Fiber Optic Cable Assemblies Workbook

Winchester Interconnect

Delphi™ branded fiber optic products are now under the Winchester Interconnect brand.

Winchester Interconnect

Fiber Optic Cable Assemblies Made Easy

We're making it easier than ever to put together a fiber optic cable assembly that meets your needs perfectly. We've pulled everything you need in one convenient place: connectors, termini, backshells, cables, flexible conduit, expandable sleeving, spiral wrap and heat shrink. Components that meet all applicable standards. Quality and service you can count on.

Whether you know exactly what you need, or need a little help, this easy-to-follow workbook will guide you through the process, one step at a time.

1 Vanderbilt, Irvine, CA 92618 | Tel: [949] 458-3100 Fax: [949] 458-3142 | email: FiberOptics@winconn.com

Winchester Interconnect

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Using this Workbook

Step 1 – Complete the "Project and Contact Information Sheet/Fax Cover Sheet" (page 6).

Step 2 – Refer to the Fiber Optic Environment Matrix (below) and select a connector based on the environment your assembly will be used in.

Step 3 – Review the "Cable Assembly Detail Sheets" (pages 7-9) and choose the configuration that best suits your application. Copy or tear out this page and refer to it through the remaining steps.

Step 4 – Complete the following in any order:

- Specify connectors A and B, termini, and dust covers using the "Connector Configuration" sheets and "Termini/Dust Cover" sheets for your selected connector series (pages 10-22).
- Select a cable from the tables provided (pages 24-26) and write the DCS part number on your "Cable Assembly Detail Sheet."
- Select any appropriate cable protection from the "Jacket Protection Requirements" page and note it on page 27. Be sure to include this page with your submission.
- Select a reel from the "Reel Options" sheet (page 30).
- Complete the length, label, connection diagram, and notes sections of the "Cable Assembly Detail Sheet."

Step 5 – Fax or e-mail the "Cover Sheet," "Cable Assembly Detail Sheet" and any other marked sheets to Delphi at the address listed at the bottom of this page.

Fiber Optic Environment Matrix

Environment	Recommended Connector				
	M28876	4, 6, 12 CH Hermaphroditic	DFOCA/ FOCUS	D38999	NGCon
Shipboard	X			X	X
Submarine	X			X	X
Ship-to-Shore	X	X			
Oil Exploration/Geophysical		X			
Mining		X			
Broadcast		X	X		
Ground Tactical			X		
Avionics/Airframe				X	X

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Winchester Interconnect™

Delphi™ Fiber Optic Cable Assemblies

Cable Assembly Detail

Connectors

Cables

Jacket Protection

Reels

Product Profiles

DELPHI

Project and Contact Information Sheet/Fax Cover Sheet

Attn: Delphi Connection Systems
FAX to: 949-458-3142
Or scan and email to: DCSfiber@delphi.com

Number of pages including cover page

Contact Information:

Date: _____

Contact Name: _____ Title: _____

Contact Phone #: _____ Email: _____

Contact Fax #: _____ Address: _____

Company Name: _____

Customer Supplied Drawing: (circle one) YES NO

First Article: _____

Quantity: _____

Need By: _____

Notes/Comments or Additional Information:

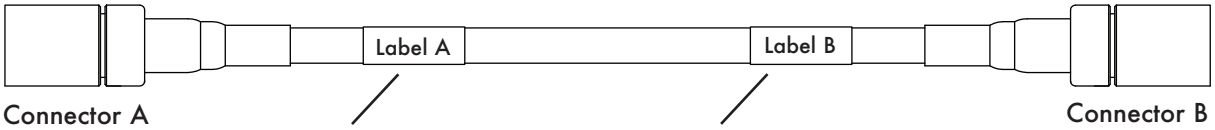
DELPHI

Cable Assembly Detail Sheet

Multi-channel Connector to Multi-channel Connector (Jacketed)

Cable PN# _____

Assembly Length _____



Label A

DELPHI 53669
(Identification number)
YYWW

Label B (if applicable)

(Any additional customer specified marking)

Connection Diagram:

Connector A Pin/ Socket	Connector B Pin/ Socket
P1/J1	
P2/J2	
P3/J3	
P4/J4	
P5/J5	
P6/J6	
P7/J7	
P8/J8	
P9/J9	
P10/J10	
P11/J11	
P12/J12	
P13/J13	
P14/J14	
P15/J15	
P16/J16	
P17/J17	
P18/J18	

Connection Diagram:

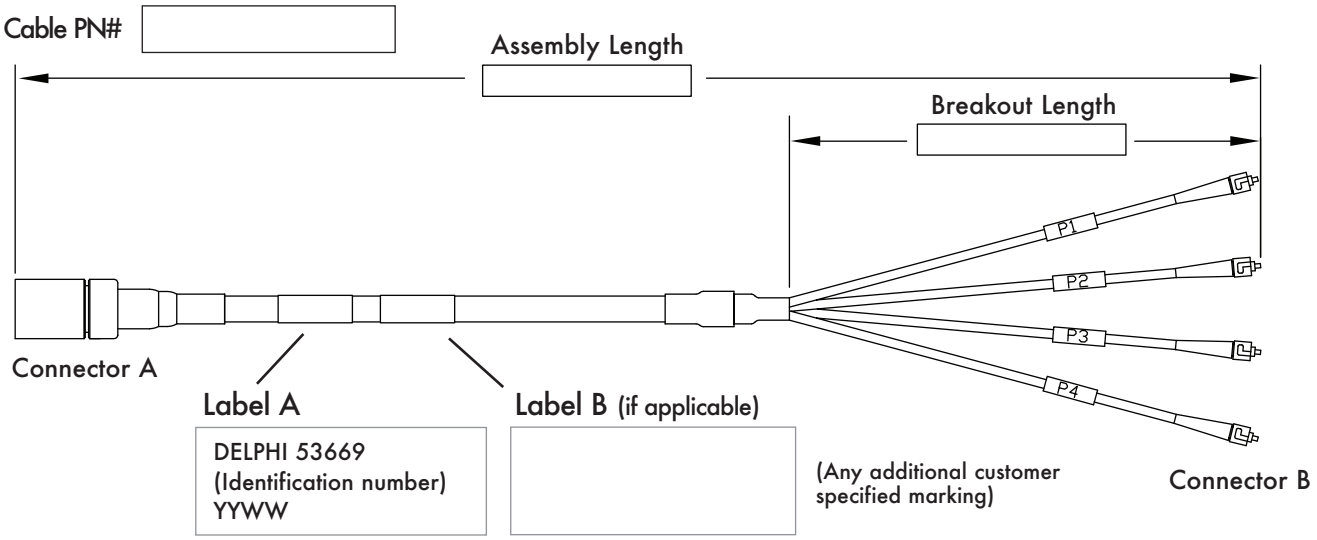
Connector A Pin/ Socket	Connector B Pin/ Socket
P19/J19	
P20/J20	
P21/J21	
P22/J22	
P23/J23	
P24/J24	
P25/J25	
P26/J26	
P27/J27	
P28/J28	
P29/J29	
P30/J30	
P31/J31	
P32/J32	
P33/J33	
P34/J34	
P35/J35	
P36/J36	

Notes and Additional Instruction:

DELPHI

Cable Assembly Detail Sheet

Multi-channel Connector to Standard Connector (Jacketed)



Connection Diagram:

Connector A Pin/ Socket	Connector B Pin/ Socket
P1/J1	
P2/J2	
P3/J3	
P4/J4	
P5/J5	
P6/J6	
P7/J7	
P8/J8	
P9/J9	
P10/J10	
P11/J11	
P12/J12	
P13/J13	
P14/J14	
P15/J15	
P16/J16	
P17/J17	
P18/J18	

Connection Diagram:

Connector A Pin/ Socket	Connector B Pin/ Socket
P19/J19	
P20/J20	
P21/J21	
P22/J22	
P23/J23	
P24/J24	
P25/J25	
P26/J26	
P27/J27	
P28/J28	
P29/J29	
P30/J30	
P31/J31	
P32/J32	
P33/J33	
P34/J34	
P35/J35	
P36/J36	

Notes and Additional Instruction:

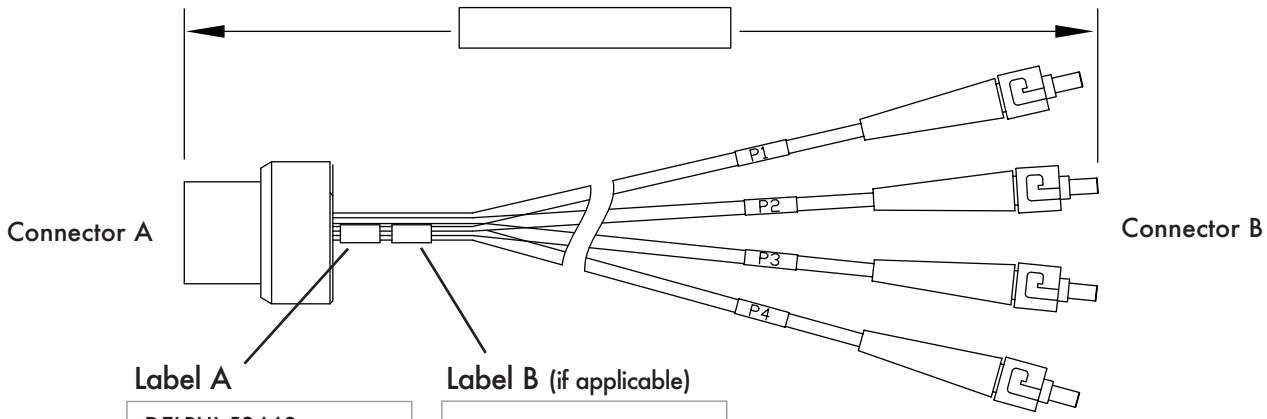
DELPHI

Cable Assembly Detail Sheet

Multi-channel Connector to Standard Connector

Cable PN# _____

Assembly Length _____



Label A

DELPHI 53669
(Identification number)
YYWW

Label B (if applicable)

(Any additional customer specified marking)

Connection Diagram:

Connector A Pin/ Socket	Connector B Pin/ Socket
P1/J1	
P2/J2	
P3/J3	
P4/J4	
P5/J5	
P6/J6	
P7/J7	
P8/J8	
P9/J9	
P10/J10	
P11/J11	
P12/J12	
P13/J13	
P14/J14	
P15/J15	
P16/J16	
P17/J17	
P18/J18	

Connection Diagram:

Connector A Pin/ Socket	Connector B Pin/ Socket
P19/J19	
P20/J20	
P21/J21	
P22/J22	
P23/J23	
P24/J24	
P25/J25	
P26/J26	
P27/J27	
P28/J28	
P29/J29	
P30/J30	
P31/J31	
P32/J32	
P33/J33	
P34/J34	
P35/J35	
P36/J36	

Notes and Additional Instruction:

DELPHI

Name

Connector PN #

Termini PN #

Notes:

M28876 Series

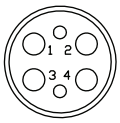
Select by filling in circles. Include with your fax to: (949) 458-3142

Connector (Select one): ◯ A ◯ B ◯ Stand Alone

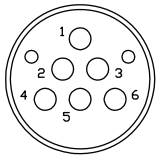
Key Arrangement (Select one): 1 2 3 4 5 6

A. Channel Count Select one

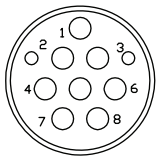
◯ 2 CH-Shell Size 11



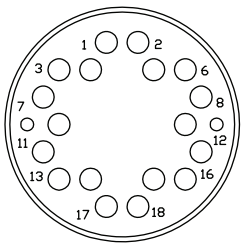
◯ 4 CH-Shell Size 13



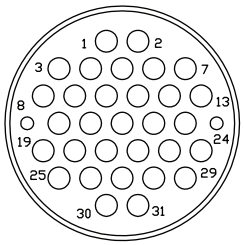
◯ 6 CH-Shell Size 15



◯ 8 CH-Shell Size 15

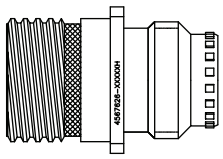


◯ 18 CH-Shell Size 23

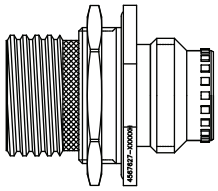


◯ 31 CH-Shell Size 23

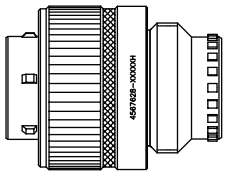
B. Receptacles/ Plugs Select one



◯ M28876 Wall Mount Receptacle



◯ M28876 Jam Nut Receptacle



◯ M28876 Plug

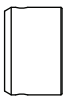
C. Backshells

Select one

◯ Integrated

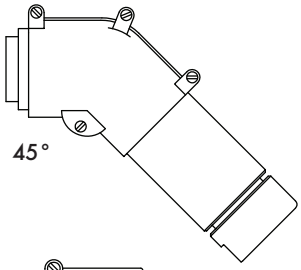
◯ Removable /27, /28, /29

Select one

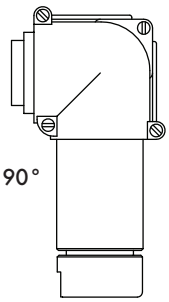


◯ None - If no backshell is required this option will provide the necessary Retention Nut and Pressure Sleeve

◯ Straight

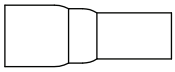


◯ 45°

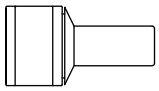


◯ 90°

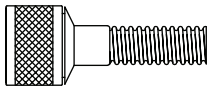
D. Adapters/ Boots Select one



◯ Straight Boot



◯ Flexible Sleeve Adapter



◯ Conduit Adapter

Termini (See following page)

Pin Style Termini for Plug

Socket Style Termini for Receptacle

Notes:

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Name

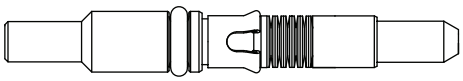
Connector PN #

Termini PN #

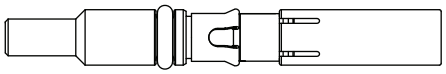
Notes:

M28876 Termini/Dust Covers

Please circle selections.



