



**NOTE**

All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters [and inches]. Unless otherwise specified, dimensions have a tolerance of  $\pm 0.13$  [ $\pm 0.005$ ] and angles have a tolerance of  $\pm 2^\circ$ . Figures and illustrations are for identification only and are not drawn to scale.

**1. INTRODUCTION**

This specification covers the requirements for application of Gigabit Ethernet (GbE)+ power sealed single insert module in cable-to-cable applications and printed circuit (pc) board applications for mounting to a panel.

For cable-to-cable applications, the insert module is available with or without size 24 data and size 22 and size 16 crimp-type power pin contacts or socket contacts. The insert module must be installed into a keyed plug or extended receptacle connector shell. A backshell is available that can be installed onto the connector shell for electromagnetic interference (EMI) shielding and cable strain relief.

For pc board applications, pin receptacle connector and socket receptacle connector are available that each has an insert module containing solder-type right-angle size 24 data and size 22 and size 16 power pin contacts or socket contacts pre-assembled to a keyed short receptacle connector shell. A tail organizer keeps the contacts in place for proper placement on the pc board. The receptacle connector is ready for placing on a pc board and mounting to a panel.

When corresponding with personnel, use the terminology provided in this specification to facilitate inquiries for information. Basic terms and features of this product are provided in Figure 1.

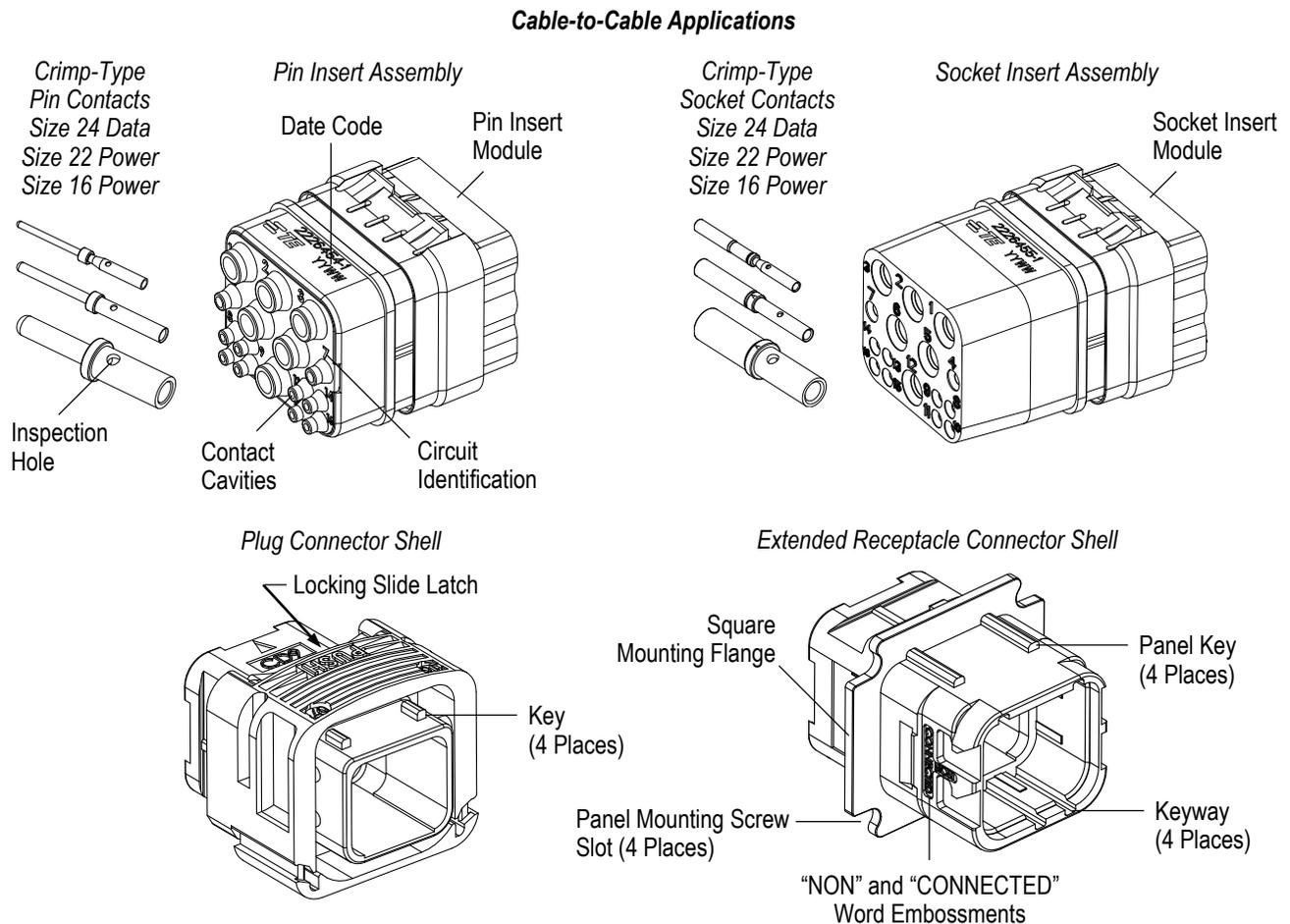
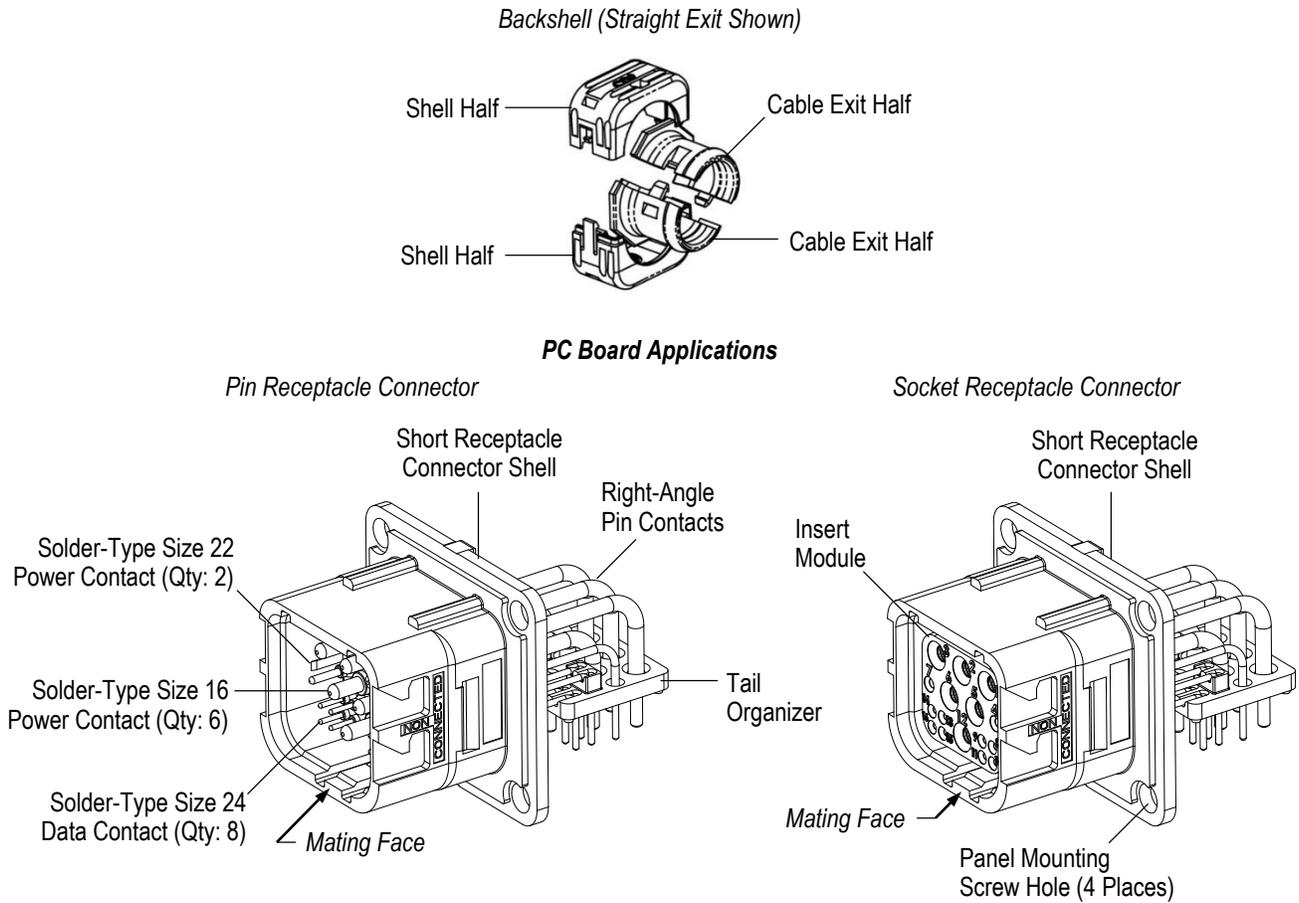


