tait communications

TB8100 Base Station

Installation and Operation Manual

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www.taitradio.com

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Contents

Preface

Scope of Manual

Welcome to the TB8100 base station Installation and Operation Manual. This manual provides information on installing and operating the TB8100 hardware. Also included in this manual are a high level circuit description, a functional description and a maintenance guide.

The 100W PA is not available in all markets. A lower power level is also available if required. Consult your nearest regional Tait office for more information.

Document Conventions

“File > Open” means “click File on the menu bar, then click Open on the list of commands that pops up”. “Monitor > Module Details > Reciter” means “click the Monitor icon on the toolbar, then in the navigation pane find the Module Details group, and select Reciter from it”.

Please follow exactly any instruction that appears in the text as an ‘alert’. An alert provides necessary safety information as well as instruction in the proper use of the product. This manual uses the following types of alert:.

Warning **This alert is used when there is a hazardous situation which, if not avoided, could result in death or serious injury.**

Caution This alert is used when there is a hazardous situation which, if not avoided, could result in minor or moderate injury.

Notice This alert is used to highlight information that is required to ensure procedures are performed correctly. Incorrectly performed procedures could result in equipment damage or malfunction.

This icon is used to draw your attention to information that may improve your understanding of the equipment or procedure.

Associated Documentation

The following associated documentation is available for this product:

- MBA-00001-**xx** TB8100 Specifications Manual.
- MBA-00010-**xx** TB8100 Service Kit User's Manual.
- MBA-00011-**xx** TB8100 Calibration Kit User's Manual.
- MB8100-80-00-806 TB8100 Alarm Center User's Manual.
- MBA-00013-**xx** TBA0STU/TBA0STP Calibration and Test Unit Operation Manual.
- MBA-00016-**xx** TB8100 Service Manual
- MBA-00012-**xx** Safety and Compliance Information

The characters **xx** represent the issue number of the documentation.

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.

All available TB8100 product documentation is provided on the Product CD supplied with the base station. Updates may also be published on the Tait Technical Support website (www.taitradio.com/technical).

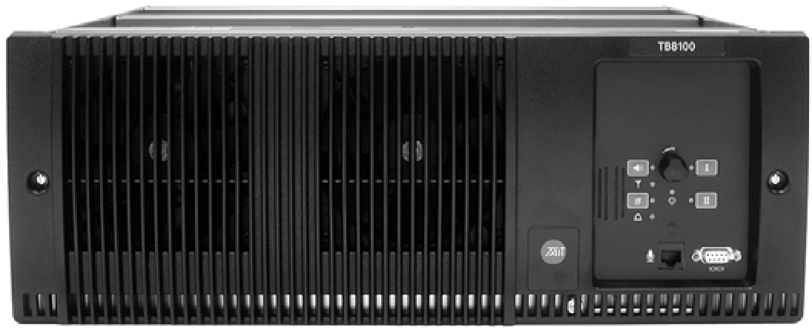
Publication Record

Issue	Publication Date	Description
1	June 2003	First release
2	March 2004	Chapter 4 "Functional Description" added
3	September 2004 (MBA-00005-03)	information added for 24 VDC and 48 VDC PMU, TaitNet RS-232 system interface board, and B-band & C-band equipment
4	December 2004	information added for K-band equipment; improved description of PMU auxiliary DC power supply, and system interface inputs and outputs
5	March 2005	information added for 12 V PA, and L-band equipment (850 MHz to 960 MHz); improved description of dual base station systems
6	June 2005	information added about PMU operation on DC input; corrections to K-band and L-band frequencies[a]
7	February 2007	information added about multi-reciter and Ethernet operation; improved descriptions of PMU auxiliary DC power supply and bidirectional digital inputs and outputs; Chapter 7 "Configuration" added
8	December 2007	■ "Short Tuning Procedure" added to Installation Chapter ■ information added about the High Density/ RS-232 and High Density/Ethernet system interfaces ■ information added on the PMU lower DC startup voltage ■ minor corrections and additions
9	May 2009	■ dual base station control panel and subrack board now used for single base stations - manual updated accordingly ■ information added about connecting to the TaitNet unbalanced audio input ■ information added about fitting a custom interface board to a reciter ■ a list of Syslog message texts added ■ minor corrections and additions

Issue	Publication Date	Description
10	November 2012	■ control panel photographs updated ■ new subrack dimensions drawing added ■ power saving modes operational constraints updated ■ connecting an external frequency reference section added ■ compliance standards added ■ PMU DC voltage limits updated ■ PMU fan duty cycles updated ■ section on reprogramming added to final reassembly
11	February 2014	■ syslog messages section updated ■ Appendix A added ■ torque setting for SMA connectors reduced ■ minor corrections and additions

a. Refer to "Frequency Bands and Sub-bands" on page 18 for the actual frequency coverage in these bands.

1 Description



The TB8100 is a software-controlled base station which is designed for operation on most standard frequency ranges[1]. It makes extensive use of digital and DSP technology. Many operating parameters such as channel spacing, audio bandwidth, signalling, etc. are controlled by software. It is also capable of generating alarms for remote monitoring.

The TB8100 comprises a number of separate modules. Each module is inserted into the TB8100 4U subrack from the front and is secured at the front with a metal clamp. Both clamp and module are easily removed for rapid module replacement. The modules are secured laterally with plastic guides which clip into the top and bottom of the subrack. These guides can be easily repositioned to change the configuration of a subrack. The heavier modules are also secured laterally by metal tabs at the rear of the subrack.

All modules are interconnected at the front of the subrack. The only connections at the rear of the subrack are:

- RF input from and output to the antenna
- external frequency reference input
- AC and/or DC power supply input
- auxiliary DC output
- system inputs and outputs (via the system interface board fitted to the reciter).

The TB8100 features rugged construction with generous heatsinks and fan-forced cooling for continuous operation from −30°C to +60°C (−22°F to +140°F). Several different configurations are possible. The most common are:

- one 5W or 50W base station plus accessory modules or extra receivers
- two 5W or 50W base stations
- one 100W base station plus accessory module or extra receiver.

1. Consult your regional Tait office for information on the most suitable equipment for your area and application.

1.1 Modules

The modules which make up the base station are described briefly below. You can find more detailed information on these modules in the other chapters in this manual, and also in the service manual.

Reciter

The receiver, exciter and digital control circuitry is located in the reciter module. It also incorporates an optional system interface board which provides standard system inputs and outputs.

A receive-only version of the reciter is available for monitoring applications (e.g. QS² simulcast and paging systems).

Power Amplifier

The power amplifier (PA) amplifies the RF output from the reciter and is available in 5W, 50W and 100W models.

The 5W and 50W models mount vertically in the subrack, while the 100W model mounts horizontally as it has a wider heatsink. The 100W PA is also fitted with an airflow duct.

5/50W PA

100W PA

All three models of PA are designed to operate on the 28VDC output provided by the TB8100 power management unit. In addition, 5W and 50W models are available for operation on 12VDC. These two 12V PAs are fitted with an internal boost regulator board, which converts the 12V nominal DC input to a 28VDC output to power the PA circuit boards. The boost regulator board also provides a 12VDC output to power the reciter.

Power Management Unit

The power management unit (PMU) provides the 28 VDC power supply for the modules in the base station. The input voltage can be AC, DC or both AC and DC, depending on the model. An auxiliary DC output is also available from the power supply board. This board is available with an output of 13.65 VDC, 27.3 VDC, or 54.6 VDC.

AC and DC PMU shown

Front Panel

The front panel is mounted onto the subrack with two quick-release fasteners. It incorporates the cooling fans for the PA and PMU.

Control Panel

The control panel is mounted onto the subrack and is accessible through an opening in the front panel. The control panel provides the user with hardware controls and connections for direct control of the base station. Three models are available: dual base station, Power Save, and multi-reciter.

dual base station control panel shown

Subrack

The 4U subrack is made of passivated steel and is designed to fit into a standard 19 inch rack or cabinet.

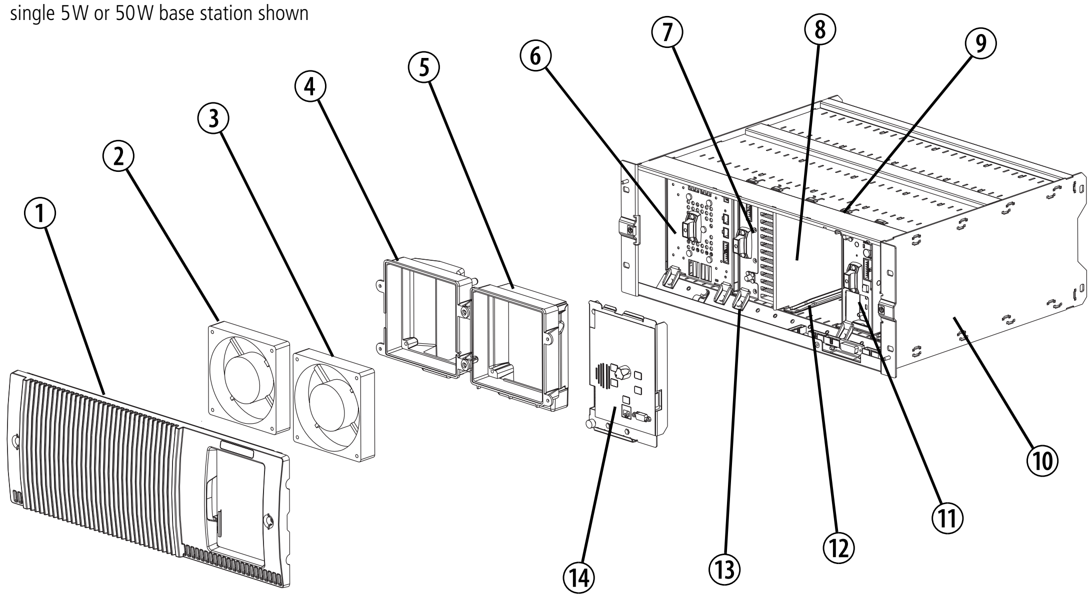
Calibration and Test Unit

The base station calibration and test unit (CTU) provides a selection of inputs and outputs which allows the TB8100 base station to be connected to standard test equipment, and also to a PC running the Service Kit or Calibration Kit software. Refer to the TBA0STU/TBA0STP Calibration and Test Unit Operation Manual (MBA-00013-xx) for more details.

1.2 Mechanical Assembly

The main mechanical components of the base station are shown in the following illustrations.

Figure 1.1 Mechanical assembly - front panel, fans and control panel



①	front panel	⑧	airflow separator
②	PMU fan	⑨	cable retaining clip
③	PA fan	⑩	subrack
④	PMU fan duct	⑪	reciter
⑤	PA fan duct	⑫	plastic guide rail
⑥	PMU	⑬	module retaining clamp
⑦	PA	⑭	control panel

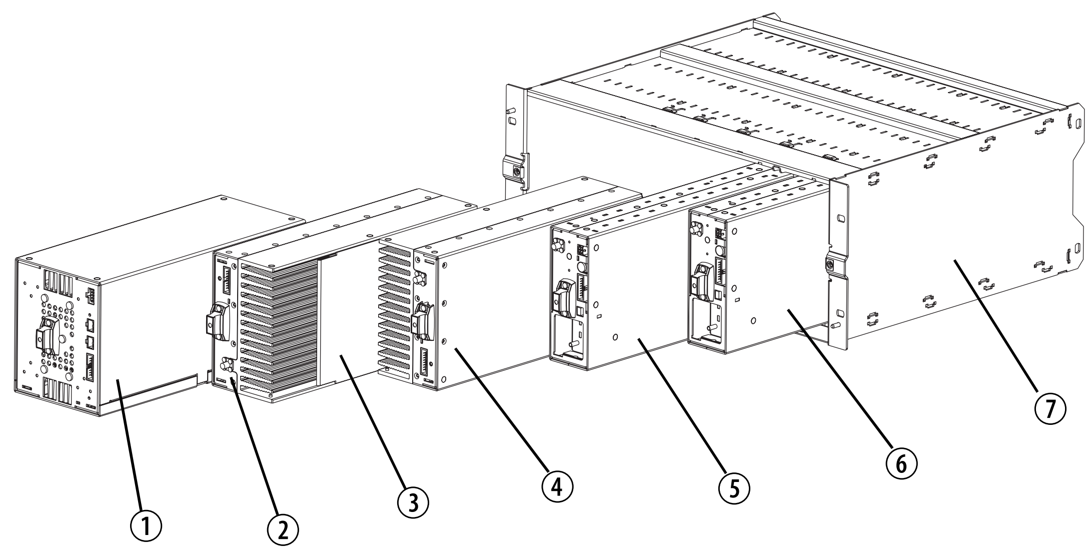
The front panel can be easily removed from the subrack by undoing two quick-release fasteners. Once the front panel is removed, the control panel can also be removed from the subrack by undoing a single screw. Refer to "Replacing Modules"on page 179 for more details.

> Figure 1.1 shows the cooling fans and their ducts detached from the front panel only for the clarity of the illustration. The cooling fans and ducts are normally screwed to the rear of the front panel.

Figure 1.1 also shows the configuration for a typical single 5 W or 50 W base station. The PMU occupies the slot at the left end of the subrack, with the PA directly beside it. The single reciter normally occupies the second slot from the right of the subrack.

The single PA is mounted vertically with the heatsink facing the centre of the subrack. This positions the cooling fins directly behind the PA fan. The airflow separator is fitted directly beside the PA to help direct the cooling airflow through the heatsink.

Figure 1.2 Mechanical assembly - dual 5 W or 50 W base station



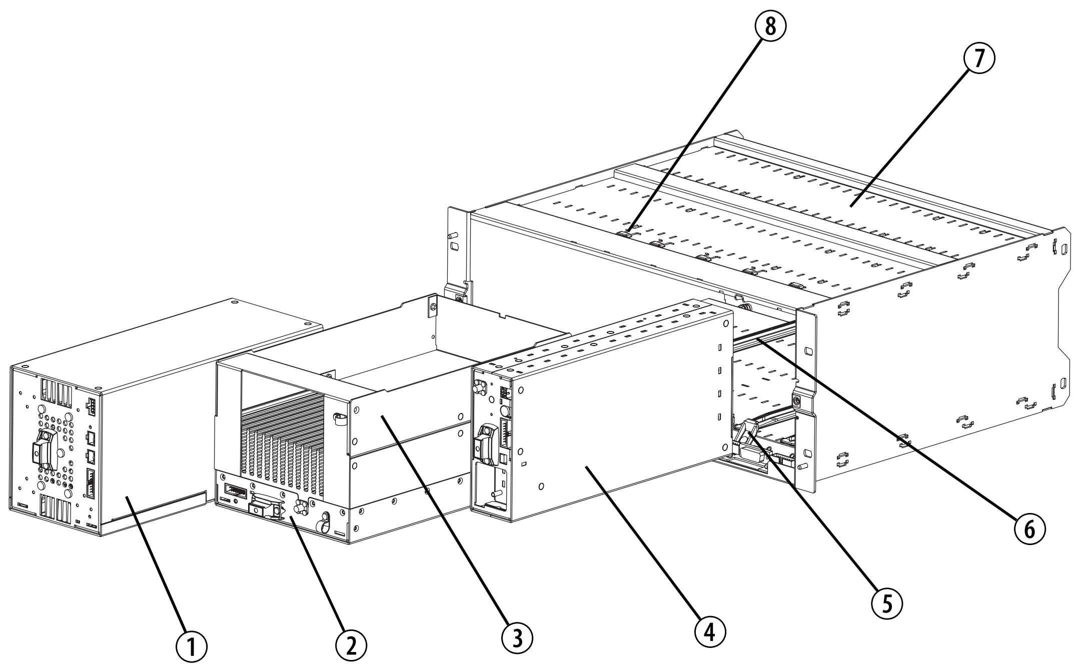
① PMU	⑤ reciter for base station 1
② PA for base station 1	⑥ reciter for base station 2
③ airflow separator	⑦ subrack
④ PA for base station 2	

Figure 1.2 above shows the configuration for a typical dual 5 W or 50 W base station. The PMU occupies its normal slot at the left end of the subrack, with the reciters in the two right-hand slots.

The two PAs are mounted vertically in the middle of the subrack with the heatsinks facing each other. This positions the cooling fins directly behind the PA fan. The airflow separator between the PAs helps to direct the cooling airflow evenly through each heatsink.

ⓘ The configuration for single and dual 12V PA base stations is the same as shown in Figure 1.1 and Figure 1.2, but the PMU and its cooling fan are not fitted.

Figure 1.3 Mechanical assembly - single 100W base station



① PMU
② PA
③ airflow duct
④ reciter
⑤ module retaining clamp
⑥ plastic guide rail
⑦ subrack
⑧ cable retaining clip

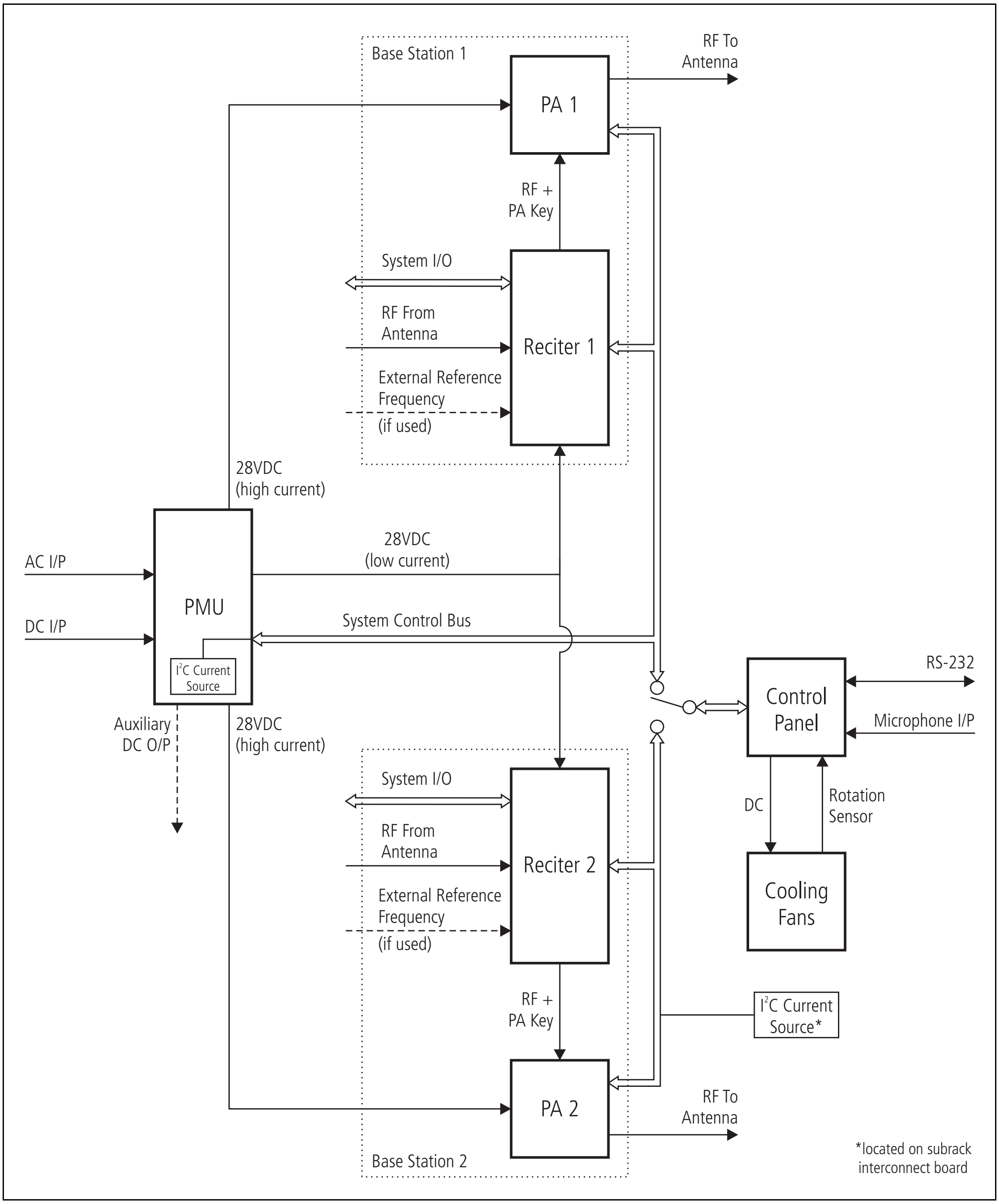
Figure 1.3 above shows the configuration for a typical single 100W base station. The PMU occupies its normal slot at the left end of the subrack, with the PA directly beside it. The single reciter occupies the slot immediately to the right of the PA.

Unlike the 5W and 50W PAs, the 100W PA is mounted horizontally with the heatsink facing upwards. It is also fitted with an airflow duct to channel the airflow from the cooling fan through the heatsink fins.

2 Circuit Description

Figure 2.1 below shows a typical dual base station of 5 W or 50 W. It illustrates the main inputs and outputs for power, RF and control signals, as well as the interconnection between modules. The circuitry of the individual modules that make up the base station is described in more detail in the following sections.

Figure 2.1 Dual base station high level block diagram



Frequency Bands and Sub-bands

Much of the circuitry in the base station modules is common to both VHF and UHF frequency bands, and is therefore covered by a single description in this manual. Where the circuitry differs between VHF and UHF, separate descriptions are provided for each frequency band. In some cases the descriptions refer to specific VHF or UHF bands or sub-bands, and these are identified with the letters listed in the following table.

	Frequency Identification	Frequency Band and Sub-band
VHF	B band	B1 = 136MHz to 174MHz B2 = 136MHz to 156MHz B3 = 148MHz to 174MHz
VHF	C band	C0 = 174MHz to 225MHz C1 = 174MHz to 193MHz C2 = 193MHz to 225MHz
UHF	H band	H0 = 380MHz to 520MHz[a] H1 = 400MHz to 440MHz H2 = 440MHz to 480MHz H3 = 470MHz to 520MHz H4 = 380MHz to 420MHz
UHF	K band	K4 = 762MHz to 870MHz[b]
UHF	L band	L0 = 850MHz to 960MHz L1 = 852MHz to 854MHz, and 928MHz to 930MHz L2 = 896MHz to 902MHz (receive only) L2 = 927MHz to 941MHz (transmit only)

a. Only PAs with hardware version 00.02 and later can operate from 380MHz to 520MHz. PAs with hardware version 00.01 and earlier can only operate from 400MHz to 520MHz.

b. The actual frequency coverage in this band is:
Transmit: 762MHz to 776MHz, and 850MHz to 870MHz
Receive: 792MHz to 824MHz

2.1 Reciter

The reciter comprises three boards: an RF, a digital, and an optional system interface board. These boards are mounted on a central chassis/heatsink. Figure 2.2 on page 20 shows the configuration of the main circuit blocks, and the main inputs and outputs for power, RF and control signals. The receive-only reciter uses a sub-populated version of the digital board. It has no transmit capability and cannot be converted into a standard reciter.

Receiver RF - VHF Reciter

The incoming RF signal is fed through a low pass filter, then through a band-pass "doublet" filter, and finally through a high-pass filter. The signal is then amplified and passed through another band-pass "doublet" filter before being passed to the mixer, where it is converted down to the 16.9MHz IF (intermediate frequency). A VCO (voltage controlled oscillator) provides a +17dBm input to the mixer, and a diplexer terminates the mixer IF port in 50Ω. The signal from the mixer is fed through a 2-pole crystal filter to the IF amplifier which provides enough gain to drive the digital receiver. Note that there are two 2-pole crystal filters, one for narrow bandwidth and one for wide bandwidth. The appropriate filter is selected by software-controlled PIN switches, according to the bandwidth selected in the Service Kit software. The signal is finally passed to the ADC (analogue-to-digital converter) in the digital receiver via an anti-alias filter.

Receiver RF - UHF Reciter

The incoming RF signal is fed through a band-pass filter, followed by a simple low-pass network. It then passes through further stages of filtering, amplification and AGC[1] (automatic gain control) before being fed to the mixer where it is converted down to the 70.1MHz IF (intermediate frequency). A VCO (voltage controlled oscillator) provides a +17dBm input to the mixer, and a diplexer terminates the mixer IF port in 50Ω. The signal from the mixer is fed through a 4-pole crystal filter to the IF amplifier which provides enough gain to drive the digital receiver. The signal is finally passed to the ADC (analogue-to-digital converter) in the digital receiver via an anti-alias filter.

Exciter RF

Audio signals from the line or microphone input are fed to the exciter RF circuitry via the DSP (digital signal processor) and CODECs (encoder/decoder). These modulating signals are applied to the exciter at two points (dual point modulation): low frequency modulation is via the FCL (frequency control loop), which modulates the exciter synthesizer's frequency reference, and speech band modulation is supplied directly to the VCO.

The VCO is phase-locked to the frequency reference via the synthesizer. The output from the VCO passes through the VCO buffer to the exciter amplifier, which increases the RF signal to +20dBm. This signal is then attenuated through a pad to +11dBm. An 8VDC PA Key signal is mixed in with the RF signal which is then fed to the PA.

The K-band and L-band reciters use two VCOs, with the appropriate VCO stage being selected for operation according to the frequency of the channel in use. Only one VCO can be operational at any one time.

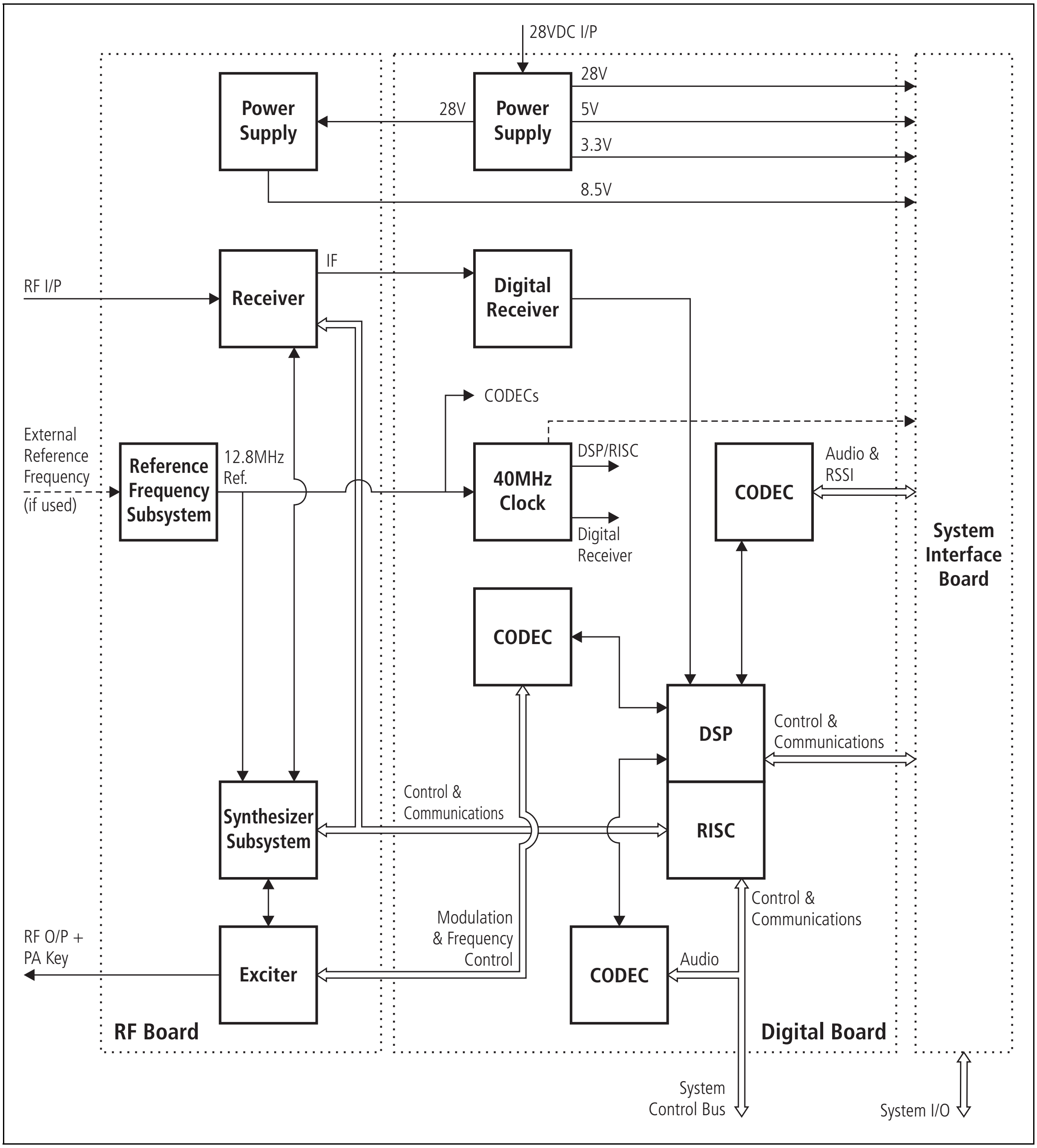
Digital Circuitry

The IF from the receiver RF circuitry is passed through an ADC and a DDC (digital downconverter) to the DSP. The DSP provides demodulation, RSSI calculation, SINAD calculations, muting, and decoding of subaudible signals. Audio and RSSI from the DSP is passed via CODECs to the system interface board.

Incoming audio from the system interface board or microphone is passed to the exciter RF circuitry via the DSP and CODECs. The DSP provides the audio characteristics, generates subaudible signals (e.g. DCS, CTCSS), and controls the CODECs for line audio input.

1. AGC is available in H-band reciters only. It can be disabled using the Service Kit software.

Figure 2.2 Reciter high level block diagram



Control Circuitry

The RISC controls the operating functions of the reciter and provides the interface to the outside world. Some of the functions it controls are:

- Tx key and Rx gate
- communications to the system interface board
- digital input from the system interface board
- communication with the other modules in the base station via the I^2C bus
- communications with the Service Kit software.

System Interface Board

The reciter can be fitted with an optional system interface board which provides the links between the reciter's internal circuitry and external equipment. The circuitry on the system interface board provides additional signal processing so that the outputs meet standard system requirements. Several different types of system interface board are available, although only one board can be fitted to a reciter at any one time. Each system interface board can identify itself to the reciter control circuitry.

Power Supply

The reciter is designed to operate off a DC supply of 10.8 VDC to 32 VDC. It is normally supplied with 28 VDC from a PMU, 12 VDC from a 12 V PA, or directly with 10.8 VDC to 32 VDC when fitted in a multi-reciter subrack without a PMU. The supply is fed to two separate power supplies, one on the RF board and a second on the digital board. The power supply on the RF board also powers some of the circuitry on the system interface board.

The power supply on the RF board provides 5.3 V and 8.5 V regulated supplies. This 5.3 V supply is boosted to 23 V and also provides a 3.3 V regulated supply. The power supply on the digital board provides 3.3 V and 5.3 V regulated supplies. It is also fed through to provide a 2.5 V supply.

2.2 PA

The PA is a modular design with the circuitry divided among separate boards which are assembled in different configurations in different models. Interconnect boards are used in certain models to connect boards that are physically separated on the heatsink. The 5 W, 50 W and 100 W PAs are available for operation on 28 VDC, while the 5 W and 50 W PAs are also available for operation on 12 VDC. Figure 2.3 on page 24 shows the configurations of a 100 W 28 V PA and a 50 W 12 V PA, along with the main inputs and outputs for power, RF and control signals.

RF Circuitry

The RF output from the reciter is fed first to the 6 W board. In the 100 W model shown in Figure 2.3, the output from the 6 W board is fed into a −3 dB hybrid coupler on a separate splitter board and then to two 60 W boards in quadrature. The outputs from these two boards are then combined by another −3 dB hybrid coupler on a separate combiner board before being fed to the low-pass filter (LPF)/directional coupler board.

In the 50 W model, the output from the 6 W board is fed to one 60 W board and then to the LPF/directional coupler board. In the 5 W model, the output from the 6 W board is fed directly to the LPF/directional coupler board.

Control Circuitry

The microprocessor located on the control board monitors and controls the operation of the PA. There are no manual adjustments in the PA because all the calibration voltages and currents required to control and protect the PA are monitored by the microprocessor. The software also automatically detects the PA configuration and controls the PA accordingly.

If any of the monitored conditions exceeds its normal range of values, the microprocessor will generate an alarm and reduce the output power to a preset level (foldback). If the measured values do not return within the normal range after foldback, the PA will be shut down. (Refer to "Power Foldback" on page 22.)

The alarms and diagnostic functions are accessed through I^2C bus messages on the system control bus via the reciter, control panel and Service Kit software. Some measurements are logged by the microprocessor and this information can also be accessed through the system control bus.

The operation of the cooling fan mounted on the front panel is determined by the temperature limits set in the PA software. If two PAs are fitted in a subrack, either PA will turn on the fan when required.

Power Foldback

If the temperature in the driver, Final 1 or Final 2 output stage has exceeded the user-configurable threshold, an alarm is raised and operation continues as normal.

If a PA temperature continues to rise and exceeds its built-in threshold (185°F/85°C for the driver or 203°F/95°C for the final stage), the PA folds back its power output to 10% of the configured power level (for example, a 50 W PA would produce 5 W).

When the temperature returns to normal (hysteresis is 9°F/5°C), the alarm clears. To see the actual temperatures, select Diagnose > Modules > PA Control Tests in the Service Kit.

Power Supply

The 100 W PA operates off a 28 VDC external power supply only, while the 5 W and 50 W PAs can operate off a 28 VDC or 12 VDC external power supply, depending on the model. The 12 V PAs are fitted with an internal boost regulator board (refer to "Boost Regulator" below).

The PA also has four internal power supplies which produce −3, +2.5, +5 and +10 VDC.

Boost Regulator

5 W and 50 W 12 V PAs are fitted with a boost regulator board. Figure 2.3 on page 24 shows the configuration for a 50 W PA, along with the main inputs and outputs for power, RF and control signals. Note that the 60 W board is only fitted to the 50 W PA.

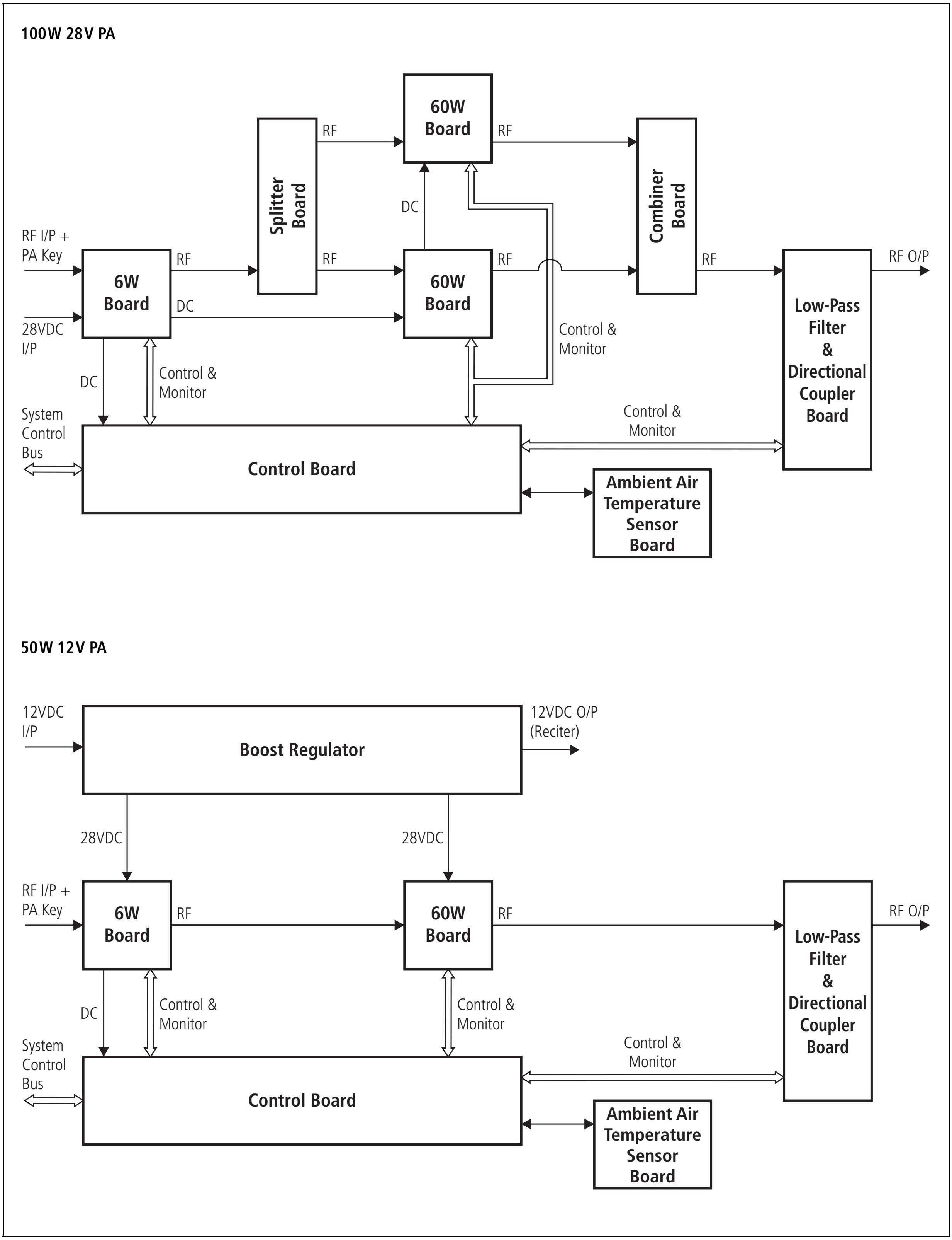
The boost regulator board accepts an input of 12 VDC nominal. The input is firstly fed through the DC input filter, and then through an output filter and switch which is controlled by a battery control circuit. This output is fed to the reciter, which operates from 12 VDC instead of the standard 28 VDC provided when a PMU is used. The output from the DC input filter is also fed to the power stage where the voltage is boosted to 28 VDC, and is then fed through an output filter to provide the 28 VDC output for the PA circuit boards.

The battery control circuitry monitors the DC input voltage from the battery. Protection is provided against the wrong input voltage being supplied. Reverse polarity protection is provided by a diode between positive and ground, and requires a user-provided fuse or circuit breaker in series with the DC input line. The fuse or circuit breaker should be rated at 15A to 18A at 30VDC.

The minimum startup voltage is 10.8VDC ±0.25V. Once started, the boost regulator will operate down to 10.5VDC ±0.25V before it shuts down to prevent deep discharge of the battery.

The startup voltage and operating voltage range are set in hardware at the factory, and cannot be adjusted in normal operation by the user. However, the startup voltage can be increased to 12VDC ±0.25V by carrying out the hardware modifications described in TN-1305 (“Changing the Startup Voltage of a 12V PA”).

Figure 2.3 PA high level block diagrams



2.3 PMU

The PMU provides stable, low-noise 28 VDC outputs to power the base station. The PMU is made up of a number of individual boards and cards which comprise two main modules, the AC module and the DC module. Figure 2.4 shows the configuration for an AC and DC PMU, along with the main inputs and outputs for power and control signals.

The PMU is available in three main configurations:

- AC PMU (AC input only)
- DC PMU (DC input only)
- AC and DC PMU (both AC and DC converters are fitted to allow both AC and DC inputs).

AC Module

The AC module accepts an input of 115/230 VAC 50/60 Hz nominal. The input is fed via the PFC (power factor control) input stage to the HVDC (high voltage DC) stage on the AC converter board. The HVDC circuitry generates the final 28 VDC outputs and provides galvanic isolation between the mains input and DC output. The output stage on the AC converter board provides a common output filter and current monitoring circuit which is used by both AC and DC modules.

Each power stage is controlled by its own plug-in control card. The microprocessor is also located on the HVDC control card. The microprocessor is used by both the AC and DC modules and is fitted to all PMU models.

The leaded high-power components are situated on the AC converter board, while the plug-in cards have only SMD control components.

DC Module

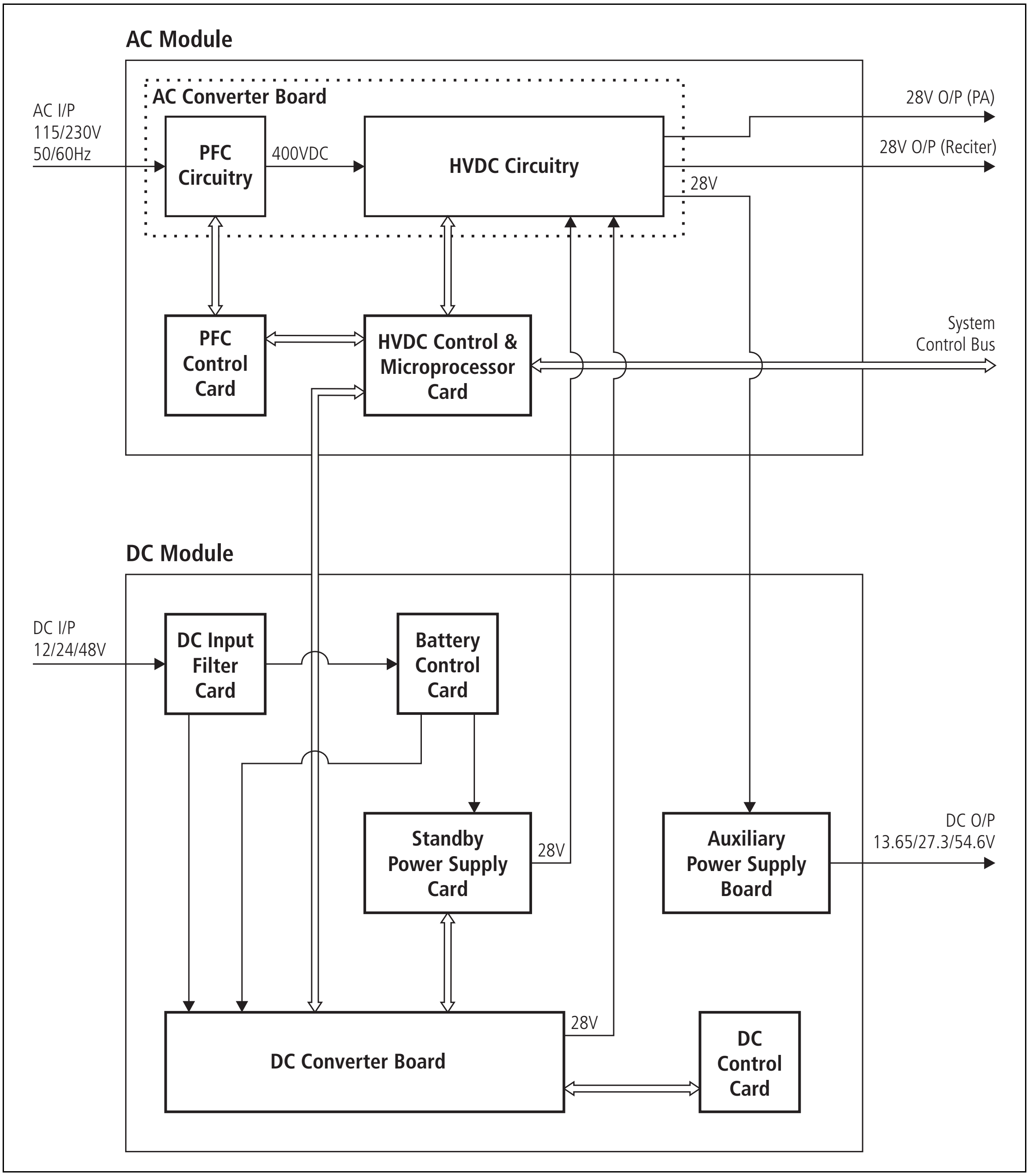
The DC module accepts an input of 12 VDC, 24 VDC or 48 VDC nominal (depending on the model). The input is fed through the DC input filter to the input of the power stage on the DC converter board. This circuitry provides PWM (pulse width modulation) conversion to produce the final DC output. It also provides galvanic isolation, allowing the DC input to be positive or negative ground. The final DC output is fed back to the output stage on the AC convertor board.

The battery control card monitors the DC input voltage and prevents the PMU from starting if an incorrect input voltage is applied. It also operates as a fail-safe to prevent deep discharge of the battery, and provides information to the microprocessor to allow the Service Kit software to display information about the battery.

The DC control card controls the power stage of the DC converter. It also provides protection from overload and short circuit conditions.

The leaded high-power components are situated on the DC converter board, while the plug-in cards have only SMD control components.

Figure 2.4 PMU high level block diagram



Standby Power Supply

This power supply card plugs into the DC converter board and provides power to the reciter output. This allows the main DC unit to be switched off to reduce current consumption in low-power situations, e.g. when the PA is not transmitting. Also, when battery capacity is low, it will maintain the power supply to the microprocessor and shut down the rest of the PMU. This card enables the software-controlled power saving feature to operate. Refer to "Power Saving"on page 65 for more information.

Auxiliary Power Supply

This power supply board is mounted on the DC module. It operates from the high current 28VDC output from the AC converter or DC converter (depending on which is operating). It provides a regulated 13.65 VDC, 27.3 VDC or 54.6 VDC output (depending on the model) to power external accessory equipment. It can be configured using the Service Kit to operate whenever AC mains voltage is available, or under the control of Task Manager.

Microprocessor

The microprocessor on the HVDC control card monitors and controls the operation of the PMU. There are no manual adjustments in the PMU because all the calibration voltages and currents required to control and protect the PMU are monitored by the microprocessor. The software also automatically detects the PMU configuration and controls the PMU accordingly.

If any of the monitored conditions exceeds its normal range of values, the microprocessor will generate an alarm and take appropriate action, depending on the configuration of the PMU.

The alarms and diagnostic functions are accessed through I^2C bus messages on the system control bus via the reciter, control panel and Service Kit software.

The operation of the cooling fan mounted on the front panel is determined by the temperature limits set in the PMU software.

Notice In base stations which use a PMU, the PMU must be connected to the system control bus at all times. The I^2C current source is located in the PMU, and if the PMU is disconnected, the state of much of the bus will be undefined. This may cause corrupted data to be present on the bus when the reciter reads the states of the switches on the control panel. This in turn may result in random actuations of microphone PTT, carrier, or speaker key, causing the base station to transmit or the speaker to be actuated incorrectly.

2.4 Control Panel

The control panel is designed to be the link between the user and the base station. The circuitry for the operation of the control panel is located on a board mounted behind its front face. All communication between the base station and the control panel is via the system control bus. Figure 2.5 on page 29 and Figure 2.6 on page 30 show the configuration of the main circuit blocks, and the main inputs and outputs for power, audio and control signals.

2.4.1 Control Circuitry

Dual Base Station and Power Save

The control panel translates I^2C messages into an appropriate response on the LEDs. It also translates button inputs from the front panel membrane and fan rotation inputs from both fans into appropriate I^2C messages. The type of control panel is also sent with I^2C messages.

The control panel translates RS-232 communications from the programming port into 0V to 5V open-collector signals which are connected to the reciter (or to the selected reciter in a dual base station).

ⓘ When a reciter fitted with a TaitNet RS-232 or High Density/RS-232 system interface board is used in a base station, the RS-232 port on the control panel is disabled. In this situation you must connect to the RS-232 port at the rear of the reciter. Refer to "TaitNet RS-232" on page 145 or "High Density/RS-232" on page 140 for more details. When a reciter fitted with a TaitNet Ethernet or High Density/Ethernet system interface board is used, the RS-232 port on the control panel is available only when the base station first powers up. Refer to "Service Kit Connection to an Ethernet Base Station" on page 152 for more details.

Multi-reciter

The control panel translates I^2C messages from the reciter into an appropriate response on the LEDs (except the channel LEDs). It also translates control panel button inputs (except the channel button) and fan rotation inputs from the PMU fan (if fitted) into appropriate I^2C messages. The type of control panel is also sent with I^2C messages.

The control panel translates RS-232 communications from the programming port into 0V to 5V open-collector signals which are connected to whichever reciter is selected with the channel button.

Figure 2.5 Dual base station and Power Save control panel high level block diagrams

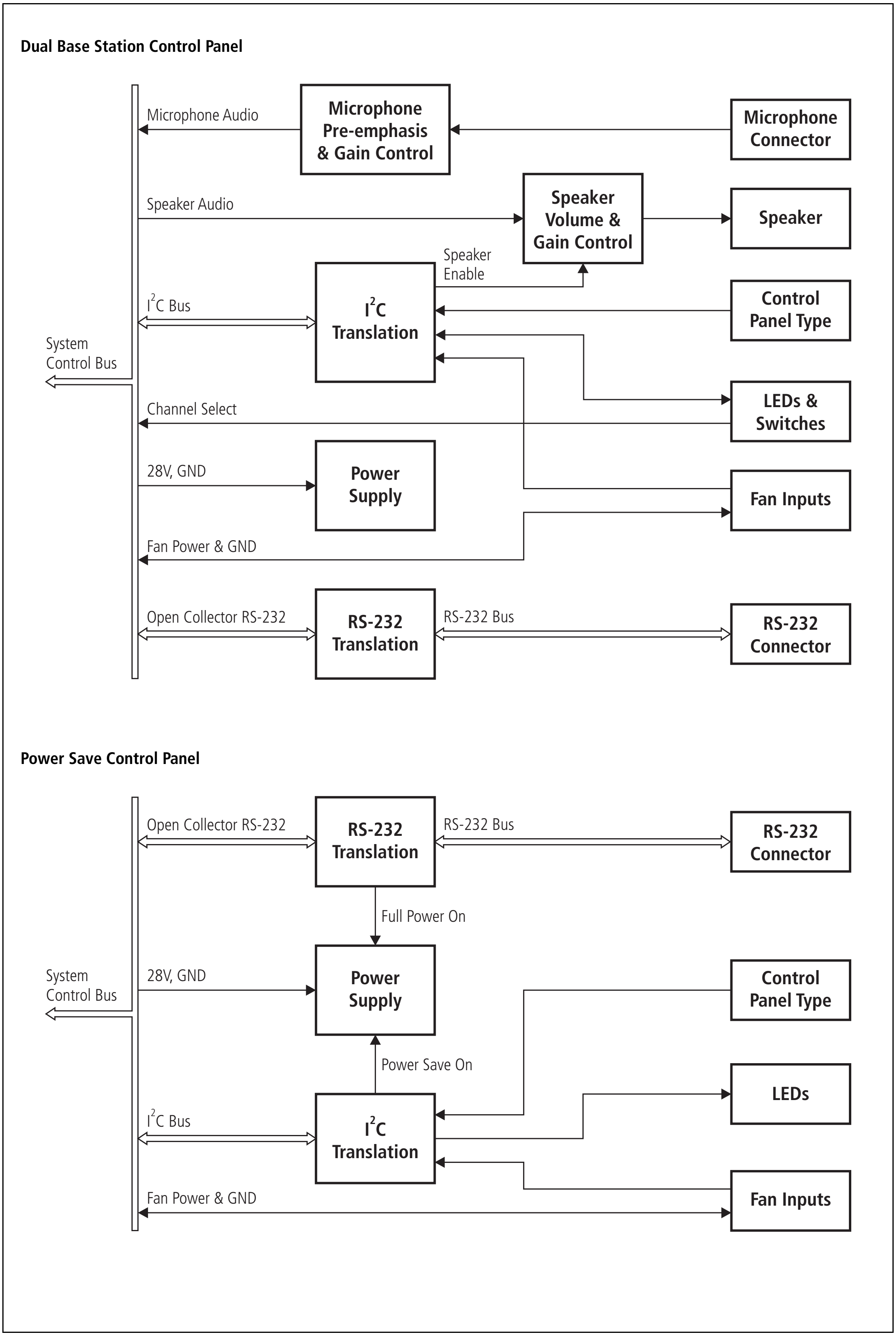
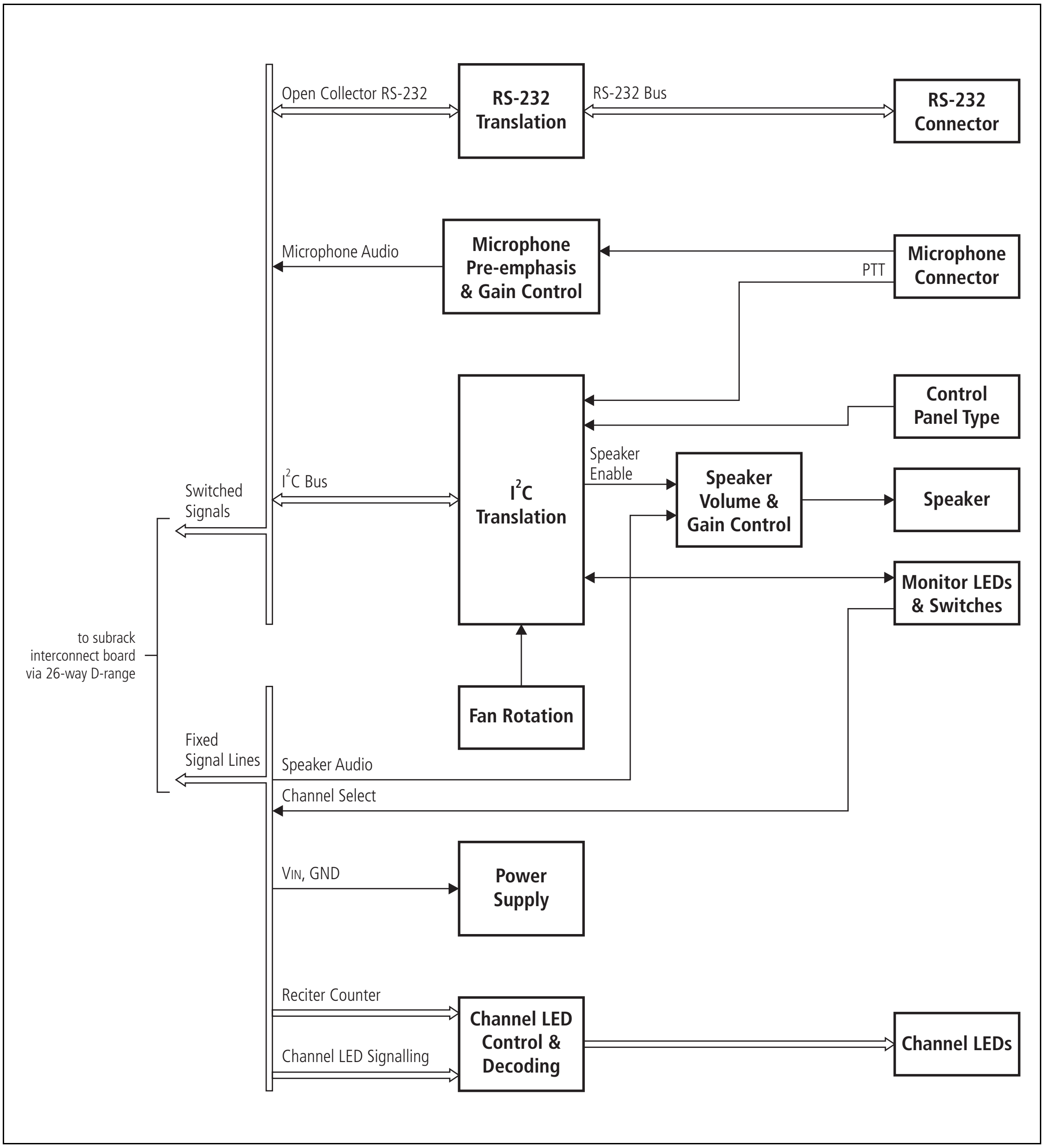


Figure 2.6 Multi-reciter control panel high level block diagram



2.4.2 Audio Circuitry

Dual Base Station

The volume of the speaker is controlled by the volume control knob. In addition, the control panel performs gain control so that, with an input of 167 mV pp, the power output into a 16 Ω speaker is ≥0.5 W at the maximum position of the volume control, and 0 W at the minimum position of the control. An LED indicates when the speaker is on.

