



APPLIED ACOUSTICS
Underwater Technology

CSP-Nv
Capacitor Charging Unit
Operation Manual

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Thank you for choosing Applied Acoustic Engineering as one of your subsea equipment suppliers.
We hope you experience many years of reliable operational use from our products.

If you do encounter any technical issues with any of our products then please don't hesitate to
contact our Technical Team via the following methods.

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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.



Due to the high voltage output of this product, the operator must ensure an adequate risk assessment is undertaken and safe working procedures are adopted.

WARNING

**THIS EQUIPMENT CONTAINS LETHAL VOLTAGES, AND MUST
BE EARTHED AT ALL TIMES.**

ENSURE ADEQUATE SAFETY PROCEDURES ARE EMPLOYED.

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thereof.

Section 1 - OPERATIONAL

1.1. Environmental Considerations

Seismic Sound Sources and Marine Life

Although not proven, there is concern in some quarters that marine mammals may be harmed or their behaviour changed by seismic activity. The sound pulses from sparkers and boomers is much lower in amplitude and higher in frequency (so it will travel less far) than air guns. However it makes sense that a precautionary approach to emitting sounds in the whales and dolphins' natural habitat should be observed.

The CSP energy sources described in this manual have the ability to “soft-start” and increase the energy emitted in the water slowly over time and this technique will give any marine mammals nearby the opportunity to escape before maximum signal amplitude is reached. It will also give them a chance to get used to the noise if they choose to stay (!) rather than being subjected to a sudden shock of a full power seismic signal.

The procedure is quite simple:-

By using a slow repetition rate – say at 1 pulse per 15 seconds and by using the “Auto” charge rate, the energy will slowly increase over the course of several minutes. Once full power has been achieved, the repetition rate can then be slowly increased until the rate desired for the survey has been achieved.

Another factor to consider is to ensure that the start of any survey line is not in such a location that any cetacean is trapped by the vessel and the noise, for example in a small harbour. In such an instance, the survey should start in such a place that any cetacean in the vicinity has a clear and rapid means of escape into open water and away from any unnatural noise source. Further details and advice can be obtained from the following web site:- http://www.jncc.gov.uk/pdf/Seismic_survey_guidelines_200404.pdf. This web site refers to UK waters and relates to air guns as the sound source (in many ways different to a sparker or boomer), but should serve as a useful guide nonetheless.

1.2. Introduction

The CSP-Nv is an evolution of the CSP-N range of seismic power supplies. The CSP-Nv has a high voltage charger rated at 2000 joules per second, and can supply up to 1200 or 2400 joules of energy per shot into the seismic sound source for example Dura-Spark. The CSP-Nv incorporates microprocessor control and configuration for greater configuration flexibility and reliability whilst retaining a fail-safe logic design.

The CSP-Nv is built on the proven high voltage technology of the industry leading CSP range of power supplies adding to the standard safety systems and operational functions found across the entire range of CSP energy sources

The CSP-Nv is configured by an intuitive menu driven app, when operational the LCD provides real time system status for operational safety and monitoring.

The CSP-Nv feature a switchable soft-start 'power save' circuit; AVIP (Automatic Variable Input Power) which allows the units to be operated from reduced generator sizes when operating at low output powers. Traditional high voltage power supplies (bang boxes) will charge the energy storage capacitors at a fixed high rate for example at 1500J per second even when the average energy drawn from the capacitors is less; a typical example may be 100 J at 3 pps (300J). This results in a rapid capacitor charge rate for 67mS followed by nothing, until the next discharge / charge cycle. This charge / no charge operation can often result in generator hunting as the load changes, and may mean that a larger generator is needed than would be the case if the power requirement was averaged over time. By reducing the peak charge rate, the generator hunting is all but eliminated, and a smaller capacity generator is required. The AVIP circuitry will automatically adjust charge rate from 20% to 100% of specification, thus lowering the peak charge rate to just 300 J / second compared to bursts of 1500J / second. The circuitry also features a soft start function, which may take around 20 seconds before the charge rate is ramped up to the correct amount for the task in hand.

The CSP-Nv allows the user to effectively 'tune' the sound source to operate at a lower frequency by lowering the operating voltage and increasing the capacitance to supply the correct energy to the sound source. This may be effective in certain instances where more penetration is required.

The CSP-Nv monitor the output of the system for open circuit fault conditions and over current fault conditions, limited to approx. 10,000A.

1.3. Installation

Siting the CSP-Nv

The CSP-Nv delivers high energy, high voltage pulses, yet still emit minimal electrical emissions, and so can carry the CE mark.

The CE marking ensure that the CSP-Nv can be sited next to sensitive electronic equipment which carry their own CE marking (for susceptibility to emissions) and will be unlikely to cause them interference. However it is often more convenient to locate the CSP-Nv nearer to the back deck and the deployment area so that the high voltage 'output' cable run is minimised.

As high voltages are present, the CSP-Nv must be located away from water spray and condensation, in an environment which is not allowed to become too hot. Care should be taken to allow safe and easy access, and that high voltage cables are out of harm's way. It should also be possible to switch off the unit quickly without having to reach over it!

Ventilation should also be present. All units draw air in from the rear and exhaust air from the front. For operation in high ambient temperatures, the rear cover of the transit case should be removed to allow a good air flow. If condensation is allowed to develop serious damage may occur. Good room ventilation should be ensured, with no sudden change in temperature (i.e. bringing the unit into a warm room from a cold area) and allow the fans to operate for 10 - 15 minutes before switching on the high voltage.



The CSP-Nv Unit will normally be supplied from the factory in a 'Hardigg' transit case. As is the case with all electronic equipment, care should be exercised in handling. For maximum airflow in high ambient temperatures it is recommended that the anti-vibration housing rear panel be removed. The CSP-Nv should be positioned on its base in a dry ventilated area. Airflow for cooling is from back-to-front of the unit; there must be at least 50-60mm clear room from the rear panel to any obstruction. If the unit is to be operated in very warm ambient temperature (25°C or above), for optimum performance an air conditioned environment is strongly advised. If the unit overheats, it will switch OFF for a few minutes until it is cool.

Although the unit produces minimal interference, and carries a CE mark, it is often good practice to put the CSP-Nv away from the navigation and survey equipment and somewhere where cabling to the sound source can be run conveniently and safely. It is this cabling which is the most common source of electrical interference.



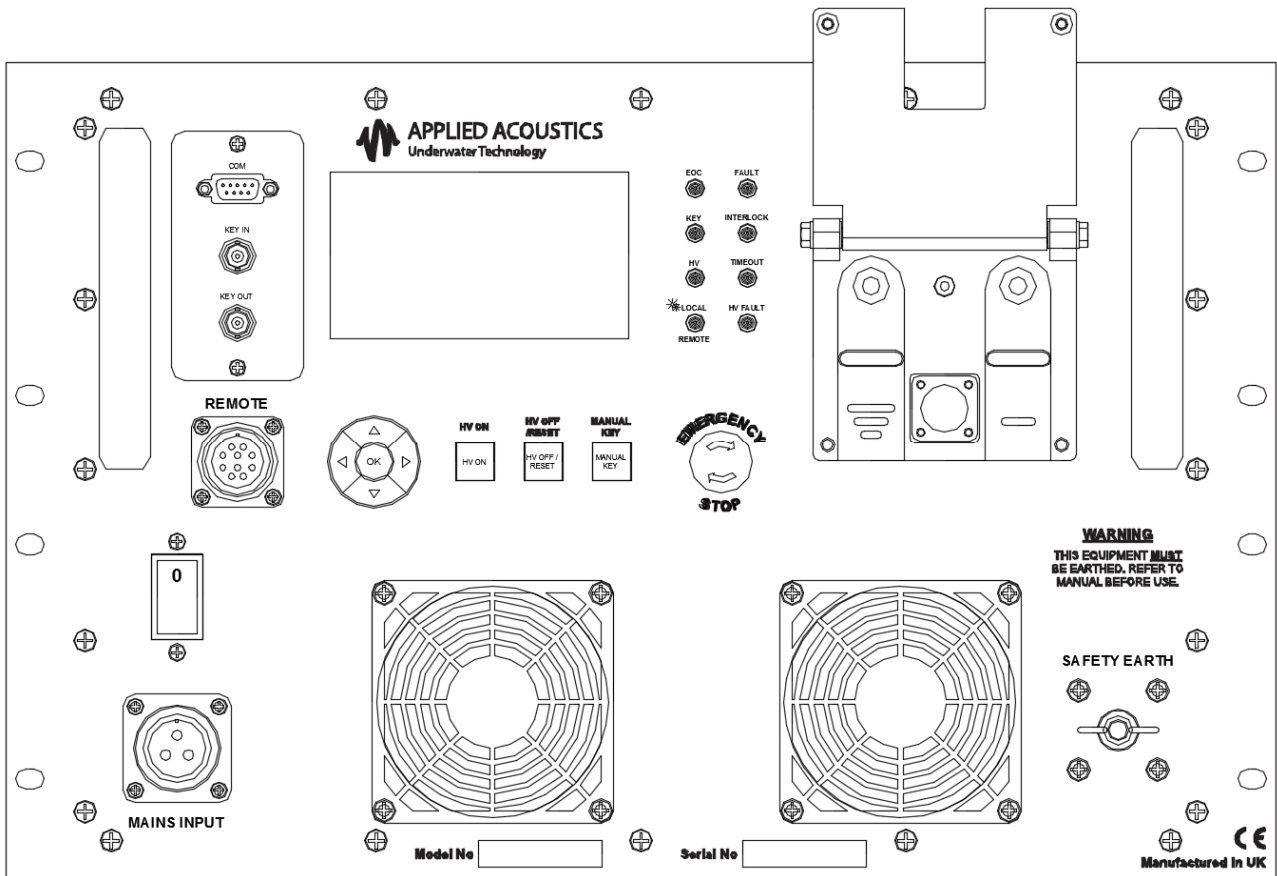
EARTHING - FURTHER REMINDER

THIS UNIT MUST BE EARTHED / GROUNDED BEFORE ANY POWER IS APPLIED. FAILURE TO DO SO MAY REPRESENT A SEVERE HAZARD TO BOTH EQUIPMENT AND PERSONNEL.

