

*Operator's Manual*  
*Astrella Ultrafast Amplifier*  
*Laser System*



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*Astrella Ultrafast Amplifier*  
*Laser System*



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Santa Clara, CA 95054

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### **Technical Support**

#### **In the U.S.:**

Should you experience any difficulties with your laser or need any technical information, please go to our web site [www.Coherent.com](http://www.Coherent.com). Should you need further assistance, please contact Coherent Technical Support by e-mail [Product.Support@Coherent.com](mailto:Product.Support@Coherent.com) or telephone, 1-800-367-7890 (1-408-764-4557 outside the U.S.). Please be prepared to supply the model and laser head serial number of your laser system also the description of the problem and any attempted corrective steps to the Product Support Engineer responding to your request.

Telephone coverage is available Monday through Friday (except U.S. holidays and company shutdowns). Inquiries received outside of normal office hours will be captured by our automatic answering system and will be quickly returned the next business day.

#### **Outside the U.S.:**

If you are located outside the U.S., please visit [www.Coherent.com](http://www.Coherent.com) for technical assistance, or contact your local Service Representative. Service Representative telephone numbers and addresses can be found on the Coherent web site.

Coherent provides telephone and web-based technical assistance as a service to its customers and assumes no liability for any injury or damage that can occur at the same time with such services. Under no conditions do these support services effect the terms of any warranty agreement between Coherent and the buyer. Operation of any Coherent laser with any of its interlocks defeated is always at the operator's own risk.

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## **Signal Words and Symbols in this Manual**

This documentation may contain sections in which particular hazards are defined or special attention is drawn to particular conditions. These sections are indicated with signal words in accordance with ANSI Z-535.6 and safety symbols (pictorial hazard alerts) in accordance with ANSI Z-535.3 and ISO 7010.

### **Signal Words**

Four signal words are used in this documentation: **DANGER**, **WARNING**, **CAUTION** and **NOTICE**.

The signal words **DANGER**, **WARNING** and **CAUTION** designate the degree or level of hazard when there is the risk of injury:

---

#### **DANGER!**

**Indicates a hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.**

---

---

#### **WARNING!**

**Indicates a hazardous situation that, if not avoided, could result in death or serious injury.**

---

---

#### **CAUTION!**

**Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.**

---

The signal word “**NOTICE**” is used when there is the risk of property damage:

---

#### **NOTICE!**

**Indicates information considered important, but not hazard-related.**

---

Messages relating to hazards that could result in both personal injury and property damage are considered safety messages and not property damage messages.

## Symbols

The signal words **DANGER**, **WARNING**, and **CAUTION** are always emphasized with a safety symbol that indicates a special hazard, regardless of the hazard level:



---

This symbol is intended to alert the operator to the presence of important operating and maintenance instructions.

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

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This symbol is intended to alert the operator to the presence of dangerous voltages within the product enclosure that may be of sufficient magnitude to constitute a risk of electric shock.

---



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This symbol is intended to alert the operator to the danger of Electro-Static Discharge (ESD) susceptibility.

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This symbol is intended to alert the operator to the danger of crushing injury.

---



---

This symbol is intended to alert the operator to the danger of a lifting hazard.

---

## Preface

This document contains user information for the Astrella modelocked Ti:Sapphire laser.



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### **NOTICE!**

**Read this Operator's Manual carefully before operating the system for the first time. Special attention should be given to the material in Section One: Laser Safety.**

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### **WARNING!**

**Use of controls or adjustments or performance of procedures other than those specified in this Operator's Manual may result in hazardous radiation exposure.**

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### **WARNING!**

**Use of the system in a manner other than that described herein may impair the protection provided by the system.**

---

## **Export Control Laws Compliance**

It is the policy of Coherent to comply strictly with U.S. export control laws.

Export and re-export of lasers manufactured by Coherent are subject to U.S. Export Administration Regulations, which are administered by the Commerce Department. In addition, shipments of certain components are regulated by the State Department under the International Traffic in Arms Regulations.

The applicable restrictions vary depending on the specific product involved and its destination. In some cases, U.S. law requires that U.S. Government approval be obtained prior to resale, export or re-export of certain articles. When there is uncertainty about the obligations imposed by U.S. law, clarification must be obtained from Coherent or an appropriate U.S. Government agency.

Products manufactured in the European Union, Singapore, Malaysia, Thailand: These commodities, technology, or software are subject to local export regulations and local laws. Diversion contrary to local law is prohibited. The use, sale, re-export, or re-transfer directly or indirectly in any prohibited activities are strictly prohibited.

# SECTION ONE: LASER SAFETY



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**NOTICE!**

**This user information is in compliance with section 1040.10 of the CDRH Performance Standards for Laser Products from the Health and Safety Act of 1968.**

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---

**NOTICE!**

**Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.**

---

This laser safety section must be thoroughly reviewed prior to operation of the Astrella laser system. Safety instructions presented throughout this manual must be followed carefully.

## Hazards

Hazards associated with lasers generally fall into the following categories:

- Exposure to laser radiation that may damage the eyes or skin
- Electrical hazards generated in the laser power supply or associated circuits
- Chemical hazards resulting from contact of the laser beam with volatile or flammable substances, or released as a result of laser material processing

The above list is not intended to be exhaustive. Anyone operating the laser must consider the interaction of the laser system with its specific working environment to identify any potential hazards.

## Optical Safety

Laser light, because of its special qualities, poses safety hazards not associated with light from conventional sources. The safe use of lasers requires all operators, and everyone near the laser system, to be aware of the dangers involved. Users must be familiar with the instrument and the properties of coherent, intense beams of light.

The safety precautions listed below are to be read and observed by anyone working with or near the laser. At all times, ensure that all personnel who operate, maintain or service the laser are protected from accidental or unnecessary exposure to laser radiation exceeding the accessible emission limits listed in ‘Performance Standards for Laser Products,’ *United States Code of Federal Regulations*, 21CFR1040 10(d).



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**WARNING!**

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

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The greatest concern when using a laser is eye safety. In addition to the main beam, there are often secondary 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 or beam splitters. While weaker than the main beam, such beams may still carry sufficient intensity to cause eye damage.

Laser beams are powerful enough to burn skin, clothing or paint even at some distance. 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 user is advised to follow the precautions below.

**Recommended Precautions and Guidelines**

1. Observe all safety precautions in the preinstallation and/or Operator’s Manuals.
2. All personnel should wear laser safety glasses rated to protect against the specific wavelengths being generated. Protective eye wear vendors are listed in the *Laser Focus World*, *Lasers and Optronics*, and *Photonics Spectra* buyer’s guides. Consult the ANSI, ACGIH, or OSHA standards listed at the end of this section for guidance.
3. Avoid wearing watches, jewelry, or other objects that may reflect or scatter the laser beam.
4. Stay aware of the laser beam path, particularly when external optics are used to steer the beam.
5. Provide enclosures for beam paths whenever possible.
6. Use appropriate energy-absorbing targets for beam blocking.
7. Block the beam before applying tools such as Allen wrenches or ball drivers to external optics.

8. Limit access to the laser to qualified users who are familiar with laser safety practices. When not in use, lasers should be shut down completely and made off-limits to unauthorized personnel.
9. Use the laser in an enclosed room. Laser light may remain collimated over long distances and therefore presents a potential hazard if not confined. It is good practice to operate the laser in a room with controlled access.
10. Post warning signs in the area of the laser beam to alert those present.
11. Exercise extreme caution when using solvents in the area of the laser.
12. Never look directly into the laser light source or at scattered laser light from any reflective surface. Never sight down the beam.
13. Set up the laser so that the beam height is either well below or well above eye level.
14. Avoid direct exposure to the laser light. Laser beams can easily cause flesh burns or ignite clothing.
15. Advise all those working with or near the laser of these precautions.



***NOTICE!***

**Laser safety glasses protect the user from eye damage by blocking light at the laser wavelengths. However, this also prevents the operator from seeing the beam. Use extreme caution even while wearing safety glasses.**

---

## **Electrical Safety**

The Astrella uses AC and DC voltages in the laser head and controller. All units are designed to be operated with protective covers in place. Certain procedures in this manual require removal of the protective covers. These procedures shall be used by a qualified trained service personnel. Safety information contained in the procedures must be strictly observed by anyone using the procedures.

The Astrella controller should be connected to the AC input using a certified 3 conductor power cord, < 10 ft length, rated for at least 10 A operation, with a 16 AWG conductor. The power cord provided in the ship kit is rated for 1625 W.



---

**DANGER!**

**Normal operation of the Astrella does not require access to dangerous electrical voltage. Removing the Pockels cell covers will expose the user to electrical hazards. These covers are labeled with the electrical hazard symbol shown to the left.**

---

**Recommended Precautions and Guidelines**

The following precautions must be observed by anyone working with potentially hazardous electrical circuitry:

1. Disconnect main power lines before working on any electrical equipment when it is not necessary for the equipment to be operating.
2. Do not short or ground the power supply output. Protection against possible hazards requires proper connection of the ground (earth) terminal on the power cable, and an adequate external ground. Check these connections at the time of installation, and periodically thereafter.
3. Never work on electrical equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment, and who is competent to administer first aid.
4. When possible, keep one hand away from the equipment to reduce the danger of current flowing through the body if a live circuit is touched accidentally.
5. Always use approved, insulated tools.
6. Special measurement techniques are required for this system. A technician who has a complete understanding of the system operation and associated electronics must select ground references.

**Component Lasers**

The Astrella system incorporates a Coherent Revolution<sup>TM</sup> and Coherent Vitara laser as components, or other compatible lasers. The beams from these lasers are hazardous. Refer to the Revolution, Vitara, or other respective Operator's Manual for additional safety information.

## **Designated Use**

The Astrella system has been built in accordance with state-of-the-art standards and recognized safety rules. Nevertheless, its use may constitute a risk to life and limb of the user or of third parties or cause damage to other material property.

The laser system shall only be used within its designated use and the instructions set out in this manual, and only by safety conscious persons who are fully aware of the risks involved in operating the laser system. Any functional disorders, especially those affecting the safety of the laser system, should therefore be rectified immediately.

The Astrella system is a mode-locked ultrafast laser amplifier designed for use in scientific applications and environments. Using the laser system for purposes other than those mentioned above is considered contrary to its designated use. The manufacturer/supplier cannot be held liable for any damage resulting from such use. The risk of such misuse lies entirely with the user.

Operating the laser system within the limits of its designated use also involves observing the instructions set out in this manual and complying with the inspection and maintenance directives.

## **Maximum Accessible Radiation Level**

The Astrella produces visible and invisible radiation over a wavelength range of 700 to 900 nm, with a maximum energy of 15 mJ per < 40 fs pulse [CFR 1040.10 (h)(2)/ EN 60825-1/ IEC 608225-1, Clause 6]. Refer to the pump and seed laser Operator's Manuals for maximum radiation levels from these lasers.

## **Safety Features and Compliance with Government Requirements**

The following features are incorporated into the instrument to conform to several government requirements. The applicable United States Government requirements are contained in 21 CFR, Subchapter J, part 1040 administered by the Center for Devices and Radiological Health (CDRH). The European Community requirements for product safety are specified in the Low Voltage Directive (LVD) (published in 73/23/EEC and amended in 93/68/EEC). The Low Voltage Directive requires that lasers comply with the standard EN 61010-1/IEC 61010-1 "Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use" and EN 60825-1/IEC 60825-1 "Safety of Laser Products". Compliance of this laser with the LVD requirements is certified by the CE mark.

---

### ***NOTICE!***

**Use of the system in a manner other than that described herein may impair the protection provided by the system.**

---



## **Laser Classification**

Governmental standards and requirements specify that the laser must be classified according to the output power or energy and the laser wavelength. The Astrella is classified as Class IV based on 21 CFR, Subchapter J, part 1040, section 1040.10 (d). According to the European Community standards, Astrella lasers are classified as Class 4 based on EN 60825-1/IEC 60825-1, clause 9. In this manual, the classification will be referred to as Class 4.

## **Protective Housing**

The laser head is enclosed in a protective housing that prevents human access to radiation in excess of the limits of Class I radiation as specified in the 21CFR, Part 1040 Section 1040.10 (f)(1) and Table 1-A/EN 60825-1/IEC 60825-1 clause 4.2 except for the output beam, which is Class 4.

## **Safety Interlocks**

The system incorporates multiple safety interlocks which activate when the top cover(s) of the laser head is removed. An interlock fault initiation will terminate the pump laser by activating a shutter mechanism as well as removing power from the infrared diodes in the pump laser power supply. While active, the interlock defeats are directly visible by anyone near the laser. It is not possible to replace the laser cover while the interlocks are active.

The laser interlocks should be defeated only for the purpose of maintenance and service by trained personnel. Extreme caution must always be observed when operating the laser with its covers removed [CFR 1040.10 (f)(2)/ EN 60825-1/IEC 608225-1, Clause 4.3].

## **Operating Controls**

The laser controls are positioned so that the operator is not exposed to laser emission while manipulating the controls [CFR 1040.10(f)(7)/EN 60825-1/IEC 60825-1, clause 4.8].

## **Display Screen**

The display screen on the operating computer may be viewed without exposing the operator to laser emission [CFR 1040.10(f)(8)/EN 60825-1/IEC 60825-1, clause 4.9].

## **Location of Safety Labels**

Refer to Figure 1-1 for the location of all safety labels. These include warning labels indicating removable or displaceable protective housings, apertures through which laser radiation is emitted, and labels of certification and identification [CFR 1040.10(g), CFR 1040.2, and CFR 1010.3/ EN 60825-1/IEC 60825-1, Clause 5].

## **Electromagnetic Compatibility**

The European requirements for Electromagnetic Compliance (EMC) are specified in the EMC Directive (published in 89/336/EEC).

Conformance to the EMC requirements is achieved through compliance with the harmonized standard EN61326-1.

Compliance of this laser with the EMC requirements is certified by the CE mark.

