Advanced Energy®

ULTRAVOLT® EFL SERIES

ENHANCED FLOATING HOT DECK LOW-VOLTAGE POWER SUPPLIES WITH ISOLATED DIGITAL AND ANALOG I/O

Enhanced floating hot deck low-voltage power supplies

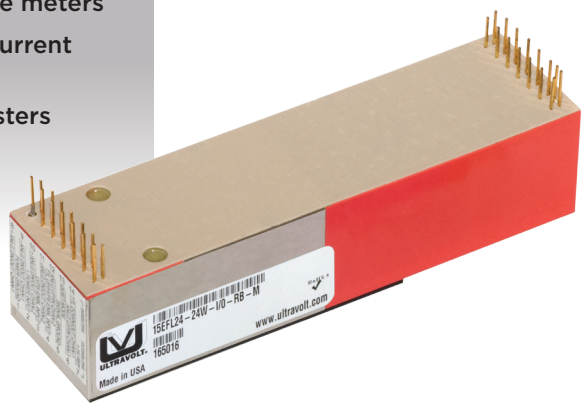
The EFL series of floating hot deck, low-voltage (LV) power supplies offers an integrated solution for systems requiring LV power and controls with high voltage isolation. Combining a highly isolated, DC-to-DC, multi-output low-voltage power supply (LVPS) with an advanced isolated digital and analog I/O topology, the EFL sub-system provides both power and controls to floating-hot-deck circuitry. This solution, when combined with one or more UltraVolt® HVPS or other circuitry, can provide high-performance solutions for a variety of applications.

Features

- Precision analog control
- Linearity of ±0.05% and accuracy of ±0.2%
- 10ppm temperature coefficient
- Isolated up to 15 kV or 30 kV
- Isolation resistance of 150 GΩ (15 kV) or 2 GΩ (30 kV)
- 4 regulated floating LV power outputs
- Isolated digital and analog I/O to and from floating hot deck

Typical Applications

- Floating/stacked ion or e-beam biases
- Floating filament bias
- Floating pulsers and gated grids
- Floating capacitance meters
- Floating high side current monitors
- Floating leakage testers



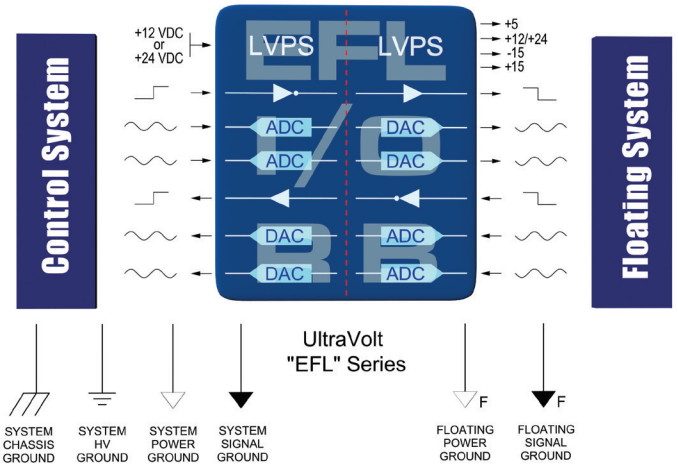
NORMAL, HALF-QUIET, AND QUIET MODES

All EFLs feature a mode control. Three different models—normal, half-quiet, and quiet—are selectable via the voltage level at the mode pin. A voltage between -1.0 and +0.8 V keeps the unit in normal mode; the up and down analog channels follow their inputs. If the mode feature is not used, the mode pin must be grounded for the EFL to operate properly.

A voltage more negative than -4.00 V places the EFL in half-quiet mode. The up channels do not respond to changes in their inputs in half-quiet mode.

A voltage greater than +3.75 V and less than +5.0 V places the EFL in quiet mode. In quiet mode, the up and down channels do not respond to changes in their inputs.

The voltage level at the mode pin must not exceed +5.0 V at any time. Please contact Advanced Energy® for an analysis of your requirements.



Note: If a voltage > 0.8 V is applied to the mode pin, it must source less than 400 µA.