The front of the CSP-Nv must be grounded to the ship's ground system. This is achieved by attaching a short length of thick wire or earth braid from the CSP-N front panel earth stud, to an appropriate earthing point on the vessel. If a suitable earth cannot be found, the CSP-N earth stud should be connected directly to the water using an adequate length of heavy wire, with the insulation removed from the submerged end in the water. A weight will also be necessary to keep the wire submerged when the vessel is underway.

The CSP-Nv range of Capacitor Discharge PSUs are compact and easy to operate. However, the units still generate lethal voltages, and the operators should make themselves aware of all necessary safety procedures. The equipment is designed so that there is no need for the operator to go inside for anything, except major repairs. We cannot be liable for any consequences should the units be opened. Health and Safety guidelines and our own Safety Policy strongly suggest that factory training is received before opening the top cover.

1.4 Connections and Indicators



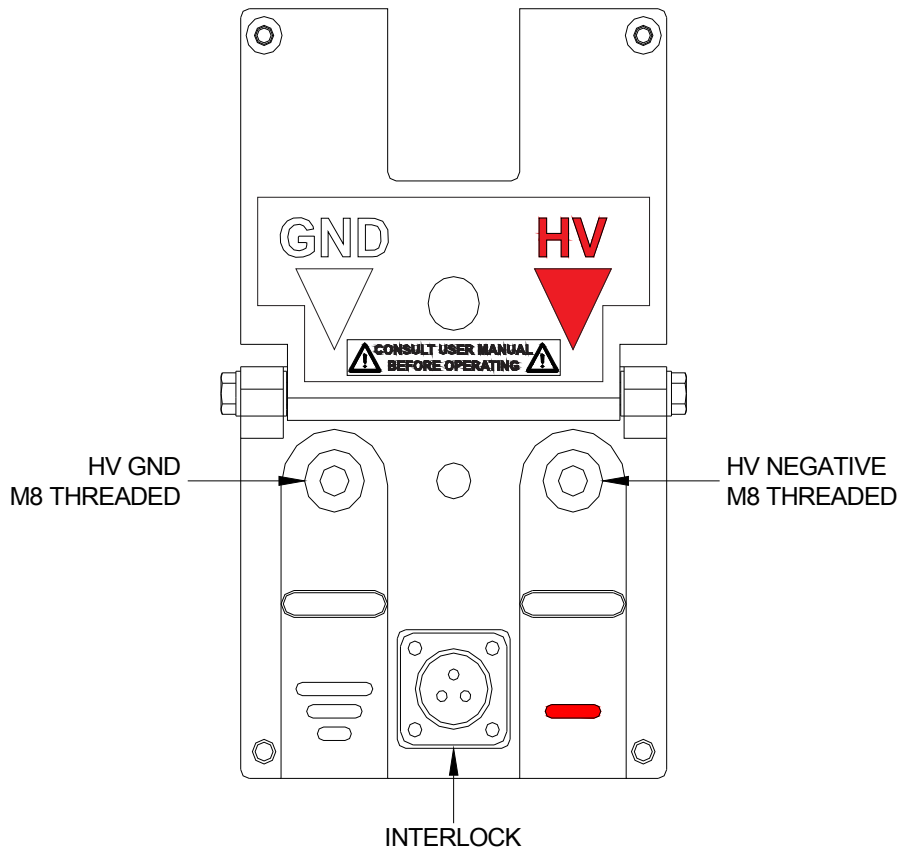
Safety Earth

The CSP-Nv MUST be earthed. The M8 earth bolt on the front panel should be connected to the vessel earth by a heavy gauge wire or cable. Typically 25mm² or greater. On larger ships, earth is usually a steel bulkhead, but for smaller fibre glass / wooden vessels a sea earth is necessary.

A sea earth can be constructed from a 25 mm² or larger copper cable with 1 – 2 metres of insulation stripped off with all the exposed copper conductor in the water. A weight will be required to ensure that the sea earth cable is in the water at all times during towing activity even during heavy roll.




It is recommended that earth arrangements are checked regularly as corrosion or abrasion (or metal cutting gear!) can cause damage which may result in the equipment becoming unsafe from having an ineffective earth.

Transducer: HV Output



The 2-pin proprietary high voltage and current terminal connector, is designed to provide a safe electromechanical connection from the CSP Power supply to the HV Junction Box. The terminal connections are proof tested to 6000 volts and can operate with current pulses up to 10,000 amps. The second connector provides the safety interlock to the HV Junction Box.

The output connector is fitted with automatic guards to prevent operators from handling the high voltage terminals when the cover is secured. When the cover is lifted for access to the terminals a 2 stage electrical and mechanical interlock protects the user disabling the high voltage and placing a shorting link across the terminals.

-  **Ensure CSPNV is switched off and VAC isolated before removing HV Output Connector Cover.**
-  **Ensure High Voltage terminals are clean and free of debris before connection. Ensure High Voltage terminals are tight using a M13 socket / ring spanner.**
-  **Connect Red HV cable from junction box to the terminal marked HV and the black cable to GND.**

Mains Input: Line Voltage Connection

Mains input is connected by the 3-Pin Amphenol on the left of the front panel. Nominal input voltage is 230VAC 45-65 Hz. The wiring to this connector is as follows:-

A	Ground / Earth
B	Neutral
C	Live

A mains supply cable will be supplied from the factory with the following colour coding:-

Green/Yellow	Earth
Blue	Neutral
Brown	Live

The operator must ensure that the AC supply is capable of supplying sufficient energy to power the CSP-Nv unit. Although the unit will operate from most generators of 5kVA, the quality and regulation vary considerably from make to make and how well they have been maintained. A voltage stabiliser is not necessary as any reasonable variation of the AC supply will not affect the output voltage (hence power) unlike older designs.

NB Some older 'inverter' type generators do not work well with the CSP-Nv.

Typical Currents

At 1500J at 1 pps (AVIP out of circuit); Non PFC charger, the following currents apply:-

Voltage	Peak Current	Average Current
240 VAC 50 Hz	19.5A	7.9A

(At 60 Hz, the peak currents are slightly smaller)

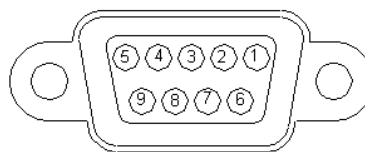
To see clearly the effect of the AVIP board the following measurements are typical:-

240 VAC at 50 Hz supply. 100J at 1 pps output power

	Peak Current	Average Current
AVIP IN	2.58A	1.06A
AVIP OUT	9.51A	1.11A

COM Serial Connector

2 Receive Data (RXD)
 3 Transmit Data (TXD)
 5 GND



Allows operator to update control firmware. Refer Appendix A.

REMOTE Socket

Allows operator to remotely control CSP-Nv.

KEY IN Input BNC

The Key In Input is connected via a BNC connector. The unit can be configured to key on a positive edge or negative key pulse trigger. The input range is 5 - 20 volts, the interface is opto-isolated to 10KV. A contact closure can be interfaced by selecting negative edge trigger mode.

KEY OUT Output BNC

The Key Out signal is available in internal and external key modes, key out is a synch pulse for the time break signal for the discharge of the CSP-Nv.

The unit can be configured to be internal or external key operation. When internal mode is selected the key out pulse is available from the Key Out BNC connector.

HV OFF / RESET Switch

This button operates as the HV OFF button and is an indicator of the HV Status. When illuminated the HV is OFF, when HV is ON press HV OFF to switch OFF.

The HV OFF / RESET also operates as a fault clearance / system reset, press to clear any reported fault modes upon power up or interlock shutdown. Note if fault persists the unit will continue to report fault status. Any faults must be cleared to allow HV operation.

HV ON Switch

Switches in capacitors and HV PSU, (note delays on switching), switch illuminates when the high voltage is switched on.



Press and Hold HV ON for 3 Seconds to enable High Voltage

MANUAL KEY Switch

Triggers the CSP unit when Manual Key mode is selected. MANUAL KEY switch indicator will flash briefly on key press.



Manual Key Mode must be selected to active manual fire mode.

MAINS POWER Switch

Double-pole switch that also acts as an over-current circuit breaker. It is situated above the mains input connector. The switch has standard O I positions.

EMERGENCY STOP switch

In the event of an emergency the unit can be shut down. This switch shuts off the control logic of the charger thus disabling the system. Rotate to reset.

KEY PAD



EOC (End Of Charge) Indicator

The EOC LED is illuminated when the storage capacitors have reached their potential voltage (~2.5 to 4 kV). In this way the operator can see if the unit is being run faster than the charger can cope with. If the operator notices loss of data on the recording system, it may mean the CSP-Nv is firing too quickly, not allowing the capacitors to charge to their full potential. Slowing the repetition rate down until the EOC LED flashes will ensure the appropriate voltage is reached across the storage capacitors, also the correct energy is being discharged in the sound source. The LCD operation screen displays a histogram of the EOC level for monitoring.

KEY Indicator

Synchronised to Key Out.

HV Indicator

Indicates HV is enabled on system

Local / Remote Indicator

LOCAL Operation indicated by LED ON.
REMOTE Operation indicated by LED OFF.

FAULT Indicator

It will illuminate during internal fault modes, see LCD display for fault identification. You will need to press RESET once the fault condition has been cured.

INTERLOCK Indicator

Illuminated if an interlock condition is detected, please see main display for details of interlock. You will need to press RESET once the interlock fault condition has been cleared.

TIME OUT Indicator

For safety, the HV is switched OFF after a user selectable period without a key pulse present. This also helps preserve the capacitors, as all pulse discharge capacitors are not designed to sit powered up indefinitely.

HV FAULT Indicator

Indicates an HV Output over-current, open-circuit condition or HV charger module fault.

Rear Panel Fuses

The rear panel contains 3 fuse holders, and these are the only things we recommend the operator checks if he has not received factory training. The fuses are rated as follows:-

F1 3A Antisurge 1¼" (240V)

F2 250mA Antisurge 1¼" (240V)

F3 3A Antisurge 1¼" (240V)

F1 Protects 12v power supply

F2 Protects the interlock board

F3 Protects the line voltage powering the high voltage relays and the front panel fans.