Pin Termini

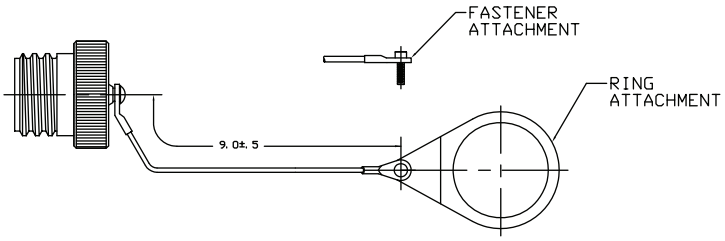


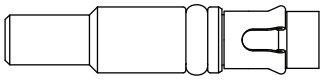
Socket Termini

Shipboard Termini/ MIL-T-29504/14 & /15				
M29504/14 - Pin Terminus (COTS)		M29504/15 - Socket Terminus (COTS)		Maximum Fiber Diameter
Multimode	Singlemode	Multimode	Singlemode	Microns
M29504/14-4130C (4569994-125F000H)	M29504/14-4140C (4569994-125F000H)	M29504/15-4170C (4569995-125F000H)	M29504/15-4180C (4569995-125F000H)	125.0
M29504/14-4131C** (4569994-126F000H)	M29504/14-4141C (4569994-126F000H)	M29504/15-4171C** (4569995-126F000H)	M29504/15-4181C (4569995-126F000H)	126.0
M29504/14-4135C (4569994-142F000H)	NA	M29504/15-4175C (4569995-142F000H)	NA	142.0

***Recommended for shipboard applications*

Dust Covers for Plug

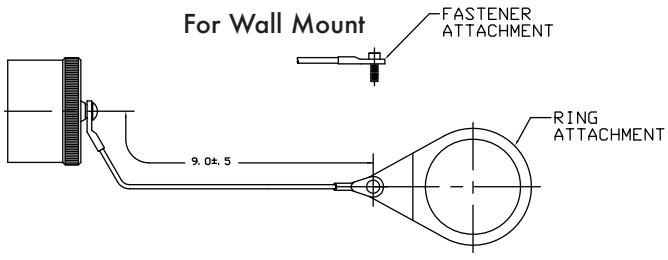




Dummy Termini/ MIL-T-29504/3
M29504/03-4038 (1143274-1S)

Use Dummy Termini to fill any unused cavities

Dust Covers for Receptacle



Select one

Dust Cover Type	MIL-Spec Number	Commercial Equivalent
◯ Plug	M28876/10	4565071S
◯ Receptacle	M28876/15	4565070S

◯ None - Plastic cap is standard when none is selected

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Hermaphroditic Series

Name

Connector PN #

Termini PN #

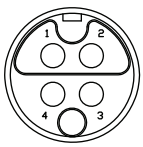
Notes:

Select by filling in circles. Include with your fax to: (949) 458-3142

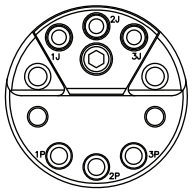
Connector (Select one): ◯ A ◯ B ◯ Stand Alone

Key Arrangement: N/A

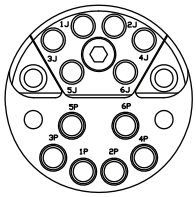
A. Channel Count Select one



◯ 4 CH

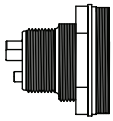


◯ 6 CH

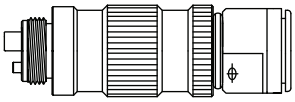


◯ 12 CH

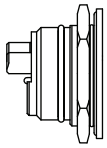
B. Receptacles/ Plugs Select one



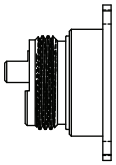
◯ 4 CH Hermaphroditic Jam Nut Receptacle



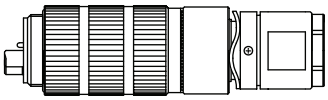
◯ 4 CH Hermaphroditic Plug



◯ 6/12 CH Hermaphroditic Jam Nut Receptacle

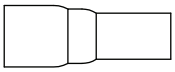


◯ 6/12 CH Hermaphroditic Wall Mount Receptacle

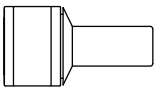


◯ 6/12 CH Hermaphroditic Plug

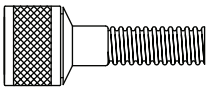
C. Adapters/ Boots Select one



◯ Straight Boot



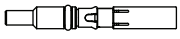
◯ Flexible Sleeve Adapter



◯ Conduit Adapter

Termini (See following page)

Pin Style Termini (50%)



Socket Style Termini (50%)

Notes:

DELPHI

Hermaphroditic Termini/Dust Covers

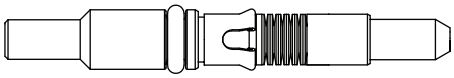
Please circle selections.

Name

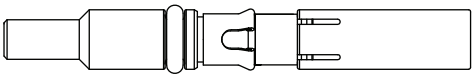
Connector PN #

Termini PN #

Notes:



Pin Termini



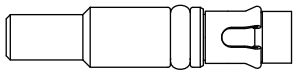
Socket Termini

Hermaphroditic Termini/ COTS MIL-T-29504/14 & /15				
4 Channel Hermaphroditic				
Pin Terminus		Socket Terminus		Maximum Fiber Diameter
Multimode	Singlemode	Multimode	Singlemode	Microns
4569994-126F000H		4569995-126F000H		126.0

6/12 Channel Hermaphroditic				
Pin Terminus		Socket Terminus (Less Alignment Sleeve)		Maximum Fiber Diameter
Multimode	Singlemode	Multimode	Singlemode	Microns
4569994-126F000H		1146719-126F000H		126.0

Select one

Dust Cover Type	Part Number
◯ 4 CH Plug	1020169H
◯ 4 CH Receptacle	1144123H
◯ 6/12 CH Plug	1123789H
◯ 6/12 CH Receptacle	1143808H

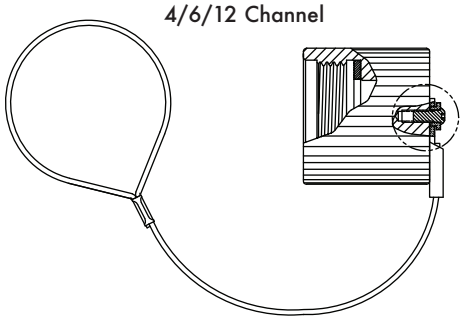


Dummy Termini
1143274-1S

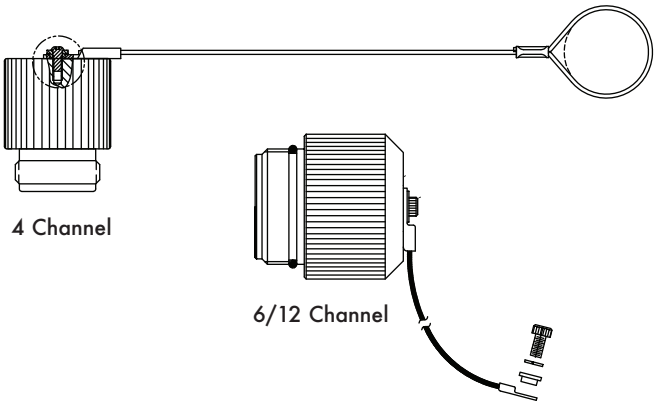
Use Dummy Termini to fill any unused cavities

Dust Covers for Receptacle

4/6/12 Channel



Dust Covers for Plug



4 Channel

6/12 Channel

◯ None - Plastic cap is standard when none is selected

DELPHI

Name

Connector PN #

Termini PN #

Notes:

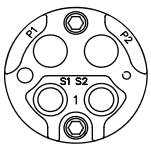
M83526 DFOCA/FOCUS Series (COTS)

Select by filling in circles. Include with your fax to: (949) 458-3142

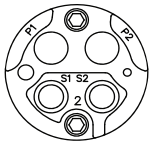
Connector (Select one): ◯ A ◯ B ◯ Stand Alone

Key Arrangement (Select one): 1 2 3 U

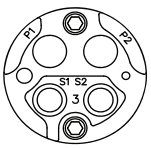
A. Channel Count Select one



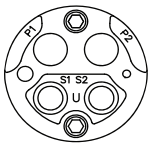
◯ 4 CH - Key 1



◯ 4 CH - Key 2

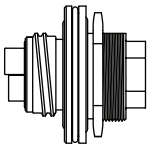


◯ 4 CH - Key 3

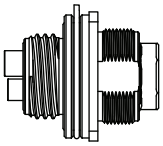


◯ 4 CH - Key U

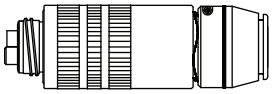
B. Receptacles/Plugs Select one



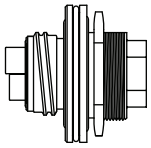
◯ DFOCA Jam Nut Receptacle



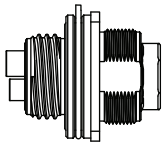
◯ DFOCA Wall Mount Receptacle



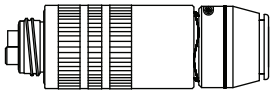
◯ DFOCA Plug



◯ FOCUS Jam Nut Receptacle

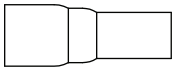


◯ FOCUS Wall Mount Receptacle

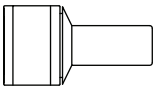


◯ FOCUS Plug

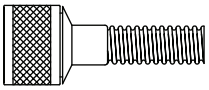
C. Adapters/ Boots Select one



◯ Straight Boot

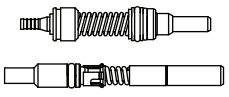


◯ Flexible Sleeve Adapter



◯ Conduit Adapter

Termini (See following page)



Genderless Termini for DFOCA

Genderless Termini for FOCUS

Notes:

DELPHI

DFOCA/FOCUS Termini/Dust Covers

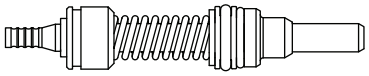
Please circle selections.

