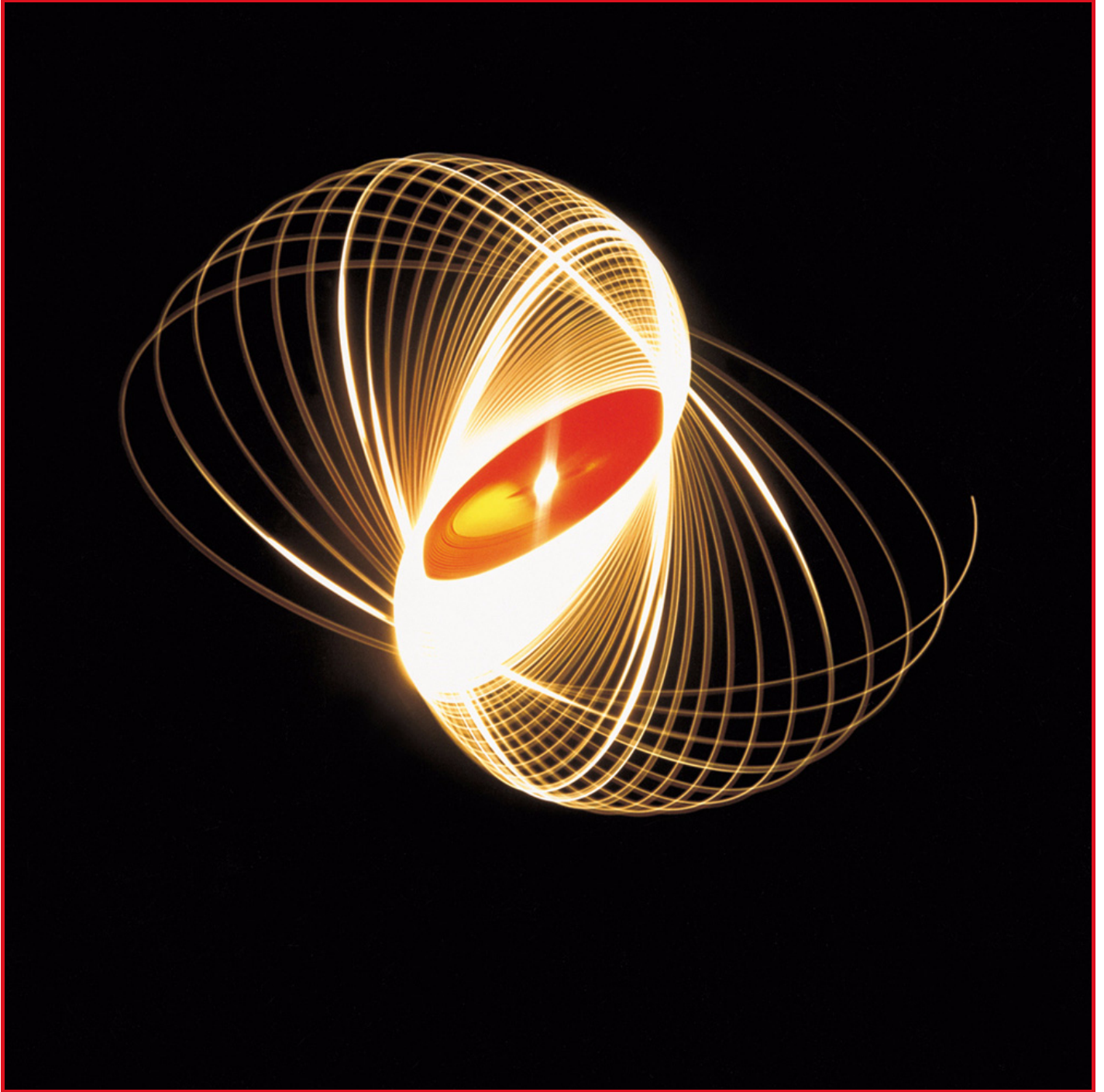


Amphenol® Fiber Optic Products for Maximum Optical Performance

12-352-2



Amphenol

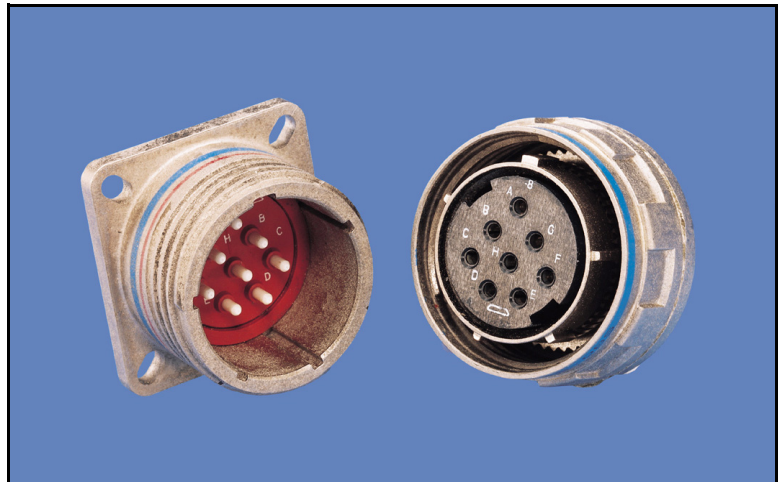
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Amphenol Corporation, well known for high quality, reliable interconnection products for the military-aerospace market, as well as the industrial market, has a wide offering of fiber optic products to meet today's needs. Included in this offering is the high performance, well-established MIL-DTL-38999 Series III cylindrical connector with fiber optic termini, and the LRM rectangular connector used in advanced avionics. In addition, the Amphenol® Advanced Fiber Optic connector with a unique removable socket front insert and enhanced tolerancing is now available.



Multi-Channel MIL-DTL-38999 Connectors

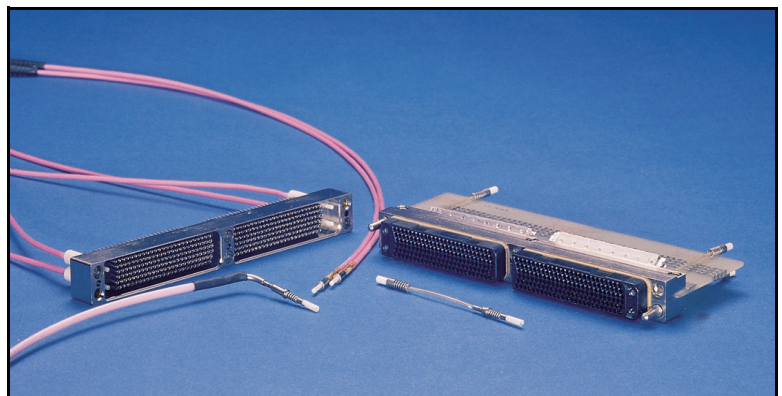


Advanced Fiber Optic Connectors
Now with captivated alignment sleeves. (Composite material shell shown)

If more information is needed concerning the products in this publication, or if you have any special application needs, please contact your nearest Amphenol sales office or Amphenol Corporation at the following address:

Amphenol Corporation
Amphenol Aerospace
40-60 Delaware Ave.
Sidney, NY 13838
Telephone: 607-563-5011
Fax: 607-563-5157
www.amphenol-aerospace.com

Amphenol Aerospace is a Certified ISO9001 Manufacturer.



LRM Surface Mount Connectors

Amphenol® Fiber Optic Products

high performance systems

The emergence of highly reliable fiber optic transmission systems that provide high speed and secure communication has led to the development of precision fiber optic multi-channel termination and interconnect systems.

Amphenol Corporation's fiber optic termination types offer low insertion loss characteristics, with high reliability and repeatability. Optical performance is maximized utilizing the unique alignment methods employed in these termination systems. Insertion losses can be expected between 0.5 and 1.0 dB. Losses are dependent upon launch conditions, fiber NA, fiber size and termination method and technique.

Amphenol® fiber optic termini have been designed to operate in the size 16 and size 20 cavities of Amphenol® MIL-DTL-38999* Series III connectors. These connectors are available in various insert arrangements, providing a wide variety of combinations. Fiber optic/electrical hybrid combinations are also easily accommodated using the MIL-DTL-38999 connector arrangements. (Insert availability for fiber optics is shown on pages 4-6). Multi-mode, single mode and 90° termini are available for use in multi-channel cylindrical connectors.

The MIL-DTL-38999 Tri-Start connectors are available in aluminum, stainless steel and composite shell materials. Amphenol Tri-Start connectors with composite shells offer a lighter weight, corrosion resistant product. See page 7 for proper ordering information. Connectors must be ordered to the CF-XXXXXX part number to guarantee correct insert callout.

Amphenol's Advanced Fiber Optic connector (see page 8) now features a captivated alignment sleeve. This alignment sleeve stays intact in the shell when socket termini are removed for cleaning. The Advanced Fiber Optic connector is designed to mate with Amphenol MIL-DTL-38999 Fiber Optic connectors while offering enhanced tolerancing.

A new addition to the Amphenol family of fiber optics is the Line Replaceable Module (LRM) interconnect system. (See pages 14 and 15). The LRM connectors, both staggered grid and chevron pattern, are capable of housing the MIL-T-29504/4 and /5 fiber optic termini.

Several additional fiber optic products expand Amphenol's offering. (See pages 17-19).



