

**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  $\pm 0.13$  [.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 Modular Jack Assemblies onto pc boards using SMT (surface mount technology) for data and telephone applications. These modular jacks are available in low-profile, single-port, or dual-port configuration in 6 or 8 positions with 2, 4, 6, or 8 contacts. Contacts in low-profile modular jacks have 1.27 [.050] centerline spacing with a modified gull wing configuration, and contacts in single-port and dual-port modular jacks have 1.02 [.040] centerline spacing with a right angle configuration.

These side entry modular jacks are available in standard latch or inverted latch. When mounted to the pc board, the standard latch has the contacts on the top and the latch on the bottom; the inverted latch has the contacts on the bottom and the latch on the top. The modular jacks are also available shielded or unshielded, and with or without panel stops. Shielded modular jacks provide low-impedance ground paths through shield tabs (pc board ground) and panel grounds. The panel stops are used to position the modular jack relative to a panel.

The modular jacks are available with plastic bifurcated mounting posts, or inward or outward metal boardlocks. The mounting posts (inserted through holes in the pc board) help to position the modular jack on the pc board and provides some stability during the soldering process. The boardlocks (soldered onto the pc board) provide some strain relief after soldering. The modular jacks feature standoffs which allow easy pc board cleaning. The modular jacks are supplied in trays for manual placement or pocket tape for high-speed automatic machine placement (typically vacuum pick and place).

When corresponding with Tyco Electronics 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.

**NOTE**

Not all features are available for all modular jack configurations. Contact your local Tyco Electronics Representative or call the Product Information Center at the number at the bottom of this page for information on specific features.

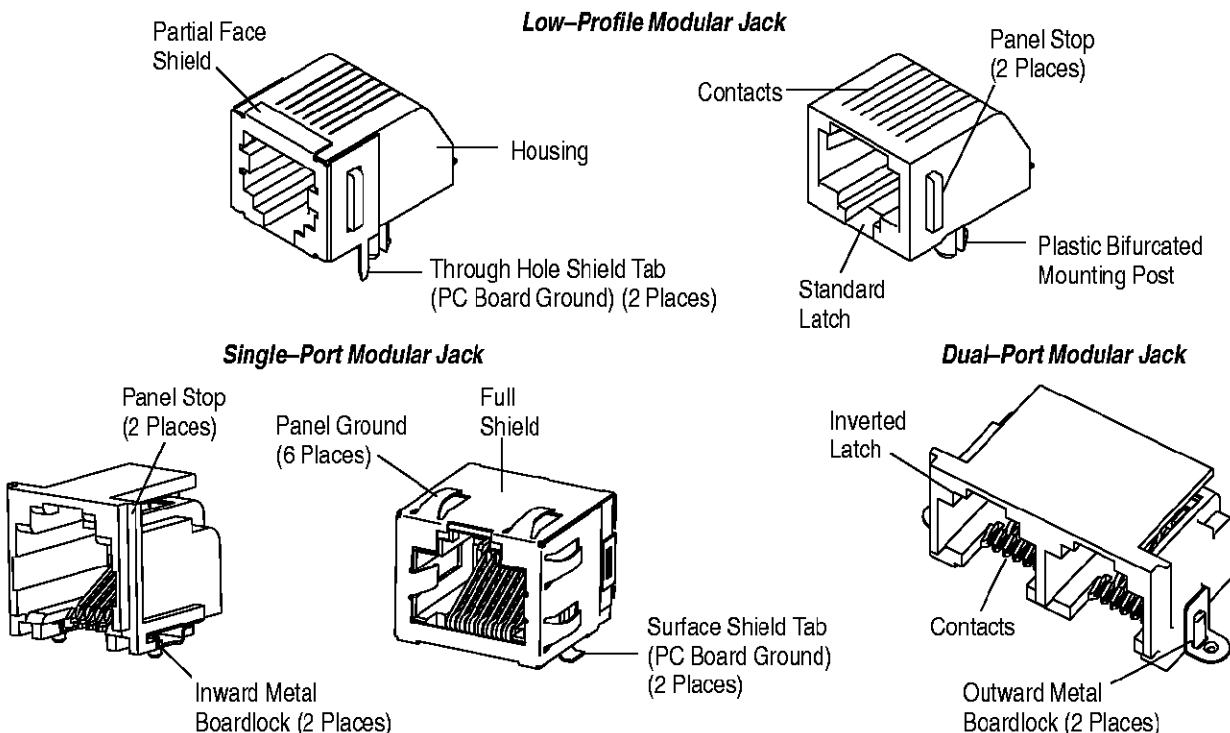


Figure 1

## 2. REFERENCE MATERIAL

### 2.1. Revision Summary

Revisions to this application specification per EC 0990–0191–02 include:

- Updated document to corporate requirements
- Changed temperature conversions (F°) in Figure 4
- Changed panel cutout dimensions in Figure 7 and added new column “C”

### 2.2. Customer Assistance

Product Part Number 406903 and Product Code A190 are representative of Modular Jack Surface Mount PC Board Assemblies. Use of these numbers will identify the product line and expedite your inquiries through a service network established to help you obtain product and tooling information. Such information can be obtained through a local Tyco Electronics Representative (Field Service Engineer, Field Applications Engineer, etc.) or, after purchase, by calling the Product Information Center at the number 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 by Tyco Electronics, call the Product Information Center at the number at the bottom of page 1.

### 2.4. Manuals

Manual 402–40 is available upon request and can be used as a guide to soldering. This manual provides information on various flux types and characteristics with the commercial designation and flux removal procedures. A checklist is included in the manual as a guide for information on soldering problems.

