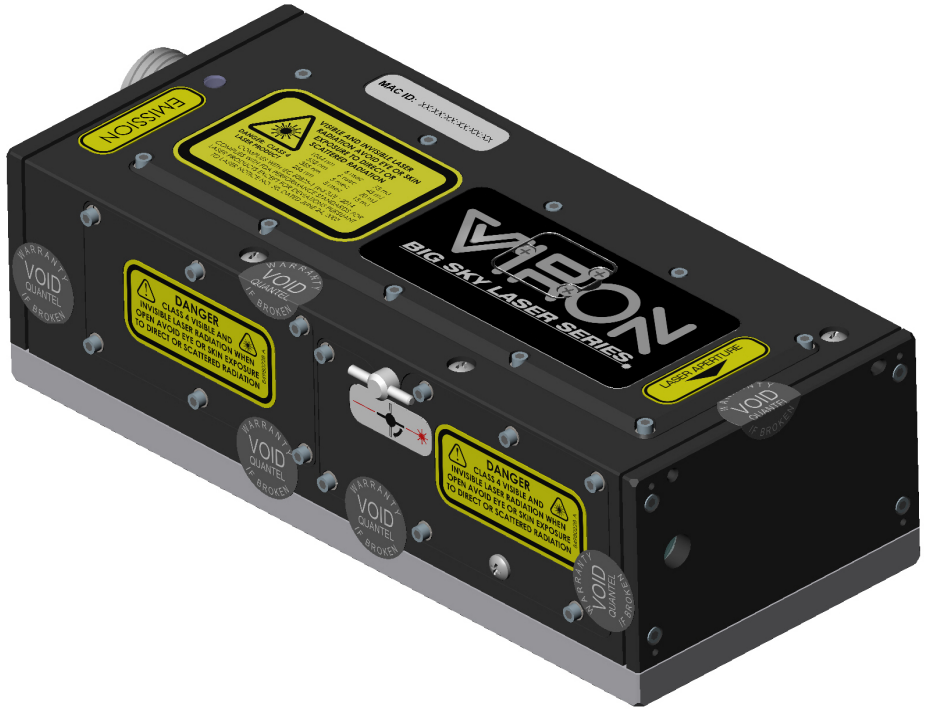
Quantel

User Manual *Viron*

Version A | # DOC00131 | August 30, 2017



VIRON
BIG SKY LASER SERIES

CE

Diode-pumped Laser

Quantel

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Viron User Manual

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VIRON
BIG SKY LASER SERIES

User Manual

Document # DOC00131

Version A

August 30, 2017

USER MANUAL

Authorization Memorandum

I have carefully assessed the User Manual for the Viron.
This document has been completed in accordance with the requirements of Quantel.

MANAGEMENT CERTIFICATION

Kim Rollefson, August 30, 2017

Quality Assurance Manager

This manual is provided in digital form to conserve paper.
If you need to print this document, please remember to select two-sided printing to help keep paper use to a minimum.

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LASER SAFETY

1.0 Hazard Information

Hazard information includes terms, symbols and instructions used in this manual or on the equipment to alert operating and service personnel to the recommended precautions in the care, use and handling of Class IV laser equipment.

2.0 Terms & Warning Symbols

 **DANGER**	Imminent hazards which, if not avoided, will result in serious injury or death.
 **WARNING**	Potential hazards which, if not avoided, could result in serious injury or death.
 **CAUTION**	Potential hazards which, if not avoided, could result in minor or moderate injury.
 **CAUTION**	Potential hazards which, if not avoided, could result in product damage.
NOTE	Points of particular interest for more efficient or convenient equipment operation; additional information or explanation concerning the subject under discussion.
 **WARNING: LASER RADIATION**	Avoid exposure of eyes or skin to direct or diffused laser radiation. Permanent eye damage or blindness may occur.
 **WARNING: HIGH VOLTAGE**	Electric shocks and burns from capacitor discharge or power circuits could lead to serious injury or even death.

3.0 Acronyms and Abbreviations

AEL: Accessible Emission Limits

BLE: Bluetooth Low Energy host communication channel

BNC: Bayonet Neill-Concelman RF connector often used with coaxial cable

DHCP: Dynamic Host Configuration Protocol

I/O: Input/Output

IP: Internet Protocol

IR: Infrared

LAN: Local Area Network/Ethernet host communication channel

LASER: Light Amplification by Stimulated Emission of Radiation

MAC: Media Access Control address that encodes a hardware identification number.

MVAT: Motorized Variable Attenuator (accessory)

NLO: Nonlinear Optic

PRF: Pulse Repetition Frequency

TEC: Thermoelectric Cooler

Dimensions listed in this manual are:
U.S. Standard Units inches [SI Metric mm].

4.0 General Hazards

The following descriptions are of general hazards and unsafe practices that may result in product damage, severe injury or death. Other more specific warnings and cautions are presented as appropriate throughout this manual.

	**DANGER Serious Personal Injury**	This Class IV laser configures to emit 1064 nm, 532 nm, 355 nm, and/or 266 nm laser radiation. Do not allow laser radiation to enter the eye by viewing direct or reflected laser energy. Laser radiation may be reflected from various surfaces; care should be taken to avoid inadvertent reflection of laser energy while working with the laser. Wear appropriate protective eye-wear when working in an area with an exposed laser beam. Never look directly into the laser output aperture or at reflections of the beam from other surfaces.
	**DANGER Serious Personal Injury**	This product is not intended for use in explosive, or potentially explosive, atmospheres.
	**WARNING Serious Personal Injury**	U.S. customers should refer to and follow the laser safety precautions described in the American National Standards Institute (ANSI) Z136.1-2014 document, Safe Use of Lasers. Procedures listed in this Standard include the appointment of a Laser Safety Officer (LSO), operation of the product in an area of limited access by trained personnel, servicing of equipment only by trained and authorized personnel, and posting of signs warning of the potential hazards. European customers should appoint a Laser Safety Officer (LSO) who should refer to and follow the laser safety precautions described in EN 60825-1,2014 – Safety of Laser Products
	**WARNING Serious Personal Injury**	Materials processing with a laser can generate air contaminants such as vapors, fumes, and/or particles that may be noxious, toxic, or even fatal. Material Safety Data Sheets (MSDS) for materials being processed should be thoroughly evaluated and the adequacy of provisions for fume extraction, filtering, and venting should be carefully considered. Review the following references for further information on exposure criteria: ANSI Z136.1-2014, Safe Use of Lasers, section 7.3. U.S. Government's Code of Federal Regulations: 29 CFR1910, Subpart Z. Threshold Limit Values (TLVs) published by the American Conference of Governmental Industrial Hygienists (ACGIH). It may be necessary to consult with local governmental agencies regarding restrictions on the venting of processing vapors.

5.0 Other Hazards

The following hazards may be considered typical for this product:

- Risk of exposure to hazardous laser energy and injury through failure to follow appropriate laser safety procedures.
- Risk of exposure to hazardous laser energy through unauthorized removal of protective covers.
- Risk of exposure to hazardous or lethal voltages through unauthorized removal of protective covers.
- Risk of injury when lifting or moving the unit.

6.0 Safe Operation of the Laser

1. Never look directly at the laser beam or one of its reflections. All alignments must be made while observing best practices for the safe use of lasers. Permanent eye damage or blindness may result if these practices are not followed.
2. Always wear appropriate protective eyewear. Refer to **Protective Eyewear on page 4** for important wavelength information. Refer to **Additional Safety Information on page 4** for additional standards information.
3. Prevent exposing any part of the body to the beam. Never block the laser beam with any part of the body.
4. Limit work area access to the required personnel only. Only use the laser in supervised areas, which are clearly marked and have supervised access.
5. Remove all objects with a reflecting or shiny surface from the laser work area.
6. Ensure there are no flammable materials in the laser work area.
7. Do not wear reflective jewelry while using the laser, as it may cause hazardous reflections.
8. Maintain a high level of ambient lighting in the laser operation area so the eye pupil remains constricted, reducing the possibility of hazardous exposure.
9. Place warning signs at all work area accesses. The signs must be appropriate and clearly visible. It is recommended that work area accesses be interconnected to the remote interlock (INTLK.IN).
10. During normal operation, the laser area (work area) must be marked off by screens, walls or other means that ensure that laser beams outside the area are less than the AEL (class 1 type laser). These screens must **not** be covered by materials that may reflect the laser wavelength. They must not be flammable, nor may they, when exposed to the direct laser beam (even only for several seconds), allow laser radiation greater than the AEL limit to pass. A warning area limited by barriers is necessary to warn all people of the potential risk that lies within the laser area.
11. Only qualified people may operate the laser. When not in use, the laser must be completely inoperable. This may be done by removing the laser key, for example. It must be impossible for unauthorized people to operate the laser.
12. Aiming laser radiation at individuals, vehicles, aircraft or any other flying object is prohibited by federal regulations.
13. Due to the risk of electric shock, the power supply must be switched off and disconnected from the Laser Head prior to any maintenance operation. Electric shocks or burns resulting from the power supply may cause serious injury or death.
14. Operate the laser at the lowest possible beam intensity, given the requirements of the intended application.
15. Increase the beam diameter wherever possible to reduce beam intensity and thus reduce the hazard.
16. Use an IR detector or energy detector to verify that the laser beam is off before working in front of the laser.
17. Provide enclosures for the beam path whenever possible.
18. Set up an energy absorber to capture the laser beam, preventing unnecessary reflections or scattering.

7.0 Protective Eyewear

Always wear appropriate protective eyewear when operating the laser.

Choose eye protection that is suited to the operation of the laser, taking into consideration emission wavelength, power/energy, and viewing conditions. See energy density ratings, safety reference EN 207, and OSHA's online technical manual for information on selecting proper eye protection.

Viron Information for Protective Eyewear Selection

Wavelength (nm)	Maximum Energy Density (J/m^2)
1064	21000
532	13000
355	7100
266	4200

8.0 Additional Safety Information

There are several public resources for good laser safety information.

United States

- The American National Standards Institute (ANSI) Z136.1-2014 document Safe Use of Lasers prescribes procedures intended to promote safety in using lasers. The document describes practices such as the appointment of a Laser Safety Officer (LSO), operation of the equipment only by trained personnel and in an area of limited access, equipment servicing only by trained and authorized personnel, and appropriate use of warning signs to increase awareness of potential hazards.
- The Occupational Safety and Health Administration (OSHA) provides an online Technical Manual (located at www.osha.gov/dts/osta/otm/otm_iii/otm_iii_6.html). Specifically, Section III, Chapter 6 and Appendix III contain specific laser safety information.
- The Laser Institute of America (LIA) has a comprehensive web site (located at www.laserinstitute.org).

Europe

- Norm EN 60825-1 - Safety of laser products, Part 1: Equipment classification, requirements and user guide
- Norm EN 207 - Personal eye protection - Filters and eye protectors against laser radiation
- Norm EN 208 - Personal eye protection - Eye protector for adjustment work on lasers and lasers systems

9.0 Disposal

This product contains material that is considered hazardous industrial waste. If for any reason a laser is rendered unusable and is not repairable, Quantel recommends that disposal of the system follow all appropriate guidelines for such hazardous waste to prevent environmental degradation. This product, must be disposed of separately from domestic household waste.

LABELS

1.0 Safety Labels

The following figures show the safety and origination labels, and their locations on the Viron laser system. These labels are installed at the factory and should not be removed by the user. If for some reason a label is removed, obscured or damaged in any way, please contact Quantel for a replacement.

Laser Head Labels

Figure 1 shows the Laser Head safety labels and the system origination label with the product serial number and information.

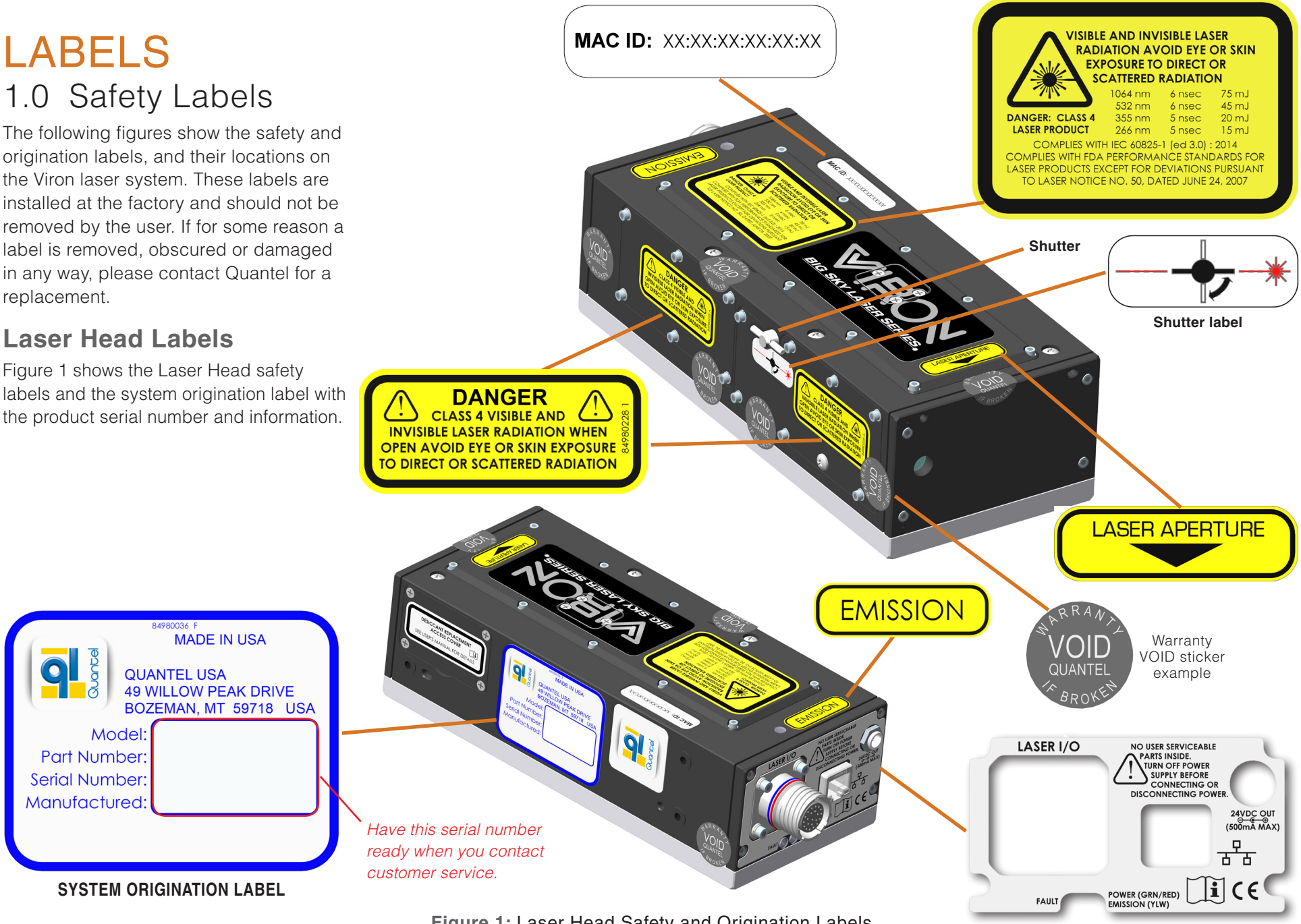


Figure 1: Laser Head Safety and Origination Labels

Interface Box Labels

The Interface Box labels are shown in Figure 2. The system origination label is located on the bottom of the Interface Box. This label lists the product serial number and information. OEM systems may not have an Interface Box. See **OEM Systems on page 34**.

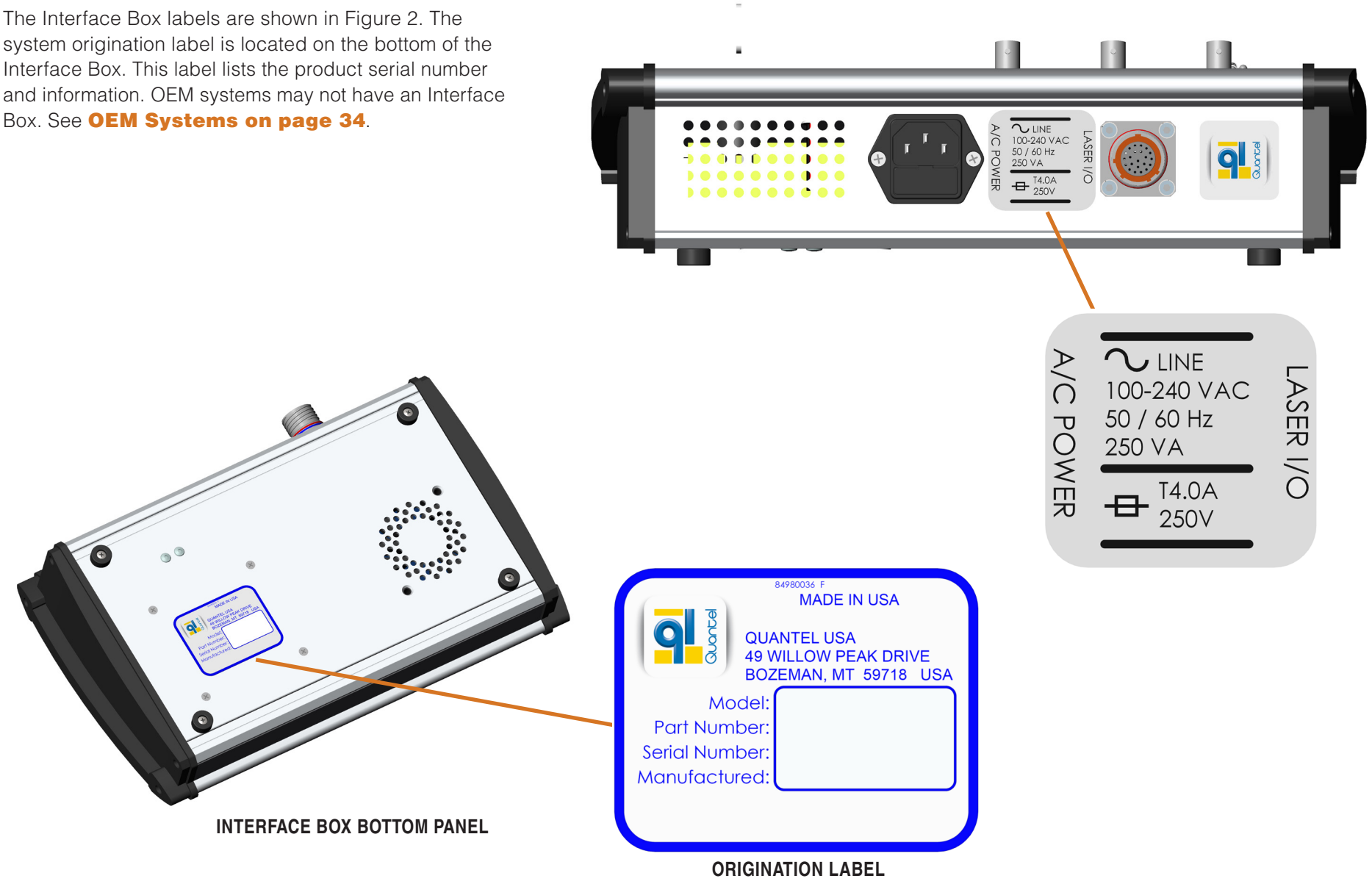


Figure 2: Interface Box Safety and Origination Labels

SETUP

Intended Use: This product is intended for use as a stand-alone laser source or as an integrated laser system for scientific and industrial applications. If you have questions regarding installation of this product for your application, contact the Quantel Sales Department.

