Spellman
High Voltage Electronics Limited

Tel : +44 (0)1798 873986
Fax : +44 (0)1798 872479
e-mail : hvsales@spellmanhv.co.uk

Broomers Park, Broomers Hill Lane
Pulborough, W. Sussex, RH20 2RY

Instruction leaflet for the VPAK DC TO HVDC CONVERTER

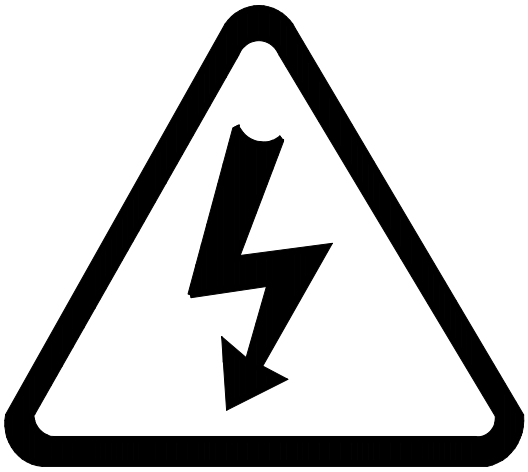
(1kV to 10kV)

Title: **Instruction leaflet for the VPAK DC TO HVDC CONVERTER** (1kV to 10kV)

Document Number: **80269-4**

APPROVAL

Issue	**A**	**1**	**2**
Date	16/07/03	02/09/04	14/11/06
Issuing Authority		4486B	5019K
Engineering Approval			
Sales/Marketing Approval			



DANGER
HIGH VOLTAGE
RISK OF ELECTROCUTION

Observe extreme caution when working with this equipment

- **High voltage power supplies must always be grounded.**
- **Do not touch connections unless equipment is turned off and the capacitance of both the load and power supply are grounded.**
- **Allow adequate time for discharge of internal capacitance of the power supply.**
- **Do not work under wet or damp conditions.**

Servicing Safety

- **This unit is not user serviceable. Return to supplier for repair/service.**

Contents

1. Introduction

The V-pak series is a high performance high voltage power module with an output of up to 10kV at 10 Watts. It is designed to operate primarily from a 24V stable supply with good short and long term stability and very low ripple and noise. The modules are fully encapsulated in order to produce a compact size, and utilise a cast metal housing to achieve extreme ruggedness and reliability. The output voltage can be controlled from zero to full output by use of external analogue control, and the unit will also includes an internal precision reference. The unit is also fully arc and short-circuit protected.

2 General Specification

2.1 Input

- DC Input Voltage
  Nominal input voltage +24V dc ± 0.5V.

- Inrush Current
  On connection the input current never exceeds the maximum current during operation.

- Input current
  The maximum input current at no load is <100 mA, and the maximum input current at full load is < 1 amp.

2.2 HV Output

- Output Voltage Settings
  There are five units in the range with nominal maximum outputs of 1kV, 2kV, 3kV, 5kV and 10kV. The nominal variation from these voltages will be +0.1%/-0% at zero load. The unit can be factory configured to have either a positive or negative polarity output.
  Once set the output voltage shall achieve a stability of better than 25ppm over 24 hours and during any 30 minute period allowing for a one half hour warm up time.
  On disconnection of the input supply the output voltage will decay to <50v within 500ms (load capacitance 1nF).

- Adjustment of Output Voltage
  The output voltage can be varied from 0v to the maximum output voltage of the unit via a 0 - 10v input supplied through two external control pins. The setting accuracy and linearity is +/-0.1% (Maximum offset ±1% of maximum output when programmed to zero or disabled using shutdown). In response to a step change in demand input (10% - 90% and 90% to 10%), the output voltage should stabilise to within 0.1% of the new demand input within 100ms of the change (load capacitance 1nF).

- Output Volt/Amp Characteristic
  The nominal output current of the seven units is :-

Model type	Voltage Range	Output Current	Ripple/Noise pk-pk (at maximum output)
VP1.0	0-1.0 kV	10.00 mA	<10 mV
VP2.0	0-2.0 kV	5.00 mA	< 20 mV
VP3.0	0-3.0 kV	3.33 mA	< 30 mV
VP5.0	0-5.0kV	2.00mA	< 50mV
VP10	0-10kV	1.00mA	< 100mV

Table 2.2 – Output Characteristics

The output stored charge is <35μC.

- Load Regulation
  The load regulation is <10ppm from 0-100% rated load.

- Line Regulation
  Variations of output voltage with varying input voltage is less than <10ppm/V under any load conditions (0 - 100%).

- Transient Response
  For a step change of 10-90-10% rated load, maximum voltage deviation is 0.5% maximum, recovering to 0.1% in <100ms. Transient response is measured at the output terminals at normal laboratory ambient and shall apply at any output voltage setting.

- Ripple and Noise
  Ripple voltage is be <100ppm peak to peak see table 2.2

- Soft Start
  Output voltage and current will ramp up with no overshoot under all load conditions. The ramp up time is be between 100ms and 1s.

- Temperature Coefficient
  Variation of output voltage with temperature is less than 25ppm per °C.

- Output Current Limit
  The output current limit shall be set to between 101% and 110% of the maximum module output current. The converter is capable of withstanding an indefinite short circuit or overload on its output and recover automatically once the short circuit is removed.

  The unit is arc protected and will survive a minimum of 10 arcs in 1 second.

- Output Over voltage
  Under all conditions, the unit will limit its output voltage to <120% of the nominal maximum.

- Thermal Protection

The converter will shut down if it detects that it is exceeding its operating temperature through excessive ambient temperature in order to protect itself. This condition can only be reset by cycling the input supply.

2.3 Operating Environment

- Operating Temperature
  The converter will supply full rated power from 0^{o}C up to +45^{o}C ambient however some heatsinking may be required at high ambient and higher power levels. The unit will start up down to temperatures of –20^{o}C and operate safely however some performance criteria will be degraded.

- Storage Temperature
  The converter will survive indefinite storage at –30^{o}C to +85^{o}C.

- Safety
  The converter has been designed to meet the requirements of EN61010. All plastic materials are rated to 94V2 or better.

3 Installation

3.1 Installation Considerations

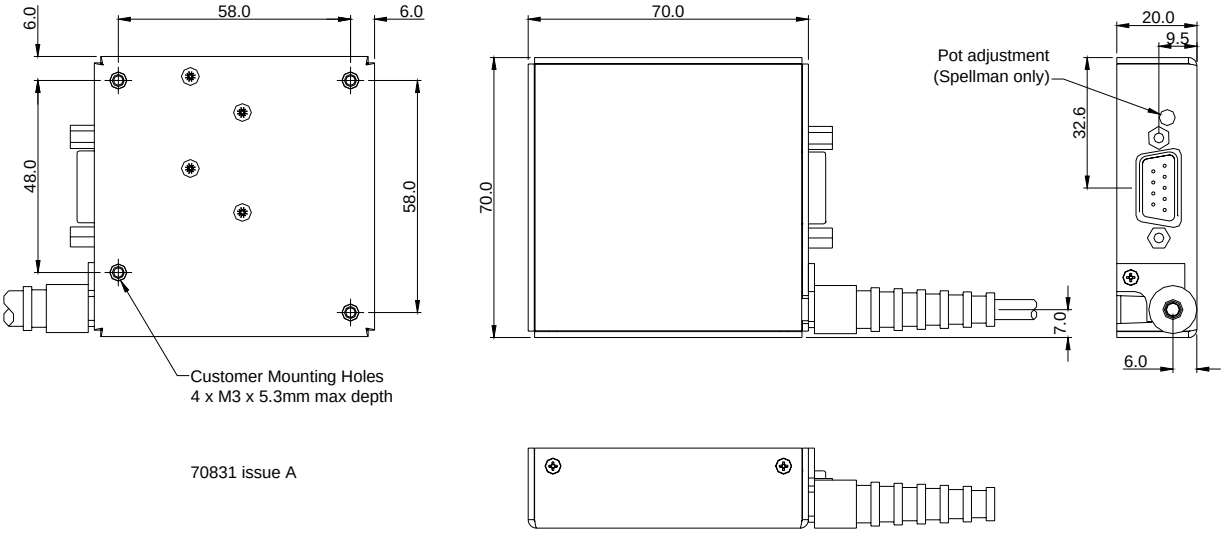
a) The unit must be properly bonded to the main protective earthing termination in the end product.

b) Consideration should be given to the conduct of the following tests with the power supply installed in the end product :

   i) Dielectric voltage withstand test, between live parts of the power supply and the end product chassis.
   ii) Permissible limit tests with the power supply installed in the end product.
   iii) Temperatures on power electronic components, and accessible surfaces.

c) The input and output connections are not suitable as field connections and are only intended for connection to internal wiring inside the end product.

3.2 Mechanical Outline



3.3 Input/output Connections

The power and signal connections are provided through a 9 pin 'D' type connector, male gender.

Connection	Label	Pin	Comment
Power Input +ve	Vin+	6	
Power Input Ground	Vin-	1	
+10V Reference	Vref	2	
Voltage control input +	V prog +	3	
Voltage control input -	V prog -	4	
Shutdown	Shd	5	
Ground (Signal)	Gnd	7	
I Monitor	Imon	8	
V Monitor	Vmon	9	

HV output connection is via a screened flying lead, minimum length 0.5m, and maximum length 3m. The cable is a UL rated type and a mechanical strain relief is provided.

3.4 EMC

As the unit is a component it has not been approved to any specific EMC standards. The user will need to take sensible EMC precautions in the use of the unit once designed into a system.

CHANGE HISTORY

Section	Reason for Change	Issue
All	First Draft	A
3.1	Installation conditions added	1
2.2	1.5kV and 2.5kV units deleted ±1% Maximum offset added Current limit changed from 105% to between 101% and 110%	2
3.2	Mechanical outline changed to show new case design.	