Instruction Manual

High Power Laser Diode Drivers/High Voltage Pulser/ High Voltage Pulse generator/Pockels Cell Driver Models:

LSP-120/500/1500/2500/5000-XX-XX
LS-1000/2000
LPC-XXXX

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

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Safety Precaution

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Before Applying Power
Verify that all safety precautions are taken. Make all connections to the unit before applying power.

Ground the Instrument
To minimize shock hazard, the instrument chassis and cover must be connected to an electrical ground. The instrument must be connected to the AC power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Fuses and/or Circuit Breaker
Only fuses with required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard. If circuit breaker is activated, take a careful inspection and don't repeat the breaker on/off.

Do Not Operate in an Explosive Atmosphere
Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover
Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

Do Not Modify the Instrument
Do not install substitute parts or perform any unauthorized modification to the product. Return the product to LIC Engineering factory for service and repair to ensure that safety features are maintained.

1.1 GENERAL

The LSP-XXXX-XX-series , LS-1000/2000-series & LPC-XXXX-series high power Laser Diode Driver/Pulse Generator/Pockels Cell Driver are designed to drive a laser diode, customer's specific load and Pockels Cell in LSP mode (Lic Super Pulse), which generates very high peak current and voltage up to *5KA* and *15KV* respectively with the rise times between *500ps-15ns* (depend on the models selected).
Special made stripline connects directly from the driver to the Laser Diode/ customer's specific load 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, Plasma Discharge, Pockelscel driver, High voltage pulser, High voltage pulse generator, H.V trigger circuit, and High voltage Gas Discharge applications, where nano-second H.V pulse are required.

1.2 DESCRIPTION

The LSP-XXXX-XX-series , LS-1000/2000-series & LPC-XXXX-series high power Laser Diode Driver/Pulse Generator/Pockels Cell Driver contain 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/high efficient power supply to supply the H.V source for the high voltage/high speed switching section.

Lic engineering is the original development company of the Super Pulse for laser applications since early 1980's in medical laser applications. ***LSP; Lic Super Pulse*** ranges from 100A to 5KA peak current and pulse width of 5ns to 100ns. To generate these high peak current, LIC Engineering uses several technics that have been accumulated for the past 35 years.

50 ohm BNC output is used to monitor the real time output current accurately. The attenuation ratio is 5mV/A-10mV/A depends on the specification selected.
The load current is sensed with an ultra small inductance and high power resistor that accuracy is +/- 1% and its inductance is extreamly small.

1.3 SPECIFICATIONS of LSP-XXXX-XX, LS-1000/2000 & LPC-XXXX

1.3.1 AC INPUT

100V, 120V, 208V, 220V, 240V: +/- 10%, Single & Three phase, 47-63Hz.
Note: Other voltage ranges are also available by request.

1.3.2 OUTPUT POWER

Peak Power: 60KW-75 Mega Watts
Average Power: 1W-8KW for LSP-XXXX-XX-series & LS-1000/2000-series & LS-series & LDC-series

1.3.3 MAX. OUTPUT VOLTAGE

Between 500V and 20KV depends on the Models
Note:
Required Max. Voltage for User's Laser Diode depends on: 1) Required Peak Current, 2) Rise Time, 3) Total lead wire inductance: This is the total of A). LD-pin inductance plus B). LD-internal lead wire inductance, plus C). External lead wire inductance.
Please refer to 2.2 LASER DIODE CONNECTION

1.3.4. MAX. PEAK OUTPUT CURRENT

Between 500A – 5KA depends on the Models Name
Note: Max. Peak Current depends on the Total wire inductance of the Laser Diode used.
Refer to 2.2 LASER DIODE CONNECTION

1.3.5 OUTPUT POLARITY

Negative(Standard).

1.3.6 OUTPUT CURRENT RISE TIME

The rise time can be set as follows
1). Less than 500ps-2ns: up to 500A.
2). Between 2-3 ns and 15ns: up to 5KA

1.3.7 MAXIMUM REPETATION RATE

Between 10Hz and 5MHz depends on the Models

1.3.8 MINIMUM PULSE WIDTH

5ns

1.3.9 PULSE DUTY

1-100%

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 Connection: Stripline length is 1" – 15"

1.3.13 CURRENT MONITOR
BNC 50 Ohm: Attnation Ratio is 10mV/A – 100mV/A

1.3.14 EXTERNAL CONTROL INPUT
BNC 1K Ohm

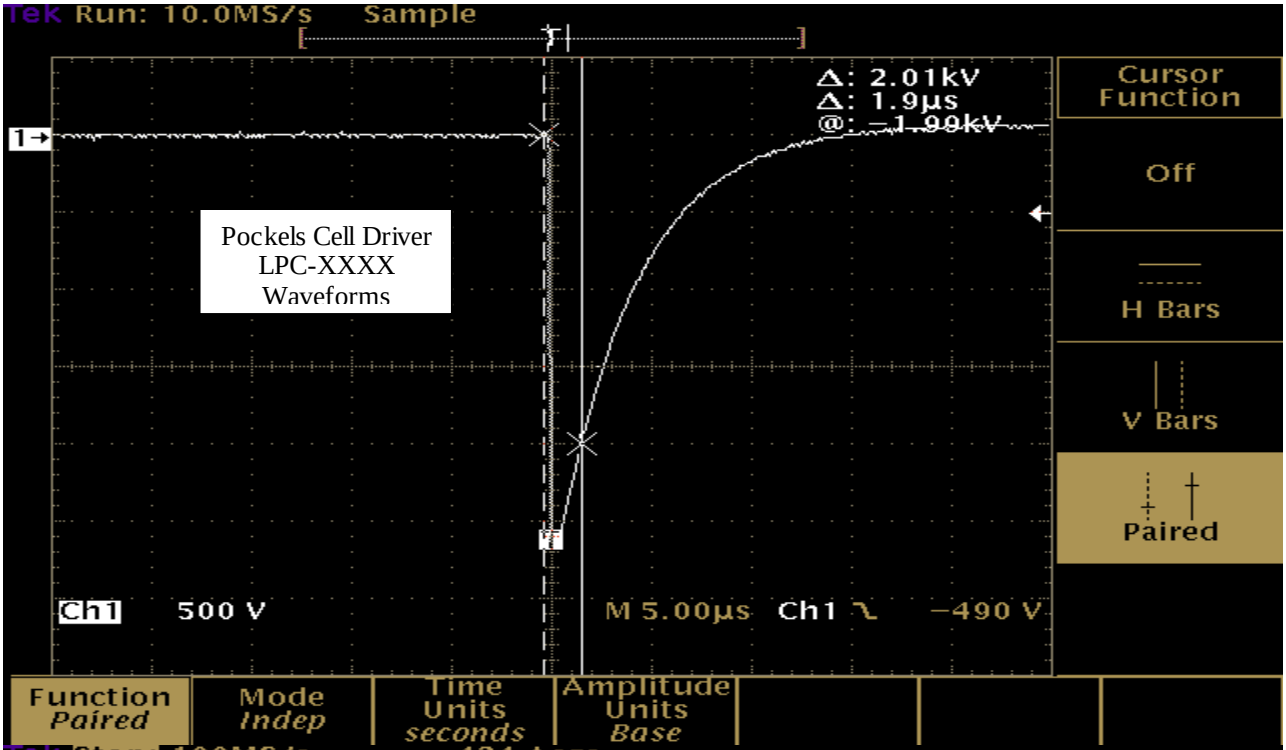
1.3.15 DIMENSIONS(LxWxH inch)
Please refer to each product

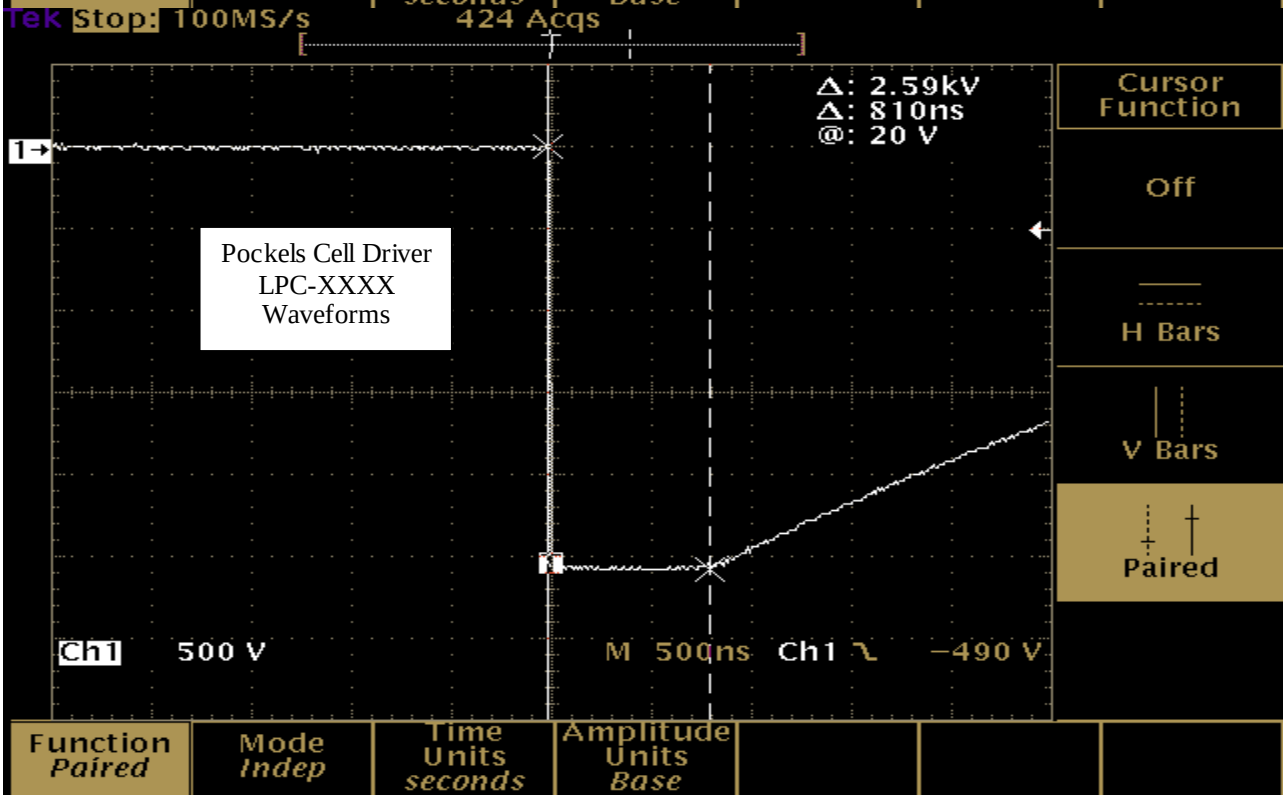
1.3.16 WEIGHT(Lb.)
Please refer to each product

