3 Introduction To Servicing

This Section provides information necessary for servicing standard T3000 radios, and covers the following topics:

Note: For additional servicing information on T3000 Factory Mutual approved intrinsically safe radios, refer to Section 8, “Intrinsically Safe (IS) Products”.

3.1 Servicing Precautions

3.1.1 Servicing Warning

The T3000 Series II handportable radios require specialised servicing techniques. This equipment should be serviced only at an approved Tait Service Centre equipped with the necessary facilities.

Repairs attempted with incorrect equipment or by untrained personnel may result in permanent damage. If in doubt, contact Tait Electronics Ltd or your nearest Tait Branch or Subsidiary.

Note: **T3000 intrinsically safe radios must be returned to an authorised Tait Branch or subsidiary for servicing. Any unauthorised repair or substitution of parts invalidates the intrinsic safety rating.**

3.1.2 Caution: CMOS Devices

This equipment contains CMOS Devices which are susceptible to damage from static charges. Care when handling these devices is essential. For correct handling procedures refer to manufacturers' data books covering CMOS devices, e.g. Philips Data Handbook Covering CMOS Devices; Motorola CMOS Data Book Section 5 (Handling Procedures), etc.

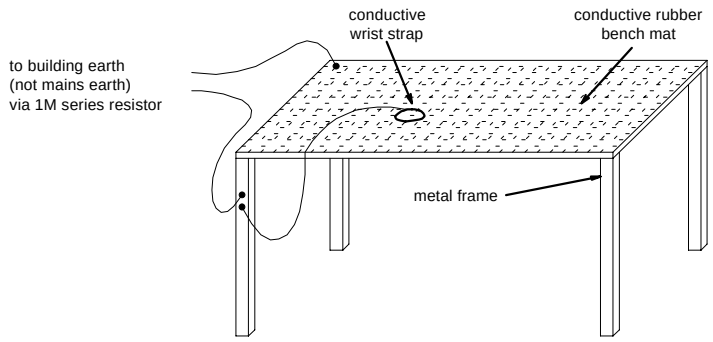


Figure 3.1 Typical Anti-Static Bench Set-Up

3.1.3 Screw Head Types

Pozidriv recess head screws and Torx recess head screws require the correct sized driver to achieve best performance.

Pozidriv recess head screws:	Use the Pozi No.1 driver for M2.5 screws and a Pozi No.0 driver for all M2 screws.
Torx recess head screws:	Use the Torx T8 driver for M2.5 screws and the Torx T6 driver for M2 screws.

3.1.4 Shield Mounting Screws

3.1.4.1 Fitting Plastite Screws

If Plastite screws are used to secure the T3000 shield onto the moulded plastic front cover, they are easily identified by their coarse self-tapping thread. Replace these screws using the following procedure.

Insert the screw into the hole and turn ½ turn backwards. The screw will 'click' into the existing thread.

Turn forwards to tighten, using a maximum torque of 0.5Nm (4.5in.lbf).

Failure to follow this procedure will result in a stripped plastic thread.

