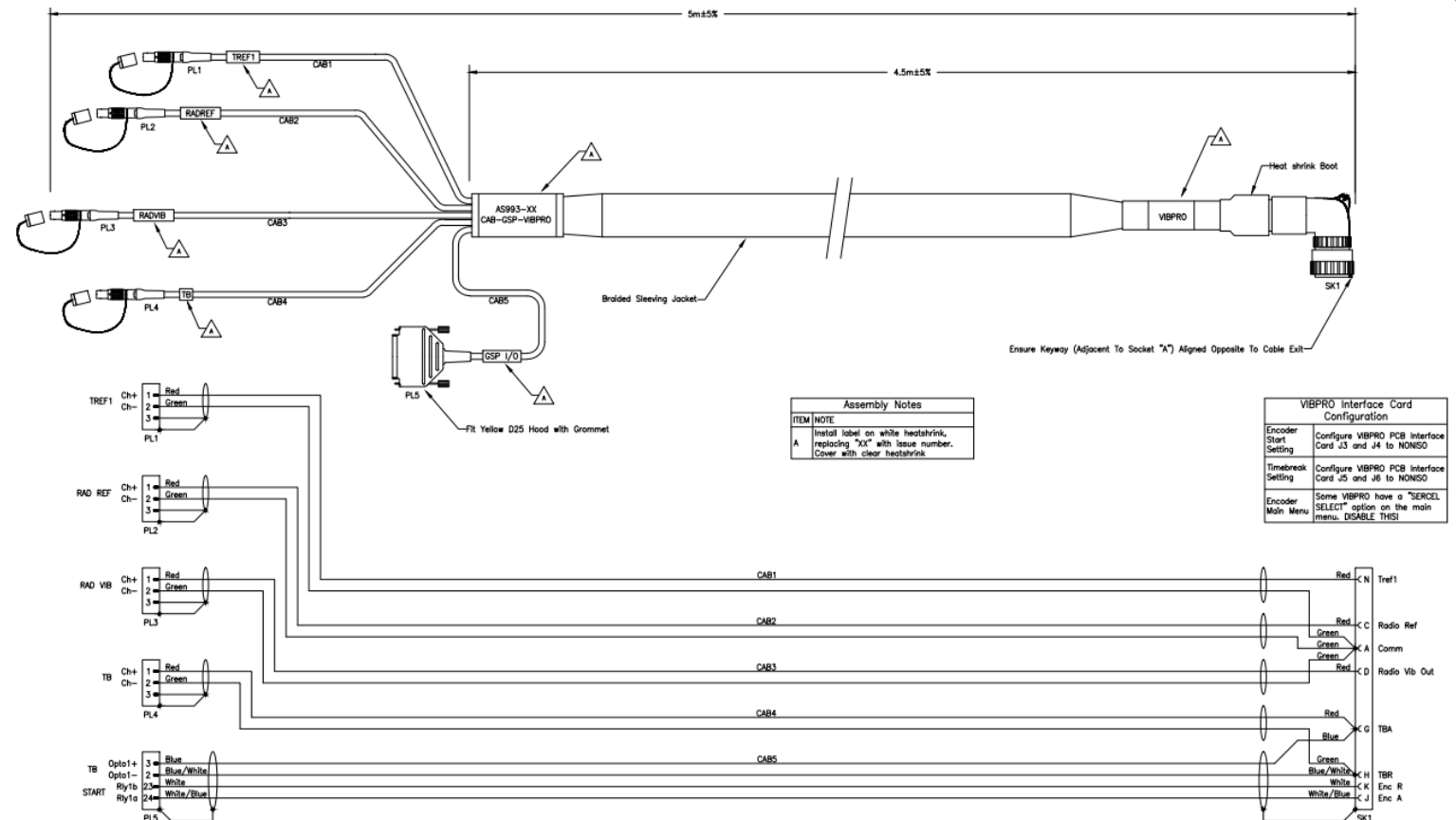
- **GSP to VIBPRO Vibrator Controller**
- Connects GSP I/O Card to 3rd Party Vibroseis Controller (VIBPRO Type)
- Includes Analog DSI Lemo Connection for return TB and Radio signals

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Parts Included

Part Number	Description	Quantity
AS993 CAB-GSP-VIBPRO	5m Surface Cable to connect ASL Recorder GSP IO & DSI to VIBPRO	1

VIBPRO Interface Card Configuration	
Encoder Start Setting	Configure VIBPRO PCB Interface Card J3 and J4 to NONISO
Timebreak Setting	Configure VIBPRO PCB Interface Card J5 and J6 to NONISO
Encoder Main Menu	Some VIBPRO have a "SERCEL SELECT" option on the main menu. DISABLE THIS!



Compatible with



GSP Recorder

Above: **AS9993** CAB-GSP-VIBRPO wiring diagram (GSP DSI Lemo x4 and D25 GSP connections (left) and angled SK1 VIBPRO connection (right)).



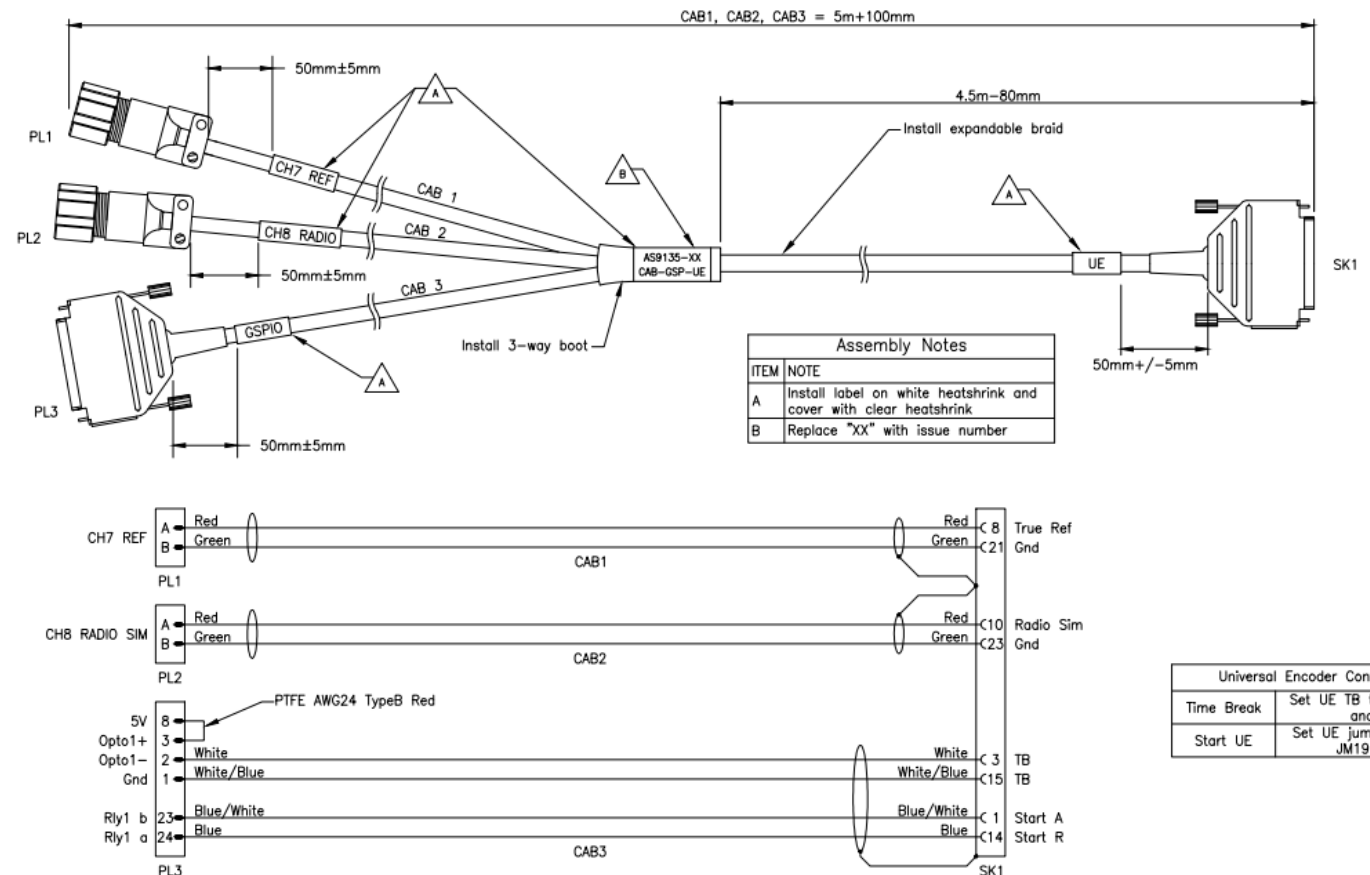
Main Features

- **GSP to Universal Encoder Vibrator Controller**
- Connects GSP I/O Card to 3rd Party Vibroseis Controller (UE Type)
- Includes Analog CH7 (Pilot REF) and CH8 (Radio AUX/GF) return connection to GSP recorder



Parts Included

Part Number	Description	Quantity
AS9135 CAB-GSP-UE	5m Surface Cable to connect ASL Recorder GSP IO & Analogue Inputs to Vibroseis Universal Encoder source controller	1



Compatible with



GSP Recorder

Above: **AS9135** CAB-GSP-VIBRPO wiring diagram (GSP I/O D25 & CH7/8 connection (left) with UE connection (right)).

AS961 Surface TEST Cable



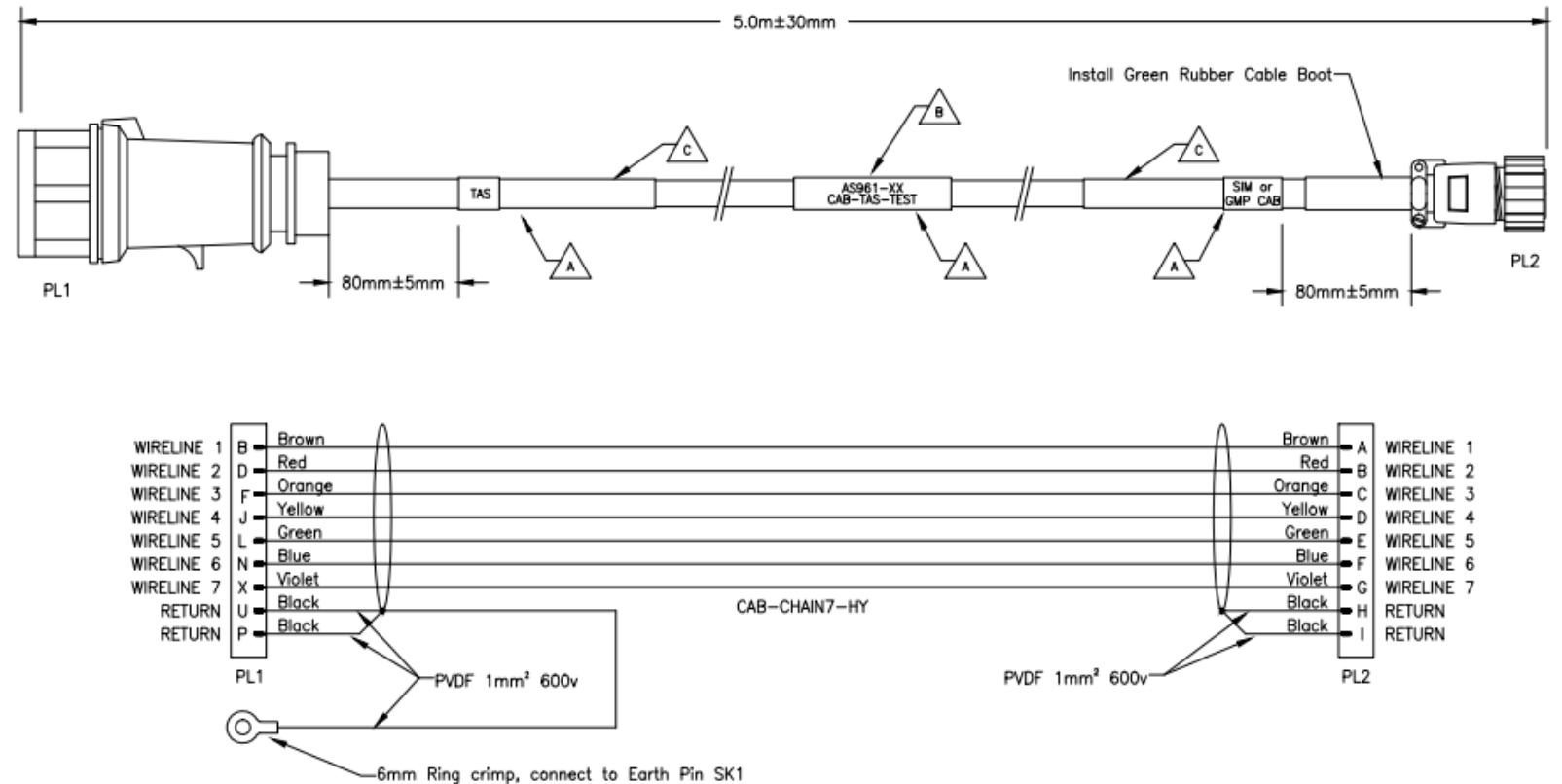
Main Features

- **Surface Test Cable for Off-Wireline Tests**
- Allows easy and quick connect from wireline SIM/Power Panel to TAS or Analogue ASR.
- Essential tool for faster tool string fault elimination & surface tests.



Parts Included

Part Number	Description	Quantity
AS961	5m Surface test cable to allow easy and quick connection to ASL TAS/ASR from surface recorder/Sim.	1



Compatible with



GPP/GMP/DCP

Above: **AS961** CAB-TAS-TEST wiring diagram (TAS/ASR Analogue surface test Connection (left), SIM/DCP/GPP/GMP connection (right)).



Main Features

- **Test Cable for Off-Wireline surface Tests between tools**
- Allows easy and quick connect between tools (seconds)
- Essential tool for faster tool string fault elimination & surface tests.



