



USER MANUAL

XLB-3000 Short Arc Xenon Lamp Ballast



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Product Overview

The XLB-3000 Xenon lamp ballast is a very compact power supply designed for OEM applications. The XLB-3000 is ideal for high power applications where economy is important and performance cannot be compromised. Compact size is possible due to a low-loss Zero Voltage Switching inverter and incorporation of planar magnetics. Power factor is greater than 0.99 and conducted emissions meet stringent European regulations. No additional line filter is required to meet EN 55011 emission requirements. Lumina Power's XLB series sets the standard for reliable lamp ignition and long-term high-power operation in a low cost, compact package. The XLB-3000 is ideal for medical, projection and industrial applications where a stable light source is essential.

As a Xenon lamp ballast, the XLB-3000 power supply first ignites the lamp with a high voltage pulse and, once the lamp is ignited, acts as a programmable current source delivering constant current based on the input program signal, I_{prog} (+), which is normally 0-10V. The XLB-3000 can be configured for output current up to 102A. Maximum output voltage is 35V. Typical lamp voltages are between 20V and 30V.

The XLB-3000 utilizes a proprietary low loss, high frequency power factor correction circuit which keeps power factor above 0.98. Power factor corrected power supplies use up to 30% less input current and meet stringent IEC harmonic requirements. The output inverter is a state-of-the-art zero voltage switching (ZVS) inverter which permits very high frequency power conversion with minimum losses and electromagnetic noise.

Explanation of Symbols



Hazard: This equipment produces high voltages which can be fatal. Only service personnel of Lumina Power, Inc. are qualified to service this equipment.



High Voltage Present: This power supply produces lethal high voltages. Only service personnel of Lumina Power, Inc. are qualified to service this equipment. Only qualified service personnel are permitted to install this power supply.

XLB-3000 Theory of Operation

(Refer to Figure 1)

The XLB-3000 Xenon lamp ballast has been designed for OEM Xenon lamp industry. With this in mind, the Xenon lamp industry has the following requirements:

- Safe lamp operation
- Reliable short pulse lamp ignition
- Compact size
- Power factor correction to conform with CE requirements
- Low conducted electromagnetic emissions
- Low leakage for medical applications

Referring to Figure 1, the XLB-3000 BLOCK DIAGRAM. The following is a brief description of operation.

AC Input Power Circuitry

AC input power is processed through a line filter to reduce the conducted EMI to an acceptable level. The XLB-3000 line filter has minimum capacitance to ground to minimize leakage currents.

Power Factor Correction Boost Inverter

The rectified input power is next applied to power factor boost inverter. This inverter boosts the input voltage to 400VDC. In the process of boosting the input AC voltage, the input AC current is adjusted so that is always in phase with the input AC voltage. Without this power factor correction circuit, the AC input current would be delivered to the power supply in high amplitude, narrow spikes, having a high harmonic content. With power factor correction, the non-50/60 Hz harmonics are reduced to near zero. Since only the fundamental frequency is now used to deliver power, the efficiency of the power supply is improved considerably.

One problem with standard input power factor correction circuits is that a high frequency switching circuit is placed across the line in the input side of the traditional input capacitor filter. This circuit results in substantial switching noise conducted to the line. Lumina Power employs a proprietary soft-switching boost inverter which produces minimum switching noise, reduces switching losses, and results in a smaller heat sink associated with the power factor circuit.

Zero Voltage Switching (ZVS) Inverter

The ZVS inverter and the output transformer are used to step the 400VDC bus down to the appropriate output value. The ZVS inverter is the most modern high frequency/low loss/low noise topology utilized in power electronics today. Instead of running the inverter in a traditional PWM mode, the inverter is run in a phase shift mode. With the appropriate output inductor and the appropriate capacitance across each switching device - in this case MOSFETS - there are virtually no switching losses in the inverter. The only losses in the devices are I^2R losses associated with the Drain/Source resistance of the

MOSFETS. Therefore, the ZVS inverter also contributes to reduced losses, reduced EMI noise and a reduction in overall system heatsink requirements.

Output Circuit

The output filter is a single stage RC filter designed to keep ripple and output noise very low.