Fan Filters

The rear panel of the units has 2 fold-down handles to ease installation, and also has 2 fan filters for the cooling air intake. These filters should be periodically cleaned to ensure maximum air flow. This can be done with a small stiff brush.



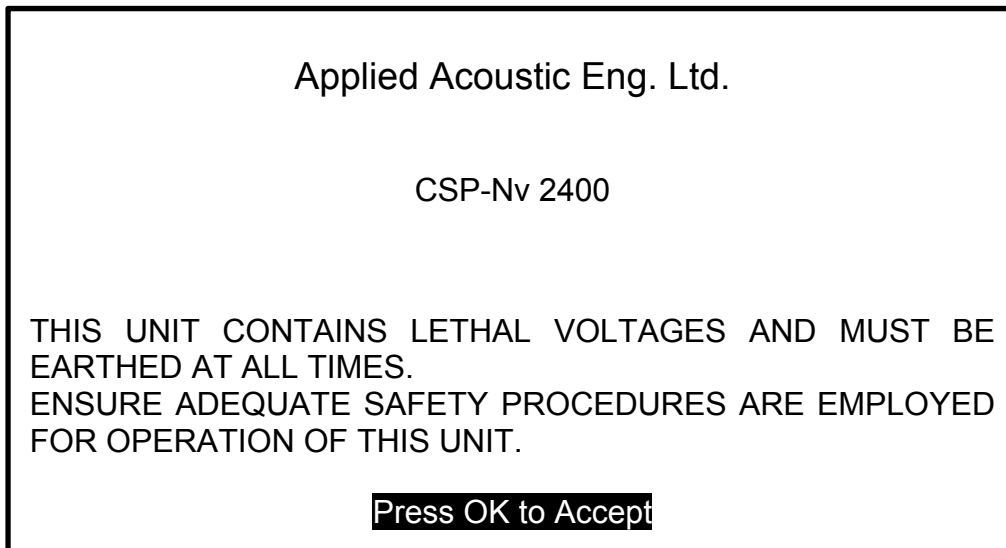
SAFETY NOTICE

All interlocks and safety features are doubled. For example, if the HV connector is removed, the HV is shut OFF by the logic which controls the charger module AND the high voltage is switched OFF by a separate relay. The interlock circuit operates from its own isolated 12V supply and operates 2 relays, as well as the control electronics. However, it cannot be stressed enough that the operator and all those who might come into contact with this equipment treat it with extreme caution and should not take any safety feature for granted.

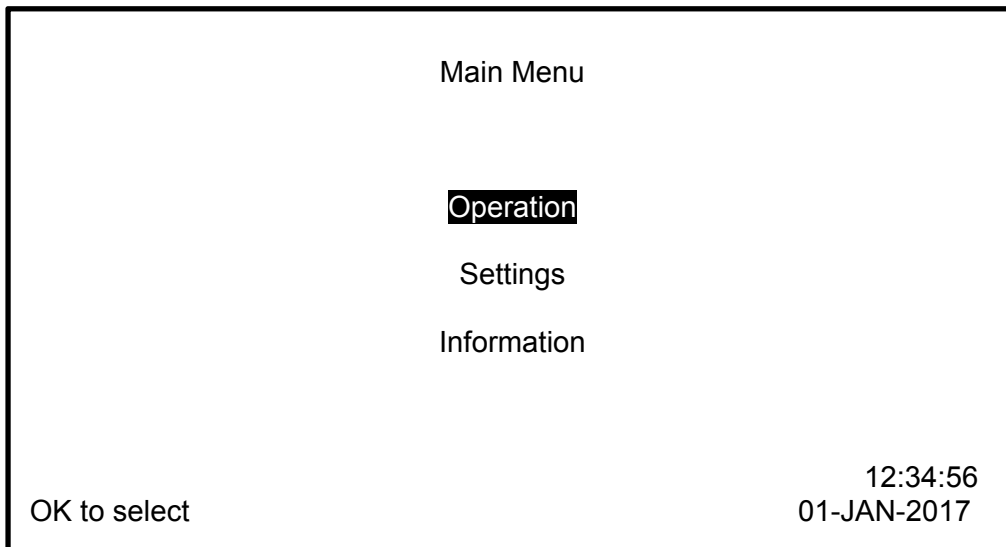
Ensure the CSPNV is electrically isolated from the sound source prior to any user adjustments to the cabling or source. Despite being heavily insulated, the HV cable should not be touched or held when the unit is operating. The load should always be in the water before operation.



1.5 Operation: System Configuration

On turn on, splash screen will detail CSP model and a safety warning:



Press OK to accept the safety warning.



Use   to navigate menu options. Press OK to select.

Settings

SETTINGS

Power: Refer section Energy Settings

Level: High
Low

Key: Int (Internal)
Ext (External)
Manual (Key Press)

Key In Polarity: Pos (Positive)
Neg (Negative)

Key Out Polarity: Pos (Positive)
Neg (Negative)

Internal Rate: 200mS to 9975mS

Key In Timeout: 10 Seconds to 60 seconds

AVIP: On
Off

Flip-Flop: On
Off

Local / Remote: Local
Remote

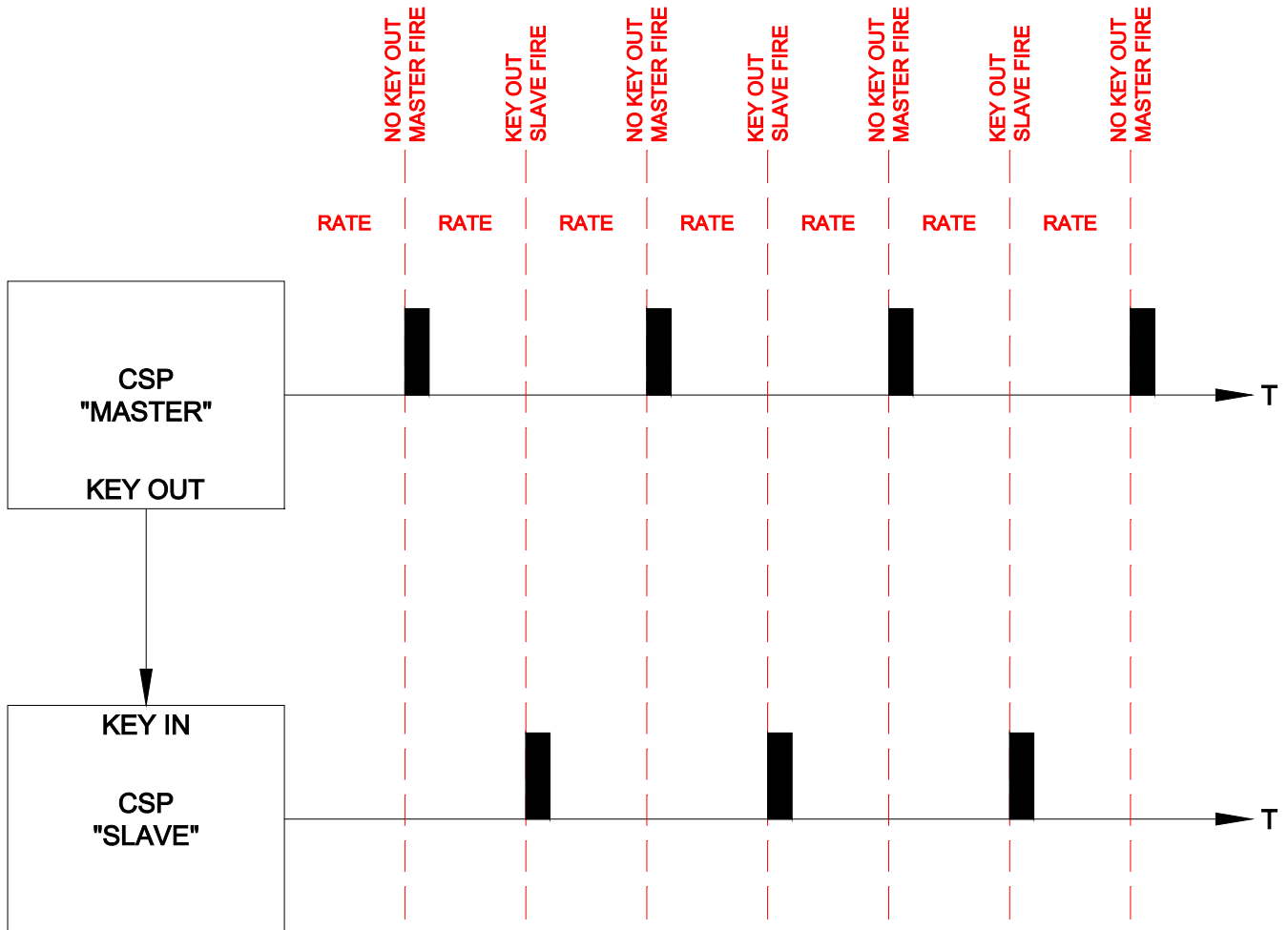
LCD Contrast: 0% to 100%



System settings are saved and restored on power up.