Name

Connector PN #

Termini PN #

Notes:



DFOCA Termini/ MIL-T-29504/16 (*Draft)			
	M29504/16 -Genderless Terminus		Maximum Fiber Diameter
	Multimode	Singlemode	Microns
	M29504/16 (*Draft Spec.) (1020970-1260CH)		126.0
Alignment Sleeves	1020964-1H	1020964-2H	

Select one

Dust Cover Type	Part Number
◯ 4 CH DFOCA/FOCUS Plug	1021370H
◯ 4 CH DFOCA/FOCUS Receptacle	1021370H
◯ 4 CH DFOCA/FOCUS Hermaphroditic	1021370H

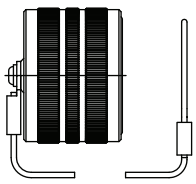
FOCUS Termini	
Genderless Terminus	
Multimode	Singlemode
1021307-1260CH	

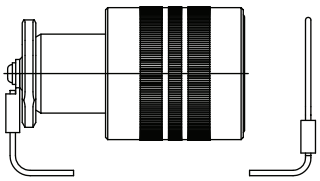
Dust Covers for Receptacle

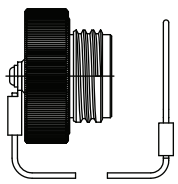
Hermaphroditic Dust Covers

Dust Covers For Plug

DFOCA/ FOCUS







◯ None - Plastic cap is standard when none is selected

DELPHI

Name

Connector PN #

Termini PN #

Notes:

D38999 Series

Select by filling in circles. Include with your fax to: (949) 458-3142

Connector (Select one): ◯ A ◯ B ◯ Stand Alone

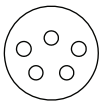
Key Arrangement (Select one): N A B C D E

A. Channel Count

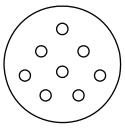
Select one

◯ 2 CH - Shell Size 11

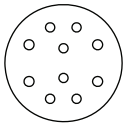
◯ 4 CH - Shell Size 13



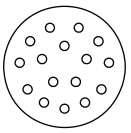
◯ 5 CH - Shell Size 15



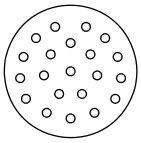
◯ 8 CH - Shell Size 17



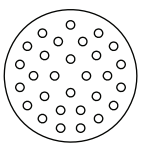
◯ 11 CH - Shell Size 19



◯ 16 CH - Shell Size 21



◯ 21 CH - Shell Size 23

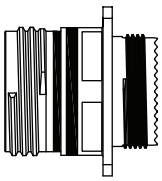


◯ 29 CH - Shell Size 25

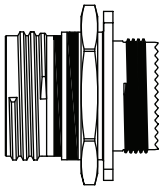
Other inserts available

B. Receptacles/ Plugs

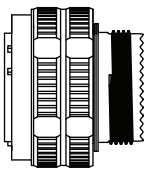
Select one



◯ D38999/20 Wall Mount Receptacle



◯ D38999/24 Jam Nut Receptacle



◯ D38999/26 Plug

C. Backshells

Select one

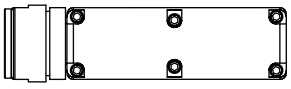
◯ Light Duty

◯ Medium Duty

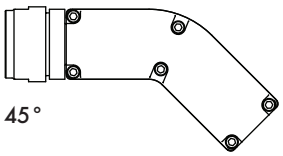
◯ Heavy Duty

Select one

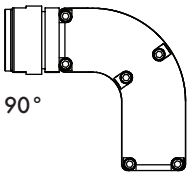
◯ None



◯ Straight



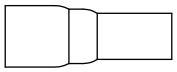
◯ 45°



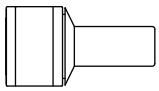
◯ 90°

D. Adapters/ Boots

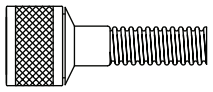
Select one



◯ Straight Boot

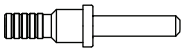


◯ Flexible Sleeve Adapter



◯ Conduit Adapter

Termini (See following page)



Pin Style Termini for Plug

Socket Style Termini for Receptacle

Select one

Material	Finish
◯ Aluminum	Electroless Nickel
◯ Aluminum	Cadmium Olive Drab over Electroless Nickel
◯ Composite	Electroless Nickel
◯ Stainless Steel	Passivated

DELPHI

D38999 Termini/Dust Covers

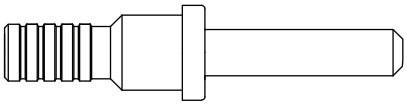
Please circle selections.

Name

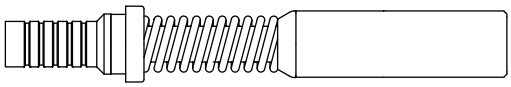
Connector PN #

Termini PN #

Notes:



Pin Termini

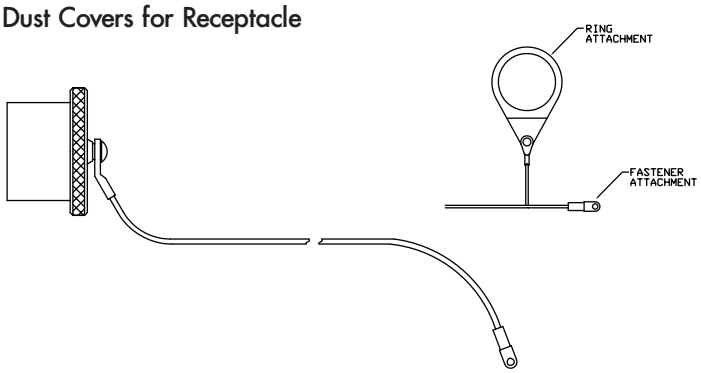


Socket Termini

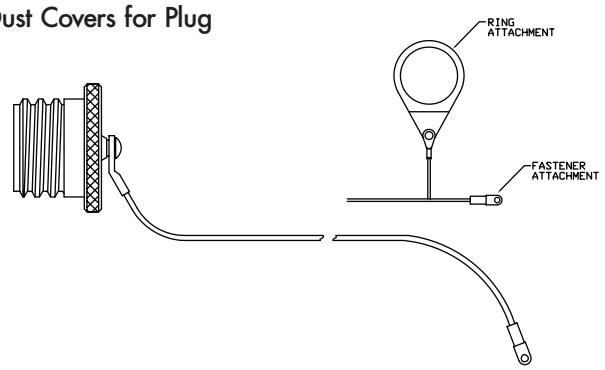
Flight Termini/ MIL-T-29504/4 & /5 Style 1 (Heat Shrink Sleeve)				
M29504/4 - Pin Terminus (COTS)		M29504/5 - Socket Terminus (COTS)		Maximum Fiber Diameter
Multimode	Singlemode	Multimode	Singlemode	Microns
NA	M29504/4-4207 (1021008-1250H)	NA	M29504/5-4236 (1021009-1250H)	125.0
M29504/4-4210 (1021008-1260H)	M29504/4-4209 (1021008-126SH)	M29504/5-4239 (1021009-1260H)	M29504/5-4238 (1021009-126SH)	126.0
M29504/4-4043 (1021008-1420H)	NA	M29504/5-4049 (1021009-1420H)	NA	142.0

Flight Termini/ MIL-T-29504/4 & /5 Style 3 (Crimp Sleeve)				
M29504/4 - Pin Terminus (COTS)		M29504/5 - Socket Terminus (COTS)		Maximum Fiber Diameter
Multimode	Singlemode	Multimode	Singlemode	Microns
NA	M29504/4-4265 (1021027-1250H)	NA	M29504/5-4279 (1021028-1250H)	125.0
M29504/4-4268 (1021027-1260H)	M29504/4-4267 (1021027-126SH)	M29504/5-4282 (1021028-1260H)	M29504/5-4281 (1021028-126SH)	126.0
M29504/4-4272 (1021027-1420H)	NA	M29504/5-4286 (1021028-1420H)	NA	142.0

Dust Covers for Receptacle



Dust Covers for Plug



◯ None - Plastic cap is standard when none is selected

DELPHI

M64266 NGCon Series

Name

Connector PN #

Termini PN #

Notes:

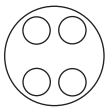
Select by filling in circles. Include with your fax to: (949) 458-3142

Connector (Select one): ◯ A ◯ B ◯ Stand Alone

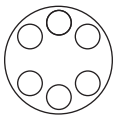
Key Arrangement (Select one): 1 2 3 4 5 6

A. Channel Count Select one

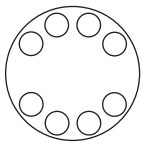
◯ 2 CH - Shell Size 11



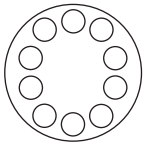
◯ 4 CH - Shell Size 11



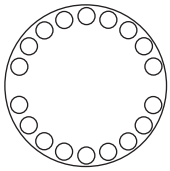
◯ 6 CH - Shell Size 13



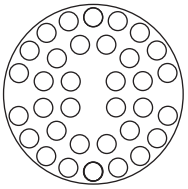
◯ 8 CH - Shell Size 13



◯ 10 CH - Shell Size 15

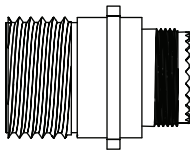


◯ 18 CH - Shell Size 23

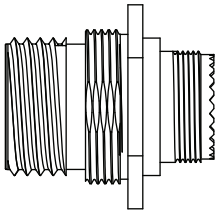


◯ 36 CH - Shell Size 23

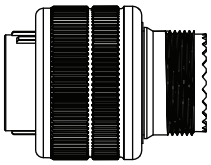
B. Receptacles/ Plugs Select one



◯ M64266/1
NGCon Wall Mount
Receptacle



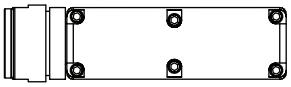
◯ M64266/3
NGCon Jam Nut
Receptacle



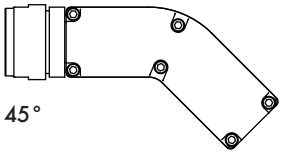
◯ M64266/2
NGCon Plug

C. Backshells Select one

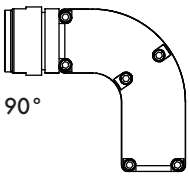
◯ None



◯ Straight

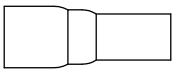


◯ 45°

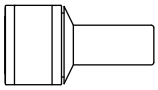


◯ 90°

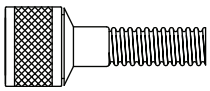
D. Adapters/ Boots Select one



◯ Straight Boot

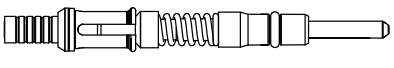


◯ Flexible Sleeve Adapter



◯ Conduit Adapter

Termini (See following page)



Genderless Style Termini for NGCon

Notes:

DELPHI

NGCon Termini/Dust Covers

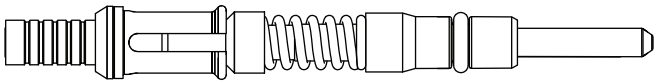
Please circle selections.

Name

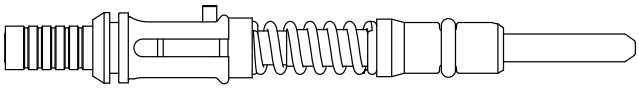
Connector PN #

Termini PN #

Notes:



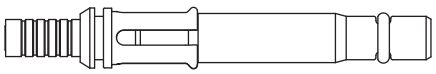
NGCon Termini/ MIL-T-29504/18		
M29504/18 - Genderless Terminus		Maximum Fiber Diameter
Multimode	Singlemode	Microns
M29504/18 (1020880-1260CH)		126.0



NGCon Termini/ MIL-T-29504/20		
M29504/20-Keyed Genderless Terminus		Maximum Fiber Diameter
Multimode	Singlemode	Microns
M29504/20 (1021342-1260CH)		126.0

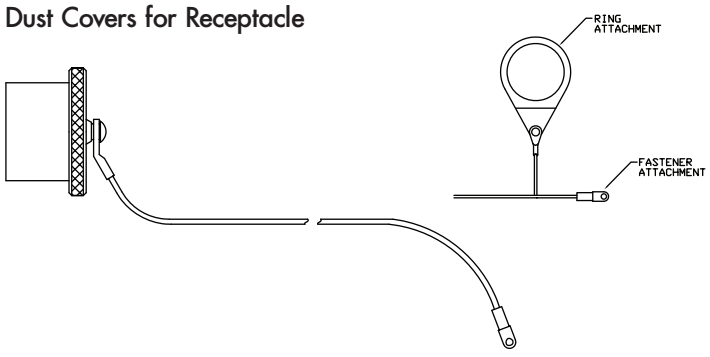
Dummy Termini/ MIL-PRF-29504/19
M29504/19 (1021496H)

Use Dummy Termini to fill any unused cavities

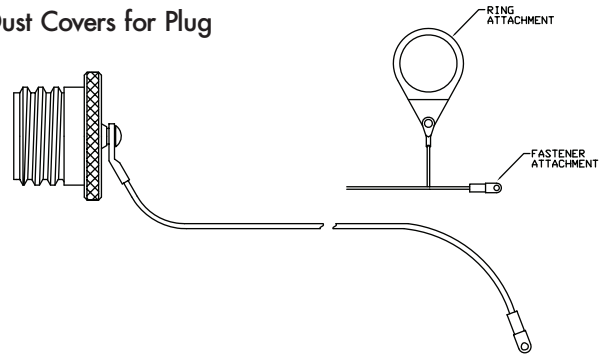


Dust Cover Type	MIL-Spec Number
◯ Plug	M64266/10
◯ Receptacle	M64266/11

Dust Covers for Receptacle



Dust Covers for Plug



◯ None - Plastic cap is standard when none is selected

DELPHI

NGCon Slim Series

Name

Connector PN #

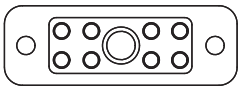
Termini PN #

Notes:

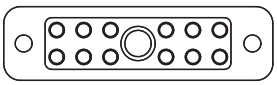
Select by filling in circles. Include with your fax to: (949) 458-3142

Connector (Select one): ○ A ○ B ○ Stand Alone

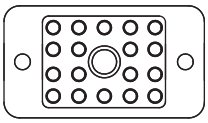
A. Channel Count Select one



○ 8 CH



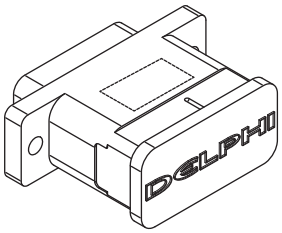
○ 12 CH



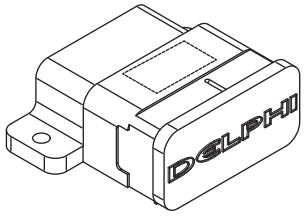
○ 18 CH

Other configurations available

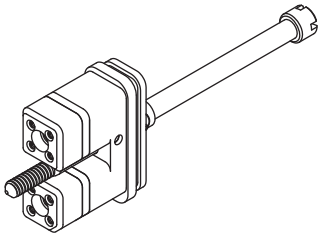
B. Receptacles/ Plugs Select one



○ NGCon Slim Receptacle Flange Mount



○ NGCon Slim Receptacle Board Mount



○ NGCon Slim Plug

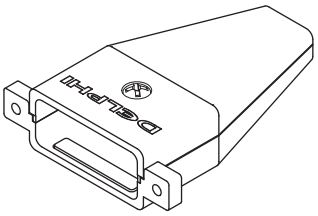
Other configurations available

C. Backshells

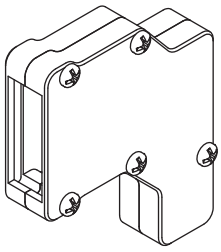
Select one

○ None

○ Straight



○ 90°



Termini (See following page)

Genderless Style Termini for NGCon

Notes:

DELPHI

NGCon Slim Termini/Dust Covers

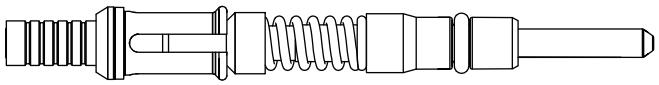
Please circle selections.