The control panel is designed to work with an electret microphone with an input range of 80 dB SPL to 115 dB SPL.

Power Save The audio circuitry is not fitted to this board.

Multi-reciter The volume of the speaker is controlled by the volume control knob. In addition, the control panel performs gain control so that, with an input of 167 mV pp, the power output into a 16 Ω speaker is ≥0.5 W at the maximum position of the volume control, and 0 W at the minimum position of the control. Speaker audio is from the currently selected reciter only. An LED indicates when the speaker is on.

The control panel is designed to work with an electret microphone with an input range of 80 dB SPL to 115 dB SPL.

2.4.3 Power Save

This circuitry is present only on the Power Save control panel board.

When the base station enters Power Save mode, the control panel will shut down after receiving the appropriate I^2C bus message from the reciter. The power LED flashes once every two seconds to indicate the base station is in Power Save mode.

The control panel will power up again when it receives a signal from the system control bus or from the serial port.

2.4.4 Power Supply

All control panels operate off the 28 V (nominal) power supply provided by a reciter. The power supply for the cooling fans mounted on the front panel is fed through the control panel.

2.4.5 Multi-reciter Signal Switching

Speaker audio and power for the control panel share common circuitry for all reciters in the subrack. Speaker audio is also controlled by software so that only the audio from the currently selected reciter is audible.

The remaining signals (microphone audio, I^2C messages, fan power, and RS-232 communications) are switched so that only one reciter is connected to the control panel at a time. This switching takes place on the subrack interconnect board and is controlled by the channel button on the control panel.

3 Operating Controls

The base station has a number of hardware controls which are available to the user. These controls are located on the control panel, reciter and PMU. This chapter identifies and describes these controls.

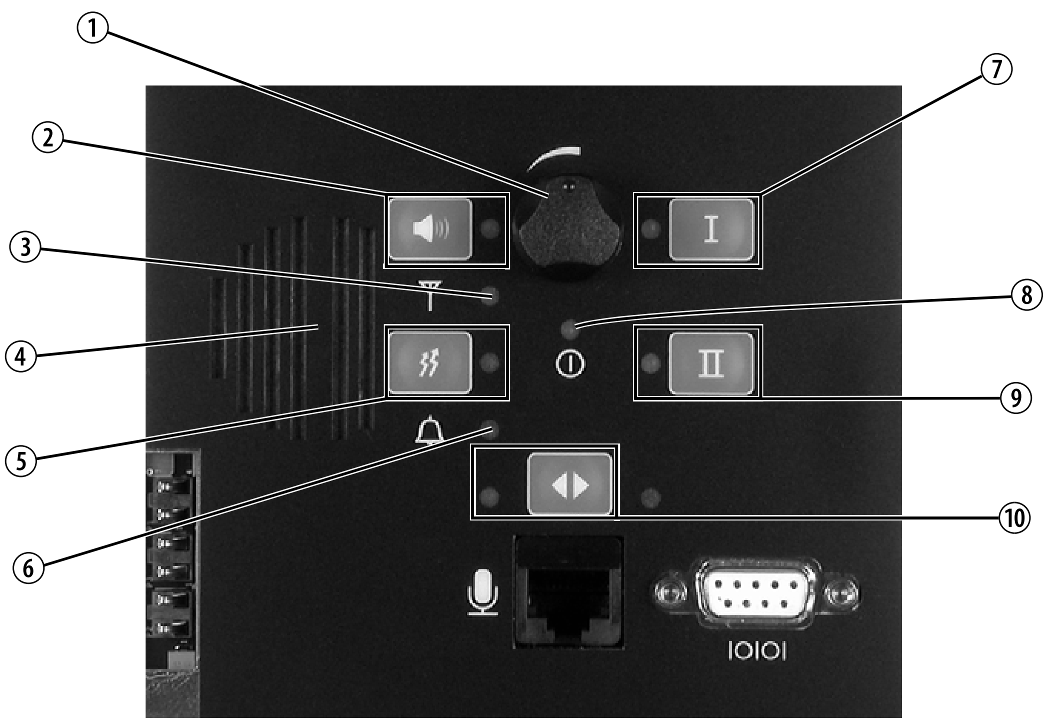
3.1 Control Panel

3.1.1 Dual Base Station Control Panel

The operating controls on the dual base station control panel allow some manual control of two base stations in a subrack. These controls and their associated LED indicators are identified in Figure 3.1, and their functions are explained in the paragraphs which follow. Refer to "Control Panel Connections" on page 120 for information on the connectors located on the control panel.

The dual base station control panel is also used with a single base station. In this configuration the base station 2 select button and LED are not used.

Figure 3.1 Operating controls on the dual base station control panel

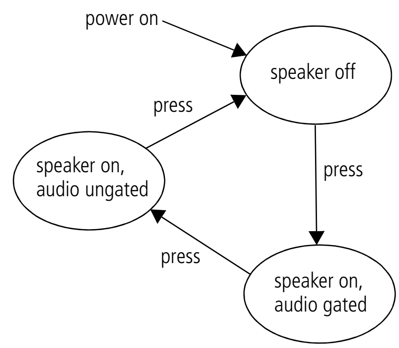


1. speaker volume
2. speaker button and LED
3. receive LED
4. speaker
5. carrier button and transmit LED
6. alarm LED
7. base station 1 select button and LED
8. power LED
9. base station 2 select button and LED
10. microphone button and LED

Speaker Volume Controls the volume of the speaker mounted behind the control panel. Rotate clockwise to increase the volume, and anticlockwise to decrease the volume.

Speaker Button and LED

The speaker button cycles the base station audio through three states. At power-on the speaker is off. Pressing the button once turns the speaker on, but leaves the audio gated (muted). Pressing the button a second time leaves the speaker on and ungates the audio (monitor mode). Pressing the button for a third time returns to the start of the sequence, with the speaker off.



The green speaker LED is lit when the speaker is turned on.

Receive LED

The green receive LED is lit when a valid signal is received on the selected base station.

Speaker

The control panel is fitted with a 0.5W speaker. Audio from either base station can be connected to this speaker.

Carrier Button and Transmit LED

The carrier button is a momentary press switch. When held down, it keys the transmitter while disabling the 600Ω balanced and unbalanced line, and microphone audio. The transmitted signal is unmodulated, i.e. carrier only.

The red transmit LED is lit while the selected transmitter is transmitting.

Alarm LED

The red alarm LED will flash at a rate of 2 to 5 Hz when an alarm has been generated by any of the base station modules. It will continue to flash until the alarm is cancelled or the fault is fixed. Note that only those alarms which are enabled using the Service Kit (Configure > Alarms > Alarm Control) will cause this LED to flash. Refer to the Service Kit documentation for more information.

Base Station 1 Select Button and LED

Pressing this button selects base station 1. Pressing the button again while base station 1 is selected has no effect. The control panel selects base station 1 on power-up.

The green LED is lit when base station 1 is selected.

> **Notice** We recommend that you select base station 1 on the dual base station control panel when you have finished monitoring or configuring a dual base station. This will prevent false fan failure alarms being raised for the PA and PMU.

Power LED

The green power LED is lit when the PMU or 12V PA is turned on and supplying power to the base station.

Base Station 2 Select Button and LED

Ⅱ

Pressing this button selects base station 2. Pressing the button again while base station 2 is selected has no effect.

The green LED is lit when base station 2 is selected.

Microphone Button and LED

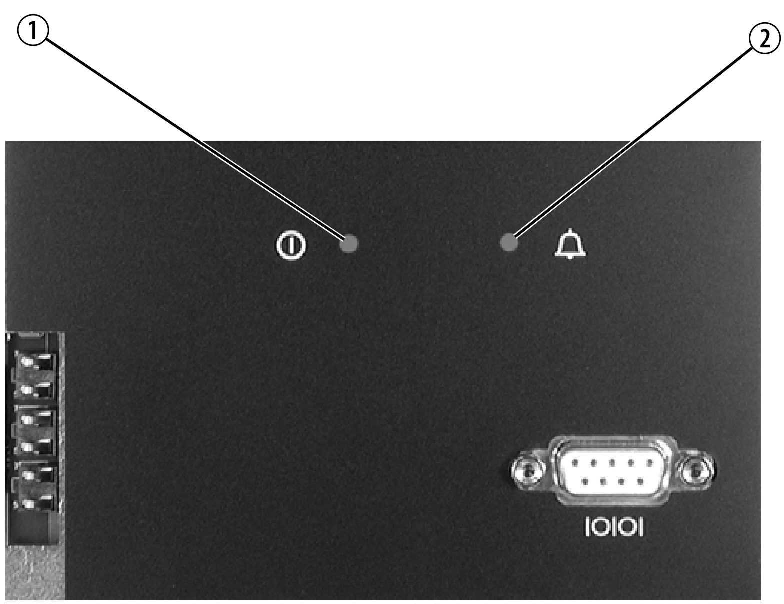
Pressing this button once enables the microphone for use on the selected base station. Pressing it a second time disables the microphone.

The green LED to the left of the button is lit when the microphone is enabled. The LED to the right of the button is not used.

3.1.2 Power Save Control Panel

The indicator LEDs on the power save control panel are identified in Figure 3.2 below.

Figure 3.2 LED indicators on the Power Save control panel



① power LED

② alarm LED

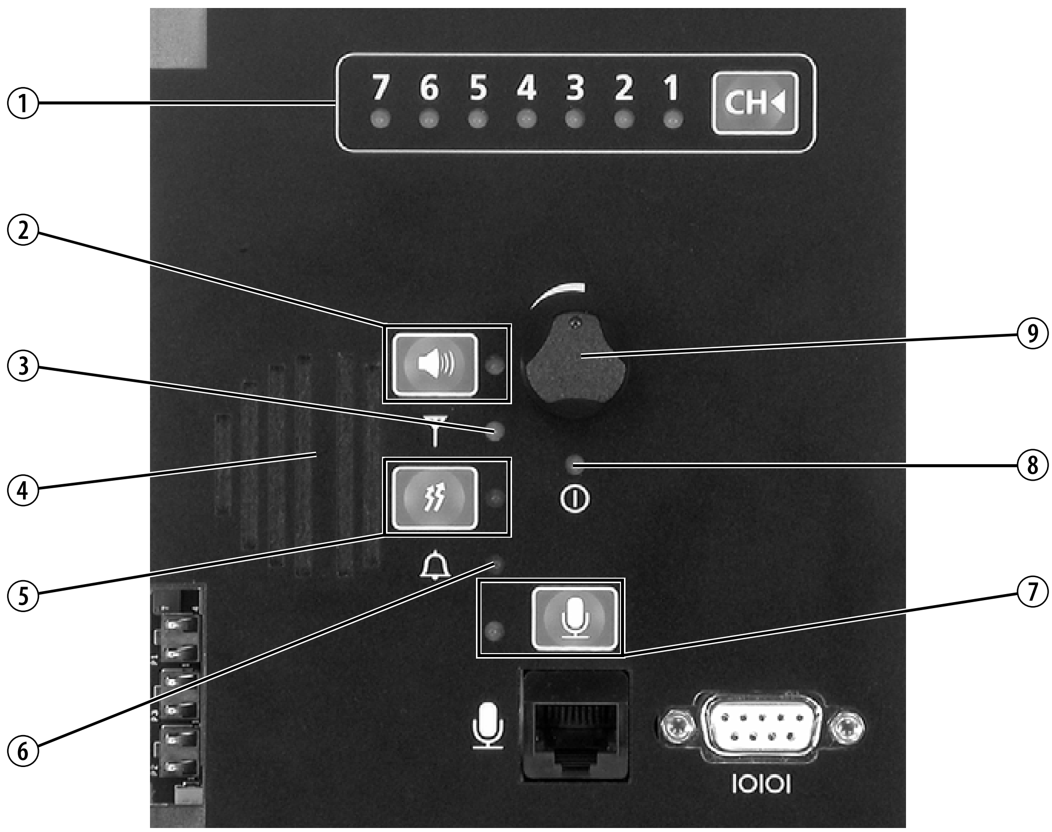
Indicator LEDs

The power LED and alarm LED behave in the same way as for the standard control panel. Refer to "Power Saving"on page 65 for information about the behavior of the LEDs when in power saving mode.

3.1.3 Multi-reciter Control Panel

The operating controls on the multi-reciter control panel allow some manual control of the equipment mounted in the subrack. These controls and their associated LED indicators are identified in Figure 3.3 below, and their functions are explained in the subsections which follow. Refer to "Control Panel Connections" on page 120 for information on the connectors located on the control panel.

Figure 3.3 Operating controls on the multi-reciter control panel



① channel button and LEDs
② speaker button and LED
③ receive LED
④ speaker
⑤ carrier button and transmit LED
⑥ alarm LED
⑦ microphone button and LED
⑧ power LED
⑨ speaker volume

Channel Button and LEDs

CH◀

The channel button selects which reciter is connected to the control panel. Repeatedly pressing this button cycles through positions 1 to 7 in the subrack, regardless of whether the position is occupied. The selection defaults to position 1 on power-up.

Notice We recommend that you select reciter 1 on the control panel when you have finished monitoring or configuring a module. This will prevent false fan failure alarms being raised for the PA and PMU, and will also allow the remote fan diagnostic test to work.

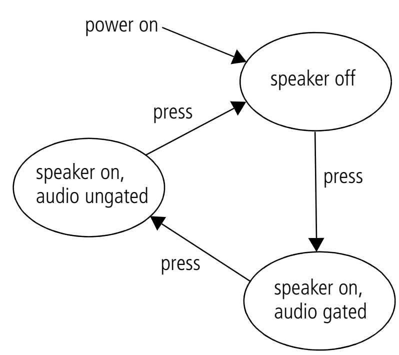
The channel LEDs have the following states (default settings):

- red — indicates which is the currently selected reciter
- green — indicates that the reciter is receiving a valid signal
- orange — indicates that the currently selected reciter is receiving a valid signal.

ⓘ The operation of these LEDs is controlled by links on the subrack interconnect and control panel boards. The links on the subrack board select whether the reciter's Rx gate or alarm status signal is connected to the control panel. The links on the control panel board select the color of the LED when the selected status signal is received from the reciter. The default settings are for the Rx gate signal to turn the LED green. Refer to "Configuration" on page 161 for more details.

Speaker Button and LED

The speaker button cycles the audio of the currently selected reciter through three states. At power-on the speaker is off. Pressing the button once turns the speaker on, but leaves the audio gated (muted). Pressing the button a second time leaves the speaker on and ungates the audio (monitor mode). Pressing the button for a third time returns to the start of the sequence, with the speaker off.



The green speaker LED is lit when the speaker is turned on.

In a multi-reciter subrack, use the channel button to select the reciter, then use the speaker button to set the speaker output mode for that reciter. Repeat this process for each reciter in the subrack.

ⓘ The speaker audio is from the currently selected reciter only.

Receive LED

The green receive LED is lit when a valid signal is received on the selected reciter.

Speaker

The control panel is fitted with a 0.5W speaker. Audio from the currently selected reciter can be connected to this speaker.

Carrier Button and Transmit LED

The carrier button is a momentary press switch. When held down, it keys the transmitter while disabling the 600Ω balanced and unbalanced line, and microphone audio. The transmitted signal is unmodulated, i.e. carrier only. The red transmit LED is lit while its associated transmitter is transmitting.

The carrier button is not used in a receive-only subrack.

Alarm LED

The red alarm LED will flash at a rate of 2 to 5 Hz when an alarm has been generated by the currently selected reciter. It will continue to flash until the alarm is cancelled or the fault is fixed. Note that only those alarms which are enabled using the Service Kit (Configure > Alarms > Alarm Control) will cause this LED to flash. Refer to the Service Kit documentation for more information.

Alarm status signals can also be connected to the channel LEDs by setting links on the subrack interconnect board (refer to "Configuring the Multi-reciter Control Panel Board" on page 167).

Microphone Button and LED

The microphone button enables and disables the microphone input. At power-on the audio is enabled, and pressing the button once disables the audio. Pressing the button a second time re-enables the audio. The microphone input is connected only to the currently selected reciter.

The green LED is lit when the microphone input is enabled.

Power LED

The green power LED is lit when the PMU is turned on and supplying power to the modules in the subrack, or when the DC supply is connected to the DC input connector at the rear of the subrack.

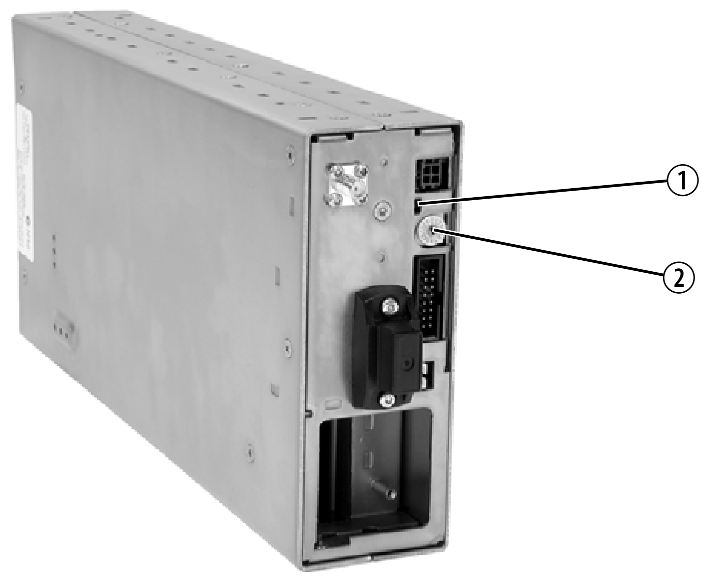
Speaker Volume

Controls the volume of the speaker mounted behind the control panel. Rotate clockwise to increase the volume, and anticlockwise to decrease the volume.

3.2 Reciter

The only controls on the reciter are the rotary hex switch mounted on the front panel, and the indicator LEDs visible through a slot in the front panel.

Figure 3.4 Operating controls on the reciter



1 indicator LEDs 2 hex switch

Indicator LEDs

These LEDs provide the following information about the state of the reciter:

- steady green - the reciter is powered up
- flashing red - one or more alarms have been generated; you can use the Service Kit software to find out more details about the alarms.

The alarm LED will flash whenever an alarm is generated, whether or not this alarm has been disabled in the Service Kit.

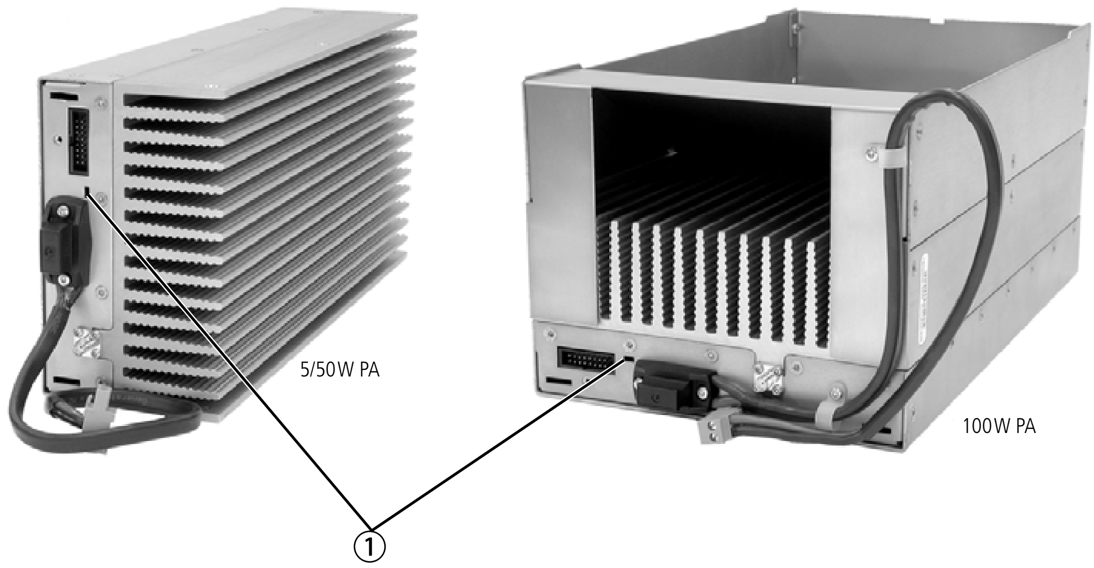
Hex Switch

The rotary hex switch mounted on the front panel is not used and has no effect on the operation of the reciter.

3.3 PA

The only controls on the PA are the indicator LEDs visible through a slot in the front panel.

Figure 3.5 Operating controls on the PA



① indicator LEDs

Indicator LEDs

These LEDs provide the following information about the state of the PA:

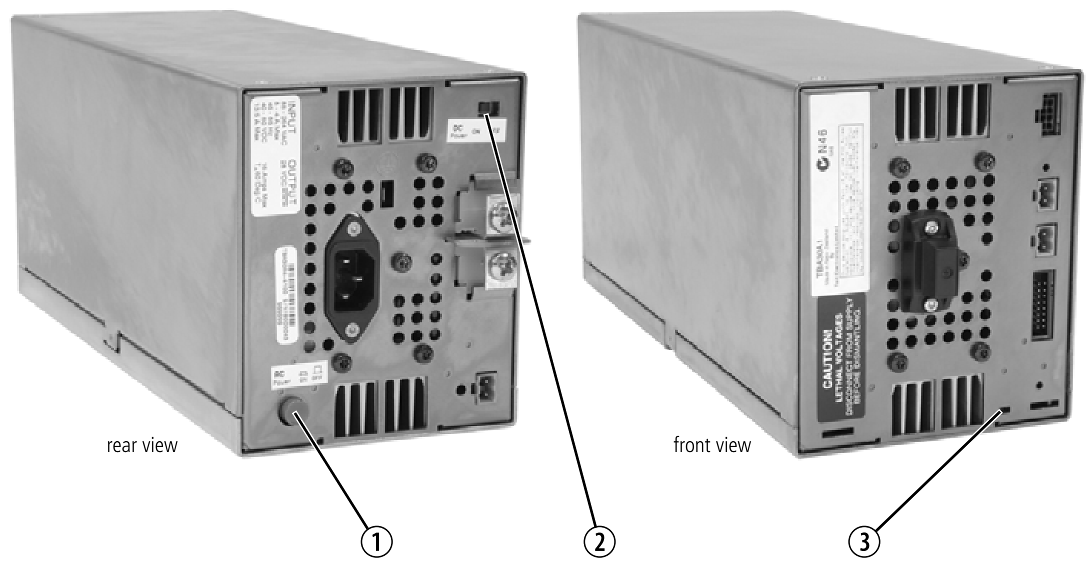
- steady green - the PA is powered up
- flashing green - the PA has no application firmware loaded; you can use the Service Kit software to download the firmware
- flashing red - one or more alarms have been generated; you can use the Service Kit software to find out more details about the alarms.

ⓘ The alarm LED will flash whenever an alarm is generated, whether or not this alarm has been disabled in the Service Kit.

3.4 PMU

The only controls on the PMU are the on/off switches on the rear panel for the AC and DC modules, and the indicator LEDs visible through a slot in the front panel.

Figure 3.6 Operating controls on the PMU



① AC module on/off switch

② DC module on/off switch

③ indicator LEDs

AC Module On/Off Switch

This switch turns the AC input to the PMU on and off. Note that this switch breaks only the phase circuit, not the neutral.

On switches fitted to PMUs up to November 2008, the red button is “in” when on, and “out” when off. On switches fitted from November 2008 onwards, the red button remains “out” whether on or off.

DC Module On/Off Switch

This switch turns the DC output from the PMU on and off. Note that this switch does not disconnect power from the DC converter itself. It disables the converter by switching off its control circuitry. Even when the DC converter is off, the DC input is still connected to its power circuitry.

The switch is recessed to prevent the DC module being accidentally switched off, thus disabling the battery back-up supply.

Warning These switches do not totally isolate the internal circuitry of the PMU from the AC or DC power supplies. You must disconnect the AC and DC supplies from the PMU before dismantling or carrying out any maintenance. Refer to the service manual for the correct servicing procedures.

Indicator LEDs

These LEDs provide the following information about the state of the PMU:

- steady green – the PMU is powered up
- flashing green – the PMU has no application firmware loaded; you can use the Service Kit software to download the firmware
- flashing red – one or more alarms have been generated; you can use the Service Kit software to find out more details about the alarms
- flashing red and green, once every 3 seconds – the PMU is in battery protection mode; check that the battery voltage is above the configured minimum startup voltage; also check that the minimum startup voltage is configured correctly; refer to Table 4.1 on page 60 for DC voltage limits
- flashing red and green, once every 5 seconds – the PMU is in Deep Sleep mode.

Refer to "Indicator LEDs" on page 60 for more detailed information.

ⓘ The alarm LED will flash whenever an alarm is generated, whether or not this alarm has been disabled in the Service Kit.

4 Functional Description

This chapter describes some principles of the TB8100 operation. Information is provided on the following topics:

- base station overview
- system control bus operation
- signal path
- power distribution
- data, control and monitoring paths
- fan control
- Power Saving
- Ethernet operation
- multi-reciter subracks.

Unless stated otherwise, the circuit descriptions are based on a single 50W base station. Power Saving is an optional feature, enabled by a specific hardware and software configuration. The additional operational features which are available in Ethernet base stations or multi-reciter subracks are described in their respective sub-sections.

4.1 Base Station Overview

4.1.1 Single and Dual Base Stations

Single and dual base stations both use the dual base station control panel and subrack interconnect board. A single base station comprises a PMU, reciter, and PA (shown in Figure 4.1 on page 48 as Reciter 1 and PA 1). In a dual base station the second base station's reciter and PA are isolated from the first base station's reciter, PA, and PMU. Solid state relays and control logic on the interconnect board isolate the two base station communication channels from each other. All other signals remain in parallel. The relays are controlled by a key press of the base station select buttons on the control panel.

Note that the fans have power supplied from the relevant PA or PMU module, with the rotation sensor alarm signal interfaced into the control panel. This signal is processed via the reciter associated with the PA or PMU.

ⓘ The dual base station subrack interconnect board has a set of switches which must be set according to the type of base station in the subrack. Refer to "Configuring the Subrack Interconnect Board" on page 162 for details of the switch settings.

The dual base station has a number of operational constraints. These are listed below.

Subrack

- The front panel LEDs, switches, and RS-232 interface are controlled by the currently selected base station.
- The second base station does not communicate with the PMU, but the PMU does provide power to it.

Power Saving

- In a dual base station with a PMU, base station 1 can have Sleep mode enabled, but not Deep Sleep mode. Only base station 1 can communicate with the PMU, and in Deep Sleep mode it will turn off the PMU, and therefore the PA in base station 2.

Service Kit

- The Service Kit can only log on to the currently selected base station (1 or 2).
- On the Monitor > Module Details > Reciter screen, the **Module** field will state "Reciter 1" irrespective of the base station.
- On the Monitor > Module Details > Power Amplifier screen, the **Module** field will state "Power Amplifier 1" irrespective of the base station.
- As there is no PMU on base station 2, no PMU settings for this base station will function. This includes the PMU battery voltage display, monitoring, diagnostics, and power management display.
- All PMU alarm LEDs on the **Alarm** screen of base station 2 will be grey.

- If you read a configuration from base station 2 and then go to Configure > Alarms > Thresholds, the PMU battery voltages will be at zero. If you want to click OK to confirm any changes to the screen, you need to re-enter the PMU voltages. If not, just click Cancel.
- In the Configure > Base Station > Miscellaneous form for base station 2, the **Power configuration** areas will display voltages of zero. If you want to click OK to confirm any changes to the screen, you need to re-enter these voltages. If not, just click Cancel.
- All fan faults will not be displayed or acted on if the failure occurs on the base station that is not currently selected.
- The display of fan states in Diagnostic forms may be incorrect.
- Email and Alarm Centre outputs are only possible from the currently selected base station[1].

Recommended Service Kit Settings

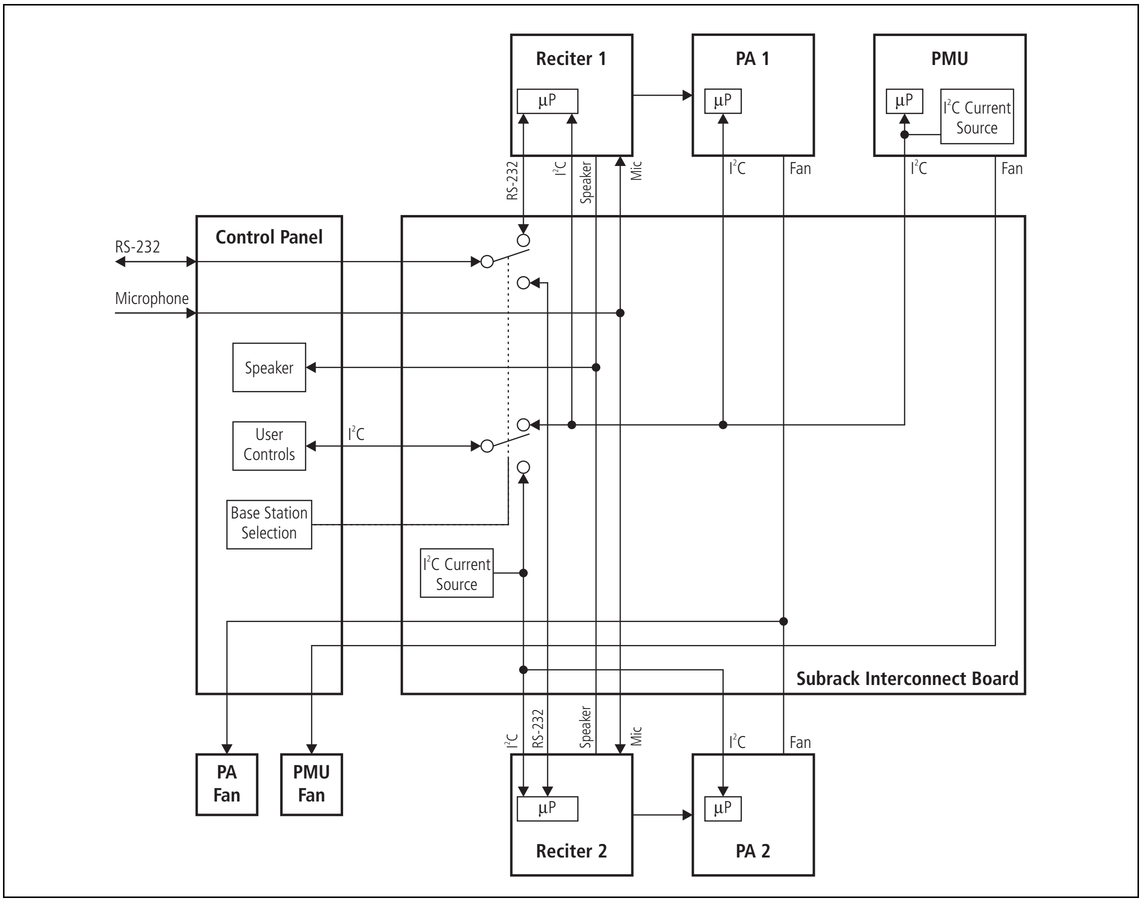
The following Service Kit settings are recommended for dual base station operation:

- Disable Alarm Center and Email on base station 2 (Configure > Communications). This will prevent false PMU alarms[1].
- Disable the "No PMU detected" alarm on base station 2 (Configure > Alarms > Alarm Control). Also on this screen disable the "Fan failure" alarm for the PMU and PA on base station 2.
- On base station 2 disable any Task Manager statements that use the "No PMU Detected" or "Fan failed" alarm inputs (Configure > Base Station > Task Manager).
- We also recommend that you disable any Task Manager statements on base station 1 that use the "Fan failed" alarm input. This will prevent false fan alarms if a dual base station is operated with base station 2 selected on the control panel.

Notice We recommend that you select base station 1 on the dual base station control panel when you have finished monitoring or configuring a dual base station. This will prevent false fan failure alarms being raised for the PA and PMU.

1. Email alarm outputs are available from both base stations if both reciters are fitted with TaitNet RS-232 or High Density/RS-232 system interface boards (see "System Interface Connections" on page 137 for more details).

Figure 4.1 Dual base station communication paths



4.1.2 Single and Dual 12V PA Base Stations

The TB8100 platform also supports the operation of one or two 12V PA base stations in one subrack. Figure 4.2 shows the main communication paths in a dual 12V PA base station. The 12V PA base station does not require a PMU, as the DC input is connected directly to the 12V PA. An internal boost regulator board converts the 12V nominal DC input to a 28VDC output to power the PA circuit boards. The boost regulator board also provides a 12VDC output to power the reciter.

Both single and dual 12V PA base stations use the dual base station control panel and subrack interconnect board. This board is mandatory for dual base station operation, but is also used for single base station operation because it provides the I^2C current source normally provided by the PMU.

ⓘ The dual base station subrack interconnect board has a set of switches which must be set according to the type of base station in the subrack. Refer to "Configuring the Subrack Interconnect Board" on page 162 for details of the switch settings.

Power Saving operation in a 12V PA base station requires an external connection between the reciter and 12V PA (refer to "12V PA Power

Saving Control Connection" on page 155). For details on Power Saving in a 12V PA base station, refer to "12V PA Operation" on page 69.

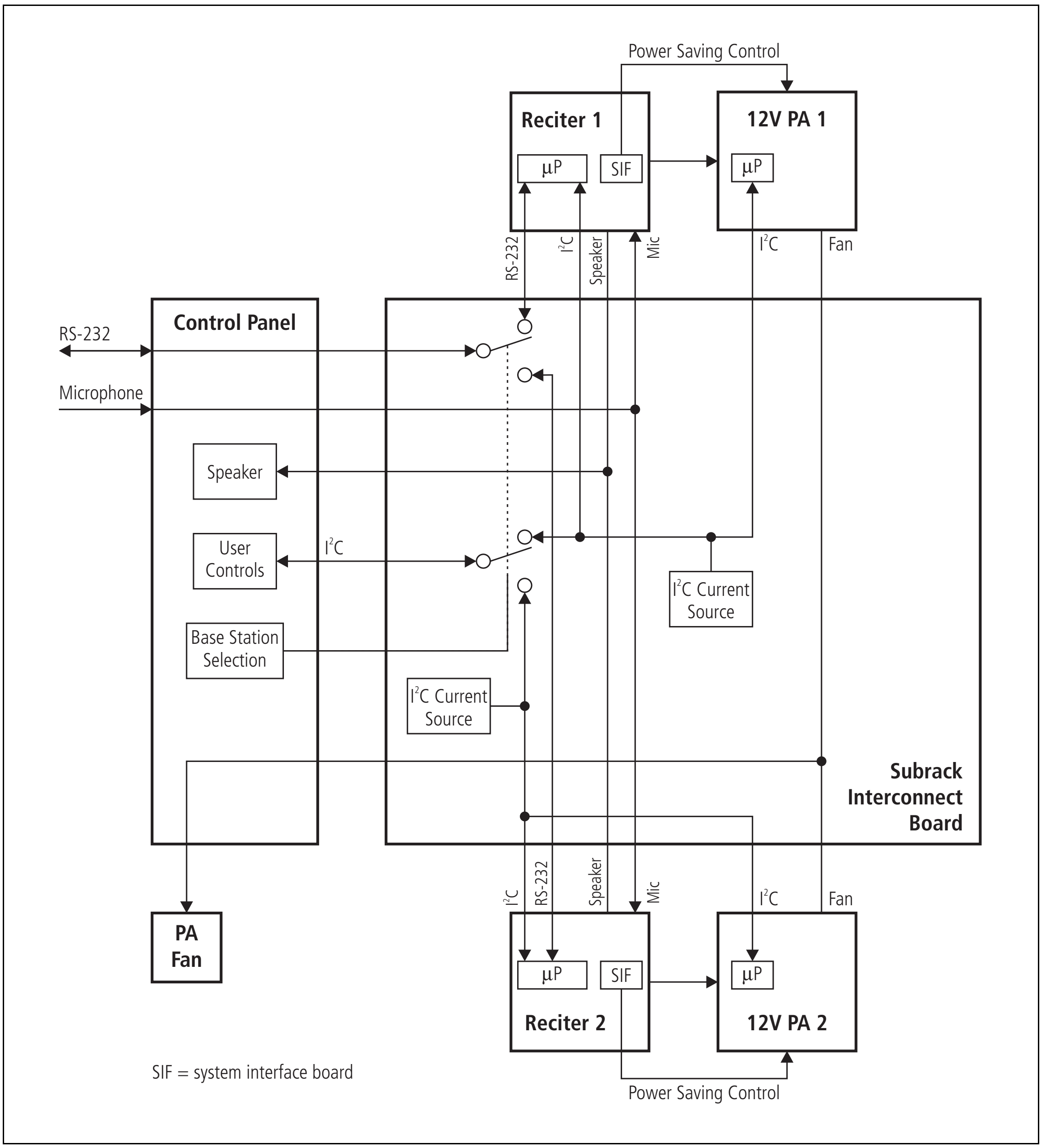
Constraints

The dual base station control panel imposes the same constraints on the operation of a dual 12V PA base station as those described in "Service Kit" on page 46, except that those which refer to the PMU do not apply.

In addition, because there is no PMU fitted, we recommend the following Service Kit settings for 12V PA base station operation:

- Disable the "No PMU detected" alarm on base stations 1 and 2.

Figure 4.2 Dual 12V PA base station communication paths



4.2 System Control Bus

The system control bus, see Figure 4.3on page 52, provides the communications link between the modules in the base station. It provides the following physical paths:

- I^2C communications between modules
- RS-232 communications between the reciter and Service Kit and Calibration Kit software, via the control panel port
- fan power from the PA and PMU
- speaker and microphone signals to and from the control panel
- power connections for the control panel.

The system control bus has been designed so that, if a major fault occurs on the bus, the basic operation of the base station is unaffected, but some features will not operate correctly. For example, if the PA is disconnected from the bus:

- the 'PA not detected' alarm is generated in the reciter; however, transmission still takes place because the transmit RF and key signals are transmitted from the reciter to the PA via the interconnecting coaxial cable
- the PA is unable to turn on its fan. Depending on the ambient temperature at the site and the transmit duty cycle, this could allow the PA to heat up to the point where it reaches the upper temperature threshold. At this point it will begin power foldback, protecting the equipment from damage.

The PMU behaves in a similar way to the PA.

The system control bus has been designed to operate only within the subrack. It has not been designed for use outside the subrack or to interconnect two subracks.

I^2C Signals

The base station uses the I^2C bus and a proprietary software protocol to provide communications between any modules connected to the bus. Typically this involves the reciter assuming "primary" status, and PAs and PMUs "secondary" status. The reciter co-ordinates the entire subrack operation, reading from and writing to all modules, including the control panel. The I^2C bus allows the reciter to perform the following functions:

- monitoring (e.g. operating status, module details, operating temperatures etc.)
- diagnostics (execution of tests to confirm correct operation)
- firmware upgrades
- configuration (of operational parameters).

The I^2C current source is located in the PMU so that the base station can operate with the control panel removed. However, the PMU must be powered up to enable the I^2C communications to operate. Base stations which use the 12V PA do not require a PMU, and in this case the I^2C current source is located on the dual base station subrack interconnect board.

RS-232 Signals

Service Kit, Alarm Center and Calibration Kit serial communications all occur directly between the connected computer (or modem) and the reciter over the RS-232 serial lines. When the connected computer needs to communicate with the PA, PMU or control panel, the reciter routes the RS-232 data stream to the I^2C bus. Only reciters use the RS-232 interface.

Fan Signals

The power and ground signals for the PA and PMU fans are routed from the modules to the front panel (via the control panel) along the system control bus. These signals are electrically isolated from all other system signals to ensure fan noise is not transferred to other sensitive system components. Protective diodes prevent the PA in one base station from being back-powered by the PA in the other base station via the fan power lines.

In a dual base station, either PA can power the PA fan at any time. Thus the PA that needs the cooling from the fan can control and receive it, while the other PA will also be cooled even if it does not require it.

Although the PA and PMU modules provide the power and ground for their respective fans, the fan rotation detection is performed in the control panel. The result is then read and processed by the reciter via the I^2C interface. The PA and PMU do not know if their fan has been correctly enabled, however, if there is a fault in the fan circuitry, each module is protected from overheating by its internal foldback circuitry.

In a dual base station, the fan rotation sensors report only to the currently selected base station. The other base station will conclude that the fan is not working and generate false alarms. Refer to "Single and Dual Base Stations" on page 46 for more information on setting the fan failure alarms.

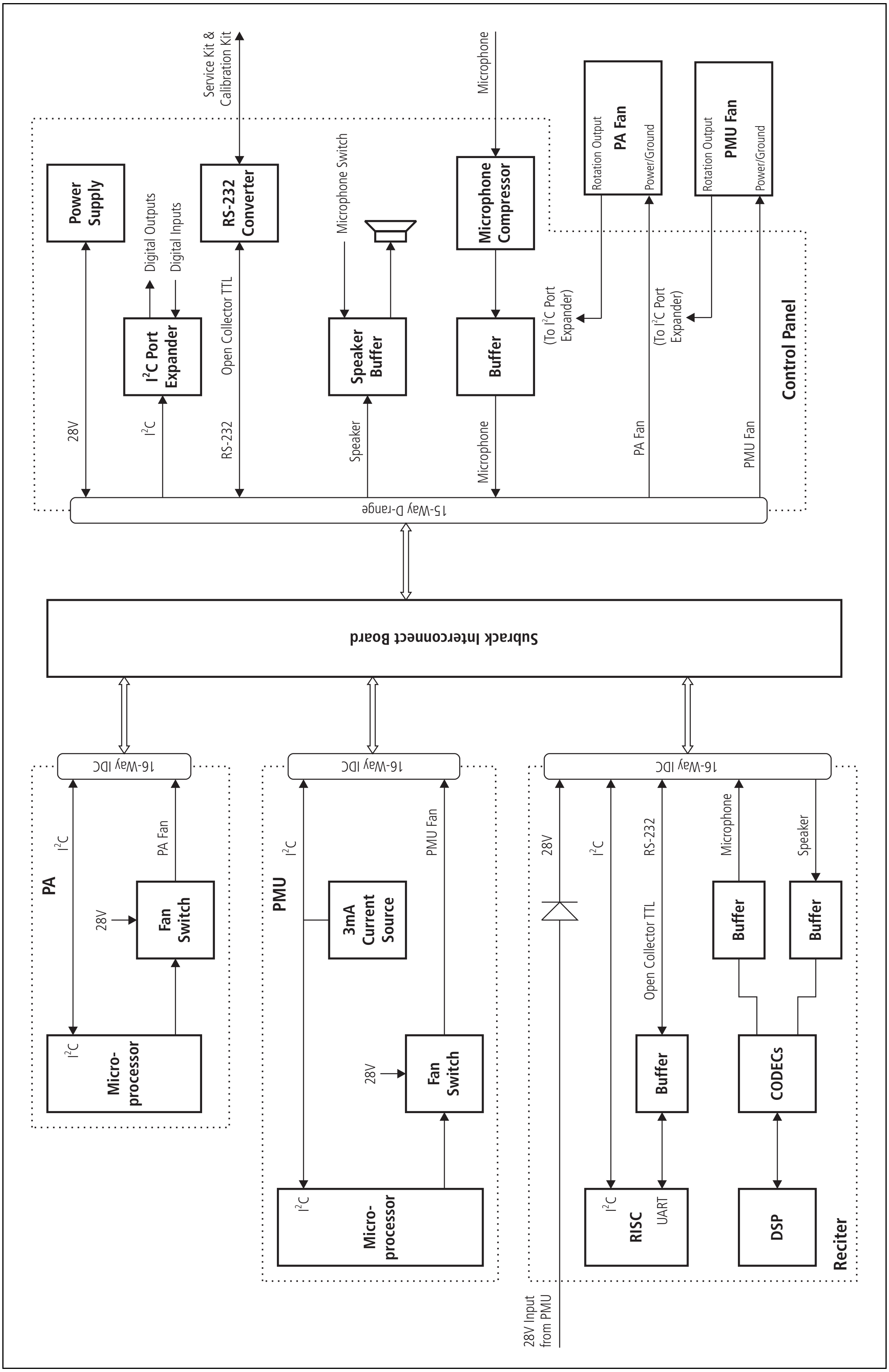
Speaker Signal

Received audio can be sent from the reciter to the control panel. This function is controlled by the speaker button on the control panel. The audio signal is then amplified and passed to the control panel speaker for monitoring purposes.

Microphone Signal

When you press the microphone PTT button, the reciter enables the transmitter and connects the audio signal from the microphone input to the modulator. The microphone PTT signal is read via the control panel using the I^2C bus and this then enables the transmitter. Note that the PTT response times are slower than the response times for the TX_KEY input from the system interface board.

Figure 4.3 System control bus high level block diagram



Power and Ground

The PMU provides power to the control panel via the reciters. Each reciter has a series diode to "diode OR" the power to the control panel, but not to backpower a reciter that does not have a power cable connected.

Pin Allocations

The subrack interconnect board at the front of the subrack provides a parallel interconnection between all connectors on the board.

The following table gives the pin allocations for the IDC connectors to the reciter, PA and PMU, and for the D-range connector to the control panel.

Signal	Reciter, PA & PMU IDC Pin	Power Save Control Panel D-range Pin	Dual Base Station Control Panel D-range Pin
I^2C interrupt	1 (not used)	8 (not used)	channel 2 select
I^2C data	2	15	15
ground (I^2C)	3	no connection	no connection
I^2C clock	4	7	7
+28V (control panel power)	5	14	14
RS-232 Tx data	6	6	6
ground (control panel power)	7	13	13
RS-232 Rx data	8	5	5
ground (analogue)	9	12	12
control panel speaker	10	4	4
control panel microphone	11	11	11
alternative PA key	12 (not used)	3 (not used)	channel 1 select
+24V switched (PA fan)	13	2	2
ground (PA fan)	14	10	10
+24V switched (PMU fan)	15	9	9
ground (PMU fan)	16	1	1

4.3 Signal Path

This section details what happens to an audio signal as it passes through the various processes within a base station, either from the RF input to the system interface, or from the system interface to the RF output.

Figure 4.10on page 84 shows the four main components of a single 50W VHF base station: the reciter, PA, PMU and control panel. Figure 4.11 on page 85 and Figure 4.12 on page 86 provide the same information for UHF base stations.

The majority of all Tx/Rx signal processing is performed within the reciter. All receiver functionality occurs within the reciter while the PA provides RF amplification of the modulated signal to be transmitted.

The reciter sections of Figure 4.10, Figure 4.11 and Figure 4.12 show the entire reciter, which is then broken down into the individual digital, RF and system interface boards. In the digital board, the solid line shows the functions provided by the DSP (Digital Signal Processor).

Also refer to "Circuit Description"on page 17 for more detailed circuit descriptions of the individual sub-systems that make up the base station.

The following sections explain the basic operation of the base station by describing the basic signal paths.

Receiver Path

On the receiver side, an RF input signal is received via the RF input BNC connector, filtered, amplified then mixed down to the IF frequency. The IF signal is further filtered and then transferred from the RF to the digital board via a coaxial interconnection cable. On the digital board the IF signal is then sampled and further sample-rate-reduced by the DDC. The DSP then demodulates the signal and generates RSSI, SINAD and sub-audible signalling values and passes these to the RISC. The demodulated signal is then split and processed using the configured options as set by the user for Path A & Path B responses. The Rx crosspoint switch patches the recovered audio signals to the correct output paths, reflecting the current status of the receiver.

The final received signal is then set to CODECs which convert the digital signal back to audio. The system interface board provides level adjustments and final output impedance buffering. The signal finally appears as audio signals on the rear panel interface connector.

Transmit Path

Audio signals presented to the system interface connector on the system interface board are buffered and level-converted based on the user input gain settings. These signals are then passed to the digital board and digitized via the CODECs, read into the DSP, and passed to the Tx crosspoint switch. Microphone audio is passed into the Tx crosspoint switch from the control panel via the system control bus. Based on the current base station status, the different audio inputs can be fed into either path A or B, which are then further processed depending on the user-configured path options. Audio from both paths is then added together and processed via the channel limiter/low pass filter. This signal then has any sub-audible signalling added to it that is needed for the active channel before it is sent to the FCL (Frequency Control Loop). The FCL performs a dual point modulation process to modulate the VCXO and exciter VCO simultaneously. The final modulated carrier signal is then buffered and passed, along with the DC PA_KEY signal, to the PA (Power Amplifier) via an SMA interconnection cable.

The PA detects and keys the PA based on this DC signal, also amplifying the +11 dBm input signal from the reciter to the final RF output power, which is determined by the current channel output power setting. The amplified RF output signal is then processed through a harmonic filter and a directional coupler. The direction coupler provides power level information to the PA to monitor and respond to the VSWR conditions on the PA output.

Clock Processing

The reciter reference clock can be selected from an external or internal source (external reference or internal TCXO). Once the clock source has been selected (based on the configuration and current operating status of the base station), the 12.8 MHz signal is passed from the RF board to the digital board. On the digital board, the 12.8 MHz signal is used by the CODECs, and also generates the 40 MHz clock for the DSP/RISC. This clock structure ensures all clocks on the reciter are phase locked together to limit possible clock interference from unlocked clock sources, generating interference or deaf channels.

Direct Signal Paths

It is possible to bypass a lot of the signal processing within the DSP on both the Tx and Rx paths via user configuration. The demodulated audio signals can be fed directly to the output CODECs, and the transmit CODEC inputs are connected directly to the modulator. This allows wide band audio signals to be processed via external equipment, if required, without the DSP overheads usually needed for path A and B audio processing.

Digital I/O

The bottom of the reciter section of Figure 4.10 shows the time-critical RX_GATE, TX_KEY and COAX RELAY signals that interface directly with the RISC. Less time-critical signals, such as digital I/O, interface to the RISC via a synchronous serial I/O interface.

Module Communication Paths

The reciter RISC supports two main inter-module communication paths: an asynchronous (RS-232) path to the control panel and a synchronous (I^2C) interface to all other modules and the control panel. Both of these paths are interconnected via the system control bus cable on the front of the modules.

The RS-232 signals from a connected computer or modem are buffered and sent to the reciter on-board UART via the system control bus. The system control bus uses an open collector TTL interface.

The inter-module I^2C bus provides a path for the RISC to communicate with all other modules and the control panel. This supports module alarms, diagnostics, monitoring and control panel LED/keypad traffic.

The Power Management Unit (PMU)

The PMU section of Figure 4.10 shows the major functional blocks of the PMU. Each converter is under the control of the PMU microprocessor, which is also under the control of the reciter RISC processor via the I^2C communication path.

The high current DC-DC converter and high efficiency standby card are both powered directly from the DC input. This means that the high power DC converter can be switched off to conserve power when not transmitting during modes.

The HVDC control and microprocessor card also provides current sources (effectively pull-up resistors) for the system control bus I^2C inter-module communications path.

