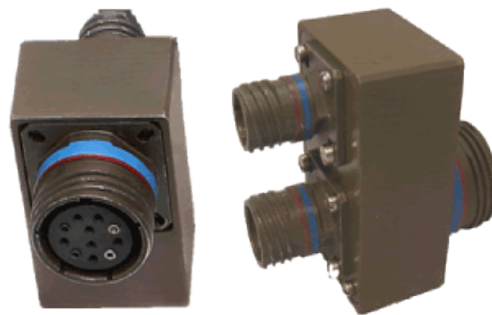


## Mercury Series

Gigabit Ethernet, External D38999, 1000Base-T/SX Media Converter, 28Vdc, Multimode, 850nm VCSEL's



### Dual Port, Flange Receptacles

#### FEATURES

- Compliant with IEEE-802.3:2005 Gigabit Ethernet
- Optical fiber link distances up to 550 Meters
- Maximum optical channel bit error rate less than  $1 \times 10^{-12}$
- Operating temperature range from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Shock, vibration and immersion resistant per Mil-Std-810 and Mil-Std-1344
- Olive Drab Cadmium plating meets stringent EMI / RFI performance specifications
- Aluminum alloy chassis and Mil-Dtl-38999 housings are strong, durable, corrosion resistant and light weight
- Mil-T-29504 compliant optical fiber connector interface
- D38999 fiber optic insert configuration conforms to Mil-Std-1560
- D38999 electrical interfaces provides robust interconnection to vehicle or platform wiring

#### APPLICATIONS

Mercury series bulkhead mounted Gigabit Ethernet media converters enable high speed network communications over long distances in harsh environments.

- Gigabit Ethernet switches and peripherals
- Telecom and datacom switch / router rack-to-rack links
- Storage or computation clusters

The Mil-Dtl-38999, Series III connectors provide sealed optical and electrical interfaces that are water-tight to Mil-Std-810 / IP67 / NEMA-4x when mated.

The multimode optical fiber interface supports applications where copper cable link distance, bandwidth, weight or bulk make the use of twisted pair, twinax or quadax copper conductors unacceptable.

### D38999 to D38999 / Optical to Electrical Media Converter

#### DESCRIPTION

Mercury series Gigabit Ethernet media converters consist of optoelectronic transmitter and receiver functions integrated along with the 1000Base-T Ethernet electrical to 1000Base-SX optical media conversion circuitry into a bulkhead mounted Mil-Dtl-38999 connector assembly.

The optical transmitters are high output 850nm VCSEL's. The optical receivers consist of GaAs PIN and preamplifier assemblies and limiting post-amplifiers.

The electrical interface to the Mercury series bulkhead optical media converters is a Mil-Dtl-38999 connector enabling interconnection to an internal or external backbone cable interface.

Mercury series Gigabit Ethernet media converters are vibration isolated, environmentally hardened components designed for use in harsh environment applications.

- Sealed against liquid and solid contaminants
- Shock and vibration resistant

#### ORDERING INFORMATION

Application	Item Number
1000Base-T to 1000Base-SX, 28Vdc	M33R-4SAT-HW 1
See Appendix A4 for more part number options	

# Facilitating Secure Communications in Harsh Environments

Dual Port Mercury Series Mil-Dtl-38999, 1000Base-T to 1000Base-SX,  
Gigabit Ethernet Media Converter, Multimode, 28Vdc, 850nm VCSEL's

## ABSOLUTE MAXIMUM RATINGS

Absolute maximum limits mean that no catastrophic damage will occur if the product is subjected to these ratings for short periods, provided each limiting parameter is in isolation and all other parameters have values within the performance specification. It should not be assumed that limiting values of more than one parameter can be applied to the product at the same time.

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Storage Temperature	$T_s$	-55		+100	°C
Supply Voltage	$V_{cc}$	-0.5		45.0	V
Data Input Voltage	$V_i$	-0.5		$V_{cc}$	V

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Operating Temperature	$T_A$	-40		+85	°C
Supply Voltage	$V_{cc}$	+18.0	+28.0	+36.0	VDC
Power Supply Noise (p-p)	$N_p$			200	mV

## SPECIFICATIONS COMPLIANCE

Requirement	Feature	Condition	Notes
MIL-STD-883	ESD	Class II	2200V
MIL-STD-810	Vibration	3.8g <sup>2</sup> /Hz	43G rms
MIL-STD-810	Shock	40.0g	6-9mS
MIL-STD-1344	Flame Resistance	Method 1012	30 Seconds
MIL-STD-1344	Damp Heat	10 Cycles	24 Hours
MIL-STD-38999	Mating Durability	500 Cycles	<0.5dB Change
FDA / CDRH / IEC-825-1	Eye Safety	Class 1	No Safety Interlocks Required

