



# Sintec Optronics Pte Ltd

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## PM Combiner

The G&H PM Combiner enables the efficient combination of two orthogonally polarised sources of light such that they are output through the same, single fibre output.

In optical amplifiers this provides a doubling of pump power whilst ensuring pump redundancy should a pump failure occur.

Applications include high power optical amplifiers and undersea systems. All ports consist of polarisation maintaining fibre.

### Key Features:

- Low insertion loss
- High power handling
- 9xx, 10xx, 14xx and 15xx variants

### Applications:

- Erbium doped fibre amplifiers (EDFAs)
- Raman amplifiers
- Undersea systems
- Coherent optical communications



### Optical Specifications

Parameter	9xx	10xx	14xx	15xx	16xx
Range of available centre wavelengths <sup>1,2</sup>	915-999nm	1000-1099nm	1400-1499nm	1500-1599nm	1600-1650nm
<b>Insertion Loss (fast axis)<sup>3</sup></b>					
Grade M	Max 0.40dB	0.40dB	0.40dB	0.50dB	0.50dB
Grade W	Max 0.60dB	0.60dB	0.60dB	0.70dB	0.70dB
Housing Option	3	3	3	3	3
Dimensions(φxL) for 1x2 & 2x2	3x71mm				
<b>Insertion Loss (slow axis)<sup>3</sup></b>					
Grade M	Max		0.35dB		
Grade W	Max		0.40dB		
Return Loss / Directivity	Min		50dB		
TDL	Typ		0.15dB		
Pigtail tensile load	Max		5N		
Optical power handling	Max		4W		
Fibre type	All ports PM fibre				
Pigtail	Primary coated fibre				
Operating temperature range	-5 to 75°C				
Storage temperature range	-40 to 85°C				

1. The centre wavelength may be selected from within the operating wavelength ranges supplied.

2. Other wavelengths are available. Please contact the sales office.

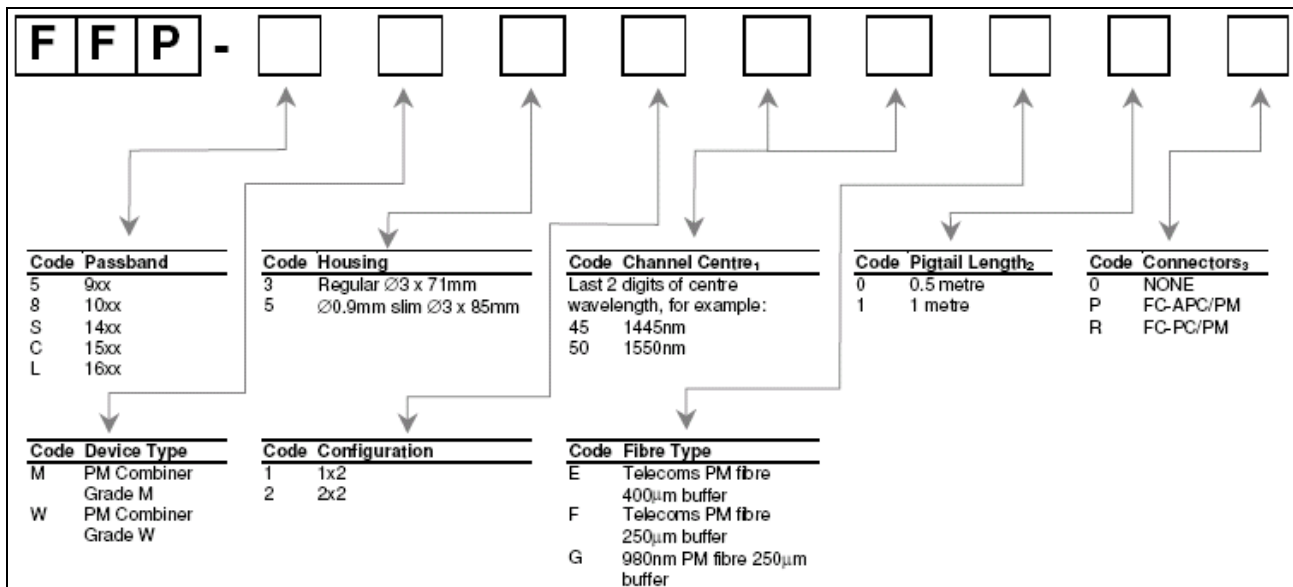
3. Insertion loss at centre wavelength (not including TDL or connector losses).

**Configuration**



**Ordering Code Information**

Example: FFP-SM3245F10 (PM Combiner, Grade M, regular housing, 2x2, channel centre = 1445nm, telecoms PM fibre 250µm buffer, 1m pigtail, no connector)



1. Channel centre must be within the wavelength ranges shown in the Optical Specifications table.
2. Minimum pigtail length. Other pigtail lengths are available on request.
3. Insertion loss in specification table does not include connector loss. Other connectors available on request.

## Multimode Power Combiner with PM Signal Feedthrough

G&H's TFB series Power Combiners provide a high efficiency means of combining light from several multimode sources into one fibre.

G&H proprietary manufacturing techniques allow the precise fusion of input fibres around a central PM polarisation maintaining) signal feedthrough fibre and a PM dual clad output fibre providing high coupling efficiency over a wide pump wavelength range.

Available in standard 3x1 and 7x1 configurations, G&H power combiners can be fabricated from a range of industry standard multimode fibres allowing ease of splicing to commercially available laser diodes.

Custom fibre and port configurations are available on request.

### Key Features:

- All fibre construction
- High power design
- High Coupling Efficiency
- Custom configurations available

### Applications:

- Cladding pumped fibre lasers
- Medical
- Industrial
- Defence

### Optical Specifications<sup>1</sup>

Parameter	Specification	Specification	Unit
Pump Input Fibre NA	0.15	0.22	
Pump Input Wavelength	900 to 1000	900 to 1000	nm
Signal Input Wavelength	1550 or 1064	1550 or 1064	nm
Pump (MM) Transmission Efficiency <sup>2</sup>	≥ 90 (Typ > 95)	≥ 90	%
Return Loss/Directivity	>40	>40	dB
Operating Temperature	0 to +75	0 to +75	°C
Storage Temperature	-40 to +85	-40 to +85	°C

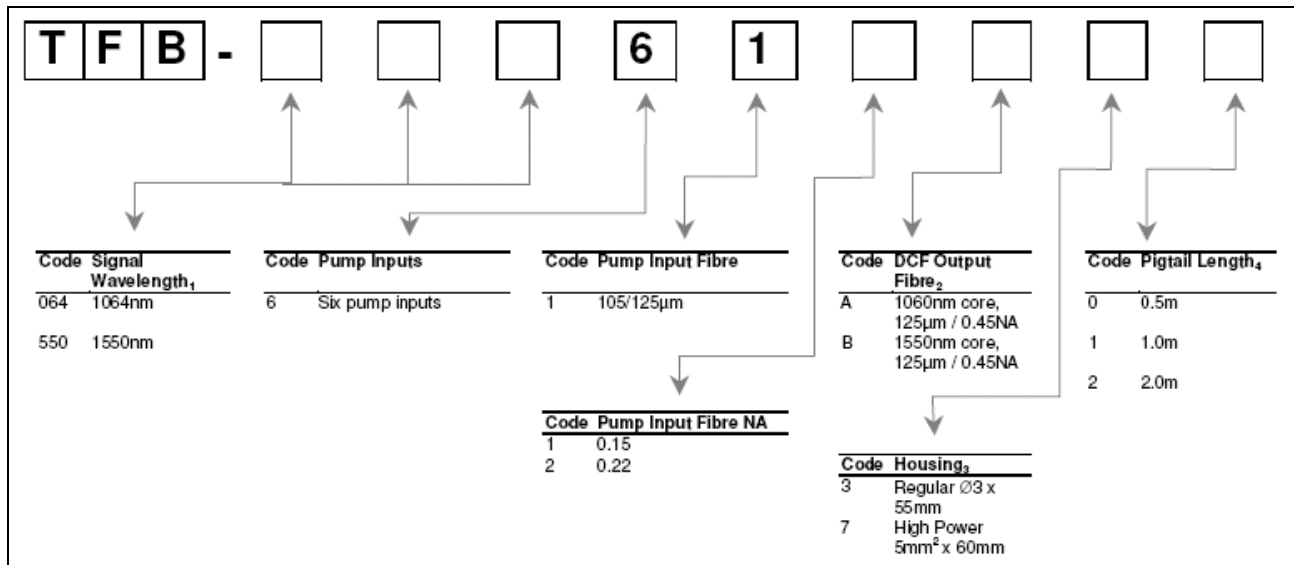
1. All specifications are for operation at room temperature.

2. Transmission efficiency based 7x1 with 125µm / 0.45NA output fibre and 0.5m pigtails. Reported at 975nm as standard.



## Ordering Code Information

Example: TFB-MMM711A70 (7x1 Tapered Fibre Bundle with seven 105/125µm 0.15NA pump inputs, one 125µm 0.45NA output in high power housing with 0.5m pigtails).