Fiber to Fiber Termini



Cable Assemblies



MFM Simplex Connectors

* MIL-DTL-38999 supersedes MIL-C-38999

Multi-Channel Fiber to Fiber System features and benefits

Amphenol® multi-channel fiber optic connectors offer a precision optic interconnect system within the high performance MIL-DTL-38999 Series III connector. The metal to metal mating feature of the Tri-Start™ connector provides protection from damage in severe physical and environmental conditions. The Amphenol Fiber Optic Series III Tri-Start* offers high performance in either standard metal shells or in composite shells which are qualified to MIL-DTL-38999, Rev. J. Special features in either the metal (stainless steel and aluminum) or composite design include “scoop-proof” recessed pin contacts, quick coupling, moisture resistance and operation under high temperature vibration through 200°C. Mismatching conditions are eliminated with the 5 key/keyway polarization feature of the Fiber Optic Tri-Start connector. Optical performance of the fiber to fiber system within the Tri-Start connector does not degrade with high level vibration.

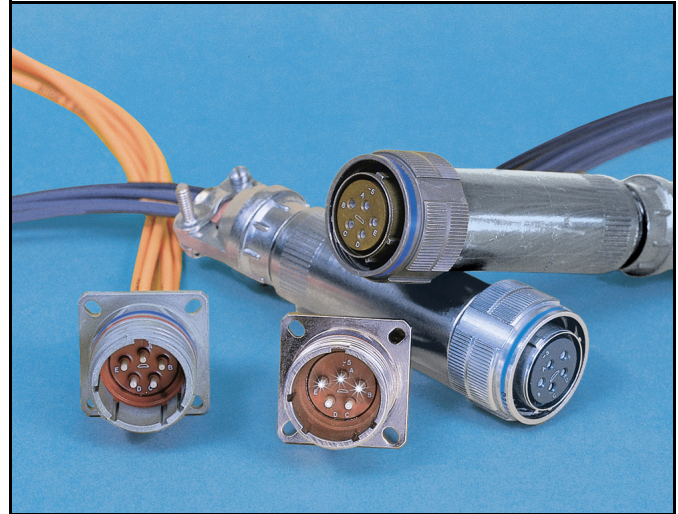
The fiber to fiber termini design when utilized in a MIL-DTL-38999 connector has the capability for operation from temperatures of -55°C to +200°C. Care should be taken to select fiber, cable, epoxy and connector finishes that also meet temperature requirements

Amphenol fiber optic termination types offer low loss characteristics, with high reliability and repeatability. Optical performance is maximized utilizing the unique alignment methods employed in these termination systems.

Amphenol multi-mode fiber optic termini have been designed to operate in the size 16 and size 20 contact cavities of MIL-DTL-38999 Series III connectors, and are available from 2 (pattern 11-2) through 37 (pattern 25-37) channels. Single mode, size 16 termini are also available in special inserts, and fiber optic/electrical hybrid combinations can be accommodated in certain patterns. Consult Amphenol, Sidney NY for further information. For insert availability for multi-channel fiber optic connectors see pages 4 - 6.

* The MIL-T-29504/4 and /5 were designed for operation in Amphenol MIL-DTL-38999 Fiber Optic Series III Tri-Start connectors. Amphenol is not responsible for the proper function of these termini in other connectors.

** For further insert availability for Tri-Start connectors - those in addition to the contact size 16 and 20 patterns which accommodate fiber optics, consult Amphenol catalog 12-092.



Multi-Channel Connectors

OPTICAL PERFORMANCE OF MULTI-CHANNEL FIBER OPTIC CONNECTORS

- **Insertion Loss at 820 nm, 100/140, .2 NA fiber, room ambient (typical .5dB – 1.0dB)**

FEATURES/BENEFITS

- **Ceramic alignment ferrule**
- **Phosphor bronze alignment (sleeve)**
Note: ceramic alignment sleeves are optional on proprietary designs.
- **Size 16 (MIL-DTL-38999, multi-mode and single mode)**
- **Size 20 (MIL-DTL-38999, multi-mode)**
- **Stainless steel body**
- **Proven epoxy/polish terminations**
- **Air gap or physical contact termination options**
- **Size 16 multi-mode qualified to MIL-T-29504/4 and /5 requirements**
- **Provides hybrid capabilities - copper contacts and fiber optic termini through the same connector**
- **Optional fiber cleaning feature**

ENVIRONMENTAL CAPABILITIES

- **Temperature** – -55°C to +200°C
- **Durability** – 500 cycles
- **Random Vibration** – per EIA/TIA 455-11, Condition 7, Letter J.
- **Shock** – per EIA/TIA 455-14, Condition D
- **Temperature Life** – per MIL-STD-1344, Method 1005, Condition D
- **Thermal Shock** – per MIL-STD-1344, Method 1003, Condition A

Multi-Channel Fiber Optic Cylindrical Connectors Tri-Start (MIL-DTL-38999, III) shell styles

TRI-START COMPOSITE[†] CONNECTORS

Wall Mount Receptacle

Shell Size	MS Shell Size Code	B Thread	L Max	M +.000 - .005	R ¹	R ²	S Max	T +.008 - .006	V Thread Metric	Z Max	TT +.008 - .006
9	A	.6250	.514	.775	.719	.594	.948	.128	M12X1-6g	.198	.216
11	B	.7500	.514	.775	.812	.719	1.043	.128	M15X1-6g	.198	.194
13	C	.8750	.514	.775	.906	.812	1.137	.128	M18X1-6g	.198	.194
15	D	1.0000	.514	.775	.969	.906	1.232	.128	M22X1-6g	.198	.173
17	E	1.1875	.514	.775	1.062	.969	1.323	.128	M25X1-6g	.198	.194
19	F	1.2500	.514	.775	1.156	1.062	1.449	.128	M28X1-6g	.198	.194
21	G	1.3750	.545	.745	1.250	1.156	1.575	.128	M31X1-6g	.228	.194
23	H	1.5000	.545	.745	1.375	1.250	1.701	.154	M34X1-6g	.228	.242
25	J	1.6250	.545	.745	1.500	1.375	1.823	.154	M37X1-6g	.228	.242

Jam Nut Receptacle

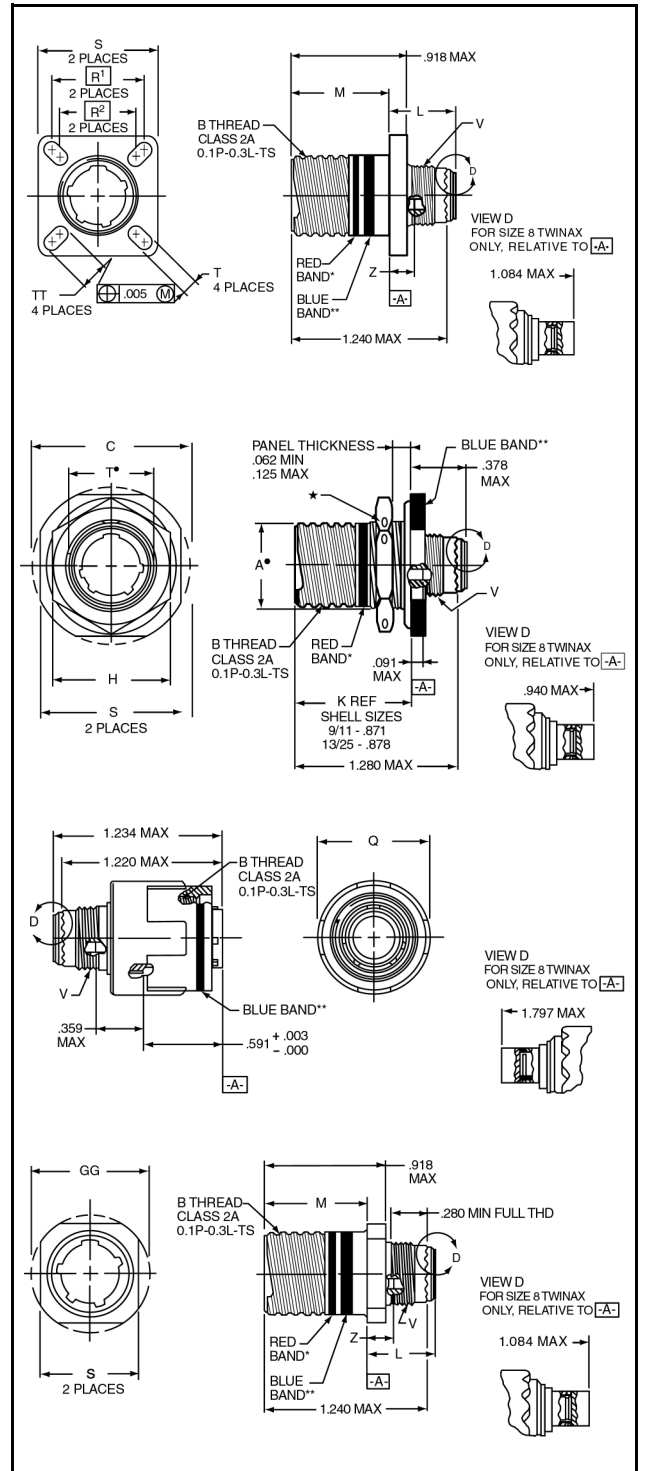
Shell Size	MS Shell Size Code	A* +.000 - .010	B Thread	C Max	H Hex +.017 - .016	S ±.010	T* +.010 - .000	V Thread Metric
9	A	.669	.6250	1.199	.875	1.062	.697	M12X1-6g
11	B	.769	.7500	1.386	1.000	1.250	.822	M15X1-6g
13	C	.955	.8750	1.511	1.188	1.375	1.007	M18X1-6g
15	D	1.084	1.0000	1.636	1.312	1.500	1.134	M22X1-6g
17	E	1.208	1.1875	1.761	1.438	1.625	1.259	M25X1-6g
19	F	1.333	1.2500	1.949	1.562	1.812	1.384	M28X1-6g
21	G	1.459	1.3750	2.073	1.688	1.938	1.507	M31X1-6g
23	H	1.575	1.5000	2.199	1.812	2.062	1.634	M34X1-6g
25	J	1.709	1.6250	2.323	2.000	2.188	1.759	M37X1-6g

