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 ±0.13 [±.005] and angles have a tolerance of ±2°. 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 unsealed single insert module in cable-to-cable applications and printed circuit (pc) board applications for mounting to a panel.

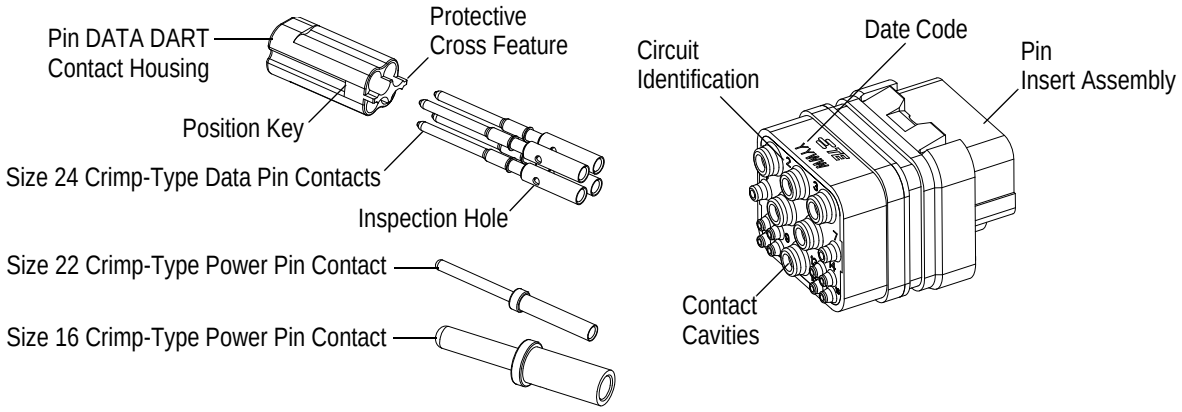
For cable-to-cable applications, the insert module is packaged as a kit containing a pin or socket insert assembly, keyed pin or socket DATA DART* contact housing, and size 24 crimp-type data contacts. The kit is available with or without sizes 22 and 16 power pin contacts and socket contacts. The insert module must be installed into a keyed plug or extended receptacle connector shell (available separately). 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 and socket mating receptacle connectors are available for the insert module. Each receptacle connector has an insert module containing non-removable solder-type pin or socket contacts pre-assembled to a keyed receptacle connector shell. 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 your inquiries for information. Basic terms and features of this product are provided in Figure 1.

Cable-to-Cable Applications

Pin Insert Module Kit



Socket Insert Module Kit

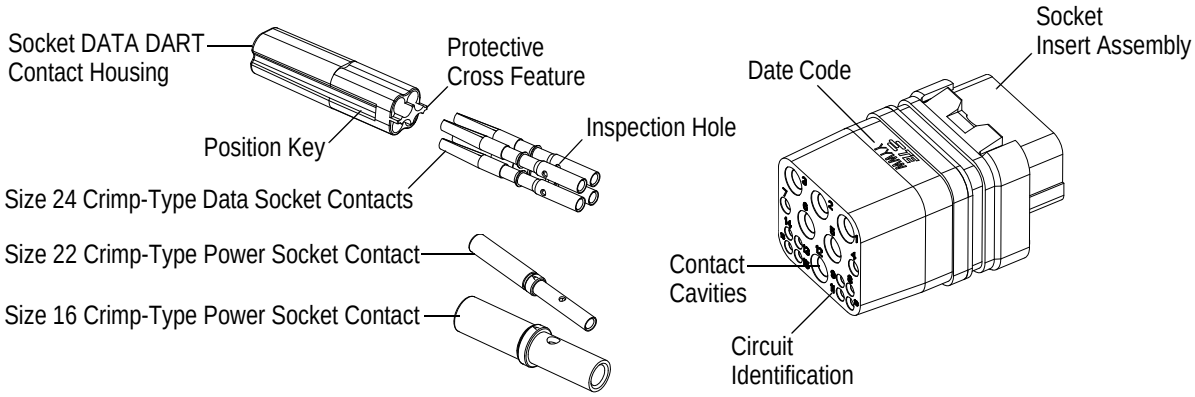


Figure 1 (Cont'd)

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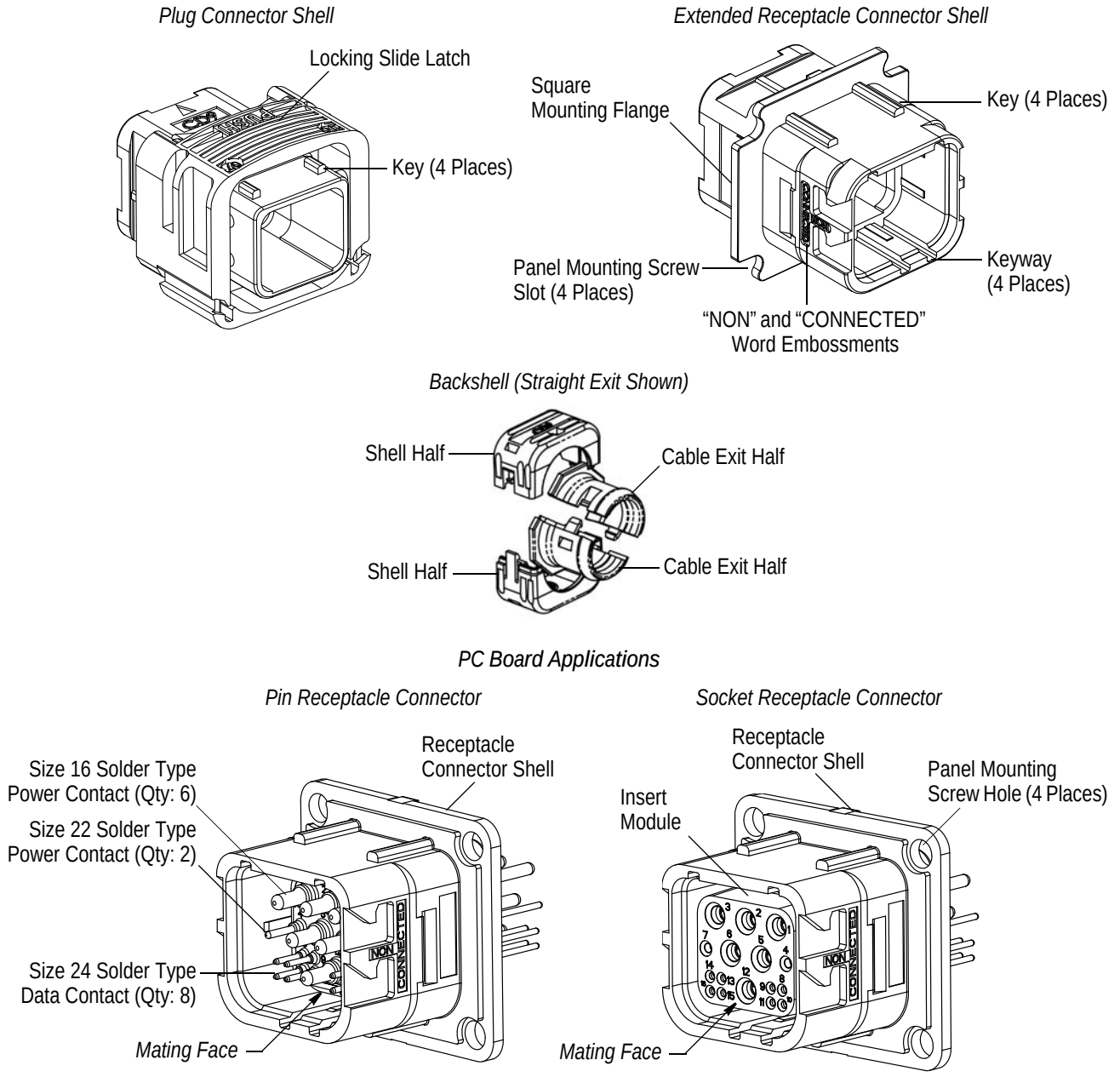