## MATERIALS

Item	Detail	Notes
D38999 Cylindrical Shells	Aluminum Alloy	
Plating	Olive Drab Cadmium	
D38999 Inserts	Thermoplastic	
Interfacial Seals	Elastomer	
Optical Alignment Sleeves	Composite Polymer	
Printed Circuits	Polyimide / FR-4	Mil-P-31032 Type 4
Housing	Aluminum Alloy	

# Facilitating Secure Communications in Harsh Environments

Dual Port Mercury Series Mil-Dtl-38999, 1000Base-T to 1000Base-SX,  
Gigabit Ethernet Media Converter, Multimode, 28Vdc, 850nm VCSEL's

## OPTICAL TRANSMITTERS $T_A$ = Operating Temperature Range

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Optical Output Power	$P_o$	-9.5		-4.0	dBm
Optical Output Wavelength	$\lambda_{OUT}$	830	850	860	nM
Spectral Width	$\Delta\lambda_{RMS}$			0.85	nM

## OPTICAL RECEIVERS $T_A$ = Operating Temperature Range

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Optical Sensitivity	$P_i$	-17.0		-2.0	dBm
Optical Wavelength	$\lambda_{IN}$	830	850	860	nM

## POWER SUPPLY CURRENT $T_A$ = Operating Temperature Range

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Supply Current per Port @ 28VDC	$I_{CCT}$		100	150	mA

## OPTICAL LINK DISTANCES

Protocol	Cable Specification	Distance
Gigabit Ethernet - IEEE-802.3:2005 - 1000BASE-SX	62.5/125 $\mu$ 200MHz*Km	275M
	50/125 $\mu$ 500MHz*Km	550M

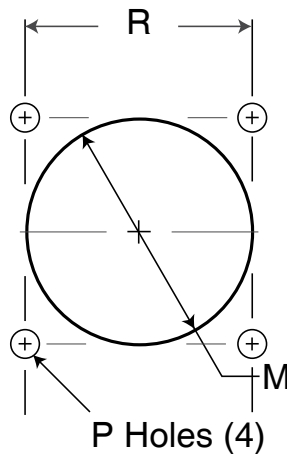
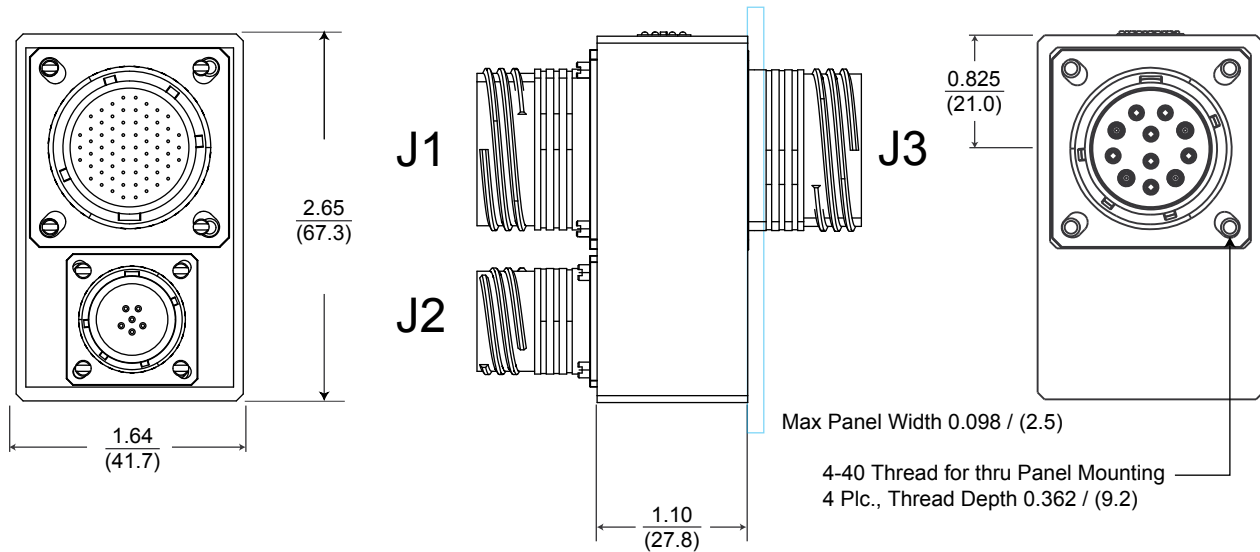
## COPPER LINK DISTANCES