Figure 1 (Cont'd)



*Figure 1 (End)*

The insert assembly has contact cavities each marked for circuit identification. Each contact cavity has a retention clip that locks onto the shoulder of the contact to provide retention when installed into the insert module. Each crimp-type contact features an inspection hole that provides a visual indicator to check for proper placement of the wire in the contact. The diameter of each data pin contact is 0.51 [.020].

The receptacle connector shell is available in extended (for cable-to-cable applications) and short (for pc board applications). Each shell has 4 panel mounting screw slots or holes that accept customer-supplied screws, a square mounting flange for rear panel mounting, and panel keys for proper orientation in the panel. To assist in proper alignment and mating, the connector shells have matching keys and keyways. To prevent accidental mis-mating, alternate key and keyway configurations are available. The words “NON” and “CONNECTED” are embossed on the receptacle connector shell to indicate full mating of the insert modules. The plug connector shell features a locking slide latch designed to hold the mated connectors together.

The backshell consists of 2 shell halves and 2 cable exit halves. For cable exit options, contact PRODUCT INFORMATION at the number at the bottom of page 1.

## 2. REFERENCE MATERIAL

### 2.1. Revision Summary

Initial release of application specification

## 2.2. Customer Assistance

Reference Product Base Part Number 2226454 and Product Code L081 are representative of Gigabit Ethernet (GbE)+ power sealed single insert modules. Use of these numbers will identify the product line and help you to obtain product and tooling information. Such information can be obtained through a local Representative, by visiting our website at [www.te.com](http://www.te.com), or by calling PRODUCT INFORMATION or the TOOLING ASSISTANCE CENTER at the numbers at the bottom of page 1.

## 2.3. Drawings

Customer Drawings for product part numbers are available from the service network. If there is a conflict between the information contained in the Customer Drawings and this specification or with any other technical documentation supplied, the information contained in the Customer Drawings takes priority.

## 2.4. Manuals

Manual [402-40](#) can be used as a guide to soldering. This manual provides information on various flux types and characteristics with the commercial designation, flux removal procedures, and a guide for information on soldering problems.

## 2.5. Specifications and Standards

Product Specification [108-32082](#) provides product performance and test information for pc board connectors.

Military Specification Sheets (MIL-Specs)-Aerospace Standards (AS) managed by SAE International (SAE) provide definition of products. Standards available which pertain to this product are:

SAE AS 39029/57, "Contacts, Electrical Connectors, Socket Crimp Removable (for MIL-DTL-24308, MIL-DTL-38999 Series II, MIL-DTL-55302/68, /71, /72, /75 and MIL-DTL-83733 Connectors)"

Crimp-type power contact size 22: BIN Code 354

Crimp-type power contact size 16: BIN Code 358

SAE AS 39029/58, "Contacts, Electrical Connector, Pin, Crimp Removable (for MIL-DTL-24308, MIL-DTL-38999 Series I, II, III, and IV, and MIL-DTL-55302/69 and MIL-DTL-83733 Connectors)"

Crimp-type power contact size 22: BIN Code 360

Crimp-type power contact size 16: BIN Code 364

The cable-to-cable insert modules meet the standards of ARINC 800 and EN 4165 series specifications.

