

LG105

Fifth Harmonic Generator for Nd:YAG Lasers

User's Manual

Del Mar Ventures

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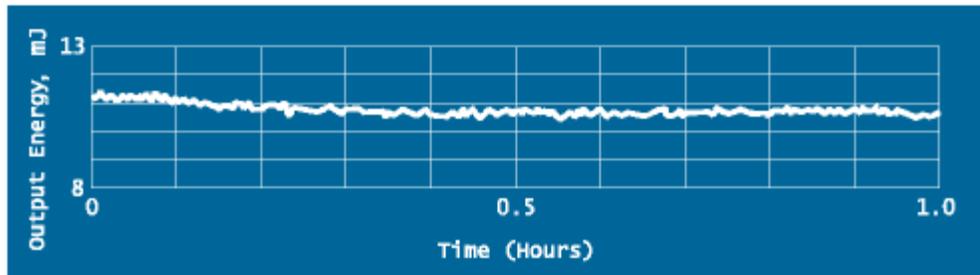
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1. INTRODUCTION



The Fifth Harmonic Generator model LG105 is compatible with any pulsed Nd:YAG laser, and is designed to produce UV-radiation at 213 nm. The Nd:YAG laser, equipped with LG105, is a versatile device, and in many applications can eliminate the necessity for excimer lasers. Solid state technology that does not use toxic gases and costs less gives you the advantages of both consistent, day-to-day operation and low maintenance. A high quality BBO crystal is used in the LG105 as the non-linear element, providing up to 20% conversion efficiency into 213 nm. The non-linear crystal is placed in a special cell ensuring long lifetime of BBO without any degradation or breakage. A harmonic separation system installed in LG105 provides nearly 100 % spectral purity of the output at 213 nm. The LG105 Fifth Harmonic Generator gives you not only high power output but also excellent radiation stability.



Fifth harmonic output from the Nd:YAG laser can be obtained by mixing either first and fourth or second and third harmonic radiation. It is the later option that is implemented in the LG105 Fifth Harmonic Generator.

2. OPTIC SCHEMATIC AND DESIGN

Figure 1, below, shows the optical layout of the LG105. The view from above, with cover removed, is presented in Figure 2. The same components are shown in the same positions on both Figures.

Second and third harmonic radiation is directed through BBO Crystal 2, which is located inside Cell 1 (refer to Fig.1). Dispersion Prism 3 divides the harmonics into three beams. Mirrors 5 and 4 reflect the fifth harmonic radiation to separate it from the second and third. Residual second and third harmonics, unconverted in the BBO crystal, are transmitted by Mirrors 4 and 5 into Dampers 8. Phase-Rotator 6 converts 213.2 nm radiation with horizontal polarization into vertically polarized radiation, for better harmonic separation.