Straight Plug

Shell Size	MS Shell Size Code	B Thread	Q Max.	V Thread Metric
9	A	.6250	.859	M12X1-6g
11	B	.7500	.969	M15X1-6g
13	C	.8750	1.141	M18X1-6g
15	D	1.0000	1.266	M22X1-6g
17	E	1.1875	1.391	M25X1-6g
19	F	1.2500	1.500	M28X1-6g
21	G	1.3750	1.625	M31X1-6g
23	H	1.5000	1.750	M34X1-6g
25	J	1.6250	1.875	M37X1-6g

Line Receptacle (Consult Amphenol Aerospace for availability)

Shell Size	MS Shell Size Code	B Thread	L Max	M +.000 - .005	S ±.010	V Thread Metric	Z Max	GG Dia ±.010
9	A	.6250	.514	.775	.635	M12X1-6g	.198	.699
11	B	.7500	.514	.775	.765	M15X1-6g	.198	.875
13	C	.8750	.514	.775	.885	M18X1-6g	.198	1.007
15	D	1.0000	.514	.775	1.100	M22X1-6g	.198	1.140
17	E	1.1875	.514	.775	1.197	M25X1-6g	.198	1.229
19	F	1.2500	.514	.775	1.260	M28X1-6g	.198	1.380
21	G	1.3750	.545	.745	1.385	M31X1-6g	.228	1.493
23	H	1.5000	.545	.745	1.510	M34X1-6g	.228	1.626
25	J	1.6250	.545	.745	1.635	M37X1-6g	.228	1.777



All dimensions for reference only. □ Designates true position dimensioning

† Drawings and dimensions are for Tri-Start, MIL-DTL-38999 Series III connectors with composite shells. For standard metal Tri-Start Connectors consult Tri-Start Catalog, 12-092 (-6 version or higher).

Some dimensions do vary from composite to metal.

See how to order Fiber Optic MIL-DTL-38999 Series III connectors on pg. 7.

• D shaped mounting hole dimensions.

* Red band indicates fully mated.

** Blue band indicates rear release contact retention system.

★.059 dia. min., 3 lockwire holes.

Multi-Channel Fiber Optic Cylindrical Connectors Tri-Start (MIL-DTL-38999, III)

insert availability

Fiber optic termini can be accommodated in any size 16 or size 20 contact cavity of MIL-DTL-38999 Series III connector insert patterns, as listed in the following chart. For availability of fiber type, either multi-mode or single mode, see note at bottom of chart.

Shell Size/ Arrangement	Total Contacts	Contact Size					
		22D	Optic Termini Availability*		12	10 (Power)	8 Coax
			20	16			
9-94	2		2				
9-98	3		3				
11-2	2			2			
11-5	5		5				
11-98	6		6				
13-4	4			4			
13-8	8		8				
13-98	10		10				
15-5	5			5			
15-15	15		14	1			
15-18	18		18				
15-19	19		19				
15-97	12		8	4			
17-8	8			8			
17-26	26		26				
17-99	23		21	2			
19-11	11			11			
19-32	32		32				
21-16	16			16			
21-39	39		37	2			

Shell Size/ Arrangement	Total Contacts	Contact Size					
		22D	Optic Termini Availability*		12	10 (Power)	8 Coax
			20	16			
21-41	41		41				
23-21	21			21			
23-53	53		53				
23-54	53	40		9	4		
23-55	55		55				
25-4	56		48	8			
25-11***	11		2		9		
25-20***	30		10	13	4†	3††	
25-24	24			12	12		
25-26	25		16		5	4	
25-29	29			29			
25-37	37			37			
25-43	43		23	20			
25-46	46		40	4		2**	
25-61	61		61				

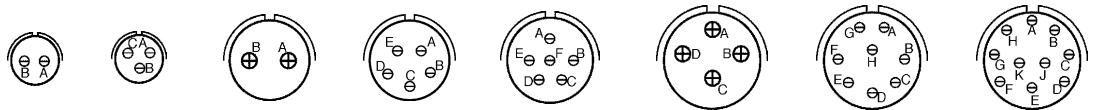
* Size 16 multi-mode and single mode fiber optic termini are readily available. For size 20 multi-mode termini please consult Amphenol, Sidney, NY for current availability.

† Coax †† Concentric Twinax

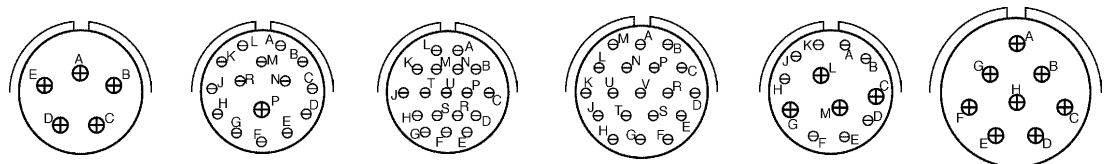
** For RG180/U and RG195/U cables only. Contact Sidney, NY for other cable applications.

*** For use in MIL-STD-1760 applications. See Tri-Start Catalog, 12-092.

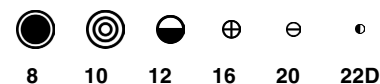
front face of pin inserts illustrated



Insert Arrangement	9-94	9-98	11-2	11-5	11-98	13-4	13-8	13-98
Service Rating	M	I	I	I	I	I	I	I
Number of Contacts	2	3	2	5	6	4	8	10
Contact Size	20	20	16	20	20	16	20	20



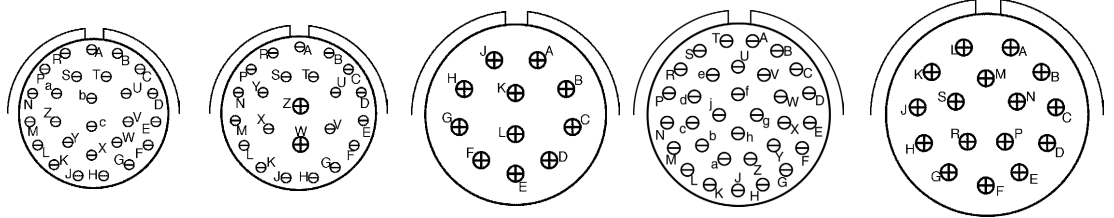
Insert Arrangement	15-5	15-15	15-18	15-19	15-97	17-8
Service Rating	II	I	I	I	I	II
Number of Contacts	5	14	1	18	8	8
Contact Size	16	20	16	20	20	16



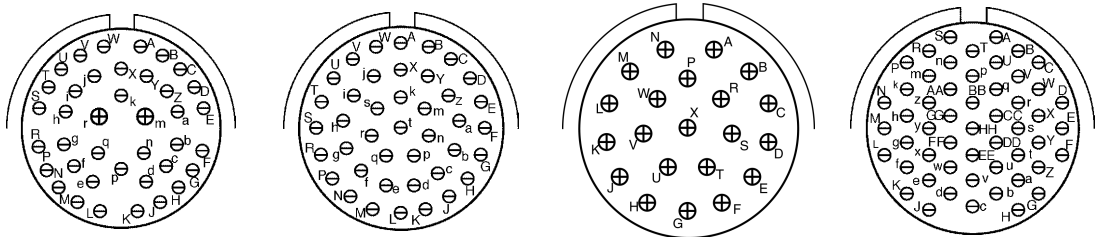
Multi-Channel Fiber Optic Cylindrical Connectors Tri-Start (MIL-DTL-38999, III)

insert availability, cont.

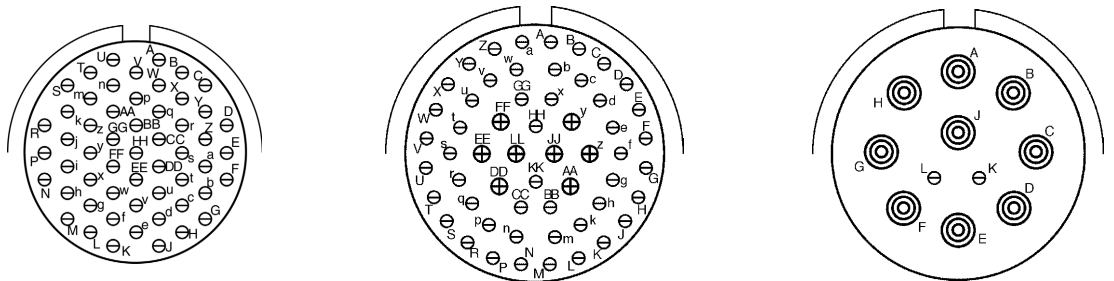
front face of pin inserts illustrated



Insert Arrangement	17-26	17-99		19-11	19-32	21-16
Service Rating	I	I		II	I	II
Number of Contacts	26	21	2	11	32	16
Contact Size	20	20	16	16	20	16



Insert Arrangement	21-39		21-41		23-21	23-53
Service Rating	I		I		II	I
Number of Contacts	37	2	41		21	53
Contact Size	20	16	20		16	20



Insert Arrangement	23-55	25-4		25-11***	
Service Rating	I	I		N	
Number of Contacts	55	48	8	2	9
Contact Size	20	20	16	20	10 Power

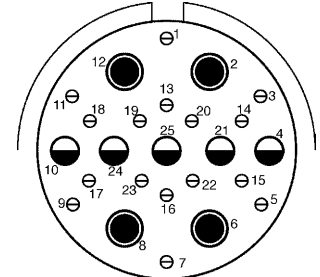
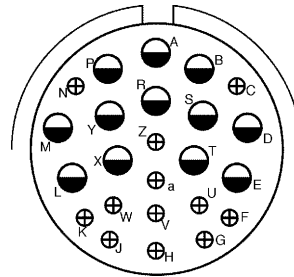
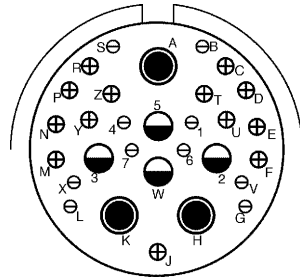
*** For use in MIL-STD-1760 applications. See Tri-Start Catalog, 12-092.



