Harmonics Generator

HarmoniXX SHG

User Manual

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IMPORTANT – READ CAREFULLY BEFORE USE – KEEP FOR FUTURE REFERENCE

This user manual contains user information for the HarmoniXX SHG . Read this manual carefully before operating the HarmoniXX SHG . The HarmoniXX SHG has only to be used as described in this manual. Differing use may endanger safety and voids warranty.

CAUTION - USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE

Symbols Used in This Manual

This symbol is intended to alert the operator to the danger of exposure to hazardous visible and invisible laser radiation.

This symbol is intended to emphasize the presence of important operating instructions.

Warranty

The warranty conditions are specified in the sales contract. Any unauthorized modification of the **HarmoniXX SHG** system components or software will void the guarantee and service contract.

Disposal Hints

All electrical and electronic products should be disposed separately from the standard municipal waste system. Proper disposal of your old appliance prevents potential negative consequences for the environment and human health.

Some components of your **HarmoniXX SHG** system are marked with the crossed-out wheeled bin symbol covered by the European Directive 2002/96/EC on waste electrical and electronic equipment (WEEE) of the European Parliament and the Council of January 27, 2003. These items must be disposed via designated collection facilities appointed by government or local authorities.

For more information about disposal of your old product, please contact Coherent Inc.

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1 Safety Instructions

1.1 Safety Features and Compliance to Government Requirements

US government requirements are contained in 21 CFR, Subchapter J, Part II administered by the Center for Devices and Radiological Health (CDRH).

The European Community requirements for product safety are specified in the “Low Voltage Directive” (2006/95/EC). The “Low Voltage Directive” requires that electronic products comply with the standard EN61010-1:2010 “Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use”.

Compliance of this product is certified by the CE mark.

1.2 Optical Safety

Because of its special properties, laser light poses safety hazards not associated with light from conventional sources. The safe use of lasers requires that all laser users – and everyone else near the laser system - are aware of the dangers involved. The safe use of the laser depends upon the user becoming familiar with the instrument and the properties of intense and coherent beams of light.

Direct eye contact with the output beam of a laser will cause serious damage and possible blindness.

The greatest concern when using laser equipment is eye safety. In addition to the main beam there are often many smaller beams present at various angles near the laser system.

These beams are formed by specular reflections of the main beam at polished surfaces such as lenses and beam splitters. Although weaker than the main beam, such beams may still be sufficiently intense to cause eye damage. Laser beams are powerful enough to burn skin, clothing, or paint. They can ignite volatile substances such as alcohol, gasoline, ether, and other solvents, and can damage light-sensitive elements in video cameras, photomultipliers, and photodiodes.

The laser beam can ignite substances in its path, even at a distance. The beam may also cause damage if contacted indirectly from reflective surfaces. For these and other reasons, the user is advised to follow the precautions below:

1. Observe all safety precautions in the user manual.
2. Extreme caution should be exercised when using solvents in the area of the laser.
3. Limit access to the laser to qualified users who are familiar with laser safety practices and who are aware of the dangers involved.
4. Never look directly into the laser light source or at scattered laser light from any reflective surface. Never sight down the beam into the source.
5. Maintain experimental setups at low heights to prevent inadvertent beam-eye contact at eye level.
6. As a precaution against accidental exposure to the output beam or its reflection, those using the system should wear safety glasses as required by the wavelength being generated.

Laser safety glasses can present a hazard as well as a benefit; while they protect the eye from potentially damaging exposure, they block light at the laser wavelengths, which prevents the user from seeing the beam. The user should therefore use extreme caution even when using safety glasses.

7. Avoid direct exposure to the laser light. The intensity of the beam can easily cause flesh burns or ignite clothing.
8. Use the laser in an enclosed room. Laser light will remain collimated over long distances and therefore presents a potential hazard if not confined.
9. Post warning signs in the area of the laser beam to alert those present.
10. Advise all those using the laser of these precautions. It is good practice to operate the laser in a room with controlled and restricted access.

1.3 Electrical Safety

The **HarmoniXX SHG** uses DC voltages. All units are designed to be operated with protective covers in place. The device complies with protection Class I / EN 61140:2007, degree of protection IP20, according to EN 60529:2010. Certain procedures in this manual require removal of the protective covers. These procedures are normally used by a qualified trained service personnel. Safety information contained in the procedures must be strictly observed by anyone using the procedures.

1.4 Electromagnetic Compatibility

The European requirements for Electromagnetic Compliance (EMC) are specified in the EMC Directive 2004/108/EC. Conformance (EMC) is achieved through compliance with the

harmonized standards EN 61000. The **HarmoniXX SHG** meets the emission requirements for Class A, Group 1 as specified in EN 55011 (05/2010).

Compliance of this product with the (EMC) requirements is certified by the CE mark.

1.5 Laser Pump Source

Observe all safety precautions associated with the pump laser. Refer to your pump laser operator's manual for additional safety precautions.

The governmental standards and requirements specify that the laser must be classified according to the output power or energy, and the laser wavelength. The **HarmoniXX SHG** is classified to emit laser radiation Class 4 based on 21 CFR, Subchapter J, Part II, Section 1040-10(d) dependent upon the pump laser.

According to the European Community standards, the **HarmoniXX SHG** is classified to emit laser radiation Class 4 based on EN 60825-1, Clause 9, dependent upon the pump laser. In the manual and other documentation of the **HarmoniXX SHG** , the classification will be referred to as Class 4.

