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underwater technology



Dura-Spark UHD 400+400 Operation Manual



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Revision History

Issue	Change No.	Reason for change	Date
A	n/a	First Issue	04/19
B	-	HVJ-4188 WIRING AMEND	04/19
1	-	Production Issue	03/20

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Applied Acoustic Engineering Ltd has made every effort to ensure that the information contained in this manual is correct at time of print. However our policy of continual product improvement means that we cannot assume liability for any errors which may occur.



These written instructions must be followed fully for reliable and safe operation of the equipment that this manual refers to. Applied Acoustic Engineering Ltd cannot be held responsible for any issues arising from the improper use or maintenance of equipment referred to in this manual or failure of the operator to adhere to the instructions laid out in this manual. The user must be familiar with the contents of this manual before use or operation.

1. Introduction to the Dura Spark Sound Source

The Dura-Spark 400+400 has been designed to provide a stable, repeatable sound source for sub-bottom geophysical surveys. The long life, durable electrodes produce a consistent pulse signature and keep operational maintenance to a minimum. This provides increased survey efficiency and equipment reliability as the sparker tips rarely need replacement.

The Dura-Spark 400+400 UHD frame is a welded frame construction, with 2 400 tip arrays separated by a fixed 30cm depth.

The Dura-Spark UHD 400 + 400 is a variable source depth catamaran, providing a stable platform whilst under tow. The upper array tow depth is set at 15cm by default. The catamaran is manufactured from marine grade stainless steel and is easily deployed from all survey vessels.

The Dura-Spark 400+400 UHD consists of 10 arrays of 80 tips split into 2 arrays, upper and lower. Each deck is split into arrays of 240 and 160 tips allowing the operator to tune the source from the vessel to its application. This flexibility, together with selectable source depth, allows the sound source to be used in both shallow and deep waters.

The typical operational bandwidth of the Dura-Spark 400+400 UHD is 300Hz to 1.2KHz. When coupled with 2 CSP-SNv Seismic Power Supplies the system offers 8000J/s peak discharge rate in flip flop mode, as well as industry leading design and safety standards.

2. Components

- Dura Spark UHD 400 + 400 Catamaran complete with 10 x 80 Tip Long Life Sparker Arrays.
- HVC3502 High Voltage Cable complete with HVJ 4188 Junction Box.
- BCN-101G GPS Receiver complete with power and communication cable (Option)

3. Theory of Operation

The sound wave is generated by the electrical energy in the capacitors of the CSP-Nv / CSP-SNv discharging across the sparker tips to the earth of the tow-body, through the sea water to produce a pressure wave.

The characteristics of the sparker source is controlled by the joules to tip ratio and tow depth. To achieve a high resolution source apply 1 to 2 joules of power to each tip with a shallow tow depth typically 15cm. As the ratio of joules to tip is increased the bandwidth of the source is lowered.

With increased energy levels a secondary discharge pulse is generated after the initial discharge. The time delay between initial and secondary is proportional to the level of energy being discharged. The secondary pulse is commonly known as the 'bubble pulse'.

Each 400 Tip array is supplied by a separate CSPNv or CSPSNv power supply by a single low loss tow cable. The tow cable has been modelled to produce $<10\mu\text{H}$ inductance with a common screen earth connection and 3 twisted screen pairs for signalling options. The lower the inductance and copper losses results a faster rising edge of the sparker, resulting in improved source signature.

The Dual deck tow depths are as standard 15cm and 45cm (+30cm), the tow depth is adjustable. The inter array spacing is fixed at 10cm. Having the sparker depths controllable allows the centre frequency of the source to be adjusted.

Each deck can be fired independently by its seismic power supply, in flip flop mode, combined with fire delays or a split fire delay. The earth of the sparker is common.

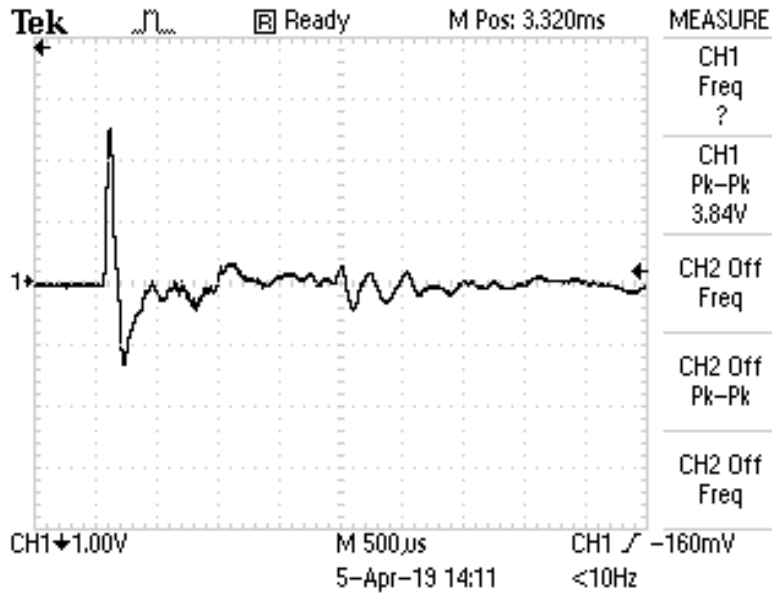


- To prevent the bubble pulse the tip to power ratio should not exceed 5J per tip.
- For high resolution the power to tip ratio should be typically 1 to 2J per tip.

