

Optical Elements - WDM

CWDM multiplexers WDM (Coarse Wavelength Division Multiplexer)

02



CWDM passive solutions - add/drop filters, multi-and-demultiplexers

Fibrain CWDM series devices utilize the TFF technology. They are characterized by high interchannel isolation, low insertion loss and flat passband profile (low ripple). Outdoor versions (for -40°C to +85°C temperature range, also in water-tight packaging) are also available. These devices are used to multiply the transmission capacity of the existing fiber links. Any number of channels from 2 up to 18 is possible. Customized and hybrid solutions (CWDM+DWDM+special channels) are also available. For applications with very tight loss budget Compact CWDM products (with ultra-low insertion losses) are recommended.

Applications:

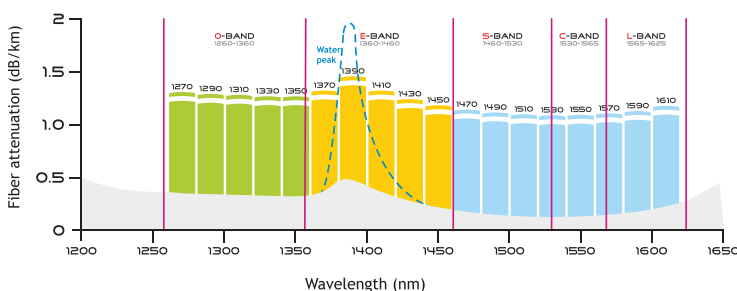
- CWDM systems,
- ADD/DROP solutions,
- telecommunication networks,
- optical amplifiers,
- CATV networks.

Features:

- high thermal stability of parameters,
- low insertion loss and polarization loss,
- high channel isolation.

Device types:

- **CWDM filters** - used to separate single CWDM from the incoming multiplex. Characterized by significantly better interchannel isolation than FBT-based products. Can be cascaded to obtain more advanced functionalities.
- **OADM (add/drop optical multiplexers)** - used to drop and add selected channels, whereas the remaining (express) channels are transmitted without change
- **MUX/DMUX modules** - installed in terminals, used to multiply the capacity of the existing fiber links, without the need to lay more cables. Most often used as 4-, 8-, and 16-channel devices, other functionalities like upgrade port, grey 1310 nm port, monitor port or OTDR 1650 nm port are also available.
- **CCWDM (Compact CWDM)** - thanks to free space technology, these devices have smaller size and smaller insertion losses than traditional CWDM filters.



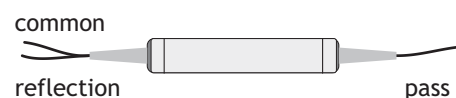
Technical data of CWDM filters ADD or DROP, for 1271-1451 nm half band:

Type	1271, 1291, ... 1451 nm or 1270, 1290, ... 1450
Interchannel space [nm]	20
Channel width [nm]	$\lambda_c \pm 6.5$
Reflection bandwidth [nm]	1260-1610
Pass bandwidth @ -0.5dB	≥ 14
Pass Channel flatness [dB]	≤ 0.3
Pass insertion loss [dB]	≤ 0.8
Reflection insertion loss [dB]	≤ 0.6
Adjacent channel isolation [dB]	≥ 30
Non-adjacent channel isolation [dB]	≥ 40
Reflection Channel Isolation [dB]	≥ 15
Directivity [dB]	> 55
Return loss [dB]	> 50
PDL [dB]	0.1
Bandwidth temperature stability	0.003 nm/°C
Attenuation temperature stability	0.005 dB/°C
Power handling [mW]	< 500 mW
Operating temperature	-5°C to +70°C
Storage temperature	-40°C to +85°C

Casing:

Fiber	250 μ m	900 μ m	900 μ m, 2.0 mm or 3.0 mm
Dimensions	$\varnothing 34 \times 5.5$ mm	$\varnothing 38 \times 5.5$ mm	90x20x10 mm

