Gooch & Housego
ENABLING PHOTONIC TECHNOLOGIES

VISIBLE WAVELENGTH COMBINER

Fused Fiber Combiner

DATASHEET

Gooch & Housego visible wavelength combiners are single mode optical fiber components and modules.

They enable any two or three primary colors in the visible wavelength region to be combined or separated.

Designed for applications in display systems, sensors and biomedical equipment, the combiners utilize G&H's low loss fused fiber technology.

No light leaves the fiber and therefore no alignment is required; and there are no unwanted reflections. Furthermore the output fiber pigtails may be directly integrated into beam delivery systems.

Combiners are available for either 2 or 3 wavelengths: 2 wavelength combiners combine red/green, blue/green or red/blue light. 3 wavelength combiners provide full RGB operation; enabling full color displays.

All variants are available on a custom basis, so please contact us to discuss your specific requirements.

Key Features

- 2 or 3 color combining or separating
- All fiber – no lens alignment
- No unwanted reflections
- Low light loss
- High power handling
- Custom Product

Applications

- Visible and display systems
- Sensors
- Biomedical equipment
- Research

Example Optical Specifications[1]

Two Wavelength Combiner

Parameter		Specification
Operating wavelengths	Blue/green	457/532 nm
	Green/red	532/633 nm
	Blue/red	457/633 nm
Channel transmission	Minimum	90%
Channel transmission	Typical	95%
Fiber type		Speciality single mode fiber
Housing		Semi-ruggedized housing ∅5.0 x 85 mm
Operating/storage temperature range		-5 – +75°C/-40 – +85°C

Three Wavelength Combiner

Parameter		Specification		
		Red	Green	Blue
Operating wavelengths		630, 633, 655 nm	532 nm	457, 460, 488 nm
Channel transmission	Minimum	85%	85%	65%
Channel transmission	Typical	90%	90%	70%
Fiber type		Speciality single mode fiber		
Fiber cut-off wavelength		430±20 nm		
Housing		Anodized aluminum housing 110 x 45 x 10 mm		
Operating/storage temperature range		-5 – +75°C/-40 – +85°C		

1 Please contact the sales office for a specification and quotation based on your exact requirements.

For further information
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NEAR INFRARED WDM

Fused Fiber WDM

DATASHEET

The Near Infrared WDM enables the low loss combining or splitting of a pair of wavelengths within the 700 nm to 1199 nm region.

Gooch & Housego can rapidly produce such custom WDMs, with typical minimum wavelength separation of 50 nm.

Designed for applications in fiber laser, sensing, biomedical, military and avionics the WDM utilizes G&H's low loss fused fiber technology. No light leaves the fiber and therefore no alignment is required. Furthermore the output fiber pigtails may be directly integrated into beam delivery systems.

Specific applications could include combining two sensor wavelengths onto one fiber, splitting laser harmonics, or combining wavelengths in fiber lasers.

For components which split optical signals of the same wavelength within the near infrared region please refer to the datasheet near infrared coupler.

Key Features

- 700 – 1199 nm operation
- Custom wavelength capability
- 50 nm minimum wavelength spacing <50 nm channel spacing available on request)
- Low loss
- High power handling
- Custom product

Applications

- Fiber lasers
- Sensors
- Biomedical equipment
- Avionics
- Military
- Research

Optical Specifications

Channel Spacing	Max Insertion Loss[1,2,3]	Min Isolation[3]
100 – 50 nm	0.5 dB	12 dB
>100 nm	0.4 dB	14 dB

1. In 2x2 components insertion loss is not specified for launch through second input port P4 (coloured blue)
2. Maximum insertion loss at operating wavelength. Not including TDL, PDL or connector losses.
3. Improved specifications may be available- contact sales department.

