TAIT *radio communications*

TB7100 base station
TB8100 base station

Tone Remote Module
Installation and Operation Manual

Contact Information

**Tait Radio Communications
Corporate Head Office**

Tait Electronics Limited
P.O. Box 1645
Christchurch
New Zealand

For the address and telephone number of regional offices, refer to our website: www.taitradio.com

Copyright and Trademarks

All information contained in this document is the property of Tait Electronics Limited. All rights reserved. This document may not, in whole or in part, be copied, photocopied, reproduced, translated, stored, or reduced to any electronic medium or machine-readable form, without prior written permission from Tait Electronics Limited.

The word TAIT and the TAIT logo are trademarks of Tait Electronics Limited.

All trade names referenced are the service mark, trademark or registered trademark of the respective manufacturers.

Disclaimer

There are no warranties extended or granted by this document. Tait Electronics Limited accepts no responsibility for damage arising from use of the information contained in the document or of the equipment and software it describes. It is the responsibility of the user to ensure that use of such information, equipment and software complies with the laws, rules and regulations of the applicable jurisdictions.

Enquiries and Comments

If you have any enquiries regarding this document, or any comments, suggestions and notifications of errors, please contact your regional Tait office.

Updates of Manual and Equipment

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

Intellectual Property Rights

This product may be protected by one or more patents or designs of Tait Electronics Limited together with their international equivalents, pending patent or design applications, and registered trade marks: NZ 409837, NZ 409838, NZ 508806, NZ 508807, NZ 509242, NZ 509640, NZ 509959, NZ 510496, NZ 511155, NZ 511421, NZ 516280/NZ 519742, NZ 520650/ NZ 537902, NZ 521450, NZ 522236, NZ 524369, NZ 524378, NZ 524509, NZ 524537, NZ 524630, NZ 530819, NZ 534475, NZ 534692, NZ 535471, NZ 537434, NZ 546295, NZ 547713, NZ 569985, NZ 577009, NZ 579051, NZ 579364, NZ 580361, AU 2003281447, AU 2004216984, AU 2005267973, AU 11677/2008, AU 13745/2008, CN 200930009301.0, CN 200930004200.4, CN 1031871, CN 1070368, EU 000915475-0001, EU 000915475-0002, GB 23865476, GB 2386010, GB 2413249, GB 2413445, US 5745840, US 7411461, US 7649893, US 10/546696, US 10/523952, US 10/ 546697, US 10/547964, US 11/572700, US 29/306491, US 61/218015, US 61/236663, US 61/238769, US 61/ 251372.

Environmental Responsibilities

Tait Electronics Limited is an environmentally responsible company which supports waste minimization, material recovery and restrictions in the use of hazardous materials.

The European Union's Waste Electrical and Electronic Equipment (WEEE) Directive requires that this product be disposed of separately from the general waste stream when its service life is over. For more information about how to dispose of your unwanted Tait product, visit the Tait Electronics WEEE website at www.taitradio.com/ weee. Please be environmentally responsible and dispose through the original supplier, or contact Tait Electronics Limited.

Tait Electronics Limited also complies with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive in the European Union.

In China, we comply with the Measures for Administration of the Pollution Control of Electronic Information Products. We will comply with environmental requirements in other markets as they are introduced.

Contents

List of Illustrations

Preface

Scope of Manual

This manual contains information on installing and configuring Tait tone remote modules for TB7100 and TB8100 base stations. It provides circuit descriptions for the module. Tone remote modules with serial numbers less than 18046132 ("older modules") have different specifications for their line levels and require different line level settings. Values for them are given in brackets after the values for newer tone remote modules.

Circuit Board Information

Circuit board information is provided in the separate TBA0M01/2 Tone Remote and Alarm Interface PCB Information Package. Included in the package is a parts list, grid references, PCB layouts and circuit diagrams. The package is available from the Tait Technical Resources website.

Circuit boards may change without notice. The latest parts lists are available from your nearest Customer Service Organisation.

Associated Documentation

TB7100 Installation and Operation Manual.

TB7100 Programming Application Online Help.

TB7100 Calibration Application Online Help.

TB8100 Installation and Operation Manual.

TB8100 Service Kit and Alarm Center User's Manuals and online Help.

TB8100 Calibration Kit User's Manual and Online Help.

Technical notes are published from time to time to describe applications for Tait products, to provide technical details not included in manuals, and to offer solutions for any problems that arise.

Document Conventions

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 a 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 procedures are performed correctly.

Publication Record

Issue	Publication Date	Description
MBA-00030-01	September 2006	Replaces MBA0M01-00-812.
MBA-00030-02	November 2007	Section added on using the programming application. Line level values for newer tone remote modules. Minor updates and corrections.
MBA-00030-03	December 2007	Inadvertent book rearrangement corrected.
MBA-00030-04	April 2009	Section 7.1 Connecting to a TB8100 Base Station updated. Section 8.4 Line In and Line Out Pin Allocations updated.
MBA-00030-05	October 2010	Part number of TB7100 connection cable corrected to TBBA04-01.

1 Description

Tait tone remote modules for TB8100 base stations are available in the following models:

■ TBA0M01: subrack with single module

■ TBA0M02: subrack with double modules

The same modules are used for TB7100 base stations, but they require different cabling and are ordered using the following model codes:

■ TBB0M03: TBA0M01 with TB7100 cabling

■ TBB0M04: TBA0M02 with TB7100 cabling

All models are tone-operated remote controller products. Double models are used with two-channel subrack systems with each tone remote module dedicated to a channel. The two modules are completely independent of each other.

Features include alarm monitoring, voting tone generation and simple high-site control. The tone remote interfaces either a two or four-wire leased circuit to TB8000 and TB7000 series base station products and so enables a dispatch console (or desktop controller) to control and monitor a remote base station. Tone remotes are 2U subracks designed to fit into a standard 19 inch rack or cabinet, just above or below the base station. A 25-way cable provides all the connections, including DC power from each TB8100 reciter or TB7100 base station to each tone remote module. Tone remote modules are configured using the Tone Remote Programming Application (TRPA) version 1.08 or later on a PC.

1.1 Tone Remote Formats

Tone remotes are operated by the remotely located user via a leased line and some form of line control equipment such as a dispatch console (or desktop controller). The line control equipment is configured to send tones according to one of three standard tone signalling schemes:

■ Simplex TX keying using Low-Level Guard Tone
  (also known as keytone)

■ Motorola/GE style Tone Remote using a single function tone
  (also known as EIA Function Tone format)

■ Motorola/GE enhanced Tone Remote using two function tones
  (also known as EIA Function Tone format)

The tone remote must be programmed to the same format as the remote line equipment.

1.1.1   Simple Transmitter Keying using Low-Level Guard Tone (keytone)

In this system, when the control room user presses the transmit key on the line control equipment (dispatch console), speech is gated to the line and a continuous low-level guard tone (LLGT) is sent. The LLGT signals the tone remote to key-up the base station and pass–through the speech audio. This continues until the user releases the transmit key. This removes speech from the line and the LLGT ceases.
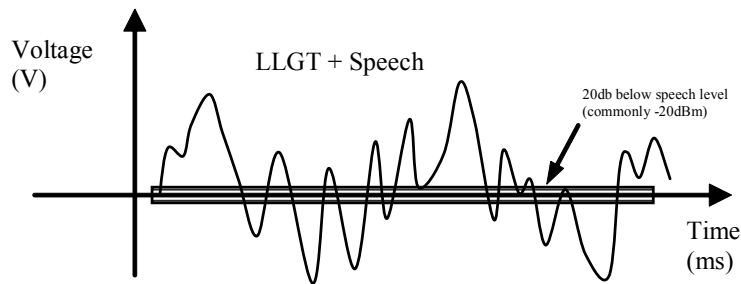
1.1.2   EIA tone remote using a single function tone

In this system, when the control room user presses an appropriately programmed function key, the line control equipment (Dispatch Console) sends a 120 ms burst of high-level guard tone (HLGT), followed by a single 40 ms function tone (FT). This function tone can be used to instruct the tone remote to change channel, monitor the radio channel (defeat receiver CTCSS) or a variety of other functions.
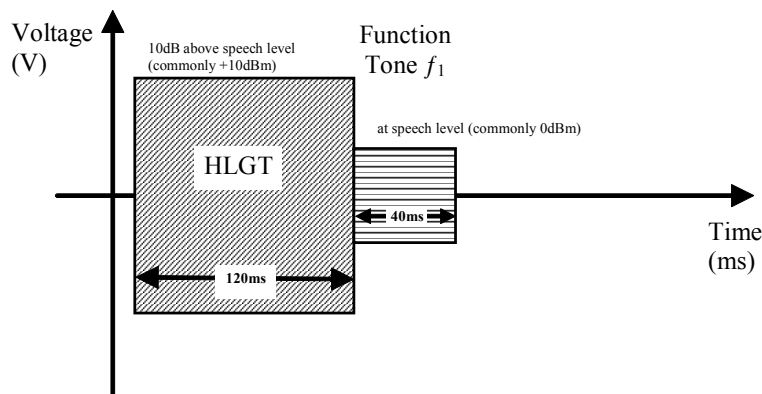
1.1.3   EIA tone remote using two function tones

This is a variant of the above scheme, where two function tones are sent, the second directly after the first. This provides 225 possible function tone combinations which can be allocated to various actions.
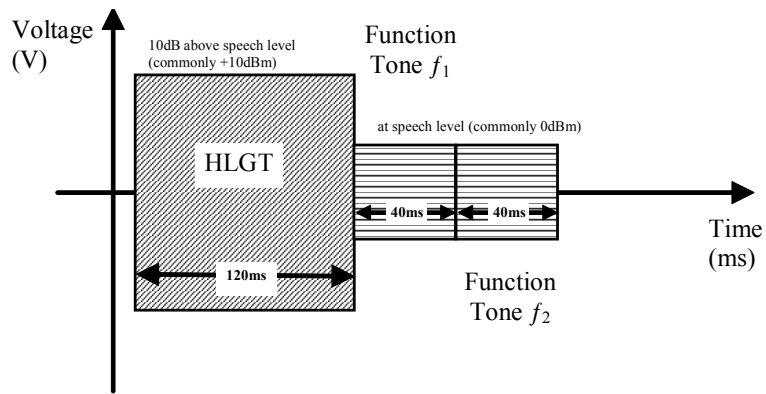
1.1.4 Combination of Signalling Schemes

Function tones are often sent in combination with the transmitter keytone (LLGT). For example, a dispatch console may be configured to always send the channel select FT every time the transmit key is pressed. The function tone(s) are always sent before the LLGT and speech as shown in the diagram below.
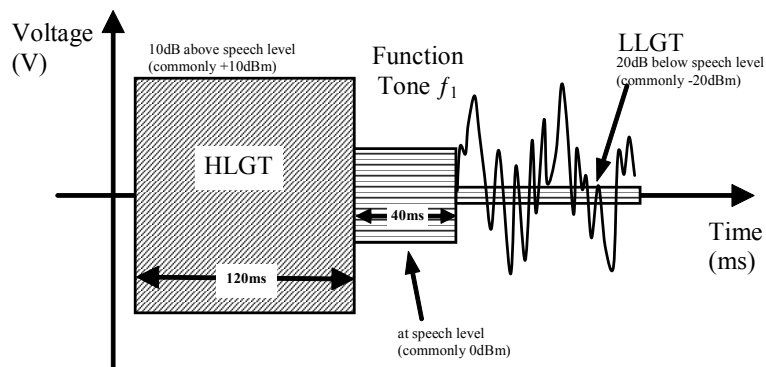
The levels of the LLGT, HLGT and function tones are relative to the speech level (also called the Line level):

- LLGT standard level is 20 dB below line level
- HLGT standard level is 10 dB above line level
- FT standard level is equal to line level

Tone Remote systems commonly use a 0 dBm Line level.

The LLGT and HLGT tone set consists of the following 11 frequencies: 1950, 2100, 2175, 2325, 2500, 2600, 2800, 2900, 2970, 3000 and 3100 Hz. The most commonly used guard tone frequency is 2175 Hz.

The FT tone set consists of 15 possible frequencies: 650 Hz to 2050 Hz in 100 Hz steps. If required, the standard durations of the HLGT (120 ms) and Function tones (40 ms) can be varied using the tone remote programming application.

1.2　Alarm Monitoring and Confirmations

The tone remote can monitor a total of eight alarms, six external closure alarms, a low voltage (power supply) alarm and a line alarm (line fail indication). Two of the external closure alarms can be triggered by base station digital outputs while the other four can be triggered by inputs on the auxiliary connector. If alarms are triggered the tone remote can be programmed to generate tone sequences (DTMF, Selcall or function tones) and/or enable auxiliary outputs, to alert system users of a problem. The tone sequences can be sent to line and/or radio. The auxiliary outputs can be directed to the tone remote auxiliary connector or to the base station's digital inputs where they can be used to initiate actions based on user programmable tasks (using the Task Manager in the TB8100 Service Kit or by using the TB7100 Programming Application).

Additionally the tone remote can be programmed to respond to as many as eight different non-alarm triggers. These can be used as confirmation that an event has occurred. Confirmations can be programmed to occur in the event of power–up, channel change and/or the detection of up to six user defined function tones. In the same way as for alarms, the tone remote can generate tone sequences and/or enable auxiliary outputs in response to a confirmation.

1.3　Voting Tones

The tone remote can also generate voting tones where a four–wire line inter-face is used. Voting systems are used where several base station receivers are tuned to the same radio channel and located at different sites, sending audio back to a central control where the best quality audio must be selected or "voted upon". Tone on Idle or Sliding Voting Tones can be generated to interface the base station to a wide variety of industry standard Radio Voting systems.

In Tone on Idle applications, a tone (normally the same frequency as LLGT) is transmitted to line when the base station's receiver is muted. When the tone disappears, control room equipment can perform signal to noise measurements on incoming audio lines and select the best for feeding to the control room user.

In Sliding Voting Tone systems, a tone is transmitted to line whose frequency is proportional to the base station receiver's RSSI. Control room equipment determines which receiver has the highest RSSI and thus selects which line carries the highest quality incoming audio.

1.4　Other Features

- Programmable Morse Code Encoder for automatic station identification (CWID)
- User programmable Line levels
- Programmable Transmit and Receive audio path delays
- Programmable (on/off) notch filtering.

1.5 Operating Controls

1.5.1 Layout and Controls

Adjust speaker volume

een = Base Station Mode
d = Repeater Mode
shing – see below

Plug in programming
cable from PC with
the Tone Remote
Programming Application

Plug in test micropho
to talk to despatcher
radios

Speaker

Green = auxiliary alarms
Red = line fail, low voltage
and TB8100 alarms
Flashing – see below

Change mode

Speaker on/off

Press toge
test mode
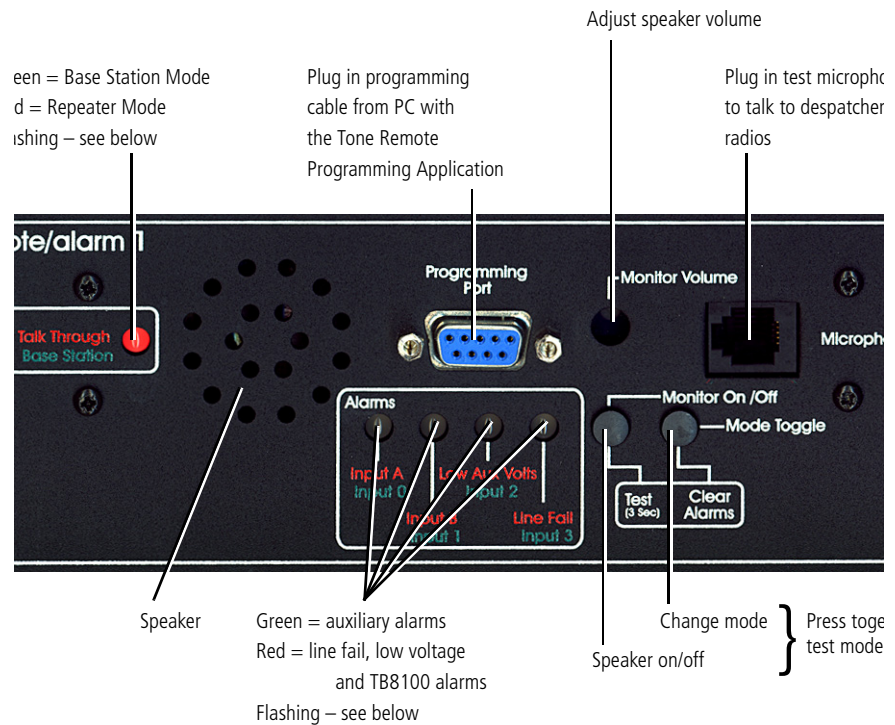
1.5.2 Mode LED

The colour of the Mode LED on the front panel indicates the mode of operation:

- Green = Base Station Mode
- Red = Repeater (talk-through) Mode

The LED flashes in different ways when particular conditions occur.

Flash Rate		Condition
	equal 0.3s on/0.3s off	Module is linked with the Programming Application
	long flash 1s on/0.3s off	Microprocessor has detected an internal communications error
	short off 0.3s on/0.08s off	Speaker is on.

Where two or more conditions occur at the same time, the precedence is in the order shown above (i.e. module linked has the highest priority, followed by microprocessor error, then speaker on).

1.5.3   Alarm LEDs

The alarm LED turns on only when its alarm condition has been latched. The colour of the LED indicates the source of the alarm trigger:

- Green – Assigned to the four external closure alarm triggers, Alarm Input0 to Input3.

- Red – Assigned to line fail, low voltage and the two external closure alarm triggers, Alarm InputA and InputB.

The LED flashes in different ways as indicated below.

Flash Rate and Colour		Alarm
	green very short off 0.32s on/0.01s off	External closure alarm Input0 to Input3.
	red short off 0.32s on/0.1s off	Line fail, low voltage or external closure alarm InputA or InputB
	alternating red and green 0.32s on/0.1s off/0.32s on/0.1s off	Combination of above alarm sources.

The factory configuration of the I/O resistor links (see Section 7.3) means that by default the green LEDs associated with external closure alarms are triggered by inputs on the Auxiliary connector while the two (external closure) red LEDs are associated with alarms triggered by the TB8100 digital outputs. These associations may change if the I/O configuration is changed.

Note   Press the Monitor and Mode Toggle buttons together to reset all alarms.

2 Specifications

The performance figures given are minimum figures, unless otherwise indicated, for equipment operating at standard room temperature ($+22°\,C$ to $+28°\,C$) and standard test voltage ($13.8\,V_{DC}$).

Details of test methods and the conditions which apply for Type Approval testing in all countries can be obtained from Tait Electronics Ltd.

General

Supply Voltage	
Operating Voltage	10.8 to 16V_{DC}
Standard Test Voltage	13.8V_{DC}
Polarity	negative earth only
Supply Current	250mA max
Operating Temperature Range	−30 to +60°C
Dimensions – module only	
Height	56mm
Width	160mm
Length	280mm
Dimensions – with front panel	
Height	2U
Width	Standard 19 inch
Depth	288mm
Weight	
TBA0M01	2.4kg
TBA0M02	3.9kg

Input Line Levels

Line-In (Level required to produce a transmitter output at 60% full system deviation)	
Programmable	−27dBm to +3dBm
Maximum input peak	+7dB relative to programmed level

Output Line Levels

Line-Out (Radio receiver level to tone remote must be $1V_{pp}$ (older modules: $650mV_{pp}$)

Programmable	−27dBm to −1dBm
Dynamic range	+7dB relative to programmed level
Maximum output peak	+5.5dBm

For compliance with TIA/EIA-IS-968, CS-03 (Canada), PTC200 (New Zealand) and HKTA 2023 (Hong Kong)

Programmable level must be set to	$\leq$−10dBm

For compliance with ACA TS002 (Australia)

Programmable level must be set to	$\leq$−11dBm

For compliance with TS PSTN1 (Singapore)

Programmable level must be set to	$\leq$−7dBm

Radio Levels

From Radio Receiver (for 1kHz tone at 60% full system deviation) (Note: This input of the tone remote is high impedance)	$1V_{pp}$ (older modules: $650mV_{pp}$) at input of tone remote
To Radio Transmitter	−10dBm (With receiver level to tone remote set to $1V_{pp}$)
Older modules:	−4.4dBm (With receiver level to tone remote set to $650mV_{pp}$)

Tone Remote

Keytone Sensitivity	29dB less than programmed Line-In level
Keytone Accept Bandwidth	±0.8% typical (±16Hz at 2175Hz) (Speech at −10dBm, keytone at −30dBm)

Talkoff
(Max. difference between speech and keytone)

Two-wire mode	32dB typical
Four-wire mode	35dB typical
Programmable Guardtone Frequencies	1950, 2100, 2175, 2325, 2500, 2600, 2800, 2900, 2970, 3000 and 3100Hz

Tone Remote (Continued)

Programmable High-Level Guard Tone Duration	60 to 200ms
Function Tone Frequencies	650 to 2050Hz in 100Hz steps
Function Tone Accept Bandwidth	±24Hz typical
Maximum Number of Function Tones	2
Programmable Function Tone Duration	20 to 100ms

Audio Response

Frequency Response	±1dB 300Hz to 3kHz except at notch frequency
Notch Filter Bandwidth at −38dB	±0.6% typical (±13Hz at 2175Hz)
Notch Filter Bandwidth at −3dB	±1.28% typical (±28Hz at 2175Hz)
Notch Filter Attenuation	38dB
Audio Distortion	
From Line	<2.5%
From Receiver	<2%
Programmable Audio Delay	
Minimum	0ms
Maximum	500ms
Step	1ms

Alarms

Low Voltage Alarm Threshold	10.7V to 14.1V (±0.05V) programmable in 0.2V steps
Line Fail Alarm Timer	off or 1 minute to 4 hours
External Closure Alarms	
Input Trigger	First and subsequent falling edges
Input Threshold	1.5V (or to 0V via 3.3kΩ resistor)
Maximum Input Voltage	5V
Alarm/Confirmation Sequence	0 to 14 tones to radio and/or line (and/or Aux output when enabled)

Alarms (Continued)

Programmable Signalling Standards	Selcall (CCIR, EIA, EEA, ZVEI, & DZVEI), DTMF and EIA Tone Remote function tone format
Tone Carrier Deviation	70% nominal system deviation at 1 kHz (for test tone set at 60%)
Alarm Pip Tone Frequency/Duration	600 Hz/200 ms on tail of audio

Morse Code

Sending Speed	20 words per minute (PARIS)
Maximum Code Length	15.36 seconds
Tone Frequency	1200 Hz
Valid Station ID	alphanumeric only
Repetition Rate	off or 1 to 60 minutes
Carrier Deviation (for test tone set at 60%)	20% nominal system deviation

Voting

Programmable Tone-On-Idle Frequencies	1950, 2100, 2175, 2325, 2500, 2600, 2800, 2900, 2970, 3000 and 3100 Hz
Programmable Sliding Voting Tone Frequencies	2700 to 3500 Hz
Voting Tone Level To Line	−40 dBr to −1 dBr (Adjustable relative to Line-Out setting)

Miscellaneous

Auxiliary Output Rating	open collector, 50V, 100 mA (at 25°C)
Momentary Monitor (CTCSS Defeat) Time	off or 1 to 20 seconds

3 Regulatory Information

3.1 Canada

This product meets:

■ Industry Canada Telecommunications Apparatus Compliance Specification CS-03. Registration No. 737A-10118A.