Figure 1 (End)

The insert assembly has contact cavities each marked for circuit identification. The DATA DART contact housing is used to group the size 24 data contacts for ease of insertion into the contact cavities of the insert assembly. The DATA DART contact housing is keyed to assist in the proper circuit arrangement and has a protective cross feature to help determine if the data contact is fully seated in the contact housing. Each contact cavity has a retention clip with a latch that locks onto the DATA DART contact housing or onto the shoulder of the power contact to provide retention when installed into the insert module. Each 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 0.60 [.023].

The receptacle connector shell has 4 panel mounting screw slots or holes that accept customer-supplied screws, a square mounting flange for rear panel mounting, and keys for proper orientation in the panel. To assist in proper 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 features a locking slide latch designed to hold the mated connector shells together.

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

Special Note: The keying positions of the insert assembly and DATA DART contact housing have changed on these components manufactured week 11 of 2013 (date code: 1311) and after. The date code is embossed on the top of the insert assembly and indicates the year and week of its manufacture. Refer to Figure 1.
The DATA DART contact housing does not have the date code embossment; however, for this identification, housings manufactured 1311 and after are natural and housings manufactured before 1311 are black.

2. REFERENCE MATERIAL

2.1. Revision Summary

Revisions to this application specification include:

- Changed status of product specification in Paragraph 2.5
- Changed orientation of DATA DART contact housings and added circuit numbers to Figure 4
- Changed circuit numbers in drawing of pin insert assembly and added socket to Detail B of Figure 5
- Removed dimensions that measured from the front of the connector shell from and corrected tolerance inch conversion for receptacle socket insert module in Figure 6
- Added document to and changed extraction tool in Paragraph 2.6 and Figure 14

2.2. Customer Assistance

Reference Product Base Part Number 2102659 and Product Code L081 are representative of Gigabit Ethernet (GbE)+ Power unsealed 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, 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. The information contained in the Customer Drawings takes priority if there is a conflict with this specification or with any technical documentation.

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 108-2470 provides product performance and test information.

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

2.6. Instructional Material

Instruction Sheets (408-series) and user manuals (TE Connectivity DEUTCH* DMC-MD series) provide product assembly instructions or tooling setup and operation procedures. Documents available that pertain to this product are:

408-32117 Extraction Tool 2226723-1 for Pin and Socket DATA DART Contact Housings

408-32071	Insertion Tool 2161946-1
408-32092	Press Fit Tool 2161930-1 (for Data Contacts)
EN 4165	DMC-MD Series Normes 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 insert module, connector shell, backshell, or receptacle connector material.

B. Shelf Life

Product should remain in the shipping containers until ready for use to prevent deformation. 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 contacts.

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

3.3. Cable Selection, Preparation, and Contact Crimping

The contacts accept solid or stranded cable having wire sizes 26 and 24 AWG (for data contacts) and 22 and 16 AWG (for power contacts). Jacketed multi-conductor, discrete, or discrete quad cable may be used.

The cable must be prepared and the contacts crimped onto the wire according to the following:

A. Multi-Conductor Cable

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. A power contact size 16 must be crimped onto the drain wire. See Figure 2, Detail B.

NOTE
The power contact must be crimped using the tooling and tool settings specified in Section 5, TOOLING. The crimped contact must meet the crimp requirements specified in the instructions packaged with the tooling.

4. A piece of shrink tubing (approximately 25.4 [1.0] long and having a diameter that will recover to 1.35 [.053]) must be installed onto the drain wire (size 16 AWG).
5. Heat must be applied to the shrink tubing. The shrink tubing must recover to the length and minimum diameter given in Figure 2, Detail B.
6. The quad shield must be stripped from each wire to the dimension given in Figure 2, Detail C.
7. Each data wire must be stripped to within the dimensions given in Figure 2, Detail D.

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.

CAUTION
It is important that each data wire is stripped within the range specified to ensure that the crimped contact will fully seat in the DATA DART contact housing and that the exposed conductor will not extend beyond the protective cross feature of the DATA DART housing.

8. Each power wire must be stripped to the dimensions given in Figure 2, Detail D.

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.

9. A data contact must be crimped onto each data wire, and a power contact must be crimped onto each remaining power wire. See Figure 3.

The crimp requirements are:

— the wire is not be damaged in any way

— wire is visible in the inspection hole of the contact

— for data contacts only, there is a 0.8 [.031] gap between the end of 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.

B. Discrete Quad Cable

1. The cable outer jacket must be stripped to the dimension given in Figure 2, Detail A.

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.

2. The cable shield must be folded back over the outer jacket to expose the tape wrap. The tape wrap must be trimmed flush with the cable shield. The cable shield must not be cut or nicked. See Figure 2, Detail B**.**

3. All wires must be fanned out to isolate the inner core. The inner core must be trimmed as close as possible to the cable. See Figure 2, Detail C.

4. Each wire must be stripped within the dimensions given in Figure 2, Detail D.

5. A data contact must be crimped onto each data wire. Refer to Figure 3.

The crimp requirements are:

— the wire is not damaged in any way

— wire is visible in the inspection hole of the contact

— there is a 0.8 [.031] gap between the end of 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.