### 2.5. Specifications

Product Specification 108–1163 (shielded and unshielded low–profile modular jacks) and 108–1689 (single– and dual–port modular jacks) provide product performance and test information.

Qualification Test Report 501–91 is an independent corporate test report confirming the information in Product Specification 108–1163.

Qualification Test Report 501–392 is an independent corporate test report confirming the information in Product Specification 108–1689.

Test Specification 109–11–1 provides solderability requirements and evaluation methods; and Workmanship Specification 101–21 provides solder fillet requirements.

### 2.6. Instructional Material

Application Specifications (114–series) provide product description and application requirements, Instruction Sheets (408–series) provide assembly instructions, and Customer Manuals (409–series) provide machine setup and operation procedures. The documents available which pertain to this product are:

- 408–6927 Design Recommendations for Printed Circuit (PC) Board Support Fixture

## 3. REQUIREMENTS

### 3.1. Safety

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

### 3.2. Material

The modular jack housing is made of high temperature thermoplastic, UL94–V–0. The contacts are made of phosphor bronze underplated with nickel and plated with gold finish; solder tines are plated with tin lead over nickel. Boardlocks are made of brass plated with matte tin–lead. The shield is made of brass plated with tin–lead over copper underplate.

### 3.3. Storage

#### A. Ultraviolet Light

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

**B. Shelf Life**

The modular jacks should remain in the shipping containers until ready for use to prevent deformation to the contacts. The modular jacks should be used on a first in, first out basis to avoid storage contamination that could adversely affect signal transmission and degrade shield appearance.

**3.4. Chemical Exposure**

Do not store modular jacks 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

**3.5. Modular Jack Spacing**

Care must be taken to avoid interference between adjacent modular jacks and/or other components. There is no required spacing between modular jacks, however spacing may be dependent on variable hardware used and the clearance required for mating modular plugs with the jacks. For minimum spacing, jacks with inward metal boardlocks should be used.

**NOTE** *The information provided is for manual placement of modular jacks. If robotic equipment is used, other space allowances will be required for the grippers.*

**3.6. PC Board**

**A. Material and Thickness**

The pc board material must be glass epoxy (FR-4 or G-10). The pc board thickness range must be 1.45 through 1.70 [.057 through .067].

**NOTE** *Contact the Product Information Center at the number listed at the bottom of page 1 for suitability of other board materials and thicknesses.*

**B. Tolerance**

Maximum allowable bow of the pc board must be 0.13 [.005] over the length of the modular jack. Coplanarity of the pads on the pc board must be 0.03 [.001].

**C. Pads**

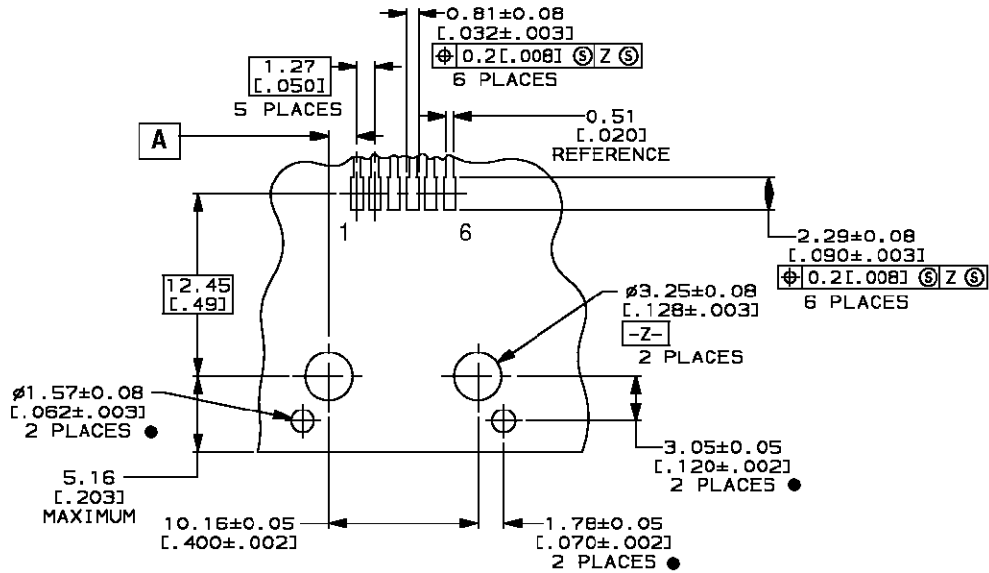
The pc board pads must be solderable in accordance with Test Specification 109-11-1.

**D. PC Board Layout**

The pads and mounting post holes must be precisely located to ensure proper placement and optimum continuity for circuits after soldering. The holes must be drilled to specific dimensions to prevent stubbing during placement of the modular jack on the pc board. Dimensions for recommended pc board layout is provided in Figure 2.

**Recommended PC Board Layout  
(Component Side)**

1.27 [.050] Centerline  
Low Profile Modular Jack  
6 Position/ 2, 4, or 6 Contact