## **Environmental Compliance**

### **RoHS Compliance**

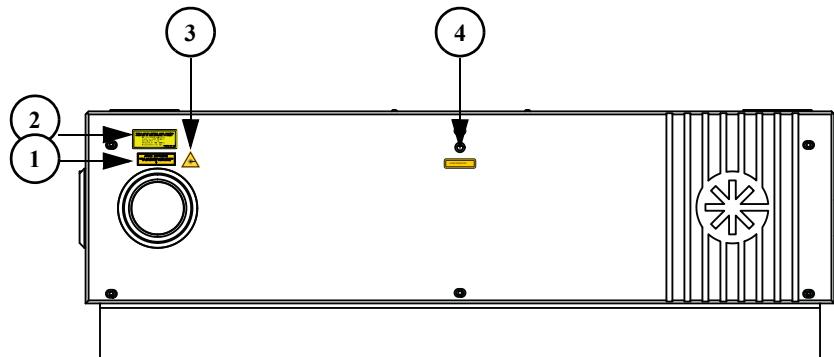
The RoHS directive restricts the use of certain hazardous substances in electrical and electronic equipment. All components of the Astrella system are RoHS compliant.

### **China-RoHS Compliance**

The China-RoHS directive restricts the use of certain hazardous substances in electrical and electronic equipment. Refer to the figures below for product components that are China-RoHS compliant.

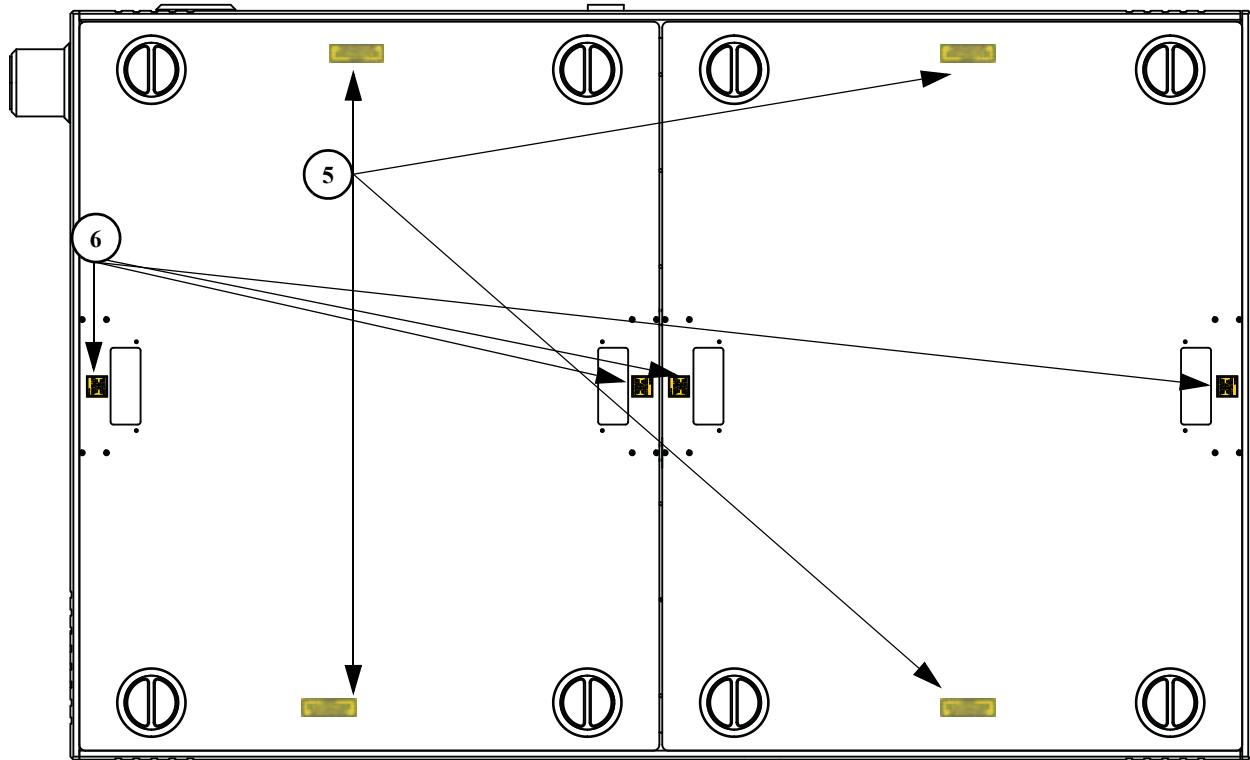
### **Waste Electrical and Electronic Equipment (WEEE, 2002)**

The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) is represented by a crossed-out garbage container label and is part of the China-RoHS label. The purpose of this directive is to minimize the disposal of WEEE as unsorted municipal waste and to facilitate its separate collection.

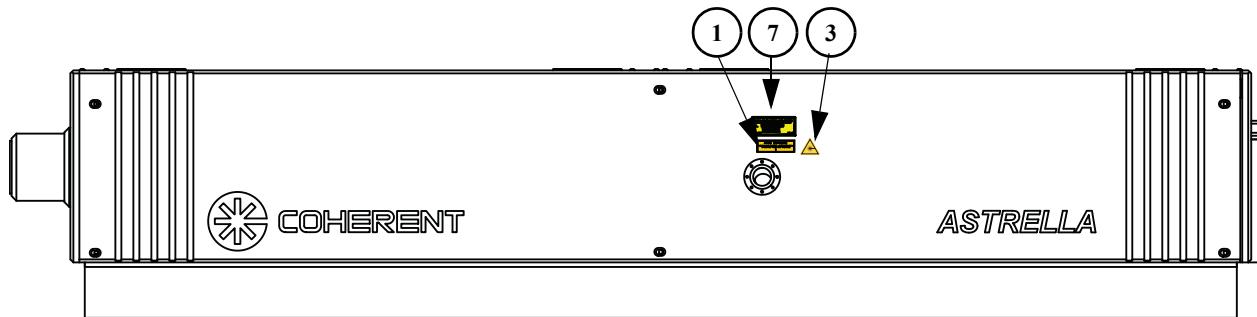


**ASTRELLA OPTICAL BENCH ASSEMBLY, FRONT VIEW**

*Figure 1-1. Astrella Safety Labels (Sheet 1 of 5)*

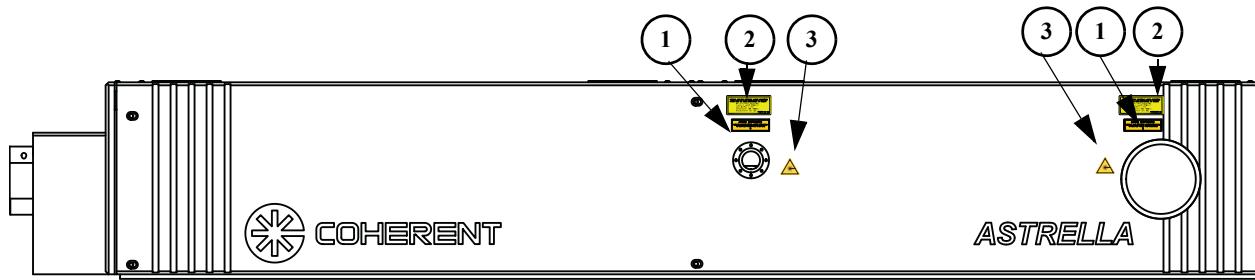


## ASTRELLA OPTICAL BENCH ASSEMBLY, TOP-DOWN VIEW

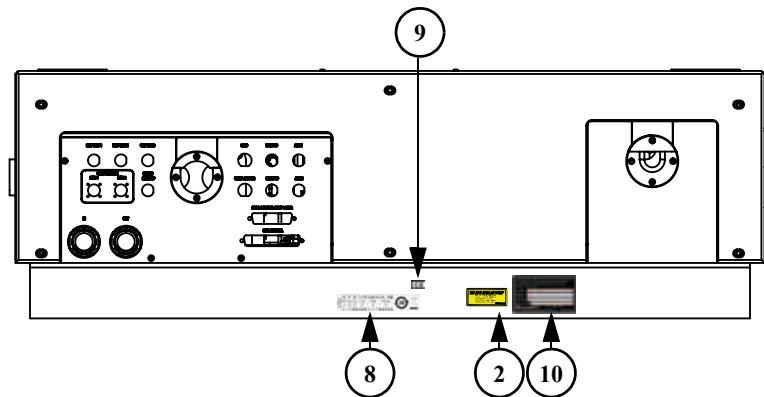


## **ASTRELLA OPTICAL BENCH ASSEMBLY, LEFT SIDE VIEW**

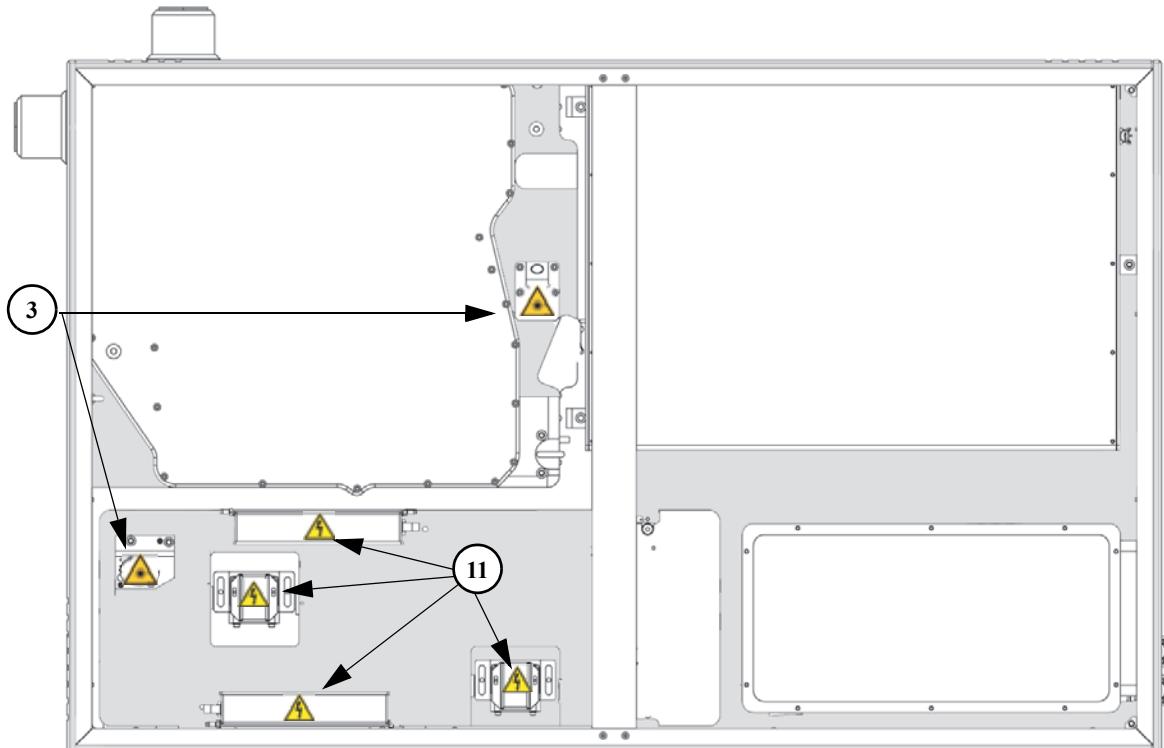
**Figure 1-1. Astrella Safety Labels (Sheet 2 of 5)**



ASTRELLA OPTICAL BENCH ASSEMBLY, RIGHT SIDE VIEW



ASTRELLA OPTICAL BENCH ASSEMBLY, REAR PANEL



ASTRELLA WITH TOP-COVERS REMOVED

*Figure 1-1. Astrella Safety Labels (Sheet 3 of 5)*



#### 1. EXIT APERTURE WARNING LABEL



#### 2. MAXIMUM RADIATION LABEL



#### 3. HAZARDOUS RADIATION EXPOSURE WARNING LABEL



#### 4. LASER EMISSION POSSIBLE INDICATOR LABEL



#### 5. HEAD COVER WARNING LABEL



#### 6. INTERLOCK DEFEAT WARNING LABEL

*Figure 1-1. Astrella Safety Labels (Sheet 4 of 5)*



## 7. OPTIONAL GREEN RADIATION LABEL

LABEL#	铅	汞	镉	六价铬	多溴联苯	多溴二苯醚
127166AC	Pb	Hg	Cd	Cr6 <sup>+</sup>	PBB	PBDE
	X	O	O	O	O	O

O=小于最高浓度值 X=大于最高浓度值

The label also includes a circular arrow icon with the number '20' and a standard recycling symbol.

## 8. CHINA ROHS LABEL, LASER HEAD



## 9. CE LABEL



## 10. SERIAL NUMBER LABEL



## 11. UNPLUG POWER CORD ELECTRICAL WARNING LABEL

*Figure 1-1. Astrella Safety Labels (Sheet 5 of 5)*

## **Sources of Additional Information**

The following are sources for additional information on laser safety standards and safety equipment and training.

### **Laser Safety Standards**

*Safe Use of Lasers*  
Document Z136.1  
American National Standards Institute (ANSI)  
[www.ansi.org](http://www.ansi.org)

*Guidelines for Laser Safety and Hazard Assessment*  
Directives PUB 8-1.7  
Occupational Safety and Health Administration (OSHA)  
U.S. Department of Labor  
[www.osha.gov](http://www.osha.gov)

*A Guide for Control of Laser Hazards*  
American Conference of Governmental and Industrial Hygienists (ACGIH)  
[www.acgih.org](http://www.acgih.org)

*Laser Safety Guide*  
Laser Institute of America  
[www.lia.org](http://www.lia.org)

### **Equipment and Training**

*Laser Focus Buyer's Guide*  
Laser Focus World  
[www.laserfocusworld.com](http://www.laserfocusworld.com)

*Photonics Spectra Buyer's Guide*  
Photonics Spectra  
[www.photonics.com](http://www.photonics.com)



## SECTION TWO: DESCRIPTION AND DIMENSIONS

### **Astrella Amplifier Laser System**

The Astrella is an all-in-one ultrafast oscillator and regenerative amplifier laser system. Solid-state laser technology is incorporated into a compact optical enclosure, providing reliable operation over thousands of hours.

