

# ULTRAVOLT FL SERIES

FLOATING HOT DECK LVPS WITH ISOLATED DIGITAL AND ANALOG I/O



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

## PRODUCT HIGHLIGHTS

- Isolated up to 15 kV
- DC leakage current of <10 nA
- AC leakage capacitance of <40 pF
- 3 regulated floating LV power outputs
- Isolated digital and analog I/O to and from floating hot deck
- UL/cUL Recognized Component; CE Mark (LVD & RoHS)

## TYPICAL APPLICATIONS

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

## AT A GLANCE

### Nominal Output Voltage

Output #1: +12/+24 VDC  
Output #2: -15 VDC  
Output #3: +5.6 VDC

### Maximum Output Power

12, 24 W

### Isolation Voltage

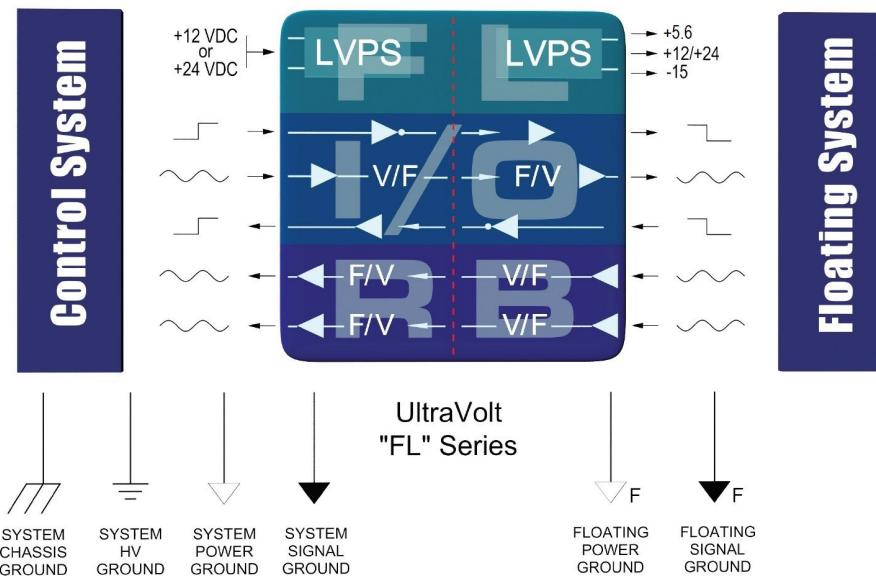
15 kV

### Temperature Coefficient

<50 ppm/°C

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### FL SERIES



## ELECTRICAL SPECIFICATIONS

| Parameter                                     | Conditions                           | Models                               |                    | Units       |
|---|--------------------------------------|--------------------------------------|--------------------|-------------|
| Input   |                                      | 12 V                                 | 24 V               |             |
| Voltage Range                                 | Full Power                           | +12 $\pm$ 5%                         | +24 $\pm$ 10%      | VDC         |
| Voltage Range                                 | Derated Power Range                  | +10.8 to +16                         | +21.6 to +30       | VDC         |
| Current                                       | Standby (Disabled)                   | <90                                  | <50                | mA          |
| Current                                       | No Load                              | <0.15                                | <0.15              | A           |
| Current                                       | Max Load                             | <1.6                                 | <1.4               | A           |
| AC Ripple Current                             | Nominal Input, Full Load             | <80                                  | <100               | mA pk to pk |
| Local Controls: Reference                     |                                      | All Types                            |                    |             |
| Output Voltage                                | T = +25°C, Initial Value             | +5.1 $\pm$ 2%                        |                    | VDC         |
| Output Impedance                              | T = +25°C                            | 464 $\pm$ 1%                         |                    | $\Omega$    |
| Stability                                     | Over Full Temperature Range          | 0.2                                  |                    | mV/°C       |
| Local Controls: Reference LVPS Enable/Disable |                                      | All Types                            |                    |             |
| Power Supply On                               | Open, or a Voltage Above TTL High    | +2.4 to 32                           |                    | VDC         |
| Power Supply Off                              | Grounded, or a Voltage Below TTL Low | 0 to +0.7 $\pm$ 0.2 (Isink 1 mA min) |                    | VDC         |
| Input/Output Isolation                        |                                      | 12 V                                 | 24 V               |             |
| Isolation Voltage                             | Continuous                           | 15                                   | 15                 | kV          |
| Leakage Current                               | All Inputs to All Outputs            | <10 std, <100 “-E”                   | <10 std, <100 “-E” | nA          |
| Leakage Capacitance                           | All Inputs to All Outputs            | <40 std, <50 “-E”                    | <50 std or “-E”    | pF          |