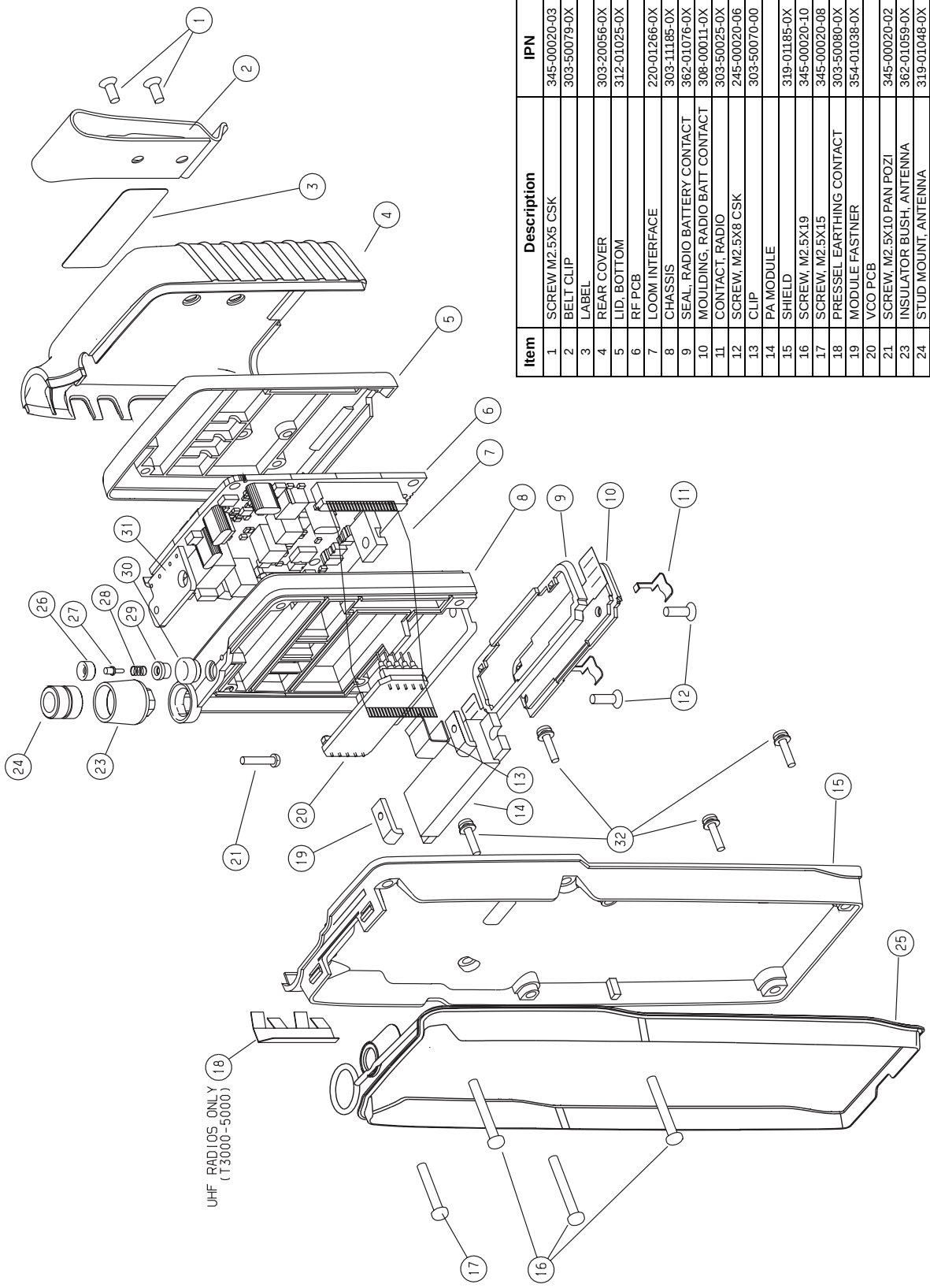
3.1.4.2 M2 Machine Screws

If M2 machine screws are used to secure the T3000 shield onto the moulded plastic front cover, they must be assembled using the original washer and screw combination.

Alternatively, the screw and washer combination can be replaced by a screw with captive washer, available as IPN 345-00080-00.

3.1.5 Technical Instructions (TIs)

From time to time TIs are issued by Tait Electronics Engineering Division. These TIs may be used to update equipment or information, or to meet specific operational requirements.



Item	Description	IPN	Quantity
1	SCREW M2.5X5 CSK	345-00020-03	2
2	BELT CLIP	303-50079-0X	1
3	LABEL		1
4	REAR COVER	303-20056-0X	1
5	LID, BOTTOM	312-01025-0X	1
6	RF PCB		1
7	LOOM INTERFACE	220-01266-0X	1
8	CHASSIS	303-11185-0X	1
9	SEAL, RADIO BATTERY CONTACT	362-01076-0X	1
10	MOULDING, RADIO BATT CONTACT	308-00011-0X	1
11	CONTACT, RADIO	303-50025-0X	2
12	SCREW, M2.5X8 CSK	245-00020-06	2
13	CLIP	303-50070-00	1
14	PA MODULE		1
15	SHIELD	319-01185-0X	1
16	SCREW, M2.5X19	345-00020-10	3
17	SCREW, M2.5X15	345-00020-08	1
18	PRESSEL EARTHING CONTACT	303-50080-0X	1
19	MODULE FASTNER	354-01038-0X	2
20	VCO PCB		1
21	SCREW, M2.5X10 PAN POZI	345-00020-02	1
23	INSULATOR BUSH, ANTENNA	362-01059-0X	1
24	STUD MOUNT, ANTENNA	319-01048-0X	1
25	MAIN SEAL	362-01077-0X	1
26	CAP, ANTENNA SWITCH	232-02034-0X	1
27	PIN, ANTENNA SWITCH	316-85024-0X	1
28	SPRING	319-01041-0X	1
29	CASE, ANTENNA SWITCH	232-02035-0X	1
30	EARTH RING	316-85025-0X	1
31	ANTENNA SWITCH PCB	220-01285-0X	1
32	SHIELD MOUNTING SCREWS	345-00080-00	4

Figure 3.2 T3000 Rear Panel Assembly

3.2 Disassembly Instructions

3.2.1 To Gain Access To The Control PCB Top Side

Refer to Figure 3.2.

Unscrew the antenna and remove the battery pack.

Unscrew the 4 shield retaining screws exposed by removing the battery. Grip the top of the radio firmly and gently pivot the front cover and shield (15) apart, opening at the bottom of the radio.

Before completely separating the front panel and rear cover assemblies (4), the flexible loom interface PCB (7) must be detached from the control PCB.

Push forward the 2 lugs at each end of the loom interface PCB connector on the control PCB. The loom interface PCB can now be withdrawn from the connector, and the front panel assembly separated from the rear cover assembly.

Do not detach the flexible loom interface PCB from the RF PCB.

For detailed instructions on refitting the main seal (25), refer to Section 3.3.

3.2.2 To Gain Access To The RF PCB Top Side

Detach the front panel, as described in 3.2.1.

Refer to Figure 3.2.

Remove the remaining 4 shield retaining screws (16, 17), and lift off the shield, guiding the flexible loom interface PCB (7) through the slot in the shield (15).

The top side of the RF PCB (6), the plug-in VCO PCB (20) and PA module (14) are now visible.

