PULSED FIBER LASER i-SERIES

MODEL: LPQxx-xx-iS
Serial Number: LPC-xxxx-xxx

Operator Manual

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Please take time to read and understand this User’s Guide and familiarize yourself with the information that we have compiled for you before you use the product. This User’s Guide should stay with the product to provide you and all future users and owners of the product with important operating, safety and other information.

NOTICES

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** Designates Selected Laser Power

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1. Safety Information

Safety Conventions

We use various words and symbols that are designed to call your attention to hazards or important information. These include:

WARNING:

Refers to a potential *personal* hazard. (⚠️ Electrical) (⚠️ Laser radiation) It requires a procedure that, if not correctly followed, may result in bodily harm to you and/or others. Do not proceed beyond the WARNING sign until you completely understand and meet the required conditions.

CAUTION:

Refers to a potential *product* hazard. It requires a procedure that, if not correctly followed, may result in damage or destruction to the product or components. Do not proceed beyond the CAUTION sign until you completely understand and meet the required conditions.

IMPORTANT

Refers to any information regarding the operation of the product. Please do not overlook this information.
Laser Classification

This device is classified as a high power Class IV laser instrument under 21 CFR 1040.10. This product emits invisible laser radiation at or around a wavelength of 1060 nm, and the total light energy radiated from the optical output is greater than 20W. This level of light may cause damage to the eye and skin. Despite the radiation being invisible, the beam may cause irreversible damage to the cornea. Laser safety eyewear is not provided with this instrument, but must be worn at all times while the laser is operational.

**WARNING:**

Use appropriate laser safety eyewear when operating this device. The selection of appropriate laser safety eyewear requires the end user to accurately identify the range of wavelengths emitted from this product. If the device is a tunable laser or Raman product, it emits light over a range of wavelengths and the end user should confirm the laser safety eyewear used protects against light emitted by the device over its entire range of wavelengths.

**WARNING:**

Use of controls or adjustments or performance of procedures other than those set forth in this User’s Guide may result in hazardous radiation exposure.

**CAUTION:**

Do not install or terminate fibers when laser is active.
Device Safety Label Locations

The figures below show the FDA regulated labels and other labels along with their placement on the product.

**Label 1**
**Certification Label**
Location
Rear Panel of Module

**Label 2**
**Identification Label**
Location
Rear Panel of Module and Driver

**Label 3**
**Warning Logotype**
Location
Top Cover or Front Panel of Device
Safety Label Location

Labels on the front panel

Labels on the rear panel
General Safety Instructions

In order to ensure the safe operation and optimal performance of the product, please follow these warnings and cautions in addition to the other information contained elsewhere in this document.

CAUTION:

Before supplying the power to the instrument, make sure the correct voltage is used. Failure to use the correct voltage could cause damage to the instrument.

WARNING:

This device and all parts or components thereof are not meant to be operator serviced, except for the replaceable fuse(s). Refer all servicing to qualified Laser Photonics LLC personnel. To prevent electrical shock, do not remove covers or system components. Tampering with or disassembly of the device or components will void the warranty and possibly expose the operator to an electrical shock hazard.

WARNING:

Laser radiation is emitted from all optical outputs simultaneously. Avoid exposure from all unused optical ports.

WARNING:

Do not enable the laser when fiber delivery cable is unattached to the optical output connector.

WARNING:

If this instrument is used in a manner other than those specified in this document, the protection provided by the instrument may be impaired and the warranty will be voided. This product must be used only in normal conditions.
Back Reflection Prevention

**CAUTION:**

Back reflection into the laser cavity can degrade the laser performance or cause laser failure. The laser is designed to accommodate normal back reflections exhibited from use of your laser output, whether it is outfitted with a connector, collimator, or a bare fiber.

For outputs with standard fiber connectors, examples of normal back reflection are as follows. Expected back reflection for FC/PC connectors is $-14$ dB. Expected back reflection for FC/APC is $-40$ dB. Proper cleaning of the connectors is an essential process for successful use of the laser. We recommend following the attached "Connector cleaning guide".