| Parameter                 | Conditions                     | Models        |               | Units      |
|---------------------------|--------------------------------|---------------|---------------|------------|
| Isolated Power Outputs    |                                | 15FL12-12W    | 15FL24-24W    |            |
| Output #1 Power           | Nominal Input, Max Iout        | 12            | 24            | W          |
| Output #1 Voltage         | Nominal Input Voltage Range    | +12 $\pm$ 2%  | +24 $\pm$ 2%  | VDC        |
| Output #1 Current         | Min to Max                     | 0 to 1        | 0 to 1        | A          |
| Output #1 Line Regulation | Nominal Input Range, Full Load | <0.1%         | <0.1%         | VDC        |
| Output #1 Load Regulation | No Load to Full Load           | <0.1%         | <0.1%         | VDC        |
| Output #1 Ripple          | Full Load                      | <2%           | <1%           | V pk to pk |
| Output #2 Voltage         | Nominal Input Voltage Range    | -15 $\pm$ 1   | -15 $\pm$ 1   | VDC        |
| Output #2 Current         | Min to Max                     | 0 to 10       | 0 to 10       | mA         |
| Output #2 Line Regulation | Nominal Input Range, Full Load | <0.1%         | <0.1%         | VDC        |
| Output #2 Load Regulation | No Load to Full Load           | <2%           | <2%           | VDC        |
| Output #2 Ripple          | Full Load                      | <2%           | <2%           | VDC        |
| Output #3 Voltage         | Nominal Input Voltage Range    | +5.6 $\pm$ 5% | +5.6 $\pm$ 5% | VDC        |
| Output #3 Current         | Min to Max                     | 0 to 10       | 0 to 10       | mA         |
| Output #3 Line Regulation | Nominal Input Range, Full Load | <1%           | <1%           | VDC        |
| Output #3 Load Regulation | No Load to Full Load           | <1%           | <1%           | VDC        |
| Output #3 Ripple          | Full Load                      | <1%           | <1%           | V pk to pk |

## ELECTRICAL SPECIFICATIONS (CONTINUED)

| Parameter   | Conditions                      | Models  | Units  |
|---|---------------------------------|---|--------|
| <b>Isolated Controls: TTL Channel "Up"</b>                      |                                 | <b>All Types with -I/O Option</b>   |        |
| Local Input   | Source Voltage, Sink Current    | 10 MΩ internal pull up to +15 V   | VDC    |
|   |                                 | <1 V low, >2.5 V high   | VDC    |
| Isolated Output   | Inverted and Buffered TTL       | Open collector with internal 1 kΩ pull up to +5 V<br>(Can sink 10 mA max) | VDC    |
| Bandwidth   | Varying Duty Cycle              | DC to >300  | kHz    |
| <b>Isolated Controls: Analog "Up"</b>                           |                                 | <b>All Types with -I/O Option</b>   |        |
| Local Input Voltage   | Range                           | 0 to +5   | VDC    |
| Isolated Output Voltage   | Range                           | 0 to +5   | VDC    |
| Local Input Impedance   |                                 | 10 Meg  | Ω      |
| Isolated Output Impedance                                       |                                 | Buffered low impedance  | -      |
| Initial Offset Error  |                                 | <±1%  | mV     |
| Gain Error  | Full Scale                      | <±2%  | VDC    |
| Linearity Error   | 0 to Full Scale                 | <±1%  | VDC    |
| Stability   | 30 Min Warmup, Per 8 h, Per Day | <0.01% / <0.02%   | VDC    |
| Temperature Coefficient   | 0 to +55°C                      | <±50  | ppm/°C |
| Bandwidth   | Symmetric or Asymmetric Signal  | DC to 30 (-3dB point is 47 Hz)  | Hz     |
| <b>-RB' Isolated Controls: TTL Channel "Down"</b>               |                                 | <b>All Types with -I/O-R/B Option</b>                                     |        |
| Isolated 'Hot Deck' Input                                       | Source Voltage, Sink Current    | 10 MΩ internal pull up to +15 V   | VDC    |
|   |                                 | <1 V low, >2.5 V high   | VDC    |
| Local Output  | Inverted and Buffered TTL       | Open collector with internal 1 kΩ pull up to +5 V<br>Can sink 10 mA max   | VDC    |
| Bandwidth   | Varying Duty Cycle              | DC to >300  | kHz    |
| <b>-RB' Isolated Controls: Analog Channels #1 and #2 "Down"</b> |                                 | <b>All Types with -I/O-R/B Option</b>                                     |        |
| Isolated 'Hot Deck' +Input                                      | Range                           | 0 to +5, 0 to +10 with >+15 VDC input power                               | VDC    |
| Isolated 'Hot Deck' -Input                                      | Range                           | 0 to -5, 0 to -10 with >+15 VDC input power                               | VDC    |
| Isolated 'Hot Deck' + or -Input impedance                       | Signal Source                   | >10   | MΩ     |
| Local Output +Voltage   | Range                           | 0 to +5, 0 to +10 with >+15 VDC input power                               | VDC    |
| Local Output -Voltage   | Range                           | 0 to -5, 0 to -10 with >+15 VDC input power                               | VDC    |
| Local Output Impedance  | Signal Source                   | Buffered low impedance  | Ω      |
| Initial Offset Error  | Signal Source                   | <±5   | mVDC   |
| Gain Error  | Full Scale                      | <±1%  | VDC    |
| Linearity Error   | 0 to Full Scale                 | <±1%  | VDC    |
| Stability   | 30 Min Warmup, Per 8 h, Per Day | <0.01% / <0.02%   | VDC    |
| Temperature Coefficient   | -20 to +55°C                    | <±50  | ppm/°C |
| Bandwidth   | Symmetric or Asymmetric Signal  | DC to 30 (-3dB point is 47 Hz)  | Hz     |