1. Signal wavelengths of 1064nm or 1550nm assume the use of Corning Hi1060 or SMF-28 (or equivalent) fibres respectively.
2. Typical core diameters are based on ~4µm for 1064nm and ~8µm for 1550nm. Fibres are passive.
3. Maximum housing lengths shown. Adequate heat-sinking is required for high power operation. For more information please contact the G&H sales team.
4. Minimum pigtail lengths.

## Multimode Power Combiner with PM Signal Feedthrough

G&H's TFB series Power Combiners provide a high efficiency means of combining light from several multimode sources into one fibre.

G&H proprietary manufacturing techniques allow the precise fusion of input fibres around a central PM (polarisation maintaining) signal feedthrough fibre and a PM dual clad output fibre providing high coupling efficiency over a wide pump wavelength range.

Available in a standard (6+1)x1 configuration, the combiner can be fabricated from a range of industry standard fibres for ease of splicing to commercially available laser diodes and fibre applications.

Custom variants using non-standard fibres are available on request.

### Key Features:

- 1.5 $\mu$ m & 1.0 $\mu$ m PM Signal fibres available
- All fibre construction
- High power design
- High Coupling Efficiency
- PM Axis maintained
- Custom configurations available

### Applications:

- Cladding pumped fibre lasers
- Cladding pumped fibre amplifiers
- Telecoms
- Medical
- Industrial
- Defence



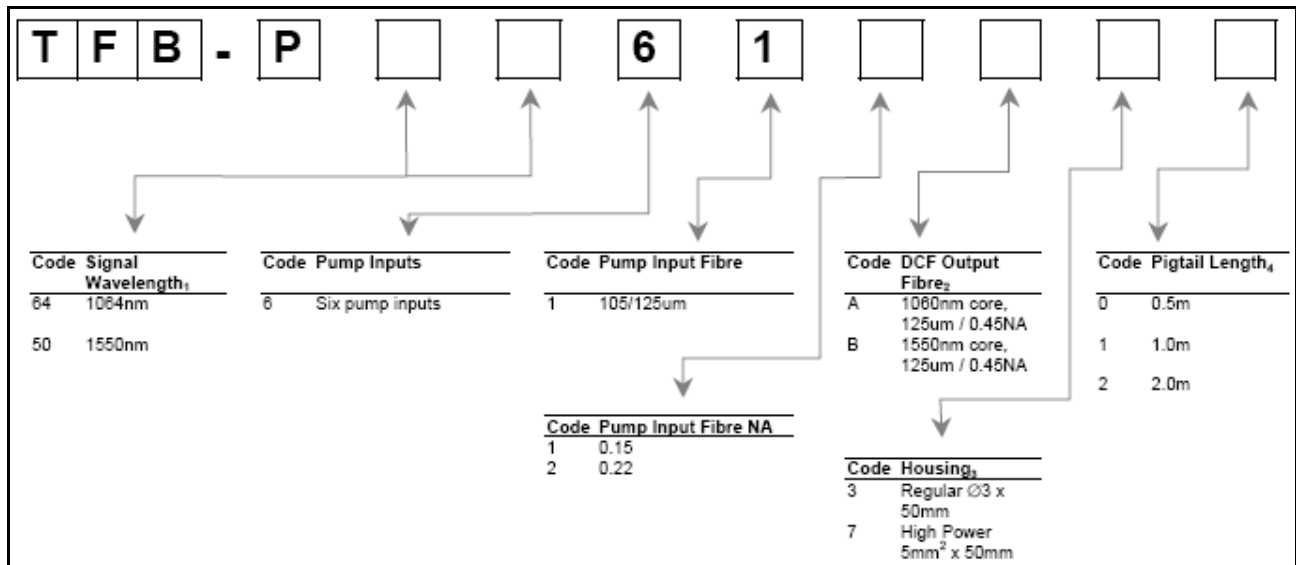
### Optical Specifications<sup>1</sup>

Parameter	Specification	Specification	Unit
Pump Input Fibre NA	0.15	0.22	
Pump Input Wavelength	900 to 1000	900 to 1000	nm
Signal Input Wavelength	1550 or 1064	1550 or 1064	nm
Pump (MM) Transmission Efficiency <sup>2</sup>	$\geq 90$ (Typ > 95)	$\geq 90$	%
Signal Transmission Efficiency <sup>3</sup>	$\geq 80$ (Typ > 85)	$\geq 80$ (Typ > 85)	%
Signal PER (Polarisation Extinction Ratio)	>20	>20	dB
Return Loss/Directivity	>40	>40	dB
Operating Temperature	0 to +75	0 to +75	$^{\circ}$ C
Storage Temperature	-40 to +85	-40 to +85	$^{\circ}$ C

1. All specifications are for operation at room temperature.
2. MM Transmission efficiencies based on typical system mode fill conditions and 0.5m pigtailed. Reported at 975nm as standard.
3. Signal (feedthrough) transmission efficiency reported at centre wavelength; specification typical for centre wavelength  $\pm 15$ nm (minimum).

## Ordering Code Information

Example: TFB-P50611B30 (6+1x1 Tapered Fibre Bundle with PM 1550nm Signal feedthrough, six 105/125um, 0.15NA pump inputs, 1550nm core DCF Output in regular housing with 0.5m pigtails).



1. Signal wavelengths of 1064nm or 1550nm assume the use of Nufern PM-980-HP and PM-1550-HP (or equivalent) signal feedthrough fibres respectively.
2. Typical mode field diameters are based on ~7.5um for 1064nm and ~10.5um for 1550nm. Fibres are passive.
3. Maximum housing lengths shown. Adequate heat sinking is required for high power operation. For more information please contact the G&H sales team.
4. Minimum pigtail lengths.

## Multimode Power Combiner with Signal Feedthrough

G&H's TFB series Power Combiners provide a high efficiency means of combining light from several multimode sources into one fibre.

G&H proprietary manufacturing techniques allow the precise fusion of input fibres around a central PM polarisation maintaining) signal feedthrough fibre and a PM dual clad output fibre providing high coupling efficiency over a wide pump wavelength range.

Available in a standard (6+1)x1 configuration, the combiner can be fabricated from a range of industry standard fibres for ease of splicing to commercially available laser diodes and fibre applications.

Custom options cover large mode area (LMA) signal feedthrough fibres, dual clad output fibres and port count / configurations and are available on request.

### Key Features:

- 1.5 $\mu$ m & 1.0 $\mu$ m Signal fibres available
- All fibre construction
- High power design
- High Coupling Efficiency
- PM Axis maintained
- Custom configurations available

### Applications:

- Cladding pumped fibre lasers
- Cladding pumped fibre amplifiers
- Telecoms
- Medical
- Industrial
- Defence



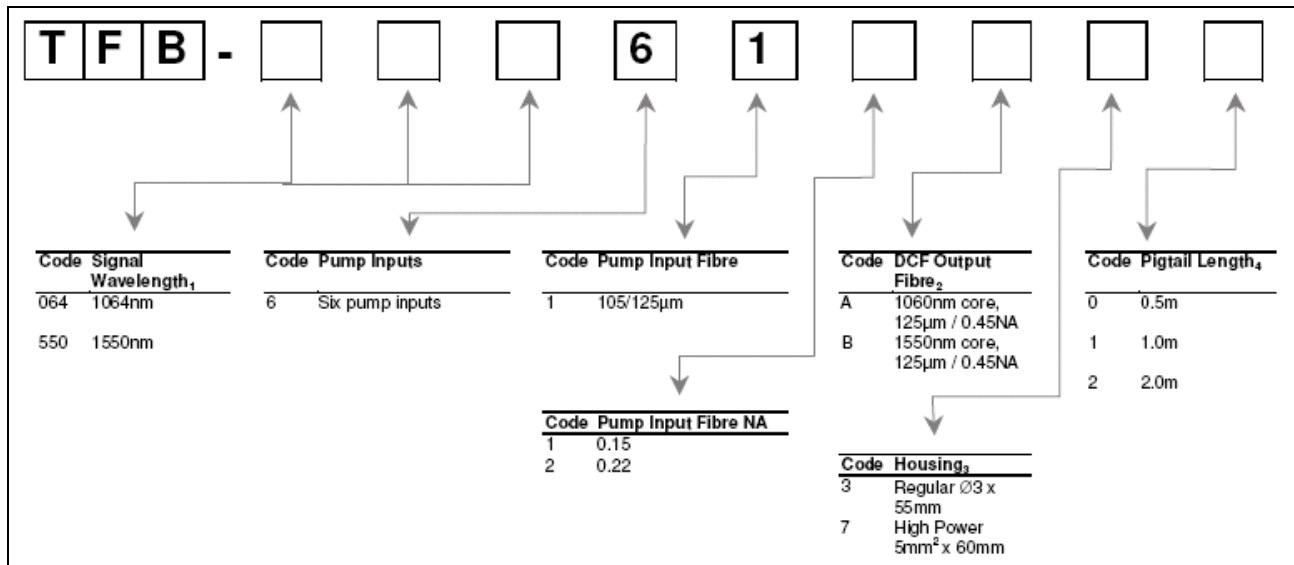
### Optical Specifications<sup>1</sup>

Parameter	Specification	Specification	Unit
Pump Input Fibre NA	0.15	0.22	
Pump Input Wavelength	900 to 1000	900 to 1000	nm
Signal Input Wavelength	1550 or 1064	1550 or 1064	nm
Pump (MM) Transmission Efficiency <sup>2</sup>	$\geq 90$ (Typ > 95)	$\geq 90$	%
Signal Transmission Efficiency <sup>3</sup>	$\geq 80$ (Typ > 85)	$\geq 80$ (Typ > 85)	%
Signal PER (Polarisation Extinction Ratio)	>20	>20	dB
Return Loss/Directivity	>40	>40	dB
Operating Temperature	0 to +75	0 to +75	$^{\circ}$ C
Storage Temperature	-40 to +85	-40 to +85	$^{\circ}$ C