Control Circuit

The control circuit handles all the functions associated with safe operation of the Xenon lamp. Reliable lamp ignition as well as tight current regulation, overvoltage and over power protection are controlled and monitored in the control circuit.

Auxiliary Power

All internal power supply requirements as well as the external +/-15V and +5V power supplies are derived from the power factor control boost inductor. All auxiliary power supplies are regulated by standard linear regulators.

Lamp Igniter Module

The igniter module provides the 40kV pulse required to break down the Xenon gas and facilitate ignition. In standard configurations, the pulse is applied through the positive output to the lamp anode. Power to the module is provided by the main power supply chassis. Internal circuitry in the igniter module senses the presence of the high voltage arc and briefly disables operation in the main power supply chassis in order to minimize damage from high voltage noise.

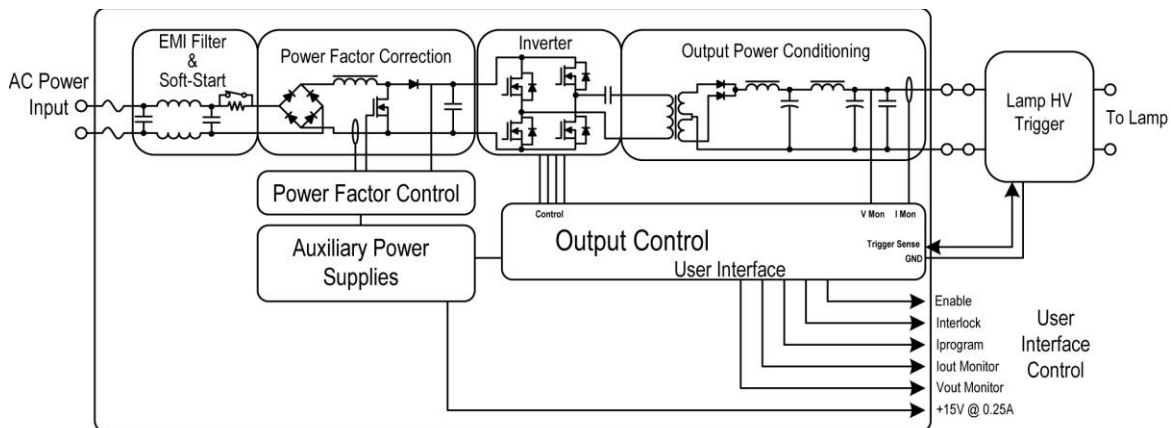


Figure 1
XLB-3000 Block Diagram

XLB-3000-XX-YY Specifications

XX = $I_{out_{max}}$ YY = $V_{out_{max}}$

Model	P _{out max}	I _{out max}	Input Voltage	Size (L x W x H)
XLB-3000-XX-YY	3000W	Configurable to 120A	200-240VAC	13" x 8.55" x 3.43" 33cm x 21.7cm x 8.71cm
Max Lamp Voltage: 35V				
Auxiliary Outputs: +15V @ 0.20A				

Input

Voltage: 200-240VAC, 50/60 Hz, 18.5A @ 208VAC
Power Factor: >.98

Interface

(See interface description page 3)
Connector: 15 Pin D-Type Sub Female

Ignition/Boost

Boost Voltage: 250V
Boost Energy: 500 mJ
Ignition Voltage: Up to 45kV (~1us rise time)
Igniter Polarity: Positive or Negative (Factory Set per customer request)
Ignition Energy: 65mJ
Igniter Dimensions: 5.5" x 3.6" x 2.6"
140 x 92 x 66mm

Performance

Line Regulation: <0.2% of maximum output current
Current Regulation: <0.5% of maximum output current
Current Ripple: <0.5% of maximum output current
Power Limit: Limited to maximum power with powerfold-back circuit

Environment

Operating Temp: 0 to 40°C
Storage: -20 to 85°C
Humidity: 0 to 90% non-condensing
Cooling: Forced air

Regulatory

Leakage Current: <350uA

Approvals:

Medical Safety: UL60601-1, IEC 60601-1, EN 60601-1, CAN/CSA C22.2 No. 601.1-M90
Emissions/Immunity: FCC 47 CFR Class A Emissions, EN55011:1998 Group 1 Class A Emissions, EN61000-3-2 Limits for harmonic current emissions, EN 61000303 Flicker, EN60601-1-2:2001 Electromagnetic emissions and immunity for medical equipment