1.6 Protective Housing

The **HarmoniXX SHG** is enclosed in a protective housing that prevents human access to radiation in excess of the limits of Class 1 radiation, which is dependent upon the pump laser, as specified in the Federal Register, July 31, 1975, Part II, Section 1040.10(f)(1) and Table 1-A/EN 60825-1, Clause 4.2 except for the output beam, which is laser radiation Class 4 dependent upon the pump laser.

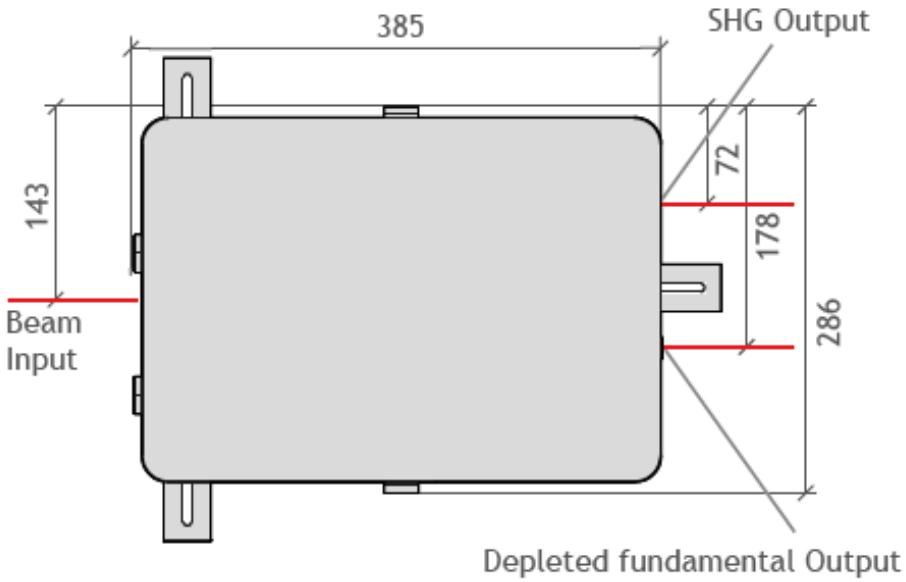
Use of controls or adjustments or performance of procedures other than those specified in the manual may result in hazardous radiation exposure. Use of the system in a manner other than that described herein may impair the protection provided by the system.

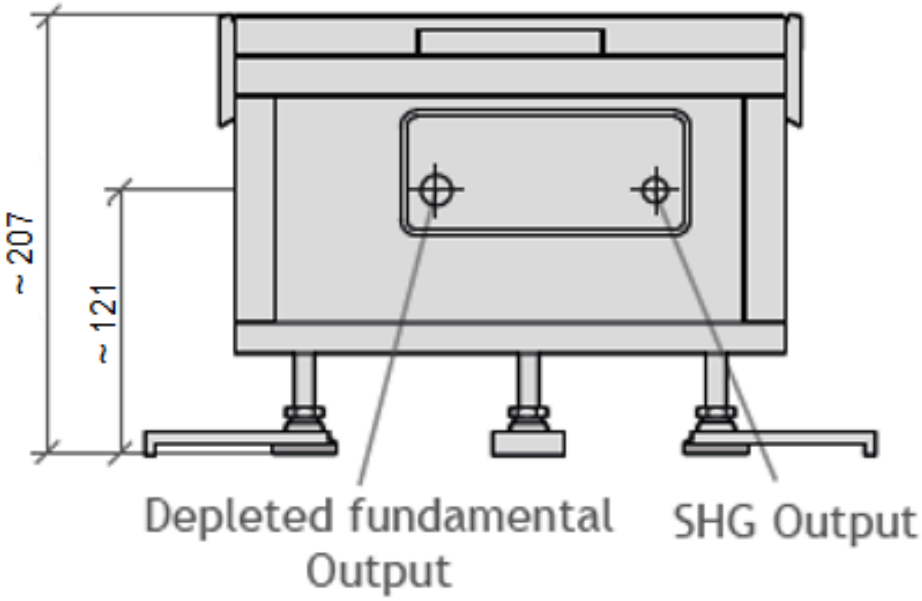
1.7 Location of Safety Labels

When the pumping beam is allowed to impinge on the crystal, both laser and collateral radiation are produced. The laser beam is emitted from the laser aperture which is clearly labeled.

The **HarmoniXX SHG** is designed to be used with the covers in position and this cover shields the operator from all collateral radiation. During initial alignment and maintenance operations, such as mirror alignment, it will be necessary to remove the covers. The covers are not interlocked with the circuitry of the pumping laser but a label provides a warning about exposure to the radiation.

Operation of HarmoniXX SHG with covers removed will allow access to hazardous visible and invisible radiation. The HarmoniXX SHG should only be opened for the purposes of maintenance and service by trained personnel cognizant of the hazards involved. Extreme caution must be observed in operating the HarmoniXX SHG with covers removed. There are high power reflections which may exit at unpredictable angles from the HarmoniXX when the pumping laser is activated. These beams have sufficient energy to cause permanent eye damage or blindness.





2 Description

2.1 Description and intended use

Figure 2.1: Photograph of the **HarmoniXX** optical unit.

APE offers a wide range of harmonic generators designed to complement ultrafast lasers, either with fixed central wavelength or widely tunable, as well as optical parametric oscillators. Its main intention is to enlarge the available tuning range towards the visible and ultraviolet wavelength range.

Item	Dimensions (L x W x H)	Weight	Power
Harmonics head	385 x 286 x 207 mm	15 kg	1 x 100-240Vac single phase
Harmonics controller	205 x 126 x 100 mm	2 kg	N/A

The standard unit is equipped with motorized drives for the nonlinear crystals.

