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LASER TO FIBER DELIVERY SYSTEM QUESTIONNAIRE

Thank you for choosing OZ Optics. In order to help you choose the best components for your system, we would appreciate it if you could answer the following questions. If you do not know what to enter, write DON'T KNOW beside the question. We will then recommend an option. If you need assistance filling out the form, you are welcome to contact your nearest distributor or our sales office where a sales representative will be happy to assist.

To help you fully understand all the relevant issues involved in designing the ideal laser to fiber delivery system, we ask you to read our ***Laser to Fiber Source Couplers Application Notes*** before completing this questionnaire.

Please note that if your source is a laser diode or LED, and is not a collimated output, then you need to instead fill out our ***Laser Diode / Led to Fiber Delivery System Questionnaire***

Section 1 of 6: Personal Information

To process your information as quickly as possible, please ensure that the fields marked in ***red italics*** are completed before submitting your request. If this data is not entered we will be unable to respond to your request.

Name: _____

Position: _____

Company: _____

Address: _____

City: _____

State / Province: _____

Country: _____

Postal / Zip Code: _____

Telephone: _____

Fax: _____

Email: _____

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Section 2 of 6: Laser Characteristics:

Complete this section to provide us information about your laser as completely as possible.

Laser Manufacturer: _____

Laser Model: _____

Laser Wavelength, in nm: _____

Laser beam diameter (BD), in mm: _____

Laser beam divergence angle (DA), in mrad: _____

My laser's output is: ❑ Pulsed, ❑ CW

Laser output power, in mW, (if CW): _____

Laser output power, in mJ (if pulsed): _____

Laser pulse duration, in nsec (if pulsed): _____

Laser repetition rate, in kHz (if pulsed): _____

Laser head adaptor (***see note 1*** on Page 8): _____

Is your laser sensitive to back reflection (***see note 2*** on Page 9)?: ❑ Yes, ❑ No, ❑ Not Sure

Will you mount the laser to fiber coupler directly onto your laser?: ❑ Yes, ❑ No

If no, how far from the laser will the coupler be mounted?: _____

Please enter below any additional information about your laser that you believe is relevant:

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Section 3 of 6: Laser to Fiber Coupler Characteristics:

Complete this section to better identify the best laser to fiber coupler (launcher) for your laser.

1) Which style of coupler would you prefer (choose one)?:
   - ❑ Receptacle Style Coupler,
   - ❑ Pigtail Style Coupler,
   - ❑ No Preference / Please Recommend

2) What connector type do you prefer (choose one)? :
   - ❑ FC Connector,
   - ❑ Adjustable FC Connector,
   - ❑ High Power FC Connector,
   - ❑ SC Connector,
   - ❑ LC Connector,
   - ❑ ST Connector,
   - ❑ E2000 Connector,
   - ❑ SMA 905 Connector,
   - ❑ High Power SMA 905 Connector,
   - ❑ Adjustable SMA Connector
   - ❑ MU Connector,
   - ❑ SMA 906 Connector,
   - ❑ I don't know / Please recommend,
   - ❑ Other (Specify) _____

3) What Connector Finish do you prefer (choose one)?:
   - ❑ Flat,
   - ❑ Super PC,
   - ❑ Ultra PC,
   - ❑ Angled PC (APC),
   - ❑ Angled Flat (AFC),
   - ❑ I don't know / Please recommend,
   - ❑ Other (Specify) _____

4) Identify which if the following accessories, if any, you would like added to your coupler (select all that apply):
   - ❑ Adjustable Focus,
   - ❑ X-Y Positioning Stage,
   - ❑ Manual Variable Attenuator,
   - ❑ Isolator,
   - ❑ Shutter,
   - ❑ Motorized Variable Attenuator,
   - ❑ Temperature Control
   - ❑ Alignment Kit
   - ❑ Polarization Alignment Tool

Please enter below any additional information about your laser that you believe is relevant:

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LASER TO FIBER DELIVERY SYSTEM QUESTIONNAIRE

Section 4 of 6: Fiber Patchcord Properties

Complete this section to better select the fiber patchcord to use in your system. (Note: Questions marked with a **red asterisk*** are also required to help select the correct type of laser to fiber coupler).

