

3 Introduction To Servicing

This Section provides information necessary for servicing T2000 Series II radios, and covers the following topics:

Section	Title	Page
3.1	Servicing Precautions	3.2
3.1.1	Caution: Accidental Transmit	3.2
3.1.2	Caution: Antenna Loading	3.2
3.1.3	Caution: Beryllium Oxide & Power Transistors	3.2
3.1.4	Caution: CMOS Devices	3.2
3.1.5	Caution: Screw Head Types	3.3
3.2	Disassembly Instructions	3.5
3.2.1	To Gain Access To The Logic PCB	3.5
3.2.2	To Remove The Bottom Cover And Microprocessor Shield	3.5
3.2.3	To Detach The Control Head	3.6
3.2.3.1	Locally Mounted Models	3.6
3.2.3.2	Remotely Mounted Models	3.6
3.2.4	To Disassemble The Control Head	3.7
3.2.4.1	T2010, T2015, T203X & T2060 Radios	3.7
3.2.4.2	T2020, T2040 & T2050 Radios	3.9
3.2.5	To Detach The EMC Filter PCB	3.11
3.2.6	To Remote A Locally Mounted T2020, T2040 & T2050	3.11
3.3	Power Amplifier - Special Instructions	3.12
3.3.1	To Replace PA Transistors	3.12
3.3.2	To Remove Case Mica Capacitors	3.12
3.4	Repair	3.13
3.4.1	Surface Mount Devices	3.13
3.4.1.1	Surface Mount Device (SMD) Precautions	3.13
3.4.1.2	Servicing Equipment Required	3.13
3.4.1.3	Removal & Replacement Of SMD Components	3.15
3.4.1.4	Common Causes Of SMD Failure	3.17
3.4.2	Leaded Component Removal	3.17
3.4.2.1	Desoldering Iron Method	3.17
3.4.2.2	Component Cutting Method	3.18
3.5	Programming	3.18

3.1 Servicing Precautions



3.1.1 Caution: Accidental Transmit

Under certain circumstances the microprocessor can key the transmitter. Ensure that all instruments are protected from accidental transmit at all times.



3.1.2 Caution: Antenna Loading

The equipment has been designed to operate with a 50Ω termination impedance, but will tolerate a wide range of antenna loading conditions. However, it is strongly recommended that the transmitter is not operated in the absence of a suitable load. Failure to observe this precaution may result in damage to the transmitter power output stage.



3.1.3 Caution: Beryllium Oxide & Power Transistors

The RF power transistors in the T2000 all contain some beryllium oxide. This substance, while perfectly harmless in its normal solid form, can become a severe health hazard when it has been reduced to dust.

For this reason the RF power transistors should not be scratched, mutilated, filed, machined, or physically damaged in any way that can produce dust particles.



3.1.4 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.

The following diagram shows a typical anti-static bench set-up.

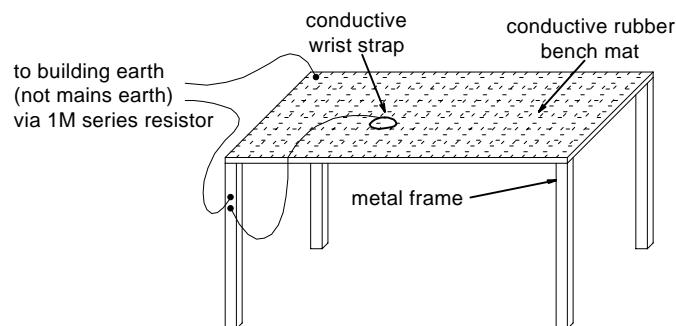


Figure 3.1 Anti-Static Bench Set-Up



3.1.5 Caution: Screw Head Types

Pozidriv screws are the preferred standard on all T2000 series equipment. Pozidriv No. 1 and 2 screwdrivers will fit all pozidriv screws used in the T2000: Philips cross-head screwdrivers are *not* satisfactory for use on these screws.

The following diagram identifies the differences between Philips and Pozidriv screwdrivers.

