050-362

PRODUCT BRIEF

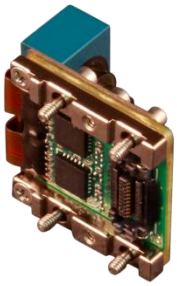
100 MBPS-5 GBPS
PRINTED CIRCUIT BOARD (PCB) MOUNT TRANSCEIVER
850NM VCSEL TRANSMITTER, PIN TIA RECEIVER
SMALL & COMPACT WITH RUGGED CONSTRUCTION FOR
HARSH ENVIRONMENTS INCLUDING RADIATION EXPOSURE

REV	DESCRIPTION	DATE	APPROVED
1	Preliminary	11/17/2016	SZ/GC
2	Edit Bag and Tag Labeling	12/13/2016	RAS/GC
3	Add Material/Finish Table and new Evalboard picture	03/10/2017	RAS/GC

BF16U2-7150

050-362 PRODUCT BRIEF
PCB Mount Transceiver
100 Mbps – 5 Gbps, MMF, 3.3V

Radiation-Tolerant PCB Mount Fiber Optic Transceiver, 100M-5Gbps, MMF, 3.3V



Glenair 050-362, is a ruggedized harsh environment PC Board Mount Transceiver designed for use in harsh environments that include high levels of gamma and neutron radiation. The transmitters utilize GaAs vertical cavity surface emitting laser (VCSEL) devices and SiGe/CMOS driver and control electronics. The receivers utilize a GaAs PIN photo-detector, a transimpedance amplifier, and a limiting amplifier Each have been tested and found to be tolerant of gamma and neutron radiation exposure to high levels. The electrical control circuitry does not employ a microprocessor. The mechanical design is suited to the harsh temperature and vibration environments found in the Aerospace, Military and Nuclear Industrial applications. The transceiver interfaces with the host PCB through a high speed surface-mount electrical connector.

The transmitter section includes the Transmitter Optical Subassembly (TOSA) and laser driver circuitry. The TOSA, containing an 850 nm VCSEL (Vertical Cavity Surface Emitting Laser) light source, is located at the optical interface and mates with the GC optical connector. The TOSA is driven by a laser driver, which converts differential logic signals into an analog laser diode drive current. This laser driver circuit regulates the optical power at a constant level provided the data pattern is DC balanced (for example 8B10B encoding).

The receiver section includes the Receiver Optical Subassembly (ROSA) and amplification/quantization circuitry. The ROSA, containing a PIN photodiode and trans-impedance preamplifier, is located at the optical interface and mates with the GC optical connector. The ROSA is mated to a limiting amplifier IC that provides post-amplification and quantization. Also included is a Loss Of Signal (LOS) detection circuit.

KEY FEATURES/BENEFITS

- SFP Compatible Electrical I/O signal levels
- 850nm VCSEL lasers to support up to 5 Gbps
- PIN PD to support high sensitivity up to 5 Gbps
- Industry standard CML input and outputs that make for simple integration on customer host PCB
- Glenair Rugged GC Optical connector
- High Operational Shock (650 g) & Vibration (54 g rms) – test reports available
- Transceiver is securely mounted with screws to PCB to ensure excellent shock and vibration performance
- High-Speed Electrical plug-in connector eliminates the need for soldering & enables ease of servicing
- Captive screws to simplify manufacturing logistics and assembly
- Small: Approx. 0.8” x 0.9” x 0.5”
- -40°C to +85°C Operating Case Temperature
  - Extended Temperature Range Option
- Glenair fiber jumpers available to connect from transceiver to any Glenair Mil/Aero Fiber Optic Connector Style
- Evaluation fixtures available
- Radiation exposure test without errors:
  - Gamma: >165 Krad
  - Neutron: 250 x 10^{10} /cm^2

APPLICATIONS

- Harsh Environment such as: Synchrotron Particle Detectors, Nuclear Generation, Medical or Processing Facilities and Equipment, Spacecraft, Shipboard
  - Ethernet, Fibrechannel, 1x, 2x, 4x, SFPDP