1) Who will provide the patchcord to be used in this system?:
- ❑ Customer,
- ❑ OZ Optics

2)* What type of fiber are you using in your system (***see note 3*** on Page 9)?:
- ❑ Singlemode,
- ❑ Multimode,
- ❑ Polarization Maintaining,
- ❑ Not sure / Recommend

3)* What are the core and cladding diameters in microns?
_____ / _____

4)* What is the numerical aperture of the fiber?
_____

5)* (For multimode fiber only):
Are you using step index or graded index fiber?:
- ❑ Step Index,
- ❑ Graded Index,
- ❑ Not Sure

6) Who will provide the fiber?
- ❑ Customer,
- ❑ OZ Optics

7) Who will add the connectors?
- ❑ Customer,
- ❑ OZ Optics

8) What is the fiber length, in meters?
_____

9) What type of cabling do you want on the fiber?
- ❑ 0.25 mm Acrylate coating,
- ❑ 0.4 mm Acrylate coating,
- ❑ 0.9 mm OD tight buffer jacket,
- ❑ 0.9 mm OD loose tube hytrel tubing,
- ❑ 2 mm OD kevlar reinforced cable,
- ❑ 3 mm OD kevlar reinforced cable,
- ❑ 3 mm OD nylon coated armored cable,
- ❑ 3 mm OD all stainless steel armored cable,
- ❑ 5 mm OD nylon coated armored cable,
- ❑ 5 mm OD all stainless steel armored cable,
- ❑ Not sure / Please recommend

10) What type of connectors do you want on the **input** end of the fibers (choose one)? :
- ❑ Not Applicable (Attached to the coupler),
- ❑ FC Connector,
- ❑ Adjustable FC Connector,
- ❑ High Power FC Connector,
- ❑ ST Connector,
- ❑ SC Connector,
- ❑ LC Connector,
- ❑ MU Connector,
- ❑ E2000 Connector,
- ❑ SMA 905 Connector,
- ❑ High Power SMA 905 Connector,
- ❑ Adjustable SMA 905 Connector,
- ❑ SMA 906 Connector,
- ❑ I don't know / Please recommend,
- ❑ Other (Specify) _____

11) What Connector Finish do you prefer (choose one)?:
- ❑ Flat,
- ❑ Super PC,
- ❑ Ultra PC,
- ❑ Angled PC (APC),
- ❑ Angled Flat (AFC),
- ❑ I don't know / Please recommend,
- ❑ Other (Specify) _____

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12) What type of connectors do you want on the **output** end of the fibers (choose one)? :

- ❑ Collimator or Focuser, (Please proceed to section 5)
- ❑ FC Connector,
- ❑ Adjustable FC Connector,
- ❑ High Power FC Connector,
- ❑ ST Connector,
- ❑ SC Connector,
- ❑ LC Connector,
- ❑ MU Connector,
- ❑ E2000 Connector,
- ❑ SMA 905 Connector,
- ❑ High Power SMA 905 Connector,
- ❑ Adjustable SMA 905 Connector,
- ❑ SMA 906 Connector,
- ❑ Bare Fiber,
- ❑ I don't know / Please recommend,
- ❑ Other (Specify) _____

13) What Connector Finish do you prefer (choose one)?:

- ❑ Flat,
- ❑ Super PC,
- ❑ Ultra PC,
- ❑ Angled PC (APC),
- ❑ Angled Flat (AFC),
- ❑ I don't know / Please recommend,
- ❑ Other (Specify) _____

Please enter below any additional information about the cable that you believe is relevant:

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Section 5 of 6: Output Optics

Complete this section to choose output optics for your system. To help understand the concepts and issues involved with fiber optic collimator and focuser assemblies, we ask you to read the ***Collimators/Focusers Application Notes***.

1) Do you need a collimator or focuser assembly for the output end of the system?
   - ❑ Yes,
   - ❑ No.

2) Do you require a fiber optic:
   - ❑ Collimator,
   - ❑ Focuser

3a) For fiber collimator users only:
   Desired Collimated Beam Diameter (mm): _____
   Desired Collimated Divergence Angle (mRad): _____

3b) For fiber focuser users only:
   Desired Spot Diameter (microns): _____
   Desired Working Distance (mm): _____

4) Do you prefer a:
   - ❑ Pigtail style assembly,
   - ❑ Connector receptacle style assembly.