The shield is still attached to the RF module by the main seal, and care must be taken that the main seal is not damaged.

3.2.3 To Gain Access To The RF PCB Bottom Side

Remove the shield to gain access to the top side of the RF PCB, as described in 3.2.2.

Refer to Figure 3.2.

Unclip the rear cover (4) and bottom lid (5) from the chassis (8). The bottom side of the RF PCB (6) is now accessible.

Detach the main seal from the antenna insulator bush (23) and earth ring (30). For detailed instructions on refitting the main seal (25), refer to Section 3.3.

When handling the RF or VCO PCBs, care must be taken with fragile SMD inductors.

3.2.4 To Remove The RF PCB

Refer to Figure 3.2.

Gain access to the top side of the RF PCB, as described in 3.2.2.

Remove the transistor clip (13) from the chassis (8) and unscrew the 2 countersunk screws (12) securing the PA module (14).

Remove the screw from the antenna switch PCB (31) and brass antenna stud (24). It should now be possible to lift the RF PCB from the chassis, first pivoting the chassis away from the loom side.

When remounting the RF PCB in the chassis, place a small amount of Loctite 410 on the thread of the antenna mounting screw. The screw should then be tightened to a torque of 0.6Nm (5in.lbf).

3.2.5 To Gain Access To The Control PCB Bottom Side

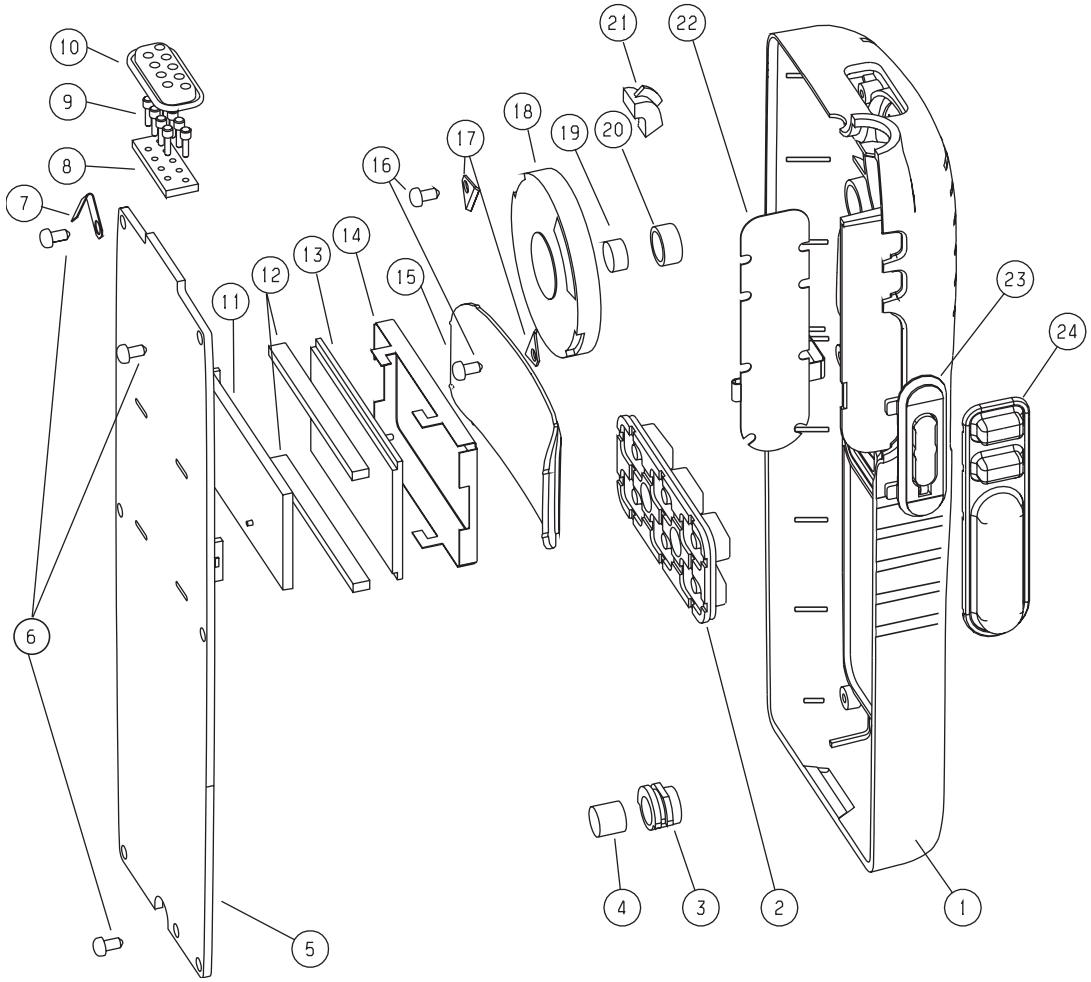
Separate the front panel and rear cover, as described in 3.2.1.

Refer to Figure 3.3 or Figure 3.4.

Remove the 3 control PCB retaining screws (6). The control PCB (5) can now be folded out.

