

QTFS-405-LD DATASHEET

Date: 3.30.2011

CUSTOMIZED FIBER-COUPLED IR LASER SOURCE

Model QTFS-405-LD/ LD-04-410

S/N SAMPLE

Test data

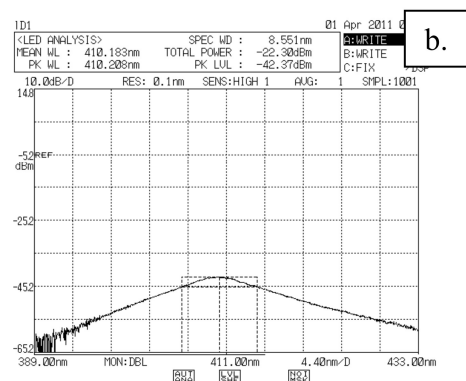
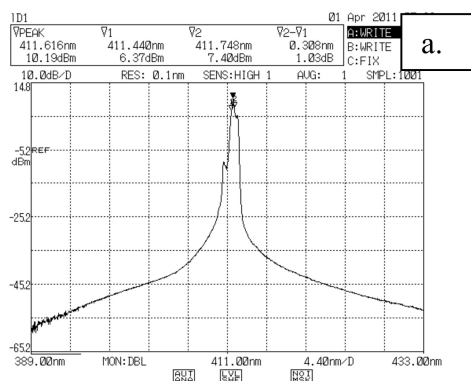
Part Number:	LD-04-410
Unit Number:	SAMPLE
Package type	AL-IV
Cooling system	Active/TEC
Fiber pigtail:	AFS105/125
Output fiber receptacle type	FC/PC
Output power control	single turn knob
Wavelength stabilization type	2APS
Laser driver/TEC	included
Operating wavelength, nm*	~411.6
Spectral (FWHM) line-width, nm*	<0.5
Cold start module wavelength nm*	~411.5
Long-term operating wavelength drift, nm*	~±0.5
Ambient temperature, °C	20
Maximum optical power dBm**	~+19
Minimum optical power dBm**	~ -18
TEC set temperature, °C	~ +24C
Remote control voltage (RCA-connector) , V***	+ (4.5 to 5.0)
Power consumption, VA*	DC: ~12/5V / 0.9A
Operating temperature range, C	10 to 30

* Measured at maximum operating power

** Power is measured at the output of ~ 1 meter long FC/PC-FC/APC connectorized fiber connected to the module fiber receptacle

*** Impedance of remote control input is ~ 500 Ohm. Input is driven using positive voltage pulses. Max repetition rate: ~ 1.1 kHz (square pulses)

Spectra and « On/Off » remote control



Uncalibrated laser spectra, measured at the end of FC/PC-FC/APC mm fiber patch cord using OSA (a) maximum drive current and (b) minimum drive current.

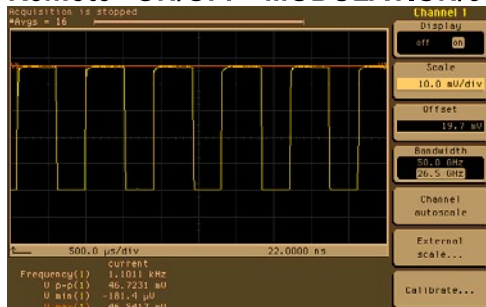
QTFS-405-LD DATASHEET

WARNING: THIS IS CLASS IIIB LASER DEVICE! VISIBLE LASER RADIATION IS EMITTED FROM THE OPTICAL ADAPTER OF THE LASER SOURCE. ALWAYS USE EYE PROTECTION WHEN WORKING WITH THE LASER!

-- STATICS SENSITIVE DEVICE!

-- USE ONLY FC/PC CONNECTORIZED (BLACK-COLORED CONNECTOR SLEEVE) MULTI-MODE OPTICAL PATCH-CORD FOR CONNECTION TO THE SOURCE.

Remote "ON/OFF" MODULATION/control



Optical waveform of light from laser source (Model LD-04-410) operating in remote control mode, measured through ~1 m long FC/PC-FC/APC connectorized multi-mode (105/125 μm) fiber extension patch-cord, using an oscilloscope and Si detector. Remote control positive polarity pulses voltage is $\sim +5\text{V}$, $f \sim 1.1\text{ kHz}$.

Equipments used in testing

OSA:

AQ-6315A (ANDO)

Wavelength meter:

TQ8325c (Advantest)

Oscilloscope:

54750A (Agilent)

Optical power meter:

ML910B (Anritsu)

Temperature measurement

Multiscan 1200 (Omega)

Pulse generator

9100 (LeCroy)

Optical splitter

ODB-1 (WT&T)

Photo receiver:

TIA-500 (TTI)

Objective:

Model-011 (WT&T)

Optical field measurement:

BeamScan (Photon Inc.)