3.4. Assembly for Cable-to-Cable Application

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

A. DATA DART Contact Housing

Data pin and socket contacts must be installed into the DATA DART contact housing designed for the specific type of contact. Each data contact must be fully inserted into the DATA DART contact housing to meet the following requirements:

NOTE
For intermateability, the diameter of each data pin contact is 0.60 [.023].

— for the data pin contact, the length of the contact from the tip of the contact to the front of the DATA DART contact housing is within the dimension given in Figure 4

— the wire circuit (color code) matches the position key of the DATA DART contact housing

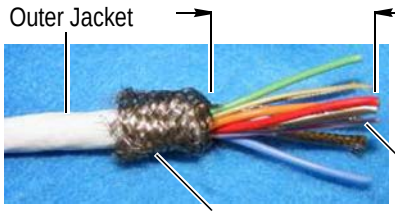
— the crimped end of the contact can be exposed up to the dimension given in Figure 4

Note: Not to Scale

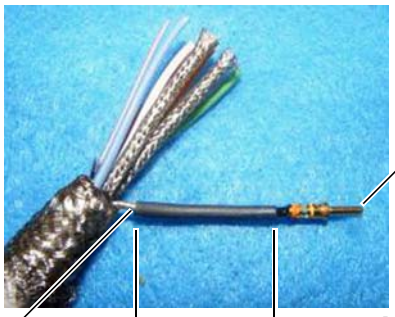
Cable Stripping and Preparation

Multi-Conductor Cable

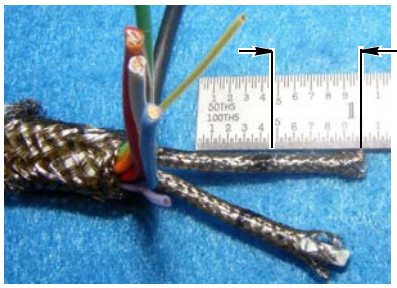
Detail A



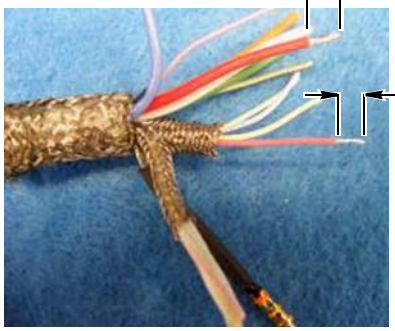
Detail B



Detail C

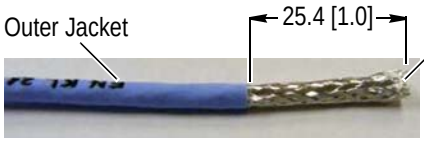


Detail D

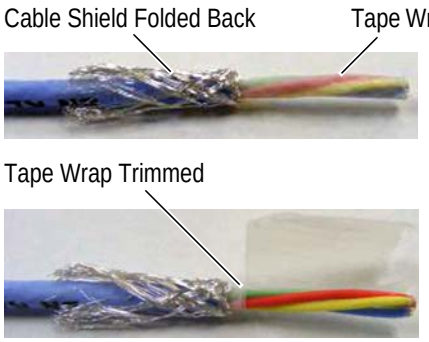


Discrete Quad Cable

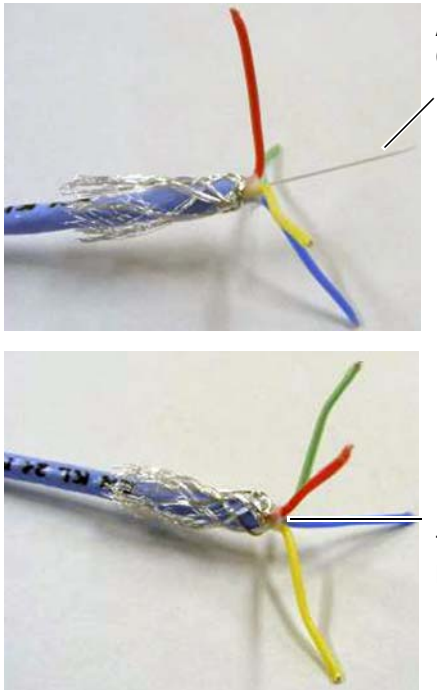
Detail A



Detail B



Detail C



Detail D

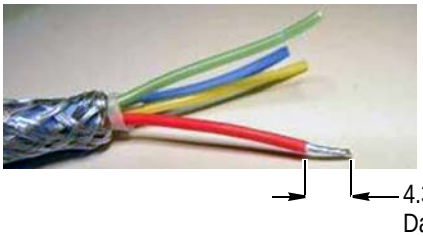
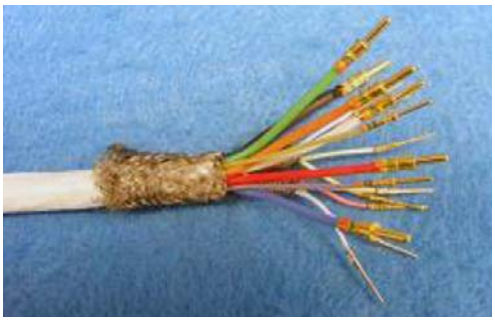


Figure 2

All Data and Power Contacts Crimped onto Cable

Multi-Conductor Cable



Discrete Quad Cable

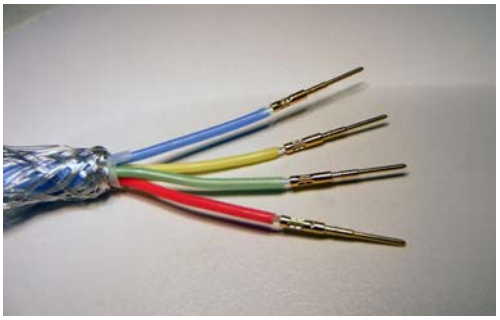


Figure 3

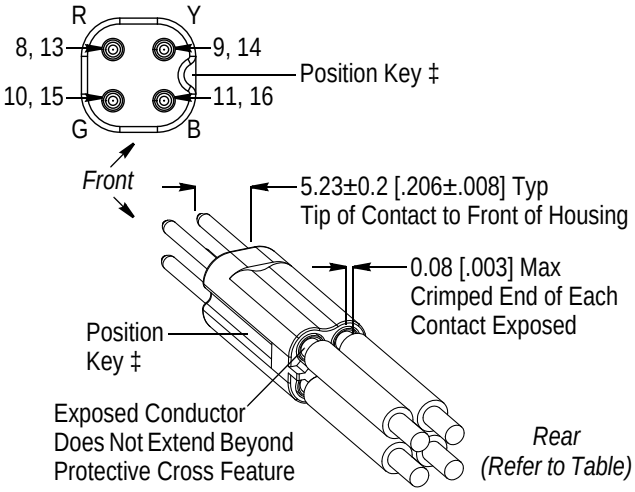
— the exposed conductor of each contact does not extend beyond the protective cross feature of the DATA DART contact housing

NOTE
After manually inserting the contacts, the end of each contact will protrude slightly from the back of the DATA DART contact housing. Full insertion must be achieved by using a press fit tool (refer to Section 5 for tool recommendation).