The Astrella laser system consists of six primary components:

- Astrella optical bench assembly
- Synchronization & delay generator (SDG Elite)
- Vitara power supply
- Revolution power supply
- Closed-loop water chiller
- 2 Laptop computers with control software



*Figure 2-1. Astrella Optical Bench Assembly*

## **Astrella Optical Bench Assembly**

The Astrella optical bench assembly comprises of four modules (See Figure 3-2 on page 3-7 for block diagram layout):

- Vitara seed laser
- Revolution pump laser
- Regenerative amplifier (REGN)
- Stretcher/Compressor

The Coherent Vitara™ serves as the seed laser for the Astrella system. This module includes a modelocked Ti:Sapphire oscillator cavity pumped by the Coherent Verdi™ G-Series, a continuous-wave diode-pumped green laser.

The Revolution is a diode-pumped Q-switched laser with a second-harmonic generator. Operating at 527 nm and a 1-kHz repetition rate, it provides the pump power to the amplifier module. The Vitara and Revolution are described in detail in their respective Operator's Manuals.

The regenerative amplifier is based on the Coherent Legend Elite™ platform. Designed in a compact, enclosed module with active cooling, the amplifier exhibits excellent stability and reduced sensitivity to environmental temperature changes. Included in this design is the Coherent Synchronization and Delay Generator (SDG Elite™).

The stretcher and compressor are sealed and thermally stable for optimum pulse width stability and reliability with no feedback or moving parts required.

## **Synchronization and Delay Generator (SDG Elite)**

The SDG Elite controls the precise timing of the regenerative amplifier's Pockels cells. It also contains high voltage supplies for the Pockels cells as well as a bandwidth detector (BWD) circuit, which serves as an interlock to protect the laser from operation with inappropriate bandwidth from the seed laser.

## **Power Supplies**

The Astrella system includes two individual power supplies for the Vitara and Revolution modules. Refer to the Vitara and Revolution Operator's Manuals for additional information.

## **Water Chiller**

The closed-loop water chiller dissipates the heat generated by the system and stabilizes the Vitara, Revolution, and amplifier cavity. The temperature is set to 20 °C and should not be changed. Refer to the chiller operator's manual for further details.

## Laptop Computer

The system is shipped with two individual laptop computers with Windows-based control software for the Vitara and Revolution.

These components may also be controlled remotely through RS-232 serial connections on the Vitara power supply, Revolution power supply, and SDG Elite rear panel.

## Specifications

The Customer Data Sheet shipped with each Astrella provides a detailed description of system performance. Specifications for all Coherent products can be found at [www.Coherent.com](http://www.Coherent.com).

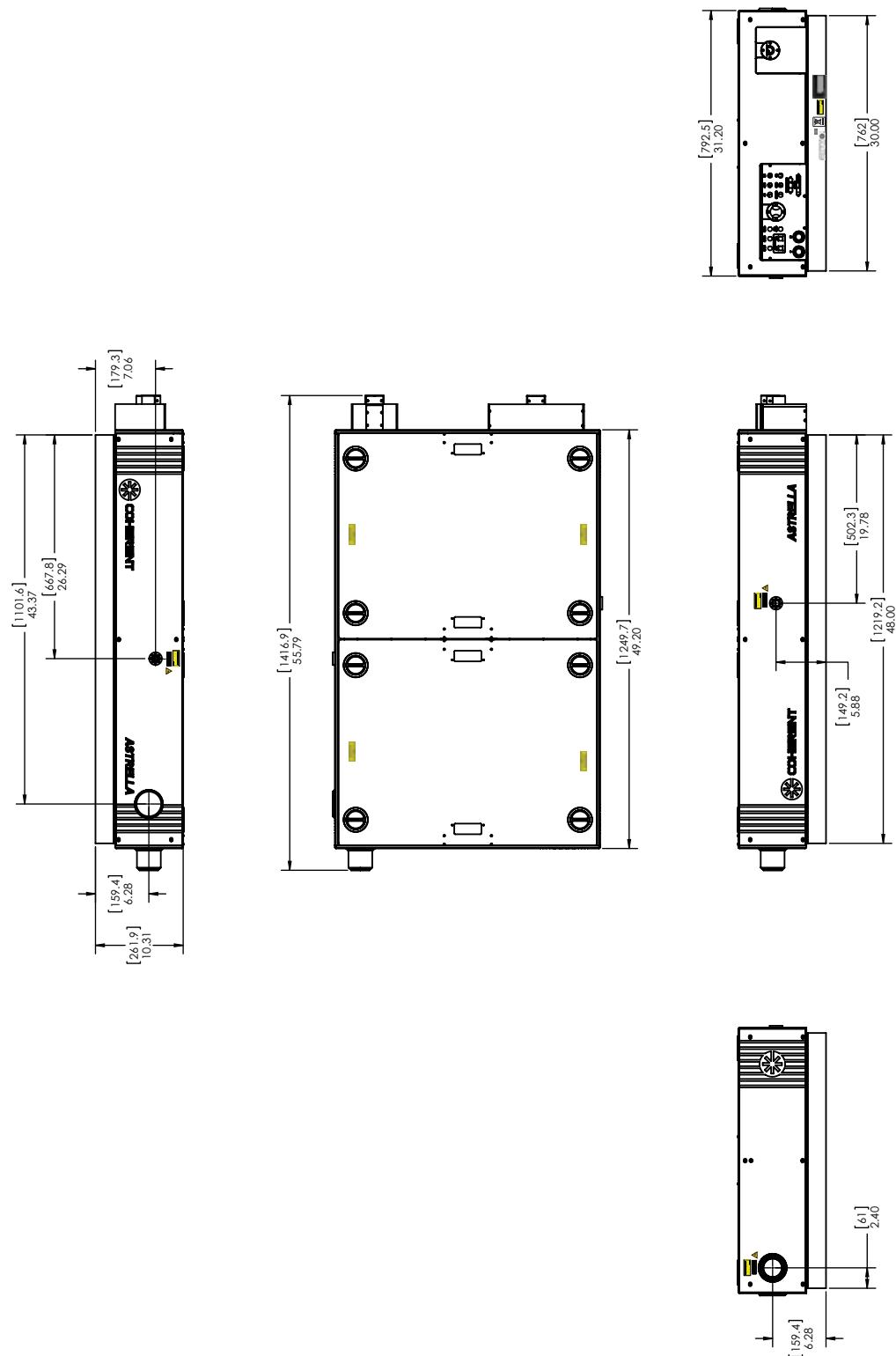
## Dimensions and Weight

Figure 2-2 gives the dimensions of the optical bench assembly. Refer to the respective Operator's Manuals for the dimensions of other components.

*Table 2-1. Summary of Dimensions & Weight*

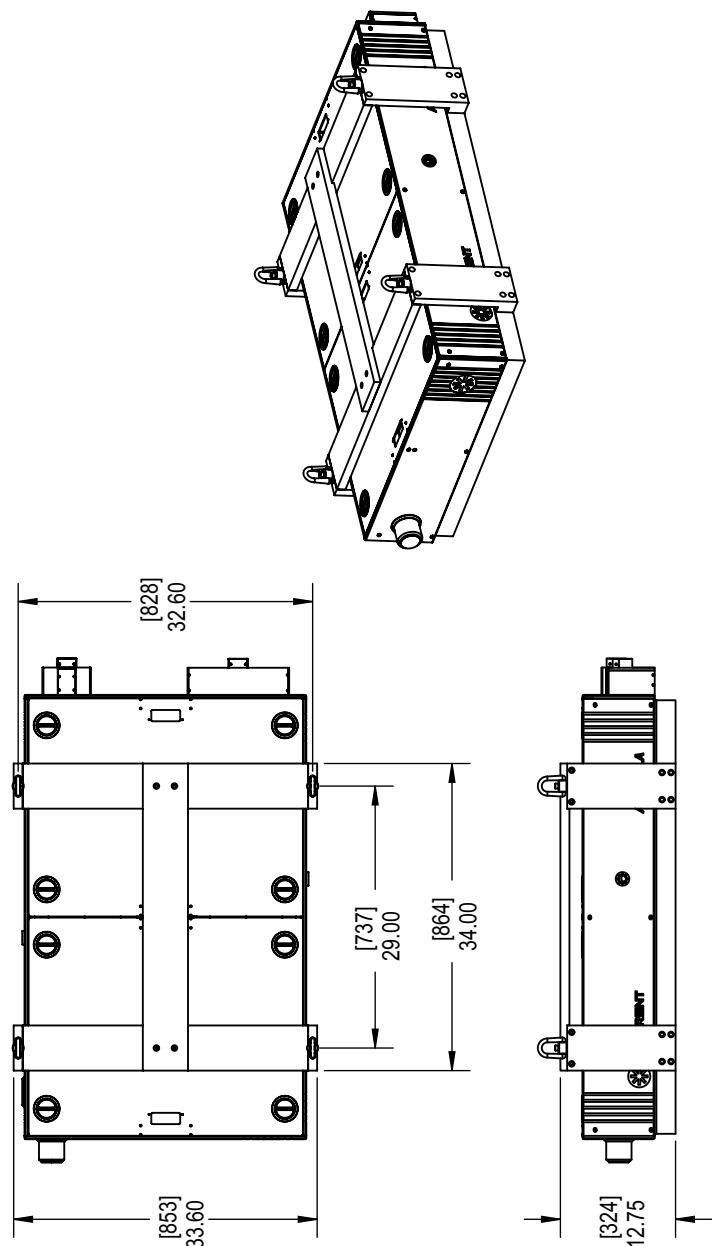
SYSTEM COMPONENT	LENGTH	WIDTH	HEIGHT	WEIGHT
<b>Astrella Amplifier<sup>a</sup></b>	124.97 cm 49.2 in.	79.25 cm 31.2 in.	26.19 cm 6.28 in.	249 kg 550 lbs.
<b>Shipping Frame</b>	86.4 cm 34 in	82.8 cm 32.6 in	32.4 cm 12.75 in	89.8 kg 198 lbs
<b>Vitara-S: Controller</b>	36.3 cm 14.3 in.	23.4 cm 9.2 in.	13.7 cm 5.4 in.	3.4 kg 7.5 lbs.
<b>Vitara-S: Power Supply</b>	36.1 cm 14.2 in.	22.9 cm 9.0 in.	16.0 cm 6.3 in.	6 kg 13.2 lbs.
<b>Revolution Power Supply</b>	43.68 cm 17.2 in.	48.26 cm 19.0 in.	13.25 cm 5.22 in.	14 kg 31 lbs.
<b>Synchronization &amp; Delay Generator</b>	48.26 cm 19.00 in.	30.48 cm 12.0 in.	9.73 cm 3.83 in.	2.2 kg 4.9 lbs.
<b>Chiller</b>	70.1 cm 27.6 in.	36.8 cm 14.5 in.	57.4 cm 22.6 in.	60.8 kg 164 lbs.

a. Weight without the shipping frame. Weight with shipping frame is 339.3 kg (748 lbs).



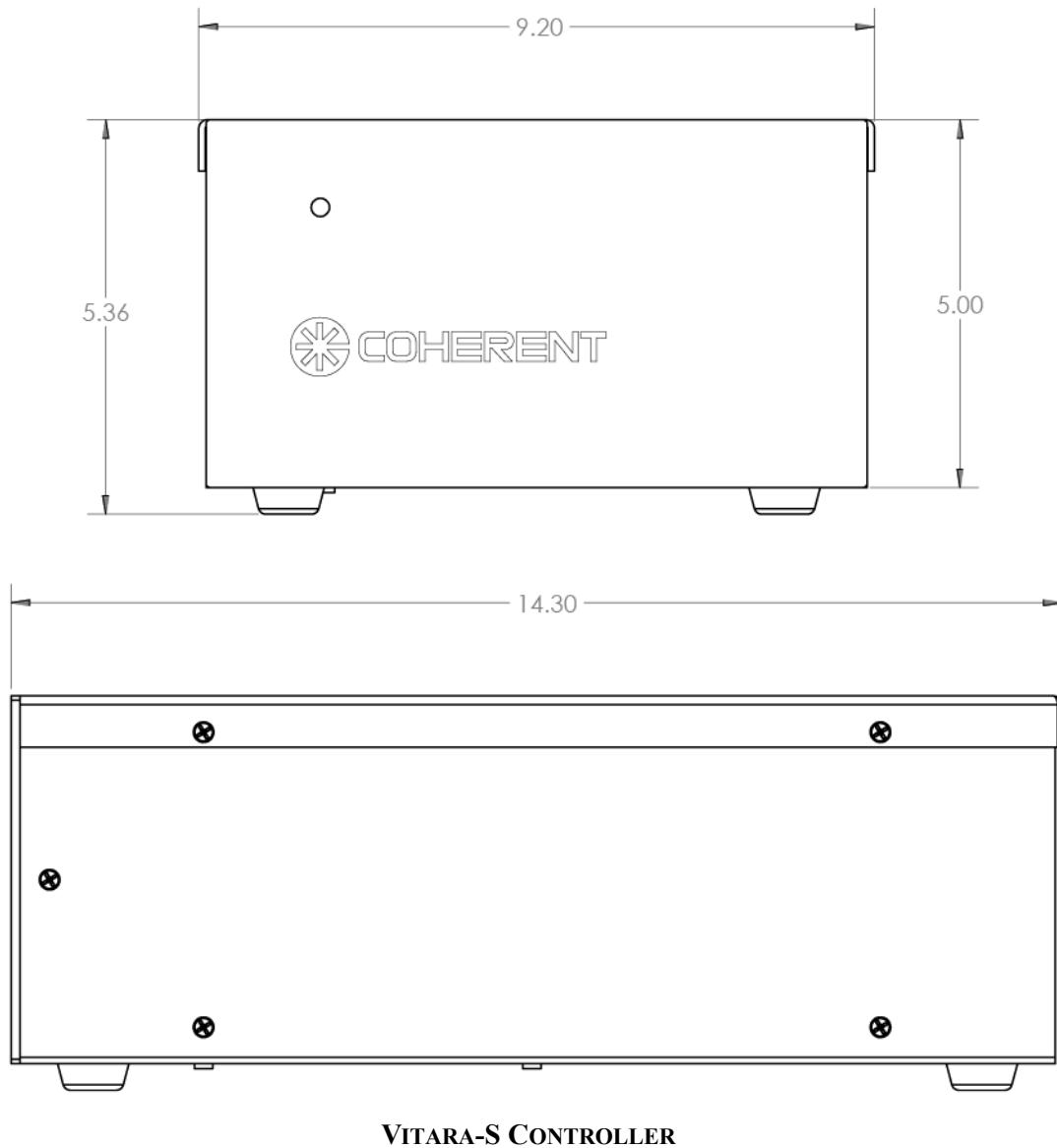
**ASTRELLA OPTICAL BENCH ASSEMBLY**

**Figure 2-2. Astrella Optical Bench Assembly & External Component Dimensions**



**ASTRELLA OPTICAL BENCH ASSEMBLY WITH SHIPPING FRAME**

*Figure 2-2. Astrella Optical Bench Assembly & External Component Dimensions (Continued)*



