

SeaRay® 428 Specifications

GLOBAL ARCHITECTURE

- Lightweight, flexible cable and electronic modules that operate to a depth of:
SeaRay® 300: 300 m – use down to 500 m with restrictions
SeaRay® 100: 100 m (smaller diameter cable)
- Active sections with distributed electronics.
- ASICS and MEMS technology (24 bit, Sigma /Delta)
- Designed for redeployable, four-component seabed seismic data acquisition.
- Fully integrated acquisition system.
- Flexible architecture: redundant telemetry and power lines (two high voltage rails).
- Multi-recorder capabilities (remote control of recorder/buoys)

Shipboard Equipment

RECORDING (BASIC CONFIGURATION)

Format	4byte, SEG-D Rev. 1.0 or 2.1 demultiplexed, 32 bit IEEE, code 8058.
Tape media	Up to 2 drives, simultaneous and alternated modes. Drive model: 3590 model B, E, H, DLT, LTO IBM 3580, 3592
Ethernet media	NFS protocol. (2 disk targets)
Sampling rate	1/4 ms, 1/2 ms, 1ms, 2 ms, 4 ms.
Maximum record length	Depends on server and line configuration. Refer to next chapter.
Maximum number of auxiliary channels	60 analog.
Maximum number of Flatpack receivers per line @8 Mbits/s with zero dead time (Typical @ 2 ms, depending on signal type and compression ratio)	220 RPs with full redundancy (telemetry and high voltage) 440 RPs without telemetry redundancy

Configuration (Results are Typical @ 2 ms, depending on signal type and compression ratio)	Distance between RPs (m)	Number of AQDSUs between SBLUs	Maximum length between SBLUs	Maximum Active Line Length (m) (1)	Quantity of SBLUs	Total RPs	Zero dead time rate with Telemetry redundancy (2) & (3)	Zero dead time rate with no Telemetry redundancy (4)	HV redundancy (5)
25m - TZLU - 8 Mbits/s - 365V									
Zero dead time with full redundancy	25	30	750	5500	9	220	-	-	Yes
Zero dead time with HV redundancy only	25	30	750	9750	14	390	77%	-	Yes
Zero dead time with no redundancy	25	30	750	11000	16	440	100%	-	No
Maximum length due to HV loss	25	30	750	14500	21	580	164%	32%	No
50m - TZLU - 8 Mbits/s - 365V									
Zero dead time with full redundancy	50	30	1500	11000	9	220	-	-	Yes
Zero dead time with HV redundancy only	50	30	1500	14500	11	290	32%	-	Yes
Maximum length due to HV loss	50	30	1500	21000	15	420	91%	-	No
25m - SBLU - 8 Mbits/s - 600V									
Zero dead time with full redundancy	25	30	750	5500	9	220	-	-	Yes
Zero dead time with HV redundancy only	25	30	750	11000	16	440	100%	-	Yes
No zero dead time with HV redundancy only	25	30	750	17250	24	690	214%	57%	No
Maximum length due to HV loss	25	30	750	23250	32	930	323%	111%	No
50m - SBLU - 8 Mbits/s - 600V									
Zero dead time with full redundancy	50	30	1500	11000	9	220	-	-	Yes
Zero dead time with HV redundancy only	50	30	1500	22000	16	440	100%	-	Yes
No zero dead time with HV redundancy only	50	30	1500	25500	18	510	132%	16%	No
Maximum length due to HV loss	50	30	1500	37500	26	750	241%	70%	No

(1) Configuration between active line and BCXU is: BCXU - Deck cable (50m) + SBLU + Extender (300m) + SBLU + Extender (300m) + SBLU + Extender (300m) + SBLU + TZAC (25m) + Active line

(2) Telemetry redundancy = means that system can work with only one telemetry line

(3) Zero dead time (%) is calculated as: (Number of RPs/220-1), where 220 is the maximum number of receiver points with zero dead time and telemetry redundancy

(4) Zero dead time (%) is calculated as: (Number of RPs/440-1), where 440 is the maximum number of receiver points with zero dead time

(5) HV redundancy = means that system can work with only one HV rail

Maximum number of Flatpack receivers per line @ 16 Mbits/s (SBLU only) with zero dead time (Typical @ 2 ms, depending on signal type and compression ratio)