## 2.6. Instructional Material

User manuals provide product assembly instructions and tooling setup and operation procedures. Instructional material available that pertains to this product is:

[DMC-MD Series Normes EN 4165 Standard](#)

## 3. REQUIREMENTS

### 3.1. Safety

Do not stack product shipping containers so high that the containers buckle or deform.

### 3.2. Storage

#### A. Ultraviolet Light

Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the product material.

#### B. Shelf Life

Product should remain in the shipping containers until ready for use to prevent deformation to components. Product should be used on a first in, first out basis to avoid storage contamination that could adversely affect performance.

### C. Chemical Exposure

Do not store product near any chemical listed below as they may cause stress corrosion cracking in the material.

Alkalies	Ammonia	Citrates	Phosphates	Citrates	Sulfur Compounds
Amines	Carbonates	Nitrites	Sulfur Nitrites		Tartrates

### 3.3. Cable Selection and Preparation

The data contacts accept multi-conductor stranded or solid cable having wire sizes 26 or 24 AWG. The power contacts accept multi-conductor stranded cable having wire sizes 22 or 16 AWG.

The cable must be prepared according to the following:

#### A. Multi-Conductor Cable Preparation

1. The cable outer jacket must be stripped to the dimension given in Figure 2, Detail A.
2. The cable shield must be folded back over the outer jacket. See Figure 2, Detail A.
3. The quad shield must be stripped from each wire to the dimension given in Figure 2, Detail B.
4. Each data wire and power wire must be stripped to within the dimensions given in Figure 2, Detail C.



**CAUTION**

*When stripping wire, care must be taken to avoid scraping, nicking, or cutting any part of the wire. Care must also be used when handling the wire during stripping to prevent cracking or breaking of the conductor and insulation.*

#### B. Discrete Cable Preparation

1. The quad shield must be stripped from each wire to the dimension given in Figure 2, Detail B.
2. Each data wire and power wire must be stripped to within the dimensions given in Figure 2, Detail C.



**CAUTION**

*When stripping wire, care must be taken to avoid scraping, nicking, or cutting any part of the wire. Care must also be used when handling the wire during stripping to prevent cracking or breaking of the conductor and insulation.*

### 3.4. Termination

A data contact must be crimped onto each data wire, and a power contact must be crimped onto each remaining power wire. See Figure 2, Detail D.

Each crimped contact must meet the following requirements:

- the wire is not be damaged in any way
- wire is visible in the inspection hole of the contact
- there is no gap between the contact and the cable jacket
- the crimp height meets the requirements specified in the instructions included with the crimp tooling



**NOTE**

*All contacts must be crimped using the tooling and tool settings specified in Section 5, TOOLING.*

### 3.5. Assembly for Cable-to-Cable Application

The following requirements apply to both pin and socket contacts for cable-to-cable application.

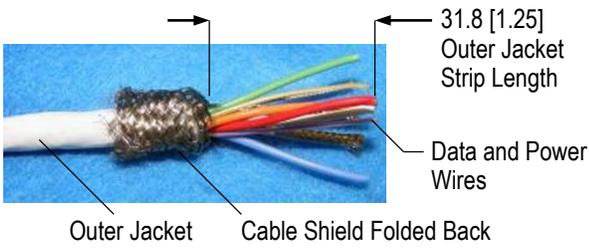
#### A. Contact Insertion

Each data and power contact must be inserted into the appropriate contact cavity from the wire end of the insert module until the retention clip is secured behind the locking shoulder of the contact. The contact cavity (row and circuit identification) for each contact and recommended order of insertion is given in Figure 3.

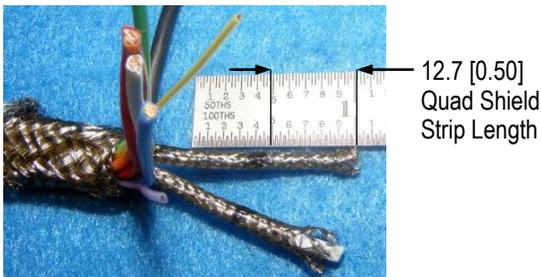
**Cable Stripping and Preparation and Termination**

Note: Note to Scale

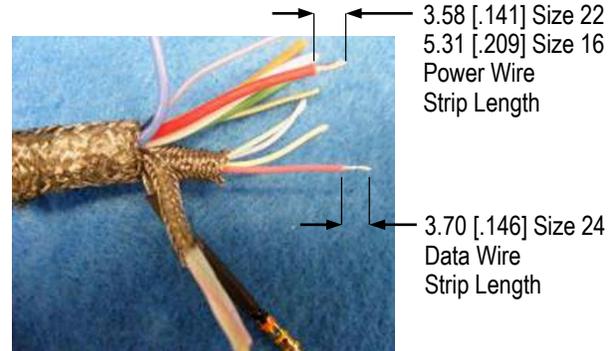
**Detail A (Multi-Conductor Cable)**



**Detail B (Multi-Conductor Cable and Discrete Wire)**



**Detail C (Multi-Conductor Cable and Discrete Wire)**



**Detail D (Multi-Conductor Cable)**

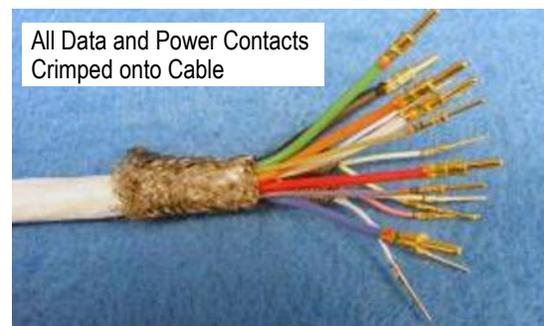
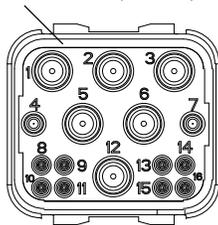