Name

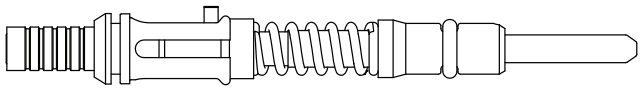
Connector PN #

Termini PN #

Notes:



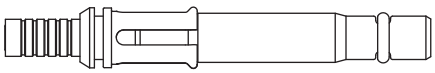
NGCon Termini/ MIL-T-29504/18		
M29504/18 - Genderless Terminus		Maximum Fiber Diameter
Multimode	Singlemode	Microns
M29504/18 (1020880-1260CH)		126.0



NGCon Termini/ MIL-T-29504/20		
M29504/20-Keyed Genderless Terminus		Maximum Fiber Diameter
Multimode	Singlemode	Microns
M29504/20 (1021342-1260CH)		126.0

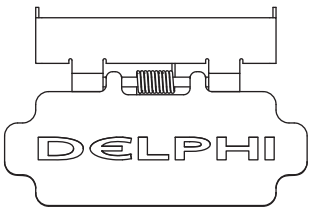
Dummy Termini/ MIL-PRF-29504/19
M29504/19 (1021496H)

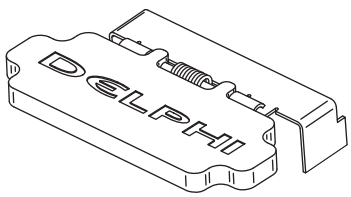
Use Dummy Termini to fill any unused cavities



Dust Cover Type	Part Number
◯ Receptacle	1021451H

Dust Covers for Receptacle





◯ None - Plastic cap is standard when none is selected

DELPHI

Standard Connector Series

Name

Connector PN #

Termini PN #

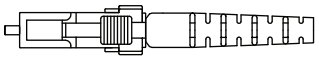
Notes:

Select by filling in circles. Include with your fax to: (949) 458-3142

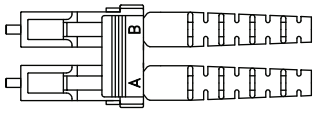
Connector (Select one): ○ A ○ B ○ Stand Alone

Key Arrangement: N/A

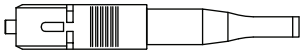
A. Connectors Select one



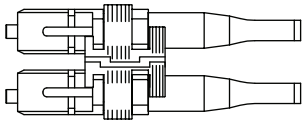
○ LC Connector



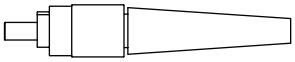
○ LC Duplex Connector



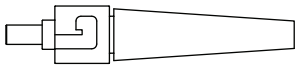
○



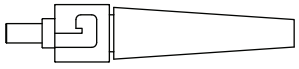
○ SC Duplex Connector



○ FC Connector



○ ST Connector

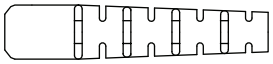


○ MIL-ST Connector

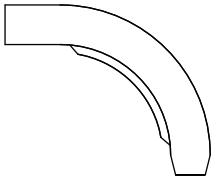
○ M83522/16-ANX ○ M83522/16-DNX

○ M83522/16-ANY ○ M83522/16-DNY

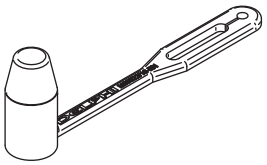
B. Boots, Dust Cover, Adapter Select one



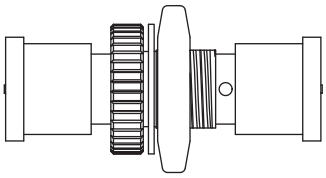
○ Straight Boot



○ 90° Boot



○ Dust Cover M83522/16-EN



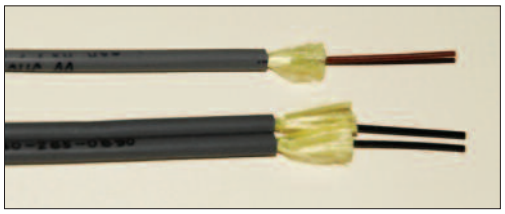
○ ST Adapter M83522/17-NY
M83522/17-NZ

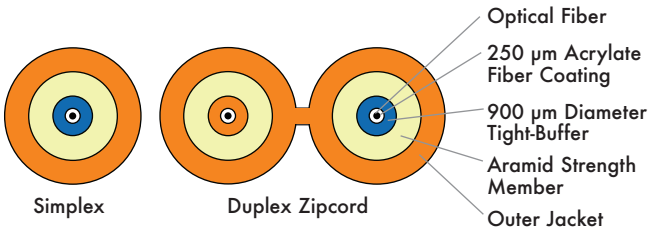
Notes:

DELPHI

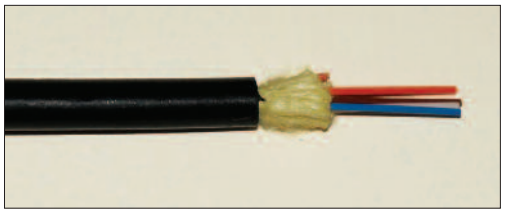
Cable Construction/Definition of Terms

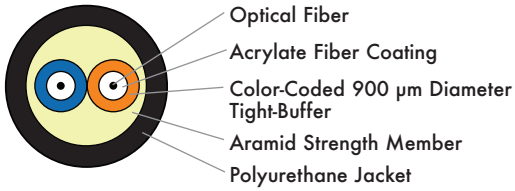
Simplex/ Duplex Cable



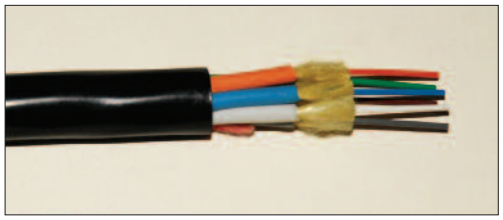


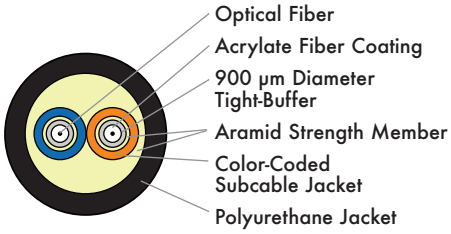
Distribution Cable

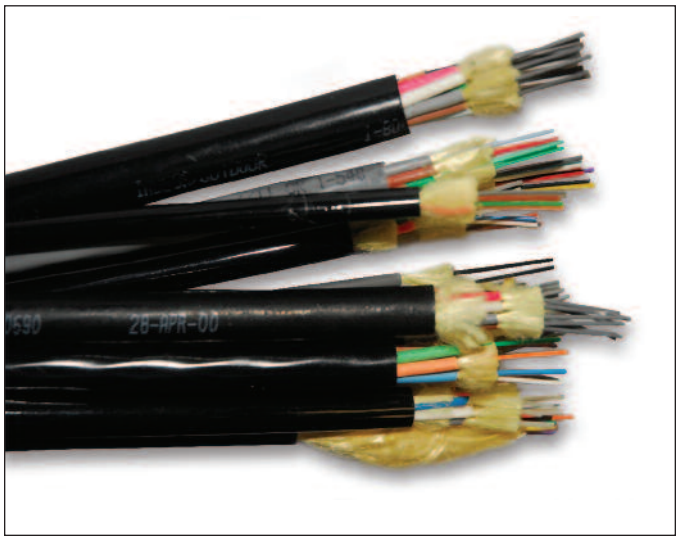




Breakout Cable







DELPHI

Cable by Application

Shipboard

MIL-Spec Part No.	Fiber Count	Fiber Type	Cable Construction	Jacket Type	Color
M85045/16-01	1	MM (62.5/125)	Simplex	LSZH, Thermoplastic	Slate
M85045/16-02	1	SM (9/125)	Simplex	LSZH, Thermoplastic	Yellow
M85045/17-01P	8	MM (62.5/125)	Breakout	LSZH, Thermoset	Black
M85045/17-02P	8	SM (9/125)	Breakout	LSZH, Thermoset	Black
M85045/18-01P	4	MM (62.5/125)	Breakout	LSZH, Thermoset	Black
M85045/18-02P	4	SM (9/125)	Breakout	LSZH, Thermoset	Black
M85045/22-01	18	MM (62.5/125)	Breakout	LSZH, Thermoplastic	Black
M85045/22-02	18	SM (9/125)	Breakout	LSZH, Thermoplastic	Black

**Other Cables available (Call for details)*

Ship to Shore (Pierside Connectivity)

DCS Part No.	Fiber Count	Fiber Type	Cable Construction	Jacket Type	Color
1020961-EHY6A11453	12	8CH-MM (62.5/125) 4CH-SM (9/125)	Breakout	Polyurethane	Black
1020961-EES6B21443	12	MM (62.5/125)	Breakout	LSZH	Orange
1020961-ECS6B21443	12	SM (9/125)	Breakout	LSZH	Orange
1020961-EES4B21283	12	MM (62.5/125)	Breakout	LSZH	Orange
1020961-EES6A11103	12	MM (62.5/125)	Breakout	Polyurethane	Black
1020961-ECS6A11103	12	SM (9/125)	Breakout	Polyurethane	Black
M85045/16-01	1	MM (62.5/125)	Simplex	LSZH, Thermoplastic	Slate
M85045/16-02	1	SM (9/125)	Simplex	LSZH, Thermoplastic	Yellow
1020948-SESA6E4N	1	MM (62.5/125)	Simplex	Polyurethane	Slate
1020948-SCSA6E4N	1	SM (9/125)	Simplex	Polyurethane	Yellow

**Other Cables available (Call for details)*

Notes and Additional Instruction:

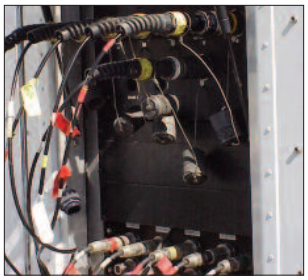
DELPHI

Cable by Application

Ground Tactical

DCS Part No.	Fiber Count	Fiber Type	Cable Construction	Jacket Type	Color
M85045/8-B4A	4	MM (62.5/125)	Distribution	Polyurethane, Radiation Hard.	Black
M85045/8-B4B	4	MM (50/125)	Distribution	Polyurethane, Radiation Hard.	Black
1020959-BES6A1058R	4	MM (62.5/125)	Distribution	Polyurethane, Radiation Hard.	Black
1020959-BDS6A1058R	4	MM (50/125)	Distribution	Polyurethane, Radiation Hard.	Black
1020959-BCS6A1058R	4	SM (9/125)	Distribution	Polyurethane, Radiation Hard.	Black
1020959-BES6A1058N	4	MM (62.5/125)	Distribution	Polyurethane	Black
1020959-BDS6A1058N	4	MM (50/125)	Distribution	Polyurethane	Black
1020959-BCS6A1058N	4	SM (9/125)	Distribution	Polyurethane	Black
1020948-SESA6E4N	1	MM (62.5/125)	Simplex	Polyurethane	Slate
1020948-SCSA6E4N	1	SM (9/125)	Simplex	Polyurethane	Yellow
1020961-BES6A10753	4	MM (50/125)	Breakout	Polyurethane	Black
1020961-BCS6A10754	4	SM (9/125)	Breakout	Polyurethane	Black

