

The 300W FR series is a high quality, high performance, high reliability & high stability high voltage power supply with low ripple & noise. Air insulation reduces weight and facilitates a lower cost of ownership.

A variety of output control options, input voltages and low output discharge currents, makes integrating this power supply into a new system or tool simple.

Designed for electrical design engineers & system integration engineers in a wide range of industries including ion implant, electron-beam welding & electron-beam additive manufacturing & many other application specific markets who are challenged with limited high voltage integration experience & tight timelines.



Features

- ▶ Output voltages 0-1kVDC to 0-60kVDC
- ▶ 1U 19" rack mount
- ▶ RS232/USB control & monitor standard, Ethernet is optional
- ▶ Output voltage & current regulated
- ▶ Low ripple <0.02% RMS of rated voltage at full load
- ▶ Voltage & current monitor outputs
- ▶ Single phase AC input
- ▶ Efficiency >85%
- ▶ Air Insulated
- ▶ Short circuit, arc & overload protection
- ▶ CE marked for EMC, low voltage (LVD) & RoHS directives
- ▶ Operating temperature: -20°C to +40°C
- ▶ 3 year warranty

Applications



- ▶ Ion implant
- ▶ E-beam/Ion beam
- ▶ Industrial technology
- ▶ Capacitor charging
- ▶ High voltage bias

Dimensions

43.8 x 482.6 x 508 mm (1.72" x 19.0" x 20.0")
1U 19" rack mount

Models & ratings

Positive polarity	Negative polarity	Reversible polarity	Output voltage	Output current	Max stored energy	Output cable ⁽¹⁾
FR1P300	FR1N300	FR1R300	0 to 1kV	0 to 300mA	0.35J	RG-58U
FR1.5P200	FR1.5N200	FR1.5R200	0 to 1.5kV	0 to 200mA	0.5J	RG-58U
FR2P150	FR2N150	FR2R150	0 to 2kV	0 to 150mA	0.3J	RG-58U
FR3P100	FR3N100	FR3R100	0 to 3kV	0 to 100mA	0.7J	RG-58U
FR5P60	FR5N60	FR5R60	0 to 5kV	0 to 60mA	0.4J	RG-58U
FR6P50	FR6N50	FR6R50	0 to 6kV	0 to 50mA	0.55J	RG-8U
FR8P37	FR8N37	FR8R37	0 to 8kV	0 to 37mA	0.4J	RG-8U
FR10P30	FR10N30	FR10R30	0 to 10kV	0 to 30mA	0.6J	RG-8U
FR12P25	FR12N25	FR12R25	0 to 12kV	0 to 25mA	0.85J	RG-8U
FR15P20	FR15N20	FR15R20	0 to 15kV	0 to 20mA	0.75J	RG-8U
FR20P15	FR20N15	FR20R15	0 to 20kV	0 to 15mA	1.2J	RG-8U
FR25P12	FR25N12	FR25R12	0 to 25kV	0 to 12mA	1.3J	RG-8U
FR30P10	FR30N10	FR30R10	0 to 30kV	0 to 10mA	1.8J	RG-8U
FR40P7.5	FR40N7.5	FR40R7.5	0 to 40kV	0 to 7.5mA	2.4J	RG-8U
FR50P6	FR50N6	FR50R6	0 to 50kV	0 to 6mA	3.0J	RG-8U
FR60P5	FR60N5	FR60R5	0 to 60kV	0 to 5mA	3.5J	RG-8U

Notes:

1. Detachable, 2.4m (8ft) RG8U shielded high voltage coaxial cable, 1.8m (6ft) NEMA 5-15 line cord, 1.8m (6ft) NEMA 6-15 line cord, 3m (10ft) null modem cable and 3m (10ft) USB cable are provided.