Protocol	Cable Specification	Distance
Gigabit Ethernet - IEEE-802.3:2005 - 1000BASE-T	TIA/EIA-568-B Cat 5E - for other transmission media, please consult the factory	100M

Dual Port Mercury Series Mil-Dtl-38999, 1000Base-T to 1000Base-SX,  
Gigabit Ethernet Media Converter, Multimode, 28Vdc, 850nm VCSEL's

## OUTLINE DRAWING

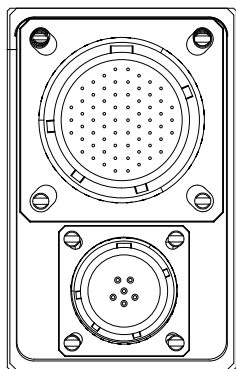
Dimensions are shown as: inches (mm)



### Panel Cutout Dimensions Rear Panel Mounting Only

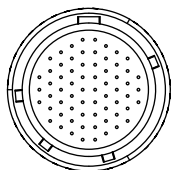
Shell Size Code	Shell Size	M Min	P Holes	R Bsc
F	19	1.297 (32.94)	0.133 (3.4) 0.123 (3.1)	1.156 (29.4)

## Dual Port Mercury Series Mil-Dtl-38999, 1000Base-T to 1000Base-SX, Gigabit Ethernet Media Converter, Multimode, 28Vdc, 850nm VCSEL's **MEDIA CONVERTER INSERT ARRANGEMENTS**

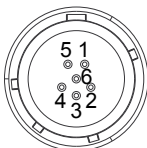


J1

### Media Converter Insert Pin Numbers



J2



### Media Converter Pin Functions

#### 1000Base-T (x)= Port Number

Pin 1=MX1+(0)	Pin64=MX1+(1)
Pin 2=MX1-(0)	Pin65=MX1-(1)
Pin 5=MX2+(0)	Pin59=MX2+(1)
Pin 6=MX2-(0)	Pin60=MX2-(1)
Pin11=MX3+(0)	Pin52=MX3+(1)
Pin12=MX3-(0)	Pin53=MX3-(1)
Pin18=MX4+(0)	Pin44=MX4+(1)
Pin19=MX4-(0)	Pin45=MX4-(1)

#### Power Supply Connector

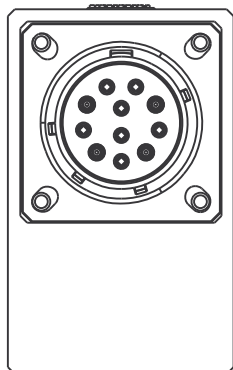
Pin 1= Case Ground
Pin 2= Case Ground
Pin 3= Case Ground
Pin 4= Case Ground
Pin 5= VEE
Pin 6= VCC

### Mating Cable Plug Connector P/N

D38999/26WF35SN  
Cat-5E Cable  
See Appendix A3  
All other pins = GND

D38999/26WA35SN  
20 Gauge Copper Wire

Media Converter Pin Numbers and Functions Shown - Mating Cable Plug Opposite

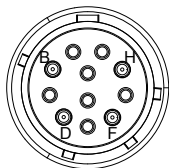


J3

### Media Converter Optical Pin Numbers

### Media Converter Optical Functions

### Mating Cable Plug Connector P/N



#### 1000Base-SX (x)= Port Number

Position H = Optical TX(0)
Position F = Optical RX(0)
Position B = Optical TX(1)
Position D = Optical RX(1)

D38999/26WF11PN  
M29504/04  
62.5/125 Fiber Cable  
See Appendix A2

MIL-STD-1560A Insert Code 19-11  
MIL-T-29504/4B Optical Termini

Media Converter Fiber Pin Numbers and Functions Shown - Mating Cable Plug Opposite

Dual Port Mercury Series Mil-Dtl-38999, 1000Base-T to 1000Base-SX,  
Gigabit Ethernet Media Converter, Multimode, 28Vdc, 850nm VCSEL's

