

## KESTREL VWF350

Multi output switch mode power supplies



### FEATURES

- 350W continuous output power, 500W surge
- Up to 5 fully regulated outputs
- Power factor corrected, universal input
- Integral fan cooling
- IEC or screw terminal input connections
- CE marked, EMC compliant
- Current limit and overvoltage protection on all outputs
- 200% current surge capability for disc drives
- Ideal for industrial, communication and networking applications

## INTRODUCTION

The VWF350 series of switch mode power supplies in the Kestrel family offers 3, 4 or 5 fully regulated dc outputs from a very wide range, power factor corrected, ac input. The 350 watt continuous output power rating is complemented by a 500 watt surge capability. This allows output 2 to support a 200% surge current, ideal for high peak surge current applications such as powering disk drives. Cooling is by integral fan and thermal protection is provided for maximum reliability.

An extensive range of output voltage combinations is available to meet the diverse requirements of modern electronic systems. For example, mixed 3.3V and 5V systems are readily supported by the Kestrel family.

All outputs, with the exception of low current output 5, have remote sense capability for accurate voltage regulation. Outputs 1 and 2 have active current share facilities for applications requiring parallel connection with other units. Unit inhibit, power fail signal and LED status indicators are provided as standard. An optional signals card gives DC OK signal, fan fail signal and a +5V 100mA auxiliary supply for external functions.

Input connection is either by standard, quick connect IEC lead or, optionally, to a screw terminal block. Output connection up to 20A is by standard, quick-mate, multi-pole plugs (available as an accessory.) Output 1 connection is via M4 mounting screws on angled busbars.

The VWF350 complies with EN60950 being CE marked to the Low Voltage Directive and is safety approved to both UL1950 and CSA 22.2 No. 234. The unit is designed to meet current and pending International EMC Directive requirements.

NEW INTRODUCTIONS - The Kestrel family is being extended with a 48Vdc input version available December 1997. Similar power supplies can be specified to support both ac mains input or 48Vdc input, with a single footprint. Also available is a range of single output units (VWS400) in the same style, described in a separate data sheet.

If you cannot see your exact requirement here, please give us a call.

## AVAILABLE OUTPUTS

A Kestrel power supply contains three to five outputs. The available outputs are as follows:

Table 1, OUTPUT 1

Nominal Voltage	Adjustment Range	Output Current	Order Code
+3.3V	3.0 - 5.5V	0 - 50A	F
+5V	3.0 - 5.5V	0 - 50A	G
+24V	18.0 - 28.0V	0 - 10A	L

Table 2, OUTPUT 2

Nominal Voltage	Adjustment Range	Output Current	Order Code
+12V	11.4 - 12.6V	0 - 12A(24A)	J
+15V	14.25 - 15.75V	0 - 12A(24A)	K

( ) Surge Rating

Table 3, OUTPUT 3 (floating)

Nominal Voltage	Adjustment Range	Output Current	Order Code
12V	11.4 - 12.6V	0 - 6A	J
15V	11.4 - 15.75V	0 - 6A	K*

\* Output 2 must be +15V

Table 4, OUTPUT 4 (floating)

Nominal Voltage	Adjustment Range	Output Current	Order Code
3.3V	3.0 - 3.5V	0 - 20A	F
5V	4.75 - 5.25V	0 - 20A	G
12V	11.4 - 12.6V	0 - 10A	J
24V	22.8 - 25.2V	0 - 5A	L
32V	28.8 - 32.0V	0 - 3A	M/9*
48V	42.0 - 58V	0 - 3A	N**

\* 600mA minimum load on Output 2 required

\*\* Output linearly derates from 3A at 48V to 2A at 58V.

