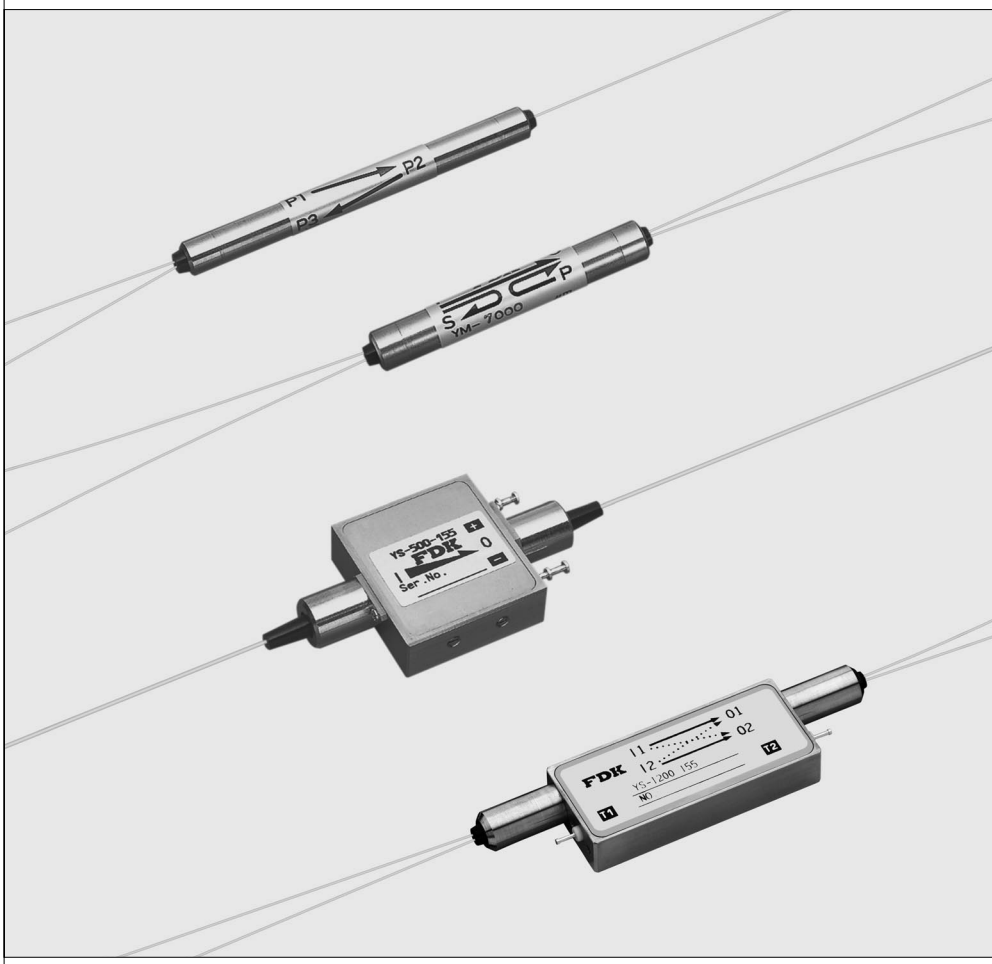
KE11001-1308-005

FDK

OPTICAL DEVICES FOR PHOTONIC NETWORKS



ISO9001 Certified
JQA-1317

FDK CORPORATION

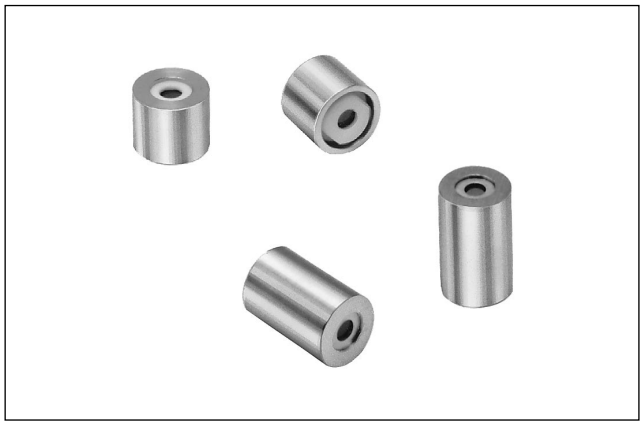
FDK produces compact, high-performance and quality optical devices, using its original, Bi-substituted garnet thick films (LPE film) and other strictly selected materials. This catalog introduces a wide variety of standard FDK optical devices.