420 RPs with full redundancy (telemetry and high voltage)
590 RPs without telemetry redundancy

Configuration (Results are Typical @ 2 ms, depending on signal type and compression ratio)	Distance between RPs (m)	Number of AQDSUs between SBLUs	Maximum length between SBLUs	Maximum Active Line Length (m) (1)	Quantity of SBLUs	Total RPs	Zero dead time rate with Telemetry redundancy (2) & (3)	Zero dead time rate with no Telemetry redundancy (4)	HV redundancy (5)
25m - SBLU - 16 Mbits/s - 600V									
Zero dead time with full redundancy	25	60	1500	10500	8	420	-	-	Yes
Zero dead time with HV redundancy only	25	60	1500	14750	11	590	40%	-	Yes
No zero dead time with HV redundancy only	25	60	1500	18000	13	720	71%	22%	Yes
Maximum length due to HV loss	25	60	1500	27000	19	1080	157%	83%	No

(1) Configuration between active line and BCXU is: BCXU - Deck cable (50m) + SBLU + Extender (300m) + SBLU + Extender (300m) + SBLU + Extender (300m) + SBLU + TZAC (25m) + Active line

(2) Telemetry redundancy = means that system can work with only one telemetry line

(3) Zero dead time (%) is calculated as: (Number of RPs/420-1), where 420 is the maximum number of receiver points with zero dead time and telemetry redundancy

(4) Zero dead time (%) is calculated as: (Number of RPs/590-1), where 590 is the maximum number of receiver points with zero dead time

(5) HV redundancy = means that system can work with only one HV rail

LCI-428

Functions	<ul style="list-style-type: none">• Field units management, up to 8000 channels real time @ 2ms (typical compression ratio: 40%).• Up to 3 LCI-428 can be linked together to handle more channels.
Electrical specifications	<ul style="list-style-type: none">• Operating voltage : 110-220 VAC, 50/60 Hz• Power consumption : 6.7 W
Physical specifications	<ul style="list-style-type: none">• Dimensions (HxWxD) : 2U 19" rackable, 86.1 x 483 x 420.7 mm (19 x 16.5 x 3.4 in.)• Weight : 4.1 kg (9.0 lbs.)

BCXU-428

Functions	<ul style="list-style-type: none">• Modified TCP-IP protocol, 100 Mbps Ethernet-based, for connection to the LCI• Built-in high-voltage converter (power supply to cable).• High-voltage remote or local operation.• Connection to Deck safety devices (Emergency stop, warning lights).• Connection to the deck cable through a 2-m Deck cable Adaptor.• The safety loop circuitry of BCXU-428 provides protection from hazardous voltages throughout the line to the fist TZLU or SBLU. It turns off the High Voltage and causes the Safety Loop red indicator to light up on the front panel														
Electrical specifications	<ul style="list-style-type: none">• Input Voltage : 110V/220V AC $\pm 20\%$.• Frequency : 50-60 Hz $\pm 5\%$.• Power rating of high voltage power supply depending on output voltage :<table border="1" data-bbox="755 913 1063 1155"><thead><tr><th>Output DC voltage</th><th>Power</th></tr></thead><tbody><tr><td>600 VDC</td><td>1500 W</td></tr><tr><td>550 VDC</td><td>1375 W</td></tr><tr><td>500 VDC</td><td>1250 W</td></tr><tr><td>450 VDC</td><td>1125 W</td></tr><tr><td>400 VDC</td><td>1000 W</td></tr><tr><td>350 VDC</td><td>875 W</td></tr></tbody></table>• Output voltage : From 100 VDC to 600 VDC. (Must be limited to 365 VDC for compliance with TZLU).• Output Current : Max. 2.5 A.• Safety features : Current limitation, High Voltage leakage measurement.• Leakage current : High Voltage leakage current measurement from -50.0 mA to +50.0	Output DC voltage	Power	600 VDC	1500 W	550 VDC	1375 W	500 VDC	1250 W	450 VDC	1125 W	400 VDC	1000 W	350 VDC	875 W
Output DC voltage	Power														
600 VDC	1500 W														
550 VDC	1375 W														
500 VDC	1250 W														
450 VDC	1125 W														
400 VDC	1000 W														
350 VDC	875 W														
Physical specifications	<ul style="list-style-type: none">• Dimensions (HxWxD) : 2U 19" rackable, 89 x 482.6 x 580 mm (without rear panel connectors)• Weight : 18 kg														

DECK CABLE

Length	Up to 100m
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STORAGE AND OPERATING CONDITIONS (SHIPBOARD)

