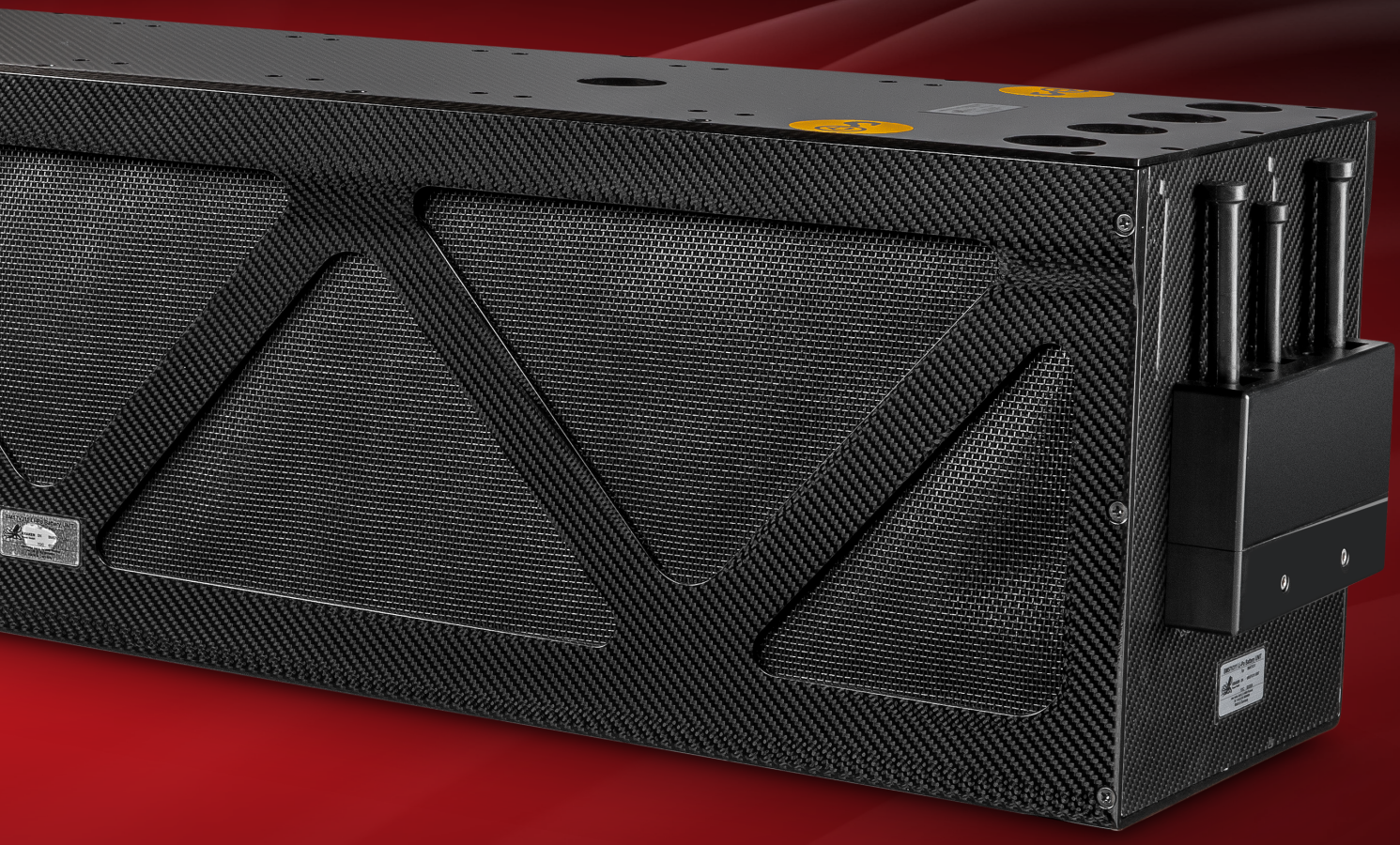
KRAKEN ROBOTICS

SeaPower™

BM72V311 Battery
Interface Control Document



General

Overview

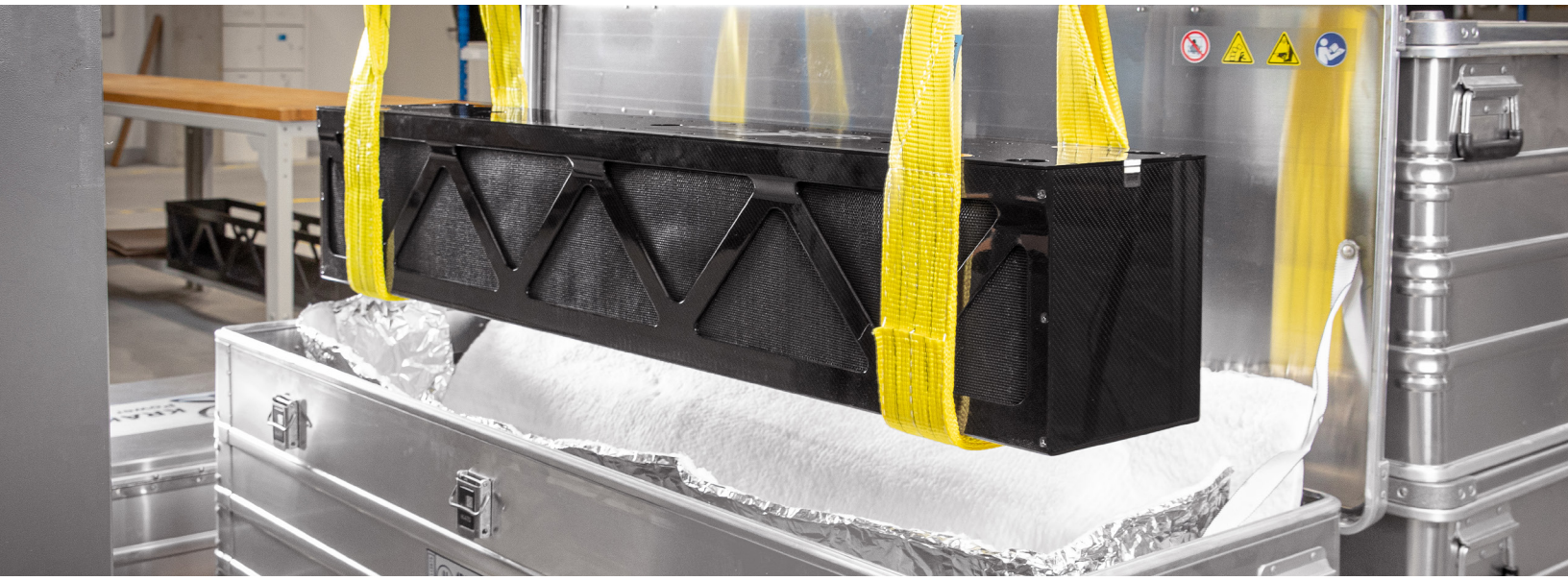
Part Number	BM72V311
Type	Subsea Potted Batteries
Nominal Energy Capacity	22.4 kWh
Nominal Voltage	311 Vdc
Depth Rating	6000 m
Certification	UN38.3 (pending)
Transport	Air, Maritime, and Land
Life Cycle (Operational)	≥1000 cycles at 80%
Life Cycle (Calendar, Operational)	≥5–10 years
Life Cycle (Calendar, Storage @ SOC 50% +/- 5%)	≥5–10 years

Storage

Storage: -20–25°C (3 months)	SOC 30%
Storage: 25–40°C (1 month)	SOC 30%
Storage: 40–60°C (1 week)	SOC 30%

Features

SeaPower™ BMS	Intelligent control platform that ensures safe and efficient battery operation.
Active Cell Balancing	Maintains voltage uniformity across all cells to optimize capacity and extend battery lifespan.
Potted Battery	Pressure-tolerant elastomer potting equalizes hydrostatic pressure, absorbs shock and vibration, and electrically isolates components without a rigid pressure housing.
Pre-Charge Circuit	Manages inrush current during connection to capacitive loads or powered systems, ensuring safe startup.
Parallel Battery Support	Enables safe connection of multiple batteries in parallel, even at differing states of charge (SOC).
State of Charge (SoC)	Calculates the battery's charge level based on voltage.



BMS

System Architecture

Microcontroller	Firmware-based state machine with autonomous and host-controlled operation.
Host Communication	Standard communication bus: RS485 & CAN-FD (multidrop bus)
Firmware Update Interface	Via standard communication bus (multidrop, in-field) ; USB port (1:1 connection)
Control Signal Lines	BMU_ON signal triggered via shorted pin logic (safety interlock).
Internal Power Supply	Isolated DC/DC converter powers BMS independently from external load.

