

# SEAL 428 Specifications

## GLOBAL ARCHITECTURE

<b>Flexible architecture</b>	<ul style="list-style-type: none"> <li>• Redundant data transmission modes</li> <li>• Data transmission reconfiguration on line failure</li> </ul>
<b>Upmost electronics integration</b>	<ul style="list-style-type: none"> <li>• ASICS technology</li> <li>• 24 bit, Sigma /Delta</li> <li>• Individual A/D converter per channel</li> </ul>
<ul style="list-style-type: none"> <li>• Active streamers sections with distributed electronics</li> <li>• Multi-boats capability</li> <li>• Fully integrated acquisition system</li> <li>• High redundancy</li> </ul>	

## Shipboard Equipment

### RECORDING (BASIC CONFIGURATION)

<b>Format</b>	4 byte, SEG-D Rev. 1.0 or 2.1 demultiplexed, 32 bit IEEE, code 8058
<b>Tape media</b>	Up to 6 drives, simultaneous and alternated modes Drive model: 3592
<b>Ethernet media</b>	NFS protocol
<b>Maximum number of streamers</b>	64
<b>Maximum number of seismic channels</b>	32,000 with zero dead time
<b>Maximum recording capacity per streamer (with zero dead time and telemetry redundancy)</b>	<ul style="list-style-type: none"> <li>• 960 channels @ 12.5 m, Typical @ 2 ms*</li> <li>• 480 channels @ 12.5 m, Typical @ 1 ms*</li> </ul>
<b>Maximum record length</b>	Unlimited in continuous acquisition mode (depending on server hardware configuration)
<b>Sampling rate</b>	1/2 ms, 1ms, 2 ms, 4 ms
<b>Maximum number of auxiliary channels</b>	60 analog. Unlimited digital auxiliary channels

### DCXU-428

<b>Functions</b>	<ul style="list-style-type: none"> <li>• Ethernet connection to the server</li> <li>• Built-in high-voltage converter (power supply to streamer)</li> <li>• Remote or local operations</li> <li>• Connection to Deck safety devices (Emergency stop, warning lights)</li> <li>• Connection to the Streamer through a 2-m Deck cable Adaptor</li> <li>• Propagation of the GPS reference time</li> <li>• Auxiliary pair connection (bird, acoustic, modem, ...)</li> <li>• NAUTILUS® connection</li> </ul>
<b>Electrical specifications</b>	<ul style="list-style-type: none"> <li>• Output voltage : from 100 VDC to 600 VDC (limited to 365 VDC by the Seal 428 software)</li> <li>• Output current : Max. 2.5 A</li> <li>• Safety features : Current limitation, High Voltage leakage measurement</li> </ul>
<b>Physical specifications</b>	<ul style="list-style-type: none"> <li>• Weight : 18 kg</li> <li>• Length : 580 mm (without the rear panel connectors)</li> <li>• Width : 19" (482.6 mm)</li> <li>• Height : 2U (89 mm)</li> </ul>

\* minimum compression ratio required : 53 % (the figures depend on signal type, sea and environmental conditions and cannot be predicted)

## LCI-428

<b>Functions</b>	<ul style="list-style-type: none"><li>• Ethernet connection to the server</li><li>• Receiving navigation message (if using serial communications)</li><li>• Receiving a physical T0 (pulse)</li><li>• Low Line port for connecting an auxiliary line (AXCU)</li><li>• Synchronized with GNSS time server connected to XDEV2 connector.</li></ul>
<b>Physical specifications</b>	<ul style="list-style-type: none"><li>• Weight : 4.1 kg</li><li>• Length : 420 mm</li><li>• Width : 19" (482.6 mm)</li><li>• Height : 2U (89 mm)</li></ul>

## GNSS TIME SERVER

<b>Functions</b>	<ul style="list-style-type: none"><li>• Acquisition synchronization between streamers.</li><li>• Synchronization of acquisition and navigation systems in continuous acquisition mode</li></ul>
<b>Physical specifications</b>	<ul style="list-style-type: none"><li>• Length : 320 mm</li><li>• Width : 19" (482.6 mm)</li><li>• Height : 1U (44.5 mm)</li></ul>

## DECK CABLES

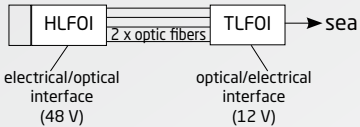
<b>Length</b>	Up to 100 m
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## STORAGE AND OPERATING CONDITIONS (SHIPBOARD)