Options

Symbol	Description
A	100/200VAC \pm 10%, 48 to 63Hz. Selectable. Shipped set for 200VAC.
F22	Required for CE Compliance - 230VAC Power Factor Corrected. AC input line rated for 198 to 264VAC, 48 to 63Hz, 400VA maximum. Active correction circuitry achieves an input line current harmonic content well below the maximum specified in EN61000-3-2. (AC Line voltage selector switch removed.) One NEMA 6-15 cord provided.
NC	Blank front panel, power switch and indicator only.
ZR	Zero start interlock. Voltage control, local or remote, must be at zero before the HV will enable.
5VC	0 to 5V voltage and current program/monitor.
ARC	Arc count and quench as described in the specifications for 1 to 6kV models.
AC	Arc Count Only
AQ	Arc Quench Only
ETH	Virtual RS-232 COM port over Ethernet network. (Requires compatible OS (eg Windows) for COM drivers)

Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Input voltage	102		132	V RMS	User selectable via rear panel switch. Single phase. Shipped set for 198 to 264V RMS.
	198		264	V RMS	
Input frequency	48		63	Hz	
Input connector	C14 connector per IEC60320 with mating line cord.				

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Output voltage range	0		60	kV	See models and ratings table.
Output current range	0		300	mA	See models and ratings table.
Polarity	Available with either positive, negative or reversible polarity with respect to chassis ground.				
Output control	Continuous, stable adjustment by panel mounted optical rotary encoder or by external +10V signals.				
Static voltage load regulation	±0.005			%	For specified line variations.
	0.005			%	+0.5mV/mA for no load to full load variations.
Dynamic voltage regulation	For load transients from 10% to 99% and 99% to 10%, typical deviation is less than 2% of rated output voltage with recovery to within 1% in 500 us and recovery to within 0.1% in 1ms.				
Stability		0.01		%	Per hour after 30 min. warm up.
		0.05		%	Per 8 hours.
Temperature coefficient		0.01		%/°C	
Voltage rise time constant		50		ms	For all models using either HV enable or remote programming control.
Voltage decay time constant		50		ms	With a 50% resistive load for 12kV to 60kV models.
		50		ms	With a 10% resistive load for 1kV to 10kV models.
Ripple	0.025			%	+0.5V RMS at full load.
Optical rotary encoder resolution		0.025		%	With Fine Adjustment mode selected.
		0.25		%	With Coarse Adjustment mode selected (default).
Repeatability			0.1	%	
Current regulation	0.1			%	When in current regulation mode, from short circuit to rated voltage, at any load condition.
Arc count	Internal circuitry senses the number of arcs caused by external load discharges. If the rate of consecutive arcs exceeds approximately one arc per second for five arcs, the supply will turn off for approximately 5 seconds to allow clearance of the fault. After this period the supply will automatically return to the programmed kV value with the rise time constant indicated. If the load fault still exists, the above cycle will repeat. Standard on 8 to 60kV models; optional on 1 to 6kV models.				
Arc quench	An arc quench feature provides sensing of each load arc and quickly inhibits the HV output for approximately 20ms after each arc. Standard on 8 to 60kV models; optional on 1 to 6kV models.				

Notes:

1. Specifications apply from 5% to 100% rated voltage.
2. Operation is guaranteed down to 0 voltage with a slight degradation of performance.

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Efficiency	85			%	At full load.
HV insulating medium	Outputs are air insulated.				
External interlock	Open = OFF, closed = ON. Normally latching except for blank front panel version where it is non-latching				
Remote HV enable/disable	0 to 1.5V = OFF; 2.5 to 15V = ON				
Voltage accuracy	0.5% of setting + 0.2% of rated				
Voltage monitor	0 to +10V, equals 0 to rated voltage, with an accuracy of 0.5% of reading +0.2% of rated. Output impedance is 10kΩ.				
Analog current monitor	0 to +10V, equals 0 to rated current, with an accuracy of 1% of reading +0.1% of rated. Output impedance is 10kΩ.				
RS232/USB/Ethernet programming & monitor accuracy	Resolution	0.025% of full scale for both the voltage and the current programs. 0.1% of full scale for both the voltage and the current monitors.			
	Remote setting accuracy	Voltage setting accuracy is better than 0.5% of setting +0.2% of rated.			
	Remote reading accuracy	Voltage reading accuracy is 0.5% of reading +0.2% of rated. Current reading accuracy is 1% of reading +0.1% of rated.			