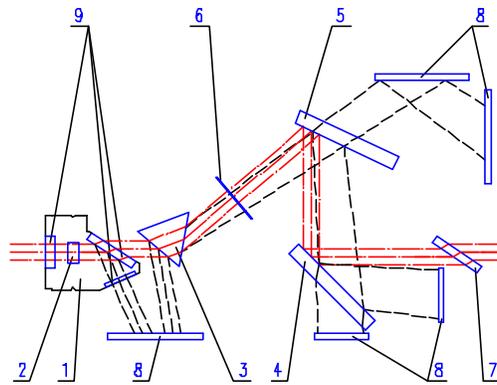


Fig.1. LG105 Optical Schematic

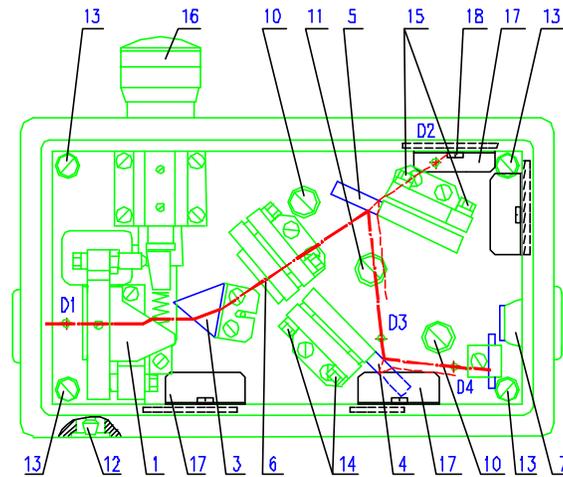


Fig.2. LG105 Top View

1. BBO Crystal Cell
2. BBO Crystal
3. Dispersion Prism
4. Folding Mirror
5. Folding Mirror
6. Phase-Rotator
7. Output Window
8. Dampers
9. Hermetically Sealed BBO Crystal Cell Windows
10. Mounting Apertures
11. Aperture for Fastening LG105 and SOLAR LS Pump Laser to Optional Mounting Plate
12. Connecting Pipe for Nitrogen Lancing
13. Legs
14. Alignment Screw for Mirror 4
15. Alignment Screw for Mirror 5
16. Fine Alignment Screw (for Crystal Phase-Matching Angle)
17. Protective Screens
18. Mounting Screw
19. Cover (Removed)

Maximum efficiency of the fifth harmonic conversion is achieved when the third harmonic is at its highest intensity and when the crystal is properly

phase-matched. To adjust the BBO Crystal to phase synchronism, use the Fine Adjustment Screw 16 (Fig.2) on the LG105 laser side panel.

Four height-adjustable Legs 13 provide for unit adjustment relative to the input beam. Two Mounting Holes 10 beneath the unit are used to secure it to an optical table.

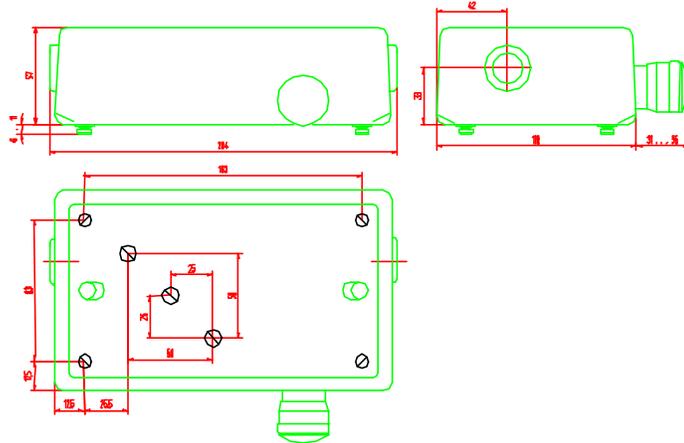
When pumped with SOLAR Nd:YAG laser, the LG105 laser is fastened to an optional mounting plate. To adjust the height of the LG105, use Aperture 11.

CAUTION!

The Fifth Harmonic Generator can produce ozone (O_3) in the laser beam's pathway. To ensure safe working conditions, take measures to pipe the laser beam and blow nitrogen (N_2) through the whole laser cavity. To connect a nitrogen tank to the unit, a Connecting Pipe is provided (Pos. 12, Fig. 2).

3. SPECIFICATIONS

The outward view of the LG105 is shown below.



The LG105 is a self-contained unit that can be used with any Nd:YAG laser that has the specifications listed in the table below.

REQUIRED INPUT LASER BEAM PARAMETERS

Input pulse duration, ns	5-8
Maximum allowed input beam diameter, mm	6
Maximum allowed input energy density, J/cm ²	
532 nm	0.75
355 nm	0.75
Input beam polarization	
532 nm	vertical
355 nm	vertical

LG105 PARAMETERS

FHG crystal	BBO
Crystal size, mm	8x8x3.5
FHG conversion efficiency is dependable	on input beam parameters (see Table "Parameters Obtained During LG105 Testing")
Output beam polarization at 213.2 nm	vertical
Output pulse duration	~ 1 ns shorter than that of the input pulse
Overall dimensions, mm	204x153x63

PARAMETERS OBTAINED DURING LG105 TEST

Output wavelength, nm	Pump parameters				Output energy, mJ
	Pump wavelength, nm	Pump energy, mJ	Pulse duration, ns	Beam diameter, mm	
213.2					