- Required only for jacks with through hole shield tabs

1.27 [.050] Centerline  
Low Profile Modular Jack  
8 Position/8 Contact

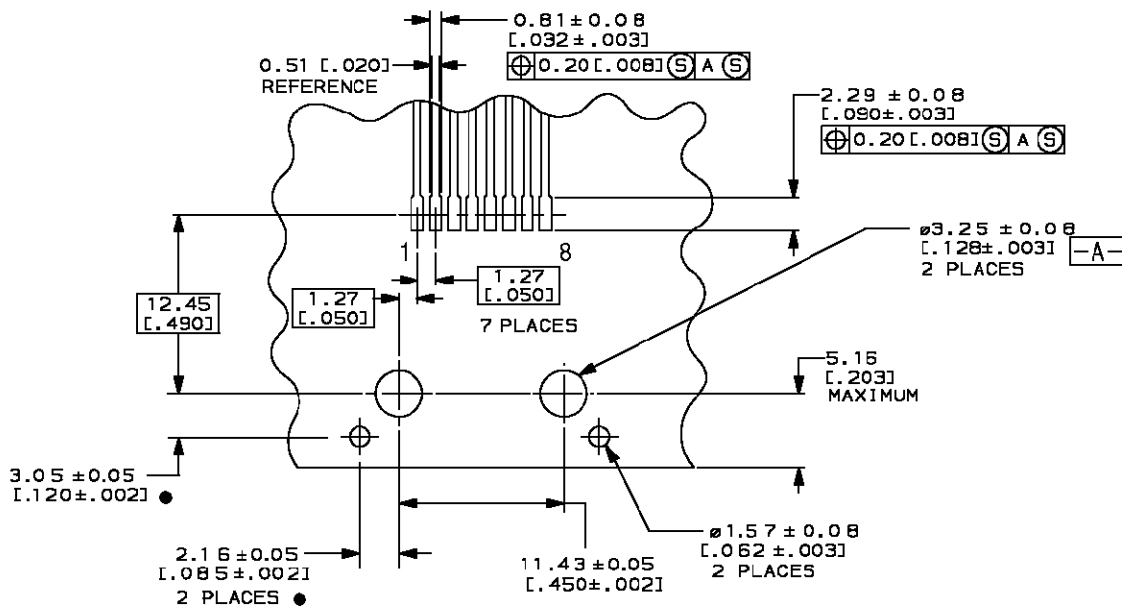
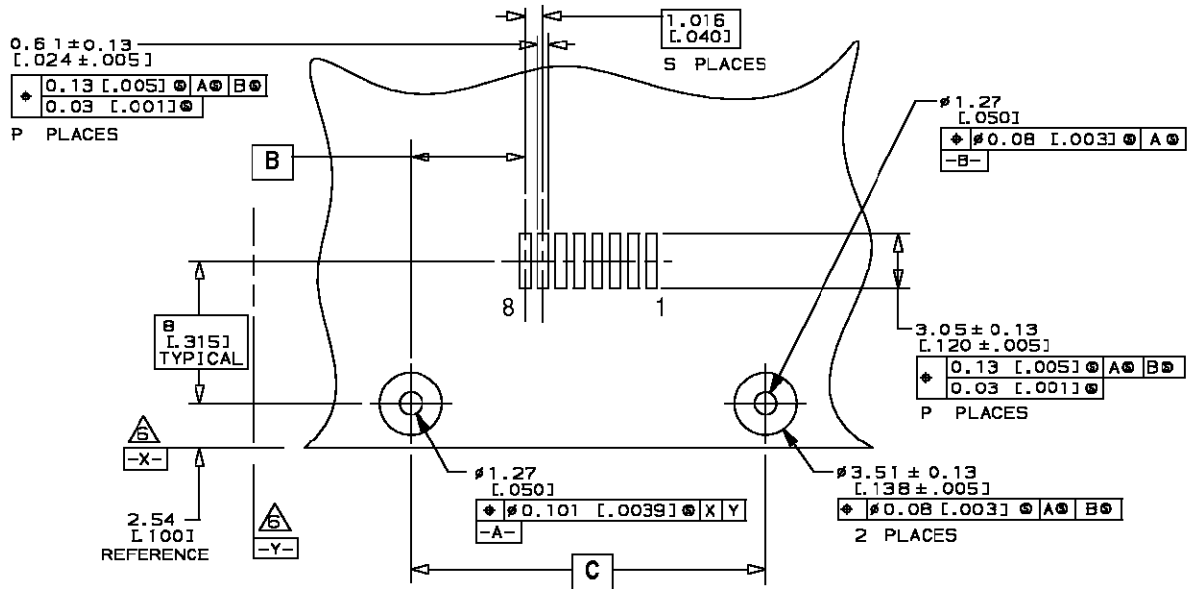


Figure 2 (cont'd)

1.02 [.040] Centerline  
Single-Port Modular Jack With Outward Metal Boardlocks  
6 Position/4 or 6 Contact and 8 Position/4 or 8 Contact