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Operating temperature	-20		+40	°C	
Storage temperature	-40		+85	°C	
Protection	Automatic current regulation protects against all overloads, including arcs and short circuits. Thermal switches and RPM sensing fans protect against thermal overload. Fuses, surge-limiting resistors, and low energy components provide ultimate protection.				
RoHS	Restriction of the use of Hazardous Substances				

EMC: emissions

Phenomenon	Standard	Test level	Notes & conditions
Conducted	EN61000-6-4		
Radiated	EN61000-6-4		

EMC: immunity

Phenomenon	Standard	Test level	Notes & conditions
Conducted	EN61000-6-2:2005		
Radiated	EN61000-6-2:2005		
Line harmonics	EN61000-3-2		

Safety approvals

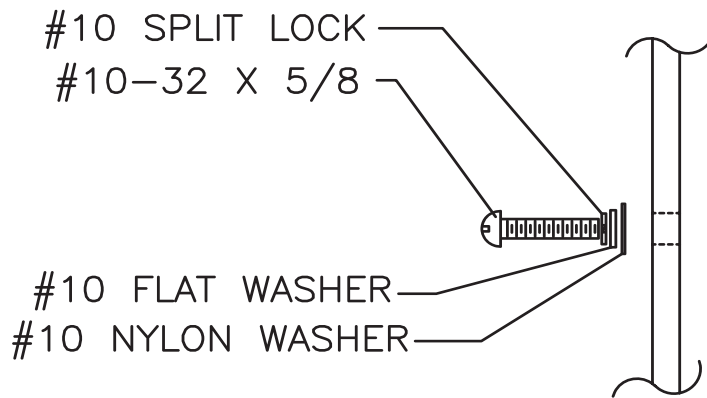
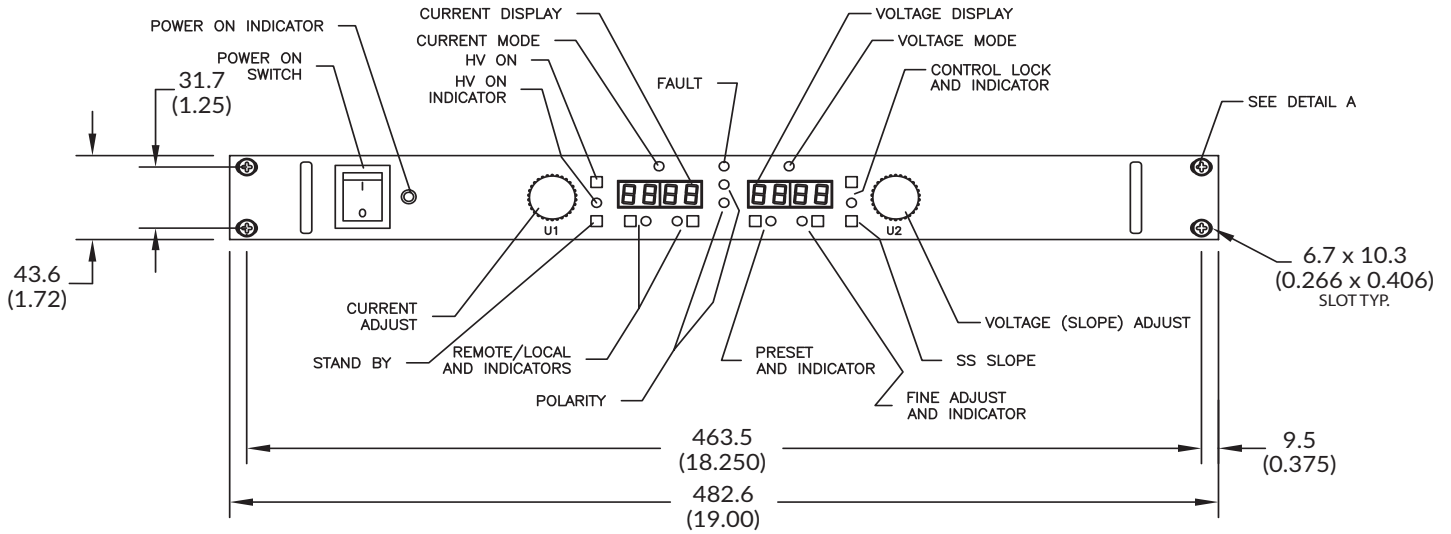
Certification	Standard	Notes & conditions
EN	EN61010/IEC61010	Safety
CE	Meets all applicable directives	
UKCA	Meets all applicable legislation	