2.2 Scope of Delivery

- **HarmoniXX** optical unit (including both focussing and collimation lens)
  - **HarmoniXX SHG** units for high energy systems include a telescope for focussing the input beam and possibly no or an external collimation lens
- mounting clamps
- **HarmoniXX** controller unit
- power supply
- connector cable for controller unit
- RS-232 cable
- USB drive with **GUI** software
- Optics Set Box containing:
  - SHG crystal
  - SHG compensator
  - slip-on target (for L2)
  - Manual

Item	Dimensions (L x W x H)	Weight	Power
Harmonics head	385 x 286 x 207 mm	15 kg	1 x 100-240Vac single phase
Harmonics controller	205 x 126 x 100 mm	2 kg	N/A

2.3 Environmental Requirements

The HarmoniXX SHG is intended for operation in dry and dust reduced rooms. It has to be firmly installed on an optical table of a similar solid, vibration-free board. During storage and transportation as well as for the installation and during operation, the ambient conditions must be observed. Ensure reasonable transport conditions, free of major shocks, jolt or fall; protect against frost. Use original packing material for transportation. Before unpacking the device wait for at least six hours to allow for acclimatization of all components.

- Ambient temperature during transportation: -30 ... +50°C
- Relative humidity during transportation: <80%, no condensation
- Ambient temperature during operation: +18 ... +27°C
- Relative humidity during operation: <60%, no condensation

2.4 Specifications

Due to the vast number of possible **HarmoniXX** models, only the typical values for titanium-sapphire lasers are shown. Please refer to your official quotation and test protocol in case you have a differing unit.

Input wavelength range	680 ... 1080 nm	
Output wavelength	340 ... 540 nm	
Configuration	fs	ps
Input pulse width	~ 130 fs	~ 1.6 ps
Efficiency @ 1.3 W, 800 nm	40 %	15 %
SHG crystal mount color	yellow	red
walkoff compensator color	black	silver

Due to limited aperture of the nonlinear crystals in ps configuration, it is necessary to split the wavelength range into two sub-ranges:

- Short range: 680 ... 960 nm
- Long range: 850 ... 1080 nm

For these two ranges two different crystals (red posts) are supplied, each crystal is labeled with the correct wavelength range. Make sure to install the appropriate crystal according to the operation wavelength.

2.5 Construction and Function

2.5.1 Optical Unit

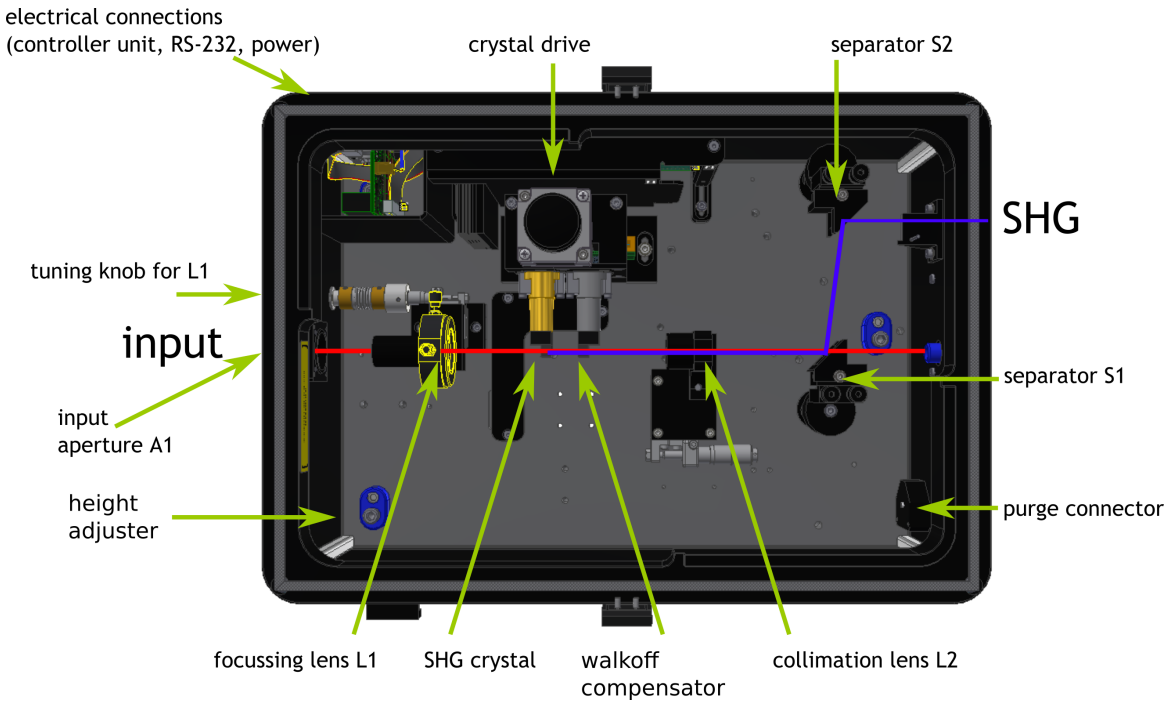


Figure 2.2: Optical Layout of the **HarmoniXX SHG** .