## ELECTRICAL SPECIFICATIONS (CONTINUED)

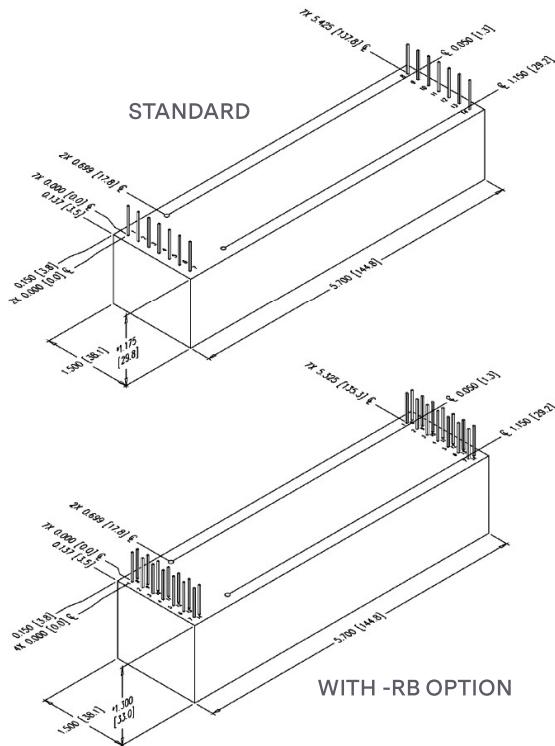
| Parameter                  | Conditions                            | Models              | Units             |
|----------------------------|---------------------------------------|---------------------|-------------------|
| <b>Environmental</b>       |                                       | <b>All Types</b>    |                   |
| Operating Temperature      | Full Load, Case Measurement           | -20 to +55°C        |                   |
| Storage Temperature        | Non-operating, Case Measurement       | -55 to +85°C        |                   |
| Thermal Shock Temperature  | Mil-Std-810, Method 503-4, Proc. II   | -20 to +55°C        |                   |
| Operating Altitude         | All Operating Conditions              | Sea level to vacuum |                   |
| Storage Altitude           | Non-operating                         | Sea level to vacuum |                   |
| <b>Shock and Vibration</b> |                                       | <b>Standard</b>     | <b>-RB Option</b> |
| Shock                      | Mil-Std-810, Method 516.5, Proc. IV 2 | 20 Gs               | 20 Gs             |
| Vibration                  | Mil-Std-810, Method 514.5, Fig.       | 10 Gs               | 10 Gs             |

