

### DOWNHOLE



GeoChain



GeoChain SLIM



GeoChain EHP



BOSS



GAMMA



PERMASEIS



SPARKER



TCU



Ancillaries

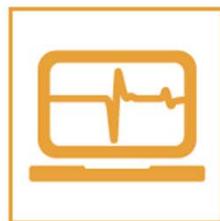
### SURFACE



GSP-GPP-DCP



RSS



Software



Ancillaries

*Downhole Advanced Sparker Source*

*GeoChain™ Advanced Seismic Receiver*



*High gain downhole electronics and high speed telemetry systems*

*GeoChainSlim™ Receiver*



**GEO**

**GEOCHAIN**



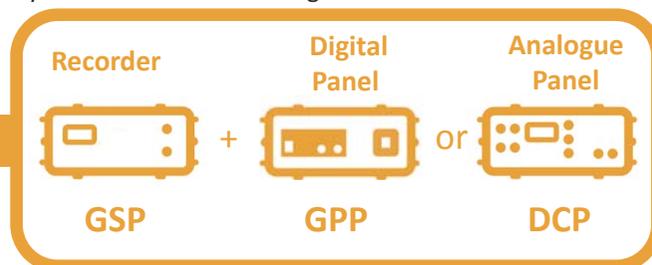
## Main Features

- 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 31/2"-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

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

### Downhole Specifications

<b>Max. No. of Satellites</b>	62			
<b>X-TAS Telemetry</b>	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	

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

### Surface Specifications

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

**AS272 'X-Series' Digitizer**

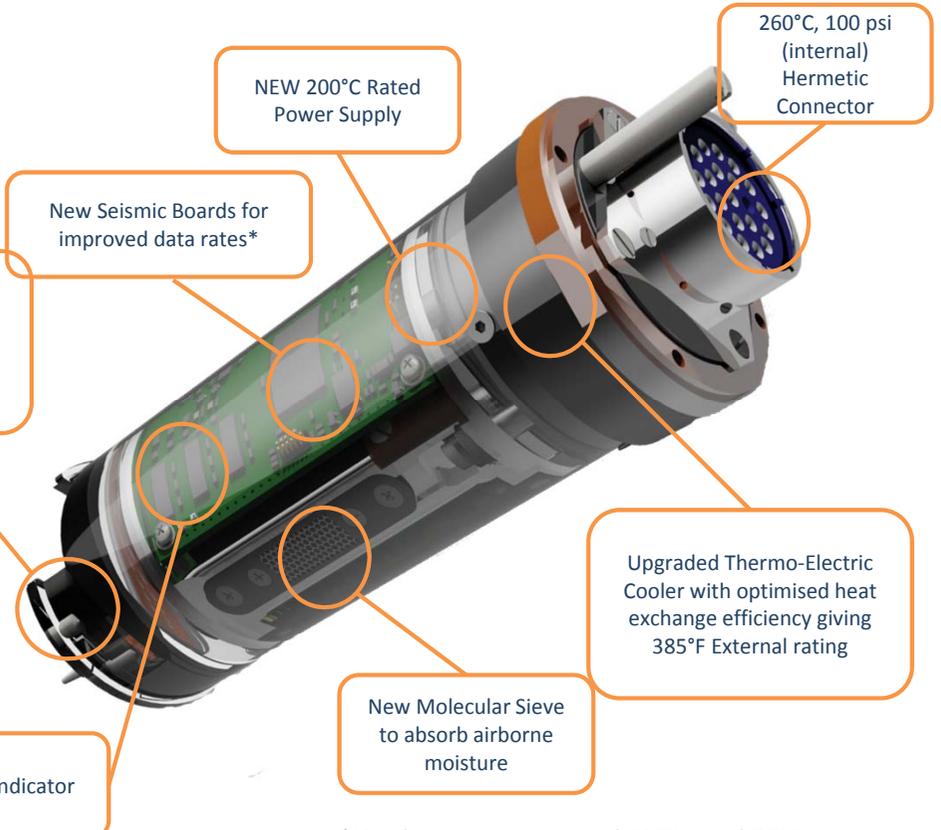


**Main Features**

- Low noise, High gain Geochain 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 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.



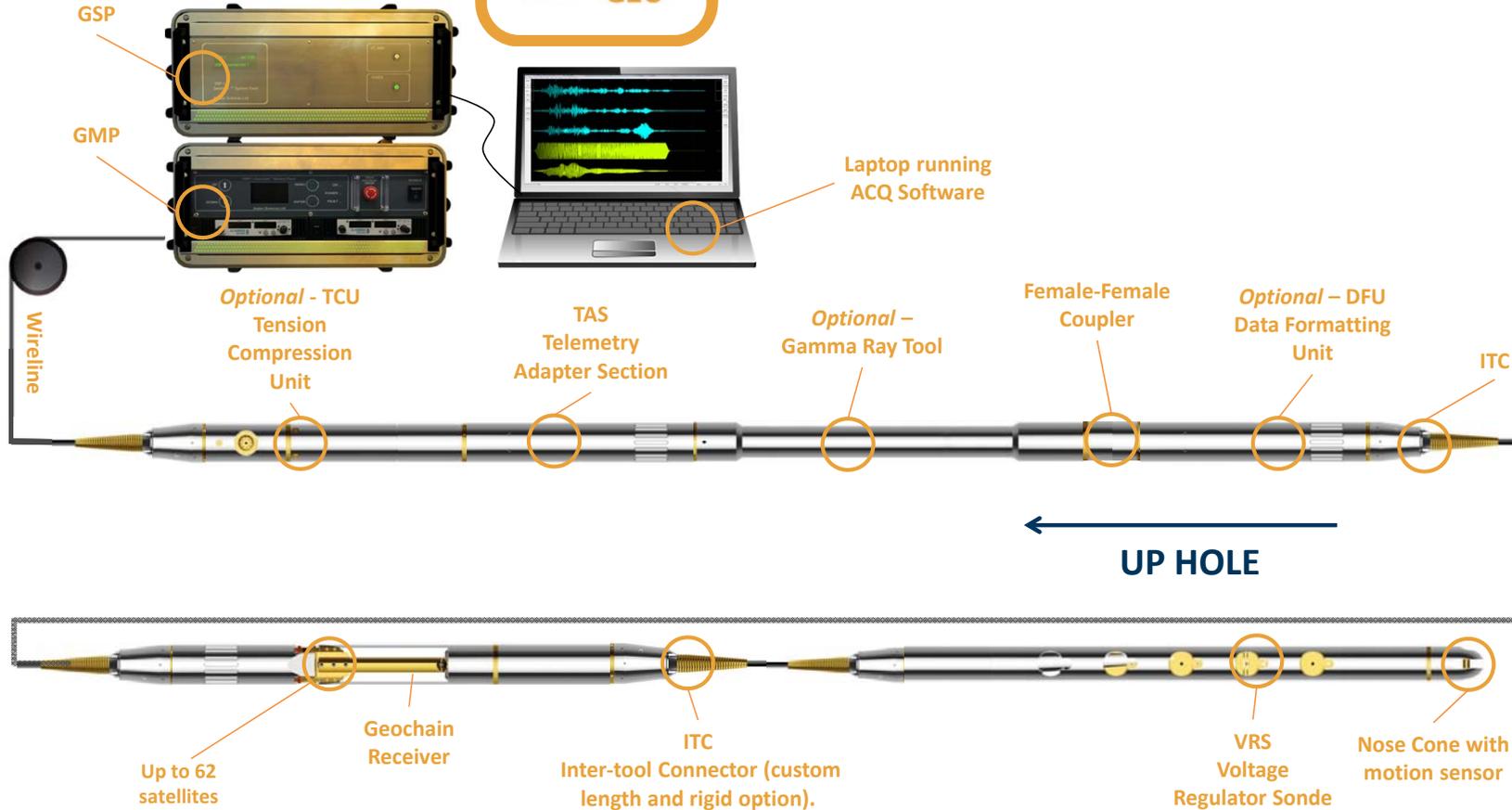
\*Used in conjunction with X-TAS and DFU unit.

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

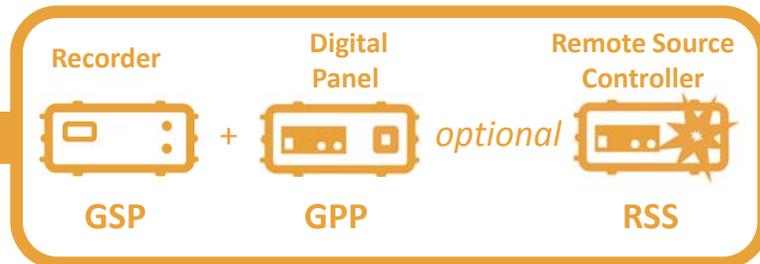
**Geochain™ –Well Seismic**



**DOWNHOLE STRING ASSEMBLY**



**SURFACE PANELS**





**Main Features**

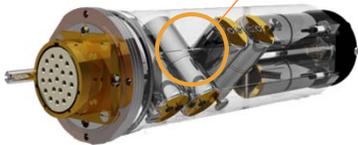
- The exchange programme will run from August 2016 to 1st January 2017. Please enquire about any other upgrades or exchanges you may have in mind.
- The exchange programme will run from August 2016 to 1st January 2017. Please enquire about any other upgrades or exchanges you may have in mind.

**NEW X-Series AS272 Digitiser**



In exchange for any AS270/271/273 at an exchange cost of \$14,000, normal tariff price for the AS272 is \$21,700

**NEW ASR 227 Quad Sensor Pack**



In exchange for any ASR-227 or 232 at an exchange cost of \$4,800, normal tariff price for the ASR-227 is \$7,874.30

**NEW TAS-X-HP Telemetry Adapter Section and DFU Data Formatting Unit (Facilitates Gapless Recording)**



In exchange for any TAS-1 or 2 at an exchange cost of \$51,000, normal tariff price of the combined TAS-X and DFU is \$85,790.00

**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**

In exchange for any PDAQ at an exchange price of \$37,000, normal tariff price for the GSP-1 is \$94,350.56

**NEW GSP-1 Surface Recorder**



In exchange for any RSS-1 at an exchange price of \$26,000, normal tariff price for the RSS-2 is \$44,212.94 - note two units are required for remote shooting.

**NEW RSS2-SET Remote Source Controller - Also includes one SIU, transceiver and all cables**



In exchange for any ASR-1 at an exchange price of \$32,000, normal tariff price for the ASR-HP-bare is \$47,211.94

**NEW ASR-HP Bare Tool & Arm Drive**



In exchange for any ITC-1 at an exchange price of \$7,800, normal tariff price for the ITC-1-HP is \$14,509.14

**NEW ITC-1 HP Inter Tool Cable**



In exchange for any DCP-1 at an exchange price of \$11,000, normal tariff price for the DCP-2 is \$16,194.48

**NEW DCP-2 Analog Control Panel**





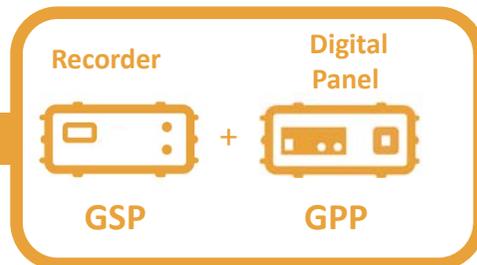
## Main Features

- 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).

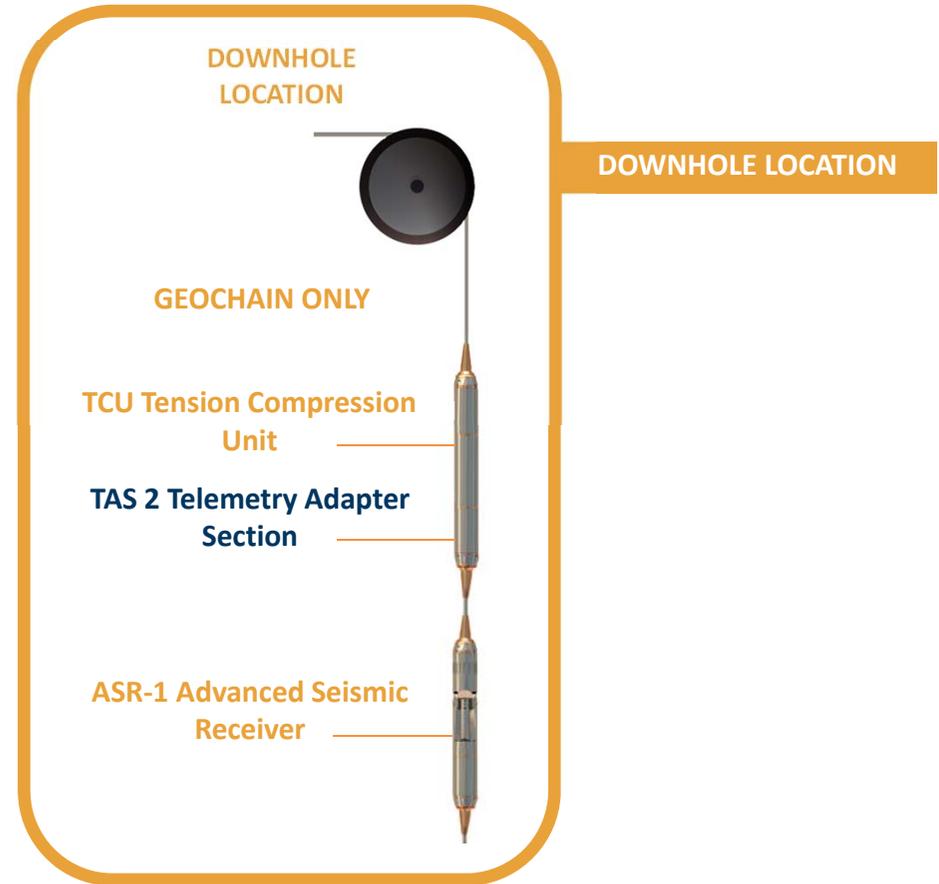
## Functionality

- 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	<b>AS283</b>
<b>Length</b>	18.7" (476mm)
<b>Diameter</b>	3" (76mm)
<b>Weight</b>	21.6lb (9.8kg)
<b>Temperature</b>	385°F (195°C) *Digital Only
<b>Pressure</b>	25,000psi (1750 bar) HP version
<b>Max Telemetry Data Rate</b>	4Mbit/second
<b>Min Telemetry Data Rate</b>	256kbit/second
<b>Panels</b>	GPP or GMP & GSP-1 (Digital)
<b>DFU Compatible*</b>	Yes – Firmware upgrade required to all previous 2015 TAS-2
<b>Wireline</b>	7 Conductor Heptacable