T&M/Quality control:

Operator 4

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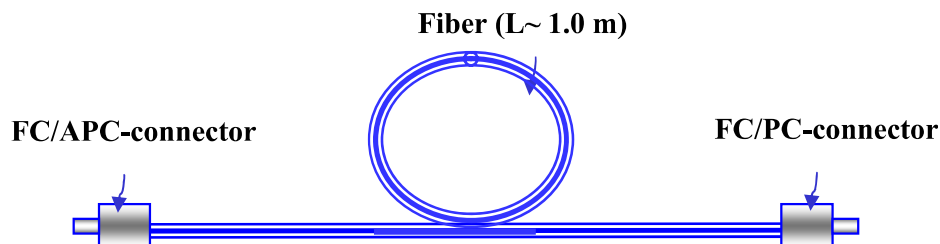
CUSTOMIZED PATCHCORD

Model 3QPL-RD0411_2

Test data

Part Number:	Multi- mode optical fiber patch-cord
Unit Number:	MM116
Fiber	AFS (105/125 μ m);
N.A.	~0.22
Operating wavelength range	~400-1800 nm
Connectors	FC/PC-FC/APC
Fiber protection	3 mm tube
Fiber length (m):	~ 1.0
Optical insertion loss , dB*	~ 0.6
Return loss, dB:	-45

* Insertion loss includes loss on FC-adapters Measured at wavelength of ~ 410 nm.



Equipments used in testing

Fiber -coupled LED:	LE-04 @405 nm (WT&T)
Fiber-coupled laser:	LD-04-410 @410 nm (WT&T)
Far field:	BeamScan (PhotonControl Inc)
Connector check:	Nikon
T&M/Quality control:	Operator 1

Warning: Clean connectors of patch-cord before use.

Do not touch connectors when laser source is "on".

When coiling the fiber, keep coil diameter larger than 15 cm.

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CUSTOMIZED FIBER-COUPLED LASER SOURCE

MODEL QTFS-405-LD/LD-04-410

Instruction/User Manual



This laser product is built and sold as a component or module for incorporation into other equipment. The purchaser assumes responsibility to comply with all applicable laser safety regulations with respect to the use of this laser and its introduction into commerce. Item is RoHS compliant.

- Please read the entire manual prior to use
- Please keep this manual with LD-04-410

Issue 1.2, April 2011

CLASS IIIB laser product

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1. Safety Information and Instructions


This manual contains operating and maintenance instructions for the LD-04-410 medium power visible (soft UV) multi-mode fiber coupled laser source. Please review this manual carefully before operating.

1.1 Safety Information

The following safety instructions must be observed whenever LD-04-410 visible/soft UV spectra laser source is operated, serviced or repaired. Failure to comply with any of these instructions or with any precaution or warning contained in the User's Manual is in direct violation of the standards of design, manufacture and intended use of the instrument. QPhotonics, LLC. assumes no liability for the customer's failure to comply with these safety requirements.

1.2 Safety Messages

The following messages may appear in the User's Manual. Please observe all safety instructions that are associated with this message.


WARNING	The procedure can result in serious injury or loss of life if not carried out in proper compliance with all safety instructions. Ensure that all conditions necessary for safe handling and operation are met before proceeding
CAUTION	The procedure can result in serious damage to or destruction of the instrument if not carried out in compliance with all instructions for proper use. Ensure that all conditions necessary for safe handling and operation are met before proceeding
	Refer to the User's Manual for instructions on handling and operating the instrument safely.



Please contact QPhotonics, LLC. (www.qphotonics.com) with any questions related to any subjects described within this manual.


In no case will QPhotonics, LLC. be liable to the buyer, or to any third parties, for any consequential or indirect damage, which is caused by product failure, malfunction, or any other problem.

1.3 WARNINGS and CAUTIONS

 WARNING
In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
Laser source must be unpacked at ESD protected work station
Use only the cords provided with LD-04 modules and original wall plug power supply. Using inappropriate cords or extending the cords may cause them to heat up abnormally and may cause fire.
Do not look into a fiber or optical connectors of LD-04-410 laser module during operation. Wearing appropriate protection goggles is required. Do not expose skin to laser radiation. This is Class IIIB laser product.
Never touch the output fiber connector when LD-04-410 is powered on. Doing so may cause device damage and represents serious hazard for your health.
Do not operate equipment, which may generate high frequency surge energy near LD-04-410 laser source or power supply.
Do not disassemble the instrument. The LD-04-410 modules contains no user serviceable parts.
Turn the laser safety key switch “OFF” and power control knob to “Minimum” position before connecting instrument MAINS. Not doing so will cause device damage.
Avoid soaking the LD-04-410 modules with water or any other liquids and operating instrument in high humidity environment. Doing so may cause fire, electrical shock or malfunction.
Do not use inappropriate MAINS voltage (currently it is only 110 V, 60 Hz). Doing so may cause fire, electrical shock or malfunction.
Do not insert or drop any metal or any flammable material into any modules of LD-04-410 through any aperture. Doing so may cause fire, electrical shock or malfunction.
Do not remove any screws and panels of LD-04-410 modules. Some parts generate high voltage. Removing screws and panels may cause electrical shock.
If abnormal sounds or extra high temperatures are observed, turn off the power, disconnect the power cords and contact QPhotonics, LLC. Continuing to operate