600mA minimum load on Output 2 required. Available Sept. 1997

Table 5, OUTPUT 5 (floating)

Nominal Voltage	Adjustment Range	Output Current	Order Code
3.3V	3.0 - 3.5V	0 - 5A	FH
5V	4.75 - 5.25V	0 - 1.5A	G
5V	4.75 - 5.25V	0 - 5A	GH
12V	11.4 - 12.6V	0 - 1.5A*	J
12V	11.4 - 12.6V	0 - 5A	JH
24V	22.8 - 25.2V	0 - 3A	LH

\* J output derated to 750mA if output 2 is 15V

## INPUT SPECIFICATION

**Voltage Range**

85 – 264Vac  
 120 – 350Vdc  
 (48Vdc input version available Dec. 1997.  
 Input range 40 – 75Vdc.)

**Frequency**

47 – 63 Hz

**Supply Type**

Single phase TN-S systems (as defined in IEC364).

**Input Current**

5.7A maximum at 90V input, 350W output  
 2.3A maximum at 198V input, 350W output

**Inrush Current**

10A maximum, hot or cold start

**Power**

460W maximum input power when delivering 350W output power

**Power Factor**

Greater than 0.95 at 350W output power, 100 to 240V input voltage. Typically 0.99.

**Efficiency**

Typically 80% at 350W output power, 230V input

**Harmonic distortion**

Complies with the requirements of EN61000-3-2.

## OUTPUT SPECIFICATION

**Voltage**

Nominal output voltages and adjustments are shown in tables 1-5. Adjustment is by means of a 20-turn potentiometer. Outputs are preset to within 6 1% of nominal.

**Current**

Recommended maximum continuous current ratings are shown in Tables 1-5. It may not be possible to draw full rated current from all outputs simultaneously due to total power rating of the unit. All maximum current ratings are applicable up to 50°C. From 50°C to 70°C derate by 2.5%/°C.

**Surge Current**

Up to 24A is available from output 2. This is fully supported by a surge power capability of up to 500W total output power. The peak current on output 2 is limited to 26.4A 6 2.4A, reducing after about 3s to reach 14.4A 6 1.8A within 8s. The limit then resets to 26.4A 6 2.4A within 1s of removal of the overload. See output current limit under "Protection." The average current over a 1 minute period must not exceed 12A.

**Power**

350W continuous up to 50°C. From 50°C to 70°C derate by 2.5%/°C.

**Surge Power**

Up to 500W surge power is available from the power supply. Typically, the surge power is available for 15 seconds in any 1 minute period.

**Load Regulation**

1% $V_{NOM}$  maximum for an output current variation of 0 to 100%  $I_{MAX}$  with all other outputs loaded to 20%  $I_{MAX}$ . The output voltage of any output is independent of the load current on any other output.

**Line Regulation**

0.2% $V_{NOM}$  maximum for an input variation over the operating range of the unit with all outputs proportionally loaded to provide 350W output power.

**Dynamic Regulation**

Outputs 1 and 2: 250mV maximum deviation, recovering to 1% of nominal within 1ms.

Outputs 3 to 5: 5% $V_{NOM}$  maximum deviation, recovering to 1% of nominal within 1ms. Both of the above apply when the load varies 50% to 100% or 100% to 50% of  $I_{MAX}$ .

**Temperature Coefficient**

Typically 6 0.02%/°C on all outputs for the temperatures within the operating range.

**Ripple and Noise**

1% or 50mV pk-pk (whichever is greater) over 500kHz bandwidth, 1% or 100mV (50mV on output 1) whichever is greater over a 30MHz bandwidth. Measurements are differential with all outputs proportionally loaded to provide 350W output power.

## TURN ON AND TURN OFF CHARACTERISTICS

**Start-up Time**

All outputs are above DC OK threshold within 0.5s of application of input power at 240V, 1.5s at 100V

**Start-up Characteristics**

The voltage rise on all outputs is monotonic with no overshoot.

**Hold Up**

>20ms at 350W output power at any input voltage within the specified range. This is sufficient energy storage to ride through a missing mains cycle.

## PROTECTION

### Input Fuse

Internally fitted fuse rated at 7A T. 250V.

### Output Current Limit

The current limit point on outputs 1, 3, 4 and 5 is set to 120% ±15% of  $I_{MAX}$  except for output 5 low current modules (1.5A output) at <3.5A. The characteristic is constant current and is non-latching.