**Figure 2-2. Astrella Optical Bench Assembly & External Component Dimensions (Continued)**

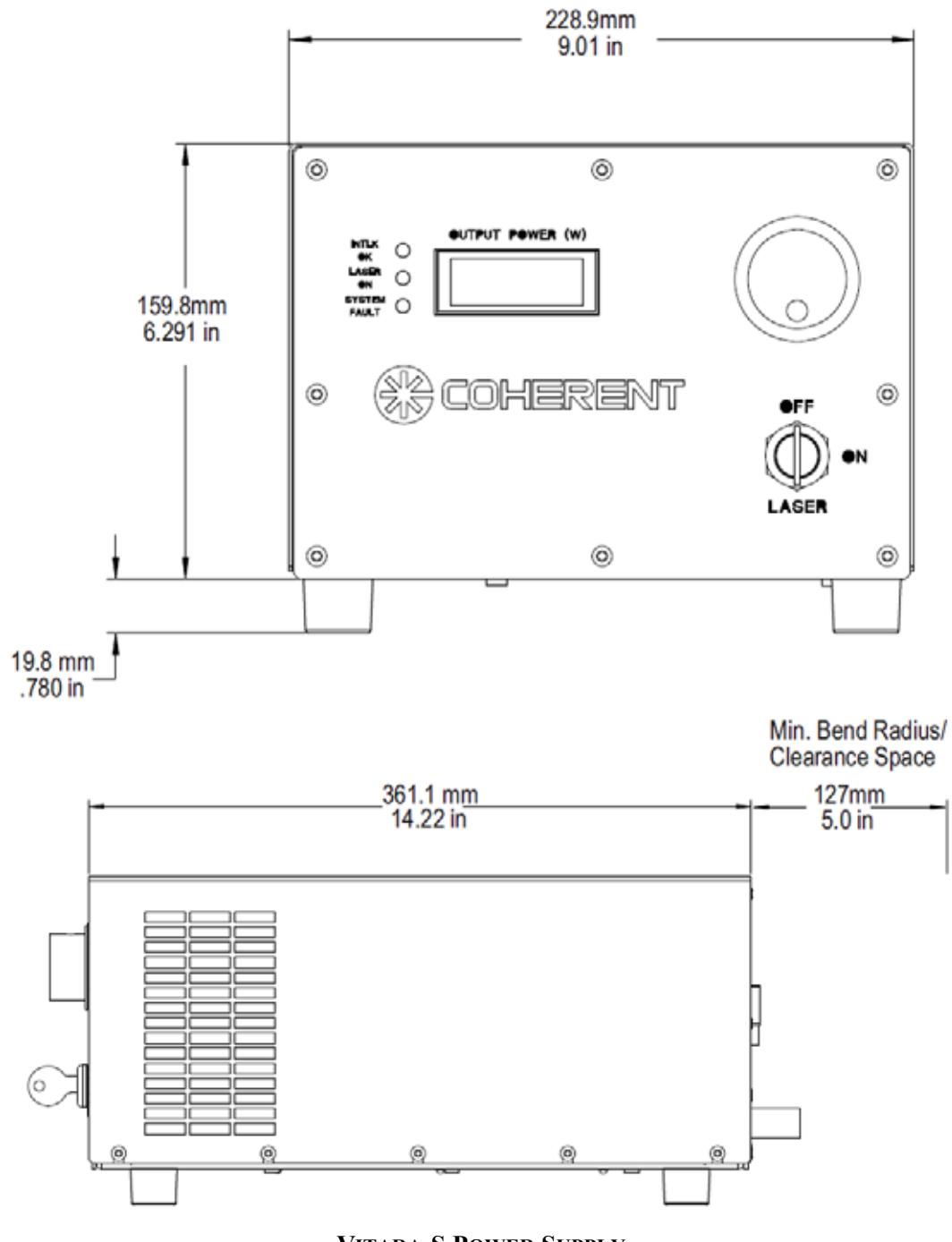
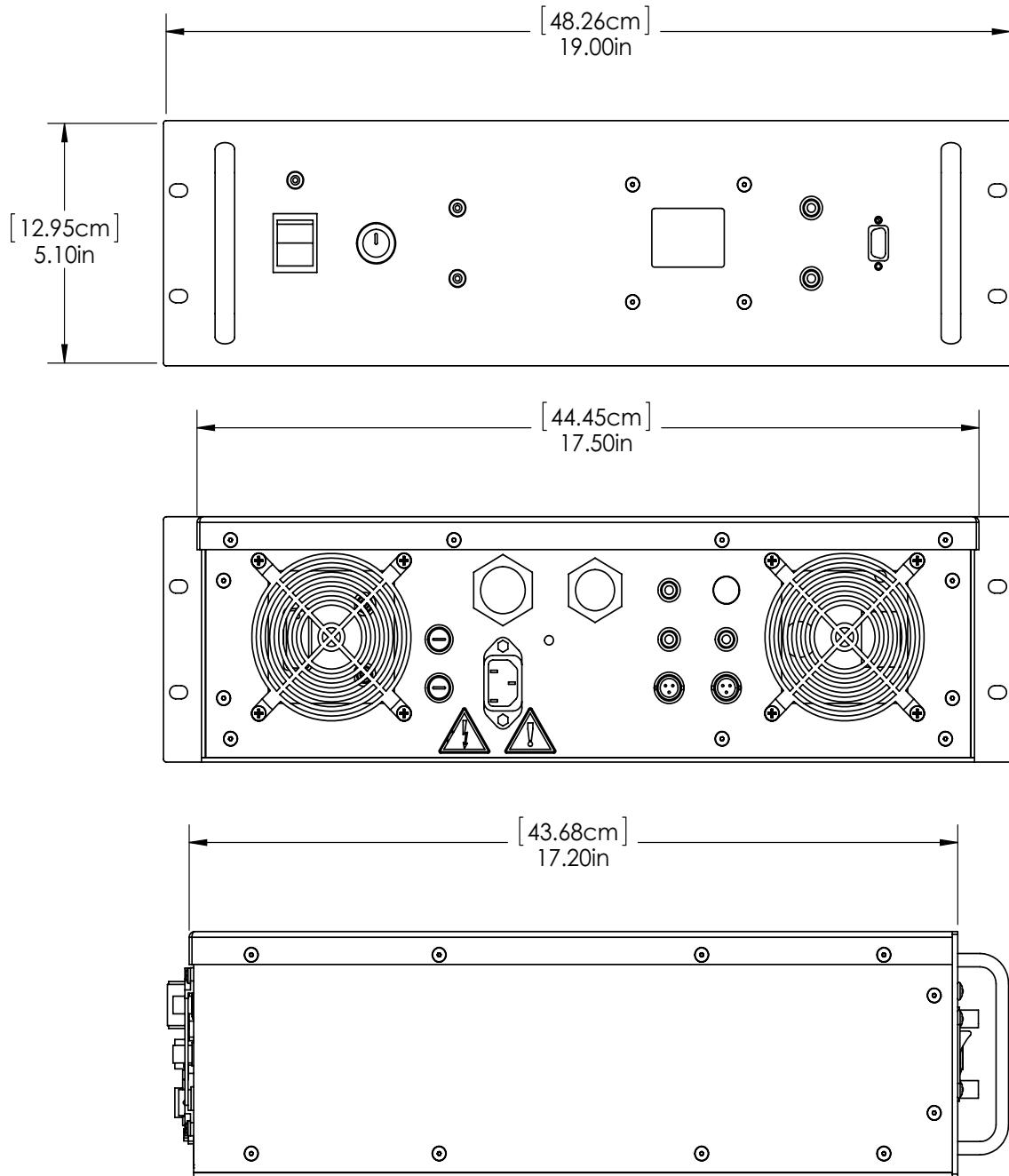
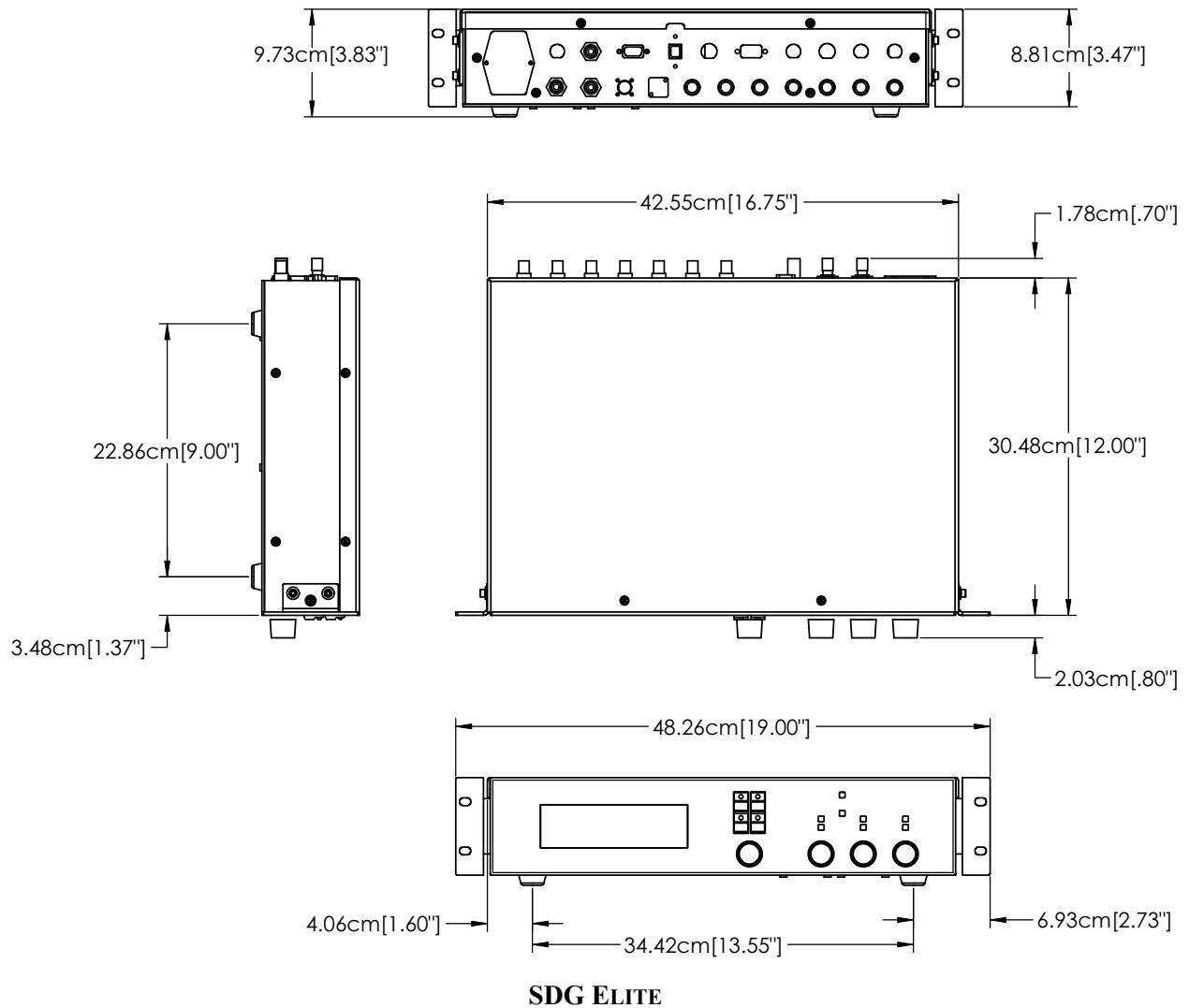


Figure 2-2. Astrella Optical Bench Assembly & External Component Dimensions (Continued)



#### **REVOLUTION POWER SUPPLY**

*Figure 2-2. Astrella Optical Bench Assembly & External Component Dimensions (Continued)*



*Figure 2-2. Astrella Optical Bench Assembly & External Component Dimensions (Continued)*



## SECTION THREE: INSTALLATION

Installation must be performed by a Coherent Field Service Engineer or an authorized representative. Any damage caused while a Field Service Engineer is not present is not included under warranty. The customer can, unpack and put the laser in the laboratory where it will be used.

Read this section completely before installation, with particular attention given to the information in Section One: Laser Safety.



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***NOTICE!***

**Do not try to install the laser without a qualified Coherent service engineer or an authorized representative. Unauthorized installation will void the warranty.**

---

### ***Receiving and Inspection***

Inspect the shipping containers for indication of rough handling or damage, and immediately report any damage to the shipping carrier and to Coherent.