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

In-Sea Equipment

SBLU	
Functions	<ul style="list-style-type: none"> • 50 VDC (± 25VDC) power supply for active channels for the two lines. • High Voltage Lines and telemetry switches. • Manages data rate of 8Mbits/s or 16Mbits/s, and can manage up to 30 receiver points (120 channels) or 60 receiver points (240 channels) respectively. • Data routing, and data pre-processing. • The safety loop circuitry provides protection from hazardous voltages throughout the acquisition line to the next SBLU or TZLU. It turns off the High Voltage and causes the Safety Loop red indicator to light up on the front panel. • The SBLU includes an equalizer and can be used as a repeater (400m @ 8Mbits/s, and up to 700 m with AQRU @ 16Mbits/s).
Electrical specifications	<ul style="list-style-type: none"> • Maximum input voltage : 600 VDC
Physical specifications	<ul style="list-style-type: none"> • Connectors : 70mm, 28 pins • Maximum outside diameter : 104 mm • Overall assembled length (including bend restrictors) : 1371 mm • Stiff length (termination + SBLU + termination) : 720.5 mm • Weight in air (termination + SBLU + termination) : 17.8 kg • Weight in seawater (termination + SBLU + termination) : 10.9 kg • Number of bend restrictors per termination : 1 brass (nearest the module), 5 plastic + 1 tapered end

TZLU	
Functions	<ul style="list-style-type: none"> • 50 VDC (± 25VDC) power supply for active channels for the two lines. • High Voltage Lines and telemetry switches. • Manages data rate of 8Mbits/s, and manage up to 30 receiver points (120 channels). • Data routing, and data pre-processing. • The safety loop circuitry provides protection from hazardous voltages throughout the acquisition line to the next TZLU. It turns off the High Voltage and causes the Safety Loop red indicator to light up on the front panel.
Electrical specifications	<ul style="list-style-type: none"> • Maximum input voltage : 365 VDC
Physical specifications	<ul style="list-style-type: none"> • Connectors : 70mm, 28 pins • Maximum outside diameter (TZLU or TZRU) : 150.3 mm • Overall assembled length (including bend restrictors) : 1420 mm • Stiff length (termination + TZLU + termination) : 769.5 mm • Weight in air (termination + TZLU + termination) : 21.0 kg • Weight in seawater (termination + TZLU + termination) : 10.9 kg • Number of bend restrictors per termination : 1 brass (nearest the module), 5 plastic + 1 tapered end

TZRU	
Functions	<ul style="list-style-type: none"> • Long-range repeater unit, required if the length between the BCXU-428 and the TZLU or between AQASs exceeds 100 meters.
Electrical specifications	<ul style="list-style-type: none"> • Power Source : 50 VDC from telemetry lines
Physical specifications	<ul style="list-style-type: none"> • Same as TZLU

FLATPACK

The Flatpack cage protects AQDSU canister, SSH-01 hydrophone cylinder and cable takeout.

Material	<ul style="list-style-type: none">• Flatpack cage : aluminum-bronze• Articulated bend restrictors : glass-fiber-reinforced plastic
Maximum outside width	174 mm
Maximum outside height	71 mm
Cage length	455 mm
Number of bend restrictors	7 + 1 tapered end link on each side
Overall length with bend restrictors	968 mm
Stiff length	392 mm
Weight in air	14.15 kg
Weight in sea water	10.88 kg

AQAS

Minimum spacing of receiver points	12.5 m
Maximum spacing of receiver points	up to 60 m

SeaRay® 100 cable

Outside diameter	21.6 mm (over ribs)
Maximum active section length	1800 m
Minimum breaking strength	22 kN
Maximum allowable working load	4.5 kN
Point (local) pressure loading	10 Mpa
Minimum sheave diameter	1.5 m
Weight in air	564 kg/km
Weight in sea water	210 kg/km
Maximum operating depth	100m

SeaRay® 300 cable

Outside diameter	28.5 mm (over ribs)
Maximum active section length	1800 m
Minimum breaking strength	66 kN
Maximum allowable working load	16.5 kN
Point (local) pressure loading	10 Mpa
Minimum sheave diameter	3 m
Weight in air	849 kg/km
Weight in sea water	231 kg/km
Maximum operating depth	300m 500m (with specific handling care)

OPTICAL EXTENDER

Construction	Double armour
Outside diameter	23.0 mm
Maximum length	2,4 kms
Minimum breaking strength	300 kN
Maximum allowable working load	80 kN
Minimum sheave diameter	3m
Weight in air	1700 kg/km
Weight in sea water	1350 kg/km
Maximum operating depth	300m 500m (with specific handling care)

STORAGE AND OPERATING CONDITIONS (IN-SEA)