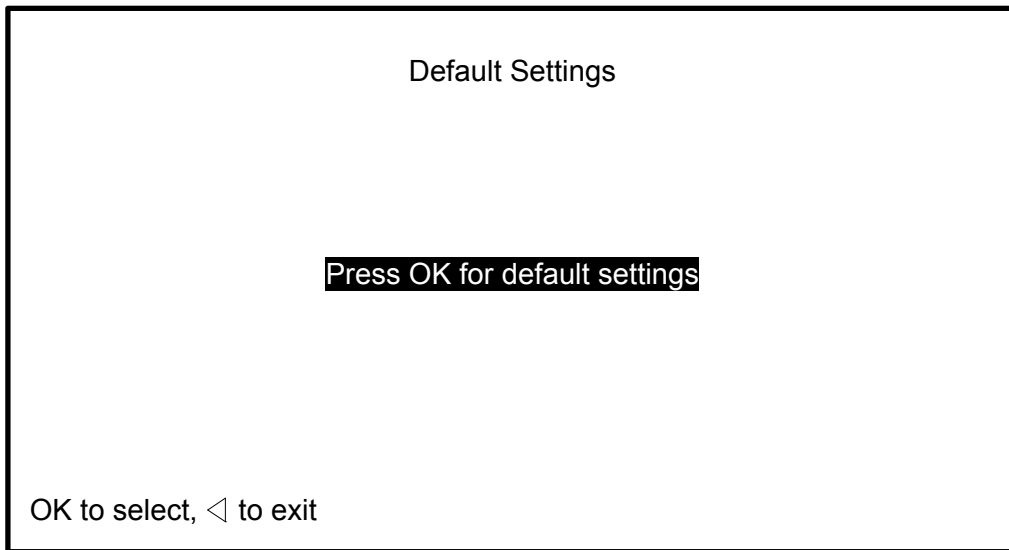
Flip-Flop Setting

With flip-flop setting selected 'On', the CSP is the master in master-slave operation as follows:



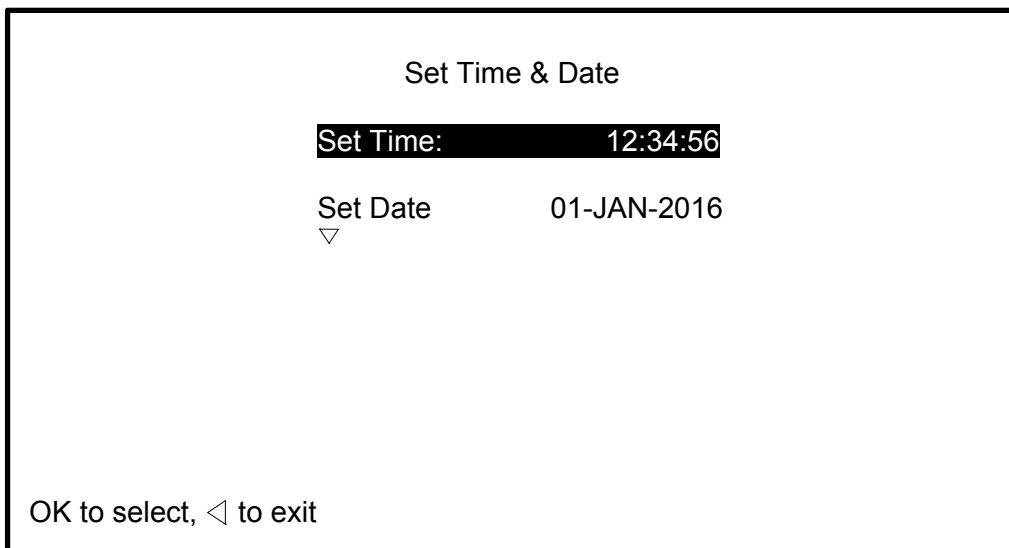
At selected rate (internal, external or manual) the master will alternately fire or output a key pulse on KEY OUT BNC to key the slave.

Default Settings



Press < to exit. Press OK for default system settings.

Set Time & Date



Press < to exit. Press ▲ ▼ to navigate menu options. Press OK to select.

Press ▲ ▼ ◀ ▶ to change time / date and press OK to select.

Time format is 24 hours HH:MM:SS

Date format is DAY-MONTH-YEAR

Download Log

In operation mode, enabling HV ON begins an operational logging procedure. The log contains all CSP settings and operational status of up to the last 2042 keys received until HV OFF due to user intervention or a fault.

The log is stored in non-volatile memory for retrieval using the COM serial connector by the user. Only one log can be stored. A log incorrectly terminated due to power supply interruption during HV ON operation is identified as invalid and cannot be retrieved.

Configure PC terminal software for log capture as detailed below:

Download Log

Connect PC RS232 port to CSP COM port.
Configure PC terminal program for:

Transfer:	Capture Text
Baud:	115200
Data Bits:	8
Stop Bits:	1
Parity:	None

Press OK to send

◁ to exit

Press ◁ to exit. Press OK to send log.

During log download, press ◁ to cancel download. Press OK to resend log.

Energy Settings

CSP-Nv 1200	
OUTPUT POWER	
High	Low
100	50
200	100
300	150
400	200
500	250
600	300
700	350
800	400
900	450
1000	500
1100	550
1200	600

CSP-Nv 2400	
OUTPUT POWER	
High	Low
100	50
200	100
300	150
500	200
750	300
1000	400
1250	500
1500	600
1750	700
2000	800
2250	900
2400	1000

- Items marked in red are not suitable for a single boomer.



Do not exceed the rated power levels of the connected sound source. The CSP-Nv is capable of delivering 2000J per second to a sound source - over driving a sound source will result in damage to equipment and present hazards to personnel.

Information

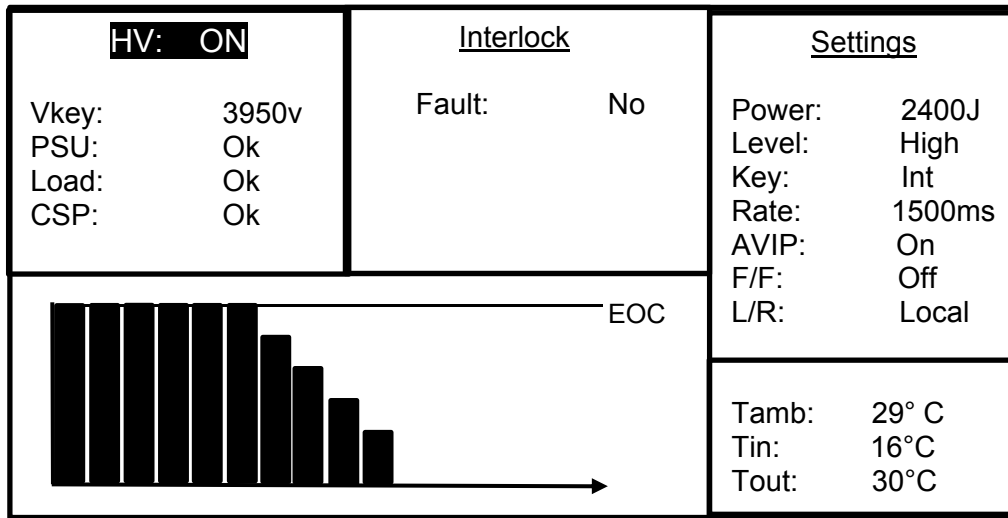
System information details model and serial number, plus current firmware revisions.

Information

Model:	CSP-Nv 2400
Serial Number:	*****
MCU Firmware:	** **
CPLD Firmware:	** **

◀ to exit

Operation



The operation mode displays system settings together with operational feedback of system status.

When HV is OFF the system continues to monitor system status.



The HV ON switch is only active in OPERATION MODE. To enable HV operation, the HV ON button must held on for 3 seconds.

The top left panel provides the status of the High Voltage (HV), HV status is also displayed by the HV ON LED and HV ON // HV OFF Switch LEDs.

“Vkey” is the output high voltage level prior to key trigger.

“PSU” indicates status of the internal HV charger module. If a PSU fault occurs the HV FAULT indicator is ON.

PSU Status	Description
Ok	Ok
Fault	HV Level Fault Load Fault, internal fault HV Capacitor. Summary Fault, internal fault Low VAC, temperature, output over voltage detected

“Load” indicates status of the load (sound source). The system monitors the output current and voltage shot by shot to check for over-current condition (short-circuit) or open-circuit condition. The Load fault type is displayed if detected. If a “Load” fault occurs the HV FAULT indicator is ON.

“CSP” indicates status of the CSP power supply.

CSP Status	Description
Ok	Ok
Fault	Internal fault, e.g. Keyboard, Control Logic.
Temp	Temperature limit 0 to 45°C
Time	Key In Time Out, external or manual key not detected
Mains	Low VAC Mains Supply detected, limit 180VAC _{RMS}

Interlock

The interlock status is displayed, the overall status is indicated that there are no interlocks present, if an interlock is present the status will change to yes and the interlock reported.

Interlock Message	Description
HV Socket	Indicates active interlock at either the HV Socket or HV Junction Box
Top Cover	Indicates active interlock on the top cover of the CSP chassis.
Thermal Switch	Indicates active over temp interlock on output thyristor
Emergency Stop	Indicates active emergency stop

A summary of the configured settings are displayed:

Power:	2400J	Discharge power level in joules
Level:	High	High / Low option
Key:	Int	Key source
Rate:	1500ms	Key rate
AVIP:	On	AVIP On or OFF
F/F:	Off	Flip-Flop On or Off
L/R:	Local	Local / Remote operation

Temperature

	Description
Tamb	Ambient Temperature
Tin	Inlet Temperature
Tout	Outlet Temperature

EOC Histogram

The histogram displays the status of the end of charge voltage history of the last 20 shots, this allows the operator to monitor the system operation at a glance with instant feedback of the overall system performance.

The histogram is only reset upon HV ON, the display is retained upon shut down to provide feedback.