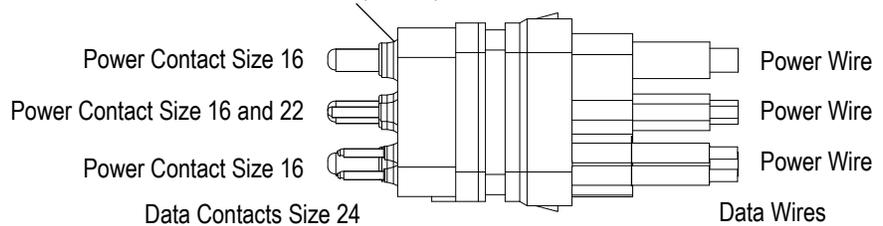
Figure 2

**Contact Insertion**

Front of Pin Insert Module (Shown)



Front of Pin Insert Module (Shown)

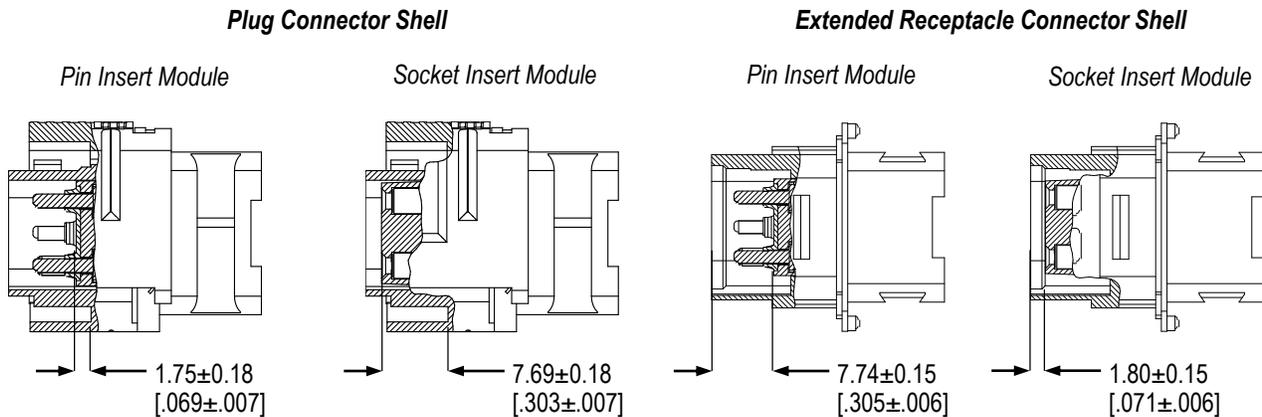


CONTACT			INSERT MODULE	
ORDER OF INSERTION	TYPE	SIZE	CIRCUIT IDENTIFICATION	ROW
1	Power	16	12	Bottom
2	Data	24	8, 9, 10, 11 and 13, 14, 15, 16	Bottom
3	Power	16	5, 6	Center
4		22	4, 7	Center
5		16	1, 2, 3	Top

Figure 3

## B. Insert Module

The insert module (with contacts inserted) must be fitted into the plug or extended receptacle connector shell within the dimensions given in Figure 4.



**Note:** The insert modules shown are examples and do not depict GbE+ power insert modules with power and data contacts.

Figure 4

## C. EMI Shielding and Cable Strain Relief

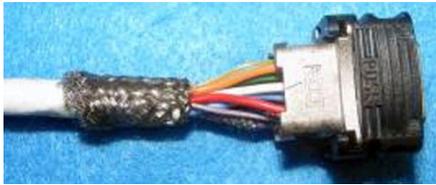
For applications requiring EMI shielding and cable strain relief, a backshell should be installed onto the connector shell so that the following requirements are met:

- For multi-conductor cable, the cable braid and wire insulation are inside of the cable exit halves of the backshell. See Figure 5, Detail A. For discrete wire, the cable braid and wire insulation are inside of the cable exit halves of the backshell by no less than the dimension given in Figure 5, Detail A.
- The cable exit halves of the backshell are fully mated with no gap in the seam. See Figure 5, Detail B.
- All cable shields are folded over the cable exit halves and compressed by a micro-band. See Figure 5, Detail C.
- The shell halves of the backshell are fully mated with no gap in the seam. See Figure 5, Detail C.

**EMI Shielding and Cable Strain Relief**

**Multi-Conductor Cable with Straight Backshell (Ref)**

**Detail A**



**Detail B**

Cable Exit Halves of Backshell Fully Mated with No Gap in Seam



**Detail C**

Shell Halves of Backshell Fully Mated with No Gap in Seam



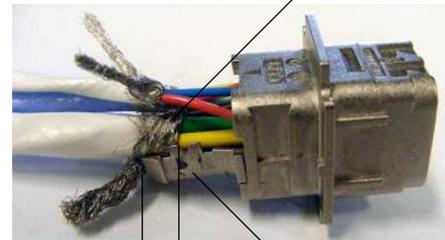
All Cable Shields Folded Over Cable Exit Halves

Micro-Band Compressing Cable Shield

**Discrete Wire with Straight Backshell (Ref)**

**Detail A**

Cable Braid and Wire Insulation



6.35 [.25]

Cable Exit Half of Backshell

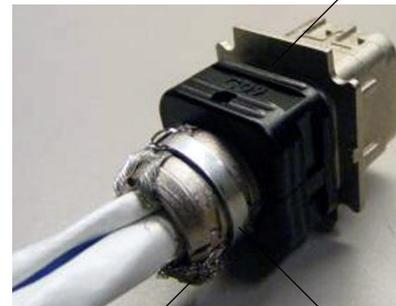
**Detail B**

Cable Exit Halves of Backshell Fully Mated with No Gap in Seam



**Detail C**

Shell Halves of Backshell Fully Mated with No Gap in Seam



All Cable Shields Folded Over Cable Exit Halves

Micro-Band Compressing Cable Shield

Figure 5

**3.6. PC Board**

**A. Material and Thickness**

The pc board material shall be glass epoxy (FR-4 or G-10 or equivalent). Contact PRODUCT INFORMATION at the number at the bottom of page 1 for thicknesses and suitability of other materials.