PARAMETER	CONDITIONS	MODELS			UNITS
Input Power		**12 W**	**24 W**	**36 W (15 kV only)**	
Voltage Range	Full Power	+12 ±5%	+24 ±10%	+24 ±10%	VDC
Current	Standby (Disabled)	< 150	< 100	< 100	mA
Current	No Load	< 0.50	< 0.50	< 0.50	A
Current	Max Load	< 2.50	< 2.30	< 3.00	A
AC Ripple Current	Nominal Input, Full Load	< 50	< 50	< 50	mA pk to pk
Local Controls: Reference		**All Types**			
Output Voltage	T = +25°C, Initial Value	+5.1 ±2%			VDC
Output Impedance	T = +25°C	464 ±1%			Ω
Stability	Over Full Temperature Range	0.4			mV/°C
Local Controls: LVPS Enable/Disable		**All Types**			
Power Supply On	Open, or a Voltage Above TTL High (Isource < 400 µA)	+3.2 to 5			VDC
Power Supply Off	Grounded, or a Voltage Below TTL Low	< 0.8 (Isink 1 mA min)			VDC
Input/Output Isolation		**15EFL**	**30EFL**		
Isolation Voltage	Continuous	15	30		kV
Isolation Resistance	All Inputs to All Outputs	150	2		GΩ
Leakage Capacitance	All Inputs to All Outputs	< 40 std, < 50 "-E"	< 40 std		pF

PARAMETER	CONDITIONS	MODELS			UNITS
Isolated Power Outputs		12 W	24 W	36 W (15 kV only)	
Output #1 Power	Nominal Input, Max Iout	12	24	36	W
Output #1 Voltage	Nominal Input Voltage Range	+12 ±2%	+24 ±2%	+24 ±2%	VDC
Output #1 Current	Min to Max	0 to 1	0 to 1	0 to 1.5	A
Output #1 Line Regulation	Nominal Input Range, Full Load	< 0.1%	< 0.1%	< 0.1%	VDC
Output #1 Load Regulation	No Load to Full Load	< 0.25%	< 0.30%	< 0.40%	VDC
Output #1 Ripple	Full Load	< 2.5%	< 1.5%	< 1.5%	V pk to pk
Output #2 and #4 Voltage	Nominal Input Voltage Range	±15 ±5%	±15 ±5%	±15 ±5%	VDC
Output #2 and #4 Current	Min to Max	0 to 50	0 to 50	0 to 50	mA
Output #2 and #4 Line Regulation	Nominal Input Range, Full Load	< 0.3%	< 0.3%	< 0.3%	VDC
Output #2 and #4 Load Regulation	No Load to Full Load	< 5%	< 1%	< 1%	VDC
Output #2 and #4 Ripple	Full Load	< 2.5%	< 2.5%	< 2.5%	V pk to pk
Output #3 Voltage	Nominal Input Voltage Range	+5.1 ±1%	+5.1 ±1%	+5.1 ±1%	VDC
Output #3 Current	Min to Max	500	500	500	mA
Output #3 Line Regulation	Nominal Input Range, Full Load	< 1%	< 1%	< 1%	VDC
Output #3 Load Regulation	No Load to Full Load	< 1%	< 1%	< 1%	VDC
Output #3 Ripple	Full Load	< 4%	< 4%	< 4%	V pk to pk
Isolated Controls: TTL Channel "Up"		All Types			
Local Input	Source Voltage, Sink Current	0 ≤ 0.5 (Isink 3 mA min)			
		1 ≥ 2.4 (300 µA max or open collector)			VDC
Isolated Output	Inverted and Buffered TTL	1 ≥ 2.4, 0 ≤ 0.55 ± (sources 0.8 mA, sinks 3 mA)			VDC
Baud Rate	Duty Cycle	< 15			ms
Isolated Controls: Analog "Up"		12 V	24 V		
Local Input Voltage	Range	0 to +5	0 to +10		VDC
Isolated Output Voltage	Range	0 to +5	0 to +10		VDC
Local Input Impedance		20.0 K			Ω
Initial Offset Error		< ±2			mV
Gain Error	Full Scale	< ±0.2%			VDC
Linearity Error	Full Scale	< ±0.05%			VDC
Stability	30 Min Warmup, Per 8 h, per day	< 0.02%			VDC
Temperature Coefficient	0 to +55 °C	< ±10			ppm/°C
Bandwidth	Symmetric or Asymmetric Signal	DC to 4			Hz