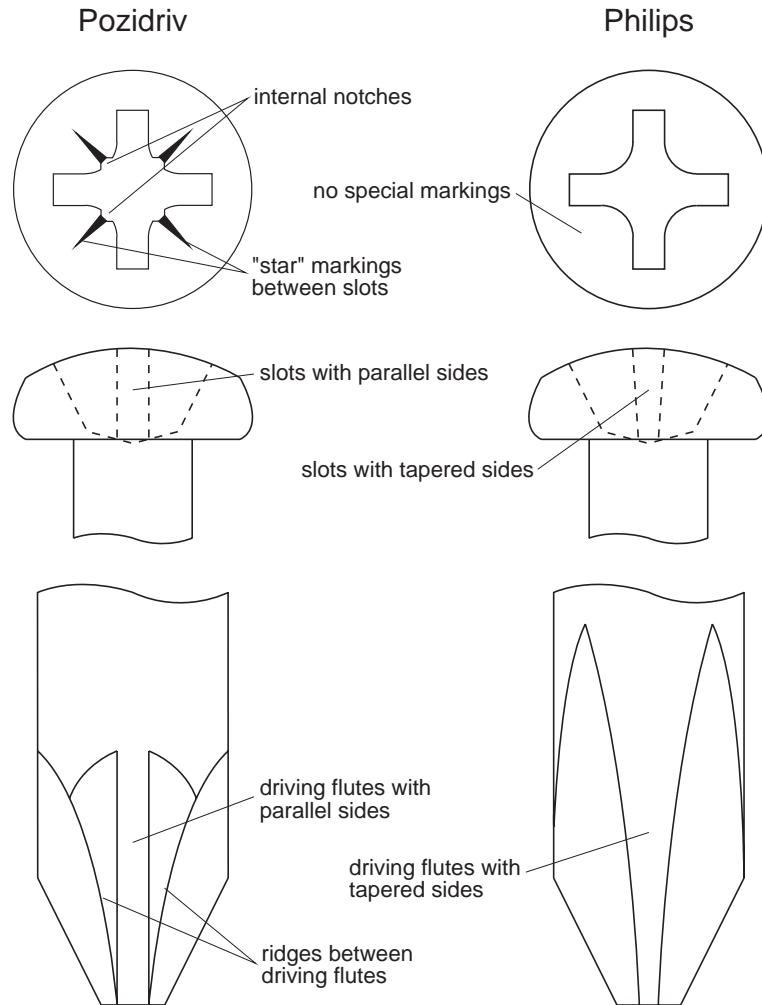
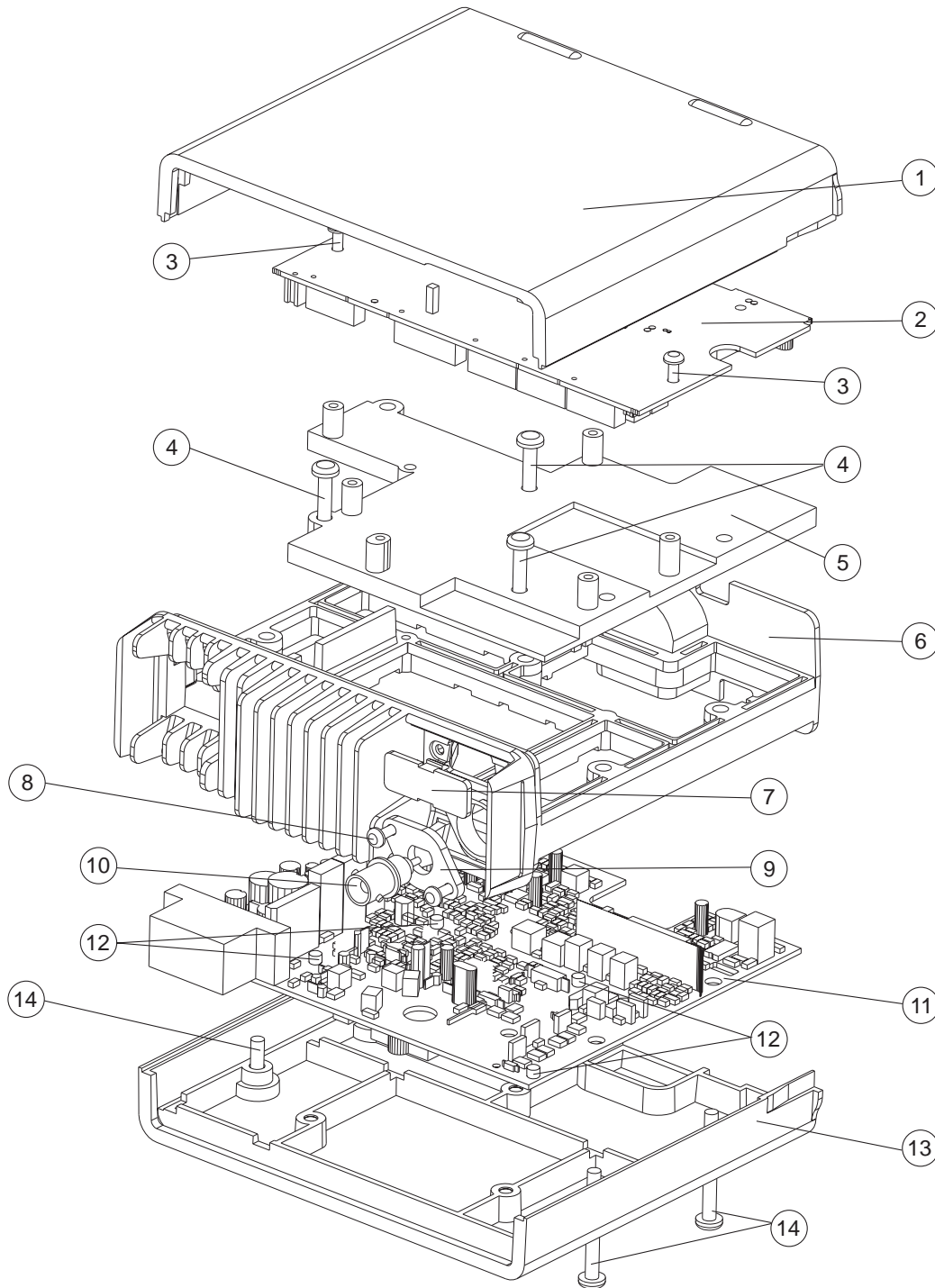