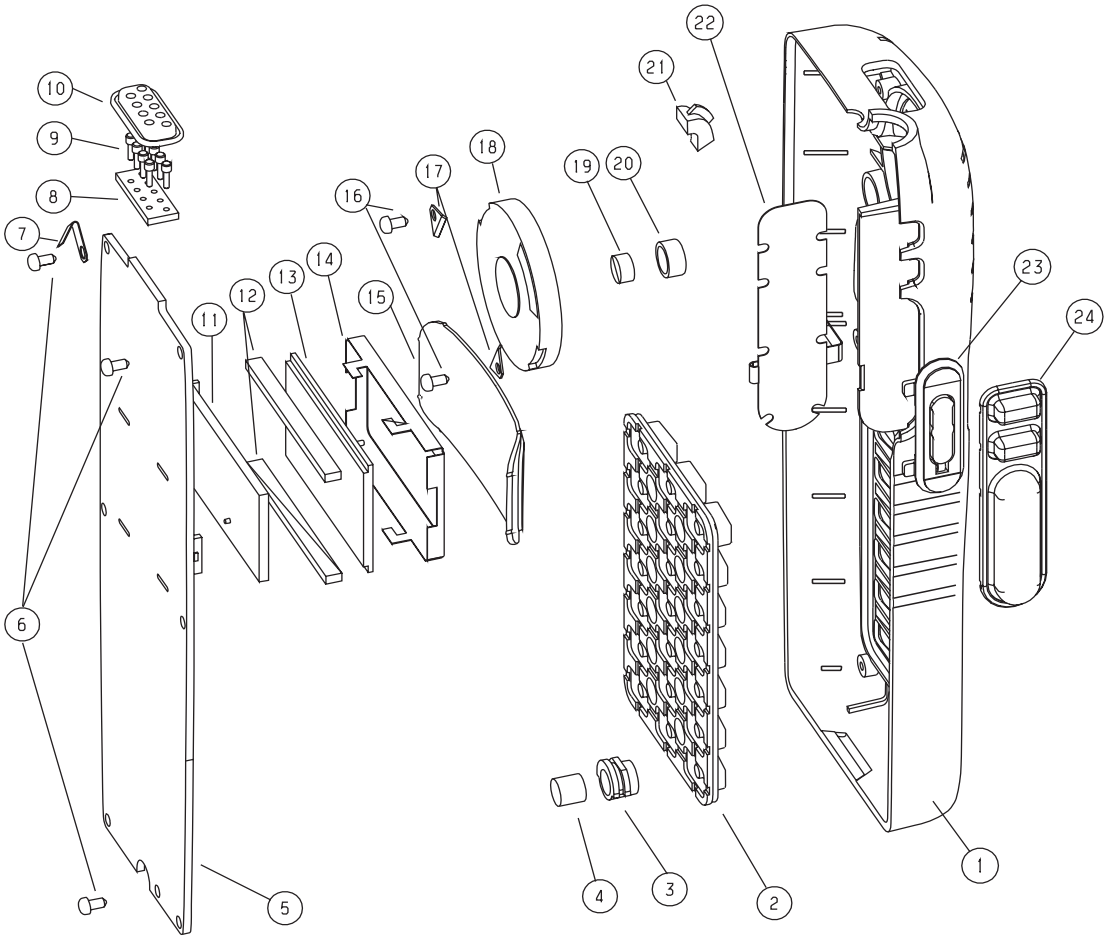
Remove the rubber key pad pressel (24) and pressel insert (23), and gently detach the flexible pressel loom (22) from the inside of the front panel. The control PCB and options connector (8, 9, 10) can now be lifted from the front panel.

To completely remove the PCB from the front panel, loosen the speaker mounting screws (16) and prise out the speaker (18) and upper microphone (19).



Item	Description	IPN	Quantity
1	FRONT PANEL	316-06600-0X	1
2	KEY PAD (6 KEY): T3010 T3030 T3035	 311-03092-0X 311-03090-0X 311-03091-0X	1
3	MICROPHONE SURROUND (LOWER)	369-01032-0X	1
4	MICROPHONE, ELECTRET (LOWER)	252-00010-41	1
5	CONTROL PCB		1
6	M2.5X6MM PAN POZI PLASTITE	349-00010-57	3
7	CONTROL PCB EARTHING CONTACT	303-50081-0X	1
8	AUX PCB		1
9	PIN, AUX (RADIO)	362-85019-0X	9
10	SEAL, AUX (RADIO)	362-01061-0X	1
11	LCD LIGHT SPREADER	304-07038-0X	1
12	ELASTOMERIC CONNECTOR	209-01028-0X	2
13	LCD		1
14	LCD FRAME	306-01042-0X	1
15	LENS	312-01056-0X	1
16	M2X4MM PAN POZI PLASTITE	349-00010-54	2
17	SPEAKER CLAMP	303-50039-0X	2
18	SPEAKER		1
19	MICROPHONE, ELECTRET (UPPER)	252-00010-41	1
20	MICROPHONE SURROUND UPPER	369-01031-0X	1
21	LENS, RX/TX	312-01048-0X	1
22	PRESSEL LOOM, FLEXIBLE	220-01281-0X	1
23	PRESSEL INSERT	311-04002-0X	1
24	KEY PAD PRESSEL	311-03073-0X	1

Figure 3.3 T3010 & T3035 Front Panel Assembly



Item	Description	IPN	Quantity
1	FRONT PANEL	316-06601-0X	1
2	KEY PAD (21 KEY)	311-03085-0X	1
3	MICROPHONE SURROUND (LOWER)	369-01032-0X	1
4	MICROPHONE, ELECTRET (LOWER)	252-00010-41	1
5	CONTROL PCB		1
6	M2.5X6MM PAN POZI PLASTITE	349-00010-57	3
7	CONTROL PCB EARTHING CONTACT	303-50081-0X	1
8	AUX PCB		1
9	PIN, AUX (RADIO)	362-85019-0X	9
10	SEAL, AUX (RADIO)	362-01061-0X	1
11	LCD LIGHT SPREADER	304-07038-0X	1
12	ELASTOMERIC CONNECTOR	209-01028-0X	2
13	LCD		1
14	LCD FRAME	306-01042-0X	1
15	LENS	312-01056-0X	1
16	M2X4MM PAN POZI PLASTITE	349-00010-54	2
17	SPEAKER CLAMP	303-50039-0X	2
18	SPEAKER		1
19	MICROPHONE, ELECTRET (UPPER)	252-00010-41	1
20	MICROPHONE SURROUND (UPPER)	369-01031-0X	1
21	LENS, RX/TX	312-01048-0X	1
22	PRESSEL LOOM, FLEXIBLE	220-01081-0X	1
23	PRESSEL INSERT	311-04002-0X	1
24	KEY PAD PRESSEL	311-03073-0X	1

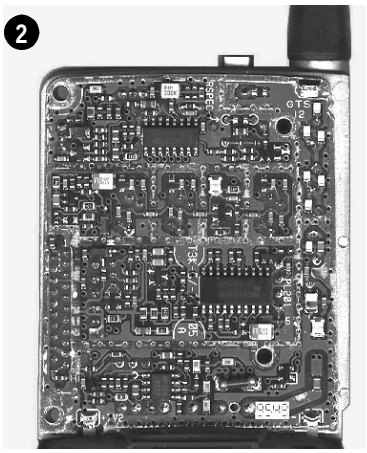
Figure 3.4 T3020 & T3040 Front Panel Assembly

3.3 Assembly Instructions

3.3.1 Fitting The Rear Cover Assembly To The Shield

Refer to Figure 3.2, and the following diagrams. The diagram number corresponds to the numbered instruction, and the numbers in brackets refer to items in Figure 3.2.

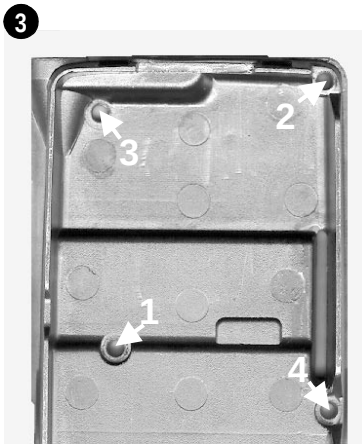
These instructions assume that the rear cover and bottom lid have been removed from the chassis, allowing access to both sides of the RF PCB.



1 Slide the flexible loom PCB (7), still attached to the RF PCB, through the slot in the shield (15).

2 Fit the bottom lid (5) to the chassis.

Fit the chassis assembly to the shield, first sliding the bottom right edge of the battery contact seal (9) behind the groove in the shield, as shown.



3 Secure the bottom lid with the top 4 shield retaining screws (16, 17). The shield retaining screws must be fitted in the order shown.

⚠ **Tighten the 4 shield retaining screws to a torque of 0.6Nm (5in.lbf). This will ensure good earthing for the audio stages, and failure to do so can result in audio distortion**

4 Slide the main seal (25) over the antenna insulator bush (23) and earth ring (30), then around the shield, positioning as shown.

5 Push the battery contact seal (9) into the grove in the bottom lid, as shown. This must remain in place while the rear cover (4) is fitted.

6 Before fitting the rear cover, check the positioning of the 3 undercuts, found on the inside of the rear cover, as shown. These allow for snap fitting of the rear cover onto the bottom lid.

Fit the rear cover over the bottom lid, firstly capturing the main seal under the top edge, and then capturing the 'wings' of the battery contact seal with the lower edge of the rear cover.

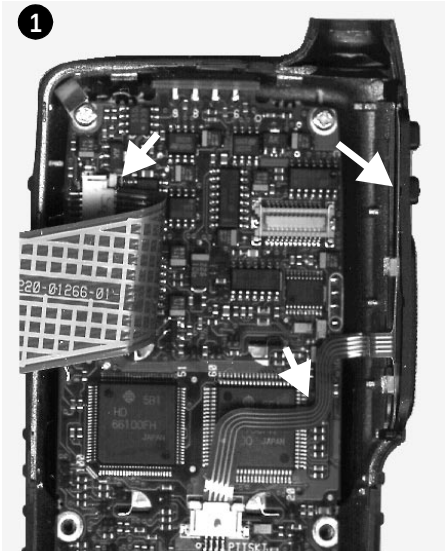
Click the rear cover in place, applying pressure at the undercut positions, and secure with the 2 belt clip screws (1).

3.3.2 Fitting The Front Panel Assembly To The Shield

Refer to Figures 3.3, 3.4, and the following diagrams. The diagram number corresponds to the numbered instruction, and the numbers in brackets refer to items in Figures 3.3 or 3.4.

1 Connect the flexible loom PCB onto the control PCB connector, and push in the 2 lugs to secure.

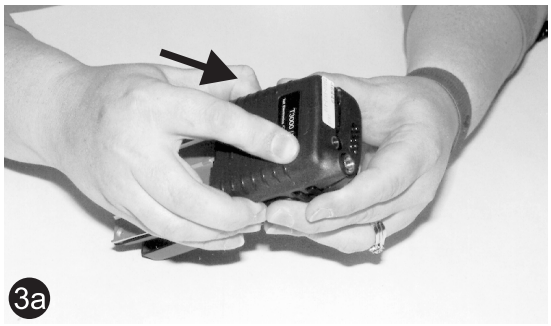
Reposition the flexible pressel loom (22), with pressel insert (23) fitted, and key pad pressel (24) in the front panel, as shown. The flexible loom PCB must pushed against the control PCB.

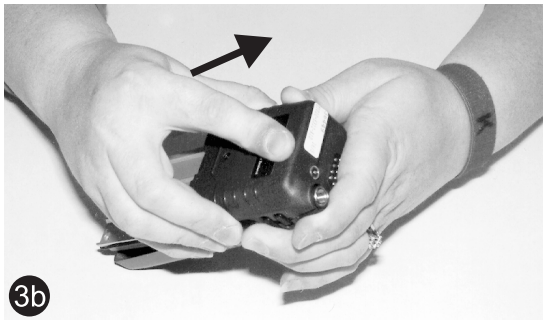


2 **T3000-5000 Radios Only**

Position the pressel earthing contact on the shield, as shown, before fitting the rear cover assembly to the front panel.

3 Fit the top of the rear cover assembly into the top of the front panel assembly, as shown. Check that the main seal remains correctly positioned on the shield.



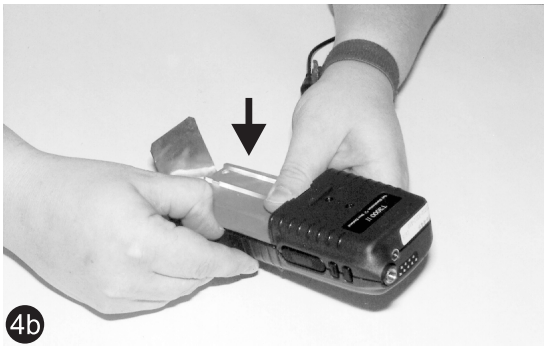


Check that no bulges appear in the top of the radio as the RF assembly is fitted into position.

Check that the flexible pressel loom (22, 23) and keypad pressel (24) are seated correctly in the front panel assembly.

4 Place a shim between the main seal and the front panel. The shim can be a rectangular piece of thin metal.

Slowly push the shield into position against the front panel assembly, pushing from the top. At the same time, keep the main seal pushed down, so that it remains in position and is not caught between the shield and the front panel.



5 Remove the shim when the main seal is completely under the shield, and is not visible.

6 Secure the front panel with the remaining 4 shield mounting screws. Refer to Section 3.1.4 for special instructions.

3.4 Accessory Connector

An accessory connector is mounted adjacent the antenna for attaching T3000 external accessories. Refer to Section 7 for details of fitting specific accessories.

The interface signals available are described in the table below.

Accessory Connector Pin No.	Function
1	EXT-SPR-: balanced external speaker output (1)
2	EXT-SPR+ : balanced external speaker output (2)
3	TXD: transmit data (used in calibration)
4	GND: options ground
5	+7.2V-AUX: low current supply for accessories
6	MIC-AUDIO: external mic. input
7	MOD-AUDIO: transmit modulation input (used in calibration)
8	RXD: receive data (used in calibration)
9	EXT-PTT: external PTT input

Table 3.1 Accessory Connector Interface Signals

The following diagram shows the accessory connector pin numbering.

Figure 3.7 T3000 Accessory Connector - Top View

3.5 Repair

3.5.1 Surface Mount Devices

Caution: Surface mount devices require special storage, handling, removal and replacement techniques. This equipment should be serviced only by an approved Tait Dealer or Service Centre equipped with the necessary facilities. Repairs attempted with incorrect equipment or by untrained personnel may result in permanent damage. If in doubt, contact Tait Electronics Ltd or your nearest Tait Branch or Subsidiary.

3.5.1.1 Introduction

The following points must be observed when servicing SMDs:

- Carry out all servicing in a static safe work area (refer to Figure 3.1).
- Always observe static precautions when handling or carrying SMDs i.e. carry in foil, anti static bags or in trays and anti-static tubes for fine pitch ICs.
- Use appropriate tools when working with SMDs (refer to 3.5.1.2).
- Do not use soldering irons on surface mount capacitors, resistors, SOIC and SOT components.
- Use new solder when replacing SMDs.
- Use the correct amount of solder (refer to Figure 3.9).
- Never reuse old SMDs.
- Do not use SMDs that have been dropped.

3.5.1.2 Servicing Equipment Required

- Hot air tool or heat gun: adjustable temperature is required and a regulated hot air blower. The nozzle is changed according to the size of the SMDs.
- Weller Pyropen®: this is a butane hot air tool, and is hotter than a heat gun. For use only for resistors, capacitors and SOTs.
- Solder paste dispenser or syringe: for SMD placement.
- Tweezers: for use when handling SMDs.
- Solderwick: for removing solder on SMD pads or for removing excess solder or bridging on QFPs, SOIC leads, LCCCs etc.

- Soldering iron: for use on electrolytic capacitors and plastic coated devices that may be damaged by a heat gun.
- Microscope: for individual SMD inspection and for SMD replacement.

Use the following diagram to identify types of SMD components.

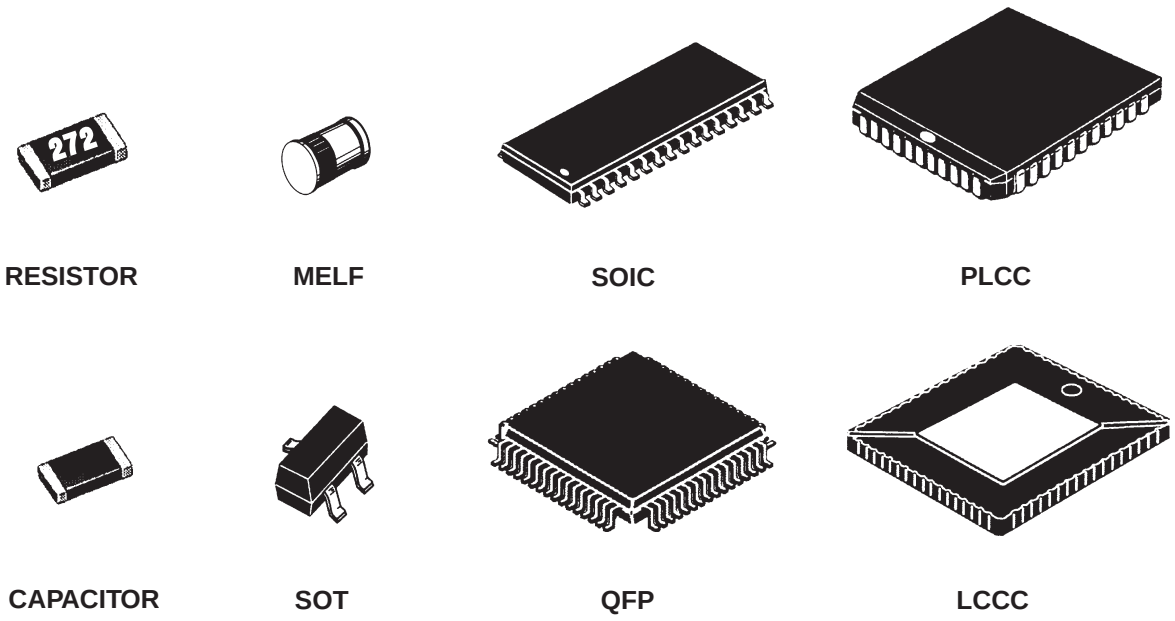


Figure 3.8 Identifying SMD Components

3.5.1.3 Removal & Replacement Of SMD Components

Refer to Figure 3.9.

(a) Capacitors, Resistors, MELF & SOT

Hold the nozzle of the hot air tool above the component and keep it moving to ensure that the PCB is not damaged.

Remove the SMD and clean away any glue using the hot air tool and a pair of tweezers.

Remove any excess solder from the pads using solderwick.

Deposit a small amount of solder paste on the pads using the solder paste dispenser or syringe.

Apply heat evenly to both sides of the device using the hot air gun or Weller Pyropen®, until all the paste has reflowed. As this happens, the device will self-align on the pads. If necessary, use tweezers to prevent the SMD from moving while heat is being applied.

(b) SOIC, VSO, QFP, LCCC & PLCC

Hold the nozzle of the hot air tool on top of the leads and keep it moving to ensure that the PCB is not damaged. A hot air tool with the correct size nozzle must be used.

After a few seconds heating, use a very gentle twisting motion to allow the device to move away from its associated pads.

Carefully remove all excess solder from the pads using a soldering iron and solderwick.

Apply an even amount of solder paste along the full length of the pads, using flux where necessary.

Align the device accurately on the pads and apply a slight pressure with the tweezers to hold in place.

Hold the heat nozzle at an angle and move it slowly along the leads, ensuring that the paste reflows properly.

If any fine bridges occur, use a spike or solderwick to clear. If this is necessary, apply more solder paste before using the hot air gun again.