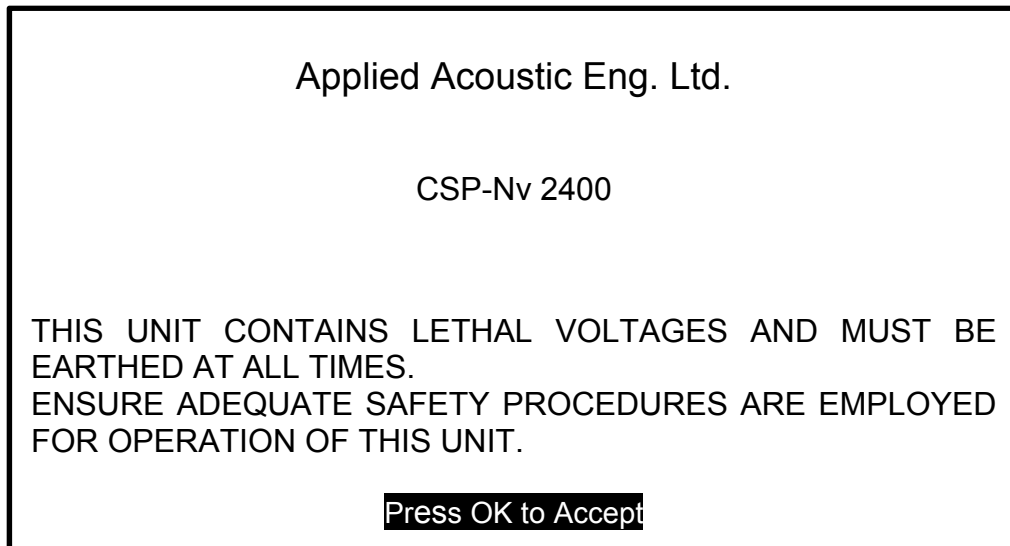
1.6. Operation: Enabling High Voltage Starting Operations

Installation check-list:-

- a) A good earth has been connected from the 'Safety Earth' bolt on the front panel preferably to both the ship and a sea earth.
- b) The sound source (boomer plate or sparker) has been connected and it is in the water.
- c) A key mode is selected – either internal or external. Key connections are connected.
- d) AC mains is connected to the 'Mains Input' connector.
- e) A safety check has been carried out to ensure that there is no-one in the water and that crew members know that the unit is about to be operated.

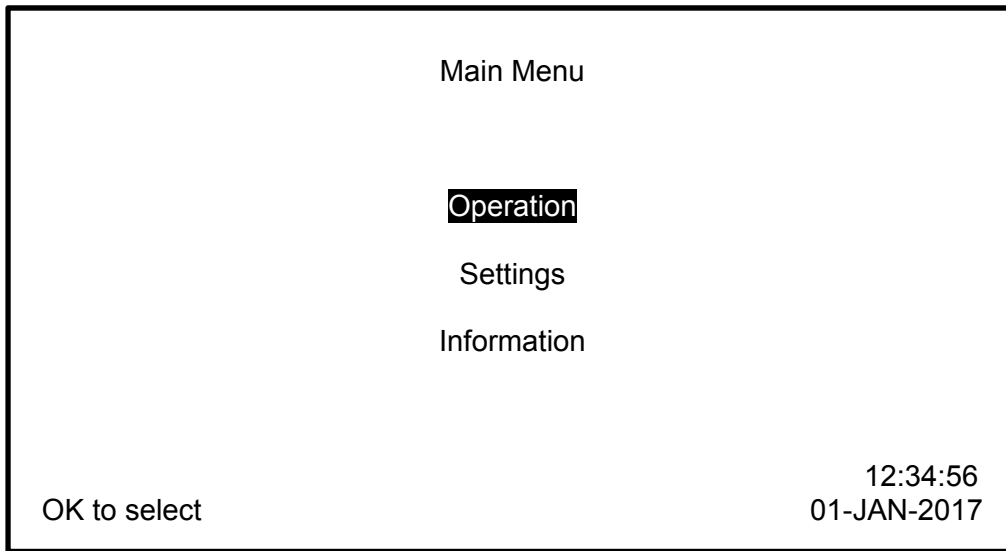
Power Up



When suitably connected to ground, the transducer and AC mains, and the sound source is deployed. The power can be applied using the ON / OFF switch and circuit breaker. The front panel fans will run, and the HV OFF / RESET button will illuminate.

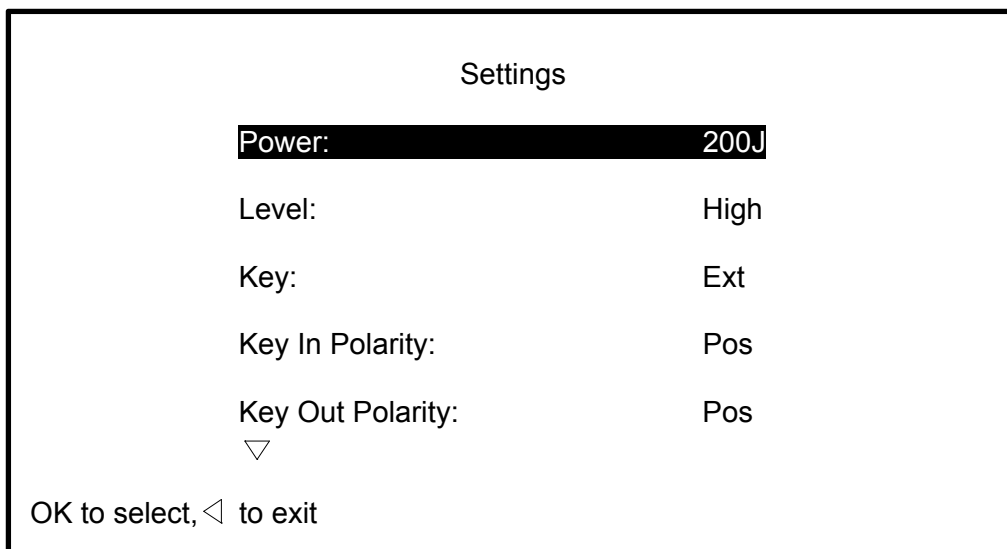


Press OK to accept safety warning and continue to Main Menu

Settings





From main menu, use   to navigate to Settings menu option. Press OK to select.

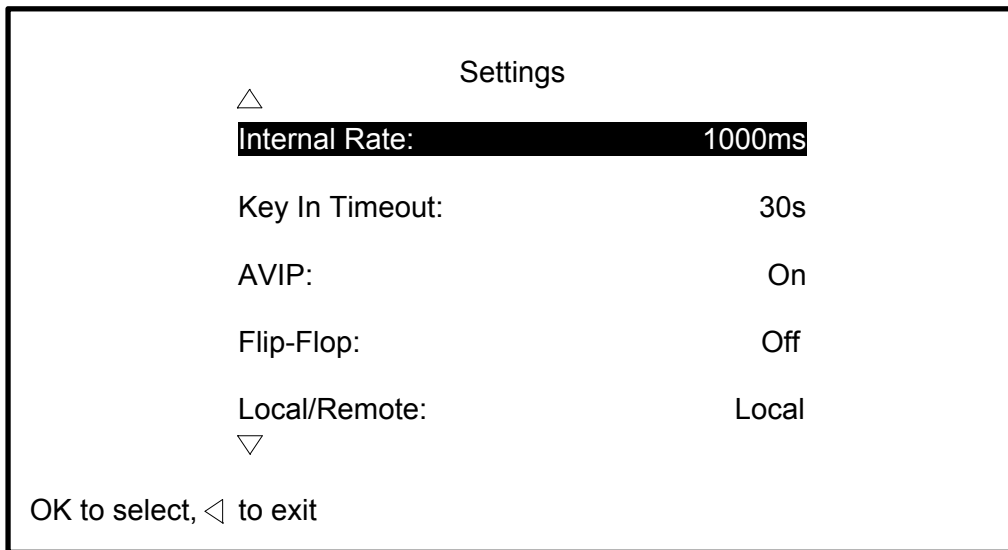


Set Power, Level and Key settings to select the appropriate power required.

Use   to navigate settings. Press OK to select a setting.

Use   to adjust a setting. Press OK to select new setting.

The maximum repetition rate is governed by the charge rate (2000 Joules per second peak) and the amount of capacitance selected. For example, at 300J / shot the CSP-Nv will run at a max of 6 PPS.



Select Internal Rate and AVIP settings.

Key In Timeout can be set in the range of 10 to 60 seconds.

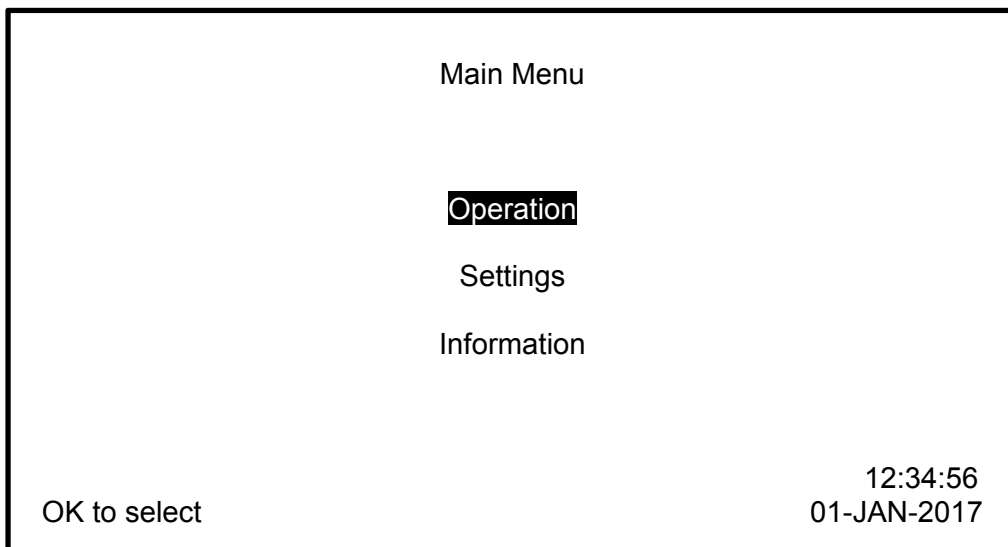
Use △ ▽ to navigate settings. Press OK to select a setting.

Use △ ▽ to adjust a setting. Press OK to select new setting.

Press < to exit to main menu.




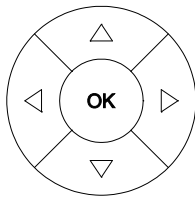
System settings are saved and restored on power up



From main menu, use △ ▽ to navigate to Operation menu option. Press OK to select.

Operation

HV: OFF		Interlock	Settings
Vkey:	0v	Fault:	No
PSU:	Ok		
Load:	Ok		
CSP:	Ok		
			Power: 200J
			Level: High
			Key: Ext
			Rate: 1500ms
			AVIP: On
			F/F: Off
			L/R: Local
			Tamb: 29°C
			Tin: 16°C
			Tout: 30°C



HV OFF / RESET switch indicator will be ON, indicating High Voltage is OFF. All other indicators should be OFF



Any Interlocks or fault modes will be displayed and indicated. If Interlock is present press HV OFF / RESET to clear or investigate if does not clear.