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under these conditions may cause fire or electrical shock.
Do not use a damaged power cord where the inner cable is exposed or severed. Doing so may cause fire or electrical shock.
If water or any other liquid is spilled into any modules of LD-04-410, turn off the laser power switch, disconnect power cords and contact QPhotonics, LLC. Continuing to operate under these conditions may cause fire or electrical shock.
If smoke or strange smells are observed turn off the power switch, disconnect power cords and contact QPhotonics, LLC. Continuing to operate under these conditions may cause fire or electrical shock.
If any modules of LD-04-410 are dropped and damaged, turn off the power switch, disconnect power cords and contact QPhotonics, LLC. Continuing to operate under these conditions may cause fire or electrical shock.

 CAUTION
Do not place LD-04-410 on an unstable or inclined surface. There is a possibility that instrument modules will fall and cause injury.
Disconnect all cords when moving LD-04-410. Failure to do so may damage the cords, which may cause fire or electrical shock. Follow standard static safety precautions, when moving device.
Do not place the electrical or optical cords around any heating instrument. Doing so may damage the cords, which may cause fire or electrical shock.
Do not connect or disconnect electrical cords with wet hands. Doing so may cause fire or electrical shock.
Do not pull electrical cords to disconnect. Doing so may damage the cords, which may cause fire or electrical shock. Hold the plug portion and disconnect the cords.
Do not put heavy items on the cords. Doing so may damage the cords, which may cause fire or electrical shock.
Do not modify the cords and do not over-bend, over-twist, or over-stretch the cords. Doing so may damage the cords, which may cause fire or electrical shock.
Ensure that the cords are disconnected when storing LD-04-410. Ensure that optical connector on laser module is closed with cap when not in use or when storing.
Do not bend optical patch-cord. Doing so might damage patch-cord fiber or results in reduction of optical power.

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Do not bend optical patch-cord. Doing so might damage patch-cord fiber or results in reduction of optical power.
--

Store LD-04-410 in a cool dry place

Use only FC/PC optical adapter/connector to connect optical fiber to LD-04-410 output receptacle. <i>Perform optical connections only when device is powered off.</i> Try to avoid unnecessary disconnections, if possible. Keep optical connectors and receptacle protected with provided caps when the laser module is not in use.

POWER REQUIREMENTS

The LD-04-410 can operate from any single-phase AC power source that supplies between 100 and 120 V at a frequency of 50-60 Hz. Please check instrument power supply voltage rating before connecting to the power source.

1.4 CORDS

The power supply module of LD-04-410 uses a three-wire power cords. Connection between the laser module and external interlocking circuits is performed using the wire cord #2, having RCA connector. Use RCA connectorized 2 wire cords to connect device to external "ON/OFF" remote control signal source.

1.5 TOXIC HAZARDS

Under normal conditions of use, storage and handling the LD-04-410 modules presents no toxic hazards. However, under the following conditions, certain precautions are necessary.

1.5.1 INCINERATION

Some of the electronics components and parts of enclosures are containing resins and other chemicals that can produce toxic fumes during incineration.

1.5.2 ACIDIC OR CAUSTIC COMPOUNDS

Some of the electronics components included in the assembly, particularly electrolytic capacitors, contain acidic or caustic compounds. In the event that damaged component come in contact with the skin, wash the affected area immediately with cold water. In the event of eye contamination, irrigate thoroughly with recognized eyewash and seek immediate medical assistance.

1.5.3 PHYSICAL DAMAGE

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Some of components used in assembly may contain very small quantities of toxic materials. There is remote possibility that physically damaged electronic components may present a toxic hazard. As a general precaution, avoid unnecessary contact with damaged electronic components and arrange for disposal in accordance with local regulations.

2. General Information

LD-04-410 is a medium power customized multi-mode fiber-coupled laser source, operating at typical wavelength of ~400-415 nm, designed for different laboratory applications demanding medium-power laser light. Light from LD-04-410 is delivered through a multi-mode fiber output FC/PC receptacle and FC/PC to FC/APC optional hybrid fiber patch-cord. Light emerging from FC/APC side of multi-mode fiber patch-cord can be collimated or focused at different distances using optional compact fiber lens collimators (Model-014, Model 011-TU2 and Model 015)

Laser source has internal temperature control, safety interlock and external remote “ON/OFF” control circuits, power controller knob and active air- cooling system. Optional accessories allow coupling laser light to optical fibers, having different optical core diameter, focusing of light into small volumes/spot size. . Laser source has good short- and long-term wavelength stability, low sensitivity to vibrations and good optical power stability, significantly improving signal-to-noise ratio of optical processing and test/measurement systems.