VRS – Voltage Regulator Section



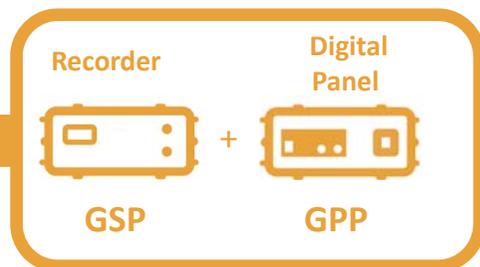
**Main Features**

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

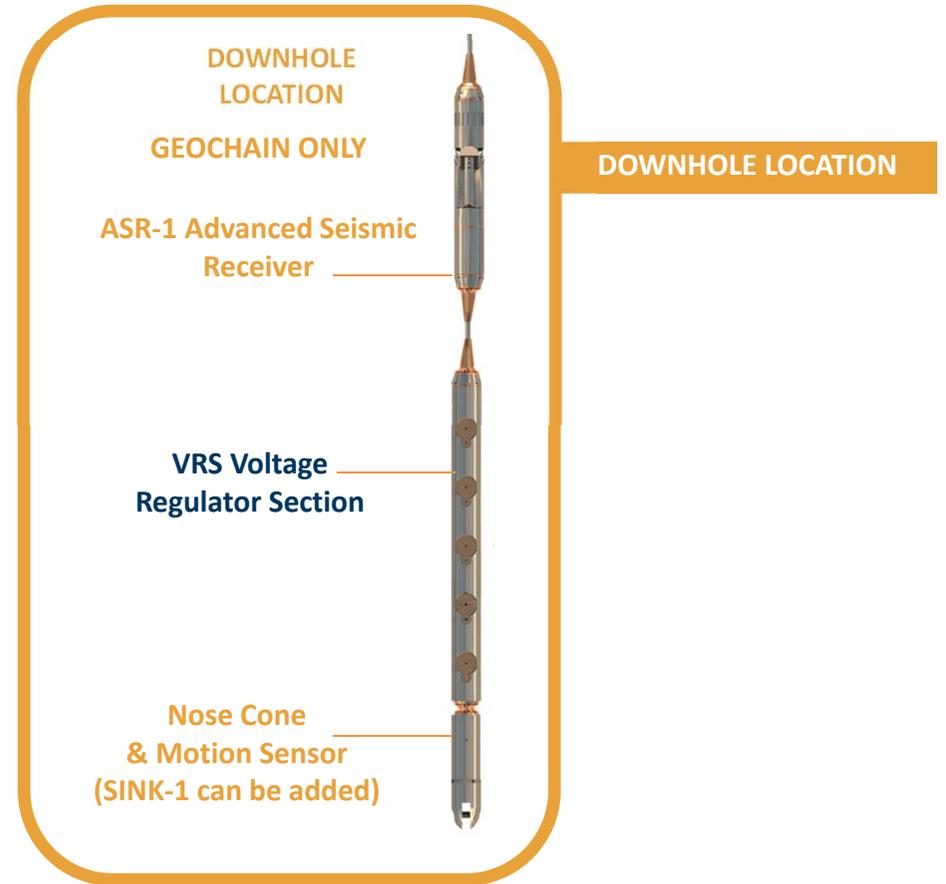
**Functionality**

- 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**



*VRS (HP) Specifications*

<b>Length</b>	64" (1326mm) with nose cone
<b>Diameter</b>	3" (76mm)
<b>Weight</b>	95 lbs (43kg) with nose cone
<b>Temperature</b>	385°F (195°C) *Digital Only
<b>Pressure</b>	25,000psi (1750 bar) HP version
<b>Panels</b>	GPP or GMP & GSP-1 (Digital)
<b>Max number of ASR's</b>	62
<b>Wireline</b>	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.

**Compatibility requirements**

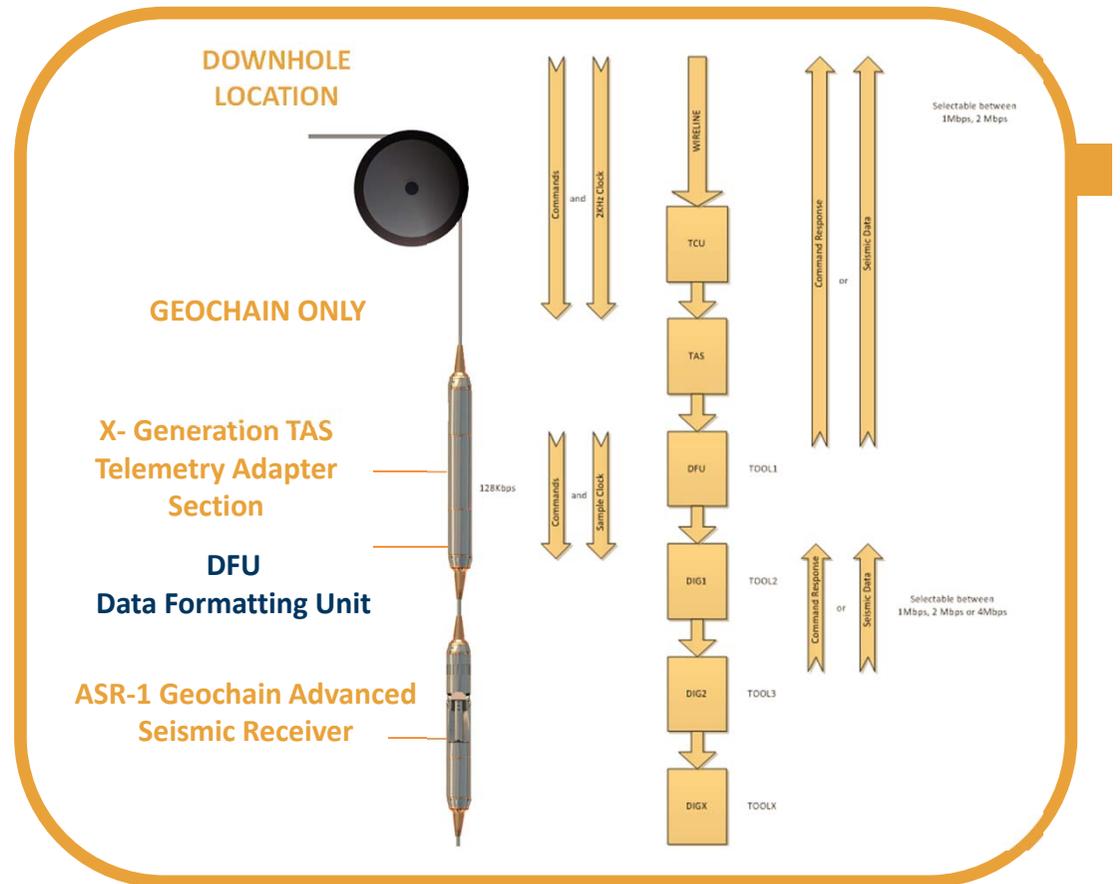
To perform gapless recording you will need:

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)**

**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**



*DFU Specifications*

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



## 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 86,350 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

	Sensor Pack	Electronics	Damping Resistors	Downhole Gain	Sensitivity undamped V/m/s	Sensitivity damped V/m/s	Overall Sensitivity V/m/s	Damping 20°C
<b>Dual</b>	AS223/232	AS271	47KΩ	54dB	104	94.4	47200	0.641
<b>Quad</b>	AS227	AS271	47KΩ	54dB	208	172.7	86350	0.7

COMPATABLE WITH



or



ASR-1 HP  
& ASR-1  
EHP

## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

### Omni 2400Ω Geophone

Optimum Orientation Horizontal  
Operational Range 0° to 180° (Omni)

### Natural Frequency (Fn)

Optimum Orientation 15 Hz +/- 5%  
Operational Range 15 Hz - 5% to +15%

### Coil Excursion P-P

Optimum Orientation >0.120 in, >.306 cm  
Operational Range >0.022 in, >.051 cm

### Spurious Frequency

250 Hz

### Resistance

2400Ω +/-5% per transducer

### Sensitivity

At Optimum Orientation 86350 V/m/s +/- 5%  
At Operational Range 86350 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 <0.70%

### Storage Temperature

-40°F to 212 °F (-40 to +100°C)

### Operating Temperature

-40°F to 392+°F (-40 to +200+°C)

### Geophone Dimensions:

Weight 49 gr  
Diameter 2.22 cm  
Height 2.70 cm (3.00 cm Including Terminals)

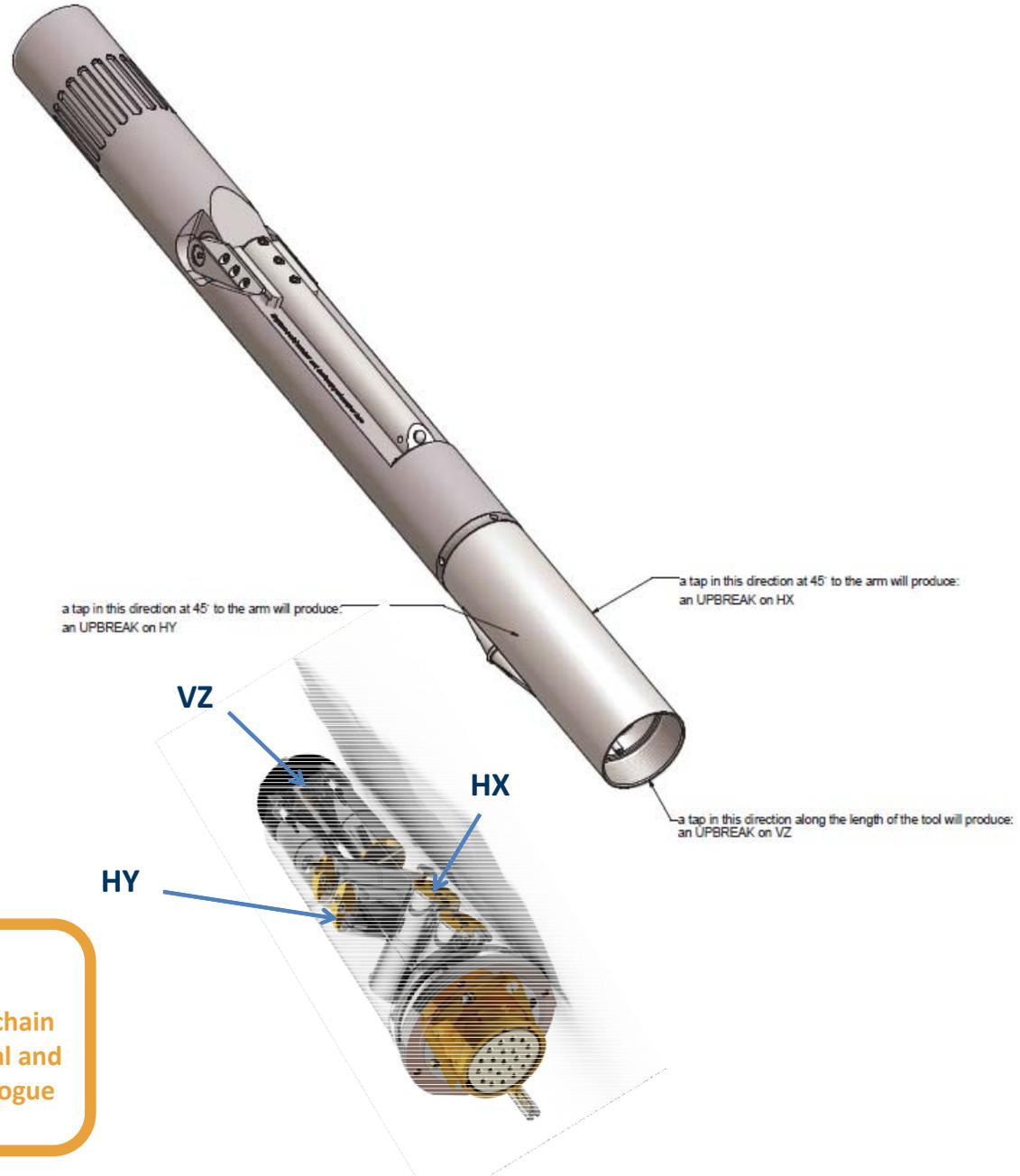


**Quad Pack Tap Orientation**



**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.



**Quad vs Dual Overall Sensitivity**

	Electronics	Damping Resistors	Downhole Gain	Sensitivity undamped V/m/s	Sensitivity damped V/m/s	Overall Sensitivity V/m/s	Damping 20°C
<b>Dual</b>	AS271	47KΩ	54dB	104	94.4	47200	0.641
<b>Quad</b>	AS271	47KΩ	54dB	208	172.7	86350	0.7

**COMPATIBLE WITH**





**SLIM**

**GEOCHAIN SLIM**



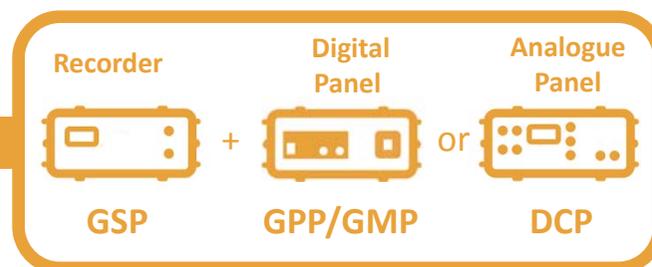
## Main Features

- 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

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



### Downhole Specifications

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

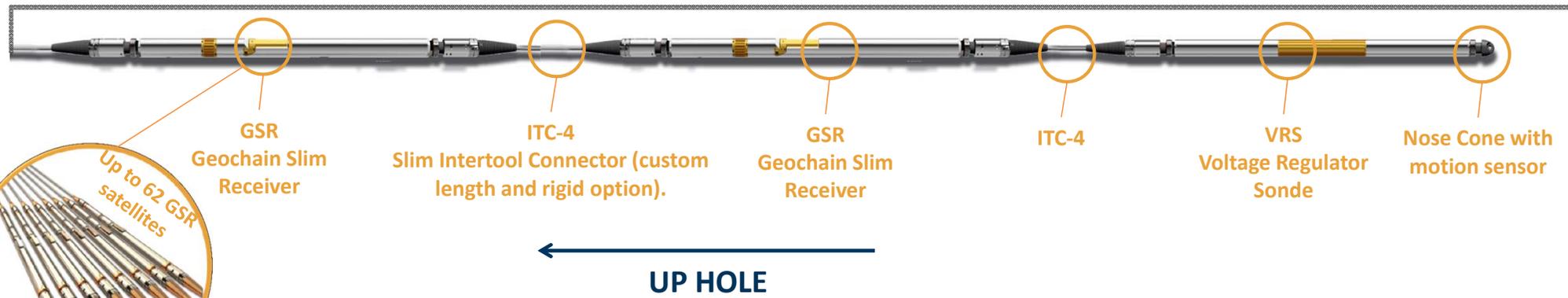
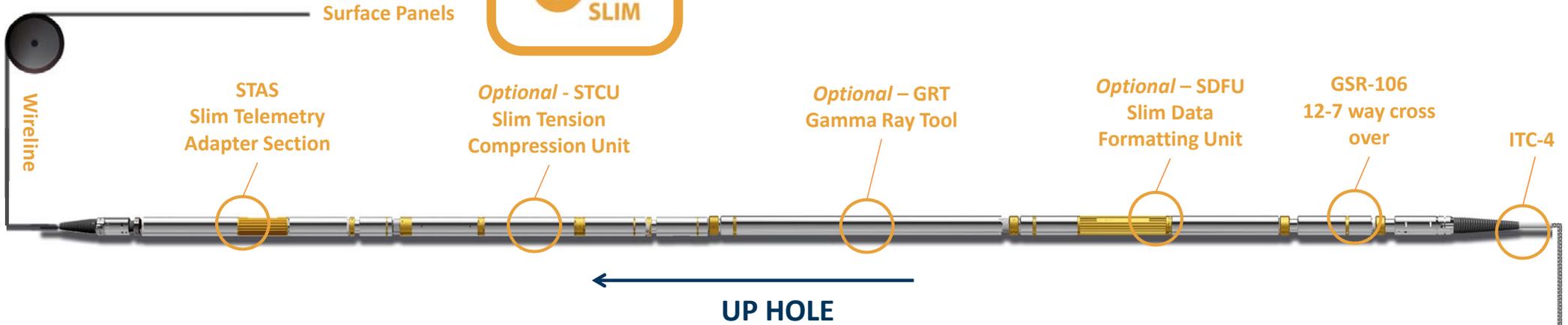
### Surface Specifications