Figure 2.2 shows the layout of the **HarmoniXX SHG** optical unit. After passing the input aperture A1 the laser beam is focused by the lens L1. This generates a beam waist with high energy density in the doubling crystal (SHG crystal). An efficient non-linear optical interaction takes place if the phase matching condition is fulfilled (optical axis of the bi-refringent crystal under a certain, wavelength defined angle with respect to the incoming beam), and frequency doubled radiation is generated (SHG).
If the input wavelength (and thus the SHG wavelength) changes the tilt angle of the crystal has to be changed to adapt to the new phase matching requirements. When tilting the crystal a beam displacement is introduced that depends on the actual wavelength. To compensate for this displacement the beam passes a compensator block that is made out of a transparent medium with a refractive index similar to that of the crystal and that is tilted in the opposite direction with respect to the crystal. The crystal drive (see Fig. 2.3) simultaneously tilts the crystal and the compensator in opposite directions for wavelength tuning.
Both, crystal and compensator (also called “crystal set”) are mounted on connectors with magnetic sockets which allow for a simple exchange in order to adapt to different pulse widths or wavelength ranges. For distinction they are marked with colored posts. With the tuning knob the crystal and the compensator can be tilted to a well defined angular position to optimize the phase matching angle according to the actual wavelength. The crystal drive is also equipped with a stepper motor to enable motorized wavelength tuning. After passing crystal and compensator the SHG and the fundamental beams are re-collimated by lens L2. The dichroic mirror S1 separates the SHG beam (90° reflection) from the depleted fundamental beam (transmission to output "Depl. F"). A second dichroic separator mirror S2 directs the SHG beam to the "SHG" output.

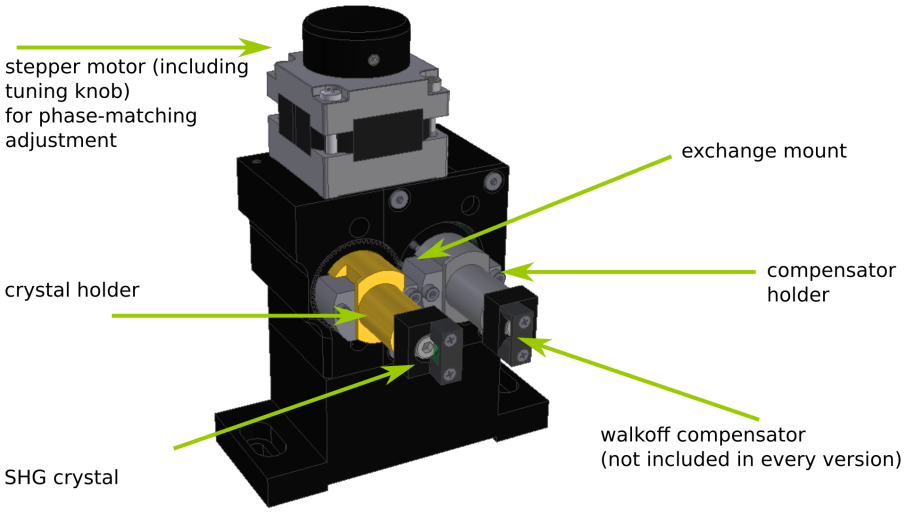


Figure 2.3: Crystal drive.

2.5.2 Controller unit

All the optical elements necessary for tuning the wavelength are equipped with stepper motors. They are controlled by a controller unit which is shown in Figure 2.4. It is connected to the optical unit by a 25-pole sub-D cable.

Figure 2.4: Photograph showing the **HarmoniXX** controller unit.

2.5.3 Menu Structure of **HarmoniXX** Controller

Main Menu of HarmoniXX :

Menu	Description	available without AT-Option
Search	search for SHG signal	No
Optim	optimize SHG signal	No
Lock	autotracker menu	No
GotoWl	set wavelength (from calibration)	Yes
Manual	move motor stepwise	Yes
Settng	change settings	Yes

Submenu of Lock:

Menu	Description
return	go back to main menu
Lock	activate autotracker
λ: xxxx	set current laser wavelength in nm

Submenu of GotoWl:

Menu	Description
return	go back to main menu
λ: xxxx	set desired input wavelength in nm

Submenu of Settng:

Menu	Description
Limits	settings for autotracker (Lock)
Xt-Set	change crystal set
Rekali	start recalibration procedure of stepper motors

Submenu of Limits:

Menu	Description
A-Lim.	minimal position change
E-Lim.	maximal position change
SubOpt	optimization after wavelength change options: On / Off / Delay (in seconds)

Upon start-up of the **HarmoniXX** controller, the **XtSet**-Menu is shown (submenu of **Settng**) where the approriate calibration curve of the chosen crystal set can be selected. In case only one crystal set has been purchased it will always be “Xtal Set #1”. Select the item with the **menu** wheel and push the wheel button so select.

2.6 AT-Option

Every **HarmoniXX** can be equipped with additional optical sensors, which is called the **AT-Option**. In most cases it consists of a large position-sensitive diode for the SHG light. A small portion of the SHG ligh is reflected off an adjustable window at the exit port.

The **AT-Sensor** will be recognized by the Firmware automatically upon startup and additional functions will be available as can be seen in the tables in section 2.5.3.
To prevent the sensor from false readings by stray light or residual light from the laser, a magnetic filter mount is attached to the sensor.