-RB' ISOLATED CONTROLS: TTL CHANNEL "DOWN"

Parameter	Conditions	All Types	Units
Isolated 'Hot Deck' Input	Source Coltage, Sink Current	0 ≤ 0.5 (Isink 1 mA Min)	VDC
		1 ≥ 2.4 (300 µA max or open collector)	
Local Output	Inverted and Buffered TTL	1 > 2.4 (sources 0.8 mA)	VDC
		0 < 0.55 (sinks 10 mA)	
Propagation Delay	Duty Cycle	< 15	ms

ISOLATED CONTROLS: ANALOG CHANNELS #1 and #2 "DOWN"*

Parameter	Conditions	All Types	Units
Isolated 'Hot Deck' +Input	Range	0 to +5 for 12 V and 0 to +10 for 24 V	VDC
Isolated 'Hot Deck' -Input	Range	0 to –5 for 12 V and 0 to –10 for 24 V	VDC
Isolated 'Hot Deck' + or -Input impedance	Signal Source	> 10	MΩ
Local Output +Voltage	Range	0 to +5 for 12 V and 0 to +10 for 24 V	VDC
Local Output -Voltage	Range	0 to –5 for 12 V and 0 to –10 for 24 V	VDC
Initial Offset Error	Signal Source	< ± 2	mVDC
Gain Error	Full Scale	< ±0.2%	VDC
Linearity Error	Full Scale	< ±0.05%	VDC
Stability	30 Min Warmup, Per 8 h, Per Day	< 0.01%/< 0.02%	VDC
Temperature Coefficient	-20 to +55°C	< ±10	ppm/°C
Bandwidth	Symmetric or Asymmetric Signal	DC to 4	Hz
Temperature	**Conditions**	**All Types**	
Operating	Full Load, Case Measurement	-20 to +55	°C
Storage	Non-operating, Case Measurement	-55 to +85	°C
Thermal Shock	Mil-Std-810, Method 503-4, Proc. II	-20 to +55	°C
Altitude		**All Types**	
Operating	All Operating Conditions	Sea level to vacuum	-
Storage	Non-operating	Sea level to vacuum	-
Shock and Vibration		**All Types**	
Shock	Mil-Std-810, Method 516.5, Proc. IV	20	Gs
Vibration	Mil-Std-810, Method 514.5, Fig. 514.5C-3	10	Gs

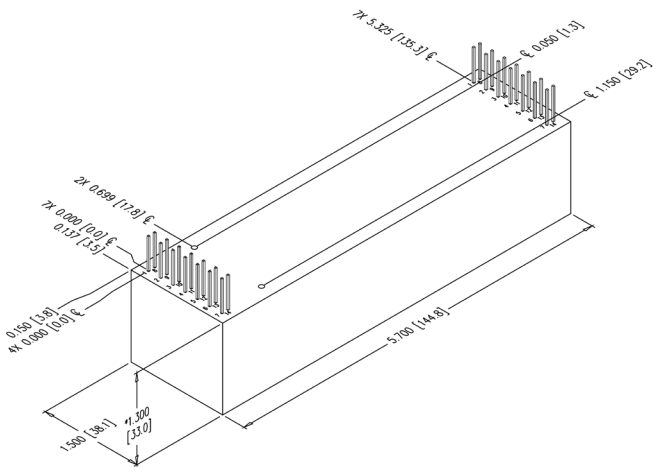
Note: Analog channels #1 and #2 DOWN parameters are valid for outputs in the range of 10 to 100% of maximum.

