

Instruction Manual

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

LDC-120/250/XXX/-XX



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



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1.1 GENERAL

The high speed laser diode driver/power supply of LDC-120/250 is primary designed to drive a laser diode with high currents and high speed in high speed pulsed mode. However, this unit can be used as a **high peak current/high voltage pulse generator** as well. By utilizing **the water-cooled** design, the user can use LDC-120/250 for **unique heavy duty and high voltage/high peak current applications**.

1.2 DESCRIPTION

The high speed, fast rise time and high current laser diode driver, LDC-120/250/XXX-XX can generate a high peak pulsed current called **Super Pulse & LSP; Lic Super Pulse** in pulse mode. The **Super Pulse** is the Lic's original development on the early 1980s for medical CO2 laser applications. By using those experience Lic engineering achieved a high peak current with a fast rise time up to **500A/1-3ns** for laser diode applications as well.

The LDC-120/250 can generate the high speed pulse of **800 picoseconds /10MHz**, with the minimum pulse width of **1.5ns**, with the fast rise time of **1-3ns**, high voltage to **450V** and a high current to **500A**.

The LDC-XXX-XX can generate the high speed pulse of **800 picoseconds /10MHz**, with the minimum pulse width of **1.5ns**, with the fast rise time of **1-3ns**, high voltage to **several KV** and a high current to **several KA** (Depends on the specifications selected).

50 ohm BNC output is used to monitor the real time output current accurately. The attenuation ratio is 5mV/A-100mV/A depends on the specification selected.

The load current is sensed with an ultra high speed & small inductance & high power resistor that accuracy is +/- 1% and its rise time and inductance are extremely small.

This unit contains a precise (**40ppm/C**), high frequency (**15MHz**) internal PWM-pulse generator and can be used as **a high current pulse generator as well as a high speed pulse generator**.



1.3 SPECIFICATIONS of LDC-120/250/XXX/-XX

SPECIFICATIONS of LDC-120/250

Output1 (Burst Pulse):

- Rise Time: 800ps
- Min. Pulse Width: 1.5ns
- Output Voltage 7V
- Output Current: 2A
- Max. Pulse Rate: 15Mhz
- Burst rate & width: 10KHz-1MHz, 200ns-10us

Output2:

- Rise Time: 1-2ns
- Min. Pulse Width: 5ns
- Max. Pulse Width: 1us
- Max. Output Voltage: 450V

- **Max. Output Current:** 500A *1)
- **Max. Pulse Rate:** 1Mhz

*1): Max. Current is limited by the pulse rate & width selected.

Output3: (Fixed Pulse Width)

- **Rise Time:** 3ns
- **Min. Pulse Width:** 10ns
- **Max. Pulse Width:** 100ns
- **Max. Output Voltage:** 450V(LDC-120), 900V(LDC-250)
- **Max. Output Current:** 120A(LDC-120), 250A(LDC-250) *1)
- **Max. Pulse Rate:** 1KHz-50KHz (depends on the pulse width selected)

*1): Peak Current is limited by the pulse rate selected.

- **Dimension** 2.40"H x 5.1"W x 5.1"L inch
- **Weight** 1.2 lb
- **Cooling** Air Cooled/Water Cooled
- **Option 1** Special Stripline

SPECIFICATIONS of LDC-XXX-XX

Output1 (Burst Pulse):

- **Rise Time:** 800ps
- **Min. Pulse Width:** 1.5ns
- **Output Voltage** 7V
- **Output Current:** 2A
- **Max. Pulse Rate:** 15Mhz
- **Burst rate & width:** 10KHz-1MHz, 200ns-10us

Output2:

- **Rise Time:** 1-2ns
- **Min. Pulse Width:** 5ns
- **Max. Pulse Width:** 1us
- **Max. Output Voltage:** 450V
- **Max. Output Current:** 500A *1)
- **Max. Pulse Rate:** 1Mhz

*1): Max. Current is limited by the pulse rate & width selected.