Compatible with

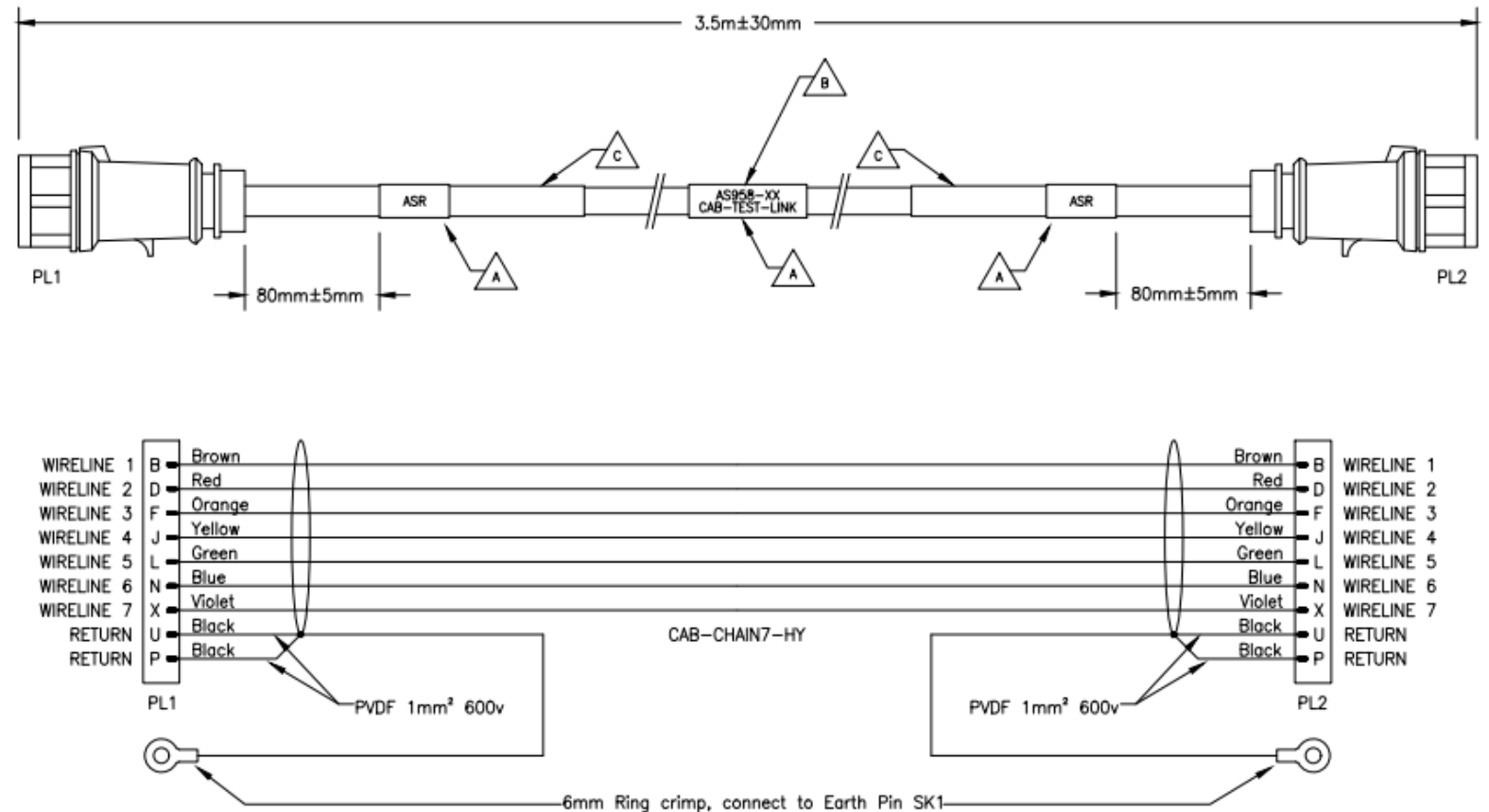


Geochain / ASR

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Parts Included

Part Number	Description	Quantity
AS958	3.5m Surface test cable to allow easy and quick connect between ASL downhole tools (Male-Male Cable connection to female tool ends).	1



Above: **AS958** CAB-TAS-TEST wiring diagram (TAS/ASR Analogue surface test Connection (left), winch/SIM/DCP/GPP/GMP connection (right)).

Heater Jacket



Main Features

- Intelligent PID controller.
- Cascade power connection.
- Configured for 110v or 230v operation.
- Internal temperature of the electronics does not exceed 302°F (150°C).

Functionality

- The 3" heater jacket is designed for use with the Geochain™ system. It is designed to fit around the electronic section of the ASR tool or TAS section and allows the units to be tested for operation at elevated temperatures without needing a dedicated oven. Care must be taken so that the internal temperature of the electronics does not exceed 302°F (150°C) otherwise damage will occur.
- When testing digital ASR's the internal temperature of the electronics is normally thirty degrees centigrade cooler than the temperature indicated on the heater jacket controller.

Compatible with

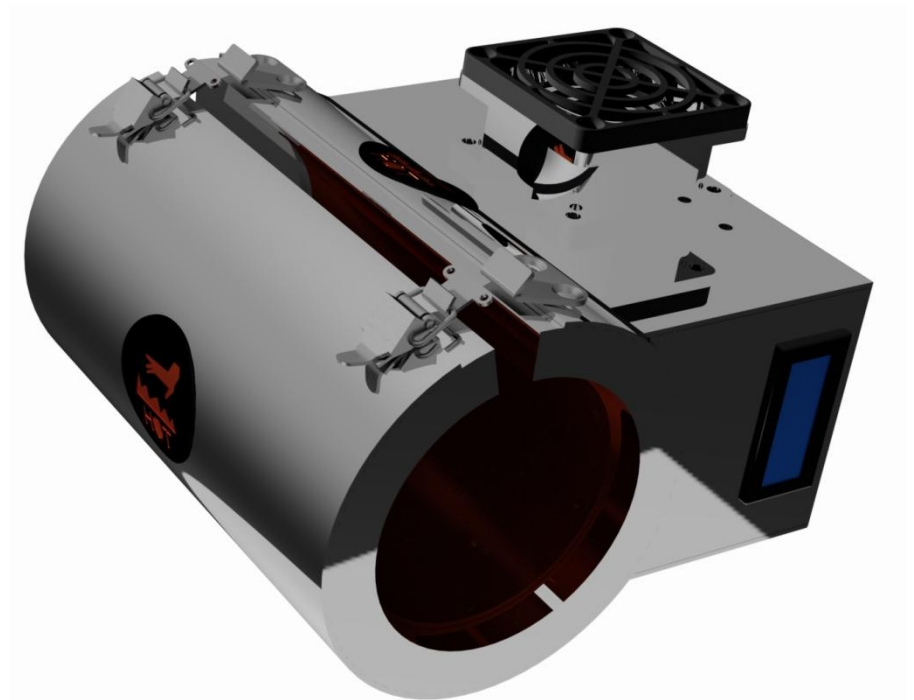


Geochain
Analogue
and Digital

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications

Diameter	3"
Max Tool Temperature	185°C
Power requirement	200 watt
Operation Voltage	110 or 220 V



MAKE-UP PLATES

Main Features

- Facilitates individual ASR/GSR connection to wireline/ITC whilst suspended in well.
- Simple to use
- 2 different heights available to accommodate working at ground/drill floor surface or at elevated well head positions.
- Adapter collar (GSR-99) available for use with Geochain Slim tools/SITCs.

Functionality

- The Geochain make up plate is designed to be placed over the well head/casing so as to allow discrete connection and disconnection of a wireline suspended intertool connector (ITC) to a downhole tool.
- The make up plate supports the weight of the tool string suspended in the well so as to allow build up/break down of individual tools at the well head without having to deploy/remove a string from a well in one single extraction manoeuvre. *The maximum tool string pull out distance before requiring a tool disconnection is limited to the height from well head to the safe suspended proximity from the crane/top sheave wheel.*

Compatible with



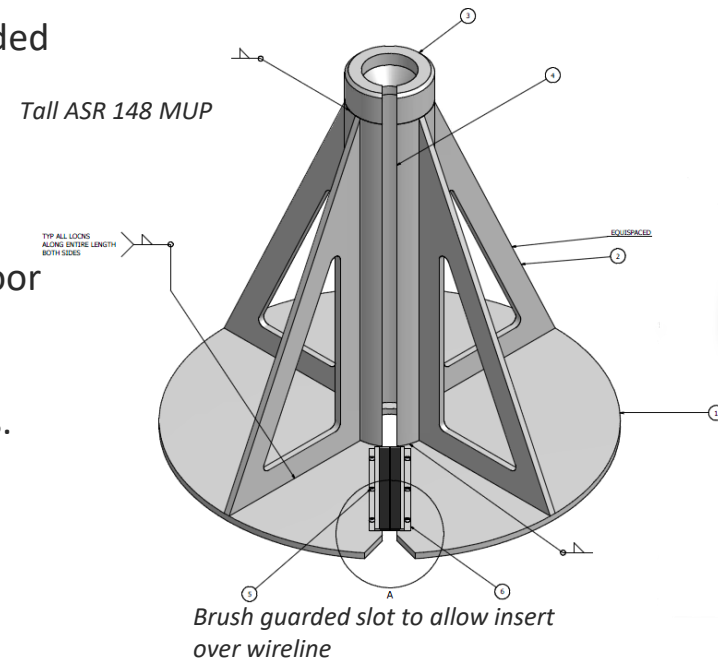
Geochain
Analogue
and Digital

GEO

SURFACE

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	ASR-148 MUP	Small MUP (SMUP)
Height	620mm	210 mm
Design Tested Max Load	5000 kg	5000 kg



SMUP Example – used on well casing, ITC-1 cable suspended in well using make up plate.



SMUP Example with slim adapter collar (GSR-99) – used on well casing, slim ITC-4 cable suspended in well using make up plate.



Main Features

- SPAK 10 ASR HP: service pack kit for 9 routine service operations and 1 major service for a Geochain HP.
- SPAK ITC-HP: service pack kit for 9 routine service operations and 1 major service of a Geochain ITC HP.
- SPAK 10 VRS-HP: service pack kit for 9 routine service operations and 1 major service of a Geochain VRS HP.
- SPAK 10 GRT-2-HP: service pack kit for 9 routine service operations and 1 major service of a GRT-2 HP.



SPAK 10 ITC
service pack kit

Compatible with



ASR-HP-SPAK10

Part Number	Description	Quantity
AVO17	O ring 58x3 V1238-95	11
AVO15	BS/AS O ring 112 747	20
AVO26	BS/AS O ring 112 V1238	20
AVO21	BS/AS O ring 036 Viton 75	1
SVO07	BS4518-0546-24 Viton 75	1
ASR-150	Shear Pin	1
AVO24	BS/AS O ring 119 V1238	20
AVO24 BU	BS/AS Backup Ring 199 Scarf Cut Arlon 1000	2
AVO17 BU	Backup Ring 59.48x64. 13x1.2 PEEL Scarf Cut	4

ITC-HP-SPAK10

Part Number	Description	Quantity
AVO17	O ring 58x3 V1238-95	22
AVO17 BU	Backup Ring 59.48X64 13x1.22 PEEK Scarf Cup	4
AVO21	BS/AS O ring 036 Viton 75	2
AVO22	BS/AS O Ring 134 Silicone 70	1
ASR-058W	Cable Head Weak Link Screw Size W	2
W61370R (ASR)	12.5x8.89x0.18mm Wave Spring Washer	2

VRS-HP-SPAK10

Part Number	Description	Quantity
AVO17	O ring 58x3 V1238-95	11
AVO17 BU	Backup Ring 59.48X64 13x1.22 PEEK Scarf Cup	4

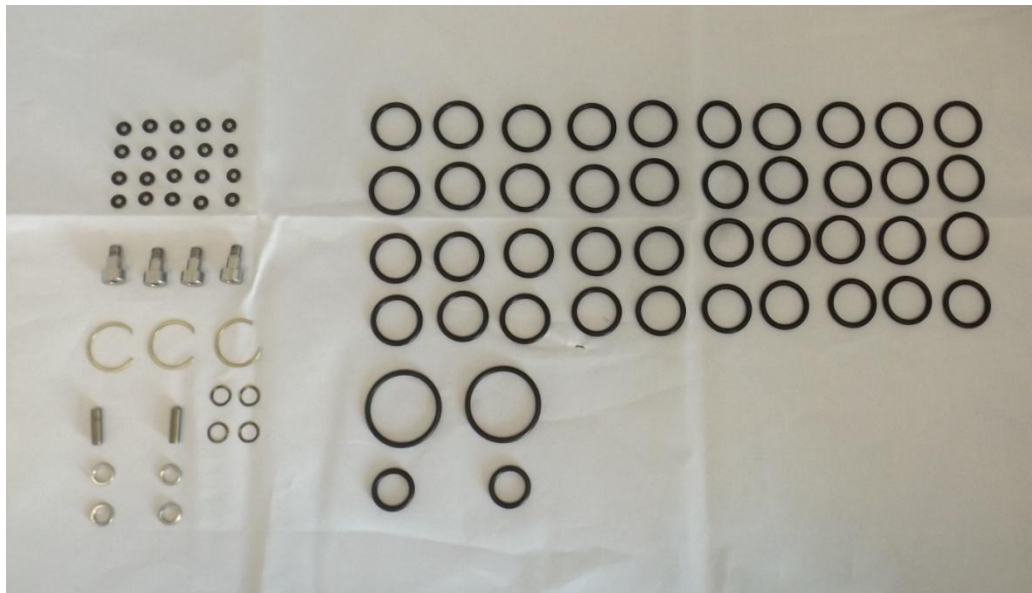
GRT-2-SPAK10

Part Number	Description	Quantity
AVO17	O ring 58x3 V1238-95	11
AVO17 BU	Backup Ring 59.48X64 13x1.22 PEEK Scarf Cup	4
AVO20	BS/AS O ring 135 V1238	20
AVO20 BU	BS/AS Back Up Ring 135	20
AVO7	BS45118-0546-25 Viton 75	2



Main Features

- SPAK 10 GSR: service pack kit for 9 routine service operations and 1 major service for a Geochain Slim.
- SPAK Slim ITC-4: service pack kit for 9 routine service operations and 1 major service of a Geochain Slim ITC.
- SPAK 10 SVRS: service pack kit for 10 routine service operations and 1 major service of a Geochain Slim VRS



Above: SPAK
Slim ITC-4

Compatible with



SPAK10 Slim
VRS Includes Nose Cone

Part Number	Description	QTY
AV039 (Tool Body)	BS/AS O Ring 126 V91A	20
AV038 (ITC-4)	BS/AS O Ring 116 V1238	20
AV037	BS/AS O Ring 019 Viton 75	20

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

SPAK 10 GSR

Part Number	Description	Quantity
GSR-Heatshrink 38.1mm x 145mm	Black heatshrink 38.1mm x 145mm long	2
AVO28 BU	ESR Back-up Ring	2
AVO44	14x3 V80	20
AVO39	BS/AS O Ring 126	40
AVO40	BS/AS O Ring 125	40
AVO37	BS/AS O Ring 019 Viton 75	2
AVO59-60	GSR Spring Seal and Backup P252048	1
CS001	Canted Spring ID 19.8 Width 1.7	2
ESR-045	ESR Shear Pin	1

SPAK Slim ITC-4

Part Number	Description	Quantity
AVO56	BS 006 O-ring V70 for use in ITC-4	20
AVO38	BS/AS O ring 116 V1238	40
AVO28	BS/AS O ring 113 V1238	2
AVO 19 (for supplying SPARES)	BS/AS O ring 123 V90	2
SRO15	Smalley Ring XVHB-81-S02	3
ESR-046 (Size 5)	ESR Tension Fail Screw Size 5	4
W61340R (GSR)	Wave Spring Washer	4
AVF004804	M6 Spring Washer (Form A) A2 SS	4
AVF006342	M5x0.8x16 LG Socket Set Screw (Cup Point) A2 SS	2

Optional Extra for SPAK Slim ITC-4

100A Oil	500ml Silicone oil 100A	1
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Main Features

- SPAK 10 ASR EHP: service pack kit for 9 routine service operations and 1 major service for a Geochain ASR EHP.
- SPAK ASR EHP ITC: service pack kit for 9 routine service operations and 1 major service of a Geochain EHP ITC.
- SPAK ASR EHP VRS: service pack kit for 9 routine service operations and 1 major service of a Geochain VRS EHP.

