



APPLIED ACOUSTICS

Underwater Technology

CAPACITOR CHARGING UNIT

CSP-CSPS-8000/B

MODELS COVERED IN THIS MANUAL:

CSP-S 4000

CSP-S 6000



OPERATION MANUAL

Section 1

CONTENTS

PAGE

1	Enviornmental Considerations	9
2	Introduction	10
2	Installation	11
3	Operation	18
4	Operator Controls and Indicators	23
5	End of Life Recycling / Disposal	27
6	Specifications	28

WARNING

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

ENSURE ADEQUATE SAFETY PROCEDURES ARE EMPLOYED.

Information in this manual is copyright 1993 – 2007, Applied Acoustic Engineering Limited.

This manual is loaned without other consideration than the agreement and condition that it is not to be reproduced, copied or otherwise disposed of directly, and is not to be used in whole or in part to assist in or to furnish any information for the making of drawings, prints, apparatus or parts thereof.

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.

Another factor to consider is to ensure that the start of any survey line is not in such a location that any cetacian 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 cetacian 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.

INTRODUCTION

This manual covers the following CSP-S models available from AAE:

- 1) **CSP-S 4000.** Based on the highly proven CSP family, the CSP-S 4000 has a dual high voltage charger rated at 2800 joules per second, and can supply up to 4000 joules of energy per shot into a Delta Spark source. The CSP-S 4000 allows the user to select 27 power level variations including a fixed 300J setting for use with a boomer source.
- 2) **CSP-S 6000.** A higher capacity version of the CSP-S 4000, the CSP-S 6000 can supply up to 6000 joules of energy per shot into a Delta Spark source. The system also has a dual high voltage charger rated at 2800 joules per second. The CSP-S 6000 allows the user to select 27 power level variations including a fixed 300J setting for use with a boomer source.

The CSP-S is a 2 module system.

Control Unit



System Control & Monitor
HV Charge
Power Setting
VAC IN

Energy Unit



Relay Switchable HV Capacitor Banks
HV Energy Switch
O/P Monitoring
O/P Connection

The CSP-S models incorporate many common parts and apart from the differing amounts of energy storage, can be considered essentially as the same.

INSTALLATION

SITING THE CSP-S

The CSP-S units can deliver 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-S 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-S 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-S 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 harms 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 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 (ie 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.

EARTHING

The CSP-S 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. 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 time during towing activity even during heavy roll.

It is recommended that earthing 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.

The CSP-S 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.

This manual is supplied in three parts:

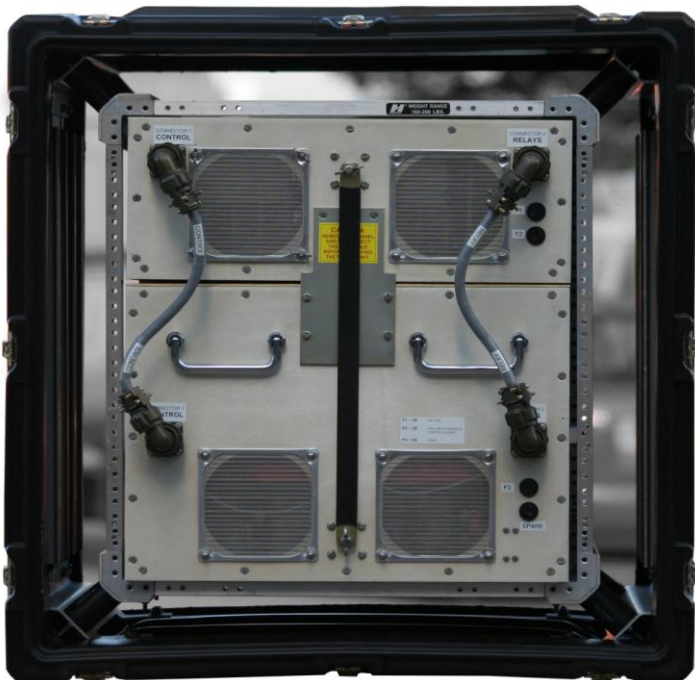
Section 1	Basic operation information details.
Section 2	For manufacturer trained technicians only and provides troubleshooting advice, schematics and circuit descriptions.
Section 3	Provides block and circuit diagrams.

INSTALLATION

The CSP-S Unit is supplied from the factory in a 'Hardigg' transit case. The CSP-S must be operated in the transit case as system interlocks will operate if removed. As is the case with all electronic equipment, care should be exercised in handling. The rear panel of the transit case must be removed to allow interconnection cabling and airflow. The CSP-S 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-S 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.

SYSTEM INTER-CONNECTIONS



Connect **CONTROL** Link Cable (Left Hand Side) as shown.

CHECK EARTH Link (Center) is as shown and tight.

Connect **RELAY** Link Cable (Right Hand Side) as shown.