Monitoring and Telemetry

Sensors	Integrated voltage, current, and temperature sensing across system.
Telemetry Output	Real-time data at cell module and system level.
Self-Check	Automatic diagnostics at startup (< 500 ms).
Fault Response	Real-time fault detection and response (< 100 ms).

Power Control

Solid-State Relays (SSR)	High-speed electronic switching for load and charger.
Hard Fuses	Permanent fault protection for catastrophic overcurrent.
Directional Diodes	Prevents reverse current during system interconnection or parallel operation.

Safety

Electrical Protection

Deep Discharge Protection	BMS automatic shutdown to prevent irreversible cell damage (276 Vdc).
Low Cell Voltage Protection	Firmware-controlled discharge cutoff to prevent undervoltage damage (3.0 Vdc).
High Cell Voltage Protection	Firmware-controlled cutoff to prevent overvoltage during charging (4.16 Vdc).
Overcharge Protection	Limits energy input based on highest cell voltage SOC thresholds (4.16 Vdc).
Overcurrent Protection	Firmware cutoff at 20 A and hardware cutoff at 23 A during excessive load or charging current.
Short Circuit Protection	Rapid isolation of output paths via hardware fuse.
Thermal Protection	Firmware-controlled cutoff in response to temperatures outside the safe operating range.
Propagation Prevention	Potted design with high-temperature flame-resistant spacers between cells.

Electrical

Battery Pack

Cell Chemistry	Lithium Cobalt Manganese Nickel Oxide
Cell Module	7S1P
Battery Pack Configuration	84S1P
Cell Voltage (Min/Nom/Max)	2.7 V / 3.7 V / 4.2 Vdc
Cell (0 to 100 % SoC)	3.0 V to 4.16 Vdc
Battery Voltage (0 to 100% SoC)	276 to 349.4 Vdc
Battery Capacity	72 Ah
Battery Fuse	23 A

Electrical Interface

J1X1 & J1X2 Power Connectors	LPBH9F (SubConn)
J1X3 COM Connector	MCLPBH9F (SubConn)
Communication Protocol	RS485 / CAN-FD
Serial Settings	115200 baud, 8-N-1

Charge

Max Charge Current in Water	15 A @ 25°C
Max Charge Current in Air	3 A @ 20°C
Max Charge Power	5241 W
Charging Temperature	10 – 45°C

Discharge

Current (Nom/Peak)	15 A / 20A
Peak Current	50 ms
Max Discharge Power	4660 W @ nominal voltage
Hotel Load	<6 W
Discharging Temperature	-10 – 45°C

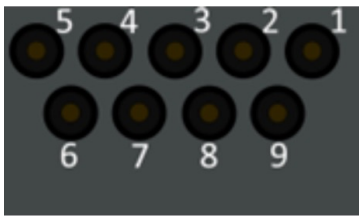
Endurance @ 20 °C

@ 100% Load (15 A)	4 h 50 min
@ 75% Load	6 h 24 min
@ 50% Load	9 h 24 min
@ 25% Load	19 h 20 min

J1X1 & J1X2

Pin	Signal
1	V+
2	V+
3	V+
4	V+
5	V-
6	V-
7	V-
8	V-
9	Safety Loop

J1X3



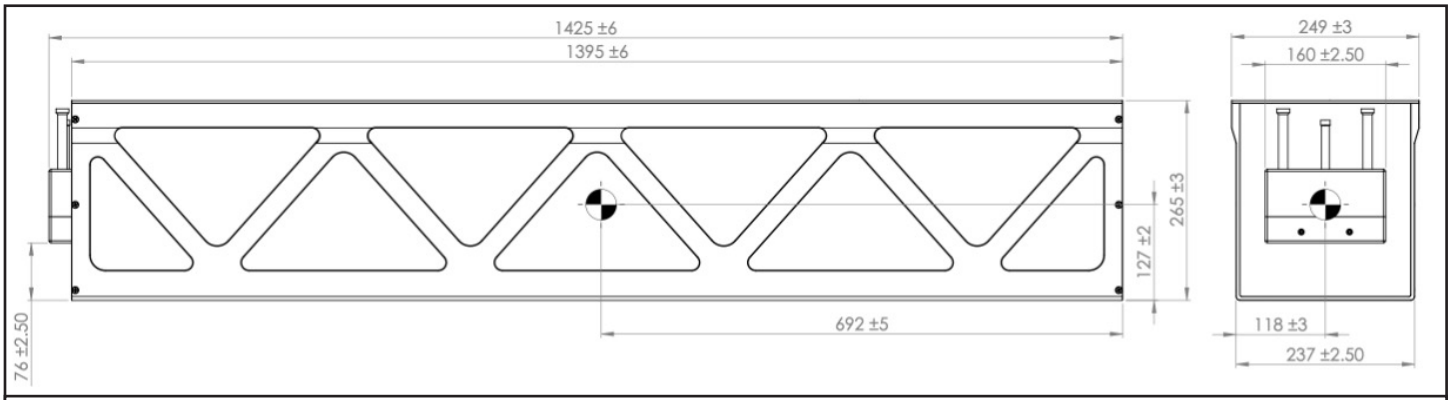
Pin	Signal
1	RS485-
2	RS485+
3	BMU ON
4	BMU RETURN
5	COM_GND
6	USB /CAN-FD H
7	USB /CAN-FD L
8	USB, PWR
9	USB, GND

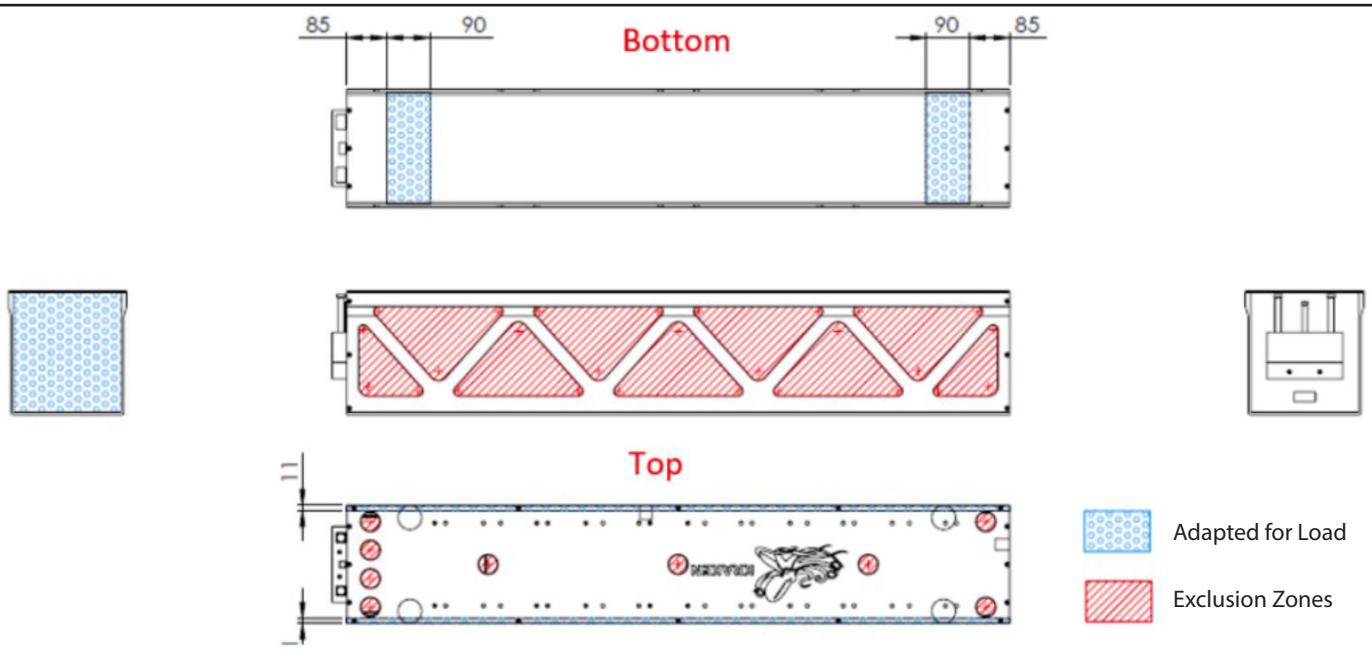
Mechanical

Overview

Weight in Air	149 +/- 5 kg
Weight in Water	63 +/- 2.5 kg
Length	1425 +/- 6 mm
Width	249 +/- 2.5 mm
Height	265 +/- 2.5 mm

Displacement	86 L
External Housing	Carbon fiber
Internal Housing	Silicone
Compensating Fluid	Silicone
Structural Hardware	Titanium





- Use the blue (Adapted for Load) areas for mechanical location and fixation
- Protect the red (Exclusion Zone) areas from impact by foreign objects. These areas include a reinforced screening to help prevent puncture of the integral silicone skin, but they should still be protected during installation