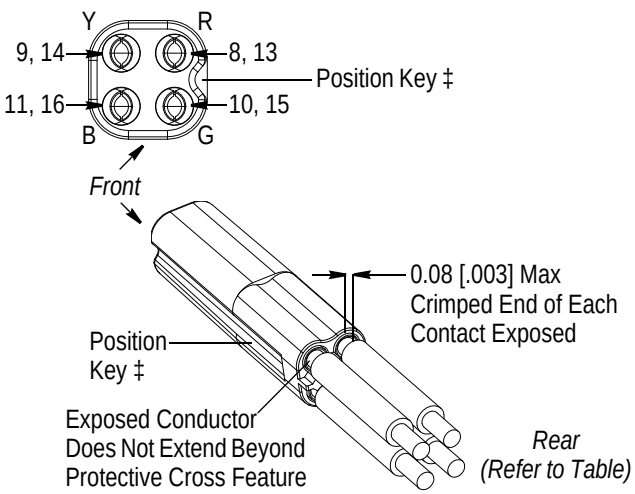
After full insertion, the contacts cannot be removed from the DATA DART contact housing.

— the contacts must not be bent or damaged in any way

Pin Contacts Installed in Pin DATA DART Contact Housing (Cable End A)



Socket Contacts Installed in Socket DATA DART Contact Housing (Cable End B)



Note: Diameter of each data pin contact is 0.60 [.023]. ‡ Refer to Special Note in Section 1

WIRE CIRCUIT NO. AND COLOR CODE (From Rear of DATA DART Contact Housing)	CABLE ASSEMBLY COMBINATION							
	1		2		3		4	
	PIN Cable End A	SOCKET Cable End B	SOCKET Cable End A	PIN Cable End B	PIN Cable End A	PIN Cable End B	SOCKET Cable End A	SOCKET Cable End B
8, 13 — Red (R)	Top Right	Top Left	Top Right	Top Left	Top Right	Top Left	Top Right	Top Left
9, 14 — Yellow (Y)	Top Left	Top Right	Top Left	Top Right	Top Left	Top Right	Top Left	Top Right
11, 16 — Blue (B)	Bottom Left	Bottom Right	Bottom Left	Bottom Right	Bottom Left	Bottom Right	Bottom Left	Bottom Right
10, 15 — Green (G)	Bottom Right	Bottom Left	Bottom Right	Bottom Left	Bottom Right	Bottom Left	Bottom Right	Bottom Left

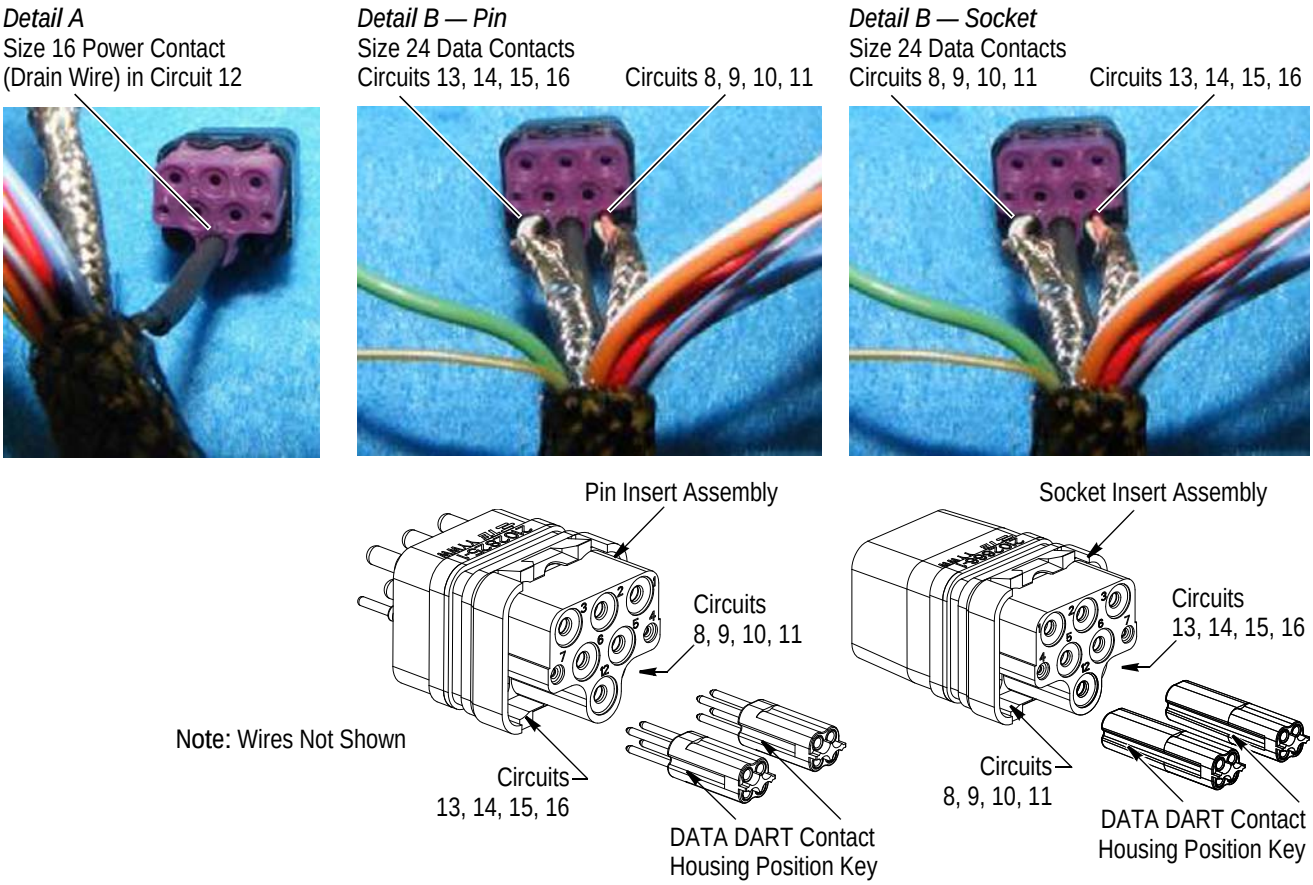
Figure 4

B. Contact Insertion

The DATA DART contact housing (containing the data contacts) and each 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 DATA DART contact housing (data contacts) and each power contact. The position key of each DATA DART contact housing must be observed. See Figure 5.