1. All specifications are for operation at room temperature.
2. MM Transmission efficiencies based on typical system mode fill conditions and 0.5m pigtailed. Reported at 975nm as standard.
3. Signal (feedthrough) transmission efficiency reported at centre wavelength; specification typical for centre wavelength  $\pm 15$ nm (minimum).

## Ordering Code Information

Example: TFB-550611B30 (6+1x1 Tapered Fibre Bundle with 1550nm Signal input, six 105/125µm 0.15NA pump inputs, 1550nm core DCF Output in regular housing with 0.5m pigtails).



1. Signal wavelengths of 1064nm or 1550nm assume the use of Corning Hi1060 or SMF-28 (or equivalent) fibres respectively.
2. Typical core diameters are based on ~4µm for 1064nm and ~8µm for 1550nm. Fibres are passive.
3. Maximum housing lengths shown. Adequate heat-sinking is required for high power operation. For more information please contact the G&H sales team.
4. Minimum pigtail lengths.

## Visible Wavelength Combiner

G&H's Visible Wavelength Combiners are singlemode optical fibre components and modules. They enable any two or three primary colours in the visible wavelength region to be combined or separated.

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

No light leaves the fibre and therefore no alignment is required; and there are no unwanted reflections. Furthermore the output fibre pigtailed 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. 3 wavelength combiners provide full RGB operation; enabling full colour displays.

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

### Key Features:

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

### Applications:

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



### Two Wavelength Combiner

Parameter	Specification	Unit
Operating wavelengths, Blue/green	457/532	nm
Operating wavelengths, Green/red	532/633	nm
Operating wavelengths, Blue/red	457/633	nm
Channel transmission (Minimum)	90	%
Channel transmission (Typical)	95	%
Fibre type	Speciality singlemode fibre	
Housing	Semi-ruggedised housing $\phi 5.0 \times 85$	mm
Operating / storage temperature range	-5 to +75 / -40 to +85	oC

### Three Wavelength Combiner

Parameter	Specification			Unit
	Red	Green	Blue	
Operating wavelengths	630, 633, 655	532	457, 460, 488	nm
Channel transmission (Minimum)	85	85	65	%
Channel transmission (Typical)	90	90	70	%
Fibre type	Speciality singlemode fibre			
Fibre cut-off wavelength	430 $\pm$ 20			nm
Housing	Anodised Aluminium housing 110 x 45 x 10			mm
Operating / storage temperature range	-5 to +75 / -40 to +85			oC

## Near Infrared Coupler

The Near Infrared Coupler splits light at any selected wavelength from 700nm to 1150nm. Designed for applications in fibre laser, sensor and avionics applications, the coupler utilizes G&H's low loss fused fibre technology. No light leaves the fibre and therefore no alignment is required; and there are no unwanted reflections. Furthermore the output fibre pigtailed may be directly integrated into beam delivery systems. For components and modules which combine different wavelengths within the near infrared region please refer to the datasheet 'Near Infrared WDM'.

### Key Features:

- 700 to 1150nm operation
- Any coupling ratio available
- All fibre – no alignment required
- No unwanted reflections
- Low light loss
- High power handling

### Applications:

- Fibre lasers
- Sensors
- Avionics
- Biomedical equipment
- Research



### Optical Specifications

Coupling Ratio (%) <sup>3</sup>	Grade	Available Wavelength(s)	Available Housing Option	Signal Path Insertion Loss (dB) <sup>1,2</sup>	Tap Path Insertion Loss (dB) <sup>1,2</sup>
1	A	700 to 1150nm	3,4,5,6	0.15	24.9
1	B	700 to 1150nm	3,4,5,6	0.20	25.3
5	A	700 to 1150nm	3,4,5,6	0.40	15.9
5	B	700 to 1150nm	3,4,5,6	0.50	16.2
10	A	700 to 1150nm	3,4,5,6	0.9	12.2
10	B	700 to 1150nm	3,4,5,6	1.1	12.4
20	A	700 to 1150nm	3,4,5,6	1.5	8.4
20	B	700 to 1150nm	3,4,5,6	1.7	8.6
30	A	700 to 1150nm	3,4,5,6	2.2	6.4
30	B	700 to 1150nm	3,4,5,6	2.4	6.4
40	A	700 to 1150nm	3,4,5,6	3.0	4.9
40	B	700 to 1150nm	3,4,5,6	3.2	5.1
50	A	700 to 1150nm	3,4,5,6	3.8	3.8
50	B	700 to 1150nm	3,4,5,6	4.0	4.0

1. In 2x2 couplers 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. Any coupling ratio available. Please contact us for specifications of coupling ratios not listed.

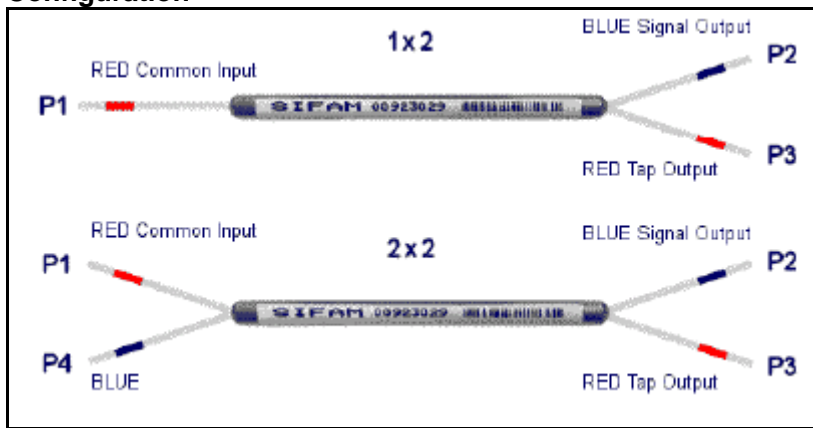
Parameter	Specification	Unit
Operating Wavelength	Specified wavelength within the range 700-1150nm	nm
Operating / Storage Temperature Range	-40 to +75 / -40 to + 85	°C
Pigtail Tensile Load	5	N
Fibre Type	Speciality singlemode fibre	

