Fiber Coupled 90° Optical Hybrid

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The FCOH is a passive, micro-optics-based 90° optical hybrid designed for coherent optical signal demodulation, including BPSK and QPSK formats. It functions by mixing the incoming signal (S) with a local oscillator reference signal (L), generating four optical outputs corresponding to the vector sums and differences of the two inputs: S+L, S−L, S+jL, and S−jL. These outputs represent four quadrature states in the complex optical field space. The signals are then directed to two pairs of balanced photodetectors, enabling differential detection of the in-phase (I) and quadrature (Q) components. This configuration allows extraction of both amplitude and relative phase information through digital signal processing. In a coherent receiver system, preserving the optical phase enables advanced functionalities such as dispersion compensation and phase noise mitigation in the electrical domain, improving overall system performance and enabling cost-effective compensation of optical transmission impairments. A block diagram illustrating the integration of the 90° Optical Hybrid in a coherent receiver is shown below.

Features

- Passive
- Compact Size
- Polarization Diversified Version Also Available

Applications

- Optical Coherent Detection
- QPSK Demodulation

Specifications

Parameter		Min	Typical	Max	Unit
Wavelength Range (C- or L-Band)		1527		1567	nm
Phase Difference [1] (between M_1, M_2 and M_3, M_4)			90 ± 5		deg
Insertion Loss [1] (without connector)	S→Mi		< 8.5		dB
	L→Mi		< 8.5		
Insertion Loss Difference [1]	between S→M_1 and S→M_2		< 1.2		dB
	between S→M_3 and S→M_4		< 1.2		
	between L→M_1 and L→M_2		< 1.2		
	between L→M_3 and L→M_4		< 1.2		
Optical Return Loss			> 27		dB
Optical Path Difference (skew, between M_1 and M_2 and between M_3 and M_4)			< 1		ps
Optical Path Difference (skew, between any other two outputs)			< 2 in fiber length		mm
Operating Temperature		15		35	°C
Storage Temperature		-40		85	°C
Optical Power Handling (CW)			300	500	mW
Fiber Type		SMF-28 with 900 µm loose tube			
Connector Type		TBD			

Notes:

[1]. Over the stated spectral and operating temperature ranges and all polarization states.

[2]. Subject to change, not including collimator sleeves extending from the two adjacent sides by 21 mm.

Note: The specifications provided are for general applications with a cost-effective approach. If you need to narrow or expand the tolerance, coverage, limit, or qualifications, please [click this link]:

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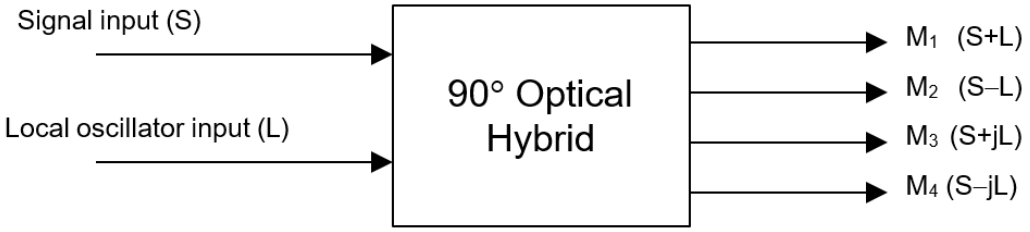
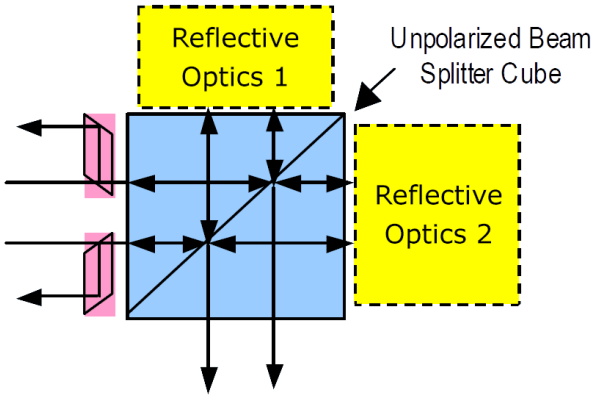
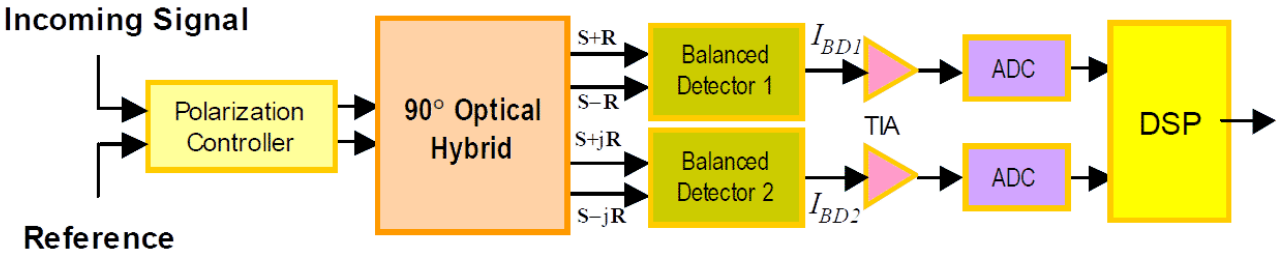
Function Diagram







Electronic Control Requirements

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Mechanical Dimension

*Product dimensions may change without notice. This is sometimes required for non-standard specifications.

Recommendation Control Circuit

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Ordering Information

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Prefix	**Type**	**Wavelength**		**Version**	**Fiber Type**	**Fiber Cover**	**Fiber Length**	**Connector**
FCOH-	Regular = 11 Special = 00	1260~1620 = B Special = 0		Standard = 1 Special = 0	SMF-28 = 1 PM1550 = B Special = 0	Bare fiber = 1 900 um tube = 3 Special = 0	0.25m = 1 0.5m = 2 1.0m = 3 Special = 0	None = 1 FC/PC = 2 FC/APC = 3 SC/PC = 4 SC/APC = 5 LC/PC = 7 Duplex LC/PC = 8 Special = 0

- **PM1550** fiber works well for **1310nm**

Fiber Core Alignment

Note that the minimum attenuation for these devices depends on excellent core-to-core alignment when the connectors are mated. This is crucial for shorter wavelengths with smaller fiber core diameters that can increase the loss of many decibels above the specification if they are not perfectly aligned. Different vendors' connectors may not mate well with each other, especially for angled APC.

Fiber Cleanliness

Fibers with smaller core diameters (<5 μm) must be kept extremely clean, contamination at fiber-fiber interfaces, combined with the high optical power density, can lead to significant optical damage. This type of damage usually requires re-polishing or replacement of the connector.

Maximum Optical Input Power

Due to their small fiber core diameters for short wavelength and high photon energies, the damage thresholds for device is substantially reduced than the common 1550nm fiber. To avoid damage to the exposed fiber end faces and internal components, the optical input power should never exceed 20 mW for wavelengths shorter 650nm. We produce a special version to increase the how handling by expanding the core side at the fiber ends.