5) **(For Receptacle Style Assemblies Only)**
   What is the desired flange size?:
   - ❑ 1.3 inch [33 mm] diameter,
   - ❑ 0.79 inch [20 mm] diameter,
   - ❑ 0.59 inch [15 mm] diameter,
   - ❑ 0.47 inch [12 mm] diameter,
   - ❑ Other (Specify) _____

6) **(For Pigtail Style Assemblies Only):**

6a) What is the maximum acceptable collimator housing diameter?
   - ❑ 1.6 mm,
   - ❑ 2.5 mm,
   - ❑ 4.0 mm,
   - ❑ 8.0 mm,
   - ❑ 12.0 mm,
   - ❑ Other (Specify): _____
   - ❑ No preference

6b) Do you need a removable flange?
   - ❑ Yes,
   - ❑ No.

6c) If yes what is the desired flange size:
   - ❑ 1.3 inch [33 mm] diameter,
   - ❑ 0.79 inch [20 mm] diameter,
   - ❑ 0.59 inch [15 mm] diameter,
   - ❑ 0.47 inch [12 mm] diameter,
   - ❑ Other (Specify) _____

Please enter below any additional information about your collimator/focuser assembly that you believe is relevant:

_____

_____

_____

_____

_____

_____

_____

_____

LASER TO FIBER DELIVERY SYSTEM QUESTIONNAIRE

Section 6 of 6: Other Options

Use this section to provide any additional information that you feel can help us provide you the system you require. For instance you could provide a block diagram of your system needs. ***See Note 4*** on Page 10 for some sample drawings. If you have any special requirements other than the ones listed (for example, a beam splitter, filter, or an wavelength division multiplexor to combine two sources), then please describe them in the space provided.

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NOTES

NOTE 1:

OZ Optics offers a wide variety of laser head adapters, to allow you to attach the coupler directly to the end of the laser below. See the table below for a list of adapters that OZ Optics offers. Drawings of these ***laser head adapters*** are available on our website. If necessary, we can provide a custom laser head adapter for your laser. If your laser does not provide any means to attach the coupler to the laser, then we recommend the post mount model (Adapter number 11). This adapter allows you to use the coupler on a post mount for an optical bench. You can also attach either adapter numbers 1, 2 or 12 onto a translational stage.

LASER HEAD ADAPTER	ADAPTER NUMBER (LH)	BC #
1"-32 TPI Male threaded adapter	1	817
1.75" O.D. Disk adapter with 4 holes on corners of a 1" square	2	830
3/4"-32 TPI Male threaded adapter	3	825
5/8"-32 TPI Male threaded adapter	4	826
1/2"-20 TPI Male threaded adapter	5	824
5/8"-25 TPI Male threaded adapter	6	919
1.75" O.D. Female Adapter for cylindrical lasers without any mounting holes	7	834
1.50" O.D. Female Adapter for cylindrical lasers without any mounting holes	8	938
35mm O.D. Female Adapter for cylindrical lasers without any mounting holes	9	939
1.25" O.D. Female Adapter for cylindrical lenses without any mounting holes	10	841
Post mount adapter with an M6 and a 1/4"-20 TPI hole	11	835
25mm O.D. Male Laser Head Adapter	12	851
M24x1 Male Laser Head Adapter	13	931
1.15" O.D. Disk Adapter with 4 holes on a 0.625" square	14	800
1.75" O.D. Disk Adapter with 4 holes on 1" square and 1"-32 TPI female thread in the middle	15	836
1/2"-40 TPI Male Laser Head Adapter	16	802
35mm O.D. Disk Adapter with 4 holes on a 27mm bolt circle	17	850
5/8"-24 TPI Female Laser Head Adapter	18	765
2.75" O.D. Disk Adapter with 3 holes on a 2.25" diameter bolt circle	19	928
1.75" O.D. Disk Adapter with 4 holes on a 35mm diameter bolt circle	20	837
1.75" O.D. Disk Adapter with 3 holes on a 1.15" diameter bolt circle	21	15351
1.75" O.D. Disk Adapter with 3 holes on a 1.15" diameter bolt circle and 3/4"-32 TPI female thread in the middle	22	15368
1.75" O.D. Disk Adapter with 4 holes on a 35mm diameter bolt circle and 1"-32 TPI female thread in the middle	23	19791