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-S 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-S front panel earth stud, to an appropriate earthing point on the vessel. If a suitable earth cannot be found, the CSP-S 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.

SYSTEM INTER-CONNECTIONS

OUTPUT CABLE CONNECTION

ENSURE POWER TO UNIT IS TURNED OFF BEFORE ANY CONNECTIONS ARE MADE. Connect the high voltage cable to the CSP-S front panel using the high voltage connector. The HV connector has 2 small sensing pins which will deactivate the high voltage if mains power is applied without the connector in place. Ensure the HV connector is fully mated to the unit. The two larger sockets should never be at a high potential but it makes sense never to attempt to touch these.

If you have our HV junction box, the two conductors of the acoustic source - boomer plate or sparker should be connected to this before connecting to the CSP-S. The terminal wing nuts should be tightened onto clean copper or tinned copper terminals. A good connection is necessary as high currents pass through these terminals. Ensure that the +ve or red terminal is connected to the + mark inside the HV Junction box. The black or -ve terminal should be connected to the - mark inside the HV junction Box. Ensure that the microswitch 'clicks' when the top cover is secured. The HV Junction Box can be bulkhead mounted before the cover is secured. In the situation of the power cable / sound source being caught on an object, the HV cable is pulled from the HV Junction Box, rather than the CSP-S unit being pulled onto the floor.

The junction box is usually supplied with a 1.5 metre lead, terminated in our HV connector. The junction box is fitted with a microswitch which is connected to sense pins in the HV plug, ie deactivating the high voltage charger if the lid is removed and the 'INTERLOCK' light will illuminate.

LINE VOLTAGE CONNECTION

Mains input is connected by the 3-Pin amphenol on the left of the control unit 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

If a ready-wired plug is supplied, it 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-S unit. Although the unit will operate from most generators of 8 kVA, 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 'inverter' type generators do not work well with CSP-S units.

AC POWER REQUIREMENTS

Voltage ratings are quoted elsewhere in this manual.

TYPICAL CURRENTS

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

Voltage	Peak Current	Average Current
110 VAC 50 Hz	56A	40A
240 VAC 50 Hz	40A	18A

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

LINE VOLTAGE DERATING

The capability of the HV charger to deliver energy to the load (storage capacitors) reduces with reduced line voltage as the following tables apply.

240 V Models.

Line Voltage	Charge Rate
180 VAC	2500 J/second
200 VAC	2800 J/second
210 VAC	>3000 J/second

115 V models

Line Voltage	Charge Rate
100 - 115 VAC	2600 J/second
116 – 130 VAC	>3000 J/second

You may notice that the low line voltages above are below those specified in the rear of this manual under 'specifications' The above tables denote the ability of the charger to perform under certain line voltage conditions, and not the complete system. We do not recommend operating the CSP-S units below the minimum voltages listed in the specification section of this manual.

FURTHER REMINDER

If the unit has recently been moved from a cold environment to a warm one, condensation may have developed, which may cause arcing in high voltage equipment. The operator is advised to switch the unit on and run the fans for 10-15 minutes before allowing the high voltage to be switched on. This will allow the unit to warm up to the room temperature, and any condensation will disperse.

OPERATION

Operation of the CSP-S is similar to previous versions of the CSP.

Installation check-list:-

- a) System interconnections on rear panel are made.
- b) The sound source (boomer plate or sparker) has been connected and that it is in the water.
- c) A key pulse is connected – either through the front panel BNC connector or through the remote input.
- d) A good earth has been connected from the ‘Safety Earth’ bolt on the front panel preferably to both the ship and a sea earth.
- e) AC mains is connected to the ‘Mains Input’ connector.
- f) 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 transducer is in the water, the power can be applied using the ON / OFF switch and circuit breaker. The fans will run, and the HV OFF / RESET button will illuminate. Select the appropriate power output required and press the RESET button to reset the internal circuitry. Turn and hold the HV ENABLE KEY & simultaneously press the HV ON button: there will be a small delay before the HV relays engage, and then the high voltage will come on as indicated by the illuminated HV ON switch. Any changes in system parameters (such as power change) will cause the HV to switch OFF, and the unit will need to be RESET before the HV can be switched on again. If the INTERLOCK indicator illuminates, check the HV plug / HV junction box.

Trigger Input

Trigger input is by BNC connector. The unit accepts +ve trigger (triggers on rising edge) 5 - 20 volts. opto-isolated, or by contact closure, as controlled by the KEY switch. (OUT for +ve key, IN for contact closure.) The manual key button can be used too and this also shows, by illumination, when a key pulse has been accepted. (A lockout circuit limits the unit to around 6PPS maximum.)