HOW TO ORDER **Table 1 Part Number Options**

Part Number	Description
050-362-1	100Mbps-2.5Gbps
050-362-2	2.5Gbps-5Gbps

Ratings and Specifications

TABLE 2 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Typ	Max	Units	Notes
Storage Temperature	Ts	-55		+100	°C	
Supply Voltage	V_{cc}	-0.4		3.8	V	VccT & VccR may not differ by more than 0.5V

TABLE 3 OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Units	Notes
Operating Temperature, Case	T_{op}	-40		+85	°C	Standard
Extended Operating Temperature, Case, Extended ET1	T_{op_ET1}	+85		100	°C	Note 1
Supply Voltage	V_{cc}	3.135	3.3	3.465	V	
Supply Current	Icc		180	200	mA	Typical @ +85°C
Power Supply Noise (Peak-Peak)	V_{cc_ripple}			100	mV_{p-p}	

TABLE 4 ELECTRO-OPTICAL CHARACTERISTICS – TRANSMITTER (T_{OP} UNLESS NOTED OTHERWISE)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Optical Output Power	P_{OUT}	-6.5	-5	-1	dBm	850nm VCSEL
Extinction Ratio, 1.25 Gbps – 2.5 Gbps	Er	7	10		dB	Exceeds OMA for GbE, 1FC, 2FC
Extinction Ratio, 2.5 Gbps - 4.25 Gbps	Er	6			dB	Exceeds OMA for 4FC
Optical Wavelength	λ_{OUT}	830	850	860	nm	
Spectral Width, rms	$\Delta\lambda$			0.85	nm	
Relative Intensity Noise	RIN			-117	dB/Hz	
Transmitter Differential Input Impedance	Zin		100		Ohms	AC coupled Internally
Differential Input Voltage	Vin_d	250		2200	mV_{p-p}	CML, 100 ohm

Ratings and Specifications (continued)

TABLE 5 ELECTRO-OPTICAL CHARACTERISTICS - RECEIVER

Parameter	Symbol	Min	Typ	Max	Units	Notes
050-362-1						
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-22.5	-19	dBm	PIN PD @ 1.25 Gbps
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-22.5		dBm	PIN PD @ 2.5 Gbps
050-362-2						
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-18.5		dBm	PIN PD @ 3.2 Gbps
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-18		dBm	PIN PD @ 4.25Gbps
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-17.5	-16	dBm	PIN PD @ 5 Gbps
Overload, BER 10^{-12}, PRBS 2^7-1	P_{IN}	-1			dBm	@1.25Gbps or @ 5 Gbps
Optical Wavelength	λ_{IN}	770		870	nm	
Receiver Differential Output Impedance	Zout		100		Ohms	AC coupled internally
Differential Output Voltage Swing	Vout_d	600		1200	mV_{p-p}	CML, 100 ohm
LOS Assert Level	LOS		-24	-22	dBm	@ 1.25Gbps
LOS Hysteresis	LOS_{HYS}	1.25	2.3		dB	@ 1.25Gbps

TABLE 6 COMPLIANCE SPECIFICATIONS

CHARACTERISTIC	Standard	Condition	Notes
Mechanical Shock	MIL-STD-810	Para. 516.6, proc. I, 650g	0.9 ms operating
Mechanical Vibration	MIL-STD-810	Para. 514.6, 40g rms	Random, operating
ESD	MIL-STD-883		500V HBM
Flame Resistance	MIL-STD-1344	Method 1012, Cond. B	30 seconds
Damp Heat	MIL-STD-1344	Method 1002.2, Cond. B	10 cycles , 24 hours
Eye Safety	CDRH and IEC-825	Class 1 Laser Product	

TABLE 7 MATERIAL/FINISH

Item	Material/Finish
PCB	FR4
PCB flex	FR4 & Polyimide
Railings	Aluminum 6061-T6 per ASTM-B221/B211M or Equivalent
Screws	CRES Type, 302, 303, 304, 305, or 316
Optical Ferrules & Sleeves	Zirconia, Ceramic
Solder type	RoHS compliant Sn95/Sb5 (232°C melting temp) & RoHS compliant Sn96.5/Ag3.0/Cu0.5 (217° melting)