Parameter	Specification
Operating wavelength	Specified wavelength within the range 700-1199 nm
Optical power handling[2, 3]	4 W
Operating/storage temperature range[1]	-40 – +75°C/-40 – +85°C
Pigtail Tensile Load	5 N
Fiber Type	Speciality single mode fiber

1 For connectorized component, operating temperature range is -5 – +75°C.

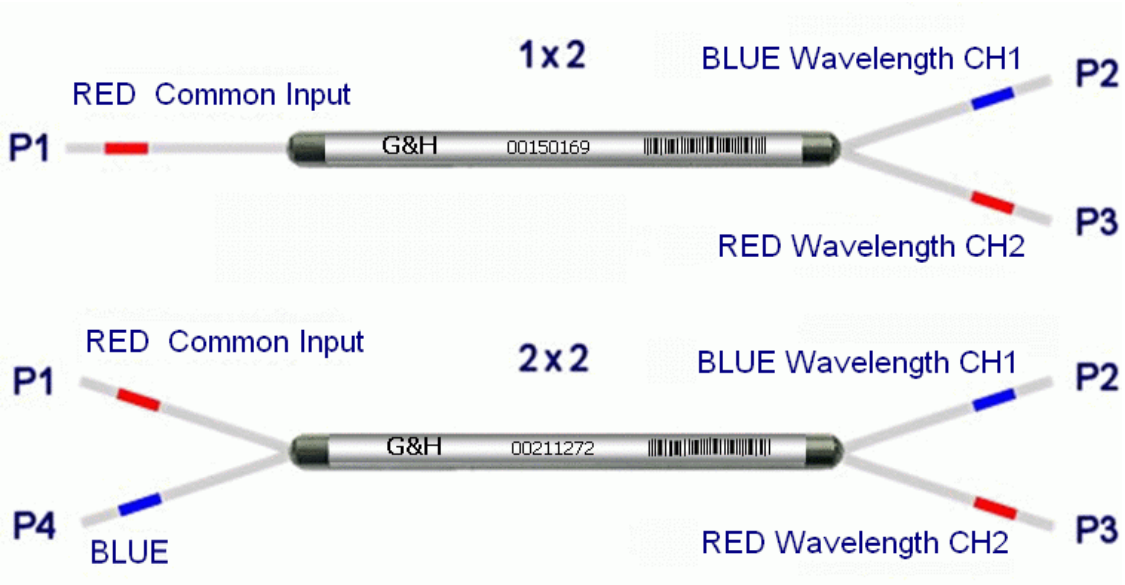
2 For operation at powers of greater than 4 W the component housing and fiber must be adequately heat-sunk (for additional information contact G&H sales). Components intended for high power operation are only available in the 2x2 configuration. Component performance and reliability under high power must be determined within the customer system.

3 The performance and reliability of optical connectors is not guaranteed for optical powers of greater than 1 W.

Housing Option

Housing Code	Description	1x2, 2x2 Dimensions (mm)	Pigtail
3	Regular	3.0 (∅) x 60 (L)	Primary-coated fiber
4	Semi-ruggedized slim	3.0 (∅) x 70 (L)	∅0.9mm loose-tube
5	Semi-ruggedized	5.0 (∅) x 85 (L)	∅0.9 mm loose-tube
7	High power housing	5 (W) x 5 (H) x 85 (L)	Primary-coated fiber
C	Regular high power	3.0 (Ø) x 60 (L)	Primary-coated fiber

Configuration



Order code

Order codes are comprised of a standard device prefix (e.g. FFW) followed by code letters or numbers which correspond to available options.