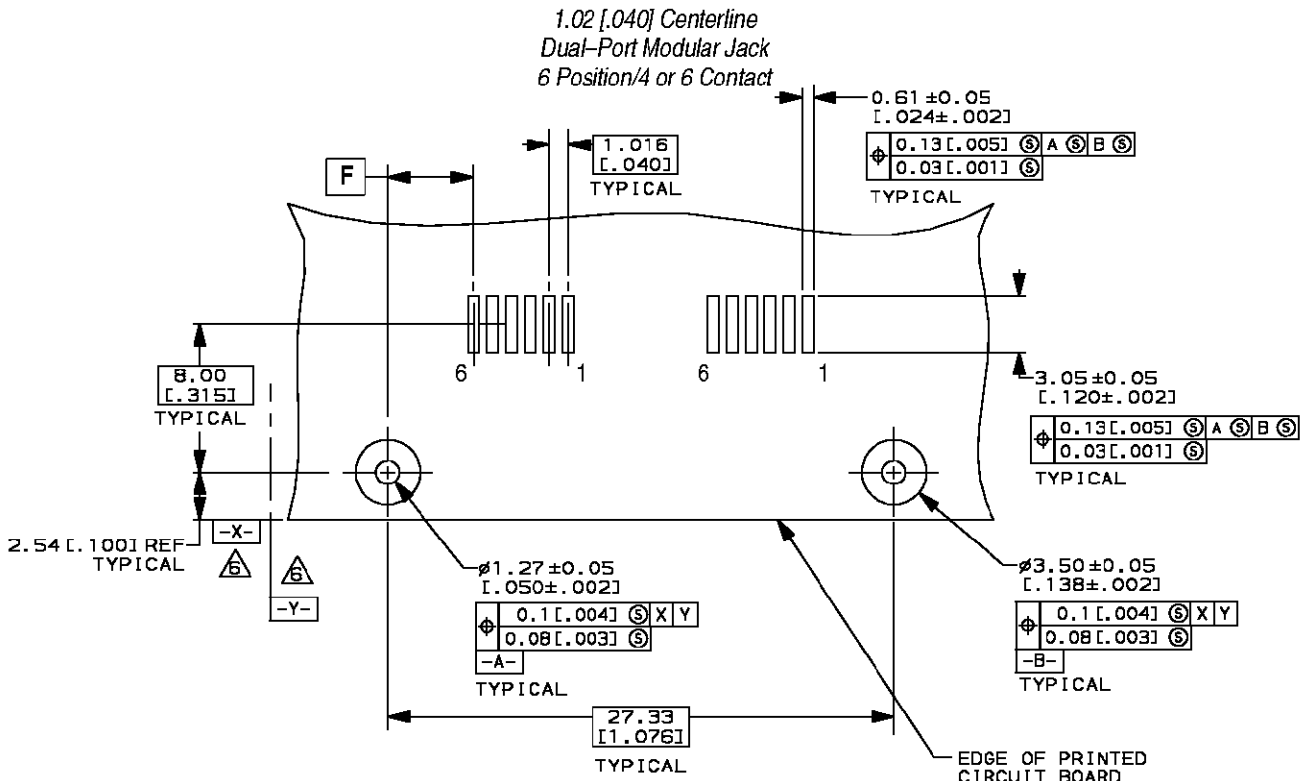


Datum established by customer

POSITION/CONTACT	DIMENSION B	DIMENSION C	P (Places)	S (Places)
6/4	6.68 [.263]	16.41 [.646]	4	3
6/6	5.66 [.223]	16.41 [.646]	6	5
8/4	8.46 [.333]	19.96 [.786]	4	3
8/8	6.42 [.253]	19.96 [.786]	8	7

Figure 2 (cont'd)





△ Datum established by customer

POSITION/CONTACT	DIMENSION F
6/4	6.68 [.263] (2 Places)
6/6	5.66 [.223] (2 Places)

Figure 2 (end)

### 3.7. Solder Paste

#### A. Composition

1. Alloy type shall be 63 Sn/37 Pb, 60 Sn/40 Pb, or 62 Sn/36 Pb/2 Ag.
2. Flux incorporated in the paste shall be rosin, mildly active (RMA) type.
3. Paste will be at least 55% solids by volume.

#### B. Volume

Recommended solder volume per pad before curing is 0.51 mm<sup>3</sup> [3.11 × 10<sup>-5</sup> in.<sup>3</sup>].

**NOTE** Solder volume may vary depending on solder paste composition. The outgassing factor (usually measured to be around 50%) will reduce volume after curing.

Since solder paste can be deposited with a stencil or screen, the following calculation should serve as a guideline in varying deposition parameters.

- With:
- V<sub>i</sub> being minimum solder volume before curing
  - a being aperture corresponding to pad width
  - b being aperture corresponding to pad length
  - T<sub>p</sub> being thickness of stencil (if used) or deposited solder paste

Minimum solder volume before curing for each pad is calculated as follows:

$$a \times b \times T_p = V_i$$

**CAUTION** *Using paste volume in excess of that recommended could cause excessive wicking of reflowed solder up the solder tine, resulting in reduction of compliance and potential solder joint failure.*

### 3.8. Stencil

The stencil aperture may be any shape as long as it prevents solder bridging from one pad to another. Varying apertures will change the required stencil thickness needed to deposit the recommended solder paste volume. Generally, the thinner stencil will need a larger aperture to maintain the given volume of solder paste. If the aperture on the stencil is the same as the nominal pad dimensions, stencil thickness would be calculated as follows:

$$T_p = \frac{V_i}{(a \times b)}$$

### 3.9. Screen

Solder screen is recommended between all pads when soldering modular jacks to minimize solder bridging between pads. The screen must not exceed the height of the pad by more than 0.05 [.002]. If a trace is run between adjacent pads on the solder side of the pc board, a screen must be applied over the trace to prevent bridging and wicking of solder away from the contact solder tines. Additionally, there should be screen covering any traces in the area of the boardlock and shield tab solder deposit. Those most suitable are Liquid Photo Imageable and Dry Film.

**CAUTION** *Since the modular jack housings may rest on top of the screen, an excessively high screen will allow too much space between the solder tine and pad for a good solder joint. A solder joint under these conditions would be weak, and would not provide long term performance for the modular jack.*

Since weave thickness and percent open area are dependent on the mesh count of the solder screen, the following calculation should serve as a guideline in varying screen parameters.

With:  $T_e$  being screen emulsion thickness  
 $T_p$  being thickness of deposited solder paste  
 $T_w$  being screen weave thickness  
 $A_o$  being decimal equivalent to percent open area

Screen emulsion thickness can be calculated as follows:

$$T_e = T_p - T_w \times A_o$$

For example, an 80–mesh screen has a 49.5% open area and nominal weave thickness of 0.20 [.008]. The amount of paste deposited through a screen is dependent on the aperture, the wire mesh, and applied emulsion. Therefore, the emulsion would be calculated as follows:

$$0.20 - (0.02 \times .495) = 0.10$$

$$[.008 - (.008 \times .495) = .004]$$

**NOTE** *Varying aperture dimensions and mesh count will change the required emulsion thickness needed to deposit the recommended solder paste volume.*

### 3.10. Mechanical Support

The mounting posts fit into holes in the pc board during placement of the modular jack. The boardlocks are soldered to pc board pads during soldering of the contact solder tines. If necessary, a hold–down apparatus may be used to keep the modular jack in place until soldering is completed.