■ Canadian ICES-003 (Radiated and conducted emissions, and electromagnetic susceptibility specifications) for Class B digital apparatus.

3.2 United States of America

A copy of the Declaration of Conformity is available at www.taitradio.com

This equipment complies with TIA/EIA/IS-968, Part 15 Class B of 47CFR and Part 68 of 47CFR as detailed below.

■ **TIA/EIA/IS-968** (Telecommunications – Telephone Terminal Equipment – Technical Requirements). Adopted criteria of the Administrative Council on Terminal Attachments (ACTA).

■ **Part 15 Class B of 47CFR** (Radiated and conducted emissions, and electromagnetic susceptibility specifications) of the FCC rules for the United States. Operation is subject to the following conditions:

    a. This device may not cause harmful interference, and

    b. This device must not accept any interference received, including interference that may cause undesired operation.

Warning:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference in one or more of the following measures:

    ■ Reorient or relocate the receiving antenna

    ■ Increase the separation between the equipment and receiver

    ■ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected

- Consult the dealer or an experience radio/TV technician for help.

Modifications not expressly approved by the manufacturer could void the the user's authority to operate the equipment under FCC rules.

- **Part 68 of 47CFR** (Connection of terminal equipment to the telephone network) of the Federal Communications Commission (FCC) rules and the requirements adopted by ACTA. On the rear face of this equipment is a label that contains, among other information, the product identifier i.e. US: 6FPNZL-34203-OT-N. If requested this number must be provided to the telephone company.

Warnings:

If this equipment, *TBA0M01 or TBA0M02 Tone remote and Alarm Interface*, causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations or procedures that could effect the operation of the equipment. If this happens the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission or corporation commission for information

If trouble is experienced with this equipment, *TBA0M01 or TBA0M02 Tone remote and Alarm Interface*, for repair or warranty information, please contact:

> Tait North America Inc
> Building 1, Suite 450
> 15740 Park Row
> Houston, Texas, 77084, USA
> Phone: 0800 320 4037
> Fax: 281 829-3320
> Mobile: 713-703-4991

Only approved Tait Dealer or Customer Service Organisations equipped with the necessary facilities should perform any servicing. Repairs attempted with incorrect equipment or untrained personnel may result in permanent damage. If the equipment, *TBA0M01 or TBA0M02 Tone Remote and Alarm Interface*, is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

3.2.1 Facility Interface and Service Order Codes

Unit Configuration	Function	USOC Jack type	REN[a]	FIC[b]	SOC[c]
TBA0M01 or TBA0M02 two-wire	two-wire leased line	RJ-11C	—	Metallic	7.0Y
TBA0M01 or TBA0M02 four-wire	four-wire leased line	RJ61X	—	Metallic	7.0Y

a. Ringer Equivalence Number

b. Facility Interface Code

c. Service Order Code

3.3 Europe

For Declaration of Conformity refer to eudocs.taitradio.com

According to the requirements of the EC Council Directive: 1999/5/EC Radio Equipment and Telecommunications Terminal Equipment Directive,

The TBA0M01 or TBA0M02 Tone Remote and Alarm Interface complies with;

- EN 301 489-5 Radiated and conducted emissions, and electromagnetic susceptibility specifications.
- EN60950 : 2000 Electrical safety

3.4 New Zealand

This product complies with the following standards:

- PTC200 Requirements for analogue telecommunications equipment.
- AS/NZS 3548 Class B Radiated and conducted emissions specifications

Warning:

TBA0M01 or TBA0M02 for use in New Zealand

"The grant of a Telepermit for any item of terminal equipment indicates only that Telecom New Zealand has accepted that the item complies with minimum conditions for connection to its network. It indicates no endorsement of the product by Telecom New Zealand, nor does it provide any sort of warranty. Above all, it provides no assurance that any item will work correctly in all respects with another item of Telepermitted equipment of a different make or model, nor does it imply that any product is compatible with all Telecom New Zealand's Network services."

"This equipment does not fully meet Telecom New Zealand's impedance requirements. Performance limitations may occur when used in conjunction

with some parts of the network. Telecom New Zealand will accept no responsibility should difficulties arise in such circumstances."

3.5 Australia

This product complies with the following standards:

- AS/ACIF S006 – 2001 Telecommunications technical standard
- AS/ NZS 3260 Electrical safety
- AS/NZS 3548 Class B Radiated and conducted emissions specifications

3.6 Hong Kong

This product complies with the Network Connection specification HKTA 2023

3.7 Singapore

This product complies with the Type Approval specification IDA TS PSTN1

4   Circuit Operation

This section provides a description of the circuit and operation of the tone remote.

Note   Unless otherwise specified, the term "Tone Remote Programming Application" used in this and following sections refers to version 1.08 or later.

Refer to the TBA0M01/2 Tone Remote and Alarm Interface PCB Information Package for detailed information on identifying and locating components and test points on the main circuit board.

4.1   Circuit Overview

The tone remote is connected to a leased line from control room equipment by means of an RJ45 connector. 600R transformers are used to couple the audio into and out of the tone remote. On the secondary of these line matching transformers are analogue transmission switches which configure the line interface as either two or four-wire compatible. Audio from line is passed through a programmable electronic potentiometer (e-pot) level control circuit before entering a CODEC where it is digitised. Audio to line is output from the same line CODEC via a second programmable e-pot level control circuit.

The line CODEC is connected to a digital signal processor (DSP) which is also connected to a similar radio CODEC (the CTCSS CODEC is not used in this application). The radio CODEC receives audio from the receiver and sends audio to the transmitter via a 25-way cable connecting the tone remote to the TB8000 series base station. Receiver audio is low frequency filtered to extend the radio CODEC's effective frequency range.

The DSP processes the digitised audio streams from the CODECs in accord with instructions sent to it by the tone remote's microprocessor. The DSP can:

- detect high-level guard tone, low-level guard tone and function tones coming from line, notch filter line in and receiver audio (used to eliminate low-level guard tone from Line-Out and transmitter audio);
- generate Selcall DTMF/function tone alarms and pip tones to Line-Out and transmitter audio;
- generate voting tones to Line-Out;
- generate morse code to transmitter audio;
- cross connect line and radio audio paths;
- adjusts the Line-In and Line-Out levels;

- mute audio from Line-In and receiver;
- delay the audio.

The microprocessor boot loads the DSP, interfaces with the user via the front panel switches and LEDs, interfaces with the Tone Remote Programming Application and runs the tone remote state machines (alarm monitoring, alarm tone generation, high-level guard tone/function tone/ low-level guard tone timing, RSSI/voting tone conversion etc.).

Figure 4.1   High-Level Block Diagram
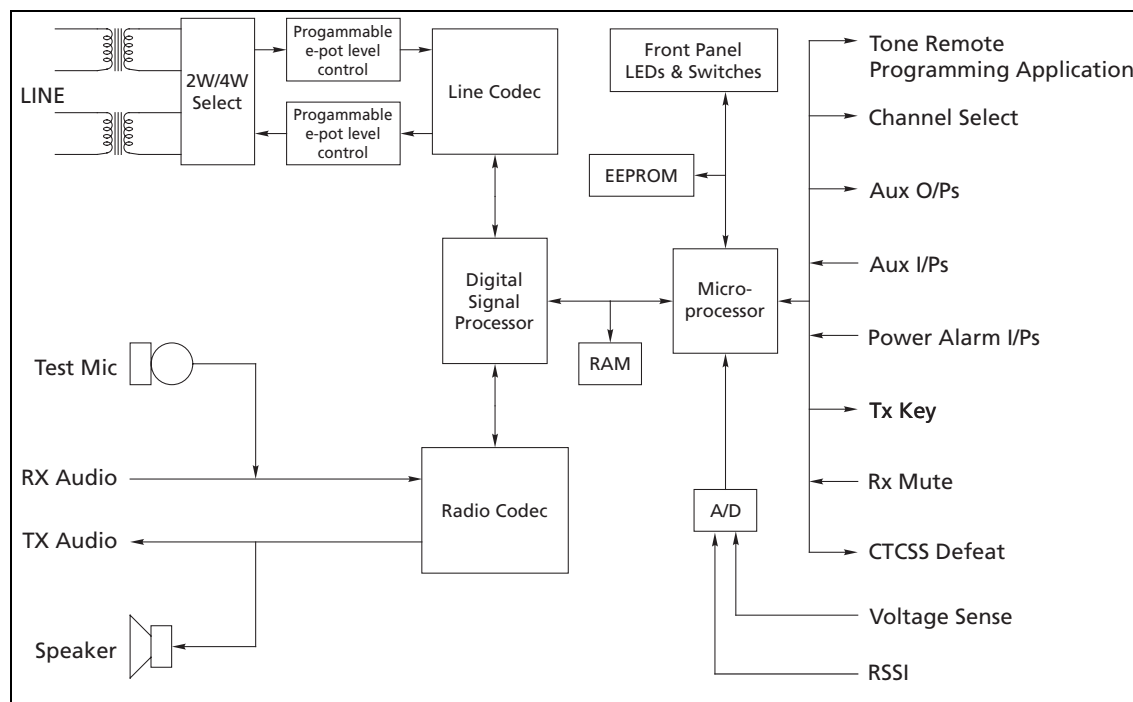
4.2   Tone Detection

In the quiescent state, audio on the Line–In pair is passed through the DSP (IC300) unfiltered to the tone remote loudspeaker (which is connected to Tx audio – TP203). The audio is bandpass filtered to detect guard tone. In normal operation (keytone and function tone operation) the tone detector threshold is set for high–level guard tone (HLGT).

If HLGT is detected, the DSP signals this detection to the microprocessor using the TONE_DETECT line (TP300 is pulled low). The microprocessor instructs the DSP, using the asynchronous serial communications connection (TP306) between them, to switch on the in line guard tone notch filter, lower the threshold of the guard tone detector (so that it can detect low-level guard tone – LLGT) and turn on the function tone detectors.

Where the tone remote is operating in two-wire mode and receiver audio (RX audio) is being gated to line, the microprocessor will soft mute the RX

audio first). The microprocessor then starts an internal timer, the duration of which is set by the HLGT and function tone times programmed by the Tone Remote Programming Application.

If a function tone is detected, the DSP signals the microprocessor using the CALL_UP line (TP301 pulled low). The microprocessor then interrogates the DSP via the serial communications connection to find out what frequency was detected.

If no tones are detected and the timer expires, the microprocessor resets the DSP to its quiescent state. If two different frequencies are detected or if only one function tone frequency is decoded and the timer expires, the microprocessor decodes them/it into an action by reading data programmed into the EEPROM (IC312) by the Tone Remote Programming Application. The microprocessor then keys on the transmitter (PTT line) and instructs the DSP to turn off the function tone detectors and the talk-through gate (if it was on). If the function tone sequence decodes into a channel number that is different from the currently set channel, the microprocessor will output the channel number on lines CH0 to CH7. These lines may then be sent to the base station and/or the Aux connector depending on the configuration of I/O link resistors.

Note   If channel selection is required for the base station, the appropriate Digital Inputs on the base station system interface will need to be configured as such.

As long as the DSP is detecting LLGT (indicated by a low level on TP300) the microprocessor will keep the transmitter keyed on. When the DSP fails to detect LLGT the microprocessor turns off the transmitter key and returns the DSP to the quiescent state.

When the tone remote is programmed for keytone-only operation, the microprocessor keying of the transmitter follows the state of the TONE_DETECT line from the DSP.

In the quiescent state when the receiver mute line (RX_MUTE) goes low, the microprocessor instructs the DSP to gate audio from the receiver to Line-Out. If the line interface is two-wire, Line-In and Line-Out are joined and the RX audio will pass through the line internally to the loudspeaker. It will therefore also reach the guard tone detector. RX audio is therefore notch filtered at the guard tone frequency to prevent false guard tone detection. If the line interface is four-wire this filtering is unnecessary but the talk-through gate must be turned on to send RX audio to the loudspeaker. If the tone remote is in Repeater Mode the transmitter is keyed and will remain so until the RX_MUTE line goes high. Note that the tone remote will not key the transmitter if the receiver's CTCSS is defeated (CD_OUT is low) to prevent receiver channel noise being transmitted.

From the description above of the keytone/function tone detection it can be seen that keying from line has priority over Repeater Mode keying and audio gating.

4.3 Alarm Monitoring

The tone remote microprocessor monitors eight alarm sources:

- Two external closure alarms: Alarm InputA and InputB
- Four external closure alarms: Alarm Input0 to Input3
- Low voltage
- Line fail

When an alarm is triggered it is latched, as indicated by the corresponding LED on the front panel. If the tone remote is keying the transmitter or sending receiver audio to the line the latched alarm is ignored. Once the tone remote re-enters the idle state the latched alarms are actioned. The microprocessor reads the EEPROM to determine what tone sequence the user programmed and instructs the DSP accordingly. If the tone sequence is to be sent to the transmitter, it is keyed 500ms before the tones are generated. Additionally the user may program any of the 4 auxiliary output ports as a response to an alarm event. The microprocessor will activate (pull low) these outputs if enabled. If several alarms are latched together they are actioned in the following order of priority:

- External closure alarms: Alarm Input0 to Input3
- External closure alarm: Alarm InputA
- External closure alarm: Alarm InputB
- Low voltage
- Line fail

If the programmed alarm action is a pip tone, the microprocessor will instruct the DSP to append 200ms burst of 600Hz tone to each transmission (to line and/or radio).

> **Note** Sub-rack alarms (Alarm Input A, Alarm Input B, Low battery or Line fail) cannot be re-triggered until they are cleared. The four external closure alarms however will resend any user programmed tone sequence if retriggered when already latched.

4.3.1 Alarm Triggers

The alarms are triggered according to their type.

External Closure Alarms (Auxiliary Input Alarms)

The 8 bit input latch (IC202) is sampled every 50ms. If two successive samples are the same value then the state of the closure alarms is tested (this has the effect of debouncing the alarm inputs). If any alarm is low, it is then latched. Note that Alarm InputA and InputB must be active (low) for two seconds before they are latched.

Low Voltage Alarm   The power supply line voltage is measured by the A/D converter (IC208) every 50 ms. If the voltage is below the programmed alarm threshold (±0.05 V) for more than 25 seconds of a 30 second sampling period, the alarm is latched. The long sampling period allows for load fluctuation effects on the supply. The level of the threshold should take into account external voltage drops in the power supply.

Line Fail Alarm   If no keying from line occurs within the period programmed by the user from the Tone Remote Programming Application, the microprocessor latches this alarm, saves the mode status and puts the tone remote into Repeater Mode. Note that programming zero as the line fail time disables this alarm.

Table 4.1   Alarm Summary Table

Priority	Alarm Name	Trigger type	Re-triggerable when latched	LED colour
1	Alarm Input0 to Input3	External closure. Sampled every 50 ms	Yes	Green
2	Alarm InputA	External closure. Sampled every 50 ms with a 2 s delay.	No	Red
3	Alarm InputB			
4	Low voltage	Voltage must be below the programmed threshold for 25 s of a 30 s period.	No	Red
5	Line fail	Programmable non-activity time period	No	Red

4.4   Confirmations

The tone remote microprocessor also monitors eight non–alarm triggers known as Confirmations:

- Power–up
- Channel change
- Up to six user defined function tone inputs

The tone remote microprocessor responds to a confirmation trigger in the same way as it does to an alarm trigger – depending on what has been programmed into the EEPROM, a tone sequence may be sent, an auxiliary output enabled and/or a pip tone enabled. These are all actioned by the microprocessor with the same rules as for alarm triggers. The only difference is that there are no LEDs associated with confirmations.

If several confirmations are triggered together they are actioned in the following order of priority: Power–up, Channel change and then User Confirmation 0 to 5. If several alarms and confirmations are triggered together the Power–up confirmation, if enabled, is always actioned first, followed by any alarms and then any other confirmations, both in their normal priority order.

Note Confirmations will re-send any user programmed tone sequence if re-triggered.

4.5 Clearing Alarms and Confirmations

The alarms can be cleared by either pressing both front panel switches together or sending the tone remote a correctly programmed ("Clear Alarms") function tone. All alarms are cleared together. Clearing alarms turns off all LEDs, cancels any associated pip tones and resets auxiliary outputs. If an alarm condition is still valid when it is cleared, it will be re-latched and the user-programmed action will be executed. If required, pip tones can be cleared separately (leaving alarms latched) by using a "Clear Alarm/Confirmation Pip tones" function tone.

When the Line fail alarm is cleared, the tone remote will revert to the mode it was in (Base Station or Repeater) before the alarm was triggered. A keying sequence from line can also clear this alarm in the same way except that the pip tone will not be cleared if used by other latched alarms. Line fail is the only alarm that can be cleared individually in this way.

Confirmations can not be cleared by a single command like the Alarms. Confirmation pip tones are cancelled by using a "Clear Alarm/ Confirmation Pip tones" programmed function tone and the auxiliary outputs are individually reset by using a "Turn OFF Auxiliary output (x)" function tone.

It is possible to have more than one Alarm or Confirmation using the pip tone. In this situation the clearing behaviour must be carefully considered:

■ Line Fail Pip – Cleared by line keying-sequence only if pip tone is not 'active' for other Alarms and/or Confirmations.

■ Alarm Pips (including Line Fail) – Cleared by "Clear Alarms" command only if Confirmation pips are not 'active'. Always cleared by "Clear Alarm/Confirmation Pip tones" command.

■ Confirmation Pips – Cleared by "Clear Alarm/Confirmation Pip tones" command.

Additionally, it is also possible to have a single Auxiliary output assigned to more than one Alarm or Confirmation. However, be aware that any command that resets auxiliary outputs, such as "Clear Alarms" or "Toggle Auxiliary Output (x)", will not make any check for multiple use – auxiliary outputs will be reset regardless.

4.6   Voting Tone Operation

When the tone remote is programmed to generate a tone on idle, the microprocessor monitors the receiver Mute-In signal. When it is high (receiver muted) the DSP is instructed to generate a voting tone to Line-Out. When receiver Mute-In is low the voting tone is turned off. To prevent false detection of the idle tone at the far end voting equipment, the DSP filters energy at the idle tone frequency from the receiver audio transmitted to Line-Out.

If the tone remote is programmed to generate a Sliding Voting Tone (Simoco compatible) the microprocessor reads the receiver RSSI level every 6ms using the A/D converter and sends this value to the DSP. The DSP generates a voting tone to Line-Out. The tone frequency is proportional to the RSSI level. To prevent incorrect operation of the far end voting equipment, the DSP low pass filters the receiver audio transmitted to Line-Out.