Figure 3.2 Screwdriver Identification

The diagrams on the following pages show the types of screws used in the T2000 Series II radios, their locations and torque specifications.



Item	Description	IPN	Quantity	Torque (in.lb)
1	TOP COVER	303-23134-01	1	
2	LOGIC PCB	SEE PARTS LIST	1	
3	SCREW M3X8 PANPOZI TAPTITE (LOGIC PCB SCREWS)	349-00020-32	3	8
4	MACHINE SCREW M4X25 (MICRO. SHIELD SCREWS)	345-00050-18	3	12
5	MICROPROCESSOR SHIELD	319-01164-XX	1	
6	CHASSIS	308-13093-XX	1	
7	D-RANGE BLANKING PLATE	360-01053-XX	1	
8	SCREW M3X8 PANPOZI TAPTITE (RF CONNECTOR SCREWS)	349-00020-32	2	8
9	RF CONNECTOR PLATE	SEE PARTS LIST (SECTION 7)	1	
10	RF CONNECTOR		1	
11	RF PCB		1	
12	SCREW M3X8 PANPOZI TAPTITE (RF PCB SCREWS)	349-00020-32	4	8
13	BOTTOM COVER	303-23135-XX	1	
14	M4X35 PANPOZI TAPTITE (BOTTOM COVER SCREWS)	349-00020-49	4	12

Figure 3.3 T2000 Series II Radio Assembly

3.2 Disassembly Instructions



Caution: To carry out alignment it is necessary to remove only the top cover (1) and logic PCB retaining screws (3). It is essential that the bottom cover (13) and microprocessor shield (5) with its three retaining screws (4) are torqued down as specified in Figure 3.3.



Caution: Various electronic components within the radio can be damaged by electrostatic discharge. A properly grounded earth mat and wrist strap should be used at all times (refer to Section 3.1.4).

3.2.1 To Gain Access To The Logic PCB

Refer to Figure 3.3.

Remove the top cover (1) by unscrewing the four bottom cover screws (14).

Remove the three logic PCB retaining screws (3).

It should now be possible to open out the logic PCB (2), giving access to both sides of the logic PCB, and access to the RF PCB (11) tuning points, audio, plug-in TCXO PCB and loop filter components.

3.2.2 To Remove The Bottom Cover And Microprocessor Shield

Refer to Figure 3.3.

Remove the top cover and logic PCB screws as instructed in Section 3.2.1, then remove the three microprocessor shield retaining screws (4).

Remove the screw securing the earthing wire from the control head to the microprocessor shield.

It should now be possible to lift off the microprocessor shield (5) and the bottom cover (13).

This will give access to both sides of the RF PCB and IF PCBs, and enable the control head to be removed.