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NOTE 2:

Backreflection often causes the laser intensity to fluctuate as well as change the laser frequency. If you have to have receptacle style couplers and backreflection is a concern, then we recommend using our HPUC non-contact receptacle style couplers with angled-flat polished FC (FC/AFC) connector fibers. Please note that we do not recommend standard angle point contact (APC) connectors. The problem with APC connectors is that the coupling efficiency into the fiber will change if you use the same coupler with a fiber with a different APC connector. This is because the position of the fiber with respect to the lens changes due to tolerances on the angle tip of the connector. For more information on this issue, please read our application note *FC/APC Connectors Versus Flat Angled Finish FC Connectors*, available on our website (***http://www.ozoptics.com/ALLNEW_PDF/APN0006.pdf***)

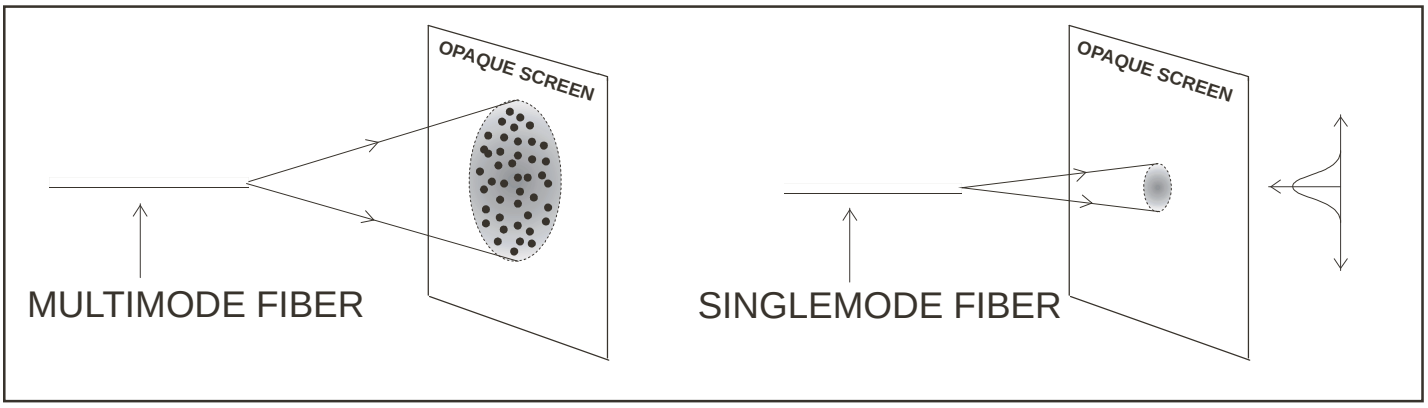
Receptacle style couplers are generally recommended for systems which are not sensitive to backreflection and where different fibers are often used. They are also recommended for high power applications where fiber ends could be burnt, in which case connectors could easily be repolished or reterminated. To minimize backreflection, both ends of the fiber should be angle polished and/or AR (antireflection) coated.

NOTE 3:

Sometimes the customer does not know what type of fiber he has or wants. In that case we need to know the customer's application to help him pick the proper fiber. The following information might help you select the fiber type.

First, a multimode fiber is not a multi-strand or bundle of fibers. A multimode fiber is a single fiber with a 25 to 1000 micron core diameter. When coherent laser light is coupled into multimode fiber, the output shows speckles as shown in the following figure. This speckle pattern changes when you bend the fiber. We can make the beam more uniform by adding a special diffuser plate at an additional cost. This will also reduce the coupling efficiency. The term multimode means there is more than one path for light to travel inside a **single** fiber. It does not mean the unit consists of multiple fibers in a bundle.

The output from a singlemode fiber (SM) shows a nice, smooth gaussian profile as shown. Singlemode fiber does not maintain polarization under stress such as bending, for that you need polarization maintaining (PM) fiber. PM fiber is also singlemode.