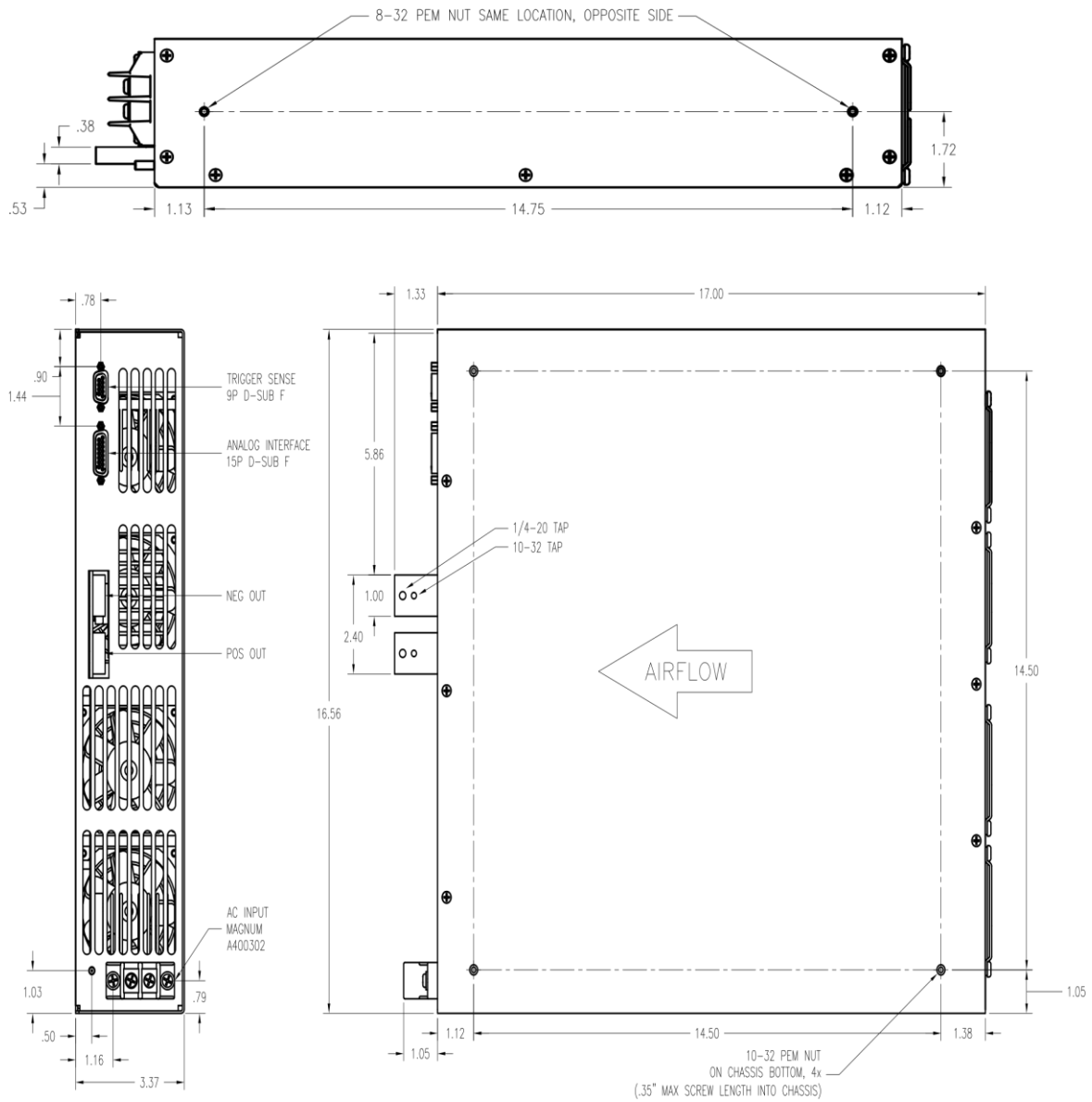


Figure 2
XLB-3000 Chassis Outline Drawing
 (For 3-D model consult factory)