**Other Cables available (Call for details)*



Broadcast

DCS Part No.	Fiber Count	Fiber Type	Cable Construction	Jacket Type	Color
1020959-BES6A1055N	4	MM (62.5/125)	Distribution	Polyurethane	Black
1020959-BCS6A1055N	4	SM (9/125)	Distribution	Polyurethane	Black
1020959-BES6D2055N	4	MM (62.5/125)	Distribution	LSZH	Orange
1020959-BDU4A1055N	4	MM (50/125)	Distribution	Polyurethane	Black
1020959-BCS4A1078N	4	SM (9/125)	Distribution	Polyurethane	Black
1020959-BCS6A1058N	4	SM (9/125)	Distribution	Polyurethane, Double	Black
1020948-SESA6E4N	1	MM (62.5/125)	Simplex	Polyurethane	Slate
1020948-SCSA6E4N	1	SM (9/125)	Simplex	Polyurethane	Yellow
1020961-BES6A10753	4	MM (50/125)	Breakout	Polyurethane	Black
1020961-BCS6A10754	4	SM (9/125)	Breakout	Polyurethane	Black

**Other Cables available (Call for details)*

Notes and Additional Instruction:

DELPHI

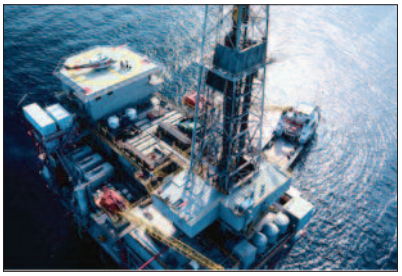
Cable Specifications

Other Applications:

- Commercial
- Avionics / Airframe
- Mining
- Oil Exploration / Geophysical

Please Specify:

1. Fiber Count: _____
2. Fiber Type: _____
3. Cable Construction (Breakout, Distribution, Simplex): _____
4. Jacket / Material Type: _____
5. Color: _____
6. Armor/ Jacket Protection: _____
7. Other Requirements: _____

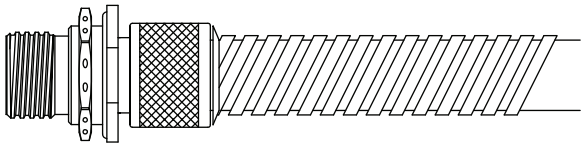


Notes and Additional Instruction:

DELPHI

Jacket Protection Requirements

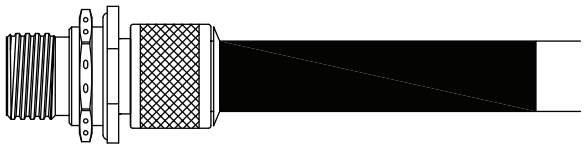
Spiral Wrap:



Type: _____

Color: _____

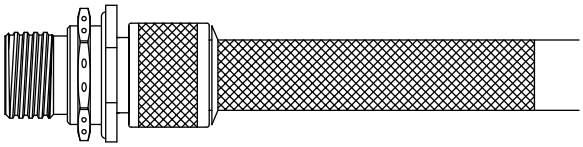
Heat Shrink:



Type: _____

Color: _____

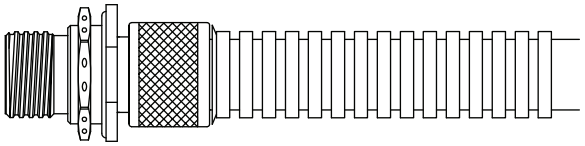
Expandable Braided Sleeving:



Type: _____

Color: _____

Flexible Conduit:

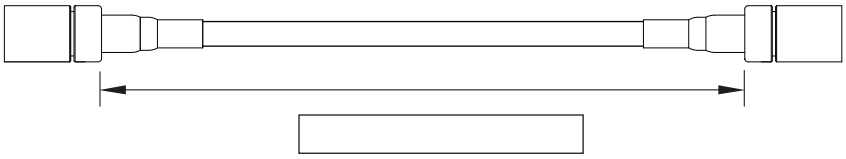


Type: _____

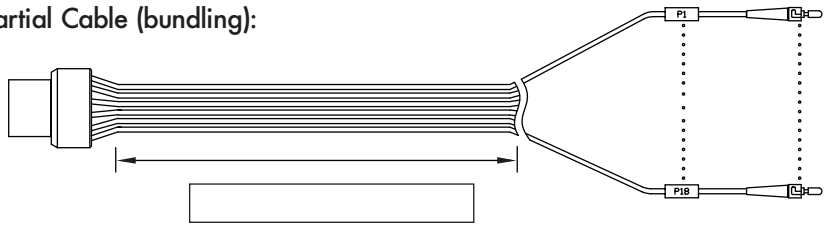
Color: _____

Coverage Options:

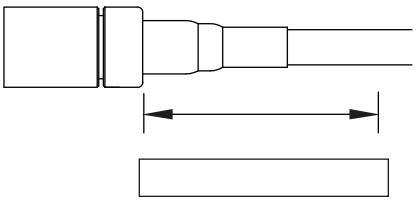
Full Cable:



Partial Cable (bundling):



Connector End:

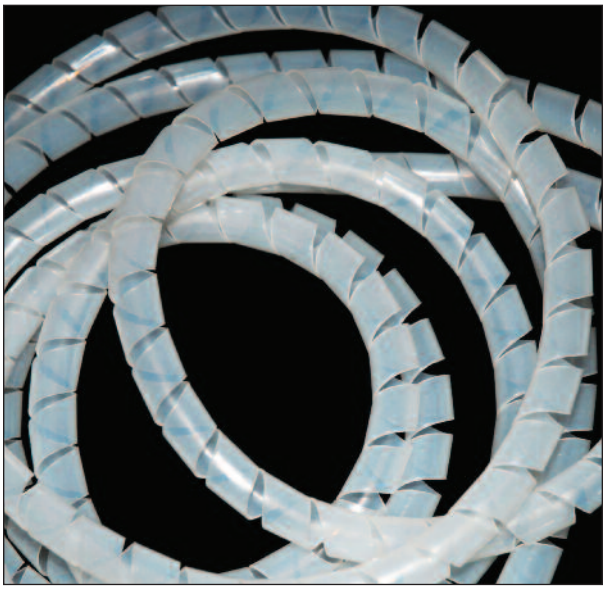


Notes and Additional Instruction: _____

DELPHI

Jacket Protection

Spiral Wrap



- Abrasion protection for wires, cables, hoses and tubing
- -40°F to +122°F
- Fire resistant and flame retardant also available
- RoHS Compliant
- Various colors and sizes

Type

P - Polyethylene

N - Nylon

Other _____

Color

0 - Black

9 - White

C - Clear

* Other colors available upon request

Heat Shrink

- Abrasion protection for wires, cables, hoses and tubing
- -67°F to +275°F
- Various colors and sizes

Type

P - Polyolefin

Other _____

Color

0 - Black

9 - White

C - Clear

* Other colors available upon request

Or Order via MIL-Spec:

M23053/	–	–

DELPHI

Jacket Protection

Expandable Braided Sleeving

- Abrasion protection for wires, cables, hoses and tubing
- High Temp. -70°C to +260°C (PEEK)
- Low Temp. -75°C to +125°C (PET, PPS, HALAR)
- Fire resistant and flame retardant available
- Halogen-free
- Various colors and sizes

Type

PPS - Polyphenylene Sulfide

PET - Polyester

PEEK - Polyetheretherketone

HALAR - Fluoropolymer

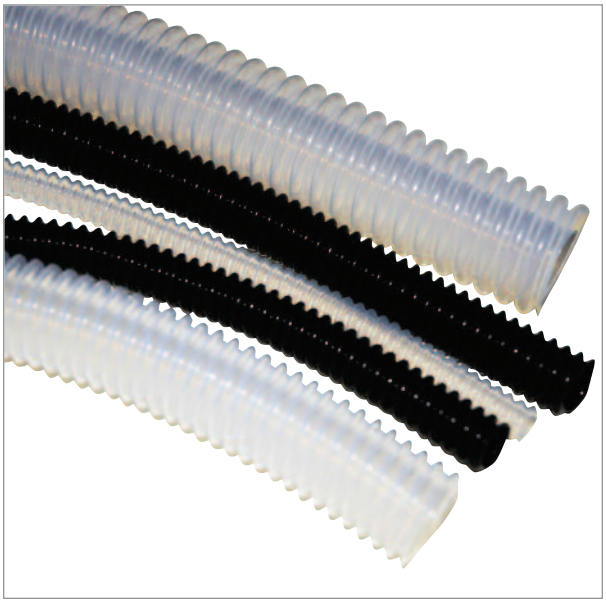
Color

0 - Black

9 - White

* Other colors available upon request

Flexible Conduit



- Abrasion protection for wires, cables, hoses and tubing
- Internally and externally corrugated all plastic tubing
- Highly resistant to acids and solvents
- Free of silicon, cadmium, halogen
- Self-extinguishing and flame retardant
- Black tubings are UV-resistant

Type

PA - Plastic (-40°C to +115°C)

HTP - High Temperature Polymer (-40°C to +180°C)

Color

0 - Black

C - Clear

* Other colors available upon request

Available upon Request

GS - Galvanized Steel (Sheathing: Plastic, PVC)

RPS - Rust Proof Steel (Sheathing: Plastic, PVC)

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Reel Options

Pierside Connectivity Reel

- Pierside / Shipboard Umbilical assembly applications.
- 3 flange reel – 2 outside and 1 divider (center) flange.
- Rugged steel frame and spool construction.
- Slotted divider disc; accommodates a minimum of 20 feet of cable.
- Gray, non-reflective finish.
- Cable / connector pass-thru between main storage area and pocket.

Notes and Additional Instruction:

Ground Tactical Reel

- Ground communications, tactical applications.
- Rugged steel frame and spool construction.
- Green, non-reflective matte finish.

Notes and Additional Instruction:

Broadcast / Commercial Reel

- Communication, broadcast, commercial applications.
- Rugged steel frame and aluminum spool construction.
- Black, non-reflective matte finish.
- Slotted divider disc; 2" wide space for storage of short cable.
- Frame clips allow stacking of reels.
- Ergonomic carrying handle.
- Adjustable cam-lock drag brake locks cable in place.

Notes and Additional Instruction:

Modular Reel Systems

- Fabricated with an impact modified polymer material which provides durability and strength while remaining lightweight.
- Cable payout and storage area enables operator to deploy small lengths of fiber cable without having to unspool the entire payload.
- Interlocking stacking system enables reels to be stacked and interlocked during transit.
- Integrated connector storage allows multi-channel cylindrical connectors to be stored and locked in place for transit.
- Molded hand openings allow for easy hand transportation and deployment.
- Built-in fiber optic connector cleaning kit.
- Available with a wide selection of deployment and cable management accessories.

Notes and Additional Instruction:

DELPHI

M28876 Product Profile

Delphi's Shipboard / MIL-PRF-28876 fiber optic connectors feature low optical insertion loss, repeatability, exceptional strain relief, and reliability in harsh environments. Commercial-Off-The-Shelf (COTS) equivalents are available that maintain key performance factors of the MIL-Spec versions. Complete tool kits and support infrastructure are commercially available.

Delphi's Shipboard / MIL-PRF-28876 Connectors are used extensively by the United States and allied naval forces in shipboard applications, and have been on the United States government's Qualified Products List (QPL) since 1983.

Benefits/Features:

- Low optical insertion loss
- Available in 2, 4, 6, 8, 18 and 31 channel configurations
- In-line and wall mount receptacles
- Singlemode and multimode capabilities
- Hybrid (electro-optic) versions available

Typical Applications:

- Navy shipboard
- Military and commercial
- Hybrid configurations for electro-optical signal transmission

Performance Characteristics:

- Optical insertion loss:
  - 9/125 SM fiber: 0.25 dB avg.
  - 62.5/125 MM fiber: 0.6 dB avg.
- Operating temperature: -28°C to +65°C
- Vibration: per TIA/EIA-455-11, Condition II & VII
- Shock: MIL-S-901, GR.A, CL.1, high impact
- Mating durability: 500 cycles

The performance characteristics above are for reference only and may not account for all the variables that would be present in an actual application. For detailed product performance information, contact Delphi.