3. Specifications and Components

3.1 Standard Specifications

Description	Min	Typical	Max	Unit
Operating wavelength	400	410	415	nm
Output power	3	50	100	mW
Output fiber receptacle style		FC/PC		
Output fiber core/cladding diameter	mm fiber 62.5/125 um or 105/125 um			
Power consumption	35	45	55	VA
Electrical	100	110	240	V
Dimensions		280 x195x 40		mm
Operating temperature	10	23	35	°C
Storage temperature	0	25	65	°C
Humidity (non-condensing)			85	%R.H

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Number of outputs		1	2	
Spectral width (FWHM)	0.3	3.5	12.0	nm

3.2 Components

Part	Part Number	Quantity
LD-04-410 laser module	LD-04-01	1
User's Manual	LD-04-02	1
Optional components		
External power supply with power cord	LD-04_PC 1	1
Cable 2 (connection to interlock)	LD-04-C2	1
Cable 3 (connection to external remote circuits)	LD-04-C3	1
Optical fiber collimator	M -014/011-TU2 or 015	1
FC/PC- to FC/PC connectorized patch-cord	LD-04-O-01	1
FC- adapter	LD-04-O-02	1
FC/APC-to-FC/PC cross-connection patch cord	LD-04-03	1
“Bulet” bare fiber adaptor	BULET	1
Ultra-splice bare fiber connector	US	1
Micro- lensed mm fiber pigtail	BLx	6

Recommended consumables

It is recommended to keep the following items with the LD-04-410:

- Protective eye glasses
- IPA and lint-free tissue
- Connector's cleaner and receptacle cleaning tools
- Fiber inspection microscope

4. External description

4.1 Laser source module LD-04-410



Front view

Side view

Back view

- **Laser source module** is shipped to end-users assembled as shown in the figure above. The assembly consists of the LD-04-410 module with high-quality FC/PC connectorized fiber receptacle. Front and back panels of the laser source module are made from dielectric material, partially coated with conductive foil. Electrical connection between the laser source module and external power supply is performed using cable through 5 pins connector mounted on the back of the laser source. Security key and laser operation mode selection switch are used to enable laser source. When security key turned clock-wise (white dot), laser is enabled. Laser source output power is controlled using a single (or 10) turn knob, positioned at the front panel of the module. Two lamps on the front panel are indicating normal operation of the TEC and semiconductor laser. Operation of the laser in local or remote control mode is selected using two positions switch at the front panel.

FRONT PANEL:



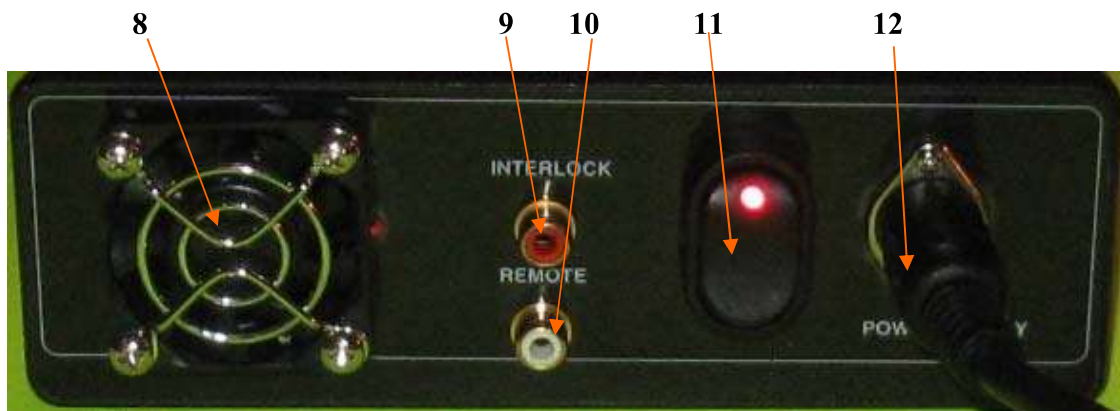
Laser source module (LD-04-410) controls are:

- | | |
|---|-------------------|
| (1) Indicate operation of the laser TEC | (green LED “TEC”) |
| (2) Laser enable/disable safety key | (OFF/white dot) |

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- | | |
|--|--------------------------------|
| (3) Switch laser power OFF/MAXIMUM/control | (3 posit switch “REG/OFF/MAX”) |
| (4) Select laser control Local-Remote (opt.) | (“LOC/REM”) |
| (5) Indicate that laser is “ON” | (green LED “LASER ON”) |
| (6) Regulates laser output power | (knob “POWER”) |
| (7) Output fiber receptacle | (“OUTPUT”) |