CAUTION: Do not position the equipment so that it is difficult to operate safety features or to disconnect the device.

1.0 Cooling

The Viron laser system is cooled by heat dissipated through the bottom baseplate. Cooling may be accomplished in the follow ways:

- mount the Laser Head to a Quantel air cooling unit.
- mount the Laser Head to a user-supplied heat sink.

  It is important that the heat sink surface be flat to within .001" [.0254 mm], to prevent distortion. The minimum mounting surface thickness must be 0.25" [6 mm].

  The user-supplied heat sink must be capable of dissipating heat at the interface plate when operating at full laser power (less heat dissipation may be acceptable when operating at reduced power) as follows:

  20 Hz version: 25 watts of heat without exceeding 40° C.

CAUTION: Do not add additional cooling without first consulting Quantel's Service Department. Doing so may interfere with temperature control and compromise laser performance.

2.0 Laser Head Cooling Attachment

Mounting to the Air Cooling Unit

Secure the Laser Head to the cooling unit using M3 x 10 mm socket head cap screws.

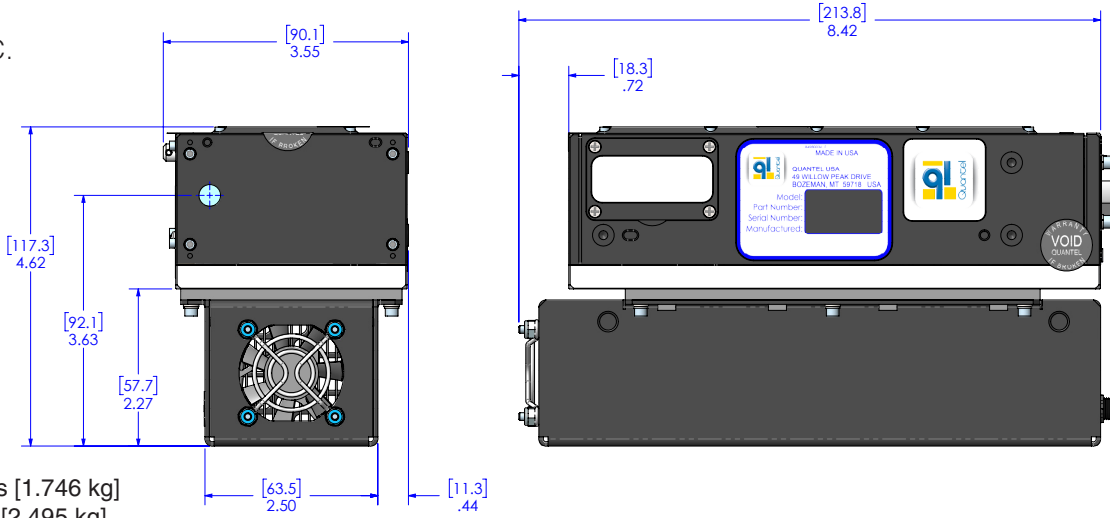
Three (3) M4 screws located on the side of Laser Head may be used to mount the system with the cooling unit installed. A precision 3 mm hole and slot are available for side mounting alignment.

CAUTION: Do not block the cooling fan.

Mounting to a Heat Sink

Mounting the Heat Sink from the Bottom: Use eight M3 screws with an engagement length between .200" to .240" to mount the heat sink to the bottom of the Laser Head. A precision 4 mm and/or 1/8" hole and slot are provided to use for alignment purposes.

Optional Mounting Features: See the drawings for the **Laser Head on page 40** and **Laser Head Side Mounting Locations on page 41** for additional information.



Weight

Laser Head	3.85 lbs [1.746 kg]
Laser Head with Air Cooling Unit	5.5 lbs [2.495 kg]

Figure 3: Mounting the Laser Head to the Air Cooling Unit

3.0 Connecting the System

CAUTION: Do not power up the laser system before thoroughly reading all installation and operation instructions.

1. Verify that the Key Switch is turned OFF.

CAUTION: Never connect or disconnect the I/O cable from the Interface Box or Laser Head with the system power ON.

2. Connect the I/O cable to the Interface Box. Connect the other end of the I/O cable to the Laser Head. All connectors are unique and keyed to ensure proper connection.

   Note: OEM systems may not have an Interface Box. See **OEM Systems on page 34** for details.

CAUTION: Ensure connections are fully seated or interlock faults may result. The connectors are fully seated when the red band is no longer visible.

3. Connect the Interface Box AC Mains power cord to 100-240 VAC, 50/60 Hz power.

CAUTION: Ensure the system is connected to the proper voltage. Operating the system at the incorrect voltage may damage the system. Ensure that the power outlet used is properly grounded. Do not replace the detachable AC Mains power cord with a cord that is inadequately rated.

4. Establish communication with the laser via a remote control option. See **Ethernet Control Interface on page 17**.

5. Remove the protective cover from the Laser Head aperture before operating.

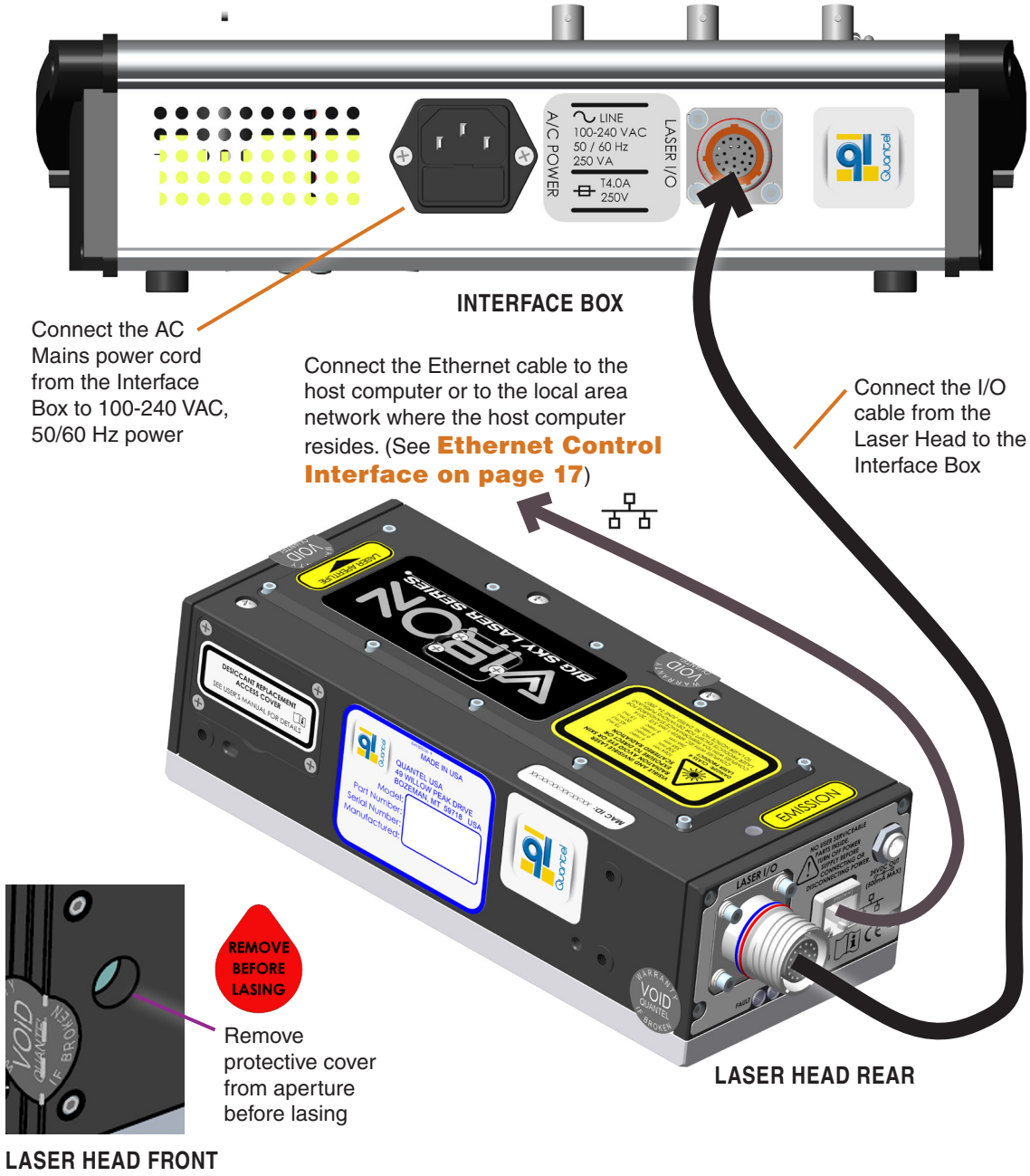


Figure 4: Connecting a Standard Viron System

FUNCTIONS

This laser system is sold either as a customer ready product that includes the Interface Box *or* as an OEM product without an Interface Box. For details of the OEM product, see **OEM Connection Pin Out on page 35**. See **Operation starting on page 13** for detailed descriptions of laser modes and use.

1.0 Interface Box Functions

Key Switch

ON: Rotate the key to the ON ("I") position to power on the system. The key is not removable when in the ON position.

OFF: Rotate the key to the OFF ("O") position to power off the system. Remove the key to keep unauthorized personnel from operating the laser.

Power ON Indicator

This indicator illuminates when the Key Switch is ON and the unit is connected to 100–240 VAC, 50/60 Hz AC Mains power.

Emission Indicator

This indicator illuminates as a warning that laser output is possible.

- Continuous illumination indicates Standby mode
- Flashing illumination indicates Fire mode

The indicator light is amber colored to ensure visibility through laser safety goggles. You must observe laser safety precautions when the Emission Warning indicator is ON.

CAUTION: Observe laser safety precautions at all times, using extra caution when the Emission indicator is ON.

2.0 The Beeper

The Viron Laser Head emits an audible warning to indicate a change of state.

A **single short beep** is emitted at power up.

A **single short beep** is sounded at an operational mode change (Stop to Standby, Standby to Stop, or entering Fire mode with the Q-Switch disabled).

A **double beep** is emitted if the change of state may result in lasing. If the Q-Switch is enabled prior to FIRE, a double beep sounds when changing to FIRE. If already in Fire mode and the Q-Switch is enabled, a double beep sounds. If Single Shot operation is selected, a double beep sounds every time the Q-Switch is enabled (the QSON 1 or QSON 2 command is sent).

A **two-tone beep** indicates a fault, in addition to the LED fault indicators. The two-tone beep may occur during the STANDBY command when the system is operating normally as the diode temperature may not be within parameter requirements resulting in an A3 fault condition. See **Fault Byte 1 on page 31**.

A **ring sound** sent from the host using the RING command is useful to identify a laser system.

A **chirp sound** indicates successful login or logout of a session.

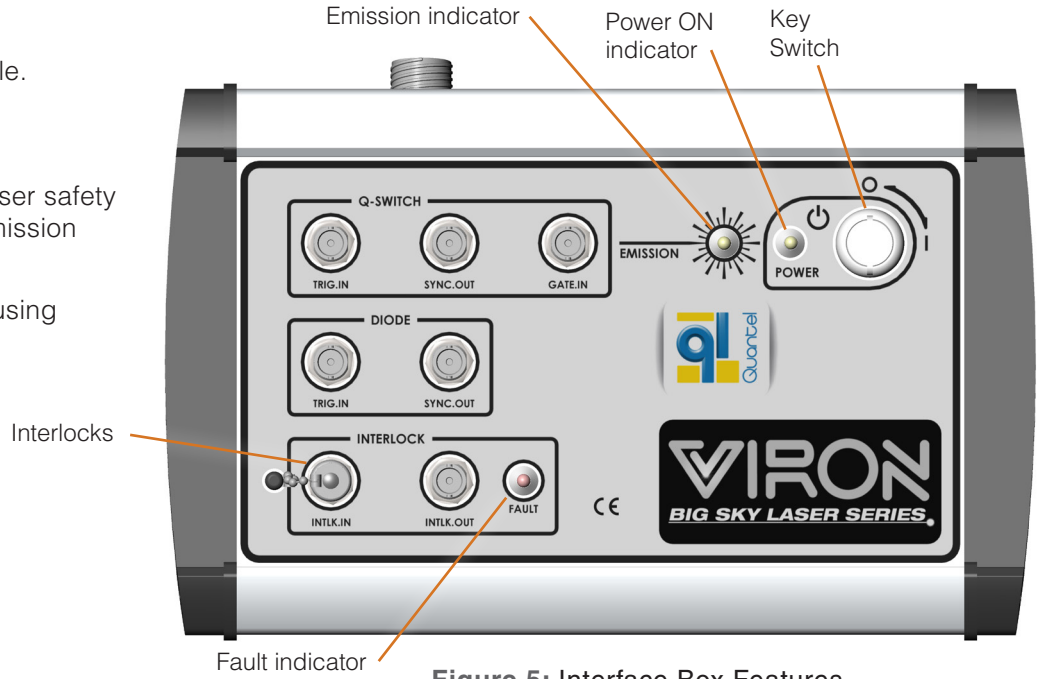


Figure 5: Interface Box Features

3.0 Interlocks

Note: Multiple safety switches must be in a series connection.

CAUTION: Test interlock function on a regular basis to verify that your safety interlock devices are operating properly.

Interlock IN (INTLK.IN): Use this BNC to connect an external safety shutdown switch. For the laser to operate, this connector must be shorted. When this circuit is open, the system enters Stop mode and remains in Stop mode until the interlock circuit is closed and the system is returned to Standby or Fire mode by the user. If you have trouble restarting after an interlock event, see **Troubleshooting starting on page 45**. Install the attached BNC shorting cap on this connector if this function is unnecessary.

Interlock OUT (INTLK.OUT): Use this BNC output to connect an external laser-warning indicator. This is an active output with ±50 mA source/sink capability. The signal is low (0 V) when the laser is operational and high (+5 V) when a fault condition exists and the laser is not operational.

NOTE: The Fault indicator and the INTLK.OUT signal are directly tied together. The indicator mirrors the INTLK.OUT signal.

Fault indicator: The fault indicator operates as follows:

- illuminates solidly when an fault condition exists.
- blinks at a 2 Hz rate, at 50% duty cycle when a warning condition exists. This mirrors the INTLK.OUT signal. Example: The indicator blinks at 2 Hz when INTLK.OUT is alternating from 0 to 5 V at 2 Hz, 50% duty cycle due to a warning condition.
- off when operating normally (no warnings or faults present)

See **Troubleshooting starting on page 45** for details on resolving fault and warning conditions.

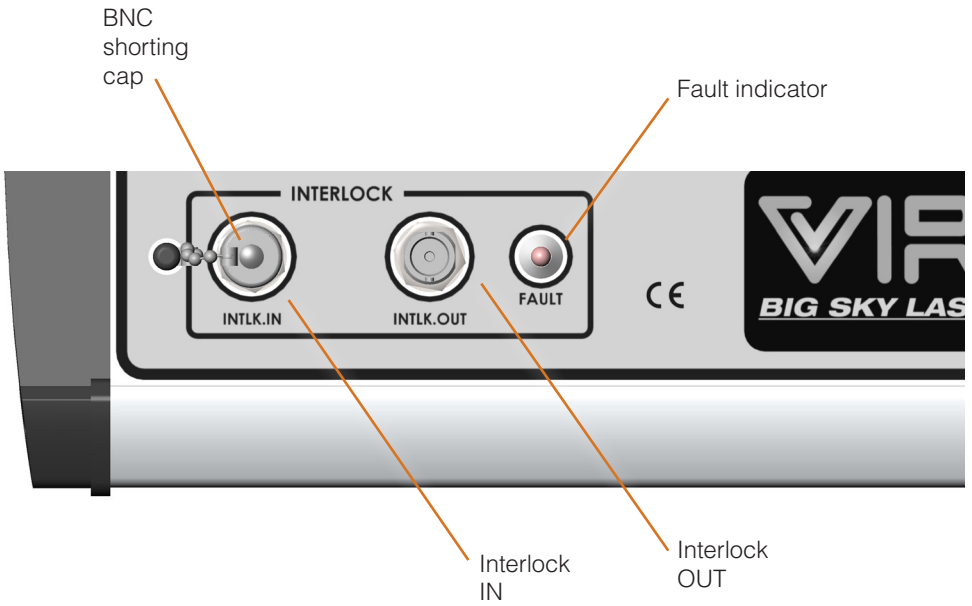


Figure 6: Interface Box Interlock Features

4.0 Interface Box BNC Connectors

The signal requirements that must be met for the Interface Box BNC connections to function are specified in the following places:

- **External Trigger Signal Requirements on page 38**
- **Timing Diagrams on page 38**

Q-Switch Connectors

Q-Switch Trigger IN (TRIG.IN)

When in external Q-Switch trigger mode, a signal applied to this BNC connector causes the Q-Switch to trigger while the system is in Fire mode (unless the GATE.IN control is shorted).

Q-Switch Sync OUT (SYNC.OUT)

This BNC connector outputs a signal synchronous with the Q-Switch trigger for internal Q-Switch trigger mode. You can use this output signal to synchronize external equipment with the Q-Switch trigger. See **QSPRE on page 26**.

Q-Switch Gate (GATE.IN)

This input BNC connector enables or disables the Q-Switch trigger. When the circuit to this BNC connector is open, the Q-Switch trigger is enabled. When the circuit to this BNC is shorted, the Q-Switch trigger is disabled.

Diode Connectors

Diode Trigger IN (TRIG.IN)

When in external Diode trigger mode, a signal applied to this BNC connector causes the laser diodes to trigger while the system is in Fire mode.

Diode Sync OUT (SYNC.OUT)

This BNC connector outputs a signal synchronous with the Diode trigger. You can use this output signal to synchronize external equipment to the diode trigger. See Timing Diagrams for the signal delay and other characteristics.

Note: See **Operating Modes starting on page 15** for details of the Stop, Standby, and Fire modes.

