Instruction Manual V2.0

# **Instruction Manual**

# High Power Laser Diode Drivers/High Voltage Pulser/ High Voltage Switch Models:

LSP-500/1000/1500/-XK-XX



This manual contains Operating, Safety, and Maintenance information and subjects to change without notice.



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SECTION 1: DESCRIPTION

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#### GENERAL

The LSP-XXXX-XX-series high power laser diode driver/power supply is designed to drive a laser diode in LSP mode (Lic Super Pulse), which generates very high peak current and voltage to *5KA* and *15KV* respectively with the rise times between *100ps-15ns* (depend on the models selected). Special made stripline connects directly from the driver to the Laser Diode you use. The length of the stripline ranges from 1" to 15" depends on the models and applications.

This product can be also used for unique applications such as a Thyratron replacement, Pockelscel driver, High voltage pulser, High voltage pulse generator, H.V trigger circuit, and High voltage gas discharge applications, where nano-second H.V switches are required.

### 1.2 **DESCRIPTION**

The LSP-series high power laser diode driver contains 1) H.V power supply and 2) High speed switches, 3) Pulse forming network (optional) in one box. User does not need to prepare an extra H.V power supply to drive the driver. The H.V power supply is an ultra compact power supply to supply the H.V source for the high voltage/high speed switching section.

Lic engineering is the original development company for the Super Pulse from early 1980's in medical CO2 laser applications. Using the accumulated pulse switching technologies for over 27 years, Lic engineering has achieved the *LSP; Lic Super Pulse* capability in Laser Diode applications, where the peak current ranges between 500A and 5KA.

### 1.3 SPECIFICATIONS of LSP-XXXX-XX with LSP-EVBD

#### 1.3.1 AC INPUT

100V, 120V, 208V, 220V, 230V: +/- 10%, Single phase, 47-63Hz. Note: Other voltage ranges are also available by request.

### 1.3.2 OUTPUT POWER

Between 5-20W for LSP-series and between 100W-500W for LDC-series.

### 1.3.3 MAX. OUTPUT VOLTAGE

Between 500V and 20KV depends on the applications Note: Required Max. Voltage depends on: 1) Required Peak Current, 2) Rise Time, 3) Lead wire inductance of The Laser Diode used. Please refer to 2.2 LASER DIODE CONNECTION

### 1.3.4. MAX. PEAK OUTPUT CURRENT

Between 500A – 5KA depends on the applications Note: Max. Peak Current depends on: 1) Output Voltage of the Driver, 2) Rise Time, 3) Lead wire inductance of the Laser Diode used. Please refer to 2.2 LASER DIODE CONNECTION SECTION 1: DESCRIPTION

### 1.3.5 OUTPUT POLARITY

Negative(Standard). Positive polarity may be available. Contact to factory for detail.

### 1.3.6 OUTPUT CURRENT RISE TIME

The rise time can be set as follows

- 1). Less than 1ns: up to 500A.
- 2). Between 2-3 ns and 15ns: up to 5KA
- 3). Avove 100ns: up to 5KA

#### 1.3.7 MAXIMUM REPETATION RATE

Up to several hundred hertz. For higher frequency, please refer to LDC-series driver.

- 1.3.8 MINIMUM PULSE WIDTH 5ns
- 1.3.9 PULSE DUTY 1-50%

#### 1.3.10 AUXILIARY POWER SUPPLY for LDC-Series LDC-Series requires an external power supply to drive the driver. This specification depends on the driver you ordered.

#### 1.3.10 External Signal

LSP/LDC-Series can use both internal and external drive signal for the driver. 1K ohm BNC connecter is used for this purpose.

- 1.3.11 OPERATING TEMPERATURE Ambient temperature: +10 to 40C
- 1.3.12 OUTPUT CONNECTORS Direct Stripline
- 1.3.13 CURRENT MONITOR BNC 50 Ohm
- 1.3.14 EXTERNAL CONTROL INPUT BNC 1K Ohm
- 1.3.15 DIMENSIONS(LxWxH inch) LSP-500/1000/1500 with LSP-EVBD: 5.0 (L) x 6.0(W) x 2.0 (H) inch Driver itself: 3.3"x3"x1.5"

# 1.4.16 WEIGHT(Lb.)

LSP-Series with LSP-EVBD: ~15 ounces

SECTION 1: DESCRIPTION

### 1.4 Waveforms





SECTION 1: DESCRIPTION





SECTION 2: INSTALLATION

### 2.0 **INSPECTION**

Check for damage incurred during shipment as follows: 1) Inspect unit case for cracking, bending, and other obvious signs of damage.

### 2.1 **POWER CORD CONNECTIONS**

Connect the AC power cord supplied to LSP-EVBD. Make sure GND wire is connected to the GND terminal on the board.

### 2.2 LASER DIODE CONNECTION

Connect the laser diode to the one of each output. **Be careful for the lead wire inductance:** *If the lead wire is not short enough, the peak current is lowered and the rise time becomes slow.* Refer to the following famous formula:

### V(v)=L(nH)xdI(A)/dt(ns)

Where, V=voltage across the lead wire (V), L=lead wire inductance (nH), DI=peak diode current (A), dt=rise time (ns)

Depends on the laser diode you use, you may need to shape the end of stripline. You can cut a copper plate of the stripline with a regular scissors to shape you desire. Refer to the following section in this manual.

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SECTION 2: INSTALLATION





Zd: Load impedance Vo: Output Voltage Io: Load Current Sensing Output (10A/V) Note: Io is not available when Zd is connected between GND & Vo

500A Driver

Mechanical Dimension (1.5-3KV model)

SECTION 3: OPERATION

### 3.0 OPERATION

### 3.1 **PRECAUTION**

### Do not disturb the signal:

Input signal to the driver is generated in the PC-Board. This signal is a high speed, noise sensitive signal. If it is disturbed by an accidental touch to metal parts, or tools, internal components of the driver may be destroyed by an <u>electro static noise</u>.

### 3.2 WITH USING INTERNAL CLOCK

- STEP 1. CONNECT AC POWER CORD Make sure On/Off SW. is still Off position.
- STEP 2. CONNECT 50OHM BNC CABLE for WAVEFORM. Connect one end of the cable to an oscilloscope. Make sure the input is set for 50 ohm.
- STEP 3. TURN VOLTAGE ADJ. TO MINIMUM. Make sure the output voltage is set for zero, or minimum.
- STEP 4. TURN INT/EXT SWITCH TO INTERNAL
- STEP 5. TURN ON AC POWER
- STEP 6. INCREASE THE VOLTAGE ADJ. Watching the output current waveform with the oscilloscope, gradually increase the voltage adj.
- STEP 7. ADJUST FREQUENCY Set the pulse rep. rate for a desirable rate.

### 3.3 WITH USING EXTERNAL CLOCK

- STEP 1. CONNECT AC POWER CORD Make sure On/Off SW. is still Off position.
- STEP 2. CONNECT 50OHM BNC CABLE for WAVEFORM. Connect one end of the cable to an oscilloscope. Make sure the input is set for 50 ohm.

SECTION 3: OPERATION

# STEP 3. TURN VOLTAGE ADJ. TO MINIMUM.

Make sure the output voltage is set for zero, or minimum.

STEP 4. CONNECT 500HM BNC CABLE for EXTERNAL SIGNAL Connect one end of the cable to a pulse generator.

Note:

Make sure the pulse rep. rate is within the specification designed for the driver. If the setting is exceeded to this range, the driver may be destroyed because of over heating.

- STEP 5. TURN INT/EXT SWITCH TO EXTERNAL
- STEP 6. TURN ON AC POWER
- STEP 7. INCREASE THE VOLTAGE ADJ. Watching the output current waveform with the oscilloscope, gradually increase the voltage adj.
- STEP 8. ADJUST FREQUENCY

Set the pulse rep. rate of the generator for a desirable rate.

SECTION 4: MAINTENANCE

## 4.0 MAINTENANCE

# 4.1 GENERAL

Lic's laser power supply contains potentiometers that are set at Lic's factory. Do not try to adjust these potentiometers. <u>There are no user-serviceable</u> parts in Lic's products.

IF USER ATTEMPTS TO OPEN, ADJUST, MODIFY, OR REPAIR THE PRODUCTS, THEN LIC ENGINEERING CAN NO LONGER BE RESPONSIBLE FOR THE SAFE OPERATION OF THE UNIT, AND THE WARRANTY SHALL BE IMMEDIATELY VOID.

# 4.2 CAUTION

- 1). DO NOT ALLOW THE UNIT TO BE IN OPEN CIRCUIT.
- 2). DO NOT ALLOW THE UNIT TO BE SHORT CIRCUIT.
- 3). DO NOT ATTEMPT TO OPEN, MODIFY OR ADJUST ANY PARTS OF THE POWER SUPPLY.
- 4). DO NOT MECHANICALLY SHOCK.
- 5). KEEP WATER OR MOISTURE OUT FROM THE UNIT EXCEPT IN-/-OUTLET
  - OF THE UNIT.
- 6). DO NOT MISUSE, OVERUSE, OR ABUSE THE UNIT.

SECTION 5: WARRANTY

5.0

### WARRANTY

### 5.1 WARRANTY

Lic engineering warrants its products against all defects in materials and workmanship to the original using purchaser for a period of one year from the date of delivery to the original purchaser.

During this period, Lic engineering will repair or replace its products if defective free of charge. This warranty applies only when the products are properly installed, maintained and used for the intended purpose, and only to the original purchase/user of the products, and only so long as the products are used in the country to which it was originally shipped by Lic engineering, or by an authorized distributor.

# Any shipping charge incurred shall be paid by the purchaser/user of the products.

This warranty is null and void if the user attempts to service the products (other than performing the maintenance described in the Instruction Manual), or if service is performed by people who are not trained and authorized to do so by Lic engineering.

THE EXPRESS WARRANTY ABOVE IS THE SOLE WARRANTY OBLIGATION OF LIC ENGINEERING AND THE REMEDY PROVIDED ABOVE IS IN LIEU OF GUARANTEES, OR WARRANTIES--ORAL OR WRITTEN, EXPRESS OR IMPLIED-- INCLUDING WITHOUT LIMITATION WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIC ENGINEERING HAS NO LIABILITY WHATSOEVER FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGE ARISING OUT OF ANY DEFECT, IMPROPER USE, OR UNAUTHORIZED SERVICE OR REPAIR.

### 5.2 **RETURN OF THE UNITS**

Prior to return of a unit, or any portion thereof, Lic must be consulted to avoid unnecessary shipping.

If returns of the units are deemed necessary, a Return Authorization Number "RAN" will be assigned. This number must be recorded on the outside of the shipping container.

Contact:

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