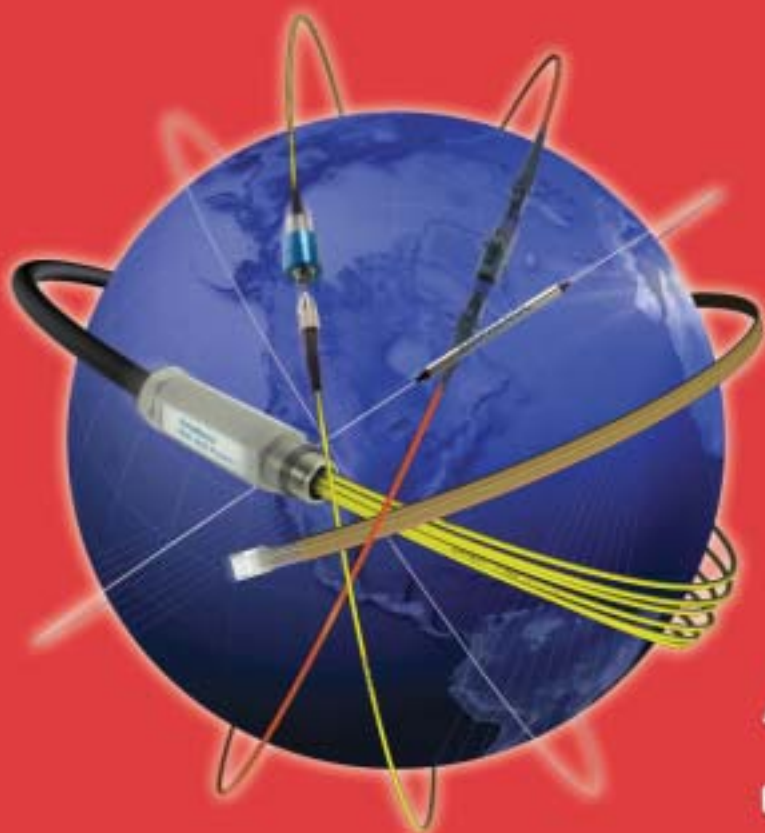


# Couplers/Splitters

## FIBER OPTIC CATALOG



**Amphenol**<sup>®</sup>  
FIBER OPTIC PRODUCTS  
60 Years of Interconnect Knowledge

# Couplers/Splitters

Amphenol Fiber Optic Products offers over 15 years experience in the manufacturing of fiber optic couplers through the fused biconic taper technology (FBT) and is licensed by British Telecom for this fabrication technique. An optical coupler is a passive device that precisely distributes light signals between two fibers over a broad-band operating window. Each device offers a bi-directional performance allowing for either power splitting or signal combining. Amphenol's couplers are manufactured using a precision computer-controlled manufacturing process capable of producing large volumes and tight unit-to-unit uniformity.

The optical coupler has proven to be a beneficial component of any optical network design. Amphenol's low loss, cost-effective devices provide a means for network design flexibility, system monitoring or increasing capacity. The excellent uniformity from unit to unit allows for ease in network design, saving our customers time and money.

In addition to Amphenol's standard product offering, we employ a full team of optical engineers to assist in the development of custom product configurations. We pride ourselves in offering innovative custom solutions to meet your application requirements with everything from integrated modular designs to working with specialty fibers. We challenge our customers to put the ownership on us to provide high-quality, integrated products that save you time, money and power.

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Single Mode Coupler Family

## Applications

- CATV networks
- Telecommunications networks
- Local/Wide Area Networks (LAN/WAN)
- Optical amplifiers & transceivers
- Test & Measurement instrumentation
- Signal monitoring devices

## Features

- Designed to meet Telcordia GR-1209 and GR-1221
- Proven FBT fabrication techniques
- Broadband performance
- Environmentally stable
- Low Insertion Loss (IL)
- Polarization insensitive
- Miniature or ruggedized package
- Standard connectors and cable leads available

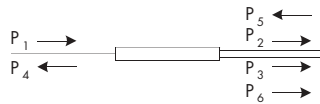
# Amphenol

[www.amphenol-fiberoptics.com](http://www.amphenol-fiberoptics.com)  
[sales@amphenol-fiberoptics.com](mailto:sales@amphenol-fiberoptics.com)  
Customer Service 800-944-6446

## Fabrication Technology - Fused Biconic Taper (FBT)

Amphenol's coupler product line is designed around the fused biconic taper process (FBT). In the FBT process two fibers are heated, fused together and then elongated while maintaining precise temperature control. As the fibers are drawn, the individual fiber diameters and the distance between the two cores are reduced such that the evanescent field of one fiber, carrying an optical signal, extends outward until it starts to overlap the core of the second fiber. At this point, energy will start to transfer to the second fiber. Precise monitoring of the two output signals allows the process to be controlled and stopped when the desired results have been achieved.

The FBT process provides a high-quality, low-loss coupler with the specific characteristics desired. Keeping the light inside the fiber at all times provides environmentally reliable and stable performance while keeping the overall optical loss, back reflection and directivity extremely low. The FBT process has proven to yield couplers with the lowest excess-loss available in the market today.



$$\text{Insertion Loss (IL)}_2 = 10 \cdot \log_{10} \left[ \frac{P_2}{P_1} \right]$$

$$\text{Coupling Ratio (\%)} = \left[ \frac{P_2}{P_2 + P_3} \right] \cdot 100\%$$

$$\text{Insertion Loss (IL)}_3 = 10 \cdot \log_{10} \left[ \frac{P_3}{P_1} \right]$$

$$\text{Directivity} = 10 \cdot \log_{10} \left[ \frac{P_6}{P_5} \right]$$

$$\text{Excess Loss} = 10 \cdot \log_{10} \left[ \frac{P_2 + P_3}{P_1} \right]$$

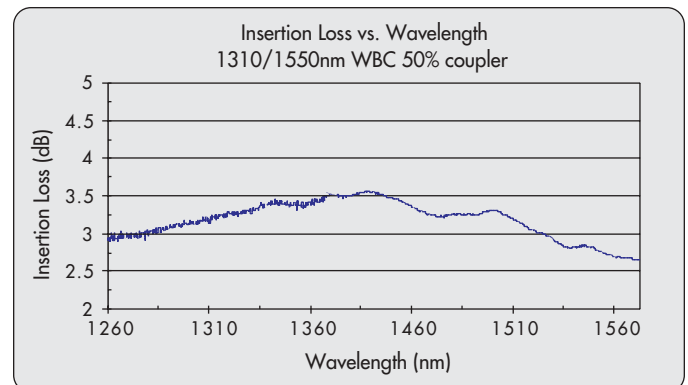
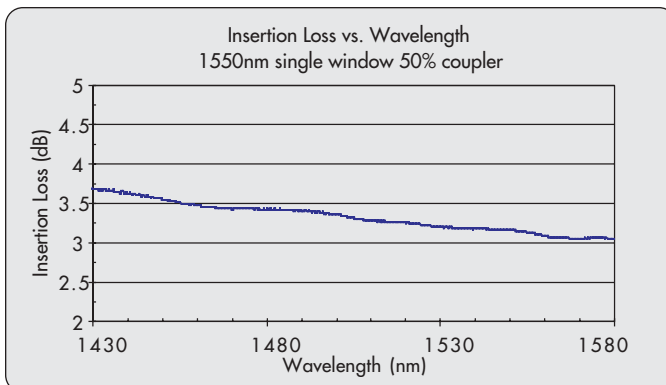
$$\text{Return Loss} = 10 \cdot \log_{10} \left[ \frac{P_4}{P_1} \right]$$

Abr.	Key Concept	Units	Description & Definition
CR	Coupling Ratio	%	ratio of one output to sum of all outputs
EL	Excess Loss	dB	overall loss from inputs to outputs
IL	Insertion Loss	dB	full loss at one output [IL = CR + EL]
D	Directivity	dB	ratio of power coupled to other ports
R	Reflectance, Return Loss	dB	ratio of reflected power back to any port
U	Uniformity (50/50 only)	dB	variation in IL values [IL max - IL min]

## Definitions

**Single Window Broadband Coupler (SWBBC):** Single mode optical coupler where a single device provides a flat wavelength response at 1310nm +/-40nm **or** 1550nm +/-40nm.