Output3: (Fixed Pulse Width)

- **Rise Time:** 3-15ns
- **Min. Pulse Width:** 10ns
- **Max. Pulse Width:** 100ns
- **Max. Output Voltage:** Several KV
- **Max. Output Current:** Several KA *1)
- **Max. Average Power:** Up to 1KW
- **Max. Pulse Rate:** 1KHz-50KHz (depends on the pulse width selected)

*1): Peak Current is limited by the pulse rate selected.

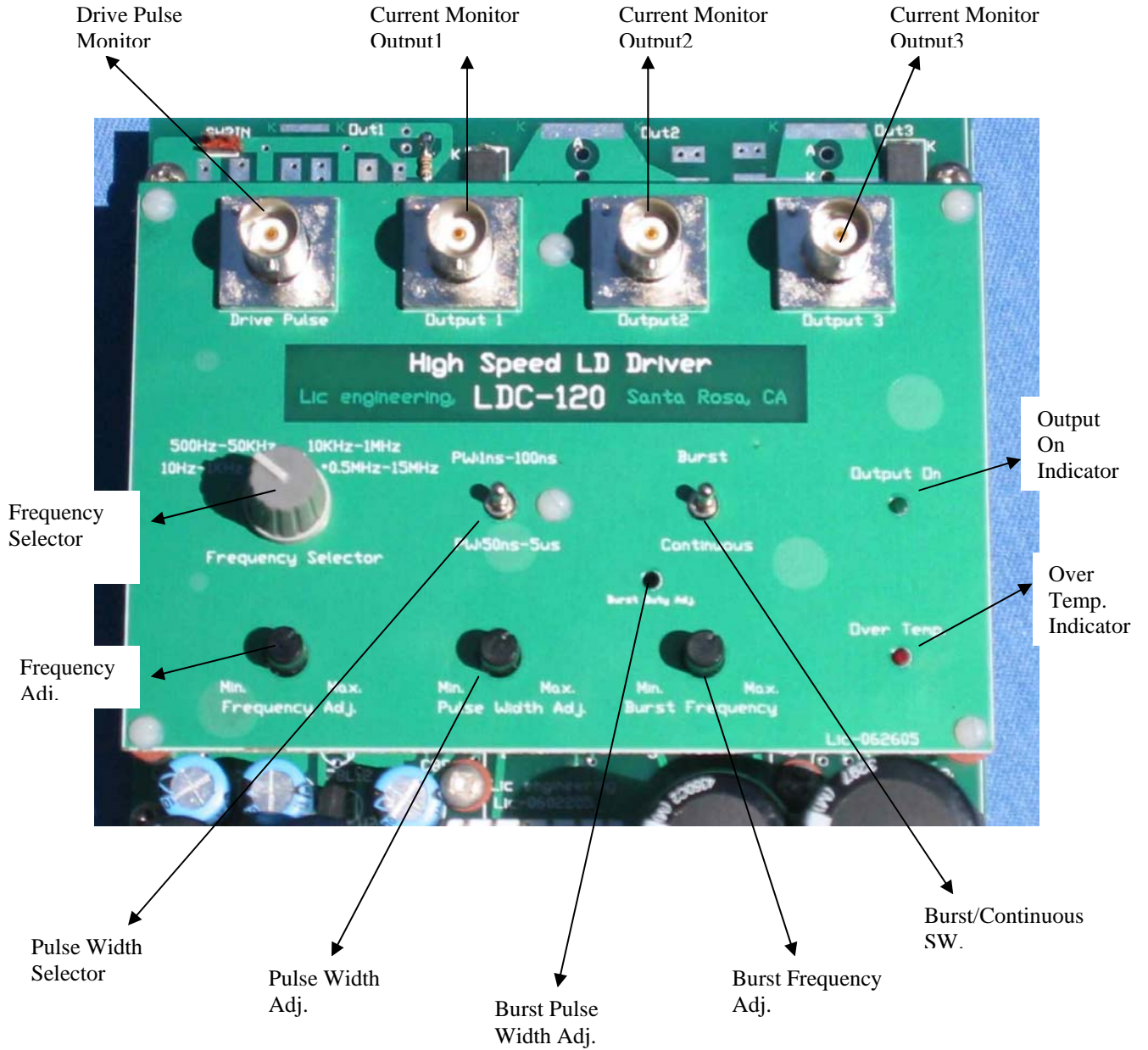
- **Dimension** 2.40"H x 5.1"W x 5.1"L inch -
2.40"H x 8"W x 8"L inch
- **Weight** 1.5 lb – 4.3 LB
- **Cooling** Air Cooled/Water Cooled
- **Option 1** Special Stripline
- **Option 1** Please contact to factory for your unique applications. We can make many special units for your specific needs.