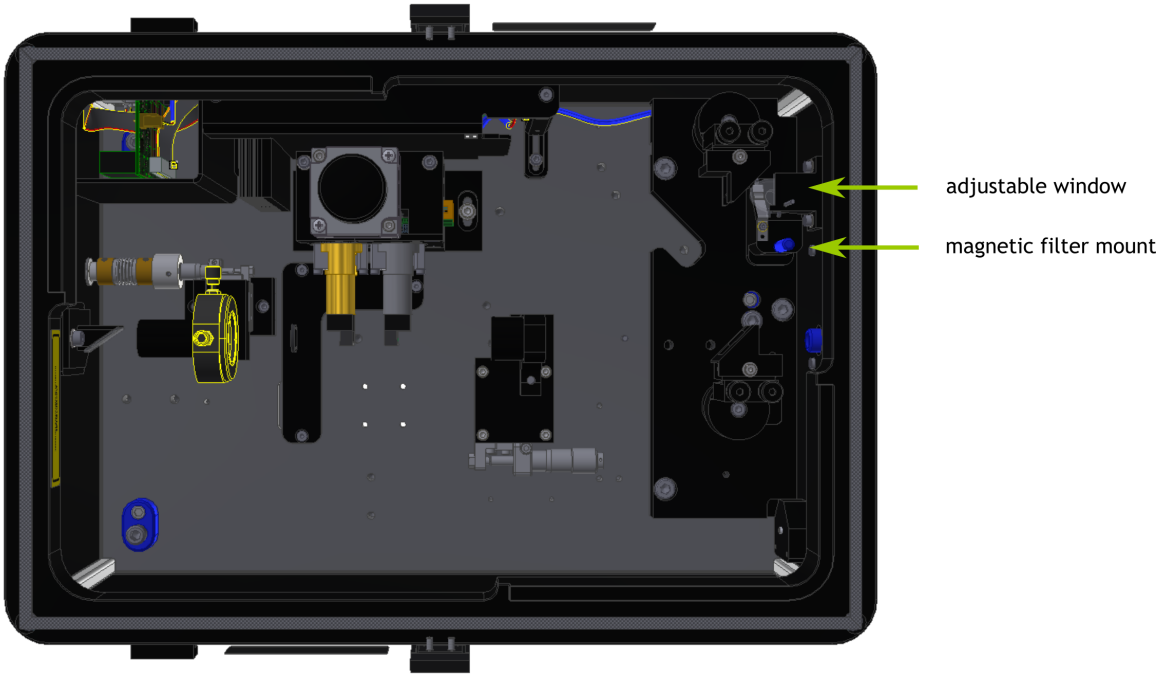


Figure 2.5: **HarmoniXX SHG** with the AT-Option installed.

Having the **AT-Sensor** installed, enable the User to use the **Search** and **Optim** Functions available, to automatically either search for the right actuator positions or optimize its output power, if possible. Again, these functions are selected by pushing my the small menu button (rotation to select, push to enable).

2.7 High energy Version

The focussing lens of the **HarmoniXX SHG** is chosen according to the peak power of the laser. When using lasers with several µJ of pulse energy, a single lens in the focussing assembly would cause too high intensity in the doubling crystal and would result in damage of the material. This could be circumvented by either using a lens with very long focal length mounted in front of the optical unit or by using a telescope assembly as shown in Figure 2.6. Here, the Lenses of the telescope are referred to as **L1** and **L2**, while the collimation lens is referred to as **L3**.

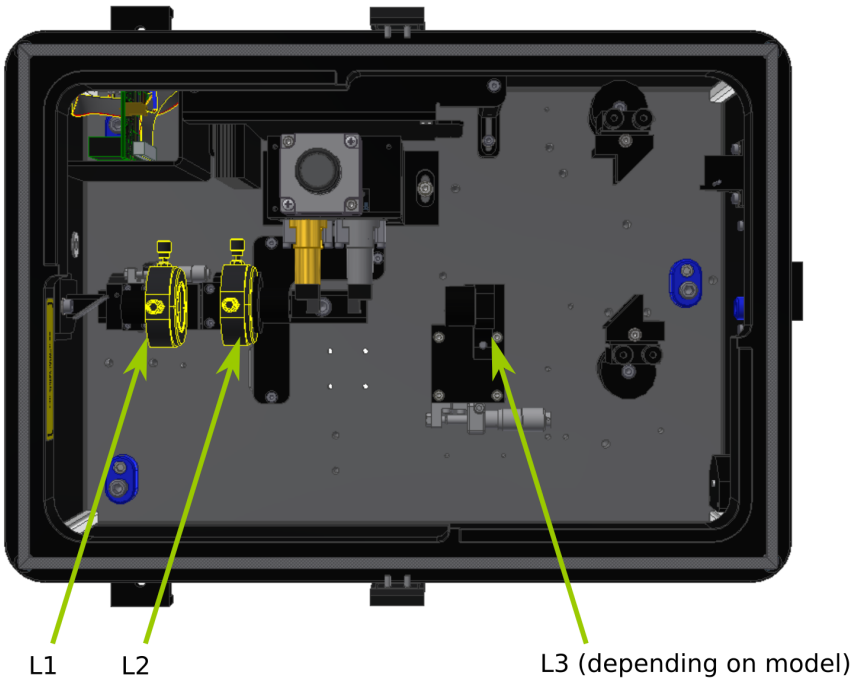


Figure 2.6: Top view of a **HarmoniXX SHG** with a telescope assembly for focussing. Depending on the power of the pump laser, the collimation lens assembly might not be included. In these cases an external collimation lens will be delivered.

Attention: Usage of the telescope version of the **HarmoniXX SHG** differs from the ordinary units and will be described in Section. 3.2.2.