3.2.3 To Detach The Control Head

3.2.3.1 Locally Mounted Models

Remove all covers, as instructed in Section 3.2.2.

Unplug the loom running between the control head and the logic PCB.

Note: In EMC model radios, the loom connects to a Micromatch connector on the EMC filter PCB (refer to Section 3.2.5).

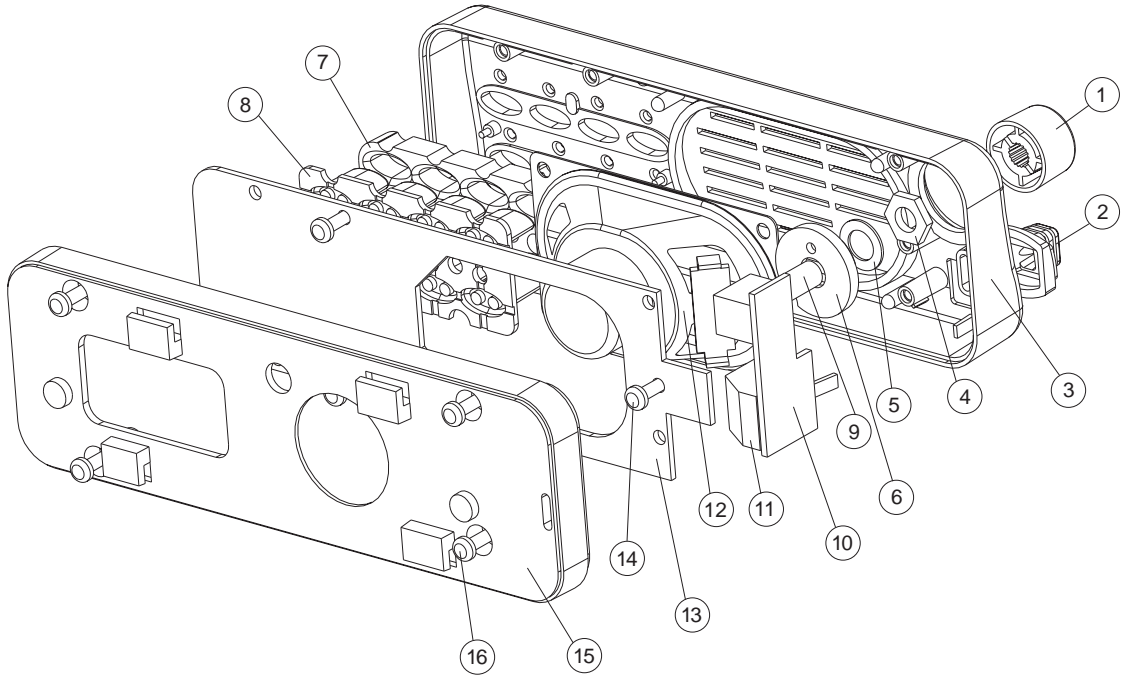
3.2.3.2 Remotely Mounted Models

Remove the four screws on the front of the radio dummy front panel. This will give access to the control head loom, which can now be unplugged.

Note: In EMC model radios, the loom connects to a Micromatch connector on the EMC filter PCB (refer to Section 3.2.5).

3.2.4 To Disassemble The Control Head

3.2.4.1 T2010, T2015, T203X & T2060 Radios



Item	Description	IPN	Quantity	Torque (in.lb)
1	KNOB	311-01042-XX	1	
2	MICROPHONE GROMMET	360-02003-XX	1	
3	FRONT PANEL	316-03095-XX	1	
4	VOLUME POT NUT	SEE PARTS LIST (SECTION 7)	1	
5	VOLUME POT WASHER		1	
6	VOLUME POT LIGHTSPREADER	304-07037-XX	1	
7	LIGHTSPREADER BUTTON	304-07035-XX	1	
8	BASIC KEYPAD	311-03095-XX	1	
9	VOLUME POT		1	
10	POT PCB	SEE PARTS LIST (SECTION 7)	1	
11	MICROPHONE CONNECTOR		1	
12	SPEAKER	250-00010-19	1	
13	CONTROL HEAD PCB (T2010, T2015, T203X, OR T2060)	SEE PARTS LIST	1	
14	NO 4X3/8 SCREW (CONTROL HEAD SCREWS)	349-00010-22	3	8
15	ADAPTOR PLATE	301-00001-XX	1	
16	NO 4X5/8 SCREW (ADAPTOR PLATE SCREWS)	349-00010-24	4	8

Figure 3.4 T2010, T2015 & T203X Control Head Assembly

Refer to Figure 3.4.