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

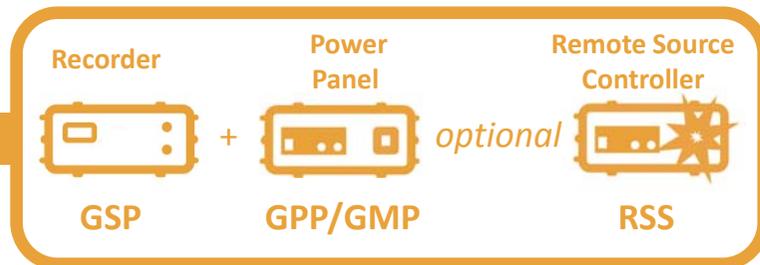
### GeochainSlim™ – Slim Well Seismic



### 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

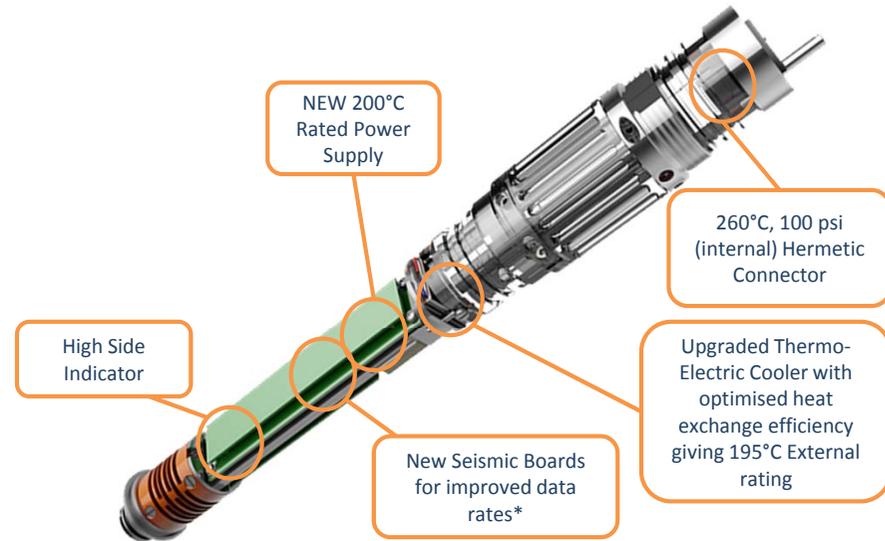
**Functionality**

- 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

**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**



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

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



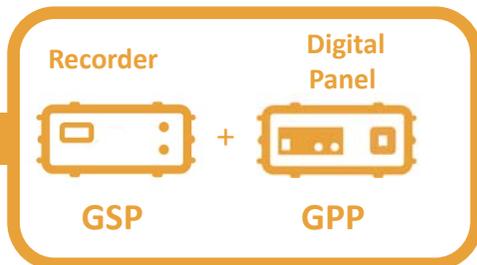
### Main Features

- 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.

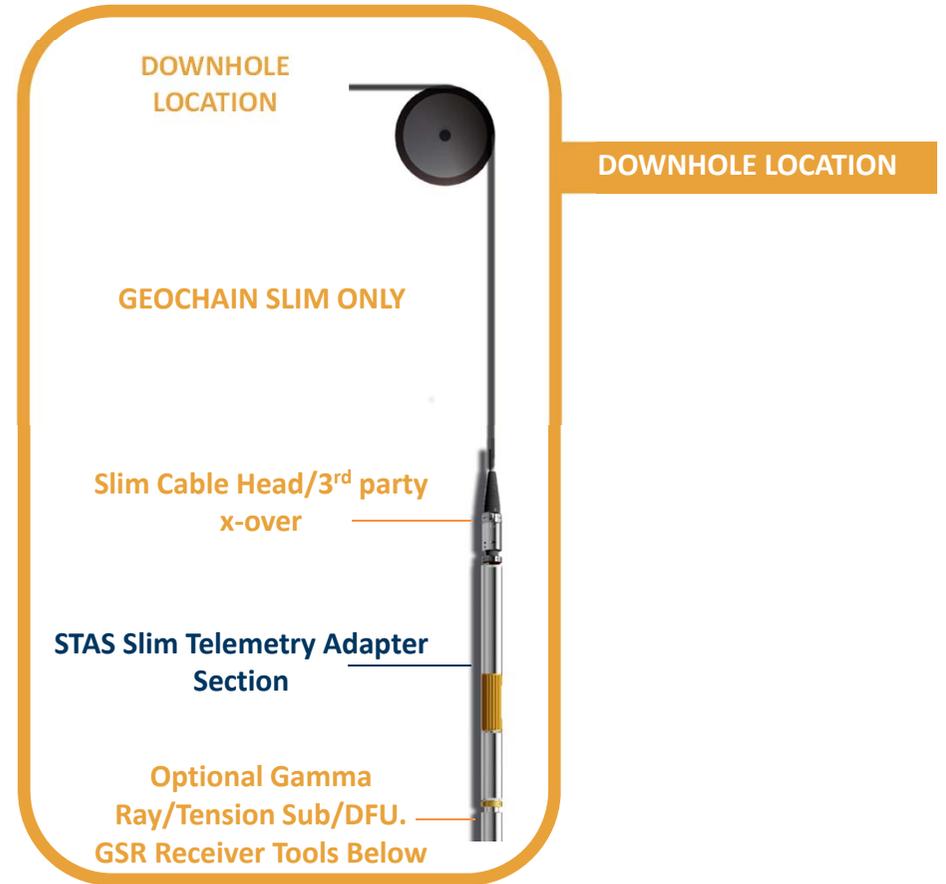
### Functionality

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





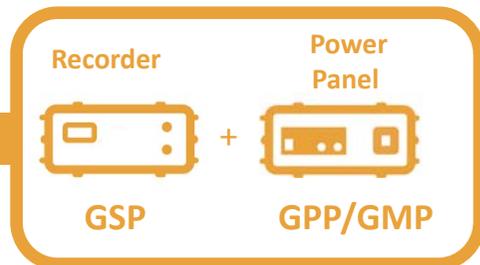
### Main Features

- 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).

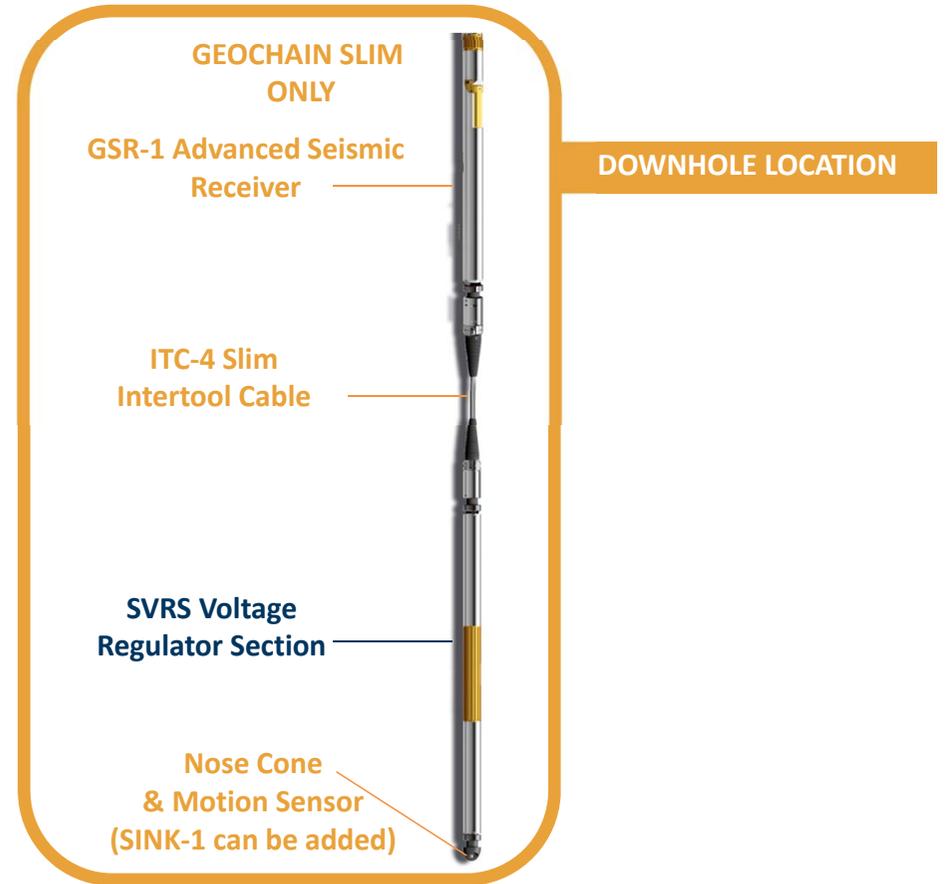
### Functionality

- 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



### SVRS Specifications

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

**SDFU – Slim Data Formatting Unit**



**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:**

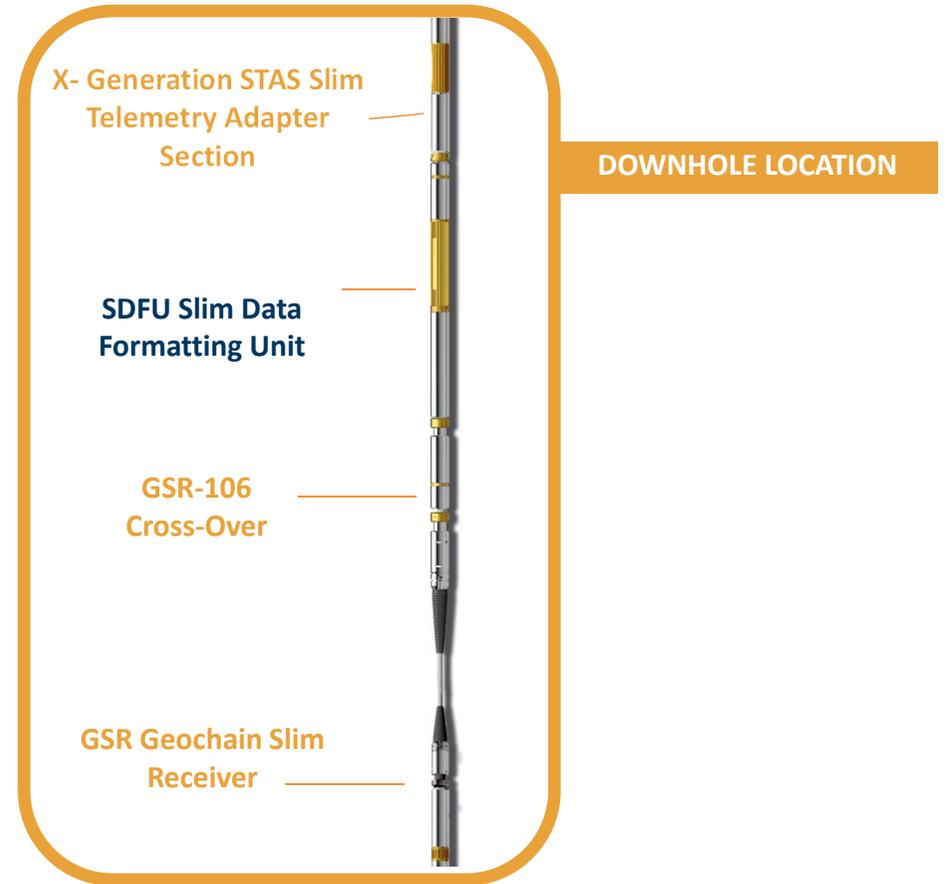
- 1. SDFU (AS-262),**
- 2. SX-TAS (AS-261),**
- 3. GSP with a USB 2B card.**
- 4. ACQ Software v.3.X+**

**+ Recommended:**

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

**Compatibility requirements**

**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**



*SDFU Specifications*

<b>Length</b>	33.7" (857mm)
<b>Diameter</b>	1 11/16" (43mm)
<b>Weight</b>	12.4 lb (5.7kg)
<b>Temperature</b>	195°C (Digital Only)
<b>Pressure</b>	20,000psi (1400 bar)

<b>Panels</b>	GMP or GPP & GSP-1 (Digital)
<b>Wireline</b>	7 Conductor Heptacable

**GeoChainSlim Quad Sensor Pack**



**Main Features**

- Ideal for **VSP & Microseismic** surveys.
- Four geophones per axis.
- Fits GeoChainSlim tools.
- Greater signal to noise ratio.

**Functionality**

- Ideal for use with high gain 54dB digitisers.
- Overall sensitivity 86,350 V/m/s at 20°C.
- Ideal for use in slim hostile wells.
- Operating temperature up to 200°C.

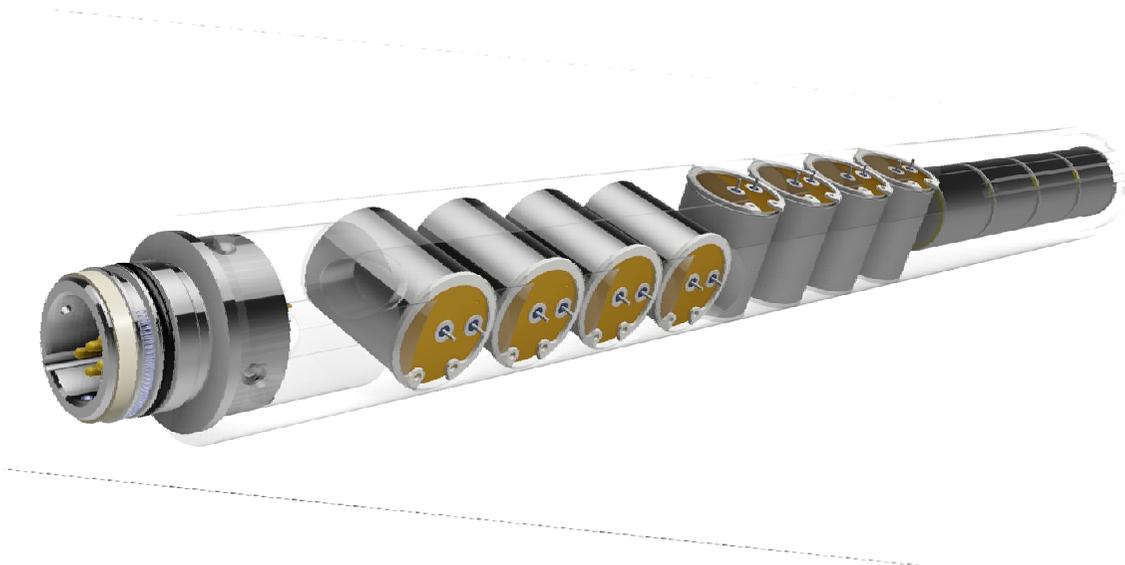
	Electronics	Damping Resistors	Downhole Gain	Sensitivity undamped V/m/s	Sensitivity damped V/m/s	Overall Sensitivity V/m/s	Damping 20°C
<b>Quad</b>		47KΩ	54dB	208	172.7	86350	0.7



**COMPATABLE WITH**

**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**

<b>Omni 2400Ω Geophone</b>	
Optimum Orientation	Horizontal
Operational Range	0° to 180° (Omni)
<b>Natural Frequency (Fn)</b>	
Optimum Orientation	15 Hz +/- 5%
Operational Range	15 Hz - 5% to +15%
<b>Coil Excursion P-P</b>	
Optimum Orientation	>0.120 in, >.306 cm
Operational Range	>0.022 in, >.051 cm
<b>Spurious Frequency</b>	
	250 Hz
<b>Resistance</b>	
	2400Ω +/-5% per transducer
<b>Sensitivity</b>	
At Optimum Orientation	86350 V/m/s +/- 5%
At Operational Range	86350 V/m/s -15% to +5% at 20°C
<b>Open Circuit Damping</b>	
Optimum orientation	0.57 +/-15%
Operational Range	0.57 -20% to +10%
<b>Moving Coil Mass</b>	
	7.6 gr +/- 5%
<b>Distortion</b>	
Optimum Orientation	<0.20%
Operational Range	<0.70%
<b>Storage Temperature</b>	
	-40°F to 212 °F (-40 to +100°C)
<b>Operating Temperature</b>	
	-40°F to 392+°F (-40 to +200+°C)
<b>Geophone Dimensions:</b>	
Weight	49 gr
Diameter	2.22 cm
Height	2.70 cm (3.00 cm Including Terminals)





**EHP**

**GEOCHAIN EHP**

**Geochain EHP – Extra High Pressure**

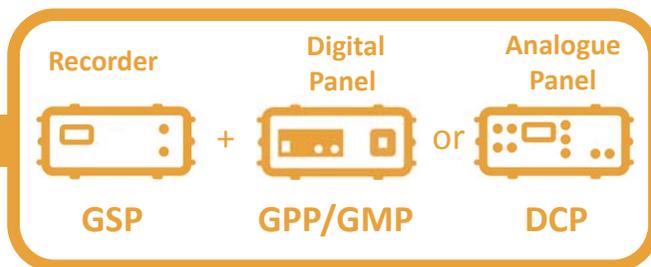


**Main Features**

- 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*

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

*Downhole Specifications*

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

*Surface Specifications*

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



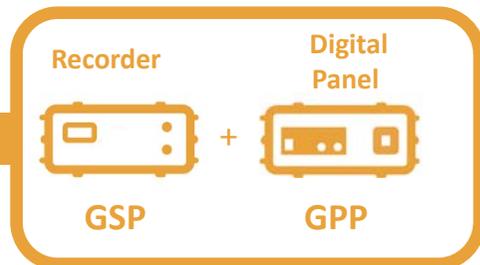
## Main Features

- 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).