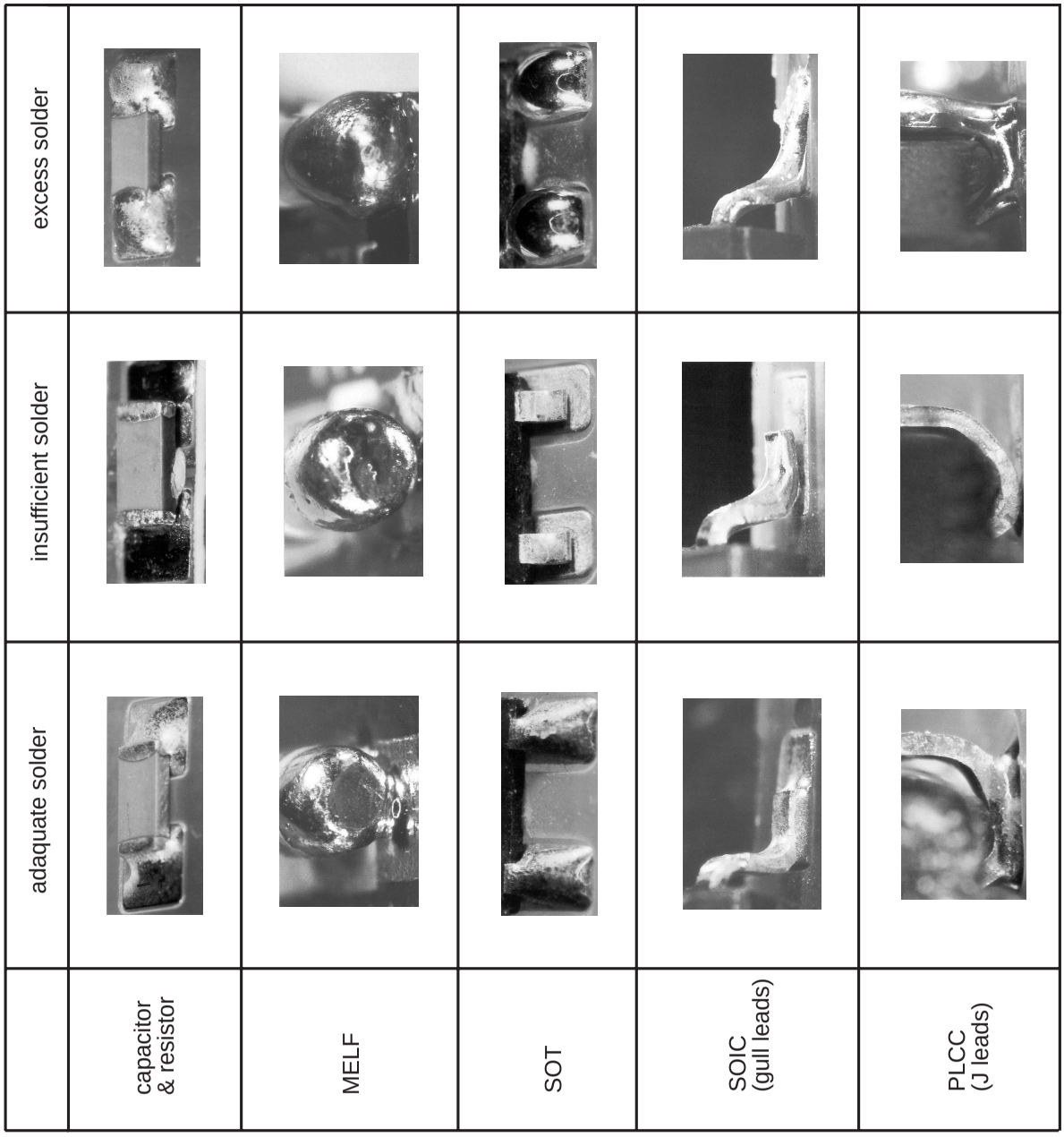


Figure 3.9 SMD Soldering Guide

3.5.1.4 Common Causes Of SMD Failure

(a) Cracked SMD

Most often occurs with capacitors, caused by:

- Thermal shock: if the SMD is heated too rapidly either it will crack or internal seals will be lost, resulting in premature failure.
- In-service temperature changes that cause invisible micro-cracks. These start at or just under the end termination and will spread throughout the device over a long period of time.

(b) Solder Joint Failure

- Stress causing flexing of the PCB leads to a cracked joint.
- Excessive or too little solder results in a poor quality joint.
- Various soldering process defects such as solder balling, device misalignment, solder bridging and glue defects.

(c) Static Damage

If static damage is suspected, remove and replace the component.

3.5.2 Leaded Components

Whenever components are removed from or fitted to the PCB, care must be taken to avoid damage to the track. The two satisfactory methods of removing components from PTH PCBs are detailed below.

3.5.2.1 Desoldering Iron Method

Use a desoldering station, e.g. Philips SBC 314 or Pace MBT-100E for this method.

Place the tip over the lead and, as the solder starts to melt, move the tip with a circular motion.

Start the suction and continue the movement until 3 or 4 circles have been completed.

Remove the tip while continuing suction to ensure that all solder is removed from the joint, then stop the suction.

Before pulling the lead out, ensure it is not stuck to the plating. If the lead is still not free, resolder the joint and try again.

The desoldering iron does not usually have enough heat to desolder leads from the ground plane. Additional heat may be applied by holding a soldering iron on the tip of the desoldering iron (this may require a helper).

3.5.2.2 Component Cutting Method

Cut the leads on the component side of the PCB.

Heat the solder joint sufficiently to allow easy removal of the lead by drawing it out from the component side: do not use undue force.

Fill the hole with solder and then clear with solderwick.

3.6 Programming

Refer to the T3000 software users' guide supplied with the T3000 programming kit. This is also available separately under IPN 439-35000-0X.

3.7 Test Facilities

Standard test facilities have been developed to perform functions independently of the radio's normal operation. For a full description of test facilities available, refer to Section 5.