SPAK 10 VR EHP

Part Number	Description	Quantity
AVO17	O Ring 58x3 V1238-95	22
AVO17 BU	Backup Ring 59.48x64.13x1.2 PEEK Scarf cut	4
AVO20	BS/AS O ring 135 V1238	4
AVO55 (Inc. AVO55BU)	Special AVO17 C-Seal 58x3 Energised REV A	6

Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

SPAK 10 ASR EHP

Part Number	Description	Quantity
AVO17	O ring 58x3 V1238-95	11
AVO15	BS/AS O Ring 112 747	20
AVO26	BS/AS O Ring 112 V1238	20
AVO21	BS/AS O Ring 036 Viton 75	1
AVO07	BS4218-0546-24 Viton	1
ARS-150	Shear Pin	1
AVO24	BS/AS O Ring	20
AVO24 BU	BS/AS Backup Ring 119 Scarf Cut Arlon 1000	2
AVO17 BU	Backup Ring 59.48x64.13x1.2 PEEK Scarf cut	4
AVO55 (Includes AVO55 BU)	Special AVO17 C-Seal 58x3 Energised REV A	2
AVO61	EHP Shaft Seal P253724, PTFE	2
AVO62	EHP Insert Seal P246107, PFE	2
AVO63	EHP Bal Screw Nut Seal P252449 incl. Back up Ring	2
ASR-EHP 126	EHP Backup Support Ring	2
ASR-EHP 127	EHP Backup Ring	2

SPAK ASR EHP ITC-4

Part Number	Description	Quantity
AVO17	O Ring 58x3 V1238-95	22
AVO17BU	Backup Ring 59.48x64.13x1.2 PEEK Scarf cut	4
AVO21	BS/AS O Ring 036 Viton 75	2
AVO22	BS/AS O Ring 134 Silicone 70	1
ASR-058W	Cable Head Weak Line Screw W	2
W61370R	12.50x8.89x0.18mm Wave Spring Washer	2
AVF006359 (M8X25 SS)	M8x1.25x25 LG Hex Socket Set Screw (Cup Point) A2 St STL DIN 916	2
AVO55 (Inc. AVO55BU)	Special AVO17 C-Seal 58x3 Energised REV A	4
AVO47	BS/AS O Ring 008 V91A	4
AVO64	M6 Bonded Washer	4



Main Features

- Tool kit for servicing a Geochain ASR, Geochain ITC and Geochain Gamma Ray Tool.



Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Tkit-1 (ASR Geochain)

Part Number	Description	Quantity
WX54079	Geochain Maintenance Tool Roll	1
ST-07 (VET-1)	VRS Extractor Tool	1
ST-019	Kemlon Boot Tool	1
Socket Set	¼ inch Kamasa Socket Set	1
ST-006	Middle Connector Mount Tool	1
M15570-16 OR M81969/14-03	MIL 6020 Connector Extractor Tool	2
DCF.92.090.3LT	Lemo Connector Extractor	1
M819696/1-02	Insertion/Removal tool for Positronic D15	1
ST-005	Motor Mount Extractor Tool	1
2mm Parallel Punch	2mm Parallel Punch	1
3mm Parallel Punch	3mm Parallel Punch	1
ST-007 (12mm ASR)	Small C-Spanner for Fuji Nut	1
ASR-191	Drive Puller	1
ST-021 (OST-1)	O-ring Over Splined Shaft Tool (Metal)	1
TL-ASR-01	Middle Connector Test Lead	1
TL-ASR-03	Lemo test lead (female)	1
M5 Bolts for Puling Insert	Hexagon Socket Head Cap Screw M5x50	1
M6 Nipple	M6 Grease Nipple	2
ST-028	M12 Fuji Nut Box Spanner	1
ST-002	Brass O-Ring Removal Tool	1



Main Features

- Tool kit for servicing a Geochain GSR, Geochain ITC-4 and Geochain Slim Gamma Ray Tool.



Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Tkit-2 (GSR Geochain)

Part Number	Description	Quantity
WX54079	Geochain Maintenance Tool Roll	1
ST-011	GRS Removal Tool	1
TL-005	GSR-063 Test Lead	1
WX38797	Tkit GSR Twin Pack Metric & imperial	1
DCF.92.090.3LT	Lemo Connector Extractor	1
ST-003	Clutch Adaptor Tool	1
ST-026	Small C-Spanner for Fuji Nut	1
ST-007 (12mm ASR)	Small C-Spanner for Fuji Nut	1
ST-027	M10 Fuji Nut Box Spanner	1
ST-028	M12 Fuji Nut Box Spanner	1
ST-002	Brass O-Ring Removal Tool	1
¼ UNF Grease Nipple	Grease Nipple	2
ST-025	AVO39 O Ring Assembly Aid	1
ST-024	Splined Shaft Assembly Tool	1
ST-016	AVO40 O-Ring Assembly Aid	1
RS 707-7322	Vinyl Pouch for Test Lead	1
ST-015	GSR Boot Assembly Tool	1
ST-023	AVO38 O-Ring Assembly Aid	1



Main Features

- Tool kit for servicing a Geochain EHP ASR, Geochain EHP ITC and Geochain EHP Gamma Ray Tool.



Part Number	Description	Quantity
ST-021 (OST-1)	O-ring Over Splined Shaft Tool	1
ST-020 (KBT-1)	Kemlon Boot Tool (Short)	1
ST-028	M12 Fuji Nut Box Spanner	1
ST-002	Brass O-Ring Removal Tool	1
ST-035	EHP Seal Insert Pusher	1
ST-037	Bullet for AVO55	1
ST-040	Pusher for AVO55	1
ST-041	Pusher for AV063	
ST-042	Re-Sizer for AVO55	1
ST-043	Bullet for AVO63	1
ST-044	Pusher for AVO63	1
ST-045	Re-sizer For AVO63	1
ST-046	AVO55 Fitting Sleeve	1
ST-047	AVO55 Assy Tool for ASR-EHP 100	1
ST-060	EHP Seal Insert Removal Tool G/A	1
ST-061	Shaft Assembly Tool (M4)	1
RS 707-7322	Vinyl Pouch for Test Leads.	1

Tkit-3 (EHP Geochain)

Rev.06

Part Number	Description	Quantity
WX54079	Geochain Maintenance Tool Roll	1
DCC.09.05B.LAG	LEMO Connector Extractor	1
Socket Set	¼ inch Kamasa Socket Set	1
ST-006	Middle Connector Mount Tool	1
M81969/14-03	MIL 6020 Connector Extractor Tool	2
ST-005	Motor Mount Extractor	1
ST-007 (12mm ASR)	Small C-Spanner for Fuji Nut	1
2mm Parallel Punch	2mm Parallel Punch	1
3mm Parallel Punch	3mm Parallel Punch	1
ST-007 (12mm ASR)	Small C-Spanner for Fuji Nut	1
M5 Bolts for Pulling Inserts	Hexagon Socket Head Cap Screw M5x50	1
ST-019 (KBT-2)	Kemlon Boot Tool Short	1
M81969/1-02	Insertion/Removal Tool For Positronic D15	1
ASR-191	Drive Puller	1
TL-ASR-01	ASR Test Lead	1
TL-ASR-03	Lemo Test Lead (Female) Sensor pack	1
ST-003	Clutch Adaptor Tool	1
M6 Nipple	M6 Grease Nipple	2

Compatible with





Main Features

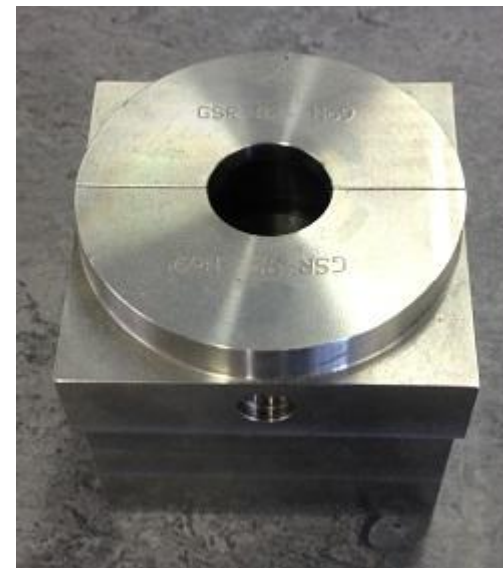
- Tool kit for rehead of ITC-4 Geochain Slim cable head.



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

*GSR-83 (GSR
ITC-4 rehead
tool kit)*

Part Number	Description	Quantity
GSR-82	Taper Bush Holder	1
BSR-118	Spreader Plate	1
BSR-140 or BSR-121	Cone Drift for 15/32" Wireline	1



Compatible with



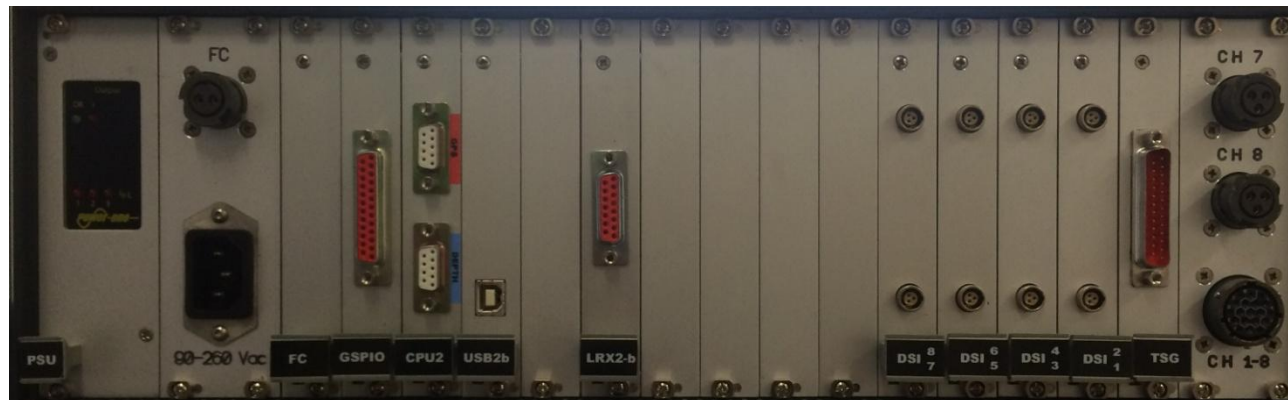
GSP SPARES DATASHEETS





Main Features

- **Firing Circuit (FC)** module allows GSP to trigger a single air gun without any additional equipment.
- **GSPIO** module includes: external source control interface, power control circuitry and controls the FC.
- **Dual seismic interface (DSI)** module allows between 2-16 Analogue channels.
- **CPU2** offers both a GPS time stamp and depth encoded interface.
- **Test signal generator (TSG)** module able to generate either precision sine wave signals or single sample impulses.
- **USB+DSP** module provides a standard USB device interface, enabling the GSP to be easily connected to almost any recent desktop or notebook PC.
- **Line Receiver (LRX/LRX 2b)** module
- **Power Supply (PSU)** module accepts a universal mains AC supply voltage of 95-260 V ac at either 50 or 60Hz.



Compatible with



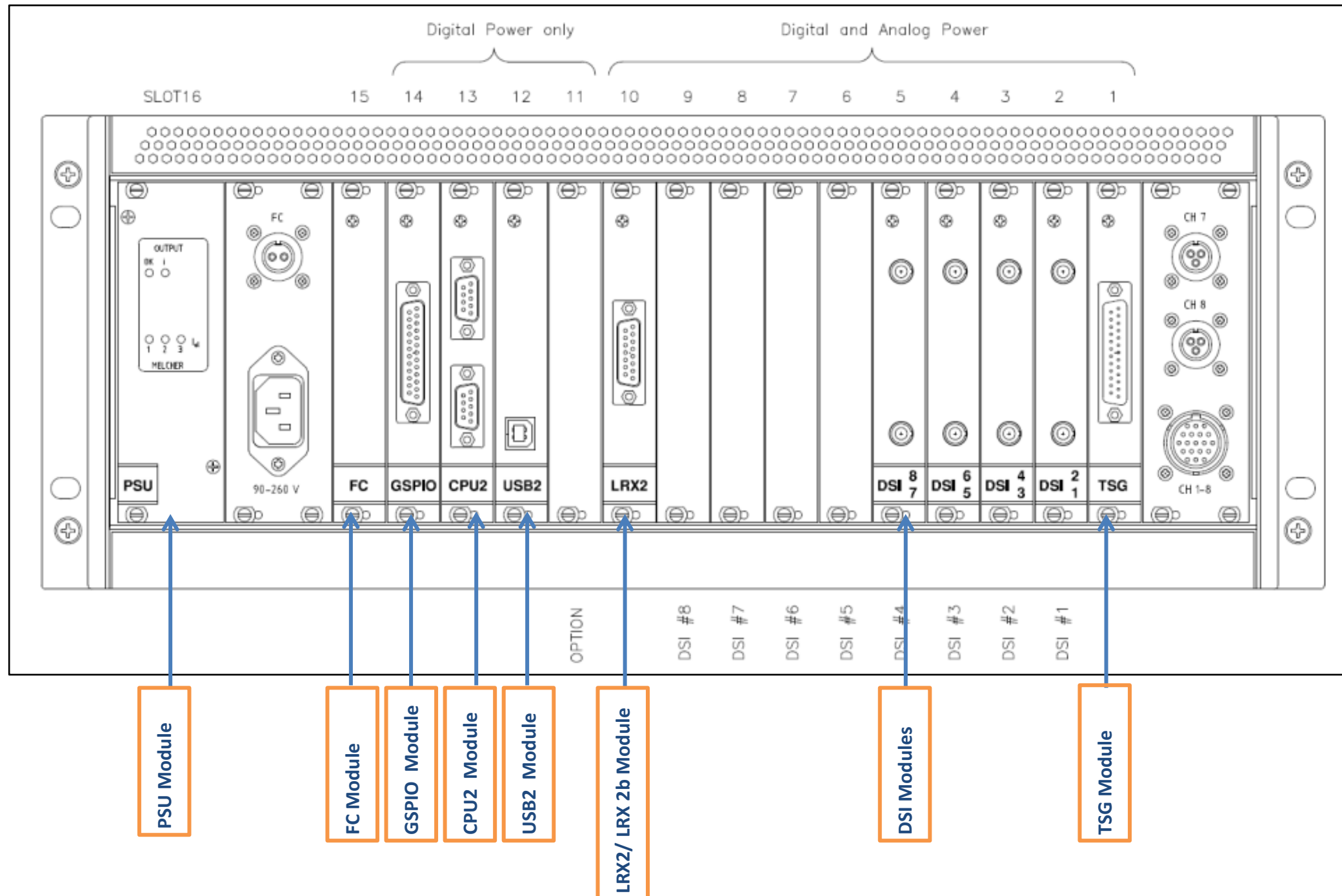
GSP back panel

GSP Spares Kit

Part Number	Description	Quantity
LM3020	Assembled PSU module for GSP	1
ASS-GSP-Spares Bag		1
ASS-GSP-Spares-Rack	GSP USB+DSP Module	1
AS2087A-02-USB2	GSP IO Module	1
AS2076B-LRX 2	GSP Line Receiver Module	1
AS2072D-DSI	Dual Seismic Input Module	1
AS2060E-CPU2	GSP CPU Module	1
AS20373D-TSG	Test Signal Generator Module	1
AS2025C-FC	GSP Firing Circuit Module	1