Prior to enabling HV, review Settings.



EARTHING - FURTHER REMINDER

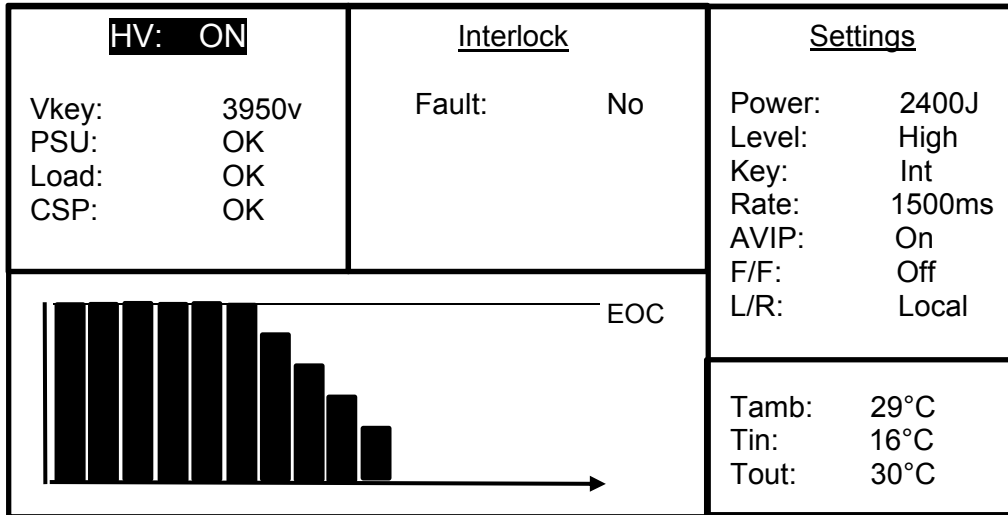
THIS UNIT MUST BE EARTHED / GROUNDED BEFORE ANY POWER IS APPLIED. FAILURE TO DO SO MAY REPRESENT A SEVERE HAZARD TO BOTH EQUIPMENT AND PERSONNEL.

Operation: Enable High Voltage

To enable High Voltage press and hold the HV ON button for 3 seconds.










Depending on settings, 1,2,3,4 or 5 relays will engage over a fixed 6 second period.

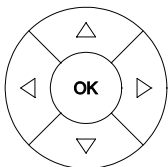
High voltage will then enable, and the system will begin to cycle.



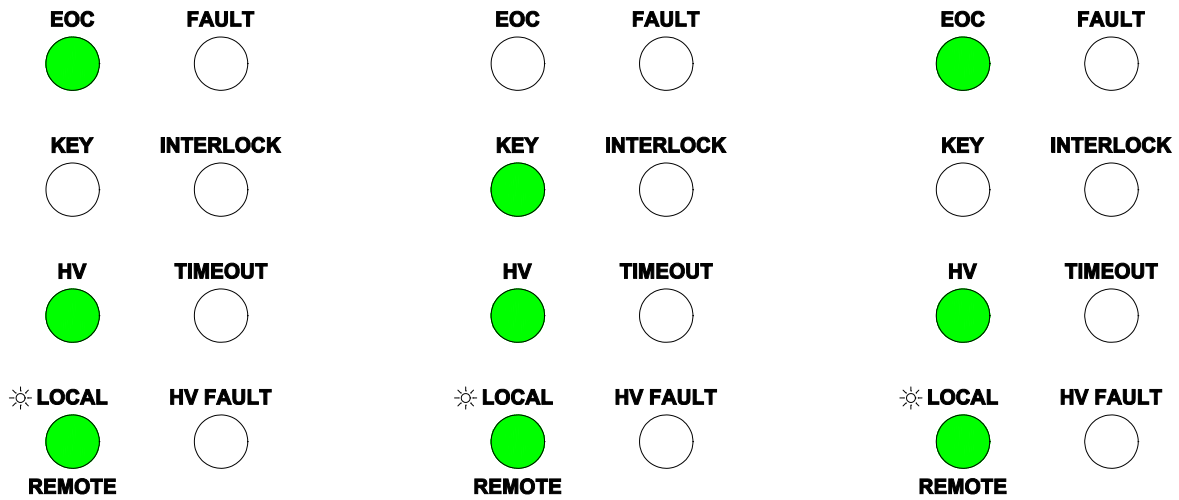
EOC and Vkey level gradually increases at start up due to AVIP function.



-  **EOC**  **FAULT** EOC is ON when EOC achieved
-  **KEY**  **INTERLOCK** Key flash to indicate fire
-  **HV**  **TIMEOUT** HV is ON when enabled
-  ***LOCAL**  **HV FAULT** LOCAL is ON for local operation
-  **REMOTE**



System Cycle of Operation



HV Capacitor(s) charged
 EOC ON
 System ready to discharge
 upon arrival of Key

Key received. Capacitors
 discharged, EOC OFF.
 No fault lights ON, system
 re-charges capacitor(s).

HV Capacitor(s) charged
 EOC ON
 System ready to discharge
 upon arrival of Key

Operation: Disable High Voltage



Press HV OFF / RESET to switch OFF High Voltage



**In an emergency, press EMERGENCY STOP or SWITCH POWER OFF.
 High Voltage is automatically discharged.**

1.7.1 Operation with a Boomer Sound Source

A boomer plate as a sound source produces a single pulse and the amplitude and duration of this pulse is controlled by the energy going into it. The energy is derived from the voltage and the quantity of energy stored in the CSP unit. Traditionally, boomers have operated from around 3500 to 3800 volts. However a feature of the AA200 and AA300 boomer plates is that they will produce a longer pulse (and hence more penetration) with a lower voltage and higher capacitance from the energy source (CSP). The Low setting achieves this so, for example, using an AA300 boomer plate at 200J at 3 pulses per second may be a common way of using the transducer with the traditional 3.5 kV supply voltage on High setting. However if Low setting is used, the same energy is being applied to the transducer although at a lower voltage, so the pulse length is increased.

Load Specifications

The CSP-Nv units are designed to deliver high currents into boomer or sparker type loads. The loads are quite different in make-up.

Boomer Load

A boomer plate consists of a coil imbedded in an epoxy or plastic material and thus by its nature is an inductive load. The inductive 'kickback' is controlled by circuitry inside the CSP. Typical currents into a boomer plate are listed below:-

Energy (HJ)	AA251 Plate	EG+G Uniboom
100J	800A	900A
200J	1050A	1200A
300J	1250A	1350A

The currents will vary according to the length and type of cable used between the load and the energy source. Note that the CSP-Nv units are specified for AAE and EG+G boomer plates and have not – to date- been tested with any other type.

Ensure that the energy and repetition rate do not overdrive the sound source! (Boomer plate - check the boomer plate manual).

1.7.2 Operation with a Sparker Sound Source

The CSP-Nv is designed for use with the Dura-Spark Sparker. The CSP-Nv is not compatible with the Squid Sparker range of sparker sound sources due to the polarity of the power supply.

The polarity of the CSP-Nv reduces tip wear to a minimum ensuring a stable repeatable sound source.

A sparker consists of a number of electrodes in the (salt) water which creates a sound pulse as the plasma bubble expands. The current into a sparker varies with cable length and type as well as by the number of tips and the salinity of the water. Typical values are shown below for the Dura Spark sparker in seawater with a salinity of 35 ppm.

Energy	Dura Spark 80 Tips	Dura Spark 160 Tips	Dura Spark 240 Tips	Dura Spark 400 Tips
300J	1800A	2000A	2500A	
500J	2400A	3000A	3500A	4500A
1250J		4500A	6000A	6500A
2000J				8500A

Operation of the CSP-Nv with a Non AAE Sound Source

The CSP-Nv is designed for use with the Dura-Spark Sparker and the AA series of Boomer Plates.

When used with sparker sound sources from other manufacturers the operator must ensure that the operational characteristics of the sparker are within the parameters of the CSP-Nv. It is recommended that the operator measures the discharge current level and rise time consulting with AAE before commencing survey operations to ensure reliability / compatibility.

Dummy Load

AAE manufacture a dummy load with precisely designed characteristics which can be used for testing of CSP-Nv units in the workshop to avoid 'water based dummy loads'.

Please check with other sparker manufacturers if their sparkers are compatible with the specifications laid out in this manual.

1.8. Product Recycling / Disposal



Within the EU all electronic components and batteries must be taken for separate collection at the end of their working life under EU WEEE directives. Applied Acoustics as a manufacturer within the EU will responsibly dispose of any returned end of life Applied Acoustics components / batteries through a registered WEEE scheme. In order to prevent uncontrolled waste disposal and promote re-cycling please return any end of life Applied Acoustic components postage paid by sender to our UK head office. Please contact Tech Support for a RMA number prior to shipping.

1.9 System Interconnection

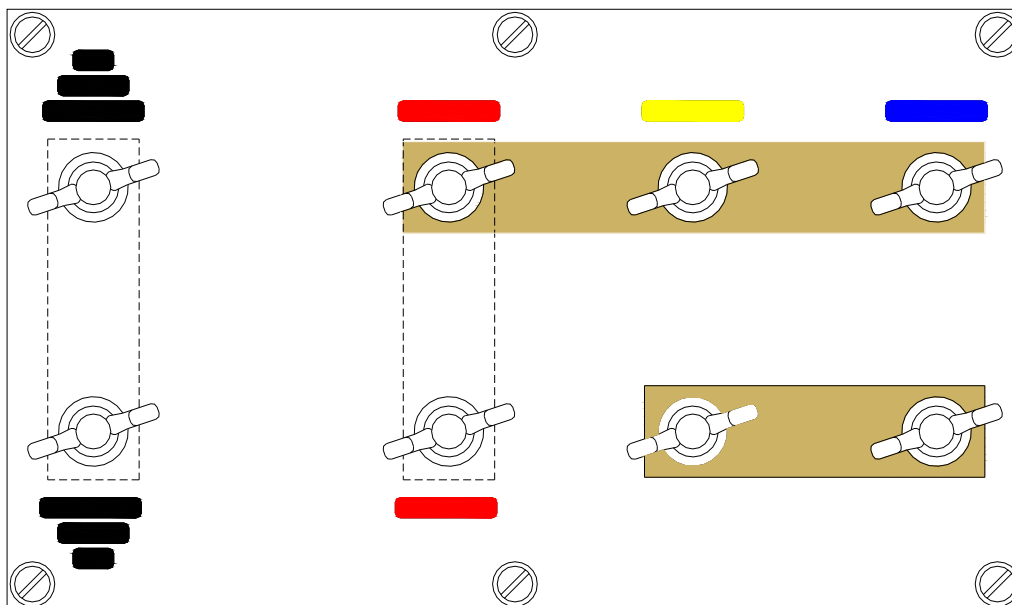
HVJ3004 HV Junction Box

The CSP-N is supplied with the HV Junction Box HVJ3004, for use with the following sound sources and HV Cables.