Multi-Channel Fiber Optic Cylindrical Connectors Tri-Start (MIL-DTL-38999, III)

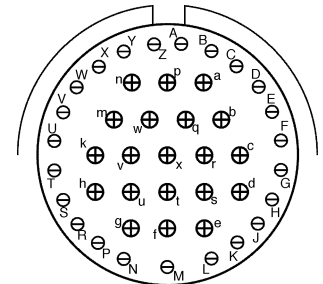
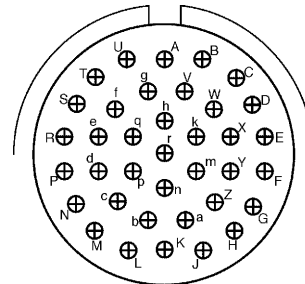
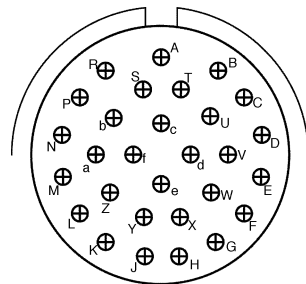
insert availability, cont.

front face of pin inserts illustrated

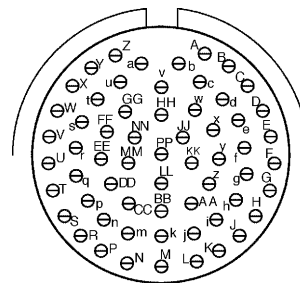
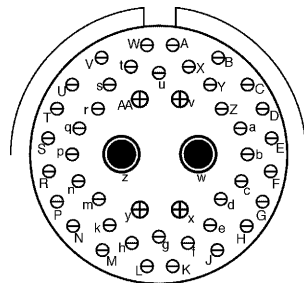


Insert Arrangement	25-20***				25-24		25-26		
Service Rating	N				I		I		
Number of Contacts	10	13	3	4	12	12	16	5	4
Contact Size	20	16	8 Twinax	12 Coax	16	12	20	12	8 Coax

(Locations U and Y - Dedicated to Fiber Optics)



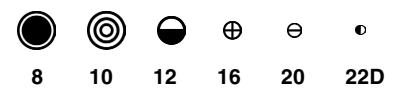
Insert Arrangement	25-29		25-37		25-43	
Service Rating	I		I		I	
Number of Contacts	29		37		23	20
Contact Size	16		16		20	16



Insert Arrangement	25-46			25-61	
Service Rating	I			I	
Number of Contacts	40	4	2	61	
Contact Size	20	16	8 Coax†	20	

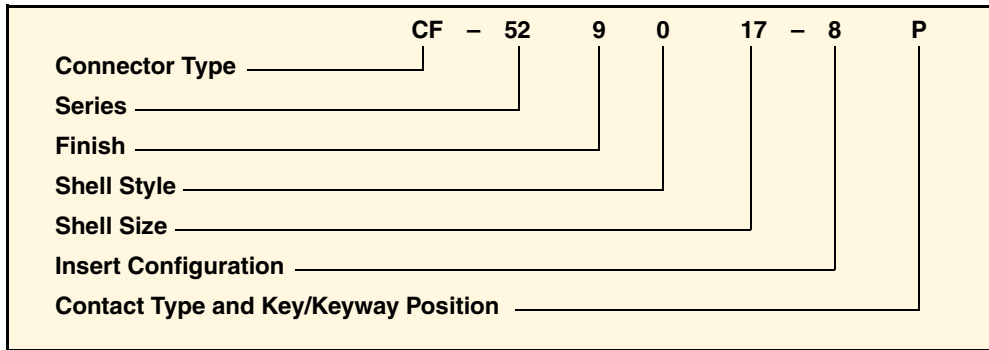
*** For use in MIL-STD-1760 applications (see page 18).

† Coax contacts for RG180 or RG195 cable.



Multi-Channel Fiber Optic Cylindrical Connectors Tri-Start (MIL-DTL-38999, III) how to order

Amphenol® Fiber to Fiber Multi-Channel fiber optic connectors for use with multi-mode and single mode termini can be ordered by coded part number. Ordering procedure is illustrated by part number CF-529017-8P as shown below:



Connector Type

CF designates Multi-Channel Fiber Optic Connector
 DF designates Multi-Channel Fiber Optic Connector similar to D38999 with sealing plugs and insertion/removal tools

Series

52 designates aluminum shell
 62 designates composite shell
 82 designates stainless steel shell

Finish

4 designates electroless nickel
 5 designates unplated composite
 6 designates stainless steel
 9 designates O.D. cadmium

Shell Style

0 designates wall mount receptacle
 2 designates box mount receptacle
 6 designates straight plug
 7 designates jam nut receptacle

Shell Size

See Insert Availability (preceding pages)

Insert Configuration

See Insert Availability (preceding pages)

Contact Type and Key/Keyway Position

P designates pin contacts
 S designates socket contacts
 For key/keyway positioning, choose the alternate rotation suffix letter from the chart below.

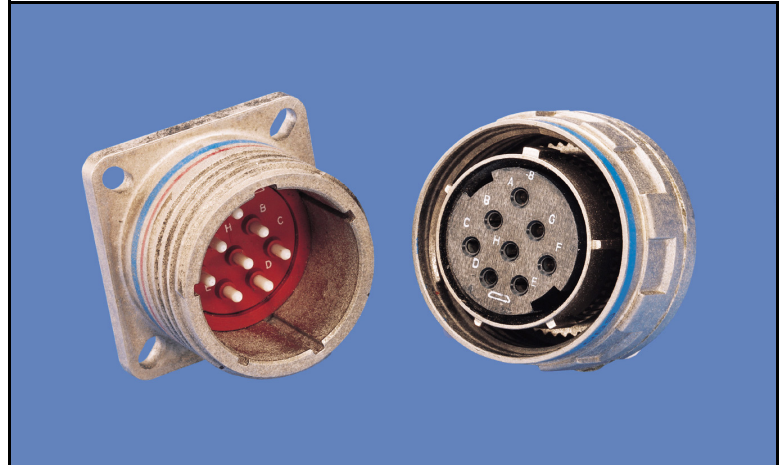
ALTERNATE POSITION SUFFIX

Alternate Position	Suffix Letter	
	Pins	Sockets
Normal	P	S
A	G	H
B	I	J
C	K	L
D	M	N
E	R	T

Advanced Fiber Optic Multi-Channel Cylindrical Connectors featuring captivated alignment sleeves

Amphenol's advanced fiber optic connector provides the cost advantage feature of captivated alignment sleeves to facilitate cleaning and maintaining fiber optic termini. Features of this new advancement include:

- **Dedicated fiber optic connector - will not accept copper contacts**
- **Captivated alignment sleeves facilitates cleaning of socket termini - no special cleaning tools required**
- **Designed to meet or exceed the requirements of MIL-DTL-38999 Series III connectors**
- **Advanced Fiber Optic insert available for both plug and receptacle connectors**
- **Available in aluminum, stainless steel and composite shell materials**



HOW TO ORDER CONNECTORS WITH PIN INSERTS
 Example part number CF-634617-08P is shown as follows:

CF - 6 3 4 6 17 - 08 P

Connector Type _____
 Connector Class _____
 Terminus Style _____
 Shell Finish _____
 Shell Style _____
 Shell Size _____
 Insert Arrangement _____
 Contact Type and Key/Keyway Position _____

HOW TO ORDER CONNECTORS WITH BONDED FRONT INSERTS AND CAPTIVATED ALIGNMENT SLEEVES
 Example part number CF-634655-08S is shown as follows:

CF - 6 3 4 6 55 - 08 S

Connector Type _____
 Connector Class _____
 Terminus Style _____
 Shell Finish _____
 Shell Style _____
 Shell Size (Coded Number - see chart below) _____
 Insert Arrangement _____
 Contact Type and Key/Keyway Position _____

Connector Type
 CF designates Advanced Fiber Optic Connector

Connector Class
 5 designates Tri-Start MIL-DTL-38999, Series III, aluminum
 6 designates Tri-Start MIL-DTL-38999, Series III, composite
 8 designates Tri-Start MIL-DTL-38999, Series III, stainless steel

Terminus Style
 3 designates epoxy polished, advanced fiber optic connector termini

Shell Finish
 4 designates electroless nickel
 5 designates unplated composite
 6 designates stainless steel
 9 designates O.D. cadmium

Shell Style
 0 designates wall mount receptacle
 2 designates box mount receptacle
 7 designates jam nut receptacle
 6 designates straight plug

Shell Size
 See insert availability for Tri-Start connectors, pages 4-6.*
 Special coded numbers are to be used in the ordering of connectors with bonded front socket inserts and captivated alignment sleeves. See chart at right for these Shell Size Coded Numbers.

Insert Arrangement
 See insert availability for Tri-Start connectors, pages 4-6.*

Contact Type and Key/Keyway Position
 P designates pin contacts
 S designates socket contacts

For key/keyway positioning, choose the alternate rotation suffix letter from the Alternate Position Suffix chart at right.

**SHELL SIZE CODED NUMBER
 (For Captivated Alignment Sleeve Connectors only)**

Shell Size (Actual)	Shell Size Coded Number
9	51
11	52
13	53
15	54
17	55
19	56
21	57
23	58
25	59

ALTERNATE POSITION SUFFIX

Alternate Position	Suffix Letter	
	Pins	Sockets
Normal	P	S
A	G	H
B	I	J
C	K	L
D	M	N
E	R	T

* Not all shell sizes and insert arrangements are presently available in the advanced fiber optic design; consult Amphenol, Sidney, NY for further information.