Contents

1) Fiber type : Change of fiber type may be available on request.
2) Connectors : Connectors will be available on request, except for free space optical isolators.
3) L-band applications : Optical devices of above category may be available for L-band applications.
4) Key : SMF (Single Mode Fiber) / PMF (Polarization-Maintaining Fiber)

Free space optical isolators

YD-109 type / YD-209 type



The YD-109/YD-209 optical isolators provide an aperture of ϕ1.2mm. These optical isolators can be connected perpendicularly to a laser diode with very small end-face reflection. Besides the products use LPE films.

Features

- Polarization-dependent
- High isolation
- Low insertion loss
- High reliability (Epoxy free)
- Minimized end-face reflection

Specifications

Items	Conditions	Part No.					
		YD-109-130	YD-109-148	YD-109-155	YD-209-130	YD-209-148	YD-209-155
Center wavelength〔λp〕	—	1.31 μm	1.48 μm	1.55 μm	1.31 μm	1.48 μm	1.55 μm
Isolation	λp, 25℃	38dB typ.			62dB typ.		
Insertion loss	λp, 25℃	0.2dB typ.			0.4dB typ.		
Aperture diameter	—	ϕ1.2mm					
Faraday rotator	—	Bi-substituted iron garnet thick films					

In-line optical isolators

YD-3600 type (Low polarization mode dispersion)

The YD-3600 is a polarization-independent optical isolator for optical communications. Using FDK's original precision fiber collimator in its input / output section, the YD-3600 has attained a high isolation and a low insertion loss. Further, its laser-welded inner connection ensures a superb reliability and durability. Besides the product uses LPE films.

Features

- Low polarization mode dispersion
- Polarization independent
- Low insertion loss
- High isolation

Specifications

Items	Conditions	Part No.			
		YD-3600-1-130S	YD-3600-1-148S	YD-3600-1-155S	YD-3600-1-159S
Wavelength〔λ〕	———	1.31μm	1.48μm	1.55μm	1.59μm
Insertion loss	@23℃, λ	0.4dB typ.			
	To , λ±15nm	0.5dB typ.			
Polarization dependent loss	To , λ	0.02dB typ.			
Isolation	@23℃, λ	40dB typ.			
	To , λ±15nm	23dB typ.		25dB typ.	
Polarization mode dispersion	To, λ	0.01ps typ.			
Return loss	To, λ	60dB typ.			
Max. incident power	λ	1W			
Fiber type	———	SMF〔Length : 2m〕			

Operating temp. range〔To〕	0 to +70℃
Storage temp. range〔Ts〕	−40 to +85℃

In-line optical isolators

YD-3700 type

The YD-3700 is a polarization-independent optical isolator for optical communications. Using FDK's original precision fiber collimator in its input / output section, the YD-3700 has attained a high isolation and a low insertion loss. Further, its laser-welded inner connection ensures a superb reliability and durability. Besides the product uses LPE films.

Features

- Polarization-independent
- Low insertion loss
- High isolation

Specifications

Items	Conditions	Part No.			
		YD-3700-1-130S	YD-3700-1-148S	YD-3700-1-155S	YD-3700-1-159S
Wavelength〔λ〕	———	1.31μm	1.48μm	1.55μm	1.59μm
Insertion loss	℃ λ	0.4dB typ.			
	λ±	0.5dB typ.			
Polarization dependent loss	λ	0.02dB typ.			
Isolation	℃ λ	40dB typ.			
	λ±	23dB typ.		25dB typ.	
Polarization mode dispersion	λ	0.7ps typ.			
Return loss	λ	60dB typ.			
Max. incident power	λ	1W			
Fiber type	———	SMF〔Length : 2m〕			

Operating temp. range〔To〕	0 to +70℃
Storage temp. range〔Ts〕	−40 to +85℃

In-line optical isolators

YD-4600 type (Low polarization mode dispersion)

The YD-4600 is a polarization-independent optical isolator use to optical communications. Using FDK's original precision fiber collimator in its input / output section, the YD-4600 has attained a high isolation and a low insertion loss. Further, its laser-welded inner connection ensures a superb reliability and durability. Besides the product uses LPE films.