4.4 Power Distribution

This section details how the input power feed is distributed throughout the base station to power its various sub-systems. The high level block diagrams in Figure 4.4 on page 58 show the power distribution paths in single and dual base stations, while Figure 4.9on page 83 provides more detailed information on a typical single base station. Also refer to "Circuit Description"on page 17 for more detailed circuit descriptions of the individual sub-systems that make up the base station.

The TB8100 can receive input power from either the AC or DC input. Internal seamless switching between the AC or DC input ensures there are no power interruptions should a changeover occur between the two inputs. The base station will default to the AC input if both AC and DC inputs are provided.

The AC converter has a series switch which isolates the mains input from the converter. The DC input, however, has much higher current ratings, and supports an on/off switch on the converter only.

The outputs from both the AC and DC high power converters are added together and fed to the PA via the PA1 and PA2 outputs. The auxiliary output is also tapped off this summed output.

When a DC module is fitted, a high efficiency standby card can be used to power up the receiver circuitry. If required, the high power but low efficiency converters can then be disabled, saving considerable power during periods of no channel activity, by using the standby card to power the reciter more efficiently.

Base stations fitted with a 12V PA do not require a PMU. In this case the DC input is connected directly to the PA, where it is fed to the internal boost regulator board. This board provides a 12VDC output for the reciter and a 28VDC output for the PA circuit boards.

The reciter input power feed is distributed to all internal reciter boards. Local regulation ensures that noise and common mode interface signals are kept to a minimum between sub-assemblies. Various power supplies in the reciter further power and isolate critical sub-sections.

The reciter also powers the control panel, via a backpower protection diode. The system control bus is used to route power to the control panel, thus whenever a reciter is powered, and plugged into the control bus, if a control panel is connected there will always be a reciter present to drive the control bus functions.

Reciter Power Control Signals

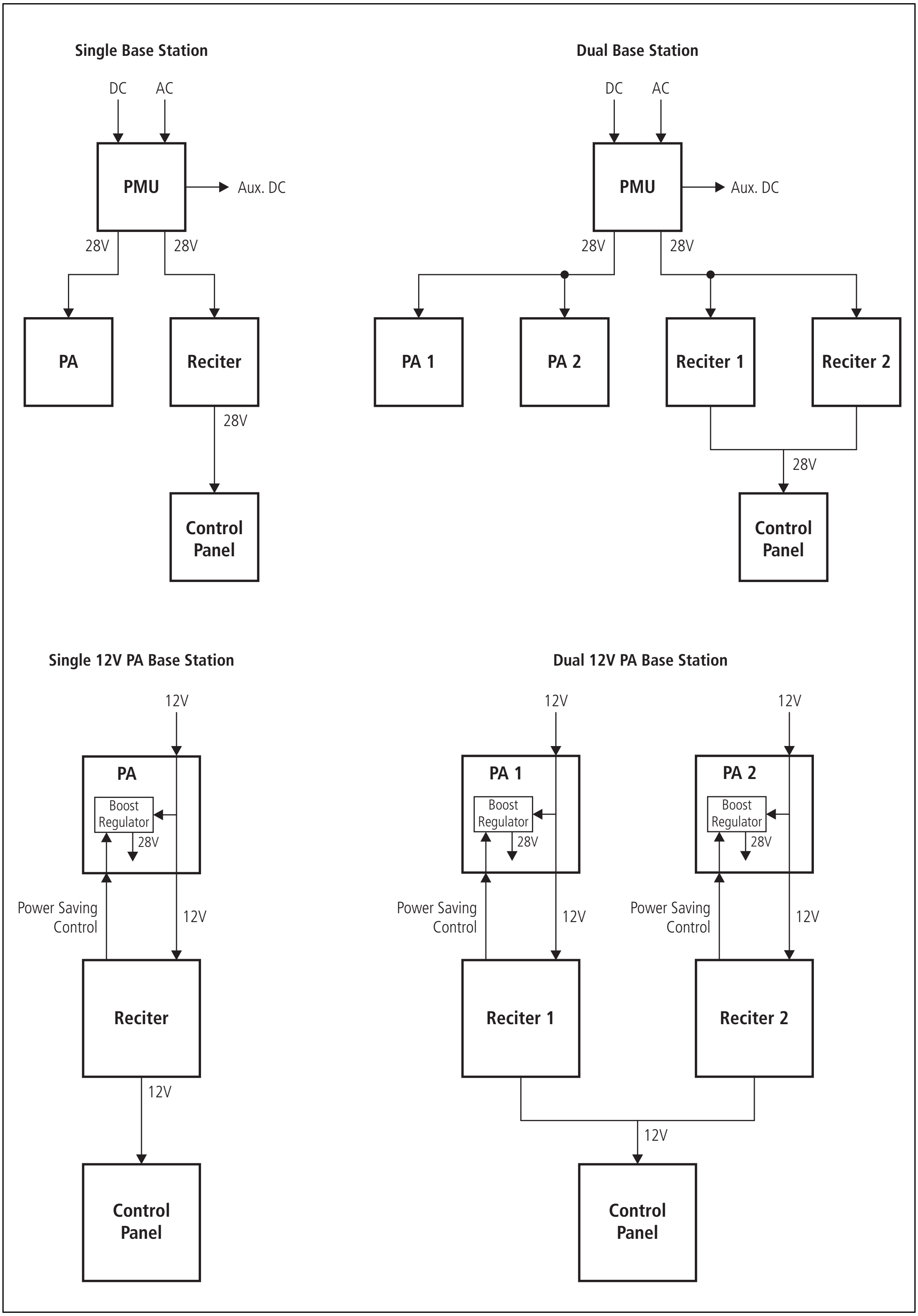
The power control signals PWD_EX, PWD_RX and PWR_ON (refer to Figure 4.9 on page 83) are control lines internal to the reciter that originate from the DSP on the digital board and are distributed to the RF and system interface boards. These lines allow the power control software to selectively turn on or off different reciter circuit blocks depending on the depth of power savings configured.

PWD_EX controls the circuitry associated with the exciter RF path, such as the exciter buffer amplifier, VCO and synthesizer.

PWD_RX controls the circuitry associated with the receiver RF path, such as the receiver VCO and synthesizer.

PWR_ON turns off all non-critical control logic that is not required to maintain a minimum level of RISC and DSP activity. This ensures a timed power-up and activity cycling process. The RF and system interface board are shut down completely.

Figure 4.4 Base station power distribution high level block diagrams



4.5 PMU Operation on DC Input

The operation of the PMU on DC input is controlled by three sets of parameters:

- user-programmable alarms
- user-programmable startup and shutdown limits
- battery protection limits.

The voltage range for each of these parameters is provided in Table 4.1 on page 60. Figure 4.5 on page 61 illustrates how these parameters interact, and how they control the operation of the PMU over a range of DC input voltages.

Alarms

User-programmable alarms can be set for low or high battery voltage. The alarms will be triggered when the set voltage levels are reached. These limits are subject to the tolerances of the battery protection circuitry, as stated in "Battery Protection (Fail-safe) Limits" in Table 4.1 on page 60.

To set the alarms, run the Service Kit and select Configure > Alarms > Thresholds. In the Thresholds form, enter the required minimum and maximum values in the **PMU battery voltage** fields.

Startup and Shutdown Limits

The user-programmable startup and shutdown limits allow for adjustable startup and shutdown voltages. These limits can be adjusted for different numbers of battery cells, or for the particular requirements of the base station operation. Once the limits are reached, the PMU will shut down. These limits are subject to the tolerances of the battery protection circuitry, as stated in "Battery Protection (Fail-safe) Limits" in Table 4.1 on page 60.

To set the startup and shutdown limits, run the Service Kit and select Configure > Base Station > Miscellaneous. In the Power Configuration area, enter the required values in the **Power shutdown voltage** and **Power startup voltage** fields.

> **Notice** The default startup voltage values in the Service Kit will not allow the PMU to start up when the battery is below its nominal voltage. However, PMUs with hardware version 00.03 and later, firmware version 02.09 and later, in conjunction with Service Kit version 03.07 and later, allow the user to set the startup voltage below the nominal voltage of the battery. Continuing to use a battery for extended periods when it is below its nominal voltage will severely shorten its service life. For more information on battery management, we recommend that you consult the battery manufacturer.

Battery Protection Limits

The battery protection limits are set in hardware at the factory, and cannot be adjusted by the user. These limits will not be reached under normal operation conditions, but are provided as “fail-safe” measures to protect the battery from deep discharge. They also remove the need for low-voltage disconnect modules.

Table 4.1 PMU DC voltage limits[a]

Parameter	Voltage Range		
	12V PMU	**24V PMU**	**48V PMU**
User-programmable Alarms[b] Low Battery Voltage High Battery Voltage	 10V to 14V 14V to 17.5V	 20V to 28V 28V to 35V	 40V to 56V 56V to 70V
User-programmable Limits[bc] Startup Voltage (after shutdown) Shutdown Voltage	 10.9V to 15.0V ±0.3V 10V to 13.5V ±0.3V	 21.8V to 30V ±0.5V 20V to 27V ±0.5V	 43.6V to 60V ±1V 40V to 54V ±1V
Battery Protection (Fail-safe) Limits Startup Voltage Undervoltage Shutdown Overvoltage Shutdown Overvoltage Shutdown Reset	 10.8V ±0.2V 9.5V ±0.3V 18.1V ±0.3V 17.1V ±0.3V	 21.6V ±0.5V 19V ±0.5V 36.2V ±0.5V 34.2V ±0.5V	 43.2V ±1V 38V ±1V 72.4V ±1V 68.4V ±1V

a. The information in this table is extracted from the Specifications Manual. Refer to the latest issue of this manual (MBA-00001-xx) for the most up-to-date and complete PMU specifications.

b. Using the Service Kit software.

c. These limits are subject to the tolerances of the battery protection circuitry, as stated in “Battery Protection (Fail-safe) Limits”.

Indicator LEDs

The indicator LEDs on the front panel are used to indicate the state of the PMU and its microprocessor. There are two LEDs, one red and one green. Each LED can be on, off, or flashing at two rates (fast or slow). The state of these LEDs can indicate a number of operating modes or fault conditions, as described in Table 4.2 on page 62.

Figure 4.5 PMU alarm thresholds and voltage limits when operating on DC

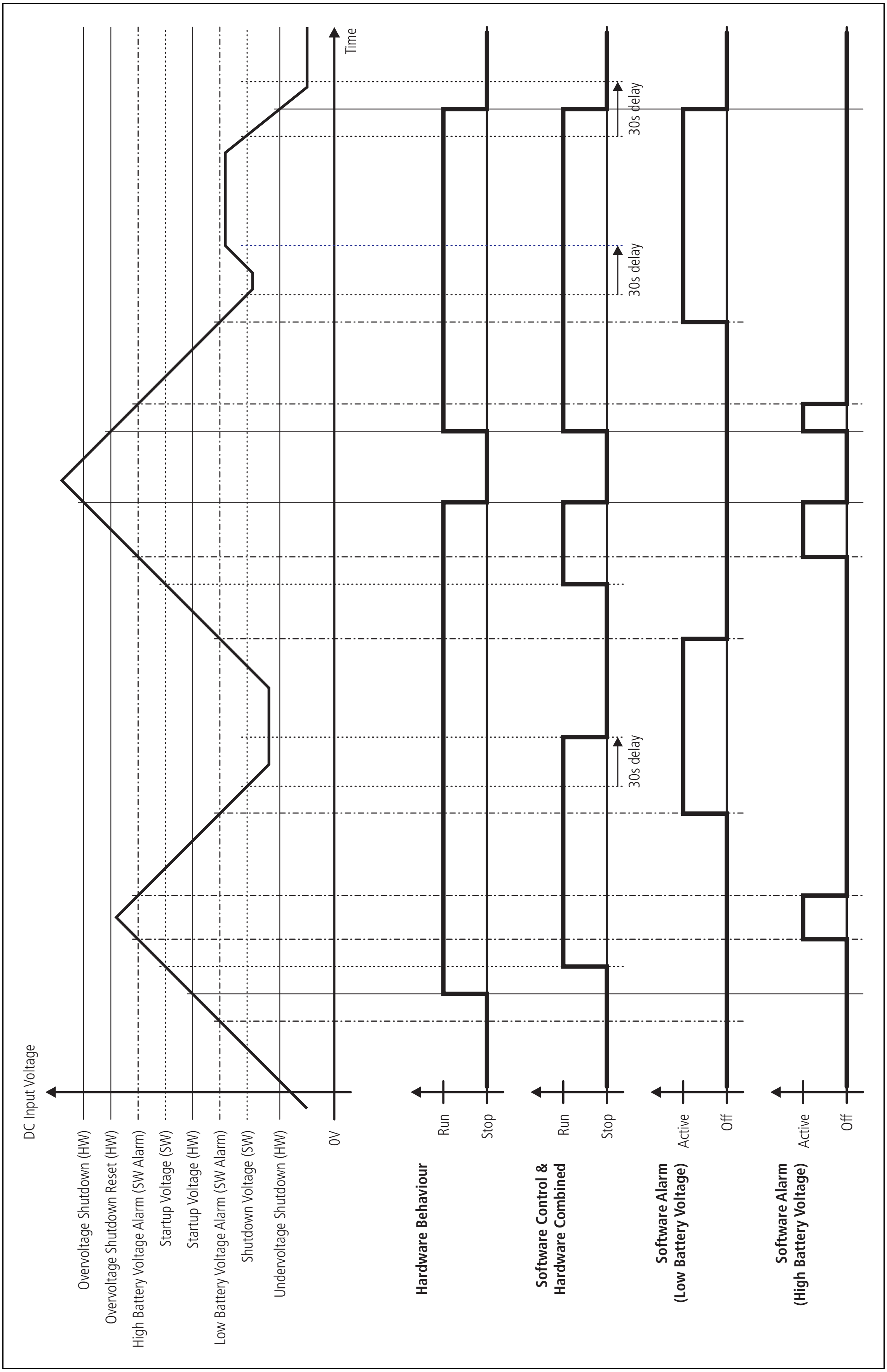


Table 4.2 PMU indicator LED states

Green	Red	PMU condition
off	off	power off (input above or below safe operating range)
flashing (3 Hz)	off	no application firmware loaded; use the Service Kit software to download the firmware
on	off	the microprocessor is operating; no alarm detected
on	flashing (3 Hz)	one or more alarm conditions detected: ■ output is overvoltage ■ output is undervoltage ■ output is current-limiting ■ overtemperature ■ mains failure ■ battery voltage is low ■ battery voltage is high ■ shutdown is imminent ■ DC converter is faulty ■ battery is faulty, or DC converter is switched off ■ auxiliary power supply is faulty ■ PMU is not calibrated ■ self-test has failed ■ PMU is not configured
flashing (on 300 ms, off 2700 ms)	flashing (on 300 ms, off 2700 ms)	PMU is in battery protection mode
flashing (on 300 ms, off 4700 ms)	flashing (on 300 ms, off 4700 ms)	PMU is in Deep Sleep mode
flashing (3 Hz)	flashing (3 Hz)	Service Kit LED test - LEDs flash alternately

4.6 Data, Control and Monitoring Paths

This section describes the types of data and the methods used to move the data around a base station. Refer to Figure 4.13on page 87 for more information.

The reciter RISC is the central command and control entity in a base station. As such it will often command modules to change state, based on the information received in a module poll message reply. Messages from the reciter over the I^2C bus can control actions in the PA and PMU hardware, such as changing Hysteresis mode in the PMU based on the current status of any active power cycling modes, or reading the ambient temperature via the PA module.

Serial Service Kit communications are transferred from the attached serial device (e.g. a personal computer running the Service Kit), buffered on the control panel and passed into the RISC's UART.

Inter-module communications traffic (for example monitoring, diagnostics and firmware download messages) is passed between the reciter and PA/PMU via the I^2C bus, which runs a Tait proprietary protocol. The reciter acts as a router, in that messages to and from the PA and PMU are passed through the reciter between the UART and I^2C ports.

When each PA/PMU module powers up for the first time, it requests the RISC, via the I^2C bus, to allocate a unique address to that module for use across the I^2C bus. Each module on the I^2C bus must have a unique address. The reciter assumes "primary" status, while all PAs and PMUs assume "secondary" status. Consequently, the reciter polls modules and the modules reply, forming a poll-response architecture with unique addresses and associations.

There is no information passed over the system control bus that is real-time dependent. All real-time processing needs, such as fault recovery for all modules, are supported by the microprocessor present in each module. The only real time signal in the system is the PA_KEY signal that is passed between the reciter and the PA. This signal is a critical part of the TX_KEY ramp up and down operation and is summed with the exciter RF output to the PA over the coaxial interconnection cable.

For example, when a TX_KEY signal is passed to the reciter system interface board, the following actions occur:

1. The TX_KEY signal is read and processed by the RISC microprocessor which, depending on the configuration and status of the reciter, will then initiate a transmission.
2. The RISC will instruct the DSP via the host port to initiate a transmission and start modulating the RF carrier.
3. The DSP will enable the PA_KEY line to the PA microprocessor.
4. The PA microprocessor will then initiate a controlled PA output ramp up.

Depending on the channel selected for the transmission, the RISC will also re-configure the synthesizer as required, though this does not automatically occur at the start of a Tx/Rx event.

At an appropriate time, the reciter's RISC processor will poll the PA and PMU modules for their status (including any alarm conditions) and process the results accordingly. Whenever a user selects a PA/PMU monitor or diagnostic screen in the Service Kit, the information is read from that module via the I^2C bus. It is then transferred through the RISC and passed to the Service Kit computer using the Tait proprietary Service Kit protocol over the serial port.

The PA and PMU sections on Figure 4.13 show most of the monitored parameters in each module and the control outputs from the microprocessors, which are also available to the reciter RISC via the I^2C bus and form the basis of the TB8100 monitored alarms.

Each reciter, PA and PMU module also stores the following information specific to that module:

- calibration parameters
- serial and product number
- factory configuration.

This ensures that the module is a true entity in its own right, thus helping to support simple "plug and play" site module replacement procedures.

The control panel provides several important functions. Depending on the control panel version these functions include, but are not limited to, the following:

- an interface point to monitor and respond to failure alarm outputs from the fans
- a point to read key presses and display base station status on output LEDs
- speaker control and amplifier for on-site monitor audio.

All control panel logic inputs and outputs are implemented by using an I^2C port expander that performs a serial (I^2C) to parallel conversion (and vice versa) over the I^2C bus. The control panel port expanders are fixed address 8-bit input and output interfaces. The heaviest user of the I^2C bus is actually the control panel keypad read polls which occur on average every 50ms.

4.7 Fan Operation

The cooling fans are mounted on the front panel. One fan is in front of the PA and another in front of the PMU. The fans do not operate continuously but are switched on and off as needed by the reciter firmware. When the base station is switched on, both fans come on for a short time and are then normally switched off. The operation of the PA fan is configurable via the Service Kit but the PMU fan is not. It has fixed on/off thresholds and a defined set of duty cycles based on the PMU temperature, as in the following tables, depending on PMU version:

Table 4.3 Fan Duty Cycles for PMUs version 3.13 and earlier

PMU Temperature	Current	Fan Duty Cycle
<149°F (65°C)	<6A 6A–8A 8A–10A 10A–12A 12A–14A ≥15A	always off 2 minutes on, 8 minutes off 2 minutes on, 6 minutes off 2 minutes on, 4 minutes off 3 minutes on, 1 minute off always on
149–167°F (65–75°C)	—	two minutes on, one minute off
>167°F (75°C)	—	always on

Table 4.4 Fan Duty Cycles for PMUs version 3.14 onwards

PMU Temperature	Current	Fan Duty Cycle
<149°F (65°C)	<4A 4A–6A 6A–8A 8A–12A 12A–14A ≥15A	always off 2 minutes on, 8 minutes off 2 minutes on, 5 minutes off 3 minutes on, 3 minutes off 4 minutes on, 1 minute off always on
149–167°F (65–75°C)	—	two minutes on, one minute off
>167°F (75°C)	—	always on

The other reason that a fan may be started is when the temperature sensor fails to get a reading.

Fans used in the base station must have the correct wiring: power and ground (2-wire fans), or power, ground and rotation detect (3-wire fans). Both fans in the subrack must be of the same type.

If 3-wire fans are fitted, the reciter can monitor whether the fans are rotating and generate an alarm if the fan fails. Refer to the Service Kit and Alarm Center documentation for more details. Refer also to "Single and Dual Base Stations" on page 46 for information on the constraints of fan rotation detection in dual base stations.

4.8 Power Saving

Base stations can be equipped with Power Saving. This set of sophisticated current-reducing measures is made available through the optional Power Saving Modes licence. Under the control of the reciter, all modules in the subrack work together to offer many levels of current reduction. The receiver circuitry can cycle on and off, parts of the PA circuitry can be switched off, and the PMU can enter a power-saving Hysteresis mode or even shut down its main DC-DC converter. These measures can achieve a dramatic reduction in power consumption during idle periods.

Power Saving is available for 5 W, 50 W and 100 W base stations. There can only be one base station in the subrack and most Power Saving measures are only available when the base station is running on battery power. Dual base stations cannot have Power Saving, but they can be configured to provide modest reductions in current consumption. The same configuration can be used for single base stations without a Power Saving licence. This brings their power consumption in line with the Tait T800 range.

Two hardware items are needed to maximise the amount of power that the base station can save. The Power Save Control Panel (for further information, see "Power Save Control Panel"on page 36) is designed for base stations with Power Saving; most of its circuitry can be switched off. The PMU standby power supply card enables it to run in Hysteresis mode or to turn off its DC-DC converter.

Power Saving is implemented in three different modes: Normal, Sleep, and Deep Sleep. This makes it possible for the extent of the power saving measures to vary depending on the amount of traffic on the channel. Each mode combines a number of power saving measures and is enabled and configured through the Service Kit.

4.8.1 Power Saving Measures

The following describes the different ways that the modules of a Power Save base station are able to reduce their power consumption. Service Kit users select these measures indirectly by selecting values for the Rx cycling time and the Tx keyup time.

Receiver Signal Path Cycling

The receiver can be cycled off for a user-definable time, then switched back on. If a signal is detected, the receiver stays on, otherwise it cycles off again. There are two levels of cycling: the first involves only the receiver, the second involves most circuitry in the reciter.

If the Rx cycling time is 100 ms or less, only the PWD_RX power rail is turned off. This turns off the receiver front end, receiver ADC (Analog to Digital Converter) and DDC (Digital Down Converter). Once the cycling time has elapsed, the following occurs:

1. The DSP turns on the PWD_RX power rail.
2. The DSP initializes the DDC. This results in a working receiver.
3. The DSP measures the RSSI to see whether there is a signal on the channel.
4. If the RSSI does not exceed the threshold, the DSP turns the power rail off.

The whole process takes about 10ms.

If the Rx cycling time is greater than 100ms, more circuitry (including the receiver VCO) cycles on and off. In this case, the DSP turns the PWD_RX and the PWR_ON power rails off (see "Power Distribution"on page 56 for more information about reciter power rails). Once the cycling time has elapsed, the following occurs:

1. The DSP turns the PWR_ON rail back on and tells the RISC.
2. The RISC programs the receiver synthesizer and waits for it to lock. This takes around 20ms.
3. The RISC tells the DSP that the synthesizer is locked.
4. The DSP turns on the PWD_RX power rail back on, and the process continues as for receiver cycling above.

Transmitter Keying

Normally, the PA uses special Fast Key circuitry to give a fast but controlled ramp-up of the PA's power output. In Sleep and Deep Sleep modes (and in Normal mode, with a Tx keyup time of 5ms or longer), this function is disabled by turning off the PA 10V power rail (see "Power Distribution"on page 56 for more information about power rails). This turns off most of the PA analogue circuitry. The process of keying the transmitter then works like this:

1. The PA receives a PA_KEY_COAX signal instructing it to key up. This is a DC signal on the coaxial cable that goes from reciter to PA.
2. The PA microprocessor turns the 10 V power rail on, and then waits for 20-30 ms for the regulator to stabilise the power.
3. The microprocessor sets the power level.
4. The microprocessor provides its usual ramping signal. This has the form of a raised cosine.

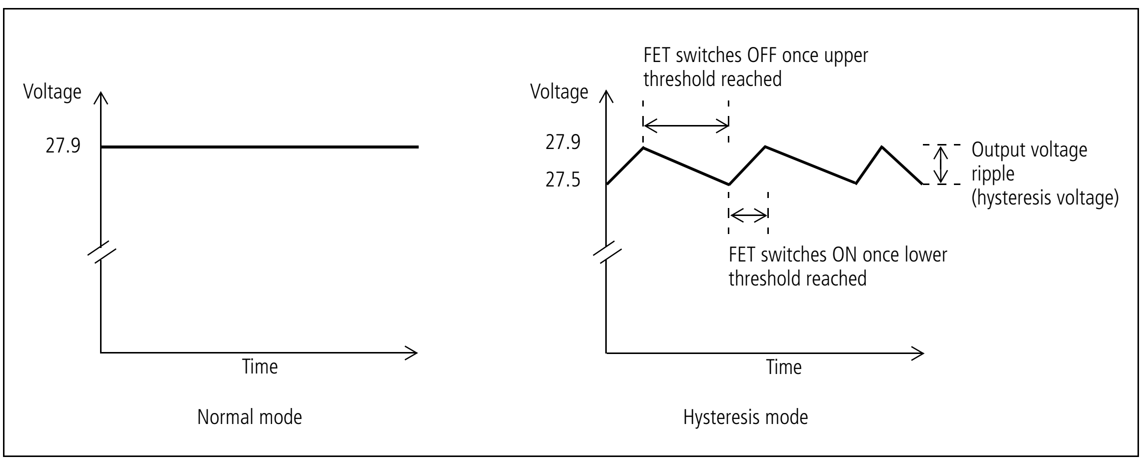
PMU Hysteresis Mode

Hysteresis mode is the first means of reducing current consumption in the PMU. It requires a PMU standby power supply card and is not available if the PMU's auxiliary power output is on.

While the PMU DC converter is highly efficient for output currents in the range of 1-15 A, it is not efficient for low output currents. This is mainly due to the current drive requirements for the heavy-duty switching FETs (field effect transistors).

Hysteresis mode resolves this issue by setting the output voltage to swing between two fixed levels. This allows the FETs drive signal to be turned off for periods of time. The FET off time is dependent on the load current drawn. Figure 4.6 on page 68 illustrates the output voltages for the PMU DC converter in both normal and Hysteresis modes.

Figure 4.6 DC converter output voltages in PMU operation modes



You can confirm whether the PMU is in Hysteresis mode by connecting an oscilloscope to the PMU's 28 V output power connector. You should see the voltage ripple.

Hysteresis mode is used only when the base station is not transmitting. The ripple generated by Hysteresis mode does not degrade the performance of the receiver. However, when the base station is transmitting, Hysteresis mode is turned off because the PA should never transmit with the ripple voltage present.

PMU Standby Operation

In Deep Sleep mode, the second means of reducing PMU current consumption takes effect. The PMU microprocessor turns the DC-DC converter off, removing all power to the PA. Only the reciter and the control panel receive power (see Figure 4.9 on page 83 for details).

The PA LEDs go off. The PMU's green Power LED also goes off, but the red Alarm LED flashes briefly about every 20 seconds (these LEDs are only visible when the subrack front panel is removed).

Control Panel Shutdown

In Sleep and Deep Sleep modes, the reciter instructs the Power Save control panel to shut down. This turns off most of its circuitry (fan detection, I^2C interface, RS-232). However, it is still monitoring the RS-232 lines for activity.

ⓘ The Power Save control panel does not shut down in Sleep and Deep Sleep modes if the reciter is fitted with a TaitNet RS-232 or High Density/RS-232 system interface board.

The red alarm LED goes off. This means that it cannot light up if an alarm is generated. If an alarm is present when the control panel shuts down, it cannot be displayed.

The Power LED flashes under hardware control to indicate that the base station is in Sleep or Deep Sleep mode.

If the base station needs to communicate with an Alarm Center, or a Service Kit attempts to connect, activity is detected on the RS-232 lines and the Control Panel turns itself on. Immediately after the Service Kit disconnects, the Control Panel shuts itself down again.

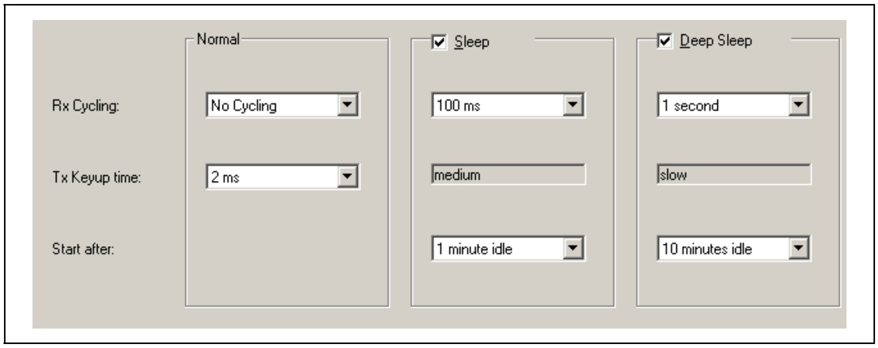
ⓘ The standard and dual base station control panels cannot shut themselves down, but their LEDs (except the Power LED) also flash in Sleep and Deep Sleep modes.

12V PA Operation

Power Saving is also available in base stations using a 12V PA. Both Sleep and Deep Sleep modes can be configured, with the same receiver cycling and Tx keyup options as a base station with a PMU. In Deep Sleep mode, the reciter shuts down the PA by shutting down the boost regulator board in the PA (refer to "12V PA Power Saving Control Connection" on page 155 for more information on this connection). The 12VDC output from the boost regulator board is unswitched and continues to power the reciter even when the rest of the circuitry on the board is shut down.

4.8.2 Power Saving Modes

The Power Saving Modes licence makes two power saving modes available: Sleep and Deep Sleep. The base station runs in Normal mode when there is activity on the channel but can transition to Sleep and/or Deep Sleep mode after it has been idle for a period of time.



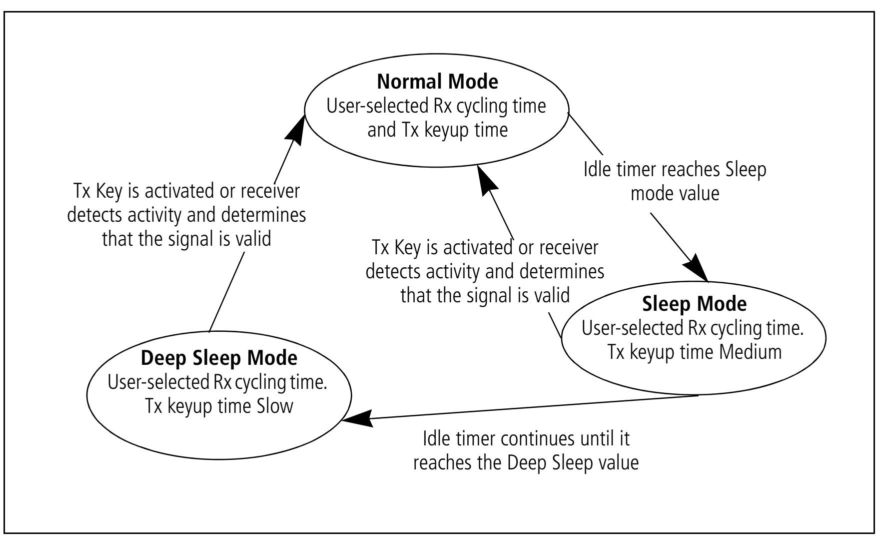
Once the base station's Power Saving Modes licence is enabled, you can use the Service Kit to enable and configure its Sleep and Deep Sleep modes (see the Service Kit online Help for details).

Each mode is defined by a receiver cycling time and a Tx keyup time and the values of these parameters determine which power saving measures are used. The transitions from Normal mode to Sleep and from Sleep to Deep Sleep modes are initiated by an idle timer.

Normal mode needs no enabling and can be configured without a Power Saving Modes licence. The configuration can involve no current reduction at all (no receiver cycling and the fastest possible Tx Keyup time), or a modest reduction to give similar performance to the T800.

The transitions between modes are shown in Figure 4.7. On startup, the base station operates in Normal mode. A timer starts as soon as there is no channel activity. PTT, front-panel carrier-only transmission, CWID bursts, and alarm tones do not count as activity, and can all occur in Sleep and Deep Sleep modes without affecting the timer.

Figure 4.7 Transitions between sleep modes



When the timer reaches the value set in the Service Kit (in the "Start after" box) for Sleep mode, the base station enters Sleep mode. If the receiver detects activity and determines that the signal is valid (or the Tx key line is activated), it reverts to Normal mode. Otherwise, the timer continues running.

When the timer reaches the value for Deep Sleep mode, the base station enters Deep Sleep mode.

If the base station is running on AC power, the timer operates as usual. However, the base station will continue to run in Normal mode, as configured in the Service Kit, even after reaching the value for Sleep or Deep Sleep mode. It only enters these modes after it has changed over to DC power. If it changes back to AC power, it returns to Normal mode.

4.8.3 Overview of Operation

The following tables show the receiver cycling times and Tx keyup times available for Normal, Sleep, and Deep Sleep modes and the power saving measures they correspond to. For more details on power and current consumption refer to the Specifications Manual (MBA-00001-xx).

Table 4.5 Power Saving measures selected by receiver cycling time

Power Saving Mode	Receiver Cycling	Reciter Power Rails		
		PWR_ON	PWD_EX	PWD_RX
Normal	No cycling	on	on	on
	5 ms	on	on	cycling
	10 ms	on	on	cycling
	20 ms	on	on	cycling
Sleep	No cycling	on	on	on
	20 ms	on	on	cycling
	50 ms	on	on	cycling
	100 ms	on	on	cycling
	200 ms	cycling	off	cycling
Deep Sleep	No cycling	on	on	on
	200 ms	cycling	off	cycling
	500 ms	cycling	off	cycling
	1 s	cycling	off	cycling
	5 s	cycling	off	cycling

Table 4.6 Power Saving measures selected by Tx keyup time

Power Saving Mode	Tx Keyup Time	PMU	PA
		28V Power	Fast key
Normal	2 ms[a][b]	on	enabled
	5 ms[a]	on	disabled
	20 ms[a]	on	disabled
Sleep	Medium	Hysteresis mode	disabled
Deep Sleep	Slow	off	n/a: PA is off

a. The Tx Keyup time you select using the Service Kit refers to the amount of time needed to key the transmitter AFTER the reciter detects valid RF or receives a Tx Key signal. The total time needed is increased by receiver cycling and varies according to where in the cycle the RF or Tx Key is applied. The reciter only looks for RF or Tx Key when the PWD_RX rail is on.

b. The **actual** Tx Keyup time may be slightly shorter or longer than this value. Refer to the Specifications Manual for further details.

Operational Constraints

Some base station configurations and functions are restricted or unavailable in Power Save modes. These operational constraints are listed below.

- The use of an external frequency reference is not supported in any Power Save mode.
- **Auxiliary power is available in Sleep mode, but not in Deep Sleep mode.**
- In a multi-reciter subrack with a PMU, the reciter in subrack position 1 can have Sleep mode enabled, but not Deep Sleep mode (refer to "Operational Constraints" on page 81 for more information).
- In a dual base station with a PMU, base station 1 can have Sleep mode enabled, but not Deep Sleep mode (refer to "Single and Dual Base Stations" on page 46 for more information).
- Hysteresis mode is only available if the auxiliary power output has not been turned on by Task Manager action.
- There may be a significant delay in the setting of digital outputs if PWR_ON is cycling. A change, such as the state of a digital input, is only read when the power cycles on. Task Manager carries out the action to set the digital output while the power is off, but this action only takes effect next time the power cycles on.
- During receiver cycling, the base station is unable to provide a continuous output on its audio output lines. When the receiver cycles off, so does its line output, even if the outputs are not gated.
- When a reciter is in Deep Sleep (mixed gate) mode, it will not respond until the received signal exceeds the set RSSI level.

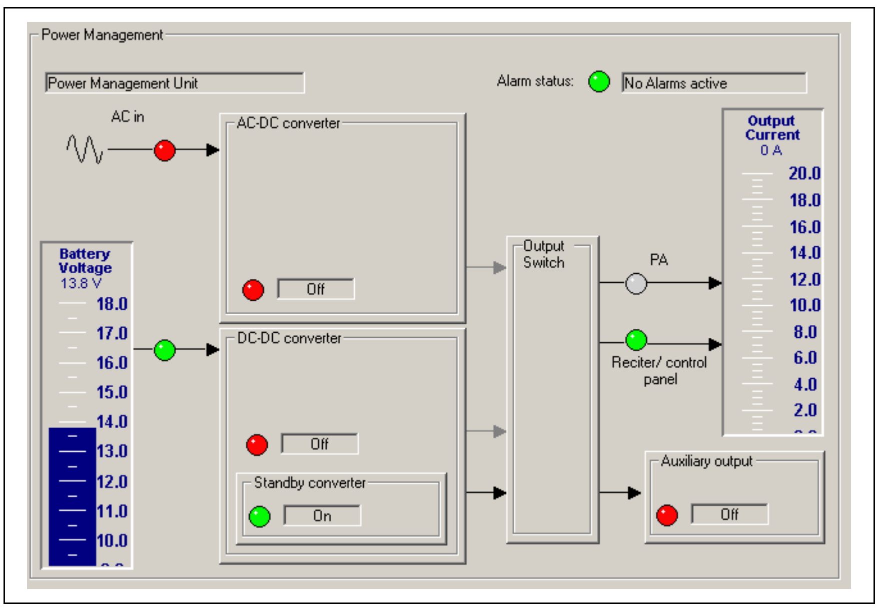
4.8.4 Using the Service Kit with Power Save Base Stations

You can connect the Service Kit to a base station in Sleep or Deep Sleep mode and log on. The reciter is still able to communicate with the Service Kit when powered by the standby power supply card. The control panel needs to wake up, but the rest of the base station does not change mode. The reciter can also initiate communications via the control panel to an Alarm Center.

You can use the Service Kit to monitor Power Save operation and see what power saving measures are currently active.

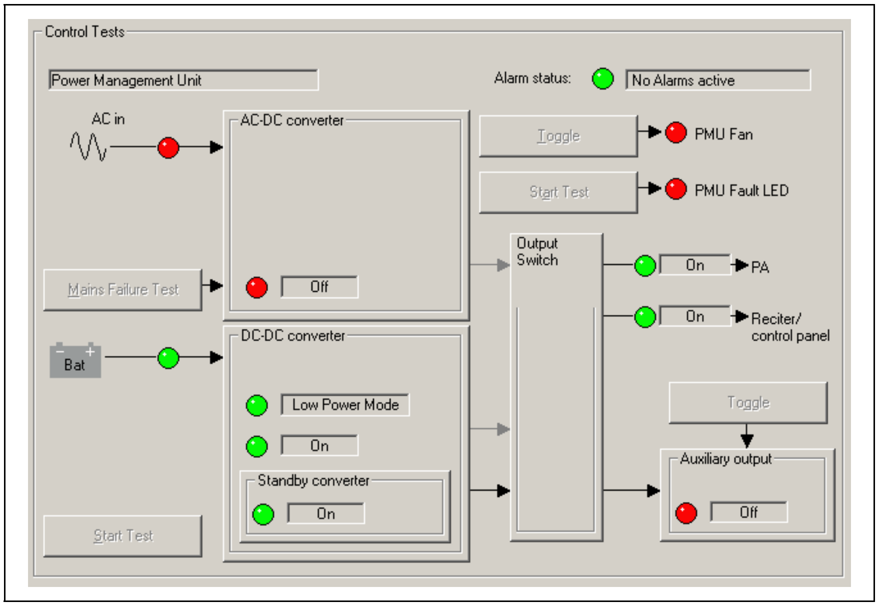
> **Notice** Displaying any PA monitoring or diagnostic screen turns the PA on. The PA stays on until the screen is closed. Make sure that you do not waste power by leaving any of these screens on.

A monitoring screen shows you whether the DC-DC converter has shut down. Select Monitor > Monitoring > Power Management.



The display shows that the DC-Converter is off, and that there is no power to the PA.

To check whether Hysteresis mode is active, select Diagnose > Power Management > Control Tests.



When the DC-DC converter display shows that Low Power Mode is on, the PMU is in Hysteresis mode.

4.8.5 Configuring Receiver Gating for Base Stations with Power Save

Settings for receiver gating can adversely affect Power Save.

In low-noise situations, Tait recommends that you use the default settings (RSSI disabled, SINAD enabled at 12 dB).

In high-noise situations, follow these guidelines:

- Use RSSI and SINAD gating.
- Set the RSSI level to be above the ambient noise level, for example −113 dBm (0.5 µV).
- Set the SINAD level as desired.
- Set the gating logic to OR.
- Have no receiver cycling in Normal mode.
- Set short idle times (for example 1 minute for Sleep mode and 10 minutes for Deep Sleep mode).

The background to these recommendations is as follows:

Receiver gating operates differently when the receiver is cycling. Whenever the receiver cycles on, it first measures the RSSI, even if its configuration disabled RSSI gating (this is because detecting the RSSI is very quick). If the RSSI exceeds the threshold, power stays on. (If the configuration doesn't specify a threshold, −117 dBm is used.)

If gating is configured for RSSI alone, the receiver unmutes straight away. If SINAD gating is enabled, the base station must first determine whether the

SINAD is above the threshold. If it is, the base station stays on, otherwise it returns to cycling in its existing mode.

To ensure the full benefits of power saving, it is important to use an RSSI level that prevents the base station unnecessarily turning the receiver on while it checks the SINAD. For example, if the RSSI gate is turned off, the SINAD gate is set to 20dB, and the receiver cycling time is 100ms, the following can happen in the presence of channel noise:

1. The receiver cycles on.
2. It detects a signal that is above the RSSI threshold.
3. It stays on for 100ms to check whether the SINAD is good enough.
4. The SINAD is too low, so the receiver cycles off.
5. 100ms later, it's time for the receiver to cycle on again and repeat the procedure.

The result is that the receiver is on for about 120ms out of every 220ms, instead of for about 20ms out of every 120ms.

The recommendations for noisy sites have the following effects.

- A high RSSI level means that the base station rarely wastes power by holding the receiver on to check the SINAD. (This may mean that users find it more difficult to gain access to the site. However, once they have access and the base station is in Normal mode, the relatively low SINAD makes access easy.)
- Receiver cycling in Normal mode is not selected so that the higher RSSI level is not required in order to open the gate.
- The 'OR' setting for gating logic provides optimal gating when the base station is in Normal mode: quick opening when the signal is strong, reliable opening when it is weaker.
- Short idle times maximise the proportion of time that the base station is in Sleep and Deep Sleep modes.

ⓘ If the base station is part of a CTCSS/DCS system, the base station will use additional power whenever it hears a signal with the wrong subtone. For example, if the receiver has the same settings as above, it would be on for 320ms out of every 420ms (a subaudible check can take up to 230ms). The only way to minimise the effects of this is to set a very long receiver cycling time, such as 5 seconds.

4.9 Ethernet Interface

The TaitNet Ethernet and High Density/Ethernet system interface boards provide the base station with an Ethernet interface, allowing it to be integrated into IP networks, for example those used for microwave links between sites (refer to Figure 6.21 on page 150).

The Service Kit supports Ethernet connection, allowing all its features such as configuration, firmware downloading, monitoring and diagnostics to be performed from any location where there is an IP connection to the site.

The TaitNet Ethernet and High Density/Ethernet system interface boards are designed for use with all TB8100 base stations, including paging, TaitNet trunking, and TaitNet QS^2 Simulcast. They support Computer Controlled Interface (CCI) commands, but do not support VoIP. They also support auto speed detection of either 10 or 100 base T.

The TaitNet Ethernet system interface board requires reciter firmware version 3.00 and later, and the High Density/Ethernet board requires reciter firmware version 3.07 and later. Both boards require hardware version 00.02 and later. PSTN Alarm Center dial-up and email services are disabled when either of these boards is fitted (refer to "Using Syslog Messages with Ethernet Connections" on page 172), but are still supported on other system interface boards.

Alarm Processing

Alarm processing has been enhanced from the solution previously available, which involved the use of a PSTN, asynchronous port switch, and Alarm Center. Base stations using an Ethernet connection cannot connect to an Alarm Center. Instead, the TaitNet Ethernet or High Density/Ethernet system interface board sends industry standard “syslog” TCP-IP messages to a syslog collector. The syslog collector then displays the alarm notifications and, depending on the actual collector used, can add further customized actions. Refer to "Using Syslog Messages with Ethernet Connections" on page 172 for further details on the syslog collector.

A typical process for fault management via Ethernet would be as follows:

1. A base station detects a fault and sends a syslog message to a syslog collector.
2. Depending on the particular syslog collector being used, the collector then:
   - Translates the message into an email notification for sending, based on various priority rules.
   - Generates audible warnings, etc., or translates the message into an SNMP trap for another SNMP-based notification service to use.
3. Once the fault has been notified, the Service Kit may be used to access the base station and diagnose the fault.

Ethernet and System I/O

The TaitNet Ethernet system interface board has an RJ45 Ethernet connector and an enhanced 15-way D-range connector. Some pins on the D-range connector can be configured to provide different signals. "TaitNet Ethernet" on page 146 has more information on these switch-selectable signals and the pin allocations of the D-range.

> ⓘ The pin allocations for the 15-way D-range connector on the TaitNet Ethernet system interface board are different from those of other TaitNet boards (refer to Table 6.3 on page 148).

The High Density/Ethernet system interface board has an RJ45 Ethernet connector and a high-density 26-way D-range connector. The D-range connector provides the standard inputs and outputs of the Isolated system interface. "High Density/Ethernet" on page 142 has more information on the pin allocations of this D-range.

Monitoring Heartbeats

Using the Service Kit you can configure the base station to send a regular heartbeat message. The interval between heartbeats can be set from one minute to 12 hours. This enhances network fault monitoring because, if the syslog collector fails to receive a periodic message from a base station, it can raise the appropriate alarm.

The heartbeat output is disabled when CCI mode is active, because it is expected that the remote device connecting to the base station will poll the base stations to validate the communications link. There is also no heartbeat if the Service Kit is connected.

Refer to "Using Syslog Messages with Ethernet Connections" on page 172 and the Service Kit documentation for more information.

> ⓘ Only one type of connection to a base station is possible at any one time (either the Service Kit, or syslog, or CCI).

Power Saving

Power Saving is still possible with the TaitNet Ethernet and High Density/ Ethernet system interface boards. However, the total power consumption will be slightly greater (for example, approximately 1 W more than the isolated system interface board).

4.10 Multi-reciter Subracks

4.10.1 Description of Operation

Refer to Figure 4.8 on page 80.

The multi-reciter subrack allows multiple receive-only reciters to be installed in a subrack. The multi-reciter subrack can accommodate one to five reciters with a PMU, or one to seven reciters with no PMU (refer to "Connection" on page 111 for more details).

ⓘ Reciters are numbered from right to left when viewed from the front of the subrack. Reciters should always be installed starting from the right-hand side of the subrack.

The important functions of the multi-reciter subrack are to:

- provide an integrated wiring solution for the system control bus and DC power connections to each reciter
- allow reciters to be replaced without affecting the operation of other reciters in the subrack[1]
- provide a means of connecting to and monitoring, configuring and diagnosing any reciter in the subrack
- allow the status of all reciters in the subrack to be monitored in real time.

Hardware

The multi-reciter configuration is made up of two special modules: the multi-reciter control panel and the multi-reciter subrack interconnect board. The control panel provides the user with some manual control of the reciters in the subrack, and can display status information for each reciter (refer to "Multi-reciter Control Panel" on page 37). The subrack board provides switching and control logic (refer to "Configuring the Subrack Interconnect Board" on page 162).

Reciters are installed in the subrack from right to left (viewed from the front), with the right-hand position corresponding to position 1 on the control panel. Only the reciter in position 1 can communicate with the PMU (if fitted).

The multi-reciter subrack interconnect board and control panel must be used together and cannot be used in other types of subracks. The connection between the control panel and subrack board is made with a high density 26-way D-range connector.

When power is applied to the subrack, the control panel will default to reciter position 1. When a PMU is fitted, power is connected to the PMU in the normal way. When no PMU is fitted, the DC input to the subrack is

1. You do need to power down reciter 2 before removing reciter 3. Refer to "Replacing the Reciter" on page 183 for more details.

connected to a terminal block mounted on the rear of the subrack (refer to "Power Supply Connections" on page 124).

Control Panel and Indicator LEDs

The multi-reciter control panel allows you to select which reciter is connected to the control panel. This reciter will then drive the status LEDs, and respond to inputs from the controls on the control panel. You can also connect to this reciter using the Service Kit (if the system interface board fitted to the reciter supports front panel connection - refer to "Service Kit Connections" on page 151 for more details).

ⓘ When a reciter is not fitted and that subrack position is selected, the status LEDs will reflect the status of the channel which was selected before the change was made. This is because there is no reciter present in the newly selected position to update or clear the status of the LEDs.

The channel LEDs use different colors to indicate the currently selected reciter, and to provide real-time status information for any reciter installed in the subrack (refer to "Multi-reciter Control Panel" on page 37). Any reciter can update (in real time) the channel LEDs to display one of two possible reciter status signals: Rx gate or alarm. Links on the multi-reciter subrack interconnect board allow you to choose which status signal (either Rx gate or alarm) is connected to the channel LEDs. Links on the control panel board also allow you to select which color (either red or green) will be used for the selected status signal; the other color will then be used to indicate the currently selected reciter. The default colors for TB8100 are green for Rx gate and red for alarm. If the LED for the currently selected reciter receives a status signal, it will change to orange. Refer to "Configuration" on page 161 for more information.

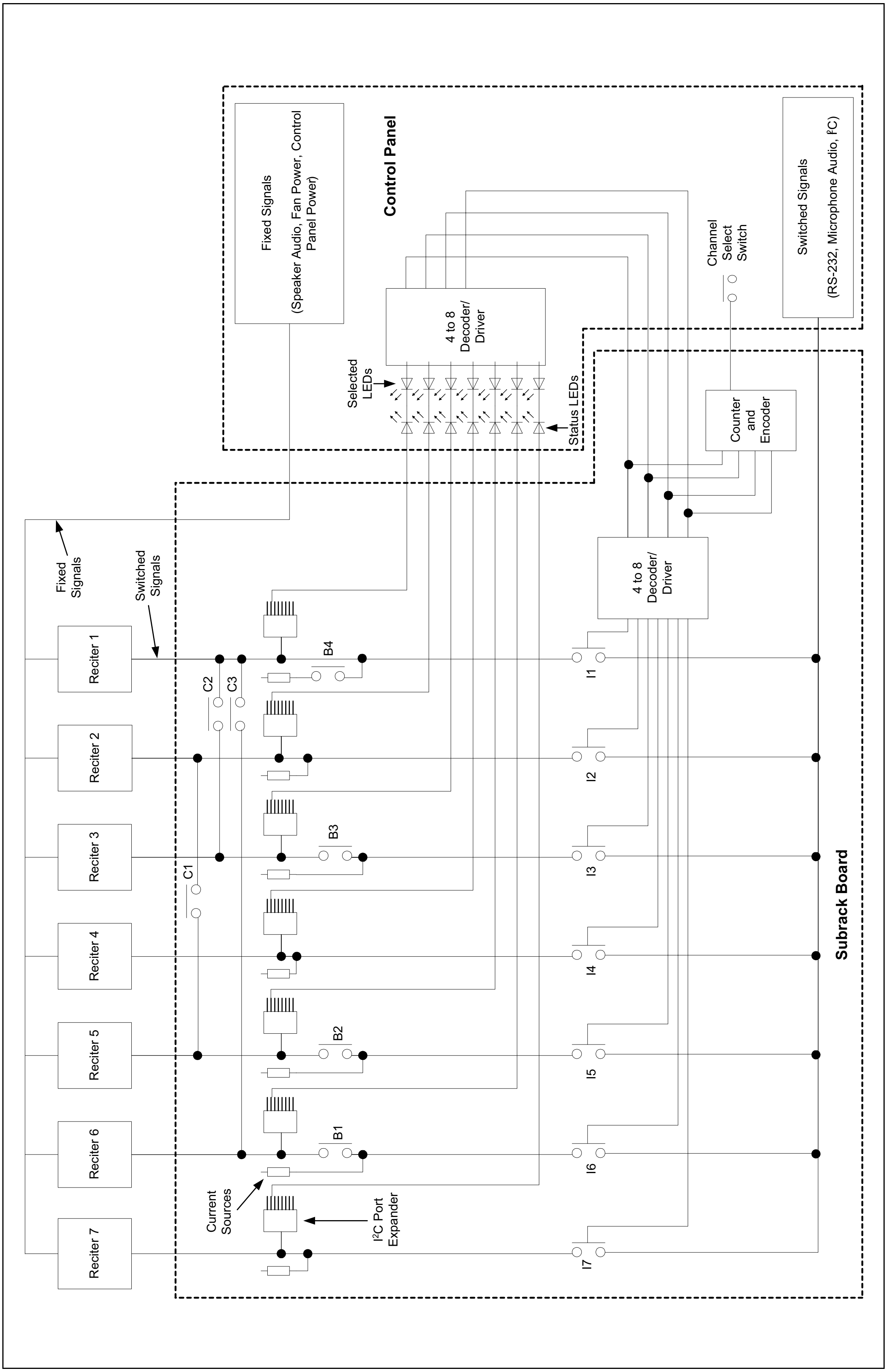
Audio

The speaker output is from the currently selected reciter only. Refer to "Speaker Button and LED" on page 38 for more details.