DELPHI

M28876 Product Profile

Connector Performance Criteria

Description	Specifications
Optical Insertion Loss*	9/125 SM Fiber -0.25 dB avg., 62.5/125 MM Fiber -0.6 dB avg. *Note - Values measured at 1300 nm per TIA/EIA-455-34*
Optical Backreflection (SM)*	Better than -40 dB with PC polish, better than -50 dB with enhanced PC polish
Mating Durability	500 cycles per TIA/EIA-455-21
Vibration	Per MIL-STD-1344, Method 2005, Condition II & VI
Mechanical Shock	Per MIL-S-901, Grade A
Thermal Cycling	-62°C to +70°C per MIL-STD-1344, Method 1003
Corrosion Resistance	500 hour salt spray per MIL-STD-1344, Method 1001
Ozone Exposure	150 PPM/2 hours per MIL-STD-1344, Method 1007
Humidity	240 hours per MIL-STD-1344, Method 1002
Fluid Immersion	Per MIL-STD-1344, Method 1016
Crush Resistance	225 pounds per MIL-STD-1344, Method 2008.1
Maintenance Aging	Per MIL-STD-1344, Method 2002
Terminus Retention Force	22 pounds minimum per MIL-STD-1344, Method 2007
Insert Retention Axial	100 PSI minimum per MIL-STD-1344, Method 2010
Cable Pull Out Force	162 pounds minimum per MIL-STD-1344, Method 2009
Cable Seal Flexing	100 cycles per MIL-STD-1344, Method 2017
Impact	Per MIL-STD-1344, Method 2015
Flammability	Per MIL-STD-1344, Method 1012
Operating Temperature Range	-54°C to +65°C
Storage Temperature Range	-62°C to +71°C

**Optical performance data figures are derived from actual field measurements taken from thousands of mated pairs of termini across Delphi's line of multichannel connectors.*

Standard Materials and Finishes:

Description	Material	Finish
Insert	Per MIL-C-28876	Per MIL-C-28876
Boot, Strain Relief	Fluorosilicone	None
Connector and Backshell Housings	Per MIL-C-28876	Per MIL-C-28876

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M28876 Product Profile

M28876/27, 28, 29 Backshells

Benefits/Features:

- This design will have the smallest footprint of any backshell on the QPL
- No special tools required / no heat shrink
- Easier to re-enter / re-work if necessary
- Entire assembly can occur ***after*** termination
- Common components allow for end user to change shells in the field as needed to convert a straight to a 45 or 90 degrees or vice versa
- Common cable prep length for all orientations within a shell size
- Shells can be opened without disturbing the cable strain relief
- Simple strain relief is easier to assemble and has fewer parts
- Captive hardware (screws)
- Common components make this a "distributor friendly" product family; customers can stock fewer components and build and ship connectors to order faster

Straight

45 Degree

90 Degree

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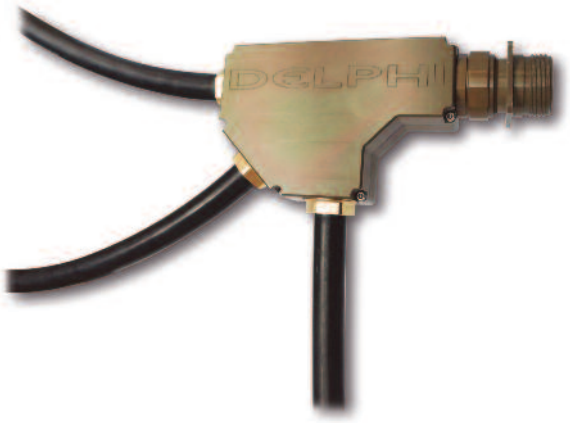
Universal Backshell Product Profile

The Universal Backshell, by way of a variety of adaptors, will accommodate the rear accessory attachment features of multiple connector types, including D38999, M28840, M28876, M5015 and M64266 (pending).

The Universal Backshell, by way of a variety of cable-exit adaptors, will accommodate different cable types and sizes, including but not limited to, electrical cables, fiber optic cables, cables with Kevlar strain relief fibers, cables with braided EMI/RFI shielding, cables routed through conduit or convoluted tubing, jacketed cables, etc.



Benefits/Features:

- The ability to provide cable exit points at 45°, 90° and 180°
- Common cable prep length for all orientations within a shell size
- Shells can be opened without disturbing the cable strain relief
- Simple strain relief is easier to assemble and has fewer parts
- Easier to re-enter/re-work if necessary
- Entire assembly can occur AFTER termination.
- Captive hardware (screws)
- Common components make this a "distributor friendly" product family; Customers can stock fewer components and build and ship connectors to order faster
- Front and rear end adapters interchangeable to different connector families
- Environmentally sealed per M28876
- Can be used for circular, Mil Spec type electrical and fiber optic connector/cable assemblies
- No special tools required/No heat shrink

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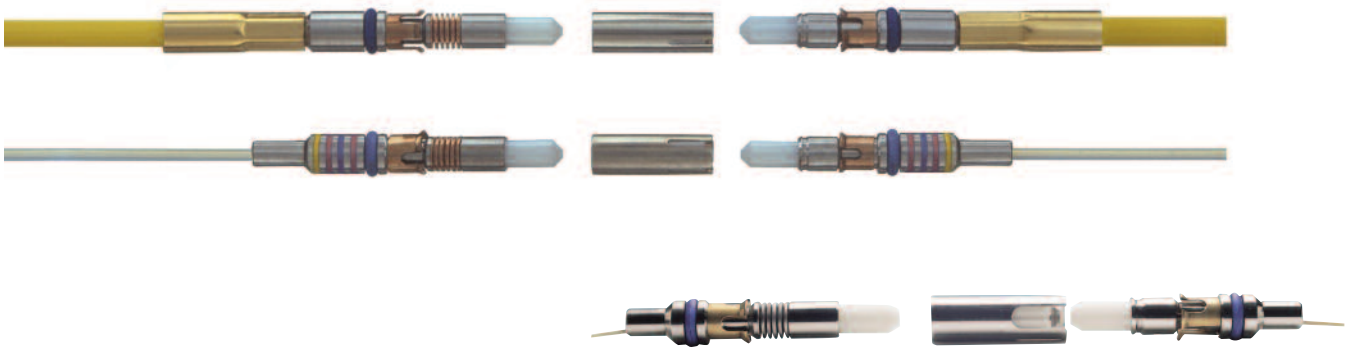
M29504/14 and /15 Product Profile



Delphi's Shipboard Termini / MIL-PRF-29504/14 and /15 are free floating, self-aligning termini which are the foundation of Delphi's field proven fiber optic connectors. The self-aligning MIL-PRF-29504 qualified termini are available in both MIL-Spec and Commercial-Off-The-Shelf (COTS) versions.

Delphi's fiber optic termini utilize a constant mating force from specially designed Belleville springs to help prevent termini separation resulting from shock, vibration or thermal cycling.

The M29504 termini "float" within the connector and self-align to provide precise mating every time due to the unique shape of the ferrule and alignment sleeve hood.

Benefits/Features:

- Qualified to MIL-PRF-29504/14 and /15
- Free-floating, self-aligning design
- Available in singlemode and multimode

Typical Applications:

- Military/aerospace
- Shipboard/pierside
- Harsh environment
- Broadcast
- Hybrid electronics
- Circular and rectangular connectors

Performance Characteristics:

- Optical insertion loss:
  - 9/125 SM fiber: 0.25 dB avg.
  - 62.5/125 MM fiber: 0.60 dB avg.
  - Return loss: (9/125) SM: 48 dB avg.
- Operating temperature: -28°C to +65°C
- Mating durability: 2,000 cycles
- Terminus retention force: 22 lbs. minimum

The performance characteristics above are for reference only and may not account for all the variables that would be present in an actual application. For detailed product performance information, contact Delphi.

DELPHI

M29504/14 and /15 Product Profile

Ceramic Alignment and Optical Performance

Performance specifications for termini housed in MIL-C-28876 connectors are available in Delphi's M28876 Fiber Optic Connectors brochure. The termini comply to both MIL-T-29504 and MIL-C-28876 specifications. The specifications and known test limits below represent actual performance testing conducted by Delphi Connection Systems' engineering.

This data is derived from several different connector types and is only a guideline.

Consult the factory to discuss your specific application.

Performance Criteria:

Operating Temperature Range	-65°C to +150°C (dependent on epoxy and cable)
Thermal Cycling	-54°C to +65°C
Thermal Shock	-55°C to +85°C
Temperature Life	+110°C for 240 hours
Vibration	68 G random
Physical Shock	500 G
Mating Durability	2,000 cycles
Salt Spray	500 hours
Pressure Sealing (Wiper Seal)	2,000 psi
Terminus Mating Force	5 lbs. [22.2 N] nominal
Terminus Retention Force	22 lbs. [97.9 N]
Cable Retention Force	25 lbs. [111.2 N] (dependent on cable construction)
Weight	0.7 grams max.

Optical Performance:

Insertion Loss (IL) and Backreflection (BR) readings are heavily dependent on launch conditions and test setup. The figures below are actuals for overfilled source fibers at 1300 nm when standard setup and testing procedures are followed per TIA/EIA-455-171. Please consult the factory for information on additional fiber sizes.

Optical Performance
Average Insertion Loss (IL):

Fiber Size	Average Insertion Loss
9/125	-0.25 dB
62.5/125	-0.60 dB

Backreflection (BR) – Singlemode:

Better than -40 dB – PC polish
Better than -50 dB – enhanced PC polish

Standard Materials and Finishes:

Description	Material	Finish
Terminus Body	Stainless Steel	Passivated
Alignment Sleeve	Zirconia	None
Alignment Sleeve Hood	Beryllium Copper	Nickel Plated
Ferrule (bushing)	Zirconia	None
Retaining Clip	Beryllium Copper	None
Belleville Springs	Beryllium Copper	None
O-Ring Seal	Fluorosilicone	None

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Hermaphroditic Product Profile

Delphi Hermaphroditic Connectors have been developed to meet the stringent demands of outdoor applications and to provide superior optical performance. Hermaphroditic Connectors allow concatenations (linked together in series) of cable assemblies to extend equipment separation without concern for connector male/female interface compatibility. Additionally "blind mating" and "scoop-proof" features help ensure easy to mate interconnects.

Benefits/Features:

- Available in 4, 6 and 12 channel configurations
- Singlemode and multimode capabilities
- 4 channel complies to SMPTE (Society of Motion Picture and Television Engineers) Standard 358M-2001
- Plug-to-plug in-line cable linking system
- Utilizes Delphi's field proven termini
- Full environmental sealing

Typical Applications:

- Broadcast
- Military pierside and tactical field usage
- Petroleum field exploration
- Field deployed equipment

Performance Characteristics:

- Optical insertion loss:
  - 9/125 SM fiber: 0.25 dB avg.
  - 62.5/125 MM fiber: 0.6 dB avg.
- Operating temperature: -54°C to +85°C
- Cable retention: 400 lbs. minimum (depending on cable construction)
- Mating durability: 1000 cycles
- Terminus retention force: 22 lbs. minimum

The performance characteristics above are for reference only and may not account for all the variables that would be present in an actual application. For detailed product performance information, contact Delphi.

DELPHI

Hermaphroditic Product Profile

4 Channel Harsh Environment Hermaphroditic Fiber Optic Connectors

Description:
Fiber optic cable connectors for harsh environment applications.
Compliant to SMPTE Standard 358M-2001.

Benefits/Features:

Genderless connection . . . . . Plug connectors can link together in series without regard to connector gender

Channel count . . . . . 4 fiber optic channels

Fiber type . . . . . Singlemode and multimode capabilities

Cable compatibility . . . . . Tactical field type, distribution, and breakout

Ruggedness . . . . . Designed to withstand crush, impact, cable pull-out, cable twist, bending moment, water and mud immersion, and many other harsh environments

Reliability . . . . . Proven performance in harsh environment applications

Connector Performance Criteria

Optical Insertion Loss	9/125 SM Fiber -0.25 dB avg., 62.5/125 MM Fiber -0.6 dB avg. *Note - Values measured at 1300 nm per TIA/EIA-455-34*
Optical Backreflection (SM)	Better than -40 dB with PC polish, better than -50 dB with enhanced PC polish
Mating Durability	1000 cycles minimum per TIA/EIA-455-21
Vibration	Per MIL-STD-1344, Method 2005, Condition II & VI-A
Mechanical Shock	Per TIA/EIA-455-2, Method C
Thermal Shock	-54°C to +85°C* per TIA/EIA-455-3, test condition A
Operating Temperature Range	-54°C to +85°C*
Storage Temperature	-65°C to +85°C*
Corrosion Resistance	500 hours salt spray per TIA/EIA-455-16
Ozone Exposure	ASTM-D-1149, 100-150 PPM for 2 hours
Temperature Humidity	Per TIA/EIA-455-5, type 2
Crush Resistance	225 pounds per TIA/EIA-455-26
Maintenance Aging	10 contact insertions/removals per MIL-STD-1344, Method 2002
Terminus (Contact) Retention Force	22 pounds minimum per MIL-STD-1344, Method 2007
Cable Retention	400 pounds minimum per TIA/EIA-455-6 (depending on cable construction)
Cable Seal Flexing	100 cycles per MIL-STD-1344, Method 2017
Cable Twist	1000 cycles per TIA/EIA-455-36
External Bending Moment	45 ft-lb at mounting panel
Impact	Per TIA/EIA-455-2
Water Pressure Sealing	Up to 25 PSI for 48 hours
Fluid Immersion	24 hours per fluid, per TIA/EIA-455-12

** Temperature ranges listed above are limited by the fiber optic cable performance window.*

DELPHI

Hermaphroditic Product Profile

6/12 Channel Harsh Environment Hermaphroditic Fiber Optic Connectors

Description:
Fiber optic cable connectors for harsh environment applications.