Features

- Low polarization mode dispersion
- Polarization-independent
- Low insertion loss
- High isolation

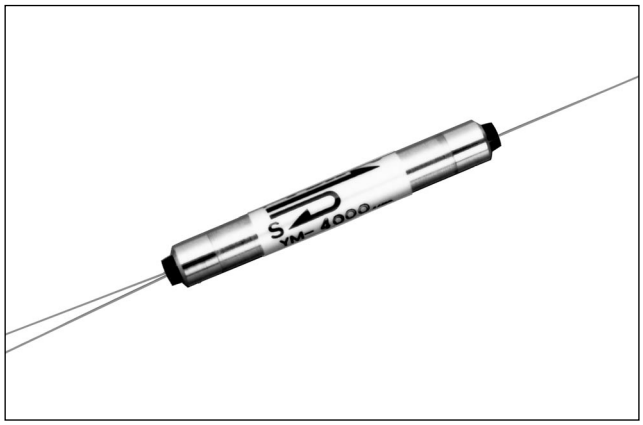
Specifications

Items	Conditions	Part No.			
		YD-4600-1-130S	YD-4600-1-148S	YD-4600-1-155S	YD-4600-1-159S
Wavelength〔λ〕	———	1.31μm	1.48μm	1.55μm	1.59μm
Insertion loss	@23℃, λ	0.5dB typ.			
	To , λ±15nm	0.6dB typ.			
Polarization dependent loss	To , λ	0.02dB typ.			
Isolation	@23℃, λ	55dB typ.			
	To , λ±15nm	43dB typ.		45dB typ.	
Polarization mode dispersion	To, λ	0.01ps typ.			
Return loss	To, λ	60dB typ.			
Max. incident power	λ	1W			
Fiber type	———	SMF〔Length : 2m〕			

Operating temp. range〔To〕	0 to +70℃
Storage temp. range〔Ts〕	−40 to +85℃

Hybrid optical isolators

YM-4000 type (Built-in coupler)



Optical signal amplification in optical transmission lines is carried out by optical fiber amplifiers (EDFA). The YM-4000 type, which is the combination of an isolator and a coupler, is connected to the amplifier to assist performance.

Features

- Designed for EDFA
- High isolation
- Low insertion loss
- High reliability
- Compact size, ϕ 5.5mm

Specifications

Items	Ports	Conditions	Part No.		
			YM-4013	YM-4063	YM-4061
Signal insertion loss	I → O	1.55μm, To	0.5dB typ.	0.6dB typ.	0.7dB typ.
Signal PDL			0.02dB typ.		
Coupling ratio	I → S	1.55μm, 25˚C	1.6 ～ 2.4%		2.4 ～ 3.6%
Signal isolation	O → I		40dB typ.	55dB typ.	
Return loss	I, O, S	1.55μm, To	60dB typ.		
Polarization mode dispersion	I → O		0.01ps typ.		
Input/output fiber	I, O, S	Diameter : ϕ 0.25mm	SMF〔Length : 2m〕		

〔Available for L-band and C+L-band〕

Operating temp. range〔To〕	0 to +70˚C
Storage temp. range〔Ts〕	−40 to +85˚C

Hybrid optical isolators

YM-5000 type (Built-in WDM filter, for forward pumping)

Optical signal amplification in optical transmission lines is carried out by optical fiber amplifiers (EDFA). The YM-5000 type, which is the combination of an isolator and a WDM filter, is connected to the amplifier to assist it by forward pumping.