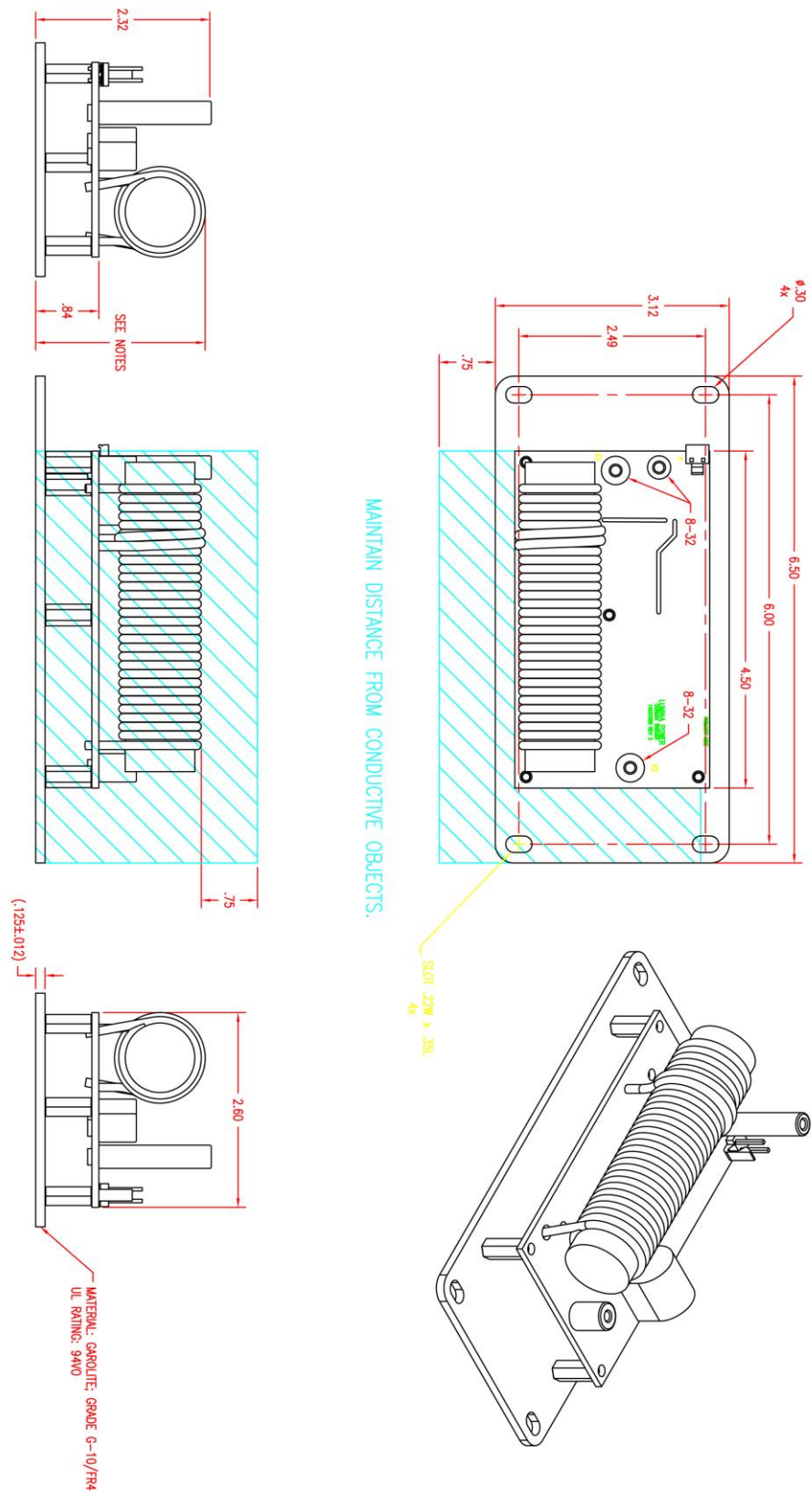


Figure 3
XLB-3000 Igniter
 (For 3-D model consult factory)

XLB-3000-XX-YY Interface

Connector Type: 15 pin D-sub Female
(Refer to Figure 4 XLB-3000 Interface Schematic)