Seismic Power Supply	HV Cable	Sound Source
CSP-N	HVC 3000	S-Boom
CSP-N	HVC-3500	Dura Spark
CSP-N	HVC-2000	AA251, AA301 Boomer

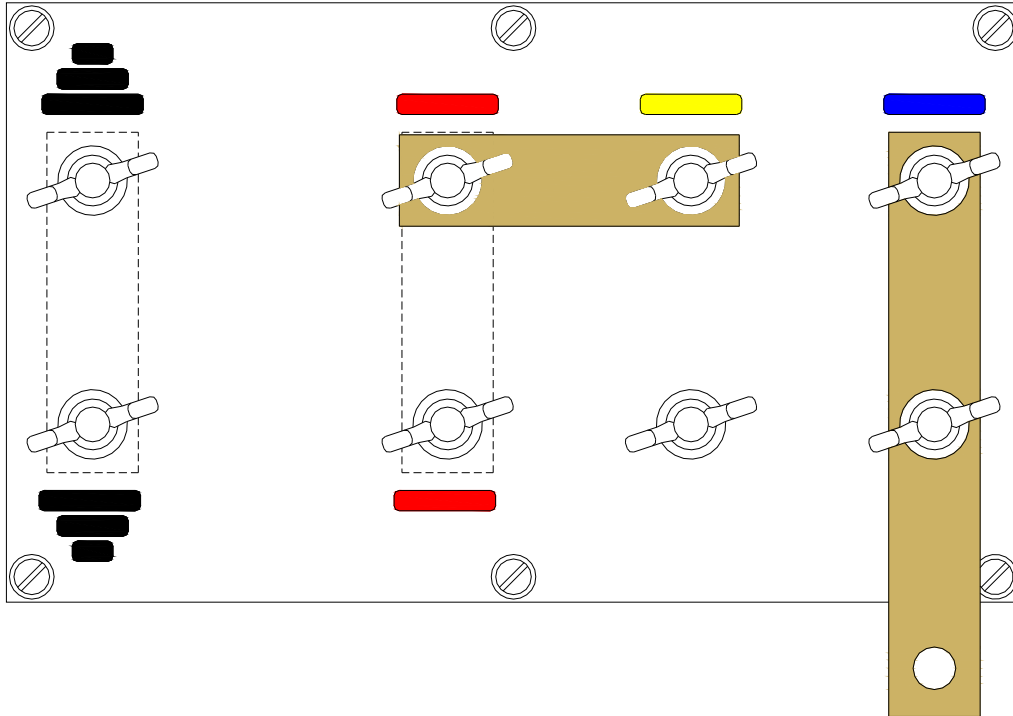
Triple Array Arrangement

400 Tips DuraSpark 400 // 240 Tips DuraSpark 240 // 3 Boomer Plate S-Boom



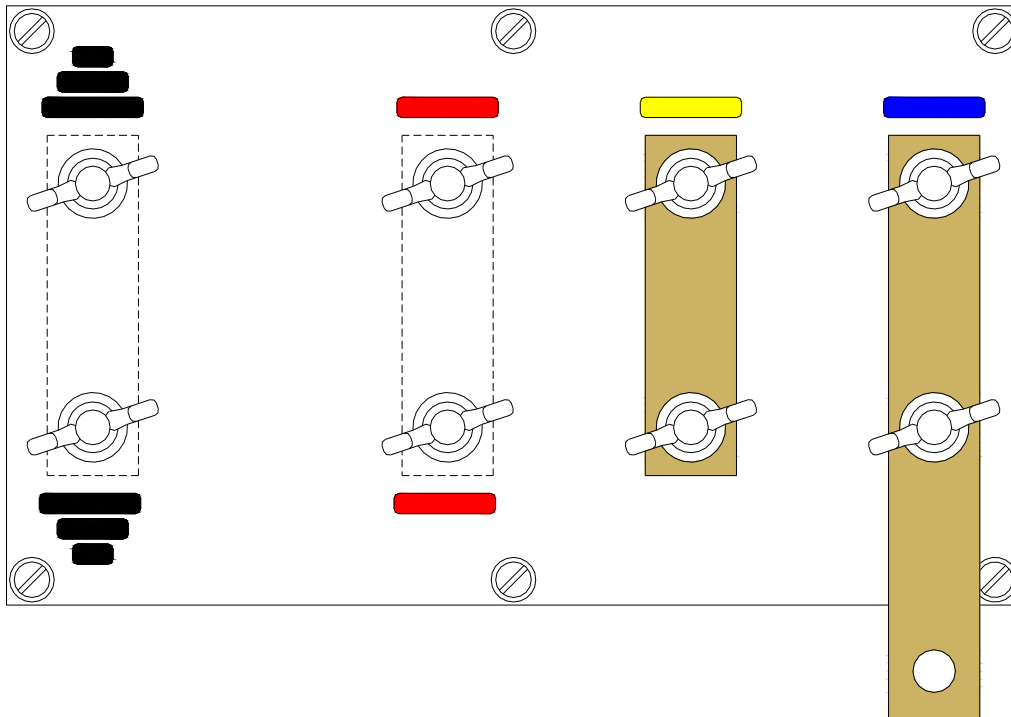
Double Array Arrangement

240 Tips DuraSpark 400 // 160 Tips DuraSpark 240 // 2 Boomer Plate S-Boom

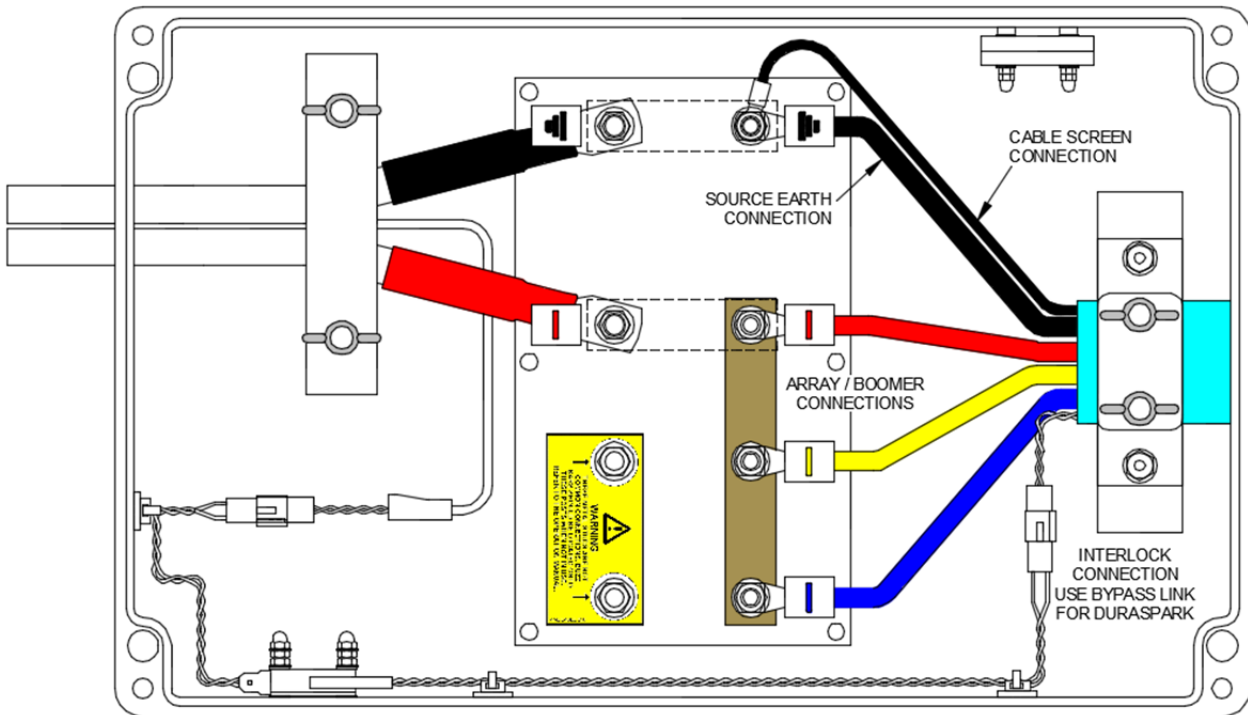


Single Array Arrangement

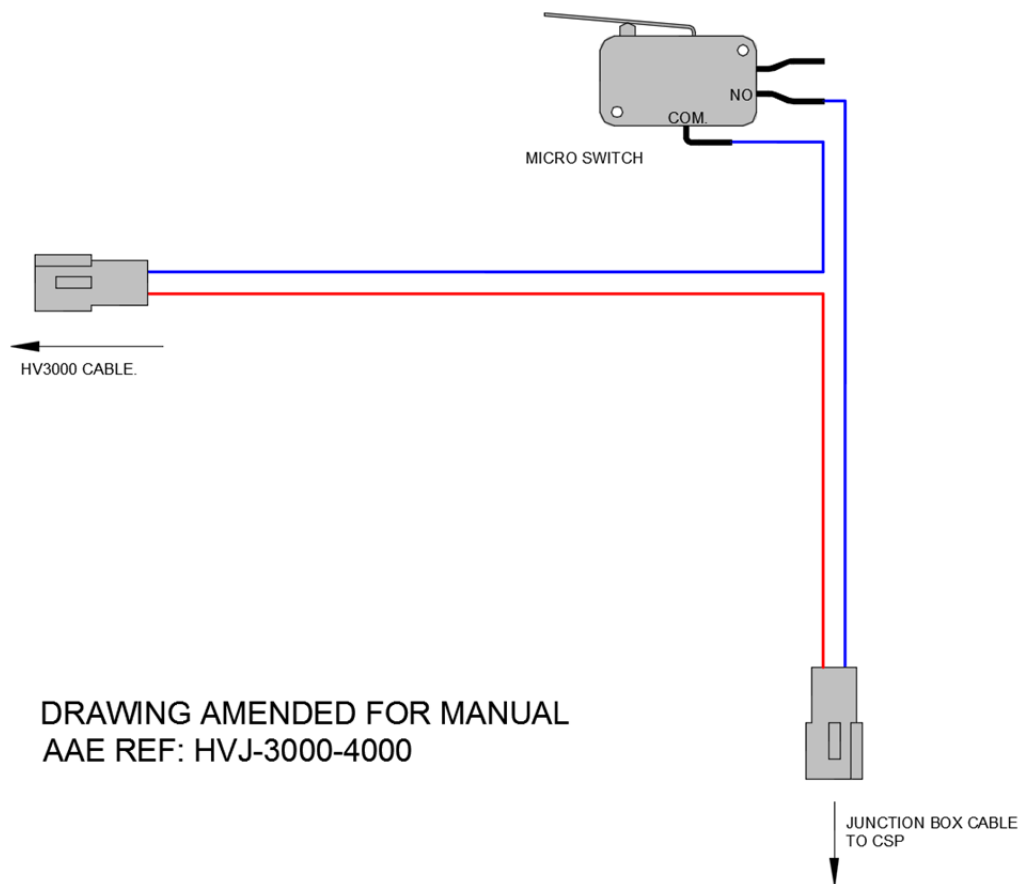
80 Tips DuraSpark 400 and 240 // Single Boomer Plate S-Boom

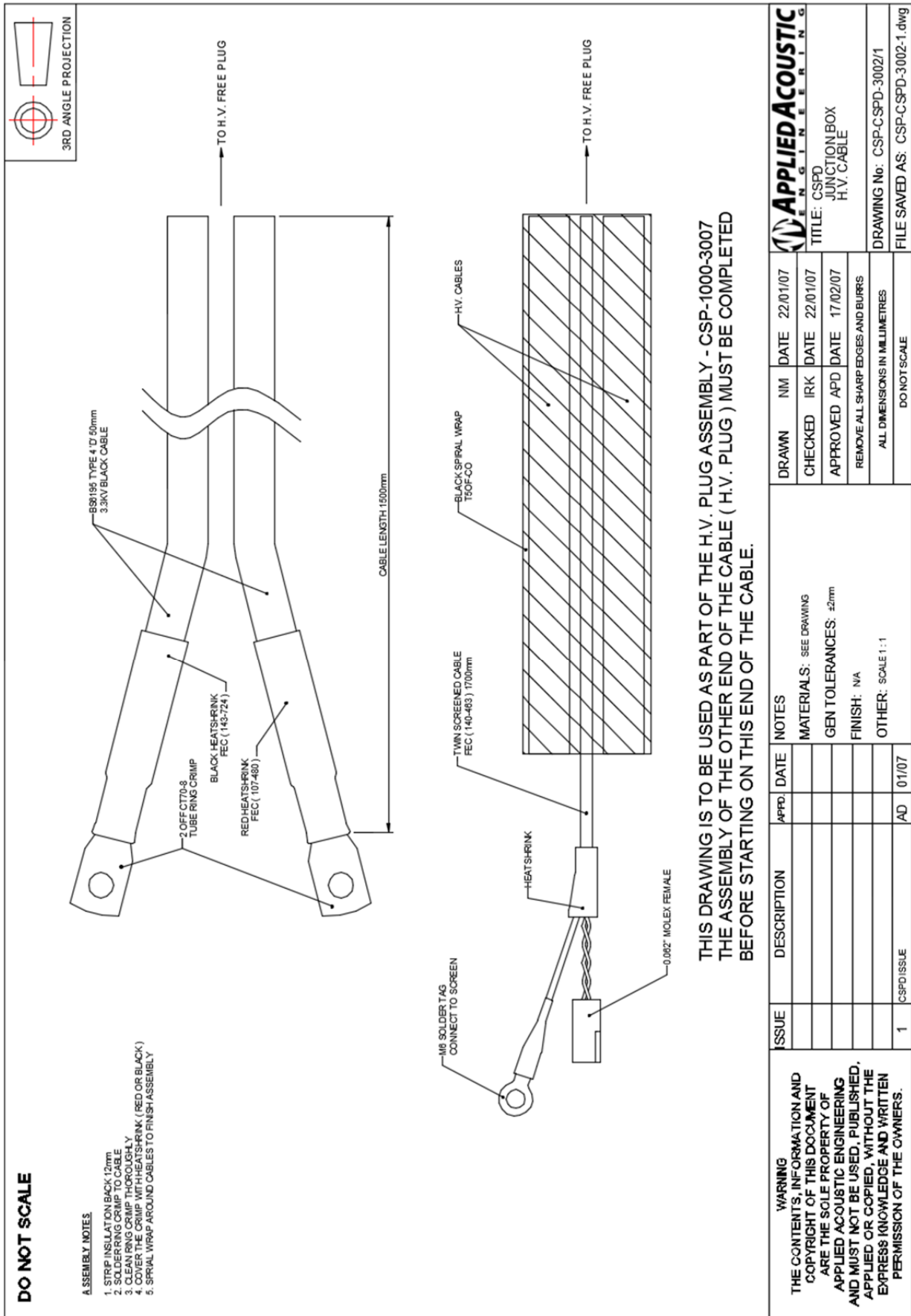


HVJ3004 Interconnections



HVJ3001 Junction Box Interlock Wiring





Specifications

Physical Specification

Size	Transit Case (7U) with cover in place and handles flat: 50cm(H) x 58cm(W) x 74cm(D)
Weight	CSP-Nv1200, case and cover: 61.5kg CSP-Nv2400, case and cover: 63.5kg

Electrical Specification

Mains Input	240Vac 45-65Hz @ 5.0kVA single phase. 3 pin connector Variable Input Power Circuitry (AVIP) 'soft start' circuitry
Voltage Output	2500 to 3950Vdc, 4 pin interlocked connector Solid state semi-conductor discharge method
Output Energy	CSP-Nv 1200 50,100,150,200,250,300,350,400,450,500,550,600 700,800,900,1000,1100,1200 Joules CSP-Nv 2400 50,100,150,200,250,300,400,500,600,700,750,800, 900,1000,1250,1500,1750,2000,2250,2400 Joules
Charging Rate	2000J/second for continuous operation at 0-45°C
Capacitance	CSP-Nv 1200 208µF, 10 ⁸ shot life CSP-Nv 2400 304µF, 10 ⁸ shot life
Trigger	User configured: External: +ve key (5-25VDC), -ve key or isolated closure Internal: +ve key (5-25VDC), -ve key Manual: Key press Opto Isolated BNC connector on front panel and remote box (optional)
Repetition rate	User configured: External: 6pps maximum Internal: 200ms to 9975ms Limited by charge rate, energy level and sound source rating
Earth	M8 stainless steel stud on front panel

Safety Features

- Main microprocessor control circuits with fail-safe layer of logic circuitry
- LCD display with system status information, configuration
- Specially designed HV connector with interlock
- High speed dump resistors for high voltage components
- Capacitor bleed resistors
- HV output open circuit shutdown
- Trigger monitoring with time out and over clock shutdown
- HV output current monitor and shutdown
- Supply Voltage monitoring and shutdown
- High Voltage monitoring
- Over temperature shut-down
- Cover and connector interlocks
- Diagnostic log download for improved support