Power Saving

Power Saving is possible in the multi-reciter subrack, but with some limitations. Refer to "Operational Constraints" on page 81 for more details.

Figure 4.8 Multi-reciter functional block diagram



4.10.2 Operational Constraints

The multi-reciter subrack imposes a number of constraints on the operation of base station modules. These are listed below.

Reciter

- Only reciters with firmware version 3.00 or later can be used in a multi-reciter subrack. The control panel will not work with earlier versions of reciter firmware.

Power Saving

Notice If there is a PMU in the subrack, the reciter in subrack position 1 can have Sleep mode enabled, but not Deep Sleep mode. If Deep Sleep is enabled for reciter 1, it will turn off the power to all reciters in the subrack.

This is because the reciters in the multi-reciter subrack are powered from the PA DC output on the PMU. In Deep Sleep mode this DC output is turned off, which will power down all the reciters.

All other reciters in the subrack can have Sleep or Deep Sleep mode enabled.

Service Kit

- The Service Kit can only log on to the currently selected reciter via the control panel.
- As the PMU is associated with reciter 1, no PMU settings for reciters 2 to 7 will function. This includes the PMU battery voltage display, monitoring, diagnostics, and power management display.
- All PMU alarms for reciters 2 to 7 must be disabled (the alarm LEDs on the **Alarm** screen will therefore be grey).
- All PA alarms must be disabled. As there are no PAs in the subrack, all reciters will generate PA-related alarms.
- In the Configure > Base Station > Miscellaneous form for reciters 2 to 7, the **Power configuration** areas will display voltages of zero.
- The display of fan states in Diagnostic forms may be incorrect.
- Email and Alarm Centre outputs are only possible from the currently selected reciter (refer also to "Service Kit and Alarm Center Connections" below).

Recommended Service Kit Settings

The following Service Kit settings are recommended for multi-reciter operation.

1. In the Configure > Alarms > Alarm Control screen:
   - Disable the “No PA detected” alarm for all reciters.
   - Disable the “Fan failure” alarm for the PA for all reciters.
   - Disable the “No PMU detected” alarm for reciters 2 to 7 if a PMU is fitted. If no PMU is fitted, disable the alarm for all reciters.
   - Disable the “Fan failure” alarm for the PMU for reciters 2 to 7 if

a PMU is fitted. If no PMU is fitted, disable the alarm for all reciters.

2. In the Configure > Base Station > Task Manager screen:
   - On reciters 2 to 7 disable any Task Manager statements that use the "No PMU Detected" alarm input. If no PMU is fitted, do this for all reciters.
   - On all reciters disable any Task Manager statements that use the "No PA Detected" alarm input.
   - On all reciters disable any Task Manager statements that use the "Fan failed" alarm input. This will prevent false fan alarms if a multi-reciter subrack is operated with reciter 2 to 7 selected on the control panel.

Notice We recommend that you select reciter 1 on the multi-reciter control panel when you have finished monitoring or configuring a reciter. This will prevent false fan failure alarms being raised for the PA and PMU.

Service Kit and Alarm Center Connections

If you want to use the serial port on the control panel to connect to a reciter in a multi-reciter subrack, you must first select the reciter using the channel button. You cannot connect to the serial port on the control panel and then remotely select the reciter you want to connect to.

It is also impossible for any reciter that has generated an alarm to dial out to an Alarm Center if that reciter is not the currently selected reciter. If you do require dial-out access to an Alarm Center, or remote dial-in access to any reciter in the subrack, you will need to install reciters fitted with High Density/RS-232 or TaitNet RS-232 system interface boards. These boards will allow connection to any reciter in the subrack via the rear panel connector.

Additional information on remote monitoring is provided in Application Note TN-742-AN ("Remotely Monitoring and Configuring the TB8100 Base Station").

Alternatively, reciters can be remotely monitored, configured, and upgraded via an Ethernet connection using the TaitNet Ethernet or High Density/ Ethernet system interface boards. Note that reciters using an Ethernet connection cannot connect to an Alarm Center (refer to "Ethernet Interface" on page 76). More information on Ethernet connections is also provided in the "Connection" and "Configuration" chapters.

Figure 4.9 Base station power distribution

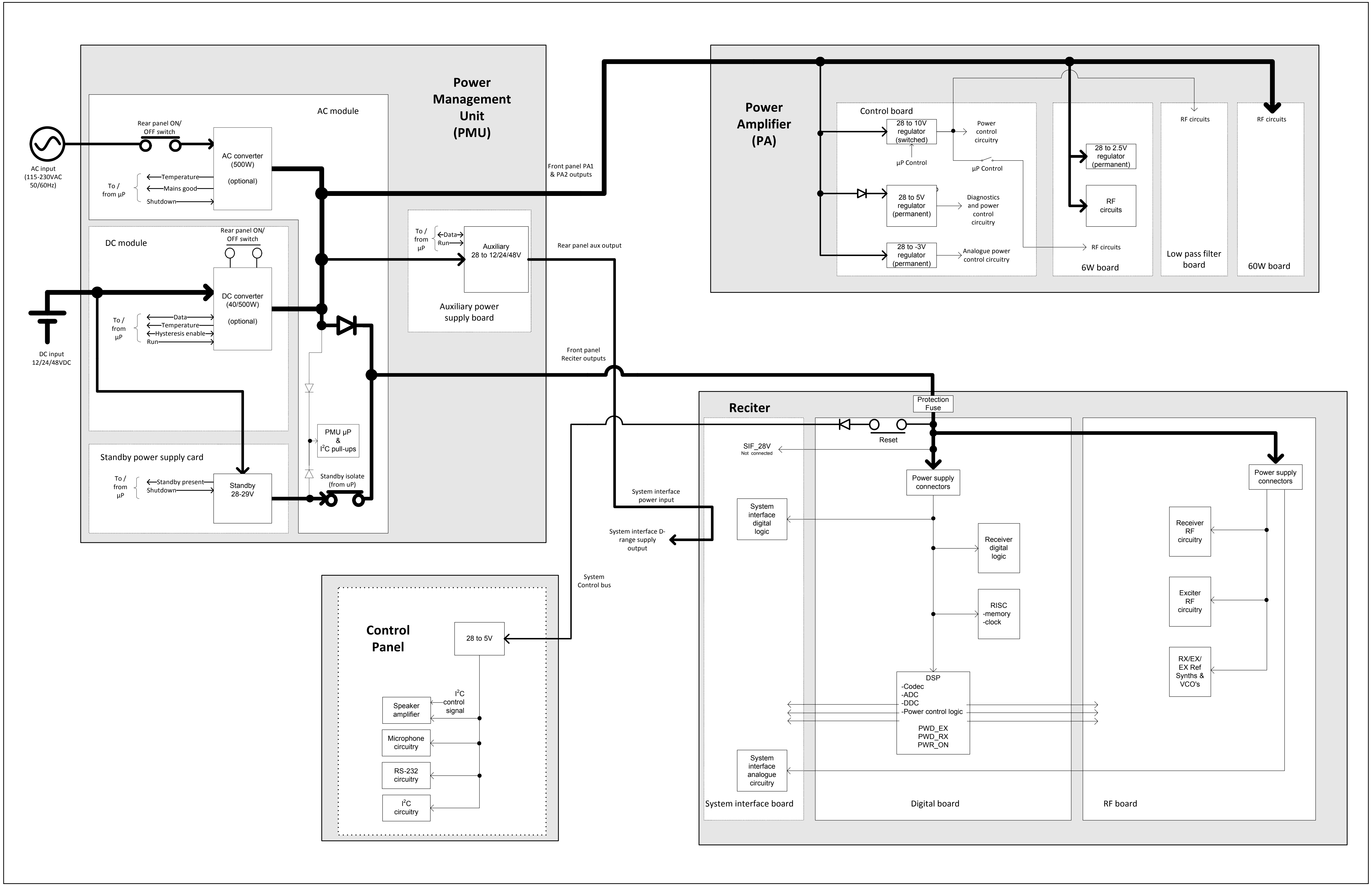


Figure 4.10 Base station VHF signal path

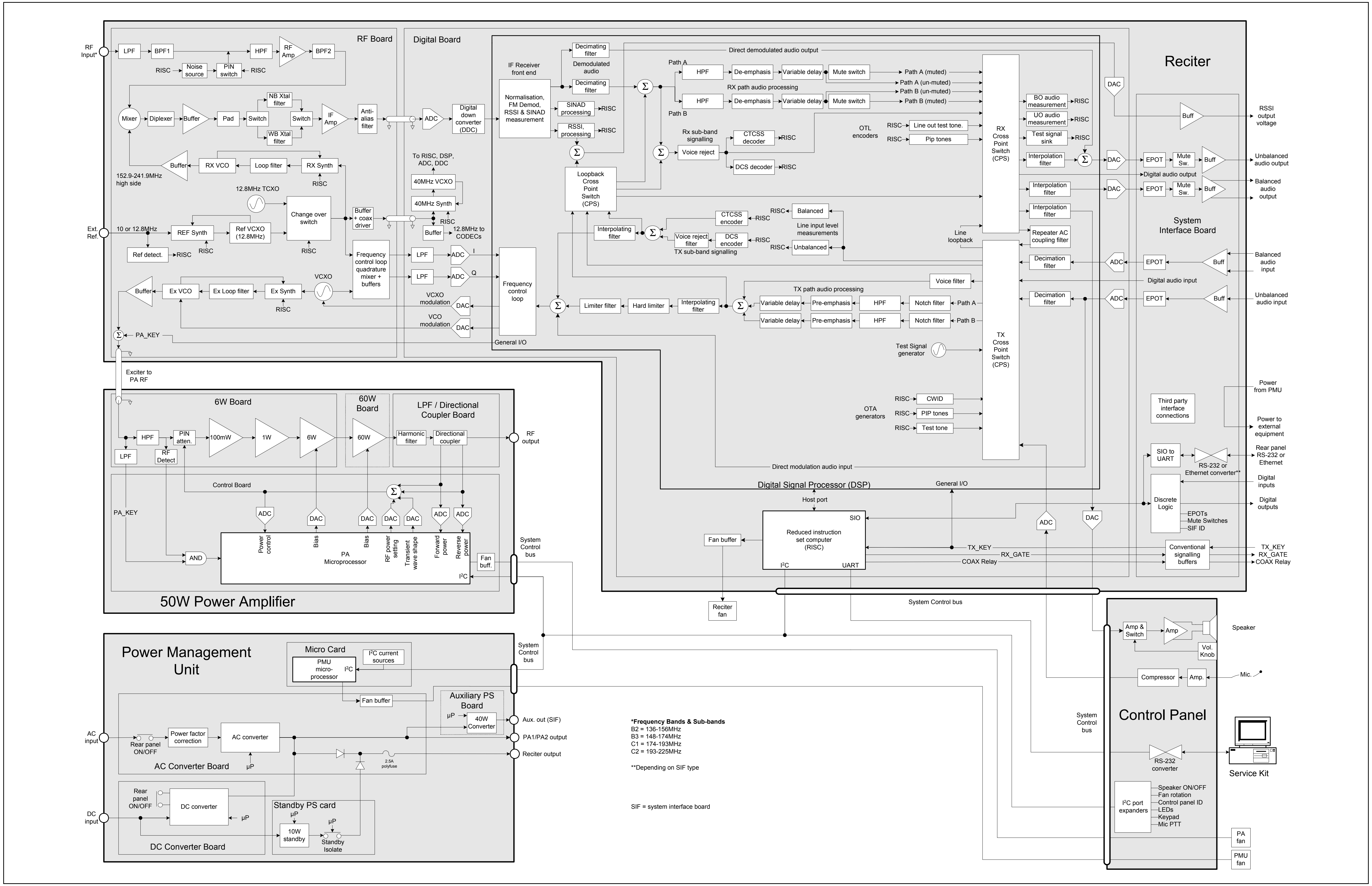


Figure 4.11 Base station UHF signal path - H band and K band

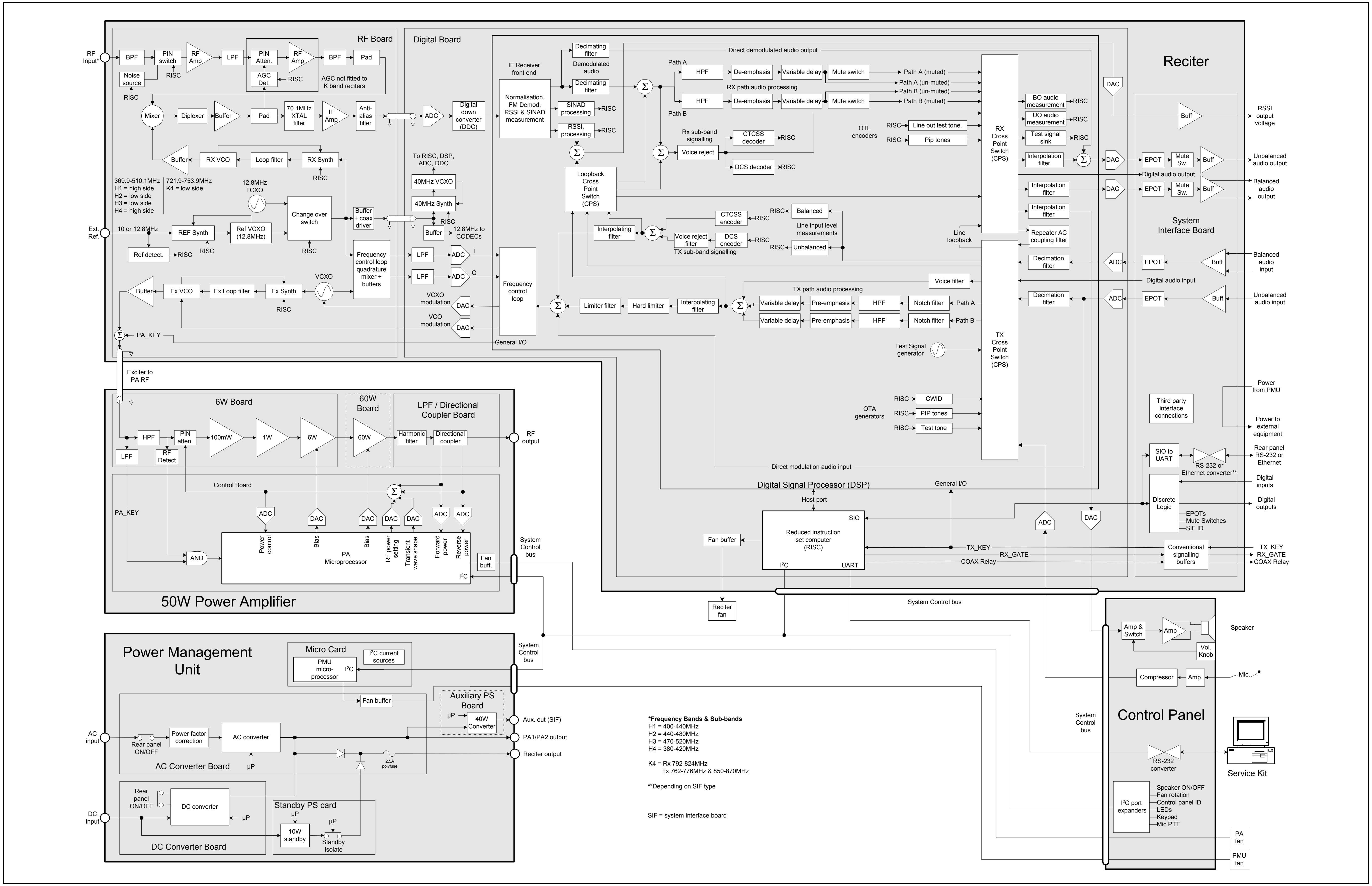


Figure 4.12 Base station UHF signal path - L band

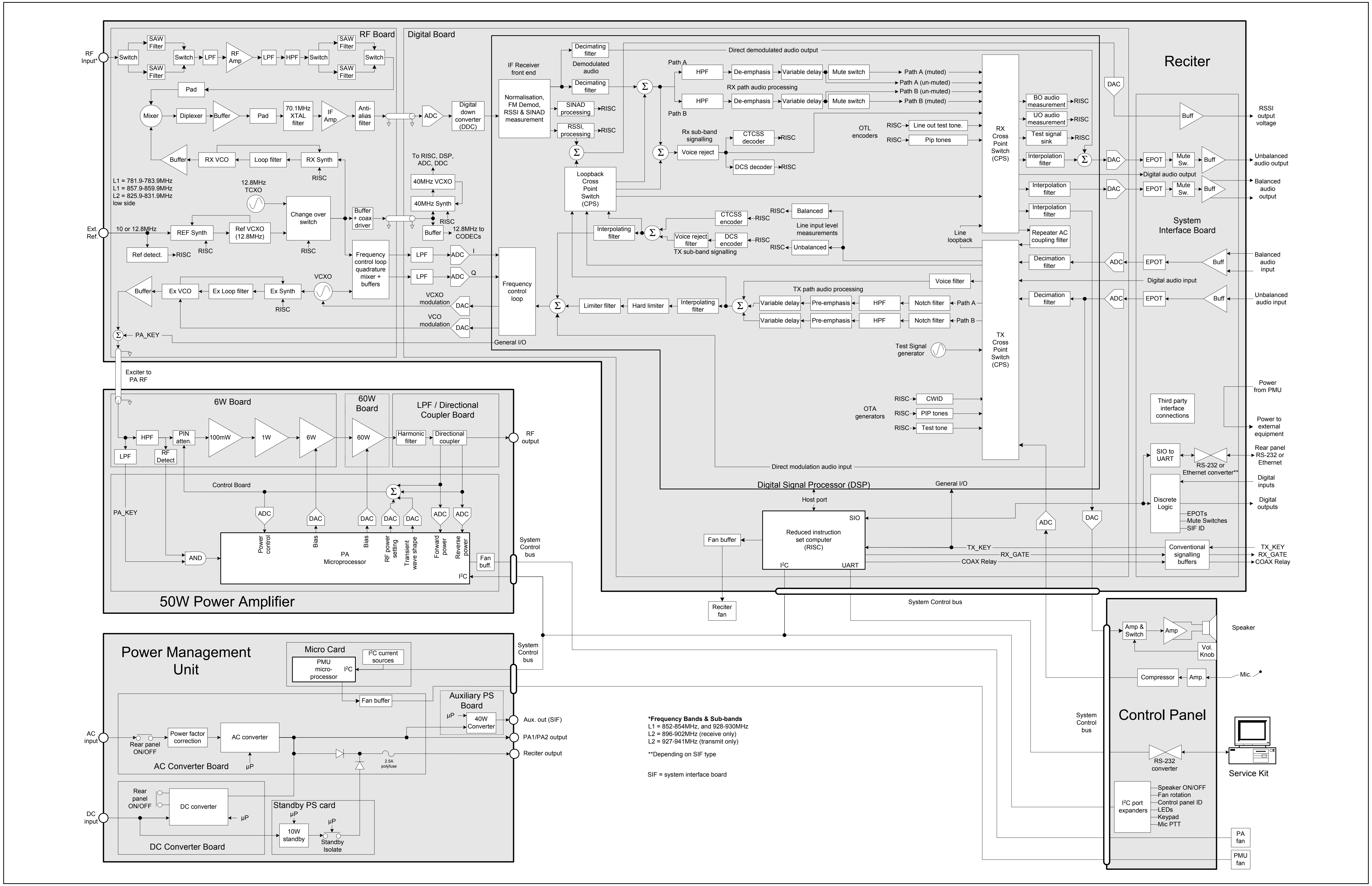
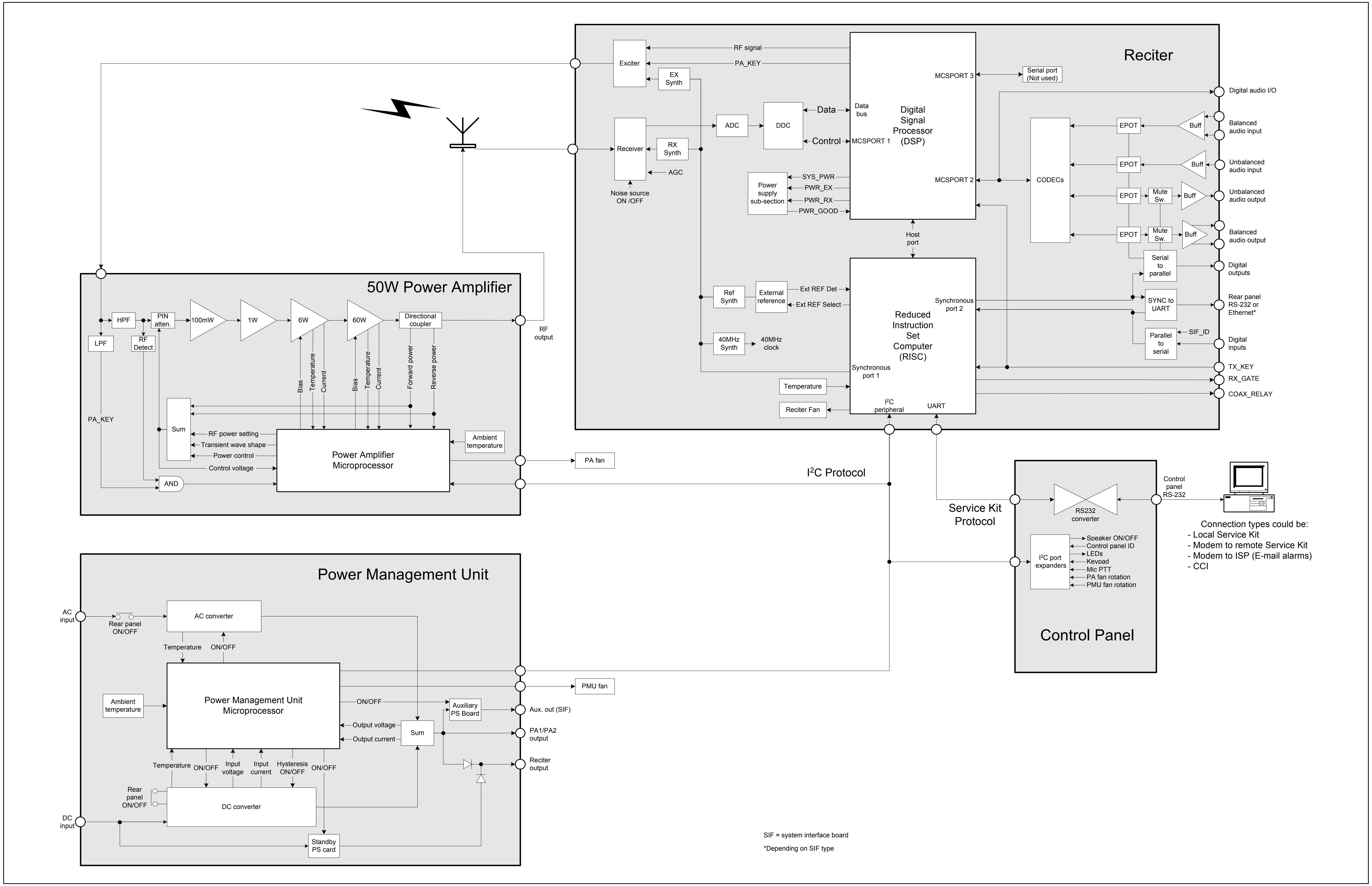


Figure 4.13 Base station data, control and monitoring path



5 Installation

This chapter describes how to install the base station in a standard 19 inch rack or cabinet. It also provides some general information on safety precautions and site requirements. We recommend that you read the entire chapter before beginning the installation.

5.1 Personal Safety

5.1.1 Lethal Voltages

Warning **The PMU contains voltages that may be lethal. Refer to the ratings label on the rear of the module.**

The base station must be installed so that the rear of the PMU is located in a service access area which is accessible only by qualified personnel. The PMU must be connected to the mains supply source by qualified personnel in accordance with local and national regulations.

Disconnect the mains IEC connector and wait for five minutes for the internal voltages to self-discharge before dismantling. The AC power on/off switch does not isolate the PMU from the mains. It breaks only the phase circuit, not the neutral.

The PMU should be serviced only by qualified technicians. There are no user-replaceable parts inside. If the PMU is damaged and does not function properly, stop the module safely and contact your regional Tait office immediately.

All servicing should be carried out only when the PMU is powered through a mains isolating transformer of sufficient rating.

5.1.2 AC Power Connection

English (en)	The PMU must be connected to a grounded mains socket-outlet.
Norsk (no)	Apparatet må tilkoples jordet stikkontakt.
Suomi (fi)	Laite on liitettävä suojamaadoitus-koskettimilla varustettuun pistorasiaan.
Svenska (sv)	Apparaten skall anslutas till jordat uttag.

5.1.3 Explosive Environments

Warning **Do not operate TB8100 equipment near electrical blasting caps or in an explosive atmosphere. Operating the equipment in these environments is a definite safety hazard.**

5.1.4 Proximity to RF Transmissions

Do not operate the transmitter when someone is standing within 90 cm (3 ft) of the antenna. Do not operate the transmitter unless you have checked that all RF connectors are secure.

5.1.5 High Temperatures

Take care when handling a PMU or PA which has been operating recently. Under extreme operating conditions (+60°C [+140°F] ambient air temperature) or high duty cycles the external surfaces of the PMU and PA can reach temperatures of up to +80°C (+176°F).

5.1.6 LED Safety (EN60825-1)

This equipment contains Class 1 LED Products.

5.2 Equipment Safety

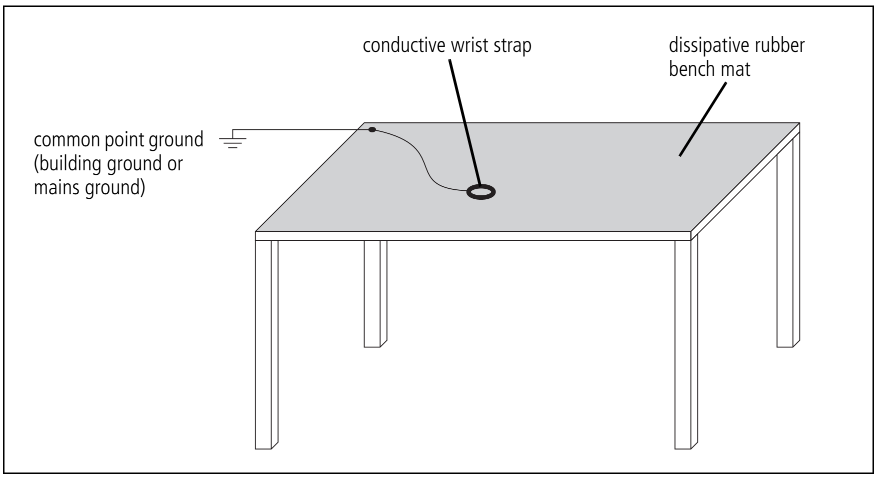
5.2.1 ESD Precautions

Notice 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. The Electrostatic Discharge Association website is http://www.esda.org.

Figure 5.1 Typical antistatic bench set-up



5.2.2 Antenna Load

Notice The PA may be damaged if the load is removed or switched while the PA is transmitting.

Introduction

One of the inherent characteristics of 28 V LDMOS technology is its lower breakdown voltage. Tait, and most other major base station manufacturers, have adopted this technology to benefit from its superb wide band performance and high efficiency.

The MRF9060 LDMOS FET is used as the final power device in the 50 W and 100 W PAs. In these PAs, the MRF9060 device is protected from high VSWR by the design of the circuitry. This circuitry makes it impossible to damage the device by keying the PA into a mismatched load, or if the load deteriorates over even a short period of time (milliseconds). Thus, no PA will fail if it is keyed while connected to a mismatched load.

However, it is possible to damage the device if **all** the following conditions happen **at the same time**:

- there is a step change in the PA load (i.e. the load is removed)
- the PA is transmitting
- the feed line loss between the PA and the mismatch is <1 dB.

The effect of such conditions is variable: some devices will not be destroyed, and some may fail after repeated load interruptions.

Ice on the antenna, or a broken antenna, is unlikely to cause damage to the PA. There should be enough coaxial cable between the antenna and PA to protect it from high VSWR.

5 W PAs will not fail due to a highly mismatched load. They do not use the 60 W board with the MRF9060 device.

Recommendations

The procedures recommended below should help to protect the PA from damage under all but the most extreme operating conditions.

1. **Do not remove the load from the PA while it is transmitting.**
2. Do not connect the PA directly to the antenna. To protect the PA output stage from load transients (i.e. switching or removing the load) or atmospheric disturbances (e.g. rain static, electrical storms, etc.), we recommend that you fit an isolator or cavity filter (e.g. duplexer) between the PA and the load.
   Fit the isolator as close as possible to the RF output connector on the PA. Do not connect any switching equipment between the isolator and the PA, unless the switch **cannot** operate while there is RF present (i.e. the base station is transmitting).
3. Fit a surge suppressor to the antenna cabling where it enters the building.
4. Inspect all cables and equipment connected to the base station for defects.

5.2.3 Equipment Grounding

To ensure safe operation the base station equipment must be correctly grounded as described in these installation instructions.

5.2.4 Installation and Servicing Personnel

The base station should be installed and serviced only by qualified personnel.

5.3 Regulatory Information

5.3.1 Distress Frequencies

The 406 to 406.1MHz frequency range is reserved worldwide for use by Distress Beacons. Do **not** program transmitters to operate in this frequency range.

5.3.2 Compliance Standards

This equipment has been tested and approved to various national and international standards. Refer to the latest issue of the Specifications Manual for a complete list of these standards.

5.3.3 FCC Compliance

This equipment complies with:

- CFR Title 47 Part 15 Class B (except PMU):
  Radiated and conducted emissions, and electromagnetic susceptibility specifications of the Federal Communications Commission (FCC) rules for the United States.
  Operation is subject to the following two conditions:
  a. This device may not cause harmful interference, and
  b. This device must accept any interference received, including interference that may cause undesired operation.
- CFR Title 47 Part 15 Class A (PMU only):
  Radiated and conducted emissions, and electromagnetic susceptibility specifications of the Federal Communications Commission (FCC) rules for the United States.
  Operation is subject to the following two conditions:
  a. This device may not cause harmful interference, and
  b. This device must accept any interference received, including interference that may cause undesired operation.

5.3.4 FCC Narrowbanding Regulations

The following information applies to all base stations, not just to those sold in countries where FCC regulations apply.

From 1 January 2013 it is an FCC requirement that land mobile radio systems must not operate channels with a bandwidth greater than 12.5kHz in the 150–174MHz and 421–470MHz frequency bands. From this date all base stations will be supplied with firmware that requires a software feature license to operate a mid-bandwidth or wide bandwidth channel in these frequency bands.

The TBAS083 Unrestricted Wideband feature license is available to any customer who is not subject to the relevant FCC regulations, or who has an FCC waiver. Note that this feature license is also required to operate a mid-bandwidth or wide bandwidth channel on the spot frequencies which are exempt from the FCC requirement. To obtain the feature license, or for more information about it, contact your regional Tait office.

5.3.5 Unauthorized Modifications

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

5.3.6 Health, Safety and Electromagnetic Compatibility in Europe

In the European Community, radio and telecommunications equipment is regulated by Directive 1999/5/EC, also known as the Radio and Telecommunications Terminal Equipment (R&TTE) directive. The requirements of this directive include protection of health and safety of users, as well as electromagnetic compatibility.

Intended Purpose of Product

This product is an FM radio transceiver. It is intended for radio-communication in the Private Mobile Radio (PMR) or Public Access Mobile Radio (PAMR) services, to be used in all member states of the European Union (EU) and states within the European Economic Area (EEA).

This product can be programmed to transmit on frequencies that are not harmonised throughout the EU/EEA, and will require a licence to operate in each member state.

Declaration of Conformity

Brief Declarations of Conformity appear on page 217. You can download the formal Declaration of Conformity from http://eudocs.taitradio.com/.

5.4 Environmental Conditions

5.4.1 Operating Temperature Range

The operating temperature range of the base station is −30°C to +60°C (−22°F to +140°F) ambient temperature. Ambient temperature is defined as the temperature of the air at the intake to the cooling fans.

5.4.2 Humidity

The humidity should not exceed 95% relative humidity through the specified operating temperature range.

5.4.3 Dust and Dirt

For uncontrolled environments, the level of airborne particulates must not exceed 100μg/m^3.

5.5 Grounding and Lightning Protection

5.5.1 Electrical Ground

The modules are grounded by physical contact between the module case and the subrack. To ensure a good ground connection you must tighten each module retaining clamp securely (refer to "Final Reassembly" on page 194 for the correct torque).

A threaded grounding connector is provided on the rear of the subrack for connection to the site ground point (refer to "Connection" on page 111 for more details).

5.5.2 Lightning Ground

It is extremely important for the security of the site and its equipment that you take adequate precautions against lightning strike. Because it is outside the scope of this manual to provide comprehensive information on this subject, we recommend that you conform to your country's standards organization or regulatory body.

5.6 Recommended Tools

It is beyond the scope of this manual to list every tool that an installation technician should carry. However, the following tools are specifically required for installing the base station:

- Pozidriv PZ3 screwdriver for the M6 screws used in the DC input terminals on the PMU; M6 screws are also used to secure the subrack to the cabinet in Tait factory-assembled systems
- Pozidriv PZ2 screwdriver for the M4 screws used to secure the module retaining clamps
- 1/4in or 6mm flat blade screwdriver for the fasteners used to secure the front panel to the subrack
- 5/16in or 8mm AF spanner for the SMA connectors, and the subrack ground connector.

You can also obtain the TBA0ST2 tool kit from your regional Tait office. It contains the basic tools needed to install, tune and service the base station.

5.7 Ventilation

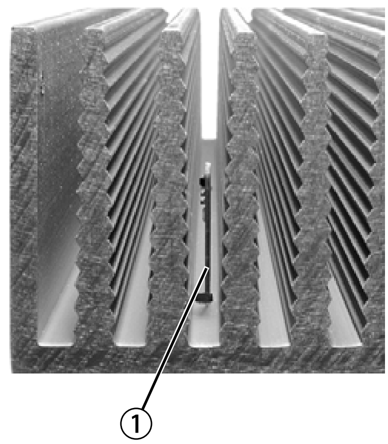
Always ensure there is adequate ventilation around the base station. **Do not** operate it in a sealed cabinet. You **must** keep the ambient temperature within the specified range, and we **strongly** recommended that you ensure that the cooling airflow is not restricted.

Notice The cooling fans are mounted on the front panel and will only operate when the panel is fitted correctly to the front of the subrack. To ensure adequate airflow through the base station, do not operate it for more than a few minutes with the front panel removed (e.g. for servicing purposes).

5.7.1 Ambient Air Temperature Sensor

The ambient air temperature reading for the base station is provided by the ambient air temperature sensor board ① fitted to the PA control board.

The sensor board is inserted through slots in the control board and heatsink to be positioned between the heatsink fins.



Notice If the sensor board is to provide accurate ambient temperature readings, it must have forced airflow and must not come into contact with the metal of the heatsink fins. **Do not stack PAs with the fins together.** It is possible for the fins on one heatsink to slide between the fins on the other heatsink. This can damage the sensor board, and possibly result in the heatsink fins becoming locked together.

5.7.2 Cabinet and Rack Ventilation

Refer to Figure 5.2on page 99.

The cooling airflow for the base station enters through the front panel and exits at the rear of the subrack. For optimum thermal performance, the heated air that has passed through a base station must not be allowed to re-enter the air intakes on the front panel. Any space at the front of the cabinet not occupied by equipment should be covered by a blanking panel.

To allow enough cooling airflow through a cabinet-mounted base station, we recommend the following:

- an area of at least 150 cm^2 (23 in^2) of unrestricted ventilation slots or holes

- in front of the air intakes for the fans for each subrack; for example, thirty 6x85mm (0.25x3.3in) slots will allow the recommended airflow
- a vent in the top of the cabinet with an area of approximately 150 cm^2 (23 in^2) per subrack, or a similar area of ventilation per subrack at the rear of the cabinet behind each subrack
- a 2U gap at the top of the cabinet.

ⓘ The ventilation opening must be unrestricted. If the slots or holes are covered with a filter, mesh or grille, the open area must be increased to allow the same airflow as an unrestricted opening.

The maximum ambient temperature entering the cabinet must not exceed +60°C (+140°F).

If you are installing multiple subracks in a cabinet, ensure that there will be enough cooling airflow through the cabinet after the equipment has been installed. For example, the recommended maximum number of subracks in a 38U cabinet is five, as shown in Figure 5.2 on page 99.

If the base station is installed in a rack or cabinet with other equipment with different ventilation requirements, we recommend that the base station be positioned below this equipment.

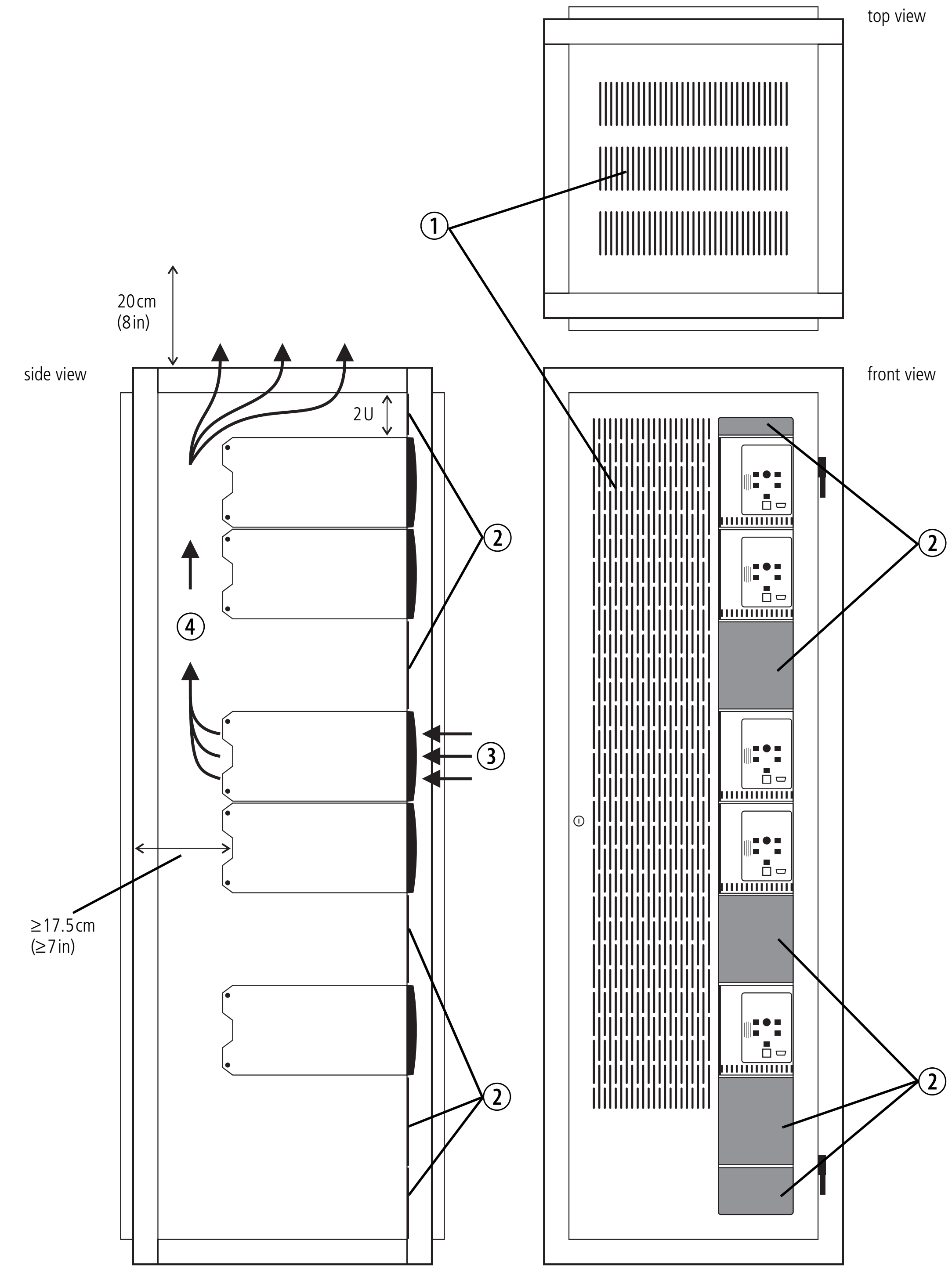
Auxiliary Extractor Fans

The base station does not require auxiliary extractor fans mounted in the top of the cabinet. If your cabinet is already fitted with fans, the following procedures apply:

- if there are six or more 120mm (4.75in) fans, each capable of extracting 160 m^3 per hour (94.2CFM), they must run continuously
- if there are fewer than six fans, you must remove them and ensure the vent in the top of the cabinet has an area of approximately 150 cm^2 (23 in^2) per subrack.

If you have any other configuration, the performance of your system will depend on how closely you comply with the base station airflow requirements described above.

Figure 5.2 Typical cabinet ventilation requirements



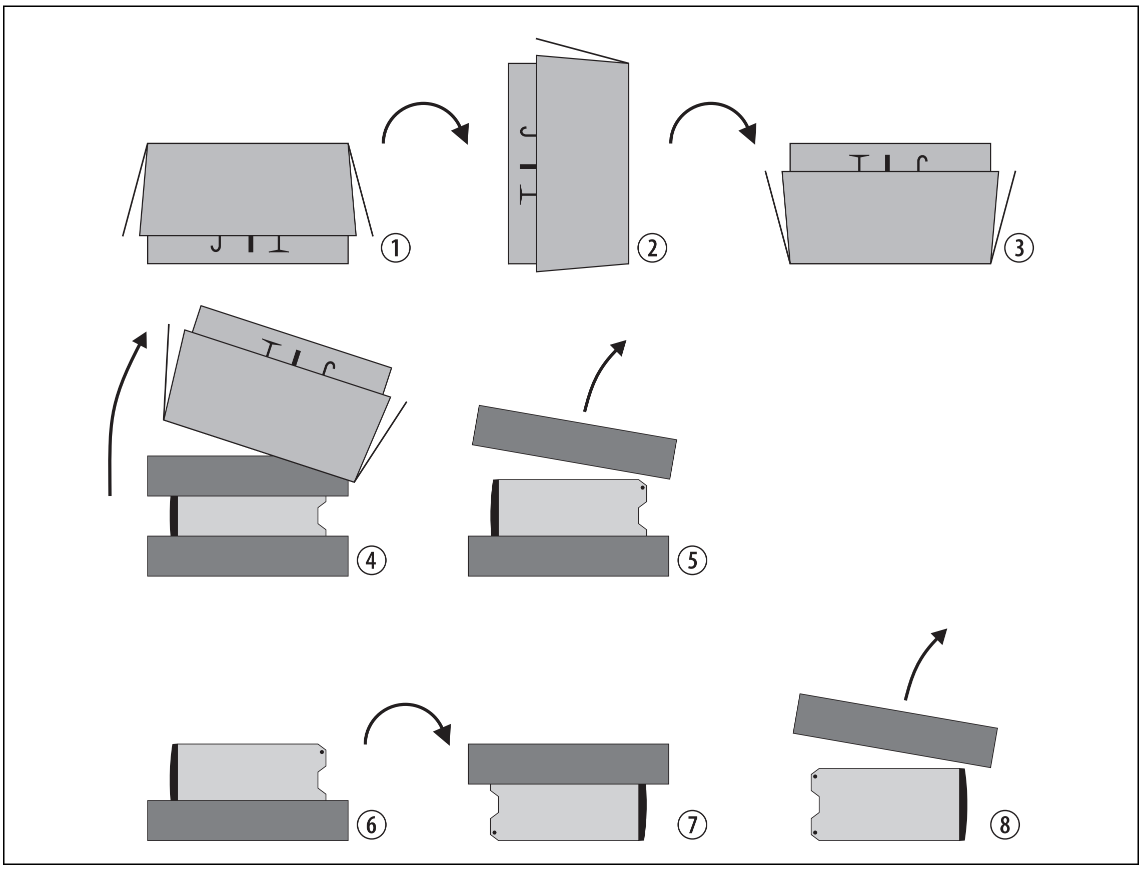
1 ventilation slots
2 blanking panels
3 airflow entry
4 airflow exit

5.8 Unpacking the Base Station

Caution A base station (subrack complete with modules) can weigh up to 28 kg (62 lb), or up to 30 kg (66 lb) complete with packaging. We recommend that you have another person help you unpack and move the base station. The TBAA03-16 carrying handles will make it easier to move the base station once it has been unpacked. If necessary, remove the modules from the subrack before moving it. In all cases follow safe lifting practices.

The base station is packed in a strong corrugated cardboard carton with top and bottom foam cushions. To prevent personal injury and damage to the equipment, we recommend that two people unpack the base station.

Figure 5.3 Unpacking the base station



1. Cut the tape securing the flaps at the top of the carton and fold them flat against the sides ①.

2. Rotate the carton carefully onto its side ② and then onto its top ③, ensuring that none of the flaps is trapped underneath.

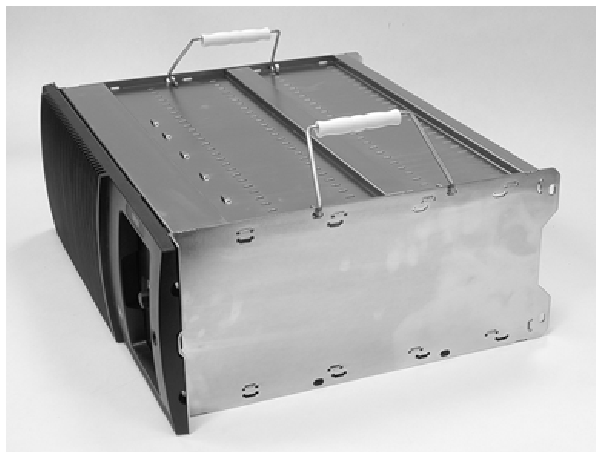
3. Slide the carton upwards over the foam cushions and lift it away ④. Remove the cushion from the bottom of the base station ⑤.

4. Rotate the base station and cushion carefully over the rear of the base station ⑥ so that the base station is the right way up with the cushion on top ⑦. Remove the cushion from the top of the base station ⑧.

Moving the Base Station

The TBAA03-16 carrying handles can be used to move the base station once it has been unpacked. The handles fit into the holes in the sides of the subrack, as shown below.

Figure 5.4 Base station carrying handles



Disposal of Packaging

If you do not need to keep the packaging, we recommend that you recycle it according to your local recycling methods. The foam cushions are CFC- and HCFC-free and may be burnt in a suitable waste-to-energy combustion facility, or compacted in landfill.

5.9 Short Tuning Procedure

Before the base station is installed on site, you may need to adjust the lock band (switching range) of the reciter and/or tune the receiver front end. These procedures assume you are familiar with the operation of the Service Kit and Calibration Kit.

5.9.1 Before You Begin

1. Using the Service Kit, select Diagnose > Reciter > Synthesizers to determine the base station's current lock band.

2. Define a channel with the desired frequency pair and make it the default channel.

3. Configure the Signal Path tab of the current channel profile to provide balanced and/or unbalanced audio to the system interface connector. You may want to clear the **Gated** check boxes, so that the audio output is not muted.

4. Program the base station with this configuration.

5.9.2 Setup

1. Remove the reciter from the subrack.

2. Reconnect power and the control bus connection to the reciter. If desired, use a 16-way IDC extension cable to provide a longer control bus connection, so that you can put the reciter on top of the subrack. Otherwise, you must place the reciter in front of the subrack. Do not borrow the ribbon cable for the PMU or PA, as this could cause the control bus to malfunction.

5.9.3 Adjusting the Lock Bands (Switching Ranges)

Adjusting the lock bands is only needed if the desired operating frequencies lie outside the current lock bands. Follow these steps.

1. Connect your PC to the serial port on the control panel.

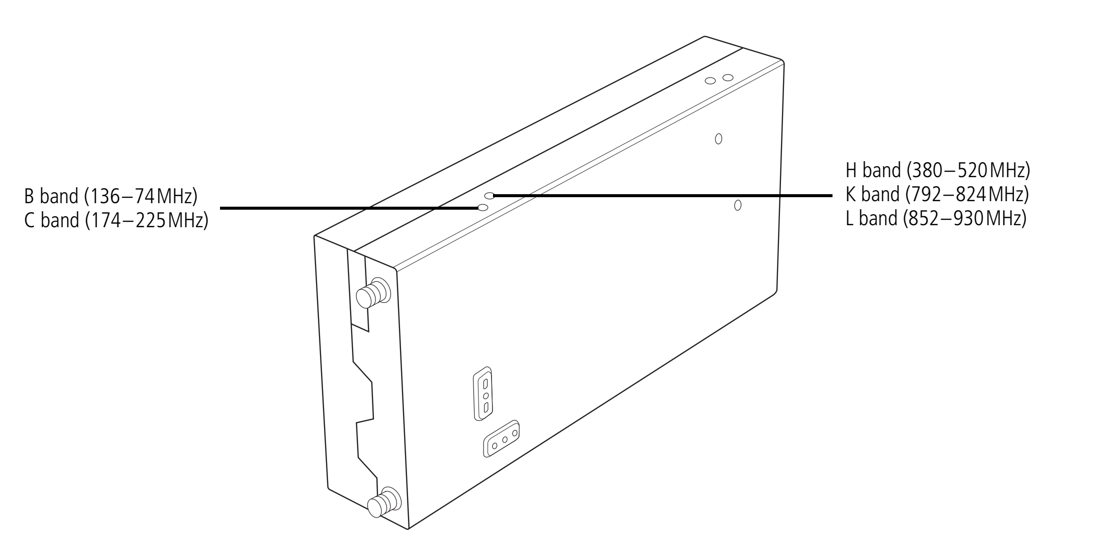
ⓘ When a reciter fitted with a TaitNet RS-232 or High Density/RS-232 system interface board is used in a base station, the RS-232 port on the control panel is disabled. In this situation you must connect to the RS-232 port at the rear of the reciter. Refer to "TaitNet RS-232" on page 145 or "High Density/RS-232" on page 140 for more details.

2. Run the Calibration Kit and establish a software connection to the reciter, as follows.
   a. Click **Connect** to start the connection process.
   b. When you see the "Waiting for logon prompt from Reciter" screen, power up the reciter. If it is already on, turn it off, and then on.
   c. When the Calibration Kit has successfully connected to the reciter, the Calibration Wizards are displayed in the main window.

Setting the Receiver Lock Band

1. In the Calibration Kit, select the Frequency Setup tab and double-click **Set Receiver VCO**. The Set Receiver VCO Wizard appears.
2. Enter the Center Frequency (which must be a multiple of 500kHz) of the lock band that you want to use, and click **Next**.
3. Insert the Murata tuning tool into the correct receiver VCO tuning hole for the reciter type (as shown in Figure 5.5) and then click **Next.**
4. Adjust the receiver VCO trimmer until the actual band matches the desired band. The bands turn green.
5. Click **Finish**. This stores the lock band in the reciter.

Figure 5.5 Receiver VCO tuning holes

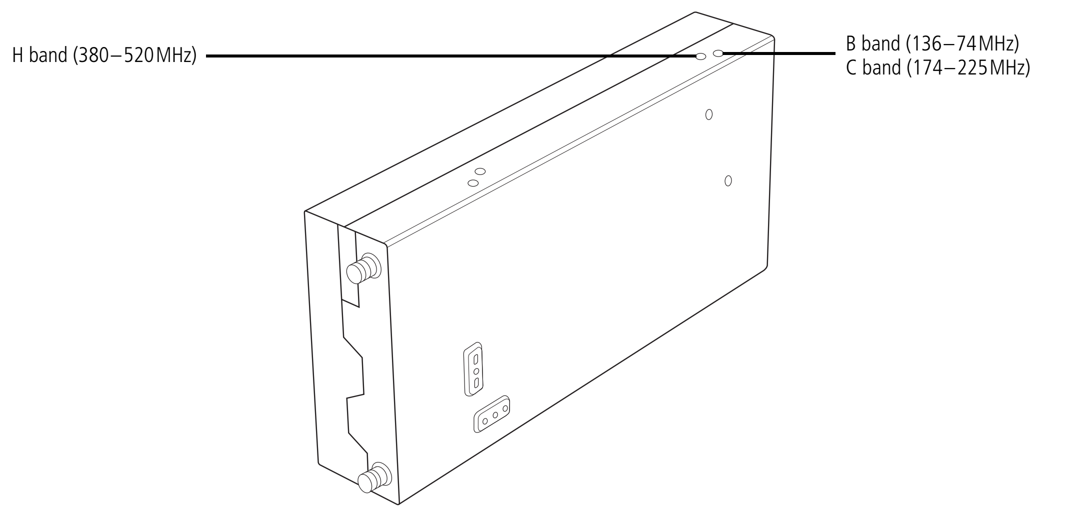


Setting the Exciter Lock Band

1. Select the Frequency Setup tab, and double-click **Set Exciter VCO**. The Set Exciter VCO Wizard appears.
2. Enter the Center Frequency (which must be a multiple of 500kHz) of the lock band that you want to use, and click **Next**.
3. Insert the Murata tuning tool into the correct exciter VCO tuning hole (as shown in Figure 5.6) and adjust the trimmer until the actual band matches the desired band. The bands turn green. Click **Finish**.