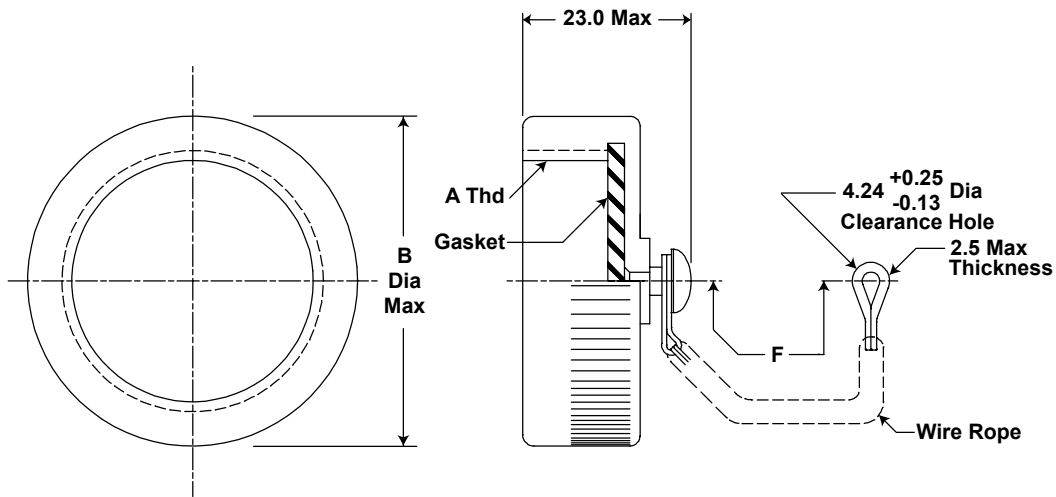
## APPENDIX A1

### RECEPTACLE PROTECTION CAPS

#### \*MIL-DTL-38999/33 PROTECTION CAP PART NUMBERS

MS RECEPTACLE CAP P/N

\*D38999/33W19R



\*See DSCC or SAE QPL for Approved Suppliers  
<http://www.dscclia.mil/programs/qmlqpl/QPLdetail.asp?QPL=38999>

#### MIL-DTL-38999/33 Outline Dimensions - mm

Shell Size Code	Shell Size	A Thread (inches)	B Max Dia	F +13.0 -7.0
F	19	1.2500-0.1P-0.3L-TS	39.0	127.00

## APPENDIX A2

### MIL-DTL-38999 FIBER OPTIC CABLE PLUG / MIL-T-29504 PIN TERMINI

\*See DSCC or SAE QPL for Approved Suppliers

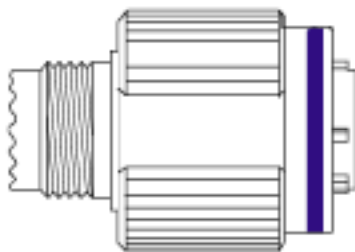
<http://www.dscclia.mil/programs/qmlqpl/QPLdetail.asp?QPL=38999>

#### \*D38999 PLUG - PIN INSERT

##### MIL-DTL-38999 CABLE PLUG

MS PLUG P/N

\*D38999/26WF11PN



#### \*FIBER OPTIC PIN TERMINUS

##### MIL-T-29504 PIN TERMINUS

MS PIN TERMINUS P/N

\*M29504/04-xxxx\*\*



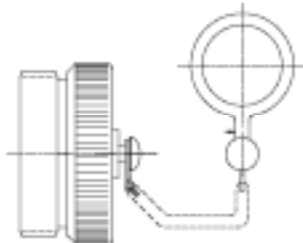
\*\*defined by fiber optic cable configuration

#### \*CABLE PROTECTION CAP

##### D38999/32 PLUG PROTECTION CAP

MS PLUG CAP P/N

\*D38999/32W19N

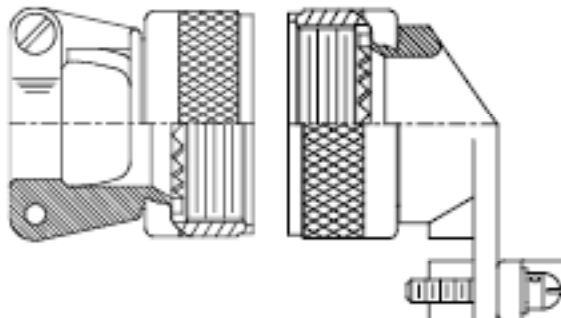


#### \*CABLE BACKSHELL

##### MIL-C-85049 CABLE BACKSHELL

MS BACKSHELL P/N

\*MS85049/xxxxxx\*\*

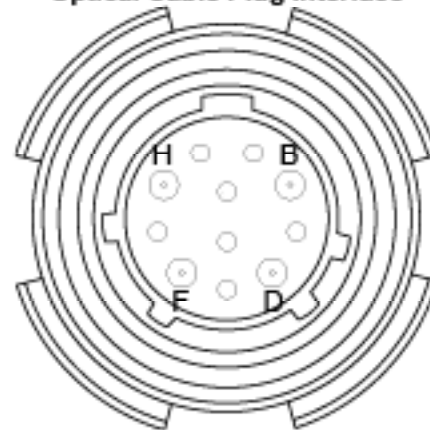


\*\*Straight or angled backshell - defined by application / mounting configuration