Local / Remote

The LOCAL / REMOTE switch allows connection of remote box for operation from the laboratory or instrument room. Using the remote box is achieved by turning the LOCAL / REMOTE switch to remote. The high voltage can only be turned on from the instrument room and *not* from the CSP-D Unit. The high voltage OFF button is operational from the CSP-D Unit *and* remote box. The CSP Unit can also be keyed from the remote box via a BNC socket. The remote also monitors the status of the key detect circuitry, and the key LED will only illuminate on reception of a valid key pulse within the CSP-D itself, thus the operator can also see if the interconnection cable is OK. The remote also has a FAULT LED, as well as high voltage ON and high voltage OFF indicators.

LOCAL Operation indicated by LED on – Switch OUT.

REMOTE Operation indicated by LED out – switch IN

OPERATION

Once switched on, the 'HV OFF / RESET' button must be pressed to reset any fault latches and the light behind the 'Manual Key' button is flashing in sequence with the key input signal. The output power can now be selected by using the two rotary switches as shown in the accompanying photographs. The two switches select a combination of capacitor settings (labelled 1 – 12) and voltage settings (labelled LO, MED and HI) so the operator can choose the power setting required for the job in hand. Please see next section. Once the appropriate setting has been made, the 'HV ON' button can be pressed whilst simultaneously turning the 'HV Enable' keyswitch clockwise.

A series of up to 5 clicks will be heard depending on the energy selected as the relays switch in circuit. Once these relays have engaged, the high voltage is enabled.

If the 1-9 power level switch is moved or if the HV off/reset button is pressed, the unit will shut down safely. In an emergency, the red 'STOP' button can be pressed.

The maximum repetition rate is governed by the charge rate (2800 Joules per second) and the amount of capacitance selected. For example, at 300J / shot the CSP-S models will run at 5 PPS. At 6000J the CSP-S 6000 will operate at 0.33 pulse per second, with a little in reserve.



Energy Settings.

CSP-S 6000 SWITCH POSITION	OUTPUT POWER (JOULES)		
	LO	MED	HI
1	200	300	350
2	800	1200	1400
3	1000	1500	1700
4	1200	1800	2100
5	1500	2100	2400
6	2100	3000	3500
7	2300	3300	3900
8	3400	4800	5600
9	3600	5100	6000

- Items marked in red are suitable for a single boomer.
- All other levels are only suitable for sparker applications.

Operation of the CSP-S with a boomer sound source.

The CSP-S has a 300J Limit switch which must be engaged when operating with a boomer sound source to prevent accidental damage. The CSP-S should only be operated on POWER Level 1 HI, MED and LOW for boomer acquisition.

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-S). The LO voltage 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.

Load Specifications:

The CSP-S 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	AA200 Plate	EG+G Uniboom
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-S 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 over drive the sound source ! (boomer plate - check the boomer plate manual).

Operation of the CSP-S with a sparker sound source.

Sparker power settings with CSP-S units.

AAE Sparker model number	Typical Input energy (Joules)
Squid 500	300 – 700
Squid 2000	600 – 2400
DELTA Spark	1200 – 6000

Sparker Load

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 AAE sparkers in standard seawater with a salinity of 35 ppm.

Energy	Squid 500 (60 tips)	Squid 2000 (120 tips)	DELTA Spark (6 Tips)
100J	1000A	1900A	N/A
600J	1300A	2800A	N/A
1500J	1300A	3000A	2600A
2000J	N/A	3300A	2800A
3000J	N/A	N/A	3200A
4000J	N/A	N/A	3500A
5000J	N/A	N/A	3750A
6000J	N/A	N/A	4000A

Dummy Load

AAE manufacture a dummy load with precisely designed characteristics which can be used for testing of CSP-S units in the workshop to avoid 'water based dummy loads' such as dustbins full of salt water etc!

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

OPERATOR CONTROLS AND INDICATORS

MAINS POWER switch

Double pole switch that also acts as an overcurrent circuit breaker. It is situated by 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.

HV OFF/RESET switch

Needs to be pressed if fault occurs, or if someone has tampered with the controls. This button also operates as the HV OFF button. Press to switch OFF.

HV ON switch

Switches in capacitors and HV PSU, (note delays on switching), switch illuminates when the high voltage is switched on operated in conjunction with the HV ENABLE key switch, thus to switch HV ON, HV ENABLE needs to be enabled simultaneously.

MANUAL KEY switch

Triggers CSP unit when pressed. Also illuminates when an external key pulse is detected

KEY POLARITY switch

Used to select either:

+ve key pulse (3.5 – 20 volts, opto isolated triggers 0.5 mS from rising edge), or contact closure (triggers 0.5 mS from falling edge or closure - not isolated).

LOCAL / REMOTE switch

Controls whether an external remote box can be used, as marked on the front panel. Note that the unit can be switched off from the front panel and the remote at any time.

300J LIMIT switch (Located on front panel)

Used to limit the output power to 300J when latched in and illuminated. When not engaged the output power is user selectable.