FIGURE 1 - OUTLINE DRAWING CONTINUED (MARKING)

LABELING:

Each unit will be shipped in an antistatic bag. The label on the antistatic bag shall be at a minimum Arial size 10 black font and contain at a minimum the following information:

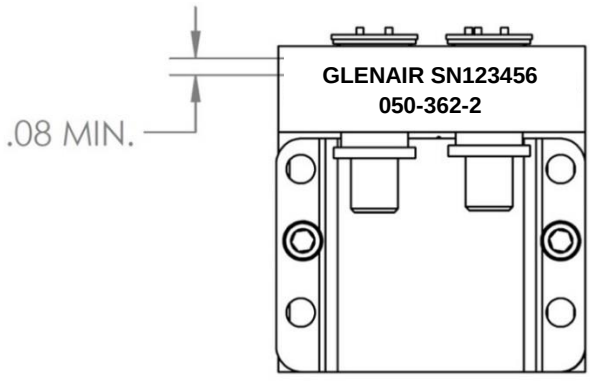
ANTISTATIC BAG LABEL:
Glenair
Cage Code: 06324
PN: 050-362-X
Rev: X
QTY: X
J/N: X
D/C:X
S/N*: XXXXXX
*If QTY is more than 1, there is no S/N

Each unit will be marked, either with a label or laser engraving, as follows:

- Marking font to be Arial, greater than .08 inches in height.
- Marking:
  FIRST LINE OF TEXT
  - Glenair
  - Serial Number (6 digits)

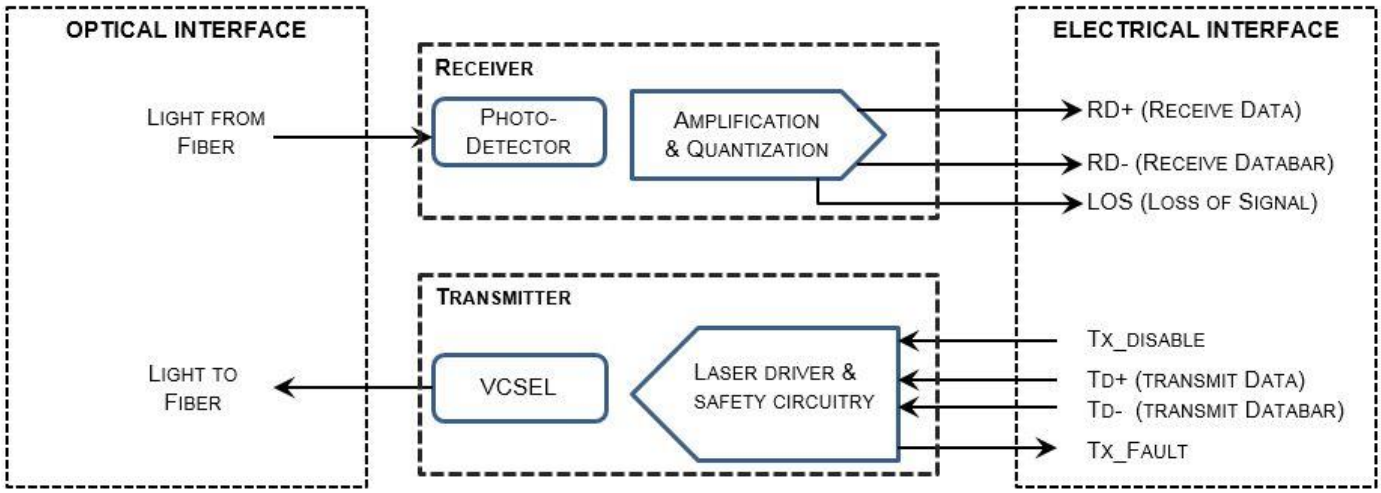
  SECOND LINE OF TEXT:
  - Part number

Example



FUNCTIONAL DESCRIPTION

Figure 2 PCB mount Transceiver Block Diagram



TRANSMITTER SECTION

Transmit Disable (TX_Disable, pin 10)

The transmitter section of the transceiver accepts a TTL and CMOS compatible transmit disable control signal input that shuts down the transmitter optical output. A high signal disables the transmitter while a low signal allows normal transceiver operation. Also laser is disabled when TX_Disable is open. In the event of a fault (e.g. eye safety circuit activated), cycling this control signal resets the module. Host systems should allow a 10ms interval between successive assertions of this control signal.