K-band and L-band exciters do not need their VCO to be set. They have two VCOs and you simply choose which one to display in the Service Kit.

Figure 5.6 Exciter VCO tuning holes



5.9.4 Tuning the Receiver Front End

Tuning not required for L band.

The following procedure is suitable if the base station will operate on a single frequency. If it will operate on a range of frequencies across the lock band, follow the instructions in the Calibration Kit manual or online Help instead.

You can tune the receiver front end by measuring either SINAD or RSSI, and both these methods are described below. We suggest you tune via RSSI first, and then use the SINAD method for subsequent repetitions to refine the response.

1. Using a test set, feed a signal at the receive frequency into the reciter's RF input. The signal should have a level that gives approximately 12dB SINAD (start at approximately −80dBm and adjust as needed).

If you do not have a test set, use a signal generator, and monitor the RSSI voltage on the system interface connector. The System Interface form in the Service Kit indicates which pin carries this signal. Refer also to "System Interface Connections" on page 137.

2. Fully unmute the front panel speaker (two presses of the speaker button).

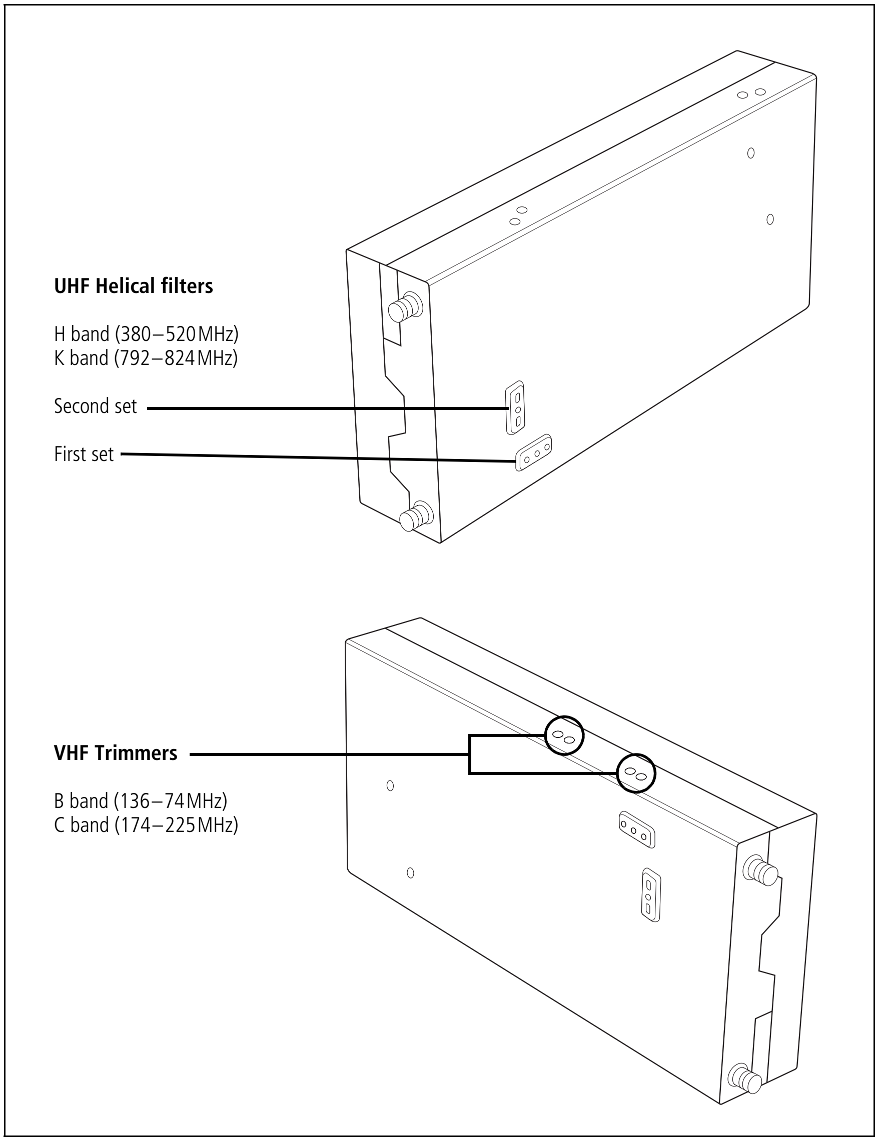
3. Connect a SINAD meter (audio frequency input on the test set) to the balanced or unbalanced line output.

4. If the receiver is UHF, adjust the front-end helical filters.
   a. Insert the Johanson tuning tool into the first hole of the first (horizontal) set (as shown in Figure 5.7 on page 106). You can start with the hole on the left side and proceed along to the hole on the right, or vice versa. On K-band reciters, the third hole tends to tune with the slug well out of the filter body. Be careful not to unscrew the slug completely.
   b. Tune each of the resonators in the first set once to give the best signal (by ear using the speaker audio and/or by the SINAD meter), reducing the RF input as required to give approximately 12dB SINAD. If RSSI is used, tune for maximum RSSI.
   c. Insert the Johanson tuning tool into the first hole of the second (vertical) set. You can start with the top hole and proceed down to the bottom hole, or vice versa. (For hardware version 00.04 or earlier H-band reciters, use the Murata tuning tool on this set instead.)
   d. Tune each of the resonators in the second set once to give the best response, reducing the RF level as above.
   e. Repeat this procedure as necessary to refine the response.
5. If the receiver is VHF, adjust the four front-end trimmers. You can do this in any order.

5.9.5 Calibrating the RSSI

Tait advise that the RSSI may need recalibrating if the front end tuning has been adjusted. If the RSSI needs to be accurate to within 1dB (for example in a voted system), recalibrate the RSSI, following the instructions in the Calibration Kit online Help or manual.

Figure 5.7 Receiver front end tuning holes



5.10 Mounting the Subrack

Caution We recommend that you have another person help you lift the subrack. If necessary, remove the modules from the subrack before lifting it (refer to "Replacing Modules" on page 179).

1. Remove the front panel, as described in "Preliminary Disassembly" on page 180.

2. Fit the subrack into the cabinet or rack and secure it firmly with an M6 (or 0.25 in if you are using imperial fittings) screw, flat and spring washer in each of the four main mounting holes ①, as shown in Figure 5.8.

If you need extra mounting security, there are additional mounting holes ② provided at the rear of the subrack for auxiliary support brackets.

Figure 5.8 Subrack mounting points

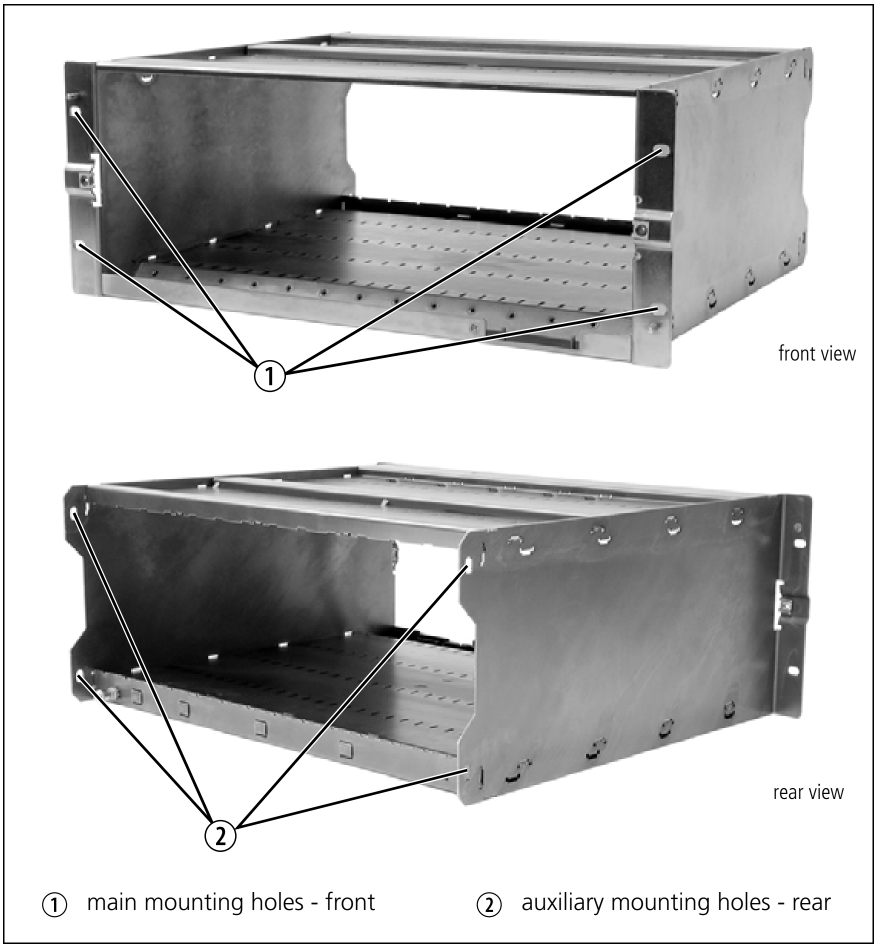
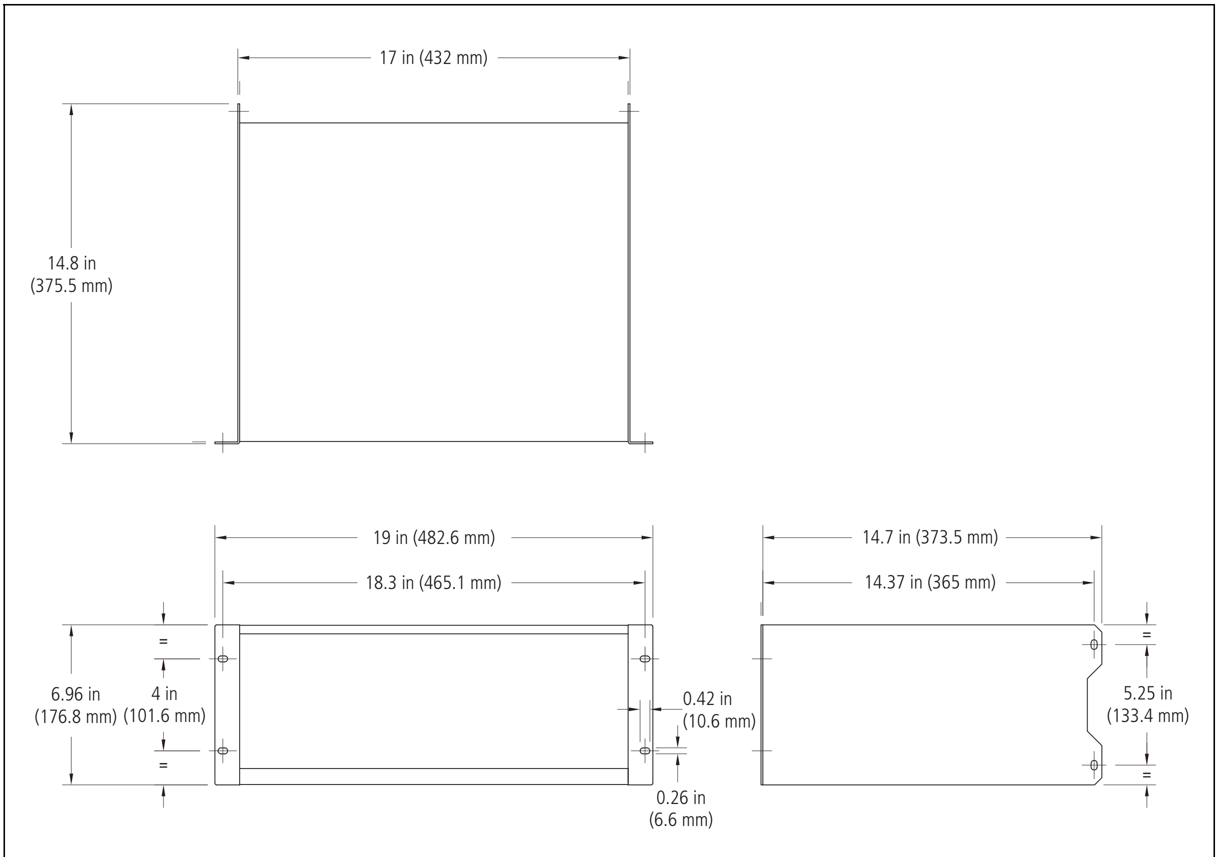


Figure 5.9 below gives the dimensions of the subrack and its mounting holes.

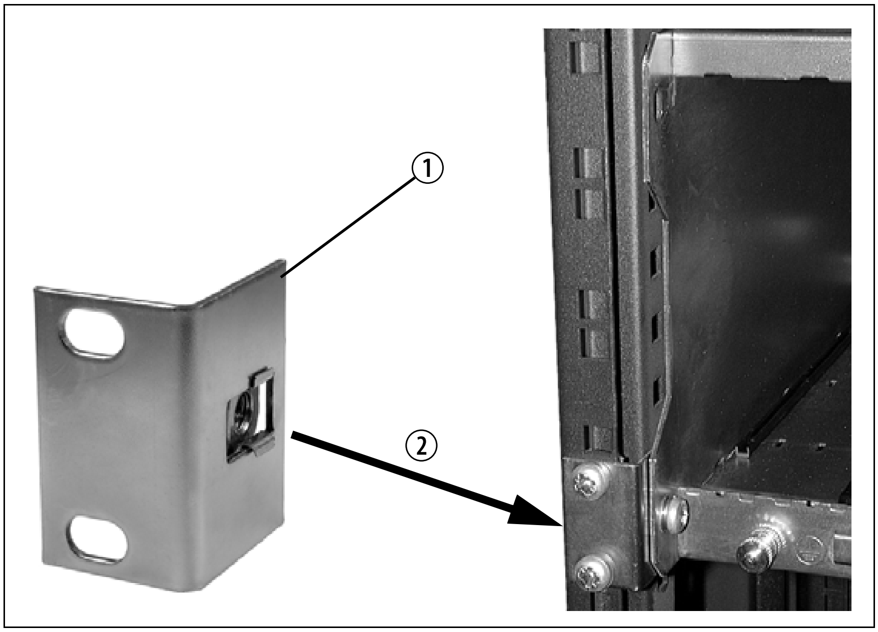
Figure 5.9 Subrack dimensions



5.10.1 Auxiliary Support Bracket

TBAA03-13 auxiliary support brackets can be fitted to the rear of the subrack to provide additional mounting security. Figure 5.10 below shows a standard TBAA03-13 bracket ① fitted in a typical Tait cabinet ②. If you are not using a Tait cabinet, you may have to make your own brackets to suit your installation.

Figure 5.10 Auxiliary support bracket



> **Notice** You **must** fit the auxiliary support brackets if you intend to transport a cabinet fitted with a fully built-up base station.

We also recommend that you fit the brackets under the following conditions:

- when the installation is in an area prone to earthquakes
- when third party equipment is installed hard up underneath the subrack.

5.11 Cabling

General

We recommend that you try to route all cables to and from the base station along the side of the cabinet so the cooling airflow is not restricted.

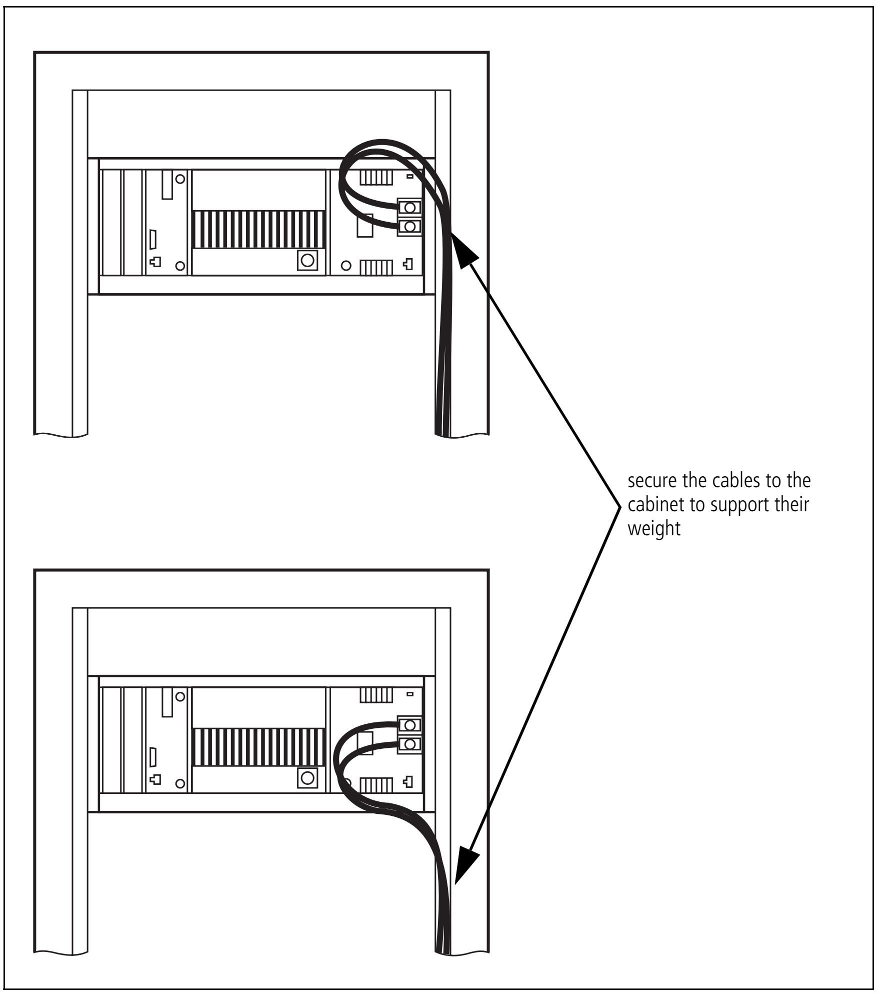
DC Power Cabling

DC power cables should be well supported so that the terminals on the PMU and on the ends of the cables do not have to support the full weight of the cables.

Figure 5.11 below shows two recommended methods of securing these cables to prevent straining either set of terminals.

We recommend that you fit the supplied covers to the DC terminals to protect against accidental shorts.

Figure 5.11 DC power cabling



6 Connection

Once the base station has been installed, you need to connect the individual modules to each other, and to any ancillary equipment required in your system. This chapter provides information on all the inputs and outputs available on the base station.

> **Notice** When refitting the front panel, ensure that all cables are secured and positioned correctly so they are clear of the fan ducts (as shown on the following pages). Otherwise the panel may not fit properly, or you may damage the cables.

6.1 Overview

This section identifies the main input and output connections for the base station.

Single and Dual Base Stations

The connections on typical single and dual base stations are shown in the following illustrations:

- dual base station front: Figure 6.1 on page 112
- single base station rear: Figure 6.7 on page 118
- dual 12V PA base station front: Figure 6.2 on page 113
- single 12V PA base station rear: Figure 6.8 on page 119
- single 100W base station front: Figure 6.3 on page 114
- subrack interconnect board connections: Figure 6.4 on page 115

Multi-reciter Subracks

The connections on a multi-reciter subrack are shown in the following illustrations:

- multi-reciter subrack with a PMU: Figure 6.5 on page 116
- multi-reciter subrack interconnect board: Figure 6.6 on page 117

Control Panels

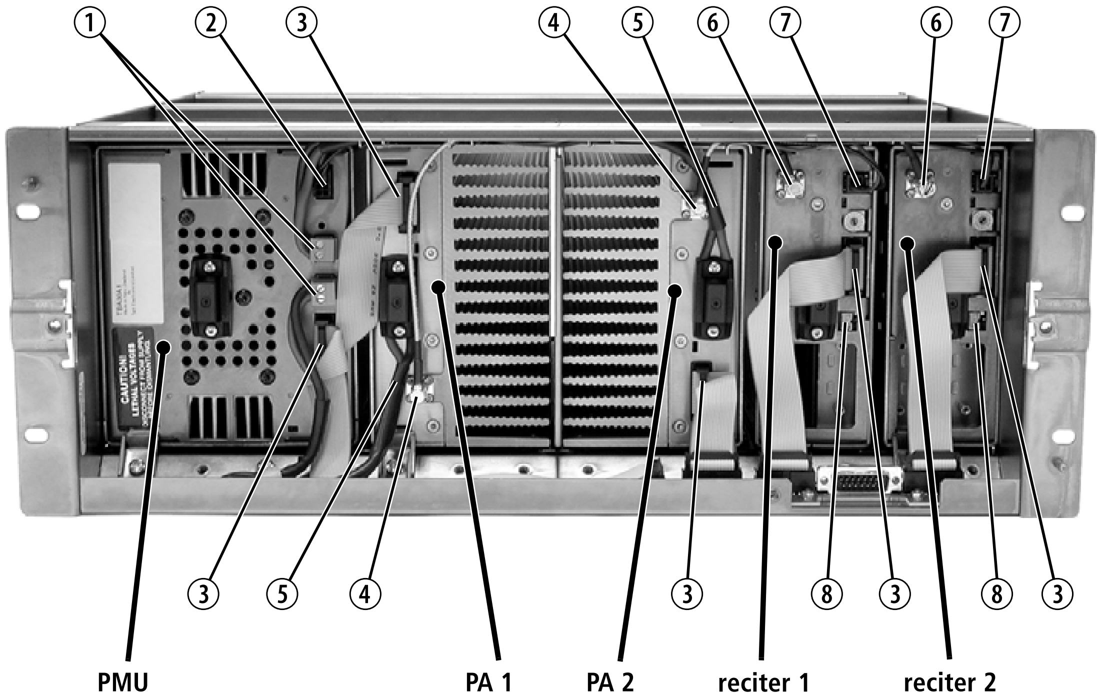
The connections on the different types of control panel are shown in the following illustrations:

- dual base station: Figure 6.9 on page 121
- Power Save: Figure 6.10 on page 121
- multi-reciter: Figure 6.11 on page 122

Refer to the following sections in this chapter for more details on these connections.

6.1.1 Module and Subrack Connections

Figure 6.1 Connections on a dual 5W or 50W base station - front view



① 28VDC high current output for PA

② 28VDC low current output for reciter

③ system control bus

④ RF input from reciter

⑤ 28VDC high current input cable from PMU

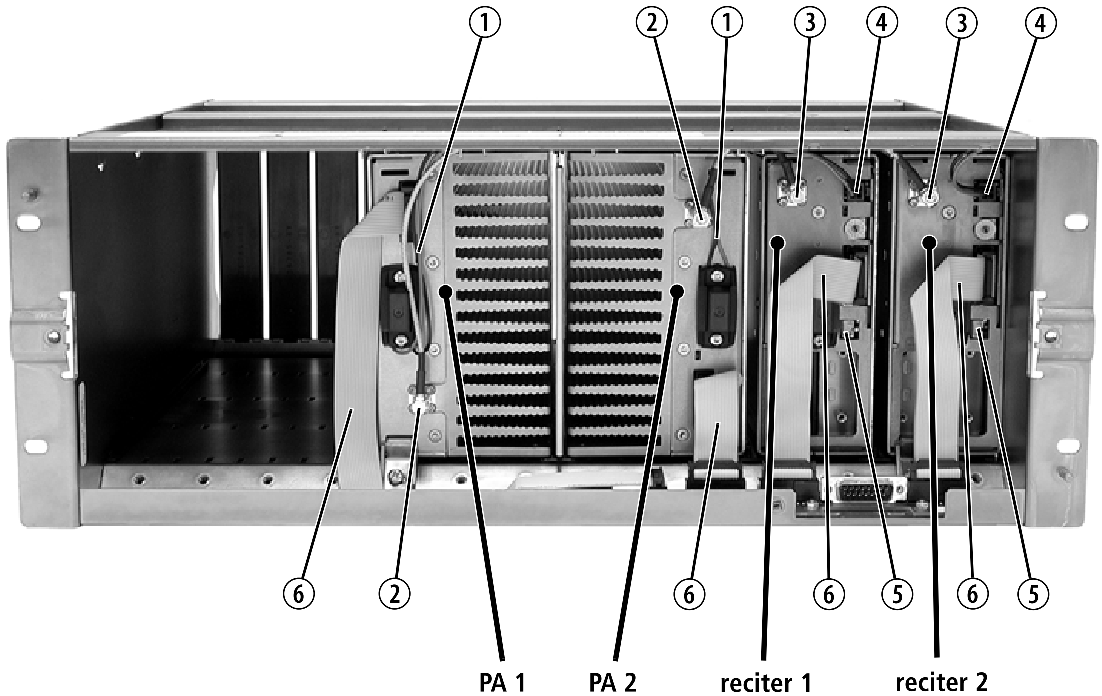
⑥ RF output to PA

⑦ 28VDC low current input from PMU

⑧ DC output (for optional reciter fan only)

Notice In base stations which use a PMU, the PMU must be connected to the system control bus at all times. The I^2C current source is located in the PMU, and if the PMU is disconnected, the state of much of the bus will be undefined. This may cause corrupted data to be present on the bus when the reciter reads the states of the switches on the control panel. This in turn may result in random actuations of microphone PTT, carrier, or speaker key, causing the base station to transmit or the speaker to be actuated incorrectly.

Figure 6.2 Connections on a dual 5W or 50W 12V PA base station - front view



① 12VDC output for reciter

② RF input from reciter

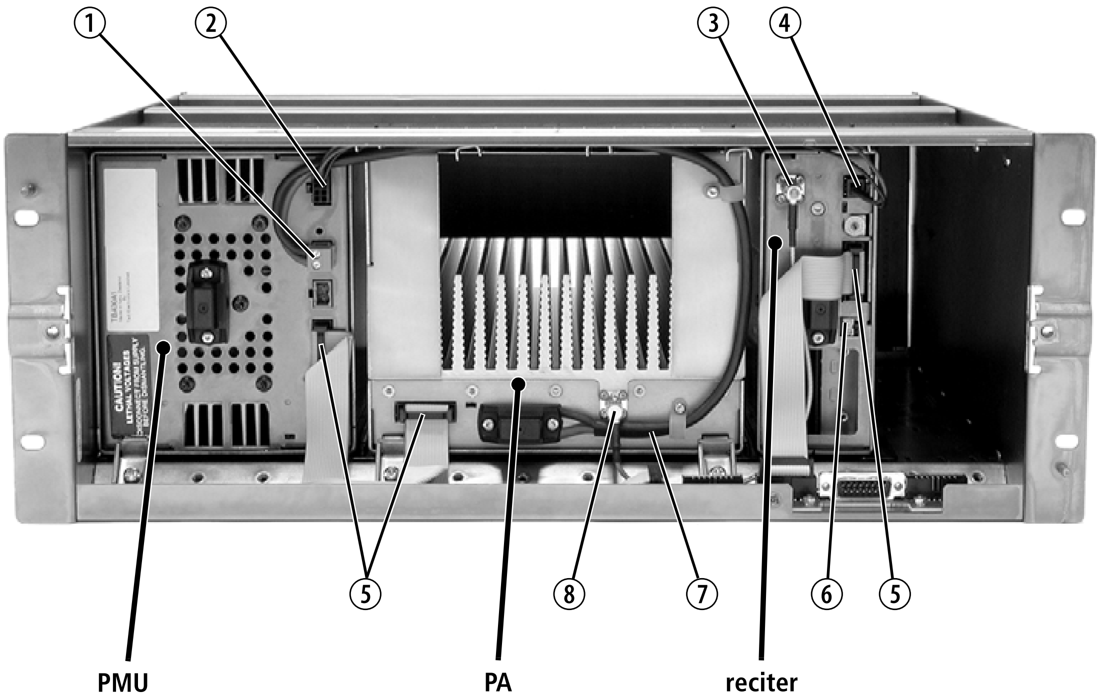
③ RF output to PA

④ 12VDC input from PA

⑤ DC output (for optional reciter fan only)

⑥ system control bus

Figure 6.3 Connections on a single 100W base station - front view



① 28VDC high current output for PA	⑤ system control bus
② 28VDC low current output for reciter	⑥ DC output (for optional reciter fan only)
③ RF output to PA	⑦ 28VDC high current input cable from PMU
④ 28VDC low current input from PMU	⑧ RF input from reciter

Figure 6.4 System control bus connections on the single and dual base station subrack interconnect board

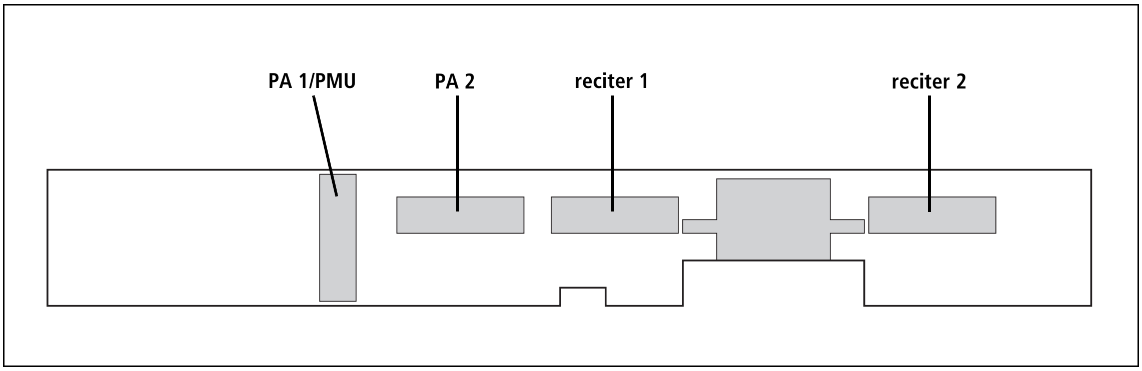
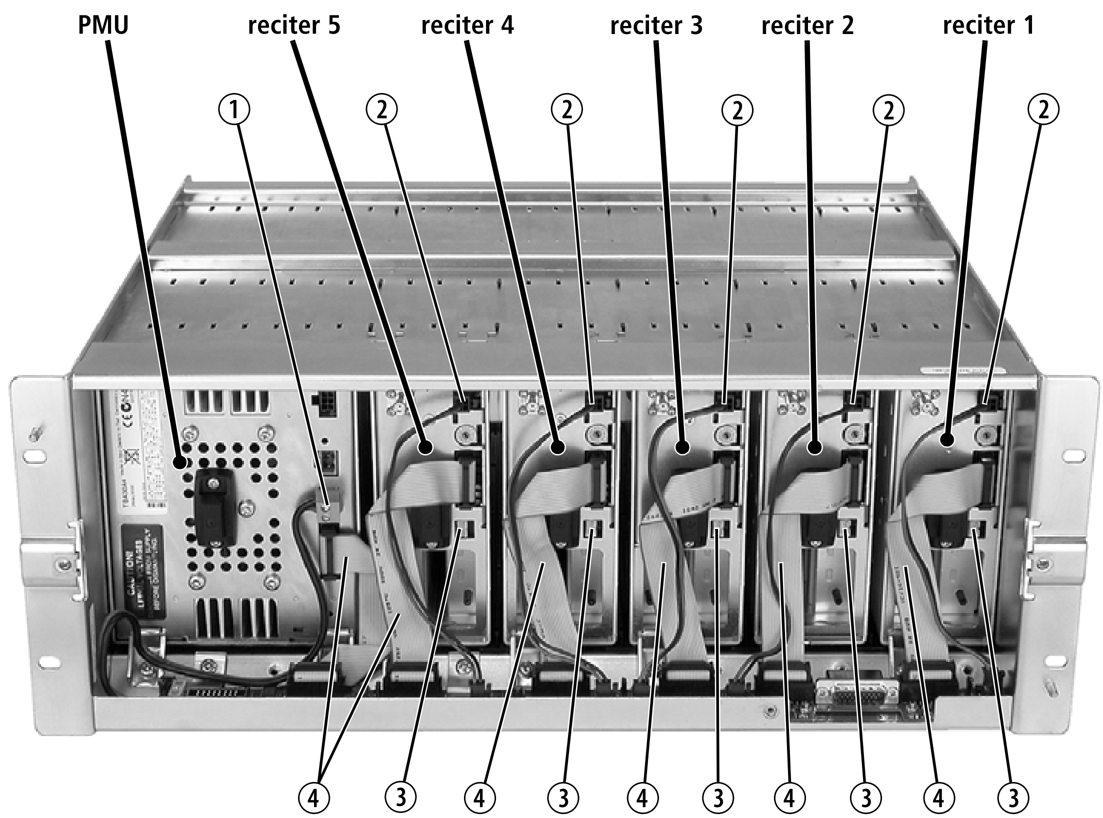


Figure 6.5 Connections on a multi-reciter subrack with PMU - front view



① 28VDC output to subrack board

② 28VDC input from subrack board

③ DC output (for optional reciter fan only)

④ system control bus

The subrack can accommodate one to seven reciters, or one to five reciters with a PMU (as shown in Figure 6.5). When fitted, the PMU occupies reciter positions 6 and 7 (numbered from right to left when viewed from the front).

When a PMU is fitted, it is associated with reciter 1 and is visible to the Service Kit for monitoring, configuration and diagnostics when reciter 1 is selected.

Figure 6.6 Connections on the multi-reciter subrack interconnect board

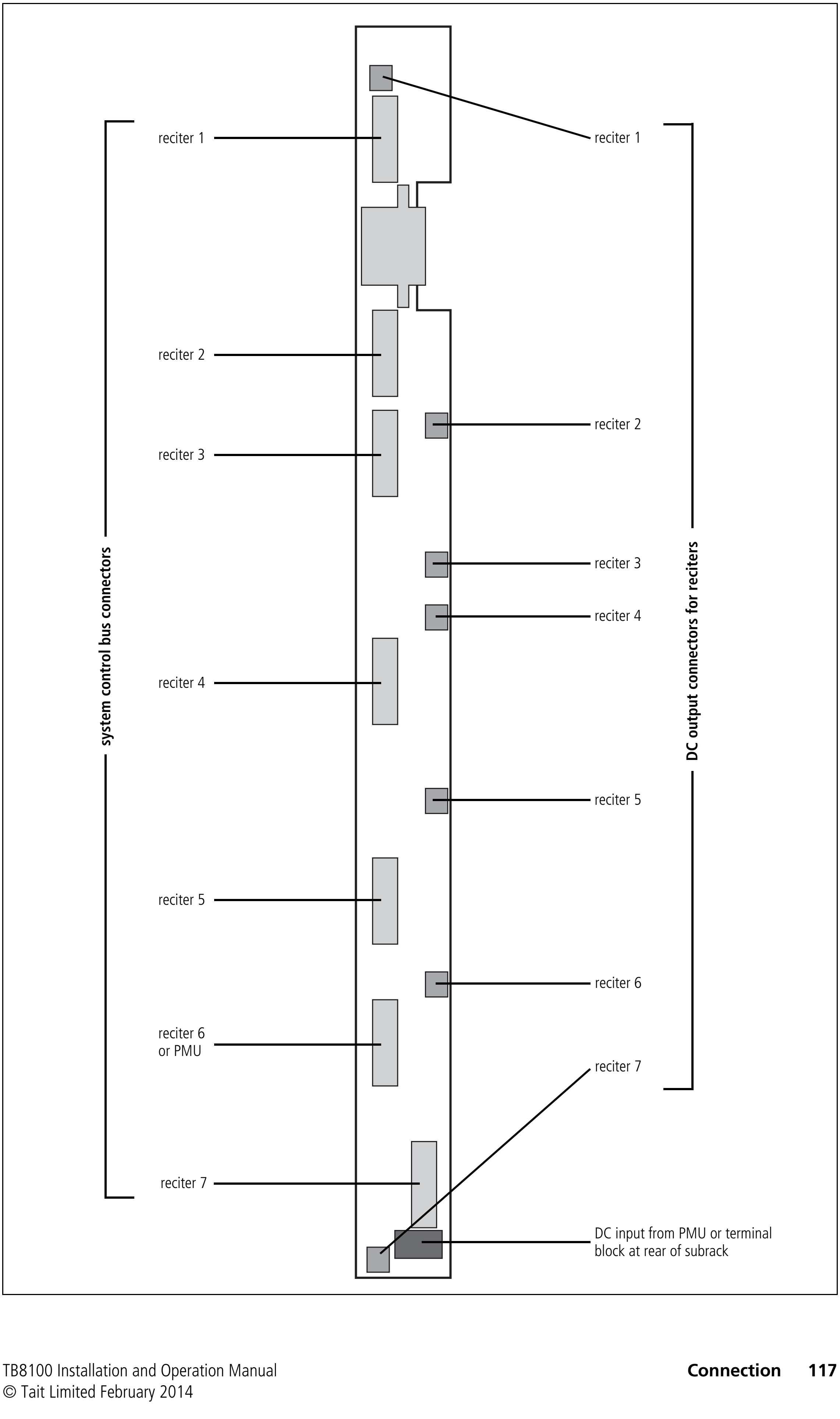
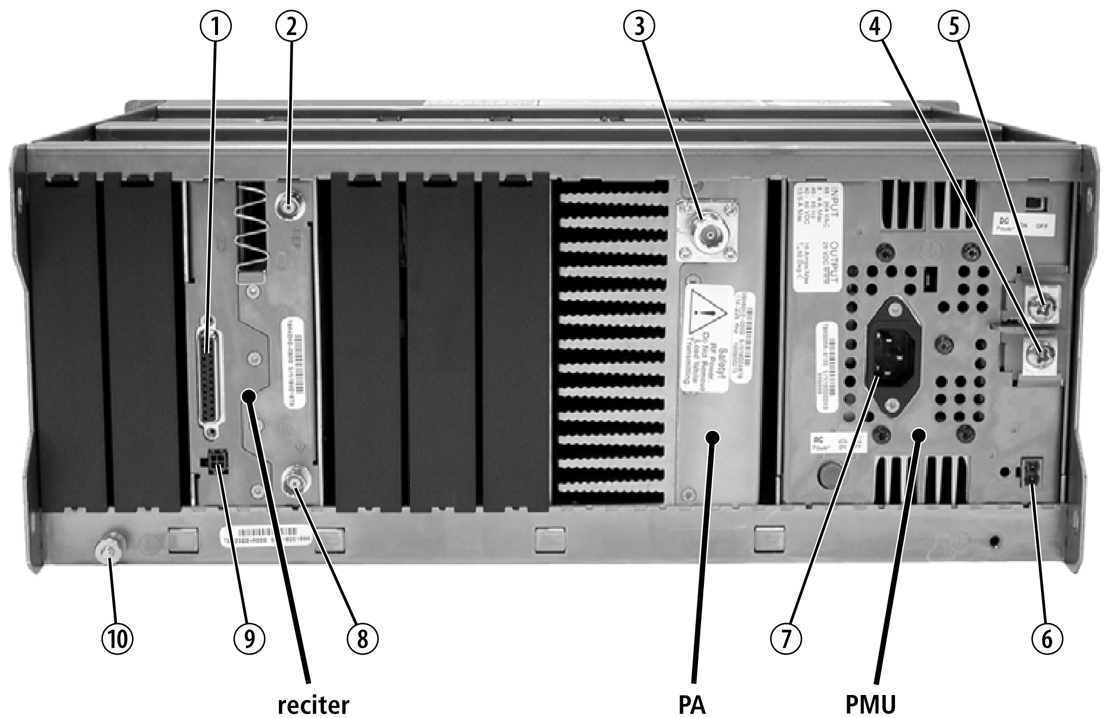


Figure 6.7 Connections on a single 5 W or 50 W base station - rear view

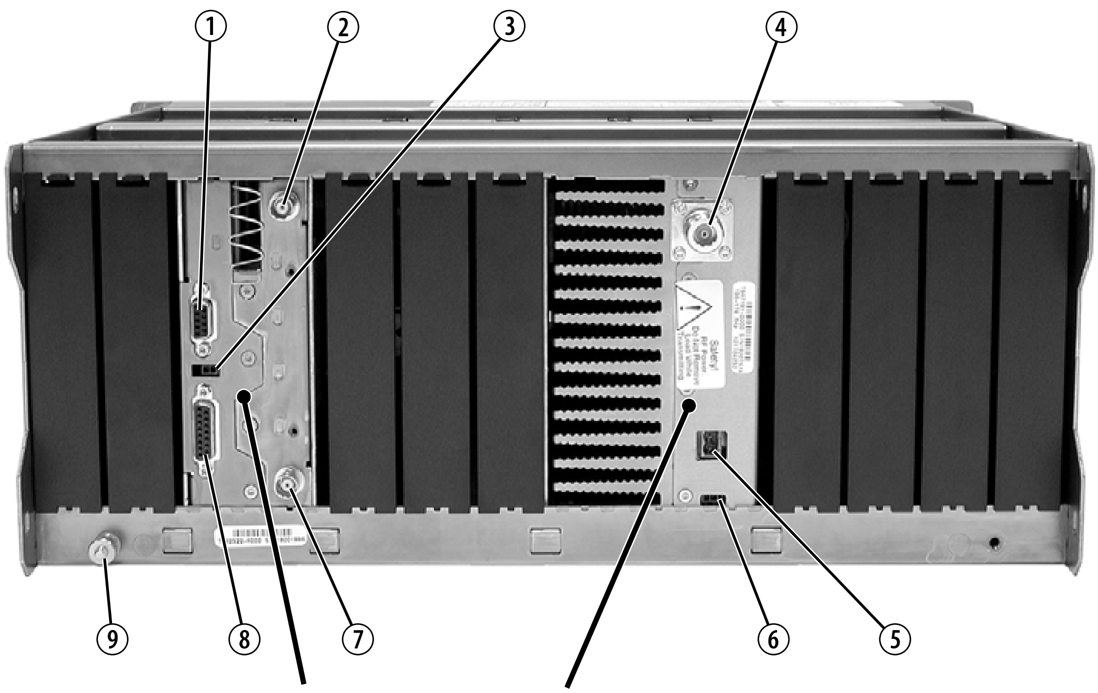


① system interface connector
② external reference frequency input
③ RF output (to antenna)
④ –VDC input
⑤ +VDC input
⑥ auxiliary DC output
⑦ AC mains input
⑧ RF input (from antenna)
⑨ auxiliary DC input for system interface[a]
⑩ subrack ground connector[b]

a. Older system interface boards use the 4-way connector shown in the photograph, while the TaitNet RS-232 board and all other boards manufactured after March 2005 use a 2-way connector. Refer to "Reciter Auxiliary DC Input from PMU" on page 129 for more details.

b. Later subracks have an M5 nut on the ground connector.

Figure 6.8 Connections on a single 5W or 50W 12V PA base station - rear view



①	RS-232 connector	⑥	Power Saving control input
②	external reference frequency input	⑦	RF input (from antenna)
③	auxiliary DC input for system interface	⑧	TaitNet system interface connector
④	RF output (to antenna)	⑨	subrack ground connector[a]
⑤	12VDC input		

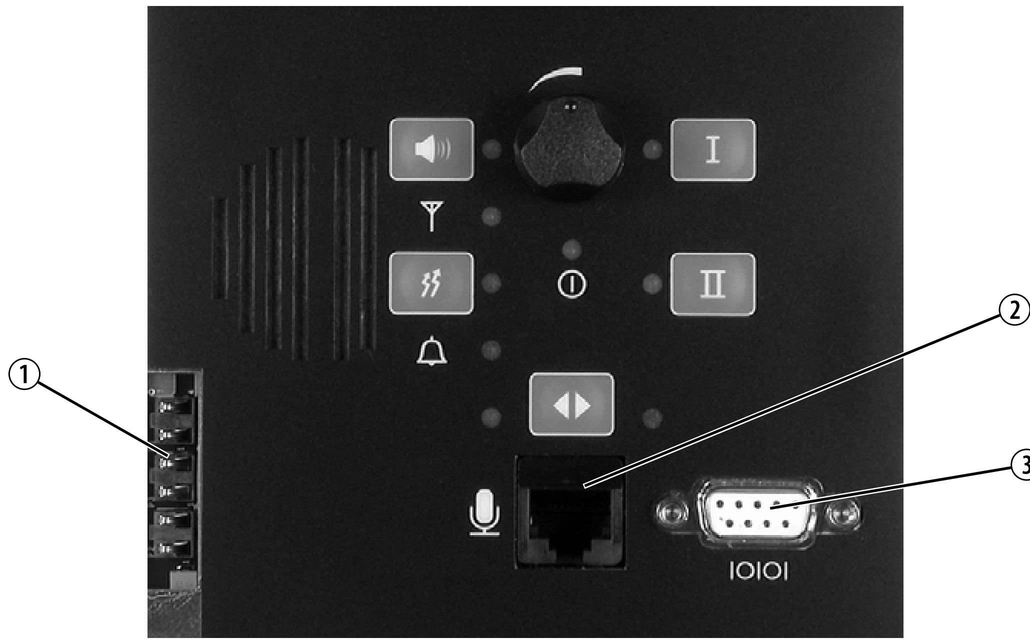
a. Later subracks have an M5 nut on the ground connector.

6.1.2 Control Panel Connections

When a reciter fitted with a TaitNet RS-232 or High Density/RS-232 system interface board is used in a base station, the RS-232 port on the control panel is disabled. In this situation you must connect to the RS-232 port at the rear of the reciter. Refer to "TaitNet RS-232" on page 145 or "High Density/RS-232" on page 140 for more details. When a reciter fitted with a TaitNet Ethernet or High Density/Ethernet system interface board is used, the RS-232 port on the control panel is available only when the base station first powers up. Refer to "Service Kit Connection to an Ethernet Base Station" on page 152 for more details.

If high-power HF equipment is located close to the base station, it can sometimes cause interference to RS-232 serial port communications. If this interference does occur, we recommend fitting ferrites on the serial cable close to the control panel. This recommendation only applies to communication equipment permanently connected to the base station.

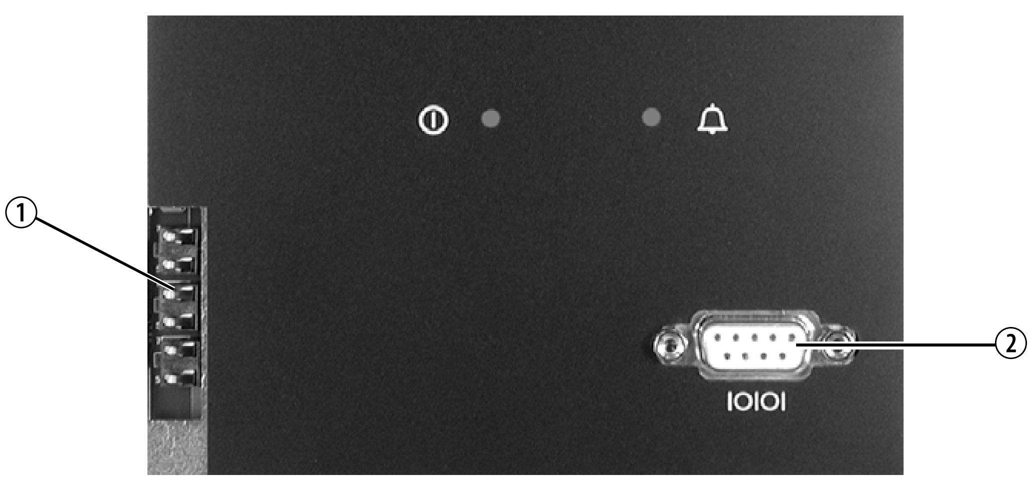
Figure 6.9 Connections on the dual base station control panel



1. DC outputs for fans mounted on front panel; also used for fan rotation detectors (if fitted)
2. microphone connector
3. RS-232 programming port

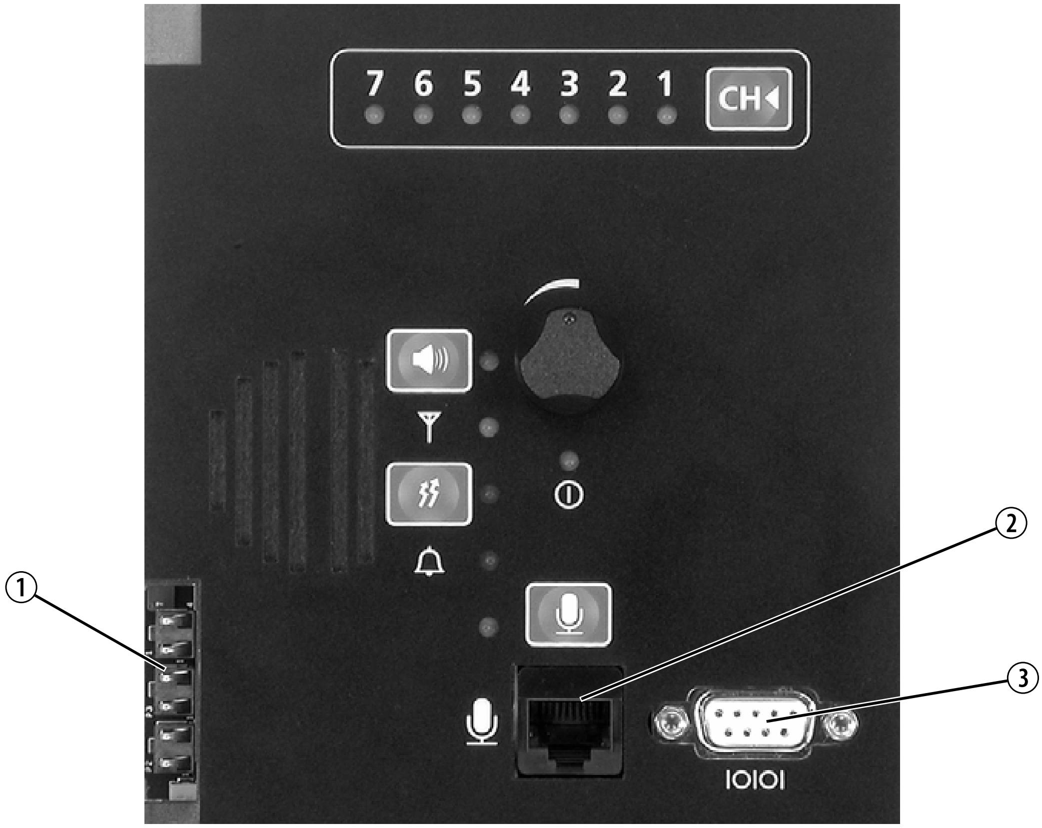
ⓘ The microphone input feeds simultaneously to both base station 1 and base station 2. However, the PTT can only be used on the currently selected base station. The RS-232 connection is only to the reciter on the currently selected base station. You should disconnect the Service Kit before switching base stations.

Figure 6.10 Connections on the Power Save control panel



1. DC outputs for fans mounted on front panel; also used for fan rotation detectors (if fitted)
2. RS-232 programming port

Figure 6.11 Connections on the multi-reciter control panel



① DC outputs for fan mounted on front panel (if fitted); also used for fan rotation detectors (if fitted)

② microphone connector

③ RS-232 programming port

ⓘ The microphone input feeds to the currently selected reciter, and the PTT can only be used on that channel. The RS-232 connection is only to the currently selected reciter. You should disconnect the Service Kit before switching reciters.

6.1.3 Connector Torque Settings

Some of the connectors used in the base station have recommended torque settings. These are listed in the following table.

Location / Function	Torque	Driver	Size
SMA connectors (reciter RF output and PA RF input)	0.6 N·m (5 lbf·in)	5/16 in or 8 mm AF	
DC input terminal screws on the PMU	2–2.25 N·m (18–20 lbf·in)	PZ3	M6
DC connectors (PA DC input cables, and PMU auxiliary DC input cable)	0.5 N·m (4.5 lbf·in)		

6.2 Power Supply Connections

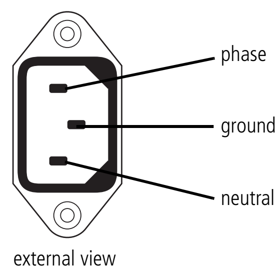
6.2.1 AC Power

The PMU is designed to accept a mains input of 88 to 264 VAC at 45 to 65 Hz. A standard 3-wire grounded socket-outlet must be used to supply the AC power. The socket-outlet must be installed near the equipment and must be easily accessible. This outlet should be connected to an AC power supply capable of providing a maximum of 600 W. The requirements of two typical AC supplies are given in the following table.

Nominal Supply Voltage	Current Requirement[a]	Circuit Breaker/Fuse Rating[a]
115 VAC	8 A	10 A
230 VAC	4 A	6 A

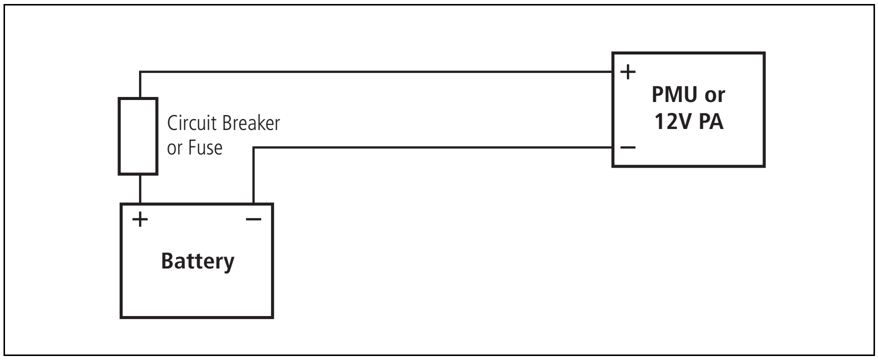
a. The actual current consumption of the base station will be lower than these requirements (refer to the Specifications Manual for more information).

Your base station should come supplied with a power supply cord to connect the male IEC connector on the PMU to the local AC supply. The pins of the IEC connector on the PMU are identified at right.