**B. Tolerance**

Maximum allowable bow of the pc board shall be 0.03 [.001] over the length of the insert module.

### C. Layout

The holes in the pc board must be precisely located to ensure proper placement and optimum performance of the insert module. The layout must be designed using the dimensions provided on the customer drawing for the specific receptacle connector. A reference sample of the recommended pc board layout is given in Figure 6.

**Reference Sample PC Board Layout**

**Note:** Not to Scale  
Dimensions are in millimeters.

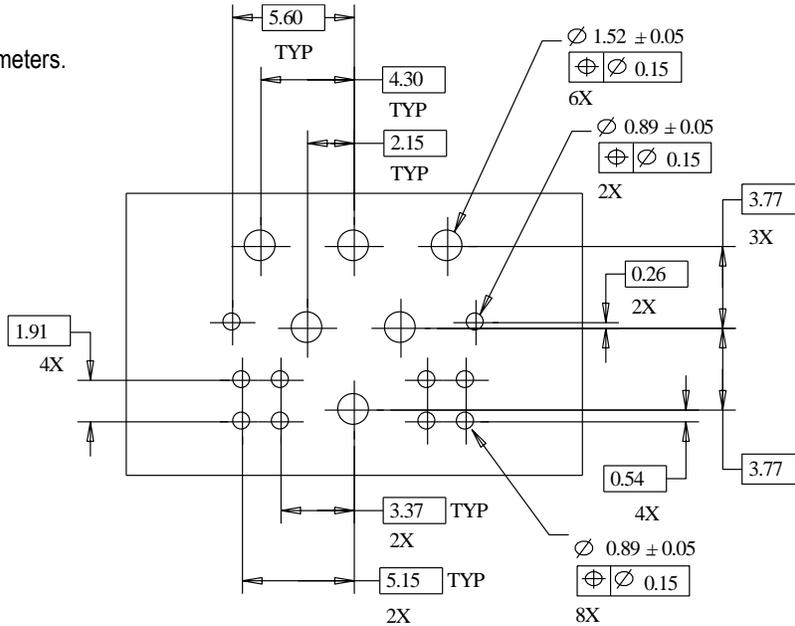
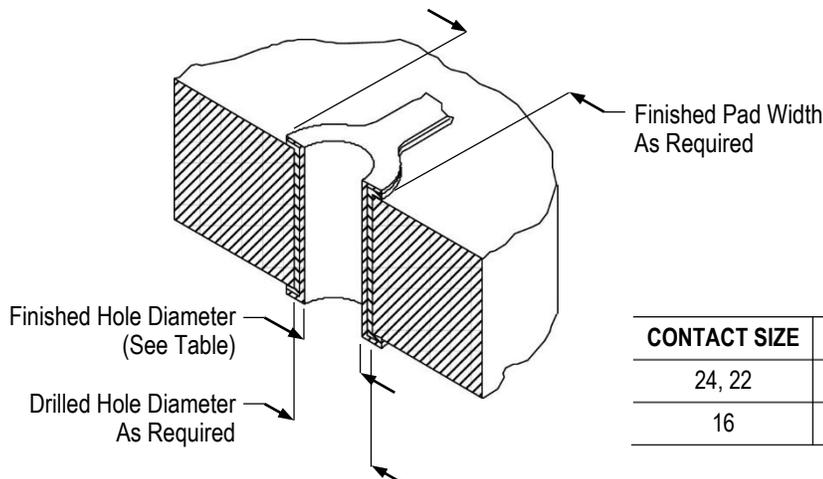


Figure 6

### D. Holes

The pc board holes must be plated through. The drilled hole size and plating types and thicknesses are dependent on customer requirements. The finished hole size must be as stated to provide unrestricted insertion and ensure adequate application of the solder to the solder tails. See Figure 7.



CONTACT SIZE	FINISHED HOLE DIAMETER
24, 22	0.89±0.05 [.035±.002]
16	1.52±0.05 [.060±.002]

Figure 7

### 3.7. Soldering

#### A. Flux Selection

Contact solder tails must be fluxed prior to soldering with a mildly active flux. Selection of the flux will depend on the type of pc board and other components mounted on the board. Additionally, the flux must be compatible with the wave solder line, manufacturing, health, and safety requirements.

#### B. Process

These insert modules can be soldered using wave or equivalent soldering techniques. The temperatures and exposure time shall be within the ranges specified in Figure 8.

SOLDERING PROCESS	TEMPERATURE	TIME (At Max Temperature)
Wave	260°C [500°F] (Wave Temperature)	5 Seconds

Figure 8

#### C. Cleaning

After soldering, removal of fluxes, residues, and activators is necessary. Consult with the supplier of the solder and flux for recommended cleaning solvents. Cleaners must be free of dissolved flux and other contaminants. It is recommended cleaning with the pc board on its edge. If using an aqueous cleaner, standard equipment such as a soak-tank or an automatic in-line machine should be used. A list of common cleaning solvents with time and temperature that will not affect the insert modules is specified in Figure 9.

CLEANER		TIME (Minutes)	TEMPERATURE (Max)
NAME	TYPE		
ALPHA 2110	Aqueous	1	132°C [270°F]
BIOACT EC-7	Solvent	5	100°C [212°F]
Butyl CARBITOL	Solvent	1	Ambient Room
Isopropyl Alcohol	Solvent	5	100°C [212°F]
KESTER 5778	Aqueous		
KESTER 5779	Aqueous		
LONCOTERGE 520	Aqueous		
LONCOTERGE 530	Aqueous		
Terpene	Solvent		

Figure 9



#### NOTE

For cleaning solvents not listed, contact *PRODUCT INFORMATION* at the number at the bottom of page 1.