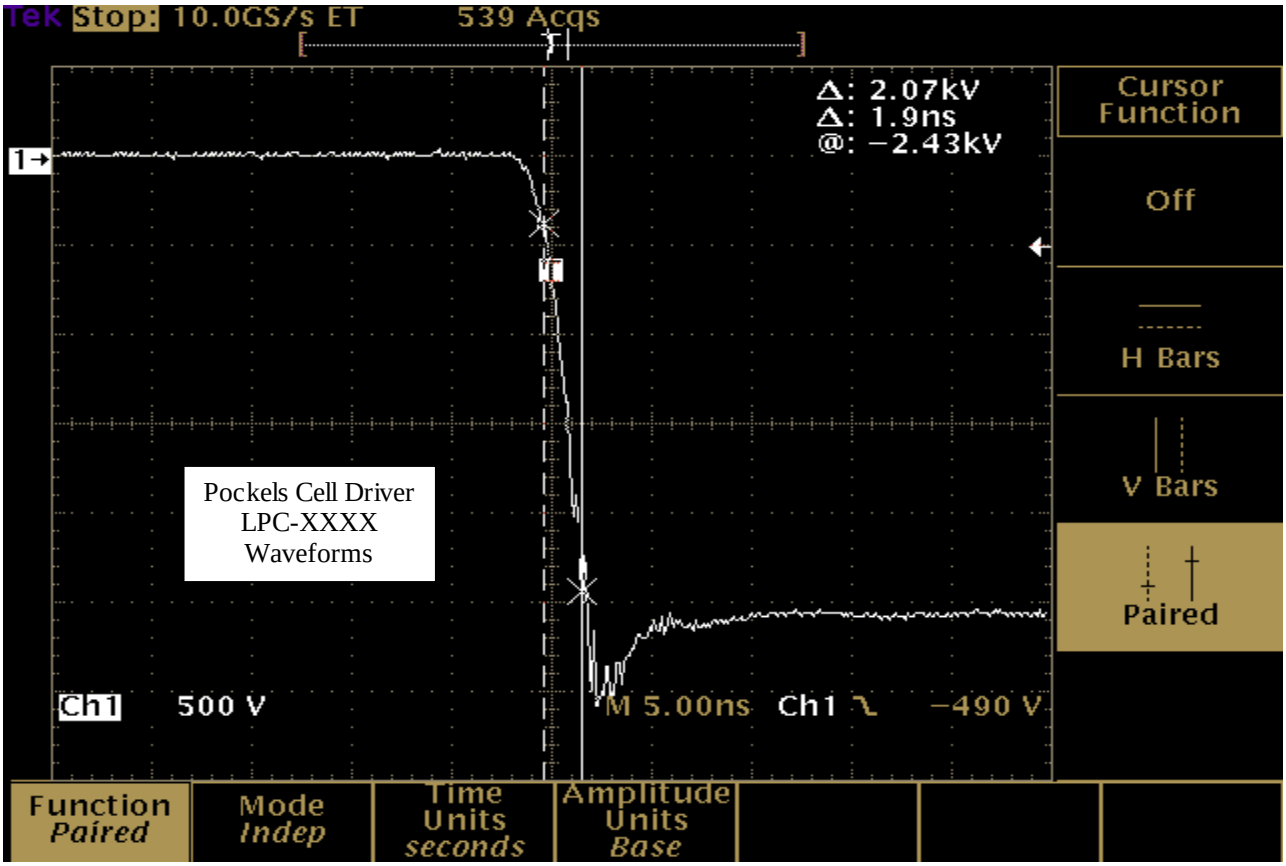
1.4 Sample Waveforms

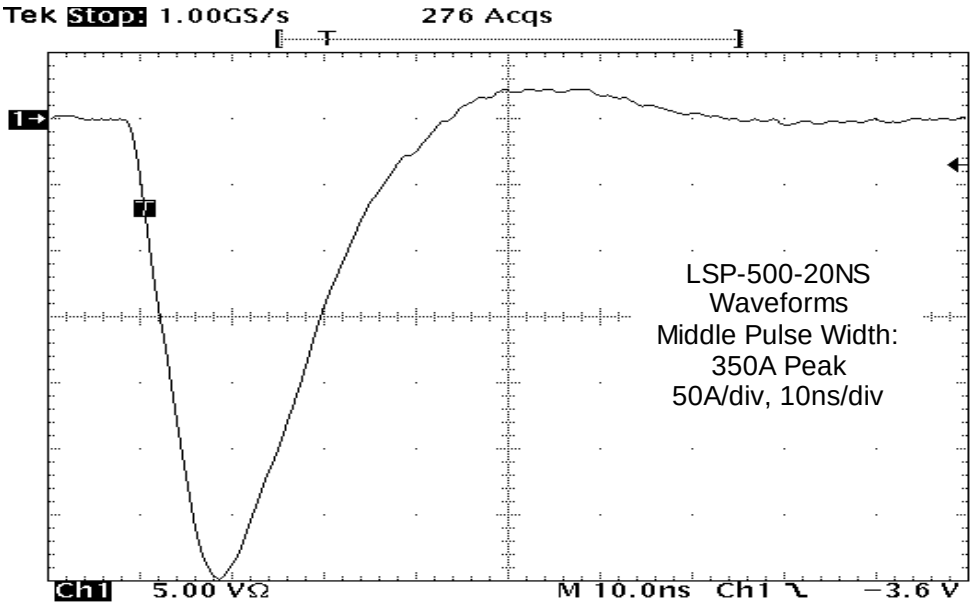
High Peak Power laser diode driver/High Voltage Pulser LSP-XXXX can generate the output pulse up to 5KA/15KV/75MW peak power. The followings show several sample waveforms took with several different units of LSP-series.

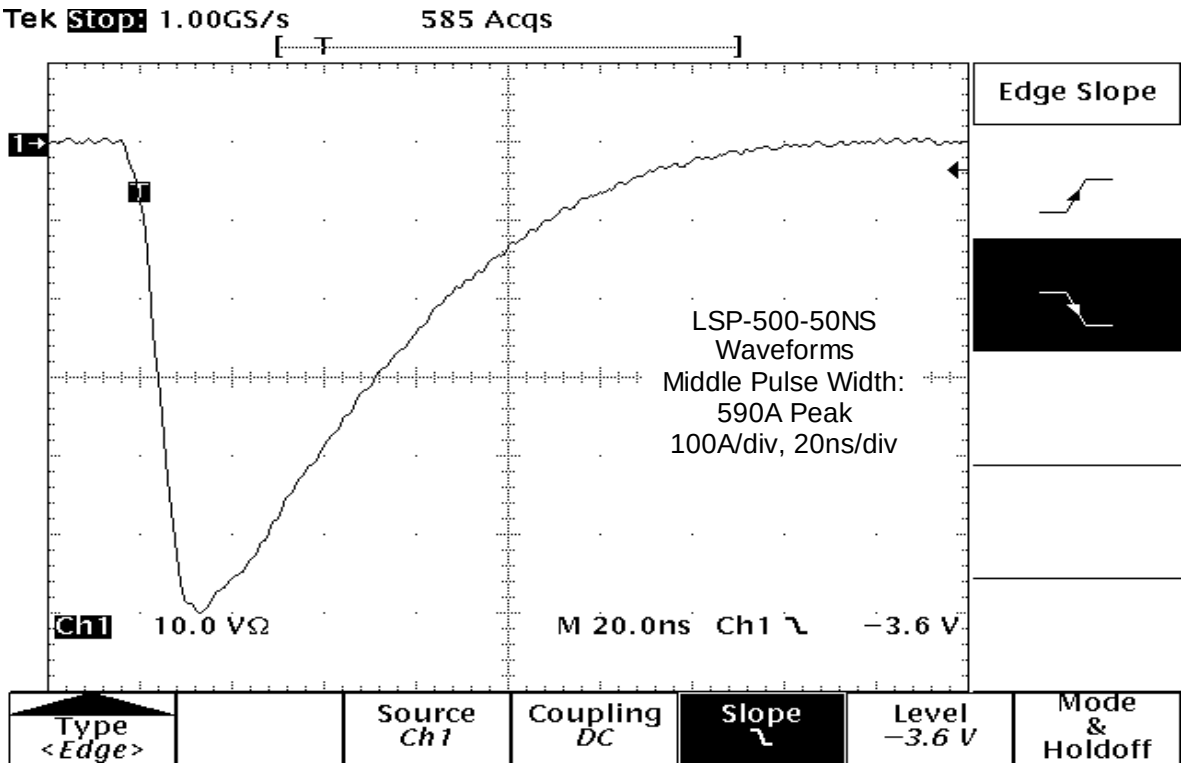
Note: If user want to see other waveforms, please contact to factory. We have many waveforms stocked.

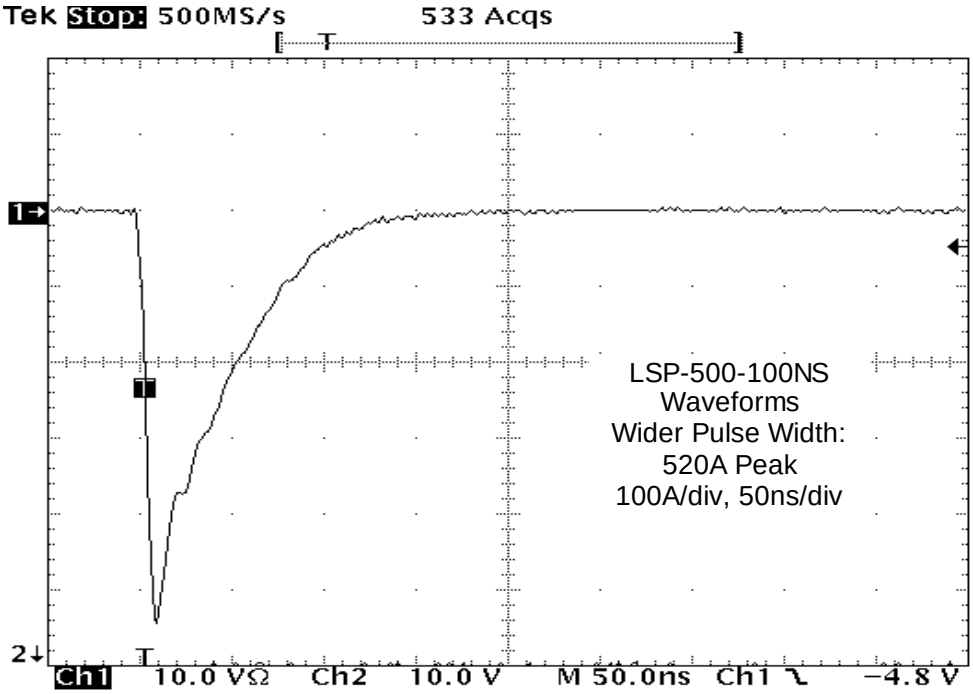

Tek Run: 10.0MS/s Sample
Δ: 2.01kV
Δ: 1.9µs
@: −1.99kV
Cursor Function
Off
H Bars
V Bars
Paired
Pockels Cell Driver
LPC-XXXX
Waveforms
Ch1 500 V
M 5.00µs Ch1 ∖ −490 V
Function Paired
Mode Indep
Time Units seconds
Amplitude Units Base