Pin Number	XLB-3000 Pin Name	Functional Voltage Level	Description
1	Lamp On/Off (input) (Note: 1)	High=RUN=5V to 15V Low=OFF=0V	The Lamp On/Off function is the control function which turns the lamp on and off. When the lamp is turned on, a trigger and boost sequence will ignite the lamp and deliver current as programmed via I _{prog} , Pin 7.
2	No connection Do not connect		
3	Interlock (input)	Open=OFF Connect to GND=RUN	The Interlock function can be connected to external interlock switches such as doors or over temp switches.
4, 9, 15	GND		
5	V_{out} Monitor: (output)	0–10V=V _{out max}	The output voltage of the supply can be monitored by V_{out} Monitor .
6	I_{out} Monitor (output)	0–10V=0–I _{out max}	The output current of the supply can be monitored by I_{out} Monitor .
7	I_{prog} (+): (input)	0–10V=0–I _{out max}	The power supply output current is set by applying a 0–10V analog signal to I _{prog} (+). Note that with I _{prog} (+) set between 0V and 2V, when the lamp is turned on via Lamp On/Off , the XLB-3000 will deliver 20% of the maximum current rating of the unit. This is the minimum current required to keep the lamp on. To deliver more than 20% of the maximum rated current, I _{prog} (+) must be set higher than 2V.
8	Lamp On/Off Status (output)	Low=Lamp On High=Lamp Off	The lamp status is monitored and if at least 20% of the rated current of the power supply is flowing through the lamp, the Lamp On/Off Status signal will be pulled low. When the lamp is off, this pin is pulled high to 15V through a 10K resistor.
10, 11, 12	No connection Do not connect		
13, 14	+15V @0.25A (output)		Auxiliary +15V power supply for user. Up to 0.25A output current available.

Table 1: XLB-3000 Interface

Installation and Operation of XLB-3000 Short Arc Xenon Lamp Ballast

The XLB-3000 chassis is rack mountable and is shown in figures 2 and 5. The XLB-3000 Igniter Module has a mounting plate shown in Figure 3.

IMPORTANT HIGH VOLTAGE INSTALLATION NOTE

- The XLB-3000 igniter module produces a 45kV pulse during lamp ignition. The igniter module should be placed as close as possible to the Xenon lamp in order to keep the leads between the igniter and the Xenon lamp as short as possible. No other wires should be in the vicinity of the igniter output wires connecting to the Xenon lamp. The HV pulse produces transients that can be destructive to low signal electronics.
- Please refer to Figure 3, XLB-3000 Igniter Outline Drawing, for information regarding required clearances around the high voltage igniter coil.



SAFETY WARNING

Because XLB-3000 units are designed for OEM applications, the user must connect AC input power to the power supply chassis. Any input AC voltage must be considered extremely dangerous, and as such, care must be taken to connect AC input power to the unit.

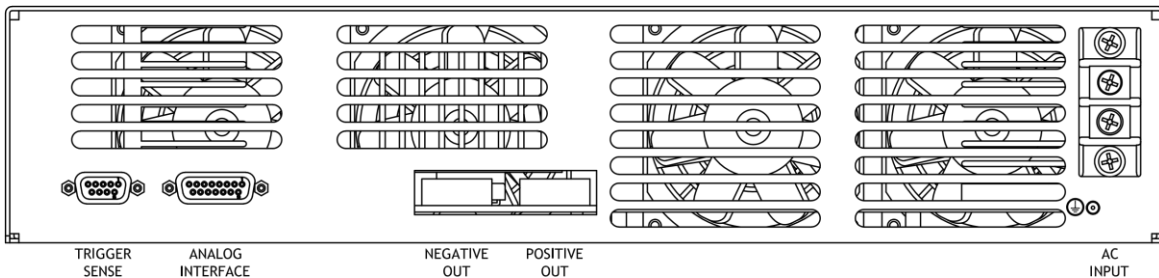
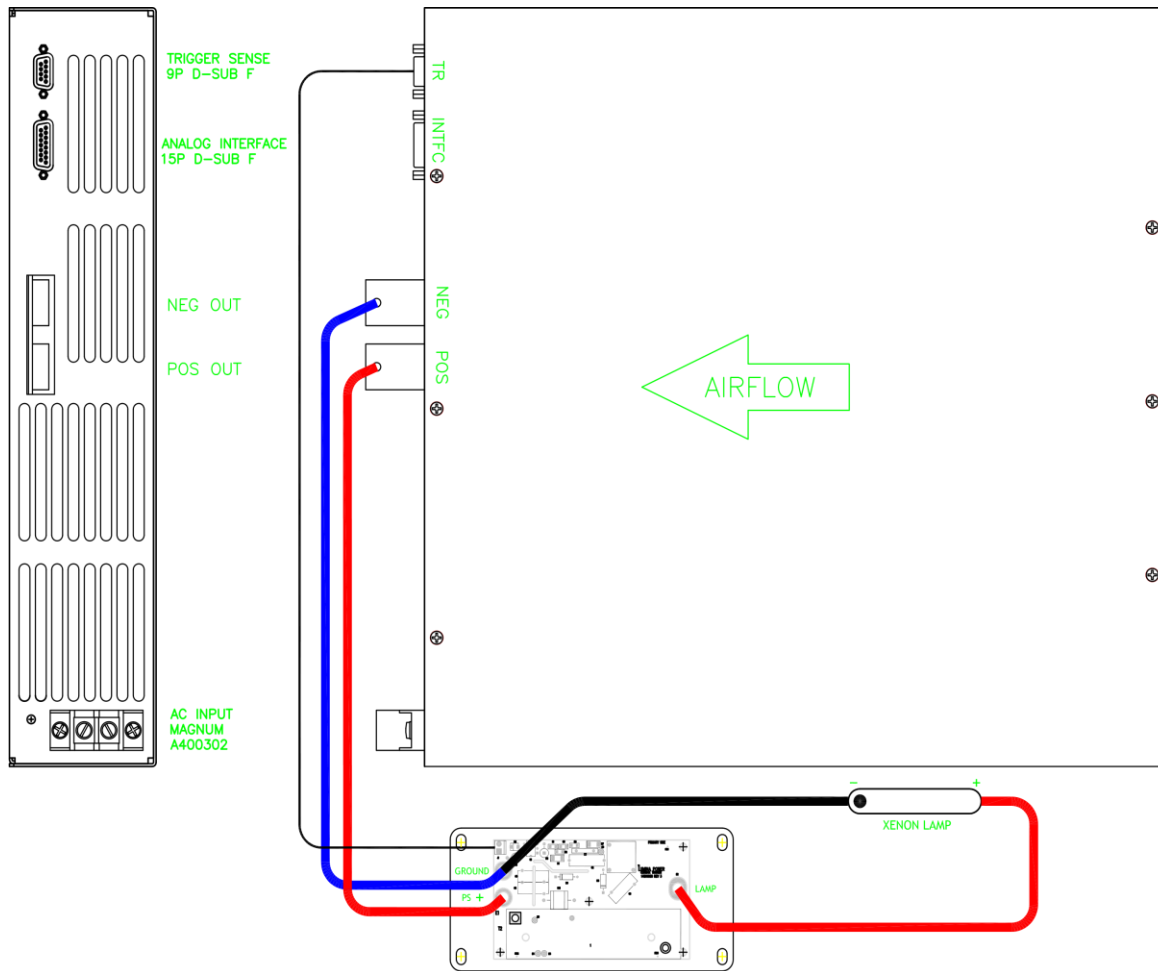


Figure 5
XLB-3000 Input and Output Connections



XLB-3000 INTERCONNECTION DIAGRAM

NOTE: Negative ignition is also available



Figure 6
XLB-3000 Lamp Connections

1. **Connecting to Xenon Lamp:** Figure 6 shows the interconnections between the XLB-3000, the Igniter module and the Xenon lamp. **Because the Igniter module produces a high speed 45kV pulse when igniting the Xenon lamp, it is important to keep connections between the igniter module and the Xenon lamp as short as possible to avoid I^2R losses in the wire. Wire length of 30 cm or less is recommended for reliable ignition!**
2. **TR Igniter Sense Connection:** Connect the TR igniter sense connection wire to the igniter module and the XLB-3000 main power supply chassis. The cable for this connection has been provided. The location of the connections is shown in Figure 6.

IMPORTANT NOTE

Make sure when connecting interface that the current program setting, I_{prog} (+), is set no higher than the value required for Xenon lamp operation. When AC power is applied and system is **Enabled**, output current will rise to this program value

3. **Interface Connection:** Connect the user system to the 15 pin D-sub connector shown in Figure 5. See Table 1 and Figure 4 for description of the XLB-3000 Interface and the associated simplified interface schematic.
4. **Provide Interface Information before applying AC Power:** The unit may be programmed for output current via Pin 7, the I_{prog} function. But there are three interface control signals which must be properly set before the output will deliver current as programmed by I_{prog} .
 - a. **INTERLOCK:** Pin 3, the **Interlock**, must be grounded via Pins 4, 9 or 15 in order for the output to deliver current.
 - b. **Lamp On/Off:** Pin 1, the **Lamp On/Off** signal is a 5V to 24V signal used to turn the output section on.
 - c. **I_{prog} :** Pin 7 accepts a 0-10V signal which results in output current as shown in the table below. Note that even with I_{prog} (+) set between 0V and 2V, when the lamp is turned on via **Lamp On/Off** the XLB-3000 will deliver 20% of the maximum current rating of the unit. This is the minimum current required to keep the lamp on. To deliver more than 20% of the maximum rated current, I_{prog} (+) must be set higher than 2V.

I_{prog} (+) Pin 7	I_{out}
0V	20% I _{o_max}
2V	20% I _{o_max}
4V	40% I _{o_max}
6V	60% I _{o_max}
8V	80% I _{o_max}
10V	100% I _{o_max}

Table 2: Current Control

5. Operating the XLB

- a. **AC Input Power Connection:** Input power is shown below in Table 2. Connect AC power connections to power supply input power terminals. Refer to Figure 5 for location of AC Input.

MODEL	INPUT POWER
XLB-3000-XX-YY	200-240 VAC, 50/60 HZ, 18.5A @ 208VAC

Table 3: XLB-3000 AC Input Power Requirements

IMPORTANT SYSTEM NOTE ON AC INPUT POWER

XLB-3000 units are fused on both input lines. It does not matter which of the two AC inputs are designated Line or Neutral.

IMPORTANT APPLICATION NOTE REGARDING AC INPUT POWER

AC Input wires and Earth Ground wire should be at least **#12 AWG**; rated for at least 300V and 105 °C.

- b. **Interface Settings:** Make sure **Interlock**, Pin 3, is connected to GND via Interface pins 4, 9 or 15.
- c. **Apply Input AC Power:** Turn ON AC power. After a few seconds the power supply fans will begin to run.
- d. **Programming Output Current:** Program the XLB-3000 power supply for the desired output current. A 0-10V signal applied to **I_{prog}**, Pin 7, will program the XLB-3000 diode driver for 0 to maximum rated output current.
- e. **Lamp On/Off:** Apply +5V to +15V to Lamp On/Off, Pin 1.

6. Monitoring the XLB output and performance:

- a. **Current Monitor** Power supply output current can be monitored via pin 6, **I_{out} Monitor**. A 0-10V signal will represent the output current from 0 to maximum rated output current.
- b. **Voltage Monitor** Power supply output voltage can be monitored via pin 5, **V_{out} Monitor**. A 0-10V signal will represent the output voltage from 0-maximum output voltage.
- c. **Lamp On/Off Status:** Once the lamp has successfully ignited and at least 20% of the maximum rated current of the power supply is being delivered to the lamp, the LAMP ON/OFF Status signal will go low.

7. DC Output Connections:

IMPORTANT APPLICATION NOTE REGARDING DC OUTPUT CONNECTIONS

The DC Output can be as high as 120 amps. It is recommended that the user refer to the NEC for wire gauge guide lines for steady state and peak current condition operation. Wire terminations should be sized accordingly and crimped & soldered. Increased resistance due to poor connections will cause voltage drops and I^2R heating which could be dangerous or damaging to improperly sized wires, wire insulation and/or terminations.

8. Servicing the XLB-3000:

XLB-3000 units have no serviceable parts. Do not attempt to repair or service this unit in the field. Removing tamper seals from chassis will void warranty. For further information, contact Lumina Power at 978-241-8260.

26 Ward Hill Dr., Bradford, MA 01835

Ph: 978-241-8260 Fx: 978-241-8262

www.luminapower.com

sales@luminapower.com