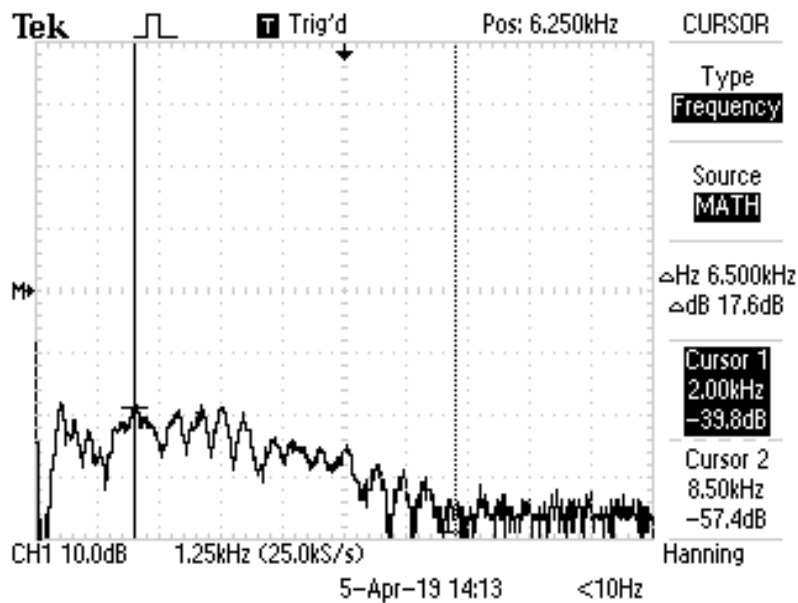
Dura Spark Typical Frequency Response

4. Pulse Signature

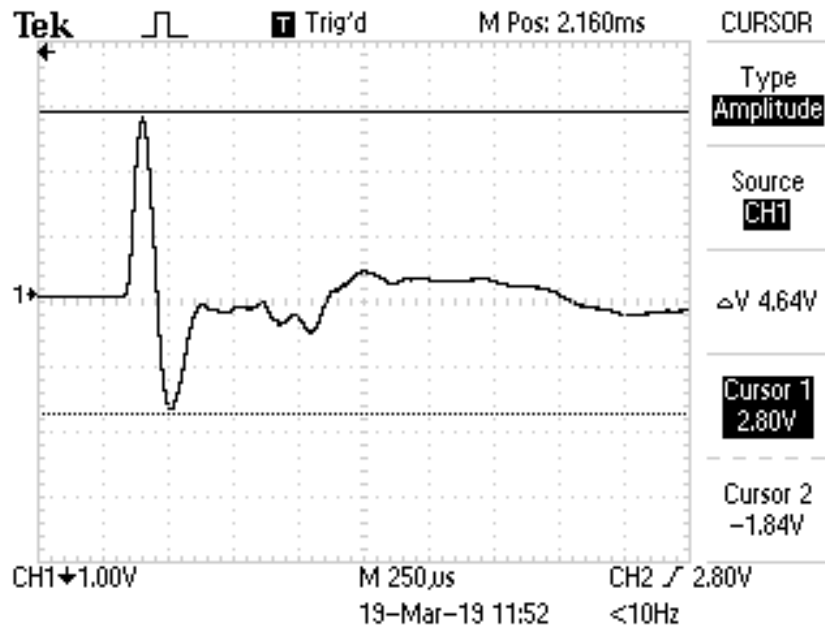
Upper Deck: Typical Dura Spark Pulse Signature at 600J with 400 tips



Pulse Width =	480	uSec
V peak to peak =	3.84	V
Source Level =	1.52988	V/Bar
	223.693	dB re 1.0V/uPa



Lower Deck: Typical Dura Spark Pulse Signature at 600J with 400 tips



Pulse Width =	300	uSec
V peak to peak =	4.52	V
Source Level =	1.8008	V/Bar
	225.109	dB re 1.0V/uPa



