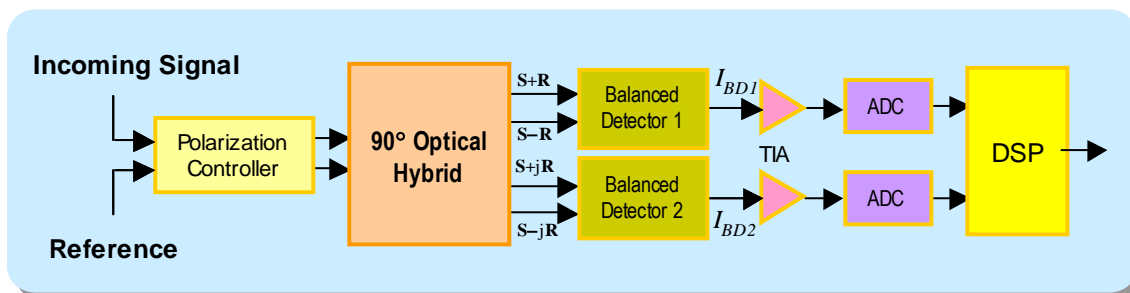


## 90° Optical Hybrid

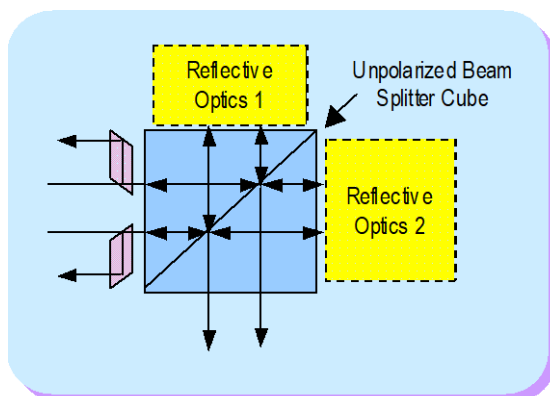
To be used for optical coherent detection, including QPSK receiver, Optoplex's six-port **90° Optical Hybrid** mixes the incoming signal with the reference signal to generate four quadratural states in the complex-field space. The optical hybrid then delivers the four light signals to two pairs of balanced detectors. See the block diagram below for the application of 90° Optical Hybrid in a coherent receiver.



Optoplex's free-space micro-optics-based, **passive** 90° Optical Hybrid is suitable for *coherent signal demodulation*, BPSK or QPSK demodulation. The patent-pending, broadband device accepts the two optical signals (S & L) and generates four output signals: S+L, S-L, S+jL, S-jL, as shown below. When these signals are detected by two balanced receivers, both the amplitude and the relative phase information between the input signals can be extracted via differential detection and digital signal processing. Moreover, in a coherent system, the preservation of the optical phase can be used to cost-effectively compensate optical transmission impairments in the electrical domain.

### Key Features and Benefits

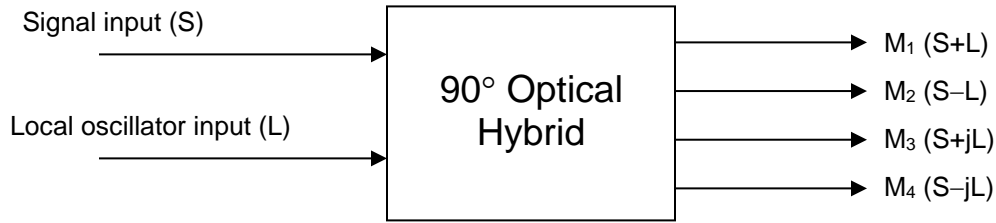
- Purely passive (no need for external electric power)
- Compact size
- Based on free-space bulk-optics design
- Polarization diversified version also available



### Applications

- Key component for the optical coherent detection
- QPSK demodulation

# Optical Hybrid Standard Product Datasheet



Parameter		Unit	Specification
Wavelength Range <sup>1</sup>	C- Band	<i>nm</i>	1525 ~ 1570
	L - Band	<i>nm</i>	1570 ~ 1610
	C+L Band	<i>nm</i>	1525 ~ 1610
	O-Band	<i>nm</i>	1310 +/-30
Phase Difference <sup>1,2</sup> (between M <sub>1</sub> , M <sub>2</sub> and M <sub>3</sub> , M <sub>4</sub> )		<i>deg</i>	90 ± 10
Insertion Loss <sup>1</sup> (without connector)	S→M <sub>i</sub>	<i>dB</i>	< 9.0
	L→M <sub>i</sub>	<i>dB</i>	< 9.0
Insertion Loss Difference <sup>1</sup>	between S→M <sub>1</sub> and S→M <sub>2</sub>	<i>dB</i>	< 1.2
	between S→M <sub>3</sub> and S→M <sub>4</sub>	<i>dB</i>	< 1.2
	between L→M <sub>1</sub> and L→M <sub>2</sub>	<i>dB</i>	< 1.2
	between L→M <sub>3</sub> and L→M <sub>4</sub>	<i>dB</i>	< 1.2
Optical Return Loss		<i>dB</i>	> 27
Optical Path Difference (skew, between M <sub>1</sub> and M <sub>2</sub> and between M <sub>3</sub> and M <sub>4</sub> )		<i>ps</i>	< 1
Operating Temperature		<i>°C</i>	-5 ~ +65
Storage Temperature		<i>°C</i>	-40 ~ 85
Dimension (L×W×H) <sup>3</sup>		<i>mm</i>	30×30×15.5
Fiber Type <sup>4</sup>		-	SMF-28e with 900 μm loose tube
Connector Type <sup>5</sup>		-	FC/APC