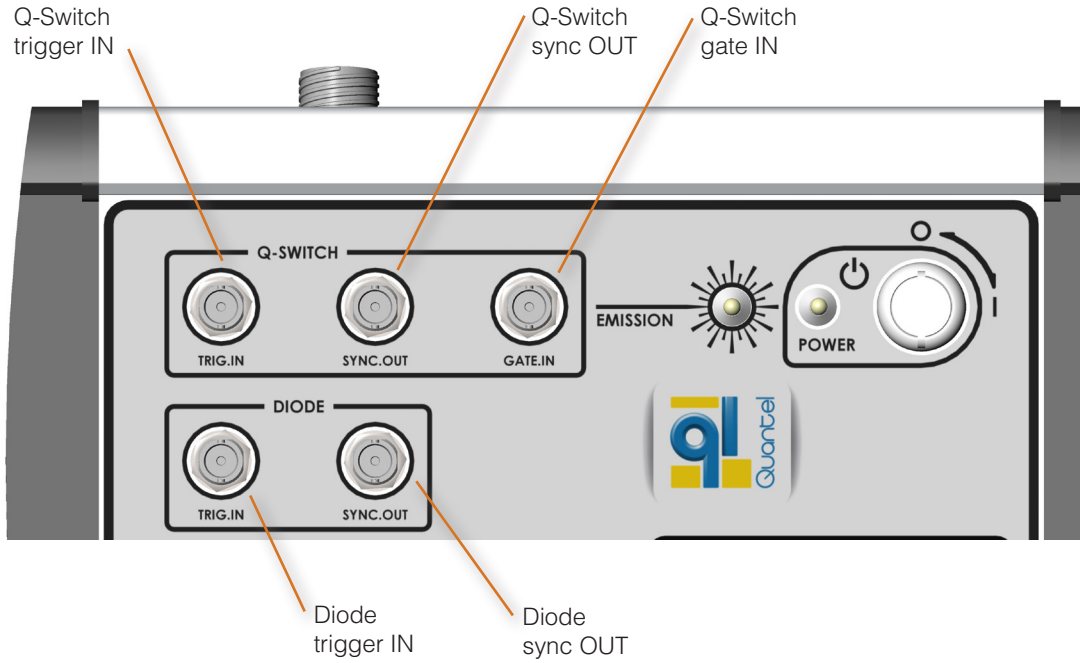


Figure 7: Interface Box Top View

5.0 Laser Head Functions

POWER/EMISSION Indicator

This multipurpose indicator on the rear of the Laser Head, illuminates in the following ways:

GREEN: Indicates that power is applied to the system. Power is applied when the system is connected to AC Mains power and the Key Switch is ON.

RED: Indicates that the input power voltage polarity to the Laser Head is reversed. This will not damage the laser, simply correct the problem before continuing.

AMBER: The indicator illuminates amber (YLW) to warn that laser emission is possible. This indictor is synchronous with the Emission indicator located on the top of the Laser Head.

CAUTION: Observe laser safety precautions at all times, using extra caution when the indicator is amber.

Note: If the Interface Box is not used see **OEM Connection Pin Out starting on page 35** for details on power connection.

FAULT Indicator (red)

FLASHING: shows a WARNING state

SOLID: shows a FAULT state

OFF: normal operation

EMISSION Indicator (amber)

This indicator located on top of the Laser Head, illuminates as a warning that laser output is possible. The indicator emits amber light to ensure visibility through laser safety goggles.

SOLID: Standby mode

FLASHING: Fire mode

OFF: Stop mode

CAUTION: Observe laser safety precautions at all times, using extra caution when the Emission indicator is ON. If the shutter is open, take precautions at all times as though the laser is capable of lasing, regardless of any other status. See **Manual Shutter on page 14** for details of shutter operation.

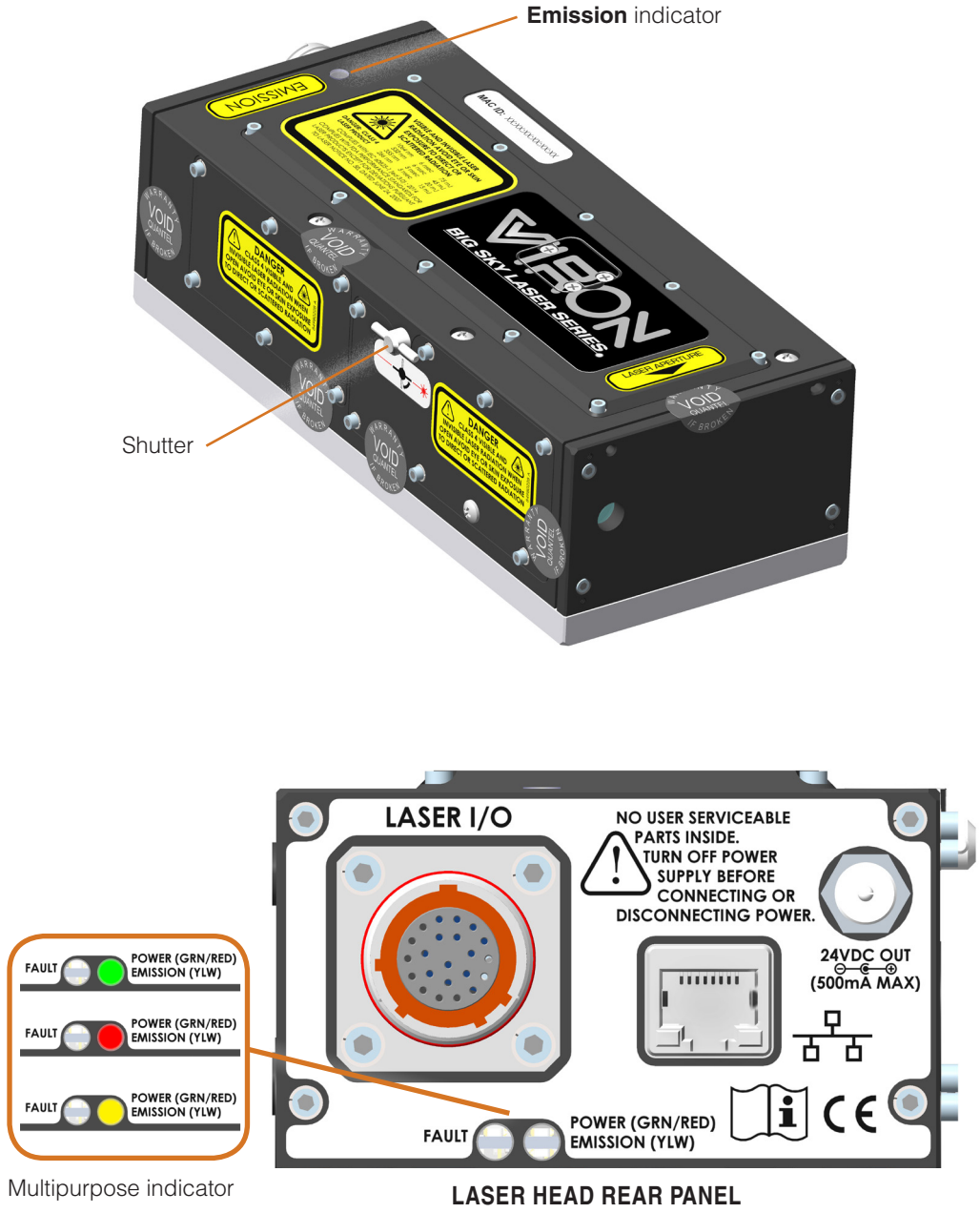


Figure 8: Indicator Locations, Laser Head

OPERATION

1.0 Safety

CAUTION: Observe all safety procedures described throughout this manual. See **Laser Safety starting on page 1**.

CAUTION: Wear eye protection. Observe all safety precautions as though the system is capable of lasing at anytime.

2.0 Precautions

Follow these guidelines to avoid laser damage.

- Store the laser in a dust-free environment. Keep the Laser Head covered when not in use. This protects the output window from dust and particulate.
- The Laser Head is sealed using low-outgassing materials. Silicone and similar sealing, bonding or insulating materials should not be used in close proximity to the Laser Head since these substances will outgas and could contaminate the output window, causing laser damage.
- Avoid back reflections. Back reflections of even a small percentage of the output energy can damage optical components in the Laser Head.

  Example: An uncoated convex lens or a glass disk calorimeter reflects about 4% of the incident energy. While the reflection may seem harmless, it can perturb the resonator operation and degrade the near-field beam intensity profile and damage laser optics. It may also affect the resonator holdoff, causing pre-lasing and catastrophic optical damage. In some cases, even anti-reflection coated glass reflects enough energy to damage laser optics. It is best to use only quality optics coated for the operating wavelength.

CAUTION: To avoid laser damage, minimize reflections back toward the laser aperture. When reflections are unavoidable, direct them away from the axis of the beam aperture by canting the axis of the reflecting optic. Failure to do so can cause laser damage and void the warranty.

3.0 Remote Interlock (INTLK.IN)

The remote interlock connection provides an interface for an external safety shutdown switch. The remote interlock can be connected to a lab door or other switches you install for safety purposes. When using the remote interlock, only an isolated switch, such as a relay, should be used in order to avoid ground loops. If multiple external safety switches are used, it is important that they are connected in series.

The remote interlock connection must be closed in order to operate the laser. If an open circuit occurs, the system is disabled and the Interlock indicator illuminates.

Note: If the remote interlock function will not be used, then the BNC shorting cap must be installed on the Interface Box INTLK.IN connector.

OEM systems do not have an Interface Box. If no interlock will be used on an OEM system, then pins 13 and 14 of the circular I/O connector must be shorted together to complete the circuit. See **OEM Systems starting on page 34**.

4.0 Emission Indicator

The Emissions indicator illuminates as a warning that laser output is possible.

- Continuous illumination indicates Standby mode.
- Flashing illumination indicates Fire mode.

The indicator light is amber colored to ensure visibility through laser safety goggles. You must observe laser safety precautions at all times, using extra caution when the Emission indicator is ON.

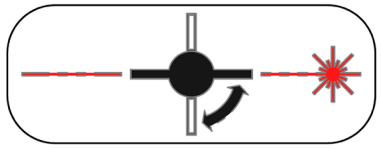
CAUTION: Observe laser safety precautions all of the time, using extra caution when the Emission indicator is ON.

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

5.0 Manual Shutter

WARNING: Whenever the shutter is open, take precautions at all times as though the laser is capable of lasing, regardless of any other status.

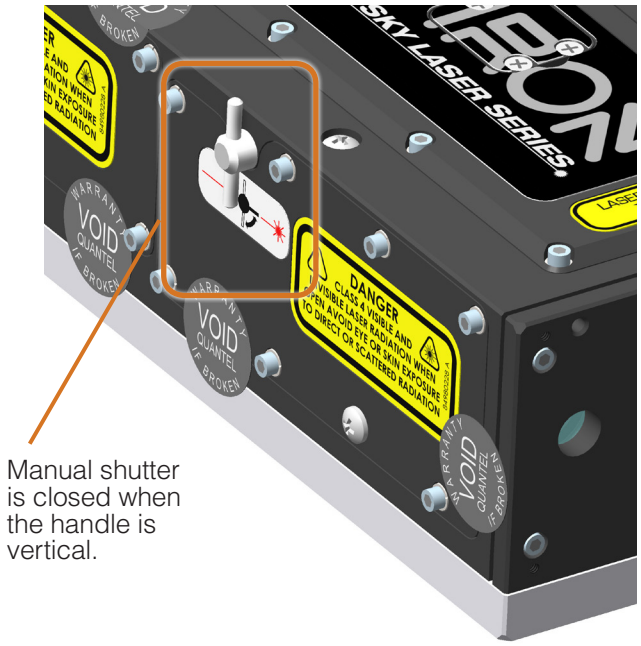
The manual shutter, located on the side of the Laser Head, allows or prevents lasing. Lasing action cannot take place with this shutter closed.



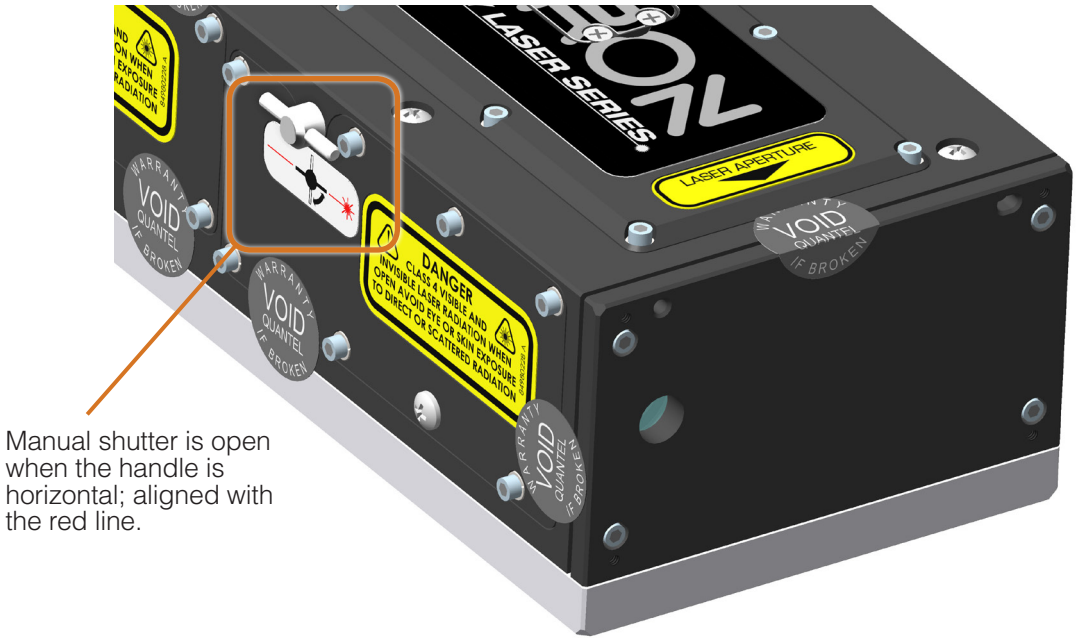
SHUTTER LABEL

Shutter Positions

Open	Turn the manual shutter handle to be horizontal and aligned with the red line on the label.
Closed	Turn the manual shutter handle to the vertical position.



SHUTTER CLOSED – LASER EMISSION PREVENTED



SHUTTER OPEN – LASER EMISSION POSSIBLE

Figure 9 Manual Shutter Operation

6.0 Operating Modes

The laser has the following operational modes:

- Stop
- Standby
- Fire

Stop: The laser system starts in this state when powered ON. Communications with the host computer are enabled.

Standby: This conditioning state prepares the laser for operation. In this mode, the laser diodes and any non-linear crystals are thermally regulated. The laser system is not ready for operation until specified conditions are met. When these conditions are met, the Fire mode becomes available.

Fire: In this mode, the diodes are firing and lasing begins when the Q-Switch driver is enabled. If the Q-Switch driver is enabled beforehand, lasing begins upon entering Fire mode. If any parameters (temperature for example) fall outside the acceptable range, the not-ready condition forces the laser to return to Stop mode to avoid possible damage to the system.

If there is no risk to the laser, but some parameter is not within optimal range, a warning condition exists but the laser remains in Fire mode. Warning conditions can be queried using the **Status Word, see page 30** or the **TEXTS, see page 28**.

WARNING: Always observe all laser safety precautions.

7.0 Example Start-Up Procedure

WARNING: Always follow all safety precautions.
The following steps result in laser light emission from the output aperture of the Laser Head. During laser operation, everyone present in the laser room must be wearing eyewear that protects against the specific range of output wavelengths.

Note: Verify that you completed all setup and network connectivity steps and have removed the protective cover from the laser aperture.

To start the laser system, follow this procedure:

1. Turn the Key Switch to ON (“I”).
2. Start the program you will use for communication with the laser system. See **Using a Telnet Session starting on page 20** for details.
3. Use the STATUS command to query the current laser configuration. See **Status Word starting on page 30** for details.
4. Send commands to change the configuration, as needed. See **Operational Commands starting on page 24** for details.
5. Send the STANDBY command to enter Standby mode.
6. When ready, send the necessary commands to begin lasing. The FIRE command begins laser emission. QSON must be set to 1 for lasing to occur. See **Operational Commands starting on page 24** for command details.

WARNING: Always observe all laser safety precautions.

8.0 Shutdown Procedure

To shut down the laser system, follow this procedure:

1. Use the Ethernet interface to send the STOP command to change to Stop mode.
2. Turn the Key Switch to OFF (“O”).

Note: The current laser configuration is stored if the system is set to Stop mode before being powered off. The next time the laser is started it will begin with the stored configuration.

SOFTWARE

1.0 Ethernet Control Interface

The Viron may be controlled by your remote computer connected via the Laser Head rear panel Ethernet port. The connection uses the following:

- Static IP addressing **or** dynamic IP addressing (DHCP). The system ships with static IP addressing set as the default, see **Factory Settings on page 18**. For use of dynamic IP addressing, see **Setting Viron for a Dynamic Address (DHCP) on page 21**.
- Standard RJ45 10Base-T or 100Base-T connector with auto-negotiation supported.
- Telnet Com port control (RFC 2217) command line protocol.
- Telnet session setup using the IP address of the laser system and a device used for communication.

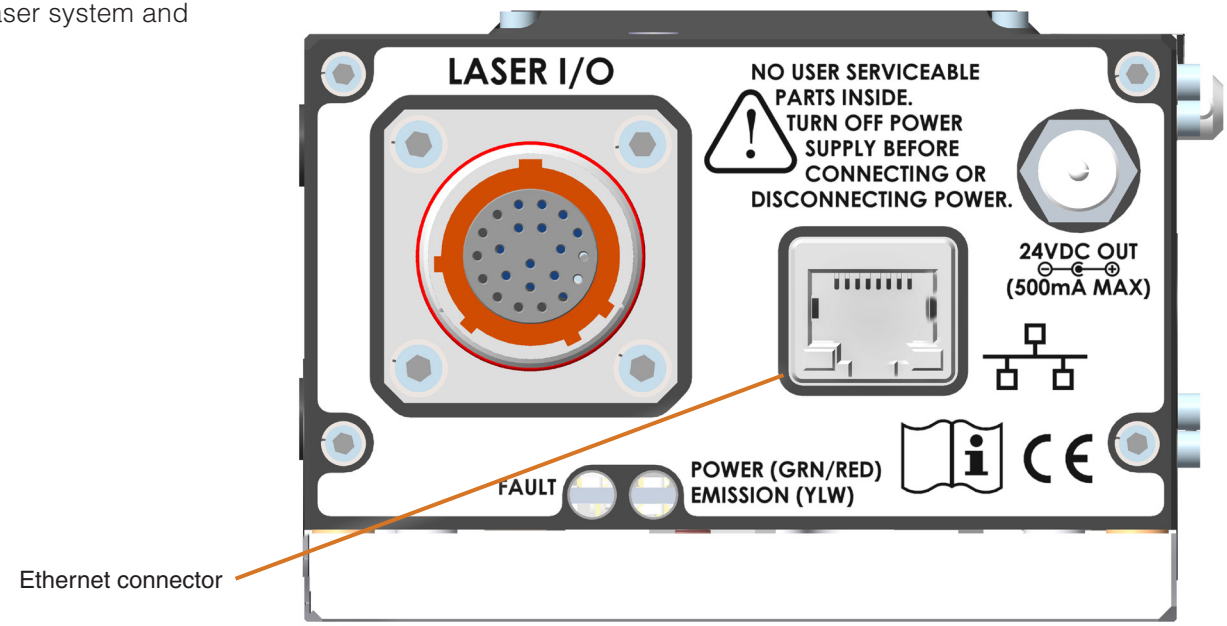


Figure 10: Ethernet Connector on Laser Head Rear Panel

2.0 Communication using Ethernet

Factory Settings

The system is shipped with the following settings:

- Static IP: 192.168.103.103 ($IDHCP 0, $IPADDR 192.168.103.103)
- Netmask: 255.255.248.0 ($NETMASK 255.255.248.0)
- IP Port Number: 23 ($IPORT 23)

Configuration of your host computer may be necessary in order to communicate with the laser for the first time. Refer to the **Viron Quick Start Guide** that shipped with your laser system for information on establishing the initial communication with the laser.

Note: The use of a crossover cable may be necessary for direct computer (non-networked) connections.

To reset to a factory IP setting, refer to **Defaulting to a Static or Dynamic IP Address on page 22**.