Output 2 current is limited to the area shown in figure 1. The cycle is initiated (time = 0) by the output current exceeding the steady state current limit point of 14.4A ± 1.8A ( $I_1$ ). At that time the current limit point is 26.4A ± 2.4A ( $I_2$ ). After 3s nom., the current limit point ramps down to reach 14.4A ± 1.8A ( $I_1$ ) at 8s nom. The current will be limited at this value until the load is reduced to draw less than the limit. The protection circuitry will reset to the higher limit point of 26.4A ± 2.4A ( $I_2$ ) within 1s of the overload being removed.

### Output Overvoltage

Output 1 has tracking overvoltage at 1V ± 0.25V above the set output voltage.

Outputs 2 to 5 overvoltage trip is set at 120% ± 10% of nominal output voltage (125% ± 5% on 3.3V outputs).

Overvoltage protection is latching and can be reset either by removing the input power from the power supply or by toggling the Inhibit input. An overvoltage condition is indicated by a red LED.

### Overtemperature

In the event of thermal overload, the unit will be disabled. Output power will be restored when the unit temperature drops to a safe level. Latching thermal trip is also available when option 1 or option 3 is specified. An overtemperature condition is indicated by a red LED.

## AUXILIARY FUNCTIONS

### Remote Sense

Available on all outputs except low current output 5 modules (1.5A). Compensates for lead drops of up to 500mV on outputs 1,2 and 3 and 250mV on outputs 4 and 5.

### Parallel Operation

Outputs 1 and 2 may be connected in parallel with the corresponding output of the same voltage rating on another unit.

Active current share: Current sharing, pro rata to the current rating of each output, can be achieved by linking current share pins of linked outputs. The -sense connections must be linked and voltages set to within 1% of each other for active current share to operate correctly.

### Series Operation

Outputs may be connected in series to provide higher output voltages. Outputs 1 and 2 have a common 0V line so cannot be connected in series with each other. Maximum voltage between outputs is 100Vdc. For full protection, each series connected output should have a diode fitted reverse biased across it. The diode must be capable of passing the maximum current available from any of the series connected outputs.

## STANDARD SIGNALS

All signals are referenced to -sense.

### Inhibit

TTL compatible input. The output power of a complete power supply may be inhibited by a logic signal applied to this input. Removal of the logic signal reinstates the output voltage. A short pulse on this input (<30ms) will cause the unit to toggle on or off. Pulsing this input will also clear a latched condition caused

by overvoltage or overtemperature. The sense of the signal is low to inhibit as standard, but specifying option 2 or 3 will provide an active high inhibit.

### Power Fail Signal

An open collector output signal provides warning of impending output failure due to loss of input. At least 5ms warning of output power loss is provided. Output is high for power OK.

## ENHANCED SIGNALS - OPTION B

### DC OK

Available when option B is specified. An open collector output provides a signal indicating that all output voltages are above 90% of nominal. Signal is high for outputs OK.