1. For connectorised component, operating temperature range is -5 to +75°C.

### Housing Option

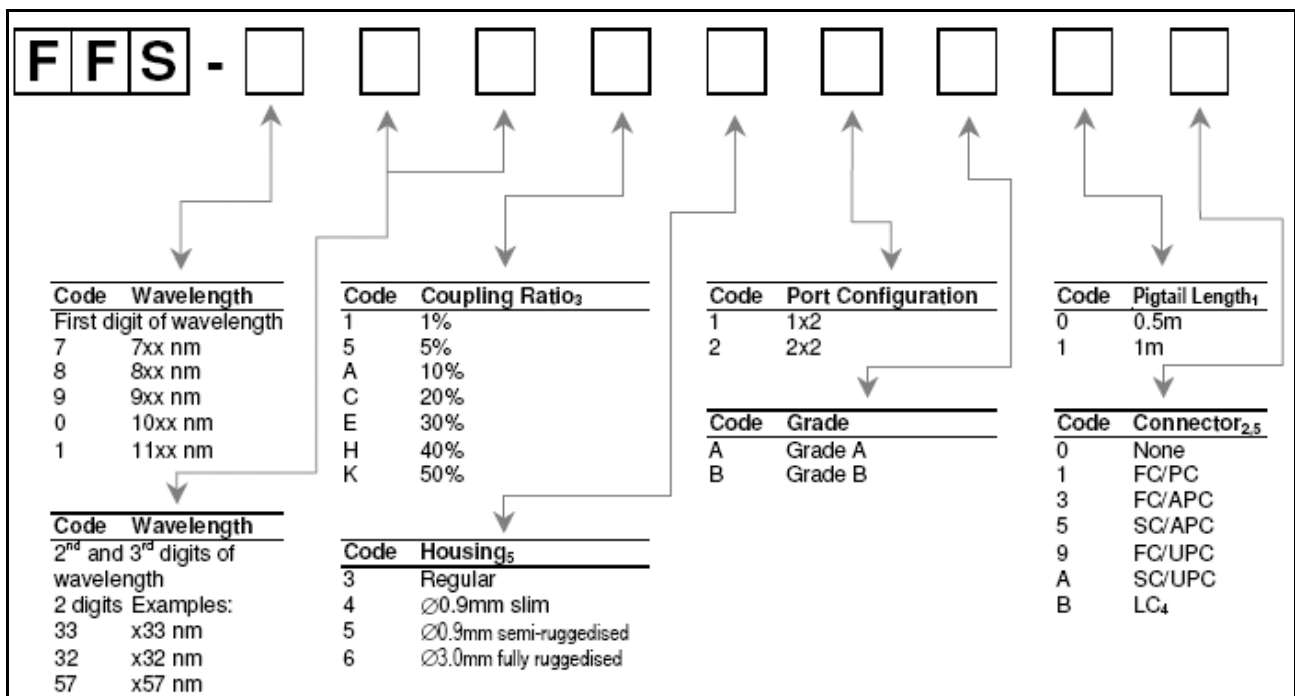
Housing Code	Description	1x2, 2x2 Dimension(mm)	Pigtail
3	Regula	3.0 (φ) x 50 (L)	Primary-coated fibre
4	φ0.9 mm slim	3.0 (φ) x 60 (L)	φ0.9mm loose-tube
5	φ0.9 mm semi-ruggedised	5.0 (φ) x 75 (L)	φ0.9 mm loose-tube
6	φ3.0 mm fully-ruggedised	80(L)x10(W)x8(H)	φ3.0 mm fan-out sleeving

**Configuration**



**Ordering Code Information**

- FFS-780K31A10 (Fused Fibre Speciality Coupler, 780nm, 50/50 coupling ratio, regular housing, 1x2, A grade, 1m pigtails, no connectors)
- FFS-060K31A10 (Fused Fibre Speciality Coupler, 1060nm, 50/50 coupling ratio, regular housing, 1x2, A grade, 1m pigtails, no connectors)



1. Minimum pigtail length. Further pigtail lengths available on request. Where connectorised, pigtail length is to connector end face.
2. Insertion Loss in specification table does not include connector losses.
3. Any coupling ratio available. Please contact G&H for ordering codes of coupling ratios not listed.
4. LC connector not available for housing code 6, fully ruggedised housing.
5. Connectors may be fitted to housing types 4, 5 and 6. For connectorisation of housing type 3 please contact the sales office.

## PM Coupler

The G&H PM Coupler enables the accurate monitoring and splitting of optical signals in polarisation maintaining fibre. Manufactured using industry-standard PM fibre, the PM Coupler is available in any coupling ratio from 1% to 50%. Based on G&H's fused fibre technology, the PM Coupler demonstrates very low loss, high power handling and there is no price penalty for adding a second input port. The centre operating wavelength may be chosen from within a wide variety of operating passbands, including 980, 1064, 1310, 14xx, 15xx and 16xx.

In common with all PM components, it is necessary to launch into either the slow or the fast axis to maintain polarisation. For the G&H PM Coupler, specifications are based on slow axis launch, although fast axis versions are also available if requested.

### Key Features:

- All PM fibre construction
- Low excess loss
- High power handling
- 980, 1064, C, L and S bands available
- Slow axis operation as standard
- Fast axis operation also available

### Applications:

- Power monitoring of PM sources
- Coherent communications
- Fibre gyroscopes
- High power fibre lasers
- Fibre amplifiers

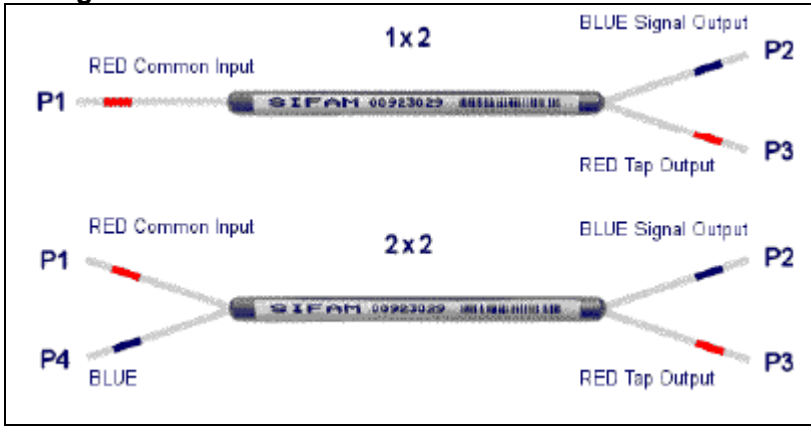


### Optical Specifications<sup>1</sup>

Parameter	Specification						Unit
	9xx	10xx	1310	14xx	15xx	16xx	
Centre Wavelength Range	9xx	10xx	1310	14xx	15xx	16xx	nm
Available Wavelengths <sup>2</sup>	915-999	1000-1099	1310	1425-1499	1500-1599	1600-1650	nm
Coupling Ratio	1/99						%
Coupling Ratio Tolerance	+/- 0.5						%
Extinction Ratio <sup>3</sup> , Grade A	20	20	20	20	20	20	dB
Extinction Ratio <sup>3</sup> , Grade B	17	17	17	17	17	17	dB
Coupling Ratio	5/95						%
Coupling Ratio Tolerance	+/- 1.5						%
Extinction Ratio <sup>3</sup> , Grade A	20	20	20	20	20	20	dB
Extinction Ratio <sup>3</sup> , Grade B	17	17	17	17	17	17	dB
Coupling Ratio	10/90						%
Coupling Ratio Tolerance	+/- 3.0						%
Extinction Ratio <sup>3</sup> , Grade A	20	20	20	20	20	20	dB
Extinction Ratio <sup>3</sup> , Grade B	17	17	17	17	17	17	dB
Coupling Ratio	33/67						%
Coupling Ratio Tolerance	+/- 4.0						%
Extinction Ratio <sup>3</sup> , Grade A	20	20	20	20	20	20	dB
Extinction Ratio <sup>3</sup> , Grade B	17	17	17	17	17	17	dB
Coupling Ratio	50/505						%
Coupling Ratio Tolerance	+/- 5.0						%
Extinction Ratio <sup>3</sup> , Grade A	20	20	20	20	20	20	dB
Extinction Ratio <sup>3</sup> , Grade B	17	17	17	17	17	17	dB
Excess Loss Grade A	0.3	0.3	0.3	0.3	0.3	0.3	dB
Excess Loss Grade B	0.5	0.5	0.5	0.5	0.5	0.5	dB
Return Loss/Directivity	50						dB
Pigtail Tensile Load	5						N
Operating Temperature	-5 to +751						°C
Storage Temperature	-40 to +85						°C
Fibre Type	Polarisation maintaining fibre (industry-standard profile)						

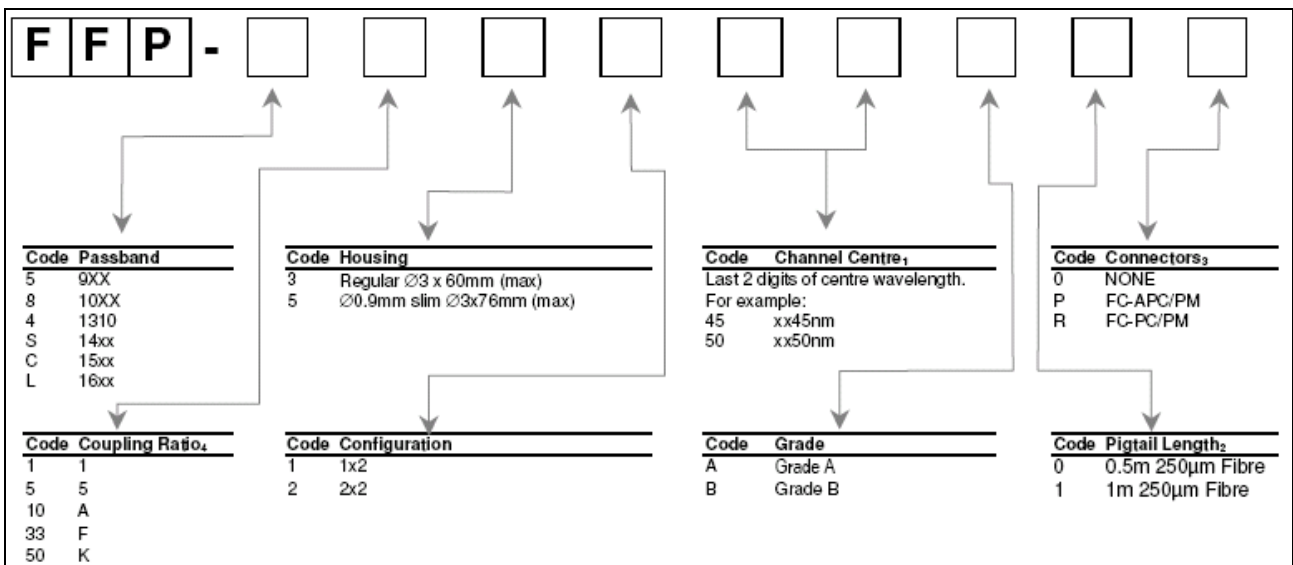
1. All specifications are for operation at room temperature.
2. The centre wavelength may be selected from within the available wavelength ranges supplied.
3. Defined for signal path P1-P2.
4. Defined for both signal path P1-P2 and tap path P1-P3.
5. Preliminary specifications.