6.2.2 DC Power

Figure 6.12 Recommended DC power connection



DC Power with a PMU

The PMU is designed to accept a nominal 12VDC, 24VDC or 48VDC input (depending on the model) with negative or positive ground. There is a minimum DC startup threshold to prevent damaging a battery which has little capacity left.

You must connect the DC supply from the battery to the PMU via a fuse or DC-rated circuit breaker with a contact separation of 3mm, and with the appropriate rating, as shown in the table below. The DC input leads should be of a suitable gauge to ensure less than 0.2V drop at maximum load over the required length of lead.

Nominal Supply Voltage	Circuit Breaker/Fuse Rating[a]	Recommended Wire Gauge[b]
12VDC	60A	35mm^2 / 2AWG
24VDC	30A	16mm^2 / 5AWG
48VDC	15A	8mm^2 / 8AWG

a. The actual current consumption of the base station will be lower than these requirements (refer to the Specifications Manual for more information).

b. For a length of 1.5m to 2m (5ft to 6.5ft) (typical).

Terminate and insulate the DC input leads so they are protected from accidentally shorting to the subrack if the PMU is removed before the leads are disconnected. Protective covers for the DC terminals are supplied with each PMU.

We recommend that you fit the supplied flat and shakeproof washers to the DC terminal screws to stop them working loose.

DC Power with a 12V PA

The 12V PA is designed to accept a nominal 12VDC input with negative ground. There is a minimum DC startup threshold to prevent damaging a battery which has little capacity left.

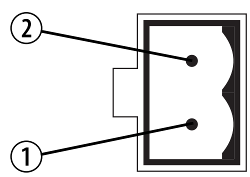
You must connect the DC supply from the battery to the PA via a fuse or DC-rated circuit breaker with a contact separation of 3mm, and with the appropriate rating, as shown in the table below. The DC input leads should be of a suitable gauge to ensure less than 0.2V drop at maximum load over the required length of lead.

Nominal Supply Voltage	Circuit Breaker/Fuse Rating[a]	Recommended Wire Gauge[b]
12VDC	15A to 18A	8mm^2 / 8AWG

a. The actual current consumption of the base station will be lower than these requirements (refer to the Specifications Manual for more information).

b. For a length of 1.5m to 2m (5ft to 6.5ft) (typical).

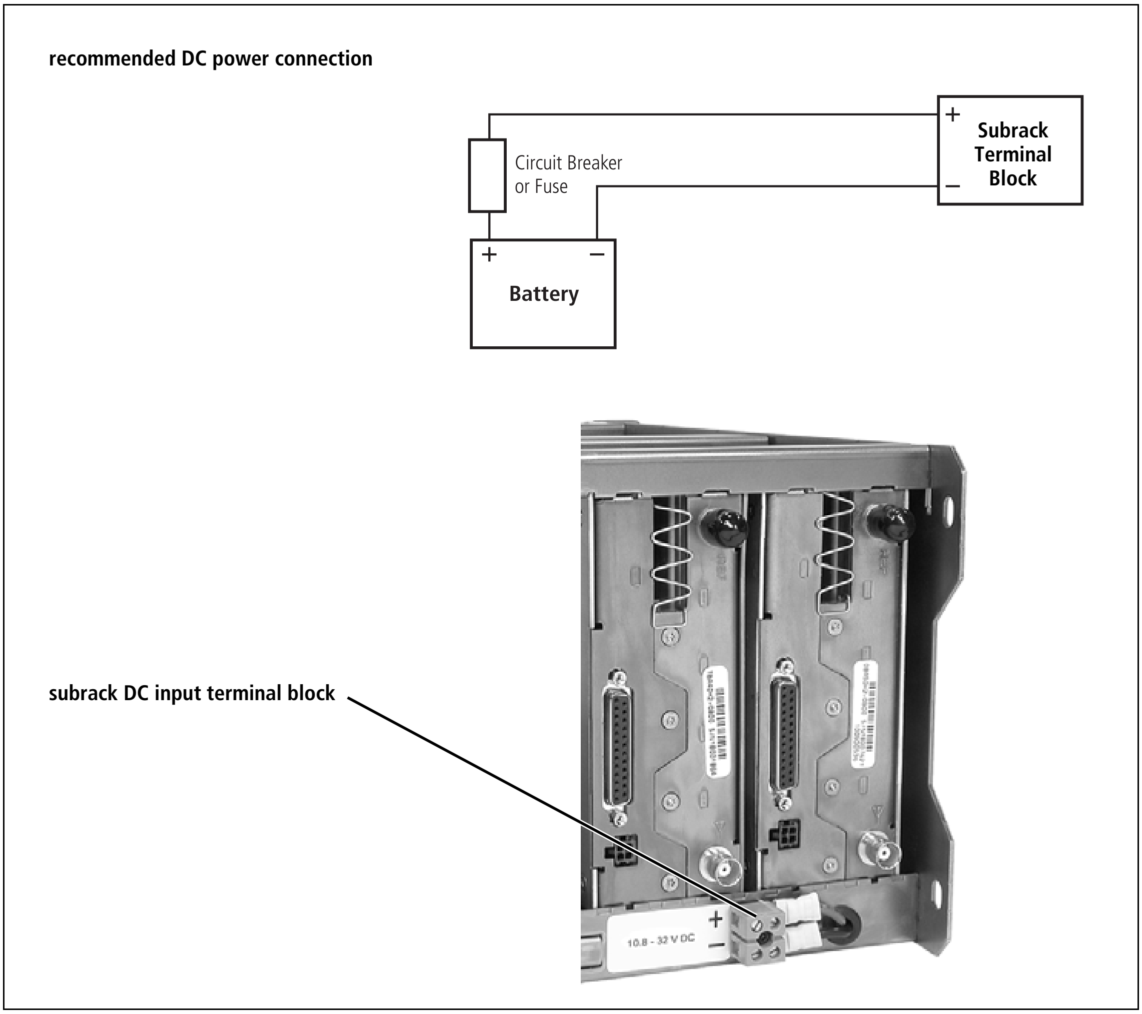
The pin allocations for the 2-way DC input connector are shown below.

	Pin	Description
 2-way connector - external view	1	+V input
	2	ground

DC Power with a Multi-reciter Subrack

The multi-reciter subrack (with no PMU) is designed to accept a DC input of 10.8VDC to 32VDC with negative ground. The DC input terminal block is mounted on the rear of the subrack (refer to Figure 6.13).

Figure 6.13 DC power supply connection for a multi-reciter subrack (with no PMU)

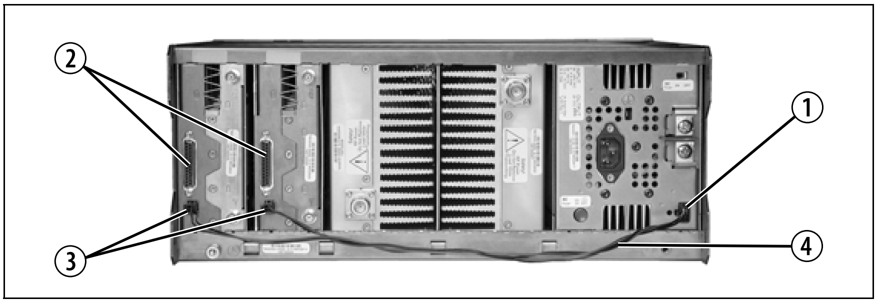


6.2.3 Auxiliary DC Power

PMU Auxiliary DC Output

The PMU can provide an auxiliary DC output from the auxiliary power board. This board is available with an output of 13.65 VDC, 27.3 VDC, or 54.6 VDC (depending on the model), and is current limited to 3 A, 1.5 A or 750 mA respectively. This power supply is available on the auxiliary DC output connector ① on the rear panel. DC from this output can be supplied to the +AUX_V pin on the system interface connector ② on the reciter via the auxiliary DC input connector ③ on the system interface board (see "Reciter Auxiliary DC Input from PMU" below). The auxiliary DC power cable ④ is described in "Auxiliary DC Power Supply Cable" on page 130.

Figure 6.14 Auxiliary DC power supply connections



The auxiliary power supply is configured with the Service Kit (Configure > Base Station > Miscellaneous > Power configuration > Auxiliary power control). Its operation can be controlled by Task Manager statements, for example:

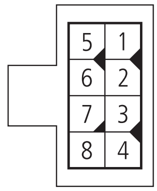
IF **Digital input 01 active** THEN **Enable auxiliary supply.**

Refer to the Service Kit documentation for more details.

ⓘ The auxiliary power supply is available in Sleep mode, but not in Deep Sleep mode.

You can connect multiple auxiliary power supply boards in parallel for redundancy purposes, or to provide an output greater than 40 W. Although no active current sharing is used, auxiliary boards connected in parallel will current-share before reaching their power limit. For redundancy purposes the failure (or switching off) of one auxiliary board will not load any other paralleled auxiliary boards in the circuit.

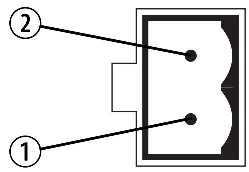
Two different types of auxiliary DC output connector have been fitted to the PMU. The pin allocations for the 8-way connector fitted to PMUs manufactured before August 2004 are given in the following table. Note that pins 1 to 4 and pins 5 to 8 on this connector are linked.



8-way connector - external view

Pin	Description	Linked Pins
1	+V output	●
2	+V output	●
3	+V output	●
4	+V output	●
5	ground	●
6	ground	●
7	ground	●
8	ground	●

The pin allocations for the 2-way connector fitted to PMUs manufactured from August 2004 onwards are given in the following table.



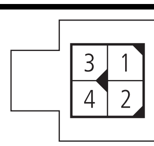
2-way connector - external view

Pin	Description
1	+V output
2	ground

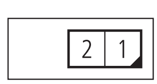
Reciter Auxiliary DC Input from PMU

The system interface board in the reciter has an auxiliary DC input connector. DC from the auxiliary DC output on the PMU can be supplied to the +AUX_V pin on the system interface connector via this input (see "PMU Auxiliary DC Output" above).

The pin allocations for the auxiliary DC input on the system interface board are given in the following table. Older boards use the 4-way connector, while the TaitNet RS-232 board and all other boards manufactured after March 2005 use the 2-way connector. Note that pins 1 & 3 and pins 2 & 4 on the 4-way connector are linked. Refer to "System Connections" on page 132 for the pin allocations for +AUX_V on each system interface board.



4-way connector - external view



2-way connector - external view

Pin	Description	Linked Pins
1	+V input	●
2	ground	●
3	+V input	●
4	ground	●

The DC output from the PMU is 13.65 VDC, 27.3 VDC, or 54.6 VDC (depending on the model). Although this power output is isolated, the negative side of the supply is grounded on the system interface board to give a +V output.

Auxiliary DC Power Supply Cable

Figure 6.15 below shows the TBAA04-05 auxiliary DC power cable. Details of the individual connector types are also provided in case you want to make up your own cable.

Figure 6.15 Auxiliary DC power cable

Contact your regional Tait office for details on the full range of wiring kits available.

6.3 RF Connections

Notice The PA may be damaged if the load is removed or switched while the PA is transmitting. Refer to "Antenna Load" on page 91 for more details.

The RF input to the base station is via the lower BNC/TNC connector on the rear panel of the reciter. The RF output is via the N-type connector on the rear panel of the PA (refer to Figure 6.7on page 118).

We recommend that you use dual-screened coaxial cable such as RG223 for the BNC/TNC connections, and RG214 for the N-type connections.

When the base station is used in simplex mode using a single antenna with a coaxial changeover relay, the isolation of this relay must be ≥40 dB.

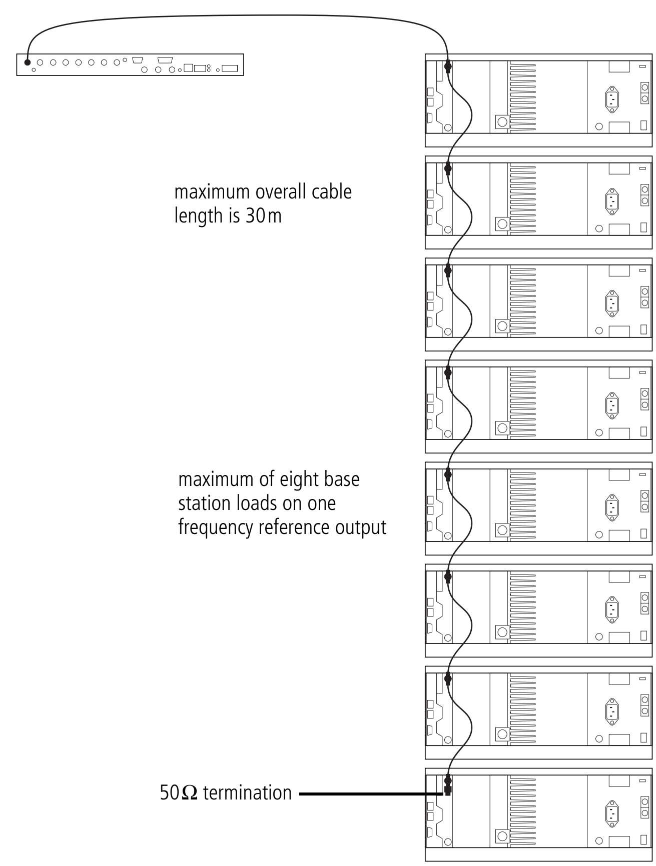
6.4 Connecting an External Frequency Reference

For K4 Band, the internal frequency reference accuracy is inadequate, and an external reference **must** be used. An external reference is also required for simulcast. The external reference frequency can be 10MHz or 12.8MHz, with an input level of 300mV$_{pp}$ to 5V$_{pp}$. The stability of this reference should be better than 50 parts per billion (for non-simulcast) or ≤1 part per billion (for simulcast).

If an external reference is required, use the CSS to program the base station for 10MHz or 12.8MHz ("Configure > Network Element > Miscellaneous"), and to enable the external reference "Absent" and "Invalid" alarms ("Configure > Alarms > Control").

Use a 50Ω coaxial cable (RG58 or RG223) to connect the external reference to the base station's external reference frequency input. You can daisy-chain up to eight base stations using T-junctions. The maximum overall cable length is 30m. Terminate the last connection with a 50Ω load.

Figure 6.16 Daisy-chaining an external frequency reference input



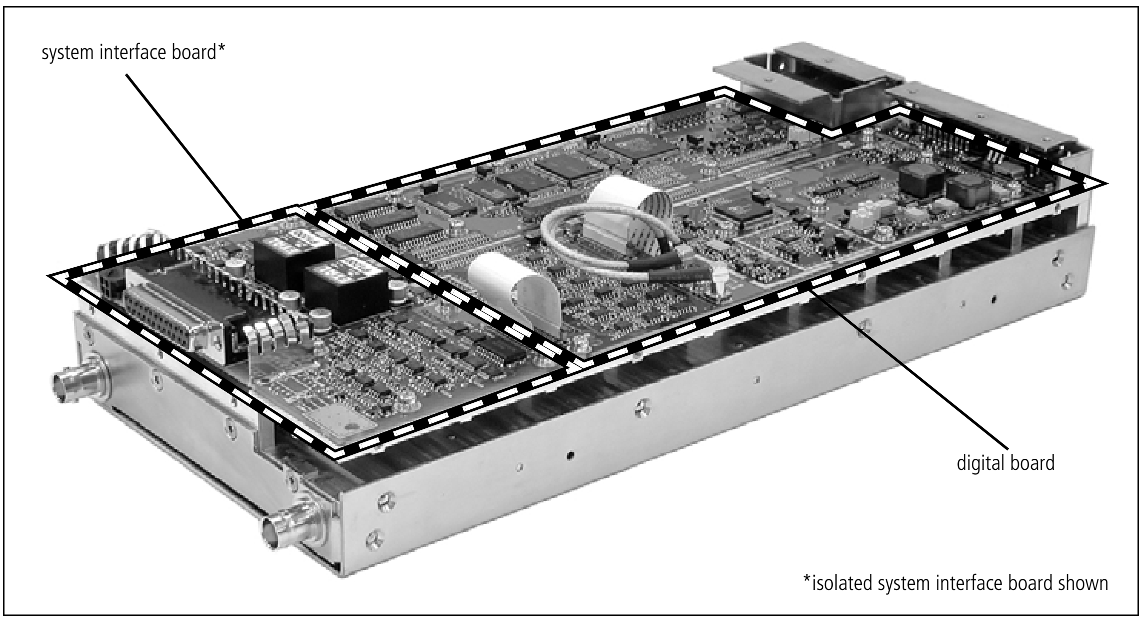
6.5 System Connections

The reciter can be fitted with an optional system interface board which provides the links between the reciter's internal circuitry and external equipment. This board is securely mounted to the reciter's chassis and is connected to the digital board with a flexible connector. The system interface board is fitted with industry-standard connectors and several standard types are available for different applications.

The circuitry on the system interface board provides additional signal processing so that the outputs meet standard system requirements. It also enables the board to identify itself to the reciter control circuitry. The system interface board is removable, which makes it possible to change the application of a reciter by removing one type of board and fitting another. Only one system interface board can be fitted to a reciter at any one time.

This section provides details on the system interface boards available at the time of publication. Other types may be developed for future applications.

Figure 6.17 System interface board



6.5.1 Digital Interface

The system interface board provides several different types of digital interface connections. The type and number of connections available depends on the type of system interface board. These connections are described in "System Interface Connections" on page 137, and also in the Service Kit (Configure > Base Station > System Interface). For details on the interface levels for these connections refer to the Specifications Manual (MBA-00001-xx).

The digital interface signals supported by the base station are described below.

Digital Inputs

Digital inputs are read by the reciter RISC and can be used to perform various actions based on the configuration of the reciter. The two major uses for digital inputs are Channel Change and Task Manager. For example, to send a status email when the status of a digital input line is changed, you can use the following Task Manager statement: IF **Digital input 01 active** THEN **Email status now**.

Digital Outputs

All digital outputs are controlled by Task Manager statements. For example, when any enabled base station alarm goes active, you can indicate this by turning on digital output 1 with the following Task Manager statement: IF **Base station alarm on** THEN **Activate digital output 1**.

ⓘ Digital outputs 1 and 2 on the reciter may be active while the TB8100 base station is powering up. This applies to reciters fitted with a version 0 (zero) system interface board, but does not apply to reciters fitted with a TaitNet RS-232 system interface board. If this will cause problems for external equipment connected to the base station, disconnect the system interface connector when resetting the base station. To check the version of a system interface board, run the Service Kit and select Monitor > Module Details > Reciter. In the **Versions** area, the **System Interface** field displays the version number.

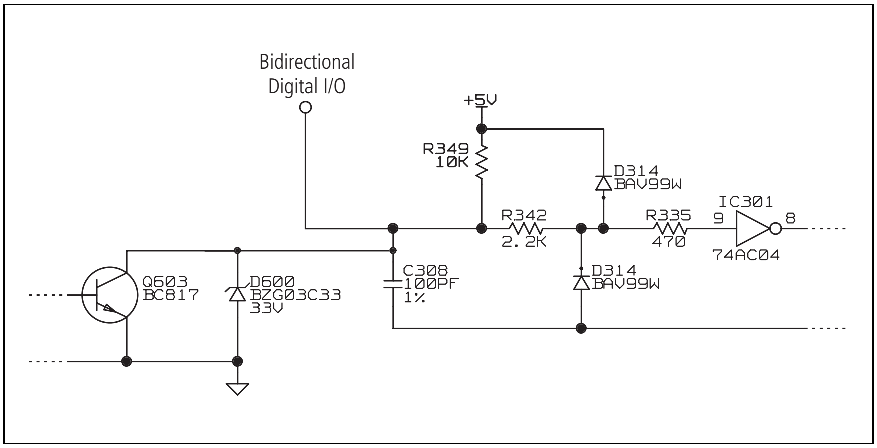
Bidirectional Inputs/ Outputs

Bidirectional signals can operate as either digital inputs or digital outputs, based on how Task Manager is configured. Bidirectional signals use the same processes described above to set and read the status of digital inputs and outputs. When a bidirectional pin has its output activated, a reading of that pin will reflect the current status on that line. Thus, it is possible to use a bidirectional pin for input-only or output-only actions, if only that specific action is configured for that digital pin number in Task Manager.

ⓘ Each bidirectional pin has a 10k pull-up resistor to +5V as part of the digital input circuitry (refer to Figure 6.18 on page 134). If you are using a bidirectional pin as a digital output, and the pull-up voltage is greater than 5V, some residual current will flow through the pull-up resistor. This may affect the operation of the digital output.

One possible way to offset this residual voltage is to use a zener diode. The voltage rating of the diode should match the difference (in volts) between the applied voltage and 5V. For example, if the applied voltage is 12V, the rating of the diode should be approximately 7V.

Figure 6.18 Bidirectional input/output circuit detail



6.5.2 Connecting to the TaitNet Unbalanced Audio Input

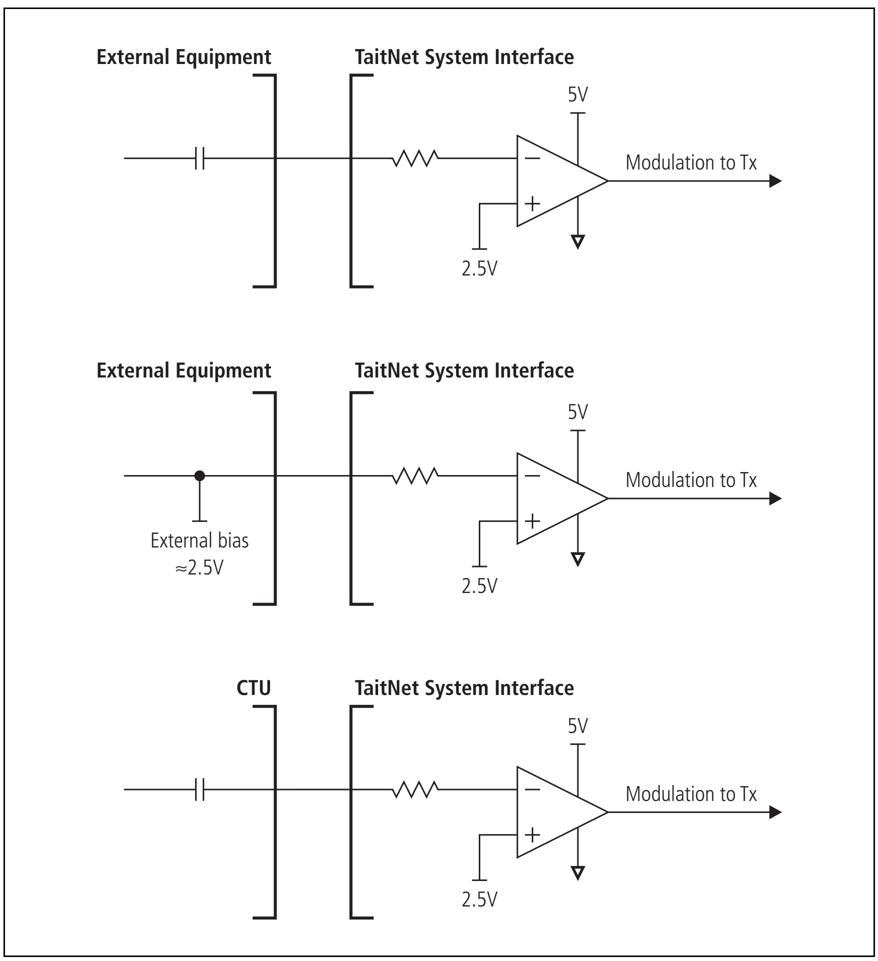
The following information refers to equipment manufactured after August 2005. Refer to "Equipment Manufactured before August 2005" on page 136 for information on earlier equipment.

The unbalanced audio input on TaitNet, TaitNet RS-232 and TaitNet Ethernet system interface boards is DC coupled. This is provided to allow fast transient inputs, such as POCSAG paging or modem connections. (Note that all other system interface boards are AC coupled.)

When connecting external equipment to the TaitNet unbalanced input, make sure that either the external circuitry is AC coupled, or the external circuitry provides a DC bias to maintain DC operating conditions. This will ensure that the transmitter modulation symmetry, audio distortion and centre frequency are not affected. The CTU can be connected directly to the TaitNet unbalanced input because it already has a DC blocking capacitor to AC couple audio into the unbalanced input.

Figure 6.19 shows a simplified version of the unbalanced input circuitry.

Figure 6.19 Unbalanced audio input circuit detail



Equipment Manufactured before August 2005

The unbalanced input on the CTU was changed from DC coupled to AC coupled in August 2005. This modification (fitting a capacitor) was necessary because the unbalanced input on TaitNet and TaitNet RS-232 system interface boards was changed at that time from AC coupled to DC coupled. This change was made for paging, and the version of these boards was changed from 0 to 1. If your reciter is fitted with a version 1 TaitNet or TaitNet RS-232 board, you must use a CTU that is AC coupled. If the CTU and system interface board are both DC coupled, and the test equipment is not AC coupled, the DC signal will directly pull the modulator carrier frequency.

To check the version of a system interface board, run the Service Kit and select Monitor > Module Details > Reciter. In the **Versions** area, the **System Interface** field displays the version number.

The TaitNet Ethernet system interface board has always been DC coupled.

CTUs with the serial number 18012507 and higher incorporate the change on the PCB, but earlier CTUs must be modified as described in TN-1082. To check if your CTU has been modified, use a multimeter to check the continuity between the centre pin of the unbalanced input BNC connector (UB INPUT) and pin 6 of the 15-way system interface connector (or pin 5 of the 25-way connector). An open circuit indicates the capacitor is fitted, a short circuit indicates the capacitor is not fitted.

6.5.3 System Interface Connections

Table 6.1 below provides an overview of the main features of the system interface boards available at the time of publication. The subsections which follow provide detailed information on the inputs and outputs available on each system interface.

Table 6.1 Main features of the system interface boards

	System Interface Board						
Feature	**Isolated**	**Isolated E & M**	**High Density/ RS-232**	**High Density/ Ethernet**	**TaitNet**	**TaitNet RS-232**	**TaitNet Ethernet**[a]
balanced audio	isolated	isolated	isolated	isolated	isolated	isolated	isolated
unbalanced audio	✓	✓	✓	✓	✓	✓	✓
unbalanced audio input	AC coupled				version 0: AC coupled[b] version 1: DC coupled		DC coupled
RSSI	✓	✓	✓	✓			✓
Rx Gate	✓	✓	✓	✓	✓	✓	✓
Tx Key	✓	✓	✓	✓	✓	✓	✓
digital inputs	6	2	6	6	1	1	
digital outputs	2	2	2	2	3	3	
bidirectional digital inputs/outputs	4[c]	4[c]	4[c]	4[c]			4[d]
Tx relay output	✓	✓	✓	✓			✓
auxiliary power	✓	✓	✓	✓	✓	✓	✓
opto-coupled input		✓					✓
opto-coupled output		✓					✓
third-party connector	✓	✓	✓	✓	✓	✓	✓
RS-232 serial port			✓			✓	
Ethernet connector				✓			✓

a. On the TaitNet Ethernet system interface board, some pins on the system interface connector can be configured to provide different signals (selectable by switch). For more details refer to "TaitNet Ethernet" on page 146.

b. The unbalanced input on these boards was changed from AC to DC coupled in August 2005. This change was made for paging, and the version of these boards was changed from 0 to 1. To check the version of a system interface board, run the Service Kit and select Monitor > Module Details > Reciter. In the **Versions** area, the **System Interface** field displays the version number.

c. On version 1 and later system interface boards, digital inputs 3, 4, 5, and 6 may also be configured as outputs using a Task Manager statement. Refer to "Digital Interface" on page 133 and to the Service Kit documentation.

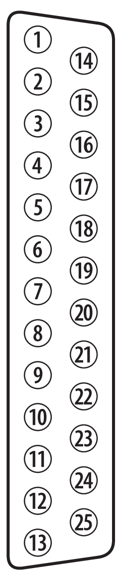
d. On the TaitNet Ethernet system interface board, digital inputs 1, 2, 3, and 4 may also be configured as outputs using a Task Manager statement. Refer to "Digital Interface" on page 133 and to the Service Kit documentation.

Isolated

This system interface board is fitted to reciters bearing the product code TBA4xxx-0B00 or TBA5xxx-0B00. If purchased separately, it has the spares code TBA-SP-S0B0. The balanced audio interfaces are galvanically (transformer) isolated. It provides the following:

- transformer isolated 600Ω balanced audio I/O
- high impedance unbalanced audio I/O
- digital I/O (2 outputs, 6 inputs, 4 bi-directional)
- Tx key
- Tx relay
- Rx gate
- RSSI

It is fitted with a 25-way female D-range connector and a 2-way auxiliary DC input connector. The pin allocations for the D-range are listed in the table below, and the pin allocations for the DC input connector are provided in "Reciter Auxiliary DC Input from PMU" on page 129.



external view

Pin	Signal Name	Signal Type	Notes
1	Rx line out +	audio output	transformer isolated line
2	Rx line out –		
3	Rx audio out	audio output	AC coupled
4	ground	ground	
5	Tx audio in	audio input	AC coupled
6	Tx line in +	audio input	transformer isolated line
7	Tx line in –		
8	RSSI	DC signal	
9	Rx gate	output	open collector
10	Tx key	input	active low
11	digital out 1[a]	output	open collector
12	digital out 2		
13	+AUX_V	power output	from auxiliary DC input; maximum current 3 A
14	digital in 1	input	5 V TTL logic active low
15	digital in 2		
16	digital in/out 3[b]		
17	digital in/out 4[b]		
18	digital in/out 5[b]		
19	digital in/out 6[b]		
20	digital in 7		
21	digital in 8		
22	digital in 9		
23	digital in 10		
24	Tx relay	output	open collector
25	ground	ground	

a. If a base station with a 12 V PA is configured for Deep Sleep, digital out 1 is dedicated to Power Saving control and cannot be used for any other Task Manager function.

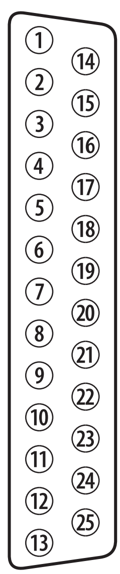
b. On version 1 and later system interface boards, digital inputs 3, 4, 5, and 6 may also be configured as outputs using a Task Manager statement. Refer to "Digital Interface" on page 133 and to the Service Kit documentation.

Isolated E&M

This system interface board is fitted to reciters bearing the product code TBA4xxx-0C00 or TBA5xxx-0C00. If purchased separately, it has the spares code TBA-SP-S0C0. It provides the following:

■ transformer isolated 600Ω balanced audio I/O	■ Tx key
■ opto-isolated keying	■ Tx relay
■ opto-isolated gate output	■ Rx gate
■ digital I/O (2 outputs, 2 inputs, 4 bi-directional)	■ RSSI

It is fitted with a 25-way female D-range connector and a 2-way auxiliary DC input connector. The pin allocations for the D-range are listed in the table below, and the pin allocations for the DC input connector are provided in "Reciter Auxiliary DC Input from PMU" on page 129.



external view

Pin	Signal Name	Signal Type	Notes
1	Rx line out +	audio output	transformer isolated line
2	Rx line out –		
3	Rx audio out	audio output	AC coupled
4	audio ground	ground	
5	Tx audio in	audio input	AC coupled
6	Tx line in +	audio input	transformer isolated line
7	Tx line in –		
8	RSSI	DC signal	
9	Rx gate	output	open collector
10	Tx key	input	active low
11	digital out 1[a]	output	open collector
12	digital out 2		
13	+AUX_V	power output	from auxiliary DC input; maximum current 3A
14	digital in 1	input	5V TTL logic active low
15	digital in 2		
16	digital in/out 3[b]		
17	digital in/out 4[b]		
18	digital in/out 5[b]		
19	digital in/out 6[b]		
20	opto +/–	isolated keying input	input voltage range ±10VDC to ±60VDC; current rating 10mA
21	opto –/+		
22	relay +/–	isolated gate output	
23	relay –/+		
24	Tx relay	output	open collector
25	ground	ground	

a. If a base station with a 12V PA is configured for Deep Sleep, digital out 1 is dedicated to Power Saving control and cannot be used for any other Task Manager function.

b. On version 1 and later system interface boards, digital inputs 3, 4, 5, and 6 may also be configured as outputs using a Task Manager statement. For more details refer to "Digital Interface" on page 133 and to the Service Kit documentation.

High Density/ RS-232

The High Density/RS-232 system interface board provides the standard inputs and outputs of the Isolated system interface, with the addition of an RS-232 interface. This is made possible by providing the isolated inputs and outputs on a high-density 26-way D-range connector.

The pin allocations for pins 1 to 25 on the high-density 26-way D-range are the same as for pins 1 to 25 on the isolated 25-way D-range. Pin 26 is ground.

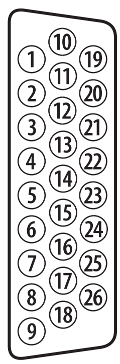
This system interface board is fitted to reciters bearing the product code TBA4xxx-0M00 or TBA5xxx-0M00. If purchased separately, it has the spares code TBA-SP-S0M0. The balanced audio interfaces are galvanically (transformer) isolated. It provides the following:

■ transformer isolated 600Ω balanced audio I/O	■ Tx key	■ RSSI
■ high impedance unbalanced audio I/O	■ Tx relay	
■ digital I/O (2 outputs, 6 inputs, 4 bi-directional)	■ Rx gate	

It is fitted with a 26-way female high density D-range connector, a 9-way female D-range connector (RS-232), and a 2-way auxiliary DC input connector. The pin allocations for the D-ranges are listed in the tables on the following page, and the pin allocations for the DC input connector are provided in "Reciter Auxiliary DC Input from PMU" on page 129.

When a reciter fitted with an High Density/RS-232 system interface board is used in a base station, the RS-232 port on the control panel is disabled. In this situation you must connect to the RS-232 port at the rear of the reciter.

Each High Density/RS-232 system interface board is supplied with a TBA101D interface board. This brings the inputs and outputs from the 26-way D-range onto a standard 25-way female D-range with the same functionality as the Isolated system interface. Refer to "TBA101D Interface Board" on page 157 for more information.

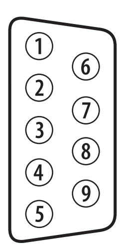


external view

Pin	Signal Name	Signal Type	Notes
1	Rx line out +	audio output	transformer isolated line
2	Rx line out –		
3	Rx audio out	audio output	AC coupled
4	ground	ground	
5	Tx audio in	audio input	AC coupled
6	Tx line in +	audio input	transformer isolated line
7	Tx line in –		
8	RSSI	DC signal	
9	Rx gate	output	open collector
10	Tx key	input	active low
11	digital out 1[a]	output	open collector
12	digital out 2		
13	+AUX_V	power output	from auxiliary DC input; maximum current 1 A
14	digital in 1	input	5 V TTL logic active low
15	digital in 2		
16	digital in/out 3[b]		
17	digital in/out 4[b]		
18	digital in/out 5[b]		
19	digital in/out 6[b]		
20	digital in 7		
21	digital in 8		
22	digital in 9		
23	digital in 10		
24	Tx relay	output	open collector
25	ground	ground	
26	ground		

a. If a base station with a 12 V PA is configured for Deep Sleep, digital out 1 is dedicated to Power Saving control and cannot be used for any other Task Manager function.

b. On version 1 and later system interface boards, digital inputs 3, 4, 5, and 6 may also be configured as outputs using a Task Manager statement. For more details refer to "Digital Interface" on page 133 and to the Service Kit documentation.



external view

Pin	Description	Linked Pins
1	not connected	●
2	receive data	
3	transmit data	
4	not connected	●
5	ground	
6	not connected	●
7	not connected	●
8	not connected	●
9	not connected	

High Density/ Ethernet

The High Density/Ethernet system interface board provides the standard inputs and outputs of the Isolated system interface, with the addition of an Ethernet interface. This is made possible by providing the isolated inputs and outputs on a high-density 26-way D-range connector.

The pin allocations for pins 1 to 25 on the high-density 26-way D-range are the same as for pins 1 to 25 on the isolated 25-way D-range. Pin 26 is ground.

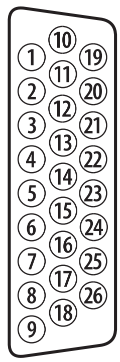
This system interface board is fitted to reciters bearing the product code TBA4xxx-0J00 or TBA5xxx-0J00. If purchased separately, it has the spares code TBA-SP-S0J0. The balanced audio interfaces are galvanically (transformer) isolated. It provides the following:

■ transformer isolated 600Ω balanced audio I/O	■ Tx key	■ RSSI
■ high impedance unbalanced audio I/O	■ Tx relay	
■ digital I/O (2 outputs, 6 inputs, 4 bi-directional)	■ Rx gate	

It is fitted with a 26-way female high density D-range connector, an RJ45 connector (Ethernet), and a 2-way auxiliary DC input connector. The pin allocations for the RJ45 and D-range connectors are listed in the tables on the following page, and the pin allocations for the DC input connector are provided in "Reciter Auxiliary DC Input from PMU" on page 129.

When a reciter fitted with an High Density/Ethernet system interface board is used in a base station, the RS-232 port on the control panel is available only when the base station first powers up. Refer to "Service Kit Connection to an Ethernet Base Station" on page 152 for more details.

Each High Density/Ethernet system interface board is supplied with a TBA101D interface board. This brings the inputs and outputs from the 26-way D-range onto a standard 25-way female D-range with the same functionality as the Isolated system interface. Refer to "TBA101D Interface Board" on page 157 for more information.

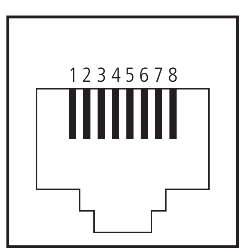


external view

Pin	Signal Name	Signal Type	Notes
1	Rx line out +	audio output	transformer isolated line
2	Rx line out –		
3	Rx audio out	audio output	AC coupled
4	ground	ground	
5	Tx audio in	audio input	AC coupled
6	Tx line in +	audio input	transformer isolated line
7	Tx line in –		
8	RSSI	DC signal	
9	Rx gate	output	open collector
10	Tx key	input	active low
11	digital out 1[a]	output	open collector
12	digital out 2		
13	+AUX_V	power output	from auxiliary DC input; maximum current 1 A
14	digital in 1	input	5 V TTL logic active low
15	digital in 2		
16	digital in/out 3[b]		
17	digital in/out 4[b]		
18	digital in/out 5[b]		
19	digital in/out 6[b]		
20	digital in 7		
21	digital in 8		
22	digital in 9		
23	digital in 10		
24	Tx relay	output	open collector
25	ground	ground	
26	ground		

a. If a base station with a 12 V PA is configured for Deep Sleep, digital out 1 is dedicated to Power Saving control and cannot be used for any other Task Manager function.

b. On version 1 and later system interface boards, digital inputs 3, 4, 5, and 6 may also be configured as outputs using a Task Manager statement. For more details refer to "Digital Interface" on page 133 and to the Service Kit documentation.



external view

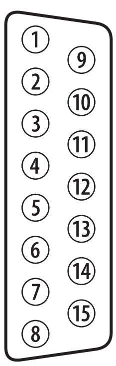
Pin	Signal	Description
1	Tx +	transmit data +
2	Tx –	transmit data –
3	Rx +	Ethernet receive data +
4		terminated
5		terminated
6	Rx –	Ethernet receive data –
7		terminated
8		terminated

TaitNet

This system interface board is fitted to reciters bearing the product code TBA4xxx-0T10. If purchased separately, it has the spares code TBA-SP-S0T1. It is designed for use with MPT trunking systems. It provides the following:

- transformer isolated 600Ω balanced audio I/O
- high impedance unbalanced audio I/O
- digital I/O (3 outputs, 1 input)
- Tx key
- Rx gate

It is fitted with a 15-way female D-range connector and a 2-way auxiliary DC input connector. The pin allocations for the D-range are listed in the table below, and the pin allocations for the DC input connector are provided in "Reciter Auxiliary DC Input from PMU" on page 129.



external view

Pin	Signal Name	Signal Type	Notes
1	Rx line out +	audio output	transformer isolated line
2	Rx line out –		
3	Rx audio out	audio output	
4	Rx gate	output	open collector
5	Tx key	input	
6	Tx audio in	audio input	DC coupled
7	Tx line in +	audio input	transformer isolated line
8	Tx line in –		
9	+AUX_V	power output	from auxiliary DC input; maximum current 3 A
10	digital out 3	output	open collector
11	no connection		
12	digital out 1[a]	output	open collector
13	digital out 2		
14	digital in 1	input	5 V logic
15	ground	ground	

a. If a base station with a 12 V PA is configured for Deep Sleep, digital out 1 is dedicated to Power Saving control and cannot be used for any other Task Manager function.

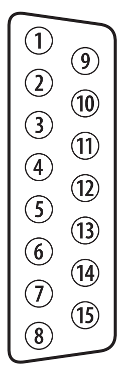
TaitNet RS-232

This system interface board is fitted to reciters bearing the product code TBA4xxx-0L00 or TBA5xxx-0L00. If purchased separately, it has the spares code TBA-SP-S0L0. It is designed for use with MPT trunking systems, and also for use with multiple base stations. It provides the following:

■ transformer isolated 600Ω balanced audio I/O ■ high impedance unbalanced audio I/O ■ digital I/O (3 outputs, 1 input)	■ Tx key ■ Rx gate

It is fitted with a 15-way female D-range connector (TaitNet), a 9-way female D-range connector (RS-232), and a 2-way auxiliary DC input connector. The pin allocations for the D-ranges are listed in the following tables, and the pin allocations for the DC input connector are provided in "Reciter Auxiliary DC Input from PMU" on page 129.

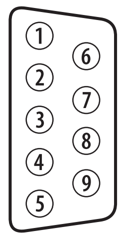
When a reciter fitted with a TaitNet RS-232 system interface board is used in a base station, the RS-232 port on the control panel is disabled. In this situation you must connect to the RS-232 port at the rear of the reciter.



external view

Pin	Signal Name	Signal Type	Notes
1	Rx line out +	audio output	transformer isolated line
2	Rx line out –		
3	Rx audio out	audio output	
4	Rx gate	output	open collector
5	Tx key	input	
6	Tx audio in	audio input	DC coupled
7	Tx line in +	audio input	transformer isolated line
8	Tx line in –		
9	+AUX_V	power output	from auxiliary DC input; maximum current 3 A
10	digital out 3	output	open collector
11	no connection		
12	digital out 1[a]	output	open collector
13	digital out 2		
14	digital in 1	input	5 V logic
15	ground	ground	

a. If a base station with a 12 V PA is configured for Deep Sleep, digital out 1 is dedicated to Power Saving control and cannot be used for any other Task Manager function.



external view

Pin	Description	Linked Pins
1	not connected	● (linked to 4, 6)
2	receive data	
3	transmit data	
4	not connected	● (linked to 1, 6)
5	ground	
6	not connected	● (linked to 1, 4)
7	not connected	● (linked to 8)
8	not connected	● (linked to 7)
9	not connected	

TaitNet Ethernet

This system interface board is fitted to reciters bearing the product code TBA4xxx-0K00 or TBA5xxx-0K00 (receive-only). If purchased separately, it has the spares code TBA-SP-S0K0. It provides the base station with an Ethernet interface.

It is fitted with a 15-way D-range connector (modified TaitNet), an RJ45 connector (Ethernet), and a 2-way auxiliary DC input connector. These connectors are described in more detail below. The pin allocations for the DC input connector are provided in "Reciter Auxiliary DC Input from PMU" on page 129.

Some pins on the 15-way D-range connector can be configured to provide different signals. These pins are as follows:

- pins 3, 4, 5 and 6 can be configured for Rx gate, Tx key and unbalanced audio, **or** E&M signalling
- pin 11 can be configured for RSSI **or** Tx relay.

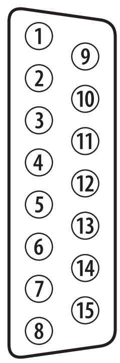
You can select which signal is connected to each pin by setting switches S1 and S2 on the system interface board.

Notice You must set both switches correctly for each D-range pin. Setting the switches incorrectly may result in both signals being connected to the pin at the same time, or no signal at all being connected.

The pin allocations and switch settings for the factory default and optional signals are listed in Table 6.2 on page 147. Figure 6.20 on page 148 shows the location of switches S1 and S2 on the board, and also provides a pictorial guide to their settings.

The pin allocations for the 15-way D-range connector on the TaitNet Ethernet system interface board are different from those on other TaitNet boards. These differences are described in Table 6.3 on page 148.

Table 6.2 Pin allocations for the TaitNet Ethernet D-range connector



external view

Pin	Signal Name	Switch S1 & S2 Settings: On	Switch S1 & S2 Settings: Off	Signal Type	Notes
1	Rx line out +			audio output	transformer isolated line
2	Rx line out –				
3	Rx audio out[a] **or** opto +/–	S1:5 S1:6	S1:6 S1:5	audio output isolated keying input	 input voltage range ±10VDC to ±60VDC
4	Rx gate[a] **or** relay +/–	S1:3 S1:4	S1:4 S1:3	output isolated gate output	open collector
5	Tx key[a] **or** relay –/+	S1:7 S1:8	S1:8 S1:7	input isolated gate output	
6	Tx audio in[a] **or** opto –/+	S1:1 S1:2	S1:2 S1:1	audio input isolated keying input	DC coupled input voltage range ±10VDC to ±60VDC
7	Tx line in +			audio input	transformer isolated line
8	Tx line in –				
9	+AUX_V			power output	from auxiliary DC input; maximum current 3A
10	digital in/out 1[b,c]			input	5V TTL logic, active low
11	RSSI[a] **or** Tx relay	S2:8 S2:7	S2:7 S2:8	DC signal output	 open collector
12	digital in/out 2[b]			input	5V TTL logic, active low
13	digital in/out 3[b]				
14	digital in/out 4[b]				
15	ground			ground	

a. Factory default settings.

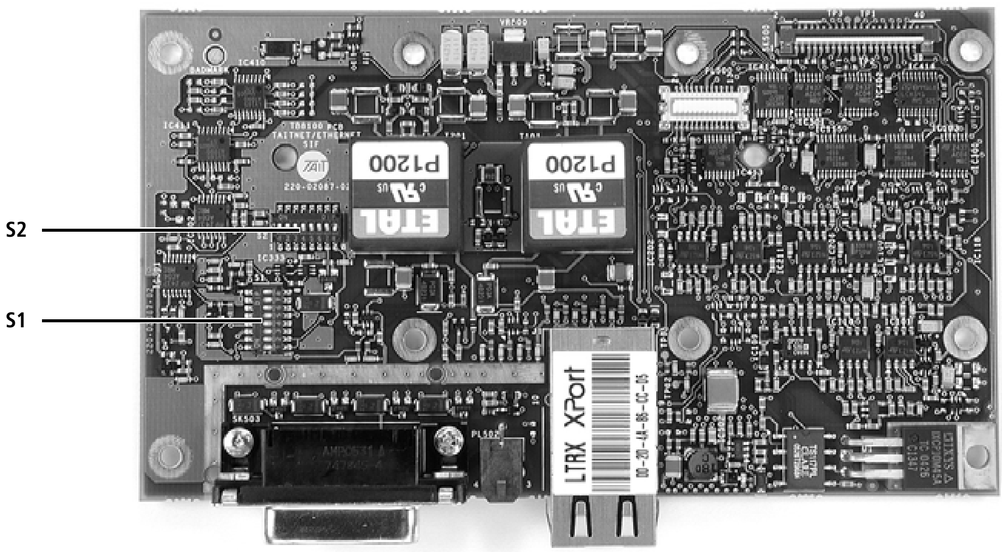
b. Digital inputs 1, 2, 3, and 4 may also be configured as outputs using a Task Manager statement. For more details refer to "Digital Interface" on page 133, and to the Service Kit documentation.

c. If a base station with a 12V PA is configured for Deep Sleep, digital out 1 is dedicated to Power Saving control and cannot be used for any other Task Manager function.

Table 6.3 Differences between the TaitNet Ethernet D-range connector and other TaitNet connectors

Pin	TaitNet Ethernet Signal Name	TaitNet and TaitNet RS-232 Signal Name
10	digital in/out 1	digital out 3
11	RSSI	no connection
12	digital in/out 2	digital out 1
13	digital in/out 3	digital out 2
14	digital in/out 4	digital in 1

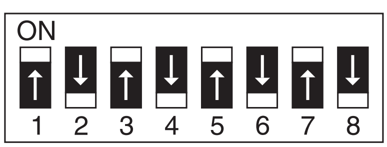
Figure 6.20 Setting switches S1 and S2 on the TaitNet Ethernet system interface board



Factory default settings

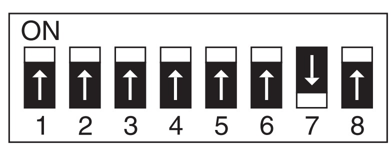
Rx gate, Tx Key, unbalanced audio

S1



RSSI

S2

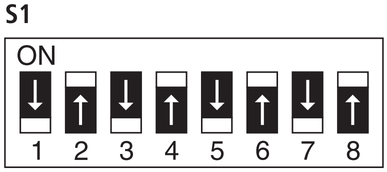


switches 1 to 6 not used

Optional settings

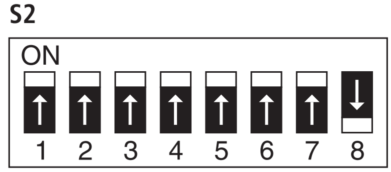
E&M signalling

S1



Tx relay

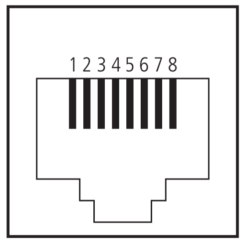
S2



switches 1 to 6 not used

The pin allocations for the RJ45 Ethernet connector are given in the following table.

Table 6.4 Pin allocations for the RJ-45 Ethernet connector



external view

Pin	Signal	Description
1	Tx +	transmit data +
2	Tx –	transmit data –
3	Rx +	Ethernet receive data +
4		terminated
5		terminated
6	Rx –	Ethernet receive data –
7		terminated
8		terminated

6.5.4 Ethernet Site and Network Connections

Site Connections

Figure 6.21 on page 150 shows typical connections for a site linked by microwave.

Network Connections

Figure 6.22 on page 150 shows an example of interconnections between base stations, a network, a syslog collector, and the Service Kit.

It is also possible for customer-specific software applications to receive the syslog message directly and integrate the handling of the message into existing processes.

Ethernet Connections

The pin allocations of the Ethernet connector are configured for a straight-through network cable. If you want to connect directly to a computer's Ethernet port, you will need to use a cross-over cable.

ⓘ The TB8100 does not support multiple, simultaneous Ethernet connections. The Ethernet interface is only able to carry out one Ethernet function at a time: either Service Kit connection, CCI command protocol, or Syslog messaging. While one of these functions is in progress, all other Ethernet functions are blocked until the current Ethernet connection is terminated.