GSP Spares Kit in aluminium storage rack (27x13cm), shipped within protective bag and peli 1450 case





Main Features

- GSP Power Supply Unit (PSU) Module for GSP
- Accepts mains AC supply voltage 95-260V (50/60Hz)
- Low Noise
- Over voltage/current protection

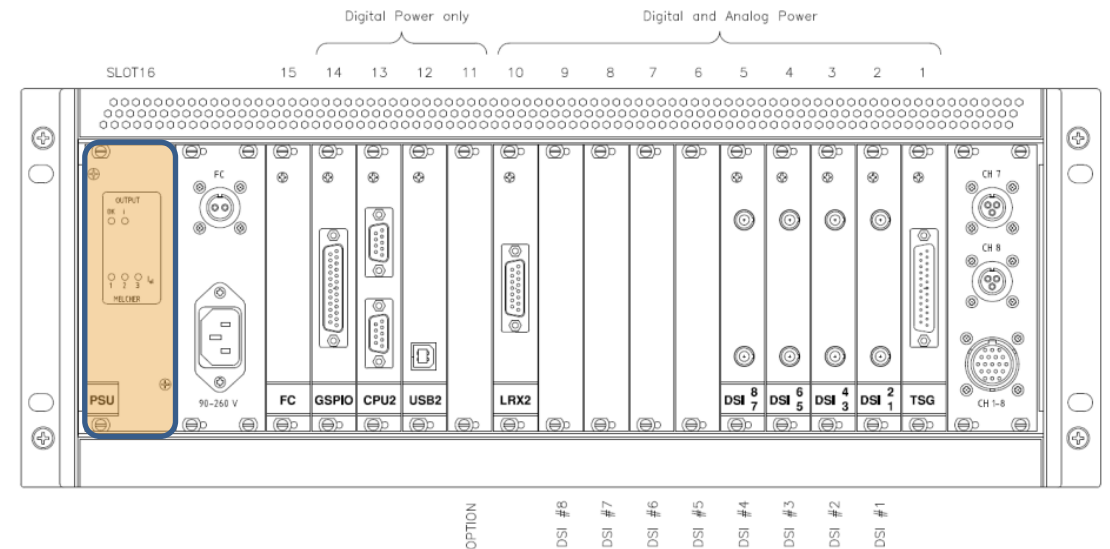
Functionality

The LM3020 power supply module (PSU) accepts a universal mains ac supply voltage of 95-260Vac at either 50 or 60Hz.

The PSU module is a triple output unit which supplies the 5 volt dc logic supply and low-noise positive and negative 12 volt dc analogue supplies. The analogue supplies use a separate ground connection, which is connected to the digital ground at the backplane only.

All three supply rails are protected against over-voltage and over-current fault conditions. A small green LED on the rear panel illuminates if the PSU module is operating normally. A red LED indicates a fault. The PSU is protected by an internal fuse.

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Drawing Ref

Part	LM3020
Drawing Rev.	A
Module	GSP Power Supply Unit

Spares Panel for





Main Features

- USB 2
- 515Kbyte FIFO Buffer
- Integrated SHARC floating point Digital Signal Processor (DSP) device.
- Allows for maximum 1.5mbps Telemetry performance.

Functionality

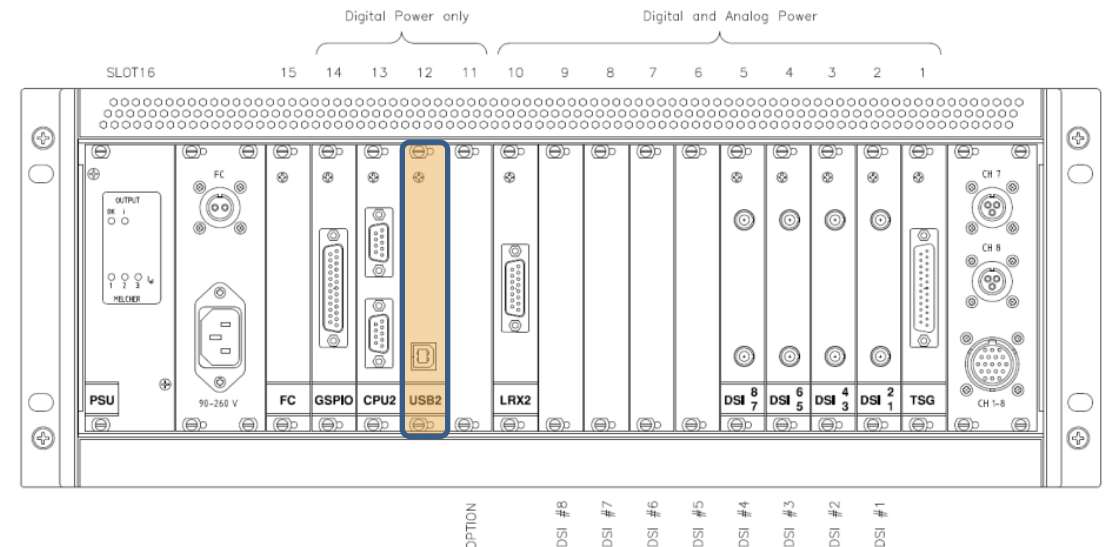
The Universal Serial Bus (USB) module provides a standard USB device interface, enabling the GSP to be easily connected to almost any recent desktop or notebook PC. Suitable spare cables are readily available from your local computer shop.

The USB module has two synchronous FIFO memory devices (U10 & U11). U11 serves as a buffer for data from the GSP analogue channels while U10 buffers the data stream from any downhole geophone array.

Spares Panel for



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Drawing Ref

Part AS2087-A-02-USB2

Drawing Rev. A

Module USB2 & DSP

The latest revision USB 2 modules are fitted with deeper 515 Kbyte FIFO devices. The programmable logic device U1 implements a state machine which efficiently multiplexes and transfers data from both FIFO out to U4, the USB interface device. U5 is an EEPROM which holds unit identification information required by Windows to locate the correct device driver



Main Features

- External source control interface
- Remote Power control circuitry
- Controls the FC
- Version C

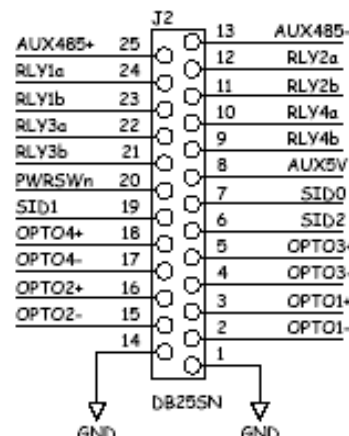
Functionality

The main purpose of the GSPIO module is to provide the external source control interface, but this module performs several other system functions. The power supply control circuitry is located on the GSPIO module, which must always be installed into slot 14, or else you will be unable to switch on the system power.

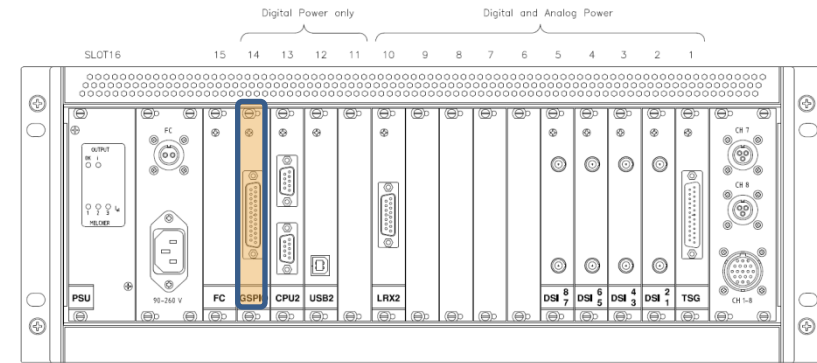
The GSPIO provides control signals required to operate the VFD display module and to allocate the serial busses between modules. The GSPIO also controls the FC module and provides two serial communications links required by associated equipment. Finally the GSPIO module reads the GSP serial number from the backplane.

REV C – PIN 6 REASSIGNED TO AUXFIRE

Spares Panel for



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



GSP-1 GSPIO MODU

Part	AS2078	
Drawing Revision	C	
Module	GSPIO	
Signal	Pins	Interface type
RLY-A	23, 24	MOSFET relay output.
RLY-B	11, 12	MOSFET relay output.
RLY-C	21, 22	MOSFET relay output.
RLY-D	9, 10.	MOSFET relay output
AUX5V	8.	+5 interface potential
GND	1, 14	Interface common.
ISO-A	3(+), 2(-)	Opto-coupler via 270R.
ISO-B	16(+), 15(-).	Opto-coupler via 270R
ISO-C	5(+), 4(-)	Opto-coupler via 270R.
ISO-D	18(+), 17(-).	Opto-coupler via 270R
SID0-1	7,19	Binary-encoded source number, active-low, open-collector. Outputs float for test record
AUXFIREn	6	Active-low auxiliary fire output (was SID2).
PWRSWn	20 (rev.C only)	Routed to panel switch connection. Pull to ground to toggle power.

REMOTE POWER CONTROL

From revision C, the AS2078 GSPIO module routes the active low signal PWRSWn out to connector pin 20, thus enabling GSP power to be remotely controlled. This feature is intended to facilitate unattended operation of the GSP, because it allows for automated recovery from a power failure or system crash. GSP power may be toggled by grounding PWRSWn for about one second. The current state of GSP power may be determined from the presence of AUX5V at pin 8, but remember to allow five seconds for GSP power to collapse after switch off.



Main Features

- Digital Seismic Input Module (DSI)
- Provides 2 low distortion analogue channels
- 8 card slots available on GSP
- Input multiplexer allows for software selectable input switching
- Input impedance protection
- Low-cut filter
- Delta-Sigma Converters

Functionality

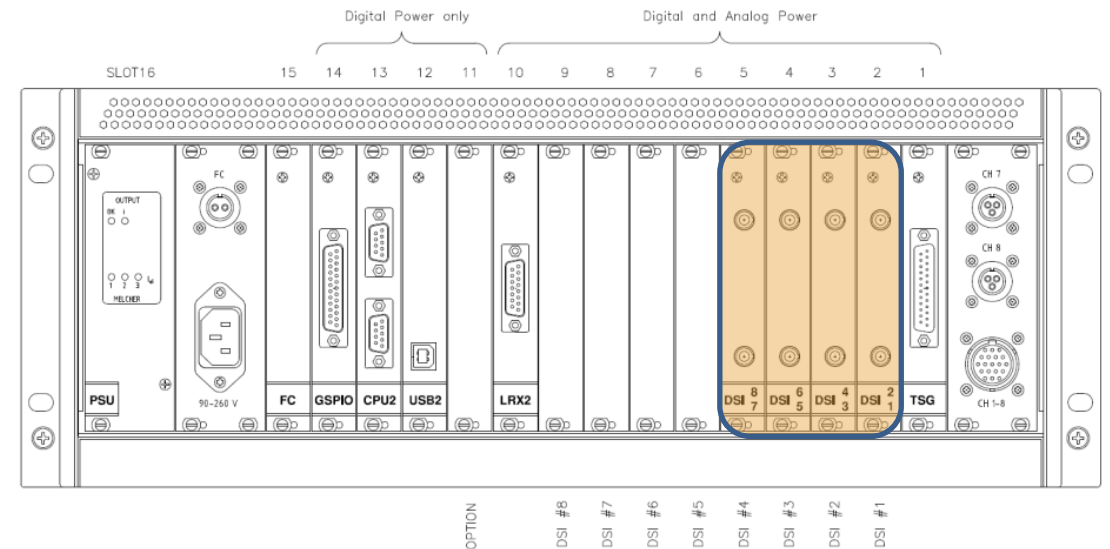
Each Dual Seismic Interface (DSI) module provides two low distortion analogue channels. For a VSP survey, the standard configuration of four DSI modules (eight channels) is usually sufficient. The GSP rack has a total of eight slots available for DSI modules, so can support up to sixteen analogue channels.

Delta-Sigma converters offer unsurpassed channel performance and also very effectively perform the anti-aliasing function, achieving a 3dB bandwidth of 40% of the sampling frequency.

Spares Panel for



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Drawing Ref

Part	AS2072-D-02-DSI
Drawing Rev.	D
Module	Digital Seismic Input Module

The DSI modules supplied with your GSP system have the correct channel identification plates fitted to the handle. If you add more modules, or swap around the existing DSI modules, you should remember to also fit the correct channel identification plates, depending upon slot location. Extra plates can be supplied on request.