**CAUTION** *If a hold–down apparatus is used, the design must ensure that the modular jack housing will not sit on the solder deposit.*

### 3.11. Shielding

Shielded modular jacks feature a shell over the housing which provides continuity for EMC (electromagnetic compatibility) applications. When mated with corresponding shielded modular plugs, grounding continuity is achieved. The shield tabs (soldered to pc board) and panel grounds (tension to panel) provide electrical continuity to any ground path on the pc board and through the equipment panel.

### 3.12. Modular Jack Placement

#### A. Alignment

When placing modular jacks on the pc board, make sure that the contact solder tines, and, if applicable, boardlocks and surface shield tabs are aligned with matching pads before placing the jack onto the pc board. The through hole shield tabs and mounting posts must be placed over their intended pc board holes, then the modular jack housing gently pressed downward.

**CAUTION** *Modular jacks should be handled only by the housing to avoid deformation, contamination, or damage to the contact solder tines.*

#### B. Position

Optimally, the contact solder tines should be centered on the pc board pads. However, slight misalignment is permissible as shown in Figure 3.

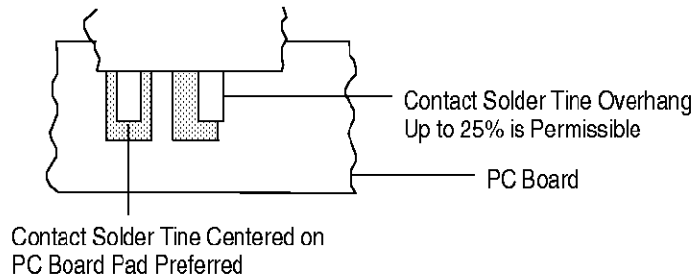


Figure 3

### 3.13. Soldering

Observe guidelines and procedures when soldering contacts, boardlocks, and shield tabs. All solder joints should conform to those specified in Workmanship Specification 101-21 and all other requirements specified in this document.

#### A. Process

The modular jacks should be soldered using non-focused infrared (IR) reflow, or equivalent soldering technique. The reflow temperature and approximate time to which the housing is subjected is specified in Figure 4.

**CAUTION** *Excessive temperatures may cause housing degradation or plating deterioration.*

**Reflow Soldering Process Cycle**

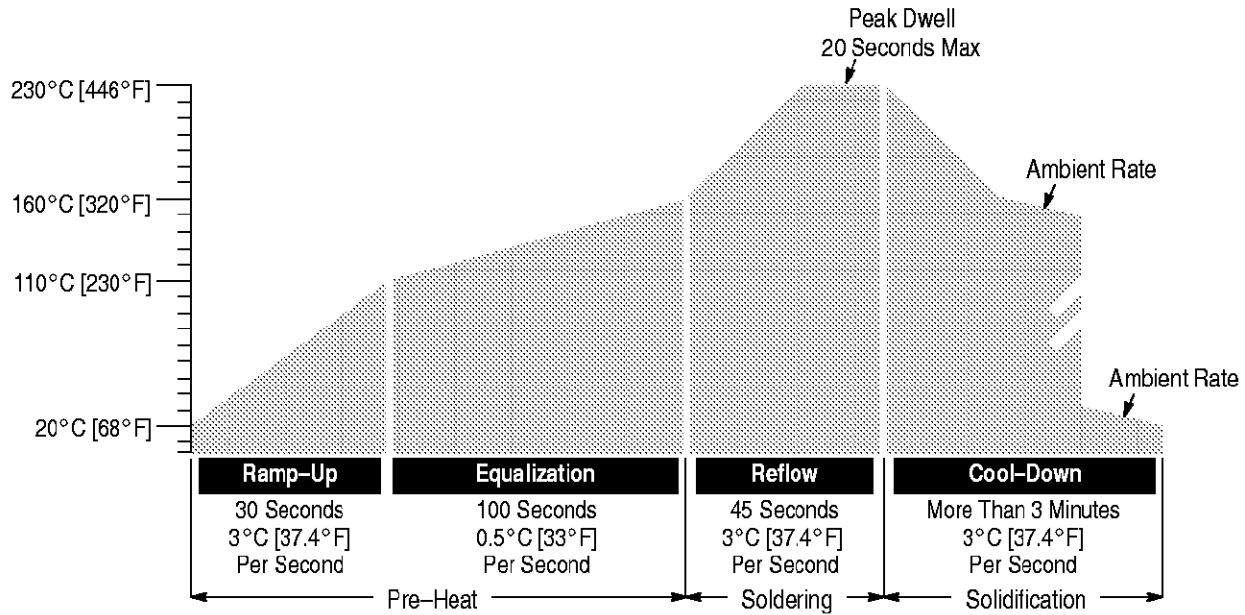


Figure 4

**B. 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. Tyco Electronics recommends cleaning with the pc board on its edge. The following is a list of common cleaning solvents that will not the affect the modular jacks for the time and temperature specified. See Figure 5.

**CAUTION** Even when using “no clean” solder paste, it is imperative that the contact interface be kept clean of flux and residue, since it acts as an insulator. Flux may migrate under certain conditions with elevated temperatures and, therefore, cleaning is necessary.