Static IP vs. DHCP

The Viron system is capable of using either a static IP address or DHCP. It is set to static IP as the default. However, DHCP is generally recommended for easy management of network addresses. In some cases it may be desirable to set a static IP address, for example, if your network administrator restricts certain IP addresses. To configure the addressing you can use Telnet.

Some advantages and disadvantages of each type are listed here:

Type	Advantage	Disadvantage
Static IP	The set IP address will remain the same. This is the default setting to make it easy to start communication with the laser.	When 2 devices on the network are set to the same address, conflicts result from the lack of a unique identifier.
DHCP	The host tracks the used/ available addresses assigned to the laser and other devices to eliminate conflicts.	The IP address of the laser or other device may change each time it goes offline.

Figure 11: Quick Start Guide

Detecting the Viron IP Address

For the next steps, the system should already be setup for network use with either a static, non-conflicting, IP address or with DHCP enabled. To discover the IP address, use the following steps:

1. Connect the Viron to your computer or network using the Ethernet connection on the Laser Head rear panel (see Figure 10).
2. Run the QuantelScan application provided on the USB memory device that shipped with your system. You can also find QuantelScan on the Quantel website Viron page.
3. Verify that the MAC ID listed in QuantelScan matches the label on the top of the Laser Head with which you are attempting to communicate (see Figure 13).
4. Once the IP address is detected continue to **Using a Telnet Session on page 20**.

Note: If the Viron system is not found, refer to **Ethernet Communications Troubleshooting on page 47**.

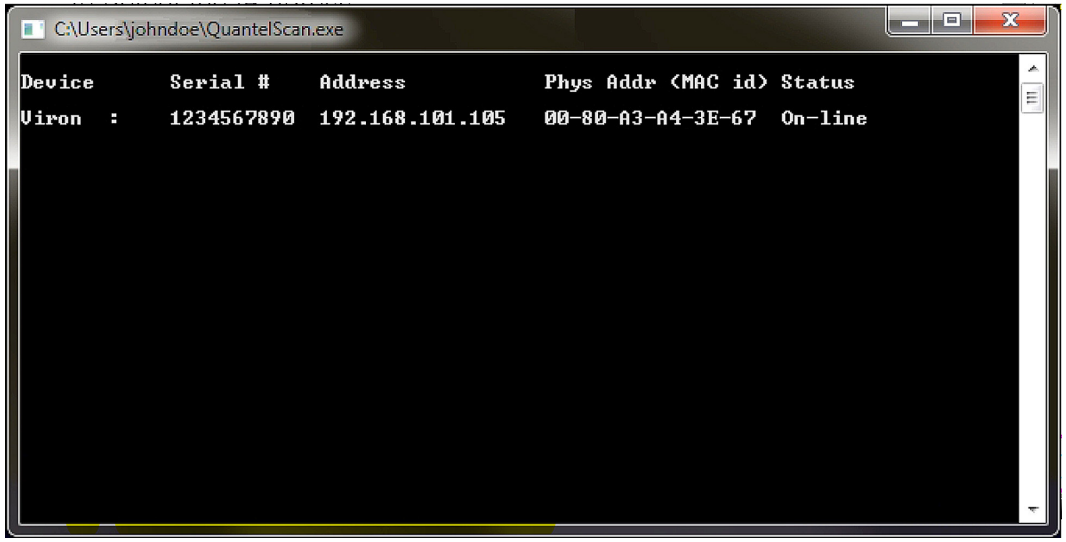


Figure 12: QuantelScan Application

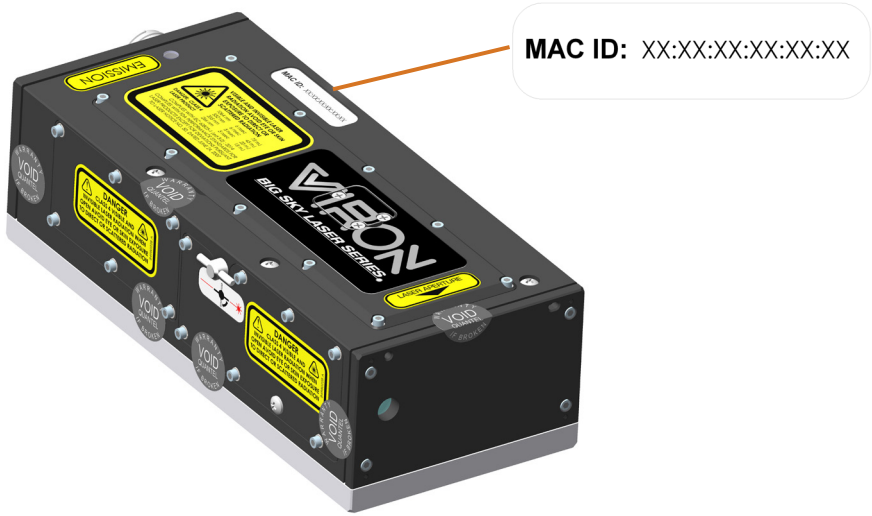


Figure 13: MAC ID Label

Using a Telnet Session

A Telnet session can be used to configure or run the Viron. These examples show Telnet using PuTTY software. You can download it from *putty.org*.

The following connection information is required:

- TCP/IP connection is set using port 23.
- IP address of the Viron (refer to **Detecting the Viron IP Address on page 19**).

Figure 14 shows an example of a Telnet session using PuTTY.

In the **Session** category,

Enter the laser IP address, for example: **192.168.101.247**

Enter the port: **23**

Select the Connection type: **Telnet**

In the **Terminal** category, select the following options for ease of use:

- Implicit CR in every LF
- Implicit LF in every CR
- Local echo Force on

Other options are available for window size, font size, background color, etc.

With all of the desired changes made, pick the **Save** button from the Session category. You may save to the default settings or create a name for storing your settings.

Once the connection is established. the network parameters may be queried or configured using the commands listed in **Network Commands on page 29**.

Once the connection is established, the laser system may be operated or configured using the commands listed in **Operational Commands on page 24**.

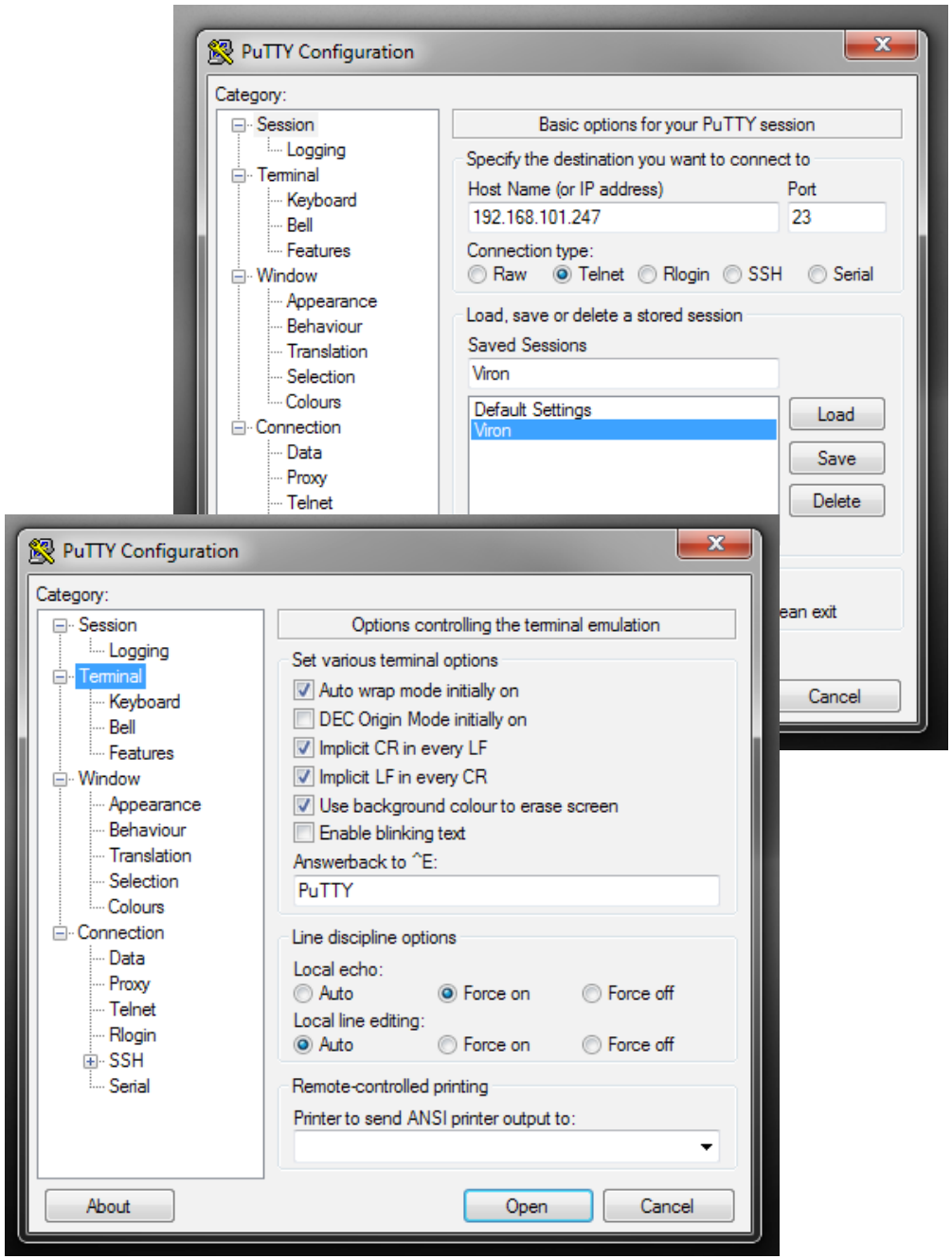


Figure 14: PuTTY Configuration

Setting Viron for a Static IP Address

To use static IP addressing, you may use a Telnet session with the laser system as described in **Using a Telnet Session on page 20**. Once this is established, you can send commands to system. See **Command Structure on page 23** and **Network Commands on page 29** for details.

To set the Viron to operate with a static IP address:

1. Verify the desired IP address is not in use by another device. Contact your network administrator for secure options for setting up static IP addresses on your network.
2. Send the command to disable DHCP (**`$IDHCP 0`**).
3. Set the IP address to the desired value (example: **`$IPADDR 192.168.103.161`**)
4. Send commands to set the broadcast domain, default gateway, and netmask to the desired values for your network. Contact your network administrator for appropriate settings. See **Network Commands on page 29**.
5. Send the **`$NETSAVE`** command to store the new values.
6. Wait until you hear the 3 beep sequence indicating that the $NETSAVE command is complete.
7. After the command has completed, cycle the Viron system power by turning the Key Switch off for 5 seconds and then turning it on again.

Note: After changing the static IP address, you will need to reconfigure your Telnet session to use the new IP address.

Setting Viron for a Dynamic Address (DHCP)

The laser ships with a static IP address set as the default. Once communication is established, you may use a Telnet session to send commands to the laser. For establishing the initial communicaitons, see the **Quick Start Guide** that shipped with the system and **Using a Telnet Session on page 20**.

To set the Viron to operate with a dynamic IP address:

1. Establish communication with the laser from the host computer.
2. Send the command to enable DHCP (**`$IDHCP 1`**).
3. Send the **`$NETSAVE`** command to store the new values.
4. Wait until you hear the 3 beep sequence indicating that the $NETSAVE command is complete.
5. After the command has completed, cycle the Viron system power by turning the Key Switch off for 5 seconds and then turning it on again.
6. Locate the Viron on your network as described in **Detecting the Viron IP Address on page 19**.

Note: After changing the IP addressing, you will need to reconfigure your Telnet session to use the new IP address.

Note: See **Command Structure on page 23** and **Network Commands on page 29** for additional networking options.

Defaulting to a Static or Dynamic IP Address

Sometimes it may be necessary to set or reset the laser to a known configuration when a connection cannot otherwise be established. The next steps describe setting the IP to either static or dynamic addressing without having prior communication with the system. This is more commonly used in troubleshooting and not for typical network operation. This process involves several of the BNC connectors on the Interface Box. See **Interface Box Functions on page 9** for BNC connector details.

Note: For OEM applications only, during a power cycle of the system short-circuit the corresponding signals of the I/O cable connection in the steps that follow (select either the static IP or the dynamic IP method depending on your situation.). See **OEM Connection Pin Out on page 35** for I/O cable pin descriptions.

Defaulting to a Static IP Address

1. Turn OFF the system power.
2. Disconnect the Ethernet cable from the Laser Head.
3. Connect INTLK.OUT to GATE.IN using a standard BNC coaxial cable.
4. Turn ON the system power and wait for the 3 beep sequence from the Laser Head indicating configuration is complete.
5. Turn OFF the system power.
6. Remove the BNC cable.
7. Connect the Ethernet cable.
8. The system is now set into a Factory Network Configuration as described in **Factory Settings on page 18**.

Defaulting to a Dynamic IP Address

1. Turn OFF the system power.
2. Disconnect the Ethernet cable from the Laser Head.
3. Connect INTLK:OUT to diode INTLK.IN using a standard BNC coaxial cable (temporarily removing the shorting BNC or remote interlock cable).
4. Turn ON the system power and wait for the 3 beep sequence from the Laser Head indicating configuration is complete.
5. Turn OFF the system power.
6. Remove the BNC cable.
7. Replace the shorting BNC or remote interlock cable on the INTLK. IN BNC.
8. Connect the Ethernet cable.
9. Turn ON system power.
10. Follow the procedures to identify the new IP address assigned to the Viron by the local DHCP server. See **Detecting the Viron IP Address on page 19**.

3.0 Command Structure

Command Format

Commands are not case sensitive.

The command format is: **$***name data***<CR>**

$	is the attention command indicating a command follows.
name	is the command name, referred to as Command in the following tables. No spaces are allowed between the $ and the command name.
data	is the value associated with name, referred to as Valid Input in the following tables. Each command dictates the type of data acceptable (string, integer, floating point). There must be a space between the ***name*** and ***data*** portions of the command. Certain commands do not require data. Commands that do not follow this format are identified in the command description.
<CR>	(carriage return) indicates the end of the command packet (command terminator). It is often the "Enter" key.

Commands are not processed until the command terminator is received.

In general, only one command can be processed per message.

Command Errors

If an error is made and identified prior to sending the command terminator, resending **$** will reset the input buffer and allow a new command to be sent.

Backspace from the keyboard is a valid method to correct an error while entering a command.

Command Echo

$ECHO 1 turns echoing on. With echoing on, the laser system will echo back all characters it receives. The <CR> is echoed followed by LF (Line Feed).

$ECHO 0 turns echoing off. With echo off, no characters are echoed.

Command Acknowledgement

Regardless of the echo status, the laser system responds to any complete command it receives using one of the following acknowledgements:

$*name data*	the command was recognized, determined to be valid, and carried out successfully.
$*name* **Bad Command**	the command itself was not recognized.
$*name* **Bad Value**	the command was recognized, but data was not valid.
$*name* **Out of Range**	the data format is valid, but the data is not in a valid range.
$*name* **Requires Login**	the command is not valid until the login is accepted.
$*name* **Not During FIRE**	the command is not accepted while in Fire mode.

A non-identified command or not-valid value results in the laser system ignoring the command.

Querying Commands

To query the current value of any valid command, replace the data value with "?". Example: **$***name* **?<CR>**.

The response displays the current value, for example: **$***name data* where *data* is the current value.

When command data values represent binary states such as on or off:

- a value of "1" represents ON or TRUE
- a value of "0" represents OFF or FALSE

Response Timeout/Command Rate

The host computer can expect an acknowledgement packet from the laser system within 50 milliseconds. An exception to this is file transfer messages. File operations, stored in flash memory, may take more than 30 seconds to complete. In general, commands should be sent at rates slower than 1 command every 50 milliseconds. Although commands provide an acknowledge response within 50 milliseconds, some commands take longer to complete, for example, the STANDBY command.

4.0 Operational Commands

Function	Operation	Command	Value/Range	Description
System Control	Fire	FIRE		Enters Fire mode, if possible. System must be in Standby mode prior to entering Fire mode. In Fire, the system is capable of lasing.
	Standby	STANDBY		Enters Standby mode, if possible. In Standby, the system prepares for operation by thermally stabilizing. You may hear a two-tone beep, indicating an A3 fault, if the diode temperature is not within the requirements. This is normal when the system is warming up and does not affect operation. See **Fault Byte 1 on page 31** for more details.
	Stop	STOP		Enter Stop mode. System temperature regulation disabled. All triggers disabled. System communication still active.
	Pairing Indication	RING		Initiates a short audible tone and fault Indicator flashes to identify successful link pairing
	Communications Echo	ECHO	0, 1, ?	Sets communications to echo the command. 0 is echo OFF. Typed characters are NOT repeated back. 1 is echo ON. Typed characters are repeated back. ? queries the parameter setting.
	Pre-Lase	UVILL	0,1, ?	If the system is exposed to rapid temperature changes and begins to pre-lase, this command activates a feature to resolve the pre-lasing condition. 1 enables the process and takes approximately 5 minutes to complete. 0 disables or aborts the process. ? queries the parameter setting.
	Factory Recall	FRECALL	01	Restores factory parameter settings.