Features

- Designed for forward pumping of EDFA
- High isolation
- Low insertion loss
- High reliability
- Compact size, ϕ5.5mm

Specifications

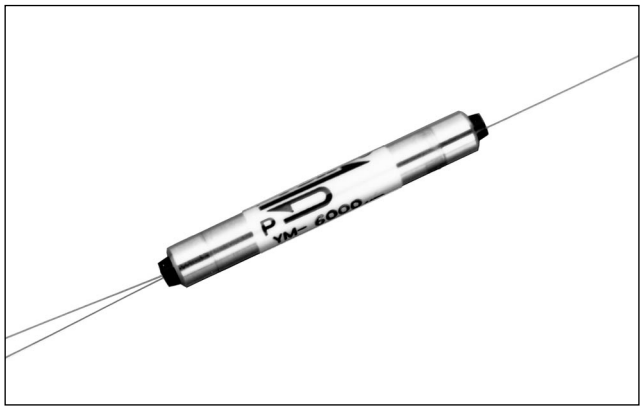
Items	Ports	Conditions	Part No.			
			1.48μm pumping		0.98μm pumping	
			YM-5010	YM-5060	YM-5011	YM-5061
Signal insertion loss	I → O	1.55μm, To	0.5dB typ.	0.6dB typ.	0.5dB typ.	0.6dB typ.
Signal PDL			0.02dB typ.		0.02dB typ.	
Pump insertion loss	P → O	1.48/0.98μm, To	0.4dB typ.		0.5dB typ.	
Pump PDL			0.02dB typ.		0.02dB typ.	
Signal isolation	O → I	1.55μm, 25℃	40dB typ.	55dB typ.	40dB typ.	55dB typ.
Return loss	I, O	1.55μm, To	60dB typ.		60dB typ.	
Polarization mode dispersion	I → O	1.55μm, To	0.01ps typ.		0.01ps typ.	
Input/output fiber	I	Diameter: ϕ0.25mm	SMF〔Length : 2m〕		SMF〔Length : 2m〕	
	O				SMF (0.98μm)〔Length : 2m〕	
	P					

〔Available for L-band and C+L-band〕

Operating temp. range〔To〕	0 to + 70℃
Storage temp. range〔Ts〕	−40 to + 85℃

Hybrid optical isolators

YM-6000 type (Built-in WDM filter, for backward pumping)



Optical signal amplification in optical transmission lines is carried out by optical fiber amplifiers (EDFA). The YM-6000 type, which is the combination of an isolator and a WDM filter, is connected to the amplifier to assist it by backward pumping.

Features

- Designed for backward pumping of EDFA
- High isolation
- Low insertion loss
- High reliability
- Compact size, ϕ5.5mm

Specifications

Items	Ports	Conditions	Part No.			
			1.48μm pumping		0.98μm pumping	
			YM-6010	YM-6060	YM-6011	YM-6061
Signal insertion loss	I → O	1.55μm, To	0.5dB typ.	0.6dB typ.	0.5dB typ.	0.6dB typ.
Signal PDL			0.02dB typ.		0.02dB typ.	
Pump insertion loss	P → I	1.48/0.98μm, To	0.4dB typ.		0.5dB typ.	
Pump PDL			0.02dB typ.		0.02dB typ.	
Signal isolation	O → I	1.55μm, 25℃	40dB typ.	55dB typ.	40dB typ.	55dB typ.
Return loss	I, O	1.55μm, To	60dB typ.		60dB typ.	
Polarization mode dispersion	I → O	1.55μm, To	0.01ps typ.		0.01ps typ.	
Input/output fiber	I	Diameter: ϕ0.25mm	SMF〔Length : 2m〕		SMF (0.98μm)〔Length : 2m〕	
	O				SMF〔Length : 2m〕	
	P				SMF (0.98μm)〔Length : 2m〕	

〔Available for L-band and C+L-band〕

Operating temp. range〔To〕	0 to + 70℃
Storage temp. range〔Ts〕	−40 to + 85℃

Hybrid optical isolators

YM-7000 type (Built-in coupler and WDM filter)

Optical signal amplification in optical transmission lines is carried out by optical fiber amplifiers (EDFA). The YM-7000 type , which is the combination of an isolator, a coupler and a WDM filter, is connected to amplifier to assist its performance by forward pumping.