Figure 4.2   Signal Flow
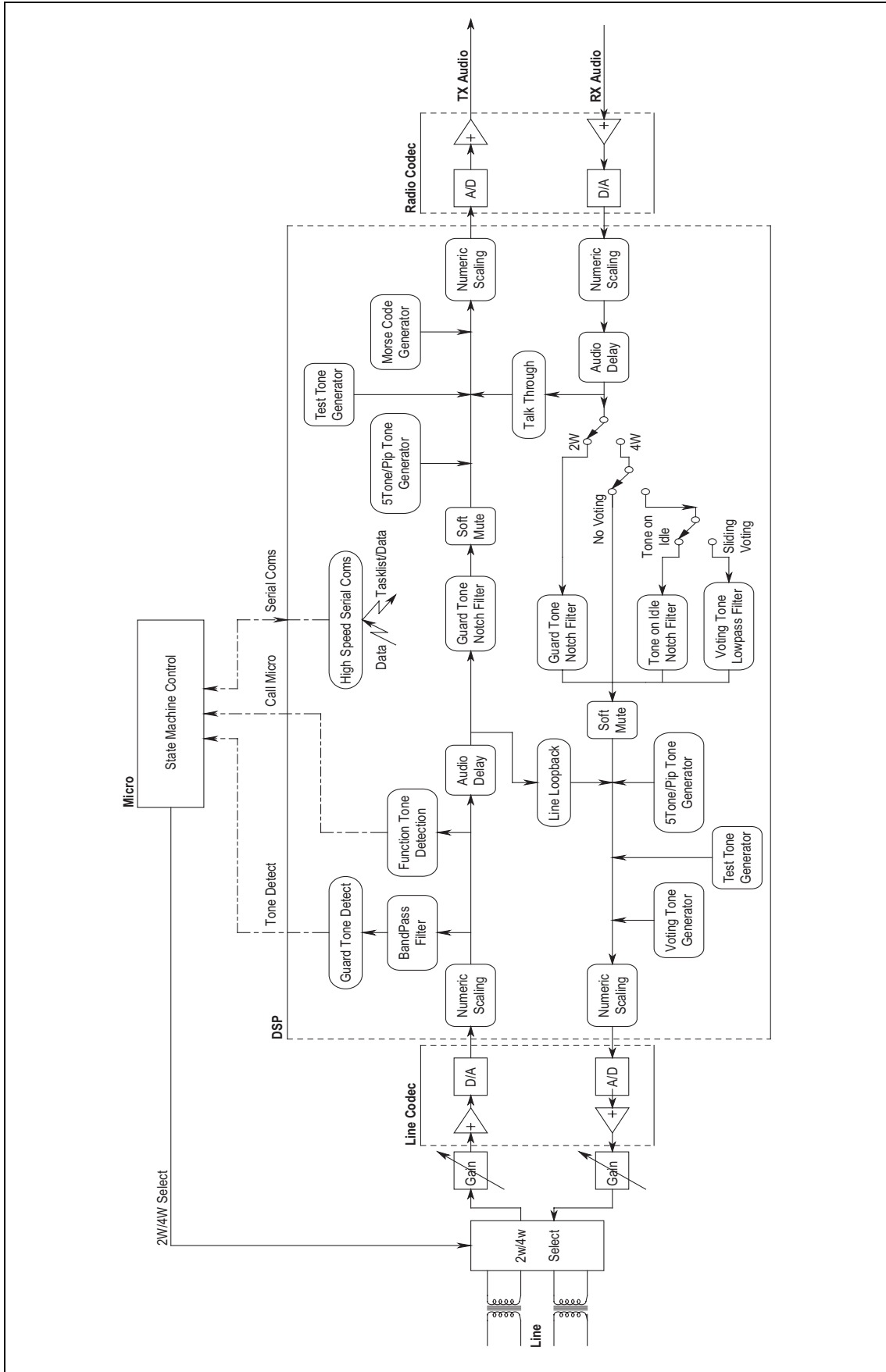
4.7 Use of Test Microphone

The tone remote test microphone is used to communicate both on air to radios and down the line to dispatch consoles. It plugs into the RJ11 connector on the front panel. It is electrically connected in parallel with the receiver (microphone with receiver audio and PTT button with receiver mute).

Most dispatch consoles are equipped with an intercom facility whereby speech can be sent to line without a keytone. This enables the dispatcher to talk to service personnel at the repeater site using the tone remote's built in speaker without broadcasting speech to air. The service personnel can talk back to the dispatcher using the tone remote test microphone (the PTT must be pressed to gate microphone speech).

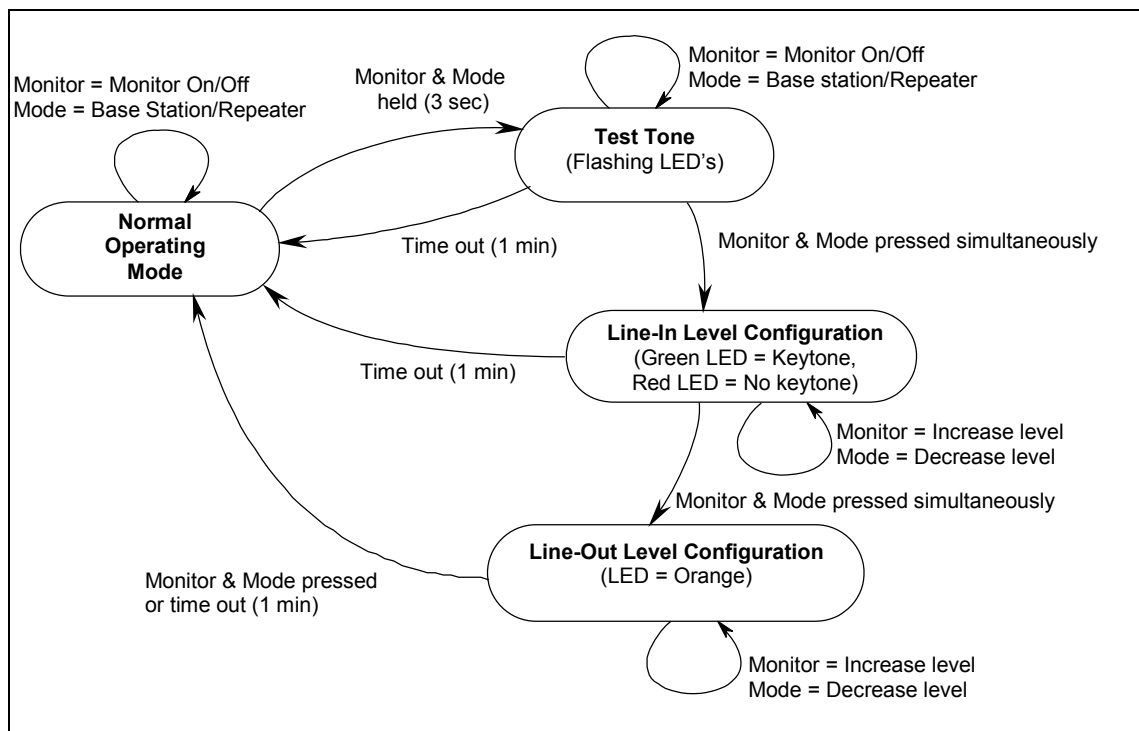*Note*   If the tone remote is in Repeater Mode, PTT on the test microphone will key up the transmitter and thus broadcast test speech to air.

4.8 Test Modes

The tone remote has three test modes to assist with setting levels:

- Test Tone Mode
- Line-In Level Configuration Mode
- Line-Out Level Configuration Mode

Figure 4.3   Mode switching cycle

To enter the test modes, press the Monitor and Mode Toggle buttons on the front of the tone remote simultaneously for three seconds. The alarm LEDs will display flashing colours travelling back and forth to indicate Test Tone Mode. The tone remote will key-on the transmitter and encode a 1 kHz test tone to the transmitter for one minute. The test tone can also be heard on the tone remote speaker.

While still in Test Tone Mode, simultaneously pressing the Monitor and Mode Toggle buttons again will change the mode to Line-In Level Configuration Mode. All the LEDs will be on – either entirely red or entirely green.

- Green = Keytone present on Line-In. The tone remote will key-on the associated transmitter.
- Red = No keytone present

While still in Line-In Level Configuration Mode, simultaneously pressing the Monitor and Mode Toggle buttons again will change the mode to Line-Out Configuration Mode. To indicate this, all the LEDs will be orange.

Note   After entering each mode, a one to two second pause is required before attempting the simultaneous press to enter the next mode (or to exit).

While in Line-In or Line-Out Configuration Mode, the Monitor and Mode Toggle buttons operate as 'gain' adjust buttons. A press on the Monitor button will increase the Line-In/Line-Out gain and toggle the left alarm LED on or off, indicating a level increase. When the top of the range has been reached, the LED will no longer toggle (it will stay on). Conversely the Mode Toggle button will decrease the gain and toggle the right alarm LED. When the bottom of the range has been reached, the LED stays on. In both of these modes Line-In audio can be heard on the monitor speaker.

To exit Line-Out Configuration Mode, simultaneously press both buttons again. Alternatively, the unit will automatically return to normal operation mode after one minute. (This occurs in all three test modes).

Note   These levels are always preserved on exit. Take care not to change them unintentionally during simultaneous button press.

5 Before Installing

This sections provides some general and advisory information on installing and configuring the tone remote.

5.1 ESD Precautions

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

We recommend you purchase an antistatic bench kit from a reputable manufacturer and install and test it according to the manufacturer's instructions. Figure 5.1 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 ANSI/ESD S20.20-1999 or BS EN 100015-4 1994.

Figure 5.1   Typical antistatic bench set-up
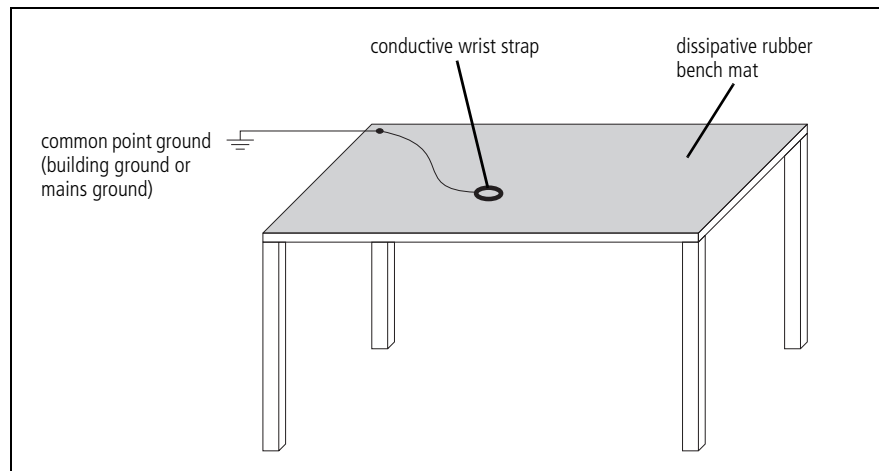
5.2   Installing the Tone Remote

Warning   **This equipment must only be installed and maintained by service personnel.**

All Tait tone remote products are 2U subracks designed to fit into a standard 19 inch rack or cabinet, just above or below the base station using M6 screws, and require a pozidriv PZ3 screwdriver.

It is beyond the scope of this manual to provide comprehensive information regarding the installation of the base station. If this is required please refer to the relevant base station Installation and Operation Manual.

Refer also to the TBA0M01/2 Tone Remote and Alarm Interface PCB Information Package for the parts lists, grid reference index and circuit diagrams which provide detailed information on identifying and locating components and test points on the main circuit board.

Note   Unless otherwise specified, the term "Tone Remote Programming Application" used in this manual refers to version 1.08 or later.

5.3   Dispatch Consoles

Third party dispatch consoles may vary in tone levels and duration. The values may be preset or user programmed. These need to be checked (allowing for line loss) when setting up a new system, or when replacing a console to allow correct setup of the tone remote.

Refer also to the introduction of Section 8 and the wiring of the RJ45 plug in Section 8.4.

6 Interfacing the Tone Remote with the TB7100

The tone remote can be used with the TB7100 base station.
The configuration of the system is best achieved in stages:

1. Cable connection to the TB7100

2. TB7100 system interface board links

3. TB7100 Programming

4. Level Configuration (See Section 8)

6.1 Cable connection to the TB7100

Figure 6.1   Tone remote to TB7100 Cable connection
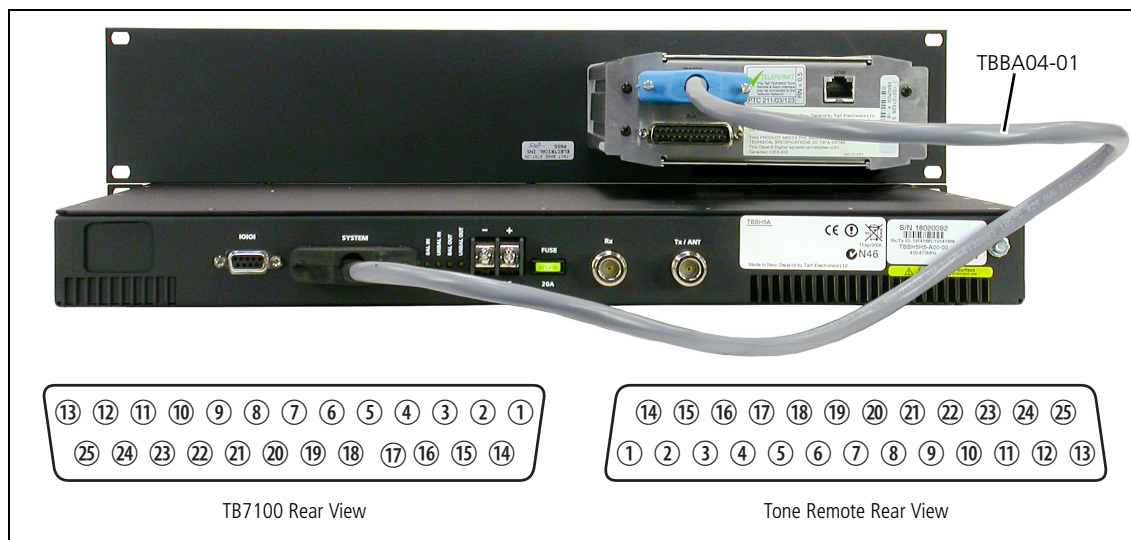
A special cable (TBBA04–01) is required between the tone remote and the TB7100, the blue end being plugged into the tone remote. Table 6.1 shows the pin allocations.

For alternative pin allocations, see Section 7.6. This section covers tone remote to/from TB8100 I/O, however, it can be used as a guide for TB7100 systems. For further assistance, please contact Tait Technical Support.

Most of the tone remote and TB7100 input/outputs are also available on the tone remote Aux connector (see Section 6.4). For systems with other external equipment requiring connection to the Aux connector, please contact Tait Technical Support.

Table 6.1   TBBA04-01 (tone remote to TB7100 cable) pin allocations

Tone remote Connector (Blue)		TB7100 System Connector (Black)		Comment
Pin	Function	Pin	Function	
1	Rx in +	1	Rx Line Output +	Balanced 600Ω output from the TB7100. Not used by the tone remote but can be routed to the tone remote Aux Connector.
2	Rx in −	4	Rx Line Output −	
3[a]	**Rx audio**	**24**	**Rx audio output**	
4	Ground			No connection required
5	Tx audio	11	Tx audio input	High Z unbalanced input to the TB7100. Direct connection from tone remote Aux connector (Pin 5)
6	**Tx out +**	**5**	**Tx Line Input +**	
7	**Tx out −**	**8**	**Tx line Input −**	
8	RSSI	9	RSSI	Used if voting is required
9	**Rx gate**	**14**	**Rx Gate**	
10	**Tx key**	**15**	**Tx Key**	
11	Alarm Input A	10	Tx digital in/out 1	Used if a TB7100 event/status (output) is required to trigger a tone remote alarm.[b]
12	Alarm Input B	19	Rx digital in/out 1	Used if a TB7100 event/status (output) is required to trigger a tone remote alarm.[b]
13	**+13.8V**	**25**	**13.8V output**	
14	Channel select 0	2	Tx/Rx Digital in 1	Used for selection of up to 2 channels.
15	Channel select 1	3	Tx/Rx Digital in 2	Used for selection of up to 4 channels.
16	Channel select 2	6	Tx/Rx Digital in 3	Used for selection of up to 8 channels.
17	Channel select 3	7	Tx/Rx Digital in 4	Used for selection of up to 16 channels.
18	Channel Select 4	19	Rx digital in/out 1	Can be used for selection of up to 32 channels.
19	Channel Select 5			No connection. Could be used for one of the TB7100 digital inputs.[c]
20	Channel Select 6			No connection. Could be used for one of the TB7100 digital inputs.[c]
21	Auxiliary Output 1			No connection. This connection could be used if a TB7100 action is required to be triggered by the tone remote/dispatch console.[c]
22	Auxiliary Output 0			No connection. This connection could be used if a TB7100 action is required to be triggered by the tone remote/dispatch console.[c]
23	CTCSS Defeat			No connection. Could be used as a TB7100 digital input.[c]
24	Coax relay driver	23	Digital output/Tx relay	Not required for tone remote operation. This TB7100 output is connected to the tone remote Aux connector (Pin 2).
25	**Ground**	**13**	**Ground**	

a. The bold shaded rows are connections that are required if making a custom cable.
b. See the TB7100 installation and operation manual for details.
c. A custom cable will be required. See the TB7100 installation and operation manual for details.

6.1.1   Power Supply

The power for the tone remote is drawn from the TB7100 through the 25 way connector as described in Table 6.1.

6.2 TB7100 system interface board links

The TB7100 system interface board, found inside the TB7100, has link settings which allow the configuration of audio paths, control signals, digital I/O, data, and fan behaviour. The table below shows the relevant links and their required positions for operation with the tone remote.

Table 6.2   TB7100 System Interface links

Link	Position	Function
J400	1-2	External PTT signal to transmitter
J500	1-2	Balanced line out set to flat response
J501	2-3	Pre-emphasis (applied to balanced Line In only)
J502	1-2	External audio line in to Tx
J503	2-3	Rx Audio sent to balanced and unbalanced external outputs
J507	2-3	Tx audio directed to tap point AUDIO_TAP_IN
W300	1-2	Optional. When fitted, Tx digital in/out 1 is connected to Rx digital in/out 1, allowing both modules to respond to the same digital input. Could be used to provide channel select line 4 for the tone remote.
W301	1-2	Optional. When fitted, Tx digital in/out 2 is connected to Rx digital in/out 2, allowing both modules to respond to the same digital input. When used with W300, provides channel select line 5 for the tone remote.
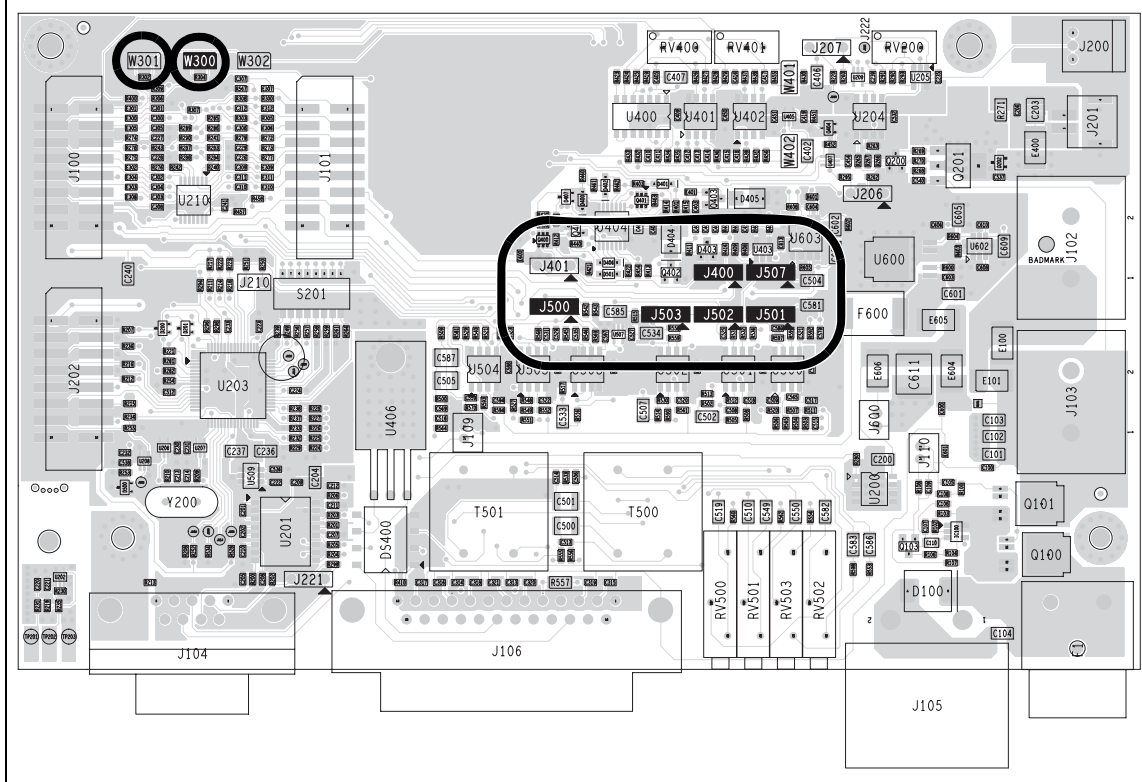
6.3 TB7100 Programming

The following describes how to program the TB7100 for operation with the tone remote, and in particular the channel select functionality. The default settings for the Rx Gate and Tx Key control lines will work with the tone remote.

Note Each TB7100 module (Tx and Rx) will need to be programmed separately.

From within the TB7100 programming application navigate to the Programmable I/O form. The form includes a table showing all the digital I/O lines. The signal lines available for channel selection are the first six pins listed in the table (AUX_GPI1 to AUX_GPI3, AUX_GPIO4, AUX_GPIO5, and AUX_GPIO6). Depending on the particular system configuration some or all of these signal lines may be used for channel select. However, the lines must be used sequentially and must start with AUX_GPI1. Additionally, if AUX_GPIO5 is used (when 32 channel select is required), Link W300 must be fitted on the system interface board and, if AUX_GPIO6 is used (64 channel select), link W301 must be fitted (see "TB7100 system interface board links" on page 37.

6.3.1 Configuring the Unbalanced Line Output for De-emphasis

As Link J500 only sets the audio response for the balanced line out, you need to provide de-emphasis to the unbalanced line out, using the TB7100 programming software.

1. Select the Programmable I/O form, and then the Audio tab.

2. In the first row, set the Tap out to R7. This tells the TB7100 to provide the unbalanced line out with receive audio that has been de-emphasised.

Figure 6.2   Selecting the Tap Out point for the Unbalanced Line Out

	Rx/PTT Type	Tap In	Tap In Type	Tap In Unmute	Tap Out	Tap Out Type	Tap Out Unmute	Tap In In
	Rx	None	A - Bypass Ir	On PTT	R7 ▾	D - Split	Busy Detect	Disabled
	Mic PTT	None	A - Bypass Ir	On PTT	None	C - Bypass O	On PTT	Disabled
	EPTT1	None	A - Bypass Ir	On PTT	None	C - Bypass O	On PTT	Disabled
	EPTT2	None	A - Bypass Ir	On PTT	None	C - Bypass O	On PTT	Disabled

Programmable I/O — Digital | Audio | BCD |

6.3.2 Setting Up Channel Selection

Steps for setting up channel selection:

1. Determine the number of signal lines required. Note that the tone remote uses binary format for channel select.

2. Set the signal direction of each line to INPUT.

3. Label the signal lines as desired.

4. Click on the ACTION field and use the drop-down menu to select BCD Pin. Use BCD Pin 0 for signal line AUX_GPI1, BCD Pin 1 for AUX_GPI2, and similarly for each line.

5. Set the logic of each line to High.

6. Set the Debounce on each line to 5 ms.

Figure 6.3 shows an example in which TB7100 inputs AUX_GPI1 to AUX_GPI3 are configured as channel select lines.

Figure 6.3 Sample Channel Select Line programming
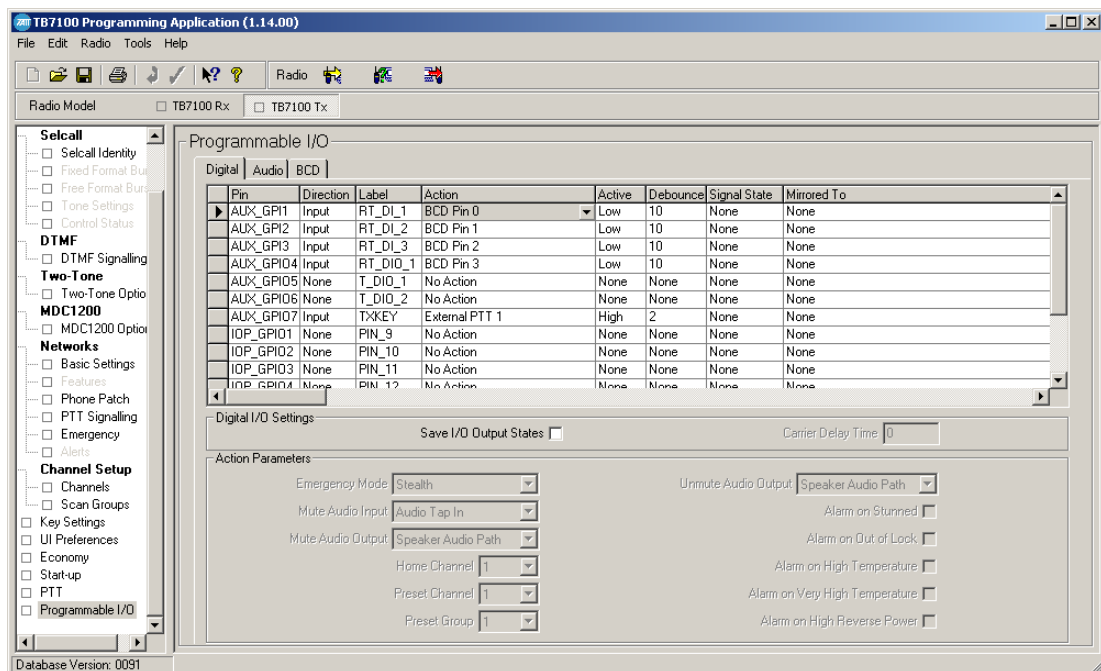
7. Click on the BCD tab.

8. Select BIN from the BCD/BIN Operation drop down menu.

9. Select Channel ID from the BCD Channel Selection

Note If this option is not available, or if Record Number is selected, the tone remote must be programmed accordingly. See "Configuring

Figure 6.4   Programmable I/O BCD tab
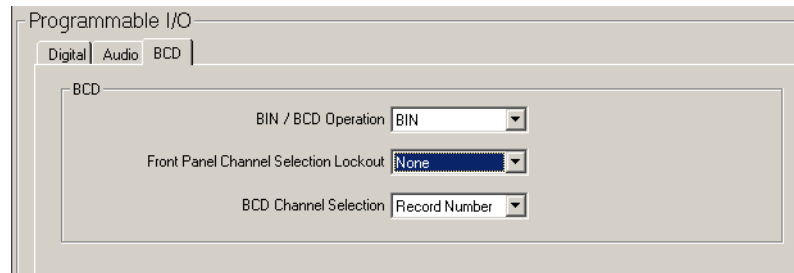
Configuring channel selection using the TB7100 Programming Application v1.08 and earlier
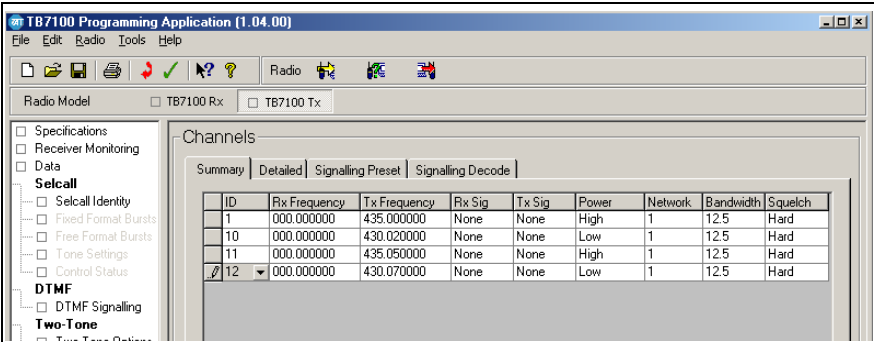
Earlier versions of the TB7100 programming application do not have the option to select the channel by Channel ID. Channel selection using external signal lines (BCD or binary) selects a channel number corresponding to the record number in the channel table – ***NOT*** the channel ID. That is, if channel 4 is selected using the tone remote the actual channel selected will be the fourth record in the channel table. The front panel channel number displayed will be the channel ID.

If it is required that the channel displayed reflect the binary channel number selected by the tone remote then ensure that the TB7100 channel IDs are sequential and start at channel 0 (whether or not channel 0 is actually used).

Alternatively the channels programmed into the tone remote can be set so that the dispatch console channel select matches the TB7100 channel display. For example, based on the channel table shown below, the dispatch console and the TB7100 can be programmed with the same channel numbers but because the binary channel select is based on the channel record in the table, the tone remote is programmed for record numbers 0 to 3.

Tone Remote Installation and Operation Manual
© Copyright Tait Electronics Limited October 2010
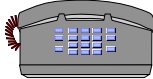
Figure 6.5   Sample configuration of Channel Selection

6.4 The Aux Connector

Tone remote Rear View

The Aux connector not only provides access to the tone remote I/O, but also allows connection to the TB7100 system interface so that communication with the base station I/O is still possible even when the tone remote is connected to the base station. The most commonly used I/O is provided by the default pin allocations on the Aux Connector.

6.4.1   Default Pin Allocation

- Direct connection to or from the TB7100 base station for:
    - Coax relay driver
    - RSSI
    - Tx Audio (high impedance input, unbalanced)
    - Rx Audio (high impedance output, unbalanced)
    - Tx Digital In/Out 1 and 2
    - Rx Digital In/Out 1 and 2
    - +13.8 V supplied by the TB7100. Current limited to 1.5A.
- All tone remote Auxiliary outputs
- Tx key output from tone remote
- Rx Gate input to tone remote
- Channel select output from tone remote (128 channel binary format)
- Tone remote Alarm Inputs 0 and 1
- A Serial Comms connection.

For alternative pin allocations, see Section 7.7.3. This section covers tone remote to/from TB8100 I/O, however, it can be used as a guide for TB7100 systems. For further assistance, please contact Tait Technical Support.

Table 6.3   Default Aux connector pin allocations

Pin	Name	Tone remote links and/or switch settings	Signal Type	Notes[a]
1	+13.8V		Power output	Current limited to 1.5A by the TB7100
2	Coax relay driver	R606A and R607A	Output	From TB7100 Tx relay (open collector)
3	RSSI		DC signal output	From TB7100
4	Auxiliary Output 0	R610A	Output	From tone remote. Open collector
5	Tx Audio In	R611A	Audio input	To TB7100. High impedance unbalanced
6	Rx Audio Out	R612B and SW600 switch 4 ON	Audio output	From TB7100. High impedance unbalanced.
7	Tx Digital In/Out 1	R643 and R605A	Output	From/To TB7100 Digital In/Out 1
8	Alarm 0 In	R615B (R605B not fitted)	Input	To tone remote Alarm input 0 (5V logic)
9	Auxiliary Output 2	R616B and SW601 switch 4 ON	Output	From tone remote. Open collector
10	Rx Digital In/Out 2	R644 and R604A	Output	To/From TB7100 Digital In/Out 2
11	Alarm 1 In	R618B (R604B not fitted)	Input	To tone remote Alarm input 1 (5V logic)
12	Auxiliary Output 3	R619B and SW601 switch 2 ON	Output	From tone remote. Open collector
13	CTCSS Defeat	R621B	Output	From tone remote. Open collector
14	Tx Key Out		Output	From tone remote. Open collector
15	Channel Select 0	DIP SW600 switch 5 ON	Output	From tone remote. 5V Logic (Active high)
16	Channel Select 1	DIP SW600 switch 6 ON		
17	Channel Select 2	DIP SW600 switch 7 ON		
18	Channel Select 3	DIP SW600 switch 8 ON		
19	Channel Select 4	DIP SW601 switch 1 ON		
20	Channel Select 5	R628B and SW601 switch 3 ON		
21	Channel Select 6	R629B and SW601 switch 5 ON		
22	Auxiliary Output 1	R630A	Output	From tone remote. Open collector
23	Rx Gate In		Input	To tone remote. 5V logic
24	Serial Comms	DIP SW601 switch 8 OFF (slave)		Ping-Pong protocol[b]
25	Ground		Ground	

a. For full specifications see Section 6.4.2.

b. A Serial Comms connection is available. This is a Ping-Pong protocol bus. By linking this connection (and ground) between modules, all the connected modules can be programmed via a RS232 on a single master module. The slave modules must have switch 8 of DIP SW601 switched OFF. The Tone Remote Programming Application will then detect and identify each connected module.

6.4.2 Aux Connector I/O specifications

The following tables describe the specifications and ratings of the signals available on the tone remote Aux connector when the tone remote is connected to the TB7100 base station.

Important If two different inputs or outputs are used in parallel ensure that the lower rating is used.

For example, the TB7100 Digital Input (max input 2.0 V) is driven by the tone remote Auxiliary Output (max input 50 V) and also by an external Digital In on the Aux Connector. The maximum voltage input level of the external Digital In must not exceed the 2.0 V of the TB7100 Digital Input.

Table 6.4   Logic signal and supply voltage specifications

Name	Signal path	Logic levels	Ratings
+13.8V	TB7100 output	—	Max 1.5A. Fused on TB7100
Alarm In	Tone remote input	≥ 3.5V (de-activated) ≤1.5V (activated)	Max input voltage = 5V
Aux Channel Select	TB7100 input	≥ 2.0V (de-activated) ≤0.8V (activated)	RC, and diode clamps to 3.3V and ground Logic sense can be inverted by TB7100 programming
Auxiliary Output	Tone remote output	open collector 0V = active	Max applied voltage = 50V Max sink current = 100mA
Channel Select	Tone remote output	5V CMOS 5V = active	Max applied voltage = 20V Max sink current = 20mA
Coax relay driver	TB7100 output	open collector < 0.4V = active	Max applied voltage = 30V Max sink current = 250mA
CTCSS defeat	Tone remote output	open collector 0V = active	Max applied voltage = 50V Max sink current = 250mA
Digital In	TB7100 input	≥ 2.0V (de-activated) ≤0.8V (activated)	RC, diode clamps to 3.3V and ground Logic sense can be inverted by TB7100 programming
Digital Out	TB7100 output	High ≥ 3.1V (no load) Low < 0.6V (10mA sink)	Pull up to 3.3V via 33kΩ
RSSI	TB7100 output	DC level range Offset 600mV, then 25mV/dB from −120dBm to −50dBm	1kΩ output impedance
Rx Gate In	Tone remote input	5V logic 0V = audio	Max input voltage = 50V
Rx Gate Out	TB7100 output	open collector < 0.4V = active	Max applied voltage = 30V Max sink current = 250mA
Shift Mix	Tone remote output	open collector 0V = active	Max applied voltage = 50V Max sink current = 250mA
Tx Key In	TB7100 input	≤2.0V (TXKEY = activated) ≥ 5.0V (TXKEY = de-activated)	Input resistance ≥ 10kΩ Internal pull up to 9V Max external pull up = 20V
Tx Key Out	Tone remote output	open collector 0V = active	Max applied voltage = 50V Max sink current = 250mA

Table 6.5 Audio Signal Specifications

Name	Signal path	Specifications
Rx Audio In	Tone remote input	Unbalanced high impedance input (>10kΩ). Level required for correct operation of tone remote is $1V_{pp}$ (older modules: $650mV_{pp}$).
Rx Audio Out	TB7100 output	Unbalanced 220Ω output. The output level is adjustable $220mV_{pp}$ to $3V_{pp}$ into 10kΩ
Rx Out+	TB7100 output	Balanced 600Ω audio interface. The output level is adjustable −20dBm to +3dBm for 60% modulation. Not used by the tone remote.
Rx Out−		
TX Audio in	TB7100 input	Unbalanced high impedance input (>10kΩ). The input level is adjustable $220mV_{pp}$ to $3V_{pp}$.
Tx Out−	Tone remote output/TB7100 input	Parallel connection to the 600Ω balanced Tx Audio path between the tone remote and the TB7100. Consequently if this audio is to be accessed on the Aux connector, this must be done using a high impedance load, thereby not upsetting the match/levels between the tone remote and the base station. Output level −4.4dBm (when the Line-In level is properly set-up or when the tone remote is in Test Tone Mode)
Tx Out+		

7 Interfacing the Tone Remote with the TB8100

This section of the manual describes how to configure the tone remote with a TB8100 series base station, and test that it is functioning correctly.

7.1 Connecting to a TB8100 Base Station

The TBAA04–08 25–way cable is used to connect a tone remote module to a TB8100 reciter that has been fitted with a system interface board. The system interface board is an optional board that provides the links between the reciter's internal circuitry and external equipment.

The tone remote is compatible with four system interface boards at the time of publication:

Standard (no longer available)
The standard system interface board was fitted to reciters bearing the product code TBA4xxx-0A0x.

Isolated
This system interface board is fitted to reciters bearing the product code TBA4xxx-0B0x or TBA5xxx-0B0x. If purchased separately, it has the product code TBA-SP-S0B0. It is the same as the standard model, except that the balanced audio interfaces are electrically isolated.

Isolated Ethernet
This system interface board is fitted to reciters bearing the product code TBA4xxx-0J0x or TBA5xxx-0J0x. If purchased separately, it has the product code TBA-SP-S0J0.

Isolated RS232
This system interface board is fitted to reciters bearing the product code TBA4xxx-0M0x or TBA5xxx-0M0x. If purchased separately, it has the product code TBA-SP-S0M0.

Each of these boards is fitted with a 26–way female high density D–range connector and an auxiliary DC input connector. An adaptor board from high density 26–way D–range to 25–way standard D–range is supplied with this interface if ordered as TBA-SP-S0J0 or can be ordered separately as a TBA101D.

The tone remote is supplied with DC power via the +AUX_V pin (pin 13) of the 26–way connection from the system interface board (see Section 7.2 below).

Figure 7.1 below identifies the connections at the rear of a dual base station

Figure 7.1   Tone remote to TB8100 cable connection

reciter   PA   PMU

① system interface connector   ④ TBAA04-0x Aux DC power cable (supplied separately)

② auxiliary DC input for system interface[a]   ⑤ auxiliary DC output

③ TBAA04-08 TB8100 tone remote connection cable (supplied separately)
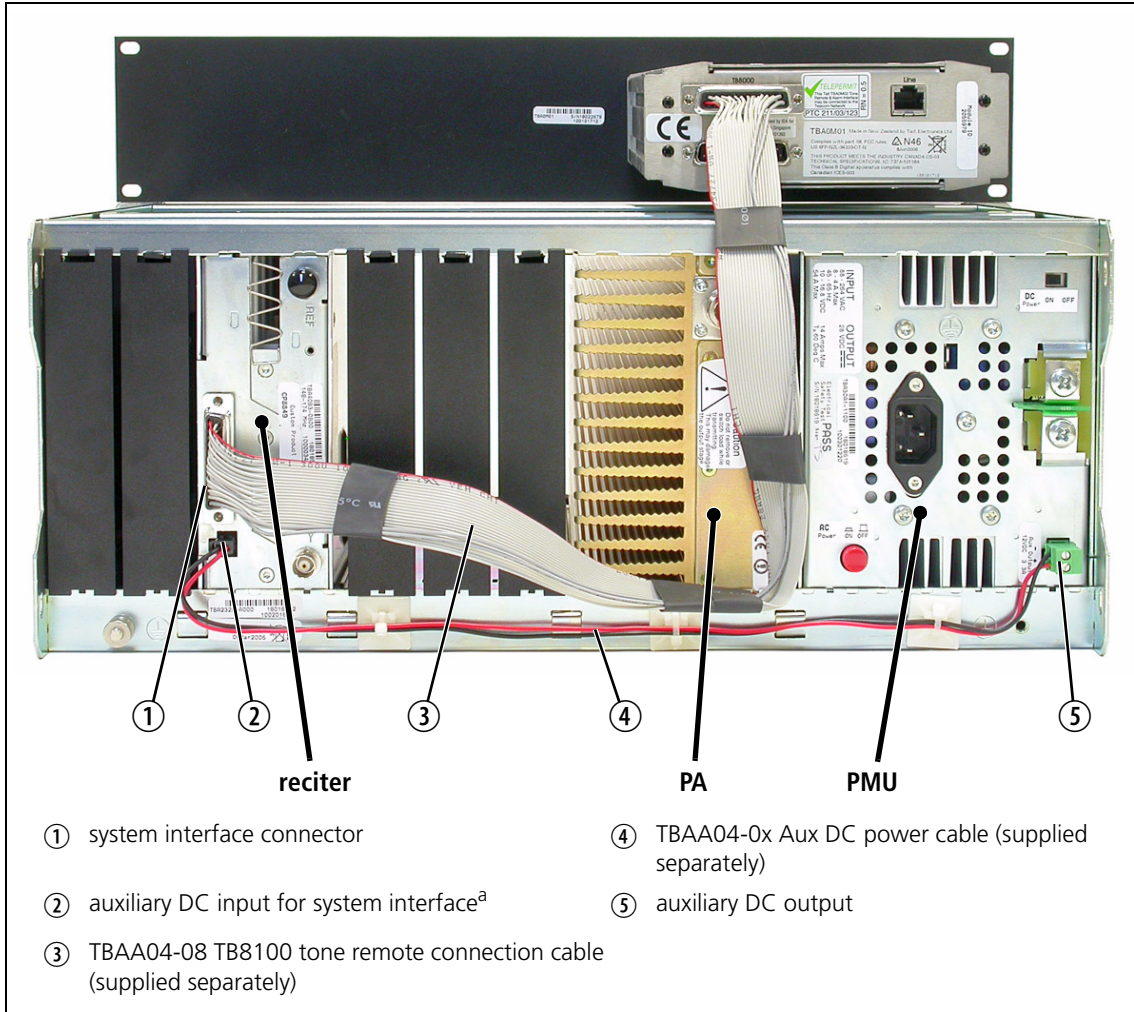
a. Older system interface boards use a 4-way connector, while the TaitNet RS-232 board and all other boards manufactured after March 2005 use the 2-way connector shown in the photograph. Refer to the TB8100 Installation and Operation Manual for more details.
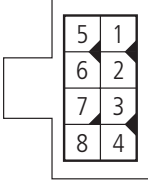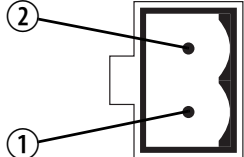
7.2   Power supply

The DC power supply for the tone remote is provided by the 40 W Auxiliary Power Supply (13.8 V option) which must be fitted to the TB8100 Power Management Unit (PMU). This power supply is current limited to 3A and is available on the auxiliary DC output connector on the rear panel of the PMU (item ⑤ in Figure 7.1). By linking this output to the auxiliary DC input on the system interface board (item ② in Figure 7.1), DC is supplied to the +AUX_V pin of the 25–way system interface connector and hence the tone remote.

The pin allocations for the auxiliary DC output on the PMU are given in the following table. Note that pins 1 to 4 and pins 5 to 8 on this connector are linked. The DC output is $13.8\,V_{DC}$. Although this power output is isolated, the negative side of the supply is grounded on the system interface board.
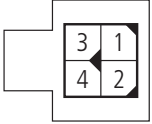
Figure 7.2   PMU auxiliary DC output pin allocations

Before August 2004	Pin	Description	Links
	1	+V output	•
	2	+V output	•
	3	+V output	•
	4	+V output	•
	5	ground	•
	6	ground	•
8-way connector – external view	7	ground	•
	8	ground	•

August 2004 onwards	Pin	Description
	1	+V output
	2	ground
2-way connector – external view		

The pin allocations for the auxiliary DC input on the system interface board are given in the following table. Note that pins 1 & 3 and pins 2 & 4 on this connector are linked.

Figure 7.3   Reciter system interface board pin allocations

	Pin	Description	Links
	1	+V input	•
	2	ground	•
	3	+V input	•
4-way connector – external view	4	ground	•
2-way connector – external view			

7.3 Tone remote Input/Output Connections

Figure 7.4   Tone remote rear panel
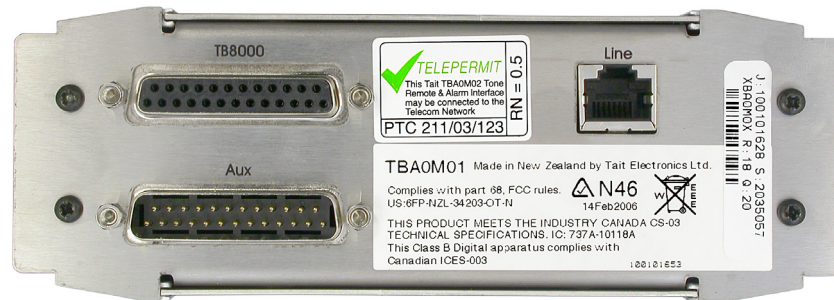
The tone remote has a twin 25–way D–range connector at the rear. The top (female) connector is dedicated to base station I/O while the lower 'Aux' (male) connector ports auxiliary I/O.

The Aux connector not only provides access to the tone remote I/O but also allows through connection to a TB8100 system interface (SIF) so that communication with the base station I/O is still possible even when the tone remote is connected to the base station. This means that most of the TB8100 I/O that are normally present on the SIF can be made available on the tone remote Aux connector.

The inter-connection between the tone remote, the base station (via the base station interface connector) and external equipment (via the Aux connector) is configurable by use of link resistors and DIP switches inside the tone remote. To access these, turn the tone remote upside down and remove the two screws towards the rear edge. The cover can then be removed by sliding towards the rear – take care to avoid sharp edges.

Refer to the TBA0M01/2 Tone Remote and Alarm Interface PCB Information Package for the parts lists, grid reference index and circuit diagrams which provide detailed information on identifying and locating components and test points on the main circuit board.

7.4 The Base Station Interface Connector

Figure 7.5   Base station interface connector
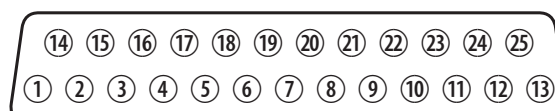
Tone remote Rear View

The supplied 25–way cable provides all the connections between the base station interface connector[1] (at the rear of the tone remote) and the TB8100 base station reciter system interface connector (item ① in Figure 7.1). The default pin allocations of this interface includes all the standard I/O required to operate the tone remote with the base station.

7.4.1   Default Pin Allocations

Table 7.1 on page 53 shows the possible pin allocations for the connection between the tone remote and the TB8100. A summary of the default pin allocations (bold shaded cells) follows.

Tone remote Alarm Input A and Input B have been associated with the TB8100 Digital Outputs (1 and 2). By creating tasks in the TB8100 Service Kit Task Manager, these digital outputs can be enabled and used to trigger the tone remote alarms.

Tone remote Channel select 0 to Channel select 6 have been assigned to the TB8100 Digital Inputs 1 to 7 respectively. This allows for selection of up to 128 channels, but the TB8100 SIF needs to be configured accordingly (See Section 7.5).

Tone remote Auxiliary Outputs 1 and 0 have been assigned to the TB8100 Digital Inputs 8 and 9 respectively. By creating tasks in the Task Manager of the TB8100 Service Kit these digital inputs can be used and to trigger some kind of TB8100 action or response. This is very useful if the base station is required to respond to a tone remote alarm or a dispatch console button press (a tone remote confirmation initiated by a function tone).

Tone remote CTCSS Defeat has been assigned to TB8100 Digital Input 10. This can be used as an input for an appropriate task.

7.5   TB8100 SIF Programming

The TB8100 SIF needs to be configured to allow use of the TB8100 inputs for channel selection.

From within the TB8100 Service Kit navigate to Configure > Base station > System Interface:

- Enable "Channel selection"
- Choose "7 bit selection"
- Select "Binary format"
- Select "Invert"

---

1. The base station interface connector on the rear of the tone remote at time of publishing is labelled 'TB8000'.

Figure 7.6   TB8100 SIF Pin Allocations
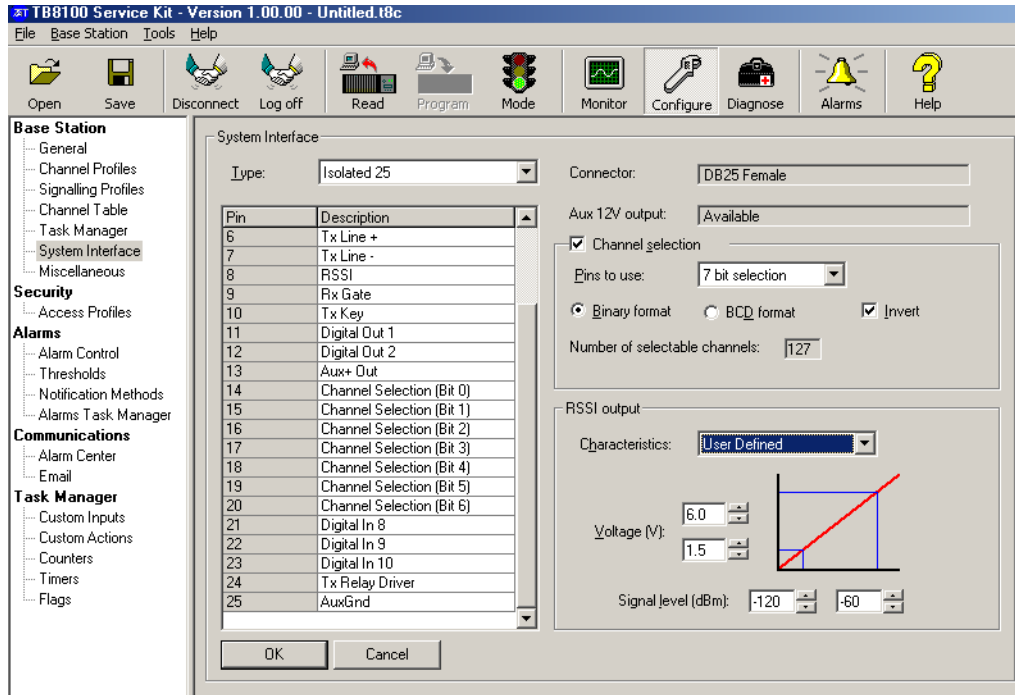
7.6   Alternative Pin Allocations

Table 7.1 shows the possible pin allocations for the connection between the tone remote and the TB8100. Following are some of the common custom pin allocations that may be configured. Refer also to the TBA0M01/2 Tone Remote and Alarm Interface PCB Information Package for detailed information on identifying and locating components on the main circuit board.

Pins 11 and 12: TB8100 Digital Outputs 1 and 2 can also be associated with tone remote Alarm Input 0 and Input 1.

Pins 14 to 21: These pins can be linked directly to pins on the Aux connector thus allowing channel selection to be achieved by external devices. Alternatively by changing the configuration of the TB8100 SIF these lines become simple TB8100 Digital inputs available for use by TB8100 tasks.

Pins 19 and 20: Instead of channel select lines they can also be linked to the tone remote Auxiliary Outputs 3 and 2, respectively. The required TB8100 SIF pins must be re-configured so that they become TB8100 Digital inputs. These are then available for use by TB8100 tasks, in response to tone remote alarms and/or confirmations.

For full details of default and alternative pin allocations, see Table 7.1 (Bold shaded cells indicate default configuration).

Table 7.1   Base Station Interface Connector possible pin allocations

| Pin	Signal Type (relative to tone remote)	Name	Required tone remote links and/or switch settings	Notes
1	Audio Input	**Rx in+**[a]		**Balanced 600Ω Not used by the tone remote but routed to Aux connector.**
2		**Rx in–**		
3	Audio Input	**Rx audio**	**DIP SW600 switch 4 ON**	**TB8100 receiver audio to tone remote. High impedance unbalanced.**
4	Ground	**Audio ground**		
5	Audio Output	**Tx audio**		**High impedance unbalanced. Direct connection from Aux connector.**
6	Audio Output	**Tx out+**		**Tone remote audio to TB8100 transmitter. Balanced 600Ω**
7		**Tx out–**		
8	DC Signal Input	**RSSI**		
9	Input	**Rx gate**	**DIP SW600 switch 3 ON**	**From TB8100 to tone remote**
			R619A, R620B and SW600 switch 3 ON	From TB8100 (open collector) to tone remote and Aux connector (P100 pin 37)
			R 619A, R620B and SW600 switch 3 OFF	From TB8100 (open collector) to Aux connector (P100 pin 37) only
10	Output	**Tx key**	**SW600 switch 2 ON**	**Tone remote keying of TB8100**
			R616A, R634B and SW600 switch2 ON	Tone remote and Aux connector (P100 pin 34) keying of TB8100 (8V logic)
			R616A, R634B and SW600 switch 2 OFF	Aux connector (P100 pin 34) keying of TB8100 (8V logic)
11	Input	**Alarm Input A**	**R605A**	**From TB8100 Digital out 1 (open collector) to tone remote Alarm input A**
			R605A and R643	From TB8100 Digital out 1 (open collector) to tone remote and Aux connector (P100 pin32)
		Alarm Input 0	R605B	From TB8100 Digital out 1 (open collector) to tone remote Alarm input 0
			R605B and R615B	From TB8100 Digital out 1 (open collector) to tone remote and Aux connector (P100 pin33)
12	Input	**Alarm Input B**	**R604A**	**From TB8100 Digital out 2 (open collector) to tone remote Alarm input B**
			R604A and R644	From TB8100 Digital out 2 (open collector) to tone remote and Aux connector (P100 pin35)
		Alarm Input 1	R604B	From TB8100 Digital out 2 (open collector) to tone remote Alarm input 1
			R604B and R618B	From TB8100 Digital out 2 (open collector) to tone remote and Aux connector (P100 pin36)
13	Power input	**+13.8V**		
14	Output	**Channel select 0**	**DIP SW600 switch 5 ON**	**Tone remote Channel Select 0 to TB8100 Digital In 1**
		Aux Channel select 0 Digital 1	DIP SW600 switch 5 OFF	From Aux connector (P100 pin 40) to TB8100 Digital In 1 (5V logic)
15	Output	**Channel select 1**	**DIP SW600 switch 6 ON**	**Tone remote Channel Select 1 to TB8100 Digital In 2**
		Aux Channel select 1 Digital 2	DIP SW600 switch 6 OFF	From Aux connector (P100 pin 41) to TB8100 Digital In 2 (5V logic)
16	Output	**Channel select 2**	**DIP SW600 switch 7 ON**	**Tone remote Channel Select 2 to TB8100 Digital In 3**
		Aux Channel select 2 Digital 3	DIP SW600 switch 7 OFF	From Aux connector (P100 pin 42) to TB8100 Digital In 3 (5V logic)
17	Output	**Channel select 3**	**DIP SW600 switch 8 ON**	**Tone remote Channel Select 3 to TB8100 Digital In 4**
		Aux Channel select 3 Digital 4	DIP SW600 switch 8 OFF	From Aux connector (P100 pin 43) to TB8100 Digital In 4 (5V logic)
18	Output	**Channel select 4**	**DIP SW601 switch 1 ON**	**Tone remote Channel Select 4 to TB8100 Digital In 5**
		Aux Channel select 4 Digital 5	DIP SW601 switch 1 OFF	From Aux connector (P100 pin 44) to TB8100 Digital In 5 (5V logic)

Table 7.1 Base Station Interface Connector possible pin allocations (Continued)

Pin	Signal Type (relative to tone remote)	Name	Required tone remote links and/or switch settings	Notes
19	Output	**Channel select 5**	**R603A and SW601 switch 3 ON**	**Tone remote Channel Select 5 to TB8100 Digital In 6**
		Aux Channel select 5 Digital 6	R603A, R628B and SW601 switch 3 OFF	From Aux connector (P100 pin 45) to TB8100 Digital In 6 (5V logic)
			R603B, R619B and SW601 switch 2 OFF	From Aux connector (P100 pin 37) to TB8100 Digital In 6 (5V logic)
			R603B, R621A and SW601 switch 2 OFF	From Aux connector (P100 pin 38) to TB8100 Digital In 6 (5V logic)
		Auxiliary output 3 and Digital 6	R603B, R619B and SW601 switch 2 ON	Tone remote Auxiliary Output 3 and P100 Pin 37 parallel connection to TB8100 Digital In 6 (5V logic)
			R603B, R621A and SW601 switch 2 ON	Tone remote Auxiliary Output 3 and P100 Pin 38 parallel connection to TB8100 Digital In 6 (5V logic)
		Auxiliary output 3	R603B and SW601 switch 2 ON	Tone remote Auxiliary Output 3 to TB8100 Digital In 6 (5V logic)
20	Output	**Channel select 6**	**R602A and SW601 switch 5 ON**	**Tone remote Channel Select 6 to TB8100 Digital In 7**
		Aux Channel select 6 Digital 7	R602A, R629B and SW601 switch 5 OFF	From Aux connector to (P100 pin 46) to TB8100 Digital In 7 (5V logic)
			R602B, R616B and SW601 switch 4 OFF	From Aux connector to (P100 pin 34) to TB8100 Digital In 7 (5V logic)
		Auxiliary output 2 and Digital 7	R602B, R616B and SW601 switch 4 ON	Tone remote Auxiliary Output 2 and P100 Pin 34 parallel connection to TB8100 Digital In 7 (5V logic).
		Auxiliary output 2	R602B and SW601 switch 4 ON	Tone remote Auxiliary Output 2 to TB8100 Digital In 7 (5V logic)
21	Output	Channel select 7	R601A and SW601 switch 7 ON	Tone remote Channel Select 7 to TB8100 Digital In 6
		Aux Channel select 7 Digital 8	R601A, R630B, R631A and SW601 switch 7 OFF	From Aux connector to (P100 pin 47) to TB8100 Digital In 8 (5V logic)
			R601B, R606B, R608A and SW601 switch 6 OFF	From Aux connector to (P100 pin 27) to TB8100 Digital In 8 (5V logic)
		Auxiliary output 1 and Digital 8	R601B, R606B, R608A and SW601 switch 6 ON	Tone remote Auxiliary Output 1 and P100 Pin 27 parallel connection to TB8100 Digital In 8 (5V logic)
		Auxiliary output 1	**R601B and SW601 switch 6 ON**	**Tone remote Auxiliary Output 1 to TB8100 Digital In 8 (5V logic)**
22	Output	**Auxiliary output 0**		**Tone remote Auxiliary Output 0 to TB8100 Digital In 9 (5V logic)**
		Digital 9	R610A	Tone remote Auxiliary Output 0 and P100 Pin 29 parallel connection to TB8100 Digital In 9 (5V logic)
23	Output	**CTCSS defeat**	**R600A**	**Tone remote CTCSS defeat control line to TB8100 Digital In 10 (5V logic)**
		Auxiliary output 3	R600B and SW601 switch 2 OFF	Tone remote Auxiliary Output 3 to TB8100 Digital In 10 (5V logic)
		Digital 10	R600B, R628A and SW601 switch 2 OFF	Tone remote Auxiliary Output 3 and P100 Pin 45 parallel connection to TB8100 Digital In 10 (5V logic)
24	Input	**Coax relay driver**	**R606A and R607A**	**From TB8100 Tx relay (open collector) to Aux connector (P100 pin27)**
25	Ground	**Ground**		

a. Bold shaded cells indicate default values.

7.7 The Aux Connector

Figure 7.7   Tone remote Aux connector
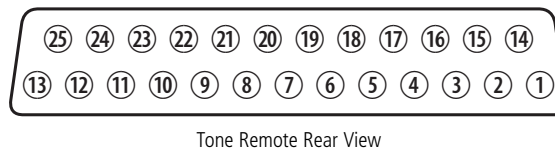
Tone Remote Rear View

The Aux connector not only provides access to the tone remote I/O, but also allows connection to the TB8100 system interface (SIF) so that communication with the base station I/O is still possible even when the tone remote is connected to the base station. The most commonly used I/O is provided by the default pin allocations on the Aux Connector.

7.7.1   Default Pin Allocation

- Direct connection to or from the TB8100 base station for:
    - Coax relay driver
    - RSSI
    - Tx Audio (high impedance input, unbalanced)
    - Rx Audio (high impedance output, unbalanced)
    - Digital Outputs 1 and 2
    - +13.8V supplied by the 40W auxiliary power supply fitted to the TB8100 PMU. Current limited to 3A.
- All tone remote Auxiliary outputs
- Tx key output from the tone remote
- Rx Gate input to the tone remote
- Channel select output from the tone remote (128 channel binary format)
- Tone remote Alarm Inputs 0 and 1
- A Serial Comms connection.

Table 7.2   Default Aux connector pin allocations

Pin	Name	Tone remote links and/or switch settings	Signal Type	Notes
1	+13.8V		Power output	Current limited to 3A by the 40W auxiliary power supply
2	Coax relay driver	R606A and R607A	Output	From TB8100 Tx relay (open collector)
3	RSSI		DC signal output	From TB8100
4	Auxiliary Output 0	R610A	Output	From tone remote. Open collector
5	Tx Audio In	R611A	Audio input	To TB8100. High impedance unbalanced
6	Rx Audio Out	R612B and SW600 switch 4 ON	Audio output	From TB8100. High impedance unbalanced.
7	Digital Out 1	R643 and R605A	Output	From TB8100 Digital Out 1 (open collector)
8	Alarm 0 In	R615B (R605B not fitted)	Input	To tone remote Alarm input 0 (5V logic)
9	Auxiliary Output 2	R616B and SW601 switch 4 ON	Output	From tone remote. Open collector
10	Digital Out 2	R644 and R604A	Output	From TB8100 Digital Out 2 (open collector)
11	Alarm 1 In	R618B (R604B not fitted)	Input	To tone remote Alarm input 1 (5V logic)
12	Auxiliary Output 3	R619B and SW601 switch 2 ON	Output	From tone remote. Open collector
13	CTCSS Defeat	R621B	Output	From tone remote. Open collector
14	Tx Key Out		Output	From tone remote. Open collector
15	Channel Select 0	DIP SW600 switch 5 ON	Output	From tone remote. 5V Logic (Active high)
16	Channel Select 1	DIP SW600 switch 6 ON		
17	Channel Select 2	DIP SW600 switch 7 ON		
18	Channel Select 3	DIP SW600 switch 8 ON		
19	Channel Select 4	DIP SW601 switch 1 ON		
20	Channel Select 5	R628B and SW601 switch 3 ON		
21	Channel Select 6	R629B and SW601 switch 5 ON		
22	Auxiliary Output 1	R630A	Output	From tone remote. Open collector
23	Rx Gate In		Input	To tone remote. 5V logic
24	Serial Comms	DIP SW601 switch 8 OFF (slave)		Ping-Pong protocol. See details below
25	Ground		Ground	

7.7.2 Alternative Pin Allocations

There are more possible inputs and outputs than there are available connector pins. Consequently, in order to help prevent loss of accessibility, many of the inputs and outputs can be linked to more than just one connector pin. This provides a high degree of flexibility.

Table 7.3 shows all the TB8100 connector input/output possibilities. The table is arranged by I/O name so that you can find the input/output you want and decide which pin you then want to use. This can then be checked against the default values in Table 7.2 to decide if the signal you are replacing also needs to be reallocated to another pin.

For example, if a third alarm input (Alarm 2 In) is required, Table 7.3 indicates that pin 7 or 8 may be used. Checking against Table 7.2, pin 7 is allocated to Digital Out 1. If we wish to keep Digital Out 1, it could in turn be reallocated to pin 9.

Pins 15 to 21 are the default tone remote Channel select outputs (128 channel binary format). However, they can also be used as Channel select inputs to the TB8100. Alternatively by programming the required TB8100 SIF pins accordingly these inputs can become TB8100 Digital Inputs (1 to 8). These are then available for use by TB8100 tasks.

Tx Out– and Tx Out+ are parallel connected to the 600Ω balanced Tx Audio path between the tone remote and the TB8100. Consequently if this audio is to be accessed on the Aux connector this must be done using a high impedance load, thereby not upsetting the match or levels between the tone remote and the base station. An example of when this may be required is if the Tx Audio is routed through an external device (connected to the Aux Connector) and processed before being passed to the base station on the unbalanced Tx Audio path (Aux pin 5 or 22).

A Serial Comms connection is available. This is a Ping–Pong protocol bus. By linking this connection (and ground) between modules, all the connected modules can be programmed via a RS232 on a single master module. The slave modules must have switch 8 of DIP SW601 switched OFF. The Tone Remote Programming Application will then detect and identify each connected module.

Refer also to the TBA0M01/2 Tone Remote and Alarm Interface PCB Information Package for detailed information on identifying and locating components on the main circuit board.

Table 7.3   Aux connector possible pin allocations

I/O Name	Signal Type	Pin	Required tone remote links and/or switch settings	Notes
+13.8V	Power output	**1**	**Direct Connection**	Current Limited to 3A by the 40W Auxiliary Power supply.
Alarm 0 in[a]	Input	**8**	**R615B (R605B not fitted)**	To tone remote Alarm input 0 (5V logic).
		9	R616A and R634A (R605B not fitted)	
Alarm 1 in	Input	**11**	**R618B (R604B not fitted)**	To tone remote Alarm input 1 (5V logic).
		12	R619A and R620A (R604B not fitted)	
Alarm 2 in	Input	7	R614B	To tone remote Alarm input 2 (5V logic).
		8	R615A	
Alarm 3 in	Input	10	R617B	To tone remote Alarm input 3 (5V logic).
		11	R618A	
Alarm A in	Input	7	R643 (R605A not fitted)	To tone remote Alarm input A (5V logic).
Alarm B in	Input	10	R644 (R604A not fitted)	To tone remote Alarm input B (5V logic).
Aux Channel select 0	Input	15	DIP SW600 switch 5 OFF	To TB8100 Digital In 1 (5V logic).
Aux Channel select 1	Input	16	DIP SW600 switch 6 OFF	To TB8100 Digital In 2 (5V logic).
Aux Channel select 2	Input	17	DIP SW600 switch 7 OFF	To TB8100 Digital In 3 (5V logic).
Aux Channel select 3	Input	18	DIP SW600 switch 8 OFF	To TB8100 Digital In 4 (5V logic).
Aux Channel select 4	Input	19	DIP SW601 switch 1 OFF	To TB8100 Digital In 5 (5V logic).
Aux Channel select 5	Input	20	R628B, R603A and SW601 switch 3 OFF	To TB8100 Digital In 6 (5V logic).
Aux Channel select 6	Input	21	R629B, R602A and SW601 switch 5 OFF	To TB8100 Digital In 7 (5V logic).
Aux Channel select 7	Input	22	R630B, R631A, R601A and SW601 switch 7 OFF	To TB8100 Digital In 8 (5V logic).
Auxiliary output 0	Output	**4**	**R610A**	From tone remote. Open collector.
Auxiliary output 1	Output	**22**	**R630A**	
		2	R606B, R608A and Sw601 switch 6 ON	
Auxiliary output 2	Output	**9**	**R616B and SW601 switch 4 ON**	
		21	R629A	
Auxiliary output 3	Output	**12**	**R619B and SW601 switch 2 ON**	
		13	R621A and SW601 switch 2 ON	
		20	R628A	
Channel select 0	Output	**15**	**DIP SW600 switch 5 ON**	From tone remote (5V Logic – active high).
Channel select 1		**16**	**DIP SW600 switch 6 ON**	
Channel select 2		**17**	**DIP SW600 switch 7 ON**	
Channel select 3		**18**	**DIP SW600 switch 8 ON**	
Channel select 4		**19**	**DIP SW601 switch 1 ON**	
Channel select 5		**20**	**R628B and SW601 switch 3 ON**	
Channel select 6		**21**	**R629B and SW601 switch 5 ON**	
Channel select 7		22	R630B, R631A and SW601 switch 7 ON	
Coax relay driver	Output	**2**	**R606A and R607A**	From TB8100 Tx relay. Open collector.
CTCSS Audio	Audio output	2	R606A and R607B	Currently unavailable.
CTCSS Defeat	Output	**13**	**R621B**	From tone remote (open collector).
Digital in 1	Input	15	DIP SW600 switch 5 OFF	To TB8100 Digital In 1 (5V logic).

Table 7.3   Aux connector possible pin allocations (Continued)

I/O Name	Signal Type	Pin	Required tone remote links and/ or switch settings	Notes
Digital in 2	Input	16	DIP SW600 switch 6 OFF	To TB8100 Digital In 2 (5V logic).
Digital in 3	Input	17	DIP SW600 switch 7 OFF	To TB8100 Digital In 3 (5V logic).
Digital in 4	Input	18	DIP SW600 switch 8 OFF	To TB8100 Digital In 4 (5V logic).
Digital in 5	Input	19	DIP SW601 switch 1 OFF	To TB8100 Digital In 5 (5V logic).
Digital in 6	Input	12	R619B, R603B and SW601 switch 2 ON	To TB8100 Digital In 6 (5V logic) with parallel connection from tone remote Auxiliary output 3.
			R619B, R603B and SW601 switch 2 OFF	Switch 2 OFF prevents tone remote Auxiliary output 3 connection to TB8100.
		13	R621A, R603B and SW601 switch 2 ON	To TB8100 Digital In 6 (5V logic) with parallel connection from tone remote Auxiliary output 3.
			R621A, R603B and SW601 switch 2 OFF	Switch 2 OFF prevents tone remote Auxiliary output 3 connection to TB8100.
		20	R628A, R603B and SW601 switch 2 ON	To TB8100 Digital In 6 (5V logic) with parallel connection from tone remote Auxiliary output 3.
			R628B, R603A and SW601 switch 3 OFF	To TB8100 Digital In 6 (5V logic).
Digital in 7	Input	9	R616B, R602B and SW601 switch 4 ON	To TB8100 Digital In 7 (5V logic) with parallel connection from tone remote Auxiliary output 2.
			R616B, R602B and SW601 switch 4 OFF	Switch 4 OFF prevents tone remote Auxiliary output 2 connection to TB8100.
		21	R629A, R602B and SW601 switch 4 ON	To TB8100 Digital In 7 (5V logic) with parallel connection from tone remote Auxiliary output 2.
			R629B, R602A and SW601 switch 5 OFF	To TB8100 Digital In 7 (5V logic).
Digital in 8	Input	2	R606B, R608A, R601B and SW601 switch 6 OFF	To TB8100 Digital In 8 (5V logic).
		22	R630A, R601B and SW601 switch 6 ON	To TB8100 Digital In 8 (5V logic) with parallel connection from tone remote Auxiliary output 1.
			R630B, R631A, R601A and SW601 switch 7 OFF	To TB8100 Digital In 8 (5V logic).
Digital In 10	Input	20	R628A and R600B	To TB8100 Digital In 10 (5V logic) with parallel connection from tone remote Auxiliary output 3.
Digital Out 1	Output	**7**	**R643 and R605A. (R614A or R614B not fitted)**	From TB8100 Digital Out 1. Open collector. Also connects to tone remote Alarm Input A.
		8	R615B and R605B (R634A not fitted)	From TB8100 Digital Out 1. Open collector. Also connects to tone remote Alarm Input 0.
		9	R616A, R634A and R605B	
Digital Out 2	Output	**10**	**R644 and R604A. (R617A or R617B not fitted)**	From TB8100 Digital Out 2. Open collector. Also connects to tone remote Alarm Input B.
		11	R618B and R604B (R620A not fitted)	From TB8100 Digital Out 2. Open collector. Also connects to tone remote Alarm Input 1.
		12	R619A, R620A and R604B	
Ground	Ground	25	Direct Connection	Ground.
RSSI	DC signal output	3	Direct Connection	From TB8100.
RX Audio in	Audio input	**6**	R612B and SW600 switch 4 OFF	To tone remote. High impedance unbalanced.
Rx Audio out	Audio output		**R612B and SW600 switch 4 ON**	From TB8100. High impedance unbalanced.
Rx gate in	Input	**23**	**Direct Connection**	To tone remote (5V logic).
Rx gate out	Output	12	R 619A, R620B and SW600 switch 3 ON	From TB8100. Open collector.
			R 619A, R620B and SW600 switch 3 OFF	Switch 3 OFF disconnects tone remote from TB8100 Rx gate.

Table 7.3   Aux connector possible pin allocations (Continued)

I/O Name	Signal Type	Pin	Required tone remote links and/ or switch settings	Notes
Rx out–	Audio output	7	R614A. (R643 not fitted)	From TB8100. Balanced 600Ω
Rx out+	Audio output	4	R610B	
		6	R612A	
Serial Comms		**24**	**DIP SW601 switch 8 OFF (slave)**	Ping-Pong protocol. See note above.
Shift mix	Output	2	R606B and R608B	From tone remote. Open collector.
Tx audio in	Audio input	**5**	**R611A**	To TB8100. High impedance unbalanced.
		22	R630B and R631B	
Tx key in	Input	9	R616A and R634B and SW600 switch 2 ON	Additional method of keying TB8100 (8V logic).
			R616A and R634B and SW600 switch 2 OFF	SW600 switch 2 OFF prevents the tone remote from keying TB8100 transmitter.
Tx key out	Output	**14**	**Direct Connection**	From tone remote. Open collector.
Tx out–	Audio output	10	R617A. (R644 not fitted)	Transmit audio from tone remote. See note above.
Tx out+	Audio output	5	R611B	

a. Bold shaded cells indicate default values.

7.7.3 Aux Connector I/O specifications

The following tables describe the specifications and ratings of the signals available on the tone remote Aux connector when the tone remote is connected to the TB8100 base station.

Important If two different inputs or outputs are used in parallel ensure that the lower rating is used.

For example, the TB8100 Digital Input (max input 20 V) is driven by the tone remote Auxiliary Output (max input 50 V) and also by an external Digital In on the Aux Connector. The maximum voltage input level of the external Digital In must not exceed the 20 V of the TB8100 Digital Input.

Table 7.4   Logic signal and supply voltage specifications

Name	Signal path	Logic levels	Ratings
+13.8V	TB8100 output	—	Current limited to 3A by the PMU 40W Auxiliary power supply.
Alarm In	Tone remote input	≥ 3.5V (deactivated) ≤1.5V (activated)	Max input voltage = 5V
Aux Channel select	TB8100 input	≥ 3.5V (deactivated) ≤1.5V (activated)	Internal pull-up to +5V Max external pull-up voltage ≤20V Input resistance = 1.8kΩ Logic sense can be inverted by TB8100 programming
Auxiliary output	Tone remote output	open collector 0V = active	Max applied voltage = 50V Max sink current = 100mA
Channel select	Tone remote output	5V CMOS 5V = active	Max applied voltage = 20V Max sink current = 20mA
Coax relay driver	TB8100 output	open collector < 0.4V = active	Max applied voltage = 30V Max sink current = 250mA
CTCSS defeat	Tone remote output	open collector 0V = active	Max applied voltage = 50V Max sink current = 250mA
Digital In	TB8100 input	≥ 3.5V (deactivated) ≤1.5V (activated)	Internal pull-up to +5V Max external pull-up voltage ≤20V Input resistance = 1.8kΩ Logic sense can be inverted by TB8100 programming
Digital Out	TB8100 output	open collector < 0.4V = active	Max applied voltage = 30V Max sink current = 100mA
RSSI	TB8100 output	Output level range 0.5V to 6V for RF input range −120dBm to −60dBm	800Ω output impedance
Rx gate in	Tone remote input	5V logic 0V = audio	Max input voltage = 50V
Rx gate out	TB8100 output	open collector < 0.4V = active	Max applied voltage = 30V Max sink current = 250mA
Shift mix	Tone remote output	open collector 0V = active	Max applied voltage = 50V Max sink current = 250mA
Tx key in	TB8100 input	≤2.0V (TXKEY = activated) ≥ 5.0V (TXKEY = deactivated)	Input resistance ≥ 10kΩ Internal pull up to 8V Max external pull up = 20V
Tx key out	Tone remote output	open collector 0V = active	Max applied voltage = 50V Max sink current = 250mA

Table 7.5   Audio Signal Specifications

| Name	Signal path	Specifications
Rx Audio In	Tone remote input	Unbalanced high impedance input (>10kΩ). Level required for correct operation of tone remote is 1V$_{pp}$ (older modules: 650mV$_{pp}$)
Rx Audio Out	TB8100 output	Unbalanced output, should only be used with high impedance loads (>10kΩ). The output level is adjustable 0.3V$_{pp}$ to 3.0V$_{pp}$, for 60% modulation (0.1V resolution). When this output is used by the tone remote the level must be set to 0.6V$_{pp}$.
Rx Out+ Rx Out–	TB8100 output	Balanced 600Ω audio interface. The output level is adjustable –20dBm to +10dBm for 60% modulation (0.1dB resolution). May be transformer isolated or AC coupled depending on the SIF. Not used by the tone remote.
TX Audio in	TB8100 input	Unbalanced high impedance input (>10kΩ). The input level is adjustable 0.3V$_{pp}$ to 3.0V$_{pp}$, for 60% modulation.
Tx Out– Tx Out+	Tone remote output/TB8100 input	Parallel connection to the 600Ω balanced Tx Audio path between the tone remote and the TB8100. Consequently if this audio is to be accessed on the Aux connector, this must be done using a high impedance load, thereby not upsetting the match/levels between the tone remote and the base station. Output level –4.4dBm (when the Line-In level is properly set-up or when the tone remote is in Test Tone Mode)

8 Level Configuration

Before using the tone remote, audio levels need to be properly configured. Tx and Rx audio levels are adjusted at the base station. They cannot be adjusted at the tone remote. Line-in and line-out levels are adjusted at the tone remote.

Figure 8.1   Adjusting Line Levels
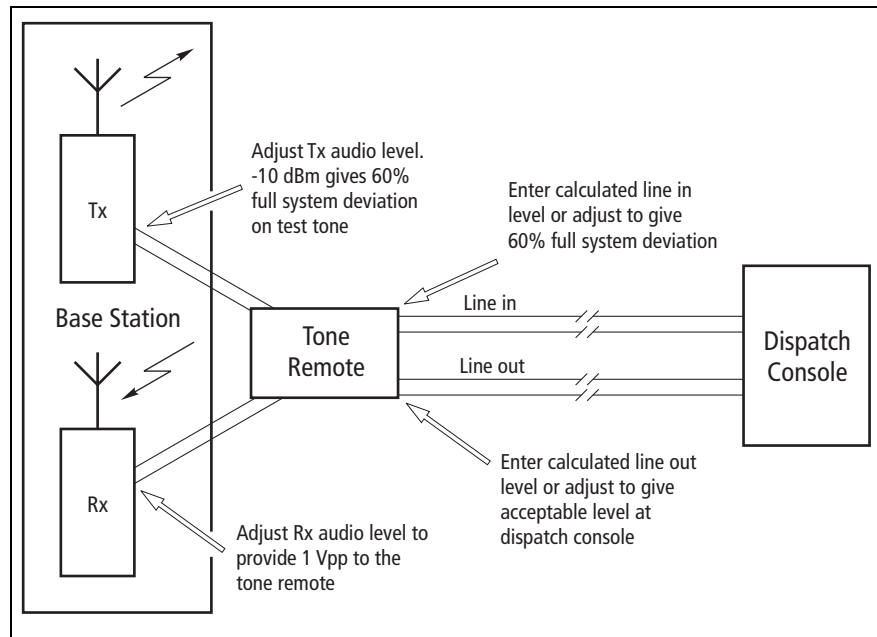
Tx and Rx audio levels do not normally need adjusting. Newer tone remote modules are designed to work with the default Tx and Rx audio levels of TB8100 and TB7100 base stations. However, if the factory configuration settings of the base station have been changed or the tone remote module is older (serial number less than 18046132), these levels will need adjusting.

Levels need to be set in the following order:

■ Tx audio (balanced)

■ Rx audio (unbalanced)

■ Line in

■ Line out

Test mode method   The Line-in and Line-out levels can be adjusted using the test modes of the tone remote (accessed via the buttons on the front panel – see Section 4.8). The advantage of the test mode method is that it can provide a direct test of the system.

The test mode method uses actual signals present on the line. For the Line-In level, the test tone and keytone are generated by the dispatch console and sent to the tone remote via the leased line (or an audio generator could be used with the line loss simulated). For the Line-Out level, the test tone is generated by the Tone remote.

Programming method
Alternatively, Line-in and Line-out levels can be entered into the Tone Remote Programming Application. The programming method is required when access to the far end dispatch console is difficult. It does not require any connection to the line. However, you need the input and output levels of the dispatch console and the actual line loss, so that you can calculate the Tone remote levels to be programmed.

While it is possible with TB8100 base stations to configure all line levels using only the Service Kit and the tone remote programming software, the following instructions include the use of a test setup that enables you to verify the correctness of the levels using an RF test set.

8.1 Equipment Setup

Set up the sub-rack and test equipment as shown below.

Figure 8.2   Rack and test equipment setup
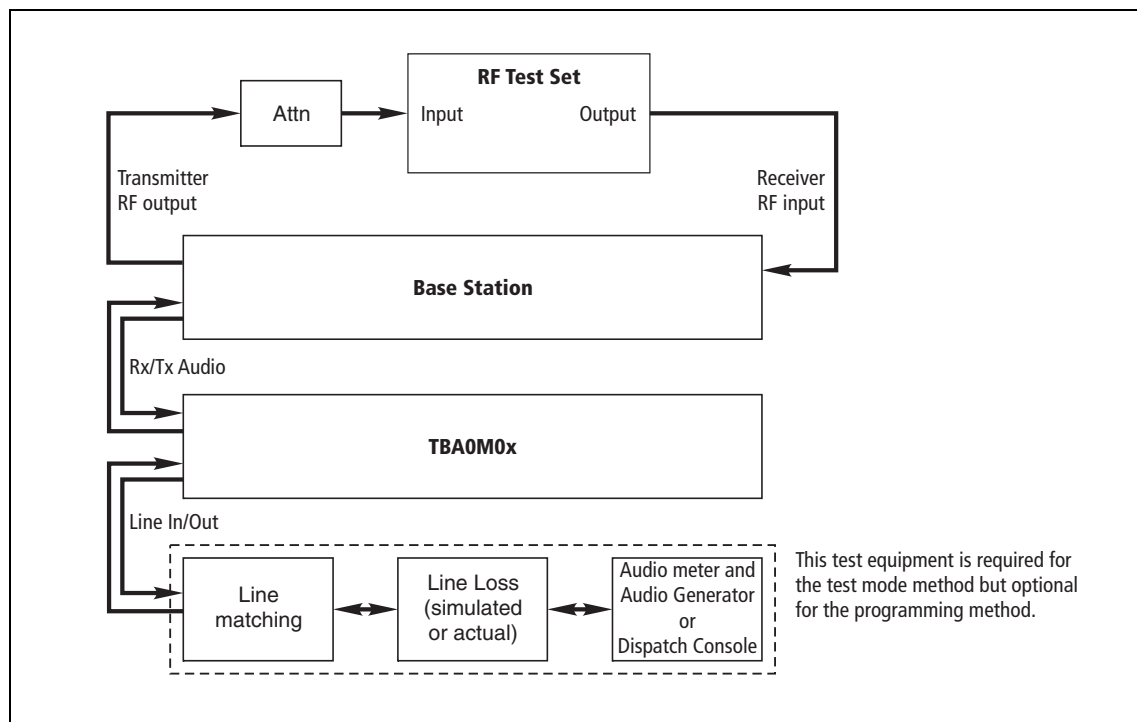
Remove any coaxial relay or duplexer in the base station modules' RF path and connect them directly to an RF Test Set. Ensure that transmitter or PA RF output is sufficiently attenuated to prevent damage to the test set.

8.2 Setting Tx and Rx Audio Levels (TB7100)

If the factory audio levels of the TB7100 have been altered or the tone remote is older (serial number less than 18046132), the Tx audio and the Rx audio levels need to be adjusted.

On the TB7100, Rx and Tx audio levels are adjusted on the rear panel. The levels can be checked using the tone remote test tone mode.

Ensure that the equipment has been setup correctly as in Section 8.1. It is important that the transmitter output is connected to the Test Set (through a load as required) because the transmitter will be keyed often during these procedures.

Figure 8.3   Location of level adjustment pots on TB7100 rear panel

Level adjustment pots
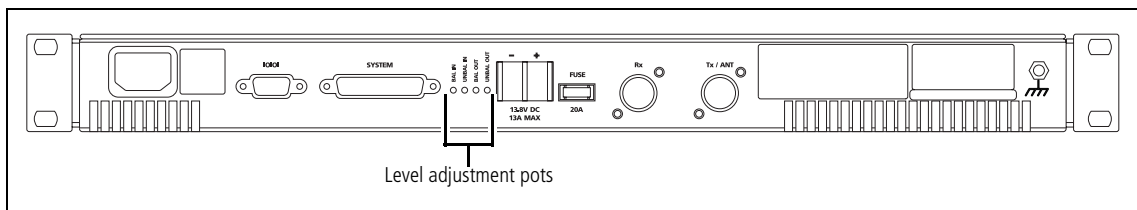
8.2.1 Tx Audio Adjustment

Make sure that the equipment is set up as shown in Figure 8.2.

1. Use the test set to monitor the TB7100 transmitter deviation. Set the de-emphasis filter **ON**.

2. Set the tone remote into Test Tone Mode by pressing the Monitor and Mode toggle buttons on the front, simultaneously[1]. Note that the Test Tone Mode will time out after 1 minute. Reactivate if necessary.

3. While monitoring the transmitter deviation, adjust the Tx Audio level using BAL IN (RV500) on the TB7100 rear panel, for 60% of maximum system deviation. Maximum system deviation will depend on the channel spacing used (see Table 8.1).

Note   The tone remote cannot adjust the talk-through gain. The Tx audio level needs to be configured at the base station so that it provides 60% full system deviation when the receiver provides the audio.

---

1. See Section 4.8 for more information on Test Modes.

Table 8.1   System Deviation for different Channel Spacings

Channel Spacing	Equivalent Max Tx Deviation (Hz)	60% of Max Tx Deviation (Hz)
12.5kHz Narrow Band	2500	1500
20kHz Mid Band	4000	2400
25kHz Wide Band	5000	3000

8.2.2   Rx Audio Adjustment

Make sure that the equipment is set up as shown in Figure 8.2. Use the test set in Duplex Mode to generate an on-channel signal to open the mute of the TB7100 receiver. Modulate the RF carrier with 1020Hz tone at 60% full system deviation (adding CTCSS tone if necessary).

Note   The Tx audio level must be set before starting this procedure.

There are two methods to set up the Rx Audio level.

Method 1

1.   Set the tone remote into Talk-Through Mode by pressing the mode toggle button on the front. This will key the TB7100 transmitter.

2.   While monitoring the transmitter deviation on the test set (with the de-emphasis filter OFF) adjust the Rx Audio level using UNBAL OUT (RV502) on the TB7100 rear panel, for 60% of maximum system deviation. Maximum system deviation will depend on the channel spacing used (see Table 8.1).

Note   If 60% full system deviation is not achieved, check that the pre-emphasis and de-emphasis filters are correctly set (including in the test set).

Method 2

1.   Measure Pin 24 of the TB7100 system interface connector with an oscilloscope (or a high impedance multimeter).

2.   Using UNBAL OUT (RV502) on the TB7100 rear panel, adjust the Rx audio level until $1V_{pp}$ (for older modules: $650mV_{pp}$) is measured.

Important   The Rx Audio level must not exceed the values specified in this procedure. This will ensure that the actual tone remote line-out level corresponds to the programmed value and ensures levels do not exceed the power level requirements of the telecommunications leased line.

8.3   Configuring Tx and Rx Audio (TB8100)

If the tone remote interfaces to a TB8100, Tx and Rx audio need to be configured by programming the base station using the TB8100 Service Kit software. The signal path must be correctly configured to enable the required paths. Tx audio and the Rx audio levels only need to be adjusted if the default level settings of the TB8100 have been altered or the tone remote is older (serial number less than 18046132). Audio levels can be checked using the tone remote test tone mode.

Accessing the Signal Path tab

To access the signal path tab in the Service Kit software, follow these steps:

1.   Run the Service Kit software, connect to the base station, and read in the configuration.

2.   Navigate to Base Station > Channel profiles.

3.   For a standard TB8100 Base Station, choose the "Default" channel profile and click the "Edit" button. For an advanced TB8100 Base Station (Advanced Profiles and Task Manager enabled) choose the channel profile name required and click the "Edit" button.

      The "Edit Channel Profile" dialog box appears.

4.   Select the Signal Path tab (shown below in Figure 8.4). This is where the Rx and Tx Audio paths can be configured as described in the following sections.

Figure 8.4   TB8100 Service Kit – Signal Path tab for the default profile
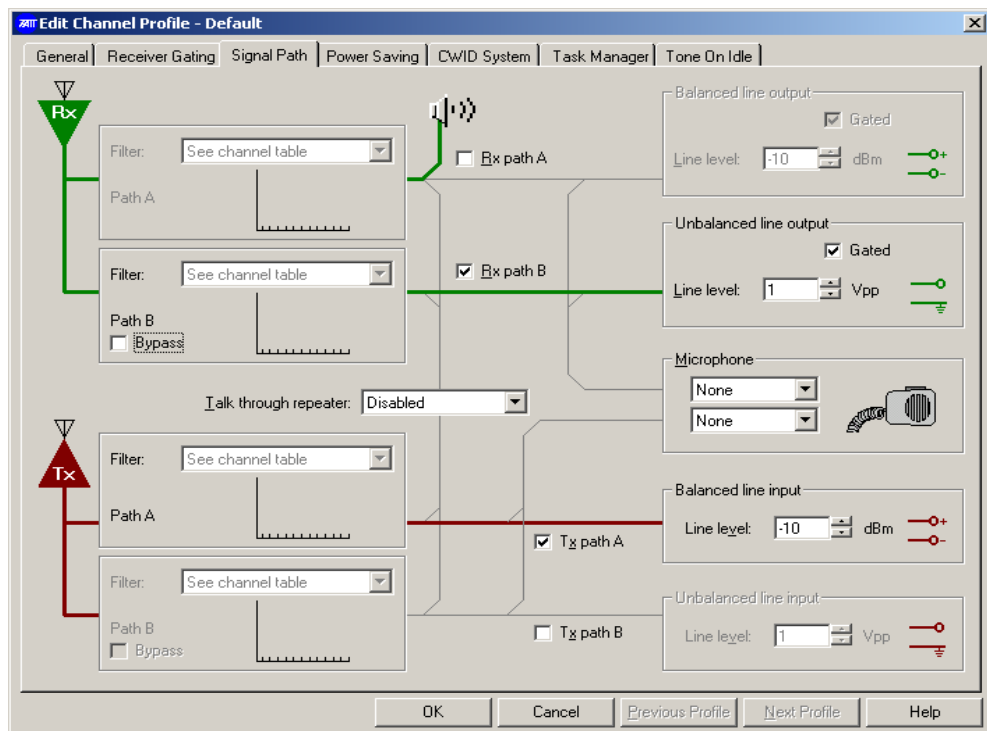
For additional help, refer to the TB8100 Service Kit User's Manual provided on the CD supplied with the base station. Additional information is also available in the TB8100 Installation and Operation Manual.

Configuring the Tx Audio Path

The Tx Audio level is adjusted on the input of the transmitter using the TB8100 Service Kit.

1. Open the relevant Signal Path tab (see "Accessing the Signal Path tab" on page 69.

2. In the Talk-through repeater list, select "Disabled." Talk-through audio needs to be passed through the tone remote, so that the dispatcher can turn it on and off as needed.

3. Select "Tx path A."

4. Set the Balanced Input level to −10 dBm (for older modules: −4.4 dBm)

   The Line level adjust boxes on the transmit path define the level of the line input that the Base Station expects. The line level affects the gain across the transmit path. When the base station receives a line input equal to the level programmed, it transmits at 60% of maximum transmit deviation.

Note The tone remote cannot adjust the talk-through gain. When the Tx audio level is set as described above, the transmitter provides 60% full system deviation when the receiver provides the audio.

5. For advanced Base Stations, set the Tx path filter to "Pre-Emph Speech Band."

6. For standard Base Stations, you need to set the Tx path filter in the channel table.
   a. Navigate to Configuration > Base Station > Channel Table.
   b. Set the "Filter" of the default channel (see Configure > Base Station > General) to "Pre/De-Emph Speech Band".
   c. Click "OK".

7. Program the TB8100.

Checking Tx path line levels

The above configuration can be checked by putting the tone remote into Test Tone Mode[1].

Make sure that the equipment is set up as shown in Figure 8.2. It is important that the transmitter output is connected to the Test Set (through a load as required), because the transmitter will be keyed often during these procedures.

---

1. See Section 4.8 for more information on Test Modes.

In Test Tone Mode the tone remote keys the base station transmitter and outputs −10 dBm (for older modules: −4.4 dBm) balanced Tx Audio (equal to average speech level). Using the RF Test Set, with the De-Emphasis filter ON, confirm that the deviation displayed equates to 60% of maximum system deviation. The maximum transmit deviation is determined by the channel spacing, or for the channels using custom profiles, it is defined by the parameter Max Tx deviation (see Table 8.1).

As another check, the TB8100 Service Kit monitoring or diagnostics tool can be used to measure and display (to the nearest 1 dBm) the actual audio level input to the base station. Within the Service Kit navigate to Monitor > Monitoring > Reciter (or Diagnose > Reciter > Audio I/O)

With the tone remote in Test Tone Mode the balanced audio input level should be displayed as −10 dBm (for older modules: −4.4 dBm). For more information refer to the Service Kit online help notes titled "Measuring the Audio Input Level".

Configuring the Rx Audio Path

The Rx Audio level is adjusted on the output of the receiver, using the TB8100 Service Kit.

Note The Tx Audio level must be set before starting this procedure.

1. Open the relevant Signal Path tab (see "Accessing the Signal Path tab" on page 69).

2. Select "Rx path B."

3. Set the Unbalanced line output level to $1 V_{pp}$ (older modules: $0.6 V_{pp}$).

4. Make sure that the Gated check box is enabled.

5. For advanced Base Stations only, set the Rx path filter to "De-Emph Speech Band."

6. For a standard Base Station, you need to configure the Rx path filter in the channel table.
    a. Navigate to Configuration > Base Station > Channel Table.
    b. Set the "Filter" of the Default channel to "Pre/De-Emph Speech Band" by selecting it from the drop-down menu shown after clicking in the "Filter" column.

7. Click "OK".

8. Program the TB8100.

Important The Rx audio level must not exceed the level specified in this procedure. This will ensure that the actual tone remote line-out level corresponds to the programmed value and thus ensures levels do not exceed the power level requirements of the telecommunications leased line.

Confirming Rx audio levels

If desired, the following methods can be used to confirm that the Rx level is correctly set:

- Checking the actual Rx audio level
- Using transmitter deviation
- Measuring the Tone Remote Line-Out Level

Checking the actual Rx audio level

You can check that the Rx audio level is as expected by measuring the voltage on pin 6 of the tone remote Aux Connector

1. Use the RF Test Set to generate an on–channel signal to un-mute the TB8100 receiver. Modulate the RF carrier with a 1020 Hz tone[1] at 60% full system deviation (adding a CTCSS tone if necessary).

2. Measure Pin 6 of the tone remote Aux Connector with an Oscilloscope or a high impedance multimeter (this assumes the default I/O link configuration of R612B and SW600 switch 4 ON has not been changed). The level should be $1\,V_{pp}$ (for older modules: $600\,mV_{pp}$).

Measuring transmitter deviation

This test requires the RF Test Set to be used in Duplex Mode with de-emphasis filter OFF on the Test Set receiver.

3. Use the RF Test Set to generate an on–channel signal to un-mute the TB8100 receiver.

4. Modulate the RF carrier with a 1020 Hz tone[1] at 60% full system deviation (adding a CTCSS tone if necessary).

5. Put the tone remote into Talk-Through Mode (Repeater Mode) using the mode toggle button[2]. The Mode LED should be red (constant or flashing) and the transmitter should be keyed-up.

6. Check for a 60% full system deviation reading on the RF Test Set. This confirms that both the Rx audio and Tx audio levels are correct as both are tested with this setup.

Note If 60% full system deviation is not achieved, check that the pre-emphasis and de-emphasis filters are correctly set (including in the test set). If necessary, re-adjust the levels, but ensure that the unbalanced line output level does not exceed $1.0\,V_{pp}$ (older modules: $0.6\,V_{pp}$.

---

1. 1020 Hz tone is used because some Test Sets can produce unstable deviation readings.

2. The Mode Toggle button may have been disabled by the Tone Remote Programming Application.

Measuring the Tone Remote Line–Out Level

7.   Use the RF Test Set to generate an on–channel signal to un–mute the TB8100 receiver.

8.   Modulate the RF carrier with a 1020Hz tone[1] at 60% full system deviation (adding a CTCSS tone if necessary).

9.   Put the tone remote into Base Station Mode using the mode toggle button[2]. The Mode LED should be green (constant or flashing).

10.   Measure the tone remote Line-Out level (balanced audio).

11.   Using the Tone Remote Programming Application, read the tone remote and note the programmed Line-Out level. The measured level (of step 10) should be approximately the same as this programmed level if the Rx Audio has been set up correctly.
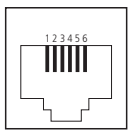
8.4   Line In and Line Out Pin Allocations

The following table describes the pin allocations for interfacing with the tone remote on two-wire and four-wire networks.

Note   The socket on the rear of the TBA0M0x is an RJ45 socket with six contacts, as shown in the diagram below. Use the "RJ45 pins (six contact)" column if wiring up a six contact plug. Use the "RJ45 pins (eight contact)" column for the correct pin allocations if wiring up an eight–contact plug.

Figure 8.5   Line Interface pin allocations

	RJ45 pins (six contact)	RJ45 pins (eight contact)	Two-Wire	Four-Wire
	2	3	NC	LineOut+
123456 external view	3	4	Line In / Out	LineIn+
	4	5	Line In / Out	LineIn–
	5	6	NC	LineOut–

The tone remote accommodates an input signal range of 28 dB. Normally this is sufficient, however by shorting JP200 (found on the tone remote circuit board) an extra 15 dB gain is added.

8.5   Setting the Tone Remote Line-In Level

Note   The Tx Audio Level must be set before starting this procedure.

Test Mode Method

1.   Set the tone remote into Line-In Level Configuration Mode (see Section 4.8).

2.   Connect a dispatch console to the far end of the line (or simulate the console and line loss using an audio generator).

3.   Press the PTT on the dispatch console. This will send a keytone to the tone remote. Ensure the console also sends a test tone at speech level to line (This audio is required for this method of configuring the Line-In level).

4.   The alarm LEDs on the front panel of the tone remote should change to green (for as long as the PTT is pressed), indicating that a keytone has been detected.

5.   Adjust the Line-In level by pressing the Monitor button (increases the level) or the Mode Toggle button (decreases the level) until the base station transmitter deviation reading, monitored on the RF Test Set, indicates 60% full system deviation.

6.   Press the PTT on the dispatch console again, but this time use speech instead of the test tone. Ensure the LEDs on the tone remote remain constant on green during speech transmission. If not, see Section 10.2 for how to troubleshoot for Talkoff.

Note   The monitor speaker is forced on in this mode so that the test–microphone may be used as an intercom to communicate to the dispatcher room (see Section 4.7).

Programming Method

1.   Determine the output level of the console. This may be a preset or default value specified in the console's manual or a value programmed by the operator.

2.   Determine the actual line–loss between the console and the tone remote.

3.   Calculate tone remote Line–In Level as follows:
       tone remote Line–In Level = console output level (dBm) − Line–loss (dB)

4.   Program the tone remote with the calculated level.

Example case:
       Console output level = −13 dBm
       Measured Line loss = 6.5 dBm
       Tone remote Line–In level = −13 − 6.5 = −19.5 dBm

8.6   Setting the Tone Remote Line-Out Level

Note   The Tx Audio and Rx Audio Levels must be set before starting this procedure.

The level of the line out from the tone remote to the dispatch console can be set up in two ways:

- ■ Test Mode Method
- ■ Programming Method.

Test Mode Method

1. Set the tone remote into Line-Out Level Configuration Mode (see Section 4.8).

2. Use the RF Test Set to generate an on–channel signal to un–mute the base station receiver.

3. Modulate the RF carrier with a 1020Hz tone[1] at 60% full system deviation, adding CTCSS tone if necessary.

4. Monitor the tone remote Line-Out level (balanced) and adjust by pressing the Monitor button (increases the level) or the Mode Toggle button (decreases the level) until the level is acceptable at the dispatch console.

Note   The monitor speaker is forced on in this mode so the test-microphone may be used as an intercom to communicate to the dispatcher room (see Section 4.7).

Programming Method

1. Determine the input level required at the dispatch console. This may be a preset or default value specified in the console's manual or a value programmed by the operator.

2. Determine the actual line-loss between the console and the tone remote.

3. Calculate tone remote Line-Out Level as follows:
   tone remote Line-Out Level = console input level (dBm) + Line-loss (dB)

4. Program the tone remote with the calculated level.

Example case:
  Console input level = –13 dBm
  Measured Line loss = 6.5 dBm
  Tone remote Line-Out level = –13 + 6.5 = –6.5 dBm

1. 1020Hz tone is used because some Test Sets can produce unstable deviation readings.

9 Using the Programming Application

The TBA0M0x Tone Remote Programming Application is needed to configure Tait tone remote modules, so that they interface correctly both to third party dispatch equipment and to the TB8100 or TB7100 base station that the module controls.

9.1 Getting Started

Connect the PC to the programming port of the tone remote module, and then run the application. A dialog box asks you to select a configuration. Click **New** to open a new configuration file, click **Open** to open an existing file, or click **Read** to read the configuration of the connected tone remote module. The main application window appears, displaying a navigation tree.
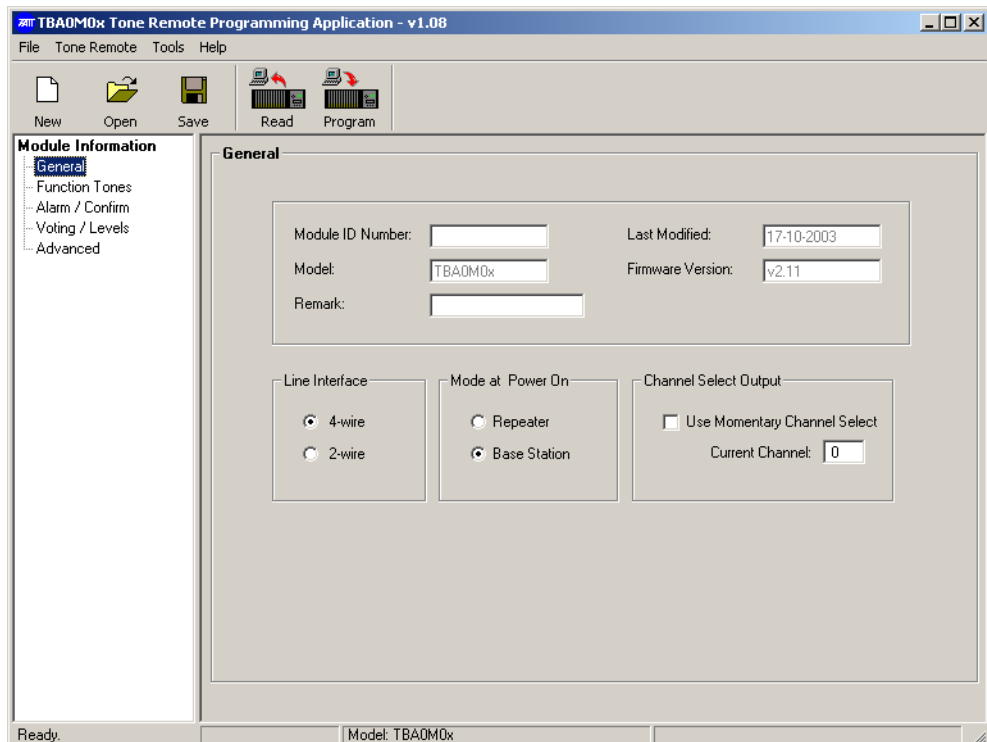
Click an item in the tree to display the relevant form. These forms configure various aspects of module operation.

Once you have made all the changes needed, select File > Save to save the configuration to file and click Program to program the configuration into the connected tone remote module.

9.2   General

The General form displays some non-editable information about the configuration and lets you configure general aspects of the tone remote module. Non-editable data is displayed gray.

Module ID Number
Displays the serial number of the tone remote module.

Model
Displays the model of the tone remote module.

Remark
Optionally enter up to 16 characters in the Remark box. This could be information about the module, for example, or a customer name, to help identify the equipment you are configuring.

Last Modified
Displays the date when the configuration was last saved or programmed into the module.

Firmware Version
Displays the firmware version that the configuration is designed for.

Line interface
Select the **4–wire** or **2–wire** check box, depending on the type of link used to connect the tone remote module to the dispatch console.

Mode at Power On
Select the mode that you want the channel to operate in on power-up. If it will be remotely controlled by a dispatcher, select **Base Station**. If it is to operate as a repeater and the tone remote module is only used as an alarm interface, select **Repeater**. The channel will continue in the selected mode until the Mode Toggle button on the front panel is pressed or the tone remote module receives a function tone command with the action 'Enable Talk-Thru' or 'Disable Talk-Thru'.

If the tone remote module is in base station mode, it can be configured to switch to repeater mode if the line fails, so that the radios can communicate directly with each other. For more information, see "Line Fail" on page 85.

In some applications, the console operator may want to be able to change from Base Station to Repeater mode, for example to enable radio users to talk directly to each other. You can set up a function tone to change the channel operating mode, see Table 9.1, "Function Tone Actions," on page 82.

You can stop anyone changing the mode at the site by disabling the Mode Toggle button on the front of the tone remote module, see "Disable Front Panel Mode Switch" on page 91.

Channel Select Output
Clear this check box when using the tone remote module with TB7100 or TB8100 base stations.

9.3　Function Tones

The Function Tones tab specifies what action the tone remote module takes in response to function tones or keytone sent from the dispatch console.

9.3.1　Configuring for Keytones Only

If the console only needs to key the base station transmitter and uses no other command tones, configure the tone remote module for keytone only.

1.　Select the **Keytone Only** check box. Any Function tone settings in the tone table above will have no effect.

2.　Check that the console uses a keytone frequency of 2175 Hz. If not, select the correct frequency from the **Keytone Frequency** list.

3.　Save your changes and write them to the module.

9.3.2　Configuring for Single-Tone Function Tones

Consoles with the Motorola Guard–Tone or GE Secur–It command formats use a single–tone function tone. They send a high–level guard tone (HLGT), then the single function tone, followed by a low–level guard tone (LLGT). The LLGT continues as long as PTT is pressed. For more information on tone remote formats, see "Tone Remote Formats" on page 9.

If the console uses single–tone function tones, follow these steps.

1.　Under **Keytone (Guard tone) Options**, select the **HLGT/Func–tion tone/LLGT** option.

2. Select the **Show One Tone Only** check box and clear the **Show Only Active Tones** check box. The table now displays only one column of tones. There is one row for each available tone frequency (650 to 2050 Hz in 100 Hz steps).