Transmit Fault (TX_Fault, Pin 2)

A catastrophic laser fault will activate the transmitter signal, TX_FAULT, and disable the laser. This signal is an open collector output (pull-up required on the host board). A low signal indicates normal laser operation and a high signal indicates a fault. The TX_FAULT will be latched high when a laser fault occurs and is cleared by toggling the TX_DISABLE input or cycling the power of the transceiver.

Eye Safety Circuit

The Transmitter section provides Class 1 eye safety by design and is compliant with US FDA CDRH AEL Class 1 and EN(IEC) 60825-1,2, EN60950 Class 1. The eye safety circuit continuously monitors optical output power levels and will disable the transmitter and assert a TX_FAULT signal upon detecting an unsafe condition. Such unsafe conditions can be created by inputs from the host board (Vcc fluctuation, unbalanced code) or faults within the module.

RECEIVER SECTION

Receiver Loss of Signal (LOS, Pin 20)

The Loss Of Signal (LOS) output indicates an unusable optical input power level. The post-amplification IC includes transition detection circuitry which monitors the ac level of incoming optical signals and provides a TTL/CMOS compatible status signal to the host. A low LOS logic level indicates the presence of an optical input while a high LOS logic level indicates an unusable optical input. The LOS thresholds are factory-set so that a high output indicates a definite optical fault has occurred (e.g. failed transmitter, broken or disconnected fiber connection to the transceiver, etc.).