Sample: FFW-780060130 (Fused fiber WDM, 780/1060 nm wavelengths, 1x2 port configuration, regular housing, 1 m pigtails lengths, no connectors)

Order code				①	②	③	④	⑤	⑥	⑦	⑧	⑨
F	F	W	-									

①	**Wavelength channel 1**	7XX	8XX	9XX	10XX	11XX
	Code	7	8	9	0	1

② ③	**Last two digits of channel 1 center wavelength**	e.g. XX20	e.g. XX50	e.g. XX70	e.g. XX80
	Code	20	50	70	80

④	**Wavelength channel 2**	7XX	8XX	9XX	10XX	11XX
	Code	7	8	9	0	1

⑤ ⑥	**Last two digits of channel 2 center wavelength**	e.g. XX20	e.g. XX50	e.g. XX70	e.g. XX80
	Code	20	50	70	80

⑦	**Port configuration**[3]	1x2	2x2
	Code	1	2

⑧	**Housing**[2,3]	Regular	Semi-ruggedized-slim	Semi-ruggedized	High Power	Regular high power
	Code	3	4	5	7	C

⑨	**Connector**[1,2]	None	FC/PC	FC/APC	SC/APC	FC/UPC	SC/UPC	LC
	Code	0	1	3	5	9	A	B

1 1 m pigtail length as standard. Further pigtail lengths available on request from G&H sales. Where connectorized, pigtail length is to connector end face.

2 Connectors may be fitted to housing types 4 & 5. For connectorization of other housings please contact G&H sales. Note that insertion loss stated does not include connector losses.

3 7 & C not available in 1x2 Port Configuration. For more information contact G&H sales.

For further information

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Gooch & Housego
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WDM FOR 2 µm OPERATION

Fused Fiber Coupler

DATASHEET

The Gooch & Housego fused WDM, combines multiple wavelengths of light in SM Fiber whilst maintaining low loss.

G&H proprietary manufacturing technology provides low loss, with low polarization dependence (PDL). The all fiber construction offers excellent reliability and high power handling characteristics.

These high performance parts are available in many wavelength configurations, housing, fiber and connector options and can therefore be readily specified in a wide variety of applications, enabling rapid design cycles and new project builds.

Key Features

- Low loss
- Low PDL (by design)
- High power handling
- Custom wavelength capability
- Custom product

Applications

- Telecoms
- Instrumentation
- IR Imaging
- Biomedical
- Industrial
- Defense
- IR Counter measures

Typical Optical Specifications[3,5]

Wavelength			Available Housing	Max. Insertion Loss[1]	Min. Isolation[1] (dB)
CH1	CH2	Spacing[4]			
1900-2100 nm	1900-2100 nm	>50 nm	3, 7 and C	0.50	12 (typ. >14)
<1900 nm[2]	1900-2100 nm	-	3, 7 and C	0.40	14 (typ. >20)

1 Insertion loss/isolation specified at center wavelength and room temperature.

2 <1900 nm wavelength range may be below the 2nd order mode cut-off for the fiber used to manufacture this product type. Performance specified for single-mode incident on this path.

3 Custom specifications available on request

4 For wavelength spacing <50 nm, please contact the sales office.

5 Stated value may not be guaranteed for some wavelength combinations.

Parameter	Specification
Return loss/directivity[1]	55 dB
Pigtail tensile load	5 N
Optical power handling[2,3]	4 W
Operating/storage temperature range	-5 – +75°C -40 – +85°C
Fiber type[4]	SM fiber

1 Measured reference port P3 input for signal wavelength, P2 input for pump wavelength and P1 input for signal and pump wavelengths.

2 For operation at powers of greater than 4 W the component housing and fiber must be adequately heat-sunk (for additional information contact G&H Sales). Components intended for high power operation are only available in the 2x2 configuration. Component performance and reliability under high power must be determined within the customer system.