BACK PANEL



- | | |
|--|-------------------|
| (8) Air cooling fan (intake) | |
| (9) Connection to INTERLOCK circuits | (“INTERLOCK”) |
| (10) Remote control signal input | (“REMOTE”) |
| (11) Switching “On/Off” module/TEC | (“ON/OFF” switch) |
| (12) Connect module to external power supply | (“Power Supply”) |

4.2 Optional modules/components

REMOTE laser power “ON/OFF” control. LD-04-410 can be equipped with laser power remote “ON/OFF” control input. Remote control input has ~500 Ohm impedance and can be triggered using 4 to 5 V positive polarity voltage signal ($I < 10$ mA). When remote control signal voltage is zero, laser power is disabled. Remote control can operate at repetition rate of up to ~1 kHz

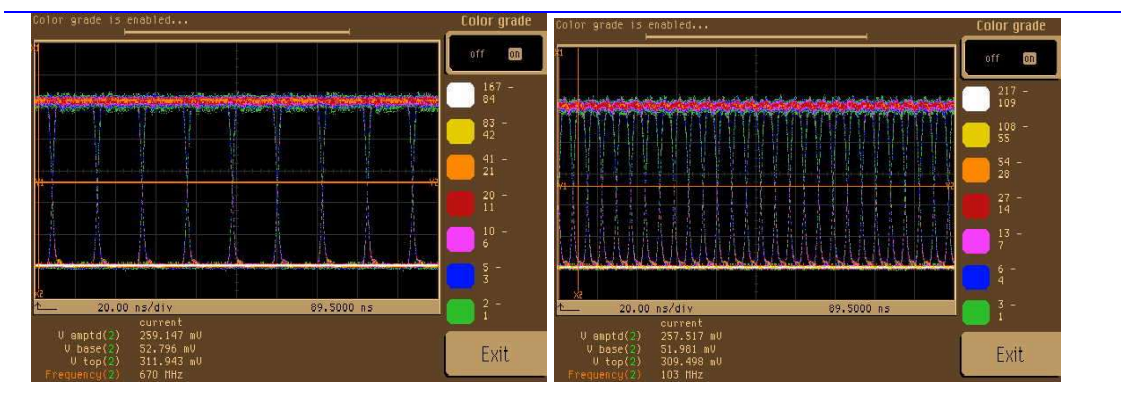
RF modulation input: LD-04-410 can be fitted with 50 Ohm impedance matched RF modulation circuits, providing RF/analog modulation of the laser output power in the frequency range of ~ 20kHz-50 MHz. Different signal sources, having 50 Ohm matched impedance can be used to drive the RF laser modulation port. Modulation depth is proportional to the voltage of the RF source. Linearity of the modulation is a function of

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the average power emitted by the laser source. Typically linear modulation with 3-6 dB depth can be achieved when laser is working at half of output power.

Also, signal from digital pattern generators can be used to drive RF port of the laser source. The waveforms of the output light for laser source modulated using pattern generator is shown below:

Bit rate : 22.29 Mb/s

68.5 Mb/s

FC/PC connectorized multi--mode fiber patch-cord used for connection between laser source module and other optical fiber components/modules. Choice of fiber core diameter: 62.5 μm ; 105 μm ; 200 μm . Fiber protection: 3 mm or 0.9 mm tubing.

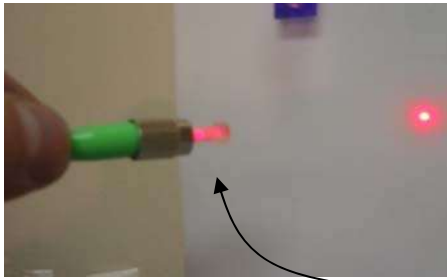
Fiber patch-cords are also available with FC/PC input and FC/APC output connector.

FC/(A)PC adapter used for connection between FC/(A)PC connectorized single mode optical cables.



Optical fiber collimator (model 014; 011-TU2; 015) provides collimation or focusing of light emitted from the end of FC/(A)PC connectorized extension patch-cord. Model 011-TU2 and Model 014 fiber collimators can be directly mounted on FC/APC or FC/PC connector at the end of the optical fiber patch cord. Model 015 collimator has fixed single mode fiber pigtail with FC-style connector. Model 015 can be supplied as collimator or focuser with factory pre-set position.

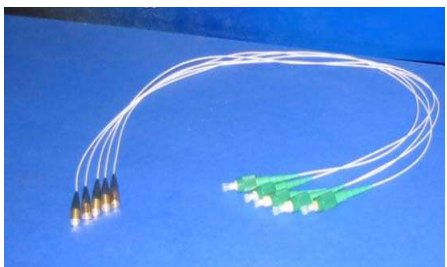
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Model 011-TU2 focusable miniature fiber collimator

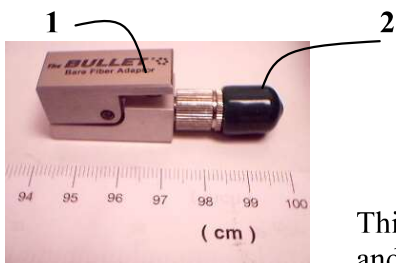


Model 014 focusable fiber collimator



Model 015 fiber pigtailed collimators with pre-set focusing or collimation.