CLEANER		TIME (Minutes)	TEMPERATURES (Maximum)	
NAME	TYPE		CELSIUS	FAHRENHEIT
Alpha 2110■	Aqueous	1	132	270
Isopropyl Alcohol	Solvent	5	100	212
Kester 5778❧	Aqueous	5	100	212
Kester 5779❧	Aqueous	5	100	212
Loncoterge 520●	Aqueous	5	100	212
Loncoterge 530●	Aqueous	5	100	212

■ Product of Fry’s Metals, Inc.    ❧ Product of Litton Systems, Inc.    ● Product of Union Carbide Corp.

Figure 5

**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. Tyco Electronics does not recommend using Trichloroethylene and Methylene Chloride because of harmful occupational and environmental effects. Both are carcinogenic (cancer-causing).

**NOTE** If you have a particular solvent that is not listed, contact Product Information at the number at the bottom of page 1.

**C. Drying**

When drying cleaned assemblies and pc boards, make certain that temperature limitations are not exceeded:  $-55^{\circ}$  to  $105^{\circ}$  C [ $-68^{\circ}$  to  $221^{\circ}$  F]. Excessive temperatures may cause housing degradation.

**3.14. Checking Installed Modular Jack**

The housing standoffs must be seated on the pc board not exceeding the dimension shown in Figure 6.

Solder fillets must be evenly formed around each contact solder tine, and, if applicable, each boardlock and shield tab. Solder must have 75% minimum solder coverage over the pc board pad. Solder fillets and contact solder tines must also meet dimensional requirements as shown in Figure 6.

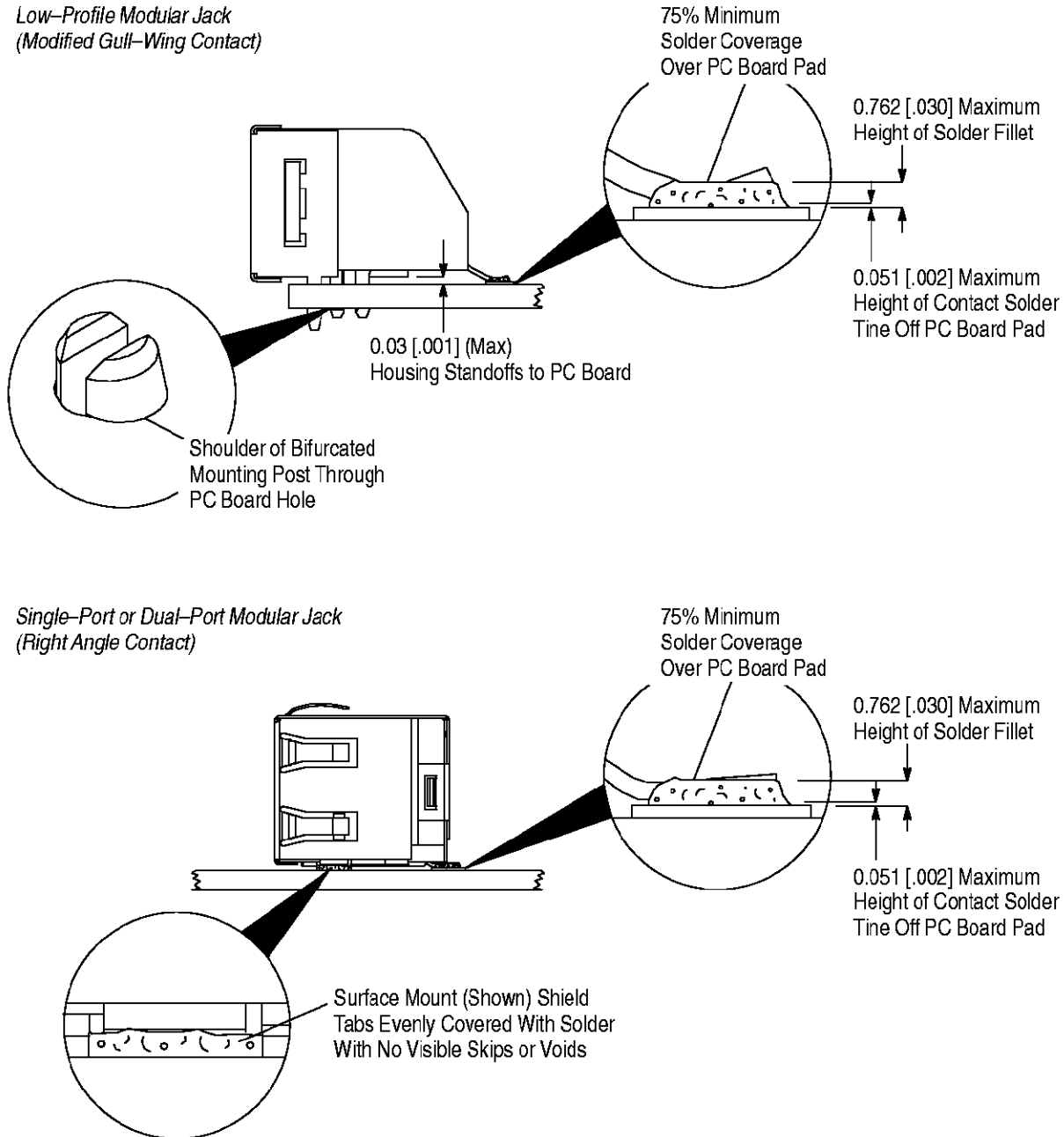
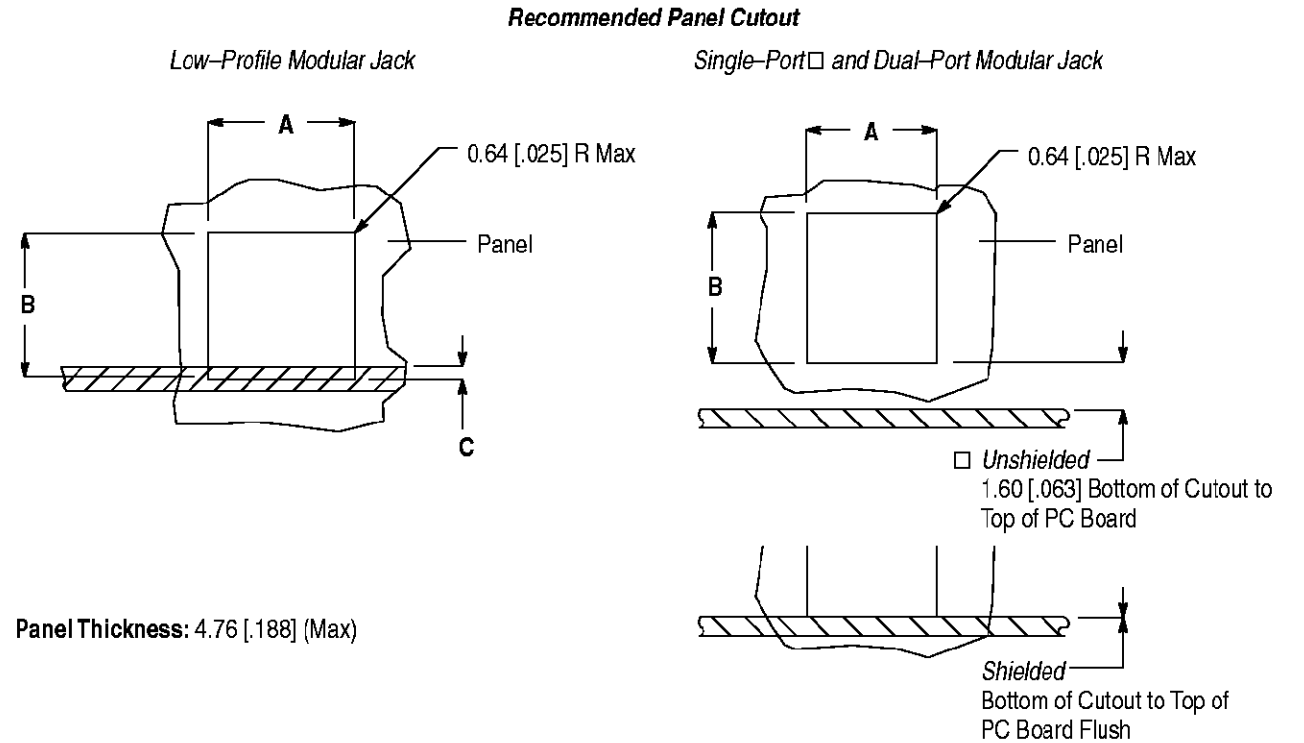


Figure 6

**3.15. Panel Cutout**

After the modular jack is secured to the pc board, the modular jack can be positioned in a cutout in a panel. Dimensions for recommended panel cutout and maximum panel thickness are shown in Figure 7.



MODULAR JACK		PANEL DIMENSION		
CONFIGURATION	POSITION/CONTACT	A	B	C
Low-Profile Shielded	6/4, 6/6	14.22+0.38/-0.00 [.560+.015/-0.000]	13.72±0.13 [.540±.005]	0.51 [.020]
	8/8	16.26+0.38/-0.000 [.640+.015/-0.000]	13.72±0.13 [.540±.005]	
Low-Profile Unshielded	6/2, 6/4, 6/6	13.60+0.38/-0.00 [.535+.015/-0.000]	13.08+0.38/-0.00 [.515+.015/-0.000]	0.25 [.010]
	8/8	15.62+0.38/-0.00 [.615+.015/-0.000]	13.08+0.38/-0.00 [.515+.015/-0.000]	
Single-Port Shielded	8/8	17.27±0.25 [.680±.010]	13.97+0.25/-0.13 [.550+.010/-0.005]	—
Single-Port Unshielded	8/4, 8/8	15.88+0.38/-0.00 [.625+.015/-0.000]	11.40+0.38/-0.00 [.449+.015/-0.000]	
	6/4, 6/6	12.08+0.38/-0.00 [.476+.015/-0.000]	11.40+0.38/-0.00 [.449+.015/-0.000]	
Dual-Port	6/4, 6/6	23.0 [.906]	11.40 [.449]	

Figure 7

**3.16. Mating**

For unimpeded access to the latch tab on mating modular plugs, standard latch modular jacks must be placed on the edge of the pc board, however inverted latch modular jacks can be placed anywhere on the pc board.

**3.17. Repair**

The modular jack may be removed from the pc board by standard de-soldering methods and replaced with a new modular jack.

**4. QUALIFICATION**

Modular jack surface mount pc board assemblies are Recognized Components by Underwriters Laboratories Inc. (UL) under File E81956, and Certified to Canadian Standards Association (CSA) under File LR 7189A.

**5. TOOLING**

No tooling is required for manual placement of these modular jacks. For automatic machine placement, a pc board support must be used to prevent bowing of the pc board during the placement of modular jacks on the board. It should have flat surfaces with holes or a channel large enough and deep enough to receive the modular jack mounting posts. The robotic equipment must have a true position accuracy tolerance of  $\pm 0.13$  [ $\pm 0.005$ ] to properly locate the modular jacks. This includes gripper and fixture tolerances as well as equipment repeatability. The equipment must use the modular jack datum surfaces detailed on the customer drawing to ensure reliable modular jack placement. The equipment feed mechanism must be compatible with the modular jack packaging containers. See Figure 8.