Filters ADD or DROP CWDM - scheme of ports



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02

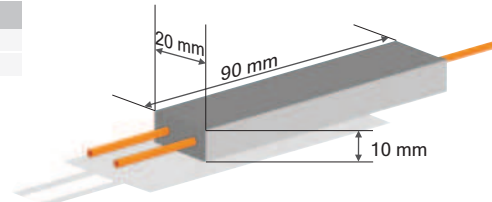
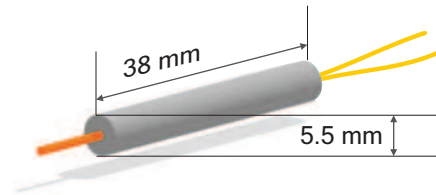
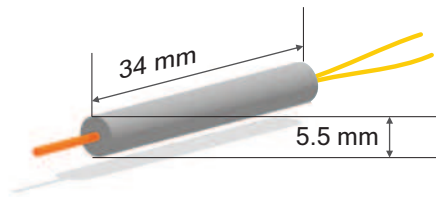
Technical data of CWDM filters ADD or DROP, for 1471-1611 nm half band:

Type	1471,1491,..1611nm or 1470, 1490,..1610 nm
Interchannel space [nm]	20
Channel width [nm]	$\lambda_c \pm 6.5$
Channel flatness [dB]	≤ 0.4
Pass insertion loss [dB]	≤ 0.6
Reflection insertion loss [dB]	≤ 0.4
Adjacent channel isolation [dB]	≥ 30
Non-adjacent channel isolation [dB]	≥ 40
Directivity [dB]	> 55
Return loss [dB]	> 50
PDL [dB]	0.1
Bandwidth temperature stability	0.003 nm/°C
Attenuation temperature stability	0.005 dB/°C
Power handling [mW]	≤ 500 mW
Operating temperature	-5°C to +70°C
Storage temperature	-40°C to +85°C

Casing:

Fiber	250 μ m	900 μ m	900 μ m, 2.0 mm or 3.0 mm
Dimensions	$\varnothing 34 \times 5.5$ mm	$\varnothing 38 \times 5.5$ mm	98x20x10 mm

CWDM examples - add / drop



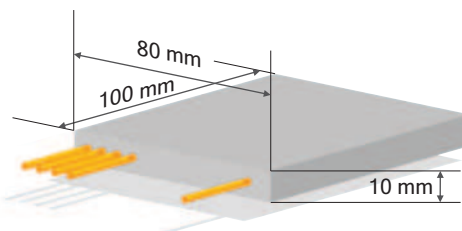
Technical data of OADM modules add/drop:

Type	1270, 1290,1310,.... 1610 or 1271, 1291, 1311....1611		
Number of channel	1ch	2ch	4ch
Interchannel space [nm]	20		
Channel width [nm]	$\lambda_c \pm 6.5$		
Channel flatness [dB]	≤ 0.4		
Insertion loss [dB]	Add/Drop Ch.	≤ 0.6	≤ 1.7
	Express Ch.	≤ 0.6	≤ 2.0
Isolation Add/Drop Channel [dB]	Adjacent channel	≥ 30	≥ 40
	Non-adjacent	≥ 40	≥ 40
Express Channel Isolation [dB]	≥ 25		
Directivity [dB]	> 55		
Return loss [dB]	> 50		
PDL [dB]	≤ 0.1		
Bandwidth temperature stability	0.003 nm/°C		
Attenuation temperature stability	0.005 dB/°C		
Power handling [mW]	≤ 500 mW		
Operating temperature	0°C to 70°C		
Storage temperature	-40°C to 85°C		

Casing:

100x80x10 mm or LGX or 19" rack 1U

OADM example - ADD/DROP



017

Fiber Optical Cables
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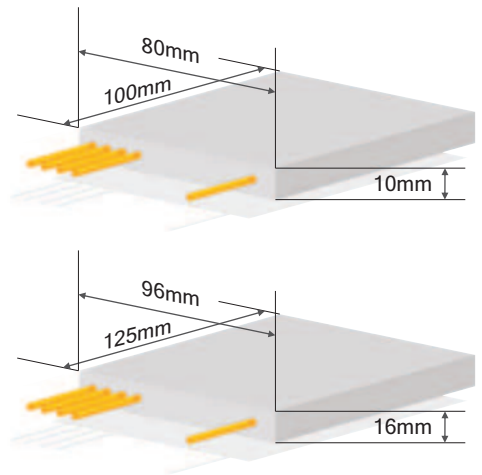
02



MUX and DMUX technical data:

Type	4 channels	8 channels	16 channels
Attenuation [dB]	<=2.0	<=3.5	<=4.5
Wavelength [nm]	1270, 1290, 1310,..1610 or 1271, 1291, 1311..1611		
Interchannel space [nm]	20		
Channel width [nm]	$\lambda_c \pm 6.5$		
Channel flatness [dB]	<=0.4		
Channel uniformity [dB]	<=1.0		
Adjacent channel isolation [dB]	>=30		
Non-adjacent ch. isolation [dB]	>=40		
Directivity [dB]	>55		
Return loss [dB]	>50		
PDL [dB]	0.15		0.20
PMD [ps]	0.10		0.15
Bandwidth temperature stability	0.003 nm/°C		
Attenuation temp. stability	0.005 dB/°C		
Power handling [mW]	<500 mW		
Operating temperature	-5°C to +70°C		
Storage temperature	-40°C to +85°C		
Casing:	100x80x10	100x80x10	125x96x16
Additional ports:	Port test 1310 +/- 50 nm Port monitor 1/99% Port upgrade 1260-1457 nm Port upgrade 1460-1610 nm		Port monitor 1/99% Port test 1310 nm +/- 50 nm

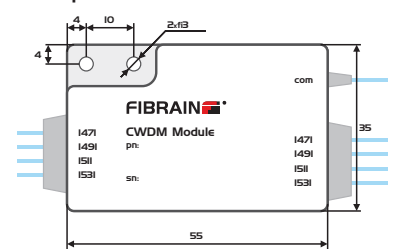
Examples MUX and DEMUX



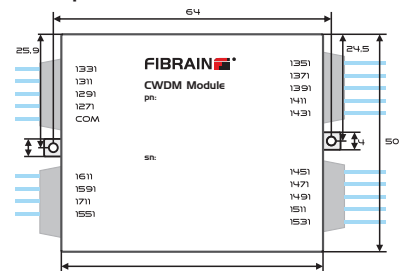
Compact MUX and DMUX technical data:

Type	4 channels	8 channels	18 channels
Attenuation [dB]	<=1.6	<=1.8	<=1.8 type (2.5 max)
Wavelength [nm]	1270, 1290, 1310,..1610 or 1271, 1291, 1311..1611		
Interchannel space [nm]	20		
Channel width [nm]	$\lambda_c \pm 6.5$		
Test port	1310 μ m +/- 50 nm		
Monitor port	1/99%		
Channel flatness [dB]	<=0.4		
Upgrade port	1260-1457 nm or 1460-1610 nm IL<=1.2 dB		
Isolation MUX Adjacent Channel [dB]	>30		
MUX Non-adjacent Channel [dB]	>40		
DMUX Adjacent Channel [dB]	>30		
DMUX Non-adjacent Channel [dB]	>40		
Upgrade port [dB]	>15		
Ripple in Passband [dB]	<=0.3		<=0.5
Directivity [dB]	>55		
Return loss [dB]	>45		
PDL [dB]	<0.15		<0.20
PMD [ps]	0.10		
Bandwidth temperature stability	0.003 nm/°C		
Attenuation temperature stability	0.005 dB/°C		
Power handling [mW]	<500 mW		<300 mW
Operating temperature	-10°C to +70°C		0°C to +70°C
Storage temperature	-40°C to +85°C		
Fiber type	250 μ m or 900 μ m SM G.652D		
Casing:	55x35x8		60x50x7
Additional ports:	Port test 1310 +/- 50 nm Port monitor 1/99% Port upgrade 1260-1457 nm Port upgrade 1460-1610 nm		