Features

- Designed for EDFA
- High reliability
- Built-in 2% coupler, 980/1550nm WDM filter
- Compact size, ϕ5.5mm

Specifications

Items	Ports	Conditions	Part No.					
			1.48μm pumping			0.98μm pumping		
			YM-7010	YM-7310	YM-7360	YM-7011	YM-7311	YM-7361
Signal insertion loss	I → O	1.55μm, To	0.8dB typ.		0.9dB typ.	0.8dB typ.		0.9dB typ.
Signal PDL			0.02dB typ.			0.02dB typ.		
Pump insertion loss	P → O	1.48/0.98μm, To	0.4dB typ.			0.5dB typ.		
Pump PDL			0.02dB typ.			0.02dB typ.		
Signal isolation	O → I	1.55μm, 23℃	40dB typ.		55dB typ.	40dB typ.		55dB typ.
Coupling ratio	I → S	1.55μm, To	0.8～1.2%	1.6～2.4%		0.8～1.2%	1.6～2.4%	
Return loss	I , S	1.55μm, To	60dB typ.					
	O , P	1.48/0.98μm, To	60dB typ.			55dB typ.		
Polarization mode dispersion	I → O	1.55μm, To	0.7ps typ.	0.01ps typ.		0.7ps typ.	0.01ps typ.	
Fiber	I , S	——	SMF〔Length : 2m〕			SMF〔Length : 2m〕		
	O , P	——				SMF (0.98μm)〔Length : 2m〕		

〔Available for L-band and C+L-band〕

Operating temp. range〔To〕	0 to + 70℃
Storage temp. range〔Ts〕	−40 to + 85℃

Optical filter devices

1480/1550 WDM (YM-1045 type)

The YM-1045 type incorporates 1480nm/1550nm WDM filter, of which is necessary device for optical fiber amplifires.

Features

- Designed for EDFA systems
- Low insertion loss
- Compact size
- Low wavelength flatness
- High reliability

Specifications

Items	Conditions	Part No.
		YM-1045
Pump band Port 1 ↔ 3	Wavelength range λ1	1460~1490nm
	Insertion loss	0.4dB typ.
	Flatness	0.06dB typ.
Signal band Port 2 ↔ 3	Wavelength range λ2	1530~1565
	Insertion loss	0.3dB typ.
	Flatness	0.04dB typ.
Directivity	@λ1 (1 → 2)	65dB typ.
	@λ2 (2 → 1)	65dB typ.
Optical return loss	———	60dB typ.
Polarization dependent loss	———	0.02dB typ.
Polarization mode dispersion	———	0.01ps typ.

Optical filter devices

C/L-band separator (YM-1056 type)

The YM-1056 type incorporates C/L band separator filter, of which is necessary device for optical fiber amplifires.

Features

- Designed for C-band/L-band in dual-band EDFA systems
- Low insertion loss
- High level rejection
- Compact size
- Wide signal band
- Low wavelength flatness
- High reliability

Specifications

Items	Conditions	Part No.
		YM-1056
C-band channel Port 1 ↔ 3	Wavelength range λ1	1535~1563nm
	Insertion loss	0.5dB typ.
	Flatness	0.06dB typ.
	Rejection @λ2	25dB typ.
L-band channel Port 2 ↔ 3	Wavelength range λ2	1569~1615
	Insertion loss	0.4dB typ.
	Flatness	0.06dB typ.
	Rejection @ λ1	20dB typ.
Directivity	@ λ1 (1→2)	60dB typ.
	@λ2 (2→1)	65dB typ.
Optical return loss	———	60dB typ.
Polarization dependent loss	———	0.02dB typ.
Polarization mode dispersion	———	0.01ps typ.