**Wideband Coupler (WBC):** Single mode optical coupler where a single device provides a flat wavelength response at 1310nm +/-40nm **and** 1550nm +/-40nm.



# 945 Single Mode Series Couplers (Splitters)

Amphenol's 1x2 and 2x2 couplers are available as either SWBBC or WBC devices with coupling ratios from 1/99 to 50/50. Amphenol couplers are available in a variety of packaging options and can be terminated with any industry standard connector. Each device is 100% optically tested for optical performance and provided with certified test data.



Single Mode Coupler Family

## Common Specifications

Coupling ratio:	1/99 to 50/50
Directivity:	≥ 50 dB (1X2) ≥ 60 dB (2X2)
Reflectance:	≤ -55 dB
PDL:	≤ 0.1 dB (≤ 0.3 dB for tap legs of ≤ 15%)
Operating Bandpass:	+/- 40 nm
Operating Temperature:	-40° to +85° C
Storage Temperature:	-55° to +85° C
Standard Lead Length:	1 meter

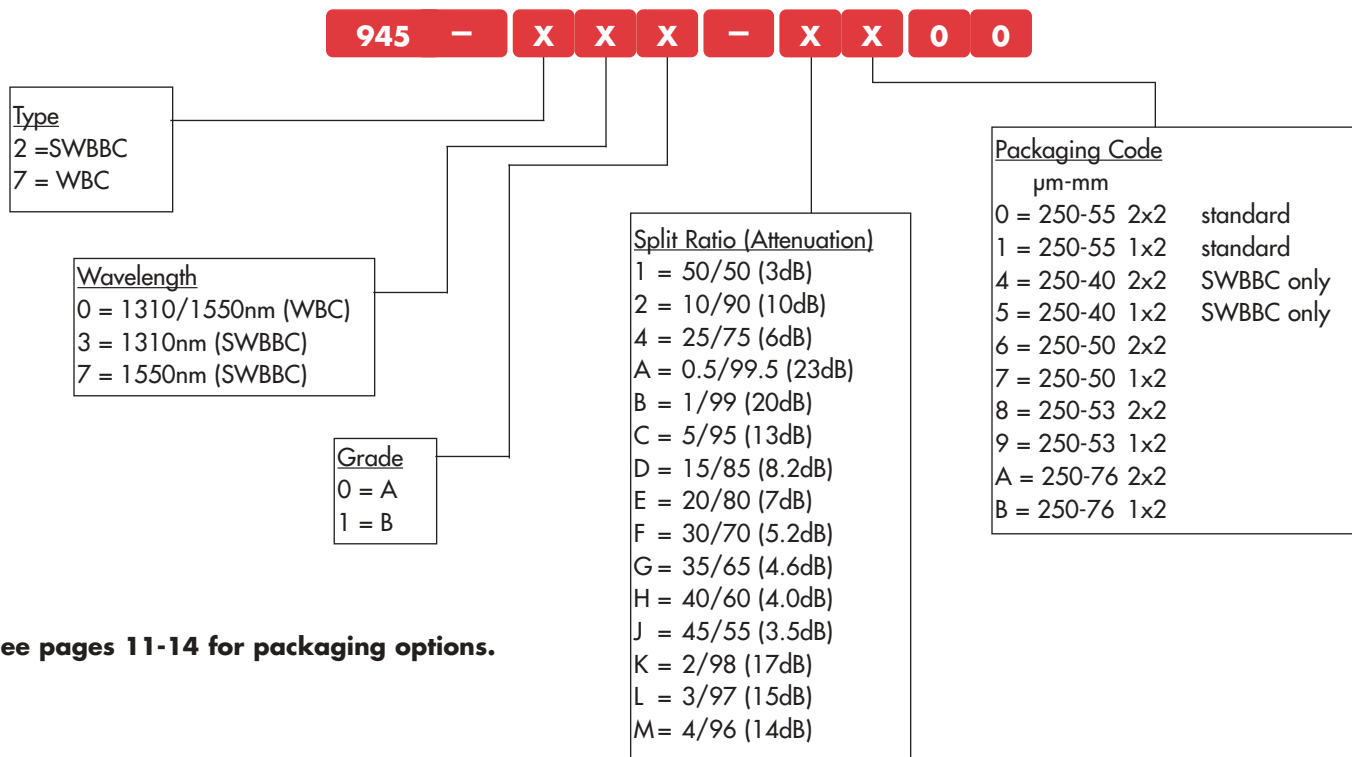
		SWBBC: 1310 or 1550nm ± 40nm				WBC: 1310/1550nm ± 40nm			
		Grade A		Grade B		Grade A		Grade B	
		EL: 0.1dB		EL: 0.2dB		EL: 0.08dB		EL: 0.2dB	
		IL*	Uniformity	IL*	Uniformity	IL*	Uniformity	IL*	Uniformity
1x2 or 2x2	50/50	3.40	0.6	3.60	1.0	3.50	0.8	3.80	1.2
1x2 or 2x2	45/55	3.90 / 2.90	n/a	4.20 / 2.10	n/a	4.15 / 3.15	n/a	4.15 / 3.35	n/a
1x2 or 2x2	40/60	4.40 / 2.50	n/a	4.70 / 2.70	n/a	4.70 / 2.70	n/a	5.00 / 2.90	n/a
1x2 or 2x2	35/65	5.10 / 2.20	n/a	5.30 / 2.30	n/a	5.35 / 2.30	n/a	5.65 / 2.50	n/a
1x2 or 2x2	30/70	5.80 / 1.80	n/a	6.00 / 1.90	n/a	6.00 / 1.90	n/a	6.40 / 2.10	n/a
1x2 or 2x2	25/75	6.70 / 1.60	n/a	6.90 / 1.70	n/a	6.95 / 1.70	n/a	7.50 / 1.80	n/a
1x2 or 2x2	20/80	7.60 / 1.10	n/a	7.90 / 1.20	n/a	7.90 / 1.40	n/a	8.50 / 1.50	n/a
1x2 or 2x2	15/85	9.00 / 0.96	n/a	10.00 / 1.10	n/a	9.60 / 1.00	n/a	10.60 / 1.10	n/a
1x2 or 2x2	10/90	11.00 / 0.63	n/a	12.90 / 0.80	n/a	11.00 / 0.70	n/a	12.70 / 0.80	n/a
1x2 or 2x2	5/95	14.60 / 0.40	n/a	18.40 / 0.50	n/a	14.60 / 0.50	n/a	18.50 / 0.60	n/a
1x2 or 2x2	4/96	15.27 / 0.37	n/a	19.00 / 0.47	n/a	15.53 / 0.46	n/a	19.50 / 0.50	n/a
1x2 or 2x2	3/97	16.63 / 0.34	n/a	20.00 / 0.45	n/a	16.88 / 0.41	n/a	20.30 / 0.47	n/a
1x2 or 2x2	2/98	18.53 / 0.30	n/a	23.00 / 0.40	n/a	18.79 / 0.36	n/a	23.30 / 0.40	n/a
1x2 or 2x2	1/99	21.6 / 0.30	n/a	25.00 / 0.35	n/a	21.60 / 0.30	n/a	25.00 / 0.35	n/a

\* IL specifications: tap / throughput.