1.3.2 PROTECTION CIRCUIT

Over temperature protection:

Detects a base temperature on which main switching devices and other power semiconductors are mounted. When the protection circuit detects these fault conditions, the unit will be shut off instantaneously, sending FAULT signal to main unit of LD-1500/3000.

1.3.3 FRONT PANEL



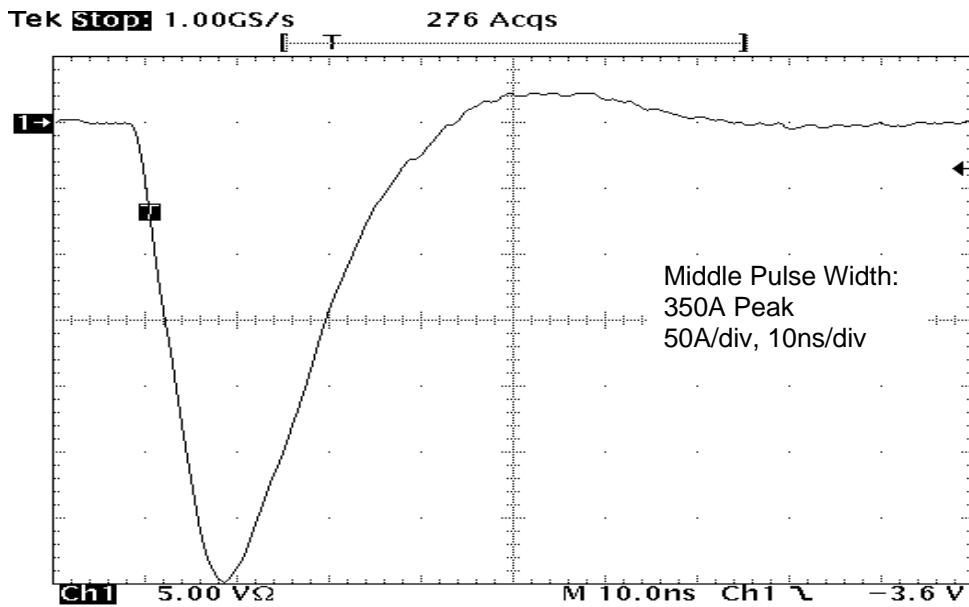
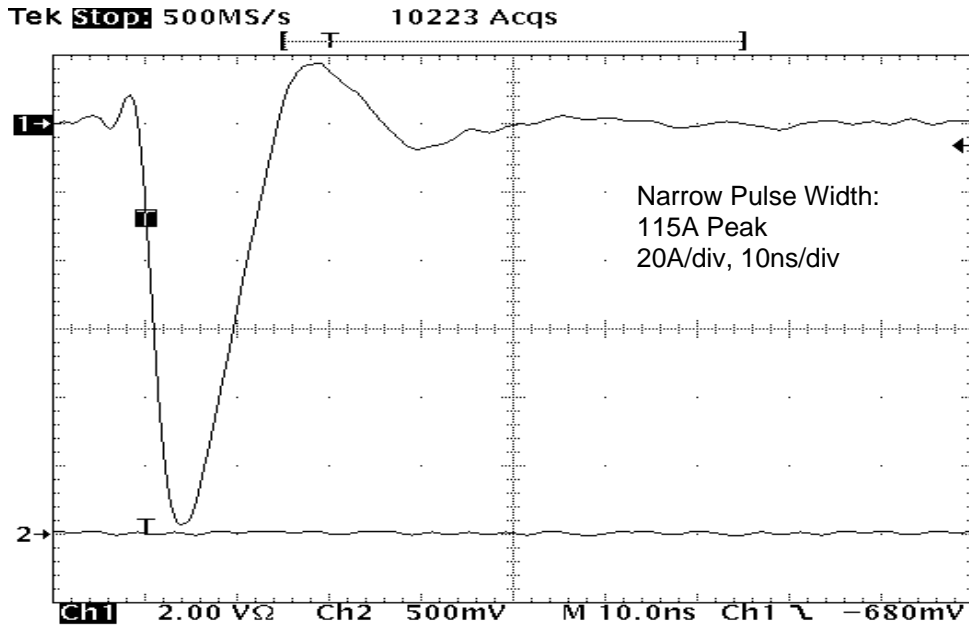
Front Panel of LDC-120

