

# SEAL 428

## Shipboard Equipment

RECORDING (BASIC CONFIGURATION)		
	Sentinel SD & RD	Sentinel MS
<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>	Unlimited (depending on server performance)	
<b>Maximum number of seismic channels</b>	Not limited by Sercel electronics	
<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	1ms, 2 ms, 4 ms
<b>Operation mode</b>	continuous	
<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</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>

## GPS 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> <li>• Maintain synchronisation within specification up to 3 hours without GPS</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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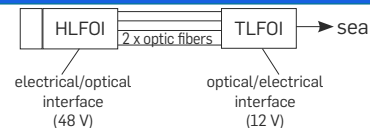
## STORAGE AND OPERATING CONDITIONS (SHIPBOARD)

<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 70 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>• 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 70 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></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>	<ul style="list-style-type: none"><li>• Weight in sea water : 1 kg (2.2 lbs)</li><li>• Spacing along the cable: 750 m @ 12.5 m @ 2 ms</li><li>• Outside diameter: 53 mm</li><li>• Length: 350 mm</li></ul>

## FDU2F/FDU2M/FDU3F

<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>Low Cut Filter</b>	<ul style="list-style-type: none"><li>• SFA: 6.1 Hz analog + 2 Hz digital</li><li>• Hydrophone - Sentinel SD / RD: 2 or 3 Hz analog (depending on section type) + optional 2 or 3 Hz digital</li><li>• Hydrophone - Sentinel MS: 2 Hz analog + optional 2 or 3 Hz digital</li><li>• Hydrophone - Sentinel HR: 4.8 Hz analog + optional 2 or 3 Hz digital</li></ul>
<b>High Cut Filter</b>	0.8 FN (linear phase)
<b>Stop Band Attenuation</b>	> 120 dB (above Nyquist)
<b>Sample Rate</b>	4, 2, 1 ms (0.5 ms option available for FDU2M and FDU2F)
<b>Word Size</b>	24 bits
<b>Time Standard</b>	True synchronous system

## PERFORMANCE\*

<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

## HEAD & TAIL POSITIONING BUOYS (TBC)

<b>Dedicated buoy power supply module</b>	
<b>Available power supply</b>	40 to 50 V / 30 W
<b>Current monitoring</b>	
<b>ON/OFF power supply remote control</b>	

## SENTINEL SD

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

<b>CONNECTOR DIAMETER OPTION</b>	Ø 50 mm	Ø 70 mm
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<b>CHANNEL SPACING OPTION</b>	12,5 m	6,25m
<b>FDU2F function</b>	A/D conversion, data digitizing and tests	
<b>FDU2F arrangement</b>	Two channels per unit	
<b>FDU2F per active section</b>	6	12
<b>Hydrophone arrays per section</b>	12	24
<b>Hydrophones per array</b>	8	4
<b>Array capacitance ( nominal)</b>	260 nF ± 10% @ 20° C	130 nF ± 10% @ 20° C
<b>Array sensitivity</b>	-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>	2Hz	3 Hz
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<b>DEPTH RESTRICTION OPTION</b>	No	Yes
<b>Maximum operating depth</b>	50 m	22 m
<b>Maximum survival depth</b>	250 m (5 days cumulative)	150 m (5 days cumulative)

<b>COMMUNICATION COILS OPTION</b>	2	4
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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>	RD
Diameter	55 mm 362 kg
Section weight in air	
<b>HYDROPHONE</b>	SFH
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>	Ø 50 mm	Ø 70 mm
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<b>CHANNEL SPACING OPTION</b>	12,5 m	6,25m
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>	2Hz	3 Hz
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<b>DEPTH RESTRICTION OPTION</b>	No	Yes
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>	2	4
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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>	
Diameter	59.5 mm
Section weight in air	419 kg
<b>Hydrophone</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>	Ø 50 mm	Ø 70 mm
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<b>CHANNEL SPACING</b>	3,125 m
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>	4,8 Hz
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<b>DEPTH RESTRICTION OPTION</b>	No	Yes
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>	2	4
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## SENTINEL® MS SOLID STREAMERS

<b>FIELD DIGITALIZATION UNIT (FDUS)</b> Arrangement Functions FDUs per active section Spacing	one per receiver point (3 channels) A/D conversion, data digitizing and tests 12 (1 FDU per location) 12.5 m	
<b>HYDROPHONES</b> Standard model Nominal capacitance Nominal sensitivity	Sercel Flexible Hydrophone (SFH) or Depth-Restricted SFH 32.5 nF ± 10% @ 20°C -192.9 dB ref to 1 V/μPa ± 1,5 dB (22.65 V/bar) @ 20°C	
<b>HYDROPHONES ARRAY</b> Cutoff frequency Groups per section Hydrophones per group Group capacitance (nominal) Group sensitivity	2 Hz 12 8 260 nF ± 10% @ 20°C -194.1 dB ref to 1 V/μPa ± 1.0 dB (19.7 V/bar) @ 20°C	
<b>ACCELEROMETERS</b> Standard model Cutoff frequency Group capacitance (nominal) Group sensitivity	Sercel Flexible Accelerometer (SFA) 6.1 Hz 42 nF ± 10% @ 20°C 66 mV/g (6.73 mV/(m/s <sup>2</sup> ))	
<b>MAXIMUM LENGTH(*)</b>	8100 m / 1944 channels (with full redundancy and 950 m lead-in) 12000 m / 2880 channels (without power / telemetry line redundancy, with 950 m lead-in)	
<b>COMMUNICATION COILS</b>	1	
<b>PHYSICAL SPECIFICATIONS</b> Section length Stress member Connector diameter Jacket material Cable diameter Section weight in air	150 m (measured at 13.3 kiloNewtons tension) Twaron/Vectran 70 mm Polyurethane, 3.5 mm thick (5.2 mm over hydropones and accelerometers) 59.5 mm 425 kg	
<b>ENVIRONMENTAL SPECIFICATIONS</b> Operating temperature Storage/shipping temperature	-10° to +40°C -35° to +50°C	
Maximum operating depth Maximum survival depth	Unrestricted 50m 250 m (5 days cumulative)	Depth Restricted 22 m 150 m ( 5 days cumulative)

(\*) 12.5 m spacing only

Note: Sercel reserves the right to change its specifications without prior notice.  
All specifications are typical at 25°C



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