Remove the control head from the main chassis, as instructed in Section 3.2.3.

Remove the four adaptor plate retaining screws (16).

Remove the control head PCB retaining screws (14).



The screws used in the control head are No. 4 Plastites, and should not be confused with the M3 screws used elsewhere. When being replaced, the No. 4 Plastite screws must be tightened to a torque of 8in.lb (0.9Nm).

With the control head face down, gently remove the PCB (13), along with the keypad (8) and lightspreader (7).

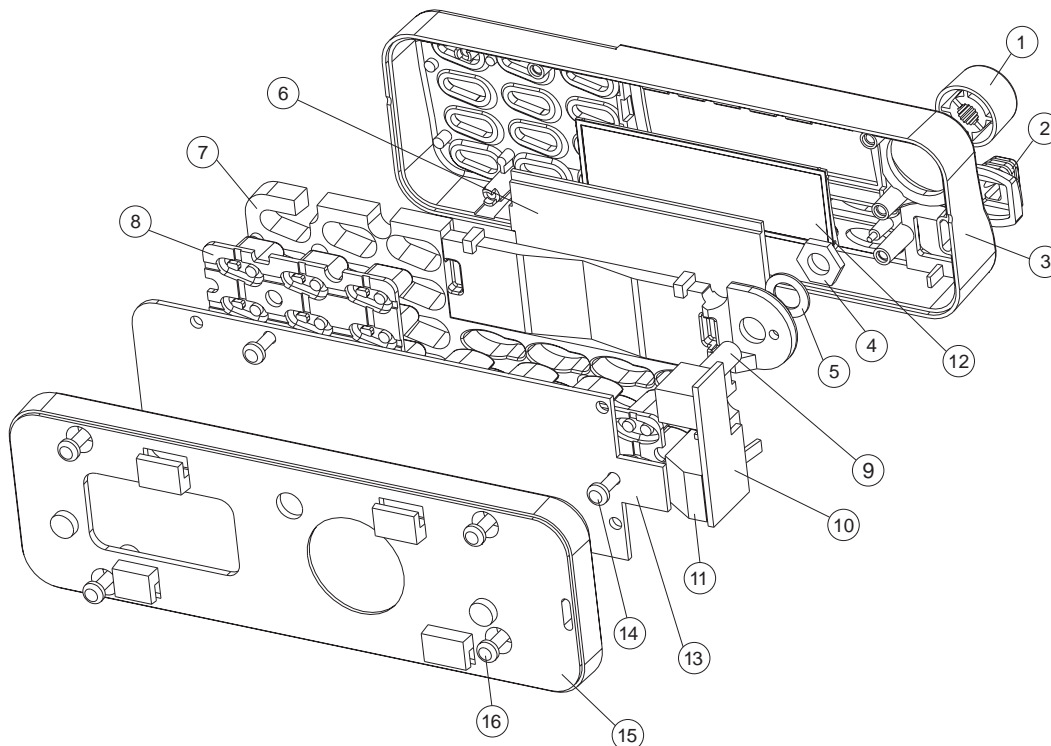


Do not disturb the positioning or height of the LEDs, as this is critical for reassembly.

Remove the speaker by carefully removing the four speaker retaining spire nuts.

Remove of the volume knob (1) and volume pot nut (5) to access the volume knob light spreader (6).

3.2.4.2 T2020, T2040 & T2050 Radios



Item	Description	IPN	Quantity	Torque (in.lb)
1	KNOB	311-01042-XX	1	
2	MICROPHONE GROMMET	360-02003-XX	1	
3	FRONT PANEL	316-06427-XX	1	
4	VOLUME POT NUT	SEE PARTS LIST	1	
5	VOLUME POT WASHER	(SECTION 7)	1	
6	LIQUID CRYSTAL DISPLAY (LCD)	008-02029-XX	1	
7	LIGHTSPREADER	304-07036-XX	1	
8	ENHANCED KEYPAD	311-03096-XX	1	
9	VOLUME POT		1	
10	POT PCB	SEE PARTS LIST	1	
11	MICROPHONE CONNECTOR	(SECTION 7)	1	
12	LENS	312-01046-XX	1	
13	CONTROL HEAD PCB (T2020, T2040 OR T2050)	SEE PARTS LIST	1	
14	NO 4X3/8 SCREW (CONTROL HEAD SCREWS)	349-00010-22	3	8
15	ADAPTOR PLATE	301-00001-XX	1	
16	NO 4X5/8 SCREW (ADAPTOR PLATE SCREWS)	349-00010-24	4	8

Figure 3.5 T2020, T2040 & T2050 Control Head Assembly - Locally Mounted

Refer to Figure 3.5 and Figure 3.6.