The contact cavity (row and circuit identification) for each contact and recommended order of insertion is also shown in Figure 5.

NOTE
The pin DATA DART contact housing must be installed in the pin insert module, and the socket DATA DART contact housing must be installed in the socket insert module.



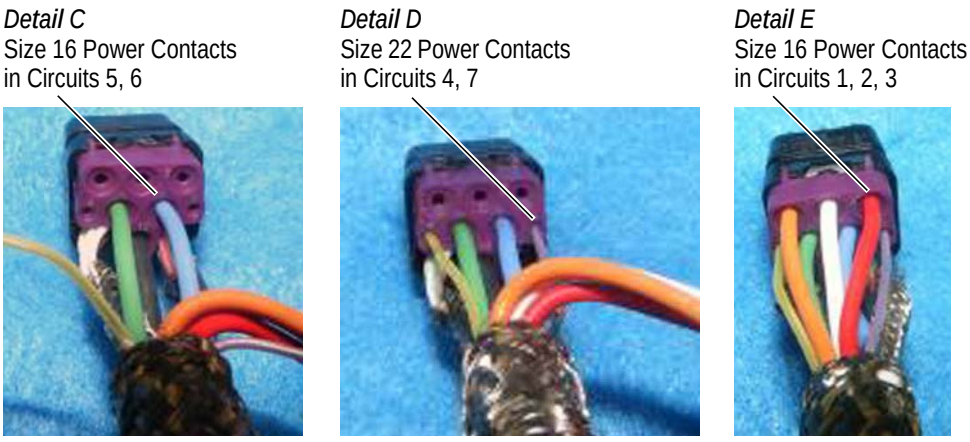
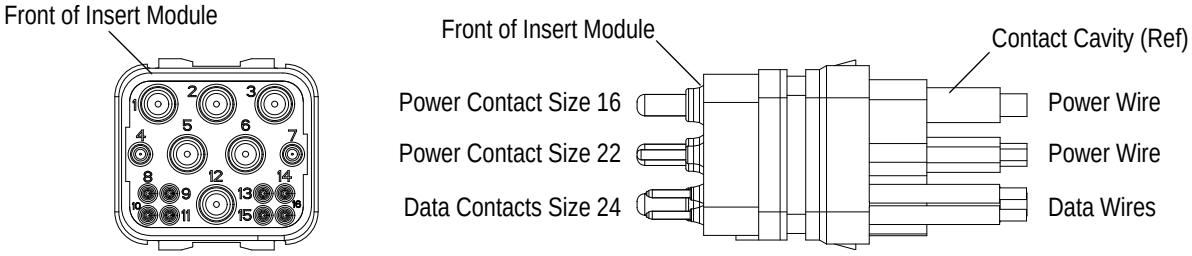


Figure 5 (Cont'd)

All Contacts Installed (See Installed Detail)



Installed Detail



CONTACT			INSERT MODULE		REFER TO
ORDER OF INSERTION	TYPE	SIZE	CIRCUIT IDENTIFICATION	ROW	
1	Power	16	12 (Drain Wire)	Bottom	*Detail A*
2	Data	24	8, 9, 10, 11 and 13, 14, 15, 16	Bottom	*Detail B*
3	Power	16	5, 6	Center	*Detail C*
4		22	4, 7	Center	*Detail D*
5		16	1, 2, 3	Top	*Detail E*

Figure 5 (End)

C. 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 6.

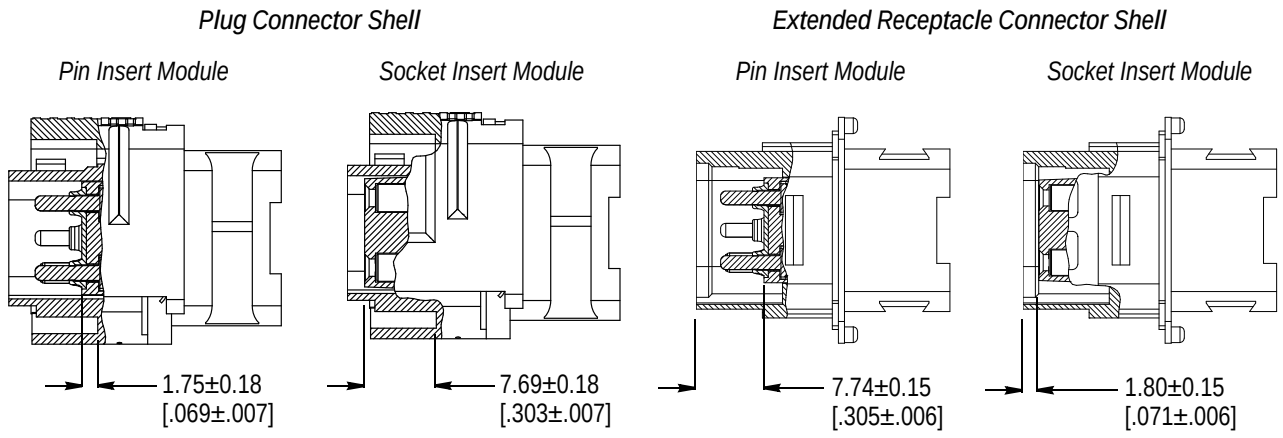


Figure 6

D. 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:

— 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 7, Detail A.

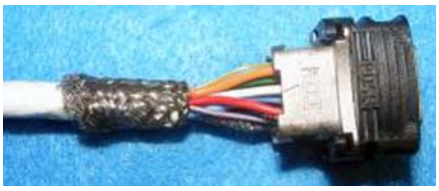
— The cable exit halves of the backshell are fully mated with no gap in the seam. See Figure 7, Detail B.

— All cable shields are folded over the cable exit halves and compressed by a micro-band. See Figure 7, Detail C.

— The shell halves of the backshell are fully mated with no gap in the seam. See Figure 7, Detail C.