~ See GSP manual for full operational notes



Main Features

- GSP Controller Module
- 16.384 MHz Processor
- 32Kbyte EPROM & 128Kbyte static RAM
- System Clock
- GPS Time stamp Interface
- CPU 2 automatic clock recalibration
- Depth Encoder Interface

Functionality

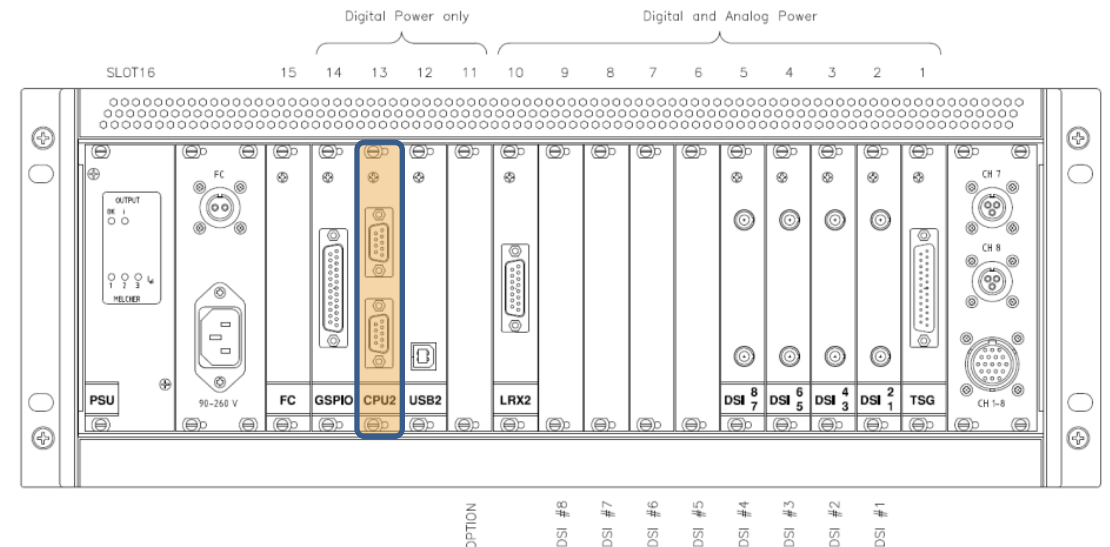
The AS2060 controller module (CPU) employs a Motorola MC68SEC000 microprocessor running at 16.384 MHz. The module provides a 32Kbyte EPROM and 128Kbytes of static RAM. The EPROM contains only a small amount of bootstrap code. The main programme code is downloaded from the PC each time the *GSP* is reset. This procedure allows us to implement code updates simply by including a new version of the *GSP* program code file (GSP.bin) as part of each new *ACQ* software release.

The CPU module houses a temperature compensated, 16.384 MHz oscillator whose output is distributed to all boards via the backplane BSYSCLK signal. The sampling clock is ultimately derived from this signal.

Spares Panel for



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Drawing Ref

Part	AS2060-E-02-CPU2
Drawing Rev.	E
Module	CPU Controller Module

CPU-2

New GSPs are fitted as standard with the CPU2 module (AS2060 revision E). The CPU2 module offers both a GPS time-stamp interface and also a depth encoder interface. The CPU2 also has a more accurate master oscillator, capable of automatic recalibration to 0.3 ppm accuracy when used with the GPS timestamp kit. Earlier GSPs may be easily upgraded through purchase of a CPU2 module.

~ See GSP manual for full operational notes



Main Features

- Firing Circuit Module
- Enables local fire of single source
- Minimizes cross talk onto source reference
- 60 volt isolated pulse for solenoid trigger

Functionality

The AS2025 FC module (firing circuit) allows the GSP to directly trigger a single air gun without any additional equipment.

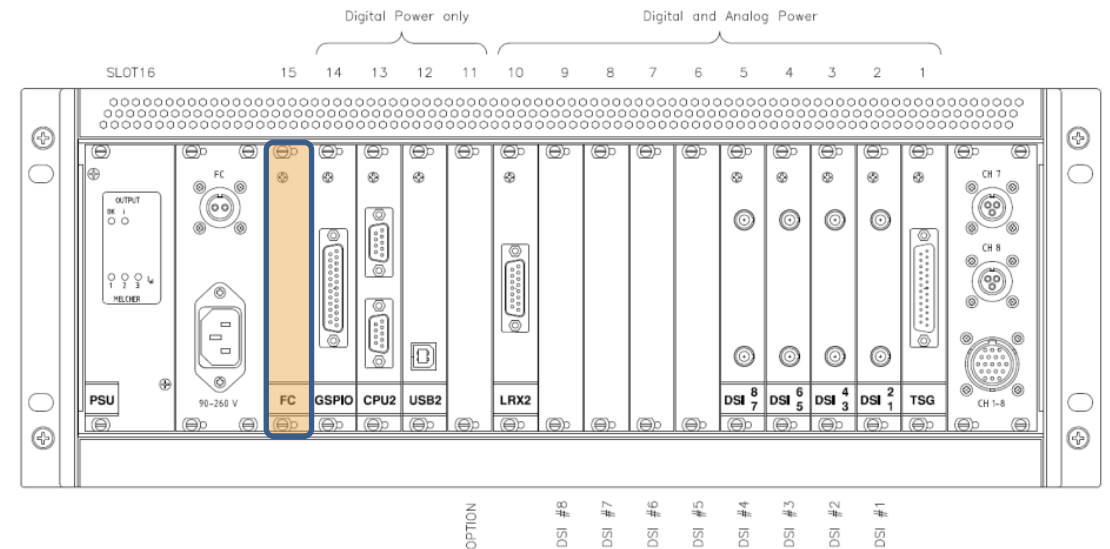
Full electrical isolation of the firing pulse helps to minimise crosstalk onto the monitor hydrophone signal through any leakage in the firing umbilical.

The FC module generates a 60 volt isolated pulse suitable for direct connection to the trigger solenoid of a standard air gun. The 60 volt potential is generated by two small DC/DC converters which require about 10-12 seconds to fully charge the 4000 uF reservoir capacitance. Discharging into a typical air gun trigger solenoid the reservoir will decay to about one-third the initial voltage by the end of the standard pulse width of 50 ms. Recharging begins at the end of the firing pulse via the constant current circuits of U1 and U2.

Spares Panel for



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Drawing Ref

Part	AS2025-B-FC
Drawing Rev.	B
Module	FC Firing Circuit Module



Main Features

- Test Signal Generator (TSG)
- Precision Voltage Reference
- Accurate A/D converter

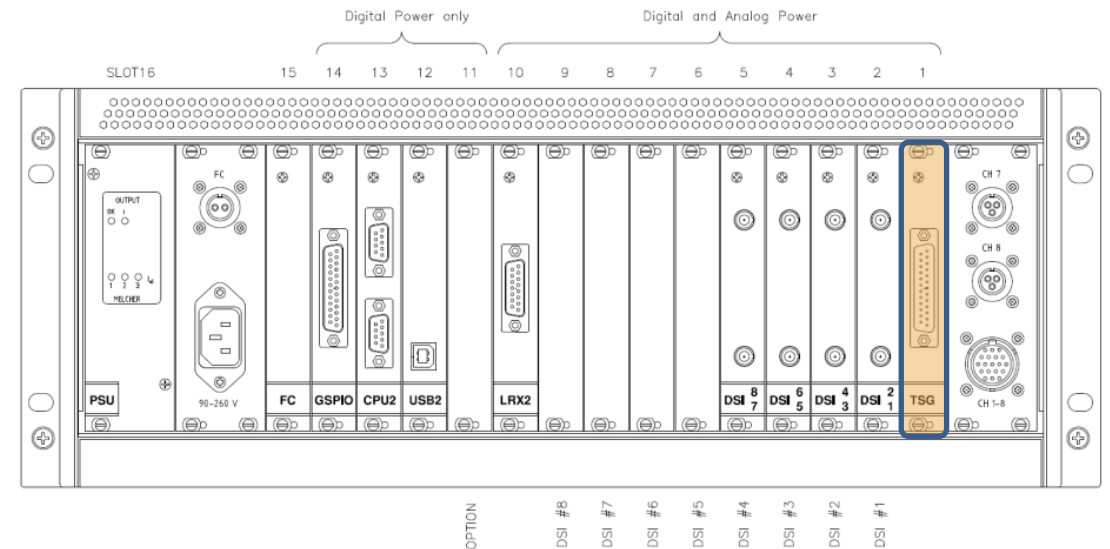
Functionality

The Test Signal Generator (TSG) module can generate either a precision sine wave signal or a single sample impulse. The TSG includes a precision voltage reference and an accurate analog to digital converter which allow the module to automatically re-calibrate itself each time you change any settings. The TSG has eight balanced outputs which can be individually switched between the test signal and ground to support channel crosstalk tests. The TSG is able to invert one output's polarity to support common-mode rejection measurements.

Spares Panel for



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



Drawing Ref

Part	AS2073-D-TSG
Drawing Rev.	D
Module	Test Signal Generator



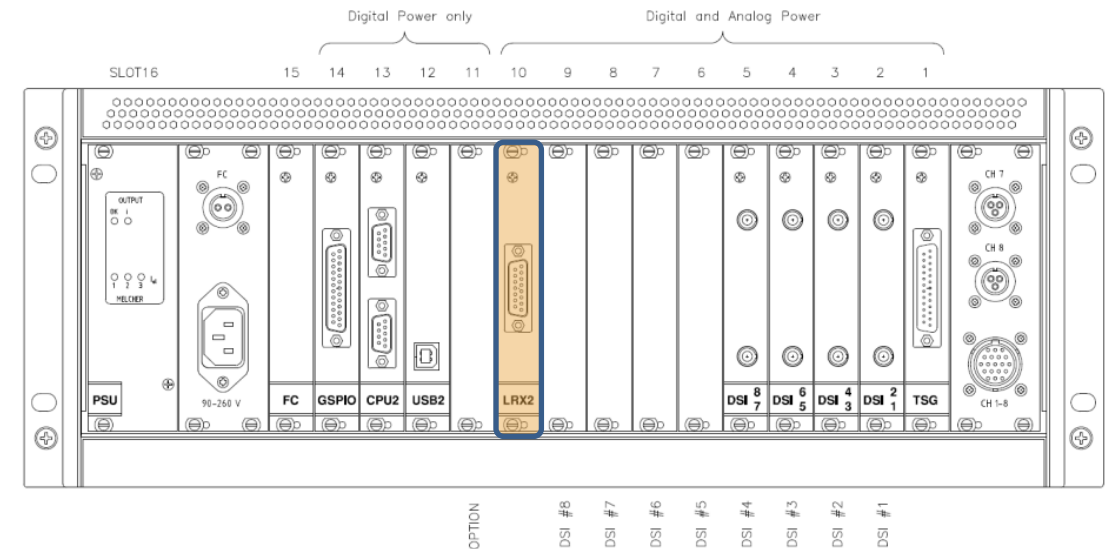
Main Features

- Accepts data from digital downhole array tool.
- Balanced signal acceptance
- Synchronised to system clock

Functionality

- The LRX (Line Receiver) board is responsible for the amplification and digitisation of the received telemetry signal. The board hosts a high speed, high resolution analog to digital converter, which outputs the digitised telemetry signal to the DSP device, via a dedicated serial bus on the GSP backplane.
- The LRX-2 implements wireline equalisation and is an essential element of the digital Geochain data transmission system.
- The LRX-2b variant is needed to support the bypass capability of AS273, AS272 and AS250 digitisers. Any LRX-2 module can be re-programmed to become an LRX-2b module.

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

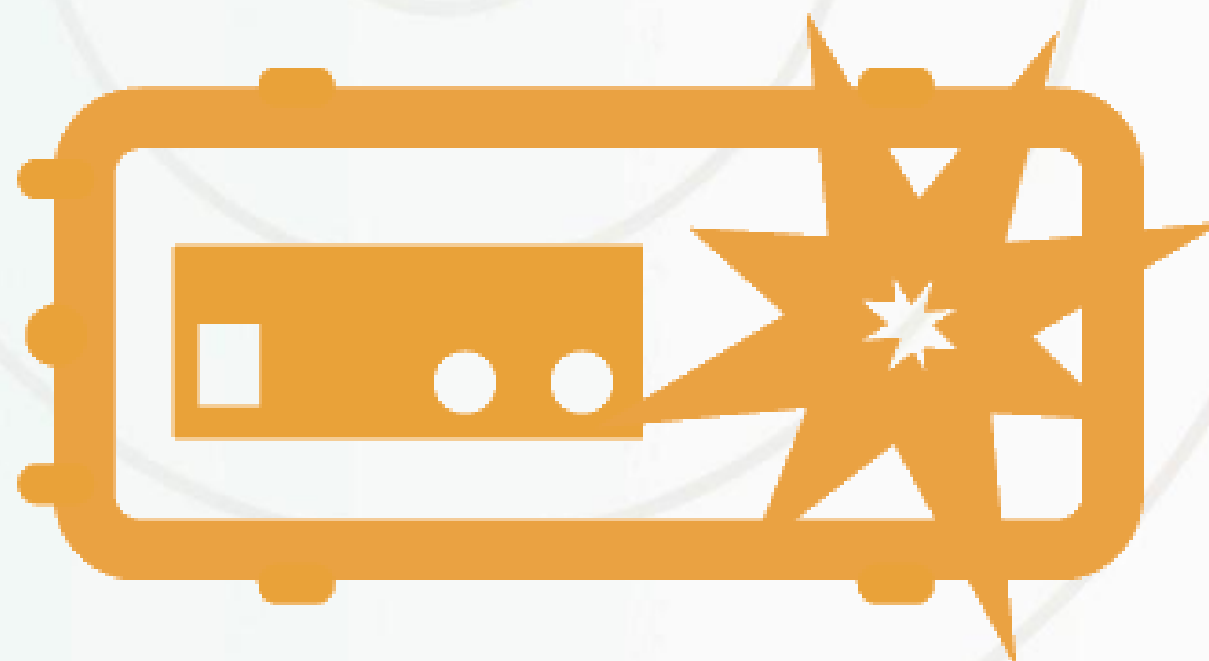


Drawing Ref

Part	AS2076-B-LRX2
Drawing Rev.	B
Module	Line Receiver Module

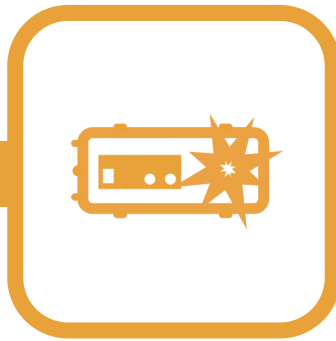
Spares Panel for





RSS Source Controller

RSS Geochain System Panel



Main Features

- Automatic source array synchronisation.
- Lightweight control umbilical.
- Each unit may control up to 32 airguns.
- Timing accuracy 0.1ms.
- Digital source signature telemetry.
- Accepts any transducer signal.
- GPS time stamp option.
- Source switching automatically controlled from within acquisition system.
- SEG-Y recording. Run, Pause and End features for complex surveys.
- PC control via USB.
- Standalone operation with GSP-1 or with third party acquisition systems.
- Synchronisation from hydrophone as well as from timing coils.
- New SIU output analogue hydrophone signal using AHA.