Remove the control head from the main chassis, as instructed in Section 3.2.3.

Remove the four adaptor plate/remote back panel retaining screws (16). Remote mounted models also have two captive nuts (17) fitted in the back cover.

Note: EMC model radios have 4 ESD plugs fitted over the remote back panel screws. These will need to be removed to access the remote back panel screws.

Remove the control head PCB retaining screws (14).



The screws used in the control head are No. 4 Plastites, and should not be confused with the M3 screws used elsewhere. When being replaced, the No. 4 Plastite screws must be tightened to a torque of 8in.lb (0.9Nm).

With the control head face down, gently remove the PCB (13), along with the keypad (8) and lightspreader (7).



Do not disturb the positioning or height of the LEDs, as this is critical for reassembly.

Carefully remove the LCD (6) and lens (12).

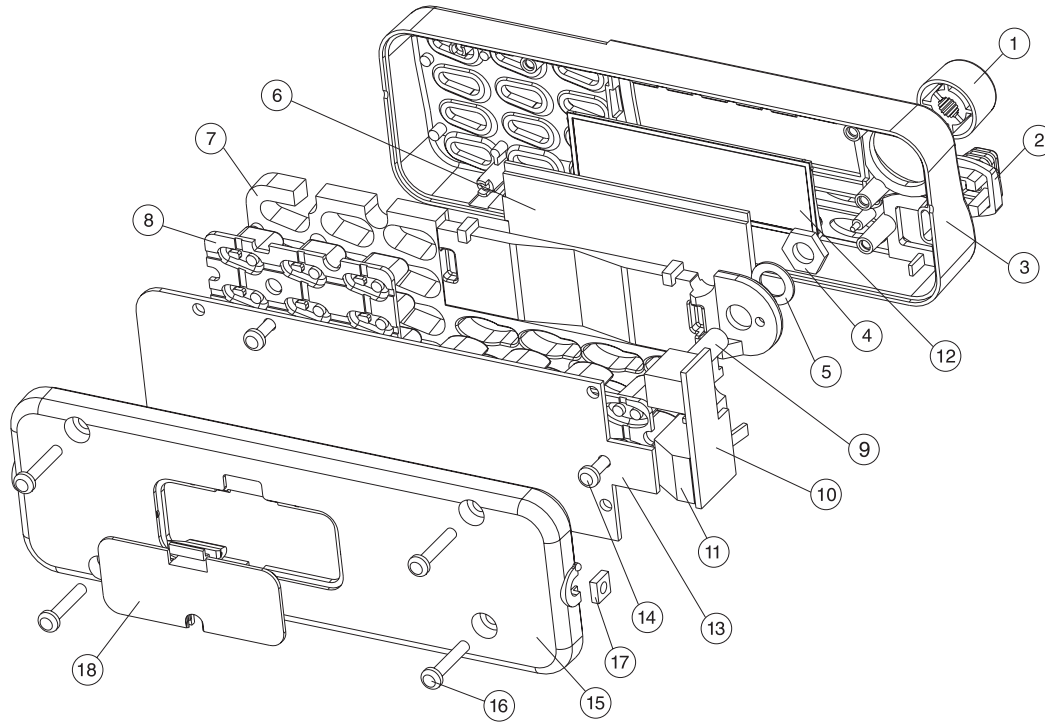
Lay the front panel (3) on a horizontal surface, with the light spreader (7) in place.

Remove the volume knob (1) and volume knob nut (5) to access the lightspreader and keypad (8).

Before reassembly, the LCD and PCB edge connectors should be wiped with alcohol.



Take care to ensure the alcohol does not come in contact with the coating on the light spreader, as this will dissolve on contact with alcohol.