5. Dura Spark Power Levels

	80 Tips	160 Tips	240 Tips	400 Tips
Min	100J	300J	500J	500J
Max	400J	800J	1200J	2400J
Typical	200J	500J	1000J	2000J

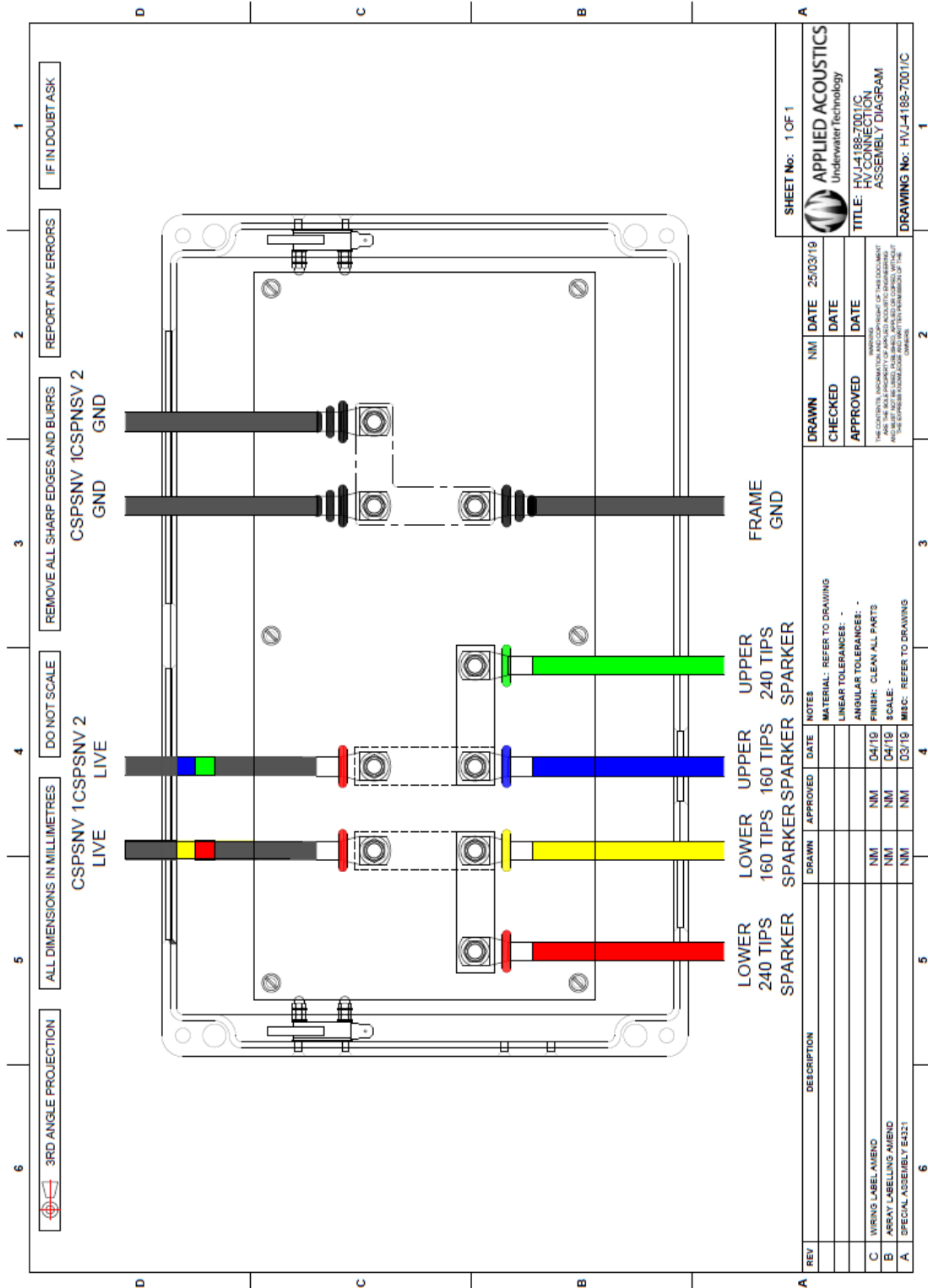
6. Configuration

The sparker arrays are configured in dual planar arrays and identified through the HV3502 cabling to the HVJ4188 Junction Box by colour codes, blue, yellow, red and green.

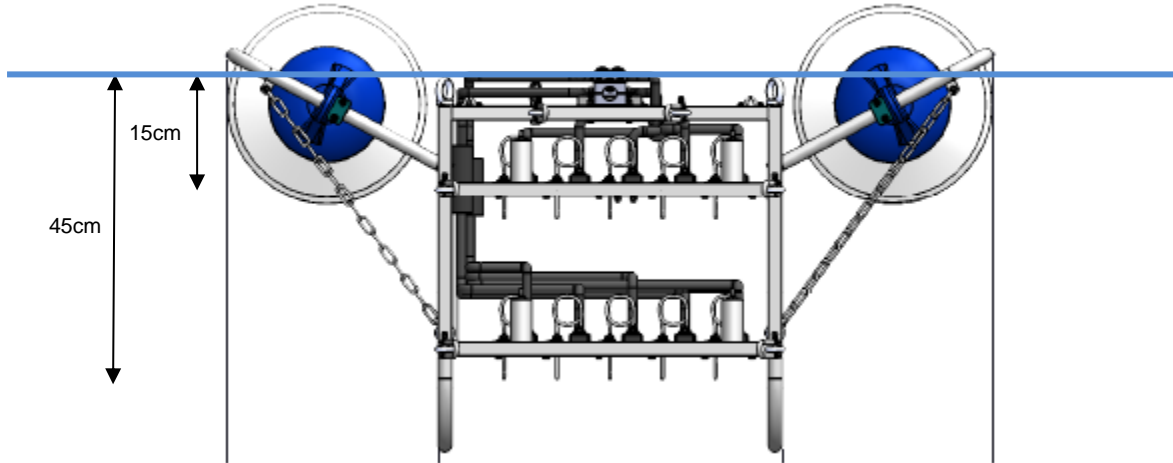
Dura Spark 400 + 400 UHD		
UPPER DECK		
160 Tips	Blue	
240 Tips		Green
400 Tips	Blue	Green
LOWER DECK		
160 Tips	Red	
240 Tips		Yellow
400 Tips	Red	Yellow

HVJ4188 Junction Box Layout and Connections

Before attempting to configure the HVJ3004 junction box with any of the following arrangements, ensure that all HV equipment is turned off and the HV cable from the CSP unit is disconnected.