---

***NOTICE!***

**The Astrella must be installed by authorized Coherent personnel.**

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***CAUTION!***

**The Astrella is heavy and has brackets and eye-bolts to be lifted with a mechanical-lift. A rigging team is recommended to position the laser onto an optical table. See Figure 3-1.**

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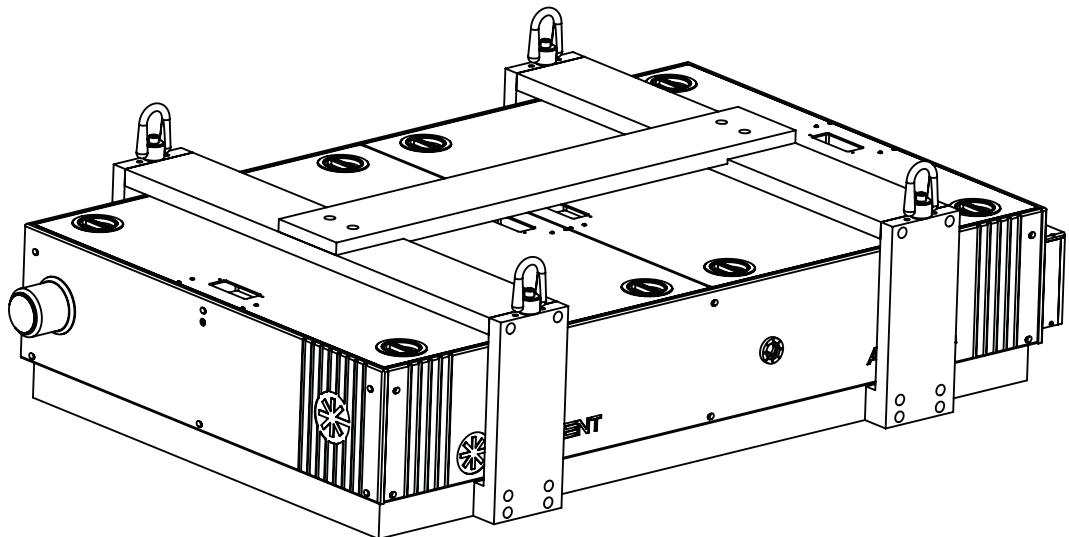


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***CAUTION!***

**The Astrella is heavy. Do not put hands or fingers under the laser while the system is suspended or moving.**

---



*Figure 3-1. Astrella with Shipping Frame for Mechanical Lift*

## **Vitara and Revolution Lasers**

Refer to the Vitara and Revolution Operator's Manuals for additional installation information.

## **Control Computer**



### ***NOTICE!***

The Astrella was manufactured and tested with the computers and control softwares sent with the laser. Coherent does not support the use of other computers or software to control the Astrella. Use of computers or software different from those sent with the system voids the warranty and can cause damage to the laser.

## **Installation Requirements**

Before installing the Astrella, use following checklist as shown in Table 3-1.

***Table 3-1. Pre-installation Checklist***

ACTIVITY & EQUIPMENT	GENERAL REQUIREMENTS	REFERENCE(S)
Laser Environment	<input type="checkbox"/> Laser area layout planned according to system dimensions. <input type="checkbox"/> No strong air currents directed at the laser. <input type="checkbox"/> No thermal gradients across the length or height of the laser. <input type="checkbox"/> Temperature fluctuations < 2° C.	“Location” on page 3-3 & “Environmental Requirements” on page 3-4
Receive and Inspect	<input type="checkbox"/> Area is clean and large enough to uncrate the laser, power supplies and chiller.	“Receiving and Inspection” on page 3-1
Utility Requirements	<input type="checkbox"/> Seed Laser <input type="checkbox"/> Pump Laser <input type="checkbox"/> Synchronization & Delay Generator (SDG Elite) <input type="checkbox"/> Laptop Computer <input type="checkbox"/> Chiller, Pump Laser	“Astrella Utility Requirements” on page 3-4
Chiller	<input type="checkbox"/> Pump Laser: Premixed Optishield II (1 pint diluted with distilled water).	“Chiller Fluid Requirements” on page 3-5
Laser Safety	<input type="checkbox"/> Laser Safety Officer (LSO) identified (recommended). <input type="checkbox"/> Laser Personnel Safety Training completed. <input type="checkbox"/> Laser controlled area established. <input type="checkbox"/> Personal protective equipment (Laser safety eye wear) available. <input type="checkbox"/> External interlock system well thought out (optional)	“Section One: Laser Safety” on page 1-1
Lab Equipment and Cleaning Material	See “Laboratory Equipment Requirements” on page 5.	“Laboratory Equipment Requirements” on page 3-5

## Location

The Astrella must be on an optical table. Coherent recommends that the Astrella be kept in a laboratory environment. The room must be free of dust, drafts, and large temperature fluctuations. For best system performance, keep the room temperature fluctuations within  $\pm 1^{\circ}\text{C}$  while system is in operation.

The Astrella requires a minimum table space of approximately 4 x 3 ft. (1.2 x 0.90 m). The customer has the responsibility to determine the best location for the Astrella. The Astrella must be placed in a position that allows easy access for service-related activities.

## Environmental Requirements

**Table 3-2. Operation Temperature, Humidity & Stability Guideline**

OPERATIONAL TEMPERATURE	TEMPERATURE STABILITY	HUMIDITY	HUMIDITY STABILITY
23° C ± 5° (73.4° F ± 9°)	± 1° C	45 ± 10 %	± 5 %

## Utility Requirements

Table 3-3 lists electrical requirements for and the amount of heat dissipated by a complete Astrella system.

**Table 3-3. Astrella Utility Requirements**

COMPONENT <sup>1</sup>	OPERATING VOLTAGE	MAX POWER	FUSE RATING 110V/220V	HEAT DISSIPATION
Seed Laser, Vitara-S: Vitara controller Vitara power supply	100-240 VAC, 50-60 Hz 100-240 VAC, 50-60 Hz	100 VA 750 VA	1 A / 0.5 A 8 A / 4 A	120 W 1000 W
Pump Laser, Revolution: Power supply Chiller	220VAC (±10%), 50-60 Hz 220VAC (±10%), 50-60 Hz	1500 VA	15 A / 10 A 12 A	1250 W 2000 W
SDG Elite	100-240 VAC, 50-60 Hz	200 VA	1 A / 0.5 A	50 W
Compressor remote control	negligible	negligible	negligible	negligible
Computer			2 A / 1 A	negligible

<sup>1</sup>Refer to the respective operator's manual for full details. Revolution power supply and chiller are not compatible with 110 V operation.

**Table 3-4. Astrella Cable & Hose Lengths**

MODEL	AC POWER CORD LENGTH	UMBILICAL/WATER LINE LENGTH
Revolution Power Supply	3 m (10 ft.)	3 m (10 ft.)
Revolution Chiller	2.4 m (8 ft.)	3 m (10 ft.)
Vitara-S Power Supply Vitara-S Controller	3 m (10 ft.)	3 m (10 ft.)
SDG Elite	3 m (10 ft.)	N/A

**NOTICE!**

Consult with the factory for any hoses or cables longer than the standard length. Damage can occur for unauthorized changes.

## Chiller Fluid Requirements

The chiller is a closed-loop system. Use only Optishield II (1 pint) diluted with distilled water (as necessary to fill the chiller tank) only.

## Facility Water Requirement<sup>1</sup>

Facility water temperature range: 8° C to 30° C.

Minimum facility water pressure 50 PSI; DO NOT exceed maximum pressure 100 PSI flow requirement to get specified cooling capacity: 3GPM typical with 20° C facility water.

## Laboratory Equipment Requirements

The following equipment is required for installation and daily operation of the Astrella:

- Safety eyewear rated to protect against wavelengths of 525 to 535 nm, and 700 to 900 nm
- Power meter with 10 W capacity (45 W for entire Revolution beam)
- A spectrometer with a spectral window of 700 to 900 nm
- 300 MHz or better oscilloscope and BNC cable
- IR viewer

1. The requirement needs to be met only if the water cooled chiller option is purchased.

- Optic cleaning supplies (lens tissue, hemostats, ultra-pure acetone and methanol, eyedropper)
- Latex or nitrile gloves or finger cots

## Cable Connections

Figures 3-1 shows the rear panel of the Astrella optical bench assembly. Refer to the Vitara and Revolution Operators Manuals for figures related to these components. See “Section Four: Controls and Indicators” on page 4-1 for more Astrella and SDG Elite connection details.

Make the cable connections shown in Figure 3-2:

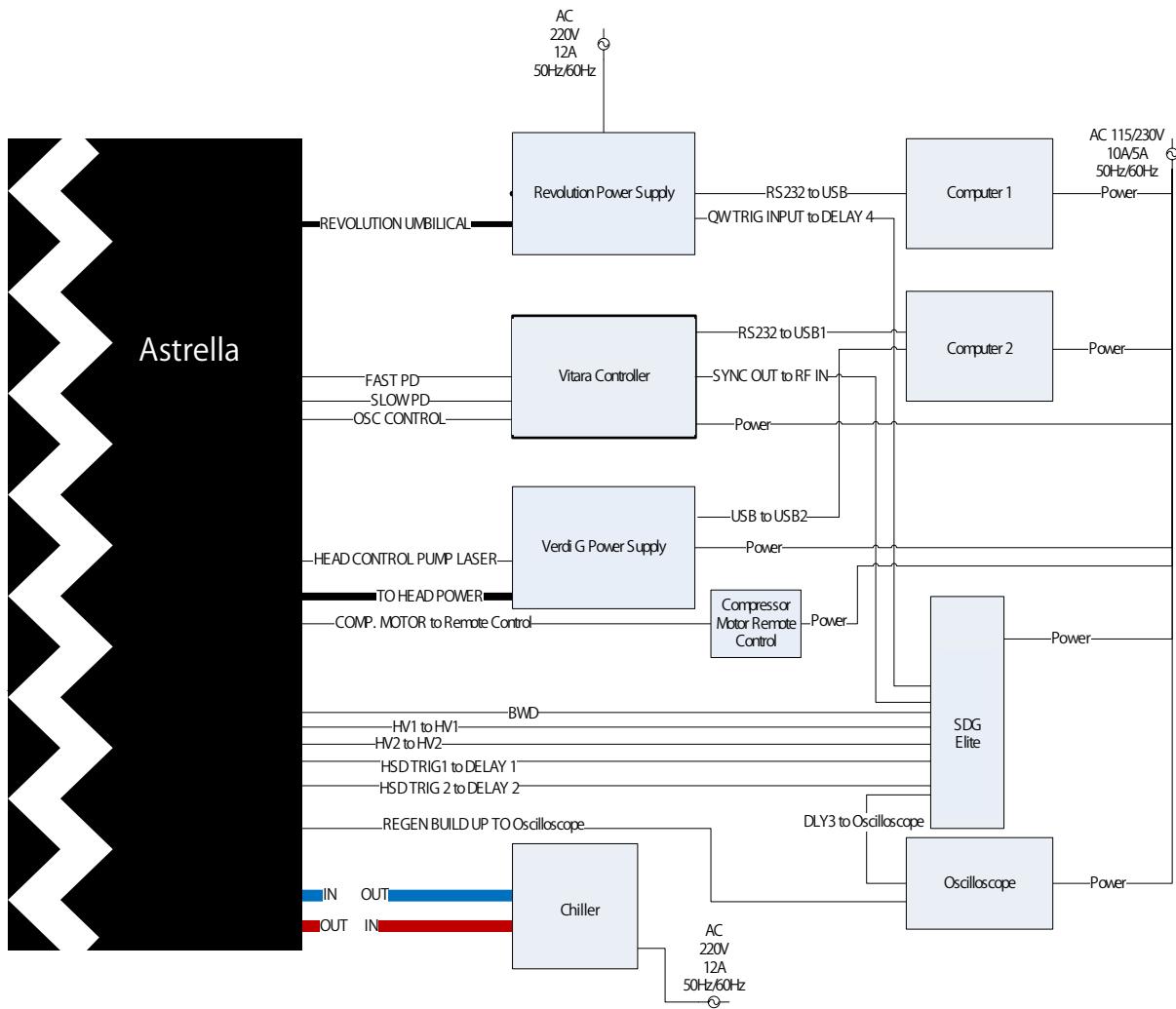


Figure 3-2. Astrella Block Diagram & Layout



*Figure 3-3. Astrella Optical Bench Assembly Rear Panel Connections*

#### **Astrella Rear Panel Connections**

#### **Standard BNC connections**

1. "HSD TRIG 1" on the Astrella rear panel, to "DELAY 1" on the SDG Elite rear panel.
2. "HSD TRIG 2" on the Astrella rear panel, to "DELAY 2" on the SDG Elite rear panel.
3. "OSC SYNC" on the Astrella rear panel is not used.
4. "Regen Build-Up" on the Astrella rear panel to the channel input of an oscilloscope terminated to 50 Ohm. Use a time base of 10 or 20 ns per division to monitor the REGN intra-cavity buildup (pulse train) during system operation.
5. "DELAY 3" on the SDG Elite rear panel, to the trigger input of the oscilloscope. Trigger the scope from this signal.
6. "AUX 1" and "AUX 2" are not used.
7. "FAST PD" on the Astrella rear panel to "FAST PD" of the Vitara controller.
8. "SLOW PD" on the Astrella to "SLOW PD" of the Vitara controller.

## **High Voltage BNC connections**



### **WARNING!**

**Verify the SDG Elite main power switch is OFF before contacting the High Voltage (HV) connectors on the SDG Elite rear panel.**

1. “HIGH VOLTAGE HSD 1” on the Astrella rear panel to “H.V. 1” on the SDG Elite rear panel.
2. “High Voltage HSD 2” on the Astrella rear panel to “H.V. 2” on the SDG Elite rear panel.

## **Remaining Cables**

1. Connect the three-pin cable assembly from the compressor stage remote control to “COMP. MOTOR” on the Astrella rear panel.
2. Connect the four-socket cable assembly to “BWD” on the Astrella rear panel, and to “BWD” on the SDG Elite rear panel.

## **Vitara and Revolution Umbilical Cables**

Large umbilical cables connect from the Astrella rear panel to the Vitara and Revolution power supplies. Do not disconnect or disassemble these cables.

## **Revolution Power Supply Connections**

1. “Q-SW Sync in” on the Revolution power supply front panel, to “DELAY 4” on the SDG Elite rear panel.