“BULET” bare fiber adapter



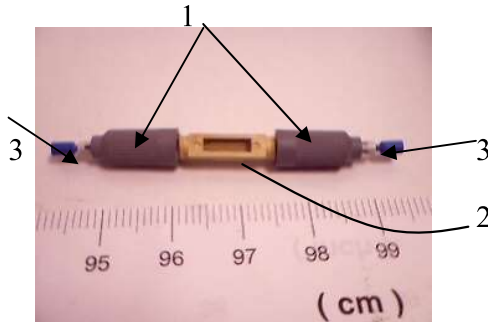
This adapter can accommodate single or multi-mode striped and cleaved fibers, having diameter of 125 μm exactly.

It provides simple and fast way to put bare cleaved fiber in connection with FC/PC (black color sleeve) connectorized patch-cord, using standard FC-FC adapter. To load stripped and cleaved fiber into adapter, push at point 1 and insert fiber through the hole at the left

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side of adapter until fiber will be seen from the connection side 2. Level the fiber end inline with the ferrule end. Release clamp 1.

“Ultra-splice”: bare cleaved fiber mechanical connector.



Ultra-splice is a high precision mechanical connector of two stripped and cleaved fibers, having diameter of 125 μm exactly. It has index-matching gel filled capillary tube, having inner diameter of 126 μm . To load the fibers, remove blue protectors. (3) and unscrew fiber clamps (1). Insert first fiber into the capillary to reach approximately center of the capillary (2) and fix the clamp 2 in place. Insert second fiber and put fibers in a contact. Fix the fiber into connector by returning second fiber clamp (1) into original position.

Micro-lensed multi-mode optical fiber pigtail (FC-connectorized): is used for delivery of collimated or focused light into extremely small volumes or devices. Please visit QPhotonics, LLC.'s website (www.qphotonics.com) for great selection of micro-lensed optical fibers.

Optical connectors and laser receptacle cleaning kit: comprise set of FC receptacle cleaners and CLETOP REEL Type A optical fiber connectors cleaner.

5. Working with laser source

5.1 Initial Inspection and electrical cords connections

1. Please inspect the shipping container for any indications of excessive shock to the contents.
2. Package must be unpacked at ESD protected workstation.
3. Inspect the contents of shipping container to ensure that shipment is complete
4. Visually inspect delivered parts of LD-04-410 and all accompanying components and cables for structural damage.

Please inform QPhotonics, LLC. immediately and, if necessary, the carrier, of any damage to LD-04-410 components, defective or missing parts, or if the LD-04-410 does not pass initial visual inspection.

WARNING

To avoid electrical shock, do not initialize or operate LD-04-410 if there is any sign of damage to any of the components.

5.2 Assembly of the LD-04-410 and laser source operation:

WARNING: Please unpack device on ESD protected workstation. Use all necessary ESD protection measures, when working with device.

- After unpacking, place laser source on the flat surface and make sure that ventilation holes are not obstructed.
- **Make sure that the “Power” switch (11) at the back panel is in the “Off” position. Power control knob (6) turned fully anti-clock-wise (minimal output power), turn security key (2) is in “OFF” position (fully anti-clock-wise) and put switch (4) in “LOC” position.**
- Unpack optional fiber patch-cord. Clean, if necessary FC- connectors, using fiber cleaner. Connect FC/PC side (black boot) of fiber patch-cord into laser source FC-receptacle. Connect other side of fiber patch-cord (FC/APC – green boot) to testing equipment/measurements setup.
- *If applicable:* Connect Fiber collimator to FC/APC connector of fiber extension patch-cord. Avoid bending and twisting of the fiber pigtail. *Optional fiber collimator is adjusted to certain position, as described in the Testing Report when shipped from QPhotonics, LLC.*
- *Connect interlock output of the laser source to your lab door safety switch. Laser source will be enabled without any delay every time when interlock circuit is closed (electrodes of RCA connector are shorted). Please consult with your local safety officer regarding interlock installation/connections. Please give a call to QPhotonics LLC if you have any doubts regarding interlock operation/connections.*
- Connect the laser source to external power supply module to the wall socket using cable 1. Put laser mode selection switch (3) in “OFF” position.
- Switch-on the laser using “Power” switch (11) at the back panel of the laser source. Green lamp “TEC” (1) will indicate that laser drivers are operational.
- Put switch (4) in “LOC” position

WARNING	Laser source can emit significant optical power. Always use protective goggles when laser source is on.
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- Insert safety key and turn it clock-wise. Put switch (3) in “REG” position.
- Laser is in operation. Red LED (5) will indicate that laser is emitting power.
- Set required laser output power using power regulation knob (6). Refer to the laser module testing report for laser output power vs. knob readings calibration curve (available for 10 turn power control knob version).