- Intelligent remote control available to configure, trigger and operator remotely

Options

Remote	:	Allows operator to control unit at a distance. Includes Key In and Key Out.
Junction Box	:	For connection of standard transducer cables to HV connector.
Shock Mount Housing	:	For transportation and operation. (Recommended.)
Transit Case	:	For storage and transportation. Foam lined.
Field Spares Kit	:	For trained technicians only. For servicing units in the field.


Although correct at time of printing, these specifications are subject to change without notice.

Appendix A – Firmware Upgrade

Requirements

- PC with RS232 serial port & Hyperterminal
- RS232 cable (not crossover type)

Procedure

1. Ensure CSP is turned off.
2. Connect RS232 cable between PC serial port & CSP front panel COM port.
3. Configure Hyperterminal for:
115200 baud
8 data bits
1 stop bit
No parity
No flow control
4. Whilst holding front panel  button, turn on CSP.
5. Check FAULT indicator is on. Check LCD is blank & LCD backlight is off. Check HV OFF/RESET switch indicator is on. These checks indicate system is in bootloader mode. Hyperterminal should display the following:

Fig

```
=====
(C) COPYRIGHT 2010 STMicroelectronics
=====
In-Application Programming Application (Version 3.3.0)
=====
By MCD Application Team
=====

===== Main Menu =====
Download Image To the STM32F10x Internal Flash ----- 1
Upload Image From the STM32F10x Internal Flash ----- 2
Execute The New Program ----- 3
=====
```

6. Press 1 on PC keyboard. Message “Waiting for file to be sent ...” will be displayed.
7. Select “Transfer”->”Send File” on Hyperterminal. Box “Send File” will open.
8. Select Protocol “Ymodem”. Select “Browse” then navigate to and select .bin file to open.
9. Select “Send”. Box will open detailing send process. After programming, Hyperterminal will display “Programming completed successfully!”
10. Press 3 on PC keyboard or turn CSP off & on to start program execution.
11. Disconnect RS232 cable from front panel COM port.

Applied Acoustic Engineering 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 devices for offshore geotechnical and seabed analysis known as sub-bottom profiling.

All products use acoustics, underwater sound waves, in location, positioning, navigation and data acquisition applications. system, Easytrak, a variety of positioning and release beacons and seismic devices for offshore geotechnical and seabed analysis known as sub-bottom profiling.



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