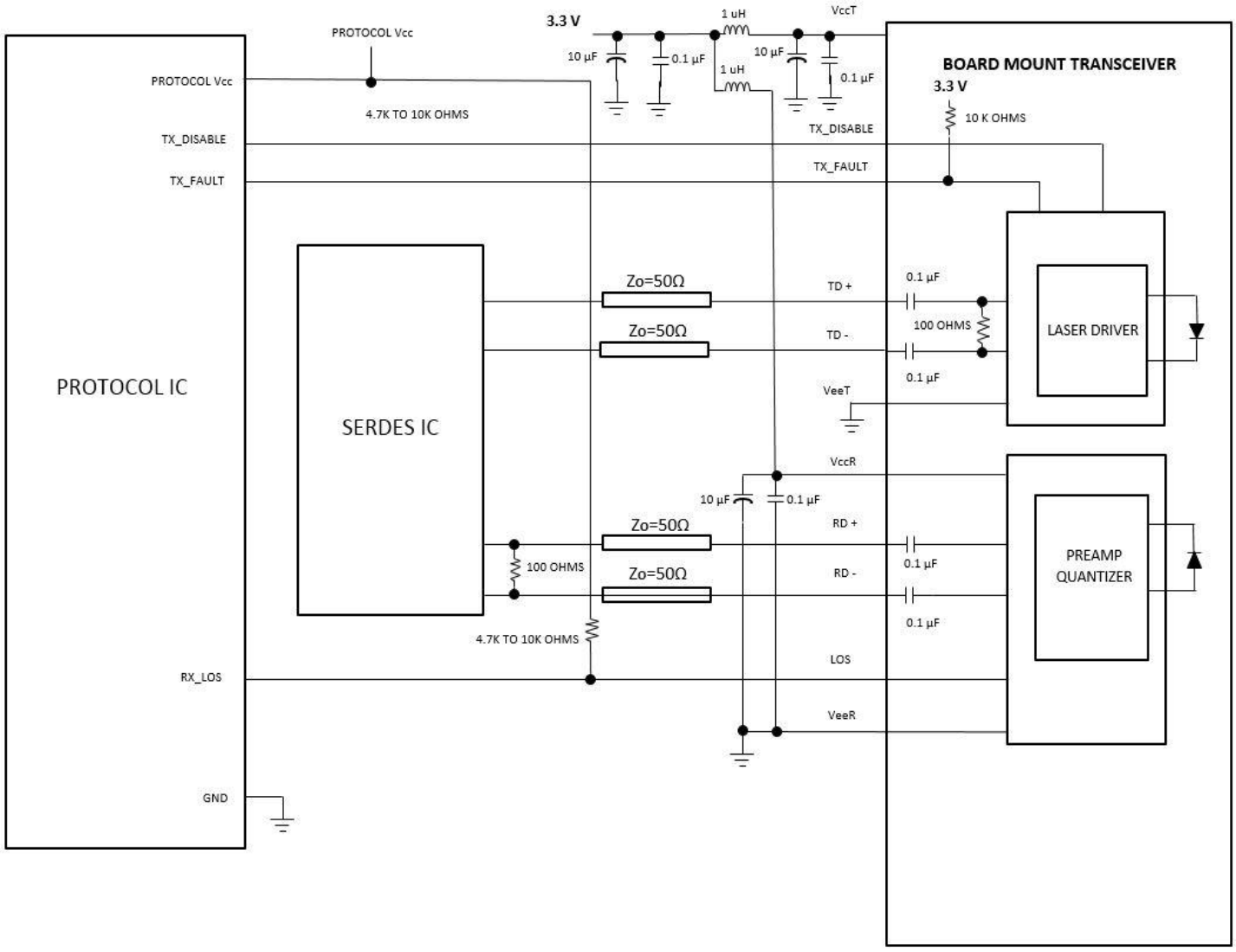
FUNCTIONAL I/O

The PCB Mount Transceiver accepts industry standard differential signals such as LVPECL and CML within the scope of the SFP MSA. To simplify board requirements, transmitter bias resistors and ac coupling capacitors are incorporated, per SFF-8074i, and hence are not required on the host board. The module is AC-coupled and internally terminated.

Figure 3 illustrates a recommended interface circuit to link the PCB Mount Transceiver to the supporting Physical Layer integrated circuits.

The PCB Mount Transceiver interfaces with the host circuit board through twenty I/O pins identified by function in Table 8. The transceiver high speed transmit and receive interfaces requires SFP MSA compliant signal lines on the host board. The TX_Disable, TX_Fault, and RX_LOS lines require TTL lines on the host board (per SFF-8074i) if used. If an application chooses not to take advantage of the functionality of these pins, TX_Disable need to be tied to GND, TX_Fault and RX_LOS do not need to be connected.

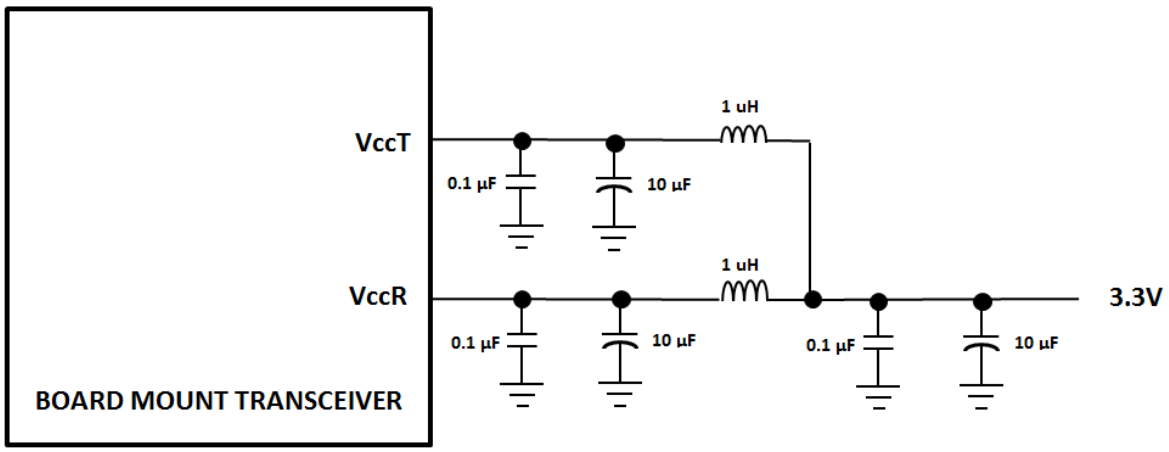
FIGURE 3 RECOMMENDED PCB MOUNT TRANSCEIVER HOST BOARD SCHEMATIC



Required Host Board Components

A power supply noise rejection filter is required on the host PCB to meet data sheet performance. This is filter incorporates an inductor which should be rated to 400 mADC and 1 Ω series resistance or better. It should not be replaced with a ferrite. The required filter is illustrated in Figure 4. Also, the host PCB for the PCB Mount Transceiver requires 4.7 K to 10 KΩ pull-up resistors for TX_FAULT and LOS lines.