## Notes:

1. Over the stated spectral and operating temperature ranges and all polarization states.
2. Premium grade with Phase Error 90 +/-5 deg available. Contact Optoplex for details.
3. Subject to change, not including collimator sleeves extending from the two adjacent sides by 21 mm.
4. Standard design with SMF for all-ports. Other options available upon request.
5. Standard connector, FC/APC. Other types available. See ordering information.

## Typical Part Numbers of 90deg Optical Hybrids

Products	MPN	Wavelength	Fiber-Type		
			Signal-Input	Lo-Input	Outputs
90-degree Optical Hybrid, C-Band, SMF for All Ports, <b>Phase 90±10°</b>	<b>HB-C0AFAS002</b>	<b>C-Band</b>	SMF	SMF	SMF
90-degree Optical Hybrid, C-Band, SMF for All Ports, <b>Phase 90±5°</b>	<b>HB-C0AFAS013</b>	<b>C-Band</b>	SMF	SMF	SMF
90-degree Optical Hybrid, C-Band, PMF for Input Ports (both Signal- and Lo-), SMF for All Output Ports, <b>Phase 90±10°</b>	<b>HB-C0AFAC016</b>	<b>C-Band</b>	PMF	PMF	SMF
90-degree Optical Hybrid, C-Band, PMF for Input Ports (both Signal- and Lo-), SMF for All Output Ports, <b>Phase 90±5°</b>	<b>HB-C0AFAC057</b>	<b>C-Band</b>	PMF	PMF	SMF
90-degree Optical Hybrid, C-Band, PMF for All Input and Output Ports, <b>Phase 90±10°</b>	<b>HB-C0AFAC055</b>	<b>C-Band</b>	PMF	PMF	PMF
90-degree Optical Hybrid, C-Band, PMF for All Input and Output Ports, <b>Phase 90±5°</b>	<b>HB-C0AFAS066</b>	<b>C-Band</b>	PMF	PMF	PMF
90-degree Optical Hybrid, L-Band, SMF for All Ports, <b>Phase 90±10°</b>	<b>HB-L0AFAS094</b>	<b>L-Band</b>	SMF	SMF	SMF
90-degree Optical Hybrid, C+L Band, SMF for All Ports, <b>Phase 90±10°</b>	<b>HB-T0AFAS095</b>	<b>C+L Band</b>	SMF	SMF	SMF
90-degree Optical Hybrid, C+L Band, PMF for Inputs, SMF for Outputs, <b>Phase 90±10°</b>	<b>HB-T0AFAS100</b>	<b>C+L Band</b>	PMF	PMF	SMF
90-degree Optical Hybrid, C+L Band, SMF for All Ports, <b>Phase 90±5°</b>	<b>HB-T0AFAS101</b>	<b>C+L Band</b>	SMF	SMF	SMF
90-degree Optical Hybrid, C+L Band, PMF for All Ports, <b>Phase 90±10°</b>	<b>HB-T0AFAP102</b>	<b>C+L Band</b>	PMF	PMF	PMF
90-degree Optical Hybrid, O-Band, SMF for All Ports, <b>Phase 90±10°</b>	<b>HB-Q0AFAS1310</b>	<b>O-Band</b>	SMF	SMF	SMF
90-degree Optical Hybrid, 1064+/-5nm, HI1060 SMF for All Ports, <b>Phase 90±10°</b>	<b>HB-A0AFAS1064</b>	<b>1064nm</b>	HI-1064	HI-1064	HI-1064
90-degree Optical Hybrid, 1064+/-5nm, PM Fiber (PM980 Panda) Inputs, HI1060 SMF for Outputs, <b>Phase 90±10°</b>	<b>HB-A0AFAP1064</b>	<b>1064nm</b>	PM980	PM980	HI-1064
90-degree Optical Hybrid, 1064+/-5nm, PM Fiber (PM980 Panda) for all Input and Output ports, <b>Phase 90±10°</b>	<b>HB-A0AFAM1064</b>	<b>1064nm</b>	PM980	PM980	PM980

Notes:

- 1) By default, the connector is FC/APC. Other connector types are available, such as FC/UPC, LC/UPC, LC/APC, SC/UPC, ..., etc.
- 2) The default 90deg phase is 90+/-10deg. Premium of 90+/-5deg applied.
- 3) Custom design for other wavelength band available. Contact [sales@optoplex.com](mailto:sales@optoplex.com)