**Configuration**



**Ordering Code Information**

Example: FFP-CK3250A10 (C band, PM Coupler, 50/50 coupling ratio, regular housing, 2x2, channel centre =1550nm, grade A, 1m pigtail, no connector)



1. Channel centre must be within the wavelength ranges shown in the Optical Specifications table.
2. Minimum pigtail length. Other pigtail lengths are available on request.
3. Optical specifications in specification table do not include connector loss. Other connectors available on request.
4. Other coupling ratios available on request.
5. PM Products are manufactured using 250 $\mu$ m PANDA PM fibre, 400 $\mu$ m PANDA PM fibre available at wavelengths higher than 1400nm.

## PM Low Ratio Tap Coupler

The G&H Fused PM LRT, taps off low power from a signal path whilst maintaining polarisation through the component. G&H proprietary PM manufacturing technology provides tap ratios as low as 0.01% with ultra low loss and high polarisation extinction ratio. The all fibre construction and excellent loss characteristics provide exceptional reliability at high powers. PM LRT's also exhibit improved tap ratio stability when input polarisation extinction ratio levels are low or fluctuating.

These high performance parts are available at a range of wavelengths with different fibre options. PM LRTs can therefore be readily specified in a wide variety of applications, enabling rapid design cycles and new project builds.

Standard parts are available at wavelengths from 900 – 1600nm. For other wavelengths or coupling ratios please contact the sales office.

### Key Features:

- Low Loss
- High PER
- High power handling
- PM PANDA Fibre on all ports

### Applications:

- Fibre lasers
- Instrumentation

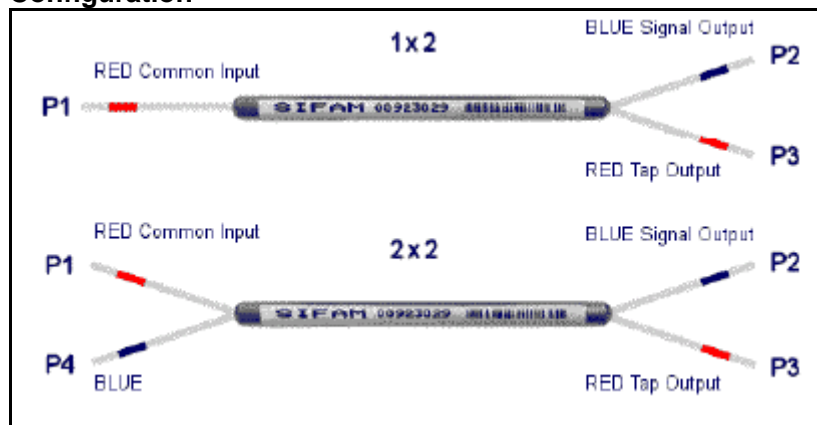


### Optical Specifications

Parameter	Specification <sup>3</sup>					Unit
	0.01	0.1	1	5	10	
Coupling Ratio	0.01	0.1	1	5	10	%
Tap Insertion Loss <sup>1</sup>	36 -44	27-33	18.2-23	11.9-14.9	8.86-1.85	dB
Signal Insertion Loss <sup>1</sup>	0.3(Typ<0.1)	0.3 (Typ<0.1)	0.37	0.6	0.9	dB
1300 – 1600 Signal PER <sup>2</sup>	>20					dB
900 – 1100 Signal PER <sup>2</sup>	>20					dB
Return Loss	>55					NA
Operating Wavelength <sup>4</sup>	Any Wavelength from 900-1100nm and 1300-1600nm					NA
Housing	Regular Ø3.0 x 60 (max)					
Fibre Type	PM PANDA Fibre					

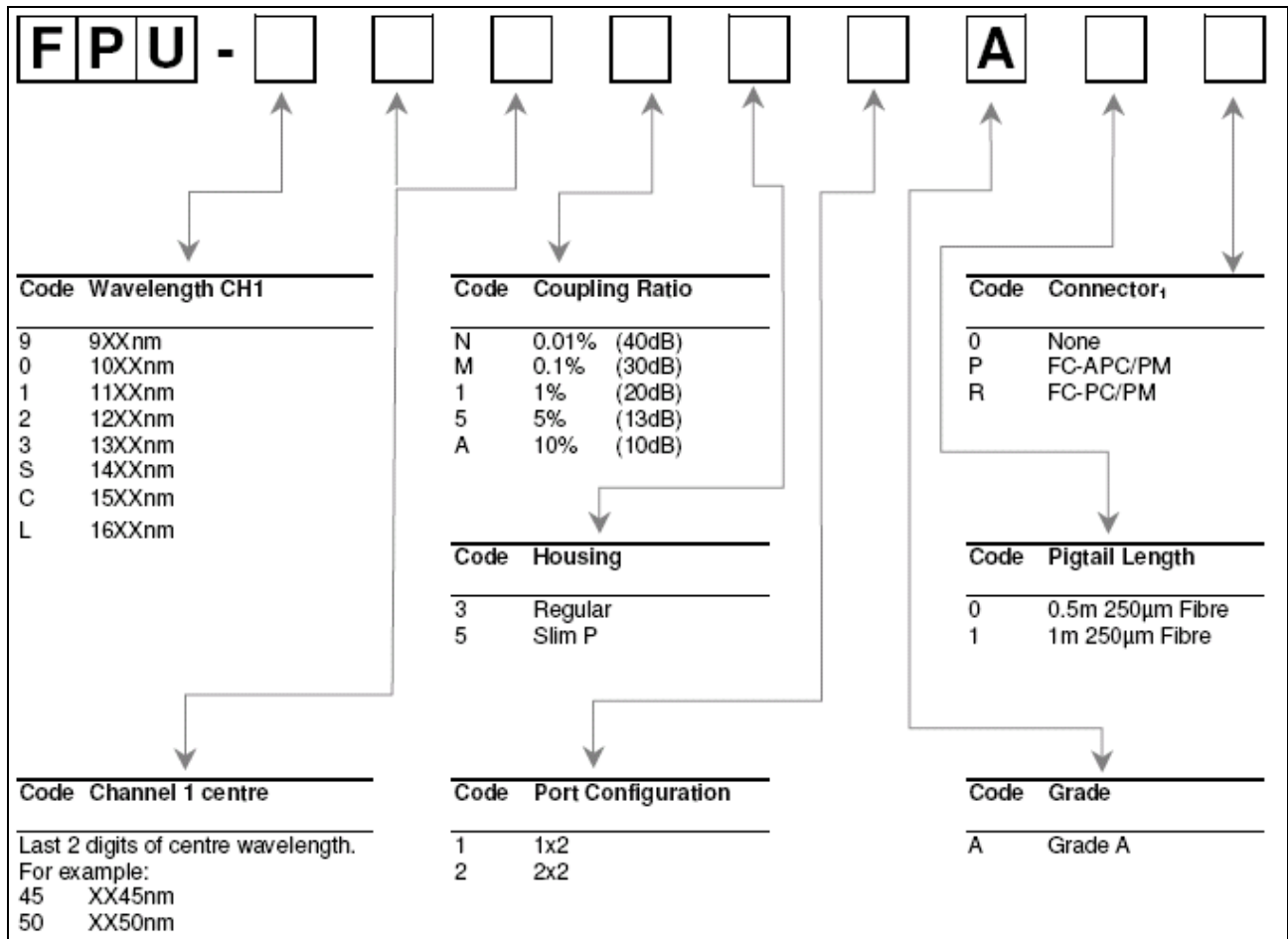
1. Insertion Loss at operating wavelength. Not including TDL.
2. Devices manufactured to operate in fast axis as standard. For use in a slow-axis system a 90° PM splice is required.
3. Specifications shown are for operation at room temperature.
4. The centre wavelength may be selected from within the available wavelength range supplied.

### Configuration



**Ordering Code Information**

Sample: FPU-060N31A10 (Fused Fibre LRT, 1060nm, 0.01% tap, Regular housing, 1x2, Grade A, 1m pigtails, No connectors)



PM Products are manufactured using 250µm PANDA PM fibre, 400µm PANDA PM fibre available at wavelengths higher than 1400nm.