Item	Description	IPN	Quantity	Torque (in.lb)
1	KNOB		1	
2	MICROPHONE GROMMET	360-02003-XX	1	
3	FRONT PANEL	316-06427-XX	1	
4	VOLUME POT NUT	SEE PARTS LIST	1	
5	VOLUME POT WASHER	(SECTION 7)	1	
6	LIQUID CRYSTAL DISPLAY (LCD)	008-02029-XX	1	
7	LIGHTSPREADER	304-07036-XX	1	
8	ENHANCED KEYPAD	311-03096-XX	1	
9	VOLUME POT		1	
10	POT PCB	SEE PARTS LIST	1	
11	MICROPHONE CONNECTOR	(SECTION 7)	1	
12	LENS	312-01046-XX	1	
13	CONTROL HEAD PCB (T2020, T2040 OR T2050)	SEE SECTION 7 PARTS	1	
14	NO 4X3/8 SCREW (CONTROL HEAD SCREWS)	349-00010-22	3	8
15	REMOTE BACK PANEL	318-08432-XX	1	
16	NO 4X5/8 SCREW (REMOTE BACK SCREWS)	349-00010-24	4	8
17	CAPTIVE NUT M4 PRESSED	352-00010-17	2	
18	REMOVING CONNECTOR COVER	316-85125-XX	1	

Figure 3.6 T2020, T2040 & T2050 Control Head Assembly - Remotely Mounted

3.2.5 To Detach The EMC Filter PCB

Refer to Figure 3.7.

Remove the top cover and open the logic PCB, as described in Section 3.2.1.

Remove the microprocessor shield and bottom cover, as described in Section 3.2.2.

The control head (locally mounted models) or dummy front panel (remotely mounted models) can now be removed.

Unplug the loom running between the logic PCB and EMC filter PCB (18).

Unplug the loom running between the EMC filter PCB and the control head.

Remove the 4 EMC filter PCB retaining screws. The EMC filter PCB can now be lifted from the chassis.

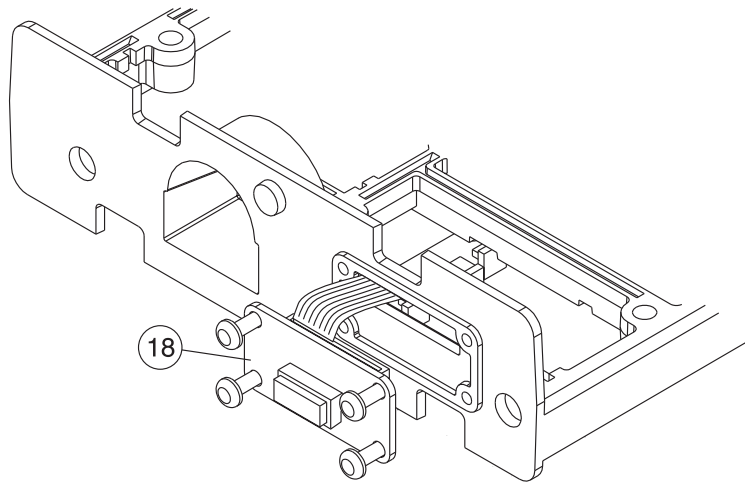


Figure 3.7 EMC Filter PCB Mounting

3.2.6 To Remote A Locally Mounted T2020, T2040 & T2050

Refer to Section 8.16, "T2000-A03/-A04/-A16 Remote Loom Kits".

3.3 Power Amplifier - Special Instructions



Caution: As the location of certain components in the PA is critical to performance, it is important that any components removed or disturbed are refitted in exactly the same location.

3.3.1 To Replace PA Transistors

Desolder the tabs by heating them with a soldering iron, then lifting them up towards the transistor with a thin stainless steel spike or screwdriver.

Unscrew the transistor mounting stud nut or screws and remove the transistor.

Trim the tabs of the replacement to make them similar to the faulty item, then lightly tin the underside of the tabs.

Apply a thin layer of heatsink compound to the underside of the transistor.

Screw the transistor tightly to the heatsink then solder the tabs.



Do not solder the tabs before tightening the screws or nut, as this will fracture the device.

3.3.2 To Remove Case Mica Capacitors

Apply a heavy duty soldering iron to the top of the capacitor case.

When the solder is molten, ease the capacitor away from the PCB with a thin stainless steel spike or screwdriver.

3.4 Repair

3.4.1 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.

3.4.1.1 Surface Mount Device (SMD) Precautions

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. 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 3.4.1.2).
- 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.

3.4.1.2 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 Pyrophen®: 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 multi-leg components.

- 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.