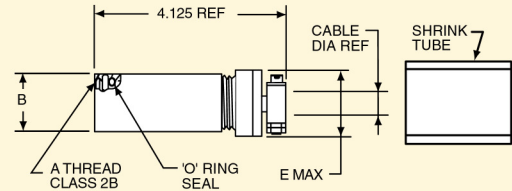
Accessories

strain reliefs for use with multi-mode and single mode fiber optic connectors

Environmental Strain Relief for Jacketed Cable with Strength Member

(Can be used with size 16 or 20, Multi-mode or Single mode Fiber Optic Termini)

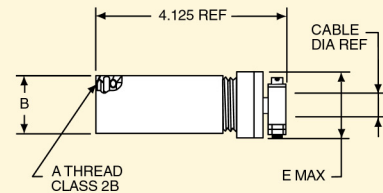
Assembly Part Number*	Cable Dia.		Shell Size	A Thread Class 2B, Metric	B Max. Dia.	E Max. Dia.
	Max.	Min.				
CF-195022-11()	.300	.182	11	M15X1-6H	.781	1.031
CF-195022-13()	.412	.282	13	M18X1-6H	.897	1.062
CF-195022-15()	.412	.282	15	M22X1-6H	1.054	1.062
CF-195022-17()	.500	.282	17	M25X1-6H	1.172	1.312
CF-195022-19()	.500	.282	19	M28X1-6H	1.290	1.312
CF-195022-21()	.500	.282	21	M31X1-6H	1.406	1.312
CF-195022-23()	.500	.282	23	M34X1-6H	1.531	1.312
CF-195022-25()	.500	.282	25	M37X1-6H	1.645	1.312



Non-environmental Strain Relief for Individual Single Fiber Cables

(Can be used with size 16 or 20, Multi-mode or Single mode Fiber Optic Termini)

Assembly Part Number*	Cable Dia.		Max. No. of Cables	Shell Size	A Thread Class 2B, Metric	B Max. Dia.	E Max. Dia.
	Max.	Min.					
CF-195025-11()	.125	.060	2	11	M15X1-6H	.781	1.031
CF-195025-13()	.125	.060	4	13	M18X1-6H	.897	1.062
CF-195025-15()	.125	.060	5	15	M22X1-6H	1.054	1.062
CF-195025-17()	.125	.060	8	17	M25X1-6H	1.172	1.312
CF-195025-19()	To be determined. Consult Amphenol, Sidney, NY.			19	M28X1-6H	1.290	1.312
CF-195025-21()				21	M31X1-6H	1.406	1.312
CF-195025-23()				23	M34X1-6H	1.531	1.312
CF-195025-25()				25	M37X1-6H	1.645	1.312



* To complete part number add finish suffix:
 -XX9 designates olive drab cadmium plate nickel plate;
 -XXG designates electroless nickel.
 For availability consult Amphenol, Sidney, NY.

Multi-mode termini, size 16

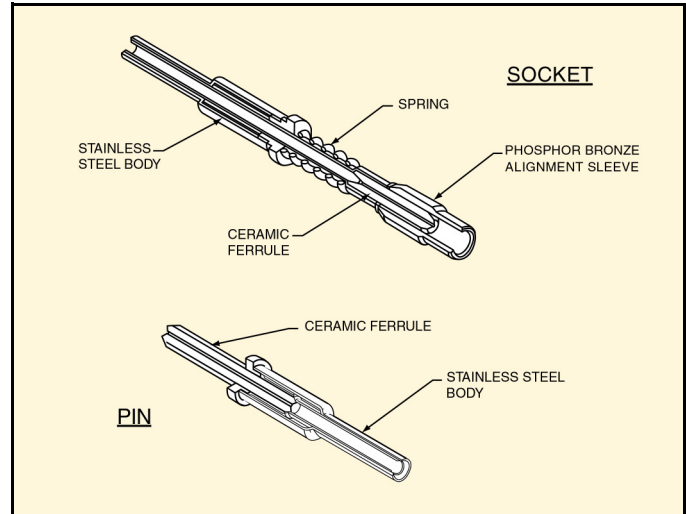
for multi-channel cylindrical fiber optic connectors

features, how to order

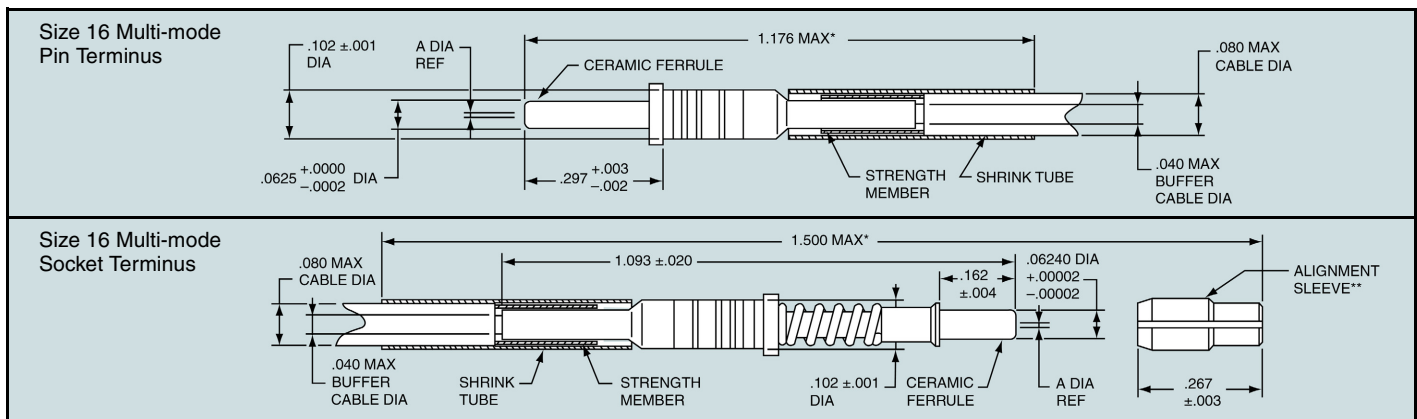
Amphenol® Multi-mode, Size 16 Termini

Features and Performance Levels:

- Ceramic alignment ferrule which precisely positions the fiber within the termini
- Phosphor bronze alignment sleeve, assembled on the socket after polishing insures accurate fiber to fiber alignment (a ceramic alignment sleeve is also available).
- Typical insertion loss for 100/140 fiber with .2 NA at 820 nm is .5 to .7 dB using Air Gap (AG) polish technique
Use of the ceramic ferrule and sleeve maximizes the ability to hold extremely tight dimensional tolerances while maintaining accurate concentricity, thus providing superior and consistent optical loss performance.
- Termination accomplished using the industry proven epoxy/polish method. Can be polished Air Gap (AG) or Physical contact (PC).
- Socket cleaning optional. Consult Amphenol, Sidney, NY for termini cleaning tool. See application tools, page 16.



Multi-mode Size 16 Fiber Optic Termini



* Indicated dimension when fully assembled.
** Alignment sleeve shipped unassembled.

Amphenol® Multi-Channel fiber optic connectors are supplied less contacts. Order multi-mode termini by Amphenol part number designation or MIL-T-29504 designation as shown in the charts below. Consult Amphenol, Sidney, NY for further availability.

Ordering Information

Multi-mode Termini (Size 16) for MIL-C-38999 Connectors

Fiber Size† Core/Cladding Dia (Microns)	Size 16 Socket	Size 16 Pin	A Dia Ref	
			Inches	Microns
50/125	CF-198035-010	CF-198036-010	.0050	127
62.5/125				
100/140	CF-198035-017	CF-198036-017	.0057	145
100/140/172	CF-198035-029	CF-198036-029	.0069	175
100/140/172	CF-198035-29A	CF-198036-29A	.0068	173.5
200/230	CF-198035-053	CF-198036-053	.0093	236
200/240	CF-198035-057	CF-198036-057	.0097	245
200/280	CF-198035-074	CF-198036-074	.0114	290
200/300	CF-198035-080	CF-198036-080	.0120	305

MIL-T-Qualified Ordering Information

M29504 Part Number		Reference Amphenol Part Number	
Socket	Pin	Socket	Pin
M29504/5-4046	M29504/4-4040	CF-198035-10	CF-198036-10
M29504/5-4050		CF-198035-17	
M29504/5-4088	M29504/4-4044	CF-198035-17	CF-198036-17
	M29504/4-4087	CF-198035-29A	CF-198-036-29A

† Additional sizes available upon request: consult Amphenol, Sidney, NY for availability.
Power contacts can be purchased separately, contact Amphenol, Sidney, NY.