List of optical filter devices

	Items	Applications	Part No.	Signal bandwidth insertion loss	Rejection bandwidth isolation
C-band series (Signal wavelength 1530-1565nm)	Noise rejection filters (1×1 port)	ASE noise blocking	YM-120	1542-1562nm 0.5dB typ.	1510-1532nm 25dB typ.
		Pump noise blocking	YM-100	1530-1565nm 0.6dB typ.	1460-1490nm 35dB typ.
	Items	Applications	Part No.	Pass bandwidth insertion loss	Reflect bandwidth insertion loss
	WDM couplers (1×2 port)	Fiber amplifier pumping (980/1550WDM)	YM-1051	1530-1565nm 0.4dB typ.	960-1000nm 0.4dB typ.
		Fiber amplifier pumping (1480/1550WDM)	YM-1054	1530-1565nm 0.4dB typ.	1460-1490nm 0.3dB typ.
		Fiber amplifier pumping (1480/1550WDM)	YM-1045	1460-1490nm 0.4dB typ.	1530-1565nm 0.3dB typ.
		Supervisory WDM (1510/1550WDM)	YM-1025	1500-1520nm 0.5dB typ.	1530-1565nm 0.3dB typ.
		Wide-band WDM (1310/1550WDM)	YM-1035	1260-1360nm 0.5dB typ.	1530-1565nm 0.3dB typ.
L-band series (Signal wavelength 1565-1610nm)	Items	Applications	Part No.	Pass bandwidth insertion loss	Reflect bandwidth insertion loss
	WDM couplers (1×2 port)	Fiber amplifier pumping (980/1570WDM)	YM-1061	1565-1610nm 0.5dB typ.	960-1000nm 0.4dB typ.
		Fiber amplifier pumping (1480/1570WDM)	YM-1046	1460-1490nm 0.4dB typ.	1565-1610nm 0.4dB typ.
		C/L band separator (1550/1590WDM)	YM-1056	1530-1563nm 0.5dB typ.	1569-1615nm 0.4dB typ.

List of optical filter devices

	Items	Applications	Part No.	Pass band insertion loss	Reflect band insertion loss
C+L-band series	WDM couplers	Fiber amplifier pumping	YM-1061 (CL)	1530-1610nm 0.4dB typ.	960-1000nm 0.4dB typ.
			YM-1064 (CL)	1530-1610nm 0.4dB typ.	1460-1490nm 0.4dB typ.
			YM-1046 (CL)	1420-1490nm 0.4dB typ.	1530-1610nm 0.4dB typ.
Pump combiner series	Items	Applications	Part No.	Pass band insertion loss	Reflect band insertion loss
	Wavelength combiners	Fiber amplifier pumping	YM-1004 (A)	1481-1497nm 0.4dB typ.	1455-1472nm 0.4dB typ.
			YM-1004 (B)	1483-1506nm 0.4dB typ.	1462-1477nm 0.4dB typ.
			YM-1004 (C)	1456-1490nm 0.4dB typ.	1420-1446nm 0.4dB typ.
			YM-1001	975±0.5nm 0.4dB typ.	980±0.5nm 0.4dB typ.
Raman series	Items	Applications	Part No.	Pass band insertion loss	Reflect band insertion loss
	WDM couplers (C-band)	Fiber amplifier pumping	YM-1045 (R)	1400-1495nm 0.4dB typ.	1510-1565nm 0.4dB typ.
			YM-1054 (R)	1530-1565nm 0.4dB typ.	1400-1505nm 0.4dB typ.
	WDM couplers (L-band)	Fiber amplifier pumping	YM-1046 (R)	1400-1495nm 0.4dB typ.	1565-1610nm 0.4dB typ.

	Items	Part No.	Tap ratio	Pass band insertion loss	Reflect band insertion loss
C-band series	Tap+WDM couplers (2×2 port)	YM-2554	5% (=13dB)	1530-1565nm 0.5dB typ.	1460-1490nm 0.4dB typ.

Polarization combiners

YM-1100 series

The YM-1101 and YM-1104 are polarization combiners. For an optical fiber amplifier, a high optical pump power is needed to obtain high gain. Polarization combiners combine two polarized pump sources into one and they yield single high pump power.

Features

- Compact size
- Low insertion loss
- Designed for EDFA systems
- High reliability

Specifications

Items	Part No.	
	YM-1101	YM-1104
Wavelength	0.98μm	1.48μm
Port	3	3
Insertion loss	0.5dB typ.@0.98μm, 23℃	0.4dB typ.@1.48μm, 23℃
Return loss	50dB typ.	53dB typ.
Directivity	60dB typ.	60dB typ.
Input / output fiber	Input fiber : PMF〔Length : 1m〕/ Output fiber : SMF〔Length : 1m〕	

Operating temp. range〔To〕	0 to +70℃
Storage temp. range〔Ts〕	−40 to +85℃

Optical circulators

YC-1100 type / YC-1250 type

This optical circulator is a passive device for optical transmission systems, applying the Faraday effect of LPE film. It has attained a outstanding characteristics (high isolation, low insertion loss) and compact size.