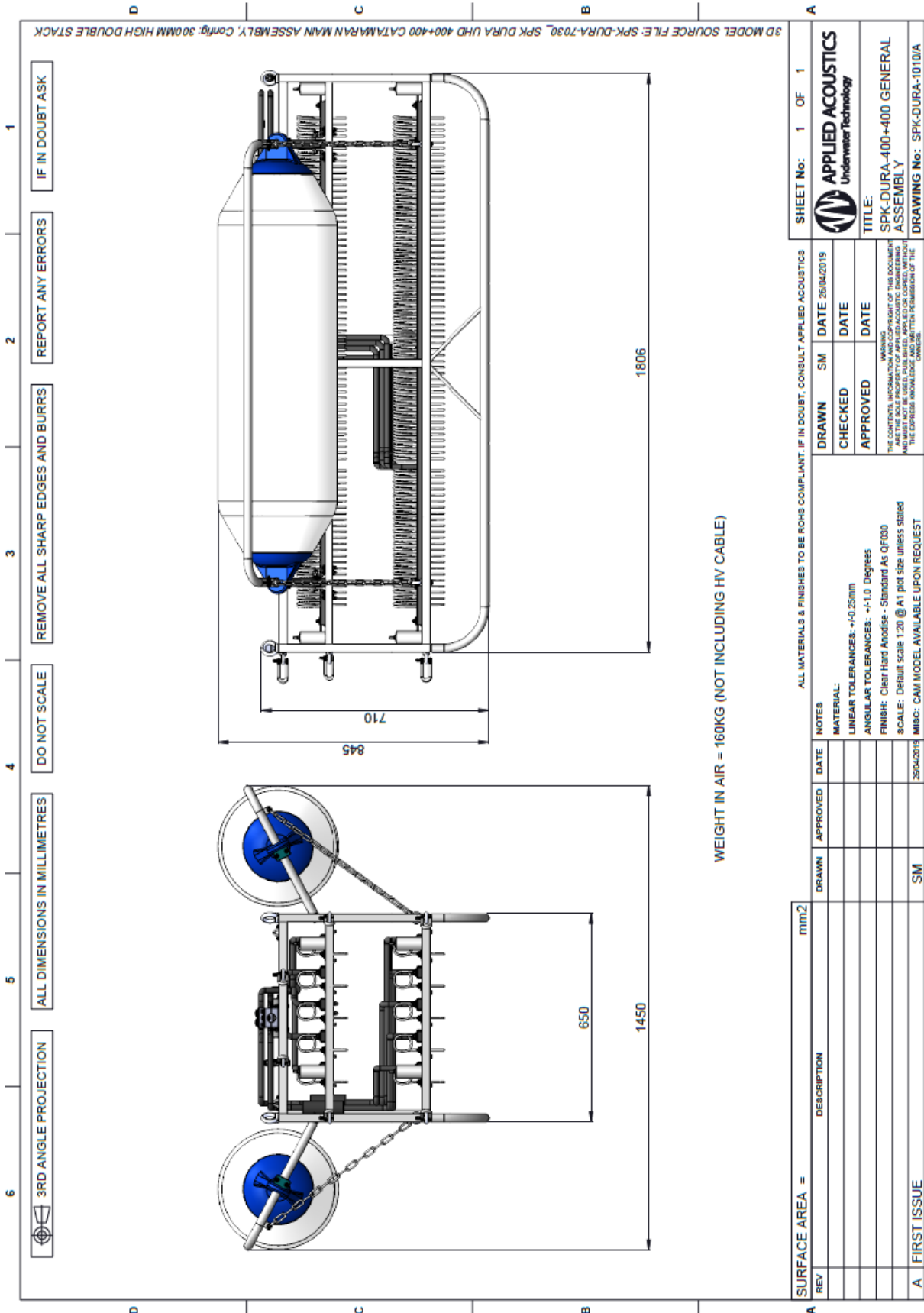
Tow Depth



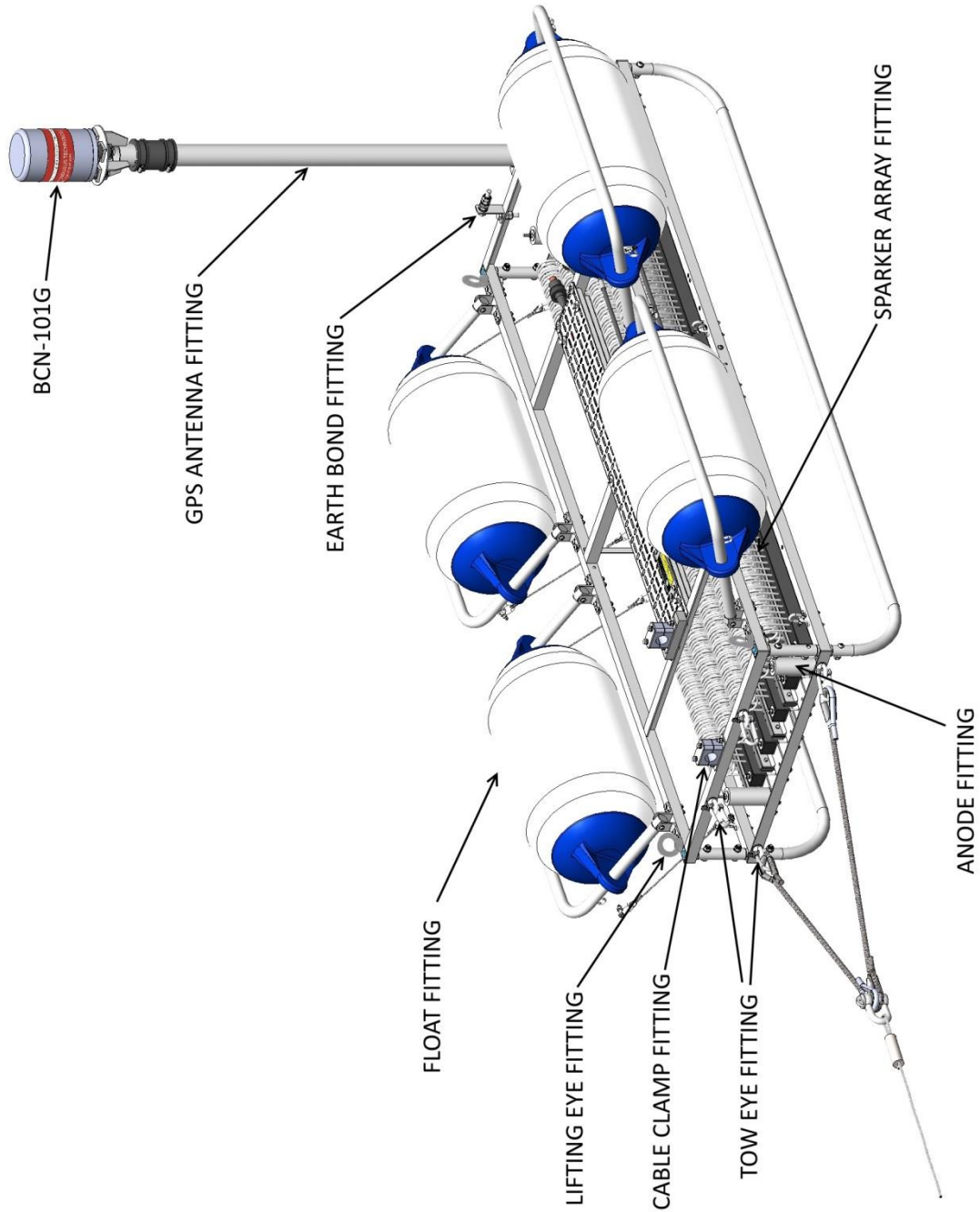
The tow depth is controlled by the length of the securing chain and can be adjusted in the field.

The standard depth is set at 15cm for the upper deck and 45cm (fixed at +30cm for upper deck) for the lower deck.