One can couple higher power into multimode fiber than into singlemode fiber. The smallest usable size of the multimode fiber for high power application depends on the laser power and wavelength. If you want to collimate or refocus the output from multimode fibers then, the larger the fiber core size is, the larger the divergence angle of the collimated beam will be.

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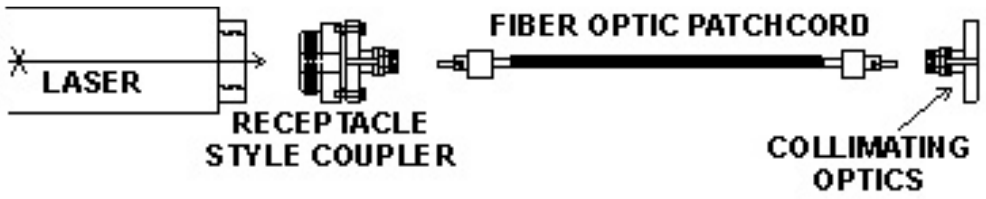
Note 4:

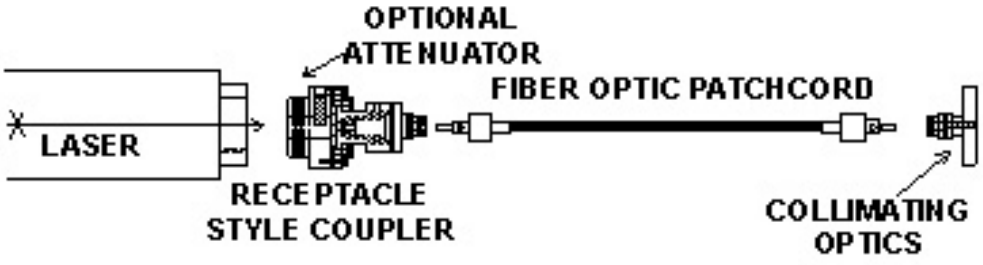
The following set of block diagrams are of the most common systems that people use. We can offer laser to fiber couplers with a splitter in the middle as shown. We also offer variable attenuators as an option for laser to fiber couplers as shown. This can reduce the cost of your overall system by combining two components into one and thus enhance your overall system efficiency.

EXAMPLE 1:

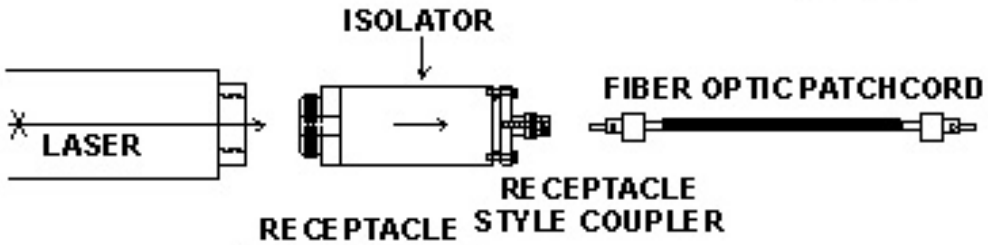


EXAMPLE 2:

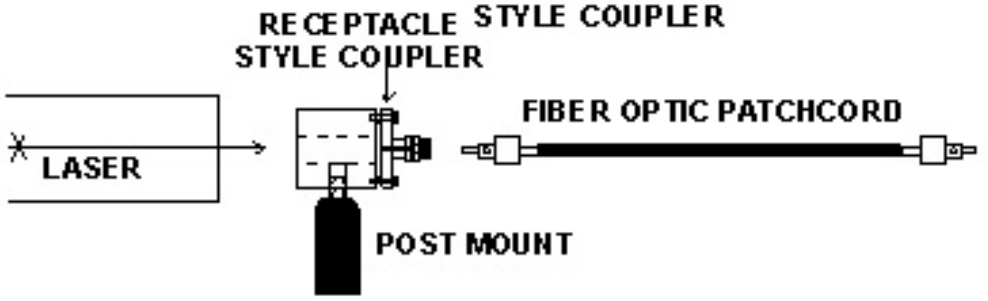
EXAMPLE 3:



EXAMPLE 4:



EXAMPLE 5:



EXAMPLE 6: