
TM8000 mobiles

XA2417-01-PBA Raywood Interface Board
Service Manual



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Preface

Scope of Manual

This manual contains information on installing, operating and servicing the XA2417-01-PBA Raywood interface accessory product for TM8100 radios.

Enquiries and Comments

If you have any enquiries regarding this manual, or any comments, suggestions and notifications of errors, please contact Technical Support (refer to “Contact Information” on page 2).

Updates of Manual and Equipment

In the interests of improving the performance, reliability or servicing of the equipment, Tait Electronics Ltd reserves the right to update the equipment or this manual or both without prior notice.

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Associated Documentation

MM8100-00-03-804 TM8100 Mobile Radio User's Guide

MM8100-02-00-812 TM8100 Mobile Radio Service Manual

All available TM8100 product documentation is provided on the TM8100 Product Support CD, product code TMAA20-01. Updates may also be published on the Tait support website.

Publication Record

Version	Publication Date	Description
1.00	June 2004	first release
2.00	August 2004	Name Change
3.00	December 2004	Value Changes

Alert Notices

Within this manual, four types of alerts are given to the reader: warning, caution, important and note. The following paragraphs illustrate each type of alert and its associated symbol.



Warning!! This alert is used when there is a potential risk of death or serious injury.



Caution This alert is used when there is the risk of minor or moderate injury to people.



Important This alert is used to warn about the risk of equipment damage or malfunction.



Note This alert is used to highlight information that is required to ensure that procedures are performed correctly.

Abbreviations

Abbreviation	Description
AF	Audio Frequency
ALC	Automatic Level Control
CD	Compact Disk
CMOS	Complementary Metal Oxide Semiconductor
DTMF	Dual Tone Multiple Frequency
DIP	Dual In-Line Package
DNI	Do Not Install
ESD	Electrostatic Discharge
IC	Integrated Circuit
IPN	Internal Part Number
LED	Light Emitting Diode
NB	Narrow Bandwidth (12.5kHz channel spacing)
PABX	Private Automatic Branch Exchange
PCB	Printed Circuit Board
PGA	Programmable-Gain Amplifier
PSTN	Public Switched Telephone Network
PTT	Press-To-Talk
PSTN	Public Switched Telephone Network
RF	Radio Frequency
SPI	Serial Peripheral Interface
WB	Wide Bandwidth (25kHz channel spacing)

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1 Safety and Servicing Information

This chapter contains general information about safety and servicing procedures when working with TM8000 radios. While many TM8100 accessories plug into external radio interfaces, some accessories are fitted inside the radio. Refer to the TM8100 Service Manual for detailed disassembly and reassembly information

1.1 Personal Safety

Explosive Environments



Warning!! Do not operate equipment near electrical blasting caps or in an explosive atmosphere. Operating the equipment in these environments is a definite safety hazard.

Proximity to RF Transmissions

Do not operate the transmitter when someone is standing within 0.9m (35 inches) of the antenna. Do not operate the transmitter unless you have checked that all RF connectors are secure.

High Temperatures

The bottom surface of the radio and heatsink fins can become hot during prolonged operation. Do not touch these parts of the radio.

1.2 Equipment Safety

ESD Precautions

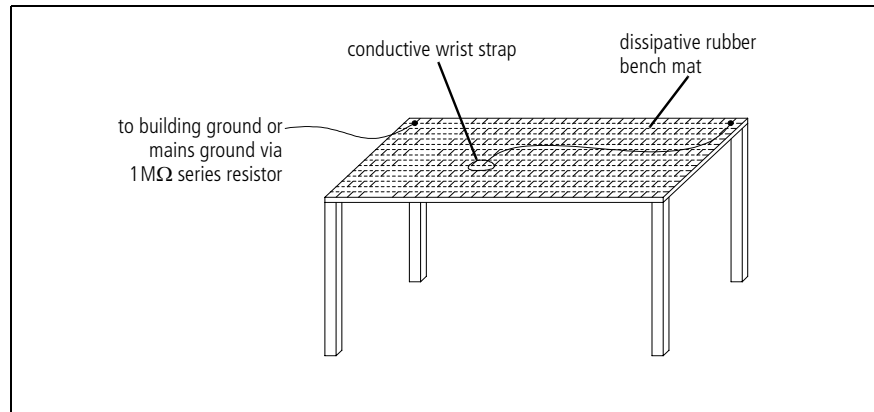


Important This equipment contains devices which are susceptible to damage from static discharges. You must handle these devices carefully and according to the procedures described in the manufacturers' data books.

Purchase an antistatic bench kit from a reputable manufacturer and install and test it according to the manufacturer's instructions. Figure 1.1 shows a typical antistatic bench set-up.

You can obtain further information on antistatic precautions and the dangers of electrostatic discharge (ESD) from standards such as ESD S4.1-1997 (revised) or BS EN 100015-4 1994. The Electrostatic Discharge Association website is <http://www.esda.org/>.

Figure 1.1 Typical antistatic bench set-up



Antenna Load

The TM8100 radio has been designed to operate safely under a wide range of antenna loading conditions. However, the radio should always be operated with a suitable load to prevent damage to the transmitter output power stage.

1.3 Identifying Screw Types

Torx Recess Head Screws

Torx recess head screws are the standard type of screw used in TM8100 equipment, although Pozidriv head screws are also used in a few special applications.

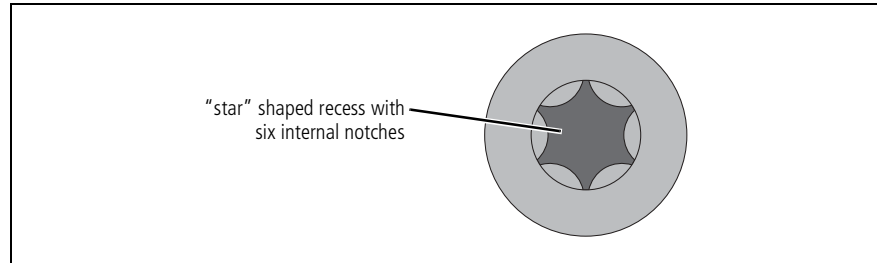
The Torx recess head has the advantage of improved screwdriver tip location, reducing the chances of screw head damage caused by the driver tip rotating within the recess. In addition, using a ball-tip Torx screwdriver allows you to drive a Torx head screw with the driver on a slight angle, which can be useful in situations where access is restricted.

It is important that you use the correct Torx screwdriver tip:

- n M2.5 screws - T8
- n M3 screws - T10
- n M4 screws - T20.

Figure 1.2 below shows a typical Torx recess head screw (the actual hardware may differ slightly from this illustration due to variations in manufacturing techniques).

Figure 1.2 Identifying Torx screws



Allen UNC Screws

Allen 4-40 UNC thread screws are used in some locations in the TM8100 radio and cannot be interchanged with M3 screws.

Pozidriv and Philips Screws

Both Pozidriv and Philips head screws are used on certain TM8100 accessories. It is important that you use the correct type and size screwdriver to avoid damaging screw heads.

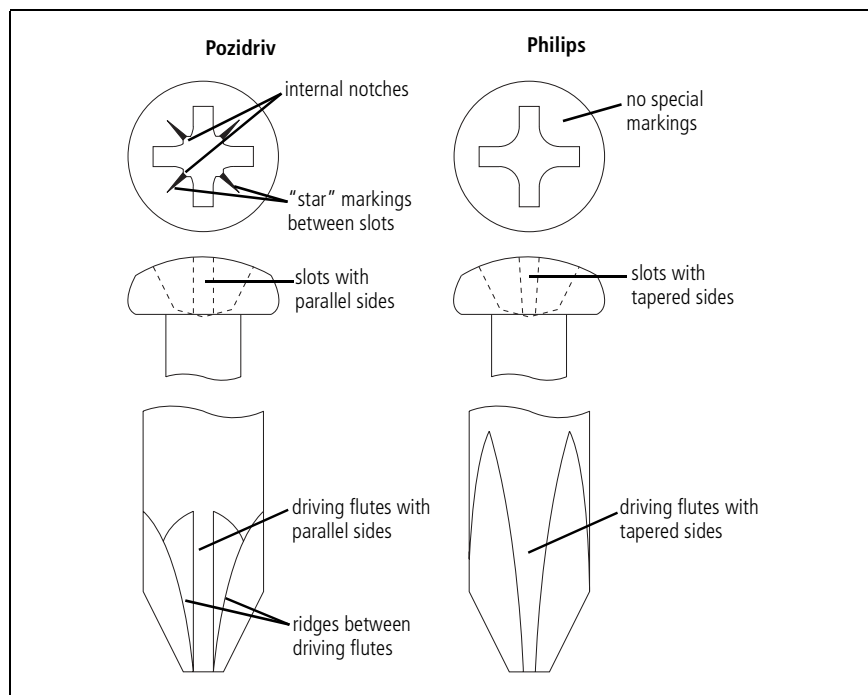
It is particularly important that you do not use Philips screwdrivers on Pozidriv screw heads as the tapered driving flutes of the Philips screwdriver do not engage correctly with the parallel-sided slots in the Pozidriv screw head. This can result in considerable damage to the screw head if the screwdriver tip turns inside the recess.



Note If you find you need excessive downwards pressure to keep the screwdriver tip in the Pozidriv screw head, you are probably using the wrong type or size screwdriver.

Figure 1.3 on the following page shows the main differences between typical Pozidriv and Philips screw heads and screwdriver tips (actual hardware may differ slightly from these illustrations due to variations in manufacturing techniques).

Figure 1.3 Identifying Pozidriv and Philips screws and screwdrivers



1.4 Regulatory Information

Any modifications you make to this equipment which are not authorised by Tait Electronics Ltd may invalidate your compliance authority's approval to operate the equipment.

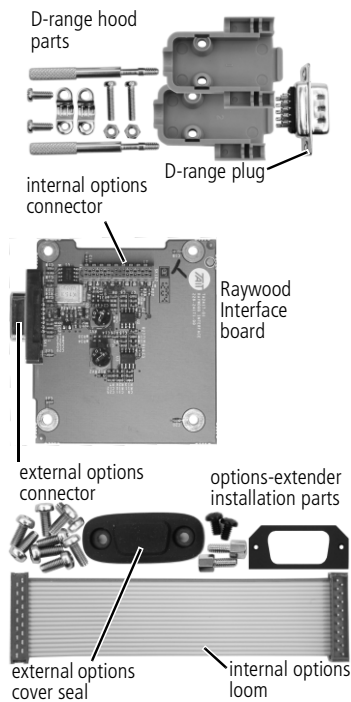
1.5 PCB Information

All PCBs are identified by a unique 10 digit IPN (internal part number) which is printed onto the PCB (usually on the top side), as shown in the example below:

226-00124-03

The last two digits of this number define the issue status, which starts at 01 and increments through 02,03, 04, etc. as the PCB is updated. If the PCB information contained in a section of this manual does not match the PCB number printed on your board, contact Technical Support (refer to "Contact Information" on page 2).

2 Introduction



The XA2417-01-PBA Raywood Interface for TM8000 provides external access to most of the required signals provided by the radio's internal options connector.

They can be found in the installation kit TMAA01-06 Ryw Interface for TM8000 and the radio TMAB12-B106 Rad Body 136 - 174M Raywood found in the following products:

1. TM8105-B1A04 136-174M Telem Raywood
2. TM8105-B1A04-10 136-174M Telem Raywood

The Raywood Interface board fits inside the radio in the options cavity and is connected to the main PCB by the internal options connector and loom.

The internal options connector signals are then made available on the high-density 15-way D-range connector mounted on the Raywood Interface board. This connector fits through the external options connector hole provided in the radio chassis.



Important

The radio does not meet the IP54 protection standard once an Raywood Interface board has been installed unless the external options cover seal is installed.



Important

To comply with EN 301 489-5, all cables connected to the external options connector must be less than three metres (10 feet) in length.

The radio must have a suitable Raywood firmware installed for this option to work.

Please contact Tait Product Support for instruction on what firmware to use.

3 Configuring the Raywood Interface Board



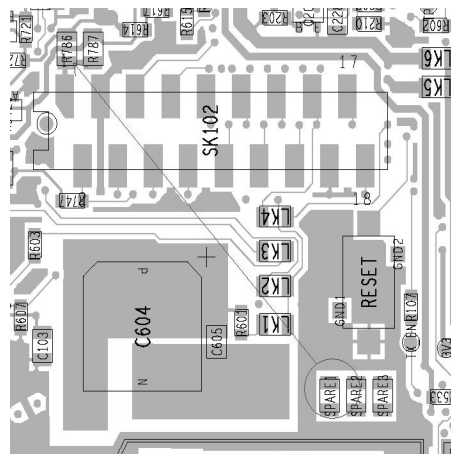
Important This equipment contains devices which are susceptible to damage from static discharges. Refer to “ESD Precautions” on page 11 for more information.

3.1 Changing the Raywood Interface Link

The Raywood Interface board configuration must be completed before the board is installed in the radio, as the top side of the Raywood Interface board is not accessible once the board is screwed to the radio lid.

The TM8000 provides an option of linking the radio power supply connection to pin 1 of the Internal Options Connector, which will supply a constant 13.8V to the Raywood Datahead.

This link is a zero ohm resistor. Spare zero ohm resistors are placed during manufacture of each radio. Take one of these (located to the lower left of the Internal Options Connector), and place on location R786.



3.2 Configuration Procedure

The Raywood Interface board configuration must be completed before the board is installed in the radio, as the top side of the board is not accessible once the board is screwed to the radio lid. To configure the board, carry out the following steps.

1. Program the radio in which the Raywood Interface board is being installed with default settings. The default test settings are explained in the following tables.



Note A general description of IOP_GPIO lines used with the Raywood interface board is given in Raywood Interface input and output connections, Table 5.1 on page 21.

Table 3.1 Raywood Interface default settings in the Programmable I/O form, Digital tab

Pin	Direction	Label	Action	Active	Debounce	Signal State	Mirrored
AUX_GPI2	input	EMERGENCY	Enter Emergency Mode	low	100	None	None
AUX_GPI3	input	PWRSENSE	Power Sense (ignition)	high	25	None	None
IOP_GPIO1	input	STANDBY	Toggle Stand-by Mode	low	25	None	None
IOP_GPIO2	input	EPTT1	External PTT1	low	25	None	None

Table 3.2 Raywood Interface settings in the Programmable I/O form, Audio tab

Rx/PTT Type	Tap Out	Tap Out Type	Tap Out Unmute	Tap In	Tap In Type	Tap In Unmute
Rx	R2	D-Split	Busy Detect	None	A-Bypass In	On PTT
Mic PTT	None	C-Bypass Out	On PTT	None	A-Bypass In	On PTT
EPTT1	None	C-Bypass Out	On PTT	T 8	A-Bypass In	On PTT
EPTT2	None	C-Bypass Out	On PTT	None	A-Bypass In	On PTT

Table 3.3 Raywood Interface settings in the PTT form, External PTT (1) tab

Field	Setting
PTT Priority	Highest
Audio Source	Audio Tap In

Table 3.4 Raywood Interface settings in the UI Preferences form

Field	Setting
Minimum Volume Level	255

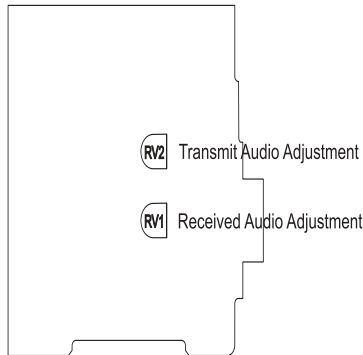
Table 3.5 Raywood Interface settings in the Data form, Serial Communications tab

Field	Setting
Command Mode Baud Rate	4800
Command Mode Flow Control	None
Data Port	Internal Options

- Disassemble the radio in order to gain access to the options cavity. For detailed disassembly instructions, refer to the disassembly procedure in the TM8100 Service Manual.
Connect the internal options loom between SK102 on the Raywood Interface board and SK102 on the radio's main PCB.
- Set up the test equipment shown in, and follow the adjustment procedure for RV1 and RV2 described in the following section. See "Adjusting RV1, RV2" on page 18.

3.3 Adjustment Points on the Raywood Interface Board

The following table describes the Raywood Interface adjustment points. Adjustments are made by two variable resistors RV1 and RV2.



All Raywood interfaces should be setup as:

* RV1 (measured between SK1.5 (Discriminator Audio) and SK1.14 (Gnd)) should be 1Vp-p into a Testset as 600ohm input.

* Inject 1KHz tone @ 600mVp-p across SK1.12 (TxA) and SK1.14 (Gnd) and adjust RV2 for 60% of FSD when SK1.8 is grounded.

This is done without a Raywood Head attached.

The issue becomes the individual Raywood heads will be different from each other and may produce different levels when actually connected.

The value of -7.3dBm was really only for Blue Star and Gold Band Taxi's in CHCH.

3.4 Adjusting RV1, RV2

3.4.1 RV1

Another point: ensure the Programmed Tx Tap-In is set as T5 not T8. It was found the Raywood head was always expecting to plug into a Mic socket and needs to Pre-Emphasise the audio.

This adjusts the audio level from the radio to the Raywood datahead. To adjust correctly apply an on channel RF carrier, modulated at 60% of full system deviation, using a 1kHz tone. Use an audio meter on pins SK1.5 and SK1.14(GND) and adjust until the level of -7.3dBm is set

3.4.2 RV2

This adjusts the transmit deviation. Connect a 1kHz tone with a level of -11dBm to pins SK1.12 and SK1.14 (GND). Connect SK1.8 to ground this will cause the radio to transmit. Use a Radio Communications test set to measure deviation, adjust RV2 for 60% of full system deviation.

4 Installing the Raywood Interface Board

4.1 Parts Required

The following table describes the parts required to install an Raywood Interface board in a radio. The parts marked with an asterisk (*) are not shown in Figure 4.1 and are used to connect to the radio's external options connector.

Table 4.1 Raywood Interface installation parts required

Quantity	Internal Part Number	Description	Figure 4.1 Reference
1	362-01110-XX ^a	foam seal	③
2	354-01043-00	screw-lock fasteners	⑦
4	349-02062-00	M3x8 screws	⑨

a. Contact Technical Support for the exact IPN.

4.2 Installation Procedure

1. Disassemble the radio in order to gain access to the options cavity.
For detailed disassembly instructions, refer to the disassembly procedure in the TM8100 Service Manual.

Refer to the diagram on the following page and the instructions below.

2. Remove the top cover and lid ① from the radio to access the options cavity.
3. Remove the external options connector bung ②, if it is fitted.
4. On the inside of the radio lid place the foam seal ③ over the external options connector cavity ④.
5. With the top side of the Raywood Interface board ⑤ facing the radio lid, guide the external options connector ⑥ (the D-range connector on the Raywood Interface board) into the external options connector cavity.
6. Screw the external options connector to the radio lid using the two screw-lock fasteners ⑦.
Tighten the fasteners to a torque of 0.9N·m (8lbf·in).

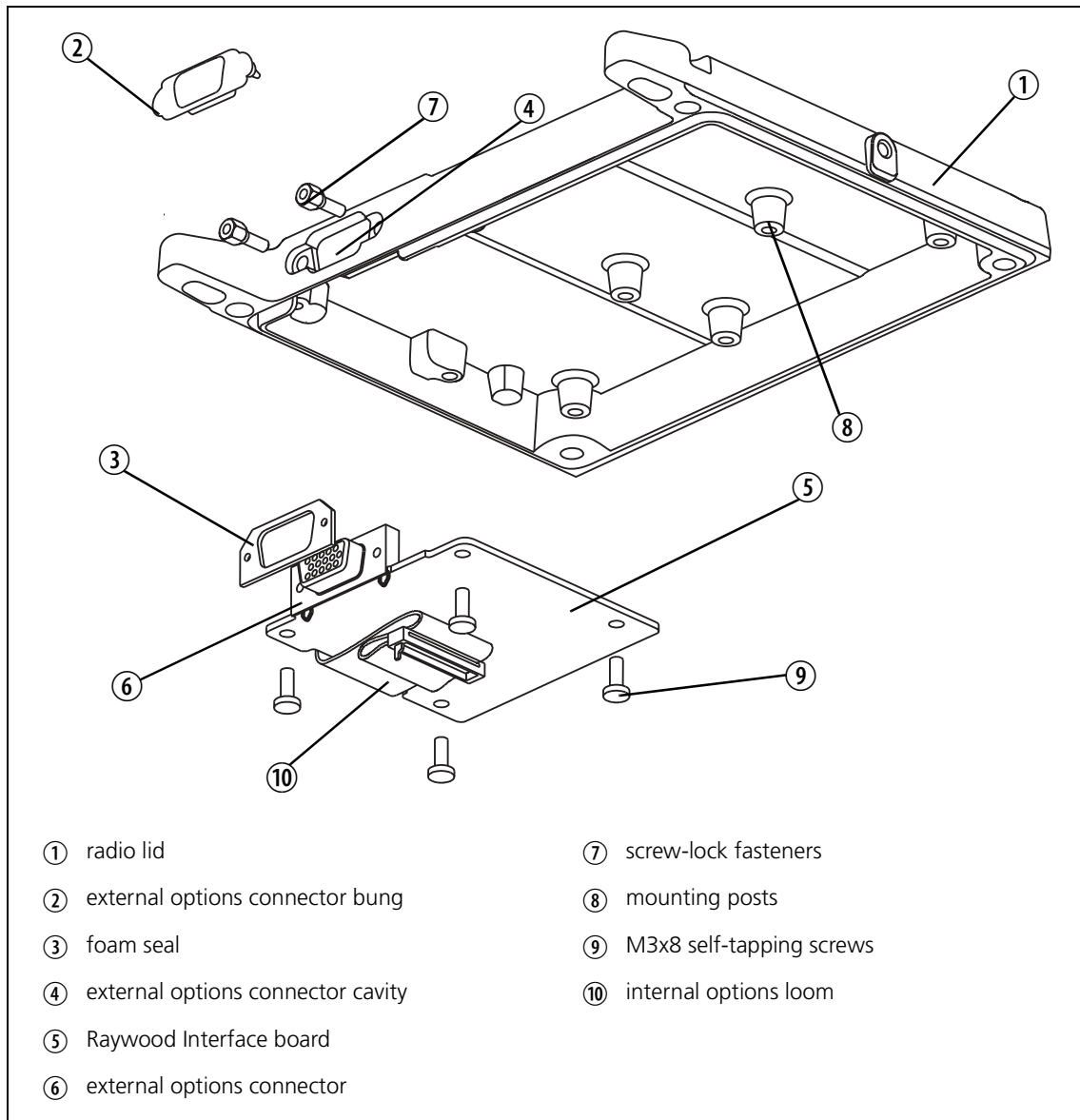


Important The external options connector screw-lock fasteners must be tightened correctly before screwing the Raywood Interface board onto the mounting posts ⑧.

7. Screw the Raywood Interface board to the mounting posts on the radio lid using four M3x8 self-tapping screws ⑨.
Tighten the M3x8 screws to a torque of 1.9N·m (17lbf·in)

8. Plug the unattached end of internal options connector loom ⑩ into the internal options connector on the radio main PCB.

Figure 4.1 Raywood Interface board installation



5 Programming Information

The behaviour of I/O lines is configured in the Programmable I/O and PTT forms of the TM8000 Programming Application. Refer to the on-line help of the programming application for more information. The following settings are used with the Raywood Interface board.

Table 5.1 Raywood Interface input and output connections

Radio Signal	Function	Comments
GPI2	Enter Emergency Mode	When this line is activated, the radio will enter stealth or non-stealth emergency mode. The radio will enter emergency mode from a powered-off state by setting Active to Low. (link LK3 fitted as default for this operation)
GPI3	Power Sense (Ignition)	The radio will attempt to power up when the line is activated, according to the Power On Mode setting. The Power On Mode can be set to Power On, Remain Off or Previous State and is set in the Start-up form. Refer to the TM8000 programming software on-line help. (Link LK2 fitted as default for this operation)
GPIO1	Toggle Standby Mode	When this line is active, the radio toggles between a powered-on state, and a stand-by state where the radio appears off. The radio will draw approximately 25 mA when in stand-by mode.
GPIO2	External PTT1	A digital input line can act as an external PTT (EPTT). When the line is activated, the behaviour of the radio will follow the settings in the PTT form > External PTT (1) tab, such as transmit, send a call, or open monitor. All PTT lines can be active at any one time. The PTT with the highest priority, as set in the PTT form, will control the audio path.

6 Interface Specification

The following tables summarize the signals used for the Raywood Interface board on the internal options connector (SK102 on the Raywood Interface board) and the external options connector (SK1 on the Raywood Interface board).



The TM8000 3DK Hardware Developer's Kit Application Manual (product code MMAA30-01-00-807) contains a detailed electrical specification for the signals available on the radio's internal options connector. This manual is part of the 3DK Resource CD, which can be purchased using product code TMAA30-01.

Table 6.1 Internal options connector (SK102) - pins and signals

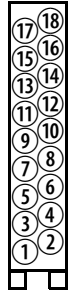
	Pin	Radio Signal	Raywood Interface Signal	Description
 <p>top view</p>	1	13V8_SW	13V8 FROM RADIO	switched 13V8 supply from the radio
	2	AUD_TAP_OUT	RX_DISC_AUD	Programmable tap point out of the receive or transmit audio chain.
	3	AGND	AGND	analogue ground
	4	AUX_MIC_AUD	—	not connected
	5	RX_BEEP_IN	—	not connected
	6	AUD_TAP_IN	TX_AUDIO	Programmable tap point into the receive or transmit audio chain.
	7	RX_AUD	RX_AUDIO	Receive Audio Output post volume pot
	8	RSSI	—	not connected
	9	IOP_GPIO1	RADIO_PWR_ON	IOP_GPIO1 from the radio 3V3 logic level, 5V tolerant
	10	IOP_GPIO2	PTT_OUT	IOP_GPIO2 from the radio 3V3 logic level, 5V tolerant
	11	IOP_GPIO3	—	not connected
	12	IOP_GPIO4	—	not connected
	13	IOP_GPIO5	—	not connected
	14	IOP_GPIO6	—	not connected
	15	IOP_GPIO7	—	not connected
	16	DGND	DGND	digital ground
	17	IOP_RXD	CH_OUT	asynchronous serial port - receive data
	18	IOP_TXD	CH_IN	asynchronous serial port - transmit data

Table 6.2 External options connector (SK1) - pins and signals

	Pin	Signal	Description
<p>front view</p>	1	RX_AUDIO	De-emphasis - Processed audio - Gated
	2	—	not connected
	3	—	not connected
	4	GND-N/C	Ground Reference
	5	RX_DISC_AUD	Flat un-processed audio
	6	RADIO_PWR_ON	Digital input signal
	7	CH_OUT	Data input signal (Radio)
	8	PTT_OUT	Digital input signal
	9	CH_IN	Data output signal (Radio)
	10	ANALOG-GND	Allow isolation if digital circuit requires it
	11	—	not connected
	12	TX_AUDIO	Audio for transmission
	13	—	not connected
	14	GND	Ground reference for supply
	15	13V8	Continuous supply fused at 1.5A.

7 Specifications

Specification	Limits
Current	Max 1.5A Continuous
Voltage	10.8V to 16VDC
Operating Temperature Range	10°C to +60°C ambient
Data Lines	CH-IN limits O/P voltage to 4V7 for active high CH-OUT I/P voltage >0.7V for active high TM8000 over voltage protection
RX_DISC_AUD	Max audio O/P 0 - 6Vpp
RX_RADIO	Max audio O/P 0 - 6Vpp
TX_AUDIO	Max I/P with RV2 fully clockwise 500mV.

8 Circuit Description

The Raywood Interface PCB relies on the programmable functionality of the TM8000 radio and has been design to utilise these signals and their excellent input protection.

This PCB takes advantage of the TM's many features including its programmability. This has simplified RADIO_PWR_ON, PTT-OUT, CHAN-OUT and CHAN-IN signals and RX_AUDIO. Two audio signals (DET_DISC_OUT and TX_AUDIO) are connected to the TM's generic audio ports. These ports are called TAP_IN and TAP_OUT. The type of audio signal at these TAP points is a programmable feature of the TM.

Two receive audio signals are required, DET_AF_OUT and RX_AUD. DET_AF_OUT is connected to TAP_OUT using the programmed option Tap "R2 type D", which provides a flat audio response. RX_AUD is directly connected to RX_AUDIO on connector SK1.1 The radio's control head does not use a speaker so a minimum volume level (255) is programmed, to provide RX_AUD.

TAP_OUT connects to a 10k centre tapped potentiometer RV1, causing a 50% reduction in signal level. The OPAMP U2 has a gain of five providing an overall gain of 1.5 between AUDIO_TAP_OUT and RX_DISC_AUD.

RX_AUD, has no adjustment. R7 and R12 provide a loading and 50% level reduction. U3 pins 5,6, and 7 provide a gain of 2.5, providing an overall gain of 1.25.

TX_AUDIO signal from the Raywood Data Head connects to a 10k centre tapped potentiometer RV2. With 50% reduction in signal this audio for transmission connects to the radio via U3 pins 1,2 and 3 and subsequently TAP_IN, using the programmed option tap "T12 type A", which provides a flat audio response. The OPAMP is configured for a gain of 4, providing an overall gain of 2.

U1 is a voltage regulator, with R1 and R2 providing a half-rail reference for the single ended OPAMPs.

Q1 and Q2 provide an invert function on the data lines CH-OUT and CH-IN. D1 ensures the voltage on CH-IN does not exceed 5V.

F1 is a self-resetting fuse. Its current rating is 1.5A.

9 PCB Information

9.1 XA2417-01-PBA Rev 004 Parts (PCB IPN 228-24171-00)

Ref	IPN	Description	Ref	IPN	Description
	228-24171-00	PCB TA2417-01 TM8K Raywood I/F	Q2	000-10008-47	Xstr SMD BC847B NPN SOT23
C1	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R1	038-15150-10	Res 0603 15K 1% WDS
C1A	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R2	038-15100-10	Res 0603 10k 1/16w +-1%
C1B	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R3	038-15470-10	Res 0603 47k 1/16w +-1%
C2	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R4	038-15470-10	Res 0603 47k 1/16w +-1%
C3	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R5	038-15100-10	Res 0603 10k 1/16w +-1%
C4	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R6	038-15180-00	Res 0603 18k 1/16w
C5	018-12470-10	Cap 0603 47p 50v NPO+-0.1	R7	038-14562-10	Res 0603 5k62 16w +-1%
C6	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R8	038-14820-00	Res 0603 8k2 1/16w +-5%
C7	018-12100-10	Cap 0603 10p 50v NPO+-0.1	R9	038-13100-10	Res 0603 100e 1/16w +-1%
C8	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R10	038-15390-10	Res 0603 39K2 1% WDS
C9	018-13150-00	Cap 0603 150p 50v NPO +-5%	R11	038-16100-10	Res 0603 100k 1/16w +-1%
C10	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R12	038-14562-10	Res 0603 5k62 16w +-1%
C11	018-12470-10	Cap 0603 47p 50v NPO+-0.1	R13	038-14820-00	Res 0603 8k2 1/16w +-5%
C12	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R14	038-10000-00	Res 0603 Zero 0hm 1/16w +-5%
C13	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R15	038-13100-10	Res 0603 100e 1/16w +-1%
C14	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R16	038-15100-10	Res 0603 10k 1/16w +-1%
C15	018-12470-10	Cap 0603 47p 50v NPO+-0.1	R17	038-15150-10	Res 0603 15K 1% WDS
C16	018-13150-00	Cap 0603 150p 50v NPO +-5%	R18	038-15390-10	Res 0603 39K2 1% WDS
C17	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R19	038-14820-00	Res 0603 8k2 1/16w +-5%
C18	018-14101-00	Cap 0603 1n 50v NPO +-5%	R20	038-10000-00	Res 0603 Zero 0hm 1/16w +-5%
C19	018-14101-00	Cap 0603 1n 50v NPO +-5%	R21	038-15100-10	Res 0603 10k 1/16w +-1%
C20	018-14101-00	Cap 0603 1n 50v NPO +-5%	R22	038-16100-10	Res 0603 100k 1/16w +-1%
C21	018-14101-00	Cap 0603 1n 50v NPO +-5%	R23	038-16100-10	Res 0603 100k 1/16w +-1%
C22	018-14101-00	Cap 0603 1n 50v NPO +-5%	R24	038-15100-10	Res 0603 10k 1/16w +-1%
C23	018-14101-00	Cap 0603 1n 50v NPO +-5%	R25	038-16100-10	Res 0603 100k 1/16w +-1%
C24	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R26	038-15390-10	Res 0603 39K2 1% WDS
C25	018-16100-01	Cap 0603 100n 16v Y5v +80-20%	R27	038-14820-00	Res 0603 8k2 1/16w +-5%
C26	018-14101-00	Cap 0603 1n 50v NPO +-5%	RV1	042-05100-06	Res Pre 10k Crbn 6mm Flat
C27	018-14101-00	Cap 0603 1n 50v NPO +-5%	RV2	042-05100-06	Res Pre 10k Crbn 6mm Flat
C28	018-14101-00	Cap 0603 1n 50v NPO +-5%	SK1	240-00011-67	Skt 15w Drng Ra Slim Dsub 7912
C29	018-14101-00	Cap 0603 1n 50v NPO +-5%	SK102	240-10000-11	Conn SMD 18w Skt M/Match
D1	001-10084-47	Diode SMD BZX84C4V7 Zen SOT23	U1	002-10078-08	IC SMD 78L08 8v Reg S08
F1	265-10060-00	Fuse SMD 1.5a Rstbl 150/33	U2	002-10003-58	IC SMD LM358 Dual 0-Amp
Q1	000-10008-47	Xstr SMD BC847B NPN SOT23	U3	002-10003-58	IC SMD LM358 Dual 0-Amp

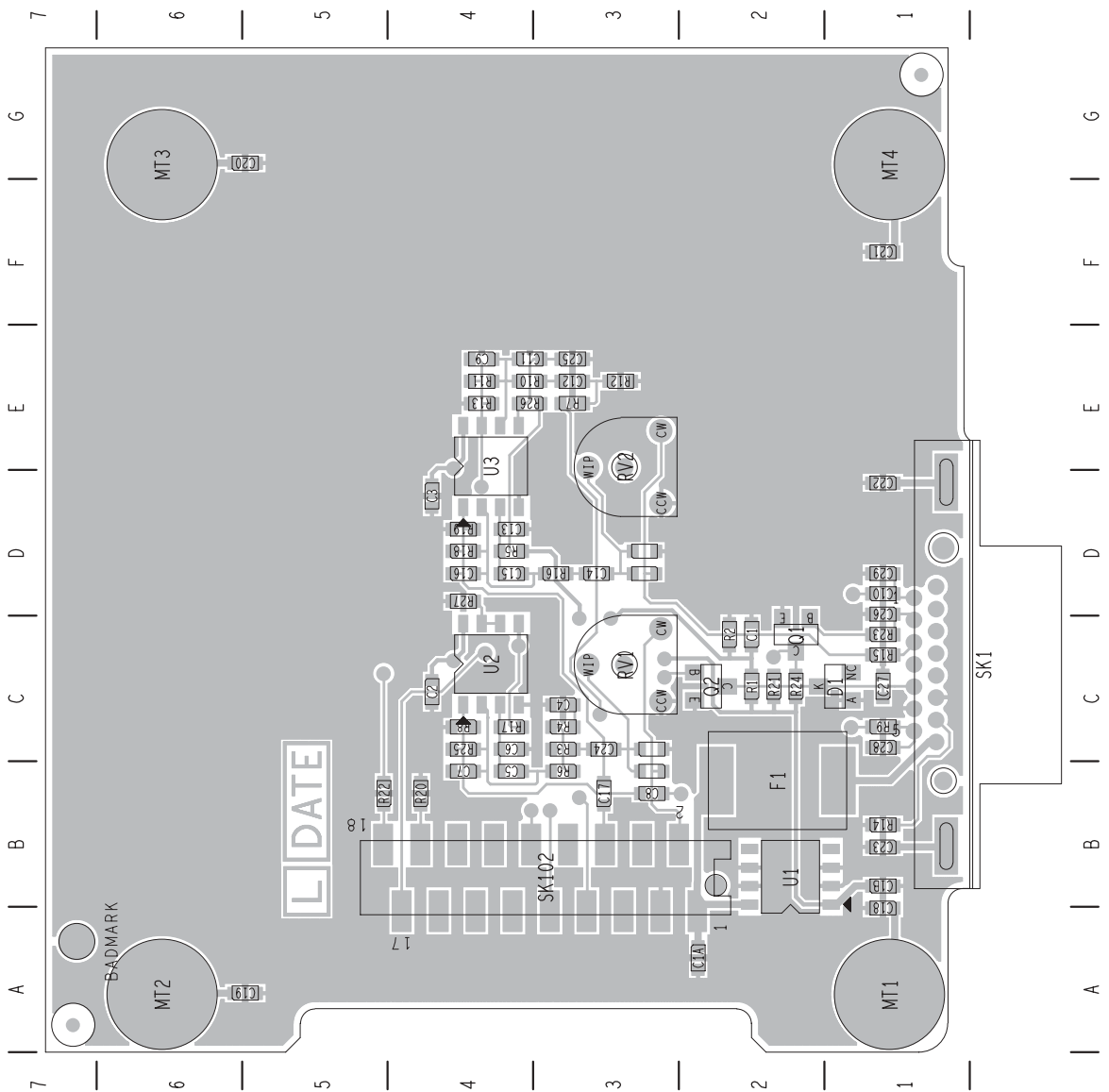
9.2 XA2417-01-PBA Grid Ref (PCB IPN 228-24171-00)

Ref	PCB	Circuit
*R31	B2	1G5
*R32	C2	1G5
*R33	D2	1D5
*R34	D2	1D5
C1	C1	1F3
C1A	A1	1F1
C1B	B0	1F3
C2	C3	1C8
C3	D3	1C9
C4	C2	1F6
C5	B3	1G6
C6	C3	1F6
C7	B3	1G7
C8	B2	1G7
C9	E3	1F8
C10	D0	1E9
C11	E3	1E8
C12	E2	1F6
C13	D3	1C4
C14	D2	1D5
C15	D3	1D4
C16	D3	1D3
C17	B2	1D2
C18	A0	1C6
C19	A4	1C6
C20	G4	1C7
C21	F0	1C7
C22	D0	1B9
C23	B0	1B9
C24	C2	1G5
C25	E2	1E8
C26	D0	1B8
C27	C0	1B9
C28	C0	1G9
C29	D0	1E9

Ref	PCB	Circuit
D1	C0	1B8
F1	B1	1G9
MT1	A0	1D6
MT2	A5	1D6
MT3	G5	1D7
MT4	G0	1D7
Q1	C1	1B3
Q2	C1	1B7
R1	C1	1F3
R2	C1	1F3
R3	C2	1G5
R4	C2	1G6
R5	D3	1D4
R6	B2	1G6
R7	E2	1F6
R8	C3	1F7
R9	C0	1G8
R10	E3	1F7
R11	E3	1F8
R12	E2	1E6
R13	E3	1E9
R14	B0	1F9
R15	C0	1D6
R16	D2	1D4
R17	C3	1G6
R18	D3	1E3
R19	D3	1D3
R20	B3	1C2
R21	C1	1C7
R22	B4	1B7
R23	C0	1B4
R24	C1	1C3
R25	C3	1G7
R26	E3	1E7
R27	D3	1F4

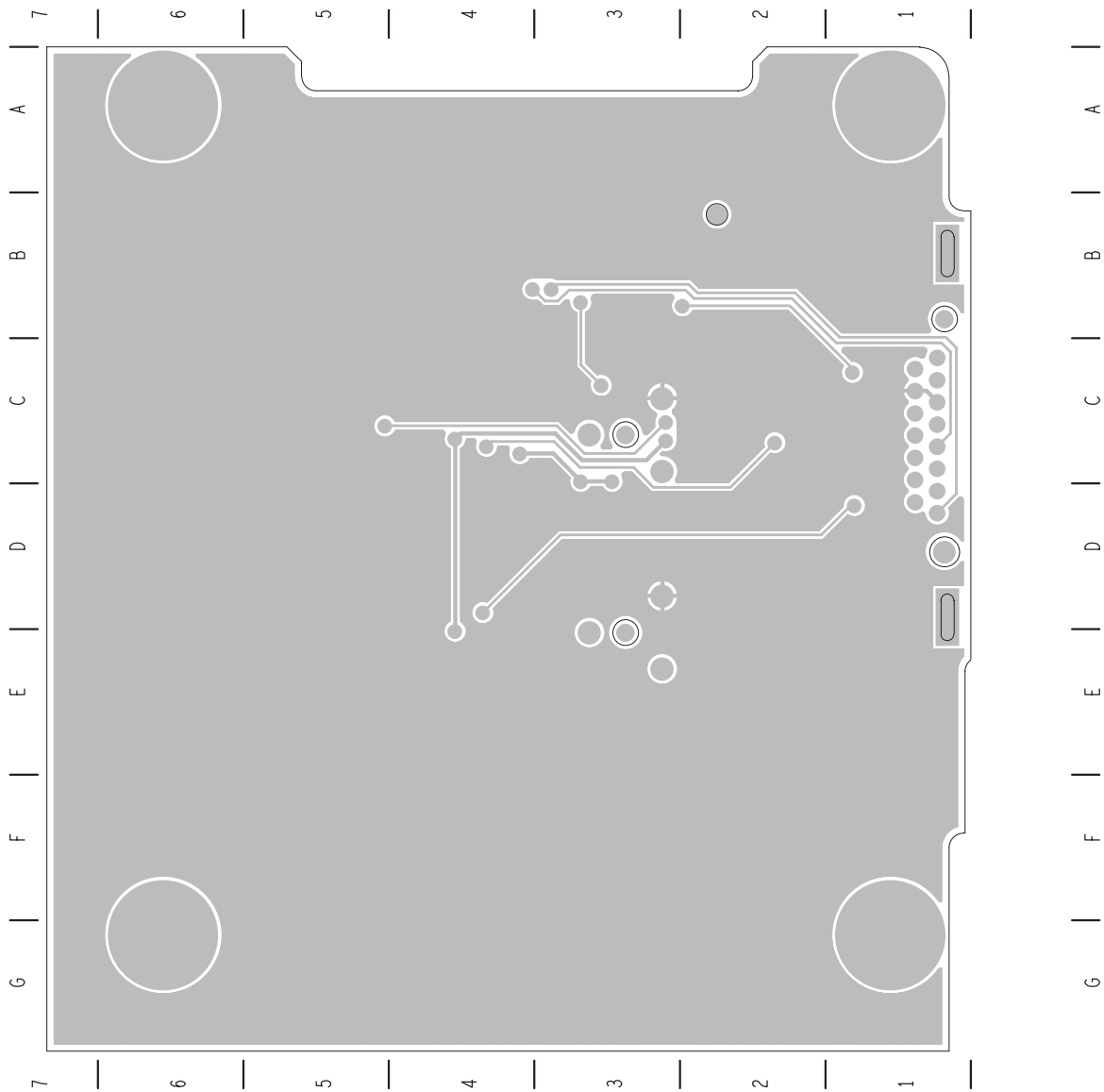
Ref	PCB	Circuit
RV1	C2	1G5
RV2	D2	1D5
SK1	D0	1D10
SK102	B2	1D1
U1	B1	1F2
U2	C3	1C9 1G7 1G4
U3	E3	1C10 1E8 1D3

9.3 Raywood Interface Board Layout (top side)



IPN 228-24171-00

9.4 Raywood Interface Board Layout (bottom side)



IPN 228-24171-00

9.5 Raywood Interface Board Circuit Diagram