#### CAUTION

Consideration must be given to toxicity and other safety requirements recommended by the solvent manufacturer. Refer to the manufacturer's material safety data sheet (MSDS) for characteristics and handling of cleaners. Trichloroethylene and methylene chloride is not recommended because of harmful occupational and environmental effects. Both are carcinogenic (cancer-causing).

#### D. Drying

When drying clean assemblies and pc boards, temperature limitations must not be exceeded: 100° through 175°C [212° through 347°F] for a period of 5 minutes. Temperature outside the allowable limitations may cause insert module degradation. Values may vary with different types of automatic cleaning equipment (follow equipment manufacturer's recommendation).

ALPHA, BIOACT, CARBITOL, LONCOTERGE, and KESTER are trademarks of their respective owners.

### 3.8. Panel

#### A. Cutout

The panel must be cut using the dimensions given on the customer drawing for the specific connector shell or receptacle connector according to keying. Sample recommended panel cutouts are given in Figure 10.

#### Sample Recommended Panel Cutout

**Note:** Not to Scale

Dimensions are in millimeters.

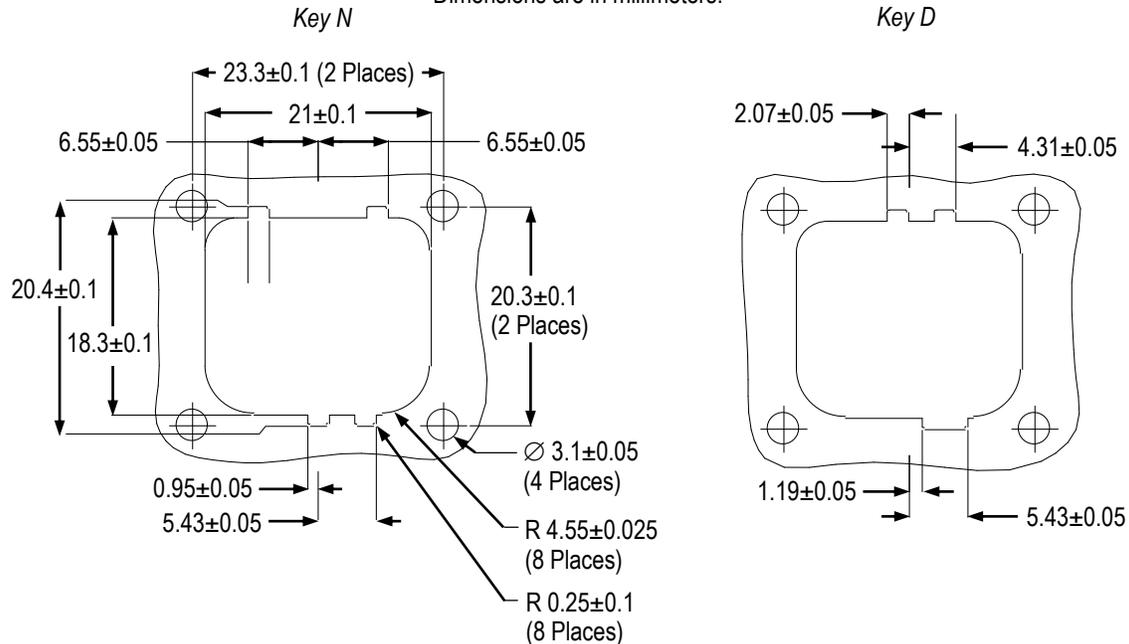


Figure 10

#### B. Mounting

The connector shells are designed for rear-panel mounting only. The panel keys of the connector shell must match the cutouts in the panel. The connector shell must be secured to the panel using 4 customer-supplied screws that accommodate the four 3.1 [.122] diameter mounting holes or slots in the mounting flange. Each screw must be tightened per the manufacturer's recommendation.

### 3.9. Mating and Unmating

When mating the insert modules, the keys and keyways of the connector shells must be aligned, the locking slide latch must be pushed down, then the insert modules can be pushed together until the connector shells bottom. When the connector shells bottom, the insert modules are fully mated. Only the embossed word "CONNECTED" (located on the side of the receptacle connector shell) must be visible and the locking slide latch of the plug connector shell must be in the up position to prevent the connector shells from accidentally separating. Refer to Figure 11.

When unmating the insert modules, the locking slide latch of the plug connector shell must be pushed down, then the connector shells can be pulled apart.

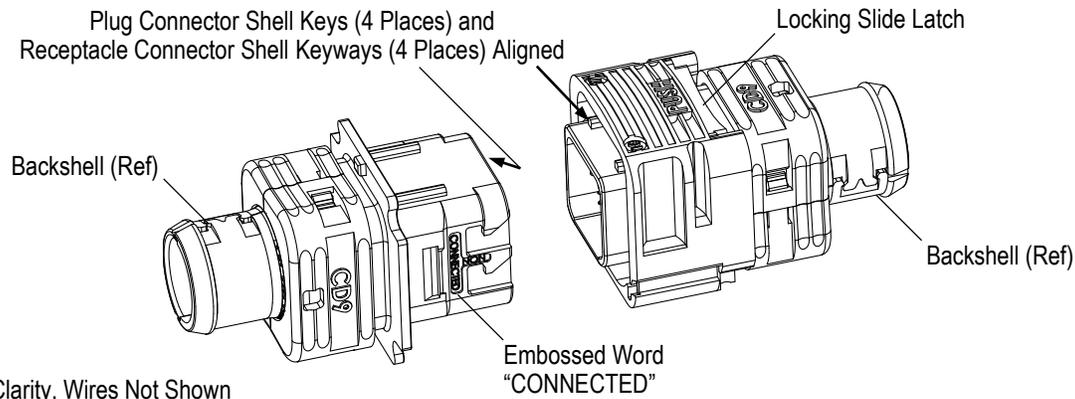


Figure 11

### 3.10. Removal and Replacement

Contacts can be removed from the insert module; however, they cannot be re-used by removing the wire. Defective or damaged components must not be used.