Features

- Compact size
- High isolation
- High reliability
- Polarization-independent

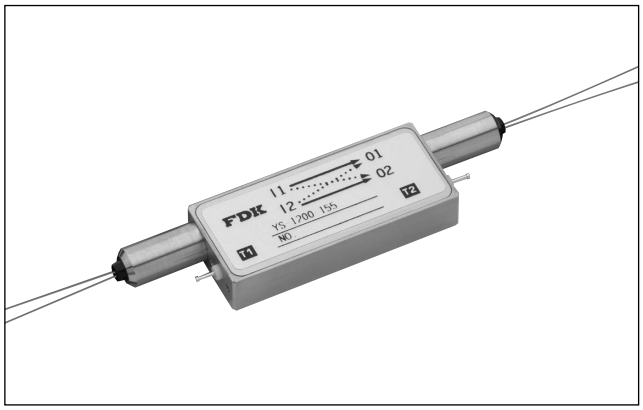
Specifications

Items	Conditions	Part No.		
		YC-1100-155	YC-1100-159	YC-1250-155
Wavelength〔λ〕	———	1.55μm	1.59μm	1.55μm
Port	———	3	3	4
Insertion loss	23℃, λ	0.5dB typ.		0.6dB typ.
	To , λ±15nm	0.7dB typ.		0.8dB typ.
Polarization dependent loss	23℃, λ	0.01dB typ.		
	To , λ±15nm	0.5dB typ.		
Isolation	23℃, λ	50dB min.		
	To , λ±15nm	40dB min.		
Polarization mode dispersion	To , λ±15nm	0.01ps typ.		
Return loss	To, λ	60dB typ.		
Directivity	To , λ±15nm	65dB typ.		
Fiber type	———	SMF〔Length : 1.5m〕		

Operating temp. range〔To〕	0 to +70℃
Storage temp. range〔Ts〕	−40 to +85℃

Optical switches

YS-1200 type / YS-1101 type / YS-1001 type



These optical switches are self latching type applying the Faraday effect of LPE film. Due to the exclusion of any moving parts based non-mechanical structures, they have attained a high reliability and rapid switching speed, and furthermore, using the two-hole ferrule collimator, attained high isolation, low insertion loss and compact size.

Features

- Non-mechanical (Magneto-optical)
- High reliability
- Latching type
- High speed switch
- Low crosstalk
- Polarization-independent

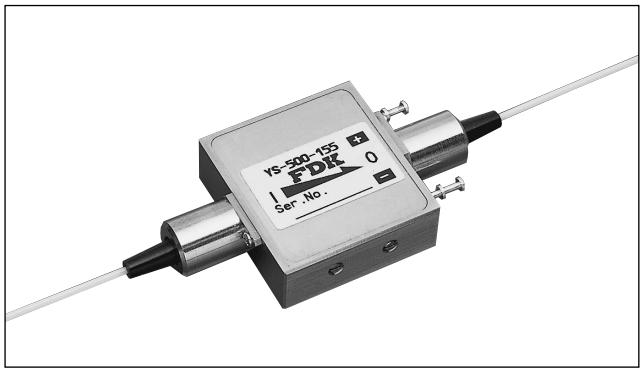
Specifications

Items	Conditions	Part No.		
		YS-1200-155	YS-1101-155	YS-1001-155
Wavelength〔λ〕	———	1.55μm		
Port	———	2input / 2output	2input / 1output	1input / 2output
Insertion loss	To , λ ±15nm	0.8dB typ.		
Polarization dependent loss	To , λ ±15nm	0.01dB typ.		
Crosstalk	To , λ ±15nm	50dB typ.		
Polarization mode dispersion	To , λ ±15nm	0.01ps typ.		
Return loss	To , λ	60dB typ.		
Coil inductance	23℃	12mH		
Response time	23℃	0.6 msec typ.		
Recommendation drive condition	Power current	200 mA		
	Pulse width	2 msec		
Fiber type	———	SMF〔Length : 1.5m〕		

Operating temp. range〔To〕	0 to +65℃
Storage temp. range〔Ts〕	−40 to +85℃

Variable optical attenuators (VOA)

YS-500 series



The YS-500 is a variable optical attenuator applying the Faraday effect of LPE film. The attenuation levels can be adjusted continuously by current control. Due to the exclusion of any moving parts, it has attained a high reliability and rapid response time.