## **Chiller Connections**

1. Connect the chiller output water hose to the IN connector on the Astrella optical bench assembly.
2. Connect the chiller return water hose to the OUT connector on the Astrella optical bench assembly.
3. Fill the reservoir with fluid.

## **Vitara and SDG Elite Computer Connections (Optional)**

The Vitara power supply and SDG Elite feature RS-232 serial ports for remote control for these components. Use USB-to-Serial adapters to simultaneously connect the Vitara, Revolution, and SDG Elite to the computer.

Control software is shipped with the system. See the “Readme” file for additional information about software features and operation.

## **Power Connections**

Connect the following equipment to facility power:

- Vitara power supply and Vitara controller
- Revolution power supply (220V)
- SDG Elite
- Chiller (220V)
- Computers
- Compressor motor remote control power adapter

## **External Interlock**

An external interlock connector is supplied on the SDG Elite rear panel. To enable or disable the circuit, use the SDG Elite interlock menu.

Alternatively, the interlock connector can be wired to an external circuit, for example, a door switch. Many types of switches can be used, but the switch must have its contacts closed when it is safe to operate the laser and open when it is not safe.

The Vitara and Revolution power supplies are also have interlock connectors, as shown in their respective Operator’s Manuals. The system is sent with interlock defeats installed on these connectors.

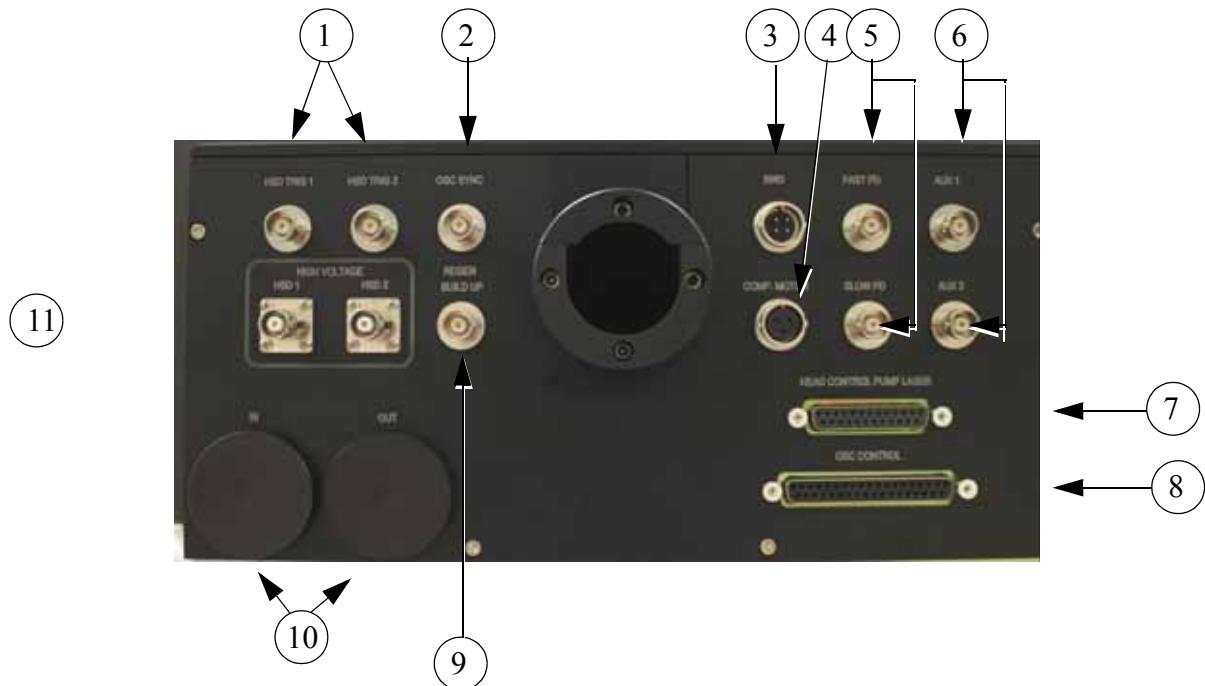
# SECTION FOUR: CONTROLS AND INDICATORS

## Astrella

This chapter covers the controls and indicators of the Astrella laser head and the SDG Elite. After Table 4-4 on page 7 is more detailed information on the SDG Elite.

The Vitara and Revolution lasers are described in detail in separate Operator's Manuals. Refer to these for descriptions of their controls and indicators.

See Figure 4-1 for Astrella controls and indicators.



*Figure 4-1. Astrella Laser Head Controls & Indicators*

***Table 4-1. Astrella Controls & Indicators***

ITEM	FEATURE	DESCRIPTION
1	HSD Trig 1/2	High speed driver trigger-connection from the synchronization and delay generator (SDG Elite) front panel. Up to 2 HSDs.
2	OSC Synch	Synch connector for oscillator seed laser output from the Vitara controller rear panel.
3	BWD	Bandwidth detector. Helps monitor the oscillator seed laser's bandwidth and provides protection to the Astrella if too narrow.
4	COMP. MOTOR	Input voltage for control of the compressor motor.
5	FAST/SLOW PD	Fast/Slow Photo Diode (PD). Fast PD signal to monitor the oscillator output pulse train. The signal is proportional to (but not linear) with the oscillator output pulse energy or power. Slow PD signal to monitor the oscillator output. The DC signal is proportional to (but not linear) with the oscillator output power.
6	Aux 1/2	Not used.
7	HEAD CONTROL PUMP LASER	Connection to Revolution Power Supply.
8	OSC CONTROL	Connection to Vitara Power Supply.
9	Regen Buildup	Can be used to monitor the pulse train inside of the Regen with an oscilloscope.
10	In/Out (Water)	Water in and out connections
11	High Voltage HSD 1/2	High voltage connection to HSD 1 or 2 (or both) from the high voltage power supply rear panel of the SDG Elite.

## Synchronization & Delay Generator - Front Panel

See Figure 4-2 for the controls and indicators of the SDG.

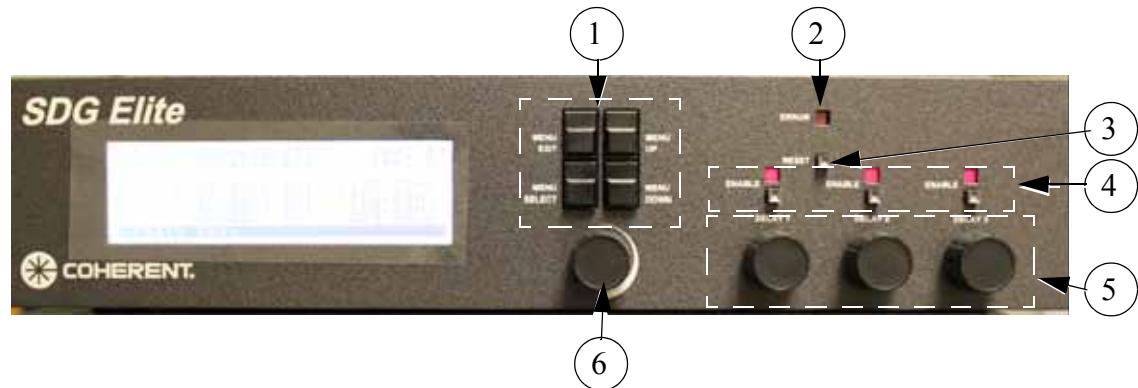
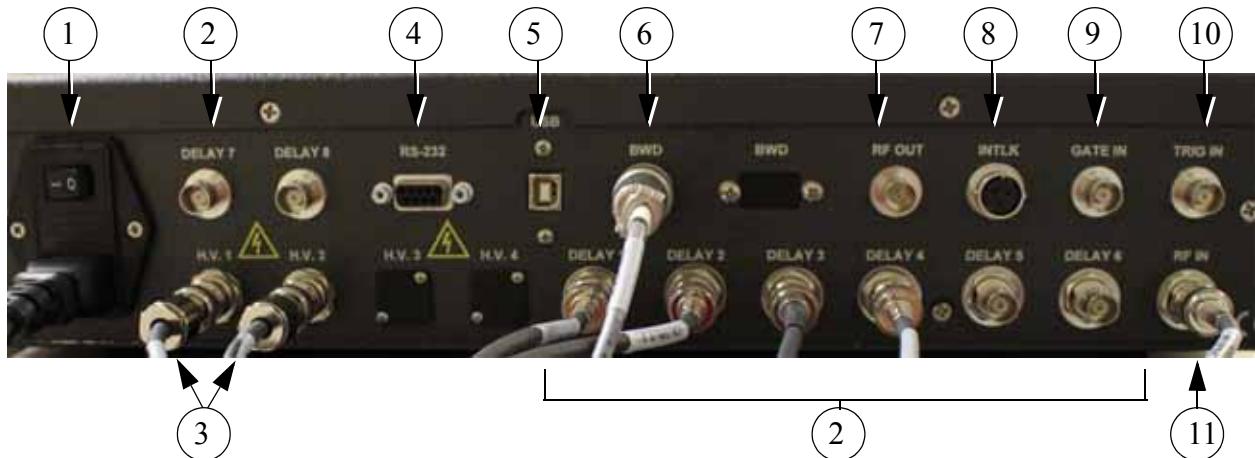


Figure 4-2. SDG Elite Front Panel Controls & Indicators

**Table 4-2. SDG Elite Front Panel Controls & Indicators**

ITEM	FEATURE	DESCRIPTION
1	MENU EXIT MENU SELECT, MENU UP MENU DOWN	<p>These keys provide navigation through the software menus.</p> <p>From the System Status screen, press MENU SELECT to access the Main Menu.</p> <p>From the Main Menu, use MENU UP and MENU DOWN to highlight the sub menus, and press MENU SELECT to access a highlighted sub-menu.</p> <p>From a sub-menu, press MENU EXIT to return to the Main Menu.</p> <p>From the Main Menu, press MENU EXIT to return to the System Status screen.</p> <p>Note: The display will automatically return to the System Status screen if no controls are adjusted for one minute.</p>
2	DELAY 1 DELAY 2 DELAY 3	These knobs adjust the values of Delays 1, 2, and 3. This is equivalent to setting Delays 1, 2, and 3 in the Delays menu. Refer to Table 4-4 on page 7 for the available delay increments.
3	ERROR LED	<p>This LED indicates an error in the system. Refer to the SDG Elite operator manual for a list of possible errors.</p> <p>Solid ON: active fault</p> <p>Blinking: fault has been cleared but RESET button must be pushed to resume operation.</p>
4	RESET	<p>This button resets a fault condition. Pushing the RESET button will silence the audible alarm, whether the fault has been cleared or not (the system will start beeping again if a new fault occurs).</p> <p>The RESET button must be pressed following a power cycle, or whenever the Bandwidth Interlock circuit is tripped or defeated.</p>
5	ENABLE pushbuttons and LEDs	<p>These three pushbuttons toggle the Delay 1, Delay 2, and Delay 3 outputs on and off.</p> <p>When a Delay is enabled, the LED lights red.</p>
6	Main control knob	This knob provides adjustment of many parameters in the software. Note that most changes take effect immediately, i.e., the adjustments are made in real time as the knob is turned. Refer to Table 4-4 on page 7 for the available delay increments.

**Figure 4-3. SDG Elite Rear Panel Controls & Indicators****Table 4-3. SDG Elite Rear Panel Controls & Indicators**

ITEM	FEATURE	DESCRIPTION
1	Power Switch and Plug	Provide main power to the unit
2	DELAY 1 through 8	The 8 individually adjustable Delay outputs, characterized below: 1-5 $\mu$ s pulse duration (selectable from the PULSEWIDTH menu) 3.3 V into high impedance, 1.65 V into 50 $\Omega$ Positive or negative amplitude (leading edge rising or falling), as selected in the software
3	H.V. 1 and H.V. 2	High-Voltage outputs to drive the Pockels cells. Voltage level is adjustable in the software. Two additional outputs (H.V. 3 and 4) are included with some units.
4	RS-232 Serial Port	Provides a connection for RS-232 control. See the SDG Elite operator manual for more information.
5	USB Port	Provides a USB interface. See the SDG Elite operator manual for more information.
6	BWD Connector	Accepts the signals from the bandwidth interlock photodiodes. This circuit may be enabled or disabled in the software, although Coherent strongly recommends that this circuit be enabled. All Delay outputs selected in the Interlock sub-menu are disabled if this circuit is open (and enabled). Signal levels may be monitored in the software.
7	RF OUT	Provides a buffered monitor for the RF IN signal.
8	INTLK	Provides a connection for a user-supplied interlock circuit. This circuit may be enabled or disabled in the software. All Delay outputs selected in the Interlock sub-menu are disabled if this circuit is open (and enabled).

***Table 4-3. SDG Elite Rear Panel Controls & Indicators (Continued)***

ITEM	FEATURE	DESCRIPTION
9	GATE IN*	Accepts a Gate input, which may be applied individually to each channel in the software. Channels may be set active HIGH or active LOW. See "Trigger" on page 9 for more information.
10	TRIG IN*	This connector accepts the pump laser trigger signal. The Delay outputs are set relative to this signal (when the system is set to External trigger).
11	RF IN*	This connector accepts the RF source which serves as the system master clock. Typically this signal is from a photodiode which monitors the seed laser pulse train. Signal must be 0 to 100 MHz, >100 mV into 50 Ω
	*The Astrella includes jumpers to set the impedance of the GATE IN (jumper J12), TRIG IN (jumper J11), and RF IN (jumper J1) inputs. When the jumper is in place the impedance is 50 Ω, when removed the impedance is high. Factory default is 50 Ω for TRIG IN and RF IN, high for GATE IN.	

## **Additional SDG Elite Controls**

### **Changing the Delay Increment**

Several increments are available when changing the Delays. See Table 4-4.