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- Turn front panel switch (3) in “MAX” position to set maximum output power delivered to laser source output receptacle. When switch (3) is set to position “MAX”, laser power control knob is disabled.

To operate laser in remote control mode,

- Connect external remote control positive polarity voltage source to “REMOTE” input (10) using provided RCA connectorized cable.
- Put front panel switch (4) to “REM” position. Laser will be enabled when +3 to +5V voltage is applied to “REMOTE” input (10). Allow source temperature to stabilize for up to ~45 seconds. When front panel switch (4) is in “REM” position, light output power from the source can be regulated using front panel “POWER” knob (6). The level of output power set using “POWER” knob is the same in internal and external (remote) control mode. The repetition rate of the remote control signal can be up to 1-2 kHz.
- DAC computer boards, most of pulse generators, computer-controlled 5 V power supplies and other similar devices, providing 4-5V positive polarity voltage (up to 10-15 mA current) can be used to provide remote control signal.

5.3 To switch laser source off:

- Reduce laser power to minimal value by turning power regulation knob (6) anti clock-wise the minimum power position.
- **Put switch (3) into position “Off”.**
- **Turn security key (2) in “OFF” position**
- Wait 10-25 seconds. Allow laser diode to cool down
- Put power switch (11) in “OFF” position
- Remove power cord from the wall plug (“Mains”).

5.4 Troubles shooting

In case if laser source emit low power or don't operate:

- Check if the LD-04-410 power is turned on (switch 11). In case if the LED indicating “TEC” state at the LD-04-410 front panel is not “ON”, check electrical connections between power supply and laser source module. Check safety interlock connection.
- Check if switch (4) is in “LOC” position.
- Make sure that safety key (2) is inserted and turned clock-wise to “white dot”.

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- Check if switch (3) is in “REG” position.
- Check integrity of safety interlock circuits.
- Clean the fiber receptacle and patch-cord connectors.
- For all other problems contact your LD-04-410 source representative or QPhotonics, LLC. directly.

WARNING	To avoid electrical shock, do not attempt open any LD-04-410 module. Contact QPhotonics, LLC. in case of problem
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6. Tips on how to keep laser source stability and output power high

In general, laser diodes (especially high power) are sensitive to light reflected back into the laser cavity from optical surfaces in the light path.. Take care to minimize the opportunity for light to be coupled back into the laser diode via the optical fiber. Here are some tips on how it can be done:

1. Use FC/APC connectors in your optical fiber setup. Clean connectors before every connection.
2. Don't bend the optical fiber. Even large diameter bends might affect output power and laser source line-width significantly. Keep fiber pigtail straight and adjust its position in space to achieve maximum output power.
3. Do not touch optical connector's ferrules.
4. Fix position of the fiber in your setup using “invisible tape”, when maximum power achieved.
5. Use polarization controller to achieve additional optical isolation. Level of optical reflection even from high quality Angled fiber connectors (FC/APC) is polarization dependant.
6. Make sure that light reflected from your setup is not entering aperture of the fiber collimator.
7. Make sure that the air-flow ventilation holes on the laser source module are not obstructed.

7. Maintenance Instructions

7.1 Fiber pigtail/patch-cord check.

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It is recommended to periodically test the quality of the fiber pigtail and patch cords, using back-reflection meter. The level of back-reflected signal should be in the range of $-25 \dots -35$ dB.

Also a simple way to check the quality of connectors is to observe far optical field emitted from the pigtail/patch-cord connectors, using white screen. Field distribution must have smooth round profile. Distortion of the field profile and reduced optical power indicates contamination (or damage) of optical connector.

7.2 Cleaning the fiber receptacle and extension patch-cords connectors

WARNING	To avoid laser source damage, switch power OFF and disconnect the power supply module from the laser source module before performing receptacle/ connectors cleaning. Contact QPhotonics, LLC. in case of problem.
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To clean the optical receptacle and connectors, please use fiber receptacle cleaning tools, ONLY IPA and fiber connector cleaning tool. Do NOT use acetone or any other solvents. Please visit www.qphotonics.com for more details.

7.3 Storage

To maintain optimum operating reliability, do not store the LD-04-410 modules in locations where the temperature falls below $+10^{\circ}\text{C}$ or rises above $+60^{\circ}\text{C}$. Avoid storing the LD-04-410 in environmental conditions that can result in internal condensation. Ensure that these temperature and humidity requirements are also met whenever the laser source is shipped.

8. Warranty and Return shipments to the QPhotonics, LLC.

WARRANTY

QPhotonics, LLC. warrants this instrument to be free from defects in material and workmanship for a period of 30 days from date of shipment/delivery. During the warranty period, QPhotonics, LLC. will repair or replace the unit, at our option, without charge.