**NOTE** Refer to EIA (Electronic Industries Alliance) 481 or the specific modular jack customer drawing for specifications of the packaging containers.

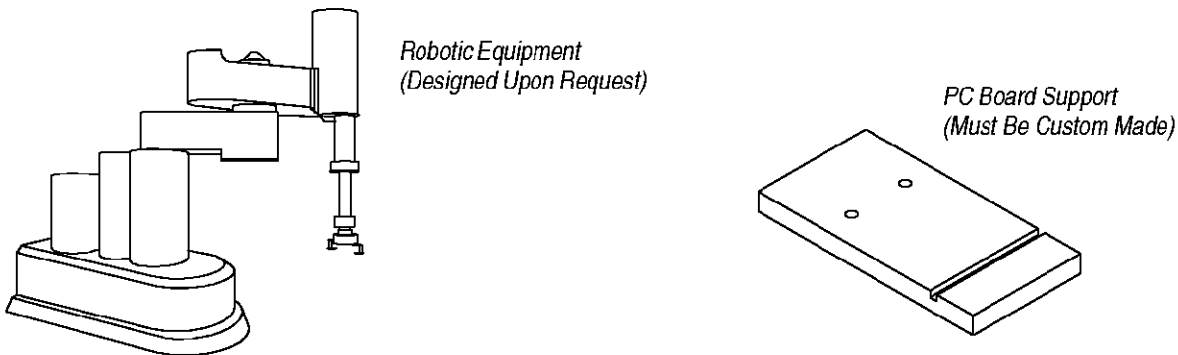
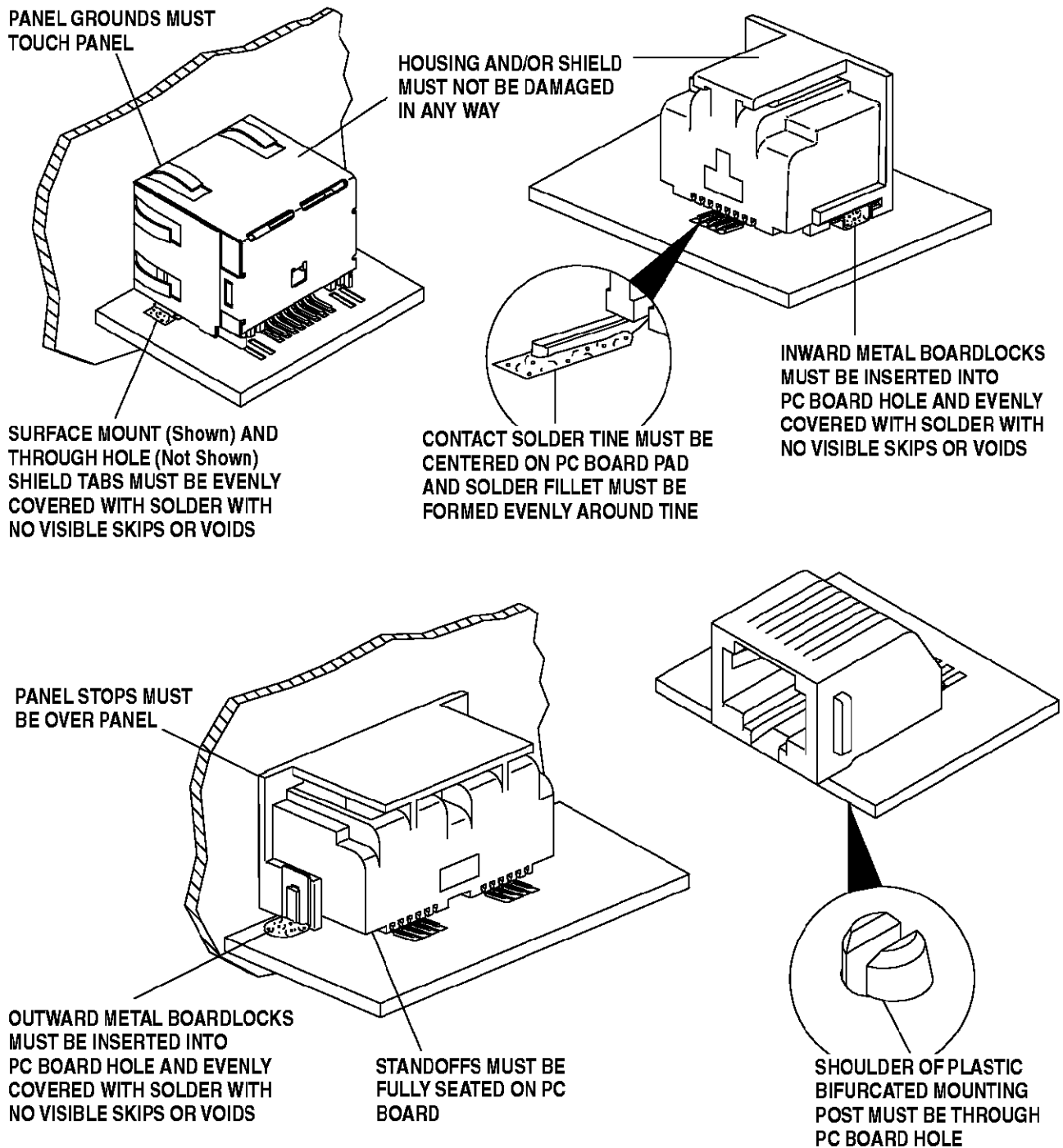


Figure 8

**6. VISUAL AID**

Figure 9 shows a typical application of Modular Jack Surface Mount PC Board Assemblies. 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 9. VISUAL AID**