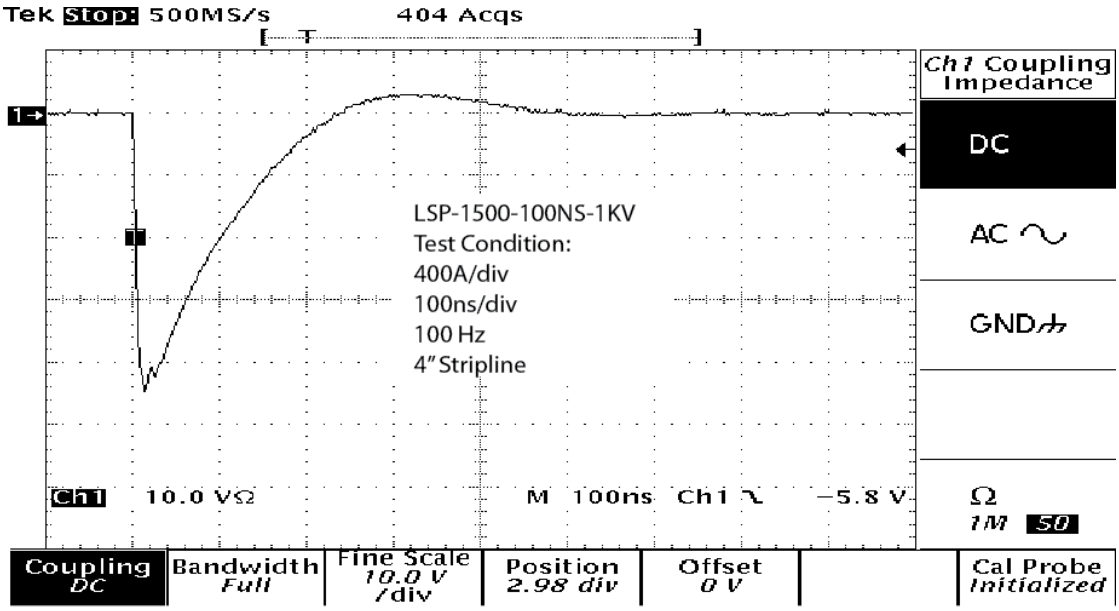

Tek Stop: 100MS/s 424 Acqs
Δ: 2.59kV
Δ: 810ns
@: 20 V
Cursor Function
Off
H Bars
V Bars
Paired
Pockels Cell Driver
LPC-XXXX
Waveforms
Ch1 500 V
M 500ns Ch1 ∖ −490 V
Function Paired
Mode Indep
Time Units seconds
Amplitude Units Base

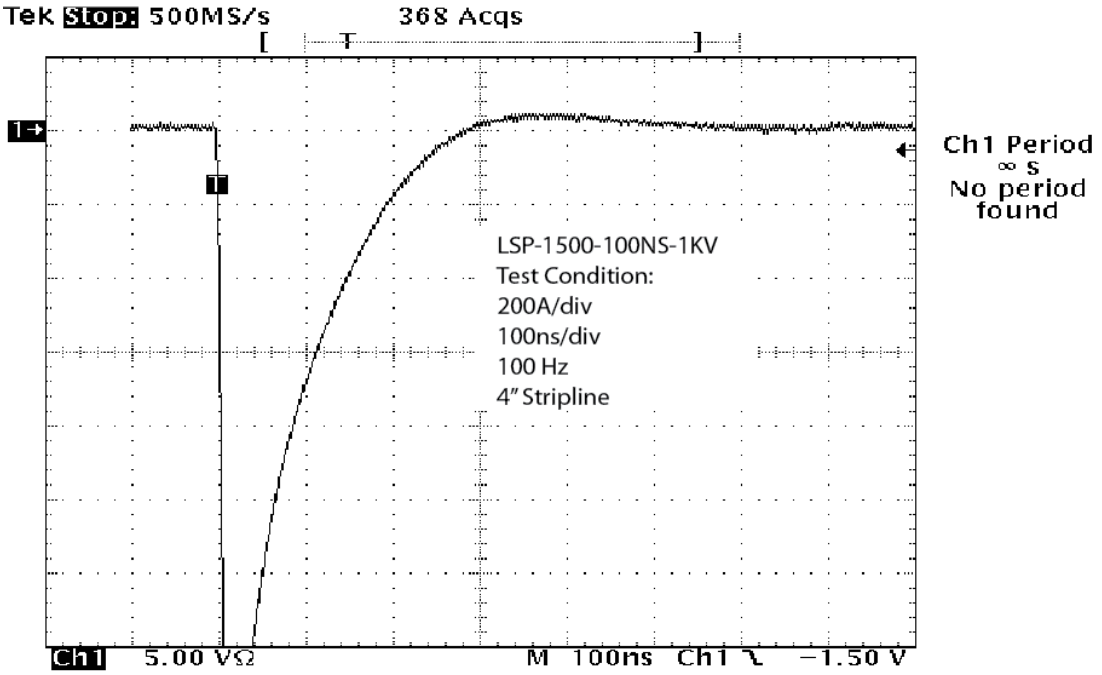

Tek Stop: 10.0GS/s ET 539 Acqs
Δ: 2.07kV
Δ: 1.9ns
@: −2.43kV
Cursor Function
Off
H Bars
V Bars
Paired
Pockels Cell Driver
LPC-XXXX
Waveforms
Ch1 500 V
M 5.00ns Ch1 ∖ −490 V
Function Paired
Mode Indep
Time Units seconds
Amplitude Units Base

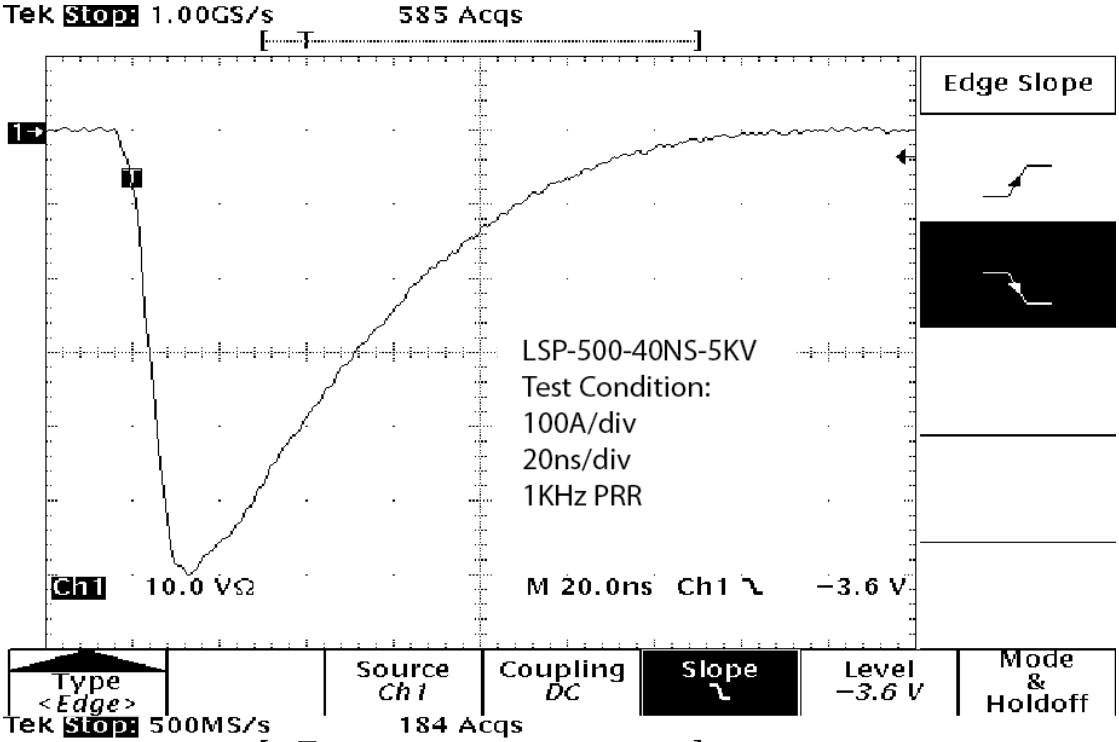

Tek Stop: 1.00GS/s 276 Acqs
LSP-500-20NS
Waveforms
Middle Pulse Width:
350A Peak
50A/div, 10ns/div
Ch1 5.00 VΩ
M 10.0ns Ch1 ∖ −3.6 V

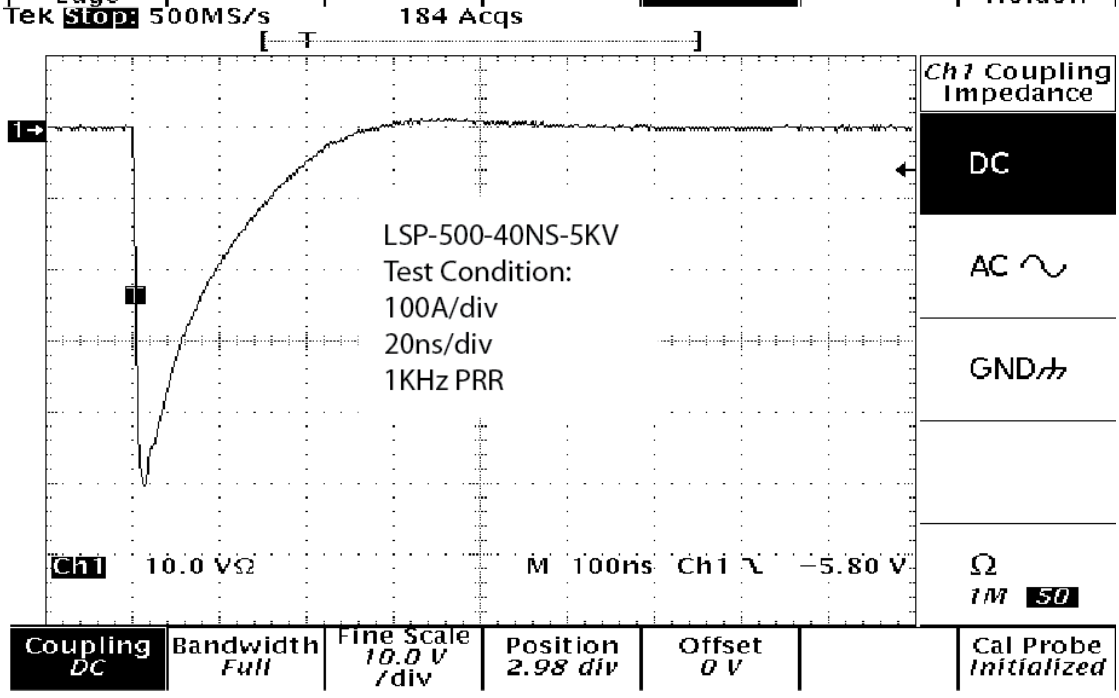

Tek Stop: 1.00GS/s 585 Acqs
Edge Slope
LSP-500-50NS
Waveforms
Middle Pulse Width:
590A Peak
100A/div, 20ns/div
Ch1 10.0 VΩ
M 20.0ns Ch1 ↘ −3.6 V
Type
<Edge>
Source
Ch1
Coupling
DC
Slope
Level
−3.6 V
Mode
&
Holdoff