Functionality

- The RSS-2 array source controller is a flexible and cost effective solution for the control of clustered “airgun” arrays. It is a development of the highly acclaimed and field proven RSS-1.
- Each RSS-2 panel can be configured as a master or slave to eliminate common backup problems and equipment mix ups. Each RSS-2 unit can control up to 8 Source Interface Units (SIU) to fire up to 32 airguns.
- A major revision of the software now allows the offset source information and log files to be transmitted to the rig. This allows the seismic engineer to monitor boatside operations. A new gun simulator unit is also available which plugs into an SIU to exercise the firing system and check deck side cables and SIU units

Functionality

RSS-2 Specifications

Number of guns:	4 per SIU, maximum 32
Control:	PC via USB port
Transmission:	Radio modem
Firing integrity:	Encoded multiple tone sequence
Sensor type:	Hydro, timing coil CC, Piezo
Synchronisation:	Better than 0.1ms
Gun firing pules:	60V (SELV compliant)
Gun firing pulse width:	Programmable
Gun fire minimum interval:	> 2s
A/D Converter:	24 bit Delta-Sigma
Power:	90-260V AC or 12V DC
Operating temp:	0-40°C (SIU-10 to 50)
Dimensions:	3U 19” rack mount
Weight (RSS-2 Panel):	36.4 lbs (16.5 kg)

Compatible with



GSP



ACQ Software

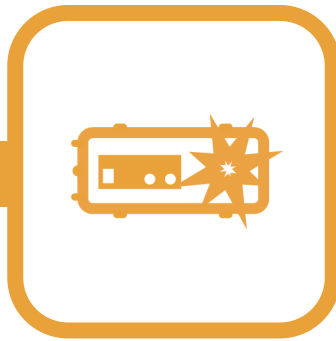


Impulsive Sources



3rd Party Recorders

SIU-100 Source Interface Unit



Main Features

SIU Source Interface Unit (interface up to 4 guns) fitted with AG gun and hydrophone connectors. Compatible with third party gun looms. This allows the RSS-2 to potentially control up to 32 guns (using 8 SIU's).

Functionality

- An SIU box houses two identical “Dual Source Interface Units” (DSIU). Each DSIU module provides two firing circuits, two firing sensor channels, one signature monitor hydrophone channel, and two 4-20mA dc sensor inputs.
- An SIU may be deployed via anything up to 25 linked 100m AS978 cables.
- Multiple SIUs can be daisy chained together, if more than 4 guns are being used.
- Source Interface Unit (SIU) includes ground wire kit for testing gun looms.

Compatible with



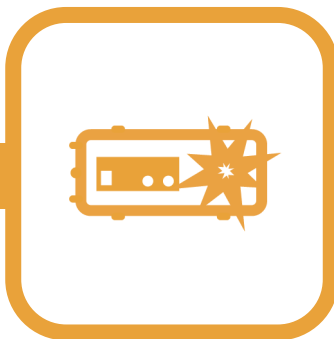
LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



SIU Specifications

Number of guns:	4 per SIU, maximum of 32
Control:	RSS-2
Sensor Inputs	4-20 mA
Gun firing pules:	60V (SELV compliant)
Gun firing pulse width:	Programmable
Gun fire minimum interval:	> 2s
Power:	90-260V AC or 12V DC
Operating temp	32-122°F (0-50°C)
Weight	26.1lb (11.85kg)

RSS Geochain System Panel



RSS Software Display Changes 2019

- Automatic source array synchronisation.
- Lightweight control umbilical.
- Each unit may control up to 32 airguns.
- Timing accuracy 0.1ms.
- Digital source signature telemetry.
- Accepts any transducer signal.
- GPS time stamp option.
- Source switching automatically controlled from within acquisition system.
- SEG-Y recording.
- PC control via USB.
- Standalone operation with GSP-1 or with third party acquisition systems.
- Synchronisation from hydrophone as well as from timing coils.
- New SIU output analogue hydrophone signal using AHA.

Functionality

- The RSS-2 array source controller is a flexible and cost effective solution for the control of clustered “airgun” arrays. It is a development of the highly acclaimed and field proven RSS-1.
- Each RSS-2 panel can be configured as a master or slave to eliminate common backup problems and equipment mix ups. Each RSS-2 unit can control up to 7 Source Interface Units (SIU) to fire up to 32 airguns.
- A major revision of the software now allows the offset source information and log files to be transmitted to the rig. This allows the seismic engineer to monitor boatside operations. A new gun simulator unit is also available which plugs into an SIU to exercise the firing system and check deck side cables and SIU units

LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Functionality

RSS-2 Specifications

Number of guns:	4 per SIU, maximum 32
Control:	PC via USB port
Transmission:	Radio modem
Firing integrity:	Encoded multiple tone sequence
Sensor type:	Hydro, timing coil CC, Piezo
Synchronisation:	Better than 0.1ms
Gun firing pules:	60V (SELV compliant)
Gun firing pulse width:	Programmable
Gun fire minimum interval:	> 2s
A/D Converter:	24 bit Delta-Sigma
Power:	90-260V AC or 12V DC
Operating temp:	0-40°C (SIU-10 to 50)
Dimensions:	3U 19” rack mount
Weight (RSS-2 Panel):	36.4 lbs (16.5 kg)

Compatible with



GSP



ACQ Software



Impulsive Sources



3rd Party Recorders



Test Wells

ROSEMANOWES FACTS

Avalon Sciences has acquired the ABB Offshore System borehole facility at Rosemanowes Quarry, Penryn in Cornwall. The acquisition of the quarry will allow Avalon Sciences to carry out testing of borehole equipment within a controlled environment. This will give Avalon an easier means of testing equipment replicating real onsite conditions, allowing us to provide a better understanding of problems that may develop in other locations.

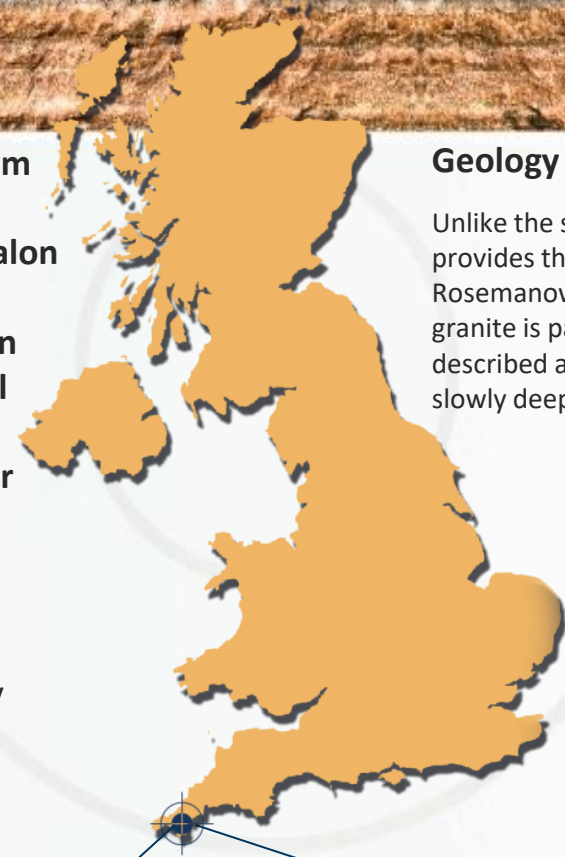
Quarry History:

The quarry was a UK Hot Dry Rock Geothermal Energy Research site, offering access to one of the most comprehensively logged well systems in the world. The boreholes are located within a fresh water filled granite environment. The quarry was the first deep geothermal project within the UK starting in 1977. The aims of the project were:

- 1) To see if hot dry rock could be fractured by water pressure alone (Achieved).
- 2) To find out if the rock was hot enough to make steam for turbine generation (Not achieved at the depths attained).

The project concluded in 1991, but studies continued until 1997.

In 2006 the quarry was used as a deep borehole test facility, making the quarry the best logged site in the world. The Quarry was purchased by ASL in 2013.

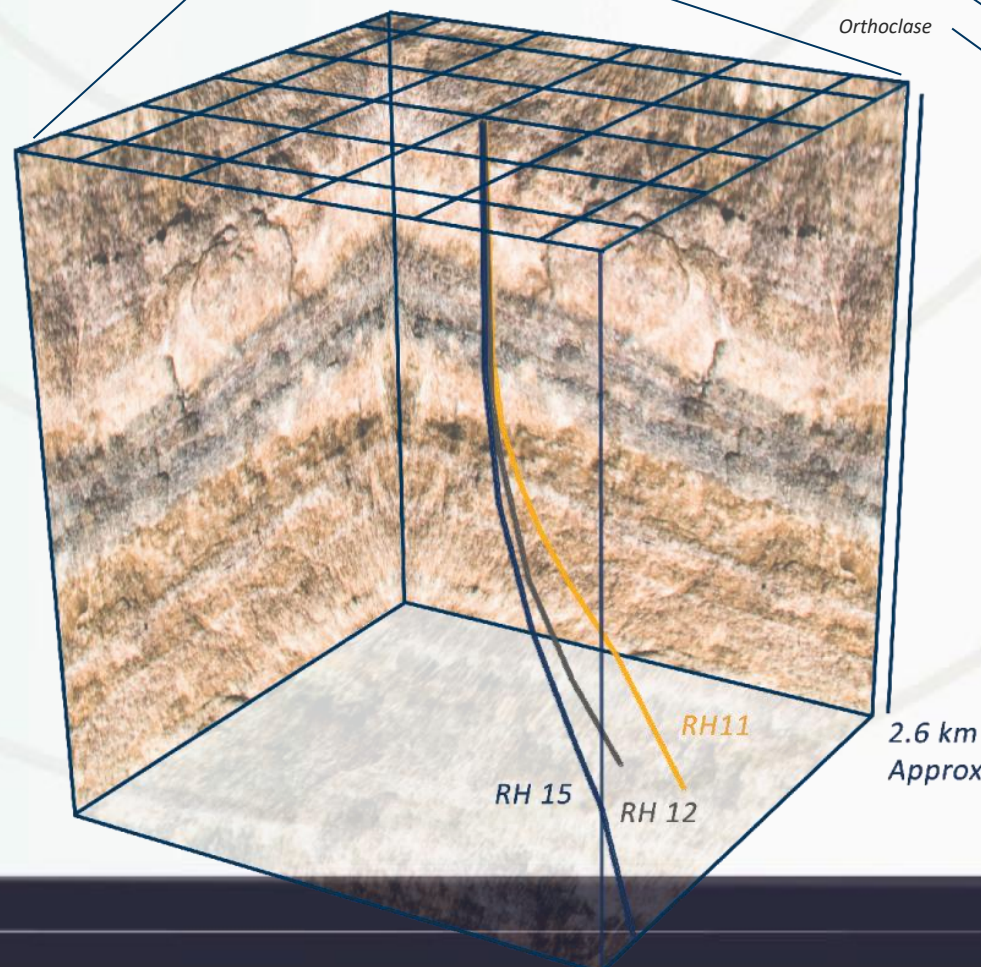
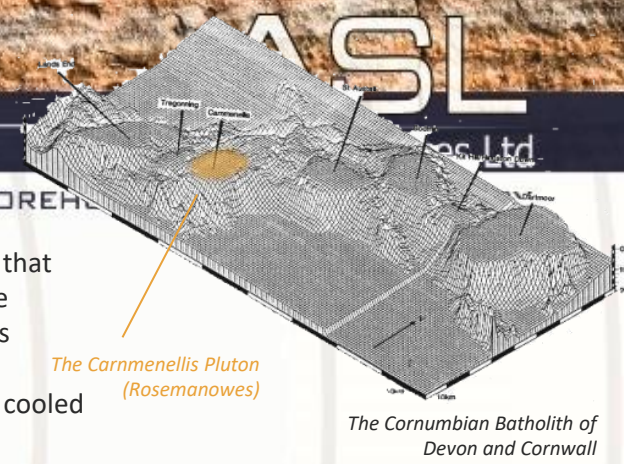


Geology Rocks:

Unlike the sedimentary marine Blue Lias limestone formation that provides the foundation strata of the ASL HQ in Somerton, the Rosemanowes quarry is dominated by an igneous granite. This granite is part of the Great Cornubian Batholith which can be described as a large emplacement of intrusive rock which has cooled slowly deep within the crust.

So what is this deep crustal rock doing at Rosemanowes!?

During the late Palaeozoic ~280Mya two ancient continental plates crashed together to form the super continent 'Pangaea'. This caused a huge mountain building event known as the Variscan Orogeny. As deep rock formations were thrust up, so were the deeper intrusive granites of the Cornubian Batholith. These rocks are known as 'Plutons' and define much of the Cornish and Devonshire landscape wherever they outcrop - Dartmoor, Bodmin, St. Austell, Land's End and Carnmenellis.



Biotite Mica (Black)
Muscovite Mica (Metallic white)
Orthoclase



Carnmenellis Granite (3mm across)

The Carnmenellis Granite is described as a 'Two Mica' granite. The granite experiences natural radiation caused by Zircon within biotite mica grains. This gives the rock the property of a 'high heat flow', which valued in geothermal exploration.

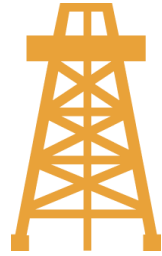
Borehole Test Facility

The quarry consists of:
x3 Deep Boreholes

Well id	Casing	Measured Depth
RH 11	9 5/8" OD	2356m/7730'
RH 12	9 5/8" OD	2180m/7150'
RH 15	9 5/8" OD	2566m/8420'

- x1 - open hole section inclined at 30 degrees
- x4 - 300m MD boreholes with 6" casing @20m
- x1 - 150m MD 8 1/2" uncased borehole inclined at 30 degrees.

How to get to the Quarry & Accommodation



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

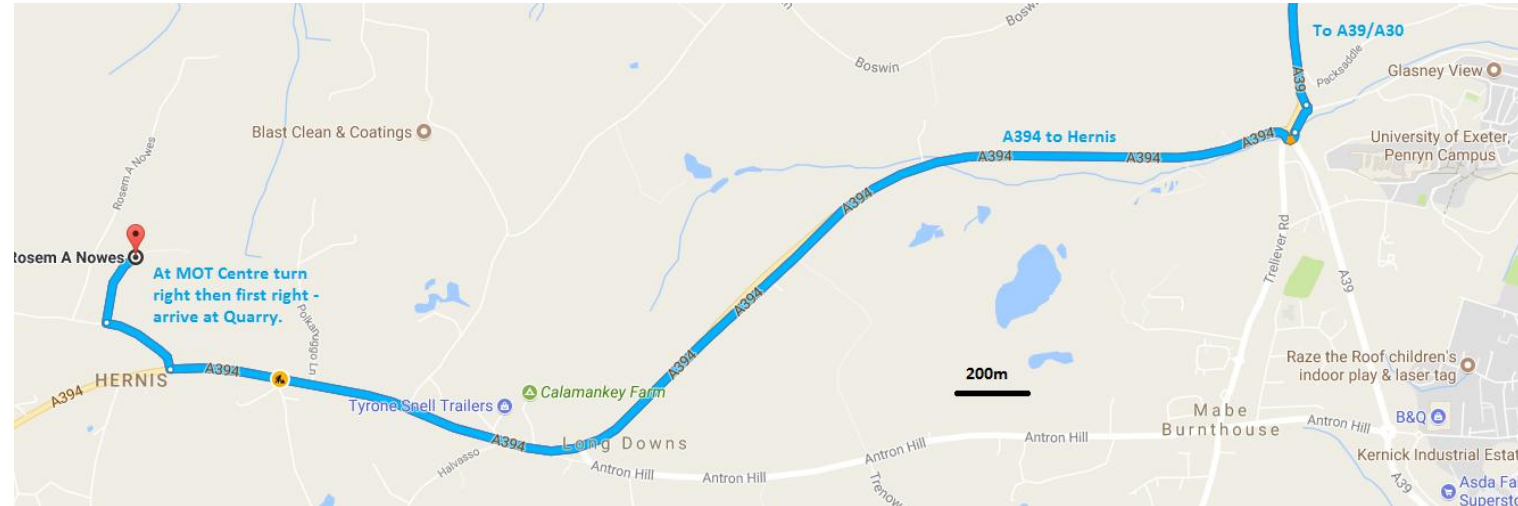
Address

Avalon Cornwall, Rosemanowes Quarry, Herniss, Longdowns, Penryn, Cornwall, UK . TR10 9DU

Phone: +44 (0) 1458 271085

Getting there by Car:

- From London – M25 Motorway to M3 West. Depart M3 onto A303 continue all the way to Exeter and join A30 to Cornwall. Take A39 towards Truro and continue to Falmouth.
- From North - M5 Motorway South to Exeter join A30 all way to Cornwall. Take A39 towards Truro and continue to Falmouth.
- Near Falmouth – Leave A39 at Treliever Roundabout (North of Falmouth) take A394 Exit to Herniss. Continue for ~1.5miles and take right turn before Cornwall Autogas & MOT Centre. Take next right into Quarry. Look for ASL logo sign. Continue slowly down Quarry drive to lower quarry parking and report to ASL Office.



Accommodation

- The Green Bank Hotel 5.6 miles from Quarry
Address: Stratton Pl, Falmouth TR11 2SR
Phone: +44 (0) 1326 312440
www.greenbank-hotel.co.uk
Onsite parking is available
Walking distance to restaurants and Falmouth boardwalk.
- Premier Inn Helston 6.8 miles from Quarry
Address: Clodgey Ln, Helston TR13 8FZ
Phone: +44 (0) 8715 278512
www.premierinn.com
Onsite parking is available
Walking distance to Helston Highstreet



Address

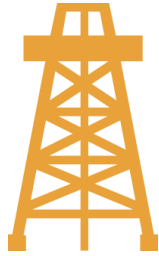
Avalon Cornwall, Rosemanowes Quarry, Herniss, Longdowns, Penryn, Cornwall, TR10 9DU

Part of the



**Avalon
Borehole
Testing
Facility**

RH12 Borehole Test Well



The RH12 borehole provides an ideal location to carry out well testing on borehole equipment. The well has a 9-5/8" (244.45mm) diameter casing to 5876 ft (1790m) depth, suitable for any tool systems.

The site also provides an opportunity for trainees to learn how to maintain, assemble and deploy ASL tool systems on site. Please refer to our ATC training brochure for more details about these courses.

Main Features

- One of three test wells located on Avalon's Borehole Testing Facility.
- The boreholes are located within a fresh water filled granite environment.
- Reaches a maximum depth of 7198ft (2194m).

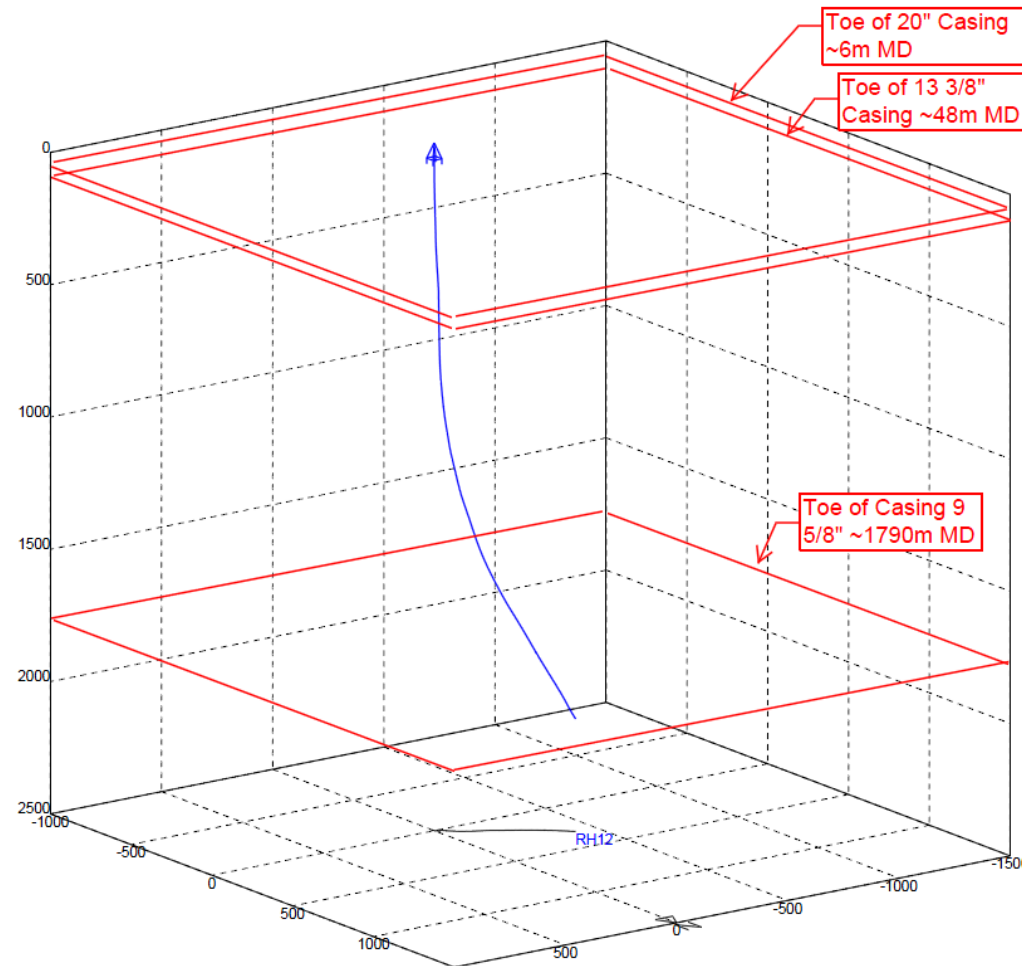
Any of the wells can be hired for use (academic discounts available).

Compatible with



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Borehole
Testing
Facility

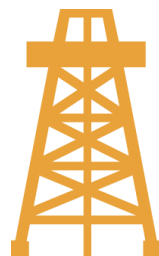
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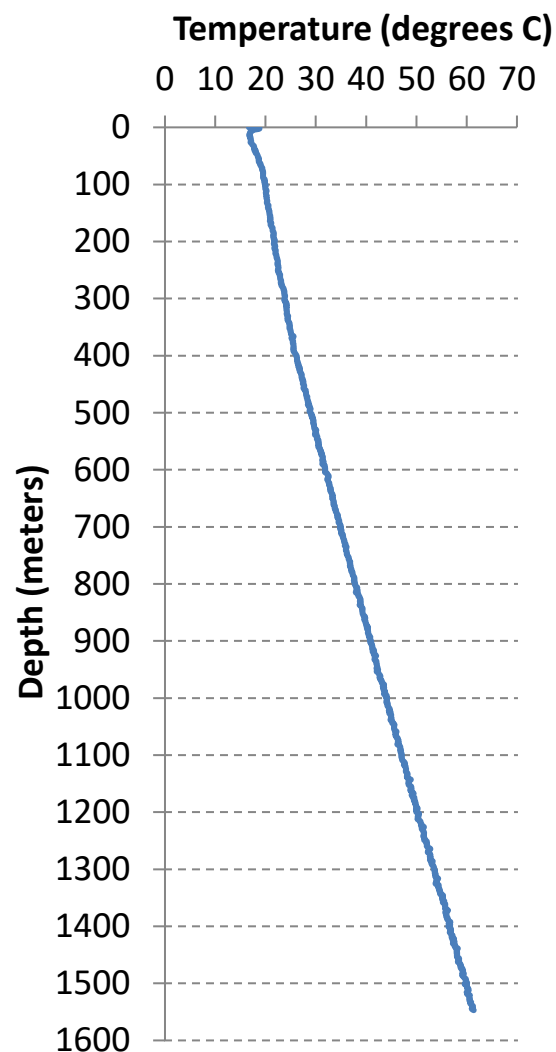
Specifications

Measured Depth	7198 ft (2194m)
Casing Depth	5876 ft (1790m)
Minimum Casing Diameter	9 5/8" (244.45 mm)
Max Temperature	194 °F (90°C)
Max Pressure	2610 psi (180 bar)

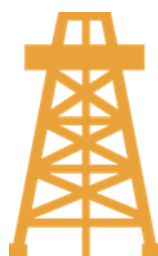
RH12 Borehole Test Well



Temperature profile



Compatible with



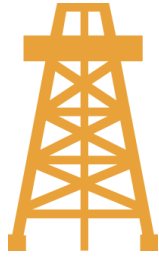
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Hole ID: RH12

MD (m)	TVD (m)	AOD (m)	Hole Conditions
0	0	164.68	Open Well: No Well Control
0	0	164.18	Ground Level
5.73	5.73	158.45	Toe of 20" casing
			13 5/8" K55 Casing
47.68	47.68	116.5	Toe of 13 5/8" Casing
			9 5/8" P110 Casing
1791.01	1740.84	1576.66	Toe of 9 5/8" Casing
			8 1/2" Open Hole
2194.31			TD

RH15 Borehole Test Well



The RH15 borehole provides an ideal location to carry out well testing on borehole equipment. The well has a 9-5/8" diameter casing to 7296ft (2224m) depth, suitable for any tool systems. The site also provides an opportunity for trainees to learn how to maintain, assemble and deploy ASL tool systems on site. Please refer to our ATC training brochure for more details about these courses.

Main Features

- One of three test wells located on Avalon's Borehole Testing Facility RH15.
- The boreholes are located within a fresh water filled granite environment.
- Reaches a maximum depth of 8366ft (2566m).
- Maximum deviation of 30°

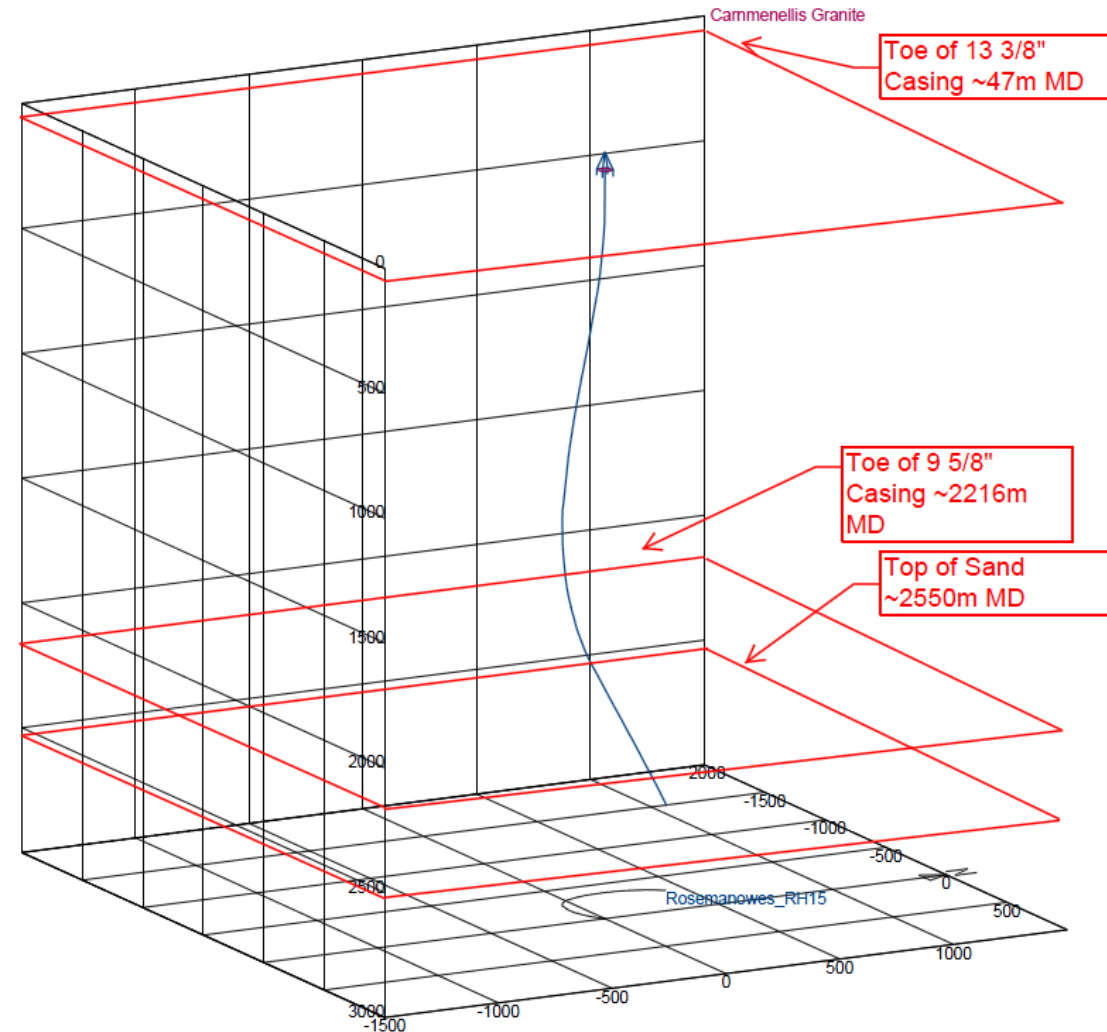
Any of the wells can be hired for use (academic discounts available).