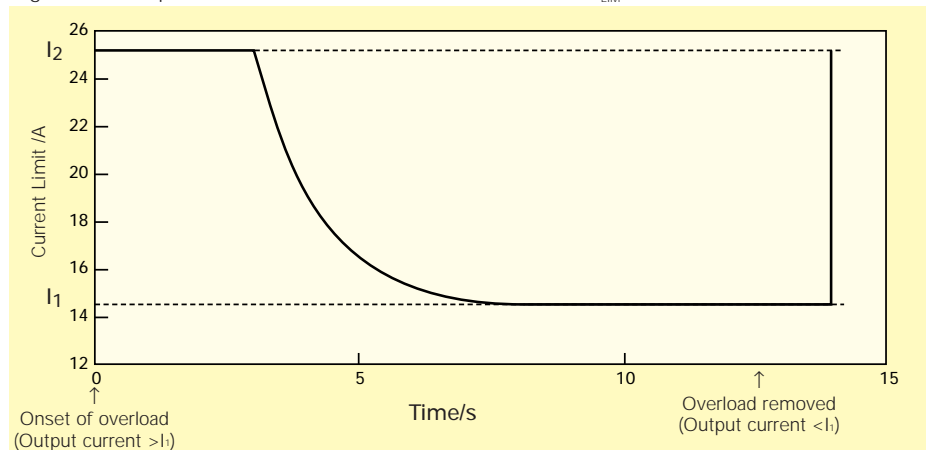
### +5 Volt Logic Supply

Available when option B is specified. This +5V supply is provided by a standard 78L05 I.C. regulator and is capable of delivering up to 100mA. It has integral thermal overload and short circuit protection. The 0V of this supply is connected to "-sense" of output 1. This output remains available even if other outputs are inhibited.

### Fan Fail

Available when option B is specified. An open collector output provides a signal indicating that the internal fan speed has dropped below a predetermined fixed level. Output is high for fan OK.

Figure 1 Output 2 Current Limit Threshold Characteristic  $I_{LIM}$  vs Time



## ISOLATION

### Primary to Secondary

Reinforced insulation to 3kVac r.m.s. for one minute. Where a safety earth is interposed between primary and secondary, this potential is split equally between input to earth and output to earth. Complete units are tested to 2.1kVdc between input and output with all output terminals connected together and connected to earth.

### Primary to Earth (ground)

Units are tested to 2.1kVdc from input to earth, with all output terminals connected together and connected to earth.

### Secondary to Earth (ground)

Units are tested to 500Vdc from output to earth, with all output and signal ports connected together.

### Earth (ground) Leakage Current

Earth current under normal operating conditions does not exceed 1.5mA.

Typically: 0.82mA at 230Vac 50Hz  
0.5mA at 115Vac 60Hz

### Operating Voltages

The maximum operating voltages between any output (power or signal) and earth or between isolated outputs must not exceed 100Vdc.

## ELECTROMAGNETIC COMPATIBILITY

### Emission

Conducted 0 to 2kHz: Units comply with EN61000-3-2.

Conducted 0.15 to 30MHz: Units comply with EN55022B. See Figure 2.

Radiated 0.03 to 1GHz: Units comply with EN55022B.

### Immunity

**Fast transients:** Units comply with IEC1000-4-4-B.

**ESD:** Units comply with IEC1000-4-2-A.

**RF field:** Units comply with ENV50140-A at 3V/m.

**Conducted RF:** Units comply with ENV50121-A.

**Surge:** Units comply with ENV50142-B.

## ENVIRONMENTAL CONDITIONS

### Ambient Temperature

0°C to 70°C operating. Above 50°C, derate power and current by 2.5%/°C.  
-40°C to +85°C non-operating.

### Humidity

0 – 85% R.H. non-condensing, operating.  
0 – 95% R.H. non-condensing non-operating.

### Altitude

0 to 3,000m (10,000 ft) operating  
0 to 10,000m (30,000 ft) non-operating

## Pollution

These power supplies are designed for use in office type environments, i.e. pollution degree 2 environments, as defined in EN60950.

## RELIABILITY

MTBF in excess of 100,000 hours calculated to MIL217 Rev F.

MTBF to HRD4 220,000 hours.

## INTERNATIONAL SAFETY APPROVALS

The Kestrel range of units have been designed, tested, and approved to the following safety specifications.

CE marked to the low voltage directive EN60950

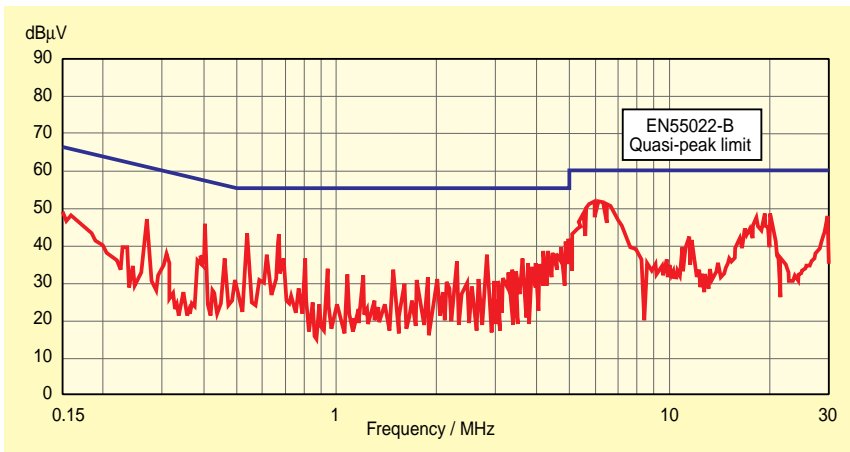
UL® 1950 - approved by CSA under the NRTL scheme.

CSA 22.2 No. 234

## WARRANTY

All Advance Power products are warranted against faulty manufacture and faulty components for a period of twelve months from the date of dispatch. See conditions of sale for full details.

Figure 2 Typical Conducted Emission



## MECHANICAL SPECIFICATION

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#### Mounting Orientation

Units may be mounted in any orientation without derating.

#### Ventilation and Cooling

Units are cooled by an integral fan and require free air flow in the area of the fan at the rear of the power supply. Air direction is entering at the fan end and exiting at the terminal end.

#### External Dimensions

All dimensions are nominal and are in mm (inches).

127 (5.0) x 63.5 (2.5) x 241.3 (9.5) + 15.8 (0.62) for terminals.

#### Mass

Typically 2kg (4.4lb.)

#### Fixings

8 x universal fixings accepting either M4 ISO or 8-32 UNC fasteners are provided and are marked "a" on the outline drawing. There are two fixings on each side and four on the base.

### CONNECTORS

The following connectors are fitted to the power supply:

#### Input

Standard IEC Connector. Screw terminal block with integral cover is available by specifying option J.

#### Output 1

Two busbars with M5 ISO standard screws.

#### Outputs 2 and 3

Beau Eurostyle 86 series 8-way connector. Mating half is Beau 860508 or Klippon 152936.

#### Outputs 4 and 5

Beau Eurostyle 86 series 6-way connector. Mating half is Beau 860506 or Klippon 152916.

#### Standard Signals

Remote sense and current share for outputs 1 and 2, power fail, and inhibit signals. Molex 7478 series 8-way wafer. Mating half is Molex 6471 series #22-01-2085.

#### Remote sense for output 3, 4, or 5

Molex 7478 series 2-way wafer. Mating half is Molex 6471 series #22-01-2025.

#### Enhanced Signals

DC OK, fan fail, and +5V logic supply. Molex 7478 series 4-way wafer. Mating half is Molex 6471 series #22-01-2045.

#### Connector Kits

All connectors are available as accessory kits:

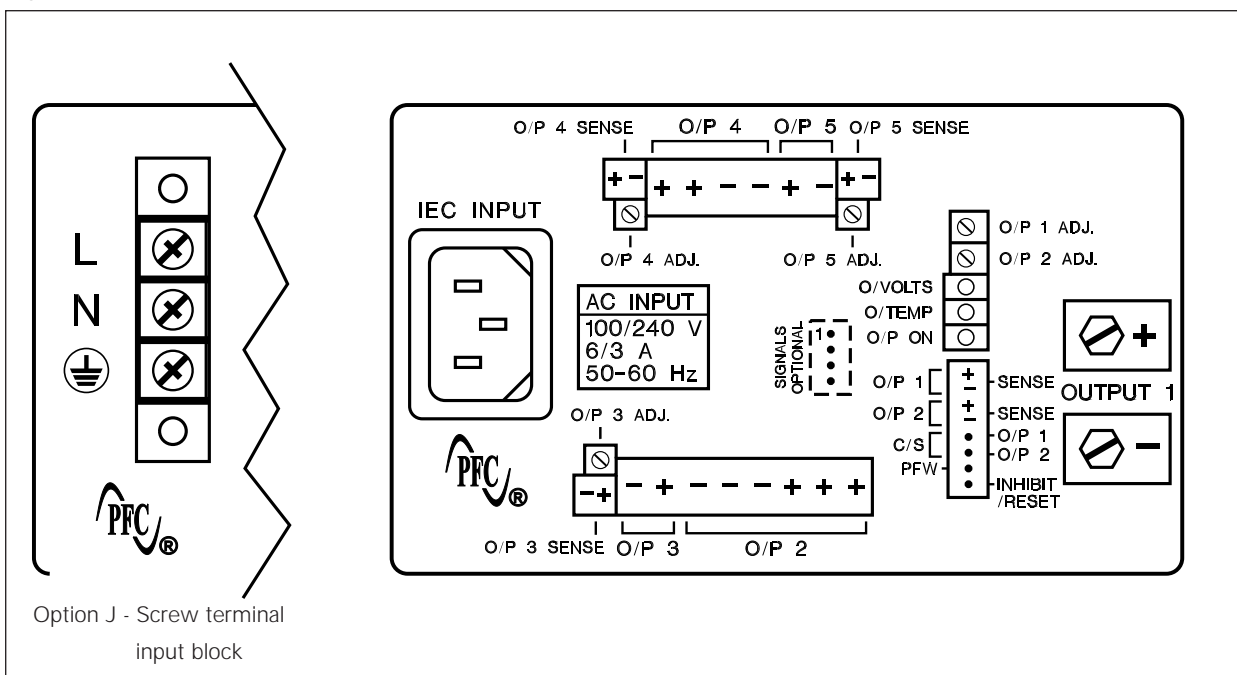
Input connector with 2m (6.6ft.) open-ended cable: order code VKI10A02

Input connector with a 2m (6.6ft.) Cable fitted with a 13A UK style plug: order code VKI13A01

Output and signals: VKC501. Includes housings and crimps for sense and signal connections in addition to power connections for outputs 2 to 5 and crimps for output 1.

The output and signals connectors are also available by specifying option K when ordering a VWF350 power supply.

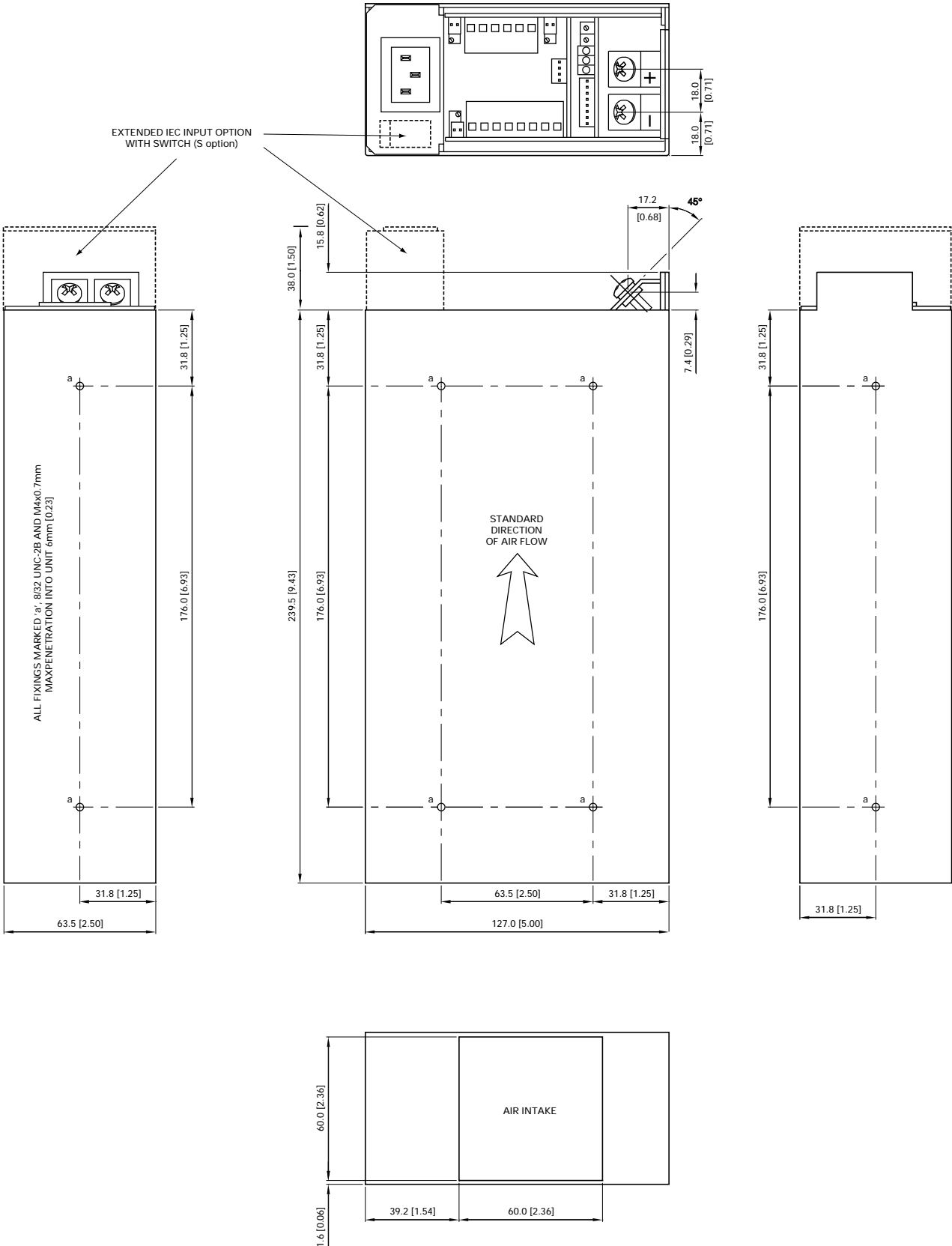
Figure 3 Connectors, controls and indicators