\* Maximum additional IL of 0.5dB per mated pair for terminated devices.

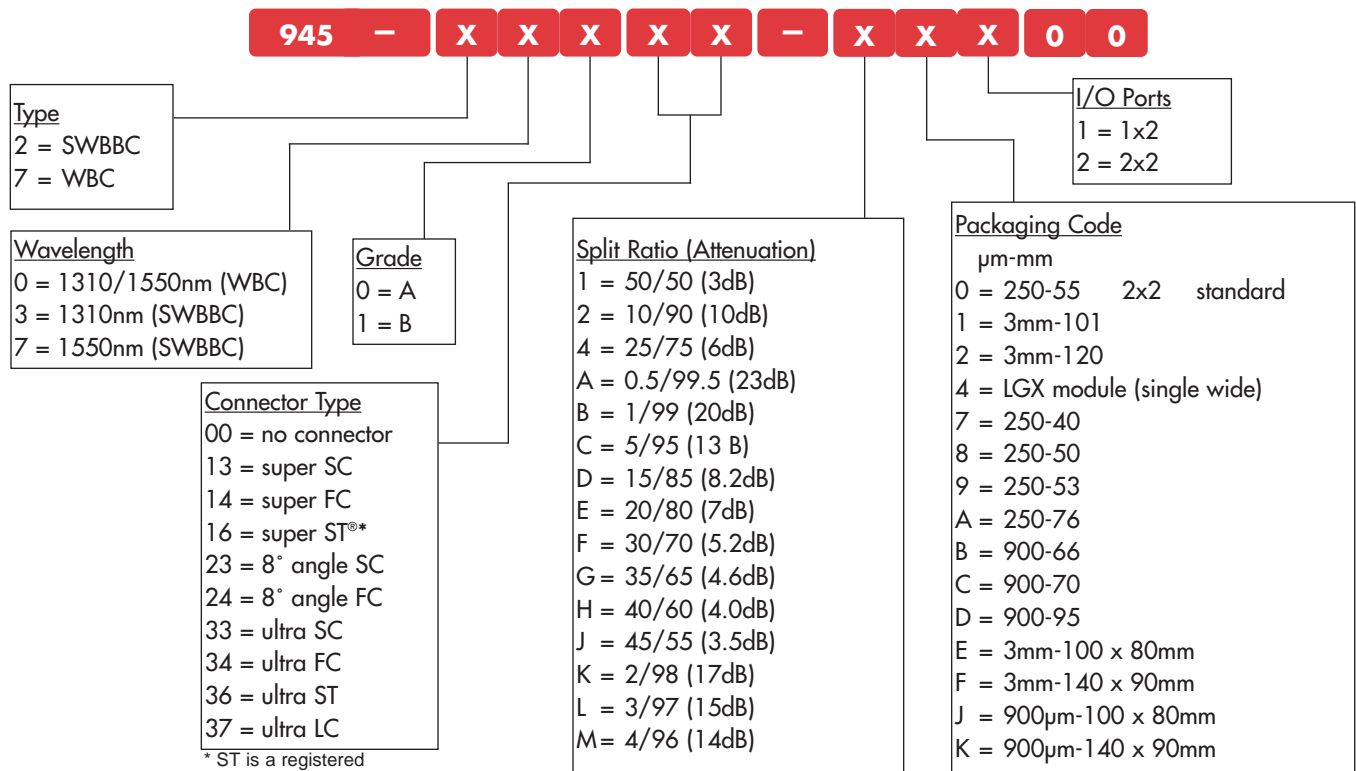
# Ordering Information

## 1x2 and 2x2 Miniature Couplers



See pages 11-14 for packaging options.

## 1x2 and 2x2 Terminated Couplers



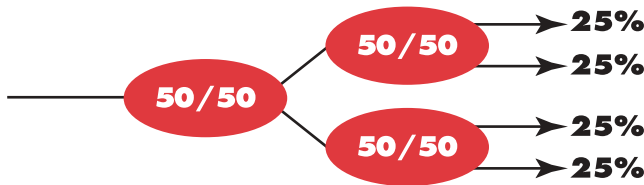
See pages 11-14 for packaging options.

# 945 Series Single Mode 1xN Tree Couplers (Splitters)

Amphenol's single mode tree couplers are available as either SWBBC or WBC style devices. The couplers are bi-directional, multi-port devices offered in equal split or custom coupling ratios. Tree couplers are manufactured by concatenating multiple 1x2 (2x2) devices together to achieve the desired output configuration. With the consistency in performance of the standard 1x2 (2x2) devices, we are able to offer excellent uniformity in the 1xN configuration as well. Each device is 100% optically tested for optical performance and supplied with certified test data.



1xN Tree Couplers



## Common Specifications

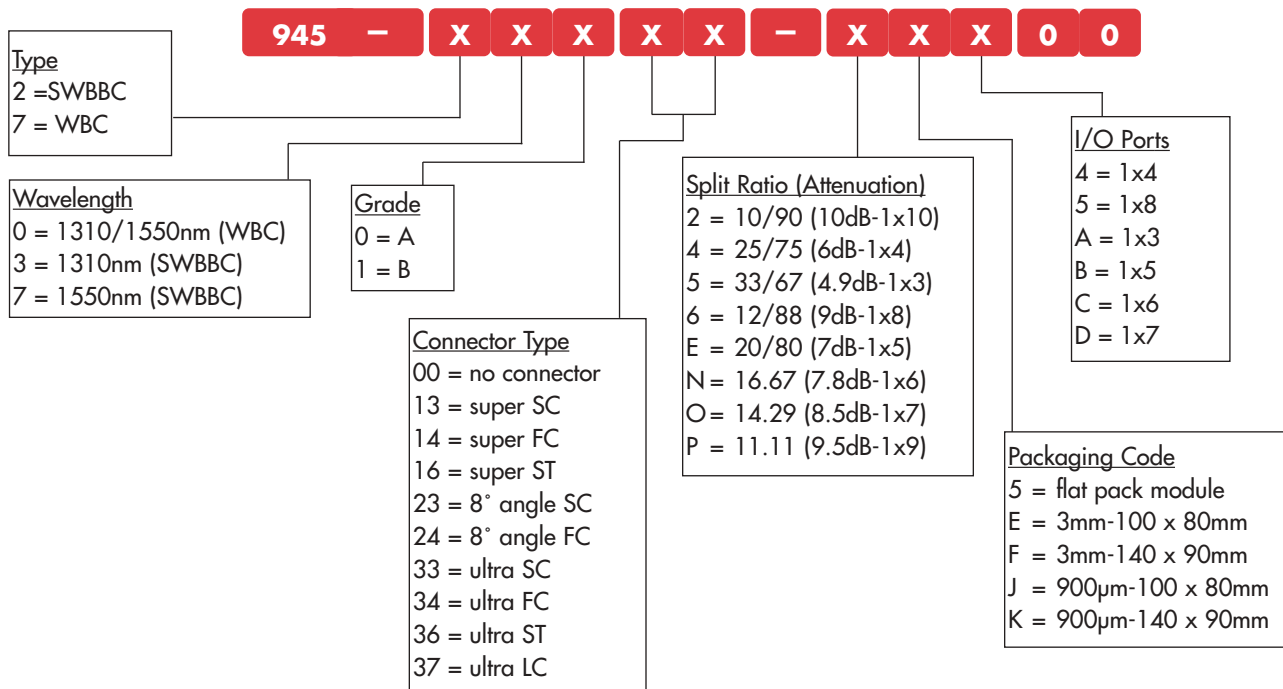
<b>Coupling ratio:</b>	<b>even, split, or custom</b>
Directivity:	≥ 50 dB
Reflectance:	≤ -55 dB
PDL:	≤ 0.3dB typical
Operating Bandpass:	+/-40nm
Operating Temperature:	-40° to +85° C
Storage Temperature:	-55° to +85° C
Standard Length:	1 meter