# ULTRAVOLT FL SERIES

## MECHANICAL SPECIFICATIONS

| Construction |  |
|--------------|--|
| Case         | Epoxy-filled DAP box certified to ASTM-D-5948  |
| Volume       | Standard: 163.9 cc (10.3 in <sup>3</sup> )<br>-R/B Option: 182 cc (11.1 in <sup>3</sup> )                                |
| Weight       | Standard: 340.2 g (12.0 oz)<br>-R/B Option: 377.1 g (13.3 oz)  |
| Tolerance    | Overall $\pm 0.050$ " (1.27 mm)<br>Pin to Pin $\pm 0.015$ " (0.38 mm)<br>Mounting hole locations $\pm 0.025$ " (0.64 mm) |

Note: 24-watt versions are an additional 0.062" (1.57 mm) in height.  
-M equipped units are an additional 0.030" (0.76 mm) in height.  
Contact Advanced Energy for drawings of models equipped with -E options.



## INTERFACE

| Local Connections |  |
|-------------------|--|
| Pin               | Function   |
| 1                 | Input Power Ground Return                            |
| 2                 | Positive Power Input                                 |
| 3                 | LVPS Enable/Disable                                  |
| 4                 | TTL Up HVPS Enable/Disable (-I/O Only)               |
| 5                 | Signal Ground Return                                 |
| 6                 | Analog Up/ HVPS Remote Programming Input (-I/O Only) |
| 7                 | +5 V Reference Output                                |

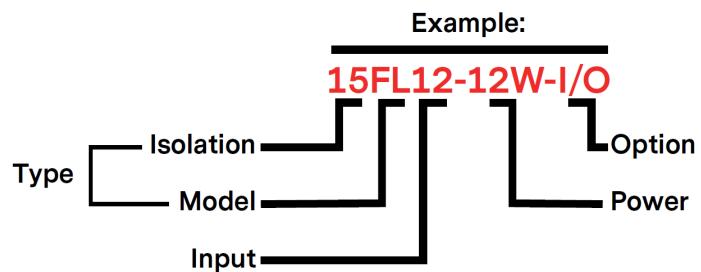
| Isolated / Floating Connections |  |
|---------------------------------|--|
| Pin                             | Function   |
| 8                               | Floating Power Ground Return                                 |
| 9                               | Floating +12 VDC or +24 VDC Output                           |
| 10                              | Floating -15 VCD Output                                      |
| 11                              | Floating TTL Up/HVPS Enable/Disable (-I/O Only)              |
| 12                              | Floating Signal Ground Return                                |
| 13                              | Floating Analog Up/HVPS Remote Programming Input (-I/O Only) |
| 14                              | Floating +5.6 VDC Reference Output                           |

| Additional Local Connections (-R/B Option) |  |
|--|--|
| Pin  | Function                                     |
| 8  | +Iout Monitor Output (Analog Down Channel 1) |
| 9  | -Iout Monitor Output (Analog Down Channel 1) |
| 10   | +Eout Monitor Output (Analog Down Channel 2) |
| 11   | -Eout Monitor Output (Analog Down Channel 2) |
| 12   | N/C  |
| 13   | N/C  |
| 14   | TTL Output (Digital Down Channel 1)          |

| Additional Isolated/Floating Connections (-R/B Only) |   |
|--|---|
| Pin  | Function  |
| 1  | Floating +Iout Monitor Output (Analog Down Channel 1) |
| 2  | Floating -Iout Monitor Output (Analog Down Channel 1) |
| 3  | Floating +Eout Monitor Output (Analog Down Channel 2) |
| 4  | Floating -Eout Monitor Input (Analog Down Channel 2)  |
| 5  | N/C   |
| 6  | N/C   |
| 7  | Floating TTL Input (Digital Down Channel 1)           |

## ORDERING INFORMATION

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



## ABOUT ADVANCED ENERGY

Since 1981, Advanced Energy (AE) — and its UltraVolt® family of products — has perfected how power performs for its customers. For both end users and OEMs, AE's comprehensive portfolio of standard and custom high-voltage components precisely match system specifications to deliver unparalleled energy, quality, and performance. Through close customer collaboration, design expertise, application insight, and world-class support, AE creates successful partnerships and enables customers to push the boundaries of innovation and stay ahead of evolving market needs.

PRECISION | POWER | PERFORMANCE | TRUST



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**CAUTION:**  
High Voltage

Read and understand all documentation before you install, operate, or maintain Advanced Energy high voltage power supplies. Follow all safety instructions and precautions to protect against property damage and serious or possibly fatal bodily injury. Never defeat safety interlocks or grounds.

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