Function	Operation	Command	Value/Range	Description
Trigger Control	Trigger Source	DTRIG	0, 1, ?	Sets the laser diode trigger source. 0 is internal. 1 is external. ? queries the parameter setting.
		QSTRIG	0, 1, ?	Sets the Q-Switch trigger source. 0 is internal. 1 is external. ? queries the parameter setting.
		TRIG	II, EI, EE, ?	Another way to set the Laser Diode and Q-Switch trigger sources. II sets Internal Laser Diode/Internal Q-Switch. EI sets External Laser Diode/Internal Q-Switch. EE sets External Laser Diode/External Q-Switch. ? queries the parameter setting.
	Trigger Control	QSON	0, 1, 2, ?	Controls Q-Switch trigger activation 0 turns the Q-Switch trigger OFF (Q-Switch disabled) 1 turns the Q-Switch trigger ON (Q-Switch enabled) 2 sets the Q-Switch trigger for single shot mode (only allows a single laser output pulse). When configured for single shot, the user must send $FIRE every time they want another single output ? queries the parameter setting

Function	Operation	Command	Value/Range	Description
Trigger Control (continued)	Trigger Frequency	DFREQ	MINPRF – MAXPRF, ?	Sets the internally generated laser diode trigger frequency, in 1 Hz increments ? queries the parameter setting
		MAXPRF	?	Queries the internal/external laser diode maximum trigger frequency limit. The trigger is inhibited if the frequency exceeds this value and a warning is generated
		MINPRF	?	Queries the internal/external laser diode minimum trigger frequency limit. If the laser is triggered below this frequency, Q-Switch trigger blanking is reinitialized if factory configured to be active.
		QSDIVBY	1 – 255, ?	Sets the Q-Switch trigger divide-by count (Q-Switch on every nth diode trigger pulse). Use this feature to change laser PRF without effecting beam quality or to operate the laser below the MINPRF setting. ? queries the parameter setting
	Blanking	QSBLANK	?	Queries the number of factory configured Q-Switch trigger blanking shots at the beginning of a Fire sequence.
	Timing	QSDELAY	0 – 400, ?	Sets the Q-Switch trigger delay (with respect to laser diode trigger) in 1 µsec increments. This parameter can be used to lower the laser output energy by increasing the timing delay. ? queries the parameter setting
		QSPRE	0 – QSDELAY, ?	Generates a Q-Switch trigger pre-sync pulse (with respect to the internal Q-Switch trigger) available on the Q-Switch Sync BNC. The rising edge of the pre-sync pulse is adjustable prior to the rising edge of the Q-Switch trigger in 1 µsec increments. Example; QSPRE of 3 will generate a pre-sync pulse 3 µsec prior to the Q-Switch trigger ? queries the parameter setting See **Timing Diagrams on page 38**

Function	Operation	Command	Value/Range	Description
Trigger Control (continued)	Burst Control	BURST	0, 1, 2, ?	Specifies a group or “burst” of laser pulses that fire based on the settings of BSTOF and BSTON 0 disables Burst mode 1 sets Burst mode to burst only Q-Switch trigger. Diode trigger runs continuously 2 sets Burst mode to burst both Diode and Q-Switch triggers ? queries the parameter setting
		BSTOF	0 – 65535, ?	Specifies the number of Diode and/or Q-Switch pulses during which the laser does NOT fire (OFF pulses), when in Burst mode 0 sets the laser to transition to Standby mode after the number of ON pulses is reached 1-65535 sets the number of OFF pulses ? queries the parameter setting
		BSTON	1– 65535, ?	Specifies the number of Diode and/or Q-Switch pulses during which the laser fires (ON pulses), when in Burst mode 0-65535 sets the number of ON pulses ? queries the parameter setting
	Trigger Termination	TERM	0, 1, ?	Sets the trigger input impedance 0 sets the trigger inputs for high impedance termination 1 sets the trigger inputs for 50Ω termination ? queries the parameter setting
	Pulse-Width	DPW	?	Queries the laser diode pulse-width (in 1 µsec)
Energy Control	Diode Current	DCURR	0.0 – MAXCURR, ?	Sets the laser diode current in amps. Use this command to change laser output energy (beam quality may change) ? queries the parameter setting
		MAXCURR	?	Queries the laser diode maximum current limit (in amps)
	Timing	QSDELAY	0 – 400, ?	Sets the Q-Switch trigger delay (with respect to laser diode trigger) in 1 µsec increments. This parameter can be used to lower the laser output energy by increasing the timing delay. ? queries the parameter setting

Function	Operation	Command	Value/Range	Description
Wavelength Control	NLO Oven	OVEN1	0, 1, ?	Controls 532 nm NLO, if installed 0 turns the oven OFF 1 turns the oven ON (2 is factory configured oven locked OFF, oven not installed) (3 is factory configured oven locked ON, if installed) ? queries the parameter setting
		OVEN2	0, 1, ?	Controls 355nm or 266nm NLO, if installed 0 turns the oven OFF 1 turns the oven ON (2 is factory configured oven locked OFF, oven not installed) (3 is factory configured oven locked ON, if installed) ? queries the parameter setting
System Status	Parameter Query	HELP	?	Lists all available commands (takes approximately 3 seconds to compile and list)
		PARA	?	Queries the current configuration parameters. Responds back with a header showing the system serial number, firmware versions and shot count; followed by each configuration parameter (preceded by $) with its current value or setting and followed by a carriage return (<CR>)
		FPARA	?	Queries the factory configuration parameters. Responds back with a header showing the system serial number, firmware versions and shot count; followed by each configuration parameter (preceded by $) with its factory value or setting and followed by a carriage return (<CR>)
	Current Status	STATUS	?	Lists the current operational state, warning and fault bytes in HEX format. Refer to Status Word Definition on page 27
		TEXTS	?	Lists all faults and warnings that have a state of 1 (indicating a problem). If no faults or warnings exist, then the response is OK
		LOG	?	Queries the last 255 Status events with the oldest entries listed first
		HOURS	?	Queries the system total time-on. hour:minute format
		RHOURS	?	Queries the run-time counter (for Standby and Fire duration) in hour:minute format
		CAPV	?	Queries the internal capacitor bank voltage

Function	Operation	Command	Value/Range	Description
System Status (continued)	Shot Counter	SHOT	?	Queries the system laser diode shot count. This shot counter is not resettable.
		USHOT	0, ?	Resets the user laser diode shot counter to zero. ? queries the shot counter.
	Temperature	LTEMF	?	Queries the laser internal temperature in degrees C.
		DTEMF	?	Queries the laser diode temperature in degrees C. Reports “OFF” when diode temperature control is disabled.
	Configuration	LTVERS	?	Queries the laser temperature controller firmware version.
		LCVERS	?	Queries the laser controller firmware version.
		MODEL	?	Queries the laser system model number.
		SERIAL	?	Queries the system serial number.

5.0 Network Commands

Command	Value Range	Function
GWIPADDR	nnn.nnn.nnn.nnn, ?	Sets the default gatewaym address. ? queries the DHCP setting.
IDHCP	0, 1, ?	Enables, disables, or queries the Dynamic Host Configuration Protocol (DHCP). Controls whether the system is automatically assigned an IP address upon starting. 0 = Disabled, 1 = Enabled, ? queries the IDHCP setting.
IPADDR	nnn.nnn.nnn.nnn, ?	Sets the IP address of the device to a static value. ? queries the IP address.
IPORT	1-65535, ?	Sets or queries the IP port number. For Telnet this number is usually 23.
LOGIN	*passcode*	Opens a session when the valid ***passcode*** is entered (see SETPASS). Required prior to any other communication. Example: $LOGIN VR789ABC for MACID 12:34:56:78:9A:BC. The passcode is case-sensitive.
LOGOUT		Ends a communication session.
MACID	?	Queries the MAC ID number.
NETMASK	nnn.nnn.nnn.nnn ?	Sets the netmask for the device. ? queries the setting.
NETSAVE		Stores the current network settings values. Disconnects communication to the laser in order to change network settings.
NPARA	?	Responds with the current network parameter configuration.
SETPASS	*new passcode*	Sets the new passcode for LOGIN. The passcode is case-sensitive, 2 characters minimum, 10 characters maximum, spaces, $ and # characters are not accepted. The default passcode is always valid.

6.0 Status Word

The Status Word provides a current state of the laser system and other pertinent parameters. It may be queried using the STATUS command. The Status Word is divided as follows:

SS	XX	AA	BB	CC	DD
State Byte1	State Byte 2	Fault Byte 1	Fault Byte 2	Warning Byte 1	Warning Byte 2

State Byte 1

BYTE	Bit	Description	Source CPU	State	
				0	1
STATE 1	S7	Fire Mode	Laser	Disabled	Fire
	S6	Standby Mode	Laser	Stop	Standby
	S5	Diode Trigger Mode	Laser	Internal	External
	S4	Q-Switch Mode	Laser	Internal	External
	S3	Divide By Mode	Laser	Normal	Divide By
	S2	Burst Mode	Laser	Continuous	Burst
	S1	Q-Switch	Laser	Disabled	Enabled
	S0	Not Ready (read only)	Laser	Ready	Not Ready

State Byte 2

BYTE	Bit	Description	Source CPU	State	
				0	1
STATE 2	X7	UV Illumination	Laser	Disabled	Enabled
	X6	Remote Q-Switch (read only)	Laser	Normal Q-Switch*	Q-Switch off
	X5	50 Ω Trigger Termination	Laser	Disabled	Enabled
	X4	BLE Session	Temp	No	Session
	X3	Diode TEC Running	Temp	Off	Run
	X2	LAN Session	Temp	No	Session
	X1	NLO Oven 2 Running	Temp	Off	Run
	X0	NLO Oven 1 Running	Temp	Off	Run

* see **Q-Switch Connectors on page 11**

See **Faults and Warnings on page 49** for additional troubleshooting information.

Fault Byte 1

BYTE	Bit	Description	Source CPU	State	
				0	1
FAULT 1	A7	Remote Interlock	Laser	No	Yes
	A6	Laser Temperature Range	Laser	OK	Fault
	A5	Charge Fault	Laser	OK	Fault
	A4	Diode Current Fault	Laser	OK	Fault
	A3	Diode Temperature High or Low	Temp	OK	Fault
	A2	Diode Temperature Control Fault	Temp	OK	Fault
	A1	System interlock: System/TEC	Temp/ Sys	OK	Fault
	A0	System interlock: Laser Node	Laser	OK	Fault

Fault Byte 2

BYTE	Bit	Description	Source CPU	State	
				0	1
FAULT 2 (Self-test)	B7	Reserved for BLE	-	No Action	No Action
	B6	Reserved	-	No Action	No Action
	B5	Operations Config Checksum	Laser/Temp	OK	Fault
	B4	Factory Config Checksum	Laser/Temp	OK	Fault
	B3	CAN bus fault	Laser/Temp	OK	Fault
	B2	Run time fault	Laser/Temp	OK	Fault
	B1	RAM test fault	Laser/Temp	OK	Fault
	B0	Watchdog Timeout	Laser/Temp	OK	Fault

**If the corresponding NLO oven is set to ON (1 or 3), Warning Byte 2 indicates an oven fault has automatically disabled the oven, preventing the corresponding harmonic wavelength generation.*

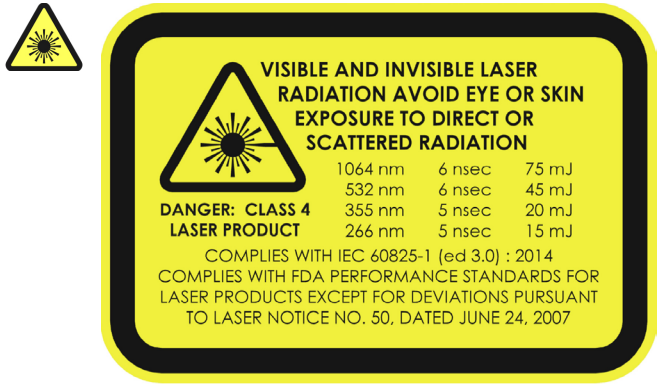
Warning Byte 1

BYTE	Bit	Description	Source CPU	State	
				0	1
WARNING 1	C7	External Lamp PRF	Laser	OK	PRF High
	C6	Laser Temperature Warning	Laser	OK	Warning
	C5	Pre-Lase Detect /Q-Switch inhibited	Laser	OK	Inhibited
	C4	CAN Bus Illegal ID or data	Laser/Temp	No	Yes
	C3	CAN Bus Overrun	Laser/Temp	No	Yes
	C2	Diode Current Limit	Laser	OK	Warning
	C1	Reserved for Log Only	-	Temp	Laser
	C0	Diode/TEC Temp. Warning	Temp	OK	Warning

Warning Byte 2

BYTE	Bit	Description	Source CPU	State	
				0	1
WARNING 2	D7	NLO Oven 2 out of tolerance	Temp	No	Yes
	D6	NLO Oven 2 timeout, oven 2 off	Temp	OK	Warning*
	D5	NLO Oven 2 over temp, oven 2 off	Temp	OK	Warning*
	D4	NLO Oven 2 open sensor, oven 2 off	Temp	OK	Warning*
	D3	NLO Oven 1 out of tolerance	Temp	No	Yes
	D2	NLO Oven 1 timeout, oven 1 off	Temp	OK	Warning*
	D1	NLO Oven 1 over temp, oven 1 off	Temp	OK	Warning*
	D0	NLO Oven 1 open sensor, oven 1 off	Temp	OK	Warning*

TECHNICAL SPECIFICATIONS



1.0 Performance Notice

Laser system performance parameters only result when the laser is installed and operated as described within this manual. Contact Quantel if you have questions regarding system integration, operation in ambient conditions outside of those specified, or specialized applications that may impact system performance.

2.0 General Specifications

Control:

- via Interface Box and Ethernet interface
- OEM only via Ethernet interface to Laser Head, no Interface Box

Power Input:

- 100-240 VAC, 50/60 Hz, 250 VA
- AC mains supply voltage shall not fluctuate more than ±10% of nominal voltage.
- User serviceable power input fuses, both lines fused.
  Time Delay Ceramic Tube Fuse: 4.0 A, 250 V, 5 mm x 20 mm
- Universal type IEC 320 power line connector for detachable cord.
  CAUTION: Do not replace the detachable AC Mains power cord with a cord that is inadequately rated.
- OEM only: +24 ±10% VDC, 10 A, per pinout defined in **Input/Output Connections on page 35**.

Quantel reserves the right to modify the specifications without notice.

Environmental Conditions:

- Ambient temperature range: 15°C to 35°C for specified system performance specifications.
- Storage Temperature Range: -10°C to 70°C.
- Altitude: 2000 m (6562 ft) maximum altitude.

Regulatory Compliance:

- Complies with the Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU.
- Complies with WEEE (2012/19/UE) and EN 50419 marking requirements. This symbol indicates that the Viron, an electrical/electronic product, must be disposed of separately from domestic household waste.

Do not dispose with domestic household wastes!

Safety:

- Installation/Overvoltage Category II; Pollution Degree 2; standard environmental rating.
- Enclosure degree of protection rated IEC 60529 IPX0.
- Conforms to Laser Emission Equipment standard EN 60825-1 and Federal Laser Product Performance Standard, 21 Viron Part 1040.10 (FDA-CDRH) except for deviations pursuant to CDRH Laser Notice 50.

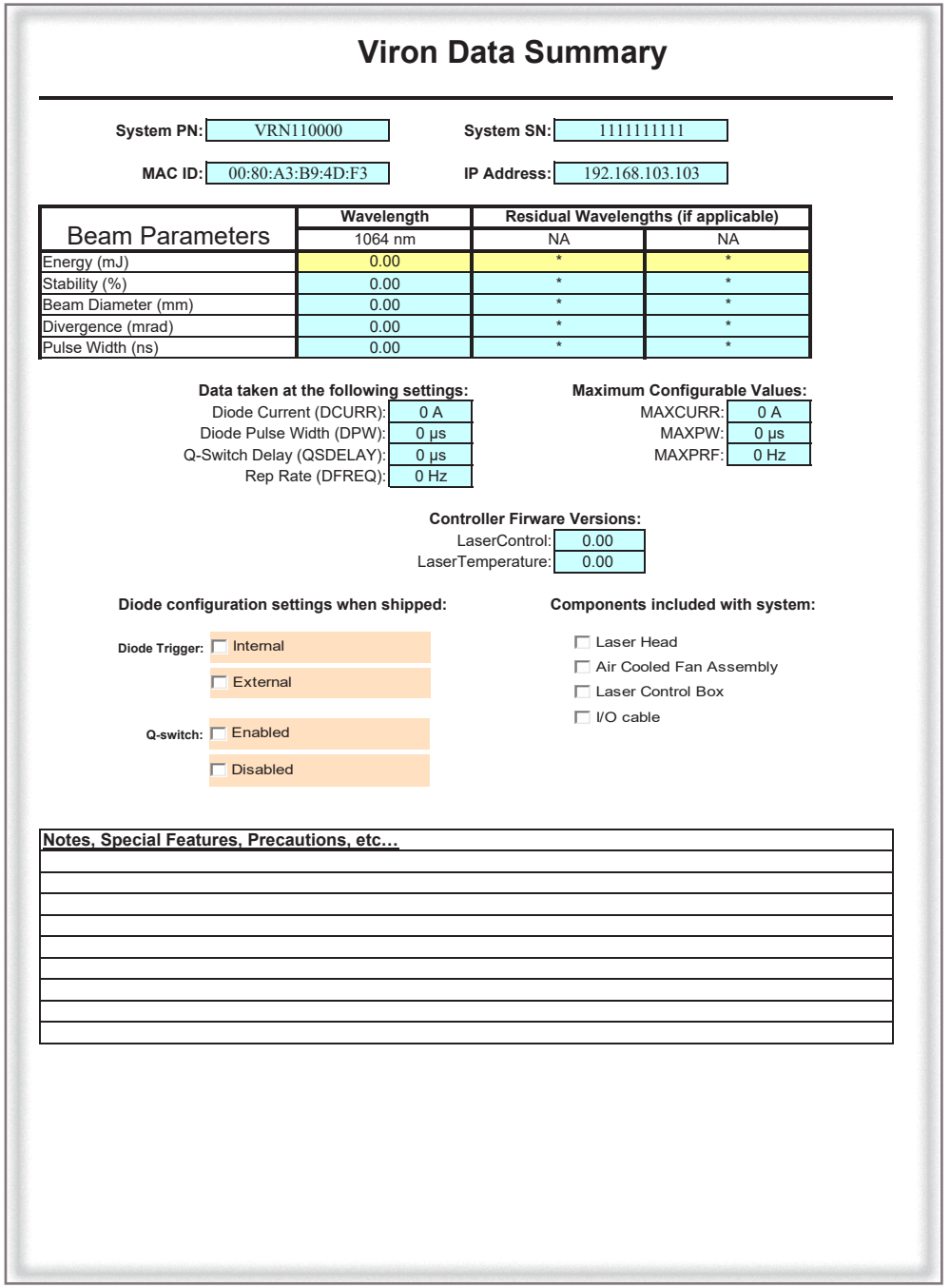
Installation:

Operates in upright or horizontal position.

- Laser Head dimensions, see **Laser Head on page 40**.
- Weight: see **Laser Head on page 40**.

3.0 Data Summary Sheet

Your system was shipped with a Data Summary Sheet that lists important information about your system. Refer to your Data Summary Sheet for the specific values for minimum and maximum limits, Q-Switch delay, and other information that may be unique to your configuration.



Viron Data Summary

System PN: VRN110000 **System SN:** 1111111111

MAC ID: 00:80:A3:B9:4D:F3 **IP Address:** 192.168.103.103

Beam Parameters	Wavelength	Residual Wavelengths (if applicable)	
	1064 nm	NA	NA
Energy (mJ)	0.00	*	*
Stability (%)	0.00	*	*
Beam Diameter (mm)	0.00	*	*
Divergence (mrad)	0.00	*	*
Pulse Width (ns)	0.00	*	*

Data taken at the following settings:

Diode Current (DCURR): 0 A
Diode Pulse Width (DPW): 0 µs
Q-Switch Delay (QSDELAY): 0 µs
Rep Rate (DFREQ): 0 Hz

Maximum Configurable Values:

MAXCURR: 0 A
MAXPW: 0 µs
MAXPRF: 0 Hz

Controller Firware Versions:

LaserControl: 0.00
LaserTemperature: 0.00

Diode configuration settings when shipped:

Diode Trigger: ☐ Internal ☐ External

Q-switch: ☐ Enabled ☐ Disabled

Components included with system:

☐ Laser Head
☐ Air Cooled Fan Assembly
☐ Laser Control Box
☐ I/O cable

Notes, Special Features, Precautions, etc…

4.0 OEM Systems

Viron systems sold for OEM use may not include an Interface Box. These systems are controlled using Ethernet communications, similarly to systems which utilize an Interface Box. However, the user must supply system power and the required control interface as defined in **OEM Connection Pin Out on page 35**.

WARNING: To avoid electric shock, ensure the safety ground to the Connector shell/cable shield is properly connected to the system installation safety ground.

Remote Interlock: If no interlock will be used on an OEM system, then pins 13 and 14 of the circular I/O connector must be shorted together to complete the circuit. See **Input/Output Connections on page 35** for additional details.

Note: The POWER indicator illuminates red to warn that the Laser Head input voltage polarity is reversed. This will not damage the laser. Correct the problem before continuing. The indicator illuminates amber to warn of laser emission. See **POWER/ EMISSION Indicator on page 12**.