2.8 Exchange of optics sets

The **HarmoniXX** optomechanical unit can be used for different lasers. There are different possibilities, more than one item may apply:

- Change of pulse duration (femtosecond or picosecond)
- Change of wavelength range (Ti:Sa laser or OPO)
- Change of average/peak power (attenuated beam, pulse picker)

For purchasing a different optics set, please inform your local **APE** distributor about serial number of your **HarmoniXX** unit and the desired new laser parameters. Depending on the change to the input beam, the following changes to the **HarmoniXX** need to be made:

Change of pulse duration

- Exchange the magnetic crystal mount
- Exchange the walkoff compensator
- Exchange the mounted focussing lens (screwed adapter in the xy lens mount)

Change of wavelength range

- Exchange the magnetic crystal mount
- Exchange the walkoff compensator
- Exchange the mounted focussing lens (screwed adapter in the xy lens mount)
- exchange the wavelength separator mounts (using 2mm hex wrench)

Change of power

- Exchange the mounted focussing lens. Depending on the power needed, remove the focussing lens assembly and exchange it with the telescope assembly. Refer to 2.6 if necessary.

3 Installation

3.1 Inspection of delivery

On receipt of the **HarmoniXX SHG** :

1. Inspect the packing crate for signs of rough handling or damage directly at arrival. If you discover any irregularities:
   - Take photographs of the condition of the package, the labels and the inside of the box, if necessary.
   - List all defects on the shipping documents and let the delivery company countersign.
   - Inform your **HarmoniXX SHG** vendor immediately.
2. Use safe lifting practices.
3. Before unpacking the **HarmoniXX SHG** wait at least six hours at environmental conditions mentioned in Section 2.3 to allow for acclimatization of all components.
4. Retain the packaging for future use.

3.2 Installation of the optical unit

Caution! Block the input beam each time you remove or install an optical component in the beam path! Make sure to have the SHG beam shield in place when crystals and compensators are installed to protect your eyes. Hazardous beam reflections from crystal and compensator which could cause serious damage of your eyes can emerge out of the top of the SHG unit without beam shield in place!

- Tune the laser to a well visible wavelength, if not possible apply IR-viewer or converter card, and set the laser to low power (cw-mode - if possible - is sufficient).
- Place the SHG unit at the desired place in the laser beam.
- Remove top cover.
- Place beam traps behind the outputs of the optical unit.
- Level the optical unit to the height of the laser beam using the three height adjusters inside the optical unit (marked blue in Fig: 2.2 and 3.1).
- Remove focusing lens L1 (unscrew lens tube), the SHG crystal and walkoff compensator.
- Close input aperture A1.
- Use external mirrors or move the entire SHG box to direct the input beam through the input aperture and to the center of the slip-on target in front of collimating lens L2.

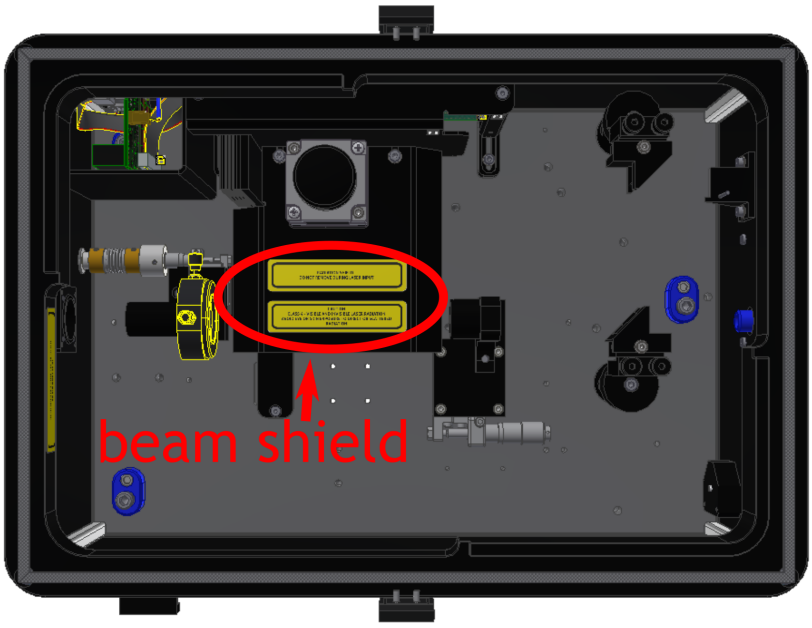


Figure 3.1: Optical Unit (top view) with Beam Shield installed.

- Fix the optical unit with the foot clamps.
- Now connect both power and controller unit to the optical unit.

Do not connect the power cable before the optical unit is leveled and fixed as you might cause short circuiting the electronic components.

- If several optics sets were delivered, insert correct focusing lens L1 according to pulse width and wavelength range. Watch mounting direction (▶ = direction of laser beam).
- Adjust the lens to center the beam at the slip-on target in front of lens L2 with transverse movements of the L1 lens mount.
- Block the input beam.
- Install SHG crystal and SHG compensator according to actual pulse width and wavelength range.

To protect your eyes make sure to have the SHG beam shield in place, see Figure 3.1!

- Tilt the SHG crystal to a position perpendicular to the beam and check if the compensator is parallel with the crystal.
- Open input aperture and unblock the input beam.
- Increase laser power to its normal value and activate pulsed operation (mode-locking).
- Tune the crystal angle until a SHG beam is generated. This can be achieved either using the **GotoWL** menu if the wavelength is known or the **Manual** menu. If an AT-Option was ordered, the **Search** Menu is also possible.

- Align the SHG beam with separation mirror S1 and beam steering mirror S2 to the center of the "SHG" output and to the desired direction.
- Collimate the SHG beam (or minimize its beam size on a distant target) using the translation stage of collimating lens L2.
- Place a power meter in the beam and optimize SHG intensity with focus position of L1 and fine tuning of phase matching angle.

3.2.1 Installation of AT-Option

- Block the input beam.
- Loosen the screws of the window mount so that movement is possible.
- Unblock the beam and now see the beam position shown on the Controller display.
- Steer the beam near the center of the Sensor (X and Y position values between -50 and +50) shown on the **HarmoniXX** controller unit.
- Fix the window mount again.