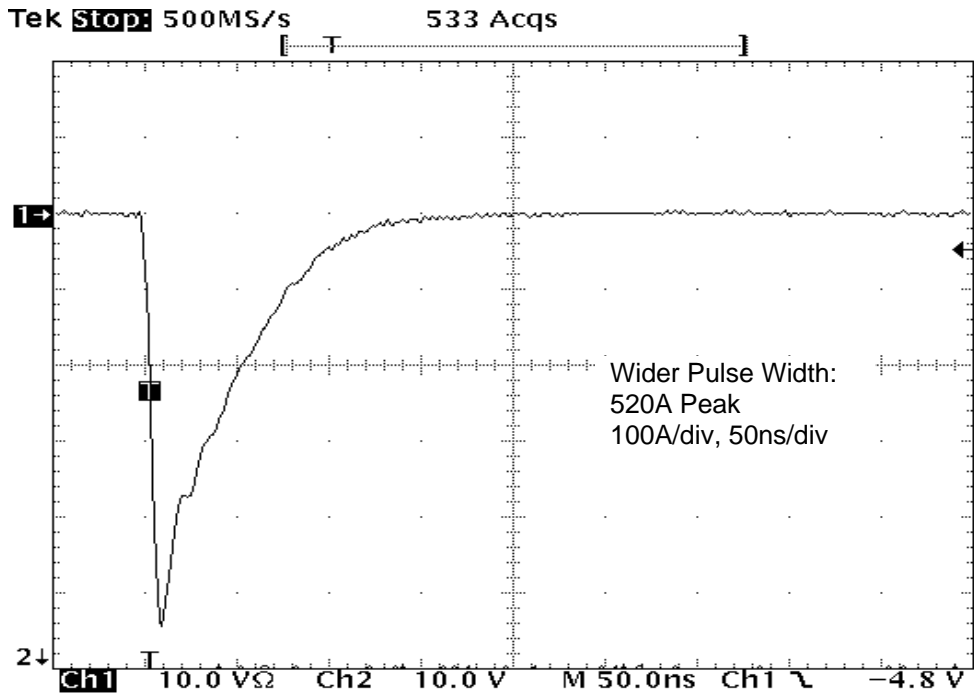
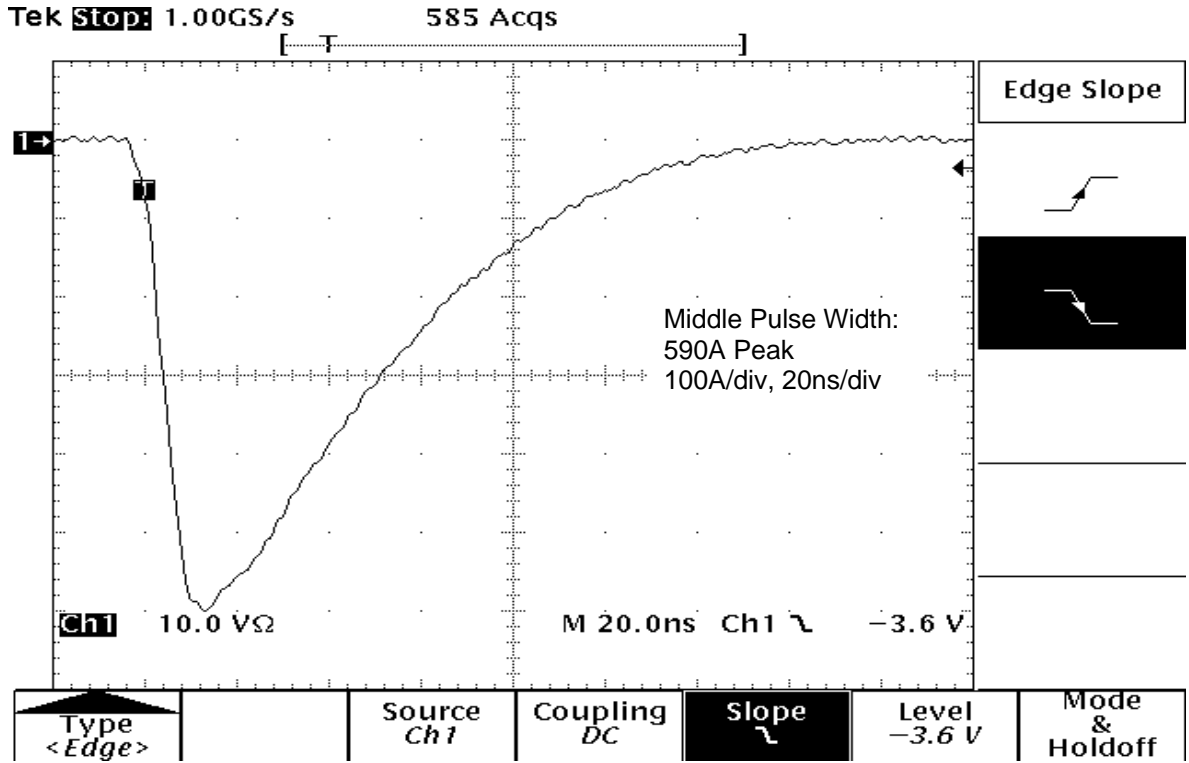
1.3.4 EXPLANATION OF FRONT PANEL