Testing Engineer _____

4. INSTALLATION AND OPERATION

1. Place the LG105 at a distance of 5–10 cm from the pump laser. Remove the cover.
2. Switch on the pump laser for operation in the free running mode. Use low-level power — just enough for viewing the laser output.
3. Remove the caps from the Input and Output Windows. Place Apertures D1 and D3 into the unit, in accordance with Fig. 2.
4. Position the LG105 in such a manner that the pump beam passes through Aperture D1 and the BBO Crystal's center (Verify this using a screen made from white paper, placing it behind the cell). The pump beam reflected by Mirror 5 (marked bold on Fig. 2) should pass through Aperture D3.

Note 1: In order to avoid pump laser damage, please make sure the beam is not reflected directly back from the BBO Crystal into the pump beam. If necessary, turn the LG105 (2-3)° in the horizontal plane.

Secure the LG105 using two Mounting Screws 10 from the Accessories Kit.

5. Remove Aperture D3. Insert Aperture D4. With the help of Alignment Screws 14, position Folding Mirror 4, in order for the 2ω beam to pass through the Alignment Aperture D4. This will provide 5ω beam passage through the center of Output Window 7. Once full alignment is achieved, withdraw the Alignment Apertures from the unit.

Note 2: Be sure the input beam parameters are in compliance with the requirements specified on page 7.

6. Close the FHG Cover. Switch on the Nd:YAG laser for operation in the Q-switch mode. Turn the Fine Alignment Screw 16 for maximum output energy.

5. TROUBLESHOOTING

FAULT	CAUSE	REMEDY
1. Low conversion efficiency or poor quality spot	Crystal phase-mismatching	Turn the Fine Adjustment Screw on LG105 side panel for maximum output
	One of the optical elements is damaged	Replace faulty optics
	Inadequate input parameters (low energy, high divergence, de-polarization, poor input beam quality)	Check for input beam parameters and adjust them to required specifications.
2. Low stability of output beam	Low stability of input beam	Check for input beam stability and, if necessary, take steps to improve laser stability.

6. WARRANTY AND SERVICING

Del Mar Ventures warrants to the original purchaser that products specified herein will perform to the published specifications when used and maintained in accordance with the manufacturer's written instructions.

With respect to the LG105 unit, the 12-month warranty period commences on the date of shipment. Warranty includes cost-free delivery of replacement parts and service maintenance by a manufacturer-approved engineer. Travel costs for on-site service are not covered by warranty terms.

The Crystal and optics are warranted for a period of 90 days from the delivery date. The BBO crystal shall be free from defect in material and workmanship when shipped from our factory.

Replacement components purchased after the original warranty expiration shall be free from defects in materials and workmanship for three month from the date of shipment from our factory. This warranty excludes optical components, which shall be warranted as free from defects in materials and workmanship when shipped from our factory.

If, due to defects in materials and workmanship, the product fails to perform to the manufacturer's published specifications, or if a consumable is not free from defects in materials and workmanship when shipped from the factory, Del Mar Ventures will, at its option, repair or replace the defective product or consumable without charge. Del Mar Ventures reserves the right to complete repairs at the factory, at any authorized repair facility, or on the purchaser's premises.

To make a warranty claim within the applicable warranty period, the purchaser shall contact Del Mar Ventures in writing or by phone, immediately following discovery of the reason for the claim:

Del Mar Ventures
4119 Twilight Ridge
San Diego, CA 92130
Phone: (858) 755-6727
Fax: (858) 630-23276
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<http://www.sciner.com/>

The warranty is null and void if the unit is serviced or repaired (other than routine maintenance as described in the User's Manual) by any person not authorized by Del Mar Ventures. In addition, the warranty is null and void if the product is used other than as specified in the User's Manual, or if the product is used with parts or accessories not specifically approved by Del Mar Ventures. The warranty does not cover damage to optical surfaces caused by improper cleaning or by customer misuse of a product.

Use the original packing boxes to secure the product during shipment.

APPENDIX

SPARE PARTS

1. Alignment aperture 2 pcs.
2. Alignment spanner 1 pcs.
3. Mounting screws 2 pcs.