## Ultra Low Ratio Tap Coupler

The Ultra Low Ratio Tap Coupler splits a very small amount of light from a signal path to a tap port. Tested at up to 50W optical power, it's main application is in the monitoring of very high power optical sources such as fibre lasers. Low tap ratios such as 0.1%, 0.01% or 0.001% enable the monitoring photodetector to operate without damage or saturation.

G&H proprietary manufacturing technology provides ultra-low loss in the signal path, thereby maximising optical power handling. Consistently high return loss (>55dB) reduces the amount of optical power reflected back along the input fibre. This helps the fibre laser operate in a stable manner.

Standard parts are available for wavelengths from 700 to 1599nm. For other wavelengths, coupling ratios or customised fibre types please contact the sales office.

### Key Features:

- Tap ratio up to 40dB
- High return loss
- Ultra-low signal insertion loss
- High power handling
- Available at wide variety of laser wavelengths
- Custom product

### Applications:

- Fibre Lasers
- RAMAN amplifiers
- High Power EDFA



### Specifications

Parameter	Specification			Unit
Coupling Ratio	0.1	0.01	0.1	%
Tap Insertion Loss	30 ( $\pm 3$ )	40 ( $\pm 4$ )	50 ( $\pm 5$ )	dB
Signal Insertion Loss <sup>1,2</sup>	0.1			dB
Return Loss	$\geq 55$			dB
Operating Wavelength <sup>3</sup>	Any selected wavelength from 700 to 1599nm			nm
Housing	Regular $\text{Æ}3.0 \times 50$			mm
Operating Temperature	-40 to 75			$^{\circ}\text{C}$
Storage Temperature	-40 to 85			$^{\circ}\text{C}$
Pigtail Tensile Load	5			N
Fibre Type <sup>4</sup>	Singlemode			

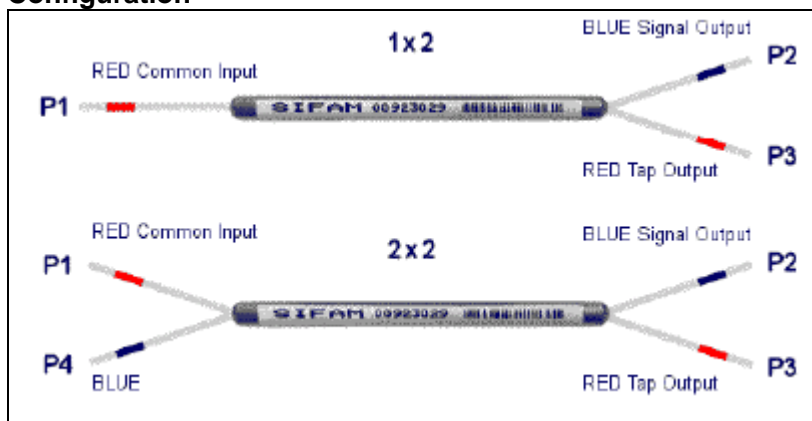
1. Maximum insertion loss at operating wavelength. Not including TDL or PDL.

2. In 2x2 couplers insertion loss is not specified for launch through second input port P4 (coloured blue)

3. Other wavelengths available as custom components. Please contact the sales office.

4. For customised fibre types please contact the sales office.

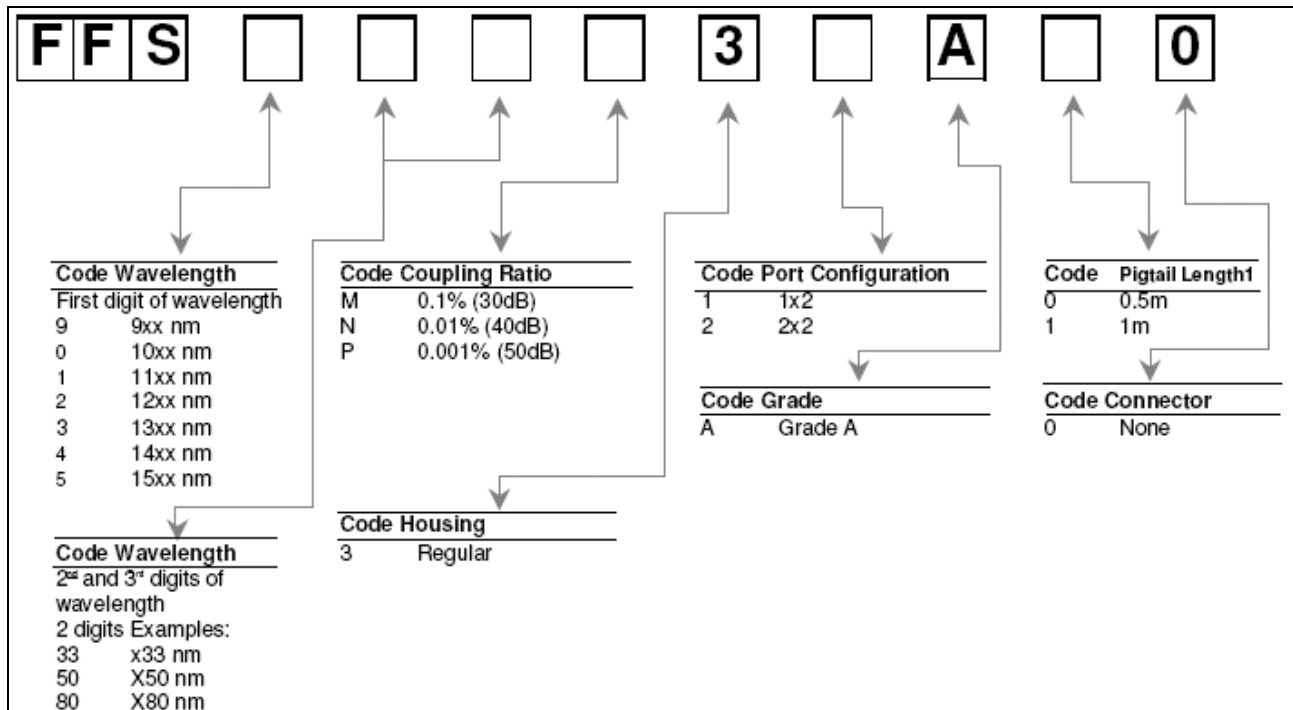
### Configuration



**Ordering Code**

Examples:

- FFS-080 P32 A10 (Fused Fibre Speciality Coupler, 1080nm, 0.001% coupling ratio, regular housing, 2x2, A grade, 1m pigtails, no connectors)
- FFS-550 M32 A10 (Fused Fibre Speciality Coupler, 1550nm, 0.1% coupling ratio, regular housing, 2x2, A grade, 1m pigtails, no connectors)



1. Minimum pigtail length. Further pigtail lengths available on request.

## Visible Wavelength Coupler

The Visible Wavelength Coupler splits or combines light in the visible region. Versions optimised for any wavelength within the range 450nm to 700nm may be selected.

Designed for applications in display systems, sensors and biomedical equipment, the coupler utilises G&H's low loss fused fibre technology.

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

For components and modules which combine different wavelengths within the visible region please refer to the datasheet 'Visible Wavelength Combiners'.

### Key Features:

- Visible wavelength operation
- Any coupling ratio available
- All fibre – no lens alignment
- No unwanted reflections
- Low light loss
- High power handling

### Applications:

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



### Optical Specifications

Coupling Ratio (%) <sup>3</sup>	Available Housing Option	Grade <sup>1</sup>	Available Wavelength(s)	Coupling Ratio Tolerance (%)	Excess Loss (dB) <sup>2</sup>
10	3,4,5,6	A	500 to 700nm	±2	0.3
10	3,4,5,6	B	450 to 700nm	±3	0.5
20	3,4,5,6	A	500 to 700nm	±3	0.3
20	3,4,5,6	B	450 to 700nm	±4	0.5
30	3,4,5,6	A	500 to 700nm	±3	0.3
30	3,4,5,6	B	450 to 700nm	±4	0.5
40	3,4,5,6	A	500 to 700nm	±4	0.3
40	3,4,5,6	B	450 to 700nm	±5	0.5
50	3,4,5,6	A	500 to 700nm	±5	0.3
50	3,4,5,6	B	450 to 700nm	±6	0.5