**Table 4-4. Variable Delay Increments**

ACTION	DELAY INCREMENT (ns PER “CLICK”)
Turn Main Control knob	0.25
Turn Main Control knob while pushing in Main Control knob	10
Turn Main Control knob while pushing in Main Control knob and Delay 1 knob	100
Turn Main Control knob while pushing in Main Control knob and Delay 2 knob	1000
Turn Main Control knob while pushing in Main Control knob and Delay 3 knob	10,000
Turn DELAY 1, DELAY 2, or DELAY 3 knob	0.25
Turn DELAY 1, DELAY 2, or DELAY 3 knob while pushing in DELAY 1, DELAY 2, or DELAY 3 knob	10

## Software Menu Structure

After the software has initialized, the System Status screen is displayed. The System Status screen is also displayed if there is no adjustment longer than one minute.

Press MENU DOWN to highlight “Main Menu,” and then press MENU SELECT to open the Astrella menu structure. From the Main Menu press MENU EXIT to return to the System Status screen.

The menu structure is described in detail below. Use the MENU UP and MENU DOWN keys to navigate within a menu. Press MENU SELECT to access a given sub-menu, and MENU EXIT to return to the top level.

## Delays

Delays 1 through 8 can be individually controlled. All changes take effect immediately.

- Delay range 0 to approximately 818000 ns (~0.8 ms) in 0.25-ns increments (select with Main control knob). Note: This is for an 80 MHz RF input. If the RF input is greater than 80 MHz, the range decreases.
- Push MENU SELECT to toggle through the following states:
  - ON Rise (positive pulse, i.e. leading edge rising)
  - OFF Rise
  - ON Fall (negative pulse, i.e. leading edge falling)
  - OFF Fall

## High Voltage

This menu includes a monitor and control for outputs HV1 and HV2. All changes take effect immediately.

- Voltage range 0 up to 5 kV (5 mA maximum). If the monitor shows 5 mA and a voltage much less than the set point voltage, a “HV ERROR” may occur. This can happen if the HSD is damaged and drawing excessive current.



---

***NOTICE!***

**Use the Main menu if changing the voltage via RS-232.**

---

## Universal Delay

All 8 delays are displayed in this menu. Turning the Main control knob introduces an offset to all 8 delays, effective immediately. Refer to Table 4-4 to see how to change the delay in large steps.

## Trigger

The Trigger menu includes some settings as shown below. Use MENU UP and MENU DOWN to highlight a parameter, and press MENU SELECT to toggle between the available values. All changes take effect immediately.

### Trigger Internal / External

When External trigger is displayed, the Astrella uses the TRIG IN input as the starting point (delay = 0) for the Delay outputs. This is the typical mode of operation, with the pump laser Trigger Out connected to TRIG IN on the Astrella.

When Internal trigger is displayed, the Astrella ignores the TRIG IN input. In this case the software divides (i.e. counts down) the RF IN signal by the RF Divisor, which causes the internal trigger repetition rate. The RF Divisor can be set to any integer in the range 2 to 131072. For an 80 MHz RF source, this agrees to a frequency range of 40 MHz to 610 Hz. The RF Divider can be changed in large steps using the Delay 1-3 knobs (similar to the delay adjustment actions shown in Table 4-4).

### Trigger Normal / Invert

When set to the NORMAL position, the system triggers on the rising edge of a HIGH signal at the TRIG IN input. Setting to Invert causes the system to trigger on the falling edge of a LOW signal.

### Trigger Divide

The trigger frequency (internal or external, depending on the trigger mode) can be divided from 1 to 1023 for output on selected channels. Those channels not selected will continue to output at the undivided trigger frequency. Channel selection is made by toggling between “DIV” and “OFF” next to the channel number.

The Trigger Divisor activates the Delay outputs at an integral divisor of the TRIG IN input repetition rate.

For example:

Trigger frequency	1 kHz
Trigger Divide	10
Astrella output rep rate	100 Hz (selected channels)
	1 kHz (channels not selected)

Use the control knob to set the Trigger Divide parameter.

**Gated / No Gate**

When Gated is displayed, all Delay outputs are subject to the GATE IN input. When No Gate is displayed, the system ignores the GATE IN input. Channels can be gated individually through the Gate Override menu.

**Gated Normal / Invert**

When Normal is displayed, the system produces output when the GATE IN signal is HIGH. When Invert is displayed, the system produces output when the GATE IN signal is LOW.

**Continuous / Single Shot**

When Continuous running is displayed, the Astrella causes Delayed outputs continuously.

When Single Shot Fire is displayed, the Astrella can output one pulse on the same channels selected for trigger frequency divide. Those channels not selected will fire continuously at the undivided trigger frequency. To produce one pulse, highlight "Fire" and press MENU SELECT or send the "man:trig" RS-232 command.

**Pulse width**

The pulse width for each channel can be set from 1.0 to 5.0  $\mu$ s with 0.1  $\mu$ s resolution.

**Gate Override**

Gated or Not Gated is individually selectable for each delay. When Gated is displayed, the delay output responds to the GATE IN signal on the rear panel. When Not Gated is displayed, the delay output ignores the GATE IN signal.

**BWD**

The Bandwidth interlock circuit monitors two photodiodes, which are typically located inside the stretcher compartment of the regenerative amplifier. A strong signal from each photodiode indicates that the seed laser spectrum has sufficient bandwidth to avoid damaging the amplifier. This menu displays the signal level of each photodiode.

If the signal level of either photodiode falls below threshold, the Bandwidth Interlock circuit will trip. This disables all outputs selected in the Interlock sub-menu and lights the ERROR LED on the front panel. After correction, the system must be reset (by pushing the RESET button or sending the reset command) to re-enable output.

Press MENU SELECT to toggle between 2Channel and Disabled. When Disabled is displayed, the system ignores the bandwidth interlock circuit. Coherent does not recommend operation in this state.

## **RF**

The Astrella includes an amplifier for the RF IN input signal. The gain of this circuit may be set from -8 to 15 dB. Press MENU SELECT to toggle Invert ON and Invert OFF.

The RF frequency is displayed, and “Input Clipping” is displayed when the internal circuitry is attenuating the input signal (when gain is negative).

## **Interlock**

The system also provides an external interlock circuit through the INTLK connector on the rear panel. Press MENU SELECT to toggle through Ignore, Normal, or Invert.

When Ignore is displayed, the system ignores the external interlock circuit.

When Normal is displayed, the system operates only when the interlock circuit is closed.

When Invert is displayed, the system operates only when the interlock circuit is open.

The user can select one or more channels to continue to output pulses during a BWD or other fault by toggling between Use and Ignore next to the channel number.

## **Recall/Save Setup**

Up to 255 system configurations can be saved.

To save a configuration:

1. Use the primary control knob to select an index, from 1 to 255.
2. Use the MENU UP and MENU DOWN keys to highlight Save.
3. Press MENU SELECT.

To recall a configuration:

1. Use the primary control knob to select an index, from 1 to 255.
2. Use the MENU UP and MENU DOWN keys to highlight Recall.
3. Press MENU SELECT.



---

***NOTICE!***

**Recalling a different system configuration will immediately change all system parameters.**

---

## **LCD/LED**

This menu provides control over LED and display settings as listed below:

LCD Contrast      150 to 250

LCD Brightness      0 to 100

LED Brightness      1 to 16

## SECTION FIVE: DAILY OPERATION



---

### WARNING!

All personnel in the area must wear laser safety eye-wear to protect against laser radiation. Read Section One: Laser Safety and be familiar with correct laser safety practices. Contact Coherent customer service (800-367-7890) with any questions or potential issues concerning laser safety.

Laser safety eye wear must be rated to protect against the following wavelengths:

*Table 5-1. Wavelengths of Radiation Generated by the Astrella*

ASTRELLA CONDITION	WAVELENGTHS
Covers in place (normal operation)	750 to 850 nm
Optical bench assembly cover removed	525 to 535 nm, 700 to 900 nm
Revolution or Vitara head cover removed	525 to 535 nm, 700 to 900 nm

The Astrella is normally operated with the laser head and power supply covers in position. Operation of the laser with the head cover removed allows access to hazardous visible and invisible radiation. Removal of the power supply cover allows access to dangerous voltage and current levels in addition to laser radiation. Remove covers only for service and maintenance by authorized personnel that understand the potential hazards. When this or any laser system is in operation, always wear safety eye-wear of OD 5 or greater for all lasing wavelengths.

---

## **Control Computer**



---

### ***NOTICE!***

**The Astrella is manufactured and tested with the computer and control software included in the shipment with the laser. Coherent does not support the use of other computers or software to control the Astrella. Use of different computer or software can damage to the laser and voids the warranty.**

---

## **System Activation Procedure**

To identify the controls and indicators referred in the instructions below, see Figure 4-2, Figure 4-3, Table 4-2, and Table 4-3.

1. Activate Revolution. Use instructions on “Revolution Activation Procedure” on page 5-4.
2. Activate Vitara. Use instructions on “Vitara Activation Procedure” on page 5-7.
3. Wait for the Revolution and Vitara to stabilize. Confirm that the Vitara is modelocked and operating at normal bandwidth.
4. Turn the main power switch of the SDG Elite to the ON position. The display on the panel indicates PWR Error. The ERROR LED on the panel flashes. This condition is normal.
5. Put a power meter detector at the Astrella output port<sup>1</sup>.
6. Press the RESET button on the front panel of the SDG Elite.



---

### ***NOTICE!***

**Always turn on ENABLE button above the DELAY 2 knob before the one above DELAY 1. Failure to follow the sequence will cause optical damage.**

---

7. Press the ENABLE button above the DELAY 2 knob on the front panel of the SDG Elite, to activate Pockels cell #2. When the Pockels cell is active, the red LED above the button illuminates.

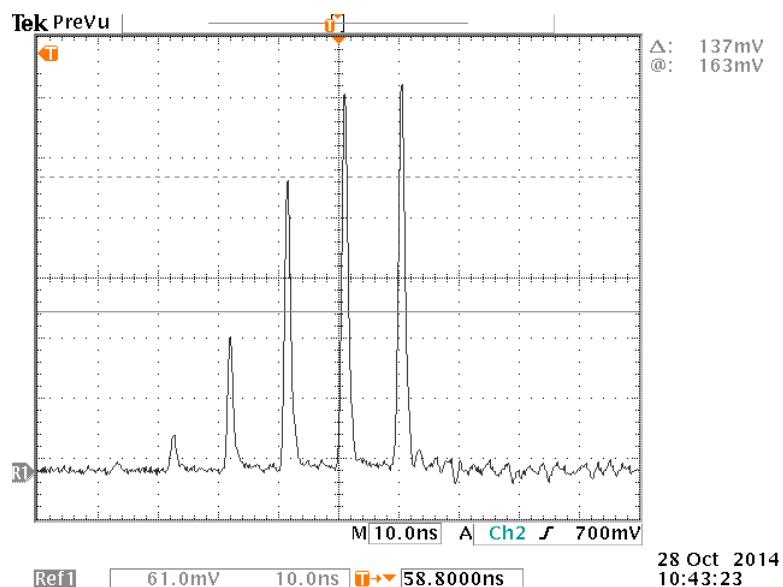
---

1. See Table A-1 for the correct combination of power/ energy sensor and meter.

**DANGER**

**Laser system emits laser radiation after the next step. Confirm a device to block the beam is in position.**

8. Press the ENABLE button above the DELAY 1 knob on the front panel of the SDG Elite to activate Pockels cell #1. When the Pockels cell is active, the red LED above the button illuminates.
9. Wait for the system to reach thermal equilibrium
10. Observe the REGEN pulse train on an oscilloscope (Figure 5-1).
11. Record system parameters each week to monitor performance<sup>1</sup>.



**Figure 5-1. Example of an Ideal Pulse Train**

1. See “Data Log Template” on page 5-14.

## Revolution Activation Procedure



---

### **WARNING!**

**Laser radiation exits the Revolution output port at the end of the procedure below. Make sure sufficient laser eye protection is worn by all persons in the room. Confirm that the anticipated beam is safely terminated into a high-power beam block or power meter.**

---

1. Press the POWER button on the chiller to activate the chiller.



*Figure 5-2. Chiller*

2. Start the computer connected to the Revolution power supply and log in (if necessary)<sup>1</sup>.
3. Set the power switch on the power supply chassis to the ON position (Figure 5-5).
4. Open the Revolution control software on the control computer.



**Figure 5-3. Revolution Software Icon**

5. The GUI opens to a warning screen. Hit the OK button.



**Figure 5-4. Warning Screen**

6. Look on the SYSTEM tab of the GUI (Figure 5-6). Confirm that the LBO heater control temperature is set to temperature specified on the data sheet. Make sure the temperature value matches the number displayed on the front panel of the Revolution power supply.
7. Confirm that the LBO heater temperature matches the temperature on the GUI SYSTEMS tab (Figure 5-6)

---

1. Figure 3-2 for connection diagram.



**Figure 5-5. Revolution Power Supply Front Panel**

8. Insert the key into the keyswitch and turn to the ON position. If the switch is in the ON position before the power switch, a VSWR fault occurs<sup>1</sup>.
9. Wait for the RUN BUTTON indicator on the GUI to illuminate (Figure 5-6).
10. Set the Current SETTING in the GUI to the operating current specified on the data sheet. Note: the current of 22.6 A in Figure 5-6 is an example.



**Figure 5-6. Revolution GUI SYSTEM Tab**

1. To clear the VSWR fault, turn the keyswitch to the OFF position then turn it to the ON position.



**NOTICE!**

The Revolution was optimized at a specific Q-switch repetition rate. The operation of the laser at a significantly different rate can cause decreased performance or optical damage.



**WARNING!**

The procedure below will cause a laser emission from the Revolution output port. Make sure all persons in the room have sufficient laser eye protection. Make sure that the anticipated beam is terminated correctly.

11. Press and hold the RUN button in the control software until the alarm starts. Release the RUN button. The LASER ACTIVE LED on the power supply chassis and the LASER ACTIVE LED illuminate. The current increases at a rate of 0.3A/s until it reaches set-point current.
12. Select the SYSTEM tab of the control software to view the power reading from the built-in power monitor (Figure 5-6).