Notes:

1. Full compliance with European Directives for FR Series models ordered with F22 option.
2. Specifications apply from 5% to 100% rated voltage.
3. Operation is guaranteed down to 0 voltage with a slight degradation of performance.

Mechanical details

Front



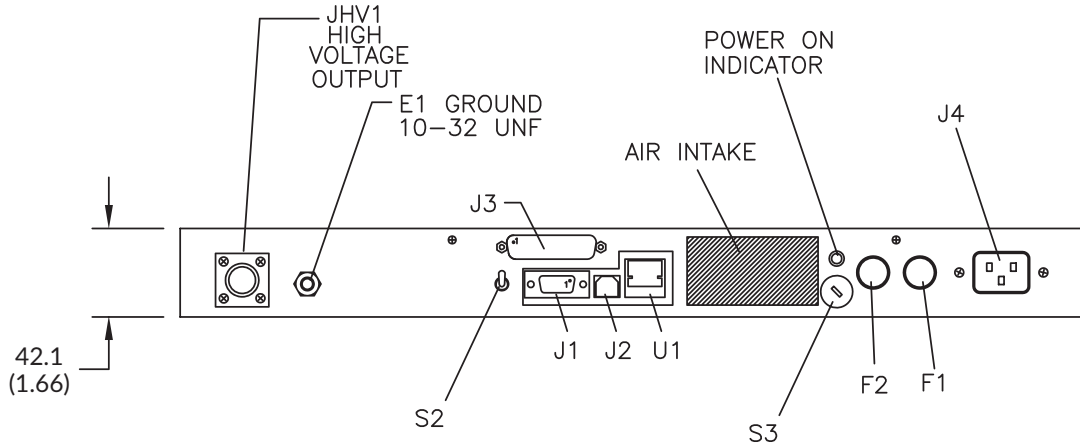
DETAIL A

Notes:

1. All dimensions shown in mm (inches).
2. Weight: 6.4kg (14lbs) approx.

Mechanical details

Rear view



J1	
Pin	Function
1	DCD
2	RX
3	TX
4	DTR
5	COMMON
6	DSR
7	RTS
8	CTS

J2	
Pin	Function
1	+5V
2	D-
3	D+
4	COMMON

U1 Option	
Pin	Function
1	TXD+
2	TXD-
3	RXD+
4	E POWER+
5	E POWER+
6	RXD-
7	E POWER-
8	E POWER-