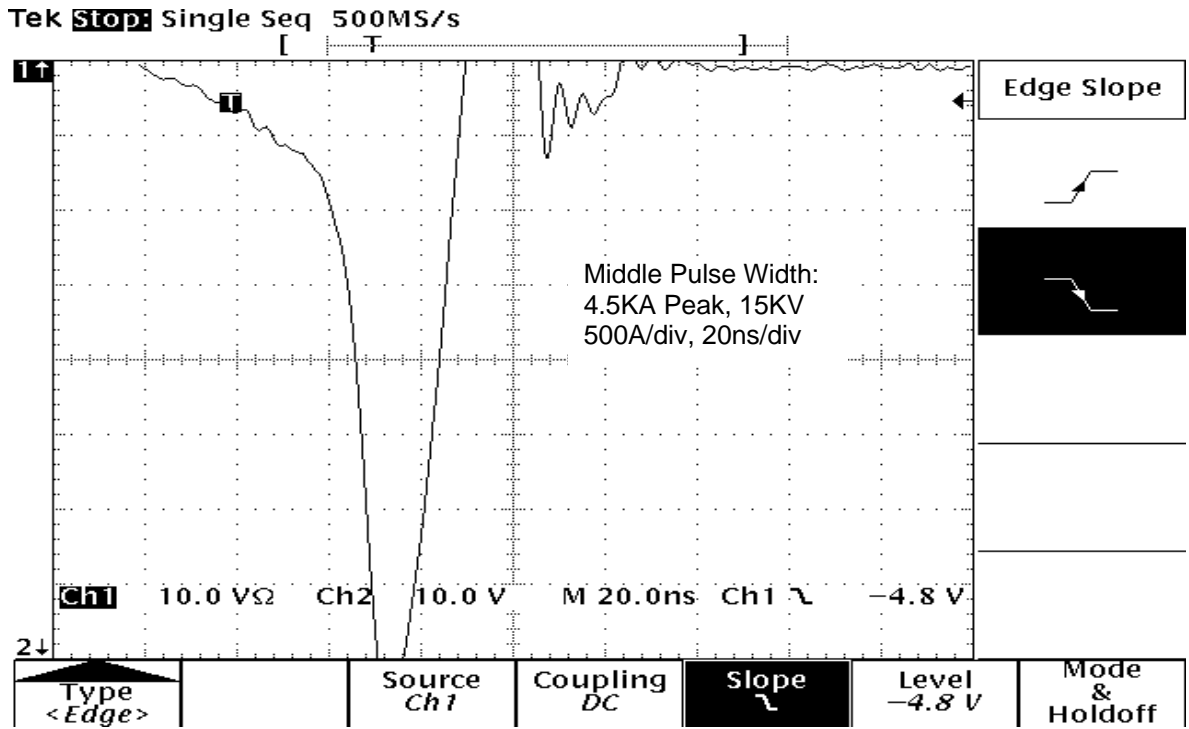
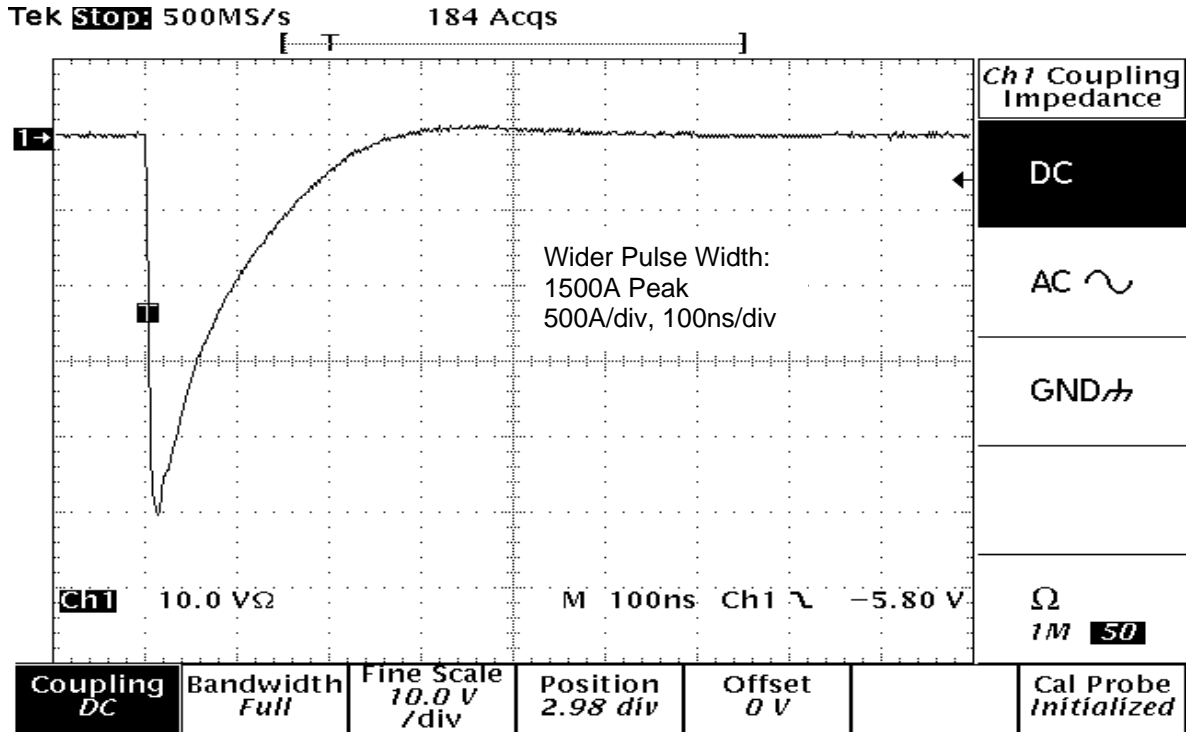
- 1.3.4.1 Drive Pulse Monitor**
This signal can be used to monitor the input drive signal. Also it can be used as a trigger signal for the output current waveform. 50ohm BNC.
- 1.3.4.2 Current Monitor Output 1**
This monitors the current waveform of the output1. The sensitivity is 1A/V, with 50ohm BNC connector.
- 1.3.4.3 Current Monitor Output 2**
This monitors the current waveform of the output1. The sensitivity is 10A/V, with 50ohm BNC connector.
- 1.3.4.4 Current Monitor Output 3**
This monitors the current waveform of the output1. The sensitivity is 10A/V, with 50ohm BNC connector.
- 1.3.4.5 Output On indicator**
Indicates the Output On signal is sent by the main unit of LD-1500/3000.
- 1.3.4.6 Over Temp. Indicator**
Indicates the Over Temp. Protection on the board is activated. When this protection is activated, all the tree outputs are shut off.
- 1.3.4.7 Burst/Continuous SW.**
This SW. changes the output pulse for either continuous pulse, or burst pulse. Since the pulse rate can be as high as 15MHz, some outputs become over load under certain pulse condition. By using this burst pulse mode, the output can be the maximum peak current even at high pulse rep. rate.
- 1.3.4.8 Burst Frequency Adj.**
This knob can change the burst frequency to set a proper gating for the setting frequency.
- 1.3.4.9 Burst Width Adj.**
This trim pot can change the pulse width of the burst pulse. Each pulse width of the burst pulse is set by this adjustment.
- 1.3.4.10 Pulse Width Adj.**
This knob changes the pulse width of the setting frequency made by Frequency Adj. & Frequency Selector.
- 1.3.4.11 Pulse Width Selector.**
This knob select the pulse width for high side, or low side, since only Pulse Width Adj. can not cover the pulse width from 1.5ns to several ms.
- 1.3.4.12 Frequency Adj.**
This along with Frequency Selector changes the setting frequency continuously.