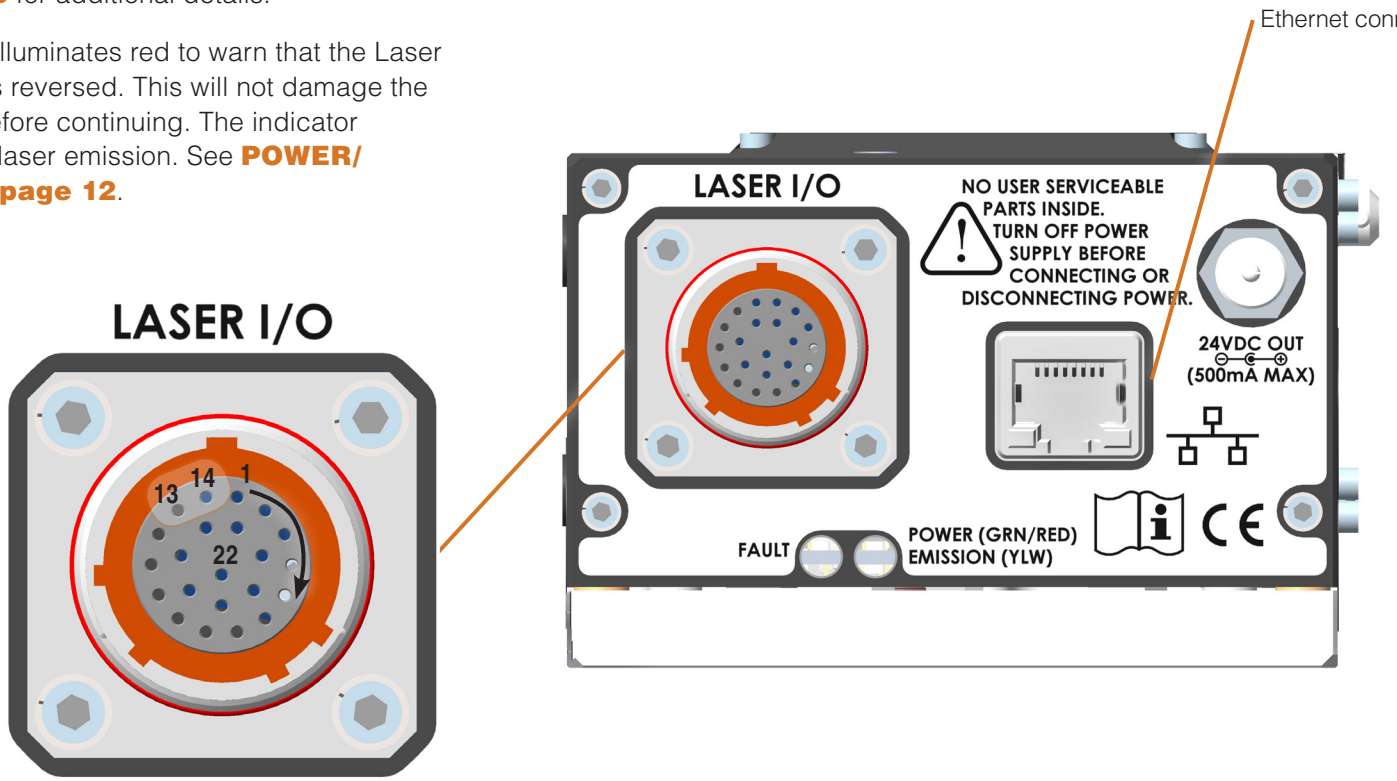


Figure 15 Ethernet Connector

5.0 OEM Connection Pin Out

Input/Output Connections

PIN	SIGNAL NAME	Req./Opt.	DESCRIPTION
1	DiodeTrig.IN	Required only for external diode trigger mode.	External Diode Trigger Input. Pulse width ~100 µs, 5 V amplitude into selectable load: either high impedance or 50 Ω. Repetition frequency not to exceed maximum value set in system software limit.
2	DiodeTrig.IN.RTN		
3	QSTrig.IN	Required only for external Q-Switch trigger mode.	External Q-Switch trigger input. Pulse width ~100 µs, 5 V amplitude into selectable load: either high impedance or 50 Ω.
4	QSTrig.IN.RTN		
5	DiodeSynch.OUT	Optional	Pulse synchronous with Diode Trigger. Pulse width is the same as Diode Drive Pulse Width (controlled by software), 5 V amplitude, capable of driving 50 Ω load.
6	GND.ISO	Required	
7	QSSync.OUT	Optional	Falling edge synchronous with Q-Switch Trigger. Pulse width set by software ($QSPRE), 5 V amplitude, capable of driving 50 Ω load.
8	GND.ISO	Required	
9	Emission	Required	Emission Indicator output designed to drive a high brightness LED at up to 20 mA. 5 V amplitude signal, active high when laser system is in Standby mode. Pulses at 0.5 Hz rate when in Fire mode. Output is not current limited. A resistor must be installed in series with LED to current limit output.
10	GND.ISO	Required	
11	Intlk.OUT	Required	Remote Interlock output.
12	GND.ISO	Required	
13	Intlk.IN	Required	Remote Interlock input required by CDRH. Interlock must be closed (pins 13 and 14 shorted together) to allow laser to operate.
14	GND.ISO	Required	
15	RemoteOFF.IN	Optional	Q-Switch gate function. When in closed position (pins 15 and 16 shorted together), the Q-Switch is gated OFF via hardware control.
16	GND.ISO	Required	
17	+24 VDC	Required	Power input: +24 ± 10% VDC, 10A
18	+24 VDC RTN		
19	+24 VDC		
20	+24 VDC RTN		
21	+24 VDC		
22	+24 VDC RTN		

Quantel USA is dedicated to assist you in successfully interfacing the Viron laser system with your control circuitry. If you have any questions or would appreciate a circuit review of your proposed interface design, please contact Quantel USA Customer Service before powering up your system.

6.0 Flying Lead Connection Pin Out

Quantel USA is dedicated to assist you in successfully interfacing the Viron laser system with your control circuitry. If you have any questions or would appreciate a circuit review of your proposed interface design, please contact Quantel USA Customer Service before powering up your system. See **Flying Lead Drawing on page 37** for pin locations.

PIN	WIRE/PAIR	COLOR	SIGNAL NAME	I/O	DESCRIPTION
1	PAIR	VIOLET	DiodeTrig.IN	IN	Diode Trigger; Differential input configuration. Active rising edge. Reference Figure 1.
2		WHITE	DiodeTrig.IN.RTN		
3	PAIR	SLATE	QSTrig.IN	IN	Q-Switch Trigger; Differential input configuration. Active rising edge. Reference Figure 1.
4		WHITE	QSTrig.IN.RTN		
5	PAIR	RED	DiodeSync.OUT	OUT	5V TTL compatible pulse synchronous with Diode fire. The diode firing corresponds to the rising edge of this positive pulse. Capable of driving into 50Ω termination.
6		WHITE	GND.ISO		
7	PAIR	ORANGE	QSSync.OUT	OUT	5V TTL compatible pulse synchronous with Q-Switch fire. The Q-Switch firing corresponds to the rising edge of this positive pulse. Capable of driving into 50Ω termination.
8		WHITE	GND.ISO		
9	PAIR	YELLOW	Emission	OUT	Laser Emission Status; 5V, 100mA source/sink maximum
10		WHITE	GND.ISO		
11	PAIR	GREEN	Intlk.OUT	OUT	Laser Interlock Status; 5V, 100mA source/sink maximum
12		WHITE	GND.ISO		
13	PAIR	BLUE	Intlk.IN	IN	Remote Laser Interlock; OPEN circuit disables the laser, SHORTED to GND.ISO allows laser operation.
14		WHITE	GND.ISO		
15	PAIR	BROWN	RemoteOFF.IN	IN	Remote Q-Switch OFF control; OPEN circuit allows Q-Switch operation, SHORTED to GND.ISO disables Q-Switching.
16		WHITE	GND.ISO		
17	PAIR	RED	VIN(+)	IN	+24 ± 10 % VDC input, 10 A. ***Note:** All three +24 VDC input wire pairs (pins 17-22) must be utilized for proper laser operation and to prevent damage to the laser power input circuitry. Use 22 AWG (7/30 stranded) wire minimum.
18		BLACK	VIN(-)		
19	PAIR	BROWN	VIN(+)	IN	
20		BLACK	VIN(-)		
21	PAIR	WHITE	VIN(+)	IN	
22		BLACK	VIN(-)		
SLD			Cable Shield & Drain wire		Cable braid shielding and un-insulated shield drain wire shall be terminated to your system ground (Earth tie point).

7.0 Flying Lead Drawing

Quantel USA is dedicated to assist you in successfully interfacing the Viron laser system with your control circuitry. If you have any questions or would appreciate a circuit review of your proposed interface design, please contact Quantel USA Customer Service before powering up your system.

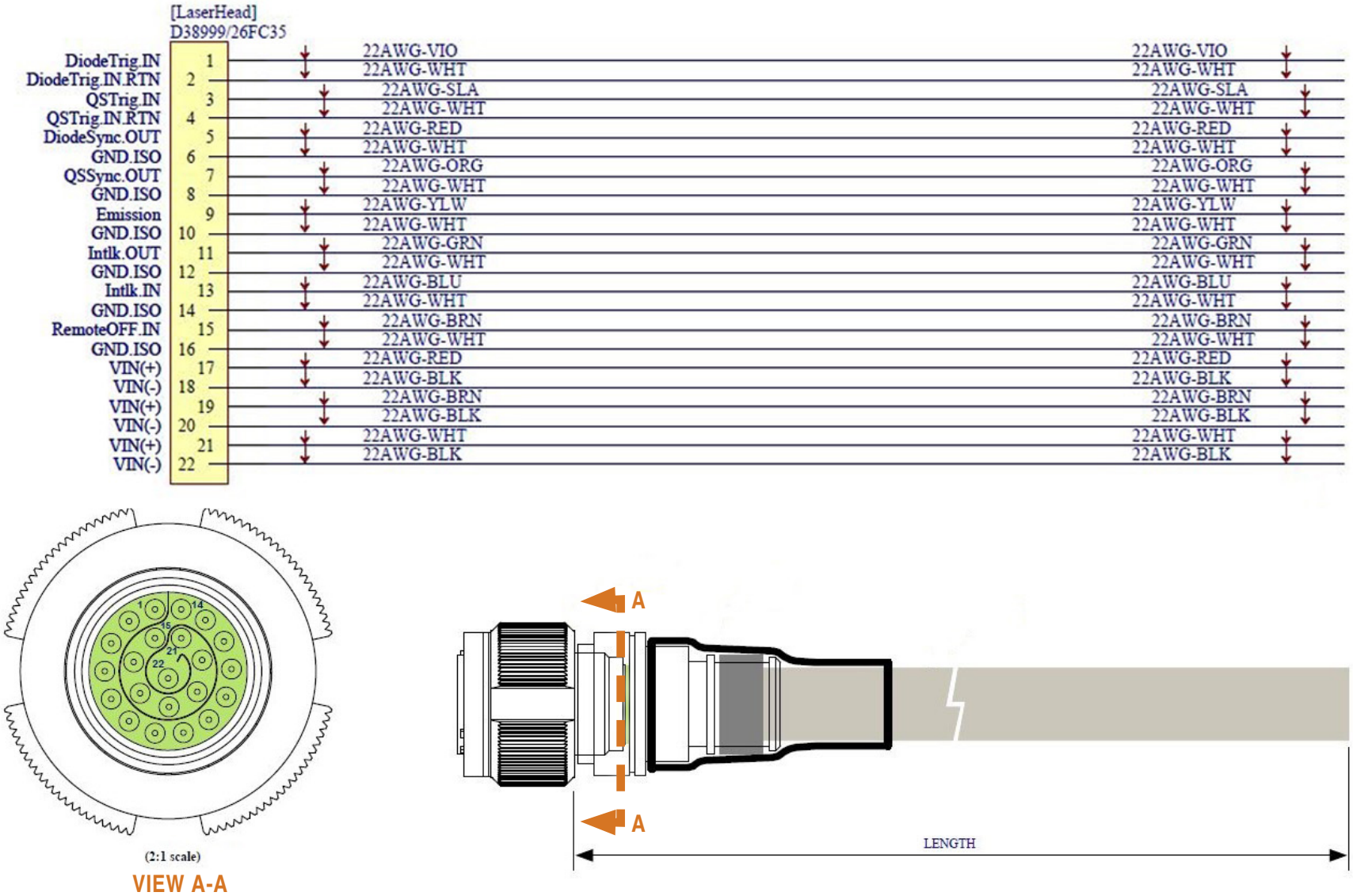


Figure 16 Flying Lead Cable Pinout

8.0 External Trigger Signal Requirements

The external diode and Q-Switch trigger pulses must be between 50 and 900 µsec. The internal diode trigger (and diode sync pulse) is generated 2 µsec ± 1 µsec after the rising edge of the external diode trigger appears. The rising edge of the internal diode trigger is considered as "t_0". All internal delays are measured from this point.

9.0 Timing Diagrams

CAUTION: To optimize trigger performance and reduce jitter, minimal protection circuitry has been utilized for the diode and Q-Switch inputs. **Do not apply voltages greater than 5 V** to prevent damage to sensitive components.

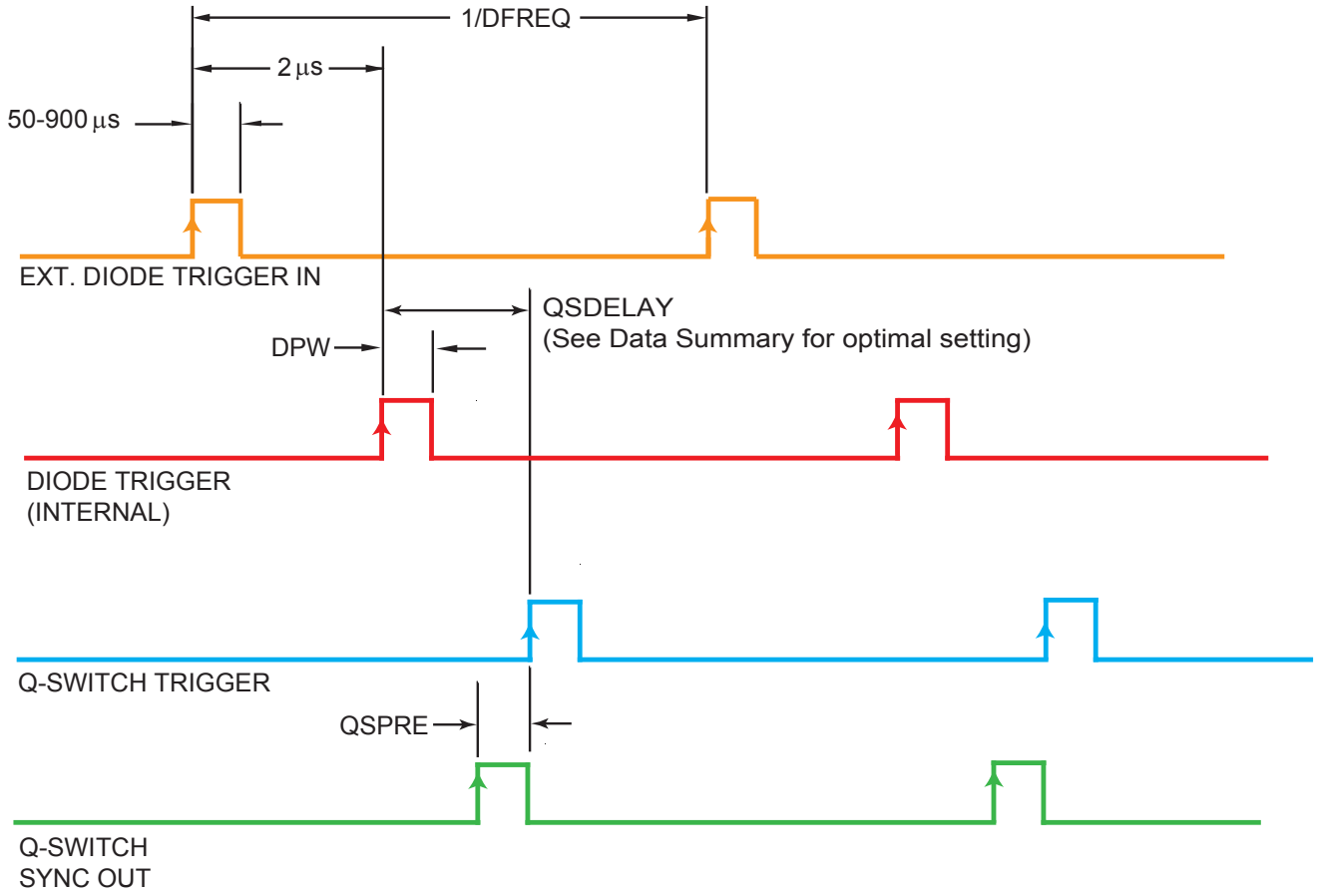


Figure 17 Typical Timing Diagram for Q-Switched Mode

OPTIONAL EQUIPMENT

1.0 Harmonic Generation Modules

The 1064, 532, 355 and 266 nm harmonic generation options are contained within the standard Viron housing. Harmonic generation modules are factory aligned.

Second Harmonic Generation (SHG)

The Viron uses a temperature-controlled frequency-doubler module inside the standard Viron Laser Head to generate 532 nm radiation. When the system is set to Standby mode, there is a short warm-up time for the oven. The 532 nm laser radiation mixed with residual 1064 nm exits the Laser Head from the output aperture. The 532 nm radiation is vertical when SHG only is used.

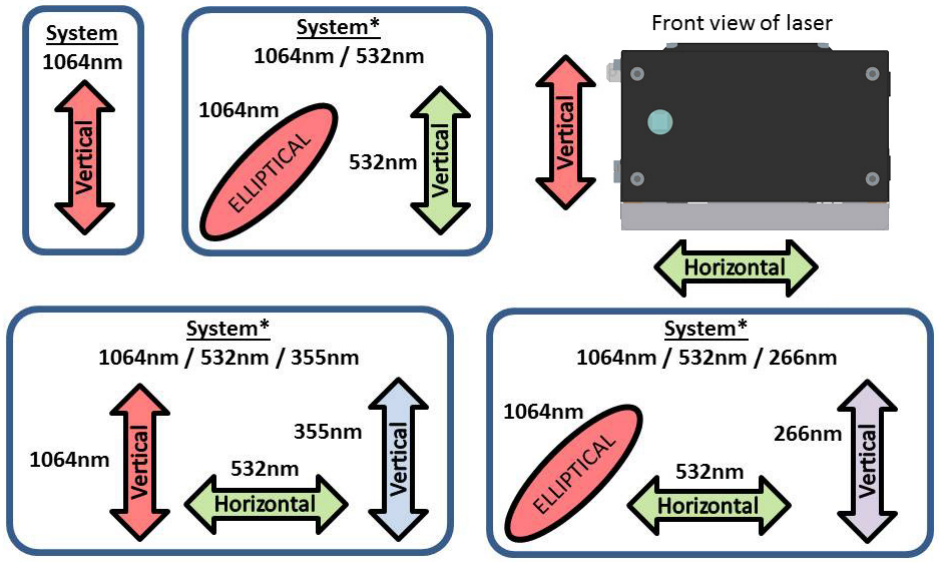
Third Harmonic Generation (THG)

Frequency-doubler and tripler ovens, mounted inside the Viron, are used to generate 355 nm laser radiation. A frequency-doubler module (see SHG) is used to generate 532 nm radiation. The 532 nm radiation is then mixed with the residual 1064 nm radiation to produce 355 nm light. The 355 nm laser radiation mixed with residual 1064 nm and 532 nm exits the Laser Head from the output aperture. The output polarization of the 355, and 1064 nm laser radiation is vertical. The output polarization of the 532 nm is horizontal.