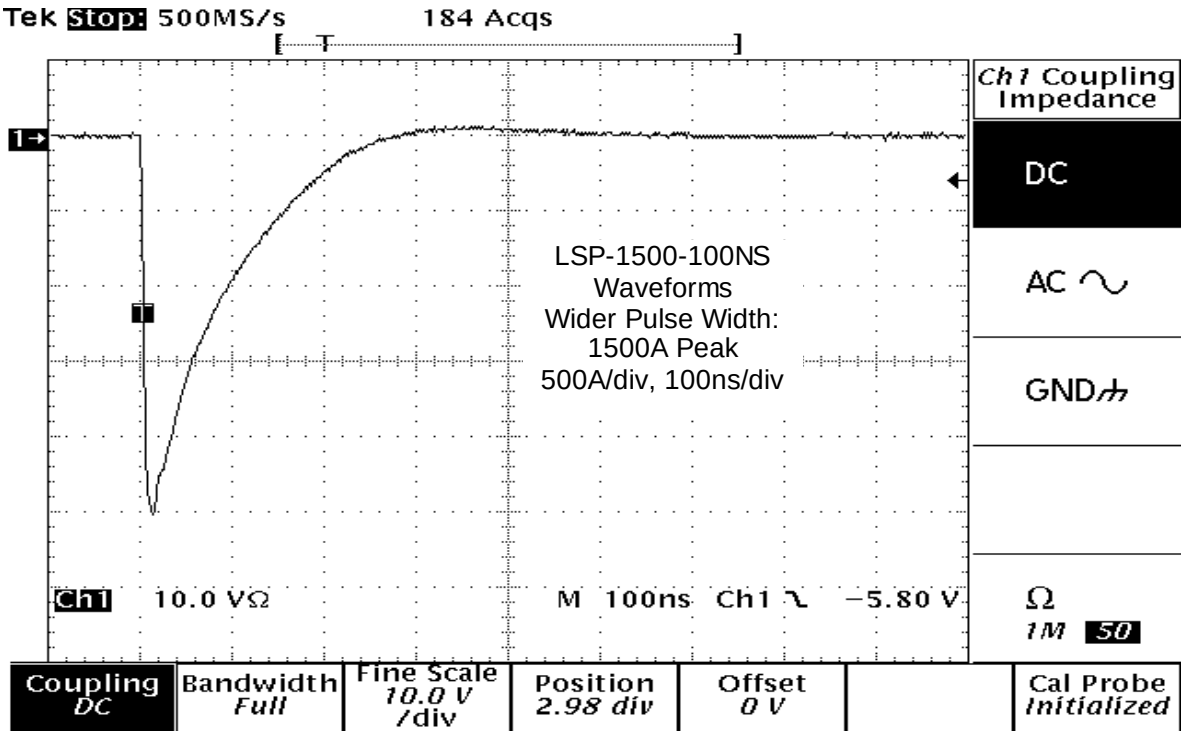

Tek Stop: 500MS/s 533 Acqs
LSP-500-100NS
Waveforms
Wider Pulse Width:
520A Peak
100A/div, 50ns/div
Ch1 10.0 VΩ Ch2 10.0 V M 50.0ns Ch1 ↘ −4.8 V

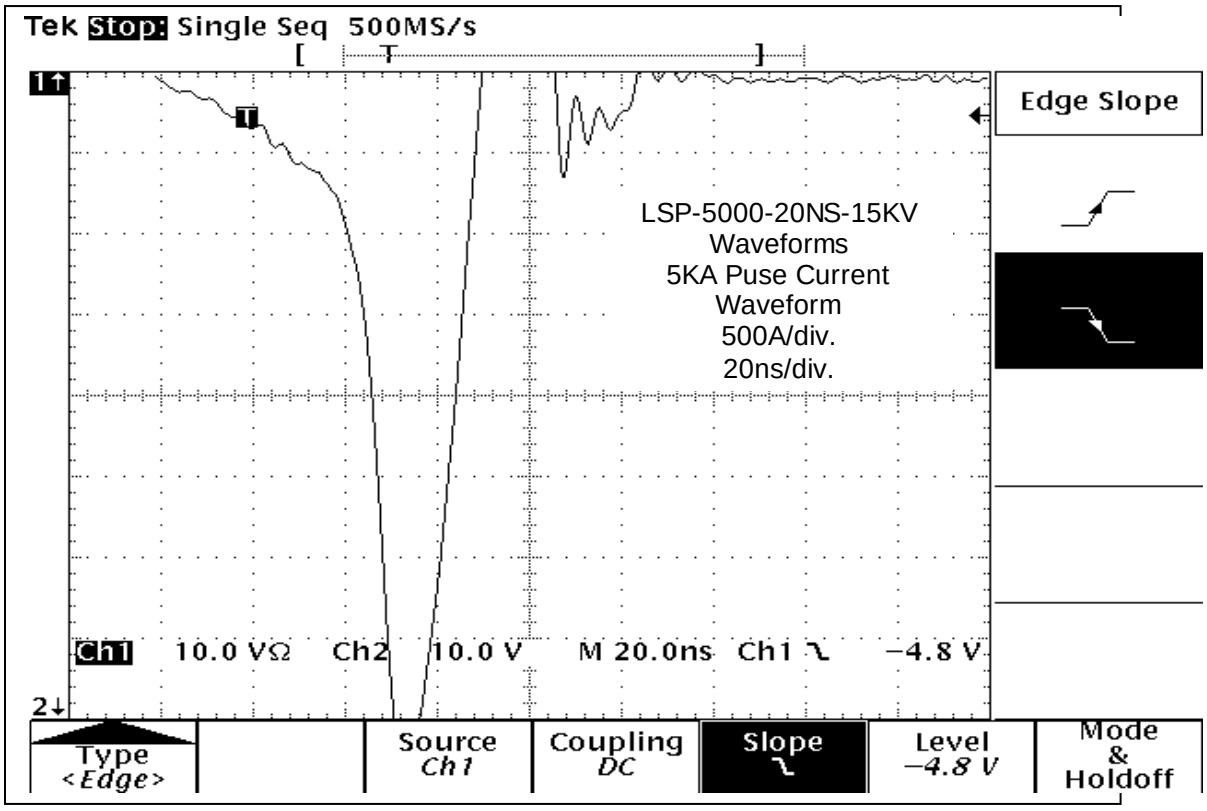

Tek Stop: 500MS/s 404 Acqs
LSP-1500-100NS-1KV
Test Condition:
400A/div
100ns/div
100 Hz
4" Stripline
Ch1 10.0 VΩ M 100ns Ch1 ∿ −5.8 V
Ch1 Coupling
Impedance
DC
AC
GND
Ω
1M 50
Coupling DC
Bandwidth Full
Fine Scale 10.0 V /div
Position 2.98 div
Offset 0 V
Cal Probe Initialized

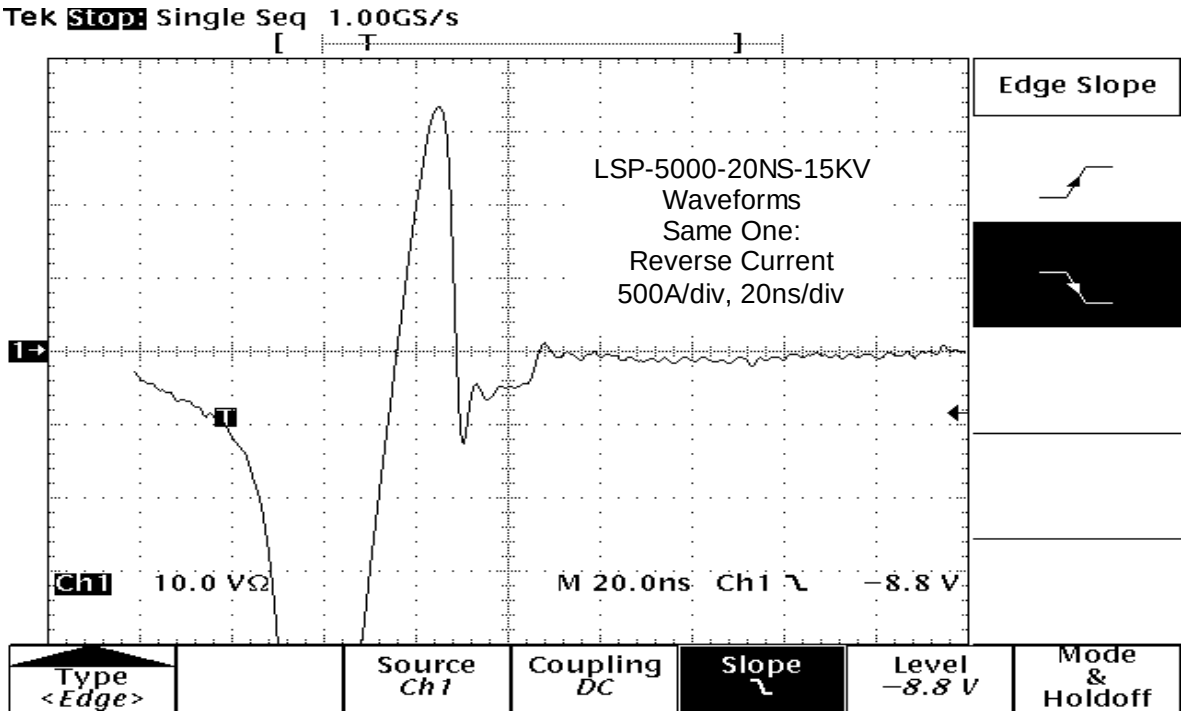

Tek Stop: 500MS/s 368 Acqs
LSP-1500-100NS-1KV
Test Condition:
200A/div
100ns/div
100 Hz
4" Stripline
Ch1 5.00 VΩ M 100ns Ch1 ∿ −1.50 V
Ch1 Period
∞ s
No period
found

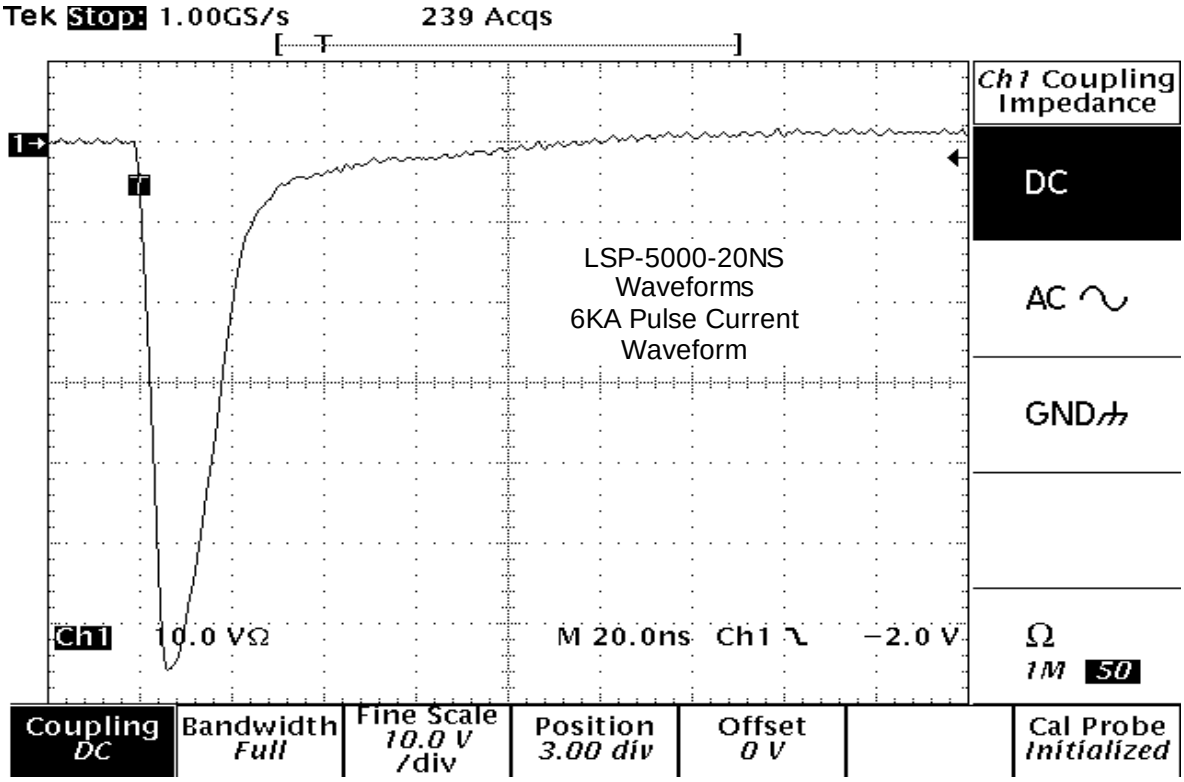

Tek Stop: 1.00GS/s 585 Acqs
Edge Slope
LSP-500-40NS-5KV
Test Condition:
100A/div
20ns/div
1KHz PRR
Ch1 10.0 VΩ
M 20.0ns Ch1 ⌥ −3.6 V
Type <Edge>
Source Ch1
Coupling DC
Slope
Level −3.6 V
Mode & Holdoff

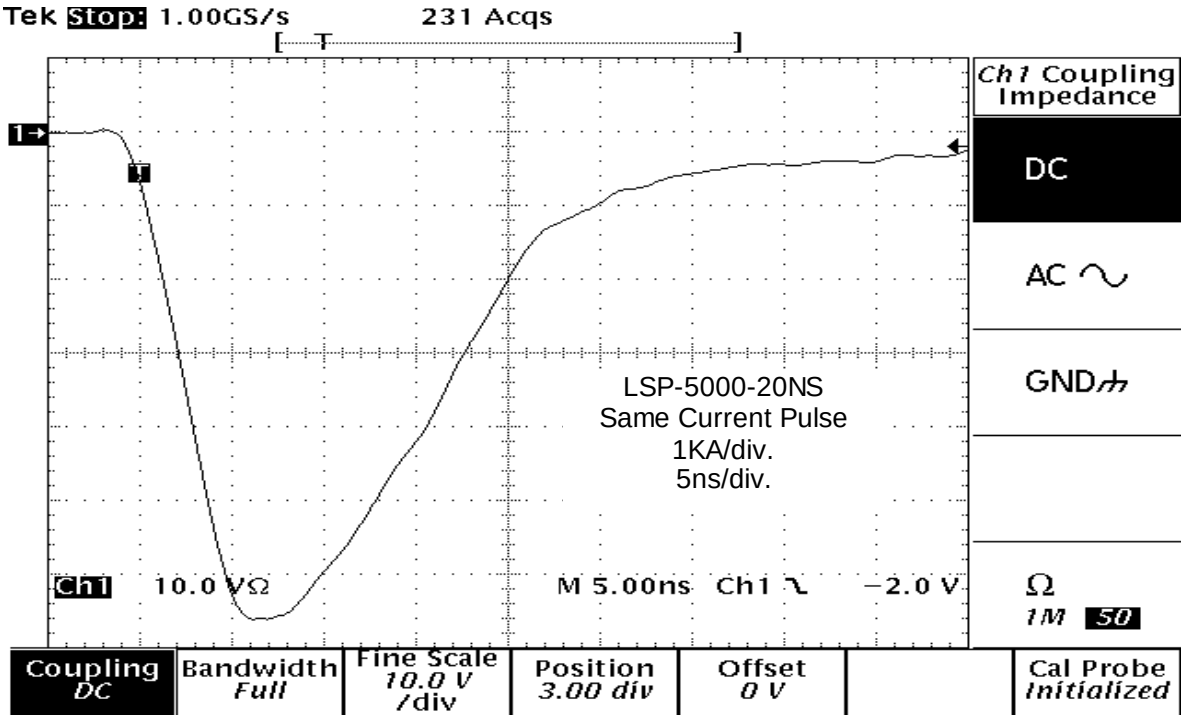

Tek Stop: 500MS/s 184 Acqs
Ch1 Coupling Impedance
DC
AC
GND
LSP-500-40NS-5KV
Test Condition:
100A/div
20ns/div
1KHz PRR
Ch1 10.0 VΩ
M 100ns Ch1 ⌥ −5.80 V
Ω
1M 50
Coupling DC
Bandwidth Full
Fine Scale 10.0 V /div
Position 2.98 div
Offset 0 V
Cal Probe Initialized

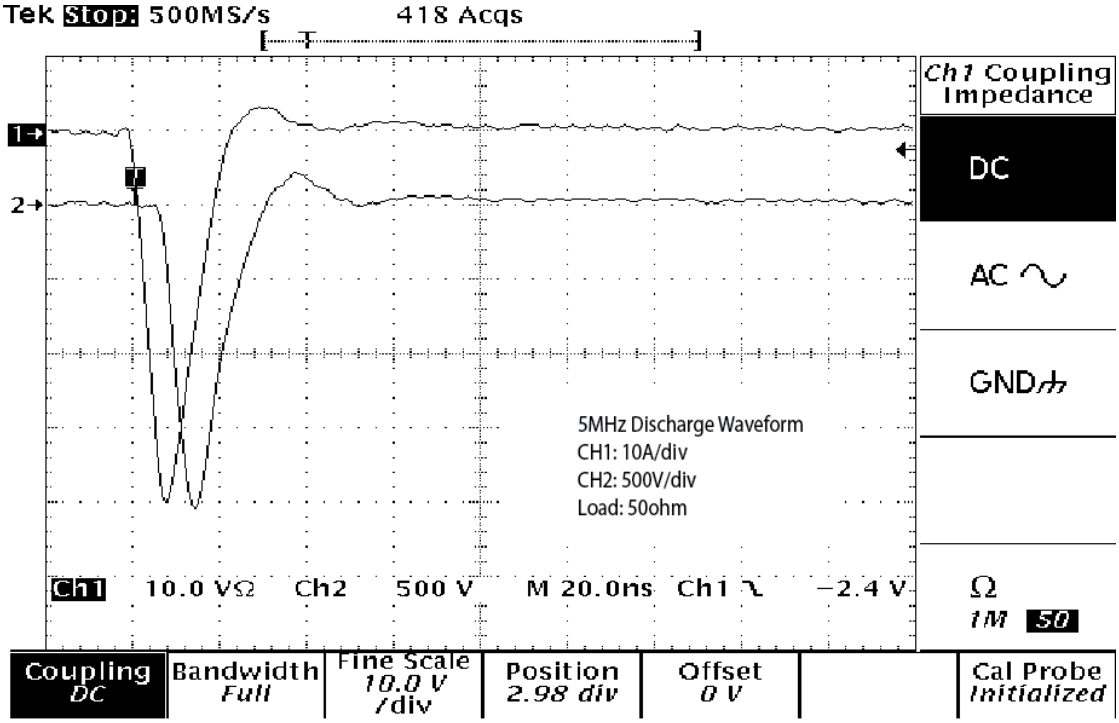

Tek Stop: 500MS/s 184 Acqs
Ch1 Coupling
Impedance
DC
AC
GND
LSP-1500-100NS
Waveforms
Wider Pulse Width:
1500A Peak
500A/div, 100ns/div
Ch1 10.0 VΩ M 100ns Ch1 ∖ −5.80 V
Ω
1M 50
Coupling
DC
Bandwidth
Full
Fine Scale
10.0 V
/div
Position
2.98 div
Offset
0 V
Cal Probe
Initialized

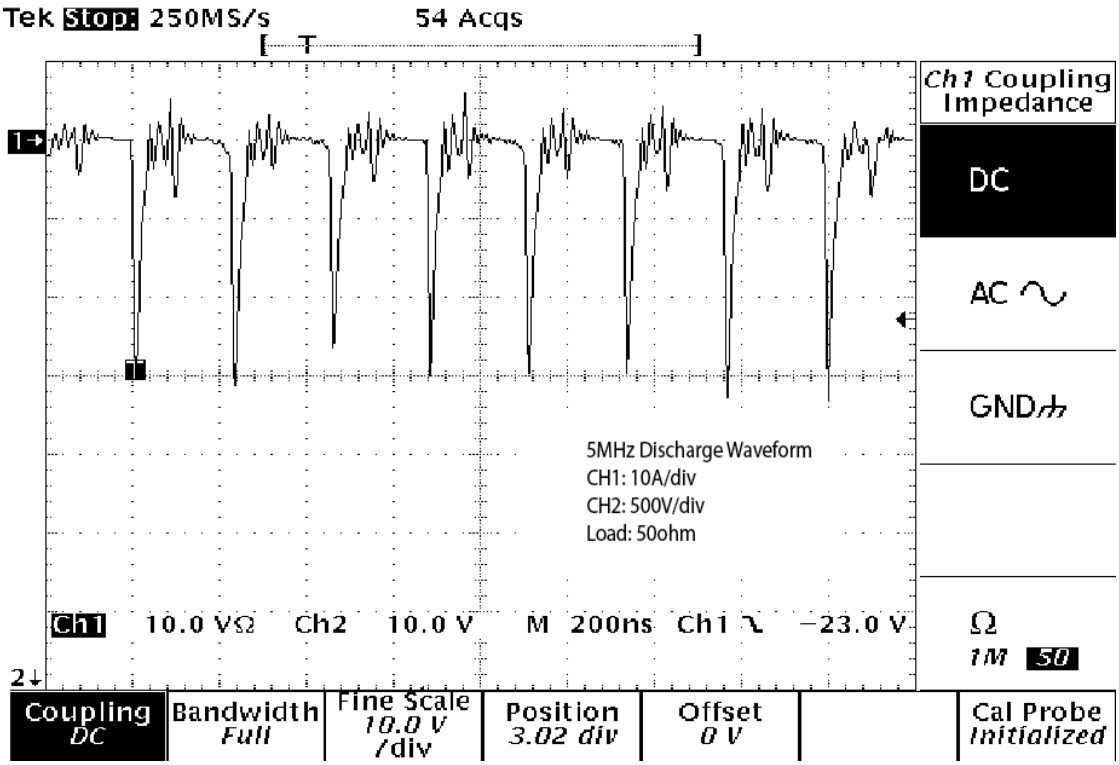

Tek Stop: Single Seq 500MS/s
Edge Slope
LSP-5000-20NS-15KV
Waveforms
5KA Puse Current
Waveform
500A/div.
20ns/div.
Ch1 10.0 VΩ Ch2 10.0 V M 20.0ns Ch1 ∖ −4.8 V
Type
<Edge>
Source
Ch1
Coupling
DC
Slope
Level
−4.8 V
Mode
&
Holdoff


Tek Stop: Single Seq 1.00GS/s
LSP-5000-20NS-15KV
Waveforms
Same One:
Reverse Current
500A/div, 20ns/div
Ch1 10.0 VΩ
M 20.0ns Ch1 ⌥ −8.8 V
Edge Slope
Type
<Edge>
Source
Ch1
Coupling
DC
Slope
Level
−8.8 V
Mode
&
Holdoff


Tek Stop: 1.00GS/s 239 Acqs
LSP-5000-20NS
Waveforms
6KA Pulse Current
Waveform
Ch1 10.0 VΩ
M 20.0ns Ch1 ⌥ −2.0 V
Ch1 Coupling
Impedance
DC
AC
GND
Ω
1M
50
Coupling
DC
Bandwidth
Full
Fine Scale
10.0 V
/div
Position
3.00 div
Offset
0 V
Cal Probe
Initialized


Tek Stop: 1.00GS/s 231 Acqs
Ch1 Coupling
Impedance
DC
AC
GND
LSP-5000-20NS
Same Current Pulse
1KA/div.
5ns/div.
Ch1 10.0 VΩ
M 5.00ns Ch1 ∖ −2.0 V
Ω
1M 50
Coupling
DC
Bandwidth
Full
Fine Scale
10.0 V
/div
Position
3.00 div
Offset
0 V
Cal Probe
Initialized


Tek Stop: 500MS/s 418 Acqs
Ch1 Coupling
Impedance
DC
AC
GND
5MHz Discharge Waveform
CH1: 10A/div
CH2: 500V/div
Load: 50ohm
Ch1 10.0 VΩ Ch2 500 V M 20.0ns Ch1 ∿ −2.4 V
Ω
1M 50
Coupling DC
Bandwidth Full
Fine Scale 10.0 V /div
Position 2.98 div
Offset 0 V
Cal Probe Initialized


Tek Stop: 250MS/s 54 Acqs
Ch1 Coupling
Impedance
DC
AC
GND
5MHz Discharge Waveform
CH1: 10A/div
CH2: 500V/div
Load: 50ohm
Ch1 10.0 VΩ Ch2 10.0 V M 200ns Ch1 ∿ −23.0 V
Ω
1M 50
Coupling DC
Bandwidth Full
Fine Scale 10.0 V /div
Position 3.02 div
Offset 0 V
Cal Probe Initialized

2.0 INSTALLATION

2.1 GENERAL

After unpacking, general inspection and preliminary checkout procedures should be performed to ensure that the unit is in proper working order. If it is determined that the unit has been damaged, the carrier should be notified immediately. Contact Lic directly:

LIC Engineering
122 Calistoga Rd. Suite 210
Santa Rosa, CA 95409 USA
Tel: (707) 327-2705
email: info@LicEngine.com

2.2 INSPECTION

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

2.3 OUTPUT STRIPLINE CONNECTIONS

Connect the stripline to the load (Laser Diode) using a soldering iron, or screws.

The physical distance between the load and tip of the stripline must be as short as possible.
Do not use any extra wires to connect between the strip line and a Laser Diode.

USING SUCH EXTRA WIRES WILL INCREASE A RISE AND FALL TIME DRAMATICALLY.

Formula is Trise-time=LxdI/Vo,

where Vo: the maximum output voltage of the unit, dI: Current increment within the time of Trise-time, L: Total inductance (LD-pin inductance plus internal lead wire inductance, plus external lead wire inductance).

Example 1):

500A load current, Total inductance=100nH, and Output voltage =50V, then, the fastest rise time T is only 1 us.

Example 2):
500A load current, Total inductance=100nH, Output Voltage =300V, then the fastest rise time will be: 170ns-200ns.

Refer to 3.1.3 RISE TIME, LOAD IMPEDANCE, AND OUTPUT VOLTAGE

THE FORWARDING VOLTAGE OF CONNECTED LD MUST BE CLOSE TO THE OUTPUT VOLTAGE SPECIFIED WHEN THE UNIT IS ORDERED.

IF THE LD VOLTAGE IS MUCH LOWERED THAN THE VALUE SPECIFIED, THE RISE TIME OF OUTPUT CURRENT BECOMES SLOW.

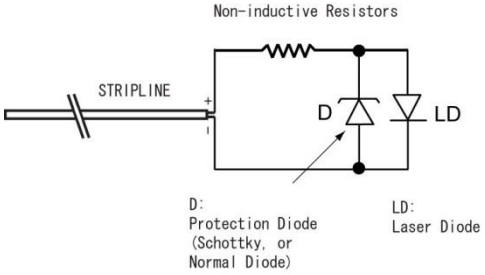
IN THIS CASE, THE SERIES RESISTOR CAN BE CONNECTED AS SHOWN IN THE FOLLOWING PICTURE.

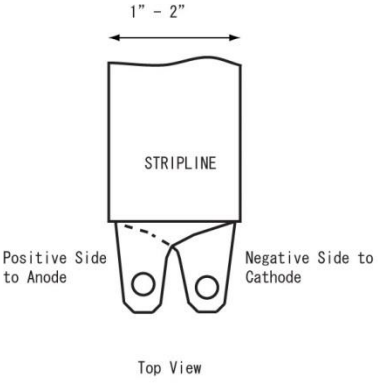
THIS SERIES RESISTORS SHOULD BE VERY LOW INDUCTANCE TYPE AND MUST SATISFIE THE EXPECTED PEAK CURRENT, VOLTAGE AND AVERAGE POWER.

Refer to 3.1.3 RISE TIME AND LOAD IMPEDANCE, OUTPUT VOLTAGE for detail.

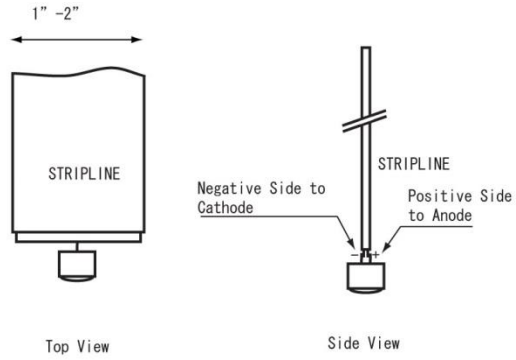
Contact factory if user can not find such resistors. Lic has a wide range of non-inductive resistor of which power ranges from 5W (air cooled) to 5KW (water cooled).

To protect user's LD from a reverse current, it is good idea to use a protection diode connected in parallel with the LD as follows. The reverse current will increase when the load inductance is increased. Check with a current monitor waveform if the reverse current is within safe area.





(1) For Screw Type Terminal



(2) For Pin Type Terminal

2.4 AC LINE CONNECTION

Confirm AC GND(Earth GND) is connected to the power supply GND. Confirm that AC line voltage is proper for the unit ordered, and AC power to the unit is still off. The standard center voltages are: 100/115/208/220, Single phase/three phase, +/- 10%

3.0 OPERATION

3.1 PREPARERATION & PRECAUTION

3.1.1 CURRENT DROOP

In QCW mode, the output current decays by the time for the given pulse width. The percentage of this current deduction is decided by A). The value of the capacitor bank, B). Pulse width, and C). The load impedance.

The formula is d=Pwx100/CxZd (%),
where d=current droop (%), Pw=Pulse width(seconds), and Zd=load impedance (ohm: LD voltage (V)/ LD current (A))

Example 1):
LD current =200A, LD voltage is 100V, C=0.25(F), Pw=5msec,
$d=5x10^{-3}X100/0.25x100/200=4\%$

Example 2):
LD current =500A, LD voltage is 50V, C=0.25(F), Pw=5msec,
$d=5x10^{-3}X100/0.25x50/500=20\%$

LD-XXXX-XX has the maximum C in the capacitor bank of 0.5 (Farads).

To improve the current droop, there are several ways:
1). Select the biggest capacitor bank.
Cons: The unit becomes expensive.
2). Decrease LD current, or Pulse Width.
Cons: Pulse width/LD current is limited.
3). Connect a resistor in series with LD.
Cons: Has to prepare the special resistor and the power loss at the series resistor.

3.1.2 AVERAGE POWER AND PULSE SETTING.

In QCW mode, both Pulse Width and Pulse Rate are limited by an average power of the unit.
Assume the ordered unit is 5KW average power, the maximum pulse width is 5ms, LD voltage is 100V, and the maximum load current is 1KA, then the maximum pulse rate of this unit is 10Hz.

$P\_average=5KW=10^3(A)x100(V)x5x10^{-3}(s)xF(Hz)$, so
$F=5x10^3/10^3(A)x100(V)x5x10^{-3}(s)=10Hz$.

Even if user attempt to increase the pulse rate, the unit automatically decrease the pulse rate to limit the average power within the power ordered to protect the capacitor charging power supply of the unit.
Or, If user attempt to increase the pre-determined pulse width, the unit becomes Fault condition.

3.1.3 RISE TIME AND LOAD IMPEDANCE, OUTPUT VOLTAGE

As a general rule, the rise time is increased when LD voltage is lowered and LD current is increased, or load impedance is lowered.

Example 1):
LD Current =500A-1KA, Output Voltage =50V, then the fastest rise time will be: 1us-2us.
Example 2):
LD Current =500A-1KA, Output Voltage =300V, then the fastest rise time will be: 100ns-200ns.

As seen above, using higher output voltage unit has a great effect to the rise time improvement. There are two reasons to do so.

1. Overcoming the inductance:
As described in 2.3 OUTPUT STRIPLINE CONNECTION, there is certain amount of Output voltage is required to overcome the inductance that exists between the end of stripline and user's LD. This inductance L is the total 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 = 200ns, Total inductance L=100n H, Then, the required Output voltage to overcome this inductance V_required is: V_required=250V,

Notice this voltage is used only for the inductance. If user's LD voltage is 50V, total voltage output voltage required from the unit is 300V.

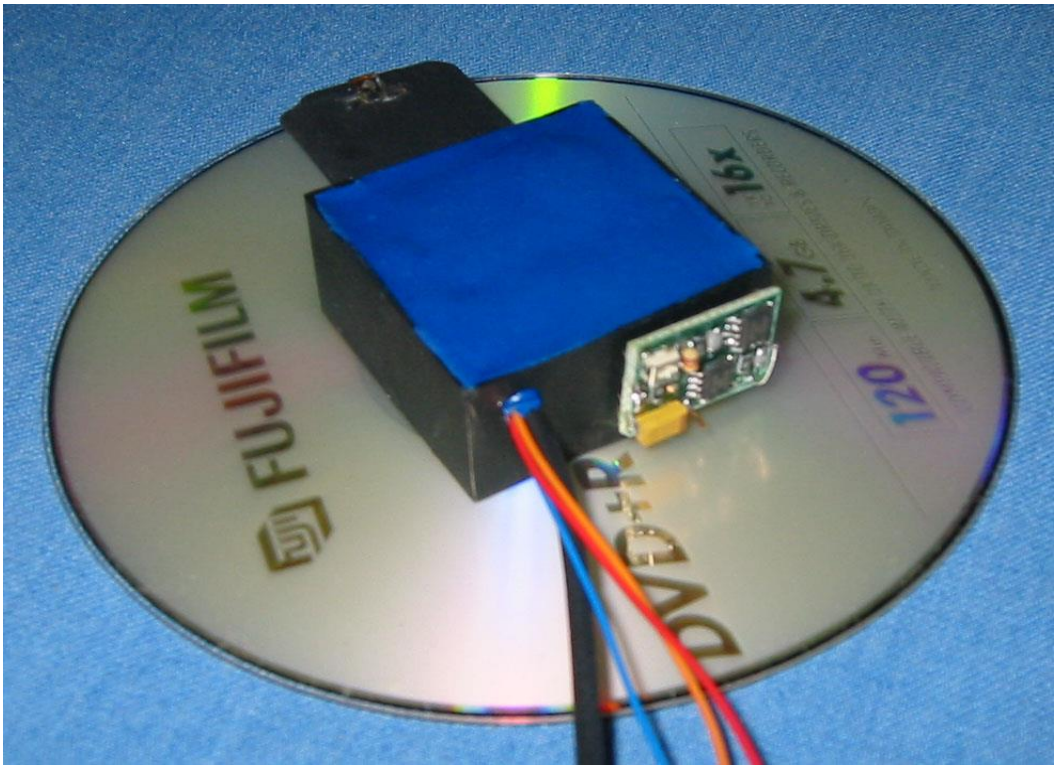
2. Series Resistor:
As seen in the Example before, Increasing a load impedance is an easy choice to improve the rise time.

However, there are Pros and Cons for the higher voltage unit:
Pros:
1) Can improve the rise time dramatically.
Cons:
1) Unit becomes expensive.
2) There are certain heating loss at the series resistor.
3) Has to prepare a low inductance, high peak current, and high power resistor.

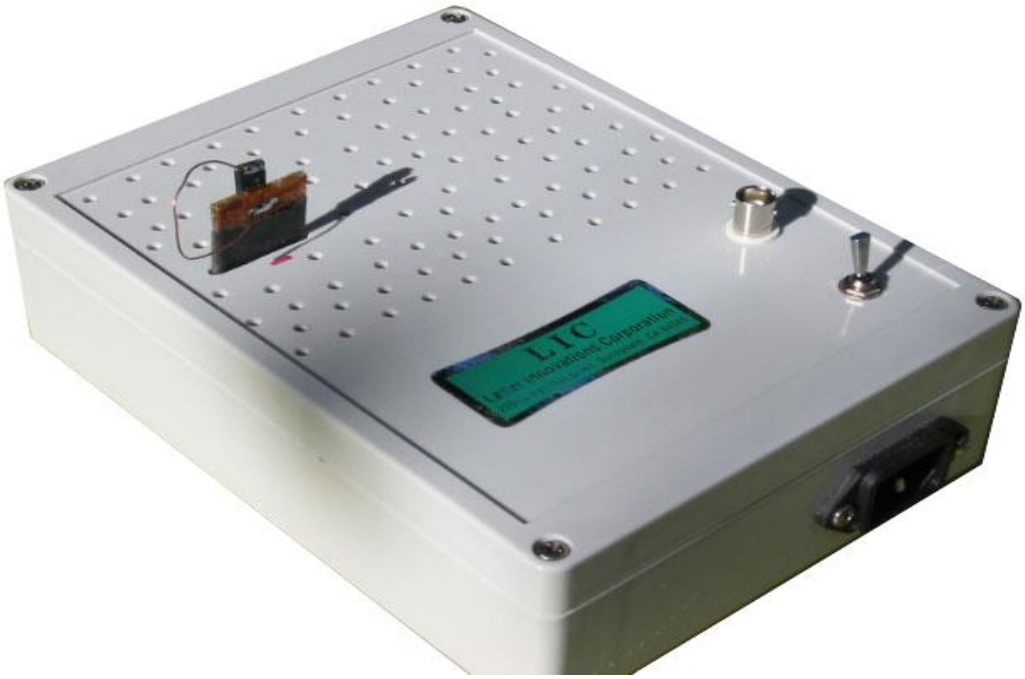
3.1.4 PRECAUTION

1). Do not shut off AC line voltage while the power supply is running. This is not a good manner from the safety point of view.
2). Confirm that Cur./Vol. Adj. is set to adequate level before turning Output SW. ON
3) Don't change Internal/External SW. while the unit is running.

4) Don't change Rise Time selection while the unit is running.

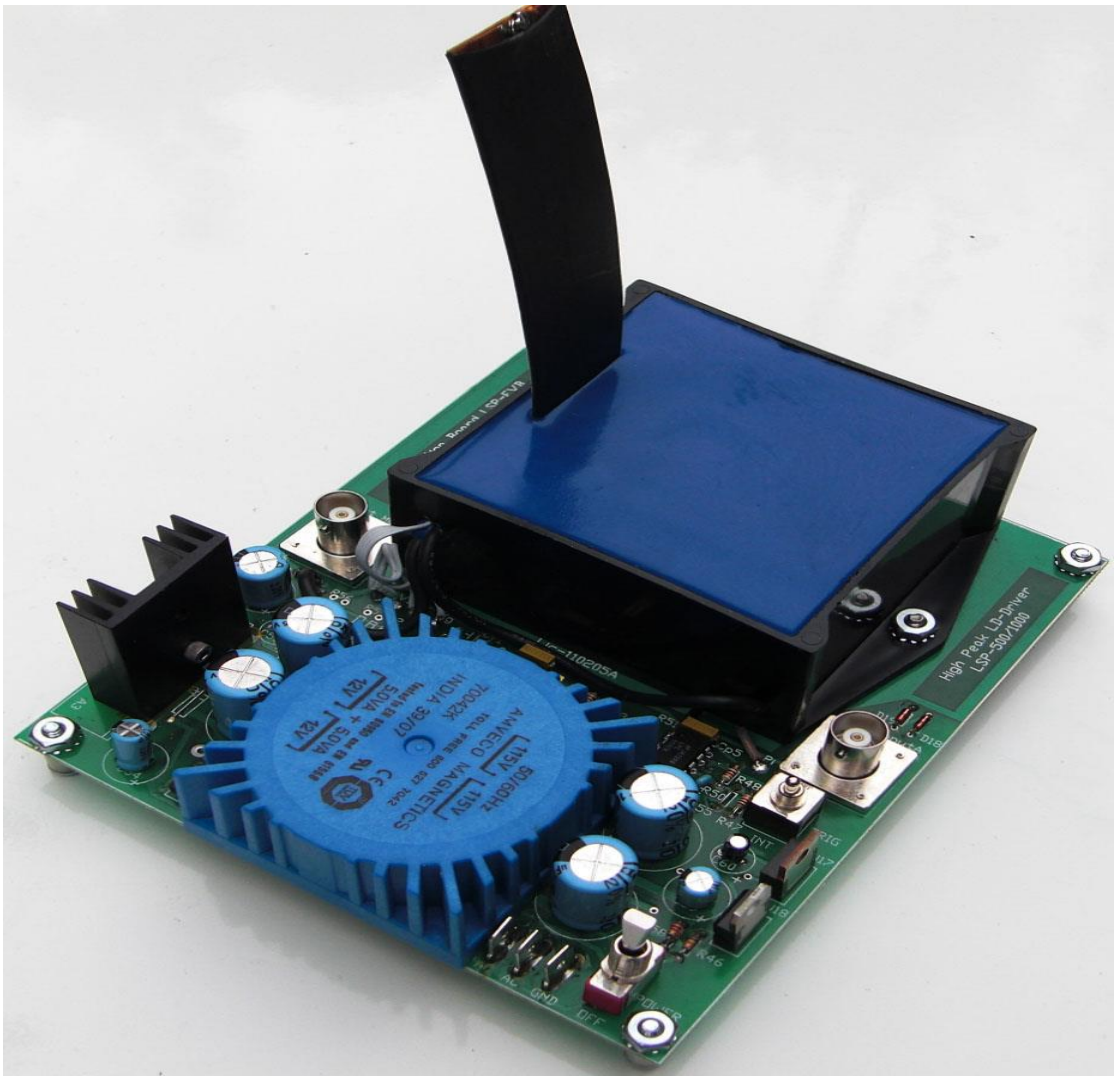


(LSP-120 LD Driver)