Configuration	Coupling Ratio	SWBBC: 1310 or 1550nm ± 40nm				WBC: 1310/1550nm ± 40nm			
		Grade A EL: 0.1dB		Grade B EL: 0.2dB		Grade A EL: 0.08dB		Grade B EL: 0.2dB	
		IL*	Uniformity	IL*	Uniformity	IL*	Uniformity	IL*	Uniformity
1x3	33.0%	5.70	0.8	6.00	1.1	5.80	0.8	6.20	1.2
1x4	25.0%	7.00	0.8	7.40	1.2	7.20	0.9	7.60	1.4
1x5	20.0%	8.00	1.1	8.50	1.8	8.20	1.2	8.70	2.0
1x6	16.7%	9.00	1.2	9.60	2.3	9.30	1.4	9.90	2.5
1x7	14.3%	9.80	1.3	10.80	2.7	10.10	1.7	11.00	2.9
1x8	12.5%	10.60	1.4	11.50	3.0	11.00	1.7	11.70	3.2
1x9	11.1%	11.20	1.5	12.00	3.1	11.40	1.7	12.20	3.3
1x10	10.0%	11.70	1.7	12.80	3.2	11.80	1.8	13.80	3.4
1x16	6.3%	14.00	2.4	15.30	3.8	14.50	2.6	15.50	4.0

\* IL specifications

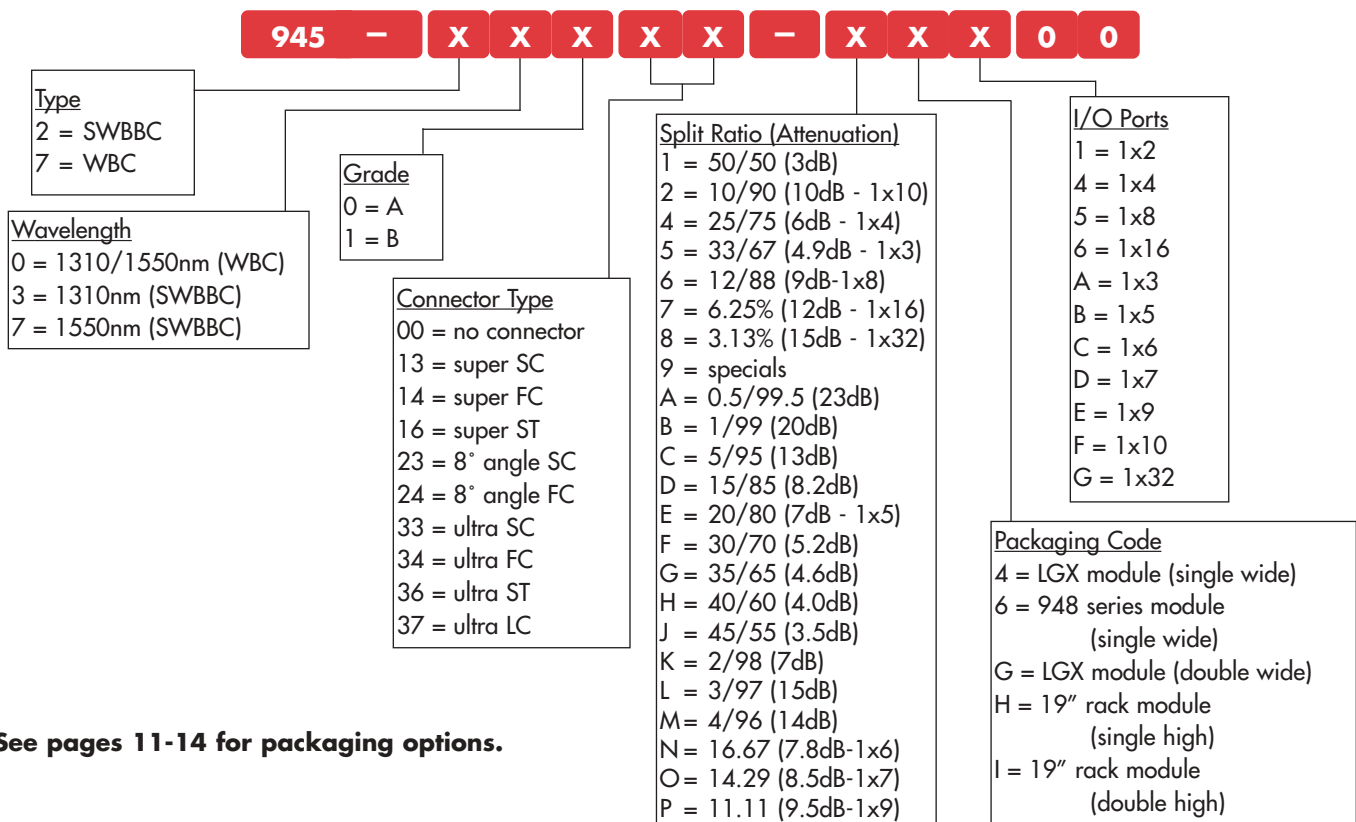
# Ordering Information

## Tree Couplers



See pages 11-14 for packaging options.

## LGX & 948 Fiber Management Modules

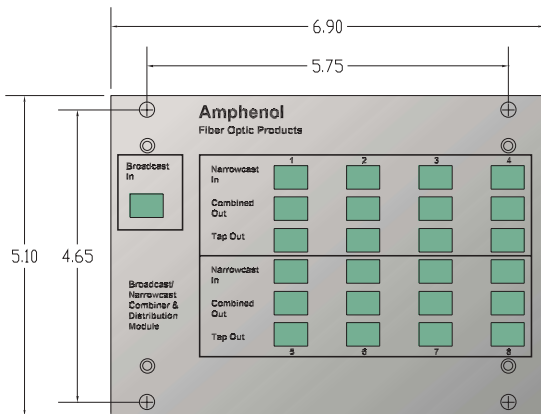
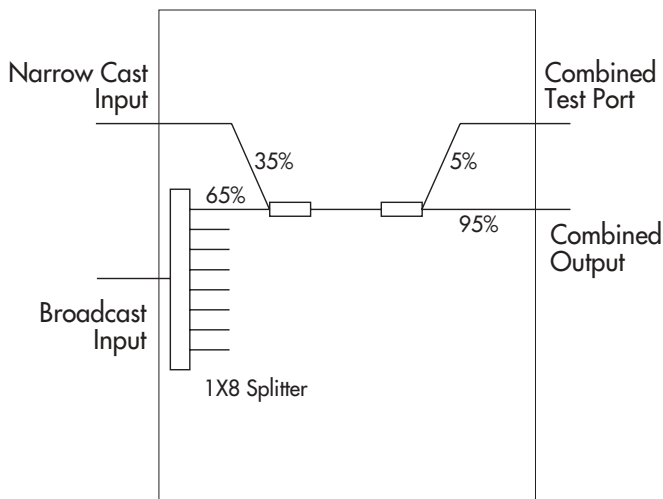


See pages 11-14 for packaging options.