# MECHANICAL SPECIFICATION

## KESTREL VWF350 OUTLINE DRAWING

All dimensions are nominal and are in mm (inches).



## ORDERING INFORMATION

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The order code consists of up to 12 fields as follows:

Series	Range	Outputs					Options	
		O/P 1	O/P 2	O/P 3	O/P 4	O/P 5		
1VWF	350							/ See options below
Voltage Code							↓ H - High current O/P 5	
3.3V	F	50A			20A		5A	
5.0V	G	50A			20A	1.5A	5A	
12V	J		12A	6A	10A	1.5A	5A	
15V	K		12A	6A				
24V	L	10A			5A		3A	
32V*	M/9				3A			
48V**	N				3A			
Options (as required)	1,2 or 3: 1 Latching overtemperature trip 2 Active high inhibit input 3 Latching overtemperature trip and active high inhibit							
	B Enhanced Signals: DC OK, Fan Fail, +5V Logic Supply							
	J Screw terminal input							
	K Output connector kit							
	S Extended input section with Switch and IEC connector rotated 180°							

\* Performance restrictions apply. \*\* Not available with high current output 5.

Outputs 1–5 are selected from those available as required. If no output 4 is required but output 5 is required, then '0' (zero) must be inserted in output 4 position to indicate that that output is omitted.

#### Examples:

For a three output unit with 5V 50A, 12V 12A, 12V 6A, the model number is: VWF350GJJ. Outputs 4 and 5 are not required and so are not specified.

For a four output unit with 5V 50A, 12V 12A, 12V 6A, 24V 5A and a DC OK signal, the model number is: VWF350GJJL/B. Output 5 is not required and is therefore not specified.

For a four output unit with 5V 50A, 12V 12A, 12V 6A, 5V 1.5A the model number is: VWF350GJJ0G. As only 1.5A is required from the auxiliary 5V output, the fifth output is used and the fourth output is not fitted, this is indicated by the '0' in the fourth output position in the part number.

For a five output unit with 5V 50A, 12V 12A, 12V 6A, 24V 5A, 5V 5A, Fan Fail signal and latching overtemperature trip, the model number is: VWF350GJJLGH/B1.

For a five output unit with 5V 50A, 15V 12A, 15V 6A, 32V 3A, 5V 1.5A, terminal block input, and connector kit, the model number is: VWF350GKKMG/9JK.



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