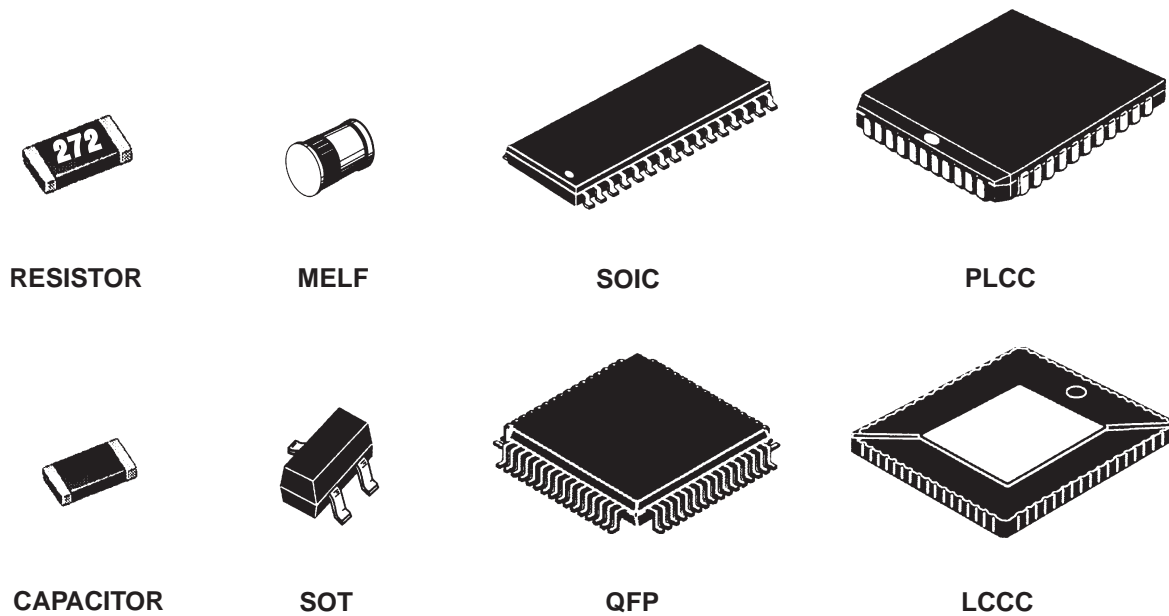


Figure 3.8 Identifying SMD Components

3.4.1.3 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 Pyro-pen[®], 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.

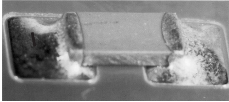
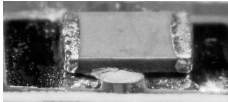
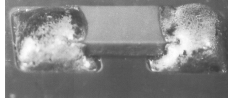
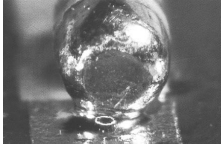
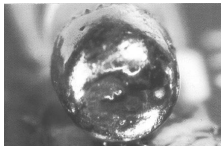
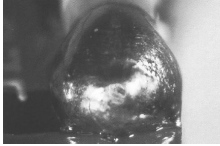
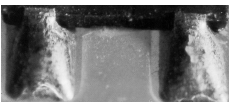
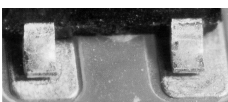
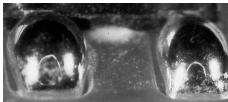
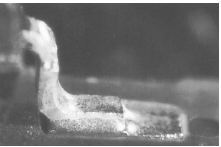
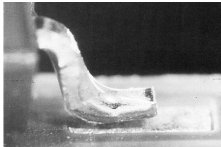

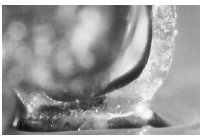
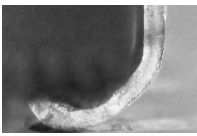
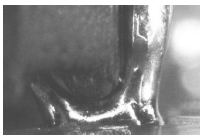
	adaquate solder	insufficient solder	excess solder
capacitor & resistor			
MELF			
SOT			
SOIC (gull leads)			
PLCC (J leads)			

Figure 3.9 SMD Soldering Guide

3.4.1.4 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 Electricity Damage

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

3.4.2 Leaded Component Removal

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.

3.4.2.1 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).

3.4.2.2 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.

3.5 Programming

Refer to the T2000 programming manual supplied with the T2000 programming kit, and Section 9 of this manual.