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amsTECHNOLOGIES
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www.amstechnologies-webshop.com
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OZ Optics
shop.ozoptics.com
www.ozoptics.com

RED/GREEN/BLUE COMBINER AND DELIVERY SYSTEMS FOR THREE TO FIVE VISIBLE WAVELENGTHS

PRELIMINARY

Features

- Combine up to five visible wavelengths within 400 nm to 660 nm
- Compact footprint
- Multimode, singlemode, and polarization maintaining fiber versions
- High power handling
- Low insertion losses and low return losses

Applications

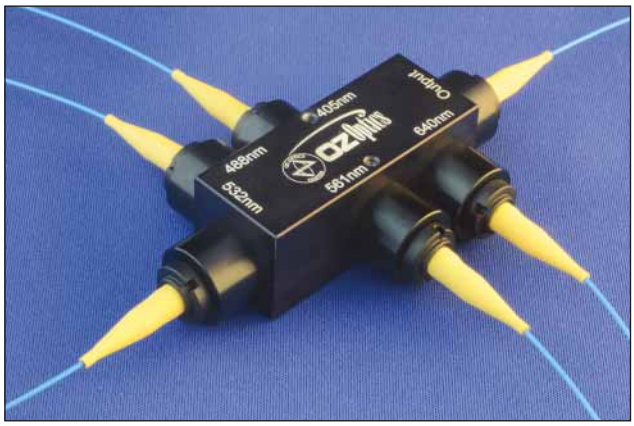
- White light displays
- Confocal microscopy
- Laser spectroscopy
- Fluorescence microscopy
- Color holography and imaging systems
- Flow cytometry

Product description

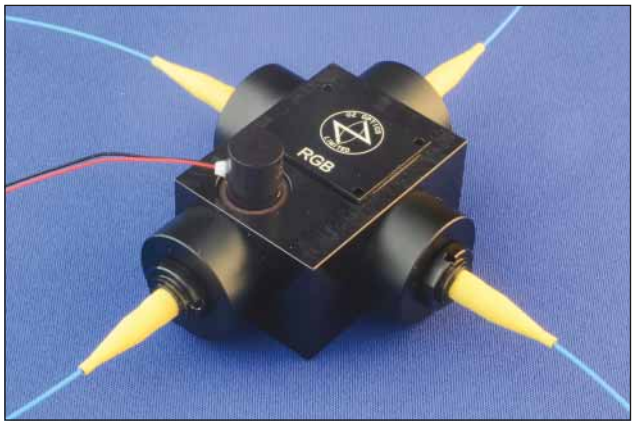
A common application today is the combination of visible laser light of different wavelengths into a single fiber. Such systems are used in a variety of applications where one wants to produce full color images. By combining red, green and blue light and varying the intensities of the signals, one can reproduce practically any color desired. For example, one of the most common emerging requirements is for a white light laser source. OZ Optics uses custom optics and dichroic filters to combine efficiently three to five visible lasers into a common output port.

OZ Optics line of RGB (Red/Green/Blue) combiners provides a complete method to deliver full color laser light from a singlemode, polarization maintaining or multimode fiber. The RGB combiner can be provided as a pigtailed passive device or as a low profile RGB laser engine with or without built-in laser diode drivers to combine light from three to five different wavelengths (red, green, and blue are the most common) to generate output light that is white in appearance from a single fiber. By varying the relative intensities of the individual transmitted visible lasers, one can generate a spectrum of colors.

The RGB system combines light from at least three sources into a common output fiber. The fiber is protected with a rugged, flexible cable. The light from the output fiber can be collimated using an optional achromatic collimator to give near ideal Gaussian beams ranging from 0.6 mm to 10 mm in diameter. Alternatively, achromatic focusers can be supplied to focus the light to spots only a few microns in diameter. Refer to our data sheets titled "*Collimators and Focusers-Receptacle Style*" and "*Collimators and Focusers-Pigtail Style*." In addition to complete RGB laser sources, OZ Optics offers Turnkey Standalone RGB Sources for more detail about this product visit:
https://www.ozoptics.com/ALLNEW_PDF/DTS0117.pdf



5 Color Visible Combiner/Splitter



Compact RGB Combiner with Shutter

RGB laser engine

Standard Specification: Fiber to Fiber Combiner

Wavelength band (nm)	400–410	440–490	510–543	560–595	633–660
Fiber type	3/125um for SM or PM fiber				
Return loss	40 dB				
Insertion loss[1]	< 1.5 dB for 3 color combiner, < 2.2 dB for 4 color combiner, < 2.8 dB for 5 color combiner				
ER	> 18 dB for 3 color combiner, > 15 dB for 4 and 5 color combiner				
Operating temperature	-20 to +60°C				
Dimensions	18 x 17 x 14 mm for 3 color combiner block, 18 x 32 x 14 mm for 4 and 5 color combiner block				

1 Excluding connector insertion loss.

RGB specifications with built-in laser diode

Channel	Purple	Blue			Green	Red	
Available wavelengths (nm)[1]	405	450	473	488	520	635–644	650–660
Output power from fiber (mW)[2]	0–50						
Long-term power stability[3]	Typically <5% peak-to-peak					Typically <2% peak-to-peak	
Short-term power stability[3]	Typically <0.5% peak-to-peak					Typically <0.5% peak-to-peak	
Polarization extinction ratio (dB)[4]	>18dB					>20dB	
Wavelength stability[5]	Typically ±0.1nm						
Output fiber type	3/125 for singlemode fiber and polarization maintaining fiber						

1 These are standard center wavelengths. Typical tolerances vary from ± 5nm to ±20nm depending on laser diode manufacturer. Contact OZ Optics if a specific wavelength is required. For yellow 565nm while we do not have a LD built in we can provide an external port.