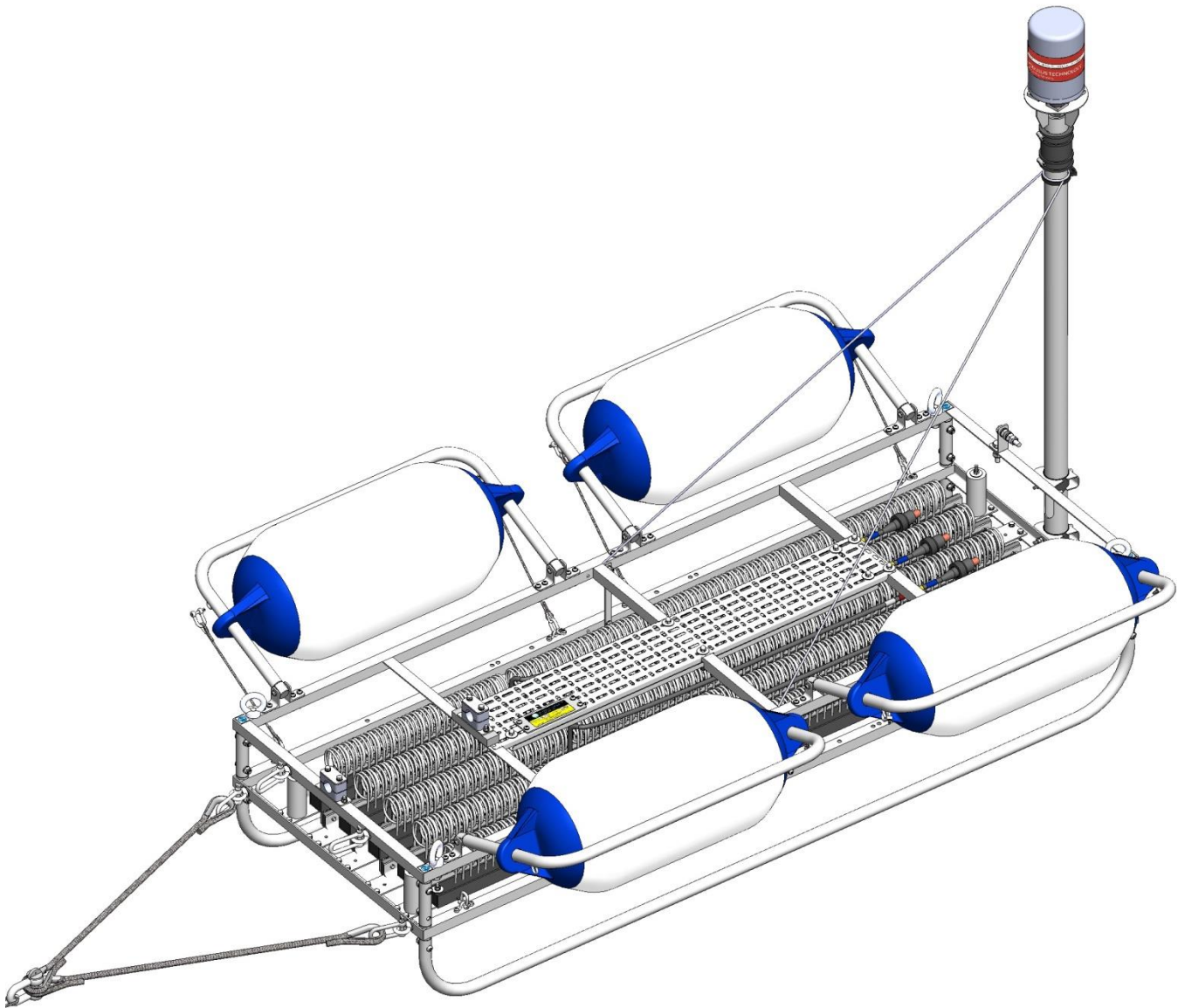
7. General Arrangement



8. Dura Spark UHD Common Parts Identification

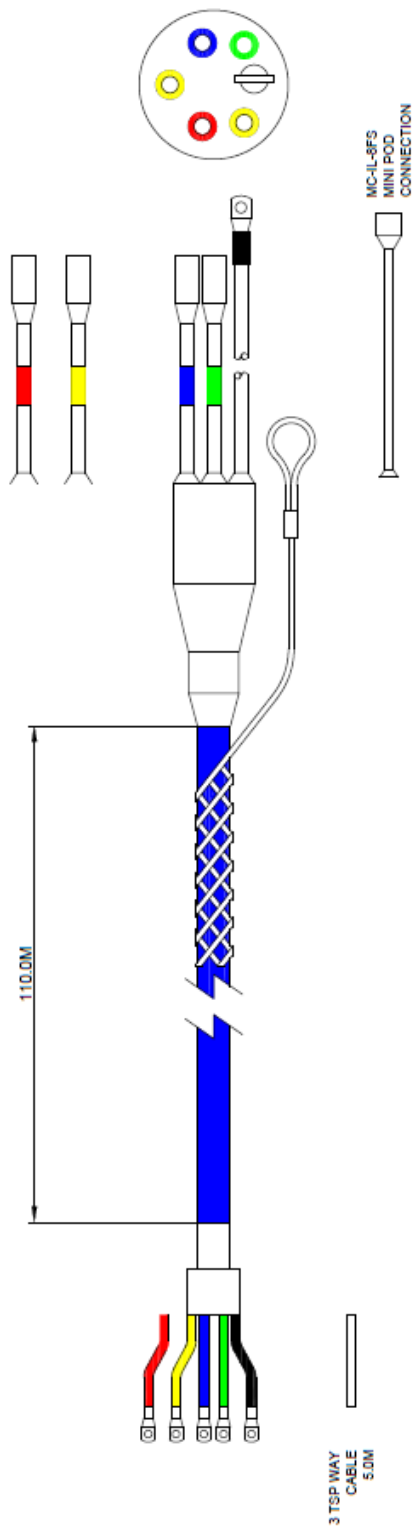


9. GPS mast support arrangement



10. Cabling

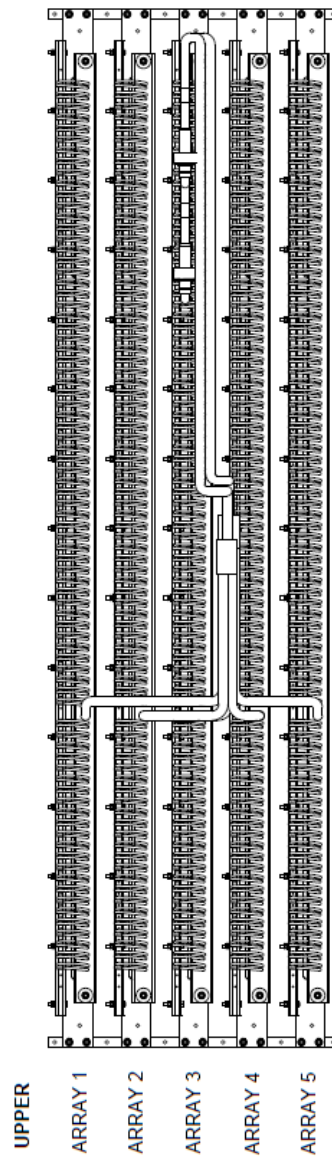
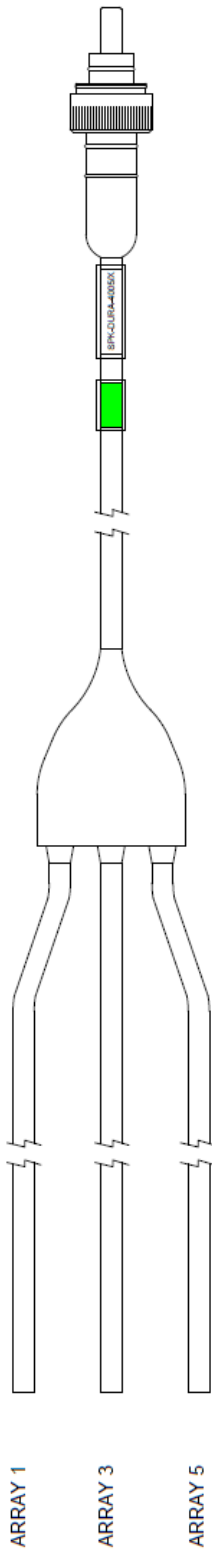
HVC3502 Cable