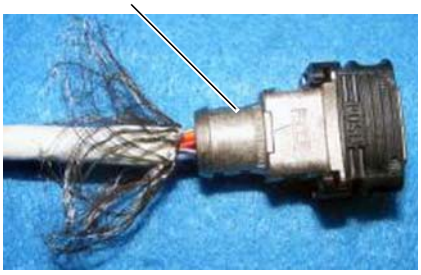
Multi-Conductor Cable with Straight Backshell

Detail A



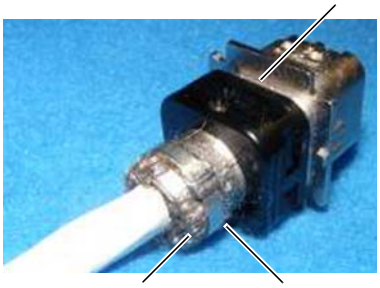
Detail B

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



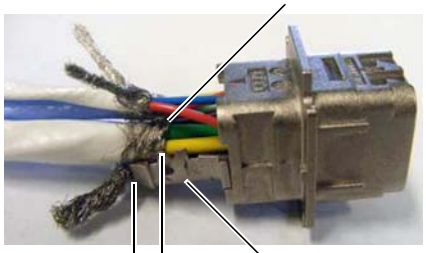
All Cable Shields Folded Over Cable Exit Halves

Micro-Band Compressing Cable Shield

Discrete Cable with Straight Backshell

Detail A

Cable Braid and Wire Insulation

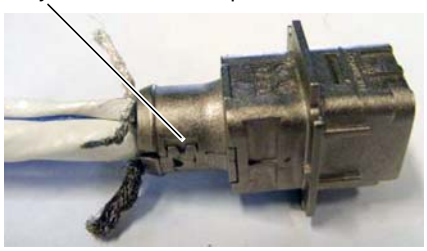


6.35[.25]

Cable Exit Half of Backshell

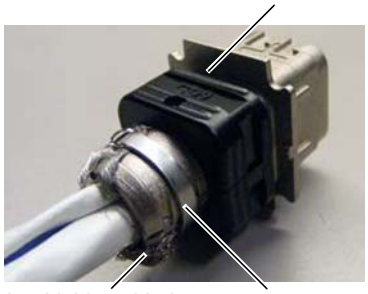
Detail B

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 7

3.5. PC Board

A. Material and Thickness

The pc board material shall be glass epoxy (FR-4 or G-10 or equivalent). The pc board thickness shall be a maximum of 1.78 [.070]. Contact PRODUCT INFORMATION at the number at the bottom of page 1 for suitability of other materials and thicknesses.

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 8.

Note: Not to Scale

Reference Sample PC Board Layout

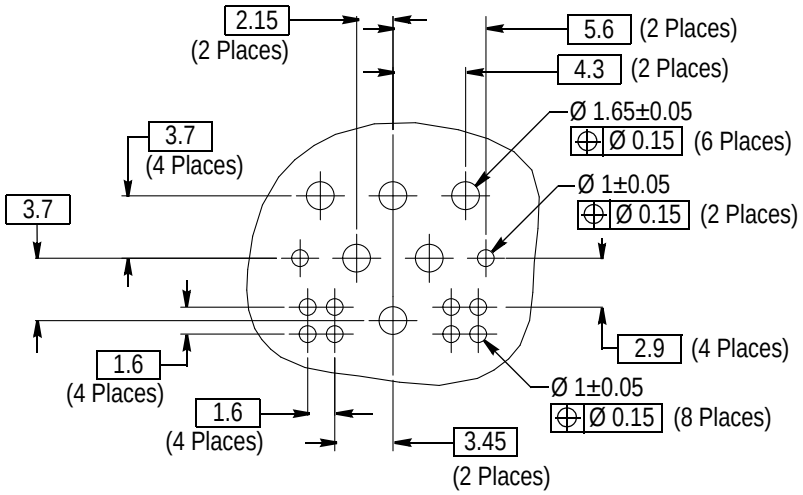
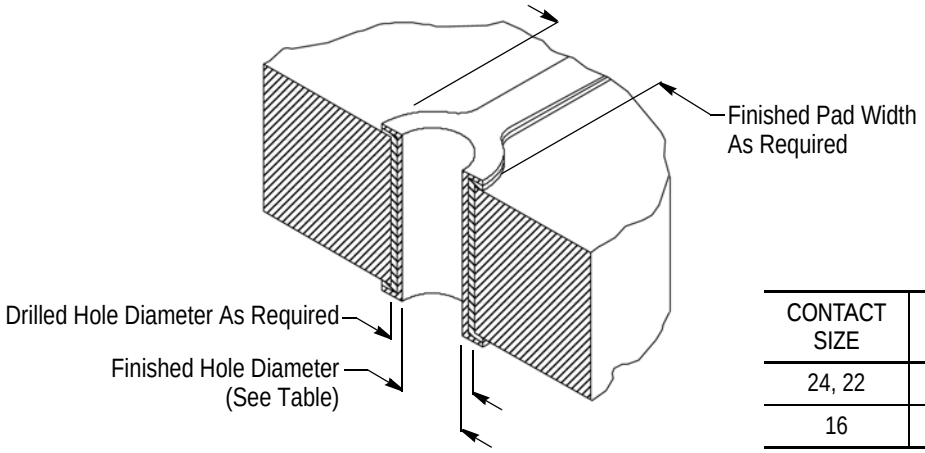


Figure 8

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 9.



CONTACT SIZE	FINISHED HOLE DIAMETER
24, 22	1.00±0.05 [.039±.019]
16	1.65±0.05 [.065±.019]

Figure 9

3.6. 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 10.

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

Figure 10

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 11.

CLEANER		TIME (Minutes)	TEMPERATURE (Maximum)
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 11

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

DANGER
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.

3.7. 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 12.

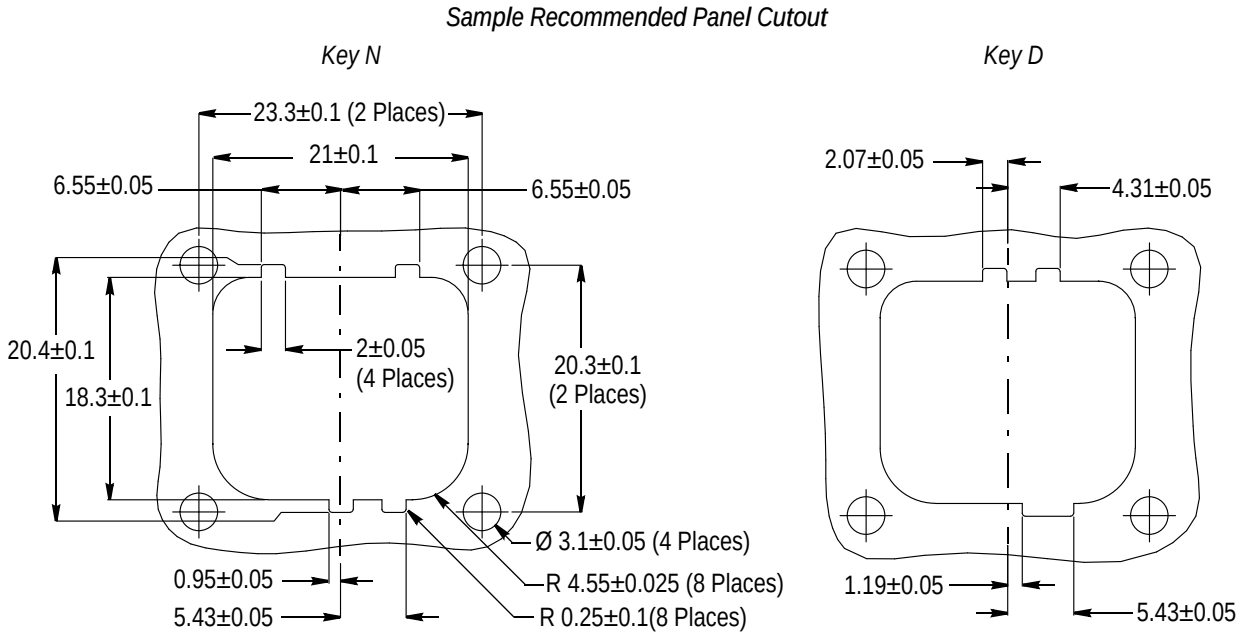


Figure 12

B. Mounting

The connector shells are designed for rear-panel mounting only. The connector shell must be secured to the panel using four 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.

3.8. Mating and Unmating

When mating the insert modules, the keys and keyways of the connector shells must be aligned, then pushed together until the connector shells bottom. When the connector shells bottom, the insert modules are fully mated. The embossed word "CONNECTED" (located on the side of the receptacle connector shell) must be visible, then the locking slide latch of the plug connector shell can be pushed down to prevent the connector shells from accidentally separating. Refer to Figure 13.

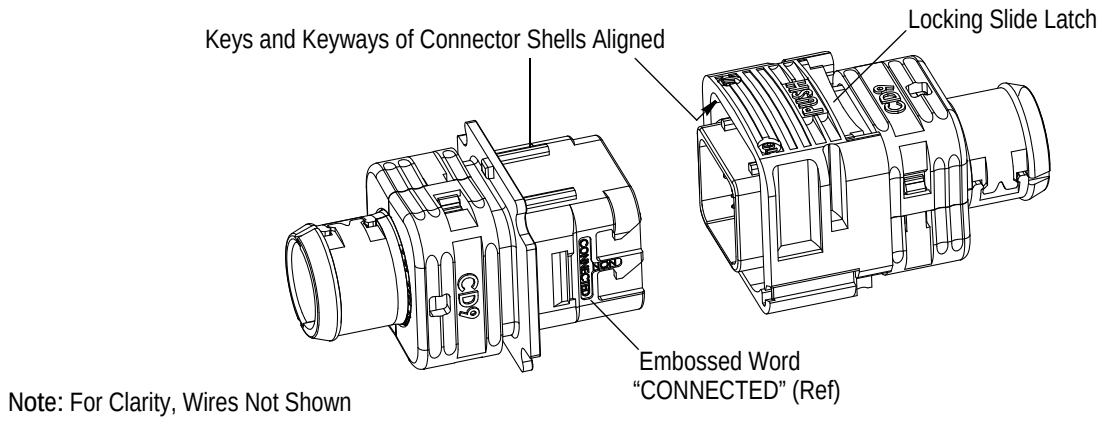


Figure 13

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.

3.9. Removal and Replacement

The data contacts cannot be removed from the DATA DART contact housing.

The DATA DART contact housing can be removed from the insert module and re-used (with the data contacts). Removal of the DATA DART contact housing requires the use of tooling specified in Section 5, TOOLING. The DATA DART contact housing can be replaced by cutting the wires from the contacts, crimping new contacts onto the wires, and inserting them into the DATA DART contact housing.

Power 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 unsealed 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 shown in Figure 14.

5.1. Crimp Tooling

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

5.2. Press Fit Tool

The manual press fit tool is designed to insert the data contacts (two at a time) into the DATA DART contact housing.

5.3. Insertion Tool

The DATA DART contact housing can be installed into the insert module manually; however, an insertion tool is available to assist in the installation.

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

5.4. Extraction and Removal Tools

An extraction tool is available designed to remove the DATA DART contact housing from the insert module by releasing the insert module retention clip, allowing the DATA DART contact housing to be removed manually without damaging any of the parts.

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

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

Positioner
(See Table)



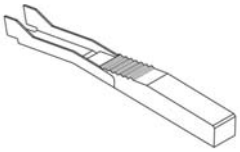


Crimp Tool Frame
(See Table)

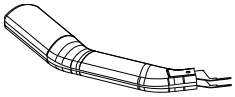
CONTACT		POSITIONER		CRIMP TOOL FRAME	
SIZE	TYPE	DMC	MIL	DMC	MIL
24	Pin	K1858	—	AFM8	M22520/2-01
	Socket	K1827			
22	Pin	K42	M22520/2-09		
	Socket	K41	M22520/2-06		
16	Pin	TH163	M22520/1-04	AF8	M22520/1-01
	Socket				



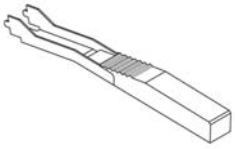
Insertion Tool 2161946- 1
(for DATA DART Contact
Housing) (408-32071)



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



Extraction Tool 2226723-1
(for Pin and Socket
DATA DART Contact
Housings) (408-32117)



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



Press Fit Tool 2161930-1
(for Data Contacts)
(408-32092)



Removal Tweezer for Crimp-Type
Power Contacts (See Table)

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

‡ Available from TE Connectivity DEUTSCH

Figure 14

6. VISUAL AID

The illustration below shows a typical application of Gigabit Ethernet (GbE)+ power unsealed single insert module. 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.