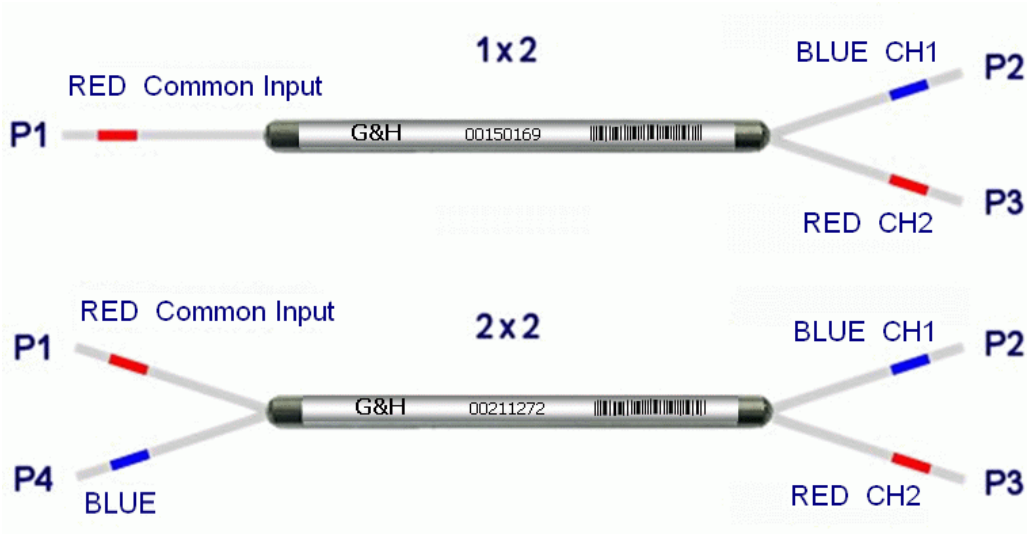
3 The performance and reliability of optical connectors is not guaranteed for optical powers of greater than 1 W.

4 Various fiber types available, please contact G&H Sales for additional information.

Housing Option

Housing Code	Description	Max Dimensions (mm)	Pigtail
3	Regular	3.0 (∅) x 85 (L max)	Primary-coated fiber
7	High power	5 (W) x 5 (H) x 85 (L max)	Primary-coated fiber
C	Regular high power	3.0 (Ø) x 85 (L max)	Primary-coated fiber

Configuration



Order code

Order codes are comprised of a standard device prefix (e.g. FFW) followed by code letters or numbers which correspond to available options.

Sample: FFW-Y40Z80230 (Fused fiber WDM, 1940/2080 nm wavelengths, 2x2 port configuration regular housing, no connectors).

Order code				①	②	③	④	⑤	⑥	⑦	⑧	⑨
F	**F**	**W**	**-**									

①	**Wavelength channel 1**	7X X	8X X	9X X	10 XX	11 XX	12x x	13 XX	14 XX	15 XX	16 XX	17 XX	18 XX	19 XX	20 XX
	Code	7	8	9	0	1	2	3	S	C	L	W	X	Y	Z

② ③	**Last two digits of channel 1 center wavelength**	e.g. XX20	e.g. XX50	e.g. XX70	e.g. XX80
	Code	20	50	70	80

④	**Wavelength channel 2**	19XX	20XX
	Code	Y	Z

⑤ ⑥	**Last two digits of channel 2 center wavelength**	e.g. XX20	e.g. XX50	e.g. XX70	e.g. XX80
	Code	20	50	70	80

⑦	**Port configuration**[3]	1x2	2x2
	Code	1	2

⑧	**Housing**[3]	Regular housing	High Power	Regular high power
	Code	3	7	C

⑨	**Connector**[1,4]	None	FC/APC	FC/PC
	Code	0	P	R

1 Insertion loss in specification table does not include connector losses.

2 Pigtail length 1 m (minimum). Further pigtail lengths available on request. Where connectorized, pigtail length is to the connector face.