## 4. QUALIFICATION

No outside agency approval for Gigabit Ethernet (GbE)+ power sealed single insert modules was defined at the time of publication of this document.

## 5. TOOLING

Tooling part numbers and instructional material packaged with the tooling are given in Figure 12.

### 5.1. Crimp Tooling

A crimp tool frame and positioner are available from Daniels Manufacturing Corporation (DMC) for crimping the contacts.

### 5.2. Insertion Tool

The insertion tool (having a short handle or long handle) is designed to fully insert the insert module into the connector shell.

### 5.3. Extraction and Removal Tools

Removal tweezers are available from DMC that will remove a crimp-type power contact sizes 22 and 16.

The extraction tool (having a short handle or long handle) is designed to remove the insert module from the connector shell.

### 5.4. Insertion/Extraction Tool

The insertion/extraction tool is designed to fully insert or remove a size 24 crimp-type data contact.

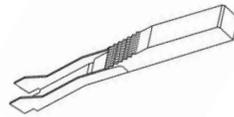
Positioner  
(See Table)



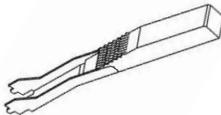
Crimp Tool Frame  
(See Table)

CONTACT		POSITIONER		CRIMP TOOL FRAME	
SIZE	TYPE	DMC	MIL	DMC	MIL
24	Pin	K1587	—	AFM8	M22520/2-01
	Socket	K1586	M22520/2-09		
22	Pin	K42	M22520/2-06		
	Socket	K41	M22520/2-06		
16	Pin	TH163	M22520/1-04	AF8	M22520/1-01
	Socket				

Refer to Paragraph 2.6  
for links to available  
instructional material.



Insertion Tool 057-0699-00 A (Long) or  
057-0699-00 B (Short) (for Insert Module)  
(DMC-MD Series Normes EN 4165 Standard)



Extraction Tool 057-0289-00 A (Long)  
or 057-0289-00 B (Short)  
(for Insert Module)  
(DMC-MD Series Normes  
EN 4165 Standard)



Removal Tweezer for Crimp-Type  
Power Contact (Size 22 and Size 16)  
(See Table)



Insertion/Extraction Tool 605837  
for Crimp-Type Data Contact (Size 24)

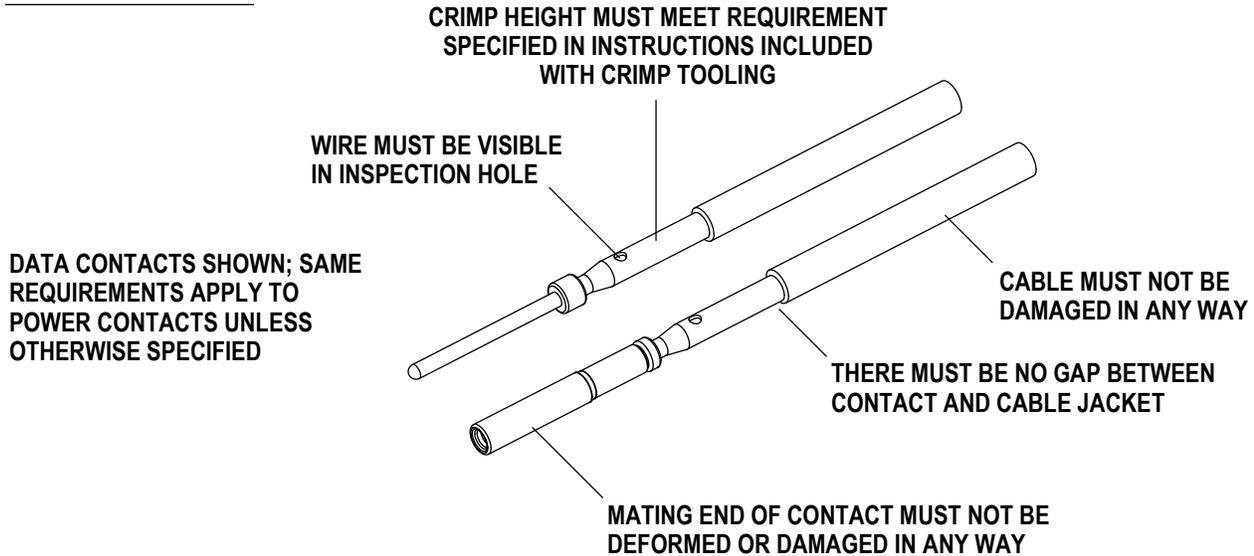
CONTACT SIZE	TE	MIL
22	DRK95-22MA	MIL M81969/8-02
16	DRK95-16B	MIL M81969/8-08