2 Maximum output power is limited by filter type used and laser diode maximum output power factor.

3 Depends on source wavelength, power level and other options. Refers to typical values achieved over a period of 8 hours for the longterm case and 1 minute for the short-term case after 30 minutes warm up time and at median operating output powers.

4 With polarization maintaining fiber only.

5 Achieved with TEC controller included. Based on thermal stability achieved with TEC controller and optimum connector termination. Assumes absence of mode-hopping and LD set at full output setting.

Ordering information for custom parts

OZ Optics welcomes the opportunity to provide custom designed products to meet your application needs. As with most manufacturers, customized products do take additional effort so please expect some differences in the pricing compared to our standard parts. In particular, we will need additional time to prepare a comprehensive quotation, and lead times will be longer than normal. In some cases non-recurring engineering (NRE) charges will be necessary. These points will be carefully explained in your quotation, so your decision will be as well informed as possible. We strongly recommend buying our standard products.

Questionnaire for custom parts

1. What wavelengths are you interested in?
2. What power levels are required?
3. What type of fiber is needed? Singlemode, Multimode or PM?
4. How long should the fiber be?
5. What type of fiber jacket/cabling do you need?
6. What connector type are you using?
7. Do you need a collimated or focused output beam?
8. If a collimated beam is required, what is the desired beam diameter?
9. If a focused spot is required, what is the desired spot size and working distance?

Description RGB combiner fiber to fiber

Wavelength Division Multiplexer: **Part number**

RGB-1*N*P-111-*W1,W2,W3*-*a/b*-*ABCD*-*LB*-*XYZ*-*JD*-*L*

N = Number of wavelengths to combine (3, 4, 5, etc.)

W1,W2,W3 = Wavelengths to be combined, in nanometers (shortest to longest) up to a maximum to five wavelengths

a/b = Fiber core/cladding size, in microns. 3/125 nm standard for singlemode or PM fiber. For multimode fiber refer to our *Standard Tables.* https://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf

ABCD = Fiber types: on each port
M = Multimode
S = Singlemode
P = Polarization Maintaining

L = Fiber length, in meters

JD = Fiber jacket type:
1 = 900 µm OD Hytrel jacket
3 = 3 mm OD Kevlar reinforced PVC cable

X,Y,Z = Connector type on each end
3S = Super NTT-FC/PC
3U = Ultra NTT-FC/PC
3A = Angled NTT-FC/PC
8 = AT&T-ST
SC = SC
SCA = Angled SC
LC = LC
LCA = Angled LC
MU = MU
X = No Connector

LB = Backreflection level: 40dB for singlemode or PM fibers only. 35dB for multimode fibers.

Description RGB laser engine

RGB system: **Part number**

RGB-100-11-*W1,W2,W3*-*a/b*-*f*-*X*-*P1,P2,P3*-*JD*-*L*-(*DR*)

W1,W2,W3 = Wavelengths to be combined, in nanometers (shortest to longest) up to a maximum to five wavelengths

a/b = Fiber core/cladding size, in microns. 3/125 standard for singlemode or PM fiber. For multimode fiber refer to our *Standard Tables.* https://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf

f = Output fiber types
S = Singlemode
P = Polarization Maintaining
M = Multimode

DR = Built-in LD devices

L = Fiber length, in meters (1 m standard)

JD = Fiber jacket type:
1 = 900 µm OD Hytrel jacket
3 = 3 mm OD Kevlar reinforced PVC cable
3AS = 3 mm OD Stainless Steel cable
5AS = 5 mm OD Stainless Steel cable

P1,P2,P3 = Output power levels in mW

X = Connector type on output
3S = Super NTT-FC/PC
3U = Ultra NTT-FC/PC
3A = Angled NTT-FC/PC
3AF = Angled Flat FC
A3A = Adjustable Focus Angled NTT-FC/PC
SC = SC

For other connectors refer to our *Standard Tables.* https://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf

Frequently asked questions (FAQs)

Q: What wavelength ranges are available?
A: OZ Optics offers a variety of sources working from 375 nm to 660 nm.

Q: What output powers are available?
A: Depending on the wavelength, up to 50 mW is possible with SM and PM. Custom configurations with higher power levels can be manufactured, depending on the laser diode output power facet and fiber used.

Q: Can the RGB system handle higher powers?
A: Yes, OZ Optics' RGB design can handle up to 200mW. For higher power applications a custom design can be done to handle up to 2W, with large core multimode fiber.

Q: Do you offer RGB sources that can combine more than three wavelengths?
A: Yes, systems that combine up to five different wavelengths can also be made.

Q: Can OZ Optics manufacture sources using a customer supplied laser diode and/or fiber?
A: Yes, please provide OZ Optics with detailed information.

Q: Does OZ Optics offer higher power sources than what is standard on the data sheet?
A: Yes, please provide OZ Optics with the requested fiber output power and fiber type and we'll work with you to find a solution.

Q: Why do you recommend integrated systems rather than individual sources and combiners for visible wavelengths?
A: For visible wavelengths the fiber core size is 4 microns or smaller. For such small sizes, mechanical tolerances may result in over 1dB (20%) losses at the receptacle interface. Using an integrated system avoids this issue.

Q: Can I control the output power of each RGB wavelength source?
A: Yes, output power for each source is adjustable via individual potentiometers, allowing the customer a wide range of colors.

Q: Can a RGB source be made to deliver a collimated or focused beam?
A: Yes, we can add a collimator or a focuser to the output end of the pigtailed fiber delivery system.

Q: Can we offer a RGB combiner with built-in optical shutter or blocking attenuator?
A: Yes, we can customized to include optical shutter, or optical variable attenuator or any other specials features. Contact OZ Optics to provide your product requirements.

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