## Vitara Activation Procedure

1. Confirm that the key switch on the power supply front panel is in the OFF position.
2. Confirm the chiller is in operation.
3. Set the power switch on the Vitara controller rear panel to the ON position. Confirm that the power indicator at the front of the controller is illuminated.
4. Set the power switch on the Vitara power supply rear panel to the ON position. The INTLK OK (pump power supply) and LASER ON (Vitara laser head) indicators illuminate. If an indicator does not illuminate, refer to Section Seven: Maintenance and Troubleshooting. If the SYSTEM FAULT indicator illuminates, refer to the Maintenance and Troubleshooting section of the Verdi G-Series Operator's manual.



**CAUTION!**

Confirm that the laser output is blocked or is pointed at an intended target. Make sure that all personnel in the area are wearing laser safety eye-wear.



**Figure 5-7. Vitara Controller Rear Panel**

5. Turn the key switch to the ON position. The LASER ON indicator flashes and then remains illuminated.
6. Start and open the GUI.
7. From the MAIN tab, select the REMOTE button to activate the remote (green arrow will indicate remote is active). See Figure 5-9.
8. From the MAIN tab, select DIODE ON to turn on the pump laser (Figure 5-9). Wait approximately one minute.
9. Let the laser find lasing power, CW power and modelocked power.
10. Confirm the LASING, Modelocked and Power Track LEDs on the Main tab of the GUI software are green (See Figure 5-9). If any of the LEDs have not turned green, see the Vitara Operator's Manual for troubleshooting.

## Pulse Width Optimization

The Astrella includes a remote control for compressor delay adjustments to optimize the pulse width if necessary. Do not make any adjustments to the remote control unless you have a device like Coherent SSA<sup>1</sup>. While monitoring the pulse width using a device like Coherent SSA, make few clicks to “+” or “-” buttons of the remote control if necessary to optimize the pulse width.

---

1. The SSA measures and monitors the pulse width.



Figure 5-8. Vitara Power Supply

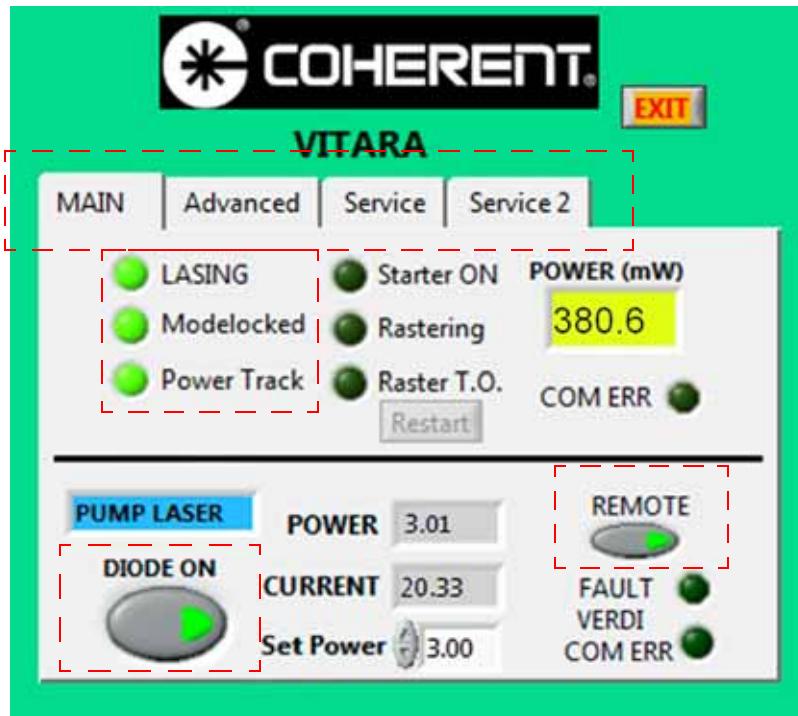


Figure 5-9. Vitara Main Panel

## System Deactivation Procedure



---

### NOTICE!

**Always turn off ENABLE button above the DELAY 1 knob before the one above DELAY 2.** Failure to follow the sequence will cause optical damage.

---

1. Press the ENABLE buttons on the SDG Elite front panel to deactivate the Pockels cells 1. Confirm the red LED has turned off.
2. Press the ENABLE buttons on the SDG Elite front panel to deactivate the Pockels cells 2. Confirm the red LED has turned off.
3. On the Revolution control software GUI, select the STOP button (Figure 5-6).

4. On the Vitara power supply, turn the keyswitch to the OFF position.



***NOTICE!***

**Always turn off the Vitara power supply BEFORE the chiller is turned off. The change to this sequence will damage the Vitara.**

---

5. Press the power button on the front panel of the chiller to turn it off.
6. Turn off the main power switch of the SDG Elite (Figure 4-3).
7. Turn the key in the keyswitch on the Revolution power supply to the OFF position.
8. Exit and close the Revolution Software. Turn off the computer used as the controller for the Revolution.
9. Turn the main power switch on the Revolution power supply to the OFF position.
10. Put the power switch on the back panel of the Vitara power supply in the OFF position.
11. Turn the main power switch of the Vitara controller to the OFF position.
12. Turn off the computer connected to the Vitara controller.
13. Turn the chiller off.



***NOTICE!***

**To prevent algae growth, run the chiller at least once a week for one hour. If the system will be in long-term storage, drain the system and the chiller.**

---



***NOTICE!***

**For faster system warm-up, keep subsystems (Revolution Power Supply, Vitara Power Supply and Controller, SDG Elite and laptops) in standby mode. To put the system in stand-by, follow steps 1-4 of the “System Deactivation Procedure” on page 5-10. The chiller must be on while the system is in standby mode.**

---

## Long-Term Storage Procedure

1. Complete steps 1 through 7 in the "System Deactivation Procedure".
2. Before exiting the Revolution software, go to the Factory tab and set the "SHUTDOWN: Set LBO to 75 DEG" toggle in the up position.



Figure 5-10. Revolution Software Factory Panel

3. Look on the SYSTEM tab (or the front panel of the power supply) and wait for the crystal temperature to reach 75°F.



Figure 5-11. LBO Temperature Reading

4. Follow rest of "System Deactivation Procedure".

## *Daily Operation*

5. Disconnect the power cord from the Revolution power supply
6. Disconnect the chiller from the system
7. Drain both system and chiller
8. Store system in clean temperature controlled environment.

**Data Log  
Template**

The following table may be used as a guide for logging system settings and output characteristics:

DATE: \_\_ / \_\_ / \_\_  
TIME: \_\_ : \_\_ : \_\_

LAB TEMPERATURE:

LAB HUMIDITY:

VERDI G [VITARA LASER PUMP]		VITARA LASER	
Verdi output power	W	Vitara modelocked power	mW
Diode current	A	Vitara bandwidth	nm
Diode hours			
REVOLUTION [AMPLIFIER PUMP]		ASTRELLA	
Output power	W	Output power	W
Diode current	A	Delay 1 setting	ns
Diode hours	H	Delay 2 setting	ns
LBO temperature	°C	Delay 4 setting	ns
		Output bandwidth	nm
		Pulse width	fs

# ACCESSORIES

## Power Meters and Sensors

Coherent offers a variety of instruments for laser test and measurement. For additional detailed information, including product selection guides, please visit our web site at [www.Coherent.com](http://www.Coherent.com).

### *A-1. Recommended Accessories*

SYSTEM/ MODULE	PARAMETER	SENSOR	POWER/ ENERGY METER
Astrella	Energy per pulse	J-25MT-10KHz P/N 1110747  	LabMax-TOP Power and Energy Meter P/N 1104622  
	Average Power	PM10 P/N 1097901  	
Revolution	Average Power	PM150 P/N 1098407  	

## Factory Calibration

Coherent sensors are highly stable and are even used as part of the NIST references.

To ensure that our products meet your expectations, we are constantly working to improve our calibration methods, their accuracy and reliability.

In principle, we calibrate our sensors against NIST-traceable standards, which in turn were calibrated against the so-called Golden NIST standards.

Coherent is ISO 9001:2008 certified and our laboratories calibrate or verify any device with traceability certificate to NIST standards laboratories in Boulder, Colorado and Gaithersburg, Maryland, USA with the highest precision.

Since the beginning of 2013, our calibration in Wilsonville Oregon is also ISO 17025:2005 certified. Learn more about it on our website at [www.Coherent.com](http://www.Coherent.com)

## **How Do You Reach Us?**

For technical information or quotes please call or send us an e-mail:

- Toll Free: +1 (800) 527-3786
- Tel: +1 (408) 764-4983
- Email: Tech.Sales@coherent.com

For LMC calibrations or repairs you can also reach us via e-mail or phone:

- Email: LMC.Sales@coherent.com
- Toll Free: +1 (800) 343-4912
- Tel: +1 (503) 454-5727

Download our latest LMC catalog at: [www.Coherent.com](http://www.Coherent.com)

# **WARRANTY**

Coherent, Inc. warrants to the original purchaser (the Buyer) only, that the laser system, that is the subject of this sale, (a) conforms to Coherent's published specifications and (b) is free from defects in materials and workmanship.

Laser systems are warranted to conform to Coherent's published specifications and to be free from defects in materials and workmanship for a period of twelve (12) months. This warranty covers travel expenses for the first ninety (90) days. For systems that include installation in the purchase price, this warranty begins at installation or thirty (30) days from shipment, whichever occurs first. For systems which do not include installation, this warranty begins at date of shipment.

## ***Optical Products***

Coherent optical products are unconditionally warranted to be free of defects in materials and workmanship. Discrepancies must be reported to Coherent within thirty (30) days of receipt, and returned to Coherent within ninety (90) days. Adjustment is limited to replacement, refund or repair at Coherent's option.

## ***Conditions of Warranty***

On-site warranty services are provided only at the installation point. If products eligible for on-site warranty and installation services are moved from the original installation point, the warranty will remain in effect only if the Buyer purchases additional inspection or installation services at the new site.

For warranty service requiring the return of any product to Coherent, the product must be returned to a service facility designated by Coherent. The Buyer is responsible for all shipping charges, taxes and duties covered under warranty service.

Parts replaced under warranty shall become the property of Coherent and must be returned to Coherent, Inc., Santa Clara, or to a facility designated by Coherent. The Buyer will be obligated to issue a purchase order for the value of the replaced parts and Coherent will issue credit when the parts are received.

## **Other Products**

Other products not specifically listed above are warranted to, (a) conform to Coherent's published specifications and (b) be free from defects in materials and workmanship. This warranty covers parts and labor and is for a period of twelve (12) months from the date of shipment.

## **Responsibilities of the Buyer**

The Buyer must provide the appropriate utilities and operating environment outlined in the product literature and/or the Pre-installation Manual. Damage to the laser system caused by failure of Buyer's utilities or the Buyer's failure to maintain an appropriate operating environment, is solely the responsibility of the Buyer and is specifically excluded from any warranty, warranty extension, or service agreement.

The Buyer is responsible for prompt notification to Coherent of any claims made under warranty. In no event will Coherent be responsible for warranty claims later than seven (7) days after the expiration of the warranty.

## **Limitations of Warranty**

The foregoing warranty shall not apply to defects resulting from:

1. Components or accessories with separate warranties manufactured by companies other than Coherent.
2. Improper or inadequate maintenance by Buyer.
3. Buyer-supplied interfacing.
4. Operation outside the environmental specifications of the product.
5. Improper site preparation and maintenance.
6. Unauthorized modification or misuse.

Coherent assumes no responsibility for customer-supplied material.

The obligations of Coherent are limited to repairing or replacing, without charge, equipment which proves to be defective during the warranty period. Repaired or replaced parts are warranted for the duration of the original warranty period only. This warranty does not cover damage due to misuse, negligence or accidents, or damage due to installations, repairs or adjustments not specifically authorized by Coherent.

This warranty applies only to the original Buyer at the initial installation point in the country of purchase, unless otherwise specified in the sales contract. Warranty is transferable to another location or to

*Warranty*

another Buyer only by special agreement which will include additional inspection or installation at the new site.

THE WARRANTY SET FORTH ABOVE IS EXCLUSIVE IN LIEU OF ALL OTHER WARRANTY, WHETHER WRITTEN, ORAL OR IMPLIED, AND DOES NOT COVER INCIDENTAL OR CONSEQUENTIAL LOSS. COHERENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.



# GLOSSARY

$^{\circ}\text{C}$	Degrees centigrade or Celsius
$^{\circ}\text{F}$	Degrees Fahrenheit
$\mu$	Microns ( $10^{-6}$ )
$\mu\text{rad}$	Microradian(s)
$\mu\text{sec}$	Microsecond(s)
$1/\text{e}^2$	Beam diameter parameter
$\lambda$	Wavelength
AC	Alternating current
AGC	Automatic gain control
Amp	Amperes
BPF	Band pass filter
BWD	Bandwidth Detector
CDRH	Center for Devices and Radiological Health
cm	Centimeter(s)
CPA	Chirped Pulse Amplification
CW	Continuous wave
DC	Direct current
EMC	Electromagnetic compliance
fs	femtosecond or $10^{-15}$ second
GHz	Gigahertz
GVD	Group Velocity Dispersion
HSPS	High speed power supply
Hz	Hertz
IR	Infrared
IR viewer	Infrared viewer
kg	Kilogram(s)
kHz	Kilohertz
LED	Light emitting diode
LVD	Low voltage directive
m	Meter(s)
mAmp	Milliampere(s)
MHz	Megahertz
mm	Millimeter(s)
mrad	Milliradian(s)
msec	Millisecond(s)
mV	Millivolt(s)
mW	Milliwatt(s)

Nd:YAG	Neodymium doped yttrium aluminum garnet
nm	Nanometer(s)
OEM	Original equipment manufacturer
ps	picosecond or $10^{-12}$ second
PZT	piezo-electric transducer
RA or REGEN	Regenerative Amplifier
RF	Radio frequency
rms	Root mean square
Rx	Receive
SDG	Synchronization and Delay Generator
TEM	Transverse electromagnetic (cross-sectional laser beam mode)
Ti:Sapphire	Titanium-doped Sapphire
Tx	Transmit
VAC	Volts, alternating current
VDC	Volts, direct current
W	Watt(s)

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