# TSC Module

The Targeted Service Combiner (TSC) module provides Amphenol's customers with a simple solution in one compact housing to feed multiple nodes in a DWDM system. The multi-coupler module allows for the combination of a general broadcast signal with unique customer and targeted service signals while tap outputs provide signal monitoring. By combining a 1x8 coupler (1x2 and 1x4 also available) with 35% and 5% couplers into a single housing, our customers are able to reduce space requirements, overall loss and installation time while achieving tighter channel to channel uniformity.

Amphenol's TSC module is based upon the proven fused biconic taper (FBT) technology and is available in either a single wavelength or dual wavelength device. Standard packaging is LGX compatible and available in 1x2, 1x4, and 1x8 configurations. Custom housing available upon request.



1x8 TSC Module



1x4 TSC Module

## Applications

- ▶ Broadband communications
- ▶ Data convergence

## Features

- ▶ Designed to meet Telcordia GR-1209 and GR-1221
- ▶ Custom coupling ratios
- ▶ Environmentally reliable and stable
- ▶ LGX compatible
- ▶ Polarization insensitive
- ▶ Standard connector configurations available
- ▶ Attenuator inputs available for signal leveling



# TSC Module

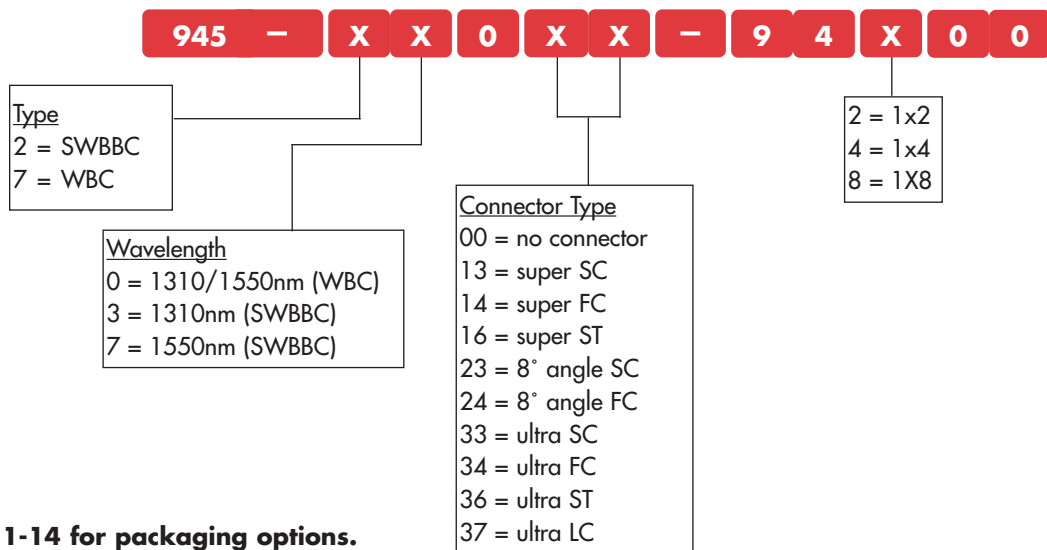
## Common Specifications

Operating wavelengths:	1310/1550± 40nm
Optical power handling capability:	+25dBm
Return Loss:	45dB
IL stability over temperature:	± 0.1dB (no connectors)
Operating temperature:	-20°C to +65°C
Storage temperature:	-40°C to +85°C

Parameter	1x2	1x4	1x8
IL: Bcast input to thru output	5.9dB typical, 6.3dB maximum	9.2dB typical, 9.7dB maximum	12.5dB typical, 13.0dB maximum
IL: Bcast input to tap output	20.5dB maximum	24.2dB maximum	27.5dB maximum
Uniformity: Bcast input to thru output	0.5dB typical, 0.7dB maximum	0.75dB typical, 1.0dB maximum	0.75dB typical, 1.0dB maximum
IL: TSI to thru output	6.5dB maximum	6.5dB maximum	6.5dB maximum
IL: TSI to tap output	21.0dB maximum	21.0dB maximum	21.0dB maximum
Polarization Dependent Loss (PDL)	≤ 0.4dB	≤ 0.4dB	≤ 0.5dB

## Ordering Information

### TSC Module



# C&L Band

Amphenol's C&L Band optical couplers provide our customers with the opportunity to expand their existing optical networks by tapping into the unused wavelengths that standard SMF-28 fiber can accommodate. The C&L Band couplers are designed to operate from 1530 - 1625nm while offering a low-loss, environmentally stable device.

## Common Specifications

Coupling ratio:	1/99 to 50/50
Directivity:	≥ 50 dB (1X2) ≥ 60 dB (2X2)
Reflectance:	≤ -55 dB
PDL:	≤ 0.1 dB (≤ 0.3dB for tap legs of ≤ 15%)
Operating Bandpass:	1530 - 1625nm
Operating Temperature:	-40° to +85° C
Storage Temperature:	-55° to +85° C
Standard Length:	1 meter

C&L Band		
EL: 0.08dB		
	IL*	Uniformity
50/50	3.60	0.8
45/55	3.90/2.90	n/a
40/60	4.40/2.50	n/a
35/65	5.10/2.20	n/a
30/70	5.80/1.80	n/a
25/75	6.70/1.60	n/a
20/80	7.60/1.10	n/a
15/85	9.00/0.96	n/a
10/90	11.00/0.63	n/a
5/95	14.60/0.40	n/a
4/96	15.27/0.37	n/a
3/97	16.63/0.34	n/a
2/98	18.53/0.30	n/a
1/99	21.6/0.30	n/a

\* IL specifications: tap / throughput  
\* Maximum additional IL of 0.5dB per mated pair for terminated devices.

## Ordering Information

### C&L Band Couplers

945 - 7 2 P - X X 0 X

Split Ratio (Attenuation)	Split Ratio (Attenuation)
1 = 50/50 (3dB)	2 = 10/90 (10dB)
4 = 25/75 (6dB)	A = 0.5/99.5 (23dB)
B = 1/99 (20dB)	C = 5/95 (13dB)
D = 15/85 (8.2dB)	E = 20/80 (7dB)
F = 30/70 (5.2dB)	G = 35/65 (4.6dB)
H = 40/60 (4.0dB)	J = 45/55 (3.5dB)
K = 2/98 (17dB)	L = 3/97 (15dB)
M = 4/96 (14dB)	

Packaging Code		
µm -mm		
0 = 250-55	2x2	(standard)
1 = 250-55	1x2	(standard)
4 = 250-40	2x2	
5 = 250-40	1x2	
6 = 250-50	2x2	
7 = 250-50	1x2	
8 = 250-53	2x2	
9 = 250-53	1x2	
A = 250-76	2x2	
B = 250-76	1x2	

See pages 11-14 for packaging options.