For collimated outputs, maintaining a clean output lens is essential. Always close (re-cap) the collimator after use. Do not touch the output lens and do not clean with any solvents.

Optical damage may result from failure to comply with the above instructions. Such damage is not covered by the warranty.
2. Environment and Precautions

**WARNING:**

Always switch the laser off when working with the output such as mounting the fiber cable into a fixture, etc. If necessary, align the output at low output power and then increase the output power gradually.

**CAUTION:**

If the output of the device is delivered through a lens with an anti-reflection coating, make sure that the lens is of good quality and clean. Any dust on the end of the collimator assembly can burn the lens and damage the laser. Check the quality of the spot emitted from the laser output at low power levels using an infrared viewer and then gradually increase the output power.

**CAUTION:**

Do not expose the device to a high moisture environment.

**CAUTION:**

The device has a fan for active cooling. Make sure there is sufficient air-flow to cool the device. Any objects that cover the ventilation holes must be removed.

**CAUTION:**

DO NOT operate fiber laser BELOW 20 kHz or ABOVE 80 kHz. Doing so will cause permanent damage to optical output fiber.

**CAUTION:**

Wait at least 3 minutes after switching on the device before enabling maximum emission.
3. Description of Your Device

Certification

Laser Photonics LLC certifies that this instrument has been thoroughly tested and inspected, and found to meet published specifications prior to shipping. Upon receiving your device check the packaging and parts for any possible damage that may have occurred in transit. If damage is apparent please contact Laser Photonics LLC immediately.

Accessories

Desk Top Configuration

<table>
<thead>
<tr>
<th>Items</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main power cord with plug</td>
<td>1</td>
<td>For connecting device to 100/240 VAC</td>
</tr>
<tr>
<td>Power ON/OFF security Keys</td>
<td>2</td>
<td>For switching ON/OFF electrical power</td>
</tr>
<tr>
<td>Shunt for REMOTE connector</td>
<td>1</td>
<td>To bypass remote functions</td>
</tr>
<tr>
<td>User’s Guide</td>
<td>1</td>
<td>This Document</td>
</tr>
</tbody>
</table>

19” Rack Mount Configuration

<table>
<thead>
<tr>
<th>Items</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main power cord with plug</td>
<td>1</td>
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<td>Power ON/OFF security Keys</td>
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<tr>
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<td>1</td>
<td>To bypass remote functions</td>
</tr>
<tr>
<td>User’s Guide</td>
<td>1</td>
<td>This Document</td>
</tr>
</tbody>
</table>
Front/Rear Panel Drawings

Front Panel of Module

Rear Panel of Module
Output Collimator

Output Collimator Dimensions

[Diagram of Output Collimator Dimensions]
## Device Controls/Display

<table>
<thead>
<tr>
<th>Controls brief description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. STOP Button</td>
<td>Shuts down the laser emission and makes laser off-power</td>
</tr>
<tr>
<td>2. START Button</td>
<td>Switch on the laser without emission. Works ONLY when 24VDC applied to “Remote” connector (see below)</td>
</tr>
<tr>
<td>3. POWER ON/OFF Keyswitch</td>
<td>Main POWER ON/OFF security keyswitch</td>
</tr>
<tr>
<td>4. Power ON indicator</td>
<td>Indicate Main Power ON</td>
</tr>
<tr>
<td>5. LASER POINTER</td>
<td>Switches the LASER POINTER ON/OFF</td>
</tr>
<tr>
<td>6. EMISSION</td>
<td>Laser Beam ON/OFF</td>
</tr>
<tr>
<td>7. READY</td>
<td>Indicate the preliminary amplifier Runningchecks</td>
</tr>
<tr>
<td>8. OVERHEAT</td>
<td>Indicate Laser Overheat</td>
</tr>
<tr>
<td>9. Air-fan inlets</td>
<td></td>
</tr>
<tr>
<td>10. Main Power switch</td>
<td>Main AC power switch</td>
</tr>
<tr>
<td>11. Air-flow outlets</td>
<td></td>
</tr>
<tr>
<td>12. OPTICAL OUTPUT</td>
<td></td>
</tr>
<tr>
<td>13. MAIN POWER AC INPUT with fuses</td>
<td>110/220V AC</td>
</tr>
<tr>
<td>14. CONTROL INTERFACE CONNECTOR</td>
<td>To apply power level, beam enabling, clock Q-switch, read back the power level etc.</td>
</tr>
<tr>
<td>15. REMOTE CONNECTOR</td>
<td>To switch 15VDC power supplies on; read laser ready status; switch on or off the laser remotely, and supply interlock circuit.</td>
</tr>
</tbody>
</table>