LIMITED WARRANTY

QPhotonics, LLC. warrants that the products it manufactures and sells will be free from defects and materials and workmanship for a period of thirty days from the date of shipment. If any such product proves defective during the applicable warranty period, QPhotonics, LLC., at its option, either will repair the defective product without charge for parts and labor or will provide a replacement in exchange for the defective product. In order to obtain service under this warranty, the customer must notify QPhotonics, LLC. of the defect before the expiration of the warranty period and make suitable

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arrangements for the performance of service. In all cases the customer will be responsible for packaging and shipping the defective product back to the service center specified by QPhotonics, LLC., with shipping charges prepaid. QPhotonics, LLC. shall pay for the return of the product to the customer.

This warranty shall not apply to any defect, failure or damage caused by improper use of, or failure to observe, proper operating procedures per the product specification or operator's manual, or improper or inadequate maintenance and care. QPhotonics, LLC. shall not be obligated to furnish service under this warranty 1) to repair damage resulting from attempts by personnel other than QPhotonics, LLC.'s representatives to repair or service the product; 2) to repair damage resulting from improper use or connection to incompatible equipment; 3) to repair damage resulting from operation outside of the operating or environmental specifications of the product.

QPHOTONICS, LLC.'S LIABILITY FOR THE MERCHANTABILITY AND USE OF THIS PRODUCT IS EXPRESSLY LIMITED TO ITS WARRANTY SET OUT ABOVE. THIS DISCLAIMER AND LIMITED WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL REPRESENTATIONS AND WARRANTIES EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE, WHETHER ARISING FROM STATUTE, COMMON LAW, CUSTOM OR OTHERWISE. THE REMEDY SET FORTH IN THIS DISCLAIMER AND LIMITED WARRANTY SHALL BE THE EXCLUSIVE REMEDIES AVAILABLE TO ANY PERSON. QPHOTONICS, LLC. SHALL NOT BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF THIS PRODUCT, NOR ANY OTHER LOSSES OR INJURIES, WHETHER A CLAIM FOR SUCH DAMAGES, LOSSES OR INJURIES IS BASED UPON WARRANTY, CONTRACT, NEGLIGENCE, OR OTHERWISE. BY ACCEPTING DELIVERY OF THIS PRODUCT, THE PURCHASER EXPRESSLY WAIVES ALL OTHER SUCH POSSIBLE WARRANTIES, LIABILITIES AND REMEDIES. QPHOTONICS, LLC. AND PURCHASER EXPRESSLY AGREE THAT THE SALE HEREUNDER IS FOR RESEARCH USE ONLY AND NOT FOR CONSUMER USES AS DEFINED BY THE MAGNUSON-MOSS WARRANTY ACT OR SIMILAR STATE CONSUMER WARRANTY STATUTE.

Please contact QPhotonics, LLC. to purchase extended warranty.

Please contact QPhotonics, LLC. to obtain return authorization prior to shipping any modules to QPhotonics, LLC. The owner's name, and address, the model number and serial number of device, return authorization number, and an itemized statement of defects must be included with the device returned for repair.

Pack the item in original transportation container and suitable protective box to prevent damage to the delicate instrument. Seal the shipping container securely and clearly mark FRAGILE on its surface.

Return shipments to the QPhotonics, LLC.

If instrument is to be shipped to QPhotonics, LLC. for repair or service, be sure to:

1. Obtain a Return Merchandise Authorization number (RMA) from QPhotonics, LLC. Customer Service.
2. Attach a tag to the instrument identifying the owner and indicating the required service or repair. Include the instrument serial number from the rear panel of the

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instrument. An itemized statement of defects must be included with the device returned for repair.

3. Attach the anti-static protective caps that were shipped with the instrument and place the instrument in a protective anti-static bag.

4. Place the instrument in the original packing container with at least 3 inches (7.5 cm) of compressible packaging material. Shipping damage is not covered by this warranty.

5. Secure the packing box with fiber reinforced strapping tape or metal bands.

6. Send the instrument, transportation and brokerage pre-paid, to QPhotonics, LLC. Clearly write the return authorization number on the outside of the box and on the shipping paperwork. QPhotonics, LLC. recommends you insure the shipment.

If the original shipping container is not available, place your instrument in a container with at least 3 inches (7.5 cm) of compressible packaging material on all sides.

Repairs are made and the instrument returned transportation pre-paid. Repairs are warranted for the remainder of the original warranty or for 30 days, whichever is greater. The owner's name, and address, the model number and serial number of LD-04, return authorization number, and an itemized statement of defects must be included with the device returned for repair.

Claims for Shipping Damage

When you receive the instrument, inspect it immediately for any damage or shortages on the packing list. If the instrument is damaged, file a claim with the carrier. QPhotonics, LLC. will supply you with a quotation for estimated costs of repair.

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QPHOTONICS, L.L.C.

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