<b>Operating temperature</b>	+5°C to +40°C (41° to 104°F)
<b>Storage temperature</b>	-15°C to +55°C (5° to 131°F)
<b>Operating humidity</b>	10 to 90% relative humidity, non-condensing
<b>Storage humidity</b>	5 to 95% relative humidity Sercel recommends storing the DCXU-428 in dry conditions for about 24 hours before power on

## In-Sea Equipment

### LEAD-IN CABLE

<b>Functions</b>	<ul style="list-style-type: none"><li>• Optical data transmission</li></ul> 
<b>Physical specifications</b>	<ul style="list-style-type: none"><li>• Cable Breaking strength : 300 kN ; 470 kN ; 570 kN</li><li>• Maximum length : 1 900 m</li></ul>

### HAU-428

<b>Functions</b>	<ul style="list-style-type: none"><li>• 50 VDC (<math>\pm</math> 25 VDC) power supply for active channels for the two lines.</li><li>• Tensile load measurement (0 to 60 kN)</li><li>• High Voltage Lines and telemetry switches</li><li>• High Voltage Lines mix</li></ul>
<b>Physical specifications</b>	<ul style="list-style-type: none"><li>• Weight in sea water : 2.26 kg (4.98 lbs)</li><li>• Outside diameter : 81 mm</li><li>• Length : 277 mm</li><li>• Connectors : standard Seal dia. 70 mm</li></ul>

## HAPU-428

<b>Functions</b>	<ul style="list-style-type: none"> <li>• 50 VDC (<math>\pm 25</math> VDC) power supply for active channels for the two lines.</li> <li>• Tensile load measurement (0 to 60 kN).</li> <li>• High Voltage Lines and telemetry switches.</li> <li>• High Voltage Lines mix.</li> <li>• Factory-configurable Head Buoy Connector pin-out</li> <li>• Head buoy power supply :             <ul style="list-style-type: none"> <li>- 50 VDC / 32 W or 28 V / 32 W output power</li> <li>- Current measurement</li> <li>- ON/OFF by remote operations</li> </ul> </li> </ul>
<b>Physical specifications</b>	<ul style="list-style-type: none"> <li>• Weight in sea water : 4.46 kg (9.83 lbs)</li> <li>• Width : 165 mm</li> <li>• Length : 277 mm</li> <li>• Connectors : standard Seal dia. 70 mm</li> </ul>

## LAUM-428

<b>Functions</b>	<ul style="list-style-type: none"> <li>• Data pre-processing</li> <li>• Data routing</li> <li>• Power distribution</li> </ul>				
<b>Physical specifications</b>	<table border="0"> <thead> <tr> <th style="text-align: center;">LAUM-428 50 mm</th> <th style="text-align: center;">LAUM-428 70 mm</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> <li>• Weight in sea water : 1.4 kg (3.08 lbs)</li> <li>• Outside diameter: 59.7 mm</li> <li>• Length: 256.5 mm</li> <li>• Connectors : standard Seal dia. 50 mm</li> </ul> </td> <td> <ul style="list-style-type: none"> <li>• Weight in sea water : 2.02 kg (4.45 lbs)</li> <li>• Outside diameter: 72.5 mm</li> <li>• Length: 274.5 mm</li> <li>• Connectors : standard Seal dia. 70 mm</li> </ul> </td> </tr> </tbody> </table>	LAUM-428 50 mm	LAUM-428 70 mm	<ul style="list-style-type: none"> <li>• Weight in sea water : 1.4 kg (3.08 lbs)</li> <li>• Outside diameter: 59.7 mm</li> <li>• Length: 256.5 mm</li> <li>• Connectors : standard Seal dia. 50 mm</li> </ul>	<ul style="list-style-type: none"> <li>• Weight in sea water : 2.02 kg (4.45 lbs)</li> <li>• Outside diameter: 72.5 mm</li> <li>• Length: 274.5 mm</li> <li>• Connectors : standard Seal dia. 70 mm</li> </ul>
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## TAPU-428 & TAPU-428 HVS

<b>Functions</b>	<ul style="list-style-type: none"> <li>• Termination of transmission lines</li> <li>• Tail buoy power supply (50V/32W).</li> <li>• Nautilus HV switch function for the TAPU-428 HVS version</li> </ul>
<b>Physical specifications</b>	<ul style="list-style-type: none"> <li>• Weight in sea water : 1.71 kg (3.77 lbs)</li> <li>• Outside diameter: 59.7 mm</li> <li>• Length: 337.5 mm</li> <li>• Connectors : standard Seal dia. 50 mm</li> </ul>