FIGURE 4 RECOMMENDED HOST BOARD POWER SUPPLY FILTERING CIRCUIT



Fiber Compatibility

The transceiver is capable of transmission at 2 to 550 meters with 50/125 µm fiber, and at 2 to 275 meters with 62.5 125 µm fiber, for 1.25 GBd Ethernet. It is capable of transmission up to 550m with 50/125 µm fiber and up to 300m with 62.5/125 µm fiber, for 1.0625 GBd Fiber Channel.

Electrostatic Discharge (ESD)

The Transceiver is compatible with ESD levels found in typical manufacturing and operating environments as described JEDEC EIA JESD22-A114, Class 1C (<2000Volts) HBM. Glenair recommends that devices are handled with ESD precautions to limit exposure to below 500V HBM.

There are two design cases in which immunity to ESD damage is important. The first case is during handling of the transceiver prior to insertion to the host board. To protect the transceiver, it's important to use standard industry ESD handling precautions. These precautions include using grounded wrist straps, work benches, and floor mats in ESD controlled areas. The ESD sensitivity of the Glenair PCB Mount Transceiver is compatible with typical industry production environments.

The second case to consider is static discharges to the exterior of the host equipment after installation, in which case the transceiver may be subject to system-level ESD requirements.

Application Support

To assist in the transceiver design and evaluation process, Glenair offers the following aids:

- Evaluation board & Product Manual, part number 050-329, which facilitates in the testing of the PCB Mount Transceiver.
- 3D Step file to support modeling of mechanical fit and routing
- PADS schematic and PCB layout library files that can be exported into customer's PCB software design program
- Applications Aid Example of PCB layout including details of high speed transmission designs

Customer Manufacturing Processes

This module is mounted with screws and interfaces with a high-speed low cost surface mount electrical connector residing on the host PC board. The PCB Mount Transceiver is not designed for aqueous wash, IR reflow, or wave soldering processes and should be mounted on the host board after host PC board has been through these processes.

Proper torque values for mounting screws must be observed. Please contact Glenair for hardware mounting process recommendations.

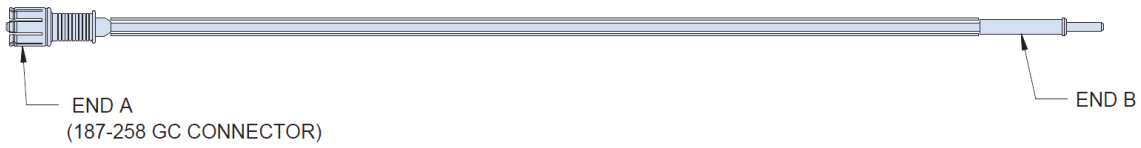
ACCESSORIES

Fiber Optic Jumper Cables to support connection to Mil/Aerospace Connectors

KEY FEATURES:

- Jumper cable between Glenair Transceiver (end A) and Mil/Aero Connector termini (End B)
- Offered with either Multimode or Single Mode fibers

FIGURE 5
Fiber Optic Jumper Cable Assembly (see separate Glenair sales drawing FA02454 for details)



PCB Threaded Inserts, PN 059-0007

KEY FEATURES

- Simplifies installation of PCB Mount Transceivers eliminating the need for washers and nuts
- Existing Options to support PCB thickness from 0.03” to 0.92”
- Can support thicker PCB if required

EVALUATION Boards, PN 050-329 Include

- Manual with test block diagram, schematic and Evaluation board PCBA
- Multiple types of PCB Mount Transceiver modules supported by this evaluation board
- 2 fiber optic cables