Storage temperature	- 40°C to + 60°C
Operating temperature	0°C to +40°C
Deployment/Testing Temperature*	-15°C to + 40°C (with degraded performance)
Maximum operating depth SeaRay® 100	100m
Maximum operating depth SeaRay® 300	300m 500m with specific handling care

* Tests can be run before deployment on the seabed

Sensors

AQDSU

GENERAL

Sensor Components	3 omni-tilt digital accelerometers and 1 hydrophone	
Sample Rate*	4, 2, 1, 0.5, 0.25 ms	
Word Size	24 bits	
Offset	0 (digitally zeroed)	
High cut filter*	0.8 FN (linear or minimum phase)	
Stop band attenuation	> 120 dB (above Nyquist)	
Time Standard	True synchronous system	
Phase accuracy	20 µs	
Power consumption	Typical (during acquisition):	320mW
	Max (during sensor tests):	370mW

* Bandwidth limited to 400 Hz with full specification

DIGITAL ACCELEROMETER CHANNELS

Type	Omni-tilt DSU-428
Full scale	5m/s ²
Tilt Max Value	± 180°
Bandwidth	0 - 400 Hz (up to 1600 Hz with degraded specifications)
Distortion	-90 dB
Amplitude Calibration Accuracy	± 0.25%
Orthogonality Calibration Accuracy	± 0.25°
Noise (10-200Hz)	0.4 µm/s ² /√Hz
System dynamic range	120 dB @ 4 ms
Tilt accuracy	± 0.5° @ 20°C

HYDROPHONE CHANNEL

Type	FDU-428 Input with charge amplifier
Full scale	@ G1600: 1.6 V RMS @ G400: 400 mV RMS
Noise (3-200Hz) (typical)	@ G1600: 450 nV RMS @ G400: 145 nV RMS
Bandwidth	3 - 1600 Hz
Instant dynamic range	124 dB
System dynamic range	136 dB
Distortion	-110 dB
CMRR	110 dB
Gain Accuracy	<0.1%
Phase Accuracy	20 µs

CANISTER

Material	Nickel aluminium Bronze
Outside diameter of canister	54 mm
Length	overall length of canister 203.2 mm length over non-mated connectors 240.1 mm length over mated connectors 300.4 mm
Weight in air	1.571 kg

SSH HYDROPHONE

GENERAL

Material	Polyurethane sleeve
Fill fluid	Silicone fluid
Outside diameter of cylinder	54 mm
Length	154 mm
Weight in air	0.405 kg
Operating temperature	-15°C to +50°C
Storage temperature	-40°C to +60°C

ELECTRICAL SPECIFICATION

Lead type	4-conductor cable with a 4pin Sercel or Impulse connector
Lead length	140 mm
Capacitance	9.6 nF ±15% at 1 V & 1 KHz (@ 20°C & 1 ATM) (Approx. 0.4% increase per degree C°). 9.6 nF stands for the equivalent capacitance of the two hydrophone elements in parallel connection. The system's sensor test reads the average of the capacitance values of the two elements, that is 4.8 nF.
Resistance, lead to lead or lead to case	> 100 MΩ @ 10 VDC.
Dissipation factor	0.02 (typical maximum)

PERFORMANCE SPECIFICATION

Voltage sensitivity	Hydrophone sensitivity: -204.5 dB re 1 V/μPa (5.96 V/bar) ± 1.5 dB at 20 Hz (@ 20°C & 1 ATM). System sensitivity (including charge amplifier): 5.66 V/bar.
Voltage sensitivity vs. temperature	<1.5 dB change from -10°C to +40°C (0.04 dB maximum change per 1°C)
Maximum operating depth	500 m

Compatibility

COMPATIBILITY BETWEEN SEARAY AND SEARAY 428

Software Version	<V2.0		>V2.0	
Transmission rate	8 MHz	16 MHz	8 MHz	16 MHz
TZRU	Yes	No	Yes	No
TZLU	Yes	No	Yes	No
SBLU	No	No	Yes Repeater : 400 m	Yes (AQRU mandatory on extenders)
Extender : 400 m	Yes	No	Yes	Yes (with 4 AQRUs)
Extender : 200 m	Yes	No	Yes	Yes
Optical Extender	Yes	No	Yes	Yes

Software Version	<V2.0		>V2.0	
BCXU output Voltage	365V	600V	365V	600V
TZRU	Yes	No	Yes	Yes
TZLU	Yes	No	Yes	No
SBLU	No	No	Yes	Yes
Optical Extender	Yes	No	Yes	Yes

GPS	Accutime Gold	Meinberg M300
Software version	< V2.0	> V2.0

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 CurveSM