3. Configure each function tone that the dispatch console and the base station support. Follow these steps.

   a. Select the tone and click **Edit**. The Edit Tone form appears.
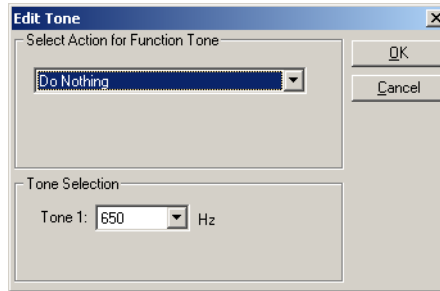
   b. Select an action (see Table 9.1 on page 82 for descriptions of the available actions).

   c. If you selected **Set Channel**, enter a channel number. If you selected an action involving an auxiliary output, specify the number of that output.

   d. Click OK. The Edit Tone form closes and the action you chose appears in the Action column.

4. Once you have defined the actions for the function tones, select the **Show Only Active Tones** check box. This makes it easier to view the function tones and their actions so that you can check that they are correct and all present.

### 9.3.3   Configuring for Two-Tone Function Tones.

Consoles with the expanded Motorola Guard–Tone or GE Secur-It command formats use a sequence of two tones to define each function. They send a high–level guard tone (HLGT), then the two function tones, followed by a low–level guard tone (LLGT). The LLGT continues as long as PTT is pressed. For more information on tone remote formats, see "Tone Remote Formats" on page 9.

If the console uses two–tone function tones, follow these steps.

1. Select the **HLGT/Function tone/LLGT** check box.

2. Clear the **Show one tone only** and the **Show only active tones** check boxes. The table now displays two columns of tones. There is a large number of rows, one for each possible combination of tones.

3. Configure each tone combination that the dispatch console and the base station support. (We recommend that you do not set tone 1 and tone 2 to the same frequency.) Follow these steps.

a. Select a row and click **Edit**. The Edit Tone form appears.
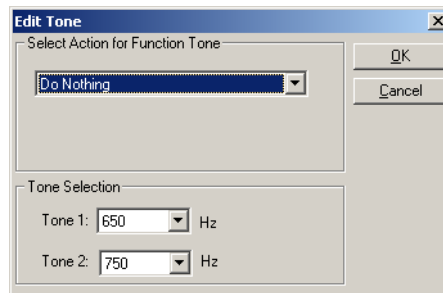
b. Select an action (see Table 9.1 on page 82 for descriptions of the available actions).

c. If you selected **Set Channel**, specify the channel number. If you selected an action involving an auxiliary output, specify the number of that output.

d. Press OK. The Edit Tone form closes and the action you chose appears in the Action column.

4. Once you have defined actions for the function tones, select the **Show Only Active Tones** check box. This makes it easier to view the function tones and their actions so that you can check that they are correct and all present.

Table 9.1   Function Tone Actions

Select This Action...	And the tone remote module does the following on receiving the Function Tone...
Set Channel [a]	Instructs the receiver and transmitter or exciter to select the channel number specified in the Channel Number box.
Turn ON Auxiliary Output[b]	Turns on the auxiliary output with the number specified in the **Output Number** box.
Turn OFF Auxiliary Output[b]	Turns off the auxiliary output with the number specified in the **Output Number** box.
Toggle Auxiliary Output[b]	Changes the status of the auxiliary output with the number specified in the Output Number box. For example, if the auxiliary output is on, it turns it off.
Enable Talk-Thru	Switches the channel to repeater mode so that any audio from the receiver is passed on to the exciter or transmitter and broadcast.
Disable Talk-Thru	Switches the channel to base station mode. Only audio from the line is broadcast.
Toggle Talk-Thru	Switches between talk-through and base station modes.
Toggle Loopback	Turns loopback on or off. When loopback is on, the tone remote module loops line audio back, that is, audio received on the line is sent back down the line. This function is only available for 4-wire connections and enables the dispatcher to check the line.
Defeat CTCSS until keyed	Instructs the base station to unmute the receiver, irrespective of any subaudible signalling. Sends the received audio down the line until the exciter/transmitter is keyed. This enables the dispatcher to hear anything that is happening on the channel's receive frequency before initiating a conversation. Consoles are often designed to initiate this action when the dispatcher lifts the handset.
Defeat CTCSS for momentary time or until keyed	Instructs the base station to unmute the receiver, irrespective of any subaudible signalling. Sends all received audio down the line for the duration of the Momentary Monitor Time (default 4 s) or until the dispatcher keys the exciter/transmitter, whichever happens first.
Toggle CTCSS Defeat (keying resets)	Changes the status of CTCSS Defeat until the dispatcher keys the exciter/transmitter.
Clear Alarm/ Confirmation Pip-Tones	Clears the beep (a 200 ms burst of 600 Hz tone) that you hear at the end of each conversation. Does not clear the Alarm LEDs on the tone remote module or reset the alarm.
Cancel Alarms	Clears any alarms. Clears pip-tones and the LEDs on the tone remote module. Resets the alarms so that they can register any future alarm condition.
Trigger Confirmation	Triggers a user confirmation. When you select this option, the Confirmation Message box appears. Enter a number between 0 and 5. For example, enter 1 to specify that the function tone or tones will trigger user confirmation 1.
Do Nothing	Does not carry out any action.

a. When you select the Set Channel option, the Channel Number box appears so that you can enter the number of the channel that the base station will change to.
b. When you select an Auxiliary Output option, the Output Number box appears so that you can enter the number of the auxiliary output you want to turn on or off.

9.4 Enabling Momentary Monitoring of the Channel

The tone remote module has various options for enabling the dispatcher to monitor activity on the channel. If the console has a Monitor Channel button, its function tone can be given one of the Defeat CTCSS actions (see Table 9.1 on page 82). Alternatively, the tone remote module can be configured to automatically provide the dispatcher with received audio (defeating subaudible signalling) for a configurable duration immediately after receiving any function tone. To enable this, follow these steps.

1. Display the Function Tones form.

2. Under **Momentary Monitor**, select the **After Function Tones** check box.

3. In the **Time** box, enter the duration in seconds that you want the dispatcher to hear the received audio for.

9.5 Configuring Other Console Functions

The following indicates how to configure the tone remote console to implement other common console functions.

9.5.1 Tone on Idle Detect

If the dispatch console has a detector that mutes audio, you can configure the tone remote module to work with it. The tone remote module can provide a tone on idle at a suitable frequency. When the console receives this tone, it mutes audio. As soon as the tone remote module receives audio from the channel, it ceases the tone and the console unmutes audio.

9.5.2 Private Lines

Some dispatch consoles have private line buttons (PL1, PL2, and so on). The intention is that these change the CTCSS frequency of the channel, so that the dispatcher can speak to a different radio user, without other channel users being able to hear the conversation. To set this up, you need to program a number of channels into the TB7100 or TB8100 channel table, each with different subaudible signalling but otherwise the same, and then use the Set Channel action to select the appropriate channel.

9.5.3 Intercom Mode

Many dispatch consoles have a button for Intercom mode. The intention is that the button makes communication possible with a technician at the site. This requires no function tone. The console sends audio without keytone down the line. The technician does the following:

1. Ensures that the tone remote module is in base station mode. (If it is in repeater mode, the test microphone will key up the transmitter and broadcast to air.)

2. Plugs the T800-80-0001 test microphone into the RJ11 connector on the front of the tone remote module labelled Programming Port.

3. Presses PTT to talk.

9.5.4 Wildcards

Some dispatch consoles have Wildcard buttons. These have configurable functions and they can be used to initiate actions at the site such as turning equipment on or off. Ascertain the function tone frequency that the button is programmed for, then select the appropriate function tone action for it, using one of the auxiliary output options (see Table 9.1, "Function Tone Actions," on page 82).

9.6 Alarms and Confirmations

The tone remote module can respond to a number of alarms (internal and external) and to non-alarm triggers, which are referred to as confirmations. For an overview, see "Alarm Monitoring and Confirmations" on page 12.

Select Alarm/Confirm to display a table of alarms and confirmations.

Click **Edit** to configure the selected alarm or confirmation. The area at the bottom of the table specifies thresholds for particular alarms and selects a standard for Selcall sequences that the alarm or confirmation responses can use.

9.6.1 Alarm Sources

The tone remote module can monitor up to eight alarms. The first two are provided by the channel equipment, the next two are built into the tone remote module, and the other four are available for any external alarms that are connected to the tone remote module via the 25-way D-range SK8.

No.	Alarm	Description
1	Input A	An alarm input from the channel equipment. For information about the base station digital outputs that this input can be connected to, see "Interfacing the Tone Remote with the TB7100" on page 35 or "Interfacing the Tone Remote with the TB8100" on page 47.
2	Input B	A second alarm input from the channel equipment. For information about the base station digital outputs that this input can be connected to, see "Interfacing the Tone Remote with the TB7100" on page 35 or "Interfacing the Tone Remote with the TB8100" on page 47.
3	Voltage Low	This alarm indicates that the tone remote module has measured a supply line voltage that is below the configurable low volt alarm threshold (the default threshold is 10.7 V and is set in the Alarm/Confirm form.) You need to set this threshold, taking into account external voltage drops in the power supply.
4	Line Fail	This alarm indicates that the tone remote module has not received a keying signal for a period longer than the line fail time. You need to configure the line fail time in the Alarm/Confirm form. The tone remote module cannot directly detect a failure in the line connecting it with the dispatch console. However, you can set a line fail time. If the line fail time elapses after the last keying signal from the dispatch console, without the tone remote module receiving another keying signal, the line fail alarm is triggered. The module takes the action that you configure for the Line Fail alarm and automatically switches the channel to repeater mode. As soon as the tone remote module receives a valid keytone signal, it returns the channel to the channel mode that existed before the alarm condition
5	Auxiliary Input0	If an external closure alarm is connected to the tone remote module and the alarm closes the circuit, the tone remote module does what you configure it to do for that alarm.
6	Auxiliary Input1	
7	Auxiliary Input2	
8	Auxiliary Input3	

9.6.2 Confirmation Sources

No.	Confirmation	Description
9	Power-up Confirmation	This confirmation is triggered when the tone remote module is powered up.
10	Channel Confirmation	This confirmation is triggered when the tone remote module receives an instruction to change channel.
11	User Confirmation 0	These confirmations are triggered when the tone remote module receives a function tone or tones that is configured with the action "Trigger Confirmation." When the confirmation message is the number n, user confirmation n is triggered.
12	User Confirmation 1	
13	User Confirmation 2	
14	User Confirmation 3	
15	User Confirmation 4	
16	User Confirmation 5	

9.6.3 Configuring the Alarm or Confirmation Response

To configure the way the tone remote module responds to an alarm or confirmation, display the Alarm/Confirm form, select a table row, and click Edit. A Define Alarm or Define Confirmation dialog box appears.

You need to enable the response, select the type of action (pip tones and an encoded signal – Selcall, DTMF, or function tones), and specify whether the action is output to line and/or over the air. You can also specify that an auxiliary output is activated.

Enable Alarms/ Confirmation

Select this check box if you want the tone remote module to respond when the alarm or confirmation is triggered.

Pip Tone

Select the Pip Tone check box and the tone remote module will respond to the corresponding alarm or confirmation. It will append a pip tone (a 200 ms burst of 600 Hz tone) at the end of every transmit sequence. ★★★is this a continuing/latched business? If so, how do you disable it? Are you sure

that the pip tones are appended and don't just run continuously when transmitting? ★★★

Selcall Encoding	Select this check box if you want the module to respond to the alarm/notification by sending a selcall sequence. Enter the selcall sequence into the Sequence box. The tone remote module will send the selcall sequence to the selected destination(s). Selcall sequences are a powerful and highly flexible way of configuring the alarm response of a remotely controlled base station. The Selcall sequence can specify the identity of a particular radio (for example the maintenance technician's portable) and trigger an alarm or display an alarm message. The Selcall sequence can also trigger an alarm on the dispatch console if it is fitted with a Selcall board.
DTMF Encoding	Select the DTMF encoding check box if you want the module to respond to the alarm/notification by sending a DTMF sequence. Enter the DTMF sequence into the Sequence box alongside. The tone remote module will send the DTMF tones to the selected destination.
FT Encoding	Select the FT encoding check box if you want the module to respond to the alarm/notification by sending one or two function tones. You must also select the HLGT frequency and the frequency of the tone(s) in the boxes alongside. The tone remote module will send the function tones to the selected destination(s).
Select Destination	Select the Output to Line check box and the module will output its action to the line interface. Select the Output to Radio check box and the module will send its action to the channel for broadcasting. DTMF sequences cannot be sent to both line and radio.
Auxiliary Output	Select the Enable Output check box if you want the module to activate an auxiliary output line when the alarm or confirmation occurs. Enter into the Auxiliary Port box the number of the line to be activated.

9.7 Voting and Levels

The Voting/Levels form specifies line levels and configures voting.

Line Levels

For instructions on setting line levels, see "Level Configuration" on page 65.

The **Line–in** box displays the expected level of audio from the dispatch console into the tone remote module. You can calculate it by subtracting the line loss in dB from the nominal console output level.

The **Line–out** box displays the nominal output level of audio from the tone remote module. Set a value that will result in audio arriving at the console at the correct level.

Voting Options

There are four voting options that you can select from.

Tone Remote Installation and Operation Manual
© Copyright Tait Electronics Limited October 2010

Option	Description
Voting Disabled	Voting does not take place.
Tone on Idle	The tone remote module sends a tone to line as long as the receiver is muted. When the tone disappears, voting equipment measures the signal-to-noise ratio of the audio on the line and compares it with audio from other receivers. The equipment then selects the audio with the best result and feeds it to the control room user. Tone on Idle can also be used to mute a console if it is fitted with appropriate equipment. See "Tone on Idle Detect" on page 83, for more information. For this option you must select a frequency for the tone on idle and a voting level.
Sliding Voting Tone	The tone remote module sends to line a tone that is proportional to the strength of the signal that the receiver is receiving. The voting equipment compares the frequency of the incoming tones, selects the incoming audio with the best result, and feeds it to the control room user. For this option, you must configure the parameters displayed on the right.
Simoco/Philips Standard	The tone remote module generates a stepped voting tone that is compatible with voting equipment from Simoco or Philips.

Voting Parameters Some voting options need parameters to be set that help define voting operation. These parameters are displayed at the bottom of the Voting/ Levels form.

Parameter	Description
Frequency	The frequency of the tone on idle (Tone on Idle voting option only)
Lower Freq	Enter the frequency that the voting equipment will interpret as indicating a very weak signal (Sliding Voting Tone option only)
Lower Level	Enter the lowest signal level that the base station receiver can detect (Sliding Voting Tone option only).
Upper Freq	Enter the frequency that the voting equipment will interpret as indicating a strong signal (Sliding Voting Tone option only)
Upper Level	Enter the level of a strong signal (Sliding Voting Tone option only).
Mute Freq	Enter the frequency that the voting equipment will interpret as indicating a muted receiver (Sliding Voting Tone option only)
Voting Level	Specify a nominal level for the voting tone (Sliding Voting Tone option) or tone on idle (Tone on Idle voting option). The level is in dBr relative to the line out level.

RSSI Signal The RSSI Signal area defines how the tone remote module interprets the voltage output on the RSSI line from the base station (sliding Voting Tone and Simoco/Philips voting options only).

1.   In the **Characteristics** list, select **User Defined**.

2. Adjust the response curve so that the response curve of the tone remote module's RSSI line matches the response curve of the connected base station.

  a. If the base station is a TB7100, enter 0.6 V and 2.1 V into the Voltage boxes and –120 and –60 dBm into the Signal Level boxes.

  b. If the base station is a TB8100, enter 1.5 V and 6 V into the Voltage boxes and –120 dBm and –60 dBm into the Signal Level boxes.

9.8 Advanced

The Advanced tab configures various settings.

High Level Guard Tone Duration

To configure the tone remote module for a non-standard high-level guard tone duration, select the **Change default value** check box and select a time from the drop-down list.

Function Tone Duration

To configure the tone remote module for a non-standard function tone duration, select the **Change default value** check box and select a time from the drop-down list.

Morse Code Identification

You can configure the tone remote module to regularly provide the base station with morse code for transmitting as a station identification. However, as TB8100 and TB7100 base stations are able to generate their own morse code identification, you may prefer to configure this identification in the base station itself.

To configure the tone remote module, follow these steps:

Enter into the **Repeat Time** box the interval between morse code transmissions. A repeat time of 0 disables the sending of any morse code identification.

Enter into the **Station ID** box a string to define the base station's identity. The following characters are available; letters A–Z, numbers 0-9, and the following – /.

Miscellaneous

The Miscellaneous area groups the rest of the configuration parameters.

Disable Front Panel Mode Switch

Select this check box to prevent unauthorised persons at the remote site from changing the mode of the tone remote module.

Notch Filtering Required

Normally, remotely controlled base stations have notch filtering, which removes the keytone or LLGT from the audio so that it is not transmitted.

If the tone remote module belongs to the channel providing the link in a linking system, clear the **Notch Filtering Required** check box, so that the linking channel propagates any function tones to the end channel.

The **Notch Filtering Required** check box is only available when the 4–wire button in the General tab is selected.

Enable Receive Path Delay

Used to eliminate squelch tail.

Enable Transmit Path Delay

Used to compensate for HLGT-FT delay.

10 Troubleshooting

The following sections will help find any problems if the Tone Remote does not function as expected. If problems persist, please contact Technical Support (contact details).

10.1 Fault Finding

1. Connect the tone remote to its companion dispatch console via the leased line. Check that speech sent from the console can be heard on the tone remote speaker (un-mute speaker if required).

   One possible cause of incorrect operation is that the line connections have become transposed in the wiring network or that the dispatch console uses different Send/Receive pairs.

2. Use the dispatch console to key-on the transmitter. If the transmitter does not key-on, check that the console and tone remote have been compatibly programmed.

   ■ check two-wire or four-wire

   ■ check the keytone frequency

   ■ check if function tones are used

   ■ check high-level guard tone and function tone periods (if used) are the same

   Finally check that the console is sending appropriate signal levels and that tone durations are correct (which are often variable), and that the line is not causing unacceptable attenuation or distortion.

3. If the console can key the transmitter but not change Repeater/Base Station Mode, change channel, auxiliary outputs, receiver defeat or cancel alarms, carry out the checks in Step 2 above, but pay particular attention to the function tone programming.

10.2　Troubleshooting Setup Problems

Sometimes misses function tone command

Set up the Line–In level so that the function tones are about $1.2\mathrm{V_{pp}}$ at TP204.

Misses function tone sequence on very fast key repetition

A minimum of 200 ms pause is required between pressing buttons on the console. Some consoles do not limit the maximum keying rate.

Loop-Line functionality (also known as Loopback)

Loopback can be enabled with the Tone Remote Programming Application. It is then activated by sending the TMA0M0x the programmed function tones.

While in Line-In Level Configuration Mode, the LEDs flash green only briefly when the dispatch console PTT is pressed

The Line–In level is too low. The tone remote is only detecting the high–level guard tone (HLGT).

While still in Line–In Level Configuration Mode, activate the console PTT and adjust the Line–In level by pressing the Monitor button (increases the Line–In level) until the LEDs remain constant green. The left alarm LED will toggle on and off, indicating a level increase until the top of the range is reached (this may take up to 65 presses). If this still fails, open up the unit and add JP200, and try again.

When the PTT is pressed, a pulsing sound can be heard from the speaker

The Line–In level is too high. The function tones can not be decoded properly hence it keys off.

While still in Line–In Level Configuration Mode, activate the console PTT and adjust the Line–In level by pressing the Mode button. The right alarm LED will toggle on and off, indicating a level decrease until the bottom of the range is reached. Using an oscilloscope measure the signal on TP204 – the function tone level should be about half the level of the high–level guard tone.

The console keys the transmitter correctly except when speech is present.

This is known as "Talkoff" and occurs when the difference between the keytone level and peak speech level exceeds specification (32 dB in two–wire mode and 35 dB in four–wire mode), causing the keytone detector to fail.

Adjust the relative audio levels (keytone and speech) sent from the dispatch console. For reliable operation the keytone level should be no more the 35 dB lower than the *peak* speech level.

If it is not possible to adjust the levels at the console, decrease the programmed Line–In level of the tone remote until Talkoff is eliminated. This requires that the Tx Audio level (from the tone remote to the TB8100 transmitter) will also need to be re–adjusted to maintain 60% full system deviation for the test tone sent from the console (see Section　for adjusting Tx Audio using the TB8100 Service kit). As a general rule, the TB8100 Tx

Audio input level will increase by the same amount as the tone remote programmed Line-In level is decreased.

Keytone Falsing in two-wire mode.

When operating in two–wire mode with lossy lines (i.e. significant separation required between tone remote Line-In and Line-Out levels) the keytone detector can become desensitised by noise.

1. Check to ensure that the Rx Audio level is setup correctly at $1V_{pp}$ (older modules: $650\,mV_{pp}$) (see Section 8.2.2 for TB7100 or Section for TB8100).

2. Check the TB8100 receiver gating level (squelch). If necessary adjust the receiver gating, using the TB8100 Service Kit, so that the receiver mute opens at a higher SINAD level (12 dB or preferably greater). This has the effect of reducing noise on the line input of the tone remote in two-wire mode.

3. If there is still a problem after the receiver gating has been adjusted as much as practicable, it becomes necessary to reduce the separation between the tone remote Line-In and Line-Out levels. This separation may need to be reduced to less than 8 dB if the receiver audio SINAD is less than 12 dB (or less than 12 dB for 14 dB receiver audio SINAD). To achieve this, adjust the relative input and output levels of the dispatch console. Again this has the effect of reducing the noise on the input of the tone remote.

If the above solutions do not help resolve the problem, the two–wire line loss may be too severe and unacceptable for normal two–wire tone remote operation. In this case a solution involving a Rx Audio path notch filter and an external two–wire/four–wire hybrid fitted across the line, may be required.