INDICATORS

EOC (End Of Charge) indicator

LED 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-D is being fired 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.

FAULT indicator

This indicator will normally illuminate when the unit is powered up, and will extinguish when the RESET button is pressed. It will otherwise illuminate during most faults. Please note that the fault light will not illuminate if the thermal cut-out operates in the charger module.

INTERLOCK indicator

Illuminated if front panel connector is left out when the unit is switched ON or if the lid of the HV junction box has not been closed correctly. The interlock LED will also illuminate if the top cover is removed. You will need to press RESET once the interlock condition has been cured.

TIME OUT indicator

For safety, the HV is switched OFF after a period of approximately 25 - 30 seconds without key. This also helps preserve the capacitors, as all pulse discharge capacitors are not designed to sit powered up indefinitely.

HV FAULT indicator

Indicates an output overvoltage, (possibly due to an open circuit capacitor), temperature fault or low input voltage condition.

CONNECTORS

MAINS INPUT

200 – 250 VAC mains input. Connection details are supplied elsewhere in this manual.

REMOTE

Allows operator to remotely control CSP-S.

HV OUTPUT

4 pin proprietary connector. Using our HV2 plug, the large connector pins are proof tested to 6000 volts and can operate with current pulses up to 6000 amps. The two small pins are used as interlock pins. If these are left open circuit, the CSP-D will not be able to enable the high voltage (INTERLOCK fault).

TRIGGER INPUT

The trigger input is connected via a BNC socket.

REAR PANEL

FUSES

The rear panel contains 2 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:-

CONTROL UNIT

F1	3A Antisurge 1¼"	(240V)	7A Antisurge 1¼"	(110V)
F2	3A Antisurge 1¼"	(240V)	7A Antisurge 1¼"	(110V)

ENERGY UNIT

F3	3A Antisurge 1¼"	(240V)	7A Antisurge 1¼"	(110V)
----	------------------	--------	------------------	--------

FAN FILTERS

The rear panel of each of the units has 2 fold-down handles to ease installation, and they also have 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

All interlocks and safety features are doubled. For example, if the HV connector is removed, the HV is shut OFF by the logic board 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.

The unit should be disabled by removal of the key switch or removal of the mains lead or the HV Plug before any attempt is made to make any wiring changes or inspection of the load. 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. Crewmembers should be made aware of these facts during mobilisations.

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.

SPECIFICATIONS

CSP-S CAPACITOR DISCHARGE POWER SUPPLIES

Models Available

CSP-S 4000 : 2800J/s at up to 4000J/shot.
CSP-S 6000 : 2800J/s at up to 6000J/shot.

Physical Specifications

Size : 19" Rack Mount 11U high.
Weight : 125 kg CSP-S 4000
 : 130 kg CSP-S 6000

Electrical Specifications

Mains Input : 207 - 260 V 1 phase.
 : 45 - 65 Hz @ 6 kVA.*
 : 3-Pin connector.
Voltage Output : 2500 to 4000 volts DC.
Output Power : 300 to 6000J depending on model.
 : By 4-Pin connector (Power and interlock).
Selection : Rotary switches.
Trigger : +ve key (+5 to 25V rising edge) opto isolated or contact closure.
 : Set by front panel switch.
Discharge Method : Semiconductor module.
Remote : 10 way amphenol.
Earth : M8 stainless stud on front panel.

* SEE TEXT ABOUT GENERATOR SELECTION. 110 VOLT VERSIONS ARE AVAILABLE.

Safety Features

Should any fault develop, the high voltage PSU (Charger) and all capacitors (which have bleed resistors) are individually dumped to ground, until the system is reset. A double layer of safety cut-outs ensure that partial failure results in system shutdown.

Interlocks	:	Dumps high voltage when fault develops.
Time Out	:	Shut down after period (~30 seconds) without key pulse.
Local/Remote	:	Disables remote (if fitted).
Load	:	Shuts down HV upon open circuit load or load over current.
Reset	:	Resets unit after fault or if interlock activated.
Keyswitch	:	Must be rotated to enable high voltage. Switch can be removed to disable unit for example when working on deck.
Open circuit detect	:	Disables firing when an open circuit load is present.
Thermal shut-down	:	HV charger shuts down if it overheats.

Options

Remote	:	Allows operator to control unit at a distance. Includes key pulse line.
Junction Box connector.	:	For connection of standard transducer cables to HV
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.



APPLIED ACOUSTICS

Underwater Technology

Applied Acoustic Engineering Ltd
Marine House
Marine Park
Gapton Hall Road
Great Yarmouth
NR31 0NL UK

Phone: +44 (0) 1493 440355
Fax: +44 (0) 1493 440720

E-mail techsupport@appliedacoustics.com
www.appliedacoustics.com