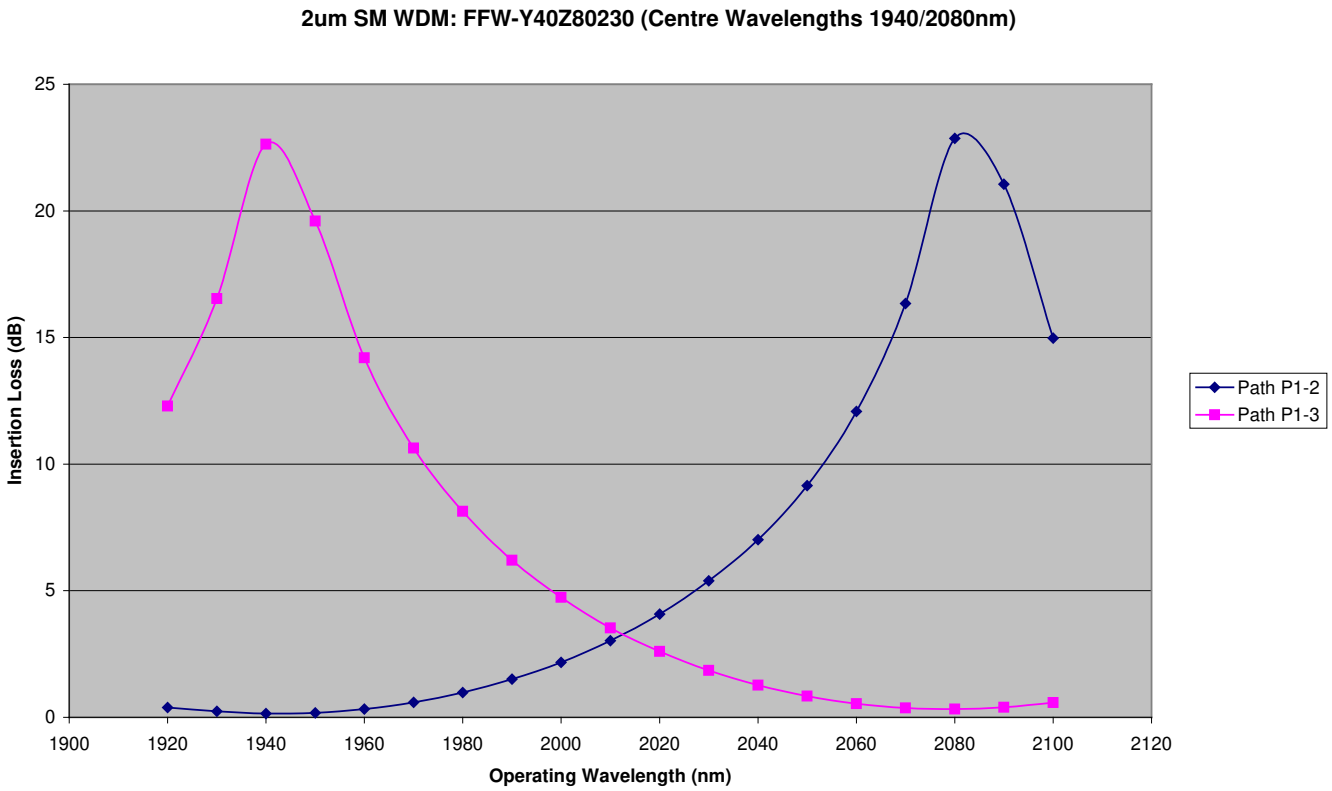
3 7 & C not available in 1x2 Port Configuration. For more information contact G&H Sales.

4 To request connectors please contact G&H sales.

Other products which may be of interest

- Fiber-Q™
- High power multimode combiners
- Combiners with all types of signal feedthrough fiber
- Ultra-low ratio tap couplers
- WDMs for combining signals with red pointer lasers
- OCT wideband couplers
- HI REL components

Typical Optical Performance



Gooch & Housego
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DUPLEXING WDM 1310/1550 nm & 1625 nm

Fused Fiber WDM

DATASHEET

The Duplexing WDM enables the low loss combining or splitting of a pair of wavelengths.

1310 nm/C band or 1310 nm/L band components are used to double network bandwidth whilst the 1310/1625 nm component is used to add or drop a supervisory wavelength from a system.

Gooch & Housego proprietary manufacturing technology provides uniquely low excess loss and wavelength dependence along with low polarization and temperature dependence for all ports.

In addition to the standard wavelengths shown, other combinations such as 1550/1625 nm are available. Please contact us with your specific requirements.