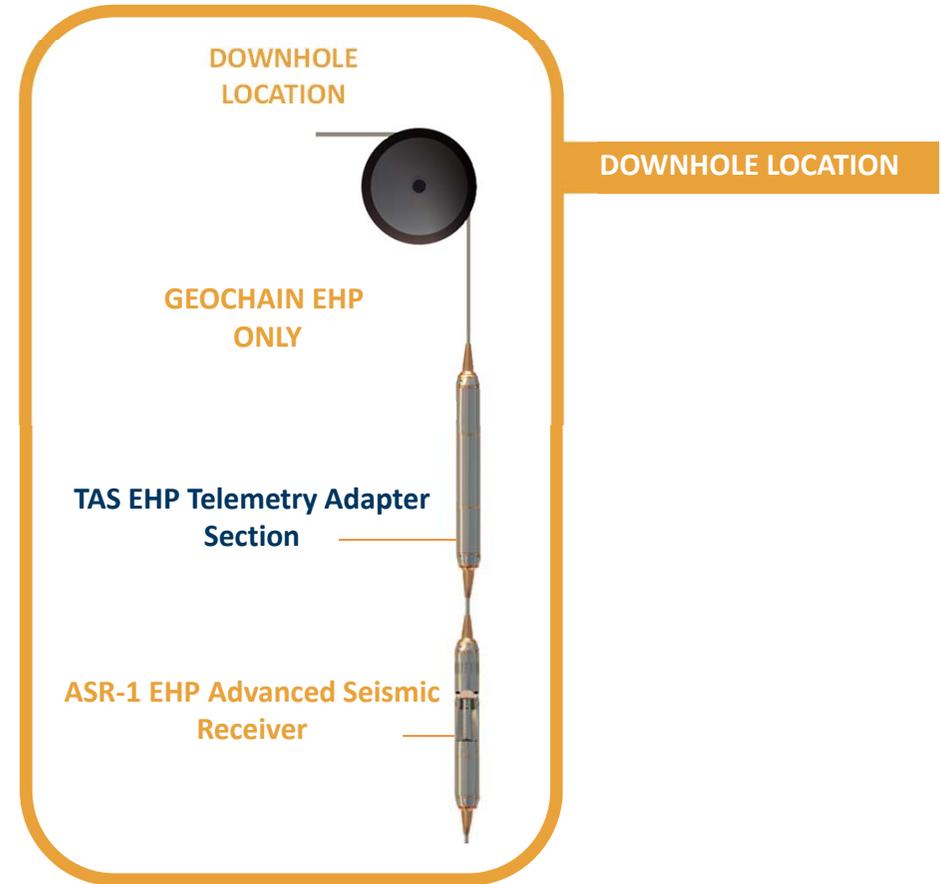
## Functionality

- 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



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

VRS EHP – Voltage Regulator Section



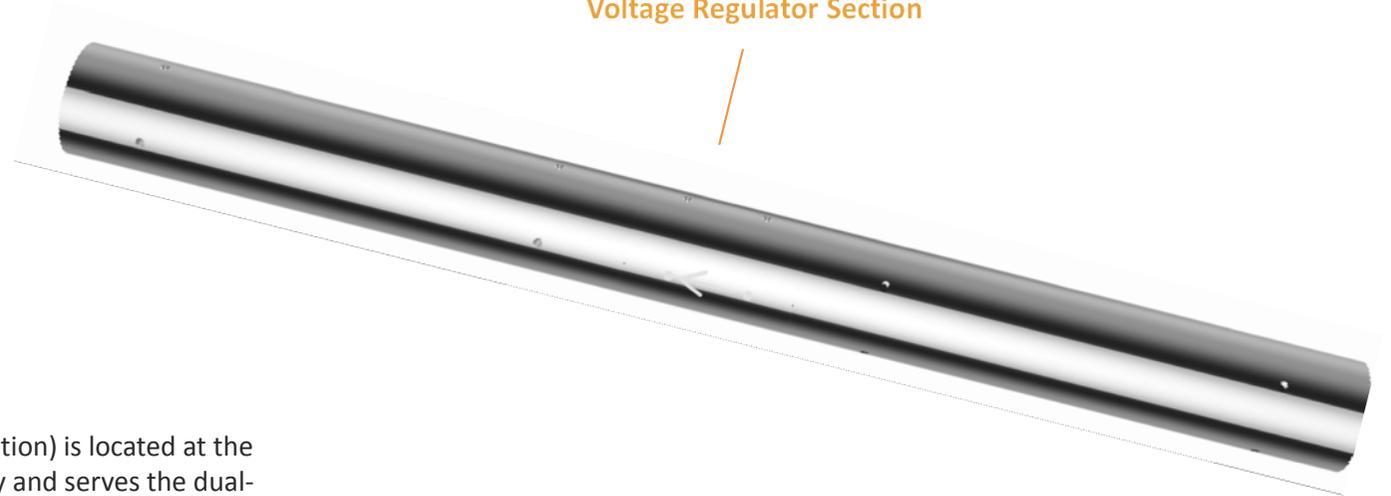
**Main Features**

- 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.

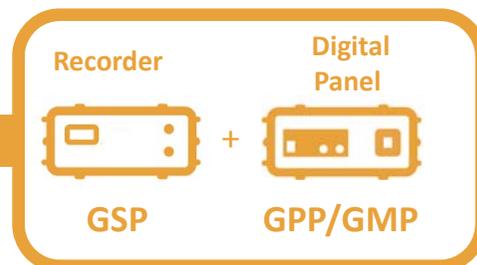
VRS EHP  
Voltage Regulator Section



VRS (EHP)  
Specifications

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

SURFACE PANELS

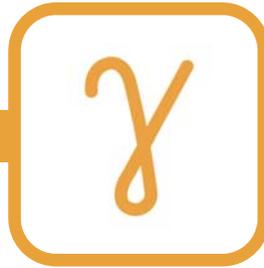




# Gamma Logging Tools



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

### SURFACE PANELS





# Advanced Sparker Tool

**AST – Advanced Sparker Tool**



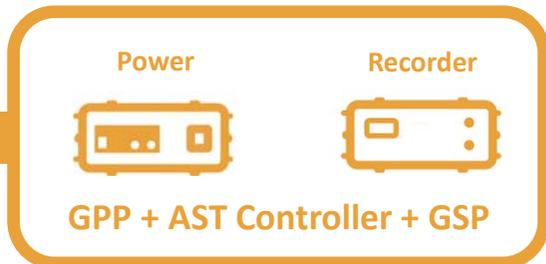
**Main Features**

- 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**

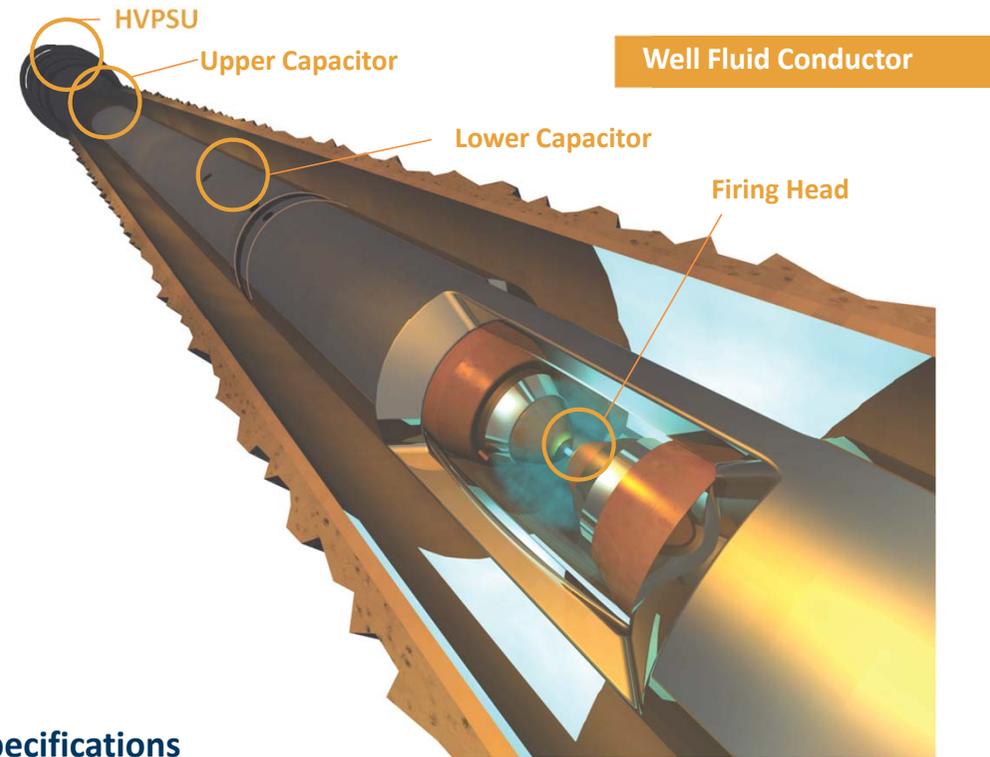
- The Advanced Sparker Tool (AST) has been developed to provide a high energy and a repeatable downhole seismic source. Primary use of the AST would be with seismic sensors deployed in an adjacent well or wells to provide cross well imaging or sensor orientation of fracture monitoring instrumentation.
- 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**



**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**

**Borehole Seismic Source**



**Specifications**

**AST Specification**

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



# Tension Compression Unit

**TCU – Tension Compression Unit**



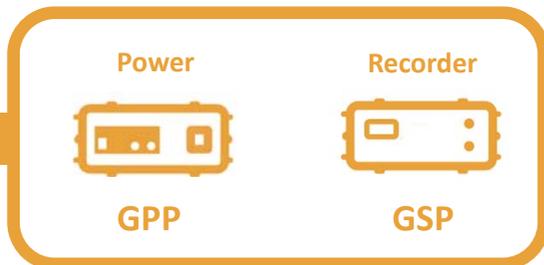
**Main Features**

- 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.

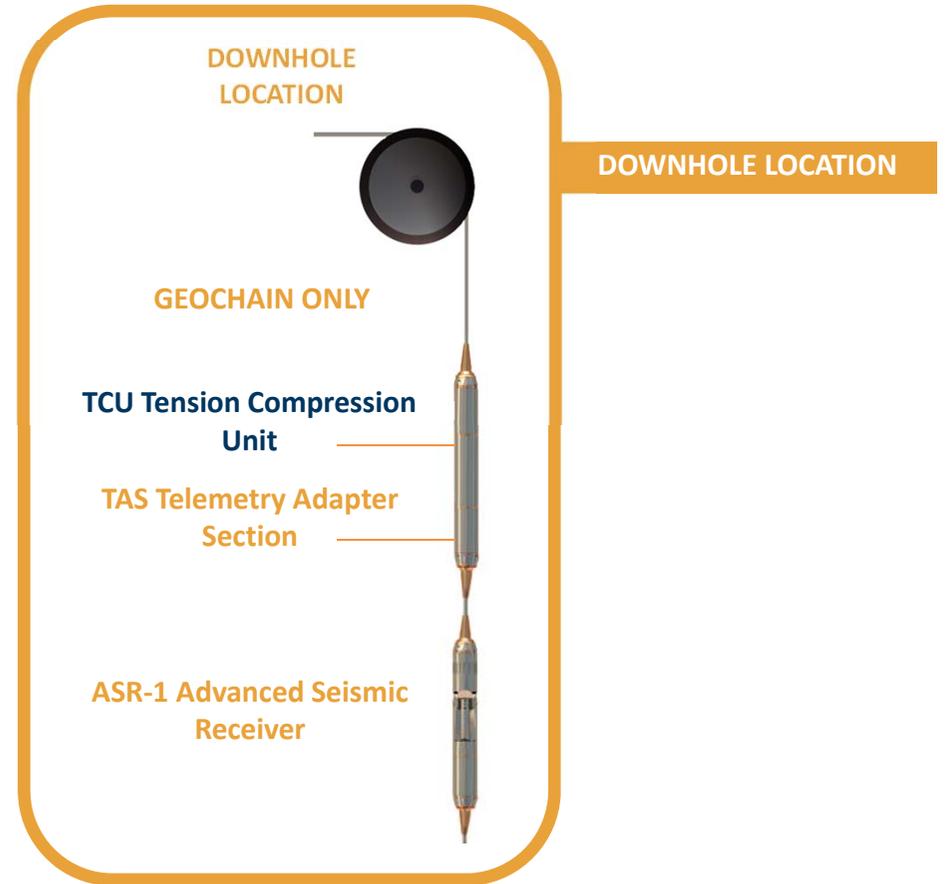
**Functionality**

- 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*

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

**STCU – Slim Tension Compression Unit**



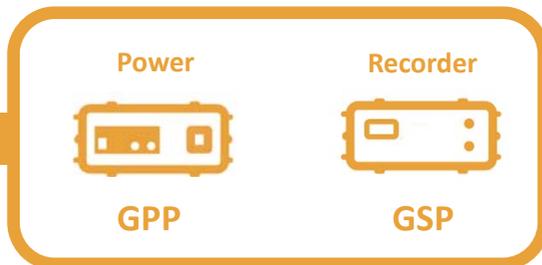
**Main Features**

- 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*

<b>Loading:</b>	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
<b>Accuracy:</b>	Better than 2% of full scale across the range of temperature and pressure.
<b>Length:</b>	44.7” (1160mm)
<b>Weight:</b>	20.5 lbs (9.3kg)
<b>Diameter:</b>	1 11/16” (43mm)
<b>Max Operational Temperature:</b>	392°F (200°C)
<b>Max Operational Pressure:</b>	20,000psi (1380 bar)





# Permaseis

Permaseis – Permanent Seismic Receiver



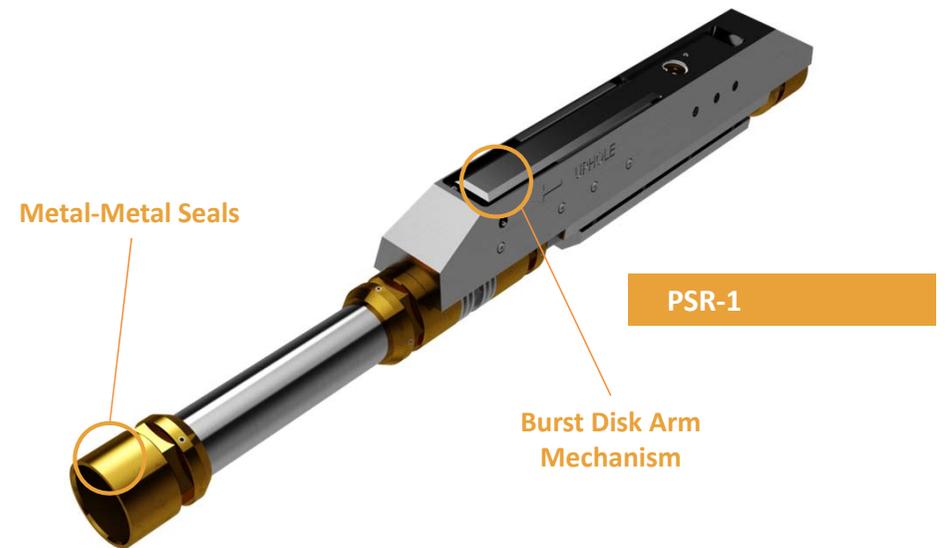
### Main Features

- 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.
- 3 component geophones.
- Burst disk operated locking arm.
- Uses standard Avalon surface control panels.
- Selectable Damping and Gain
- Integrated High Side Indicator
- X-series electronic upgrades

### Functionality

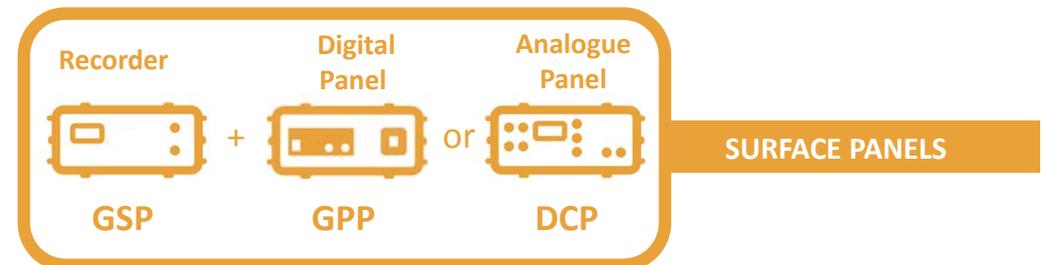
- The Permaseis™ digital array is one of the latest adaptations of our highly regarded Geochain™ array. The system utilises the new PSR-1 downhole receivers along with the standard GSP and GPP surface panels from our Geochain™ system.
- The high continuous temperature rating and the robust telemetry system will ensure semi/permanent operation in the harshest of well environments.
- The tool is developed from the tried and tested ESR and 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.

## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



#### Permaseis Specifications

• <b>Max number of tools:</b>	• 60 (Digital) 2 Analogue HT & EHT
• <b>Dynamic Range:</b>	• >100db
• <b>Noise Floor:</b>	• <75 nV
• <b>Distortion:</b>	• <0.02%
• <b>Bandwidth:</b>	• 15-1,600 Hz
• <b>Sensors:</b>	• 15Hz Omnidirectional Geophone Dual or Quad
• <b>Max Temp:</b>	• 385°F (195°C) Digital / 392°F (200°C) HT / 437°F (225°C) EHT (Analogue)
• <b>Max Pressure:</b>	• 20,000 psi (1400 bar)
• <b>Projected lifespan:</b>	• 10 year at 302°F (150°C)
• <b>Control Panels:</b>	• GSP







# Borehole Optical Seismic System

**BOSS – Borehole Optical Seismic System**



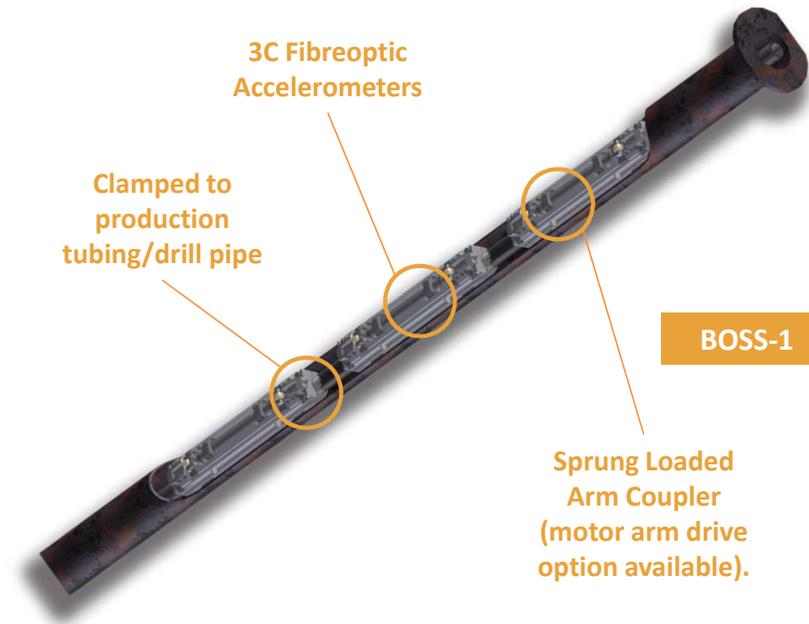
**Main Features**

- No Downhole Electronics.
- Passive Fibreoptic Borehole System.
- 356°F (180°C) Continuous Operation.
- 20,000 psi (1400 bar) Pressure Rated.
- Metal-Metal Seals.
- High Sensitivity and recording bandwidth ideal for microseismic.
- Low Noise.
- Fibre optic/Geochain Hybrid variants available.

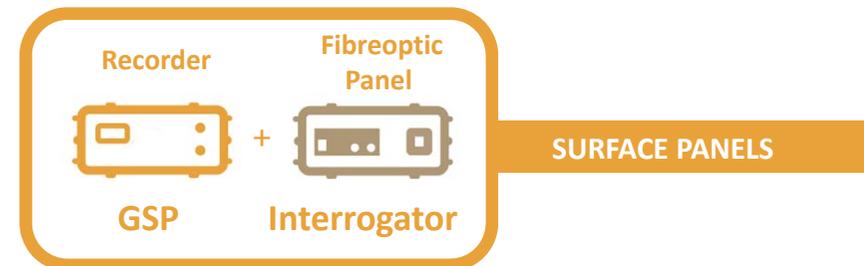
**Functionality**

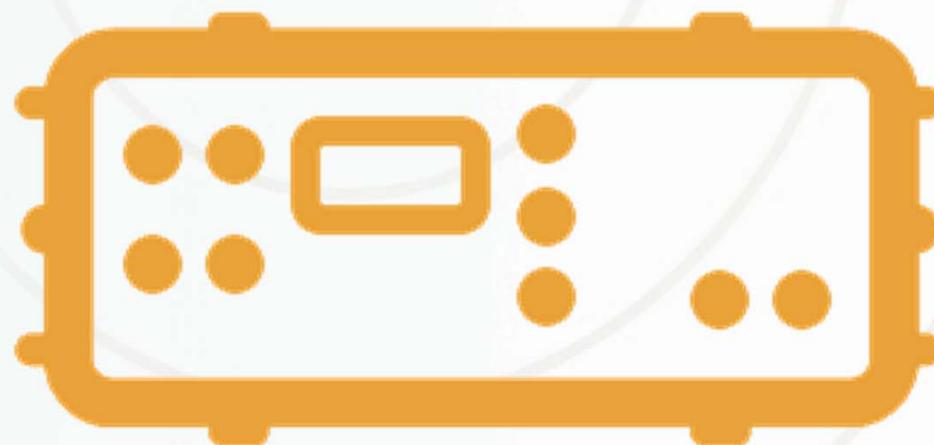
- BOSS™ is a completely new innovation for Avalon Sciences (coming soon). The system is entirely passive downhole with sophisticated electronics remaining at the surface in a controlled environment.
- The high continuous operational temperature rating (356°F (180°C)) and solid mechanical coupling system 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.
- The system is fully expandable from a small microseismic 16 level system up to hundreds of stations for large 3D VSPs. The fibreoptic system can also survive more permanent deployment due to metal to metal C-rings throughout, meaning it can be considered for life-of field installations.
- The stations are deployed on jointed or coiled tubing as standard with optical wireline as an option. The array can be spaced at just a few meters or at several hundred meters for total well coverage.
- The tool system is still currently under development with expected client ready systems to be available in 2015. Please email [sales@avalonsciences.com](mailto:sales@avalonsciences.com) for further details.

**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**



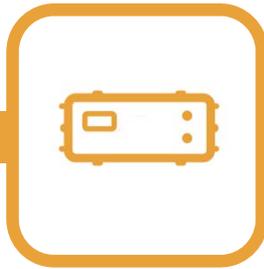
• BOSS Specifications	
• <b>Max number of tools:</b>	• 16 tools (up-scalable to 100)
• <b>Dynamic Range:</b>	• >100db
• <b>Noise Floor:</b>	• <50 ng/vHz
• <b>Distortion:</b>	• <0.01%
• <b>Bandwidth:</b>	• 1-1,600 Hz
• <b>Sensors:</b>	• Omni Directional Fibreoptic Accelerometer
• <b>Max Temp:</b>	• 356°F (180°C) *Digital Only
• <b>Max Pressure:</b>	• 20,000 psi (1400 bar)
• <b>Projected lifespan:</b>	• 10 years at 302°F (150°C)
• <b>Control Panels:</b>	• GSP & Interrogator





## Surface Panels

## GSP – Geochain System Panel



### Main Features

- Surface Recorder and PC interface.
- Up to 16 analogue channels.
- 24 bit delta sigma converters.
- 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

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

#### GSP-1 Digital section

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

#### GSP-1 Analogue section

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



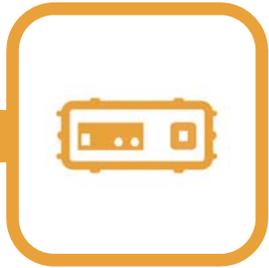
## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



### GPP-1 Specifications

#### Electrical

<b>Output Voltage:</b>	0 – 600 Vdc
<b>Output Current:</b>	0 – 1.7 A
<b>Output Power:</b>	1020 W
<b>Rated AC Input Voltage:</b>	100/120/200/220/230/240 Vac (nominal)
	Derate maximum output power to 900 W for AC input less than 95 V.
<b>Maximum Input Power:</b>	1250 VA
<b>Maximum Input Current:</b>	13 A maximum at 100 Vac, 11 A max at 120 Vac, 6 A maximum at 220 Vac
<b>Input Frequency Range:</b>	47-63 Hz
<b>Power Factor:</b>	0.99 minimum for full load and 120 Vac input
<b>Input Harmonic Distortion:</b>	EN61000-3-2 compliant
<b>Switching Frequency:</b>	62.5 KHz nominal (125 KHz output ripple)
<b>Isolation Voltage:</b>	Input to output: 1350 Vac
<b>Efficiency:</b>	85%, full power at 115 Vac input
<b>Operating Temp Range:</b>	32 to 104°F (0 to 40°C)
<b>Storage Temperature Range:</b>	-40° to 140°F (-40° to 60°C)
<b>Humidity Range:</b>	10% to 80% RH, non-condensing
<b>Physical</b>	
<b>Format:</b>	19" rack mountable case
<b>Width:</b>	450 mm (480mm inc. ears)
<b>Height:</b>	4U (180 mm)
<b>Depth:</b>	385 mm behind mount ears plus 45 mm in front of ears
<b>Weight:</b>	25lbs (11.5 Kg)
<b>AC Input Connector Type:</b>	IEC320
<b>Fuses:</b>	20 A, 250 V, 5 x 20 mm slow
<b>Cooling:</b>	Fan cooled. Air exhausts at right hand side, front and rear. Over-temperature shutdown



### 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.

#### GMP Specifications

##### Electrical

<b>Power Supply</b>	2 x Glassman LPC600-1.4
<b>Output Voltage:</b>	600V
<b>Output Current:</b>	1.42A
<b>Output Power:</b>	850 W
<b>Rated AC Input Voltage:</b>	90-240 Vac (nominal)
<b>Input Harmonic Distortion:</b>	EN61000-3-2 compliant
<b>Efficiency:</b>	
<b>Operating Temp Range:</b>	32 to 104°F (0 to 40°C)
<b>Storage Temperature Range:</b>	-20° to 140°F (-20° to 60°C)
<b>Humidity Range:</b>	30% to 90% RH, non-condensing
<b>Physical</b>	
<b>Format:</b>	19" rack mountable case
<b>Width:</b>	450 mm (480mm inc. ears)
<b>Height:</b>	4U (180 mm)
<b>Depth:</b>	385 mm behind mount ears plus 45 mm in front of ears
<b>Weight:</b>	27kg
<b>AC Input Connector Type:</b>	IEC320
<b>Fuses:</b>	20 A, 250 V, 5 x 20 mm slow

### Power Panel for



Geochain Digital



Geochain Slim Digital



Geochain EHP Digital



GRT-2, GRT-5

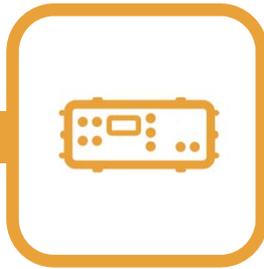


Permaseis



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

<b>Maximum Input Power:</b>	1250 VA
<b>Maximum Input Current:</b>	13 A maximum at 100 Vac, 11 A max at 120 Vac, 6 A maximum at 220 Vac

<b>Operating Temp Range:</b>	32-104°F (0-40°C)
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<b>Storage Temperature Range:</b>	-40 to 60 degrees Centigrade
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<b>Humidity Range:</b>	10% to 80% RH, non-condensing
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#### Physical

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

### Compatible with



Geochain Analogue



Geochain Slim Analogue



Geochain EHP Analogue



GRT-2, GRT-3



Permaseis



GSP-1



# 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.

### 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 passive monitoring operation to double the number of satellites in a string. These can record continuously at the highest sample rate for maximum picking accuracy and recording bandwidth.

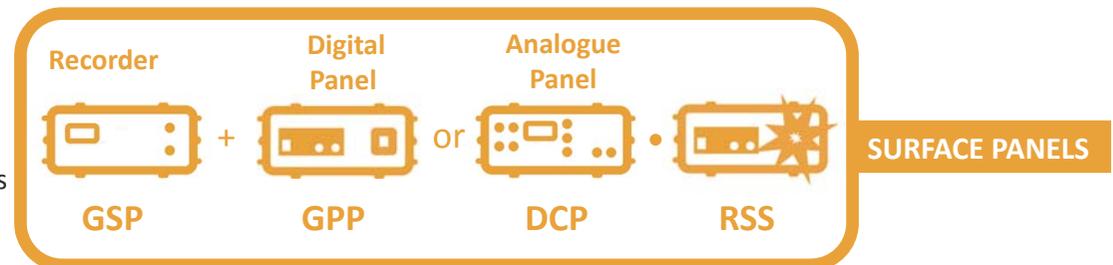
## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

### 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.

#### ACQ Specifications

<b>Version:</b>	2.2
<b>Operating System:</b>	Windows 7 (Recommended)
<b>Interface:</b>	PC via USB port
<b>Size:</b>	Encoded multiple tone sequence
<b>Compatible Tools:</b>	All Geochain™ Product Range, Permaseis, Gamma, TCU-2, Downhole and Surface Analogue Trace Display.
<b>Data Type Output</b>	MIRF-4 Easily convertible to SEG-Y
<b>Microseismic Mode (Gapless):</b>	Coming Soon





# DOWNHOLE

## Downhole Ancillaries

**SINK-1 – Roller Sinker Bar (Ancillary)**



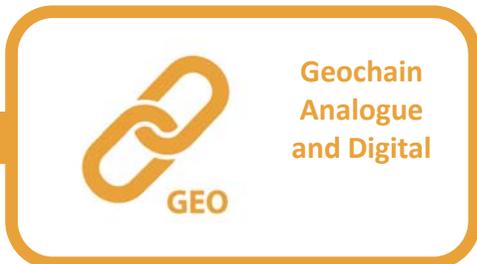
**Main Features**

- 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.

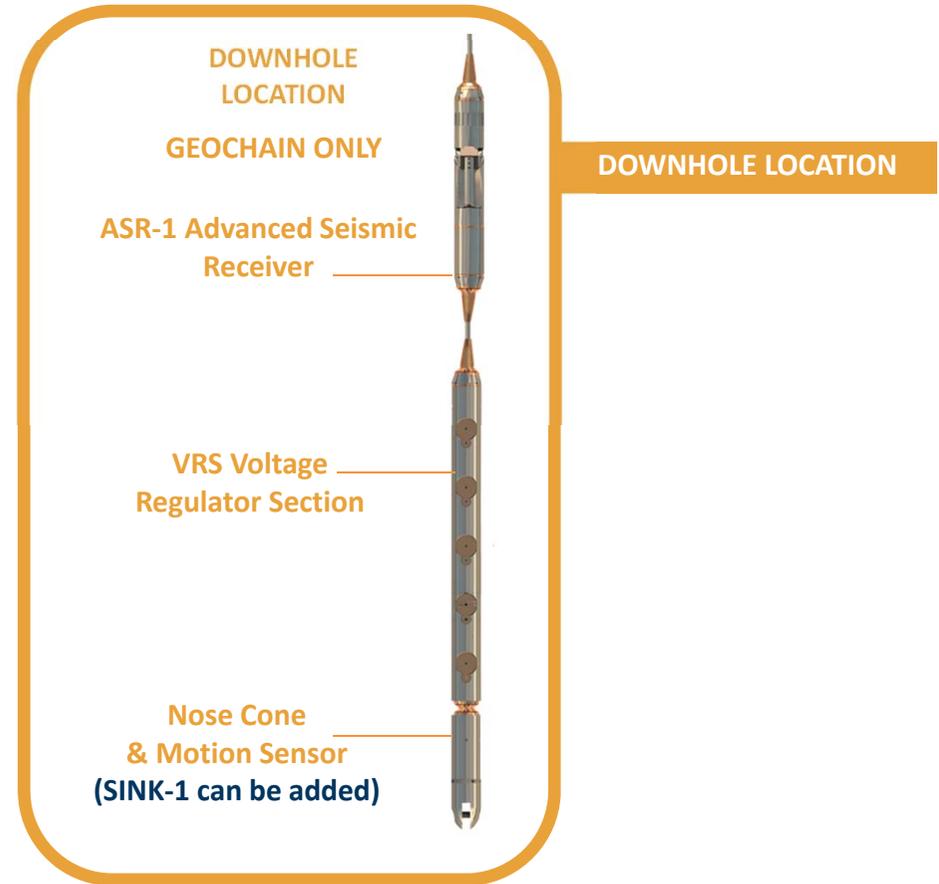
**Functionality**

- 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**



**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**



*SINK-1 Satellite Specifications*

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

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

## Geochain Inter-Tool Cable HP



### 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-HP
<b>Separation Length</b>	Up to 600 ft (200m) per section
<b>Cable Head Diameter</b>	3" (76mm)
<b>Temperature</b>	400°F (205°C)
<b>Pressure</b>	25,000 psi (1750 bar)
<b>Weight</b>	50ft-39lbs 100ft-58lbs
<b>Cable Specifications</b>	
<b>Cable Type</b>	Slammer
<b>Cable Weight</b>	392 lb/kft (583 kg/km)
<b>Outer Diameter</b>	0.475" (12.04mm)
<b>Breaking Strength</b>	109kN (24,500 lbf)
<b>Weak Link Specifications</b>	
<b>Weak Link Screw size</b>	A to W
<b>Load</b>	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

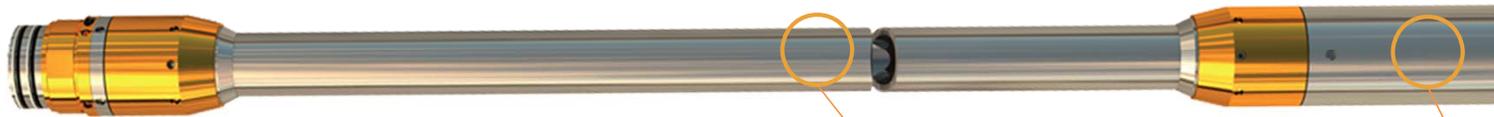


### Main Features

- 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.

Compatible with



Geochain  
Analogue and  
Digital  
(EHP & Slim  
variant available)

## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

Specifications	RITC-31	RITC -47 (F-F Coupler)
<b>Separation Length</b>	Up to 25 ft per section	Female-Female Coupler gives 50ft spacing with x2 RITC 31
	Multiple RITC coupled to give max 200' separation.	
<b>Cable Head Diameter</b>	3" (76mm)	3" (76mm)
<b>Temperature</b>	400°F (205°C)	400F (205°C)
<b>Pressure</b>	20,000 psi / 1400 bar	20,000 psi / 1400 bar
<b>Cable Specifications</b>		
<b>Cable Type</b>	7-conductor within pressure housing	
<b>RITC Weight - 25ft</b>	133 lbs (60.4 kg)	35.3 lbs (16 kg)
<b>Load</b>	Up to 10,000 lbf (44482 N)	
<b>Weak Link Specifications</b>	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

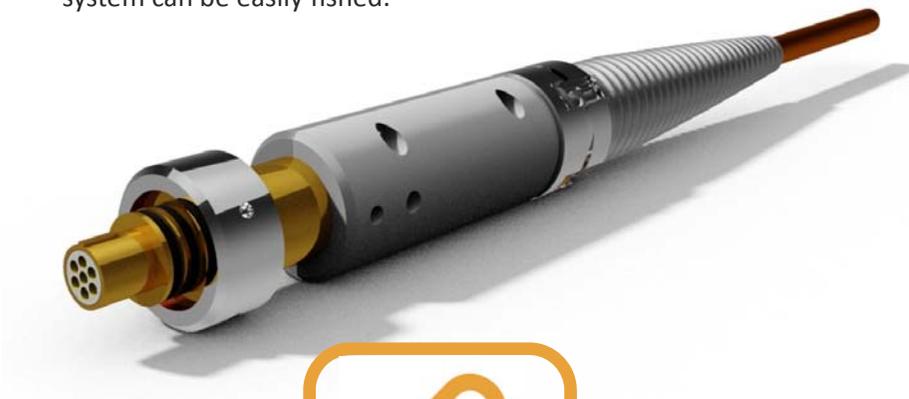


## Main Features

- 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

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

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

Weak Link Specifications	
<b>Weak Link Screw size</b>	3.0 to 3.5 mm
<b>Load</b>	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

- 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).

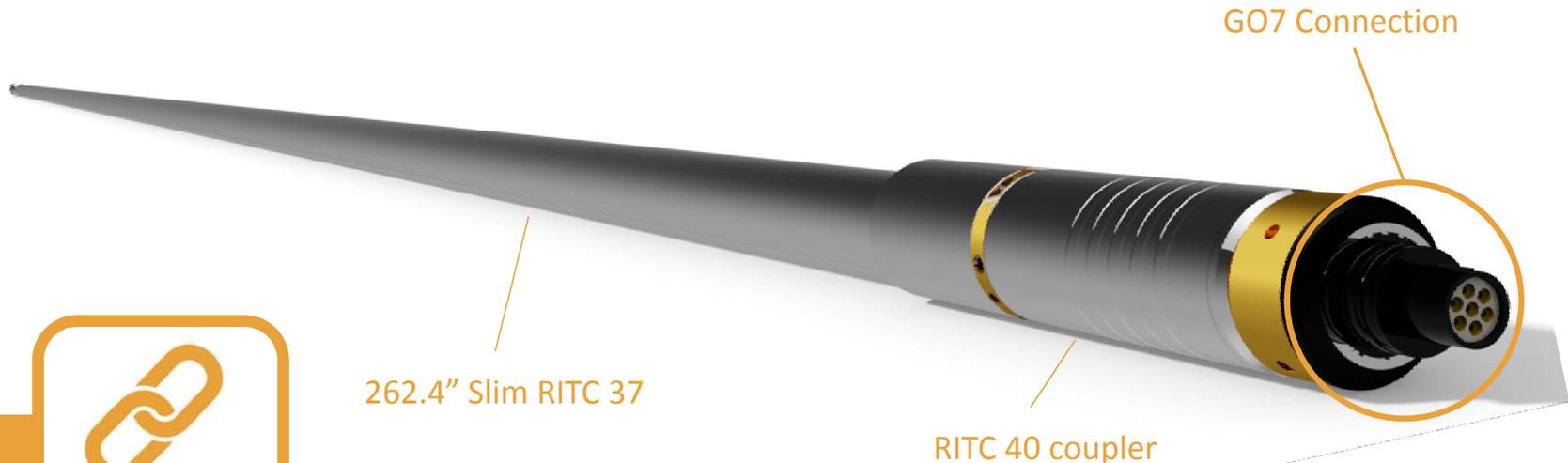
## Functionality

- 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.

## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

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

**Weak Link Specifications** No Weak Links



Compatible with



262.4" Slim RITC 37

RITC 40 coupler



### 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.

Specifications	ITC-HP
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)



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*

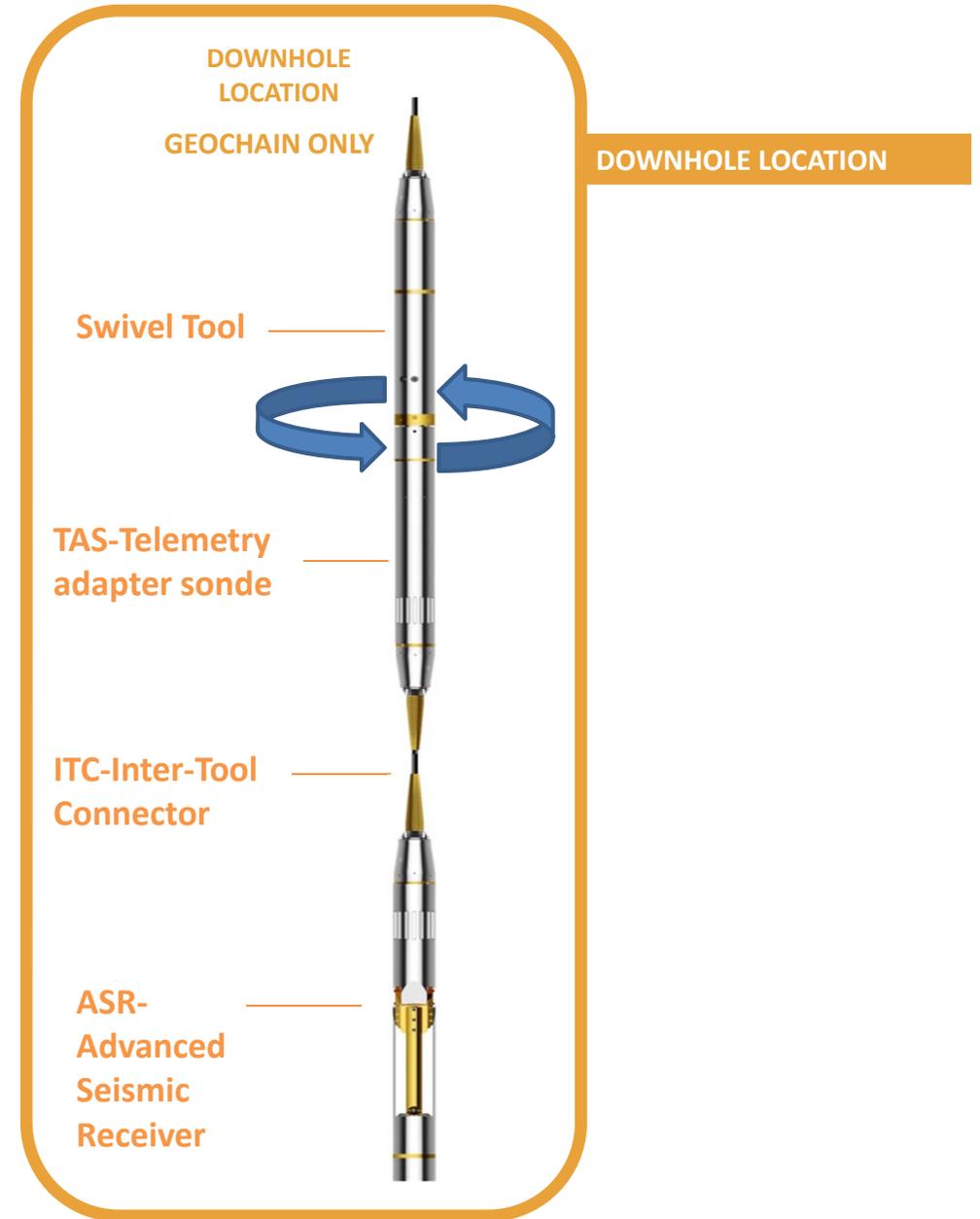
<b>Length</b>	25.9" (657mm)
<b>Diameter</b>	3" (76mm)
<b>Weight</b>	5.7lbs (2.6kg)
<b>Temperature</b>	437°F (225°C)
<b>Pressure</b>	25000 psi ( 1724 bar)

Compatible with



Geochain Analogue and Digital

**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**



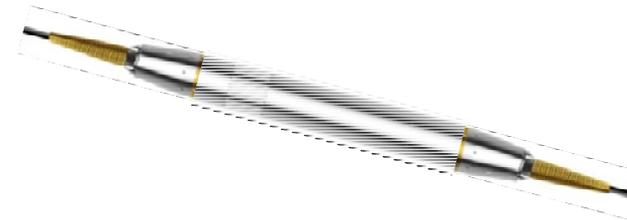
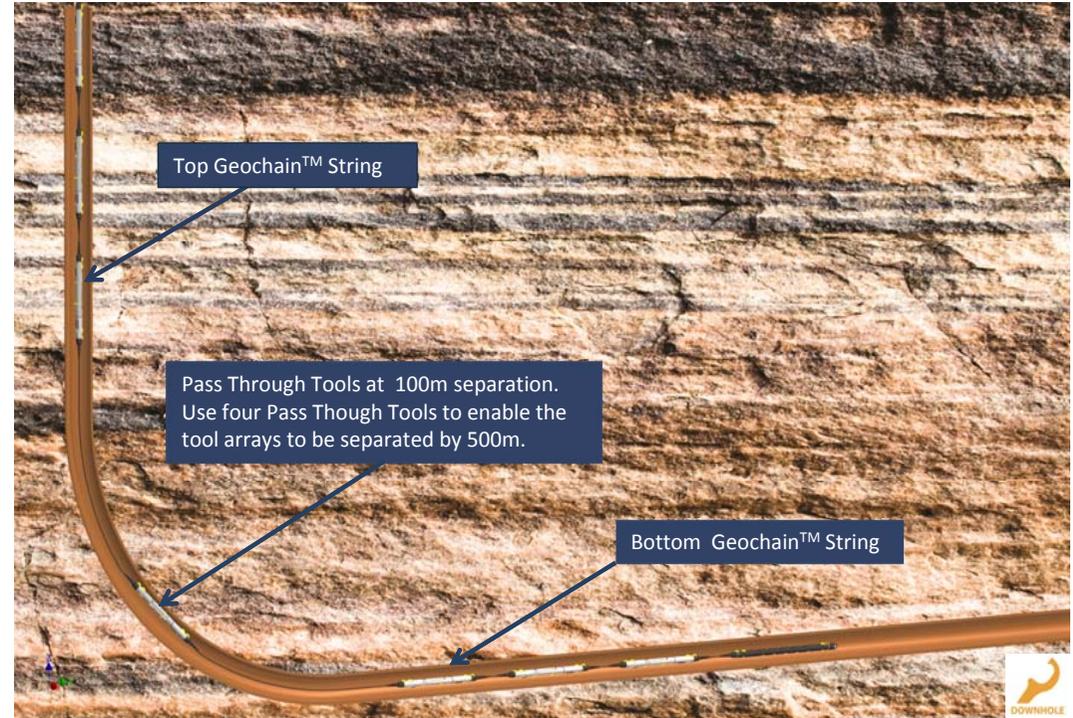


**Main Features**

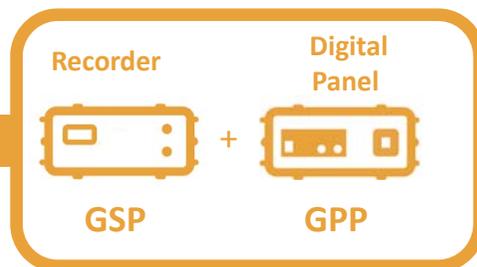
- Enables increased tool separation (Up to >1600' (500m) between satellites.)
- Does not impact sample rates
- Allows deployment of separate arrays in the same well
- 356°F (180°C) Temperature Rating
- 25,000psi Pressure Rating
- 3" Outside Diameter Tool.
- Standard 7 conductor wireline.
- Real time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



**Pass Through Tool**

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



**Main Features**

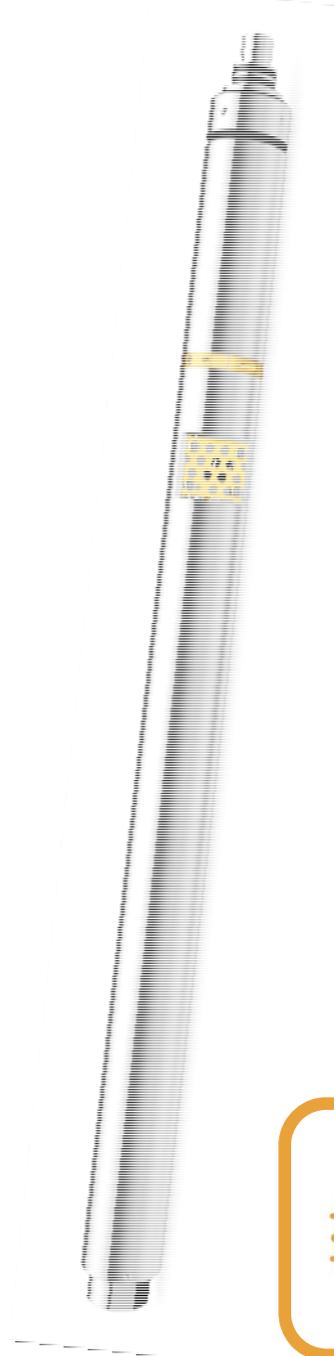
- The DHH-2 downhole hydrophone is part of the GeochainSlim system. The DHH-2 is designed to fit anywhere within an analogue system. The tool utilises an inline GO-7 style coupling and can be used in conjunction with a gamma tool to provide depth correlation. The DHH-2 system can be modified to be tractor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

**Avalon Downhole hydrophone specification table**

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



Compatible with



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 ensure 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 ensure string. The sub can be wired to failsafe into either tractor mode or Geochain mode.

### Specifications

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

Compatible with





## Main Features

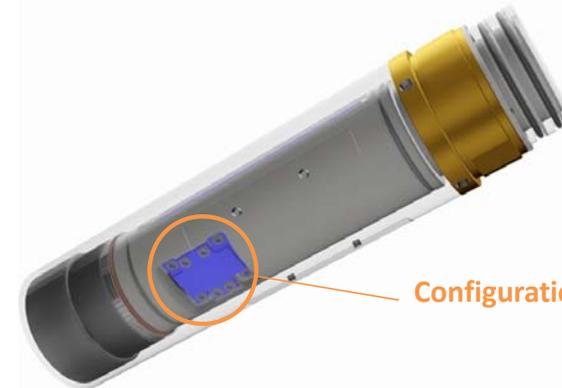
- The switching sub allows the six outer conductors to be combined downhole to minimise voltage drop when deploying a tractor at the bottom of a Geochain™ Slim string.
- Dedicated high current wiring then routes the tractor power along the central line 7 conductor through the ensure string.
- Wired to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

### Specifications

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



Configuration pin board

Compatible with





*Specifications*

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

**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.

*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*



Compatible with



## Cross Over Tools



### Functionality

- Avalon provide a range of cross over tools that allow the Geochain systems to be utilised with third party equipment. Such third party equipment includes logging tool, downhole receiver tool and sparker tools.

### 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
<b>Cross over type</b>	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
<b>Length</b>	5.5" (140mm)	6" (152mm)	12.5" (318mm)	12.5" (318mm)	13" (330mm)	9" (229mm)	10.91" (277mm)
<b>Outer Diameter</b>	3.1" (78mm)	3.1" (78mm)	3.6" (92mm)	3.6" (92mm)	3.4" (86mm)	3.5" (88mm)	3.0" (76mm)
<b>Weight</b>	3kg (6.6lbs)	3kg (6.6lbs)	8.3kg (18.3lbs)		8.5kg (18.7lbs)	6kg (13.2lbs)	4.5kg (10lbs)
<b>Temperature</b>	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)
<b>Pressure</b>	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





## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

### ASR-HP Maintenance

<b>Minor Maintenance frequency</b>	After <b>every survey</b> .
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.
<b>Major Maintenance frequency</b>	<ul style="list-style-type: none"> <li>Once per year or once per 10 surveys whichever comes first</li> <li>Whenever the tools have been run in a well with aggressive borehole fluid or high gas levels</li> <li>Whenever the tools have been exposed to temperatures &gt;150°C for &gt;10 hours</li> </ul>
Overview	Remove and replace all O rings Clean and inspect Continuity and resistance test.

### TAS Maintenance

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

### ITC-HP Maintenance

<b>Minor Maintenance frequency</b>	After <b>every survey</b> .
Overview	Check insulation and continuity. (conduct major maintenance if test fails) Clean head and replace O rings. <ul style="list-style-type: none"> <li>Once per year or once per 10 surveys whichever comes first</li> <li>Whenever the cable have been run in a well with aggressive borehole fluid or high gas levels</li> <li>Whenever the cable have been exposed to temperatures &gt;150C for &gt;10 hours</li> </ul>
<b>Major Maintenance frequency</b>	Disassemble head and clean out grease Clean and check connectors Fill cable head with fresh silicone grease.

### VRS-HP Maintenance

<b>Minor Maintenance frequency</b>	After <b>every survey</b> .
Overview	Replace all O rings <ul style="list-style-type: none"> <li>Once per year or once per 10 surveys whichever comes first</li> <li>Whenever the tools have been run in a well with aggressive borehole fluid or high gas levels</li> <li>Whenever the tools have been exposed to temperatures &gt;150°C for &gt;10 hours</li> </ul>
<b>Major Maintenance frequency</b>	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 <b>start of every survey</b> .
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### GPP Maintenance

Testing	Check WIB induction, should be tested before <b>every survey</b> . Carry out a telemetry test within ACQ, before <b>every survey</b> .
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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 ( <b>after every job</b> ).





# SURFACE

## Surface Ancillaries

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

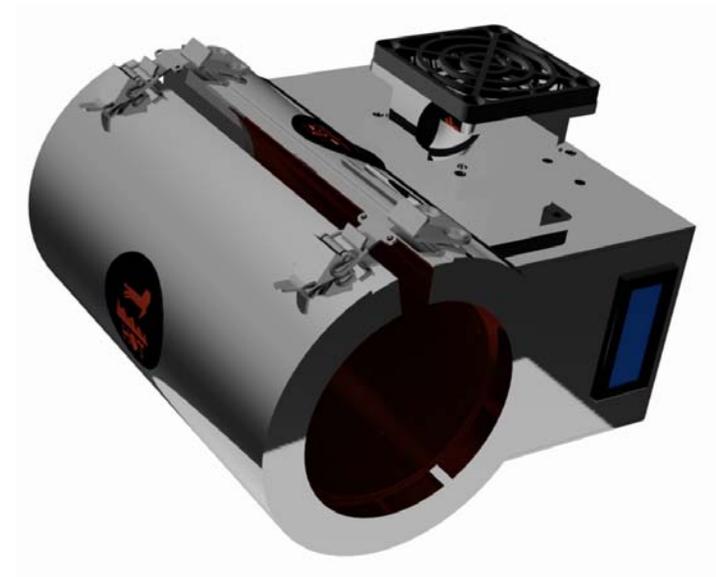


Geochain  
Analogue  
and Digital

**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**

*Specifications*

<b>Diameter</b>	3”
<b>Max Tool Temperature</b>	185°C
<b>Power requirement</b>	200 watt
<b>Operation Voltage</b>	110 or 220 V





## 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 ITC  
service pack kit



Compatible with

## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

### SPAK 10 ASR HP

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

### SPAK 10 ITC HP

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

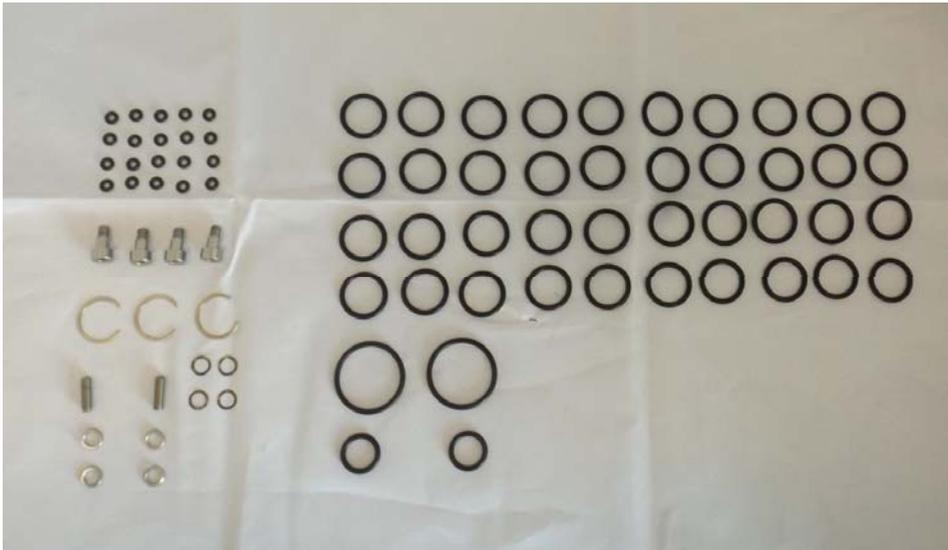
### SPAK 10 VRSHP

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 Slim ITC-4

Compatible with



## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

### SPAK 10 GSR

Part Number	Description	Quantity
GSR-Heatshink 38.1mm	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
Bal Seal X584378	Canted Spring ID 19.8 Width 1.7	2
ESR-045	ESR Shear Pin	1

### SPAK Slim ITC-4

Part Number	Description	Quantity
100A Oil	500ml Silicone oil 100A	1
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



## 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-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-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
RS 707-7322	Vinyl Pouch for Test Leads.	1

## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY

### Tkit-3 (EHP Geochain)

Part Number	Description	Quantity
WX54079	Geochain Maintenance Tool Roll	1
DCF.92.090.3LT	Lemmo Connector Extractor	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
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	Kemlon Boot Tool Short	1
M81969	Insertion/Removal Tool For Positronic D15	1
ASR-191	Drive Puller	1
TL-ASR-01	ASR Test Lead	1
ASR-TL-3	Lemo Test Lead (Female)	1
ST-003	Clutch Adaptor Tool	1
M6 Nipple	M6 Grease Nipple	2

Compatible with





GSP Spares



## 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)** module.
- **Power Supply (PSU)** module accepts a universal mains AC supply voltage of 95-260 V ac at either 50 or 60Hz.



GSP back panel

Compatible with

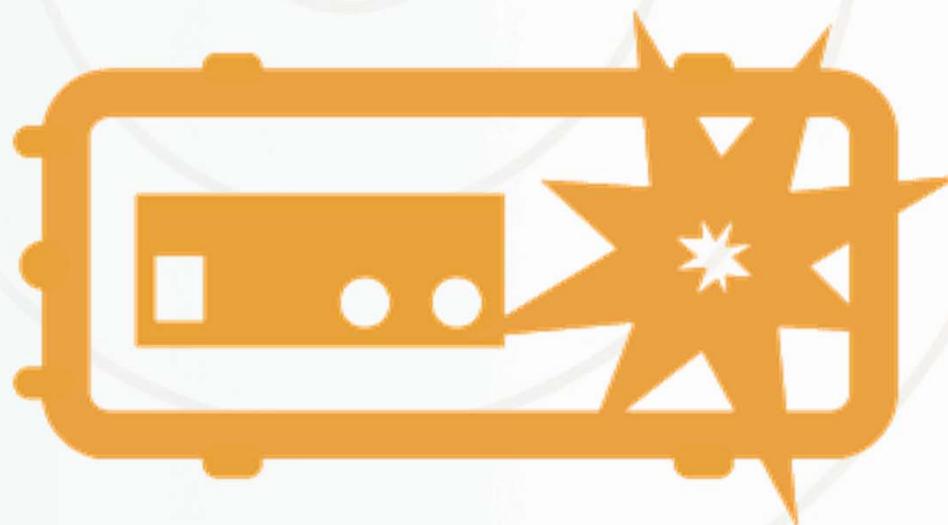


GSP Spares Kit

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

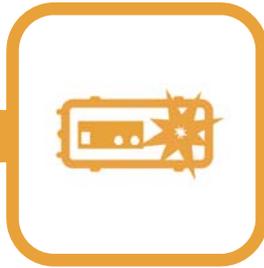


GSP Spares Kit



## Source Controllers

**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.
- 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

**Functionality**

*RSS-2 Specifications*

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

**Compatible with**



GSP



ACQ Software

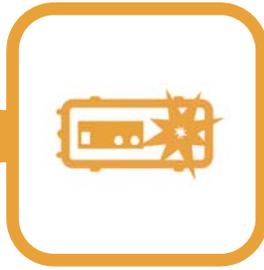


Impulsive Sources



3<sup>rd</sup> 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 7 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.

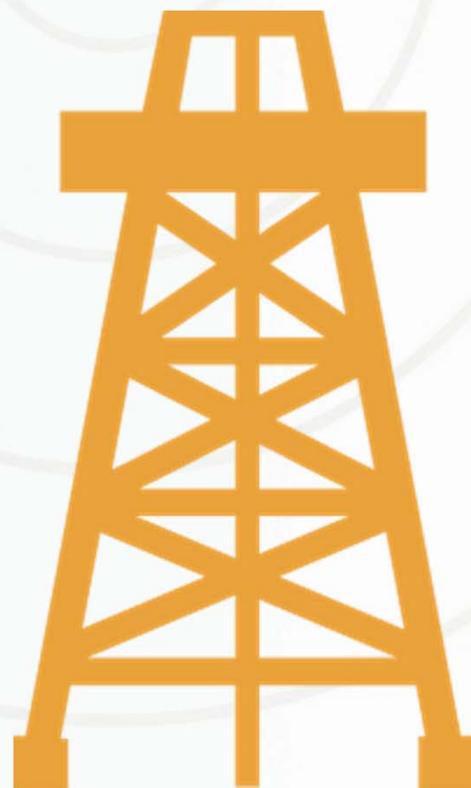
*SIU Specifications*

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

Compatible with



RSS-2



## Test Wells

**Somerton Test Well & Source Pit**



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**



*Well Specifications*

<b>Measured Depth</b>	656 ft (200m)
<b>Casing Depth</b>	656 ft (200m)
<b>Minimum Casing Diameter</b>	9" (228mm)

<b>Max Temperature</b>	86°F (30°C)
<b>Max Pressure</b>	500 psi (34 bar)

*Source Pit Info*

<b>Max Depth</b>	16ft (5m)
<b>Gun</b>	20 cu in Sleeve
<b>Pressure</b>	Upto 1000psi (69 bar)

<b>Well Offset</b>	10ft (3m)
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<b>Gas</b>	Nitrogen
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## 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.

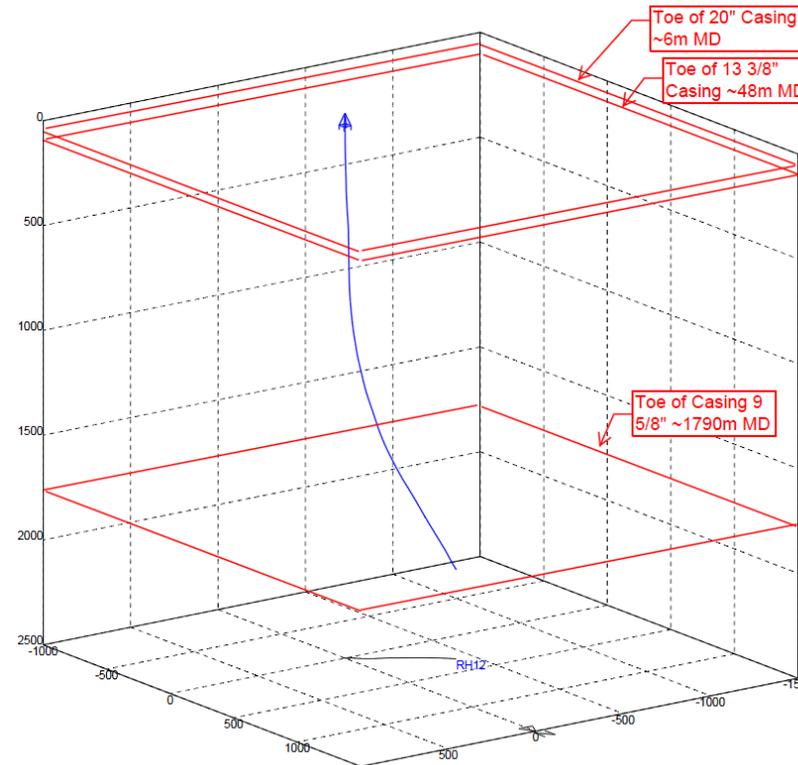
### Main Features

- 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



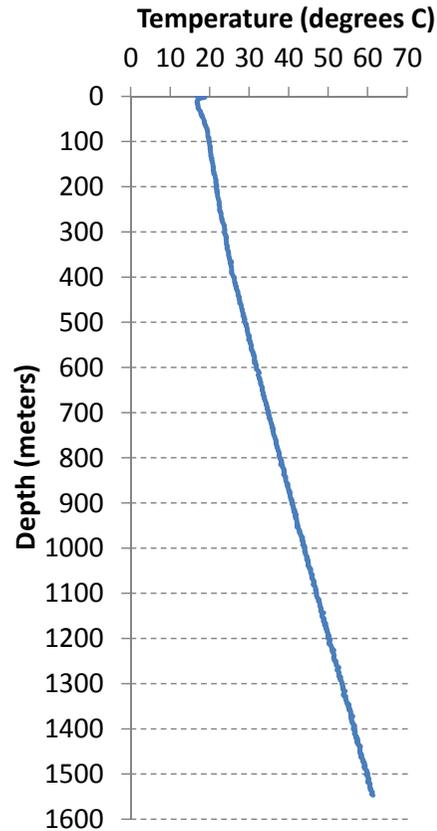
### Specifications

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

**RH12 Borehole Test Well**



**Temperature profile**



Compatible with



**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.

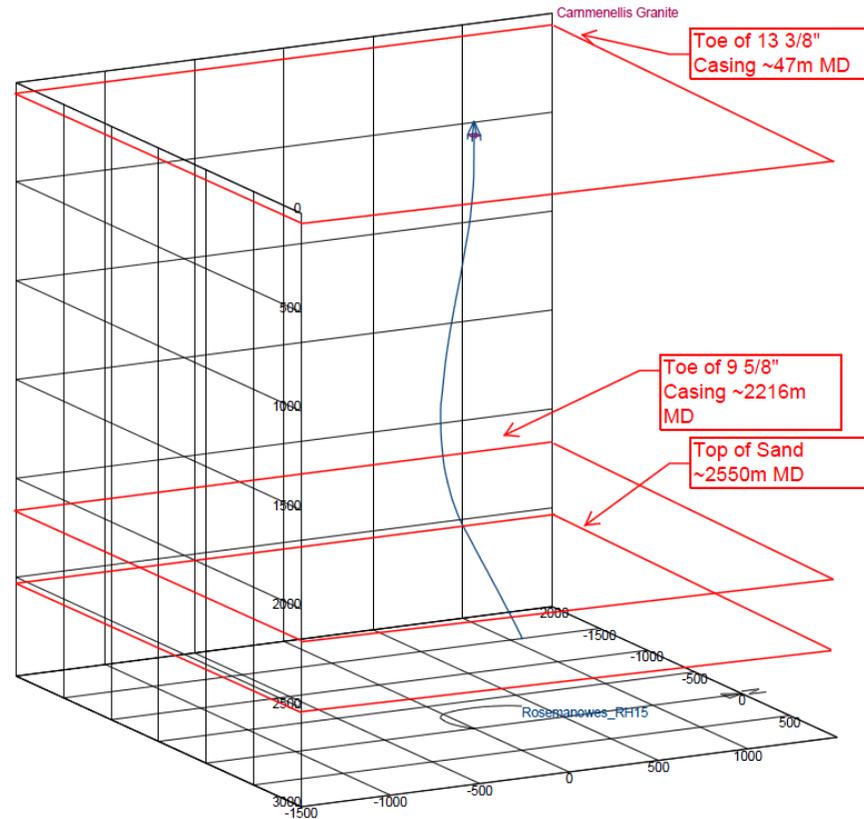
### Main Features

- 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).



Compatible with



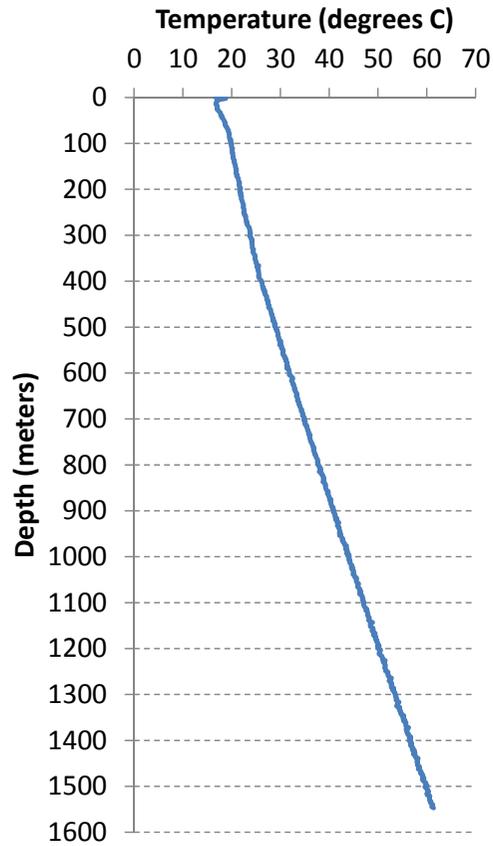
### Specifications

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

**RH15 Borehole Test Well**



**Temperature profile**



Compatible with



**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**

Hole ID: RH15

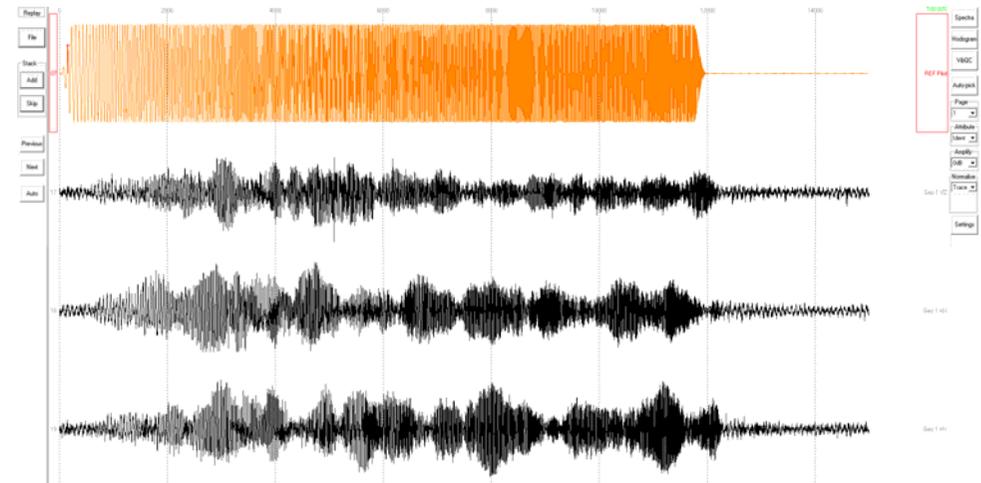
MD (m)	TVD (m)	AOD (m)	Hole Conditions
0	0	164	Open Well: No well Control
0	0	164	Ground Level
5.21	5.21	158.97	Toe of 20" Casing
			13 5/8" K55 Casing
46.11	46.11	118	Toe of 13 5/8" Casing
			9 5/8" C95 Casing
2216.61	2133.75	1969.57	Toe of 9 5/8" Casing
			8 1/2" Open Hole
2542.31			Top of Sand
2777.31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

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



Compatible with



**ROSEMANOWES LOWER QUARRY**



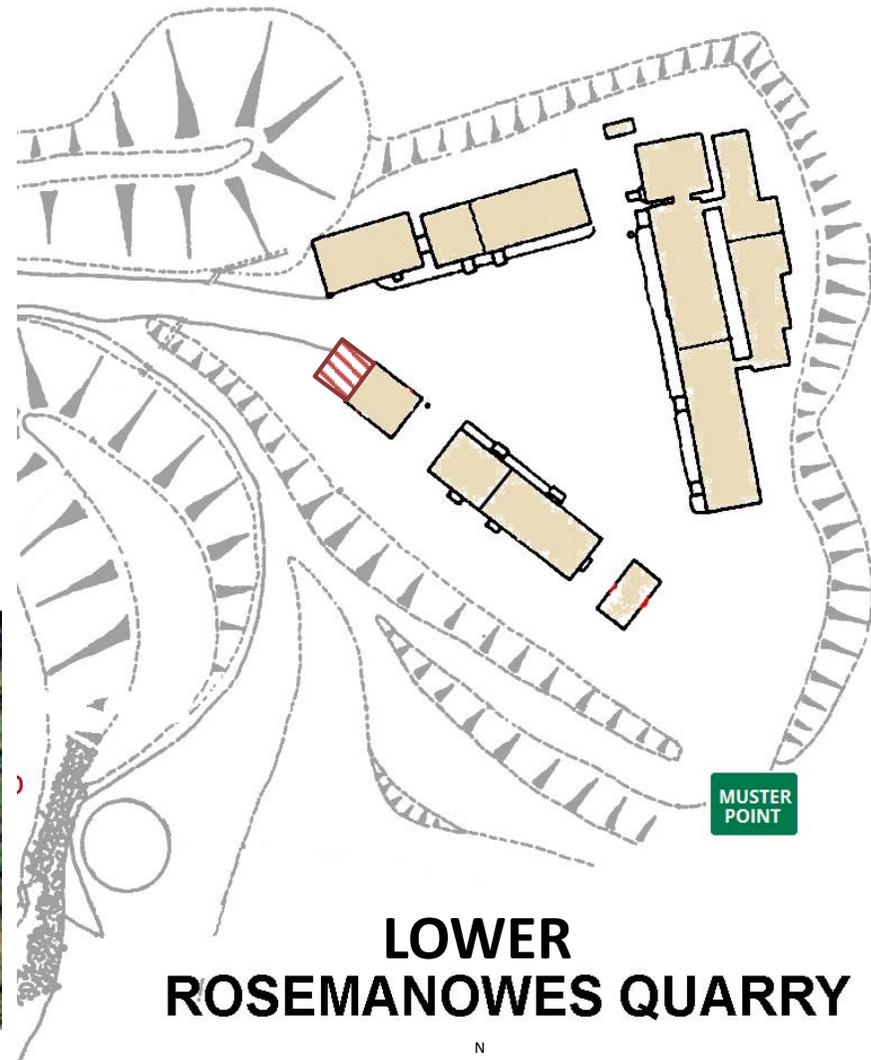
- Rosemanowes Quarry, near Penryn, Cornwall, United Kingdom, was a granite quarry and the site of an early experiment in extracting geothermal energy from the earth using hot dry rock (HDR) technology.
- In February 2014 Rosemanowes Quarry was purchased by Avalon Sciences Ltd (a Somerset Based Borehole 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



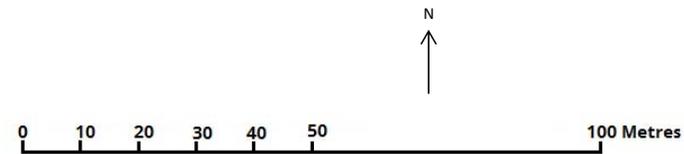

**Avalon  
Borehole  
Testing  
Facility**

Part of the

**LEADERS IN BOREHOLE SEISMIC TECHNOLOGY**



**LOWER  
ROSEMANOWES QUARRY**



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



## 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*

**First Hour in the Day** £320

**Subsequent Hours** £160

**Whole Day (8 hours)** £1300

**Whole Week (5 Days)** £5500



Compatible with

## LEADERS IN BOREHOLE SEISMIC TECHNOLOGY



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