Fourth Harmonic Generation (FHG)

Frequency-doubler and quadrupler ovens, mounted inside the Viron, are used to generate 266 nm laser radiation.

The 532 nm radiation (see SHG) is doubled again to produce 266 nm light. The 266 nm laser radiation mixed with residual 1064 nm and 532 nm exits the Laser Head from the output aperture. The output polarization of the 1064 light is elliptical, the 532 nm light is horizontal, and the 266 nm light is vertical.



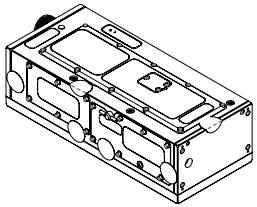
** For all configurations including dichroics.*

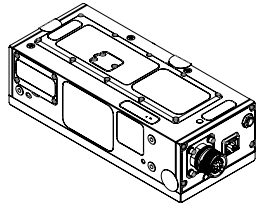
Figure 18 Polarization Directions

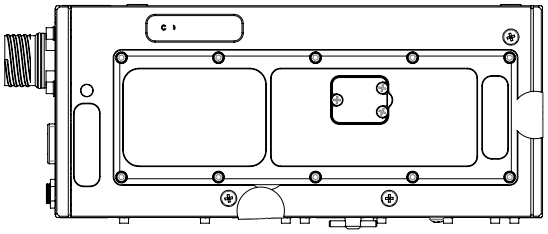
Quantel | Viron

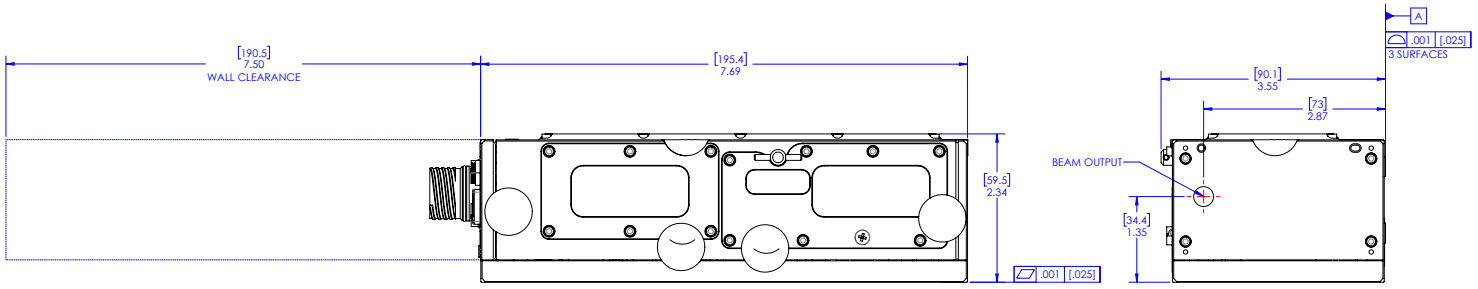
DRAWINGS

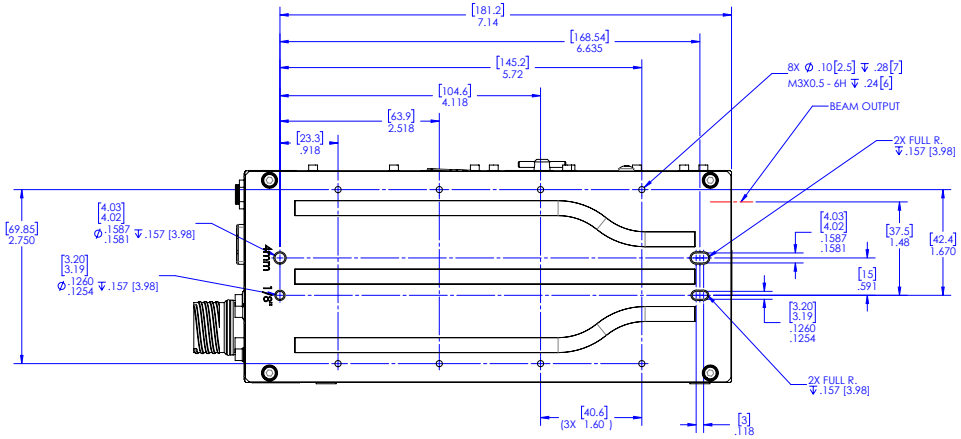
1.0 Laser Head









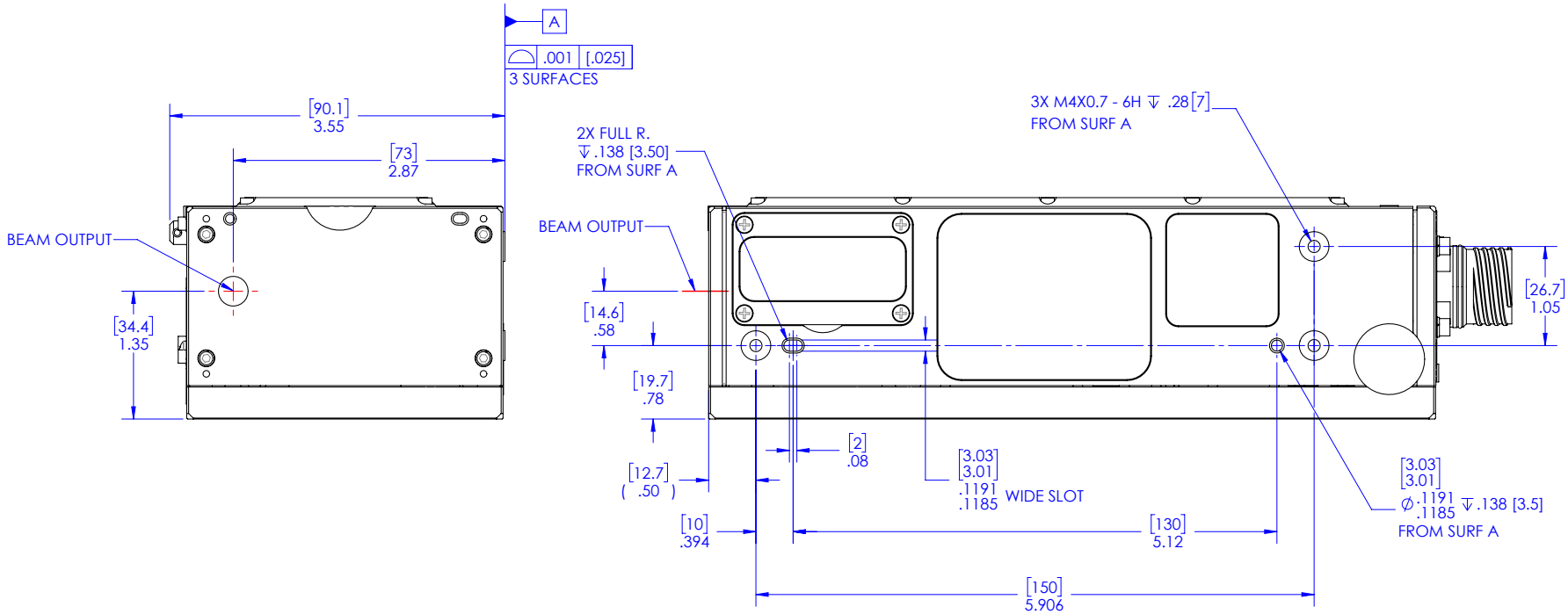


See **Laser Head Side Mounting Locations on page 41** for more details.

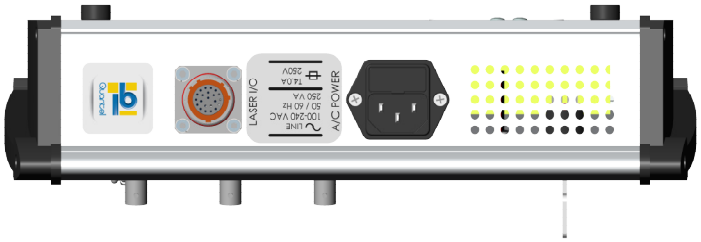
WEIGHT

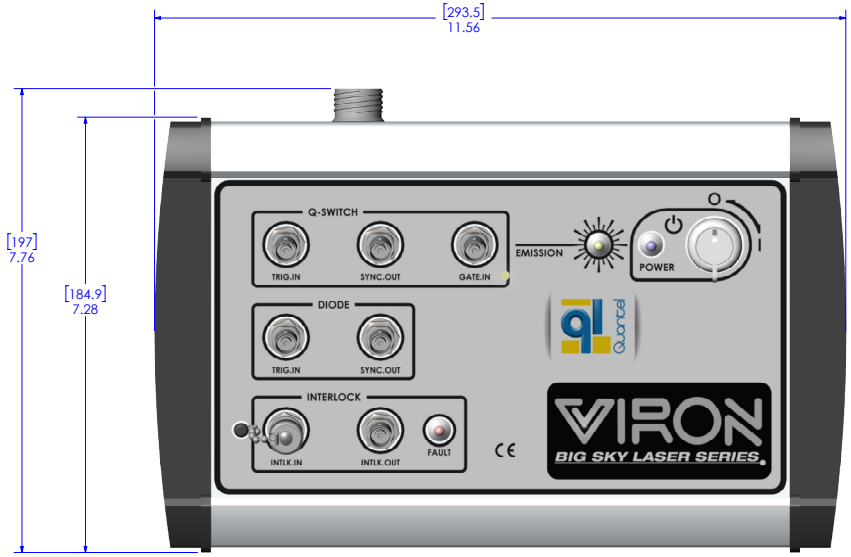
Laser Head	3.85 lbs [1.746 kg]
Laser Head with Air Cooling Unit	5.5 lbs [2.495 kg]

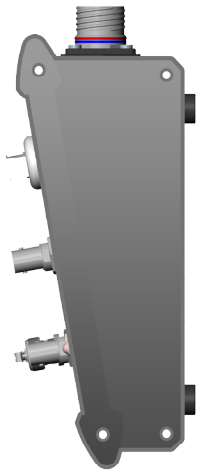
2.0 Laser Head Side Mounting Locations

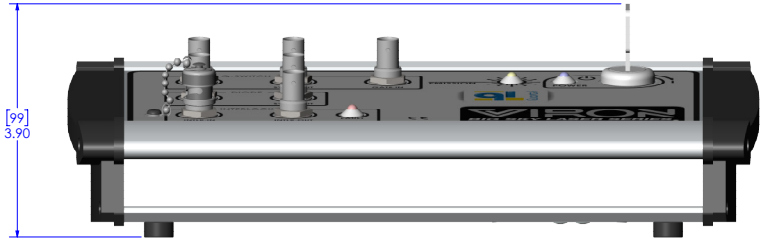


3.0 Interface Box









Interface Box Weight 3.75lbs [1.7kg]

MAINTENANCE

1.0 Replacing the Interface Box Fuses

If necessary, use the following steps to replace the Interface Box fuses.

1. Disconnect the Interface Box from all power sources.
2. Press down on the tab and remove the cap to expose the fuse, see Figure 19.
3. Replace the blown fuses. Verify the fuses are completely inserted into the holder. The label lists the specified fuse rating. Use a time delay, ceramic body fuse T 4.0 A, 250 V fuse, 5 X 20 mm.
   Quantel Part Number: **70850131LF**.

CAUTION: Only replace the fuses with those specified. Failure to do so may result in equipment damage or personal injury. For your safety, always disconnect the power cord before servicing fuses.

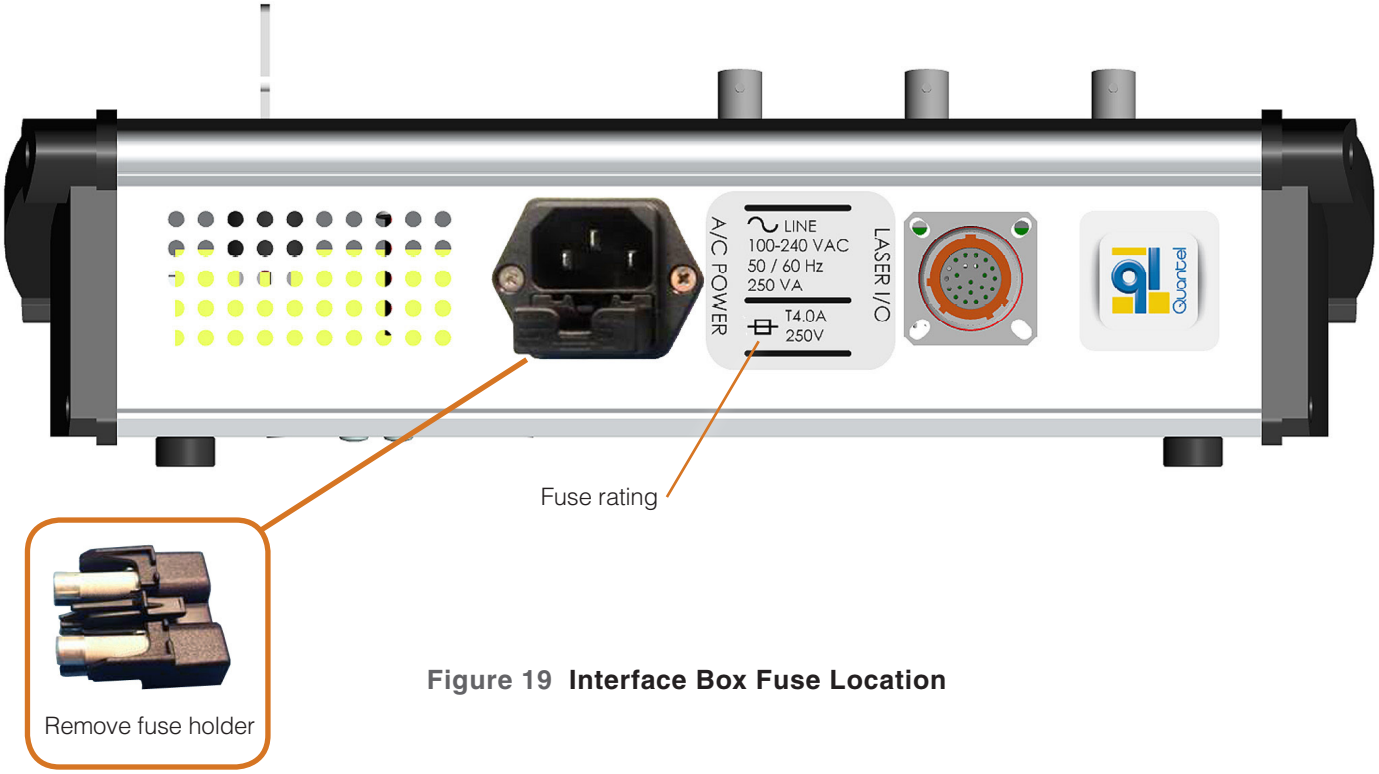


Figure 19 Interface Box Fuse Location

2.0 Replacing the Desiccant

The desiccant in the Laser Head should be replaced every 6 months. To replace the desiccant:

1. Remove the four (4) #2-56 x 1/4” flat/phillips screws from the side of the Laser Head.
2. Remove the cover.
3. Replace the desiccant bag (Quantel part number: **72006020**)
4. Reinstall the cover and screws.
5. Remove the seal screws.
6. Purge the system by flowing Ultra High Purity (UHP) dry nitrogen through the Laser Head for 5 to 10 minutes.
7. Reinstall the seal screws.

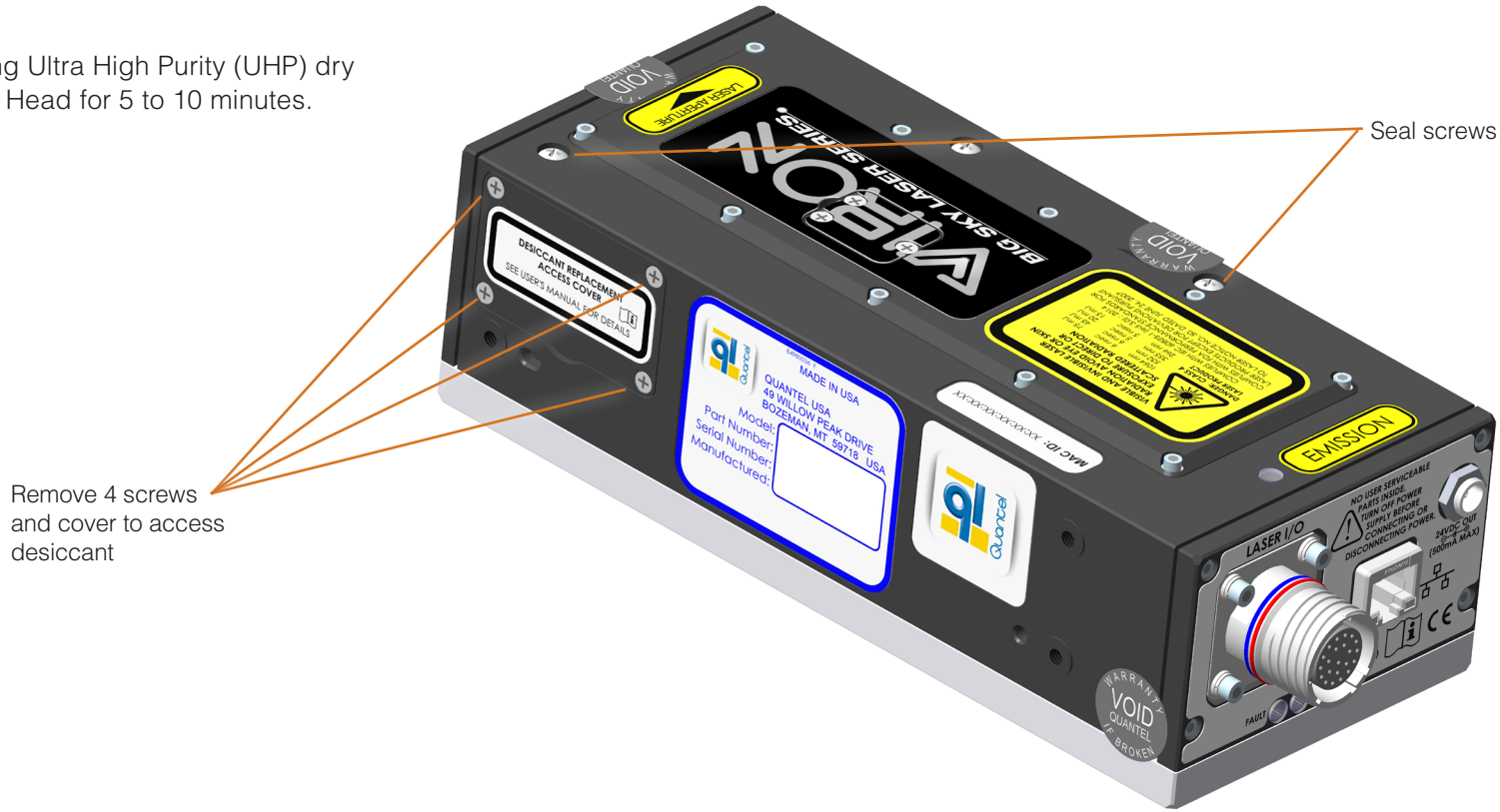


Figure 20 Desiccant Access and Seal Screws

TROUBLESHOOTING

The microprocessor-based system monitors the laser system and automatically shuts down if a fault occurs. Software limits have been factory selected to protect the laser system against damage. The following section may help you correct or identify the problem before calling Quantel Customer Service.

www.quantel-laser.com

Contact Us

QUANTEL HEADQUARTERS (Worldwide)
2 bis avenue du Pacifique – Z.A. de Courtaboeuf
BP 23 – 91941 Les Ulis Cedex – France
Phone: +33-1-6929-1700
Fax : +33-1-6929-1729
service@quantel.fr

QUANTEL USA, Inc. (North America)
49 Willow Peak Drive
Bozeman, MT 59718 USA
Service toll free: +1-800-914-8216
Fax: +1-406-522-2007
CustomerService@quantelusa.com

1.0 General Information

No internal parts of the Viron Laser Head and Interface Box are user serviceable. The only items on the Viron laser system that may be serviced by the user are:

- Fuses, see **Replacing the Interface Box Fuses on page 43**.
- Desiccant, see **Replacing the Desiccant on page 44**.