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Testing
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Compatible with

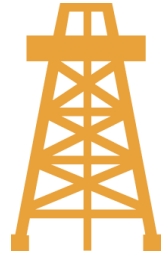
LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



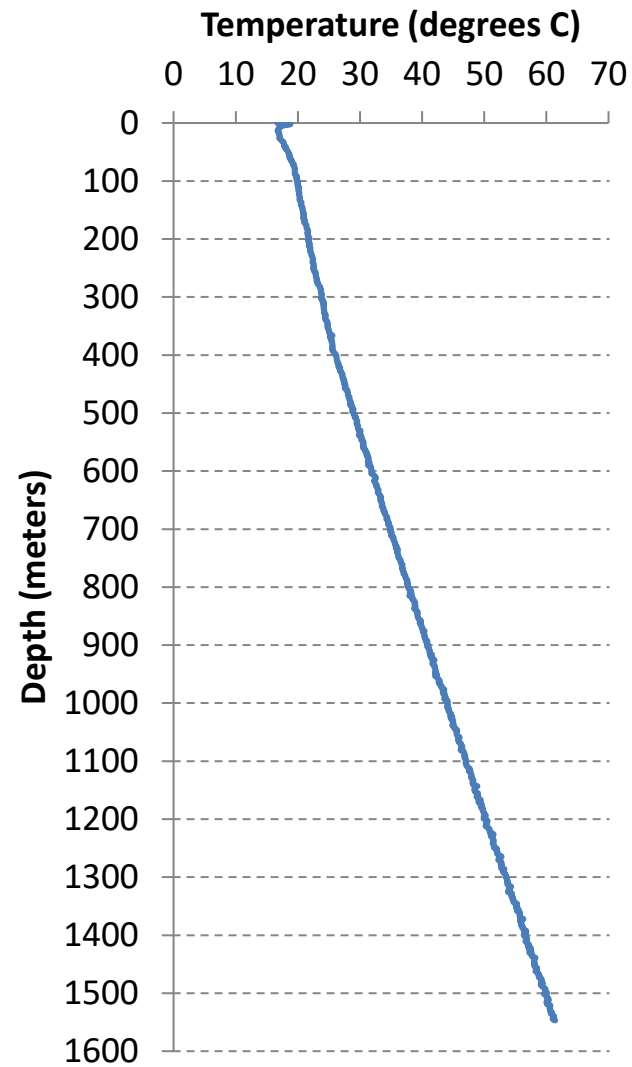
Specifications

Measured Depth	8366 ft (2566m)
Casing Depth	7296 ft (2224m)
Minimum Casing Diameter	244.45 mm (9 5/8")
Max Temperature	194 °F(90°C)
Max Pressure	2610 psi (180 bar)

RH15 Borehole Test Well



Temperature profile



Compatible with

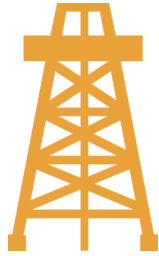
**Avalon
Borehole
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LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Hole ID: RH15

MD (m)	TVD (m)	AOD (m)	Hole Conditions
0	0	164	Open Well: No well Control
0	0	164	Ground Level
5.21	5.21	158.97	Toe of 20" Casing
			13 5/8" K55 Casing
46.11	46.11	118	Toe of 13 5/8" Casing
			9 5/8" C95 Casing
2216.61	2133.75	1969.57	Toe of 9 5/8" Casing
2542.31			8 1/2" Open Hole Top of Sand
2777.31			Blockage
2810	2661	2480.64	TD

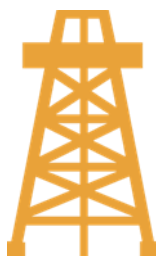
Test Facility Vibrator Source



Five Mertz M22 vibrator trucks are located at the Avalon Borehole Test Facility. The vibrators provide a broadband frequency range and ability to perform walk away surveys or multiple offset source locations.

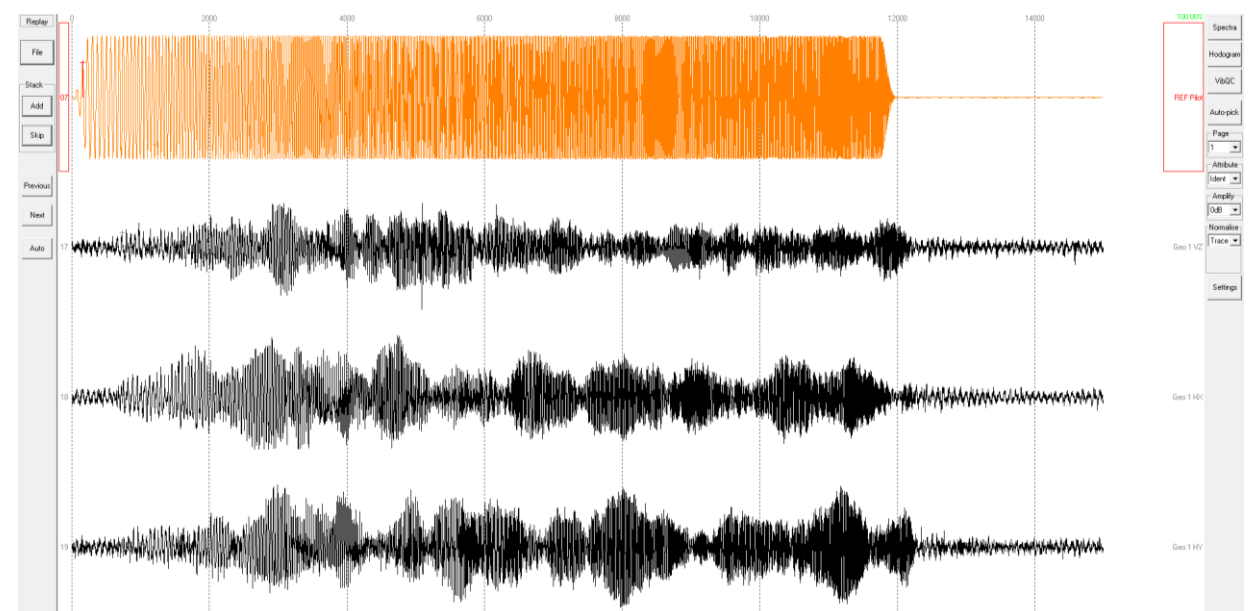
Vib Model:	Mertz M22
Max Ground Force:	30,000 lbs (133 kN)
Vib Controller:	Sercel VE416
Max Sweep Period:	64000ms
Min Start Frequency:	5Hz – 250Hz
Max End Frequency:	5Hz – 250Hz
Sweep shape options:	Sweep Laws: Linear, Linear with Parametric portion, Logarithmic Law, Law with parametric logarithmic portion, T to the power n
Mass of reaction mass:	4600 lbs (2086kg)
Mass of base plate:	2700 lbs (1225kg)
Hold down Weight:	32,500 lbs (47742kg)
Hold Down Percent of Force	108%

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ROSEMANOWES LOWER QUARRY



- Rosemanowes Quarry, near Penryn, Cornwall, United Kingdom, was a granite quarry and the site of an early experiment in extracting geothermal energy from the earth using hot dry rock (HDR) technology.
- In February 2014 Rosemanowes Quarry was purchased by Avalon Sciences Ltd (a Somerset Based Borehole Seismic Instrumentation Company) with the intention to develop the site in to an industry leading facility for testing down hole seismic and logging instrumentation.
- The extensively characterised boreholes and wells within homogenous granite facilitates an ideal locality to prove down hole seismic receivers and sources, all extensively used within the Oil and Gas exploration and monitoring industries. This upper quarry site is available for use to both industry and academic institutions by the end of 2014/early 2015.
- The sheltered **lower quarry** hosts a number of industrial units available for rent.
- Onsite parking is available

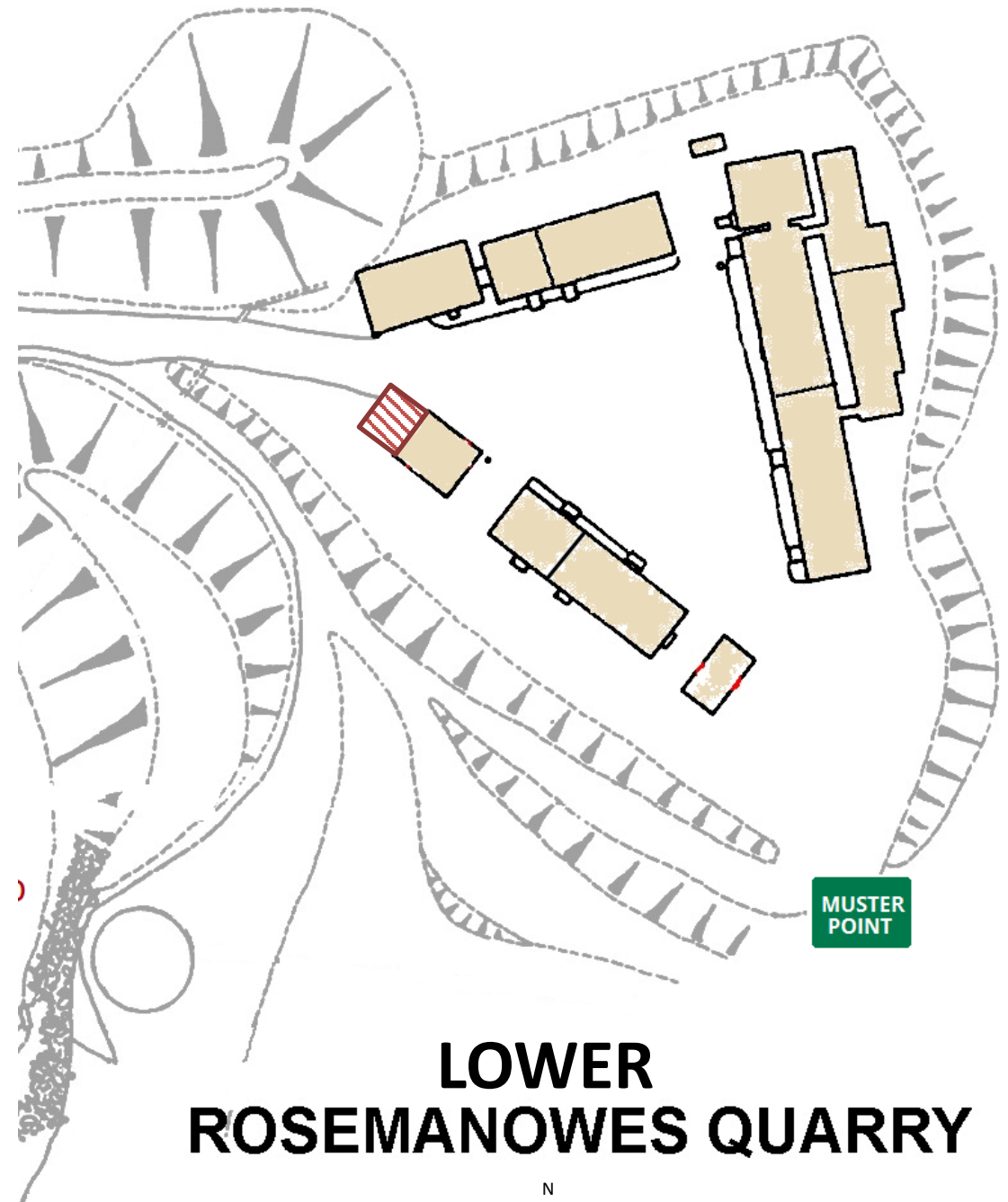


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LOWER ROSEMANOWES QUARRY

Address

Avalon Cornwall, Rosemanowes Quarry, Herniss,
Longdowns, Penryn, Cornwall, TR10 9DU



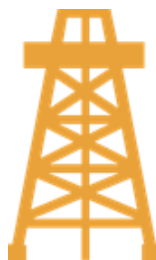
ASL HQ has an onsite vertical 656ft (200m) cased well with a dedicated electronic winch, wireline and local airgun source pit. This provides great infrastructure for quick well deployment proof of concept testing and downhole tool deployment training.

Main Features

- Located on the Avalon HQ site in Somerton, Somerset .
- The well is steel cased to total depth.
- Reaches a maximum depth of 656ft (200m)
- The well is accompanied by a Rochester 7-H-472K Hepta (1km) wireline and Electric Winch.
- Range of engineers, technicians and winch operators available for operations support

Any of the wells can be hired for use (academic discounts available).

Compatible with



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Well Specifications

Measured Depth	656 ft (200m)
Casing Depth	656 ft (200m)
Minimum Casing Diameter	9" (228mm)
Max Temperature	86°F (30°C)
Max Pressure	500 psi (34 bar)

Source Pit Info

Max Depth	16ft (5m)
Gun	20 cu in Sleeve
Pressure	Upto 1000psi (69 bar)
Well Offset	10ft (3m)
Gas	Nitrogen



Pressure Testing Facilities



Service Provided

Avalon Sciences Ltd. operates one of the few high pressure test facilities in the country. Three chambers are available for testing of any components subject to an external pressure. The chambers are quick to load and pressurise; a typical 20,000 psi test can be conducted in about thirty minutes. The latest HT/HP chamber can run to 35,000 psi at 500°F.

Availability & Prices

Avalon Sciences have three pressure test rigs which are available for third party use. The rigs can be booked by the hour, day or week and include an experienced operator who will run and log your test.

Prices

Halfday (min use – 4 hour) £1275

Subsequent Hours £225.45

Compatible with



LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



	Chamber 1	Chamber 2	Chamber 3
Internal Diameter	5" (127mm)	3 ¹⁵ / ₁₆ " (100mm)	3 ¹⁵ / ₁₆ " (100mm)
Internal Length	141 ³ / ₄ " (3600mm)	59 ¹ / ₁₆ " (1500mm)	74 ¹³ / ₁₆ " (1900mm)
Test Pressure	30,000psi	27,500 psi	35000psi
Test Temp	Ambient	500°F (260°C)	500°F (260°C)
Electrical Feedthru	Yes	Yes	Yes
Full PC Control	No	No	Yes