### C&L Band Terminated Couplers

945 - 7 2 P X X - X X X 0 0

Connector Type
00 = no connector
13 = super SC
14 = super FC
16 = super ST
23 = angle SC
24 = angle FC
33 = ultra SC
34 = ultra FC
36 = ultra ST
37 = ultra LC

Split Ratio (Attenuation)	Split Ratio (Attenuation)
1 = 50/50 (3dB)	2 = 10/90 (10dB)
4 = 25/75 (6dB)	A = 0.5/99.5 (23dB)
B = 1/99 (20dB)	C = 5/95 (13dB)
D = 15/85 (8.2dB)	E = 20/80 (7dB)
F = 30/70 (5.2dB)	G = 35/65 (4.6dB)
H = 40/60 (4.0dB)	J = 45/55 (3.5dB)
K = 2/98 (17dB)	L = 3/97 (15dB)
M = 4/96 (14dB)	

Packaging Code	
µm-mm	µm-mm
0 = 250-55 2x2 standard	B = 900-66
1 = 3mm-101	C = 900-70
2 = 3mm-120	D = 900-95
7 = 250-40	E = 3mm-100x80mm
8 = 250-50	F = 3mm-140x90mm
9 = 250-53	J = 900µm-100x80mm
A = 250-76	K = 900µm-140x90mm

I/O Ports
1 = 1x2
2 = 2x2

# Multimode Couplers

Amphenol's multimode couplers precisely divide light signals between two multimode fibers. The couplers are bi-directional in performance for either power splitting or combining and operate 800nm to 1300nm.

Amphenol's multimode couplers are offered with standard 50/125µm or 62.5/125µm fiber. The devices can be assembled into miniature or ruggedized packages and can be terminated with industry standard multimode connectors.



3mm Ruggedized Multimode Coupler

## Applications

- ▶ Telecommunication systems
- ▶ Local/Wide Area Networks (LAN/WAN)
- ▶ Test and Measurement instrumentation
- ▶ Premise distribution networks
- ▶ Fiber optic sensors

## Features

- ▶ Environmentally reliable and stable
- ▶ Low insertion loss
- ▶ Miniature or ruggedized package options
- ▶ Standard connector/cable leads available

## Common Specifications

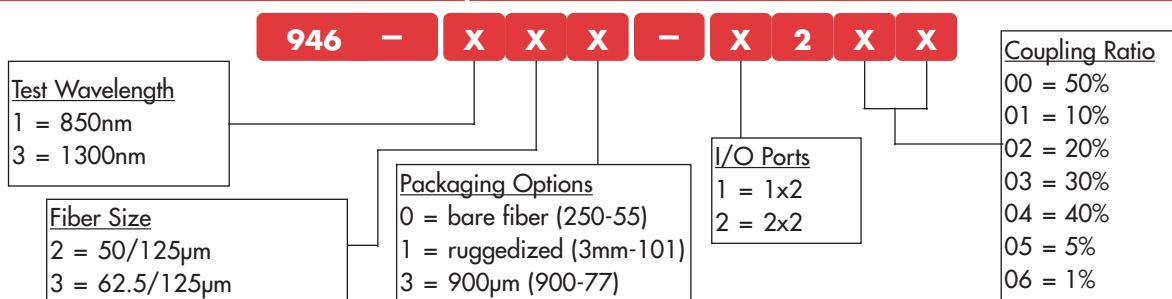
Operating Wavelength:	850nm or 1300nm
Coupling Ratios:	1% - 50%
Directivity:	≤ -40dB
Operating Temperature:	-40° C to +85° C
Storage Temperature:	-55° C to +85° C
Port Configuration:	1x2 or 2x2
Standard Length:	1 meter

	EL: 0.7dB	
	Thermal Stability: < 0.2dB	
	IL*	Uniformity
50/50	3.90	0.7
40/60	4.9 / 3.0	n/a
30/70	6.2 / 2.3	n/a
20/80	8.0 / 1.8	n/a
10/90	11.3 / 1.25	n/a
5/95	14.9 / 0.9	n/a
1/99	22.1 / 0.7	n/a

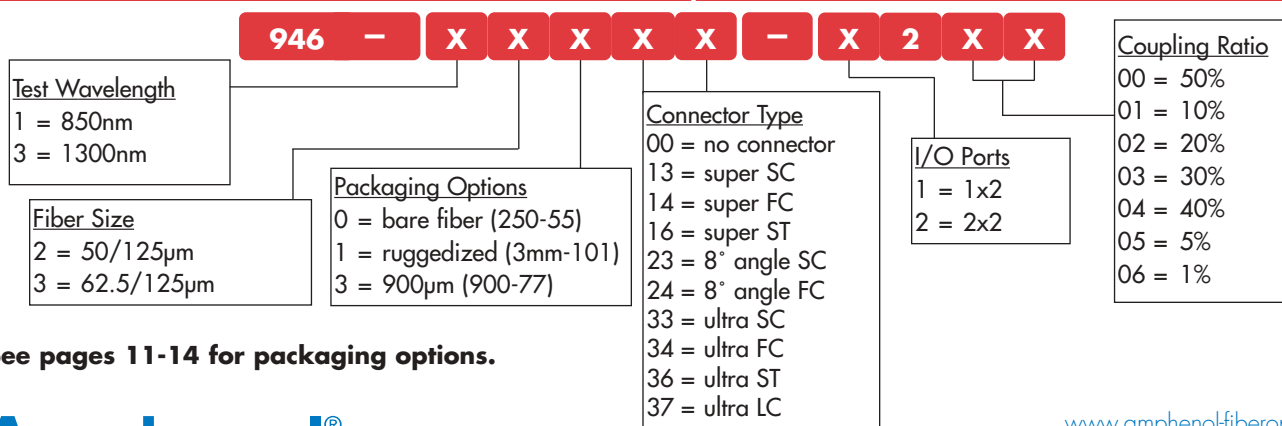
\* IL specifications: tap / throughput

# Ordering Information

## 1x2 and 2x2 Miniature Multimode Couplers



## 1x2 and 2x2 Miniature Multimode Terminated Couplers



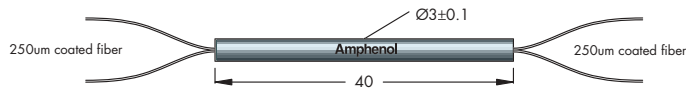
See pages 11-14 for packaging options.