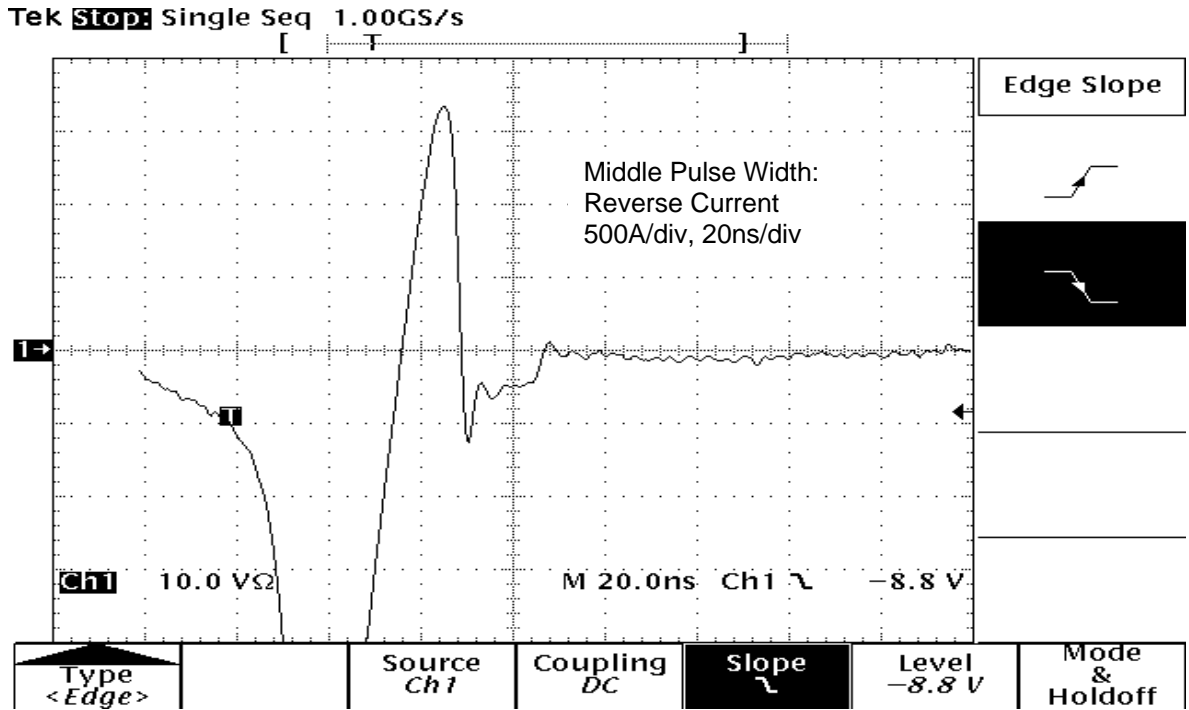
- 1.3.4.13 **Frequency Selector.**
Since the Frequency Adj. cannot cover the entire frequency range, this knob selects the base frequency range.
- 1.3.5 **AUXILIARY POWER SUPPLY for LDC-Series**
LDC-Series requires an external power supply to drive the driver. This specification depends on the driver you ordered.
- 1.3.6 **External Signal**
LSP/LDC-Series can use both internal and external drive signal for the driver. 1K ohm BNC connector is used for this purpose.
- 1.3.7 **OPERATING TEMPERATURE**
Ambient temperature: +10 to 40C
Water temperature: below 25C
- 1.3.8 **OUTPUT CONNECTORS**
Direct Stripline Connection: Stripline length is 1" – 15"
- 1.3.9 **CURRENT MONITOR**
BNC 50 Ohm: Attnation Ratio is 5mV/A – 100mV/A
- 1.3.10 **EXTERNAL CONTROL INPUT**
BNC 1K Ohm
- 1.3.11 **DIMENSIONS(LxWxH inch)**
2.40"H x 5.1"W x 5.1"L inch -
2.40"H x 8"W x 8"L inch
- 1.3.12 **WEIGHT(Lb.)**
LSP-Series with LSP-EVBD: Max. 2lb
- 1.4 **Sample Waveforms**
High Peak Power laser diode driver/High Voltage Pulser LDC-XXX-XX can generate the output pulse up to several KA/several KV/several MW peak power. The followings show several sample waveforms took with several different units of LDC-series.

Note: If user want to see other waveforms, please contact to factory. We have many waveforms stocked.









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 LDC-120/250/XXX-XX CONNECTIONS

Connect the unit to LD-1500/3000 main unit with the cable supplied. If the unit is designed for an independent unit, connect the power cord to an appropriate AC voltage. 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, then the peak current is lowered and the rise time becomes slow.

Refer to the following famous formula:

$$V(v)=L(nH)\times dl(A)/dt(ns)$$

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

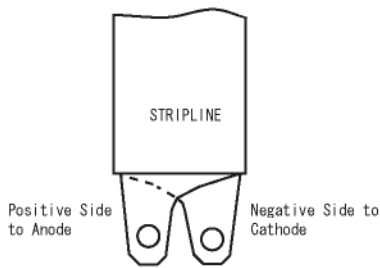
Please notice that in LSP-Series high voltage laser diode driver, almost 100% of the output voltage is used to overcome the inductance. This inductance L is the sum of 1). LD-pin inductance plus 2). LD-internal lead wire inductance, plus 3). External lead wire inductance.

Example 1):

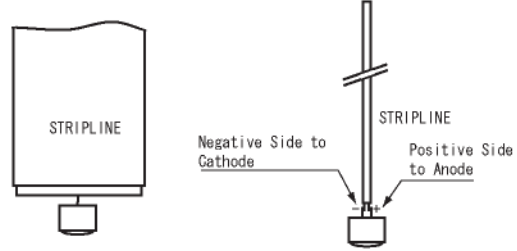
LD current =500A, Rise time required = 3ns, Total inductance $L=10nH$,
Then, the required Output voltage to overcome this inductance V_{required} is:
 $V_{\text{required}}=1.7KV$,

Example 2):

LD current =2500A, Rise time required = 5ns, Total inductance $L=30nH$,
Then, the required Output voltage to overcome this inductance V_{required} is:
 $V_{\text{required}}=15KV$.



(1) For Screw Type Terminal



(2) For Pin Type Terminal

3.0 OPERATION

3.1 PRECAUTION

***Never 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 by a metal parts, or tools, internal components of the driver may be destroyed by an electro static noise.***

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.

- STEP 3. TURN VOLTAGE ADJ. TO MINIMUM.
 Make sure the output voltage is set for zero, or
 minimum.
- STEP 4. CONNECT 50OHM BNC CABLE for EXTERNAL SIGNAL
 Connect one end of the cable to a pulse generator.
- Note:**
***Make sure the external pulse 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.

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. **There are no user-serviceable 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.

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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Santa Rosa, CA, USA
Tel: (707) 575 8821
Fax: (707) 526 3905
email: info@LicEngine.com