#### D38999 PLUG PORT FUNCTIONS

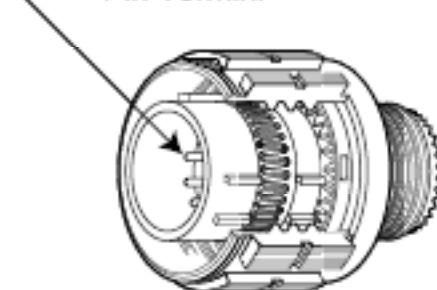
PORT NUMBER	TX	RX
0	H	F
1	B	D

TOP  
Optical Cable Plug Interface



Front face of the optical cable plug pin insert shown. Transceiver insert opposite.

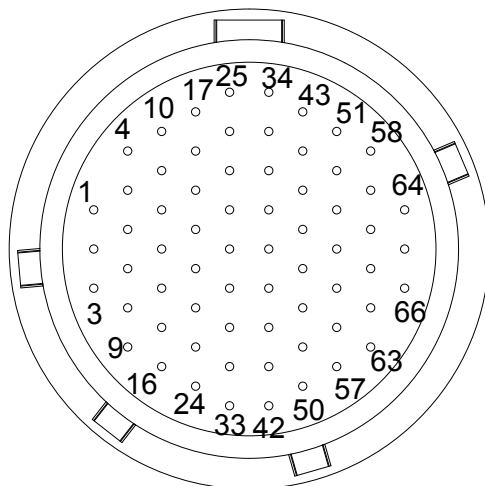
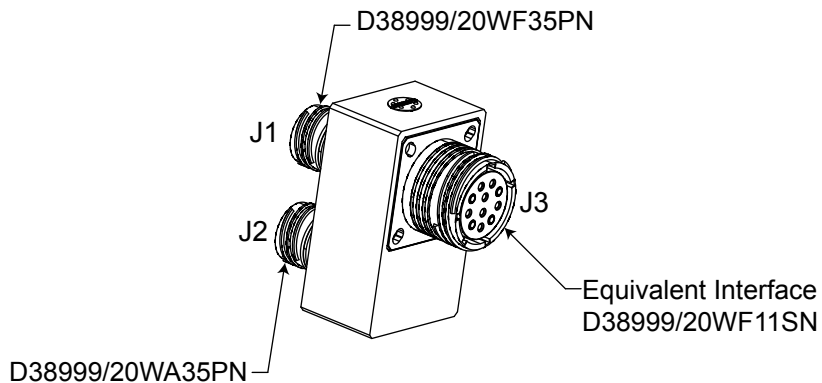
Pin Termini



Dual Port Mercury Series Mil-Dtl-38999, 1000Base-T to 1000Base-SX,  
Gigabit Ethernet Media Converter, Multimode, 28Vdc, 850nm VCSEL's

## APPENDIX A3

### Electrical Data Cable - Connector Wiring Schematic



#### J1 1000BASE-T ELECTRICAL PIN ASSIGNMENTS

PIN #	PORT #	FUNCTION	PIN #	PORT #	FUNCTION	RJ-45 EQ.
1	0	MX1+	64	1	MX1+	1
2	0	MX1-	65	1	MX1-	2
5	0	MX2+	59	1	MX2+	3
6	0	MX2-	60	1	MX2-	6
11	0	MX3+	52	1	MX3+	4
12	0	MX3-	53	1	MX3-	5
18	0	MX4+	44	1	MX4+	7
19	0	MX4-	45	1	MX4-	8



Dual Port Mercury Series Mil-Dtl-38999, 1000Base-T to 1000Base-SX,  
Gigabit Ethernet Media Converter, Multimode, 28Vdc, 850nm VCSEL's

## APPENDIX A4

### PART NUMBER OPTIONS

Dual Port, Gigabit Ethernet, 850nm

**M33R - 4 S A T - F X X**

Shell Configuration  
M33R= 38999 Receptacle

# Channels (TX+RX)  
4= 2TX + 2RX

Wavelength  
S= 850nm

Power Supply Voltage  
A= 28.0VDC

Fiber Optic Interface  
T = 1.25 Gbps

Shell Size Code  
F = 19 - 11

Shell Plating  
F = NI  
W = OD CD / NI  
Z = ZN / NI

Shell Polarization  
(leave blank) \_ = N  
A = A  
B = B  
C = C  
D = D

Other wavelength, mounting and port count options are available.  
Please consult the Protokraft website for alternate configurations.