## FDU2F/FDU2M

<b>Functions</b>	<ul style="list-style-type: none"> <li>• Data transmission with CRC control 24 bits A/D conversion</li> <li>• D/A conversion with programmable bit stream</li> </ul>
<b>Full Scale Input Levels</b>	@ G1600: 1.6 V RMS @ G400: 400mV RMS
<b>Offset</b>	0 (digitally zeroed)
<b>High Cut Filter</b>	0.8 FN (linear or minimum phase)
<b>Stop Band Attenuation</b>	> 120 dB (above Nyquist)
<b>Sample Rate</b>	4, 2, 1, 0.5 ms
<b>Word Size</b>	24 bits

## PERFORMANCE\*

<b>Time Standard</b>	True synchronous system
<b>Noise (3-200 Hz)</b>	@ G1600: 700 nV RMS @ G400: 200 nV RMS
<b>Instant Dynamic Range</b>	124 dB
<b>System Dynamic Range</b>	136 dB
<b>Distortion</b>	-105 dB
<b>Gain Accuracy</b>	<0.1%
<b>Phase Accuracy</b>	20 $\mu$ s
<b>CMRR</b>	110 dB

\* Typical @ 2 ms

## SENTINEL SD

<b>Section</b>	
Section length	150 m
Stress member	Twaron/Vectran
Jacket material	Polyurethane 3.5 mm thick (5.2 mm over hydrophones)
Operating temperature	-10° C to +40° C
Storage/shipping temperature	-35° C to +50° C
<b>Cable</b>	<b>SD</b>
Diameter	59,5 mm
Section weight in air	419 kg
<b>Hydrophone</b>	<b>SFH</b>
Nominal Capacitance	32.5 nF ± 10% @ 20° C
Nominal Sensitivity	-192.9 dB ref to 1 V/μPa ± 1.5 dB (22.65 V/bar) @ 20° C
<b>Streamer</b>	
Maximum length - 2D	15750 m/1260 channels
Maximum length - 3D	12000 m/ 960 channels

<b>Connector diameter option</b>	<b>Ø 50 mm</b>	<b>Ø 70 mm</b>
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<b>Channel spacing option</b>	<b>12,5 m</b>	<b>6,25m</b>
FDU2F function	A/D conversion, data digitizing and tests	
FDU2F arrangement	Two channels per unit	
FDU2F per active section	6	12
Hydrophone arrays per section	12	24
Hydrophones per array	8	4
Array capacitance ( nominal)	260 nF ± 10% @ 20° C	130 nF ± 10% @ 20° C
Array sensitivity	-194.1 dB ref to 1 V/μPa ± 1.0 dB (19.7 V/bar)@ 20° C	-195.15 dB ref to 1 V/μPa ± 1.0 dB (17.5 V/bar)@ 20° C

<b>Cutoff frequency option</b>	<b>2Hz</b>	<b>3 Hz</b>
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<b>Depth restriction option</b>	<b>No</b>	<b>Yes</b>
Maximum operating depth	50 m	22 m
Maximum survival depth	250 m (5 days cumulative)	150 m (5 days cumulative)

<b>Communication coils option</b>	<b>2</b>	<b>4</b>
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## SENTINEL RD

<b>Section</b>	
Section length	150 m
Stress member	Twaron/Vectran
Jacket material	Polyurethane 3.5 mm thick (5.2 mm over hydrophones)
Operating temperature	-10° C to +40° C
Storage/shipping temperature	-35° C to +50° C
<b>Cable</b>	<b>RD</b>
Diameter	55 mm
Section weight in air	362 kg
<b>Hydrophone</b>	<b>SFH</b>
Nominal Capacitance	32.5 nF ± 10% @ 20° C
Nominal Sensitivity	-192.9 dB ref to 1 V/μPa ± 1.5 dB (22.65 V/bar) @ 20° C
<b>Streamer</b>	
Maximum length - 2D	15750 m/1260 channels
Maximum length - 3D	12000 m/ 960 channels

<b>Connector diameter option</b>	<b>Ø 50 mm</b>	<b>Ø 70 mm</b>
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<b>Channel spacing option</b>	<b>12,5 m</b>	<b>6,25m</b>
FDU2F function	A/D conversion, data digitizing and tests	
FDU2F arrangement	Two channels per unit	
FDU2F per active section	6	12
Hydrophone arrays per section	12	24
Hydrophones per array	8	4
Array capacitance ( nominal)	260 nF ± 10% @ 20° C	130 nF ± 10% @ 20° C
Array sensitivity	-194.1 dB ref to 1 V/μPa ± 1.0 dB (19.7 V/bar)@ 20° C	-195.15 dB ref to 1 V/μPa ± 1.0 dB (17.5 V/bar)@ 20° C