Figure 6.21 Typical site connections

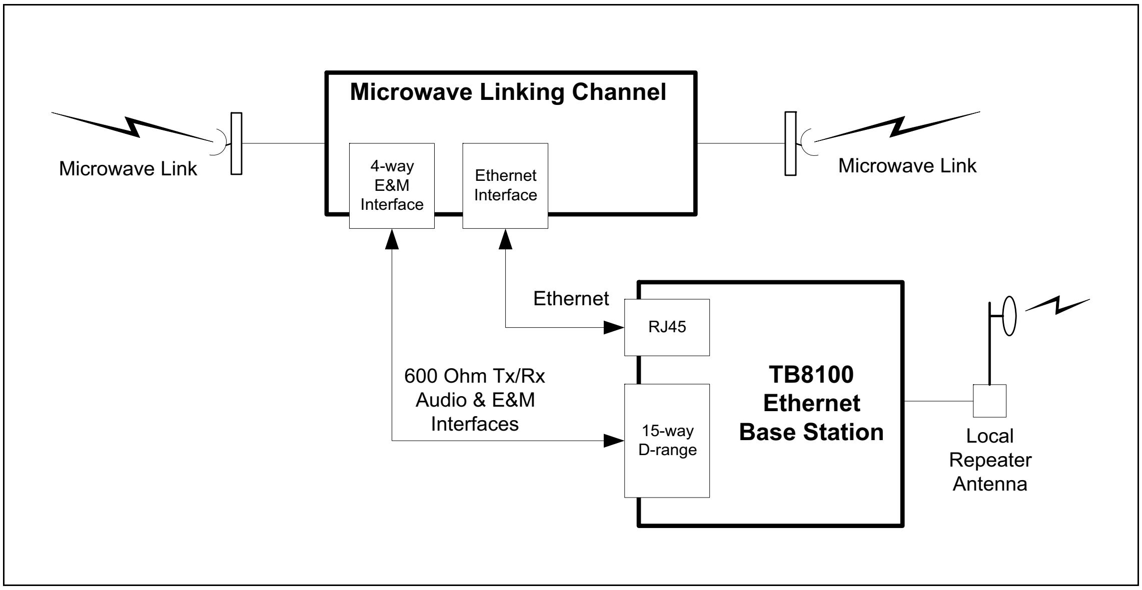
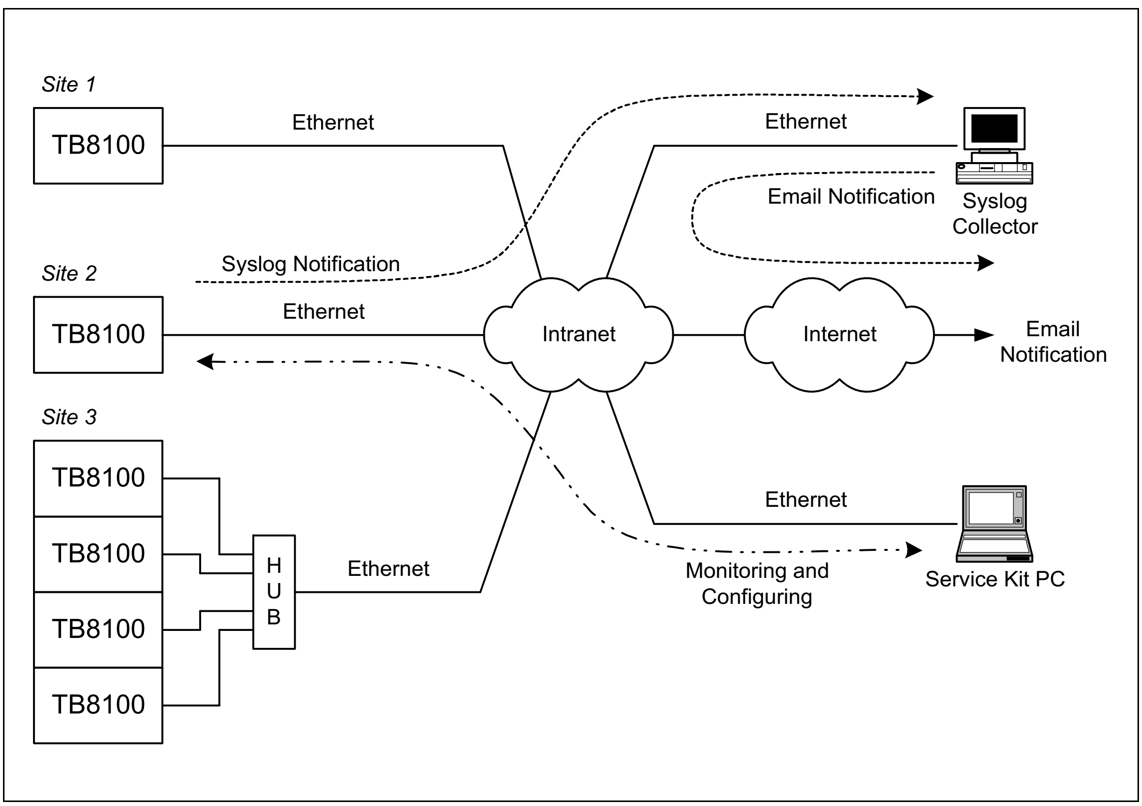
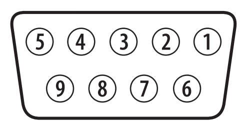


Figure 6.22 Example network connections



6.6 Service Kit Connections

The Service Kit is connected to the base station via the RS-232 serial port on the control panel. This port is a 9-way female D-range connector. Use a straight through cable, as supplied with the Service Kit, to connect your programming computer to the base station. The pin allocations for the serial port are given in the following table. Note that pins 1, 4 & 6 and pins 7 & 8 are linked. This port is also used for remote connection to the Service Kit or Alarm Center software via a modem or radio modem.



external view

Pin	Description	Linked Pins
1	not connected	
2	receive data	
3	transmit data	
4	not connected	
5	ground	
6	not connected	
7	not connected	
8	not connected	
9	not connected	

When a reciter fitted with a TaitNet RS-232 or High Density/RS-232 system interface board is used in a base station, the RS-232 port on the control panel is disabled. In this situation you must connect to the RS-232 port at the rear of the reciter. Refer to "TaitNet RS-232" on page 145 or "High Density/RS-232" on page 140 for more details.

When a reciter fitted with a TaitNet Ethernet or High Density/Ethernet system interface board is used, the RS-232 port on the control panel is available only when the base station first powers up. Refer to "Service Kit Connection to an Ethernet Base Station" on page 152 for more details.

6.6.1 Service Kit Connection to an Ethernet Base Station

There are various ways of connecting the Service Kit to a TB8100 base station that is fitted with a TaitNet Ethernet or High Density/Ethernet system interface board. These are described briefly below. Refer also to the Service Kit documentation.

The TB8100 does not support multiple, simultaneous Ethernet connections. The Ethernet interface is only able to carry out one Ethernet function at a time: either Service Kit connection, CCI command protocol, or Syslog messaging. While one of these functions is in progress, all other Ethernet functions are blocked until the current Ethernet connection is terminated.

Only one Service Kit can connect to the base station at one time.

Direct Connection to the Control Panel

You can use an ordinary RS-232 modem cable to connect the serial port on the Service Kit PC to the serial port on the base station's control panel. This connection is available only when the base station first powers up.

1. Connect a serial cable from the Service Kit PC to the control panel.
2. Run the Service Kit and click **Connect**. In the Connecting dialog box, select a direct connection, and click **Connect**.
3. Power up the base station.
4. If the base station has a multi-reciter or dual base station control panel, select the appropriate channel.

When the base station is configured with a zero IP address (i.e. the IP address field in the Service Kit is blank), direct connection at the control panel is always available. There is no need to restart the base station.

When a reciter fitted with a TaitNet Ethernet or High Density/Ethernet system interface board is first powered up, the Service Kit (or Calibration Kit) can connect via the reciter's front panel serial port (16-way IDC connector). If the reciter detects no activity on this port, it will switch to communicating via the system interface board. All connection via the front panel serial port will then be disabled until the next power cycle.

Direct Connection by Ethernet Crossover Cable

You can connect the Service Kit PC directly to the RJ45 Ethernet connector on the base station using an Ethernet crossover cable.

1. Connect an Ethernet crossover cable from the Service Kit PC to the RJ45 connector at the rear of the reciter.
2. Configure the Service Kit PC with a fixed IP address that is on the same subnet as the base station's IP address. The PC will not be able to obtain an IP address automatically. On some versions of Windows, you will need to restart the PC.

If the base station has the default IP address (192.168.1.2), configure the Service Kit PC as follows:
IP address: 192.168.1.3
subnet mask: 255.255.255.0
default gateway: none.

3. Run the Service Kit and click **Connect**. In the Connecting dialog box, select the appropriate network connection for the base station, and click **Connect**.

Local Connection by Ethernet at a Radio Site

Before connecting a Service Kit PC to the Ethernet at a site, you must configure the PC with an appropriate fixed IP address.

1. Configure the Service Kit PC with a fixed IP address that is on the same subnet as the base station at the site.

2. At the site, use a normal (non-crossover) Ethernet cable to connect the PC to a spare port on the switch or hub.

3. Run the Service Kit and click **Connect**. In the Connecting dialog box, select the appropriate network connection for the base station, and click **Connect**.

Remote Connection over the Network

If both the Service Kit PC and the base station have network access, you can make a remote Service Kit connection.

1. Ensure that the Service Kit PC has network access, either via an office network, or via modem to an ISP.

2. Run the Service Kit and click **Connect**. In the Connecting dialog box, select the appropriate network connection for the base station, and click **Connect**.

Remote Connection over the Internet

You can connect the Service Kit PC to more than one base station over the Internet using a single router with a fixed IP address.

1. Make sure that the remote router is capable of port mapping, and has a fixed IP address allocated by your ISP.

2. Find out the internal IP address range required by the router, and allocate one IP address from this range to each base station.

3. Configure the router as follows:
   - map a public port (10001, 10002, etc.) to each internal IP address allocated in Step 2
   - set the private port for each internal IP address to 10001.

4. Using a direct connection from your PC, run the Service Kit and configure each base station (Configure > Base Station > General) with the IP address allocated to it in Step 2.

5. On the Service Kit PC, set up a connection to each base station (Tools > Configure Connections) as follows:
   - set the IP address of each base station to the fixed IP address of the router
   - set the public port for each base station to the number allocated to that base station in Step 3.

Lost or Forgotten IP Address

If you misplace the IP address of the base station, connect to the reciter in the normal way using RS-232, as described in "Direct Connection to the Control Panel" on page 152. You can then read or configure the IP address without using the network interface.

6.7 Calibration Kit Connection

The standard methods of connecting the Calibration Kit to a base station are described in detail in the Calibration Kit documentation. This section describes the specific connection methods required for an Ethernet base station and multi-reciter subrack.

6.7.1 Connecting to an Ethernet Base Station

The Calibration Kit still connects via RS-232. You must connect the Calibration Kit to the reciter's front panel serial port (via the control panel or a Calibration Test Unit) as described in the Calibration Kit documentation.

When a reciter fitted with a TaitNet Ethernet or High Density/Ethernet system interface board is first powered up, the Calibration Kit (or Service Kit) can connect via the reciter's front panel serial port (16-way IDC connector). If the reciter detects no activity on this port, it will switch to communicating via the system interface board. All connection via the front panel serial port will then be disabled until the next power cycle.

6.7.2 Connecting to a Multi-reciter Subrack

You can connect to a particular reciter in a multi-reciter subrack via the control panel by using the following procedures.

If the subrack is already powered up.

1. Connect the PC to the RS-232 port on the control panel.
2. Using the channel button on the control panel, select the reciter you want to calibrate.
3. Start the Calibration Kit program.

4. Click **Connect** to start the connection process.

5. As soon as you see the “Waiting for logon prompt from Reciter” screen, disconnect then reconnect the power to the selected reciter.

6. The reciter will generate the logon prompt within 20 to 30 seconds after power-up and complete the connection to the Calibration Kit.

If the subrack is not powered up.

1. Connect the PC to the RS-232 port on the control panel.

2. Start the Calibration Kit program.

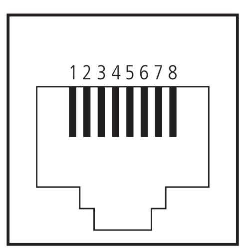
3. Click **Connect** to start the connection process. The “Waiting for logon prompt from Reciter” screen appears.

4. Power up the subrack.

5. Within 20 seconds, select the reciter you want to calibrate using the channel button on the control panel. The selected reciter will generate the logon prompt and complete the connection to the Calibration Kit.

6.8 Microphone Connection

You can connect a microphone to the base station via the standard RJ45 socket on the control panel. If a standard TB8100 microphone has not been supplied with your base station, you should use an electret microphone. The pin allocations for the microphone socket are given in the following table.



external view

Pin	Description
1	not connected
2	not connected
3	not connected
4	PTT
5	voice band (microphone) input
6	microphone ground
7	not connected
8	not connected

6.9 12 V PA Power Saving Control Connection

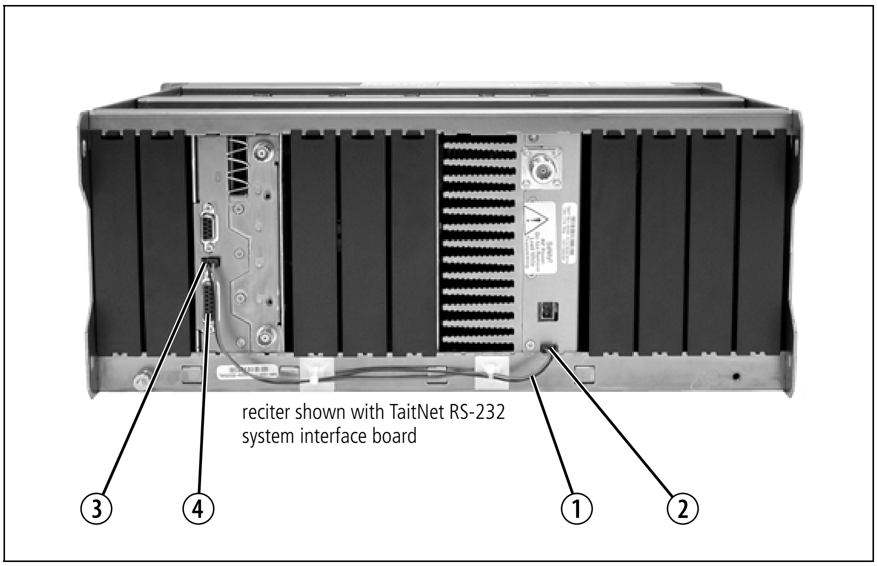
To enable Power Saving in the 12 V PA, you must connect digital out 1 on the reciter’s system interface connector to pin 1 of the Power Saving control connector on the rear panel of the PA. Once this connection is made, the PA will shut down whenever the reciter goes into Deep Sleep mode. For more information on the operation and configuration of Power Saving, refer to "Power Saving" on page 65.

When a base station with a 12V PA is configured for Deep Sleep, digital out 1 is dedicated to Power Saving control and should not be used for any other Task Manager function.

When connecting a CTU to a base station fitted with a 12V PA, do not power the CTU from the reciter (via the system interface) if the Power Saving control cable is connected between the PA and reciter. Either disconnect the Power Saving control cable, or power the CTU from another source. Leaving the control cable connected while powering the CTU from the reciter will cause the PA to go into Sleep mode and shut down.

Two ways of making the Power Saving control connection between the 12V PA and reciter are described below. The circled numbers in the following instructions refer to Figure 6.23.

Figure 6.23 Fitting the Power Saving control cable to a 12V PA



Method 1

1. Connect one end of the Power Saving control cable ① (Tait part number 219-02971-00) to the Power Saving control connector ② at the rear of the PA. Connect the other end to the auxiliary DC input connector ③ at the rear of the reciter.

If you are using an older reciter with a 4-way connector, you will need to use Method 2.

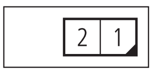
2. On the D-range plug that is fitted to the system interface connector ④ on the reciter, link digital out 1 to +AUX_V.

Method 2

1. Connect one end of the Power Saving control cable ① to the Power Saving control connector ② at the rear of the PA.

2. Cut the socket off the other end of the cable. Connect the wires directly to the D-range plug fitted to the system interface connector ④ as follows:
   - red - digital out 1
   - black - ground.

The pin allocations for the Power Saving control connector on the PA are given in the following table.



external view

Pin	Signal Name	Signal Type	Notes
1	PA shutdown	input	active low
2	ground	ground	

If you wish to make up your own cable, use the following connector for both the PA and reciter connections:

- 2x1-way Molex 43025-0200/crimp socket 43030-0001 female.

6.10 TBA101D Interface Board

Refer to Figure 6.24 on page 158.

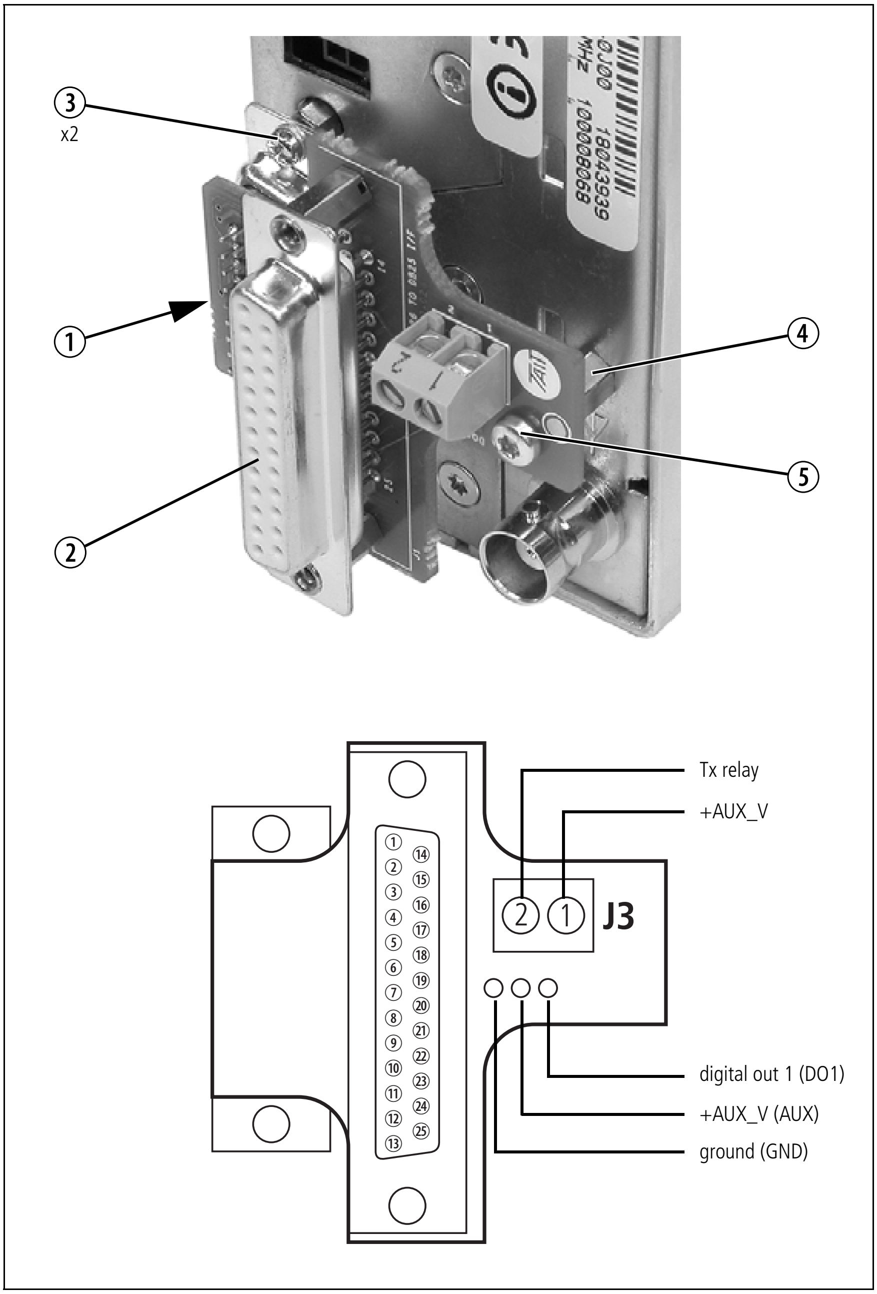
The TBA101D interface board plugs into the high-density 26-way D-range connector ① on the High Density/RS-232 and High Density/Ethernet system interface boards. It brings the inputs and outputs from this connector (pins 1 to 25, pin-for-pin) onto a standard 25-way female D-range ②. This 25-way D-range has the same functionality as the Isolated system interface.

The Tx relay and +AUX_V lines are also available on connector J3, providing an alternative connection for a coaxial relay.

Digital out 1, +AUX_V and ground are also available on solder pads DO1, AUX and GND respectively, providing alternative connections for Power Saving control of a 12V PA. Linking DO1 to AUX allows the Power Saving cable to be connected between the 12V PA and the reciter's auxiliary DC input, as described in Method 1 in "12V PA Power Saving Control Connection" on page 155. You can also solder one end of the Power Saving control cable directly to pads DO1 and GND, as described in Method 2.

Mount the TBA101D onto the reciter with the supplied 4-40 UNC screws ③, spacer ④ and M3 screw ⑤. If required, fit the supplied retaining clips to the 4-40 UNC screws.

Figure 6.24 Fitting the TBA101D to a reciter



6.11 Custom Interface Boards

Some customers may wish to design and fit their own interface boards to the reciter's system interface. Figure 6.25 and Figure 6.26 provide dimension drawings for the D-range connectors and mounting holes on the different rear panels available on the reciter.

Figure 6.25 Custom interface board mounting details - sheet 1

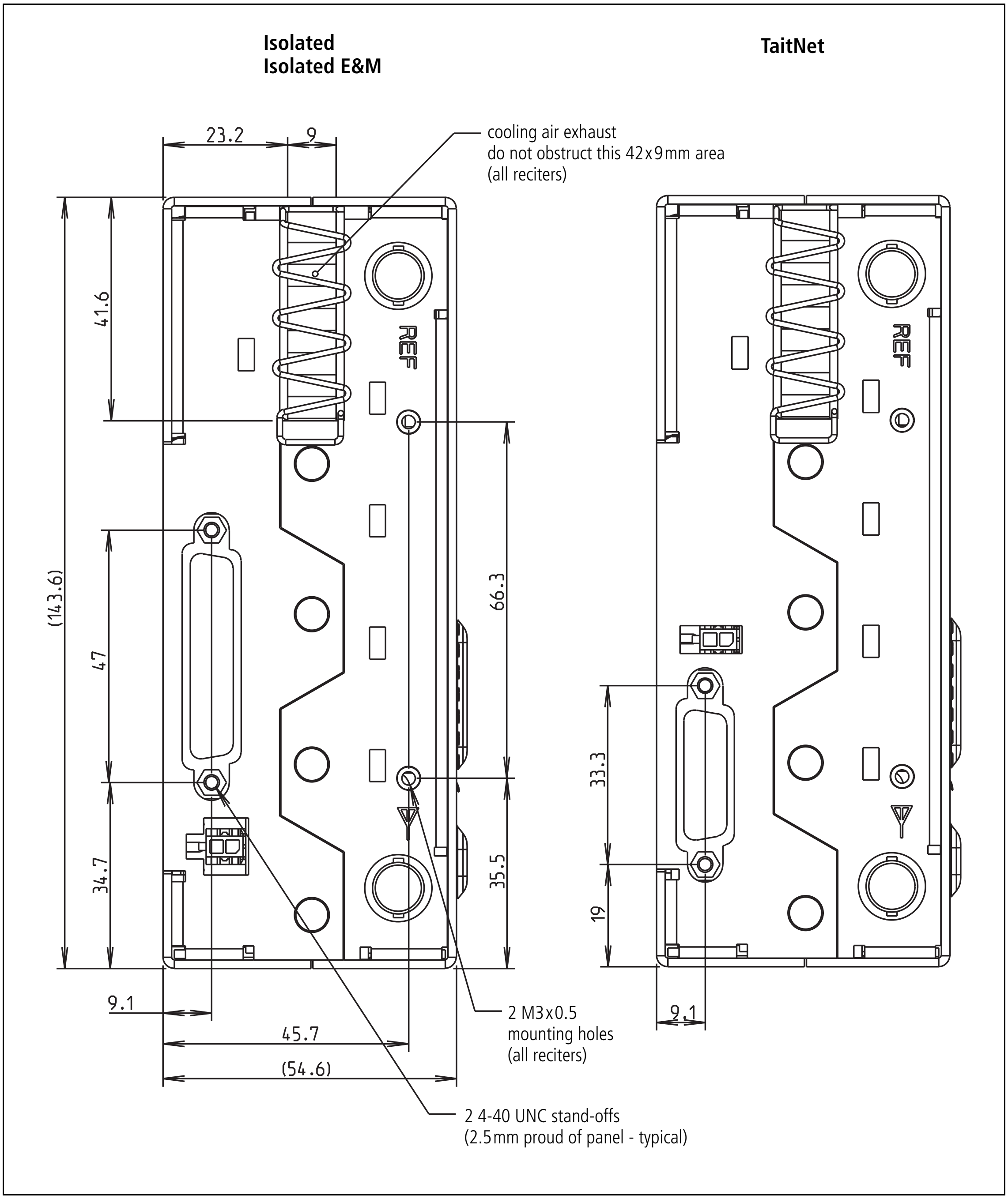
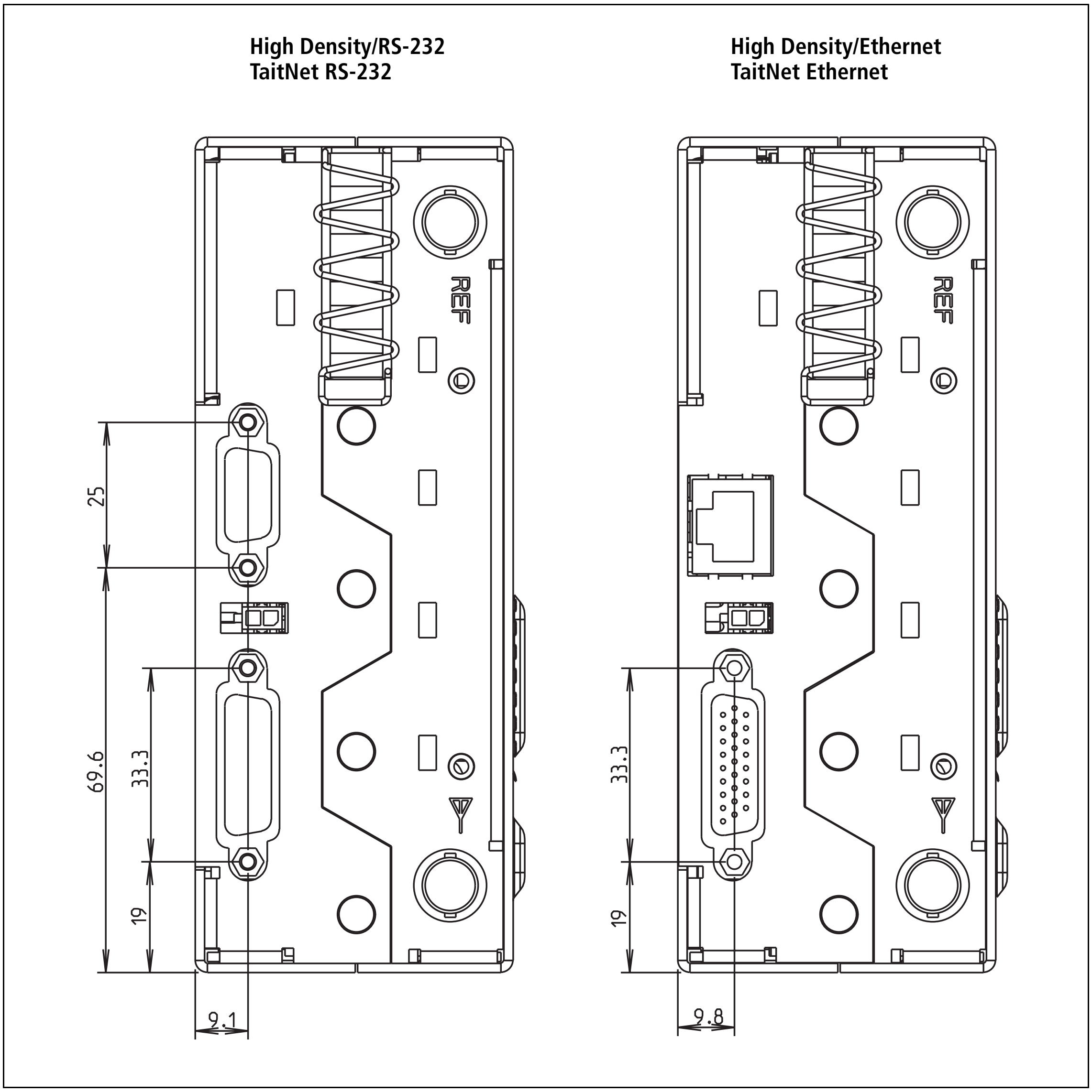


Figure 6.26 Custom interface board mounting details - sheet 2



7 Configuration

The operation of the base station can be configured in both hardware and software. This chapter provides detailed information on the hardware configuration required for single and dual base stations and multi-reciter subracks. It also provides an overview of software configuration using the Service Kit, and more detailed information on configuring the base station for Ethernet operation.

Refer also to the Service Kit and its associated documentation for additional information on software configuration.

7.1 Configuring the Subrack Interconnect Board

7.1.1 Dual Base Station Board

Switch Settings

You must set the switches ① on the dual base station interconnect board correctly. The switch settings depend on the type of base station(s) installed in the subrack, and on the part number (IPN) of the board itself.

Table 7.1 gives the switch settings for older boards with the part number 220-02037-02. This board can only be used with dual base stations using a PMU.

Table 7.2 gives the switch settings for newer boards with the part number 220-02037-04 and later. These boards are used with single and dual base stations using a PMU or 12V PA.

Table 7.1 Switch S1 settings - IPN 220-02037-02

Switch	Function	Dual Base Station with PMU
		State
1	CH1 select button active	on
2	CH2 select button active	on
3	independent CH1 and CH2 channels	Tait use only - leave on
4	channel 2 I^2C_CLK pullup	on
5	channel 2 I^2C_DATA pullup	on
6	unused	off
7	grounded CAN	off
8	connected CH1 and CH2 channels	Tait use only - leave off

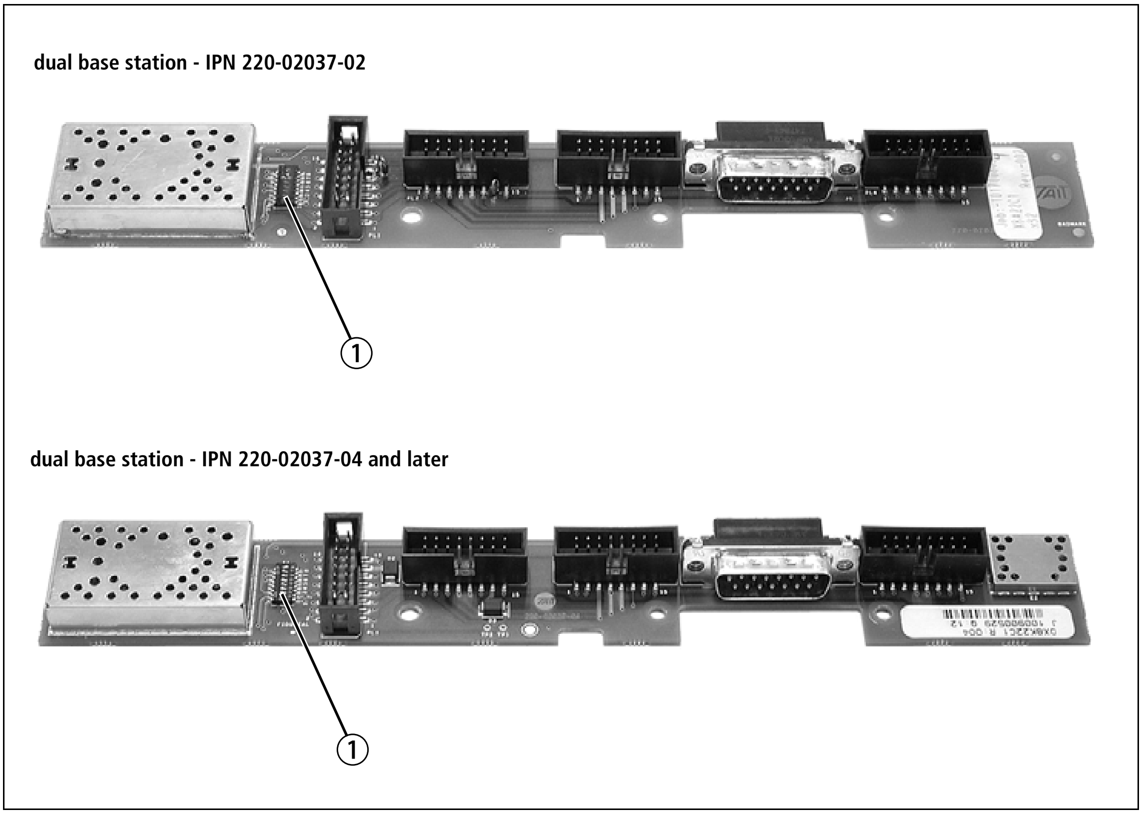
Table 7.2 Switch S1 settings - IPN 220-02037-04 and later

Switch	Function	Single or Dual Base Station with PMU	Single or Dual Base Station with 12V PA
		State	State
1	CH1 select button active	on	on[a]
2	CH2 select button active	on	on[a]
3	independent CH1 and CH2 channels	Tait use only - leave on	Tait use only - leave on
4	channel 1 I^2C_CLK pullup	on[b]	on
5	channel 1 I^2C_DATA pullup	on[b]	on
6	channel 2 I^2C_CLK pullup	on	on
7	channel 2 I^2C_DATA pullup	on	on
8	connected CH1 and CH2 channels	Tait use only - leave off	Tait use only - leave off

a. If you are using an older standard control panel (now obsolete) with a single 12V PA base station, set switches 1 and 2 off.

b. Changed from off to on in June 2013 so that the channel 1 I^2C pullup resistors are active when a PMU is fitted.

Figure 7.1 Location of switch S1 on the dual base station subrack interconnect board



7.1.2 Multi-reciter Board

The multi-reciter subrack can accommodate up to seven reciters, or up to five reciters with a PMU (as shown in Figure 6.5 on page 116). The PMU occupies reciter positions 6 and 7 (numbered from right to left).

The multi-reciter subrack interconnect board has a set of DIP switches and links that must be set correctly before the equipment is used. The locations of these switches and links are shown in Figure 7.2 on page 166.

Switch Settings

You must set switches S1, S2, S3 and S4 according to the type of modules installed in the subrack. The switch settings are given in Table 7.3.

Table 7.3 DIP switch settings for subracks with and without a PMU

Switch Number	Switch Settings with a PMU[a]	Switch Settings without a PMU
S1:1 S1:2 S1:3 S1:4	not used not used off off	not used not used on on
S2:1 S2:2 S2:3 S2:4	off off on on	off off on on
S3:1 S3:2 S3:3 S3:4	off off on on	off off on on
S4:1 S4:2 S4:3 S4:4	on on off off	off off on on

a. Note that these switch settings allow the Service Kit to communicate with the PMU associated with reciter 1.

Link Settings

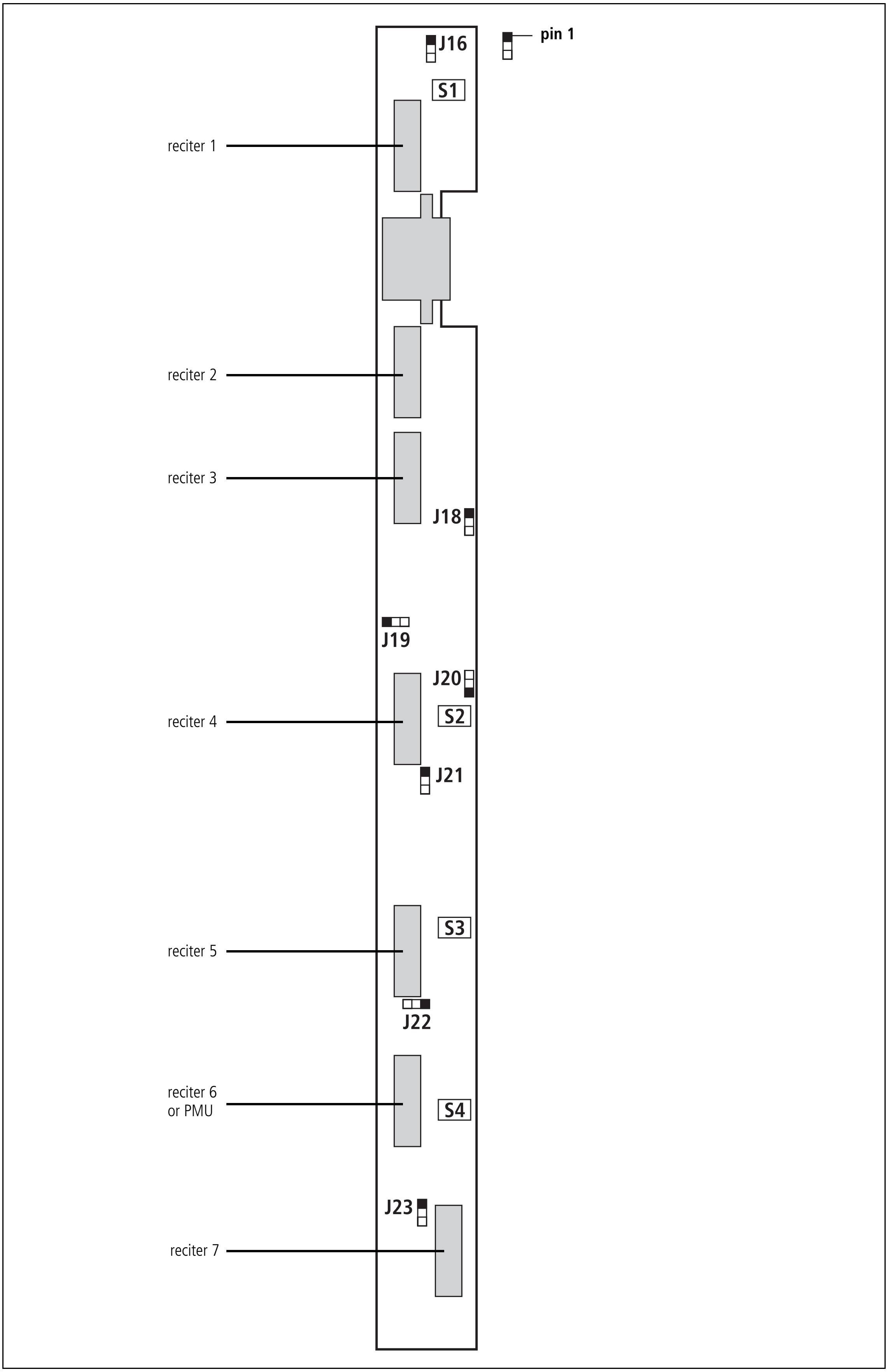
A set of links is provided on the interconnect board for each position in the subrack, as described in Table 7.4. You can set these links to connect either the reciter's alarm or Rx gate status signal to the appropriate channel LED on the control panel (refer to "Multi-reciter Control Panel" on page 37).

There is a link on the control panel board which allows you to select the color displayed by these LEDs. Refer to "Configuring the Multi-reciter Control Panel Board" on page 167.

Table 7.4 Link settings for selecting alarm or Rx gate signals

Subrack Position	Link	Link Settings
1	J16	alarm status signal: link pins 1 & 2 Rx Gate status signal: link pins 2 & 3
2	J18	
3	J19	
4	J20	
5	J21	
6	J22	
7	J23	

Figure 7.2 Location of switches and links on the multi-reciter subrack interconnect board



7.2 Configuring the Multi-reciter Control Panel Board

A link (J300) is provided on the control panel board which allows you to select the color displayed by the seven channel LEDs (refer to the examples below). This link selects the color for all the channel LEDs.

Figure 7.3 on page 168 shows the bottom side of the board (as seen with the board mounted in the control panel chassis). J300 is mounted on the top side of the board, and is accessible from the top of the control panel assembly.

Examples of LED Colors

Example 1

With the following link settings:

- subrack interconnect board links set for Rx gate status signal
- control panel board link across pins 1 and 2

the channel LEDs will have the following states:

- red — indicates which is the currently selected reciter
- green — indicates that the reciter is receiving a valid signal
- orange — indicates that the currently selected reciter is receiving a valid signal.

The link settings described above are the TB8100 factory default settings.

Example 2

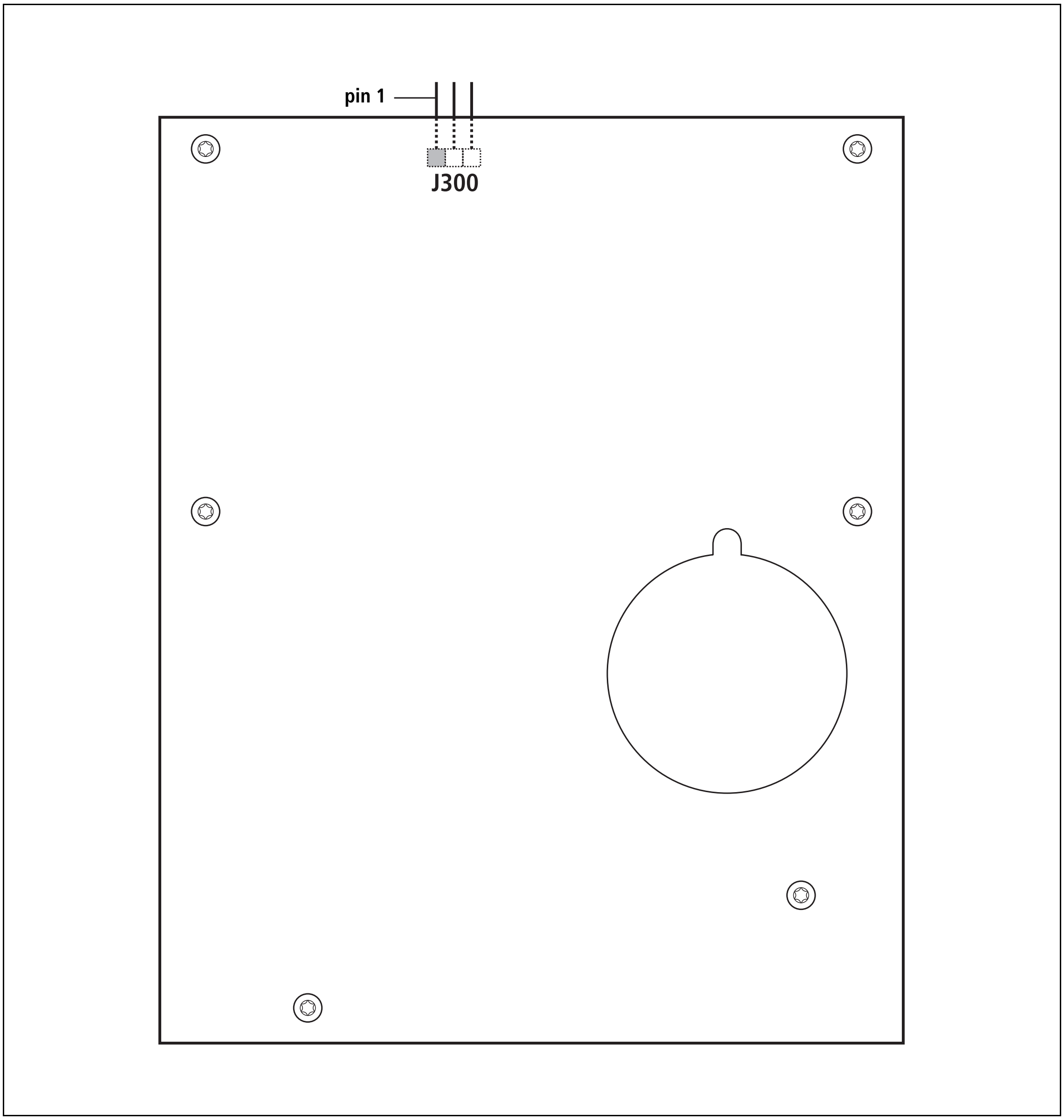
With the following link settings:

- subrack interconnect board links set for alarm status signal
- control panel board link across pins 2 and 3

the channel LEDs will have the following states:

- green — indicates which is the currently selected reciter
- red — indicates that the reciter is generating an alarm
- green, flashing orange — indicates that the currently selected reciter is generating an alarm.

Figure 7.3 Location of links on the multi-reciter control panel board



7.3 Configuring the Base Station with the Service Kit

The base station can be configured using software to operate in many different ways. Although it is programmed with a default configuration at the factory, you will need to use the Service Kit software to configure your base station to suit the requirements of your radio system.

Refer to the Service Kit and its associated documentation for full details of all the options available in the complete configuration process.

ⓘ The base station will be programmed at the factory with default passwords which you will need to use to log on for the first time. Refer to the Service Kit Help for more information on these passwords and how to change them.

7.4 Network Configuration for Ethernet Connections

7.4.1 Configuring the Base Station Network Identity

IP Address

This is the unique number that identifies this particular base station. The address is allocated by the network administrator, and is only valid within that network.

Typically, you will need to add a route to any PC that wishes to connect to the base station from outside the network (refer to "Defining Routes for a Networked PC" below).

On the TB8100, the IP address 0.0.0.0 (i.e. the IP address field in the Service Kit is blank) means that the Ethernet interface is not enabled, and the base station will not appear on the network at all. When configured with this address, direct Service Kit connection remains permanently available at the control panel.

Subnet Mask

The subnet mask is a bit mask used to tell how many bits in the IP address identify the particular subnetwork, and how many bits (the rest) represent an individual host within that subnet. For instance, a subnet mask of 255.255.255.0 means that the first 24 bits (3 8-bit bytes) of the IP address identify the subnet, and the remaining 8 bits identify a particular host (e.g. a base station or Syslog server) within that subnet. The subnet mask will be determined by the network administrator.

Default Gateway

The default gateway address is used by the base station when an IP packet's destination address is outside the local subnet. The default gateway is usually an interface belonging to a router that is connected to the outside world. The default gateway address will be determined by the network administrator, and may be left blank.

7.4.2 Defining Routes for a Networked PC

You may need to define routes so that the Service Kit PC uses the correct IP routing path to the base station subnet. Without a correct entry in the network routing table, the Service Kit will be unable to remotely connect to the base station. You can provide this using the “route” command. The operating system Help gives assistance on the use of this command.

To define a route, proceed as follows:

1. Select Start > Run.
2. Enter “cmd”.
3. At the command line prompt, enter “route print”.

4. If the displayed list of persistent routes at the bottom of the output does not provide a route to the base station subnet, add one or more persistent routes in the format:

   route -p add *destination* mask *subnetmask gateway*

   For example:

   route -p add 172.16.16.0 mask 255.255.240.0 172.25.206.252

   This example tells the PC that all packets destined for the 172.16.16.0 subnet will need to go via the gateway router found at 172.25.206.252.

7.4.3 Testing

You can use "ping" to check the connection to a base station. To use ping under Windows, proceed as follows:

1. Select Start > Run.
2. Enter "cmd".
3. At the command line prompt, enter "ping *IP address*".

   For example:

   ping 172.16.16.0

Typical responses are as follows:

Request timed out

Either the connection is faulty, or an intervening gateway is blocking access to the ping service. Consult your network administrator.

Reply from 172.16.16.0: bytes=32 time<10ms TTL=64

The connection is OK.

7.5 Using Syslog Messages with Ethernet Connections

When base stations have Ethernet connections instead of RS-232, they are not able to communicate with a Tait Alarm Center. Instead, they can send any alarms as syslog messages to a syslog collector. Other elements in the network such as routers and switches can also be configured to send syslog messages to the syslog collector.

Computers running Unix or Linux have a syslog collector as part of their operating system. Windows-based PCs need a suitable third party syslog collector. Tait has tested the TB8100 with the Kiwi Syslog Daemon (see www.kiwisyslog.com). The Kiwi Syslog Daemon is able to handle the syslog messages of Cisco routers as well. The freeware version can be used to explore its capabilities, but the registered version offers useful additional functions, such as the ability to display different screens for different base stations.

To use syslog messages in your system, proceed as follows:

- Use the Service Kit to enable and configure the sending of alarm messages to the Syslog collector (Configure > Communications > Syslog).
- Configure the syslog collector to listen for TCP syslog messages.

TB8100 syslog messages are sent as TCP packets and, by default, the Kiwi Syslog Daemon does not listen to them. In the Kiwi Syslog Daemon, select File > Properties > Inputs > TCP > Listen for TCP Syslog Messages, TCP Port 1468.

- **Optional:** Set things up to monitor base station failure. First, use the Service Kit to enable the sending of a heartbeat and to configure its interval. Then set up a script in your syslog collector that takes action if the heartbeat is not received (emails the technician, pages the technician, or sends a syslog message).
- **Optional:** Set up your syslog collector to email the duty technician when significant error messages are received from a TB8100 or a router.

7.5.1 Syslog Operation

The TB8100 optionally sends syslog messages in Standby and in Run modes.

Because the Ethernet interface communicates internally via RS-232, the TB8100 cannot send syslog messages when it is in CCI mode or when a Service Kit is connected. The fault log is able to store up to 50 messages until they can be sent.

TB8100 syslog messages are not fully reliable, even though they use TCP. They can be lost if Internet traffic is particularly heavy. This is due to limitations of the base station's Ethernet device. Syslog messages are also lost if the fault log becomes full, for example during a long Service Kit session.

Task Manager actions can disable the sending of syslog messages. The fault log continues to store any messages that are generated, and they are sent when Task Manager re-enables the syslog service.

If Task Manager clears the alarm log, any syslog alarm messages that have not already been sent are lost.

7.5.2 Message Format

From reciter firmware version 3.30 onwards, TB8100 syslog messages have the following format:

IP address module: timestamp, alarm code - text

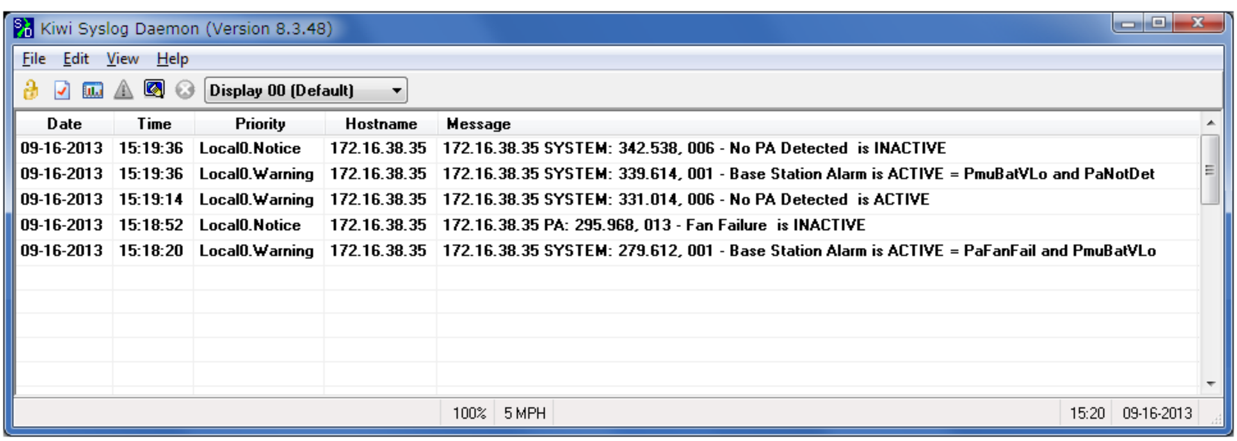
with the words "is ACTIVE" or "is INACTIVE" appended at the end of the message.

For example:

09-16-2013 15:19:14 Local0.Warning 172.16.38.35 172.16.38.35 SYSTEM: 331.014,006 - No PA Detected is ACTIVE

09-16-2013 15:18:52 Local0.Notice 172.16.38.35 172.16.38.35 PA: 295.968,013 - Fan Failure is INACTIVE

They appear in the Kiwi Syslog Daemon like this:



Date and Time Syslog collectors display the date and time that the message was received.

Priority The priority consists of a facility code and a severity level. The default facility code used by TB8100s is Local0. Messages have a severity of Notice if an alarm is inactive, and a severity of Warning if an alarm is active.

Hostname The host name or IP address that appears in the “sender” field of the TCP packet containing the syslog message. If the network uses NAT, this will be different from the IP address of the base station.

Message The message part of a TB8100 syslog message has the following parts:

IP Address: The IP address of the TB8100 that originated the syslog message.

Module Code: The module code indicates which base station module generated the message:

Module Code	Module
SYSTEM	TB8100 base station
REC	reciter
PA	power amplifier
PMU	power management unit

Timestamp: The timestamp gives the value of the base station timer since its last start-up. It consists of a number of seconds and milliseconds.

Alarm Code: The alarm code is the last three characters of the CCI data tag for the alarm (for a list of CCI data tags, see TN-947-AN).

Text: The text is an English description of the reason for the message. Table 7.5 lists the available message texts along with their alarm codes. Note that the words “is ACTIVE” or “is INACTIVE” are appended at the end of each message.

Table 7.5 Syslog alarm codes and message texts

001 - Reciter Power Up Fail 002 - Exciter Synth Out Of Lock 003 - Digital Synth Out Of Lock 004 - Receiver Synth Out Of Lock 009 - Invalid Chan Selected 001 - VSWR High 002 - Forward Power Low 003 - Reverse Power High 004 - Final1 Temp High 005 - Final2 Temp High 006 - Driver Temp High 009 - Shutdown Imminent 00A - PA Driver Current High 00B - PA Final1 Current High 00C - PA Final2 Current High 00D - Supply Voltage High 00E - Supply Voltage Low 00F - Invalid Calibration 010 - Hw Config Invalid 011 - Power Foldback 012 - Current Imbalance 013 - Fan Failure 001 - Mains Failure	002 - Battery Voltage High 003 - Battery Voltage Low 004 - Protection Mode 005 - Shutdown Imminent 006 - Temp High 007 - Output Voltage High 008 - Output Voltage Low 009 - Output Current High 00A - Power Up Fault 00B - Fan Failure 001 - BS Summary 002 - Reciter Summary 003 - PA Summary 004 - PMU Summary 005 - No PMU Detected 006 - No PA Detected 007 - Unbalanced Line Input Low 008 - Balanced Line Input Low 009 - RSSI High 00A - RSSI Low 00B - Air Temp High 00C - Air Temp Low 00D - External Reference Absent 00E - External Reference Invalid

7.5.3 Heartbeat Messages

The TB8100 can send a regular heartbeat message. You can enable this function and select an interval between heartbeats using the Service Kit.

From reciter firmware version 3.30 onwards, additional alarm status information is now available in heartbeat syslog messages. The new message format leaves the current heartbeat message as it was before, and appends the active alarms to the end. As many alarms as are necessary can be appended to the end of the message. If more than one active alarm is sent with the heartbeat message, they are separated by the word “and”.

Heartbeat messages have a severity of Notice if an alarm is inactive, and a severity of Warning if an alarm is active. Reciter alarms are prefixed with “Rec”, system alarms with “Sys”, PA alarms with “Pa”, and PMU alarms with “Pmu”. The alarm text has been abbreviated while still trying to keep it human-readable. Table 7.6 lists the available message alarm texts along with their descriptions.