Multi-mode termini, size 20

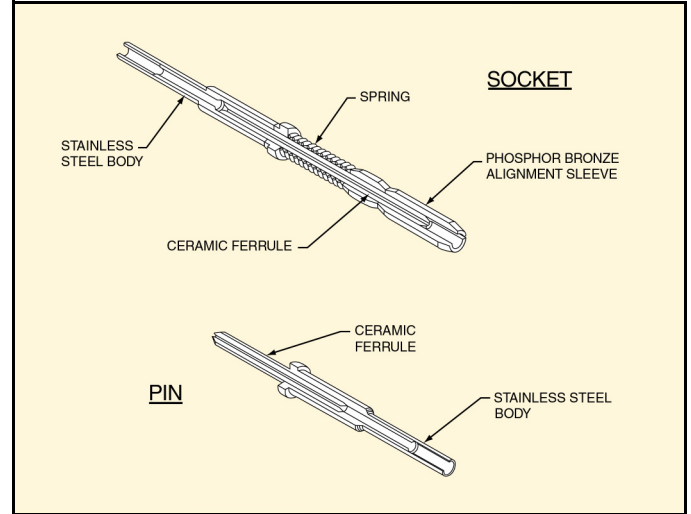
for multi-channel cylindrical fiber optic connectors

features, how to order

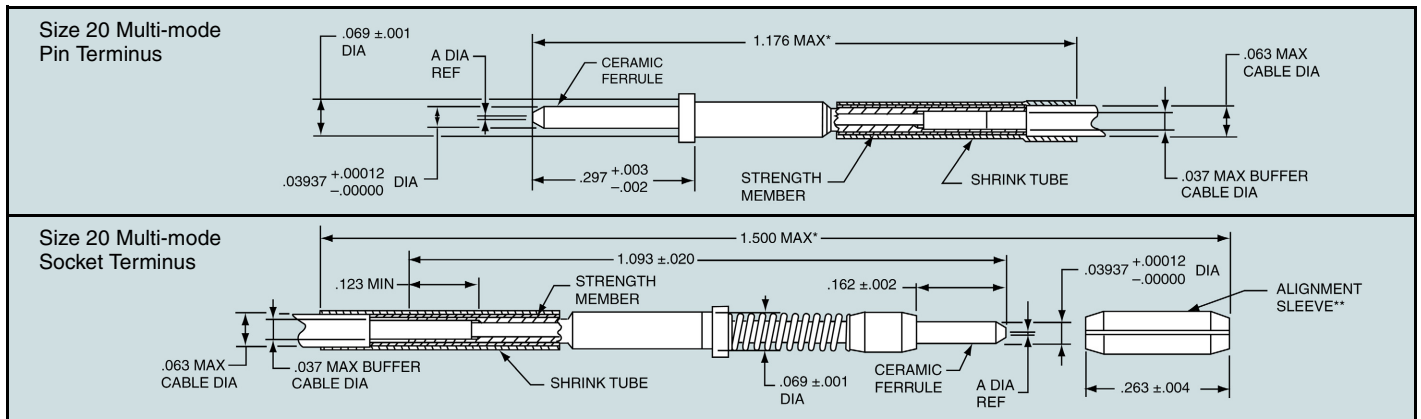
Amphenol® Multi-mode, Size 20 Termini

Features and Performance Levels:

- Designed for use in size 20 cavities of MIL-DTL-38999 Series III connectors
- Designed with similar high performance components as the proven size 16 termini
- Comparable performance and reliability to the size 16 termini can be expected
- Offers increased termini density in Amphenol MIL-DTL-38999 connectors
- Maintains fiber optic/electrical hybrid capabilities
- Allows for multiple fiber accommodations
- Termination accomplished using the industry proven epoxy/polish method. Can be polished Air Gap (AG) or Physical contact (PC).
- Socket cleaning optional. Consult Amphenol, Sidney, NY for termini cleaning tool. See application tools, page 16.



Multi-mode Size 20 Fiber Optic Termini



Amphenol® Multi-Channel fiber optic connectors are supplied less contacts. Order multi-mode termini by Amphenol part number designation as shown in the chart below. Consult Amphenol, Sidney, NY for further availability.

* Indicated dimension when fully assembled.
** Alignment sleeve shipped unassembled.

Ordering Information

Multi-mode Termini (Size 20) for MIL-C-38999 Connectors

Fiber Size† Core/Cladding Dia (Microns)	Size 20 Socket	Size 20 Pin	A Dia Ref	
			Inches	Microns
50/125	CF-198080-010	CF-198081-010	0.0050	127
62.5/125				
100/140	CF-198080-017	CF-198081-017	0.0057	145

† Additional sizes available upon request: consult Sidney, NY for availability.
Power contacts can be purchased separately, contact Sidney, NY.

Single mode termini, size 16

for multi-channel cylindrical fiber optic connectors features, how to order

Amphenol® Single mode, Size 16 Termini Features and Performance Levels:

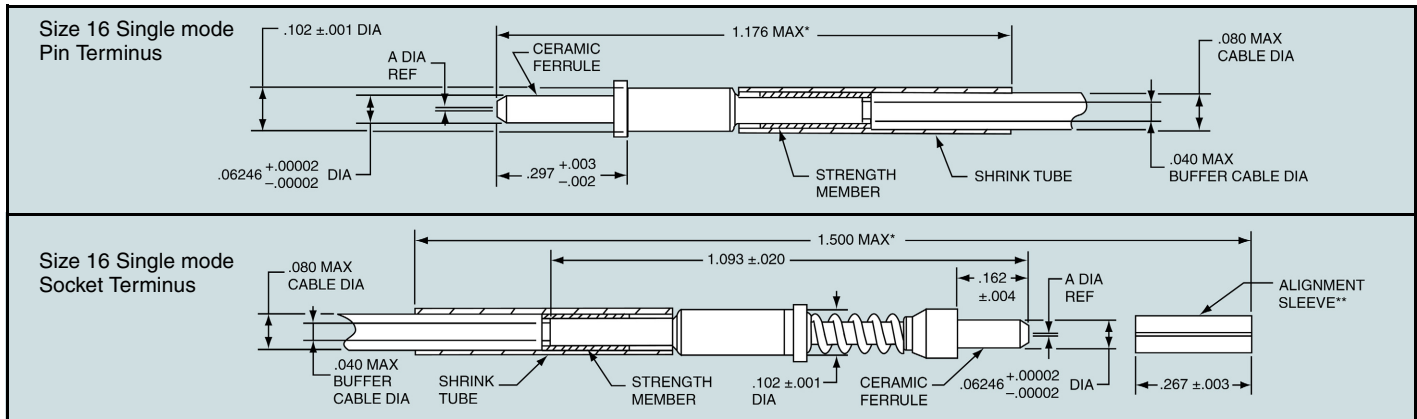
- Designed for use in size 16 cavities of Amphenol MIL-DTL-38999 Series III connectors
- Designed with similar high performance components as the size 16 multi-mode termini
- Comparable performance and reliability to the size 16 multi-mode termini can be expected
- Maintains fiber optic/electrical hybrid capabilities
- Allows for multiple fiber accommodations
- Termination accomplished using the industry proven epoxy/polish method providing Physical contact (PC) for low return loss
- For recommended cleaning and application tools, consult Amphenol, Sidney, NY

Amphenol® Multi-Channel fiber optic connectors are supplied less contacts. Order single mode size 16 termini by Amphenol part number designation as shown in the chart below. Consult Amphenol, Sidney, NY for further availability.

Ordering Information Single mode Termini (Size 16) for MIL-DTL-38999 Connectors

Fiber Size† Cladding Dia (Microns)	Size 16 Socket	Size 16 Pin	A Dia Ref	
			Inches	Microns
124	CF-198095-007	CF-198096-007	0.00488	124
125	CF-198095-008	CF-198096-008	0.00492	125
126	CF-198095-009	CF-198096-009	0.00496	126

† Additional sizes available upon request: consult Sidney, NY for availability.
Power contacts can be purchased separately, contact Sidney, NY.



* Indicated dimension when fully assembled.
** Alignment sleeve shipped unassembled.

90° multi-mode socket termini, size 16

for multi-channel connectors - features, how to order

Amphenol provides 90°, size 16 fiber optic termini that can be used with multi-channel cylindrical connectors. Consult Amphenol for the 90°, size 16 termini for use in LRM rectangular connectors.

90° Socket Termini (Size 16)

Ordering Information for 90° Multi-mode Socket Termini

Fiber Size† Core/Cladding Dia (Microns)	Socket, Size 16 Amphenol Part Number For use in Cylindrical Connectors	A Dia Ref	
		Inches	Microns
50/125	CF-198111-010	.0050	127
62.5/125			
100/140	CF-198111-017	.0057	145
100/140/172	CF-198111-29	OR	.0069
	CF-198111-29A		.0068

† Additional sizes available upon request: consult Amphenol, Sidney, NY for availability.
* Consult Amphenol, Sidney, NY for ordering information.
** Indicated dimension when fully assembled.
*** Shrink tubing and alignment sleeve are shipped unassembled.
For 90°, size 16 fiber optic termini for use in LRM rectangular connectors consult Amphenol, Sidney NY.

90° Pin Termini (Size 16)

Ordering Information for 90° Multi-mode Pin Termini

Fiber Size† Core/Cladding Dia (Microns)	Pin, Size 16 Amphenol Part Number For use in Cylindrical Connectors	A Dia Ref		B Max (Inches)	C Ref (Inches)
		Inches	Microns		
50/125	CF-198110-010	.0050	127	1.121	1.100
62.5/125					
100/140	CF-198110-017	.0057	145	1.121	1.100
100/140/172	CF-198110-029	OR	.0069	1.121	1.100
	CF-198110-29A		.0068		
50/125	CF-198112-010	.0050	127	1.003	.900
62.5/125					
100/140	CF-198112-017	.0057	145	1.003	.900
100/140/172	CF-198112-029	OR	.0069	1.003	.900
	CF-198112-29A		.0068		

† Additional sizes available upon request: consult Amphenol, Sidney, NY for availability.
* Consult Amphenol, Sidney, NY for ordering information.
For 90°, size 16 fiber optic termini for use in LRM rectangular connectors consult Amphenol, Sidney NY.

LRM Surface Mount Connectors

with MIL-C-55302 type Bristle® Brush® contacts and fiber optic termini for integrated avionics packaging

The introduction of high speed integrated circuitry such as VHSIC and MMIC has enabled the Design Engineer to accomplish far more on his printed circuit board than ever before. This, coupled with the emergence of a revolutionary change in avionics packaging - modular avionic architectures - has created the need for a high performance, low insertion force PCB connector with significantly increased contact density.