Features

- Non-mechanical (Magneto-optical)
- Current control
- High speed response
- Polarization-independent
- High reliability

Specifications

Items	Conditions	Part No.			
		YS-500		YS-504	
Wavelength〔λ〕	———	C-band	L-band	C-band	L-band
Driving current	———	0~70mA			
Maximum attenuation	———	23dB typ.	20dB typ.	35dB typ.	
Minimum attenuation	λ, 25℃	0.8dB typ.			
	To , λ , I	1.5dB typ.			
Polarization dependent loss	Under 10dB attenuation	0.25dB typ.			
Wavelength dependent loss	Under 10dB attenuation	1.0dB max.			
Polarization mode dispersion	———	0.05ps typ.			
Return loss	———	55dB typ.			
Response speed	———	320μsec typ.			
Input/output fiber	———	SMF〔Length : 2m〕			

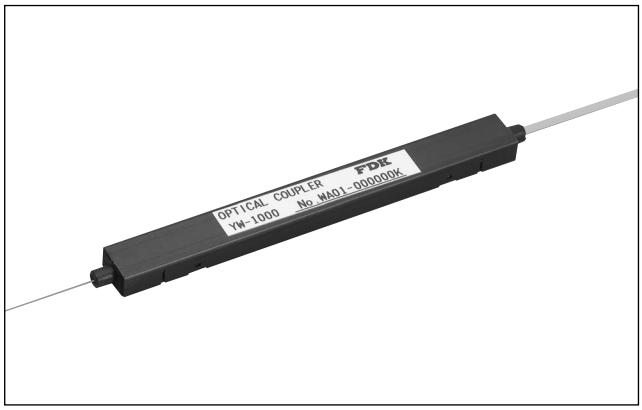
Items	Conditions	Part No.				
		YS-505		YS-506	YS-508	
Wavelength〔λ〕	———	C-band	L-band	C-band	C-band	L-band
Driving current	———	0~70mA				
Maximum attenuation	———	35dB typ.		15dB min.	35dB typ.	
Minimum attenuation	λ, 25℃ 0mA	0.8dB typ.				
	λ,To , 0mA	1.5dB typ.				
Polarization dependent loss	Under 10dB attenuation	0.2dB typ.		0.25dB typ.		
	Under 17dB attenuation	0.3dB typ		———	———	
Wavelength dependent loss	Under 10dB attenuation	1.0dB max.		0.4dB max.	———	
	Under 20dB attenuation	———		———	0.8dB max.	
Polarization mode dispersion	———	0.05ps typ.				
Return loss	———	55dB typ.				
Response speed	———	320μsec typ.				
Input/output fiber	———	SMF〔Length : 2m〕				

C-band (1.53~1.56μm) L-band (1.575~1.605μm)

Operating temp. range〔To〕	0 to +65℃
Storage temp. range〔Ts〕	−40 to +85℃

Optical couplers

YW-1000 series



Optical couplers are used for variety in optical networks. YW-1000 type is waveguide coupler which applies the ion exchange technology. It has attained excellent characteristics such as low insertion loss, low polarization dependent loss and good loss uniformity.

Features

- Low insertion loss
- Low polarization dependent loss
- Good loss uniformity
- Low wavelength dependent loss

Specifications

Items	Conditions	Part No.
		YW-1000
Port	————	1x8
Wavelength〔λ〕	————	1.26-1.36/1.48-1.58μm
Insertion loss	To, λ	10.0dB typ.
Loss uniformity	To, λ	0.4dB typ.
Polarization dependent loss	To, λ	0.03dB typ.
Return loss	To, λ	60dB typ.
Directivity	To, λ	60dB typ.
Input/output fiber	0ch : φ0.25mm 1-8ch : Ribbon	SMF〔Length : 2m〕

Operating temp. range〔To〕	0 to + 70℃
Storage temp. range〔Ts〕	−40 to + 85℃

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For improvement of its products, FDK reserves the right to change specificaitons
without prior notice to customers.