### “Remote” connector

Used to support remote ON/OFF function; series of interlock switches; READY status signal.

- Pins 1 & 2 – 24V output from internal 24VDC power supply (1 – “-”; 2 – “+”).
- Pins 3 & 4 – 24VDC interlock input (3 – “-”; 4 – “+”). To have internal interlock circuit be closed, besides of interlock switch, need to apply external 24VDC. This voltage can be taken from pins 1 & 2 (using bypass shunt).
- Pins 5 & 6 – 24VDC input to make remote switching on the unit (5 – “-”; 2 – “+”). Without this voltage, Fiber Laser internal 24VDC power supply (for the laser itself) will NOT be allowed to turn on. Button START will be ignored. This voltage can be provided from external 24VDC supply or from pins 1 & 2 (using bypass shunt).
- Pins 7 & 8 – Laser Ready status output (7 – “0V”; 8 – “24V or 0V”). When fiber laser is in operating temperature range and no Emergency Stop status present, all interlock switches are closed, EMISSION button is pressed, so there is ready-for-emission status gets active. As far as READY output is open-collector of optocoupler, so need to pull-up this output to some voltage.

For detailed information on how to use remote functions refer to Section “I/O Support”.

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## “Laser Control” connector

<table>
<thead>
<tr>
<th>Pin#</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D0</td>
<td>TTL - INPUTS. Uses to define the power level from 0 to maximum (depends from laser model). The range is h00-hFF (from 0 to 100% of power). For example, hFF value means maximum power; h7F – 50% of power; h3F – 25% of power; etc.</td>
</tr>
<tr>
<td>2</td>
<td>D1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>D2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>D3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>D4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>D5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>D6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>D7</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Beam ON</td>
<td>TTL - INPUT. Emission ON/OFF. 0V or disconnected – emission OFF; TTL-logic “1” – Emission ON</td>
</tr>
<tr>
<td>11</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
<td>Digital GND</td>
</tr>
<tr>
<td>14</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>+5VDC</td>
<td>Supplying voltage from internal power source.</td>
</tr>
<tr>
<td>16</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Power ON</td>
<td>INPUT. Remote power ON. 0V or disconnected – power off. 24VDC – power on.</td>
</tr>
<tr>
<td>18</td>
<td>Preamp</td>
<td>TTL-INPUT. AO modulator ON/OFF.</td>
</tr>
<tr>
<td>19</td>
<td>Freq. QSw</td>
<td>TTL-INPUT. Clock for Q-Switch. Fmin = 20kHz; Fmax= 80kHz</td>
</tr>
<tr>
<td>20</td>
<td>Pwr monitor</td>
<td>Analog OUTPUT. Represents power level. Current loop 4-20mA</td>
</tr>
<tr>
<td>21</td>
<td>Pwr_mon return</td>
<td>Analog GND</td>
</tr>
<tr>
<td>22</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Laser Ready</td>
<td>OUTPUT. 24VDC when laser is ready for emission. 0V when Emergency Stop or overheating or other internal problem. Electrically it is the same signal as at pin 5 of “Remote” connector</td>
</tr>
<tr>
<td>25</td>
<td>NC</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE 1:**
1) When laser is ready for emission, “Beam ON” signal must be applied at least 5 ms after applying “PreAmp” signal.
2) When switching emission off, signal “PreAmp” must go low at least 5 ms after falling edge of “Beam ON” signal.
3) Between falling edge and next rising edge of “PreAmp” signal must be at least 20 ms.