Key Features

- Ultra-low typically <0.05 dB excess loss
- Wide range of regular parts available
- High power handling

Applications

- Optical networking
- Two-channel WDM
- Supervisory wavelength

Applications

- Telcordia GR-1221

Optical Specifications

Device Type	Grade	Available Housing	Insertion Loss[1] (dB)	WDL[2] (dB)	PDL[3] (dB)	TDL[4] (dB)	Isolation (dB)
1310/C Band	P	2,3,4,5,6	0.30	0.20	0.10	0.10	15
	A	2,3,4,5,6	0.50	0.30	0.10	0.10	14
1310/L Band	P	3,4,5,6	0.30	0.20	0.10	0.10	15
	A	2,3,4,5,6	0.50	0.30	0.10	0.10	15
1310/1625 nm	P	3,4,5,6	0.30	0.20	0.10	0.10	15
	A	2,3,4,5,6	0.50	0.30	0.10	0.10	15

1 Insertion loss over operating wavelength range (not including PDL, TDL or connector losses).

2 Change in insertion loss over the operating wavelength range.

3 Change in insertion loss over all input polarization states in signal wavelength range.

4 Change in insertion loss from -5 – +75°C.

Parameter		Specification
Operating wavelength range	1310 nm	1290-1330 nm
	C band	1528-1563 nm
	L band	1570-1605 nm
	1625 nm	1610-1640 nm
Return loss/directivity[1]		55 dB
Pigtail tensile load		5 N
Optical power handling		4 W
Operating/storage temperature range[2]		-40 – +75°C/-40 – +85°C
Environmental qualification		Telcordia GR-1221

1 Measured reference port P3 input for longer wavelength, P2 input for shorter wavelength and P1 input for both wavelengths.

2 For connectorized component, operating temperature range is -5 – +75°C.

Housing Option

Housing Code	Description	Dimensions (mm)	Pigtail
2	Miniature	Ø3.0 x 50 (L)	Primary-coated fiber
3	Regular	Ø3.0 x 55 (L)	Primary-coated fiber
4	Ø0.9 mm slim	Ø3.0 x 70 (L)	Ø0.9 mm loose-tube
5	Ø0.9 mm semi-ruggedized	Ø5.0 x 80 (L)	Ø0.9 mm loose-tube
6	Ø3.0 mm fully-ruggedized	80 (L) x 10 (W) x 8 (H)	Ø3.0 mm fan-out sleeving

Configuration

Order code

Order codes are comprised of a standard device prefix (e.g. FFW) followed by code letters or numbers, which correspond to available options.

Sample: FFW-4L32P1110 (Fused Fiber WDM, 1310 nm/Lband wavelengths, regular housing, 2x2 port configuration, P grade, Corning SMF-28, 1 m pigtail length, no connectors).

Order code				①	②	③	④	⑤	⑥	⑦	⑧	⑨
F	F	W	-	4					1	1		

①	**Pump wavelength**	1310 nm				
	Code	4				
②	**Signal wavelength**	C band		L band		1625 nm
	Code	C		L		7
③	**Housing**	Miniature	Regular	Semi-ruggedized slim	Semi-ruggedized	Fully-ruggedized
	Code	2	3	4	5	6
④	**Port configuration**	1x2		2x2		
	Code	1		2		
⑤	**Grade**	Grade P		Grade A		
	Code	P		A		
⑦	**Fiber type**	Corning SMF-28				
	Code	1				
⑧	**Pigtail length**[2]	0.5 m		1 m		
	Code	0		1		

⑨	**Connector**[3]	None	FC/PC	FC/APC	SC/APC	FC/UPC	SC/UPC	LC[1]
	Code	0	1	3	5	9	A	B

1 Not available for housing option 6.

2 Minimum pigtail length. Further pigtail lengths available on request. Where connectorized, pigtail length is to connector end face.

3 Connectors may be fitted to housing types 4, 5 and 6. For connectorization of housing type 3 please contact the sales office.

For further information

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