J4
Input receptacle C14 per: IEC60320

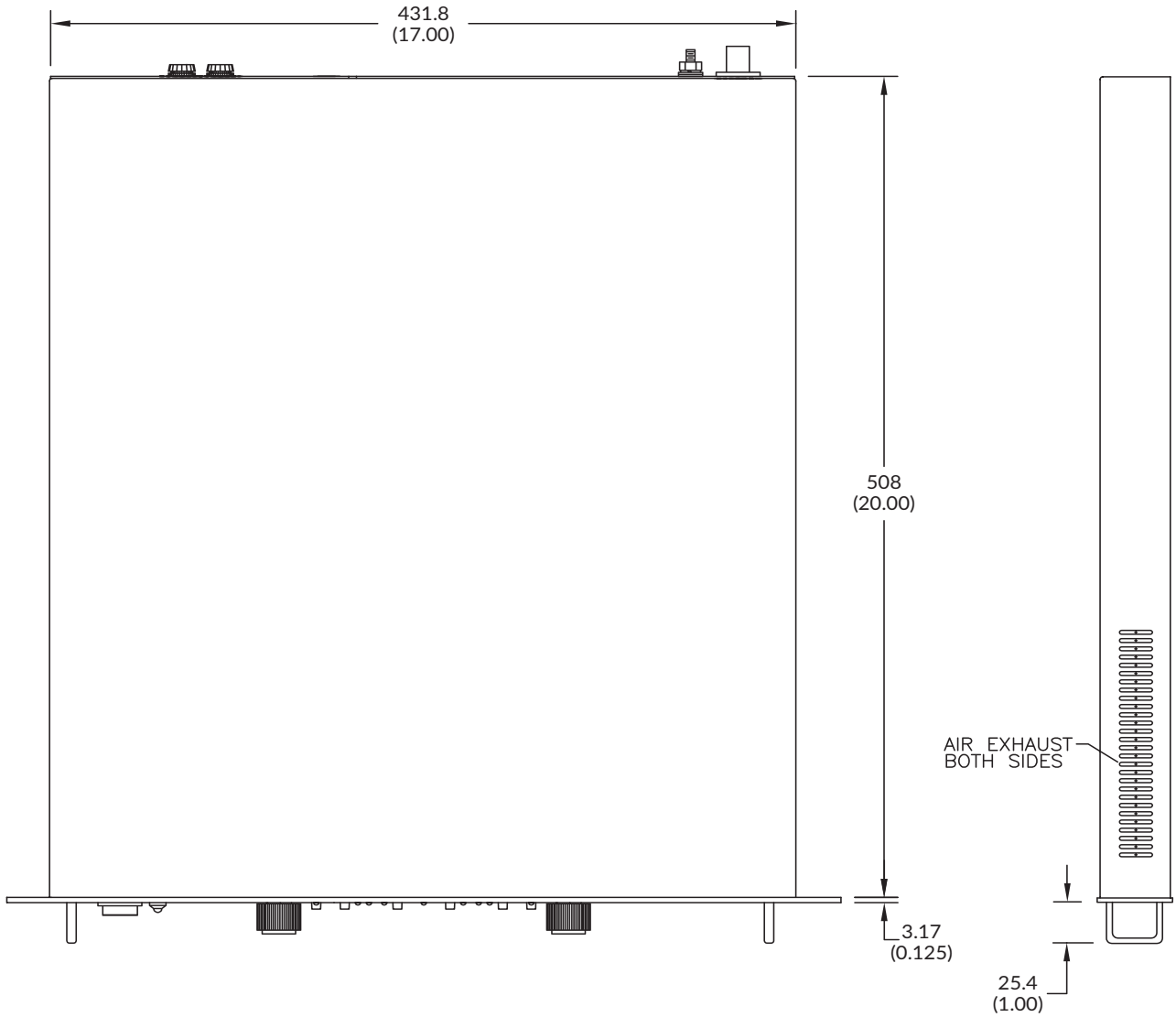
S2	S3
CT/CL select	115/230VAC selector

JHV1: HV output
1kV to 5kV KINGS SHV 1704-1 or equivalent
6kV to 60kV AMPHENOL 83-1R-RFX or equivalent

J3					
Pin	Function	Pin	Function	Pin	Function
1	GROUND	10	CURRENT MONITOR	19	RESERVED
2	COMMON	11	COMMON	20	HV ENABLE
3	INTERLOCK	12	REFERENCE	21	HV STATUS
4	RESERVED	13	RESERVED	22	FAULT STATUS
5	RESERVED	14	RESERVED	23	MODE STATUS
6	VOLTAGE PROGRAM	15	REMOTE HV ON	24	ARC STATUS
7	CURRENT PROGRAM	16	REMOTE HV ON	25	GROUND
8	COMMON	17	RESERVED		
9	VOLTAGE MONITOR	18	RESERVED		

Mechanical details

Front & typical side view



Notes:

1. All dimensions shown in mm (inches).
2. Weight: 6.4kg (14lbs) approx.

Specifications subject to change without notice.