3.2.2 Installation of high energy version

- Ensure that the laser beam is well collimated and has the diameter described in the device report.
- Proceed with the installation according to section 3.2 until connection of the controller unit and power cable. Make sure to also remove both focussing lens tubes (L1 and L2) from their mounts.
- Remove collimation lens L3 if it is existent.
- Insert the first focussing lens L1 into the mount closer towards the laser. Do not change its position along the beam path, only adjust horizontal or vertical position if necessary. The beam should exit the optical unit through the center of the “depl. F” port.
- Proceed with the second focussing lens L2 in the second mount. Take care of the correct direction. Adjust its position if necessary.
- Now observe the laser beam transmitted through the “depl. F” exit port on a target about 1 meter behind the optical unit.
- Change the distance of L1 and L2 by carefully rotating the micrometer screw of L1 so that the diameter of the beam on the target is minimized.
- **Attention: Increasing the distance more will result in too high intensity at the position of the nonlinear crystal and its damage.**
- Now insert the doubling crystal and compensator and proceed as described in section 3.2.

3.3 HarmoniXX Routine Operation

There are three possibilities to set up the **HarmoniXX** for easy and efficient conversion of the fundamental. These are:

- User Wavelength Adjust
- User Actuator Adjust
- Remote Wavelength Adjust

Remote wavelength adjust depends on use of the GUI software and connection an external Ocean Optics CCD spectrometer. The other two modes are accessible from both the controller and from the GUI software.

Note that the Search, Optimise, and Lock menu options are redundant in VUE Harmonics and should not be selected.

3.3.1 User Wavelength Adjust

This mode of operation requires the user to simply enter the desired wavelength via the controller, or via the supplied GUI software.

- Note the fundamental wavelength from the Chameleon laser, e.g. 790nm.
- Select the GoToWL (Go To Wavelength) menu on the controller using the rotary MENU button to scroll and then press to select.
- Select the desired fundamental wavelength using the rotary TUNING button. Note that pressing the TUNING button repeatedly scrolls between small, medium, and large step sizes (1, 10, 100) – visible in the bottom right corner of the screen.
- The **HarmoniXX SHG** actuators will move to preset positions per the fundamental wavelength selected. Second/third harmonic light should be visible.

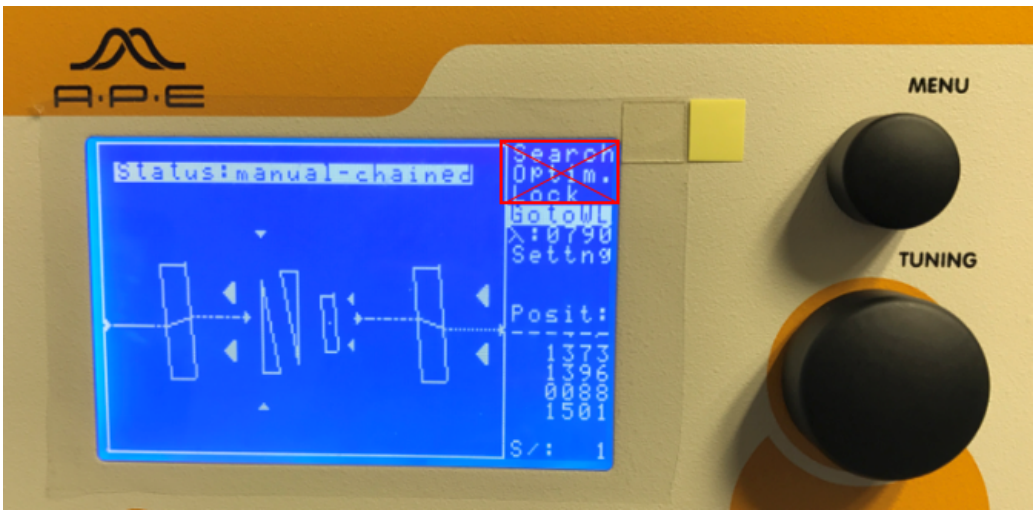


Figure 3.2: Goto WL menu

3.3.2 User Actuator Adjust

It is also possible for the user to define the precise positions of each individual actuator. This option can be useful, for example, to fine-tune second/third harmonic output power after setting the fundamental wavelength via the GoToWL function (see previous section).

This is achieved via the MANUAL menu on the controller, or via the supplied GUI software.

Press the MENU button to toggle between GoToWL and MANUAL.

- Select the MANUAL menu on the controller.
- Scroll using the MENU button to highlight the desired actuator, then adjust the desired position of that actuator using the TUNING button. Note that pressing the TUNING button repeatedly scrolls between small, medium, and large step sizes (1, 10, 100) – visible in the bottom right corner of the screen.
- Repeat as necessary for each actuator.

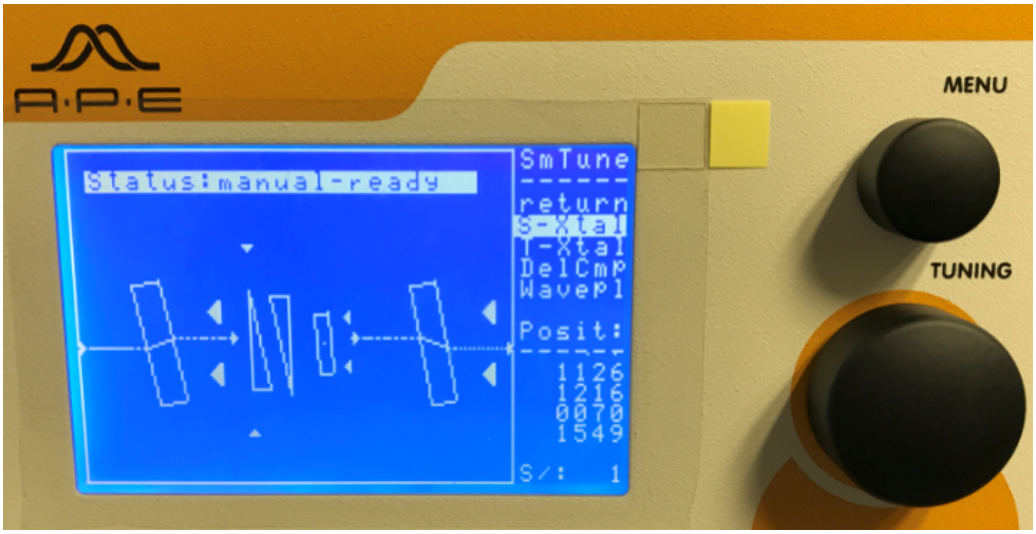


Figure 3.3: Manual actuator adjust.

3.4 GUI-software

The **GUI** software provides the same function as the controller unit, only conveniently available on a standard Windows© PC. After installation and connecting the **HarmoniXX** to a COM Port, the **GUI** should automatically detect the available unit. In case an Ocean Optics CCD Spectrometer is connected, it will be automatically detected as well.

Figure 3.4: User Actuator Adjust using GUI.

3.5 Routine Operation

- Check beam alignment (including output window when using **AT-Option**).
- Install the appropriate crystal and compensator for fs or ps operation, respectively.
- Optimize phase matching angle and L1 focus (maximize SHG output power).
- When changing the laser wavelength tune crystal angle.

4 RS-232 command list

If the GUI software is not needed, the **HarmoniXX SHG** is able to connect to a PC by a serial RS-232 connection. The following settings are needed to establish a connection:

Baud rate	38400
Data bits	8
Parity	None
Stop bits	1
Handshaking	None
End character	None

Here is a complete command list for the control of the **HarmoniXX SHG** :

Command	Description	Response	Format
GST,	Get Status	BST + 3 Byte	HEX
GID,	Get Identity	BKN + 20Byte	ASCII
GXY,	Get X-Position, Power, Gain		
BRK,	Break	BST+3Byte	HEX
SRS	Search	BST + 3 Byte	HEX
SRO	Search+Optimize	BST + 3 Byte	HEX
OPT,	Optimize	BST+3Byte	HEX
MMN,	Manual mode	BST+3Byte	HEX
MCL,	Lock at Lambda	BST+3Byte	HEX
NWL,	GOTO Lambda	BST+3Byte	HEX
NWO,	Goto Lambda and Optimize	BST+3Byte	HEX

5 Maintenance and Troubleshooting

The crystals are slightly hygroscopic. Therefore the instrument is to be kept from humidity and the crystals are to be kept in a dry box when not in use.

Problem: No or very weak SHG Signal
Possible reasons:

- No pulse generation of the laser.
- Crystal length not according to the pulse width.
- Crystal and compensator mounted at the wrong positions.
- Focusing strongly detuned.

5.1 Technical Support

For technical questions or problems within Germany, please contact:

APE Angewandte Physik & Elektronik GmbH
Plauener Straße 163 - 165, Haus N
D - 13053 Berlin
tel +49 30 98601130
fax +49 30 986011333
service@ape-berlin.de
http://www.ape-berlin.com

To contact our international distributors, please have a look at our website:

http://www.ape-berlin.com
For technical support in all other countries, please contact your local **HarmoniXX** vendor.

Declaration of Conformity to EU RoHS

Products listed below that are manufactured by APE Angewandte Physik & Elektronik GmbH are in compliance with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (also known as “RoHS Recast”). In addition, this declaration of conformity is issued under the sole responsibility of APE Angewandte Physik & Elektronik GmbH. Specifically, products manufactured do not contain the substances listed in the table below in concentrations greater than the listed maximum value.

Substance	Maximum Limit (ppm)
Lead (Pb)	1000
Cadmium (Cd)	100
Mercury (Hg)	1000
Hexavalent Chromium (Cr6+)	1000
Poly Brominated Biphenyls (PBB)	1000
Poly Brominated Diphenyl ethers (PBDE)	1000

Product Identification:
Product

HarmoniXX SHG fs for Ti:Sapphire oscillators
APE Id: 128603

HarmoniXX SHG ps for Ti:Sapphire oscillators
APE Id: 117604

HarmoniXX SHG dual (fs + ps) for Ti:Sapphire oscillators
APE Id: 119408

HarmoniXX SHG fs for OPO Signal
APE Id: 130283

HarmoniXX SHG ps for OPO Signal
APE Id: 130284

HarmoniXX SHG dual (fs + ps) for OPO Signal
APE Id: 130285

HarmoniXX SHG fs for OPO Idler
APE Id: 131816

HarmoniXX SHG ps for Levante Emerald Signal
APE Id: 132271

HarmoniXX SHG ps for Levante Emerald Idler
APE Id: 132272

HarmoniXX SHG fs for Coh. RegA (manual)
APE Id: 130291

HarmoniXX SHG fs (manual) for Coh. OPA 9800 Signal
APE Id: 130292

HarmoniXX SHG fs (manual) for Coh. OPA 9400 Signal
APE Id: 130293

Signature:

Name (printed): Dr. Bodo Richter
Title: CEO

Telephone: +49 30 98601130
Email: service@ape-berlin.de