1. In 2x2 couplers performance is not specified for launch through second input port P4 (coloured blue)

2. Includes fibre losses for up to 1m pigtail length. Does not include connector losses.

3. Any coupling ratio available. Please contact us for specifications of coupling ratios not listed.

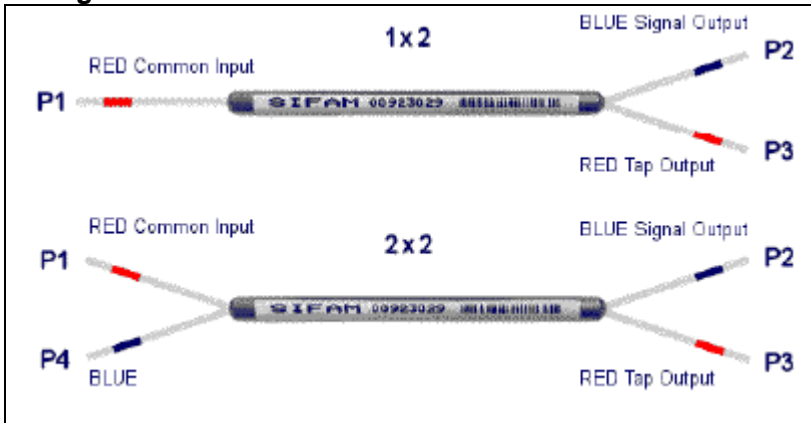
Parameter	Specification	Unit
Operating Wavelength	Specified wavelength within the range 450-700nm	nm
Operating/Storage Temperature Range <sup>1</sup>	-40 to +75 / -40 to + 85	°C
Pigtail Tensile Load	5	N
Fibre Type	Short wavelength speciality fibre	

1. For connectorised component, operating temperature range is -5 to +75°C.

### Housing Option

Housing Code	Description	Dimensions (mm)	Pigtail
3	Regular	3.0 (φ) x 55 (L) max.	Primary-coated fibre
4	φ0.9 mm slim	3.0 (φ) x 76 (L) max.	φ0.9 mm loose-tube
5	φ0.9 mm semi-ruggedised	5.0 (φ) x 85 (L) max.	φ0.9 mm loose-tube
6	φ3.0mm fully-ruggedised	80 (L) x 10 (W) x 8 (H)	φ3.0 mm fan-out sleeving

**Configuration<sup>1</sup>**

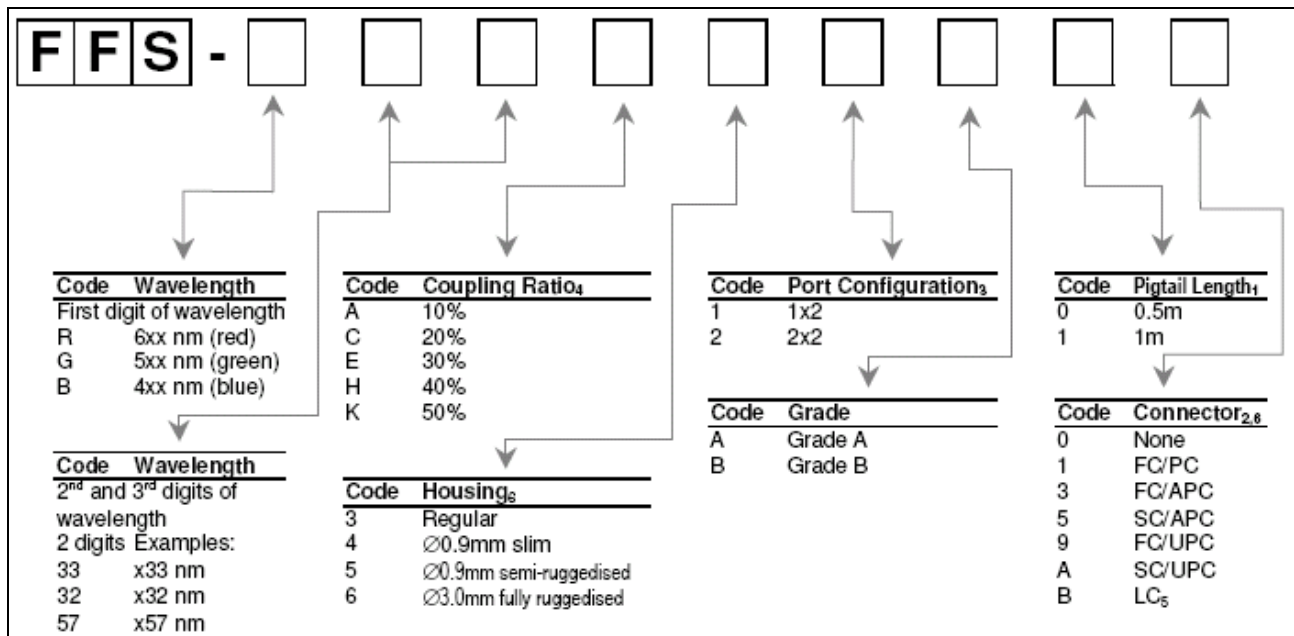


1. 1x2 couplers for blue wavelengths i.e. <500nm are supplied as a 2x2 with an external termination on port P4.

**Ordering Code Information**

Example:

FFS-G32K31A10 (Fused Fibre Speciality Coupler, 532nm, 50/50 coupling ratio, regular housing, 1x2, A grade, 1m pigtails, no connectors)



1. Minimum pigtail length. Further pigtail lengths available on request. Where connectorised, pigtail length is to connector end face.
2. Excess Loss in specification table does not include connector losses.
3. 1x2 couplers for blue wavelengths i.e. <500nm are supplied as a 2x2 with an external termination on port P4.
4. Any coupling ratio available. Please contact G&H for ordering codes of coupling ratios not listed.
5. LC connector not available for housing code 6, fully ruggedised housing.
6. Connectors may be fitted to housing types 4, 5 and 6. For connectorisation of housing type 3 please contact the sales office.

## Near Infrared WDM

The Near Infrared WDM enables the low loss combining or splitting of a pair of wavelengths within the 700nm to 1150nm region. G&H can rapidly produce such custom WDMs, with typical minimum wavelength separation of 50nm.

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

Specific applications could include combining two sensor wavelengths onto one fibre, splitting laser harmonics, or combining wavelengths in fibre 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 to 1150nm operation
- Custom wavelength capability
- 50nm minimum wavelength spacing (<50nm channel spacing available on request)
- Low loss
- High power handling
- Custom product

### Applications:

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



### Optical Specifications

Channel Spacing	Available Housing	Max Insertion Loss <sup>1,2,3</sup>	Min Isolation <sup>3</sup>
100 – 50nm	3,4,5	0.5dB	12dB
>100nm	3,4,5	0.4dB	14dB

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.

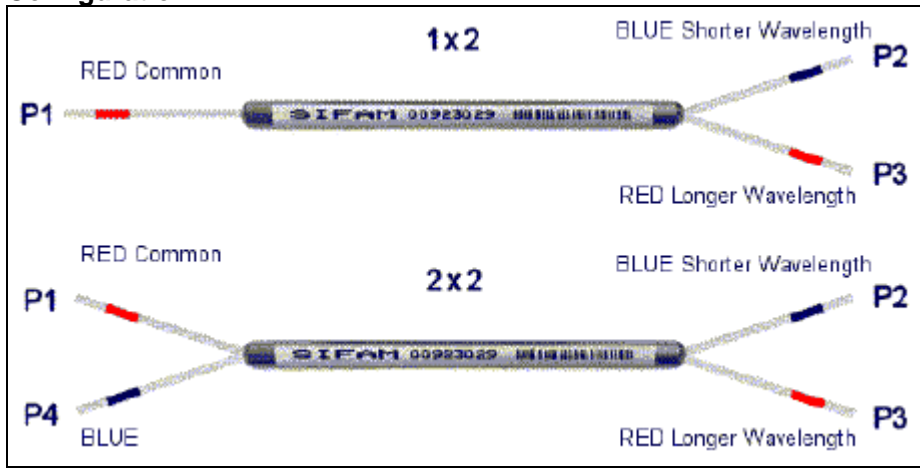
Parameter	Specification	Unit
Operating Wavelength	Specified wavelength within the range 700-1150nm	nm
Operating/Storage Temperature Range <sup>1</sup>	-40 to +75 / -40 to + 85	°C
Pigtail Tensile Load	5	N
Fibre Type	Speciality singlemode fibre	