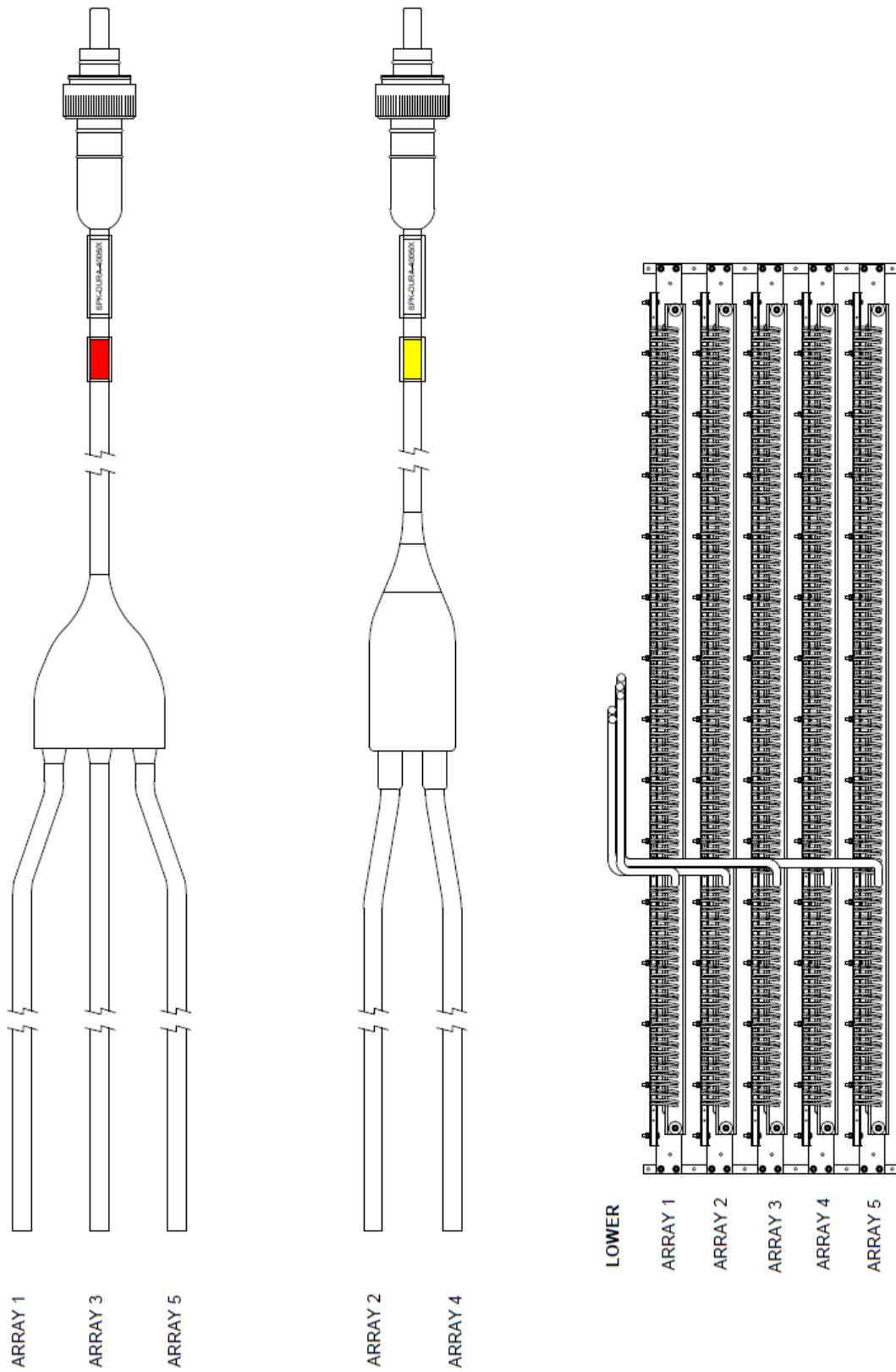
BCN-101G MINI-POD WIRING TABLE				
6-WAY CONNECTOR	SURFACE	CABLE	SUBSEA	CONNECTOR
C	SCREEN	TWP 1 - SCRN	OUTER & IND SCRN	MC-IL-8F PIN 2
B GND	BLACK	TWP 1 - BLACK	BLACK // BLACK	MC-IL-8F PIN 1
A 24VDC	RED	TWP 1 - RED	RED // BLUE ELD050044	
F	SCREEN	TWP 2 - SCRN	IND SCRN	
E DATA -	BLACK	TWP 2 - BLACK	BLACK // BLACK	MC-IL-8F PIN 4
D DATA +	GREEN	TWP 2 - RED	GREEN // WHITE ELD050044	MC-IL-8F PIN 3

HV WIRING TABLE			
SURFACE	CABLE	SUB-SEA	
		ID	FUNCTION
RED	CORE 1+2	RED	DURA LOWER
YELLOW	CORE 3+4	YELLOW	DURA LOWER
BLUE	CORE 5+6	BLUE	DURA UPPER
GREEN	CORE 7+8	GREEN	DURA UPPER
BLACK	SCREEN	BLACK	GROUND / EARTH

Dura Spark UHD 400 + 400 Upper Deck Connections



Dura Spark UHD 400 + 400 Lower Deck Connections



11. Deployment / Installation

The towing bridle should be secured to the catamaran using two stainless shackles on either of the two tow points.