LOCAL CONNECTIONS

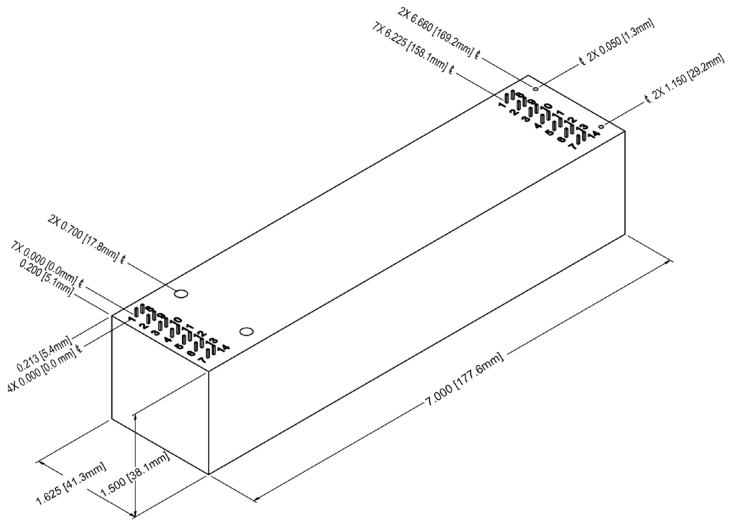
Pin	Function
1	INPUT POWER GROUND RETURN
2	POSITIVE POWER INPUT
3	LVPS ENABLE/DISABLE/SYNC IN
4	TTL UP
5	SIGNAL GROUND RETURN
6	ANALOG UP CHANNEL 1
7	+5 V REFERENCE OUTPUT
8	ANALOG DOWN CHANNEL 1, +
9	ANALOG DOWN CHANNEL 1, -
10	ANALOG DOWN CHANNEL 2, +
11	ANALOG DOWN CHANNEL 2, -
12	ANALOG UP CHANNEL 2
13	MODE
14	TTL OUTPUT (INVERTED DIGITAL DOWN CHANNEL 1)

ISOLATED/FLOATING CONNECTIONS

Pin	Function
1	ANALOG DOWN CHANNEL 1, +
2	ANALOG DOWN CHANNEL 1, -
3	ANALOG DOWN CHANNEL 2, +
4	ANALOG DOWN CHANNEL 2, -
5	+15 VDC OUTPUT
6	ANALOG UP CHANNEL 2
7	FLOATING TTL INPUT (DIGITAL DOWN CHANNEL 1)
8	FLOATING POWER GROUND RETURN
9	FLOATING +12 VDC OR +24VDC OUTPUT
10	FLOATING -15 VDC OUTPUT
11	FLOATING TTL UP
12	FLOATING SIGNAL GROUND RETURN
13	FLOATING ANALOG UP CHANNEL 1
14	FLOATING +5.1 VDC REFERENCE OUTPUT



15EFL Module



30EFL Module

Note: Pins appear shorter in the outline drawing than actual module to ease visibility of pinout numbers. Minimum pin height from the cover is 7.62 mm (0.300").

PHYSICAL SPECIFICATIONS

Construction	Epoxy-filled DAP box certified to ASTM-D-5948
Size	
Volume	15EFL: 181.9 cc (11.1 in^3)
	30EFL: 275.3 cc (16.8 in^3)
Weight	15EFL: 377.1 g (13.3 oz)
	30EFL: 569.8 g (20.1 oz)
Tolerance	
Overall	±1.27 mm (0.050")
Pin to Pin	±0.38 mm (0.015")
15EFL	Mounting hole locations ±0.64 mm (0.025")
30EFL	Mounting hole locations ±0.76 mm (0.030")

ORDERING INFORMATION

Type	15 kV Isolation	15EFL
	30 kV Isolation	30EFL
Input Voltage	12 VDC Nominal	12
	24 VDC Nominal	24
Power	Watts Output (12 Vin Only)	-12 W
	Watts Output (24 Vin Only)	-24 W
	Watts Output (15 kVout, 24 Vin Only)	-36 W
Standard Features	(1) Digital Up Channel and (2) Analog Up Channels	-I/O
	(1) Digital Down Channel and (2) Analog Down Channels	-R/B
Options	Partial Mu-Metal Shield	-M
Case	Plastic Case—Diallyl Phthalate	Standard
	"Eared" Chassis Mounting Plate (15 kV only)	-E

RoHS COMPLIANT

Non-RoHS compliant units are available. Please contact the factory for more information.

Example: **15EFL12-12W-I/O-RB**

Type — Isolation — Model — Input — Power

For international contact information, visit
advanced-energy.com.

ENG-HV-EFLSeries-230-H 4.16