# Packaging Options (Units: inches [mm])

## bare fiber packages

## Package Description

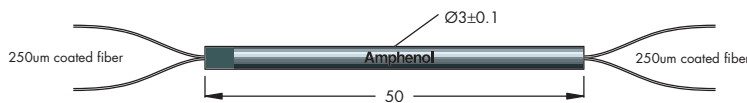
250-40



Available for: 1x2, 2x2, SWBBC only

mm

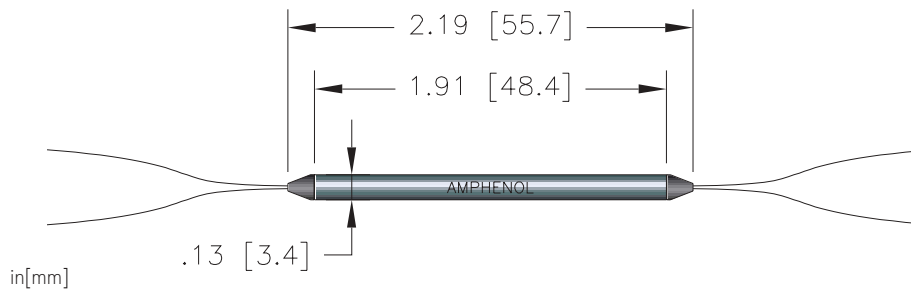
250-50



Available for: 1x2, 2x2, SWBBC, WBC

mm

250-55



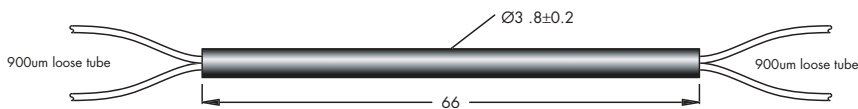
Available for: 1x2, 2x2, SWBBC, WBC

in[mm]

## 900µm packages

## Package Description

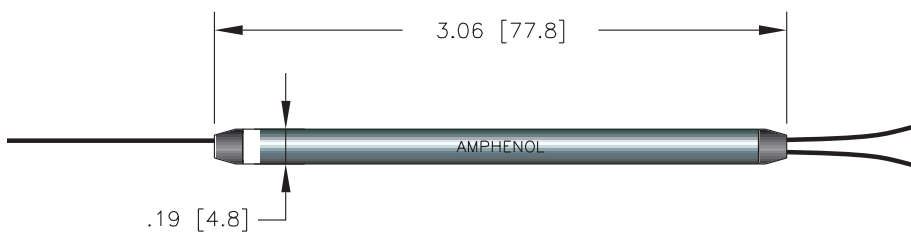
900-66



Available for: 1x2, 2x2, SWBBC, WBC

mm

900-77



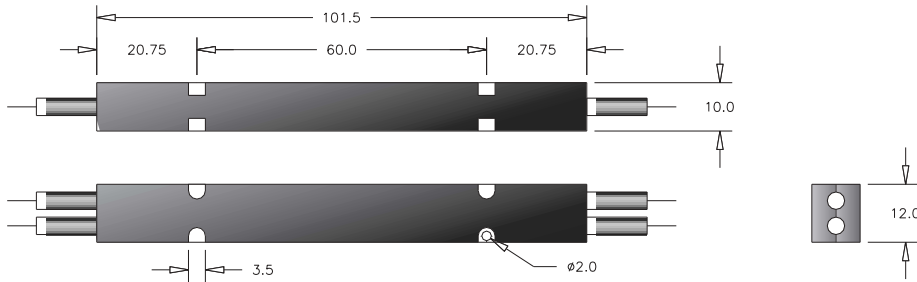
Available for: 1x2, 2x2, SWBBC, WBC

in[mm]

# Packaging Options (Units: inches [mm])

## 3mm/900µm jacketed packages

## Package Description



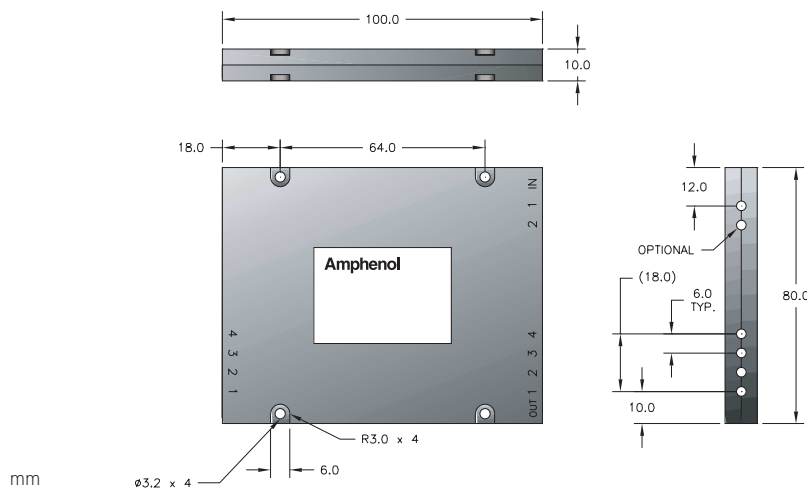
**3mm-101**  
(3mm, 900µm, or bare fiber)

Available for: 1x2, 2x2, SWBBC,  
WBC

mm

## Tree coupler packages

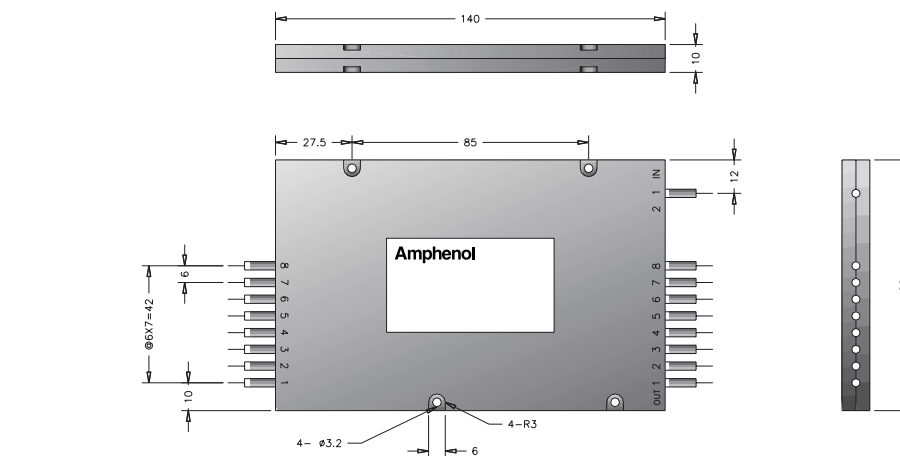
## Package Description



**3mm-100x80**  
(3mm, 900µm, or bare fiber)

Available for: 1x3, 1x4 SWBBC,  
WBC

mm



**3mm-140x90**  
(3mm, 900µm, or bare fiber)

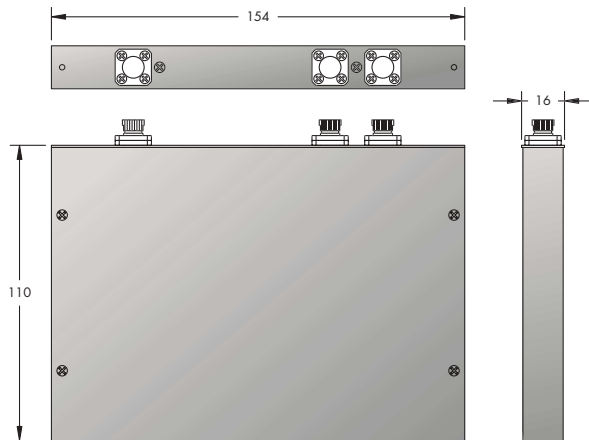
Available for: 1x5, 1x6, 1x7, 1x8  
SWBBC, WBC