Figure 12

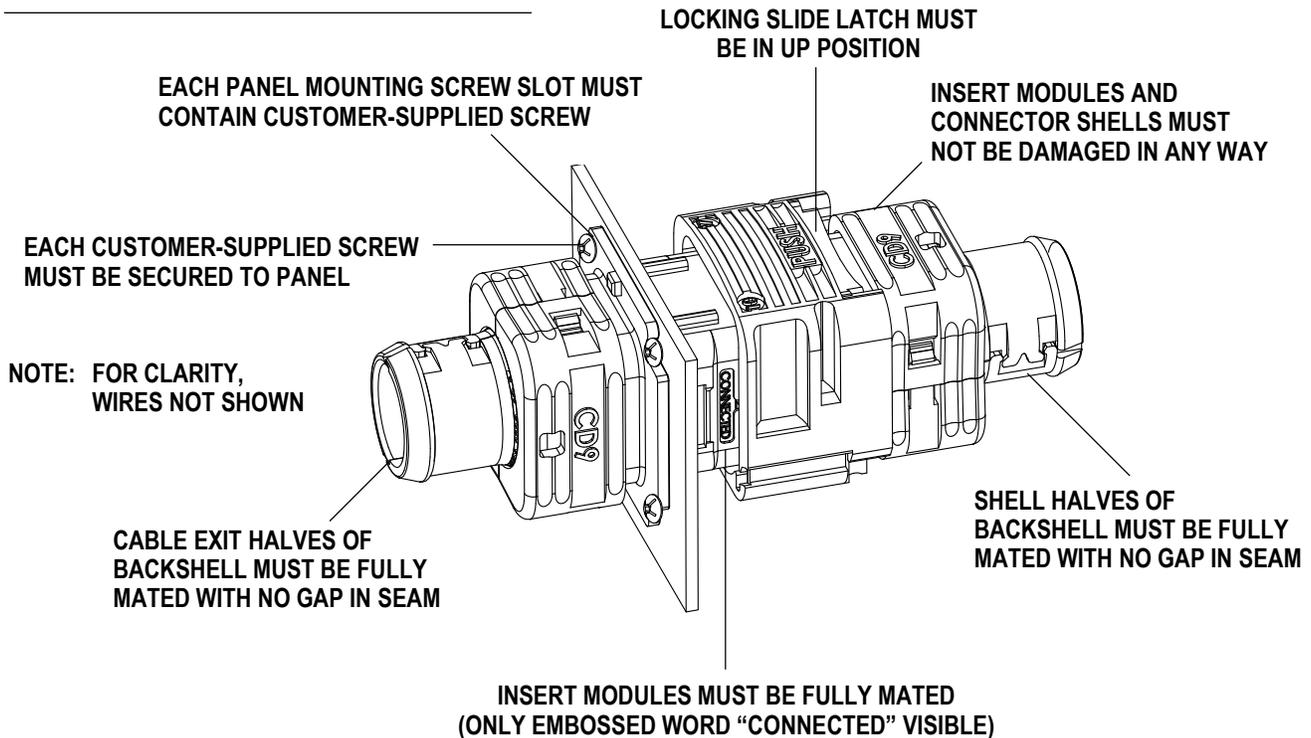
## 6. VISUAL AID

The illustration below shows a typical application of Gigabit Ethernet (GbE)+ power sealed single insert modules. This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

### CRIMPED CONTACTS

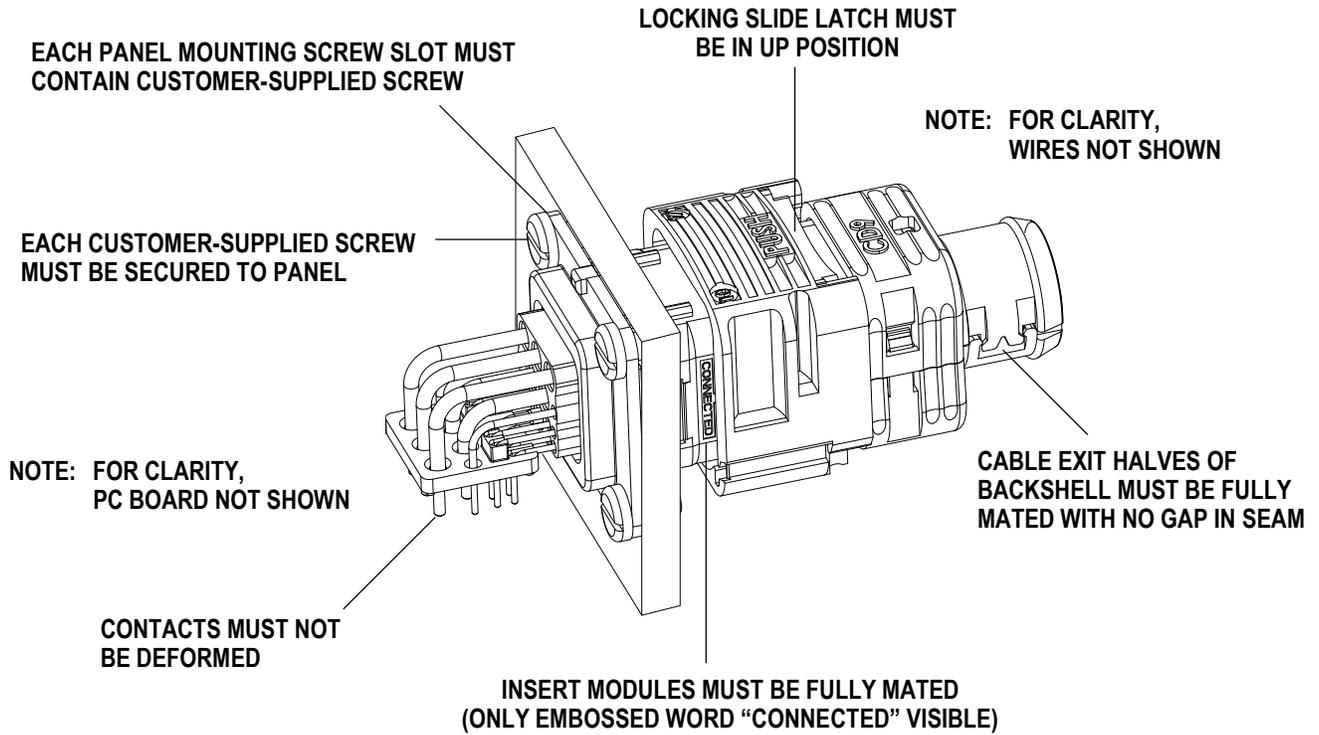


### CABLE-TO-CABLE PANEL-MOUNT APPLICATION



**FIGURE 13. VISUAL AID (CONT'D)**

**PC BOARD APPLICATION**



**FIGURE 13. VISUAL AID (END)**