Benefits/Features:

Genderless connection. . . . . Cable connectors can link together in series without regard to connector gender

Maintainability . . . . . Removable socket endface

Channel count . . . . . 6 or 12 fiber optic channels

Fiber type . . . . . Singlemode and multimode capabilities

Cable compatibility . . . . . Tactical field type, distribution and breakout

Ruggedness . . . . . Designed to withstand crush, impact, cable pull-out, cable twist, bending moment, water and mud immersion, and many other harsh environments

Reliability . . . . . Proven field performance in harsh environment applications

Connector Performance Criteria

Optical Insertion Loss	9/125 SM Fiber -0.4 dB avg., 62.5/125 MM Fiber -0.7 dB avg. *Note - Values measured at 1300 nm per TIA/EIA-455-34*
Optical Backreflection (SM)	Better than -40 dB with PC polish, better than -50 dB with enhanced PC polish
Mating Durability	1000 cycles minimum per TIA/EIA-455-21
Temperature Cycling	-40°C to +65°C* per TIA/EIA-455-3
Operating Temperature Range	-54°C to +85°C*
Storage Temperature	-65°C to +85°C*
Corrosion Resistance	500 hours salt spray per TIA/EIA-455-16
Ozone Exposure	ASTM-D-1149, 100-150 PPM for 2 hours
Temperature Humidity	Per TIA/EIA-455-5, type 2
Crush Resistance	225 pounds per TIA/EIA-455-26
Maintenance Aging	10 contact insertions/removals per MIL-STD-1344, Method 2002
Terminus (Contact) Retention Force	22 pounds minimum per MIL-STD-1344, Method 2007
Cable Retention	400 pounds minimum per TIA/EIA-455-6 (depending on cable construction)
Cable Seal Flexing	100 cycles per MIL-STD-1344, Method 2017
Cable Twist	1000 cycles per TIA/EIA-455-36
External Bending Moment	50 ft-lb at mounting panel
Impact	Per TIA/EIA-455-2
Water Pressure Sealing	Up to 25 PSI for 48 hours
Fluid Immersion	24 hours per fluid, per TIA/EIA-455-12

** Temperature ranges listed above are limited by the fiber optic cable performance window.*

DELPHI

DFOCA Product Profile

Delphi Fiber Optic Cable Assembly (DFOCA) / MIL-PRF-83526 Connectors are next-generation hermaphroditic fiber optic connectors engineered for harsh environments and military tactical applications. DFOCA Connectors are high performance, high quality connectors designed to military specifications MIL-PRF-83526 and MIL-PRF-29504/16. These second generation connectors with genderless termini replace an original biconical termini design.

Delphi is first-to-market with advanced design features that help simplify assembly and repair in the field, where time is critical. DFOCA Connectors feature an innovative internal subassembly that provides several advantages, including, reduced assembly complexity, fewer subcomponents, and quicker access to termini. An innovative one-piece terminus insertion/removal tool is designed for ease of use and to help prevent fiber breakage. These features help make assembly and field repair easier, quicker and safer while still providing superior optical performance and reliability.

DFOCA Connectors have a rugged design that withstands crush, impact, cable pull-out, water and mud immersion, and other harsh environments.

Benefits/Features:

- Designed and built to MIL-PRF-83526
- Genderless connection
- Singlemode and multimode
- Removable endface
- Reduced assembly complexity
- Innovative one-piece insertion/removal tool

Typical Applications:

- Tactical field communications
- Radar systems
- Missile defense systems
- Mobile launchers

Performance Characteristics:

- Optical insertion loss:
  - 9/125 SM fiber: 0.25 dB avg.
  - 62.5/125 MM fiber: 0.6 dB avg.
- Operating temperature: -46°C to +71°C
- Mating durability: 2000 cycles
- Crush resistance: 450 lbs.

The performance characteristics above are for reference only and may not account for all the variables that would be present in an actual application. For detailed product performance information, contact Delphi.

DELPHI

DFOCA Product Profile

Connector Performance Criteria

Optical Insertion Loss	9/125 SM Fiber – 0.4 dB avg., 62.5/125 MM Fiber – 0.3 dB avg.
Optical Backreflection	Singlemode > -50 dB with UPC polish
Fiber Type	Singlemode and multimode
Ferrule	2.5 mm ceramic
Operating Temperature Range	-46°C to +71°C
Storage Temperature	-52°C to +85°C
Humidity Immersion	Per MIL-STD-1344, Method 2010, 5 cycles
Corrosion Resistance	500 hours salt spray per TIA/EIA-455-16
Mud	5 minute immersion, 10 cycles
Water Pressure	1 meter for 24 hours
Freezing Water Immersion	7 hour immersion
Mating Durability	2000 cycles minimum per TIA/EIA-455-21
Flammability	MIL-STD-1344, Method 1012
Vibration	Per MIL-STD-1344, Method 2005.1
Mechanical Shock	Per TIA/EIA-455-14, Condition A
Impact	Per TIA/EIA-455-2
EMI Shielding	> 60 dB
Crush Resistance	450 pounds per TIA/EIA-455-26
Cable Retention	400 pounds minimum per TIA/EIA-455-6
Cable Twist	1000 cycles per TIA/EIA-455-36
Cable Seal Flexing	100 cycles per MIL-STD-1344, Method 2017, Procedure 1

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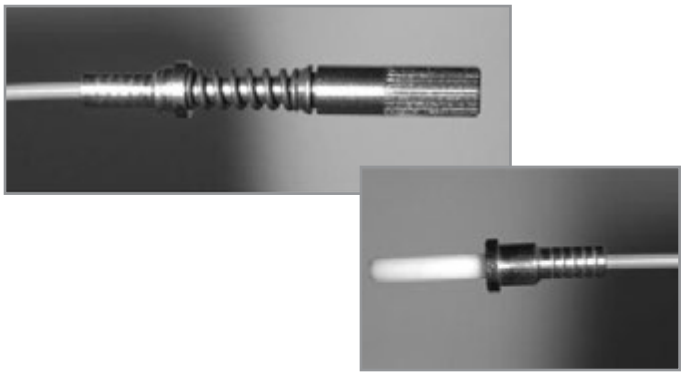
M29504/4 and /5 Product Profile

Delphi's Flight Termini / MIL-PRF-29504/4 and /5 Style contain self-aligning termini which are the foundation of Delphi's field proven fiber optic connectors. The self-aligning termini are available in a Commercial-Off-The-Shelf (COTS) version.

Delphi's fiber optic termini utilize constant pressure from a specially designed coil spring to help prevent termini separation resulting from shock, vibration or thermal cycling. The M29504 termini "float" within the connector and self-align to provide precise mating every time due to the unique shape of the ferrule and alignment sleeve hood.



Benefits/ Features:

- Designed to MIL-PRF-29504/4 and /5
- Available in Style 1 shrink sleeve or Style 3 crimp sleeve
- 1.58 mm ferrule
- Singlemode and multimode
- Improved terminus retention features

Typical Applications:

- Military avionics
- Commercial avionics
- D38999 connectors

Performance Characteristics:

- Optical insertion loss:
  - 9/125 SM fiber: 0.25 dB avg.
  - 62.5/125 MM fiber: 0.60 dB avg.
- Return loss (9/125 SM): 48 dB avg.
- Operating temperature: -55°C to +165°C
- Cable retention (Style 3): 50 lbs.

The performance characteristics above are for reference only and may not account for all the variables that would be present in an actual application. For detailed product performance information, contact Delphi.

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M29504/4 and /5 Product Profile

Optical Performance

Insertion Loss (IL) and Backreflection (BR) readings are heavily dependent on launch conditions and test setup. The figures below are actuals for overfilled source fibers at 1300 nm when standard setup and testing procedures are followed per TIA/EIA-455-171. Please consult the factory for information on additional fiber sizes.

Performance Criteria:

Operating Temperature	-67°F to +329°F (-55°C to +165°C)
Storage Temperature	-40°F to +185°F (-40°C to +85°C)
Terminus Engagement Force	30 oz. (8.3 N) Max. /5 only
Cable Pull Out Force	22 lbs. (98 N) Min.
Mating Durability	500 mating cycles, per TIA/EIA-455-6
Maintenance Aging	10 insertion/removal
Weight	1.0 gram maximum
Salt Spray	TIA/EIA-455-16, Test Condition C
Mechanical Shock	MIL-S-901, Grade A, Type B, Class I
Vibration, Sine and Random	Sine vibration, 60 G @ ambient temperature, per MIL-DTL-38999
Thermal Shock	-55°C to +165°C, per TIA/EIA-455-71, Schedule C-0 (5 cycles)
Temperature Life	165°C for 1,000 hours, per TIA/EIA-455-4

Optical Performance Average Insertion Loss (IL):

Fiber Size	Average Insertion Loss
9/125	-0.25 dB
62.5/125	-0.60 dB

Backreflection (BR) – Singlemode:

Better than -40 dB – PC polish
Better than -50 dB – enhanced PC polish

Standard Materials and Finishes:

Description	Material	Finish
Terminus Body	Stainless Steel	Passivated
Alignment Sleeve	Zirconia	None
Alignment Sleeve Hood	Stainless Steel	Passivated
Ferrule (bushing)	Zirconia	None
Spring	Stainless Steel	Passivated

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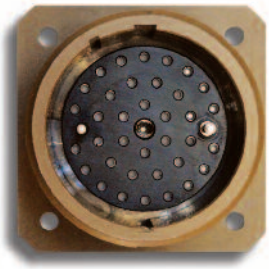
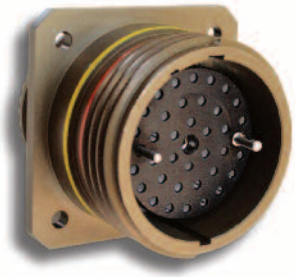
M64266 NGCon Product Profile

New Standard for High Density Fiber Optic Interconnect Applications

NGCon connectors combine proven technology from M28876 and D38999 designs.

Delphi Connection Systems is participating in a DSCC technical working group to develop appropriate slash sheets to Military Specification MIL-PRF-64266. The termini are designed to meet the requirements of MIL-PRF-29504/18.





Benefits/ Features:

- Designed to meet the requirements of MIL-PRF-64266
- Removable Alignment Sleeve Retainer (ASR) for easy cleaning of terminations on both sides of the connector
- Tighter mechanical tolerances than D38999, allowing interoperability
- High density arrangements available
- Removable genderless design
- Rear insertion/ rear release
- 1.25 mm ferrules
- Singlemode and multimode capability
- Captive alignment sleeves
- Environmental sealing on the termini
- Allows for multiple backshell designs, many styles and configurations available off the shelf.

Typical Applications:

- Maritime
- Aerospace
- Industrial

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M64266 NGCon Product Profile

Optical Performance

Insertion Loss (IL) and Backreflection (BR) readings are heavily dependent on launch conditions and test setup. The figures below are actuals for overfilled source fibers at 1300 nm when standard setup and testing procedures are followed per TIA/EIA-455-171. Please consult the factory for information on additional fiber sizes.

Performance Criteria:

Terminus Retention Force	22 lbs. (98 N)
Cable Pull Out Force	162 lbs. (720.3 N) Min.
Mating Durability	500 mating cycles, per TIA/EIA-455-6
Thermal Shock	TIA/EIA-455-71, Schedule C (5 cycles)
Temp./Humidity Cycling	TIA/EIA-455-5, Method B
Temperature Cycling	TIA/EIA-455-3
Life Aging	TIA/EIA-455-4
Freezing Water Immersion	TIA/EIA-455-98, Method A, Procedure 1
Sand and Dust	TIA/EIA-455-35
Electromagnetic Effects	IEEE-299, from 100-18,000 MHz
Fluid Immersion	TIA/EIA-455-12
Salt Spray	TIA/EIA-455-16, Condition I
Flammability	EIA-364-81
Fungus Resistance	TIA/EIA-455-56
Ozone Exposure	TIA-455-189
Vibration	Shipboard, TIA/EIA-455-11, Test Condition II, IV & VII
Shock	Shipboard, MIL-S-901, Grade A, Class I. Aerospace, EIA-364-27, Condition D (300 G, 3 ms)
Water Pressure	32 ft. (9.8 m) for 48 hours
Shell to Shell Conductivity	EIA-364, Method 83
Altitude Immersion	EIA-364, Method 3

Optical Performance Average Insertion Loss (IL):

Fiber Size	Average Insertion Loss
9/125	-0.25 dB
62.5/125	-0.60 dB

Backreflection (BR) – Singlemode:

Better than -40 dB – PC polish
Better than -50 dB – enhanced PC polish

Standard Materials and Finishes:

Description	Material	Finish
Connector and Backshell Housings	Per MIL-PRF-NGCon	Per MIL-PRF-NGCon
Boot, Strain Relief	Fluorosilicone	None
Terminus Cavity Insert	Per MIL-PRF-NGCon	Per MIL-PRF-NGCon
Alignment Sleeve Retainer (ASR)	Per MIL-PRF-64266	Per MIL-PRF-64266
Terminus Body	Stainless Steel	Passivated
Alignment Sleeve	Zirconia	None
Ferrule (bushing)	Zirconia	None
Retaining Clip	Stainless Steel	Passivated
Spring	Beryllium Copper	None
O-Ring Seal	Fluorosilicone	None

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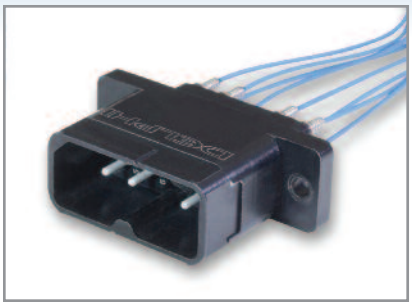
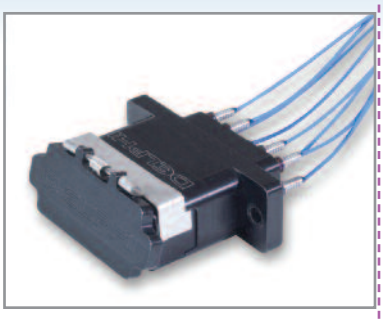
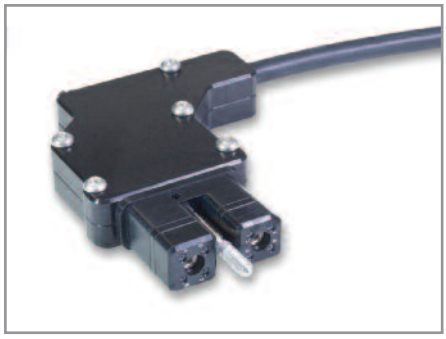
NGCon Slim Product Profile







Delphi's fiber optic NGCON Slim Connector features low optical insertion loss, repeatability, and reliability in harsh environments.