mm

# Packaging Options (Units: inches [mm])

## MB packages

## Package Description



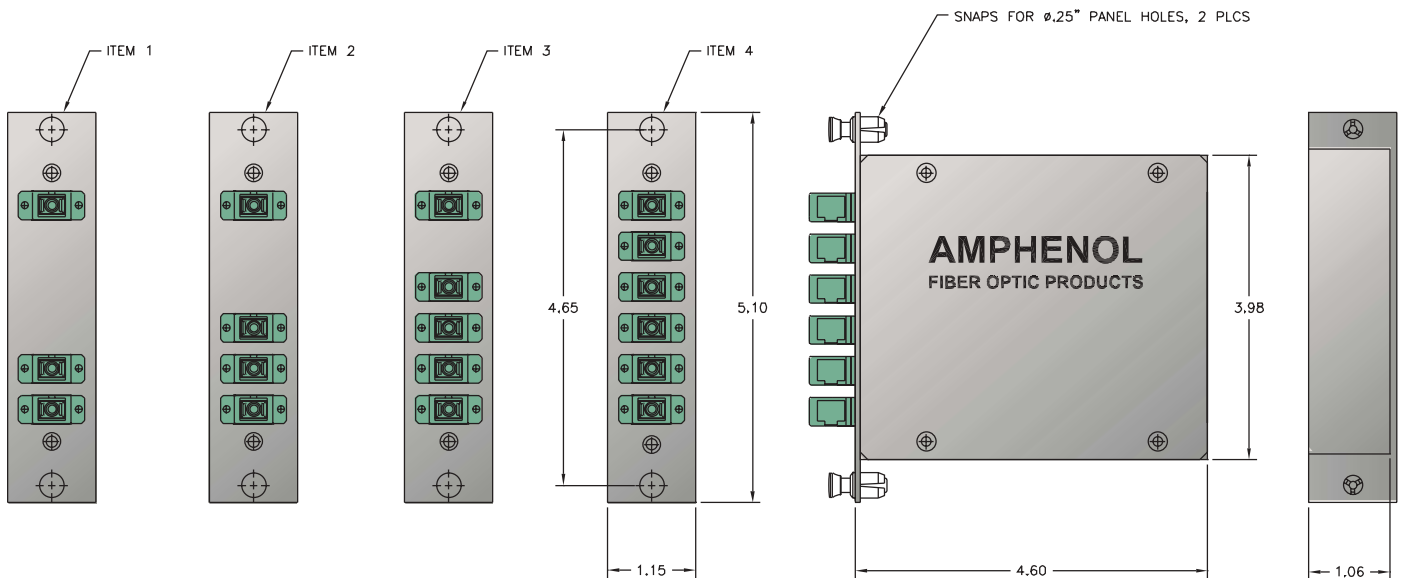
module - 110 x 154

Available for:  
 1x2, 1x3, 1x4 SC  
 1x2, 1x3, 1x4, 1x5, 1x6, 1x7,  
 1x8 FC, SWBBC, WBC

mm

## LGX compatible modules

## Package Description



mm

## Configurations

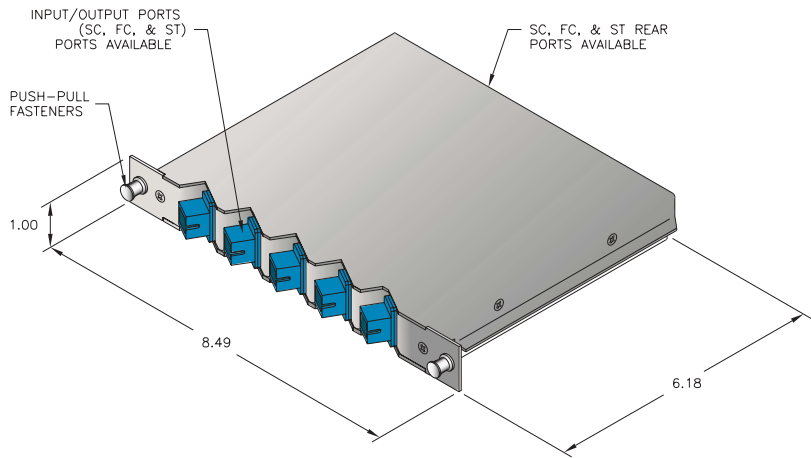
Item #	Part #	Configuration
1	945-70023-14101	1X2
2	945-70023-54A01	1X3
3	945-70023-44401	1X4
4	945-70023-E4B01	1X5

LGX Compatible

Available for: 1x2 SWBBC,  
 1xN SWBBC, 2xN SWBBC,  
 1x2 WBC, 1xN WBC, 2xN WBC

# Packaging Options (Units: inches [mm])

**948 modules** **Package Description**

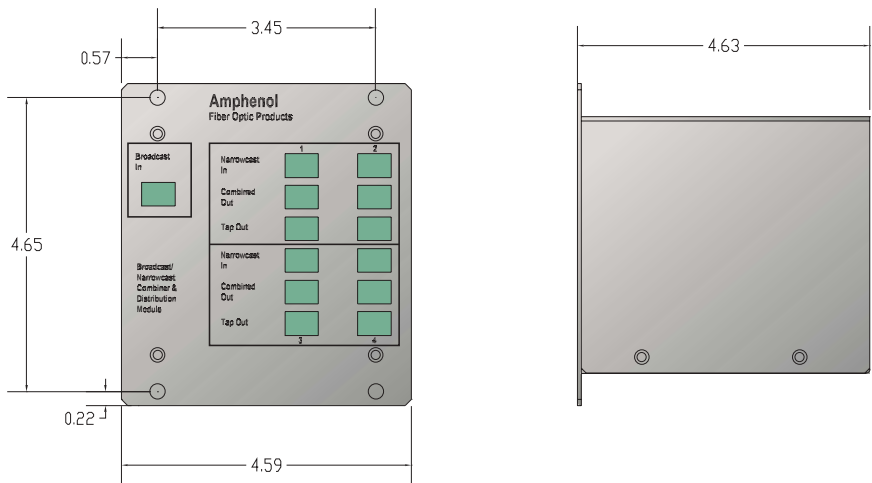


948 module

Available for: 1x2 SWBBC,  
1xN SWBBC, 2xN SWBBC,  
1x2 WBC, 1xN WBC, 2xN WBC

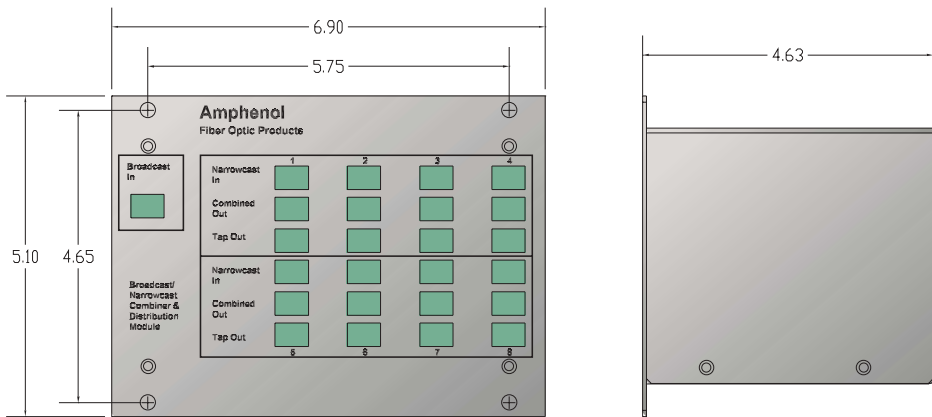
mm

**TSC modules** **Package Description**



1x4 TSC module

mm



1x8 TSC module

mm

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