Example CCWDM 8 channels



Example CCWDM 18 channels

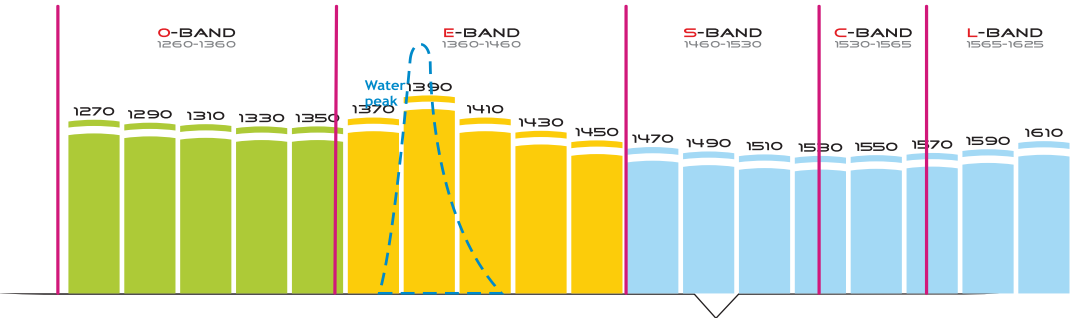


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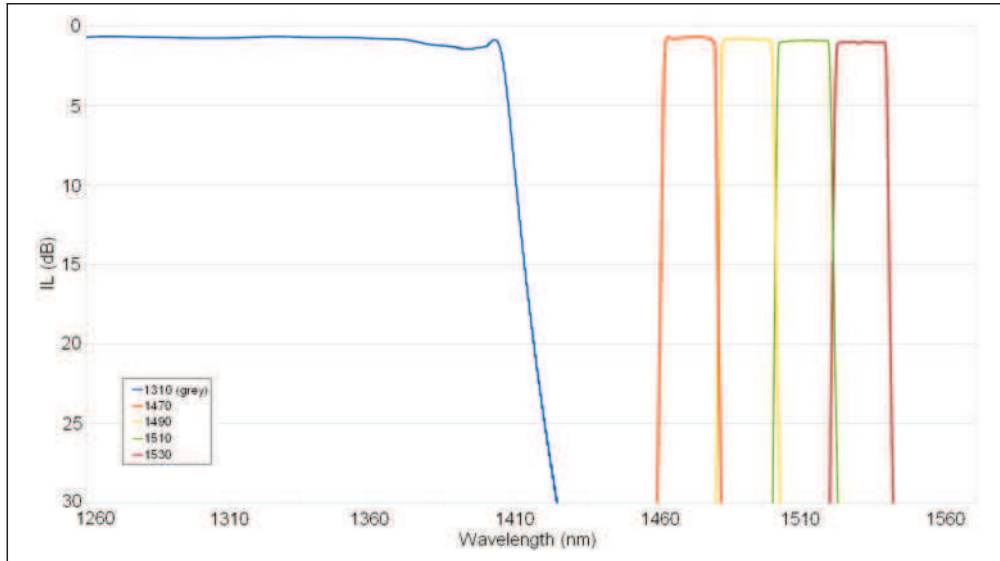
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02



Spectral loss profile of a 4 CWDM channels + grey 1310 channel multiplexer

CWDM transmission is very often utilized in metro links, where signal quality is very important and operators cannot accept the risk of reducing this quality, as often high priority and sensitive data is sent. To provide the max information about our products, Fibrain CWDM devices are always measured in the whole spectral range and delivered with test reports showing the full loss spectral profile. Thanks to this rigorous quality control, all IL and isolation values quoted in test reports are always worst case values.

Quality: S0/S1 G0/G1 T0/T1 P0/P1	Split: 0004 - 4CH 0008 - 8CH 0016 - 16H 1004 - 4CH 1310MM 1104 - 4CH 1310 1/99 MONITOR 1114 - 4CH 1310 1/99 UPGRADE 1260-1557 1124 - 4CH 1310 1/99 UPGRADE 1460-1610	Wavelength: MUX - MUX DUX - DMUX MDUX - MUX/DMUX CMUX - COMPACT MUX DDUX - COMPACT DMUX ADD DROP OADM	Casing type: 1 - 5.5x34 mm pipe 2 - 5.5x38 mm pipe 3 - 90x20x10 mm 4 - 100x80x10 mm 5 - 120x80x15 mm 5 - 125x96x16 mm 6 - 140x115x18 mm A - 55x35x8 mm B - 60x50x7 mm				
CWDM - G0 - 1 - 0003 - 1 - MUX - 90 - 47 - 51 - 4 - SC - SC	Fiber: 1 - G652CD 2 - G657A 3 - G657B 4 - MM50 5 - OM3 6 - M62.5	Length: 0 - 0.5 m 1 - 1 m 2 - 2 m	Fiber type: 25 - 250 μm 90 - 900 μm 20 - 2.0 mm 30 - 3.0 mm	Starting channel: 47-1470 nm 49-1490 nm 51-1510 nm	End channel: 47-1470 nm 49-1490 nm 51-1510 nm	Connector type: ST SC SCA FC FCA LC LCA E20 E2A x - other	Connector type: ST SC SCA FC FCA LC LCA E20 E2A x - other

CWDM-G0-1-0008-1-MUX-25-47-51-1-SC-SC

Example: Fibrain CWDM multiplexer, 3 channels, starting channel 1470, end channel 1510 nm, 900 μm pigtails, pigtail length 1 m, 100x80x10 mm packaging, SC PC connectors.