1. For connectorised component, operating temperature range is –5 to +75oC.

### Housing Option

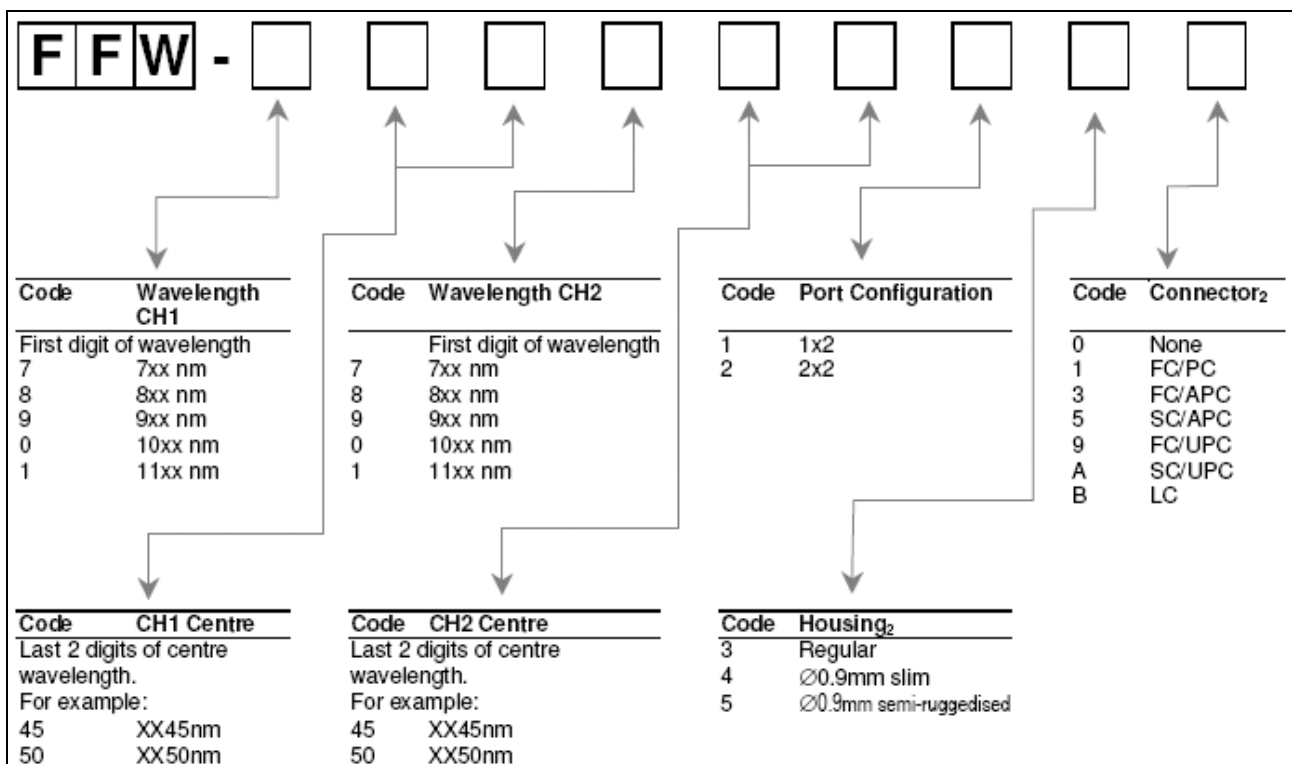
Housing Code	Description	1x2, 2x2 Dimensions (mm)	Pigtail
3	Regular	3.0 (φ) x 60 (L)	Primary-coated fibre
4	φ0.9 mm slim	3.0 (φ) x 70 (L)	φ0.9mm loose-tube
5	φ0.9 mm semi-ruggedised	5.0 (φ) x 85 (L)	φ0.9 mm loose-tube

**Configuration**



**Ordering Code Information**

FFW-780060130 (Fused Fibre WDM, 780/1060, 1x2, Regular Housing, 1m pigtails, No connectors)



1. 1m Pigtail length as standard. For custom pigtail length requirements please contact the sales office.
2. Connectors may be fitted to housing types 4 and 5. For connectorisation of housing type 3 please contact the sales office.

## PM WDM

The G&H Fused PM WDM, combines multiple wavelengths of light in PM Fibre whilst maintaining polarisation. G&H proprietary PM manufacturing technology provides low loss, with high polarisation extinction ratio. The all fibre construction offers excellent reliability and high power handling characteristics.

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

In common with all PM components, it is necessary to launch into either the slow or the fast axis to maintain polarisation. For the G&H PM WDM, specifications are based on slow axis launch, although fast axis versions are also available if requested

### Key Features:

- Low Loss
- High PER
- High power handling
- PM PANDA Fibre on all ports
- Slow Axis operation as standard
- Fast Axis operation available on request

### Applications:

- Pump signal WDM for EDFA
- Fibre lasers
- Instrumentation

### Optical Specifications

Wavelength			Available Housing	CH1 Insertion Loss1 (dB)	CH2 Insertion Loss1 (dB)	CH1 PER	CH2 PER
CH1	CH2	Spacing		Max (Typ)	Max (Typ)		
900-1100nm	900-1100nm	50-100nm	3	1.0 (0.5)	1.0 (0.5)	>15dB	>15dB
900-1100nm	900-1100nm	>100nm	3	0.7 (0.3)	0.7 (0.3)	>17dB	>17dB
900-1100nm <sup>2</sup>	1450 - 1600nm	-	3	0.32(0.2)	0.5(0.2)	>17dB2	>20dB
1300 - 1600nm	1300 - 1600nm	50-100nm	3	1.0 (0.5)	1.0 (0.5)	>17dB	>17dB
1300 - 1600nm	1300 - 1600nm	>100nm	3	0.7 (0.3)	0.7 (0.3)	>20dB	>20dB

1. Insertion loss specified at centre wavelength and room temperature.
2. 900-1100nm wavelength range may be below the 2nd order mode cut-off for the fibre 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 <50nm, please contact the sales office.

Parameter	Specification	Unit
Return Loss/Directivity1	55	dB
Pigtail Tensile Load	5	N
Optical Power Handling	1	W
Operating / Storage Temperature Range	-5 to +75 / -40 to +85	°C
Fibre Type	PM PANDA Fibre	

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

### Housing Option

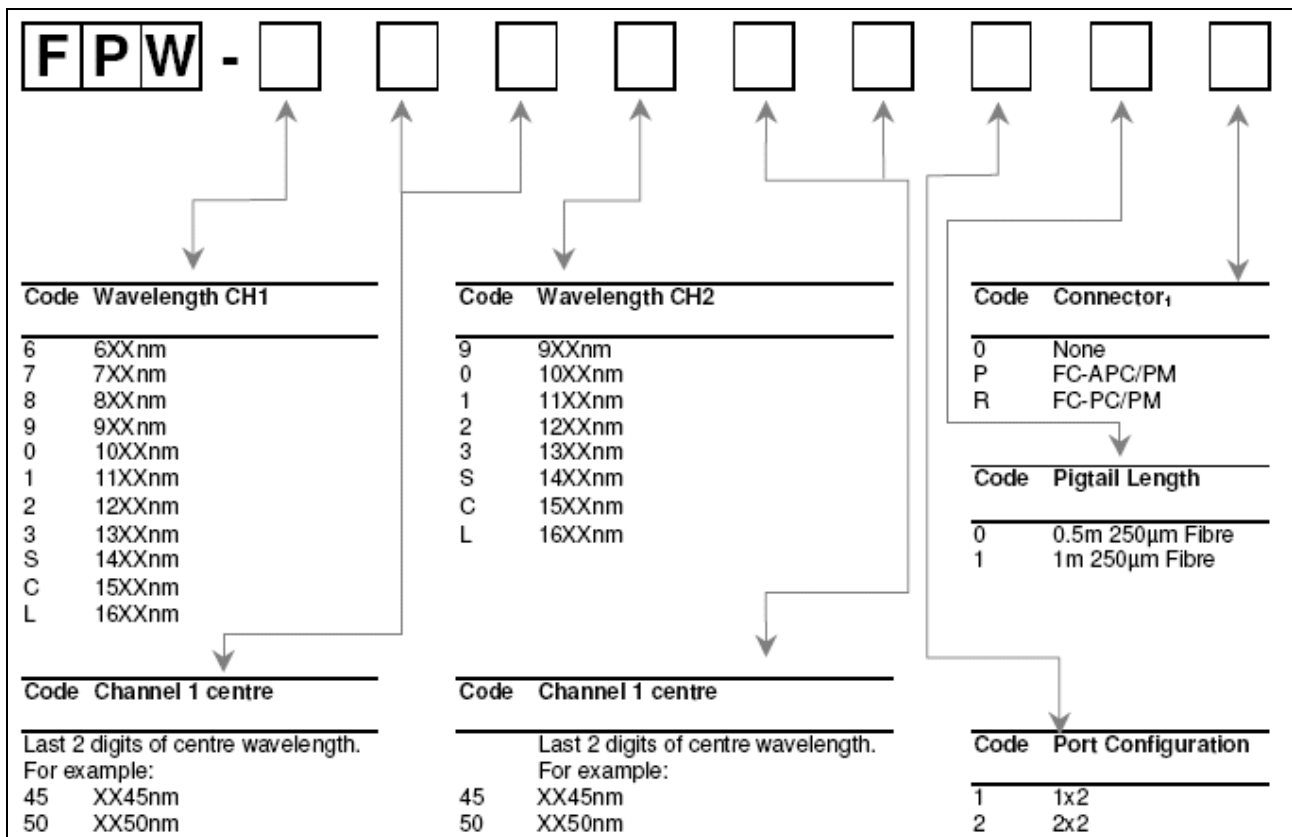
Housing Code	Description	Max Dimensions (mm)	Pigtail
3	Regular	3.0 (φ) x 85 (L)	Primary-coated fibre

Configuration



Ordering Code Information

Sample: FPW-980060110 (Fused Fibre WDM, 980/1060, 1x2, 1m pigtails, No connectors)



1. Insertion loss in specification table does not include connector losses.
2. The G&H high power housing option is available on request for this product.
3. PM Products are manufactured using 250µm PANDA PM fibre, 400µm PANDA PM fibre available at wavelengths higher than 1400nm.