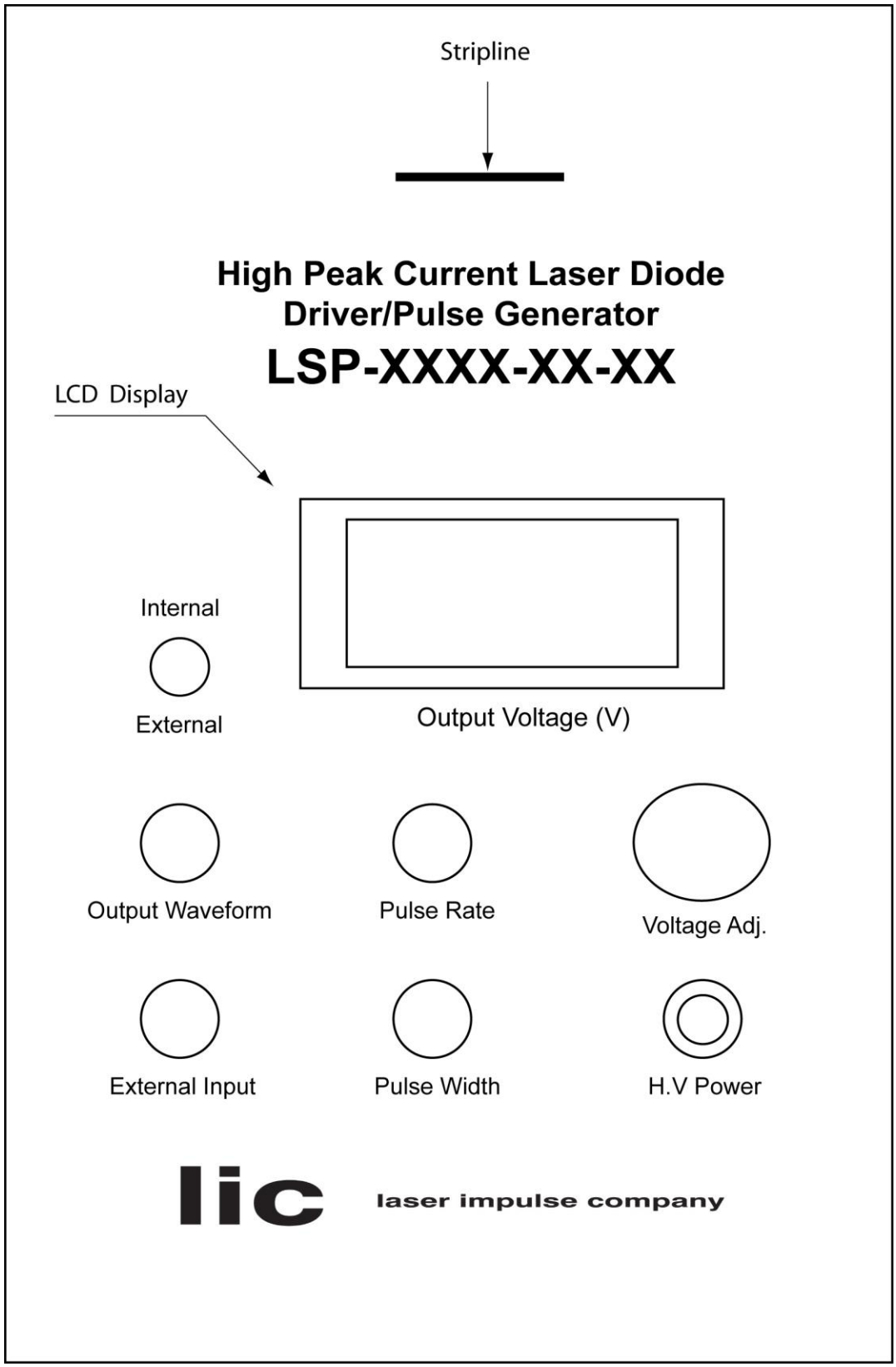


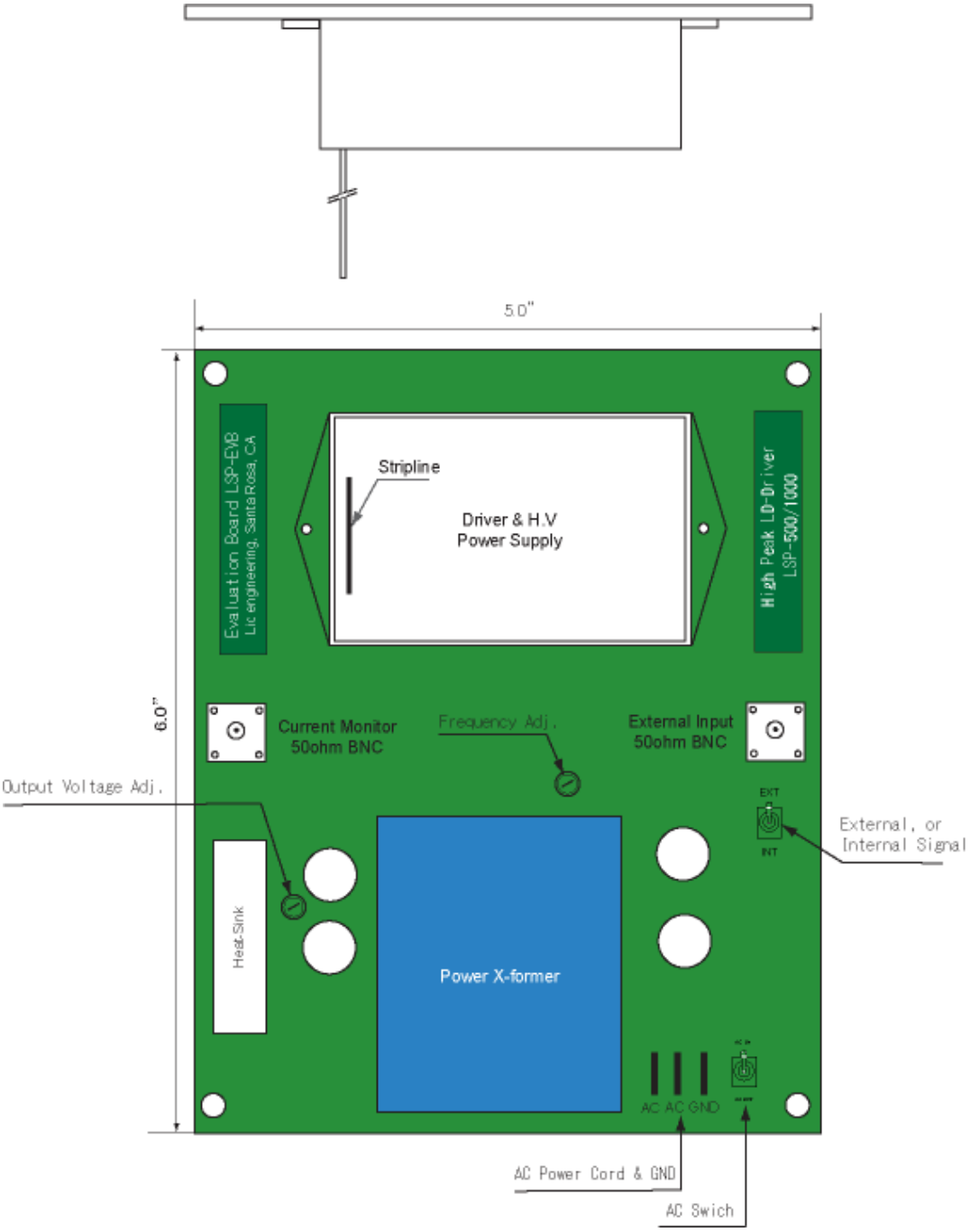
(LSP-2500-20N-15KV Driver)

(LSP-5000-20N Driver/Pulse Generator)

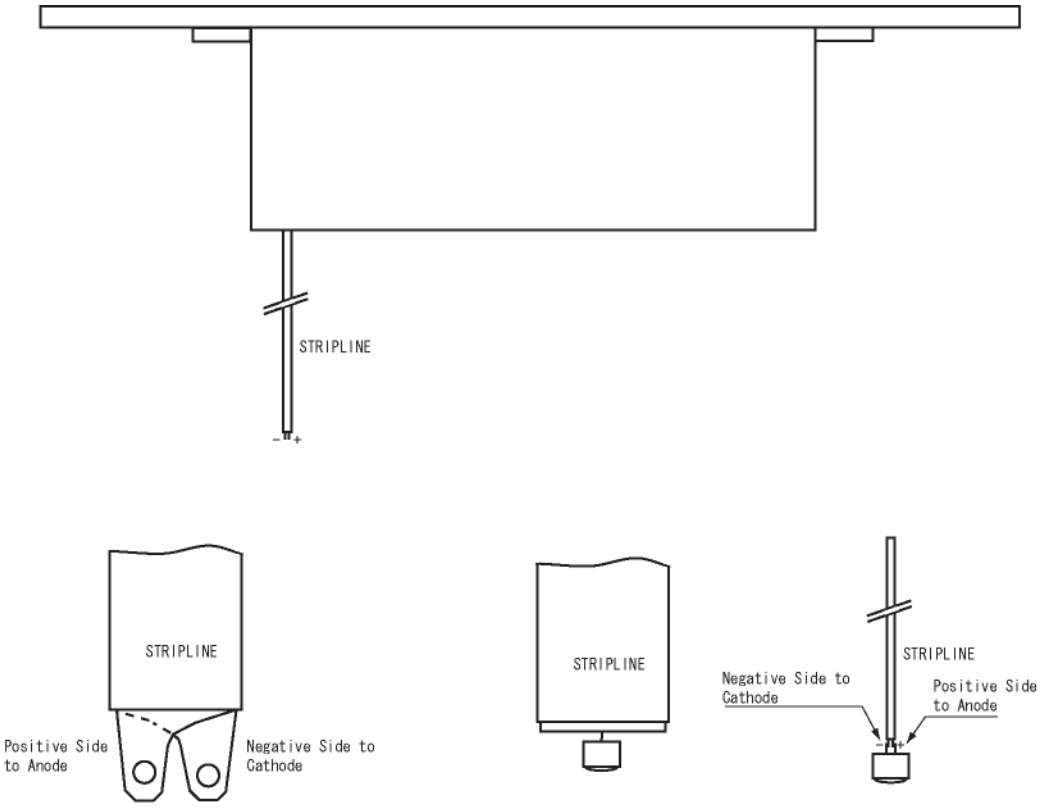


(LSP-XXXX-XXX-XX Driver)


Stripline
High Peak Current Laser Diode
Driver/Pulse Generator
LSP-XXXX-XX-XX
LCD Display
Internal
External
Output Voltage (V)
Output Waveform
Pulse Rate
Voltage Adj.
External Input
Pulse Width
H.V Power
lic
laser impulse company



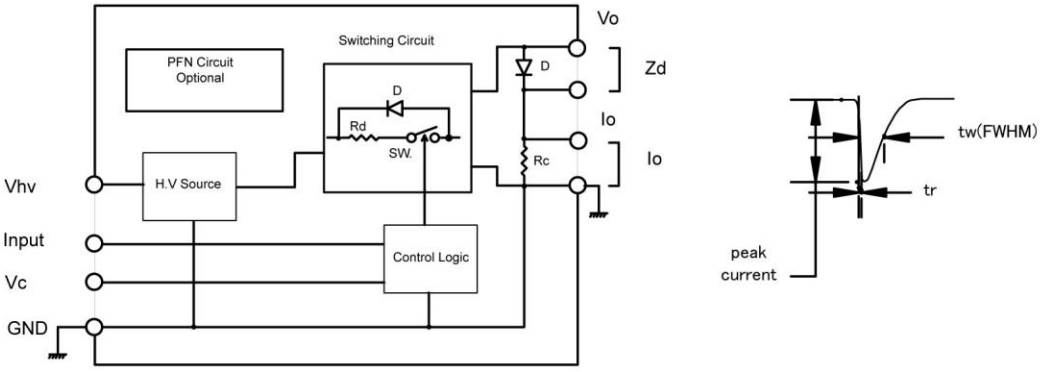
(Evaluation Board)



(1) For Screw Type Terminal

(2) For Pin Type Terminal

500A Driver internal circuitry

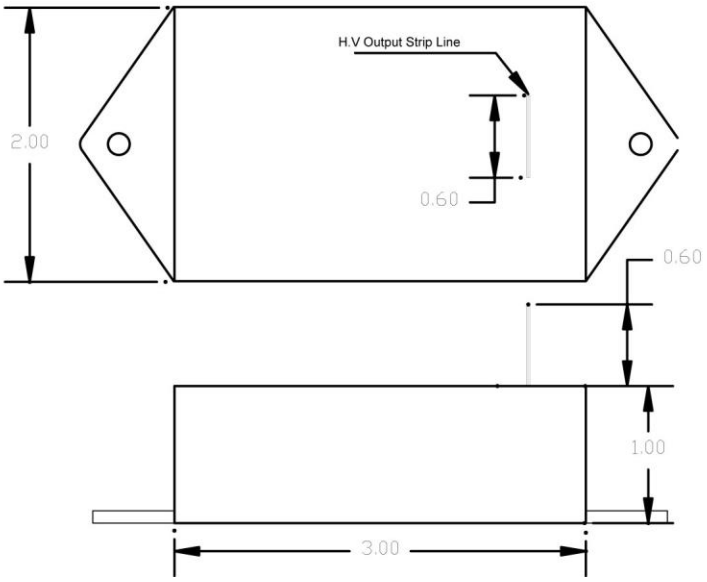


Vhv: H.V Source voltage (DC10-12V/0.3A)
Input: Pulse input 10-15V, tr 10ns
Vc: Control circuit voltage (DC25-30V/0.1A)

SW.: Switching device
D: Protection diode
Rc: Current sensing resistor
Rd: Internal resistance

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

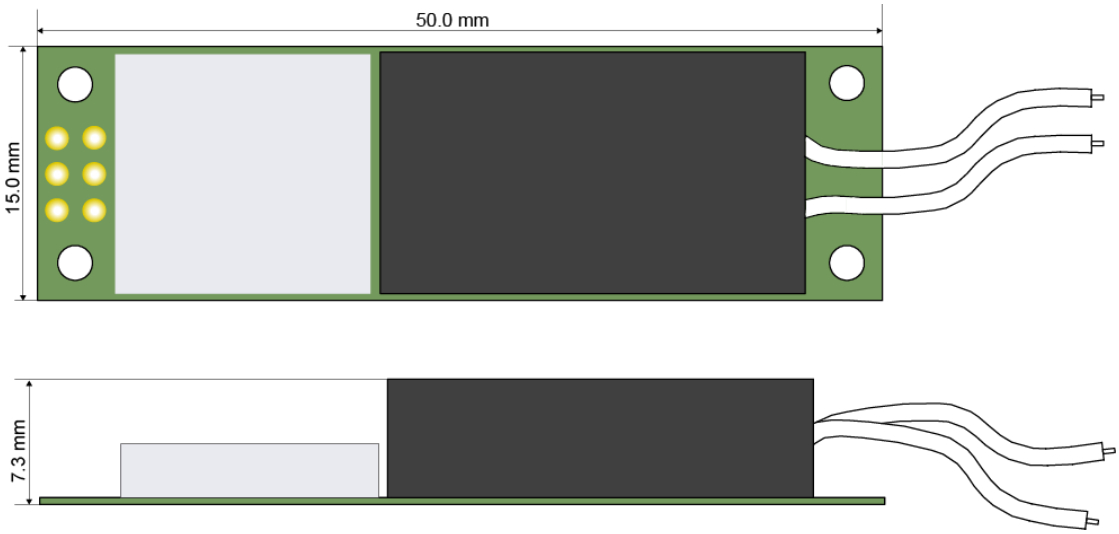
Mechanical Dimension (1.5-3KV model)



(LSP-500-50N-1KV LD Driver)

(LS-1000 Pulse Generator/Driver)

(LS-2000 Pulse Generator/Driver)



(Ultra Miniature Pockels Cell Driver)

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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122 Calistoga Rd. Suite 210
Santa Rosa, CA 95409 USA
Tel: (707) 327-2705
email: info@LicEngine.com