If timing requirements (1-3) are not provided from outside, internal logic will force signals “PreAmp” and “Beam ON” to meet those, which may cause emission start maximum 5ms later than “Beam ON” applying.

**NOTE 2:**
Q-Switch clock signal must be in range, specified in part 5 “Specifications” (Repetition Rate Range). If frequency of clock signal is out of range, or if there is no clock at all, internal logic will force it to meet the specified range or minimal acceptable frequency will be supplied.
4. Using Your Device

Device Setup

**CAUTION:**

1. Connect the power cord to the AC input outlet on the rear panel of the Laser Driver.

2. Connect bypass shunt to “REMOTE” connector. Or support remote functions according to section “I/O Support”.

3. Insert the key into the main power switch on the front panel of the Laser Driver, and turn it on.

4. Press START button.

5. The laser is now ready for operation.

6. Please refer to the Laser System Operation manual for further instruction.
5. Specifications

This section lists specifications of the product. Specifications describe warranted performance under the temperature range 25°C +/- 5°C and relative humidity <80% (unless otherwise noted). All specifications apply after the instrument’s temperature has been stabilized after 1 hour of continuous operation.

### Fiber Laser Performance Specifications

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>LPQ5-0.5</th>
<th>LPQ10-0.5</th>
<th>LPQ20-1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode of operation</td>
<td></td>
<td>pulsed</td>
<td>pulsed</td>
<td>pulsed</td>
</tr>
<tr>
<td>Energy per pulse (PRR = 20kHz)</td>
<td>mJ</td>
<td>0.5</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Polarization</td>
<td></td>
<td>random</td>
<td>random</td>
<td>random</td>
</tr>
<tr>
<td>Central emission Wavelength</td>
<td>nm</td>
<td>1060-1070</td>
<td>1060-1070</td>
<td>1060-1070</td>
</tr>
<tr>
<td>Emission bandwidth (FWHM)</td>
<td>nm</td>
<td>&lt;5</td>
<td>&lt;3</td>
<td>&lt;3</td>
</tr>
<tr>
<td>Pulse width (FWHM)</td>
<td>ns</td>
<td>60-80</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Pulse Repetition Rate*</td>
<td>kHz</td>
<td>20-80</td>
<td>20-80</td>
<td>20-80</td>
</tr>
<tr>
<td>Nominal average output power</td>
<td>W</td>
<td>5</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Output power range</td>
<td>%</td>
<td>10-100</td>
<td>10-100</td>
<td>10-100</td>
</tr>
<tr>
<td>Long term power stability</td>
<td>%</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Typical beam quality, M²</td>
<td></td>
<td>1.4</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Output fiber delivery length</td>
<td>m</td>
<td>Up to 5</td>
<td>Up to 5</td>
<td>Up to 3</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>VAC</td>
<td>110/220</td>
<td>110/220</td>
<td>110/220</td>
</tr>
<tr>
<td>Max. power consumption</td>
<td>W</td>
<td>150</td>
<td>160</td>
<td>220</td>
</tr>
</tbody>
</table>
6. Warranty

General Warranty

All products are warranted by Laser Photonics LLC against defects in materials and workmanship for the period of time as set forth on the applicable purchase order or in the specifications starting with the date of shipment. In the absence of a specified period of time, such warranty is one year from date of Laser Photonics LLC shipment. Laser Photonics LLC also warrants that this product will meet the agreed upon specifications during the warranty period under normal use.