Designed to meet the high density needs of today's integrated electronic modules, this Straddle Mount connector uses the Amphenol® Bristle Brush Contact which has been proven in military avionics packages and meets the requirements of MIL-C-55302. The low mating force, extended service life and stable electrical performance of the B³* contact allows this product to provide the high level of performance demanded by today's Line Replaceable Module (LRM) applications.

Amphenol® LRM Surface Connector Features:

Available in Chevron and Staggered Grid Patterns, in SEM "E" and Proprietary Formats.

- **Contact to Board Attachment:**
 - **Module:** Surface mount - Straddle mount with .025 spacing between leads, with rows of leads on each side of the module
 - **Backplane:** Available with through-hole solder posts or with compliant pins for solderless applications
- **Connector Configurations:**
 - **Chevron Grid:** Six contact rows with .075 inch center-to-center contact spacing in each row, .075 inch row-to-row spacing with .025 inch offset. Available with Amphenol straight and 90° fiber optic termini - see pages 15 -17.
 - **Staggered Grid:** Eight contact rows with .100 inch center-to-center contact spacing in each row, .050 inch row-to-row spacing with .050 inch offset. For information on fiber optics for use in staggered grid LRMs, please contact Amphenol, Sidney, NY.
- **Polarization:**
 - Insert arrangement controls mating orientation
 - Up to 4096 keying combinations
- **PCB/Heat Sink Accommodations:**
 - A wide range of combinations available
- **Serviceability:**
 - Backplane contacts are front replaceable
- **Low Mating and Unmating Forces**
 - 1.5 oz. per contact (typical)
 - 70% to 90% lower than with conventional pin and socket contacts
- **Temperature Range:**
 - Suitable for vapor phase soldering
 - Normal operating temperature -65°C to +125°C
- **Current Rating:** Consult Amphenol, Sidney, N.Y.
- **Dielectric Withstanding Voltage:**
 - Chevron Grid = 1000 volts at sea level
 - Staggered Grid = 100 volts at sea level (due to incorporation of ESD shield)

- **Vibration:** Superior performance under vibration
- **Brush Contact Durability:**
 - 20,000 cycles of mating and unmating
- **Superior Electrical Characteristics:**
 - Redundant current paths
 - Minimized constrictive resistance
 - Uniform current densities
 - Stable time/life contact resistance
 - Gas tight and electrical contact site integrity
- **ESD Protection:**

The Staggered Style connectors are standard with ESD** protection. These connectors utilize the Faraday Cage principal to shunt electrostatic discharge events to the conductive enclosure on which the connector is mounted, thus never allowing the high voltage, high current discharge event to reside on any contacts. The ESD protected connectors have the same physical envelope as their standard counterparts, and do not require special mounting or terminating techniques. All of the contacts remain fully functional, and electrical characteristics such as capacitance are not effected. See Amphenol Product Data Sheet No. 177, for more information on ESD protection.

- **A Broad Family of LRM Products:**

LRM Surface Mount Connectors are offered in configurations with up to 540 electrical contacts. Other products available in the family are:

- RF module connectors for LRM applications requiring blind mate, radio frequency capability
- High-voltage inserts for LRM power supply applications, designed to control the effects of high voltage at altitude
- Fiber optic configurations for high speed secure communications

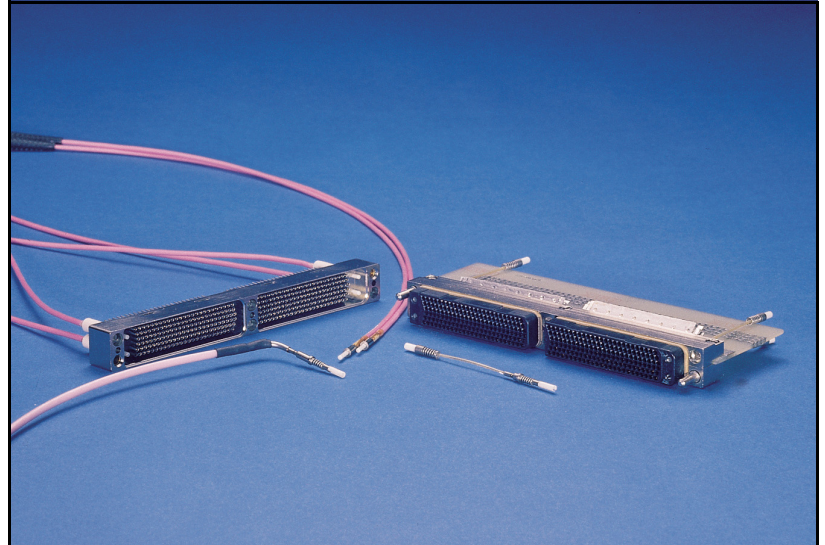
Consult Amphenol, Sidney, NY for further information on these products and any special design applications. Ask for publication L-2081.

Multi-mode straight termini, size 16 for LRM connectors

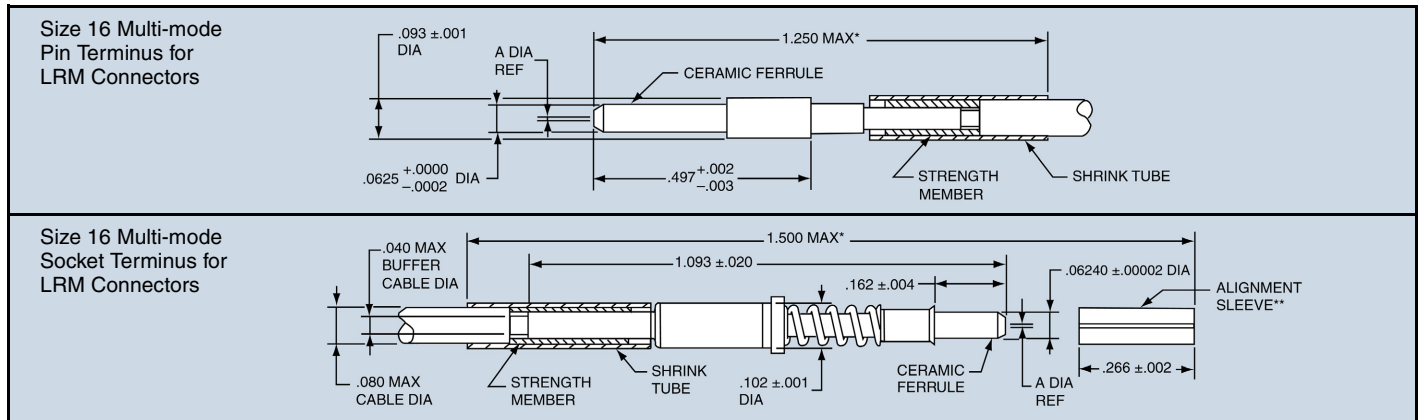
features, how to order

Fiber Optic Termini for Line Replaceable Module (LRM) Connectors

Termini for rectangular LRM connectors are determined by insert and shell style of the connector. For ordering information on straight and 90° termini for LRM connectors consult Amphenol, Sidney, NY.



**LRM Connectors with Fiber Optics
(Chevron Grid Pattern)**



Fiber Size† Core/Cladding Dia (Microns)	A Dia Ref	
	Inches	Microns
50/125	.0050	127
62.5/125	.0050	127
200/230	.0093	236
200/240	.0097	245

Typical LRM fiber optic straight termini are depicted above. However, these illustrations do not represent all configurations. The fiber optic termini for LRM connectors may vary per connector shell style and insert. Consult Amphenol, Sidney, NY for further information.

* Indicated dimension when fully assembled.

** Alignment sleeve shipped unassembled.

† Additional sizes available upon request: consult Amphenol, Sidney, NY for availability. Power contacts can be purchased separately, contact Amphenol, Sidney, NY.

Application tools for multi-mode termini[♦] for use in multi-channel cylindrical connectors

The following data includes information pertaining to the application tools which have been established for polishing, inserting and removing multi-mode fiber optic termini within multi-channel connectors. Insertion and removal tools are common to MIL-DTL-38999 size 16 and size 20 tools. Installation instructions L-1262 for multi-mode size 16 and L-2103 for multi-mode size 20 provide proper installation and polishing procedures for these termini. For additional information contact Amphenol, Sidney, NY.

Termination kits, as shown at right, are available for each Amphenol connector family. The kit includes the carrying case, heat gun, crimping and stripping tools and microscope with adapters. Curing ovens for each connector family are also available.



Termination Kit

Application Tools for Multi-Channel, Multi-mode Fiber Optic Termini

Contact Size/ Type	Termini Part Number	Hand Polishing Tools*	Machine Polishing Tools		Termination Kit (Includes necessary field termination equipment)
			Amphenol/Buehler Fibrmet*** Polishing Tool Part Number	Amphenol/Buehler Fibrscope*** Adaptor Body Part Number	
16 Multi-mode	CF-198035-()** Socket CF-198036-()** Pin	11-12123 or 11-12195 (grooved for wet polishing)	11-12103	11-12104	CF-8500-1†
20 Multi-mode	CF-198080-()** Socket CF-198081-()** Pin	11-12153	N/A	N/A	CF-8500-3††

Contact Size/ Type	Insertion Tools					
	Plastic Tools (Double ended insertion/removal tool)		Metal Tools			
	MS Part Number	Color	Angle Type		Straight Type Proprietary Part Number	Color
			MS Part Number	Proprietary Part Number		
16 Multi-mode	M81969/14-03	Blue/White	M81969/8-07	11-8674-16 11-012197-16†††	11-8794-16 11-012198-16†††	Blue
20 Multi-mode	M81969/14-10	Red/Orange	M81969/8-05	11-8674-20	11-8794-16	Red

Contact Size/ Type	Removal Tools						
	Plastic Tools (Double ended insertion/removal tool)		Metal Tools				
	MS Part Number	Color	For Unwired Contacts Proprietary Part Number	Angle Type		Straight Type Proprietary Part Number	Color
				MS Part Number	Proprietary Part Number		
16 Multi-mode	M81969/14-03	Blue/White	11-10050-10	M81969/8-08	11-8675-16	11-8795-16	White
20 Multi-mode	M81969/14-10	Red/Orange	11-10050-9	M81969/8-06	11-8675-20	11-8795-20	White

♦ FOR APPLICATION TOOLS FOR SINGLE MODE TERMINI, CONSULT AMPHENOL, SIDNEY, NY.