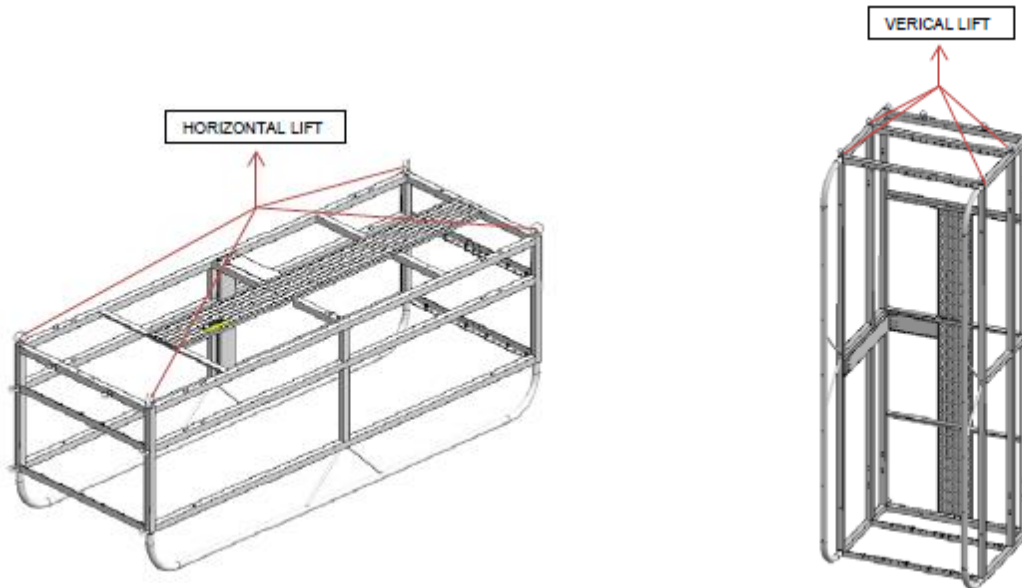


Note: No stress should be applied to the unprotected electrical connections whilst the unit is undertow as this may cause failure during operation.

The HV Cable Grip should be connected to the tow points and adjusted so that in case of tow rope failure no load is applied to the electrical connections or cable clamp.

A quick sea trial should be undertaken to check the floatation / towing characteristics of the catamaran underway at roughly 3-5 Knots.

Lifting Arrangement



The above diagram shows the recommended lifting arrangement using 4 lifting eyes in a 4 point lift either for lifting or towing (vertical).

This arrangement has been tested to the following specification

Horizontal

Tare Weight	240kg
SWL Weight	240kg
Proof Load	480kg

Vertical

Proof Load 1	350kg
Proof Load 2	500kg



Note: Proof load includes excludes HVC3502 Cable. Additional allowance of 90Kg added to tare for motion loads.



The lifting eyes (and any additional lifting accessories used) are subject to the end users own country's lifting equipment regulations and should be thoroughly examined at regular intervals. For users in the UK, this is a six month interval.

12. Maintenance Procedures

Tip Wear

Although Sparker tip wear is very low the sparker tips should be inspected prior to deployment to ensure tip spacing is secure and electrode insulation is adequate. If insulation has deteriorated remove excess tip and re-align tip.

Mechanical

The below procedures are advisory guidelines that are recommended.

Pre-Deployment:

- The recommended interval for a visual inspection is on every deployment of the catamaran.

Visual Inspection (Pre Deployment)

- Check Electrical Connections are secure.
- Check Earth Connection to frame.
- Check for mechanical damage to fastenings and tow points.
- Check the floats.
- Check condition of anodes, replace if expired.

The Applied Acoustic Engineering Dura Spark does not require regular servicing with the exception above operational inspections.



Note: - When storing for long periods it is recommended the catamaran is cleaned with fresh water.

13. End of Life Recycling / Disposal



Within the UK, all electronic components and batteries must be taken for separate collection at the end of their working life under the Waste Electrical and Electronic Equipment (WEEE) Regulations 2013 and Waste Batteries and Accumulators Regulations 2009 respectively. The AAE Technologies Ltd group (AAE Tg) of companies as UK manufacturers will responsibly dispose of any returned end of life AAE Tg components/batteries through registered/approved recycling schemes. In order to prevent uncontrolled waste disposal and promote recycling, please contact Technical Support for a RMA number and return any end of life items (if safe to do so) carriage paid by the sender to our UK head office

14. Specification

Physical

Dura-Spark UHD 400+400	Length	1806mm
	Height	710mm frame 845mm including floatation
	Width	650mm frame 1450mm including floatation
	Weight kg	160kg

Electrical Specification

Dura-Spark UHD 400+400 Each 400 Deck.
2000J 5J per tip to minimise bubble collapse component
2400J Maximum

Compatibility

Source	Seismic Power Supply	HV Cable
Dura-Spark UHD 400+400	CSP-Nv 1200, 2400 CSP-SNv 1250	HVC-3502

Performance

Sound Output	240 Tip	223dB Typical
	400 Tip	226dB Typical
Pulse Length	0.5 to 1.5ms depending on power	
Number of Tips	400 Total. 5 x 80 0 160 // 240 // 400 400 Total. 5 x 80 0 160 // 240 // 400	
Connector Type	RMK 1/0	



Note: Specification is subject to change without notice

Applied Acoustic Engineering Limited is a leading company in the design and manufacture of a wide range of subsea navigation and positioning products, and marine seismic survey equipment.

The extensive product range includes the innovative USBL tracking system, Easytrak, a variety of positioning and release beacons and seismic sub-bottom profiling equipment for offshore geotechnical and seabed analysis.

All products use acoustics, underwater sound waves, in location, positioning, navigation and data acquisition applications.