All other service or repair of the Interface Box, Laser Head or Laser Head optical alignment issues require a qualified Quantel technician or trained Field Service Representative.

Basic troubleshooting can help you resolve:

- security system faults, such as external safety interlocks
- connection issues

If a failure occurs at start-up or during operation, use the Key Switch to turn the laser OFF. Then use the following troubleshooting methods to resolve the issue.

2.0 Interlocks

The controller electronics constantly monitor the system for potentially hazardous conditions. If any of these conditions exist, the laser operation ceases and the Interface Box interlock indicator illuminates along with the fault indicator on the Laser Head rear panel. If the Interface Box is not used, as in OEM applications, use the STATUS command to query the system conditions.

Ensure INTLK.IN is shorted with a BNC shorting connector if not in use (see **Interlocks on page 10** for details).

NOTE: Interlock condition states are “latched” until read to ensure that any temporary or transitory conditions are reported. Once read, the interlock is cleared if the problem has been resolved. Due to this, it is recommended to query the STATUS command twice to verify the system state.

NOTE: Contact Quantel for any repair actions necessary beyond those described in this manual. Attempts to adjust, repair or replace any portion of the laser system may damage the system and void the warranty

3.0 Resolving Fault Conditions

A *fault* is any detected failure or condition that may cause a hazard to personnel or damage to the system. When a fault is detected the laser is immediately prevented from operating. The interlock indicator on the Interface Box **illuminates continuously** when a fault is detected.

A *warning* is any detected event or condition that may eventually cause a fault or hazard if not corrected, or to indicate “not ready”. A warning condition does not prevent laser operation. The interlock indicator on the Interface Box **illuminates flashing** when a warning condition is detected.

Important Fault Handling Notes

- The laser system is only able to enter Fire mode if no fault conditions exist.
- When a fault is detected, the laser system is prevented from entering Standby* or Fire Mode.
- If a fault is detected and the laser system is in Standby***** or Fire mode, the system immediately transitions to Stop mode.
- Fault and warning status can be viewed via the Ethernet interface using the STATUS command. The STATUS command reports the operational state in hexadecimal format (See **Status Word on page 30**). The TEXTS command may also be used to report a more verbose listing of the faults and warnings of the status.
- The detected fault or warning condition is “latched” in memory until it is read using the STATUS command or TEXTS command. This ensures that any temporary or transitory fault conditions are captured.
- Once the system status is read, if the condition causing the fault or warning is no longer present, the next read will report the current status. Therefore, it is recommended to **always read the status at least twice** in a row to get correct and current system status.

*****exception: An A3 diode temperature fault will not prevent the laser from entering Standby mode.

4.0 Ethernet Communications Troubleshooting

Problem	Possible Cause	Solution/Suggestion
QuantelScan.exe or Telnet unable to detect the laser	No system power	Verify that all cables are fully connected and the Key Switch is on.
	Laser network settings are incompatible with current connection method	Refer to **Communication using Ethernet on page 18**. For direct connections, a crossover Ethernet cable and a static IP address must be used. For network connections, a straight through Ethernet cable must be used. Either dynamic or static IP addressing can be used (ensure your static IP address is not already in use by another device). Refer to **Defaulting to a Static or Dynamic IP Address on page 22**.
	DHCP is enabled while trying to directly connect (non-networked)	Setup the system for a static IP address. Refer to **Communication using Ethernet on page 18**. If you cannot communicate, default to a static IP address (refer to **Defaulting to a Static or Dynamic IP Address on page 22**.)
Connection refused	Another device or application is already connected to the Viron	Verify that other individuals are not using the system. Unplugging the Ethernet and plugging it back in will break any pre-standing Ethernet connection.
Unable to login	Incorrect passcode	Verify the passcode is entered correctly using ALL CAPS The passcode is case-sensitive.
Static IP address is not accepted during a $NETSAVE	DHCP is enabled	Establish communication with the laser, then send command `$IDHCP 0` to disable DHCP, configure the static IP address parameter using `$IPADDR` and then send `$NETSAVE` to try again.
No direct or network communication with the laser	No system power	Verify that all cables are fully connected and the Key Switch is on.
	Incorrect port setting	See **Communication using Ethernet on page 18**.
	Incorrect IP address	See **Communication using Ethernet on page 18** for detecting and communicating with the system.
	Host connection is off or not functioning correctly.	For direct connections, verify that the Host LAN hardware is enabled and functioning. For network connections, verify that the network access being used is functioning. Contact your Network Administrator for assistance.
	Faulty laser hardware	Check to see that the Ethernet port lights on the Laser Head are flashing during start up. If they do not, contact Quantel Customer Service for further assistance.
Erratic or no communication	Static IP address conflict	Turn laser system power off and then verify the set IP address is not already in use by another device on the network. Contact your network administrator for an available static IP address or to determine if an address is already in use.
	Wrong type of Ethernet cable	For direct connections, verify that a crossover cable is being used. For network connections, verify that a typical straight-through cable is being used.
Dynamic addressing returns 169.XXX.XXX.XXX address when connected to the network	DHCP server was unable to assign the laser an IP address	First, restart the laser system to see if the problem persists. Next, verify there are no other errors on your network. If the problem persists, refer to **Defaulting to a Static or Dynamic IP Address on page 22**.

5.0 Diagnosing Problems

Problem	Possible Cause	Solution/Suggestion
No System Power	No power connected	Check the simple things first—make sure the power cord is plugged into the outlet and making connection. Verify that the circuit breaker is allowing power to the outlet.
	Key Switch is OFF	Turn the Key Switch on the front of the Interface Box to the ON "I" position.
	System fuses	Check the fuses. See for **Replacing the Interface Box Fuses on page 43** details.  **WARNING:** Disconnect the power cord and communications cable prior to servicing fuses!
Red Power Indicator	Laser Head input voltage polarity is reversed	The Power indicator on the Laser Head illuminates red to warn that the Laser Head input voltage polarity is reversed. This will not damage the laser. Correct the problem before continuing.
No Laser Output	System Fault condition	If the Interface Box interlock indicator is illuminated a fault exists. A fault locks out use of the laser system until it is corrected. Enter the STATUS command using a computer connected to your laser system to determine the system status. Decode the fault bytes to determine the source of the problem, or use the TEXTS command to provide a decoded list of active faults and warnings. See **Status Word on page 30**.
	Cable not connected	With the system turned OFF and the system unplugged, check all electrical connections to the Laser Head and the Interface Box. Ensure connections are fully seated. The I/O cable connectors are fully seated when the red band is no longer visible. If any of the cables are not installed properly, the system will not function. Disconnect the system power before connecting or disconnecting any cables. Inspect the Interface Box cables to make sure they are attached securely.
	Q-Switch not enabled	Verify that the Q-Switch is enabled and properly functioning.
	Q-Switch timing not correct	Verify that the Q-Switch is enabled and that the Q-Switch trigger is set up properly. Use the Sync outputs to verify the timings.
	Shutter is closed	Check that the manual shutter is open and allowing laser output. See for **Manual Shutter on page 14** details.  **WARNING:** Whenever the shutter is open, take precautions at all times as though the laser is capable of lasing, regardless of any other status.
	Trigger settings are incorrect	Always check for laser output with internal triggering first if external triggering fails to produce output. Verify the trigger signal used meets the requirements, if using an external trigger. See **External Trigger Signal Requirements on page 38**.
	Q-Switch gating is activated	Verify the Q-Switch GATE.IN BNC connector is open to enable the Q-Switch trigger. See **Q-Switch Gate (GATE.IN) on page 11**.
	Standby mode not entered	The Standby mode must be entered before the Fire command.

Problem	Possible Cause	Solution/Suggestion
Low Laser Output	Incorrect Q-Switch delay	The Q-Switch delay value is system dependent. Your system shipped with a Data Summary Sheet specifying the correct Q-Switch delay for your system.
	Misaligned	If beam quality has degraded, it may suggest an alignment problem. Contact Quantel for details.
No Interlocks	Faulty laser I/O cable	Verify laser I/O cable connectors are fully inserted.
Laser does not trigger in External mode	Incorrect trigger signal	Refer to the **External Trigger Signal Requirements on page 38**.

6.0 Faults and Warnings

The Status Word provides a current state of the laser system and other pertinent parameters. When the Status Word is queried using the STATUS command the fault and warning bytes may be decoded to aid in troubleshooting. See **Status Word on page 30** for additional information on decoding the Status Word.

Fault Byte 1 (AA)	Description/Location	Solution/Suggestion
Remote Interlock Fault (A7)	The I/O connector and Interface Box INTLK.IN	The INTLK.IN contacts must be shorted. This feature is required to comply with federal regulations.
Laser Temperature Range Fault (A6)	Internal temperature sensor	A laser overtemperature fault requires the system to remain in Stop mode until it has cooled down. Verify the system is being operated within its specified temperature range. If problem persists, contact Quantel Customer Service.
Charge Fault (A5)	Diode driver cannot reach voltage requirement	If problem persists, immediately turn the system OFF and contact Quantel Customer Service.
Diode Current Fault (A4)	Diode current could not be set properly	The Diode current experienced a problem and could not be set at the correct setting. If problem persists, contact Quantel Customer Service.
High or Low Diode Temperature Fault (A3)	TEC is not able to hold the laser diode temperature within the fault tolerance	Verify the system is being operated within its specified temperature range. Allow the system to cool in Stop mode. If problem persists, contact Quantel Customer Service. **Note:** It is normal when this fault (signaled by the fault LED and a two-tone fault beep) occurs in going from Stop to Standby mode or after long idle periods. In this case internal control will regulate the diode temperature and end the fault condition allowing operation.
Diode Temp Control Fault (A2)	TEC is not able to properly regulate the laser diode temperature.	If problem persists, contact Quantel Customer Service.
System Interlock: System (A1)	TEC controller or internal connection fault caused a system interlock	To clear the fault, turn system off and resecure the I/O cable before trying again.. If the problem persists, contact Quantel Customer Service.
System Interlock: Laser (A0)	Laser controller fault caused a system interlock	This indicates that one of the other faults is being reported from the Laser Controller. Check the solution for the reported fault.

Fault Byte 2 (BB)	Description/Location	Solution/Suggestion
Operation Config Checksum (B5)	Operational settings in non-volatile memory have become corrupted.	To clear the fault, send the FRECALL command. If the problem persists, contact Quantel Customer Service.
Factory Config Checksum (B4)	Factory settings in non-volatile memory have become corrupted.	To clear the fault, cycle the system power off and then on. If the problem persists, contact Quantel Customer Service.
Internal Communications Fault (B3)	The internal communication bus encountered non-recoverable error(s)	To clear the fault, cycle the system power off and then on. If the problem persists, contact Quantel Customer Service.
Run Time Fault (B2)	A hardware fault occurred during operation	To clear the fault, cycle the system power off and then on. If the problem persists, contact Quantel Customer Service.
RAM Self-test Fault (B1)	The RAM memory failed the self-test.	To clear the fault, cycle the system power off and then on. If the problem persists, contact Quantel Customer Service.
Watchdog Timeout Fault (B0)	The watchdog timer caused a system reset	To clear the fault, cycle the system power off and then on. If the problem persists, contact Quantel Customer Service.

WARRANTY

We at Quantel are proud of our specialty laser systems. Our manufacturing and quality control processes emphasize consistency, stability, ruggedness, reliability and performance. We strive to make reliable laser systems and to provide superior customer support.

Should there be a problem with operation or failure of any kind, please call the Quantel USA customer service hotline toll-free at **1-800-914-8216**.
International customers, please call Quantel Service Center France **33-1-6929-1700** (International)

Quantel toll-free customer service hotline **1-800-914-8216** (inside the U.S. & Canada)

We will do our best to get your system fully operational as quickly as possible.

Feedback

We welcome your feedback regarding your use, the performance of the laser system and these manuals. Product improvements and refinements come about from your input as we strive to continually improve our product reliability, performance and customer satisfaction.

International customers, please call our service center in France at 33-1-6929-1700. Within the United States and Canada, call our toll free number: 1-800-914-8216.

You can also visit us online at: www.quantel-laser.com.

Warranty

(a) Quantel USA warrants the lasers it manufactures and produces to be free from defects in materials and workmanship for twelve (12) months following the date of shipment provided that all operating instructions are properly followed. Diodes are warranted for 1 billion shots or one year, whichever comes first. This warranty is limited to the original purchaser of the laser and is not transferable.

During the 12 months warranty period, we will repair or replace, at our option, any defective products or parts at no additional charge, provided that the product is returned. Contact Quantel for return shipping instructions. All replaced parts and products become the property of Quantel USA.

(b) This warranty is the only warranty made by QUANTEL USA with respect to the goods delivered hereunder and no representative or person is authorized to bind QUANTEL USA for any obligations or liabilities beyond this warranty in connection with the sale of QUANTEL USA's goods.

(c) Remedies are available only if QUANTEL USA is notified in writing by Buyer promptly upon discovery of any defects and in any event within the warranty period for the individual goods, whereby Seller's examination of such goods discloses to QUANTEL USA's satisfaction that such defects actually exist and the goods have not been (i) repaired, worked on or altered by persons not authorized by QUANTEL USA so as, in QUANTEL USA's sole judgment to effect the stability, reliability or proper operation of such goods; (ii) subject to misuse, negligence, abuse or accident; or (iii) connected, installed, used or adjusted otherwise than in accordance with the instructions furnished by QUANTEL USA or normal usage.

(d) All goods that Buyer considers defective shall be returned, freight and insurance prepaid, to QUANTEL USA's office, as designated on the face hereof. QUANTEL USA shall not be liable for additional transportation costs arising from the goods having to be shipped to a location remote from the original one. Buyer shall obtain return authorization from QUANTEL USA before returning any goods. QUANTEL USA shall not bear responsibility for damage or loss to goods not properly prepared for transportation.

(e) If it is found QUANTEL USA's goods have been returned without cause and are still serviceable, Buyer will be notified and the goods returned at Buyer's expense, freight collect. In addition, a charge for testing and examination and/or for reimbursement of shipment costs paid by QUANTEL USA under subsection (d) above, may, at QUANTEL USA's sole discretion, be made on goods so returned which such charges shall also be payable by the Buyer.

(f) The foregoing warranty is exclusive and in lieu of all other warranties whether written, oral or implied, including any warranty of merchantability or fitness for a particular purpose, and shall be the Buyer's sole remedy and QUANTEL USA's sole liability on contract or warrant or otherwise for the product.

(g) This warranty shall not apply in the event that the original device identification markings have been removed, defaced or altered, or if any parts have been substituted or modified without the express consent of QUANTEL USA.

(h) This warranty will not apply if the customer's general account at QUANTEL USA is delinquent in whole or in part.

QUANTEL USA's liability under, for breach of, or arising out of this agreement and/or sale will be limited to repair or replacement of any defective goods or a refund of the purchase price of the goods, at QUANTEL USA's sole discretion. In no event will QUANTEL USA be liable for costs of procurement of substituted goods by buyer, nor will QUANTEL USA be liable for any special, consequential, incidental or other damages (including without limitation loss of profit) whether or not QUANTEL USA has been advised of the possibility of such loss, however caused, whether for breach or repudiation of contract, breach of warranty, negligence or otherwise.

CERTIFICATES

CE Certificate of Conformance

By affixing the CE marking, Quantel assures that the Power Supply meets all the essential requirements of all applicable European Union (EU) directives required for market placement in the European Economic Area (EEA).

Attestation of Conformity

Conforming to standards according to ISO/IEC Guide 22 and EN 45014. See the Attestation of Conformity for Electromagnetic Compatibility (EMC), electrical and laser safety standards, and requirements applicable to the CE certification mark of the Power Supply.

CE

Quantel USA
49 Willow Peak Drive, Bozeman, MT 59718 (USA)
Phone: 406-586-0131
www.quantel-laser.com

ATTESTATION OF CONFORMITY

Date of Issue: 2017-07-12

Quantel USA hereby declares that testing has been completed and reports generated for;

Product: Class 4 Laser System

Model: Viron

That this product has been assessed and found to comply against the following Standards:

EN 61326-1:2013;	**Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements**
EN 61010-1:2010;	**Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements**
IEC 60825-1:2014	**Safety of laser products – Part 1: Equipment classification and requirements**

The aforementioned standard(s) is/are one of several standards that are rquired under the EMC & LVD Directive(s);

Directive 2014/30/EU	**Electromagnetic Compatibility**
Directive 2014/35/EU	**Low Voltage**

Additional standard(s) may be rquired to fulfill the EMC & LVD Directive(s).

Application of the CE Mark is permitted only after all applicable requirements are met in accordance wut the European Union Rules, including the manufacture's issuance of a "Declaration of Conformity."

Attestation by: Kim Bares
Director of Engineering (Quantel USA)

Signature

2017-07-12
Date

ROHs

This product is documented as fully meeting RoHS regulations.

Quantel USA
49 Willow Peak Drive, Bozeman, MT 59718 (USA)
Phone: 406-586-0131
www.quantel-laser.com

RoHS Compliance Certificate

Quantel USA herby certifies that all of its products are RoHS compliant, in conformity with European Directive 2011/65/EU, unless otherwise identified. Quantel manufactures products within Category 9 of the directive, "Industrial Monitoring and Control Instruments."

RoHS2 (Restriction of Hazardous Substances) bans the use of certain materials commonly used in electronics and electrical equipment. The hazardous and restricted substances in RoHS2 are outlined in Annex II of the directive with maximum concentration values tolerated by weight to homogeneous materials. They are:

1. Lead - (0.1%)
2. Mercury - (0.1%)
3. Cadmium - (0.01%)
4. Hexavalent chromium - (0.1%)
5. Polybrominated biphenyls - (0.1%)
6. Polybrominated diphenyl ethers (PBDE) - (0.1%)

Kim Bares
Director of Engineering (Quantel USA)

Signature

July 13, 2017
Date

RoHS Compliant

www.quantel-laser.com