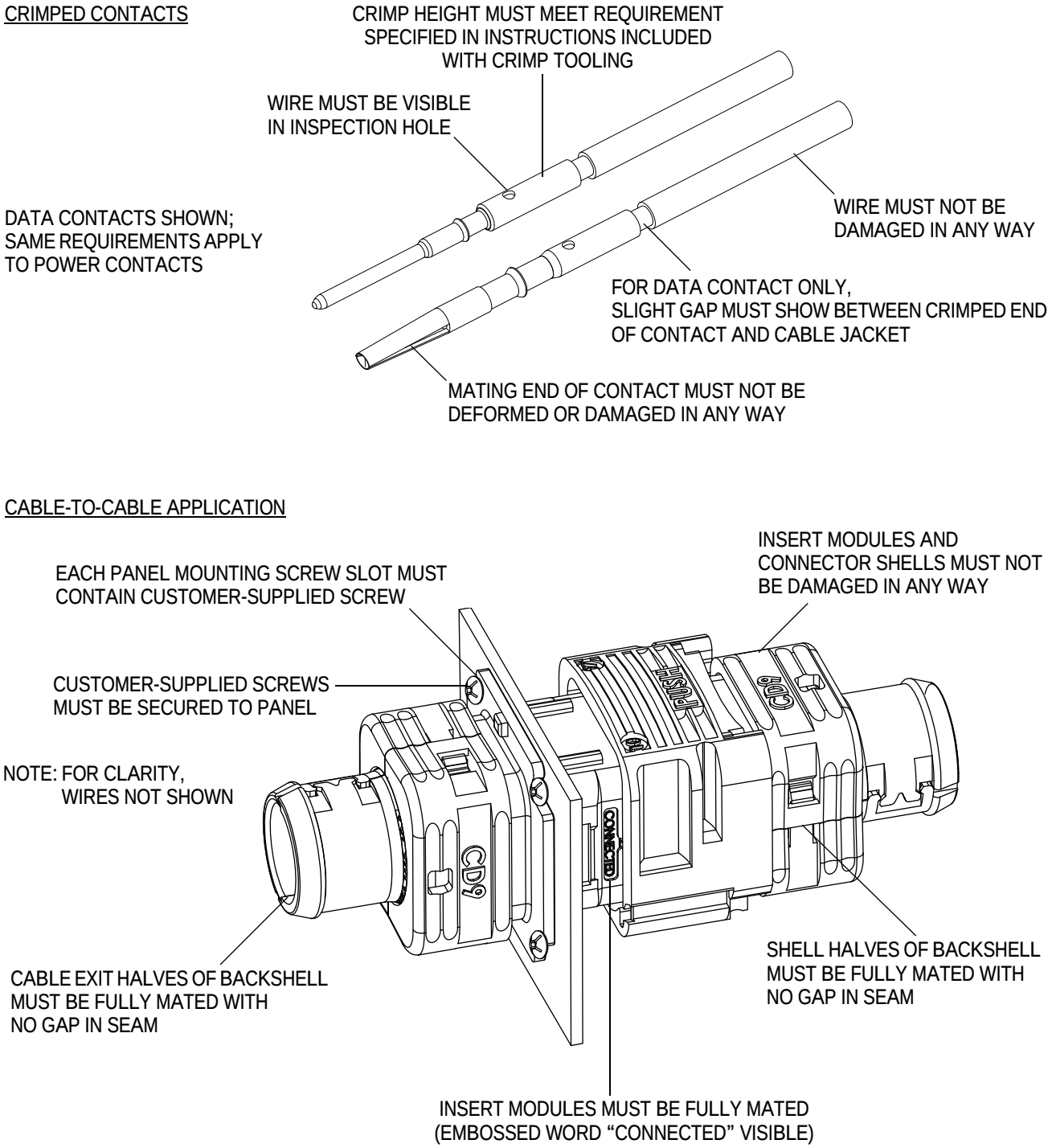


FIGURE 14. VISUAL AID (CONT’D)

PC BOARD APPLICATION

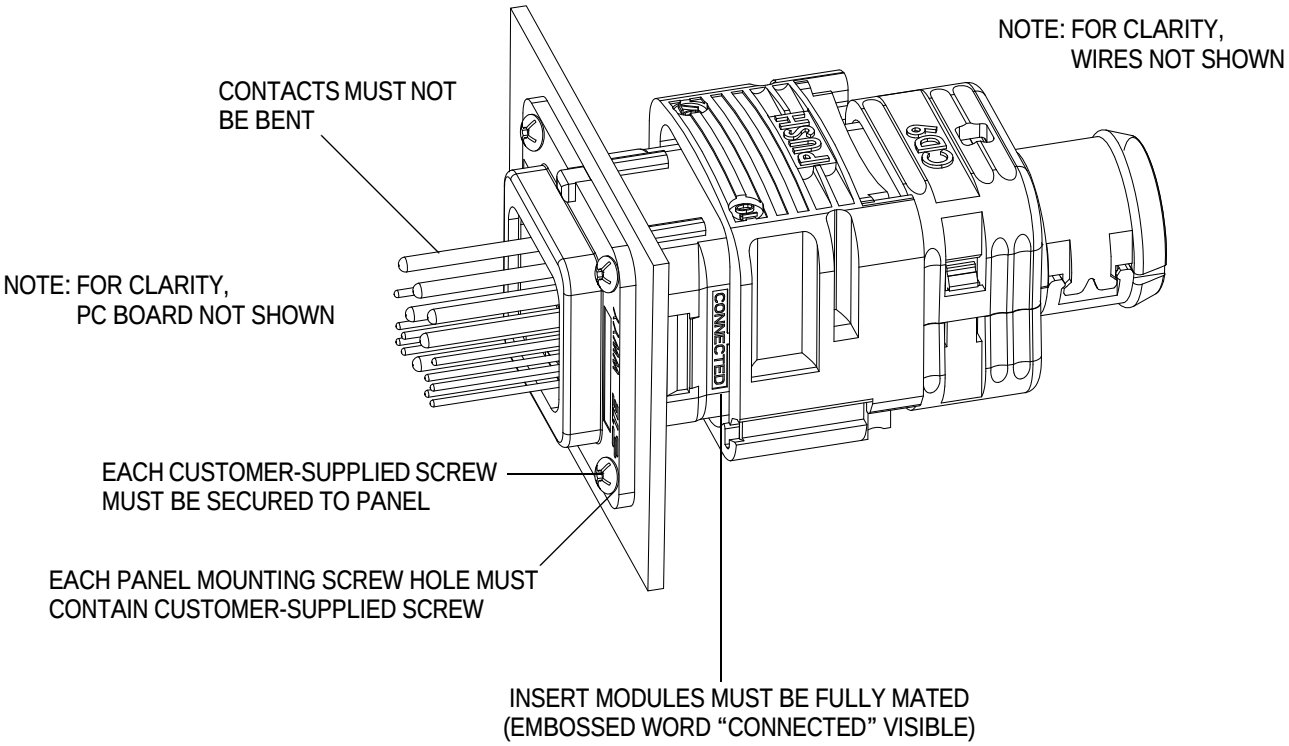


FIGURE 14. VISUAL AID (END)