Laser Photonics LLC shall, at its option, repair or replace any product that proves, in the reasonable opinion of Laser Photonics LLC, to be defective in materials or workmanship during the warranty period. All products repaired or replaced under warranty are only warranted for the remaining unexpired period of time in the original warranty for the particular defective product. Laser Photonics LLC reserves the right to issue a credit note for any defective products that have proved defective through normal usage. This warranty supersedes any warranty in any applicable terms and conditions.

Warranty Limitations

This warranty excludes products, parts (including fiber connectors) or equipment which have been tampered with, opened, disassembled or modified by persons other than Laser Photonics LLC personnel, as well as misused, neglected, or damaged by accident, used in applications which exceeds their specifications or ratings, used outside of environmental specifications for the product, used with buyer software or interfacing improperly installed, maintained or otherwise abused or used other than in accordance with the information and precautions contained in this User's Guide. It is the customer's responsibility to understand and follow operating instructions in this User's Guide and specifications prior to operation—failure to do so will result in voiding this warranty. Accessories and fiber connectors are not covered by this warranty.

Buyer must claim under the warranty in writing no later than 30 days after the claimed defect is discovered. This warranty does not extend to any third party, including without limitation Buyer's end-users or customers, and does not apply to any parts, equipment or other products not manufactured by Laser Photonics LLC.

Driver Software

Any driver software provided now or in the future is provided solely under non-exclusive license from Laser Photonics LLC. By using the software, you agree to the terms herein. The driver software is protected by trade secret laws, United States copyright laws and international treaty provisions. Laser Photonics LLC reserves all ownership rights. The owner of the device may only use the driver software, only with the product(s) identified by Laser Photonics LLC, and may make duplicate copies of the software solely for archival backup purposes. Any alterations of the driver software will void the warranty on the equipment provided by Laser Photonics LLC.

The driver software is provided “as is” with no warranties whatsoever, whether express or implied, including the warranties of fitness for a particular purpose. Laser Photonics LLC does not warrant that the functions contained in the software will meet the user's requirements or that the operation of the equipment or driver software will be uninterrupted or error free. Not all driver software has gone
through Laser Photonics LLC’s normal quality control for product purposes, but is provided to users as an accommodation to respond to their requests. End-user support is not implied or provided, and you are assumed to have working knowledge of a particular development language. Laser Photonics LLC may make changes to the driver software and has no obligation to distribute newer versions.

The use of any other software will void the warranty on the equipment provided by Laser Photonics LLC.

**Exclusive Remedies**

The remedies provided herein are buyer’s sole and exclusive remedies. In no event shall Laser Photonics LLC, be liable for direct, indirect, special, incidental, consequential, exemplary or punitive damages (even if advised of the possibility of such damages) arising from our relating to the product (including, loss of profits) whether based on contract, tort or any other legal theory. Laser Photonics LLC’s maximum liability will not exceed, in the aggregate, the total amount paid for the product by buyer.

Except for the limited warranties expressly set forth above, Laser Photonics LLC, specifically disclaims any and all other warranties to buyer, including without limitation, any and all implied warranties, such as freedom from infringement, merchantability and fitness for a particular purpose.

**Service and Repairs**

**CAUTION:**

No operator serviceable parts inside. Refer all servicing to qualified Laser Photonics LLC personnel. All requests for repair or replacement under this warranty must be made within 30 days after the defect has been noticed and must be directed to Laser Photonics LLC or its representative in your area. Items authorized for return by us must be returned in a suitable container.

Any damage noted upon receipt of the unit must be documented for appropriate claim against the carrier.

**IMPORTANT**

Never send any product back to Laser Photonics LLC without a Return Merchandise Authorization (RMA).

The customer will be charged for the cost of repairing the product if the product is not under warranty or if the repair is not covered under the warranty.

**CHANGES:**

We reserve the right to make changes in design or construction of any of our products at any time without incurring any obligation to make changes or install the same on units previously purchased.