The NGCON Slim was designed to use the M29504/18 NGCON termini. It is a multi-channel rectangular connector available in both Singlemode and Multimode configurations and can reside on a PCB or mounted to a panel where real estate is a premium.

Delphi's NGCON Slim is available in a plug, flange-mount receptacle and board mount receptacle to meet your design needs.

Benefits/ Features:

- High density – up to 36 termini
- Employs M29504/18 Termini 1.25 mm ferrules (same size as LC connectors)
- Genderless termini
- Captivated alignment sleeves
- Rear release
- PCB or Edgecard/Backplane
- Singlemode and multimode capability

Typical Applications:

- Navy shipboard
- Aerospace
- Various military and commercial applications

Performance Characteristics

Optical Insertion Loss	0.20 dB Typ. Singlemode 0.30 dB Typ. Multimode
Return Loss, Singlemode	Better than -40 dB with PC polish, better than -50 dB with enhanced PC polish
Mating Durability	> 500 cycles EIA-455-21
Vibration	TIA/EIA-455-11
Shock	EIA-455-14 / MIL-STD-901D, Grade A, Type A, Class I
Impact	TIA/EIA-455-2, Method B
Temperature Humidity	TIA/EIA-455-5
Flammability	Per MIL-STD-1344, Method 1012
Fungus Resistant	TIA/EIA-455-56
Ozone Exposure	150 PPM/2 hours per MIL-STD-1344, Method 1007
Normal Temperature Operating Temperature Range Storage Temperature Range	 -28°C to +65°C -40°C to +70°C
High Temperature Operating Temperature Range Storage Temperature Range	 -55°C to +165°C -40°C to +85°C
Terminus Retention Force	22 pounds minimum per EIA/TIA-455-6
Sleeve Retainer Retention Axial	100 PSI minimum per MIL-STD-1344, Method 2010

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M83522 Product Profile

Delphi's M83522 fiber optic Military ST Connector and Adapter feature low optical insertion loss, repeatability, and reliability in harsh environments. Commercial-Off-The-Shelf (COTS) equivalents are available that maintain key performance factors of the Mil-Spec versions.

The M83522 ST Connectors and Adapters consist of a rugged stainless steel design to withstand corrosive harsh environments. They are available in singlemode and multimode versions with locking or non-locking boots as well as a dust cover with a non-metal lanyard.

Benefits/ Features:

- Designed to meet MIL-C-83522
- Rugged stainless steel design
- Ultra PC polish capabilities
- Singlemode and multimode capability
- Locking and non-locking boots
- Fungus resistant
- Low smoke – zero halogen
- RoHS complaint dust cover

Typical Applications:

- Navy shipboard
- Pierside connectivity
- Military and commercial electronic systems
- Field deployed equipment
- Military tactical arrays
- Mobile broadcasting
- Geophysical

Performance Characteristics

Optical Insertion Loss	0.20 dB Typ. Singlemode 0.30 dB Typ. Multimode
Return Loss, Singlemode	> 50 dB
Mating Durability	> 500 cycles EIA-455-21
Tensile Loading	> 230 MIL-STD 1344, Method 2009
Thermal Shock	DOD-STD-1678, Method 4020
Vibration	MIL-STD-1344, Method 2005
Shock	EIA-455-14 / MIL-STD-901D, Grade A, Type A, Class I
Impact	8 times, 1.5 meters
Salt Spray	MIL-STD-1344, Method 1001
Temperature Humidity	DOD-STD-1678, Method 4030
Flammability	MIL-STD-1344, Method 1012
Fungus Resistant	MIL-STD-810, Method 508
Dust	MIL-STD-202, Method 110
Ozone Exposure	MIL-STD-1344, Method 1007
Fluid Immersion	MIL-STD-1344, Method 1016
Normal Temperature Operating Temperature Range Storage Temperature Range	 -46°C to +85°C -62°C to +85°C
High Temperature Operating Temperature Range Storage Temperature Range	 -55°C to +125°C -65°C to +200°C

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Snap Lock Product Profile

Delphi's innovative Snap Lock miniature, single channel, fiber optic connectors will meet your rugged, space limited, cost efficient design requirements without sacrificing performance. Snap Lock's push/pull coupling design provides an efficient mate/demate feature while maintaining the same high optical performance associated with our multi-channel connectors.

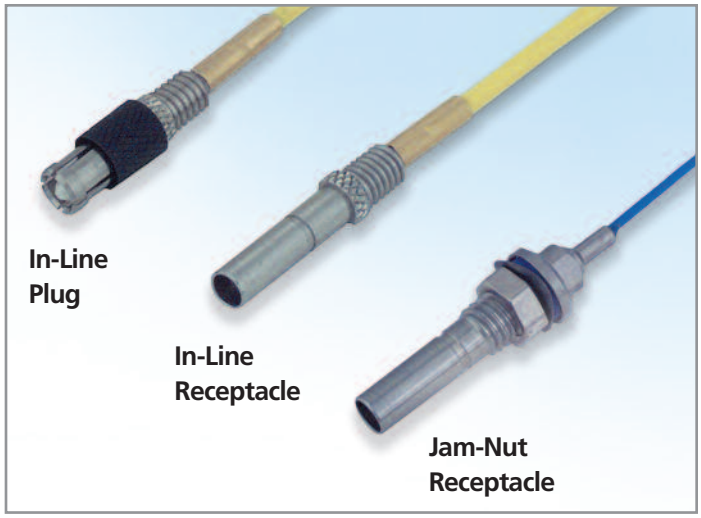
Delphi's Snap Lock can reside on a PCB where real estate is at a premium. This miniature connector can be mounted directly onto the board, and further space reduction is achieved without the need for a threaded coupling ring. Snap Lock is available in several versions, including in-line plug, in-line receptacle and jam-nut receptacle to meet design requirements.

Self-Aligning Termini

Delphi's fiber optic termini utilize constant pressure from Belleville springs, rather than lower force coil springs, to help prevent termini separation resulting from shock, vibration or thermal cycling. The termini "float" within the connector and self-align to provide precise mating every time. For further information on our termini, please refer to Delphi's Fiber Optic Termini Catalog.*

Delphi also provides complete cable assembly and testing capabilities.

** Delphi's Fiber Optic Termini MIL-T-29504 and Commercial Equivalent Catalog.*



Benefits/Features:

- Compact size, with a maximum diameter of less than .25 inch [6.35 mm] for in-line and less than .30 inch [7.62 mm] for jam-nut mount
- Push/pull style single channel connector houses Delphi's field proven termini and reduces space required for mounting
- Conveniently utilizes the same termini and termination processes common to other Delphi fiber optic connectors
- Pull-proof (non-optical disconnect)
- Lightweight
- No threaded coupling-ring required for mating

Typical Applications:

- Where single channel connectors are typically used
- Military and commercial electronic systems
- Navy shipboard
- Satellite systems
- Mechanical splices
- Test equipment
- Towed arrays
- Bulkhead mounts

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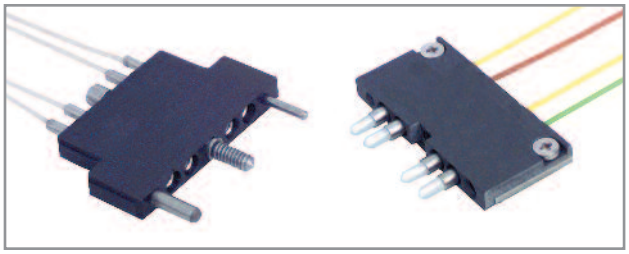
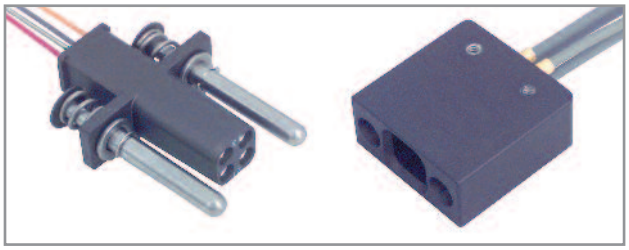
Edgecard Mounted Product Profile

Delphi's low profile printed circuit board and edgecard/backplane fiber optic connectors – plugs and receptacles with removable termini.



Low Profile PCB Connectors



Edgecard/Backplane Connectors

Typical Applications:

- Commercial
- Military
- Airborne, land based, shipboard and space flight

Benefits/ Features:

Connection Type . . . . . Blind mating or jackscrew mating versions are available.

Channel Count . . . . . 2, 4, 8 or more fiber optic channels.

Fiber Type Compatibility . . . . Singlemode or multimode fiber compatible (or mixed modes in same connector).

Ruggedness . . . . . Designed to utilize the same Delphi proven individual termini used in our harsh environment commercial or severe environment military connectors. Capable of performing during critical shock and vibration events. Temperature cycling handled without failures. Multiple high count mating cycles with precise alignment and repeatable, dependable optic performance.

Reliability . . . . . Utilized in all manner of applications. Proven termini performance in Air-Land-Sea-Space environments.

Connector Performance Criteria:

Optical Insertion Loss	9/125 SM Fiber -0.25 dB avg., 62.5/125 MM Fiber -0.60 dB avg., 100/140 MM Fiber -0.40 dB avg. *Note – Values measured at 1300 nm per TIA/EIA-455-34*
Optical Backreflection (SM)	Better than -40 dB with PC polish, better than -50 dB with enhanced PC polish
Operating Temperature Range	-54°C to +85°C*
Storage Temperature	-65°C to +85°C*
Thermal Shock	-54°C to +85°C* per TIA/EIA-455-3, Test Condition A
Mating Durability	1000 cycles minimum per TIA/EIA-455-21
Vibration	Per MIL-STD-1344, Method 2005, Condition II & VI-A
Mechanical Shock	Per TIA/EIA-455-2, Method C
Terminus (Contact) Retention Force	22 pounds minimum per MIL-STD-1344, Method 2007
Maintenance Aging	10 contact insertions/removals per MIL-STD-1344, Method 2002

** Temperature ranges listed above are limited by the fiber optic cable performance window.*

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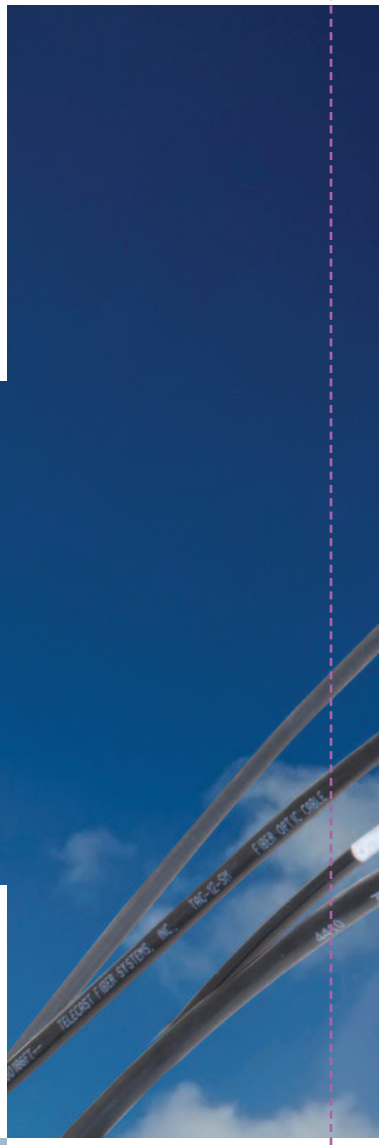
Notes & Sketches



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