The M81969/8, 11-8675 and 11-8794 metal contact insertion and removal tools will accommodate wires having the maximum outside diameter of .105 for size 16 and .084 for size 20. When wire diameters exceed this, the plastic tools must be used.

* Single Termini Capability

** To complete order number add fiber size; see ordering information on page 9 for size 16 multi-mode, and page 10 for size 20 multi-mode.

*** Fibrmet and Fibrscope are registered trademarks of Buehler Ltd.

† This includes hand polishing tool 11-12123.

†† This includes hand polishing tool 11-12153.

††† Recommended tool for socket termination insertion.

Additional Fiber Optic Products

MFM family of connectors

The Amphenol MFM family of connectors was specifically designed for use in the aerospace & military and in other harsh environmental condition applications. Design features of the MFM connector series are given below. Consult Amphenol, Sidney, NY for further information.

Shown in Photo:

Top: Hermaphroditic MFM Connector

Center: Duplex MFM Connector

Bottom: Simplex MFM Connector



HERMAPHRODITIC MFM CONNECTORS

- Duplex MFM connection system, designed to facilitate the interconnection of fiber optic cable assemblies
- Eliminates the need for polarizing the assemblies
- Eliminates the use of in-line adapters
- Fully hermaphroditic product
- Active receptacle
- Low insertion loss due to butt joint ceramic ferrule technology with a ceramic alignment sleeve
- Simple termination of sub-assembly due to one-piece construction
- Durability >1500 matings
- Shell machined from non-corrosive nickel aluminium bronze
- Both shells and ferrules are keyed for optimum repeatability

DUPLEX MFM CONNECTORS

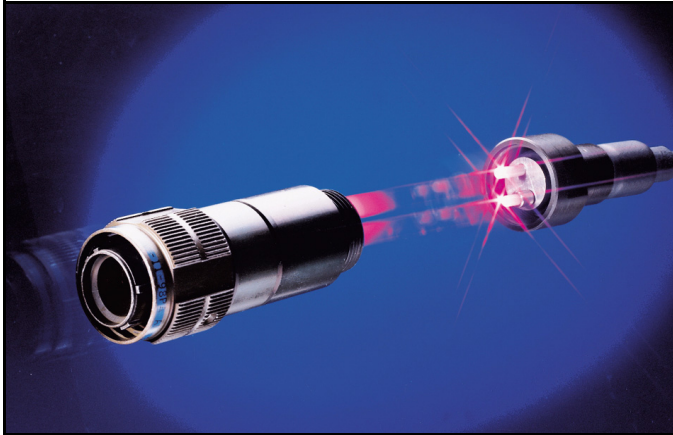
- High performance, lightweight MFM connectors developed specifically for external applications
- Low insertion loss due to butt joint ceramic ferrule technology with a ceramic alignment sleeve
- Keyway polarization
- Simple termination of sub-assembly due to one-piece construction
- Both shells and ferrules are keyed for optimum repeatability
- Environmental silicon O-ring sealing

SIMPLEX MFM CONNECTORS

- Small, lightweight MFM connectors capable of withstanding the most stringent environments
- Interface with a wide range of rugged fiber optic cables
- Low insertion loss due to butt joint ceramic ferrule technology with a ceramic alignment sleeve
- Keyway polarization
- Both shells and ferrules are keyed for optimum repeatability
- Environmental silicon O-ring sealing
- Anti-vibration coupling mechanism
- RFI receptacle gasket

Additional Fiber Optic Products

fiber optic active plug, CTOS field deployable lens connector, multi-way backplane connector



FIBER OPTIC ACTIVE PLUG

Amphenol offers an electrical connector (MIL-C-38999, Series III) which accepts DC inputs, converts to optical and couples to an optical connector/cable interface. A fiber optic plug is attached to the accessory section of the electrical connector. The user sees an electrical interface, not an optical interface. One interface transmits; a second receives. Duplex single mode operation using WDM is available. Consult Amphenol, Sidney, NY for further information.



CTOS FIELD DEPLOYABLE LENS CONNECTOR

The Amphenol Optical Tactical Connectors have been developed for battlefield conditions and quick deployable large capacity links. Incorporating expanded beam technology, the connector interface can easily be cleaned and will perform in harsh environmental conditions with insertion losses below 2dB and also will provide EMI insensitivity.

The entire connector family is equipped with the same hermaphroditic interface in order to extend the optical links by adding identical cable sections. The CTOS connector, measuring 38mm in diameter, is available in 2 and 4 channel configurations and will accommodate both single mode (9/125) and multi-mode (50/125 to 200/240) fiber.

The bodies of the connectors are made of stainless steel for longevity and resistance to corrosion. Ergonomic and ribbed synthetic rubber shells improve handling and ensure mechanical protection.



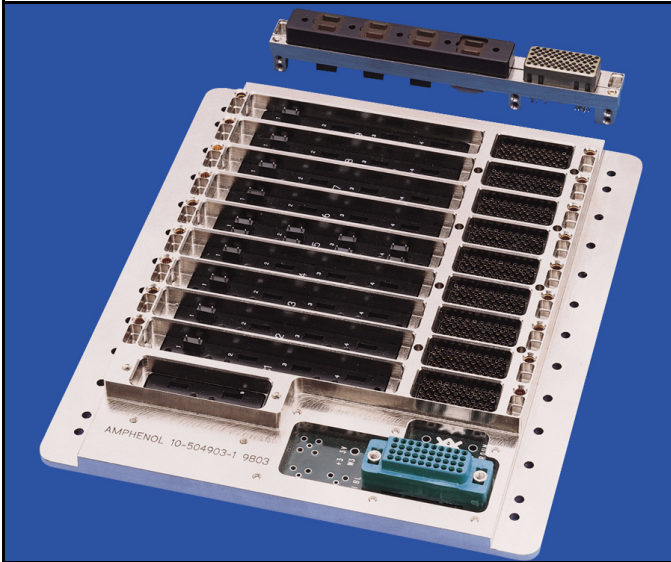
MULTI-WAY BACKPLANE CONNECTOR

The Multi-way Backplane Connector (MBP) utilizes proven PC technology in a high density fiber optic connector. The connector design is motherboard, daughterboard and chassis mountable and is available in a 4 channel or an 8 channel variation. For positive alignment and improved performance, the MBP series connector features a keyed ferrule assembly and free floating optical termini. The robust one-piece construction enhances the connector's reliability and, at the same time, reduces the costs of assembling the connector.

In conjunction with the MBP series of connectors, Amphenol also offers the necessary termination tooling for customer assembly. Consult Amphenol, Sidney, NY for further information.

Additional Fiber Optic Products

optical backplane system, MT cylindrical series, hybrids - fiber optic and Brush contacts



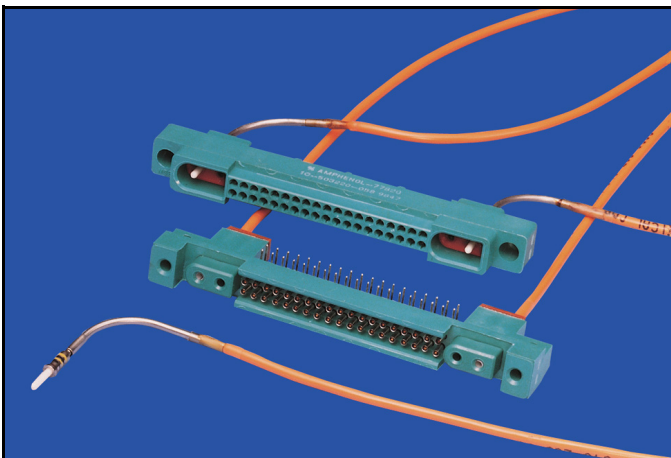
OPTICAL BACKPLANE INTERCONNECT SYSTEMS

Amphenol offers electro-optical backplane interconnect systems for advanced avionics systems high speed optical/digital signal processing. Available in SEM-E or custom form factors, these systems integrate the total electrical and optical rack interconnect needs into one discrete package. Amphenol's ruggedized LRM connectors provide the interconnect housings, and the fiber terminations are 12 channel MT optical ferrules. Ribbon cable routing allows programming flexibility; thus rendering the entire system easily upgradeable.



CYLINDRICAL MT SERIES

The Amphenol D38999 connector can be supplied with MT optical ferrules. This offers a high fiber density in a relatively small cylindrical connector package, with all the advantages of the Series III, MIL-DTL-38999 proven connector. High performance in tough environments and high speed signal processing can be accomplished in this connector series.



HYBRID CONFIGURATIONS - FIBER OPTICS & BRUSH CONTACTS IN THE SAME CONNECTOR

Amphenol's superiority and breadth of product offering is demonstrated in its capability for packaging both fiber termini and the popular Brush contact in a printed circuit board rectangular connector. High performance polyester dielectric moldings are the rectangular housings for these connectors, and high circuit count interconnections are possible with two, three and four row patterns. See the low mating force advantages of bristle brush contacts, shown in the LRM page descriptions of this catalog.

Notes