**INSTRUCTIONS FOR PRODUCT RETURNS:**
Laser Photonics LLC will only accept returns for which an approved Return Material Authorization (RMA) has been issued by Laser Photonics LLC. You must first call the Quality Manager of Laser Photonics LLC at 407-829-2613 to discuss the return and request a RMA number. You must return defective products freight prepaid and insured to Laser Photonics LLC at the address shown herein. All products which have returned to Laser Photonics LLC but which are found to meet all previously applicable specifications for such products or which indicate damage to the fiber connectors not resulting from defect in manufacturing or use not in accordance with this Users Guide, shall be subject to Laser Photonics LLC’ standard examination charge in effect at the time and these costs shall be charged to the Buyer. All products returned to Laser Photonics LLC which are not accompanied by an itemized statement of defects, shall be returned to the Buyer at the Buyer’s expense and Laser Photonics LLC shall not carry out any evaluation of such products. Laser Photonics LLC warrants to Buyer that its services, labor and replacement parts, assemblies and modules will be free of defects in material and workmanship for ninety (90) days from the date of shipment or performance of services.

Warranty Returns - Domestic & *International Buyers should pay for one-way freight costs to Laser Photonics LLC. Laser Photonics LLC will reimburse Buyers for applicable reasonable third-party freight costs and Laser Photonics LLC will pay for freight return cost back to the Buyer.

Non-Warranty Returns - Domestic & *International Buyers are responsible for two-way freight costs. If shipment consists of returns that are both warranty and non-warranty, the shipment will be considered as non-warranty. Any UNAUTHORIZED shipments billed to Laser Photonics LLC without authorization will be re-invoiced to the Buyer. Confirming purchase orders are required for non-warranty returns.

*International Returns must include applicable DUTIES AND TAXES, and you must mark air bills with “U.S. GOODS, RETURNED FOR REPAIR”. In any event, where Laser Photonics LLC accepts a shipment, Laser Photonics LLC will invoice to the Buyer for any charges as stated above.

Returns for credit will not be accepted unless authorized in advance, in writing by Laser Photonics LLC, in accordance with Laser Photonics LLC’s Terms and Condition. In most cases, restocking fees will apply.
All returns must be packaged adequately to avoid damage during shipment. Complete packing list with product model and serial number will insure prompt repair, if the other terms of this form are followed.

Read the User’s Guide and see the Laser Photonics LLC Terms and Conditions for the applicable warranty for the products before you request the return of the products.
7. Troubleshooting

Problem: Main Power Is ON, But Fiber Laser Unit Will Not Run

Possible Solutions
- Verify all connections are made as described previously in the Operator's Manual
- Check to make sure ALL AC connectors are properly connected to appropriate AC power source
- Verify KEY is turned to the ON position and depress the green START button
- Verify green “Power” indicator is on
- Make sure bypass shunt is connected to REMOTE connector, or verify +24VDC is applied to pin 3 and GND is connected to pin 1 of “REMOTE” connector. Only after that “ON” button will operate.
- If power is on, but fiber unit will not lase – confirm one of the following:
  i. Lens cover is removed
  ii. EMISSION button is pressed and.
  iii. Bypass Shunt is connected to REMOTE connector, or series of interlock switches is closed and interlock circuit is supplied with 24VDC (refer section “I/O Support”).
  iv. In case of customizing remote function, make sure POWERON voltage is supported to pins 5&6 of REMOTE connector (refer section “I/O Support”).
  v. Fiber Laser Output Collimator is installed properly.
  vi. During lasing make sure “READY” indicator is on. If not:
  vii. Check for programming errors in FiberScan software

Problem: Pointer For Setting Up Parts/Programs Will Not Turn On

Possible Solutions
- Verify GUIDE button is pressed and EMISSION button is released;
- If DIODE POINTER button is pressed, but beam isn't visible – verify lens cover is removed