<b>Cutoff frequency option</b>	<b>2Hz</b>	<b>3 Hz</b>
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<b>Depth restriction option</b>	<b>No</b>	<b>Yes</b>
Maximum operating depth	50 m	22 m
Maximum survival depth	250 m (5 days cumulative)	150 m (5 days cumulative)

<b>Communication coils option</b>	<b>2</b>	<b>4</b>
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## SENTINEL HR

<b>Section</b>	
Section length	150 m
Stress member	Twaron/Vectran
Jacket material	Polyurethane 3.5 mm thick (5.2 mm over hydrophones)
Operating temperature	-10° C to +40° C
Storage/shipping temperature	-35° C to +50° C
<b>Cable</b>	<b>SD</b>
Diameter	59.5 mm
Section weight in air	419 kg
<b>Hydrophone</b>	<b>SFH</b>
Nominal Capacitance	32.5 nF ± 10% @ 20° C
Nominal Sensitivity	-192.9 dB ref to 1 V/μPa ± 1.5 dB (22.65 V/bar) @ 20° C
<b>Streamer</b>	
Maximum length	6000 m

<b>Connector diameter option</b>	<b>Ø 50 mm</b>	<b>Ø 70 mm</b>
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<b>Channel spacing</b>	<b>3,125 m</b>
FDU2F function	A/D conversion, data digitizing and tests
FDU2F arrangement	Two channels per unit
FDU2F per active section	24
Hydrophone arrays per section	48
Hydrophones per array	2
Array capacitance ( nominal)	65 nF ± 10% @ 20° C
Array sensitivity	-196.95 dB ref to 1 V/μPa ± 1.0 dB (14.2 V/bar)@ 20° C

<b>Cutoff frequency</b>	<b>4,8 Hz</b>
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<b>Depth restriction option</b>	<b>No</b>	<b>Yes</b>
Maximum operating depth	50 m	22 m
Maximum survival depth	250 m (5 days cumulative)	150 m (5 days cumulative)

<b>Communication coils option</b>	<b>2</b>	<b>4</b>
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## ACQUISITION LINE SECTION (ALS)

	ALS	ALS Depth restricted
<b>Field Digitalization Unit (FDU2M)</b> Unit arrangement Unit spacing (Typical) Functions	one for two channels 25 m A/D conversion, data digitizing, tests	one for two channels 25 m A/D conversion, data digitizing, tests
<b>Hydrophone specifications</b> Standard model Nominal capacitance  Nominal sensitivity	SLH 20 or Geopoint 16 nF @ 20°C ± 10% -194 dB re 1 V/μPa ± 1,5 dB (20 V/bar) @ 20°C	Exportable SLH 20 or Geopoint 16 nF @ 20°C ± 10% -194 dB re 1 V/μPa ± 1,5 dB (20 V/bar) @ 20°C
<b>Hydrophones array arrangement (*) (Typical)</b> Hydrophones per group Group capacitance Group sensitivity (electronics included) Analog filter low-cut frequency	12.5 m 16 256 nF @ 20°C  17.4V/bar @ 20°C 3 Hz	12.5 m 16 256 nF @ 20°C  17.4V/bar @ 20°C 3 Hz
<b>Maximum length without power line nor telemetry line redundancy and with a 950 m long lead in</b>	12000 m / 960 ch	11250 m / 900 ch
<b>Physical specifications</b> Nominal section length Cable diameter Stress members Groups per section(*) Typical group spacing(*) Jacket	150 m 50 mm (1.97 in) Two Vectran ropes 12 12.5 m Polyurethane, 3.3 mm wall	150 m 52 mm (2.05 in) Two Vectran ropes 12 12.5 m Polyurethane, 3.3 mm wall
<b>Environmental specifications</b> Operating temperature Storage temperature Maximum operating depth Maximum survival depth Filled section weight in air	-10° to +40°C -35° to +60°C 30 m 250 m 320 kg	-10° to +40°C -35° to +60°C 17 m 150 m 325 kg
<b>Mechanical specifications(**)</b> Terminated UTS Operating tension Streamer length @ 5 knots Ballast fluid capacity Drag of a 12 km Streamer Maximum Retrieval Tension	> 100 kN up to 30 kN up to 12 km 200 l 30 kN @ 5 knots < 20 kN	> 100 kN up to 30 kN up to 12 km 200 l 30 kN @ 5 knots < 20 kN

(\*) Other configurations available on request

(\*\*) See operational model for more details

Note: Sercel reserves the right to change its specifications without prior notice.  
 All specifications are typical at 20°C

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Ahead of the Curve<sup>SM</sup>