Custom alarms are not reported in heartbeat messages. A heartbeat message can be up to 500 characters long.

In the following example, the PA forward power low, PMU AC (mains) failure, and PA supply voltage low alarms are active (this message is 155 characters long):

06-21-2013 11:34:55 Local0.Warning 172.16.38.35 172.16.38.35 SYSTEM: 133.522, 001 - Base Station Alarm is ACTIVE = PaFwdPwrLo and PmuAcFail and PaSuplyVLo

If AC power is restored, and the PA forward power low and PA supply voltage low alarms are still active, the heartbeat message is:

06-21-2013 11:34:55 Local0.Warning 172.16.38.35 172.16.38.35 SYSTEM: 133.522, 001 - Base Station Alarm is ACTIVE = PaFwdPwrLo and PaSuplyVLo

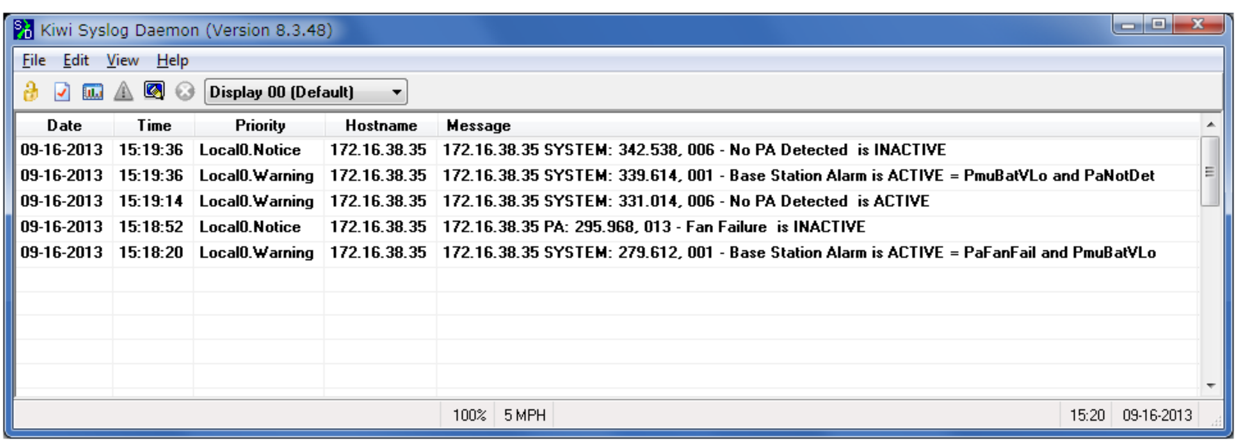


Table 7.6 **Heartbeat message alarm texts and descriptions**

	Message Alarm Text	Alarm Description
Reciter	`RecChInvald`	Channel invalid
	`RecExOol`	Exciter synthesiser out of lock
	`RecDigOol`	Digital synthesiser out of lock
	`RecRxOol`	Receiver synthesiser out of lock
	`RecPwrUpFail`	Power up failure
System	`SysExtRefAbsnt`	External reference absent
	`SysExtRefInvald`	External reference invalid
	`SysBalInLo`	Balanced input low
	`SysUbalInLo`	Unbalanced input low
	`SysRssiHi`	RSSI high
	`SysRssiLo`	RSSI low
PA	`PaFanFail`	PA fan failure
	`PaShutDn`	PA shutdown
	`PaVswrHi`	PA VSWR high
	`PaDrivIHi`	PA driver current high
	`PaFin1IHi`	PA Final 1 current high
	`PaFin2IHi`	PA Final 2 current high
	`PaSuplyVHi`	PA supply voltage high
	`PaSuplyVLo`	PA supply voltage low
	`PaPwrFoldBak`	PA power foldback
	`PaFwdPwrLo`	PA forward power low
	`PaRevPwrHi`	PA reverse power high
	`PaCalInvald`	PA calibration invalid
	`PaHwConfInvald`	PA hardware configuration invalid
	`PaDrivTempHi`	PA driver temperature high
	`PaFin1TempHi`	PA final 1 temperature high
	`PaFin2TempHi`	PA final 2 temperature high
	`PaNotDet`	PA not detected
	`PaAirTempHi`	PA ambient air temperature high
	`PaAirTempLo`	PA ambient air temperature low
	`PaIImbal`	PA current imbalance
PMU	`PmuFanFail`	PMU fan failure
	`PmuShutDnImnt`	PMU shutdown imminent
	`PmuBatVHi`	PMU battery voltage high
	`PmuBatVLo`	PMU battery voltage low
	`PmuProtMode`	PMU entering battery protect mode
	`PmuAcFail`	PMU AC (mains) failure
	`PmuTempHi`	PMU temperature high
	`PmuVOutHi`	PMU output voltage high
	`PmuVOutLo`	PMU output voltage low
	`PmuIOutHi`	PMU output current high
	`PmuNotDet`	PMU not detected

To set up a syslog collector to respond to base station failure, proceed as follows:

1. For each base station, set up a filter for any message from the base station's IP address.
2. Set up an action for that filter: if the syslog collector receives a message, it starts a timer.
3. Set up a duration for the timer. This needs to be long enough to cope with the unavailability of syslog messages when the base station is connected to a Service Kit, or when it is in CCI mode.
4. Set up an action if the timer expires (for example, send an email to the duty technician).

(If you are using the Kiwi Syslog Daemon, these capabilities are only available in the licensed version.)

There is no heartbeat when CCI mode is active or if the Service Kit is connected.

8 Replacing Modules

Caution The PA and PMU weigh between 4.6kg (10.1lb) and 7kg (15.4lb) each. Take care when handling these modules to avoid personal injury.

Notice The cooling fans are mounted on the front panel and will only operate when the panel is fitted correctly to the front of the subrack. To ensure adequate airflow through the base station, do not operate it for more than a few minutes with the front panel removed (e.g. for servicing purposes). Both the PMU and PA modules have built-in protection mechanisms to prevent damage from overheating.

Notice Be careful when removing module retaining clamps and screws in a live multi-reciter subrack. Dropping any metal items onto the subrack interconnect board can cause shorts which may damage the equipment.

8.1 Saving the Base Station's Configuration

Before replacing a module in the base station, you should decide whether you need to save its configuration data. If you are unsure whether you have a record of the configuration, use the Service Kit to read the base station and save the configuration file before removing any modules. Once you have replaced the module, you will be able to restore the original configuration by programming the saved configuration back into the base station. If one or more of the modules is faulty, you may be unable to read the base station. In this case, you will have to restore the configuration from a back-up file. Refer to the Service Kit and its associated documentation for more information.

8.2 Preliminary Disassembly

Hot-pluggable Modules

The reciter, PA and control panel are hot-pluggable and can be removed from the base station without powering down the whole subrack. These modules can also be removed without disrupting the system control bus communications with the other modules in the base station.

> **Notice** In base stations which use a PMU, the PMU must be connected to the system control bus at all times. The I^2C current source is located in the PMU, and if the PMU is disconnected, the state of much of the bus will be undefined. This may cause corrupted data to be present on the bus when the reciter reads the states of the switches on the control panel. This in turn may result in random actuations of microphone PTT, carrier, or speaker key, causing the base station to transmit or the speaker to be actuated incorrectly.

In a dual base station, you can remove the reciter and/or PA from one base station without disrupting the operation of the other base station.

If you want to disconnect the power before working on the base station, carry out the instructions in "Disconnect the Power" below.

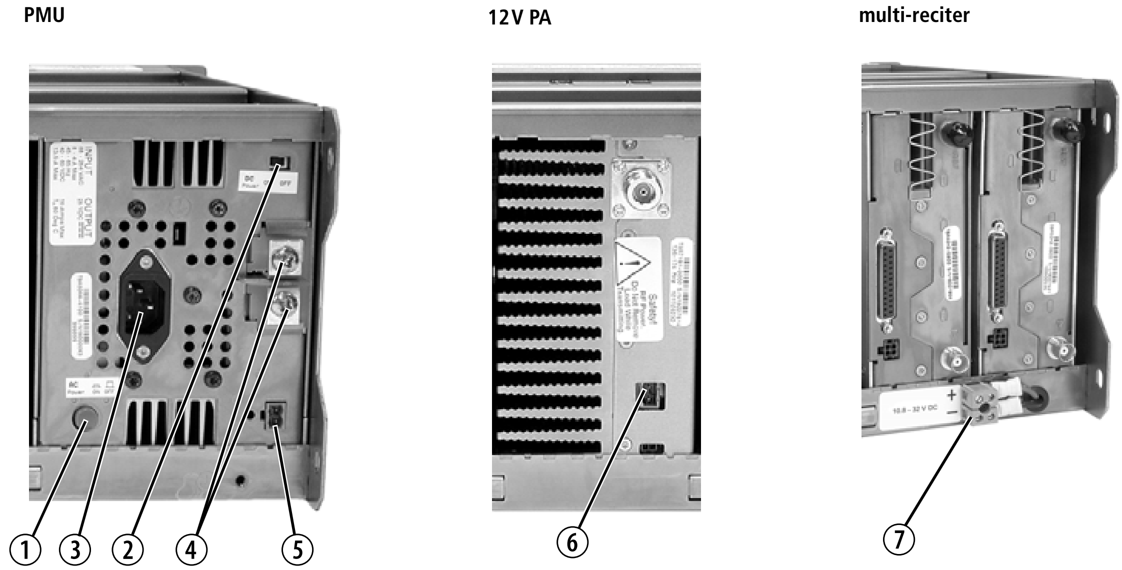
> **Notice** Before removing a PA, disconnect the DC input and RF input first, followed by the RF output (and DC output on the 12V PA). After refitting the PA, reconnect the RF output (and DC output on the 12V PA) first, followed by the RF input, and then the DC input.

Disconnect the Power

If you want to disconnect the power before working on the base station, follow these steps.

> **Caution** Before disconnecting the battery supply leads from the PMU, open the circuit breaker or disconnect the supply leads from the battery.

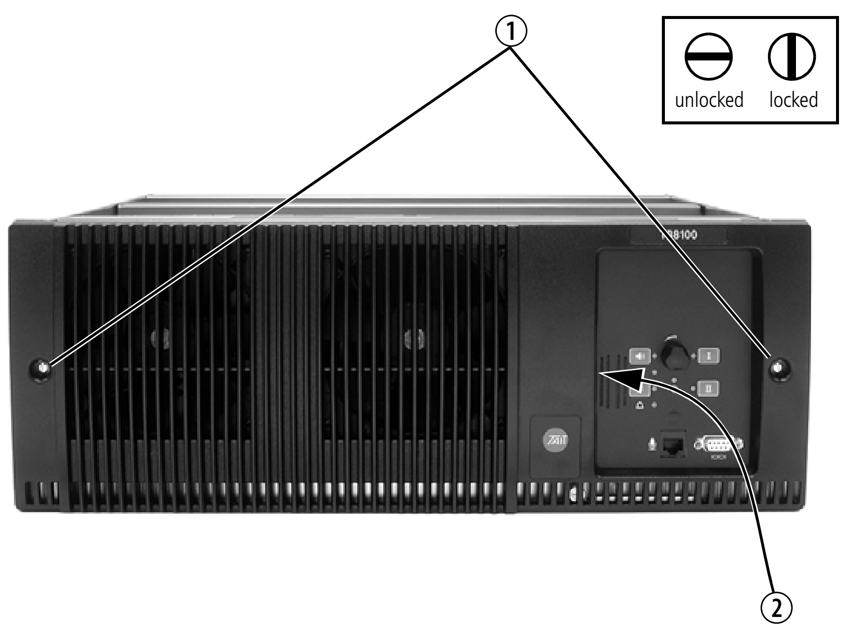
1. Turn off the AC ① and DC ② switches at the rear of the PMU.
2. Also at the rear of the PMU disconnect the mains ③ and battery ④ supply leads, and the auxiliary DC supply lead ⑤ (if fitted).
3. **12V PA only:** Disconnect the battery supply lead ⑥.
4. **Multi-reciter only:** Disconnect the battery supply lead ⑦.



Remove the Front Panel

1. Undo the fastener at each end of the front panel ① with a quarter turn anti-clockwise.

2. While supporting the left end of the front panel, place your fingers in the recess provided on the left side of the control panel opening c and pull the right end of the front panel away from the subrack. You will need to overcome the resistance of the spring clip securing the front panel to the control panel.



8.3 Replacing the Control Panel

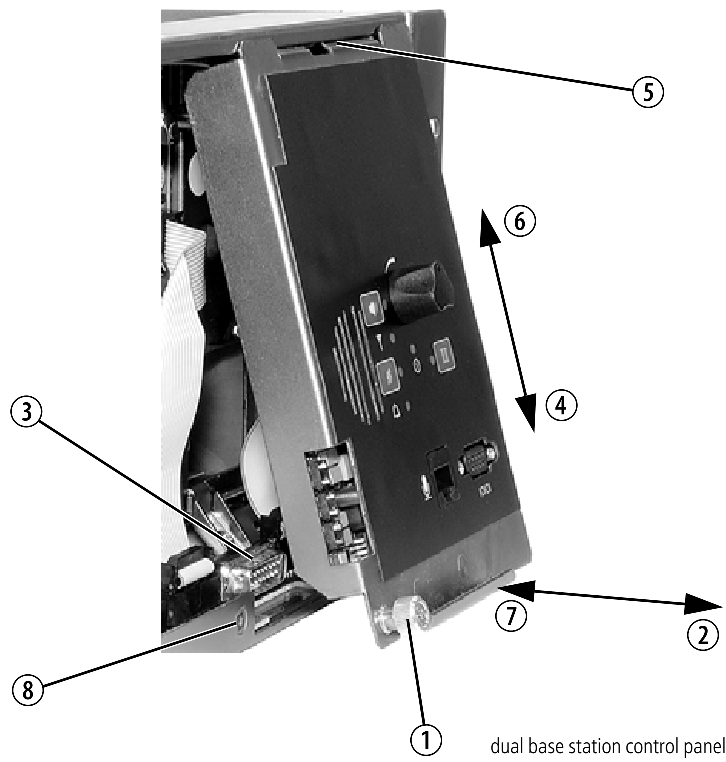
Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly"on page 180.

2. Undo the retaining screw ①. Note that the screw stays attached to the control panel.

3. Pull the bottom of the control panel away from the subrack ② to disconnect the D-range socket on the back of the panel from the plug ③ on the subrack.

4. Pull the control panel down ④ to disengage the centre tab ⑤ from the subrack.



dual base station control panel shown

Refitting

1. Fit the top of the control panel to the subrack so that the centre tab is behind the lip of the subrack and between the two locating tabs formed in the lip. Push the control panel firmly upwards ⑥.

2. Align the D-range socket on the back of the control panel with the plug on the subrack. Gently push the bottom of the panel home against the subrack ⑦ to engage the plug into the socket.

3. Insert the securing screw into the floating nut ⑧ in the subrack and tighten. Note that you may have to push the screw in and down to pick up the floating nut.

4. Carry out the instructions in "Final Reassembly"on page 194.

8.4 Replacing the Reciter

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly"on page 180, and remove the control panel, as described in "Replacing the Control Panel"on page 182.

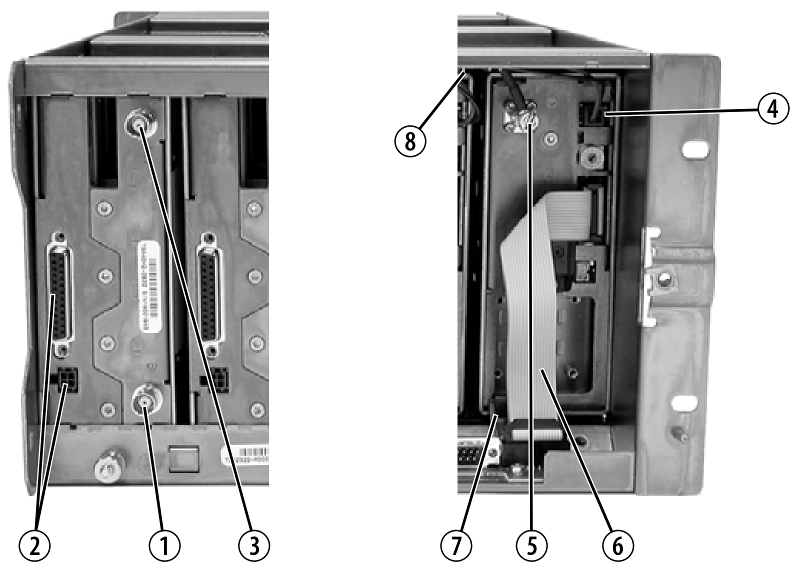
2. At the rear of the reciter, unplug the RF input cable ①, any system cables ② and the external reference cable ③ (if fitted).

3. At the front of the reciter, unplug the DC input cable ④ and the RF output cable ⑤, and move both cables to one side. Unplug both ends of the system control bus ⑥ and remove it.

In a multi-reciter subrack, the DC output connector on the subrack interconnect board for reciter 2 is located in front of reciter 3. You will need to disconnect reciter 2's power cable from the subrack board before removing reciter 3.

4. Loosen the screw securing the retaining clamp ⑦ and rotate the clamp through 90° to clear the module.

5. Slide the reciter out of the subrack, taking care not to damage any of the cables.



Refitting

1. Slide the replacement reciter into the subrack and secure it with the retaining clamp.

2. Reconnect all the front and rear panel cables previously disconnected. Ensure the front panel cables are retained by the cable retaining clips ⑧ in the top of the subrack.

Notice **Do not** force the system control bus behind the reciter handle as this may damage the ribbon cable.

ⓘ If you need to remove any front panel cables, simply pull the front of the cable retaining clip down and then slide it out from the subrack until it reaches the end of its travel.

3. Tighten the nut on the SMA connector to a torque of 0.6Nm (5lbf·in).

4. Refit the control panel, as described in "Replacing the Control Panel"on page 182.

5. Carry out the instructions in "Final Reassembly"on page 194.

8.5 Replacing the Power Amplifier

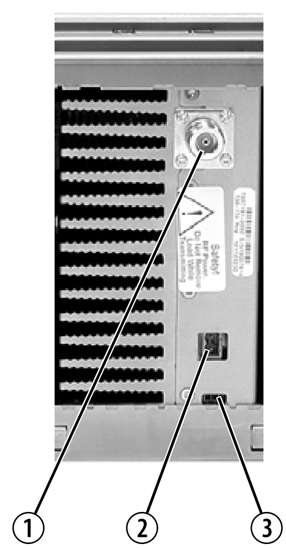
Notice Before removing a PA, disconnect the DC input and RF input first, followed by the RF output (and DC output on the 12V PA). After refitting the PA, reconnect the RF output (and DC output on the 12V PA) first, followed by the RF input, and then the DC input.

Notice If you are replacing the H-band PA in a base station which operates on H4 band (380MHz to 420MHz), make sure that the replacement PA has the correct version of hardware. Only H-band PAs with hardware version 00.02 and later can operate from 380MHz to 520MHz. H-band PAs with hardware version 00.01 and earlier can only operate from 400MHz to 520MHz.

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly"on page 180. If necessary, remove the control panel, as described in "Replacing the Control Panel"on page 182.

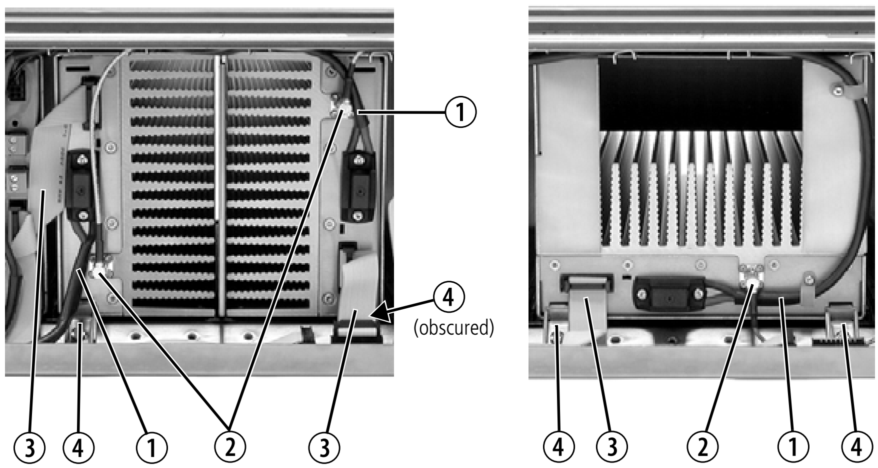
2. At the rear of the PA, unplug the RF output cable ①. **12V PA only:** also unplug the battery supply lead ②, and Power Saving control cable ③ (if fitted).



3. At the front of the PA, unplug the DC input cable (DC output cable on the 12V PA) ① and the RF input cable ②, and move both cables to one side. Unplug both ends of the system control bus ③ and remove it.

4. Loosen the screw securing the retaining clamp(s) ④ and rotate the clamp(s) through 90° to clear the module.

5. Slide the PA out of the subrack, taking care not to damage any of the cables.



Refitting

1. Slide the replacement PA into the subrack and secure it with the retaining clamp(s).

2. Reconnect all the front and rear panel cables previously disconnected. Ensure the front panel cables are retained by the cable retaining clips in the top of the subrack.

ⓘ If you need to remove any front panel cables, simply pull the front of the cable retaining clip down and then slide it out from the subrack until it reaches the end of its travel.

3. Tighten the nut on the SMA connector to a torque of 0.6Nm (5lbf·in).

4. If necessary, refit the control panel, as described in "Replacing the Control Panel"on page 182.

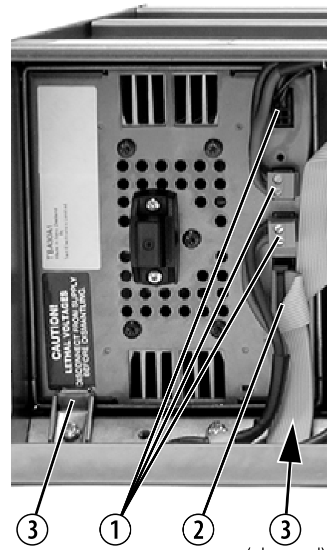
5. Carry out the instructions in "Final Reassembly"on page 194.

8.6 Replacing the Power Management Unit

Notice You must disconnect the AC and DC power cables before removing the PMU from the subrack.

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly"on page 180.
2. At the front of the PMU, unplug the output power cable(s) ① and system control bus ②, and move them to one side.
3. Loosen the screw securing the retaining clamps ③ and rotate the clamps through 90° to clear the module.
4. Slide the PMU out of the subrack, taking care not to damage any of the cables.



Refitting

1. Slide the replacement PMU into the subrack and secure it with the retaining clamps.
2. Reconnect all the front and rear panel cables previously disconnected. Connect the DC power cables on the rear panel as shown in Figure 5.11on page 110. Ensure the front panel cables are retained by the cable retaining clips in the top of the subrack.

ⓘ If you need to remove any front panel cables, simply pull the front of the cable retaining clip down and then slide it out from the subrack until it reaches the end of its travel.

3. Carry out the instructions in "Final Reassembly"on page 194.

8.7 Replacing the Front Panel Fans

Unless otherwise indicated, the following instructions refer to Figure 8.2on page 189. The front panel used in multi-reciter subracks has some minor differences. These are explained in "Multi-reciter Subracks" on page 188.

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly"on page 180.
2. PA Fan
   a. Remove the four screws labelled ① and remove the duct and fan assembly from the front panel.
   b. Unplug the fan from the fan contact board ②.
   c. Remove the fours screws holding the fan into the duct ③ and remove the fan.
3. PMU Fan
   a. Remove the PA fan/duct assembly as described above.
   b. Remove the two screws labelled ④ and remove the PMU fan/duct assembly.
   c. Unplug the fan from the fan contact board ⑤.
   d. Remove the fours screws holding the fan into the duct ⑥ and remove the fan.

Refitting

1. Fit the replacement fan into the duct with the power wires located in the slot in the side of the duct ⑦.
2. Refit the four screws securing the fan into the duct. **Do not** overtighten these screws or you will distort the fan body.
3. PMU Fan
   a. Refit the PMU fan/duct assembly onto its mounting bosses. Note that the two inner mounting tabs ⑧ fit over the bosses.
   b. Plug the fan into the fan contact board ⑤ and route the wires around the PA fan opening ⑨.
   c. Refit the two screws labelled ④.
   d. Refit the PA fan as described below.
4. PA Fan
   a. Plug the power wires into the fan contact board ② and route the wires around the PA fan opening ⑨.
   b. Refit the PA fan/duct assembly onto its mounting bosses. Note that the two inner mounting tabs ⑩ fit over the inner tabs of the PMU fan. Ensure that all the power wires are secured under the retaining hooks ⑪ and are not crimped.
   c. Refit the fours screws labelled ①.

5. Carry out the instructions in "Final Reassembly"on page 194.

Notice You must connect the fans to the correct sockets on the fan contact board. If the fan connections are reversed, the wrong fan will be activated when a module needs cooling. The module may then fold back and shut down. When you power-up the base station, check that the PMU fan runs first, followed by the PA fan. Each fan will run for about five seconds.

Notice You must refit the correct duct to the PA fan. There are several small but important differences between the duct for a 5 W or 50 W PA and the duct for a 100 W PA. Refer to Figure 8.5on page 194 for more details.

Multi-reciter Subracks

To replace the PMU fan (if fitted), follow the basic procedures described above. When refitting the fan, note the following points (refer to Figure 8.1):

- the PMU fan assembly is secured with two M3 washers ① where the PA fan would normally sit
- secure the fan wires with the two sleeved solder tags ②
- connect the fan wire to the correct socket ③ on the fan contact board.

Figure 8.1 PMU fan installation for multi-reciter subracks

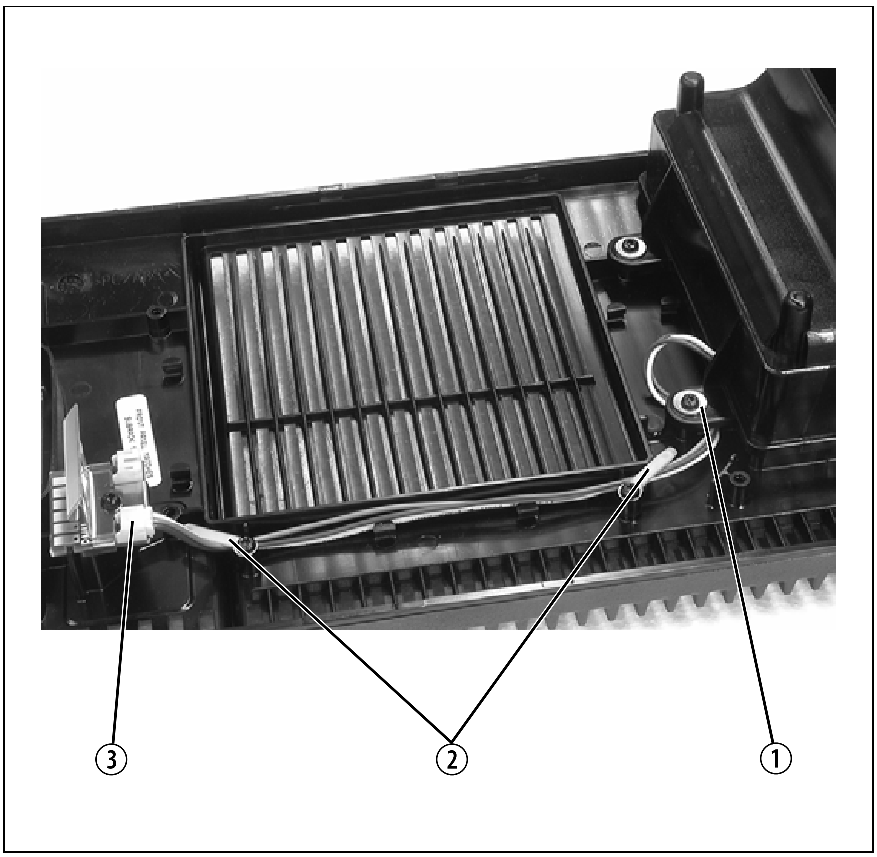
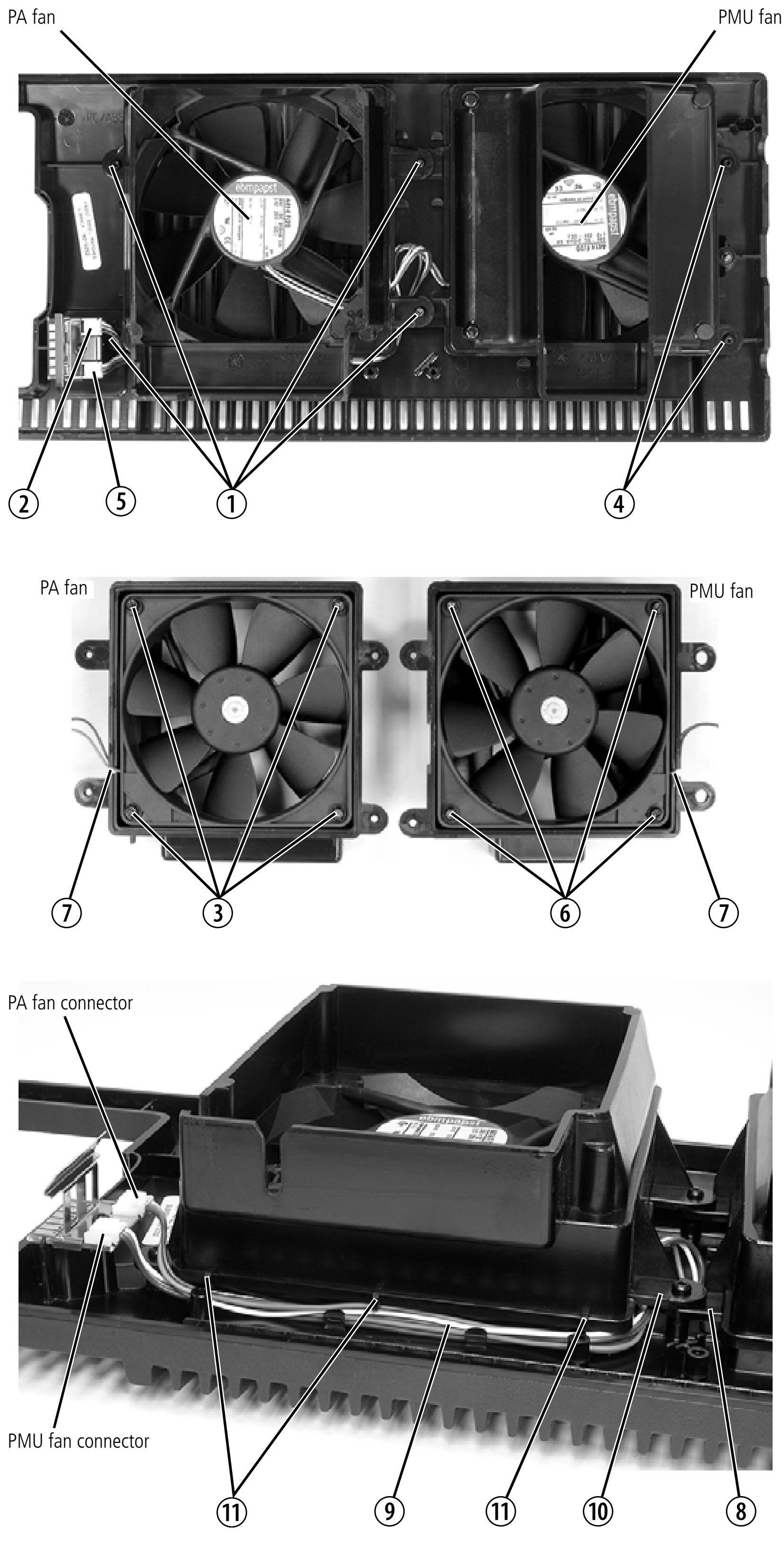


Figure 8.2 Replacing the front panel fans



100W base station front panel shown

8.8 Replacing the Module Guide Rails

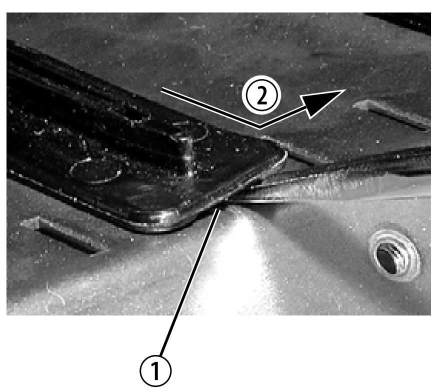
The module guide rails are held in place by four hooks that fit through the slots in the top and bottom of the subrack. There is also a locking tab which prevents the guide rails from working loose.

ⓘ Subracks produced from late 2008 onwards have wider slots than earlier subracks. Guide rails designed for these wider slots will not fit older subracks with narrow slots.

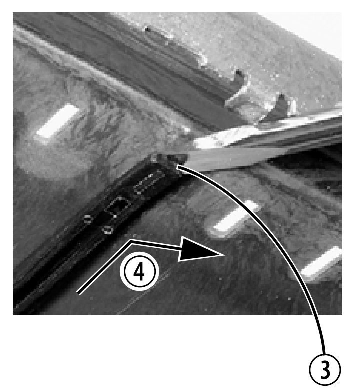
Removal

1. Bottom Guide Rails
   a. Insert a small flat-blade screwdriver under the front end of the guide rail and lift it slightly ①. This will ensure the small locking tab is clear of the slot in the subrack.
   b. Whilst holding the front end of the guide rail up, pull the guide rail towards the front of the subrack ② and lift it clear of the slots.
2. Top Rails
   a. Insert a small flat-blade screwdriver under the rear end of the guide rail and lift it slightly ③. This will ensure the small locking tab is clear of the slot in the subrack.
   b. Whilst holding the rear end of the guide rail up, pull the guide rail towards the rear of the subrack ④ and lift it clear of the slots.

bottom guide rail



top guide rail



Refitting

1. Bottom Guide Rails
   a. With the locating hooks pointing towards the rear of the subrack, insert the hooks into the slots in the subrack.
   b. Push the guide rail towards the rear of the subrack until you hear the locking tab “click” into place.
2. Top Guide Rails
   a. With the locating hooks pointing towards the front of the subrack, insert the hooks into the slots in the subrack.
   b. Push the guide rail towards the front of the subrack until you hear the locking tab “click” into place.

8.9 Replacing the Subrack Interconnect Board

Three different subrack interconnect boards have been used since the base station was first released. These are described in the table below. You can identify the type of board by referring to the product code printed on the label on the top of the board. Figure 8.3 on page 192 and Figure 8.4 on page 193 show the three types of board.

Board Type	Product Code	Spares Code	Description
single base station	XBAK22C0	TBA-SP-K22C0	■ for single base stations with PMU ■ PCB IPN 220-02029-xx up to late 2006 ■ PCB IPN 220-02037-05 (sub-populated) from late 2006 until December 2008
			■ for single Power Save base stations with PMU ■ PCB IPN 220-02037-05 (sub-populated) March 2009 onwards
dual base station	XBAK22C1[a]	none	■ for dual base stations with PMU ■ PCB IPN 220-02037-02
dual base station	XBAK22C2	TBA-SP-K22C2	■ for dual base stations with PMU ■ for single and dual base stations with 12 V PA ■ PCB IPN 220-02037-04 up to March 2007 ■ PCB IPN 220-02037-05 March 2007 onwards
			■ December 2008 onwards: all base stations except multi-reciter ■ March 2009 onwards: all base stations except multi-reciter and single Power Save ■ PCB IPN 220-02037-05
multi-reciter	XBAK22C6	TBA-SP-K22C6	■ for multi-reciter subracks with or without PMU ■ PCB IPN 220-02129-xx

a. Obsolete. No longer available.

In late 2006 the circuit board used in XBAK22C0 changed from IPN 220-02029-04 to a sub-populated version of the dual base station board, IPN 220-02037-05 or later. This sub-populated version of the dual base station board must be used only for single base stations with a PMU. From December 2008 onwards, XBAK22C0 was replaced with XBAK22C2. In March 2009 XBAK22C0 was reintroduced only for single Power Save base stations.

Unless otherwise indicated, the circled numbers in the following instructions refer to Figure 8.4 on page 193.

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly"on page 180, and remove the control panel, as described in "Replacing the Control Panel"on page 182.

2. Disconnect all cables from the interconnect board.

3. Remove the M3 nuts and spring washers ① securing the board to the subrack.

4. **Multi-reciter board only:** Remove the two retaining clamps ① securing the left end of the board, as shown in Figure 8.3 on page 192.

5. Remove the board. If you are changing the type of board, also remove the insulator ②.

Refitting

1. If previously removed, replace the insulator. If you are changing the type of board, you must fit the matching insulator.

2. **Multi-reciter board only:** Reconnect the DC feed wires to connector J17 ② on the interconnect board (red (+) to pin 1), as shown in Figure 8.3 on page 192.

3. Refit the board and secure with the M3 nuts and spring washers.

4. **Multi-reciter board only:** Replace the two retaining clamps.

5. **Dual base station board only:** Set the switches of S1 ③ as described in "Dual Base Station Board" on page 162.

6. **Multi-reciter board only:** Set the switches and links as described in "Multi-reciter Board" on page 164.

7. Reconnect all cables as shown in "Connection":
   - single and dual base stations, refer to Figure 6.4 on page 115
   - multi-reciter subracks, refer to Figure 6.6 on page 117.

Figure 8.3 Replacing the subrack interconnect board in multi-reciter subracks

XBAK22C6

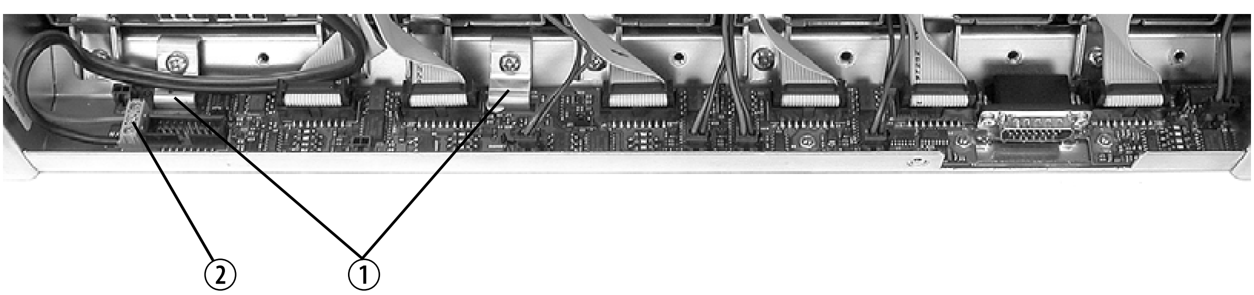
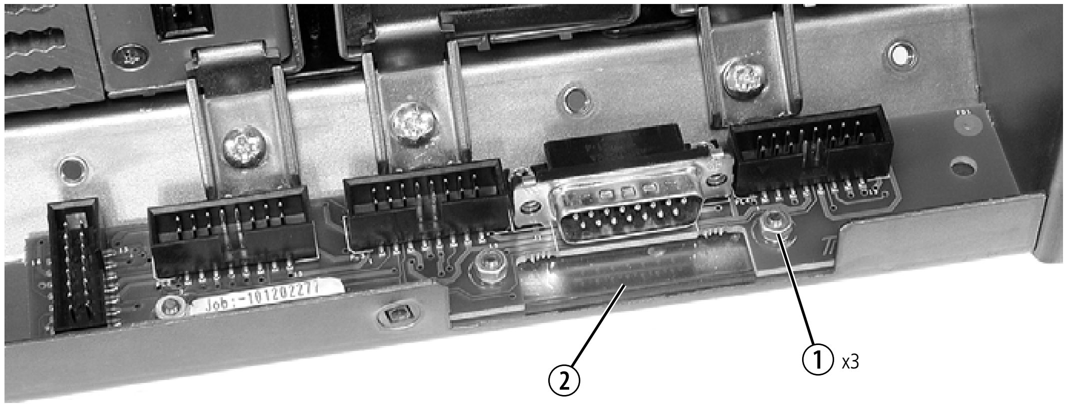


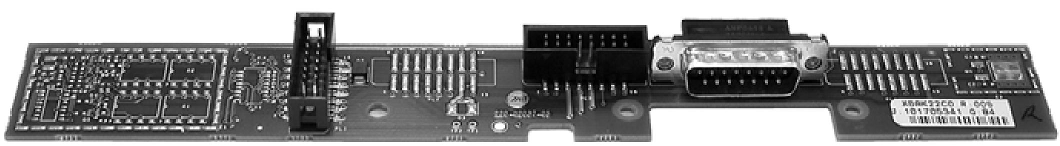
Figure 8.4 Replacing the subrack interconnect board in single and dual base stations

XBAK22C0

single base station with PMU - IPN 220-02029-04 and earlier (obsolete)

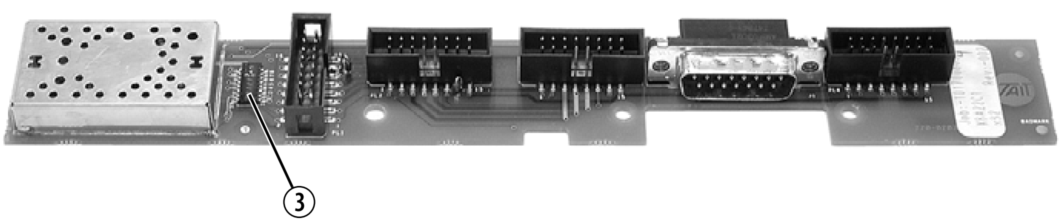


single base station with PMU (late 2006 to December 2008)
single Power Save base station with PMU (March 2009 onwards) } **IPN 220-02037-05**



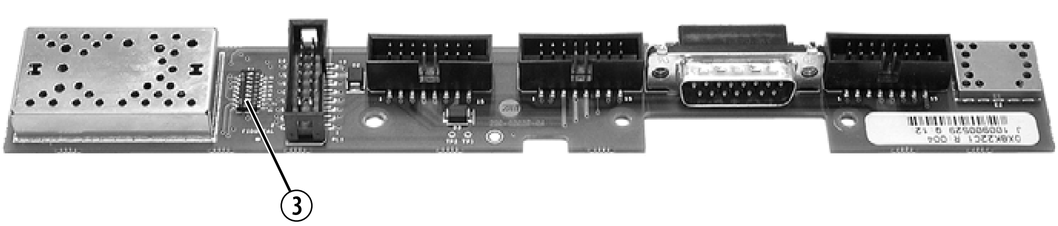
XBAK22C1

dual base station with PMU - IPN 220-02037-02 (obsolete)



XBAK22C2

dual base station with PMU
single/dual base station with 12 V PA } **IPN 220-02037-04 and later**
all base stations except multi-reciter and single Power Save IPN 220-02037-05 and later



8.10 Final Reassembly

8.10.1 Reprogramming

We strongly recommend that you reprogram the base station with the required configuration after replacing a module. This is especially important after factory repair, as the repaired module may be programmed with a test configuration. Also check that all modules are programmed with compatible firmware versions (as described in the Release Notes).

8.10.2 Fitting the Front Panel and Powering Up

Notice You must refit the correct type of front panel to your TB8100 base station. There are several small but important differences between the front panel for a 5 W or 50 W base station and the front panel for a 100 W base station. These differences are in the duct for the PA fan and are described in the following paragraphs.

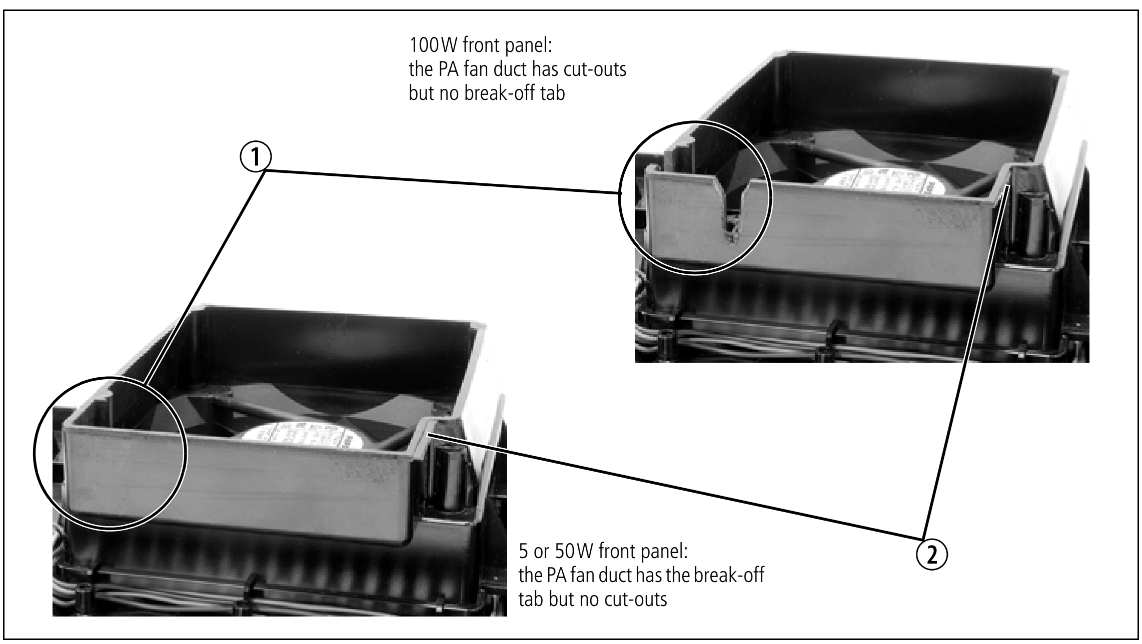
5 W or 50 W Front Panel

The PA fan duct does not have the cut-outs ① required for the 100 W PA RF and DC cables. The break-off tab ② will also still be present and will jam on the system control bus. Do not try to fit this front panel to a 100 W base station or you will damage these cables and possibly the front panel itself.

100 W Front Panel

Do not fit this front panel to a 5 W or 50 W base station. The presence of the cut-outs and absence of the break-off tab will allow air to escape and reduce the velocity of air directed through the heatsink.

Figure 8.5 Identifying the correct front panel

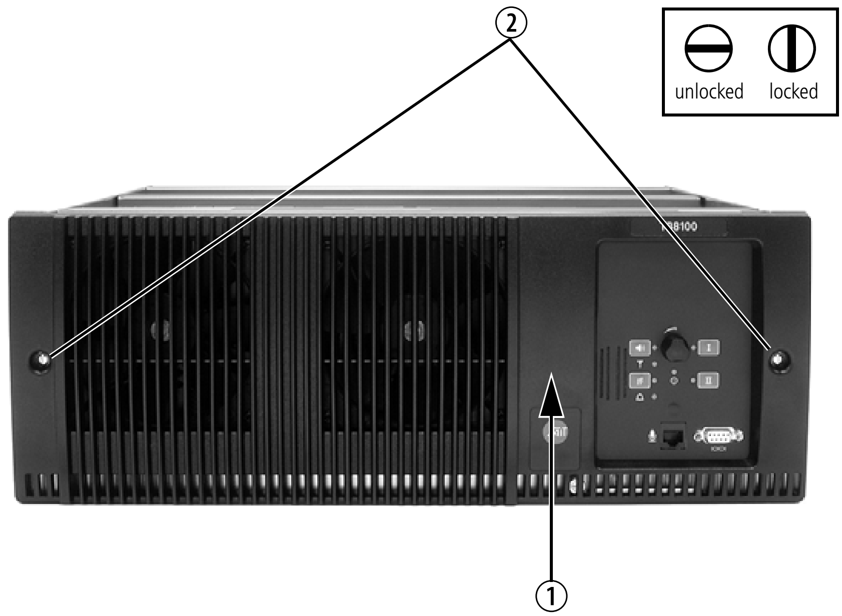


1. Before fitting the front panel, ensure that all cables are secured and positioned correctly so they are clear of the fan ducts (refer to "Overview" on page 111). Otherwise the panel may not fit properly, or you may damage the cables.

2. Refit the Front Panel

   a. Fit the front panel onto the locating pegs on the subrack Fit the left end first, followed by the right end, pressing the panel in the centre as shown ① to secure the spring clip behind the control panel.

   b. Secure the fastener at each end ② with a quarter turn clockwise. Align the slot horizontally, then press the fastener in and turn to lock.



ⓘ If the front panel is difficult to fit onto the subrack, and the fasteners are difficult to fit or tighten, the top left mounting tab of the PMU fan duct may be jamming against the subrack mounting screw. TN-1278 describes a method of trimming the mounting tab to allow the front panel to fit correctly.

3. Before powering up the base station, check that all power, RF and system cables are connected correctly and securely at the rear of the base station.

Notice When refitting modules, make sure they are fitted correctly into the subrack and all retaining clamps are securely tightened. The recommended torque for the retaining clamp screws is 1.9 Nm (17 lbf·in). As well as holding the modules in place, the retaining clamps push the modules hard against the rear rail of the subrack to ensure a good ground connection between the modules and subrack.

9 Preparation for Operation

Once the base station has been installed and connected, it is time to prepare it for operation. The main procedures required to ensure your base station is ready for operation are as follows:

- tuning
- configuration
- applying power
- test transmissions.

The following sections provide more detail on these procedures. Some sections provide only an overview, as the full procedures are described in other documents.

9.1 Tuning

You may need to adjust and tune the reciters before operating them in your radio system. Refer to "Short Tuning Procedure" on page 102 for details on how to adjust the lock band (switching range) and tune the receiver front end.

Refer to the Calibration Kit documentation for full details on the complete adjustment and tuning procedures.

9.2 Configuration

You must ensure that the base station has been correctly configured, both in hardware and software, before operating it in your radio system.

Refer to "Configuration" on page 161, and also to the Service Kit and its associated documentation, for full details of all the options available in the complete configuration process.

9.3 Applying Power

1. Before turning the base station on:
   - check that the PMU is turned off (refer to "Preliminary Disassembly" on page 180)
   - **12 V PA and multi-reciter only:** check that the battery supply lead is disconnected (refer to "Preliminary Disassembly" on page 180)
   - remove the front panel (refer to "Preliminary Disassembly" on page 180)
   - check that all looms and cables at the front and rear of the base station are fitted correctly (refer to "Overview"on page 111)
   - check that all connectors are secure
   - refit the front panel - ensure it is fitted correctly so that the fans will operate if needed (refer to "Final Reassembly"on page 194).

2. Apply power by turning on the PMU, or by connecting the battery supply lead to the 12V PA or subrack.

3. Check that the base station powers up correctly:
   - check that the cooling fans in the front panel turn on in the correct order after power-up: the PMU fan will run first, followed by the PA fan; each fan will run for about five seconds and then switch off (note that the PMU fan is not fitted to a 12V PA base station)
   - check that the appropriate LEDs on the control panel turn on after about five seconds, as listed below:

dual base station	power and base station 1 LEDs
Power Save	power LED
multi-reciter	power, microphone, and channel 1 LEDs;

     all other LEDs should remain off (refer to "Control Panel"on page 34)
   - at this point you can also safely press the speaker button and check that it is operating correctly.

9.4 Test Transmissions

Once you have completed the procedures described in the previous sections, you may want to make some test transmissions. These will verify that your base station is operating correctly.

ⓘ You may wish to have the Service Kit software running during these tests so that you can monitor the performance of the base station.

1. Ensure that the base station is correctly connected to an appropriate antenna and that all RF connectors are secure.
2. Plug the microphone into the RJ45 socket on the control panel.
3. Select the base station you wish to transmit on.
4. Turn on the speaker audio for the selected base station.
5. Press the PTT switch on the microphone and make your transmission. Check that:
   - the red transmit LED turns on
   - there are no alarms generated
   - the audio quality on the receiving radio is good.
6. When the other radio answers your transmission, check that:
   - the green receive LED turns on
   - the audio quality from the speaker in the control panel is good (adjust the speaker volume as required).

10 Maintenance Guide

The base station is designed to be very reliable and should require little maintenance. However, performing regular checks will prolong the life of the equipment and prevent problems from happening.

It is beyond the scope of this manual to list every check that you should perform on your base station. The type and frequency of maintenance checks will depend on the location and type of your system. The checks and procedures listed below can be used as a starting point for your maintenance schedule.

Remote Monitoring

You can monitor the performance of your base station remotely by using the Service Kit and Alarm Center software provided with the equipment. You can use the Service Kit to configure the base station to generate alarms when its performance falls outside your own pre-defined limits. Refer to the Service Kit and Alarm Center documentation for more details.

Performance Checks

We suggest you monitor the following operational parameters using the Service Kit:

- VSWR
- DC input voltage, especially on transmit
- receiver sensitivity
- the setting of the receiver gate opening
- any temperature alarms.

These basic checks will provide an overview of how well your base station is operating.

Reciter

There are no special maintenance requirements for the reciter. You may, however, choose to recalibrate the TCXO frequency periodically. Refer to the Calibration Kit documentation for more details.

PA

There are no special maintenance requirements for the PA.

PMU

There are no special maintenance requirements for the PMU. However, we suggest that you periodically check that the screws on the DC input terminals are tight. They may work loose with thermal cycling. Also, if you are using battery back-up, you should check the batteries regularly in accordance with the manufacturer's recommendations.

Ventilation

The base station has been designed to have a front-to-back cooling airflow. We strongly recommend that you periodically check and maintain the ventilation requirements described in "Ventilation"on page 97 to ensure a long life and trouble-free operation for your base station.

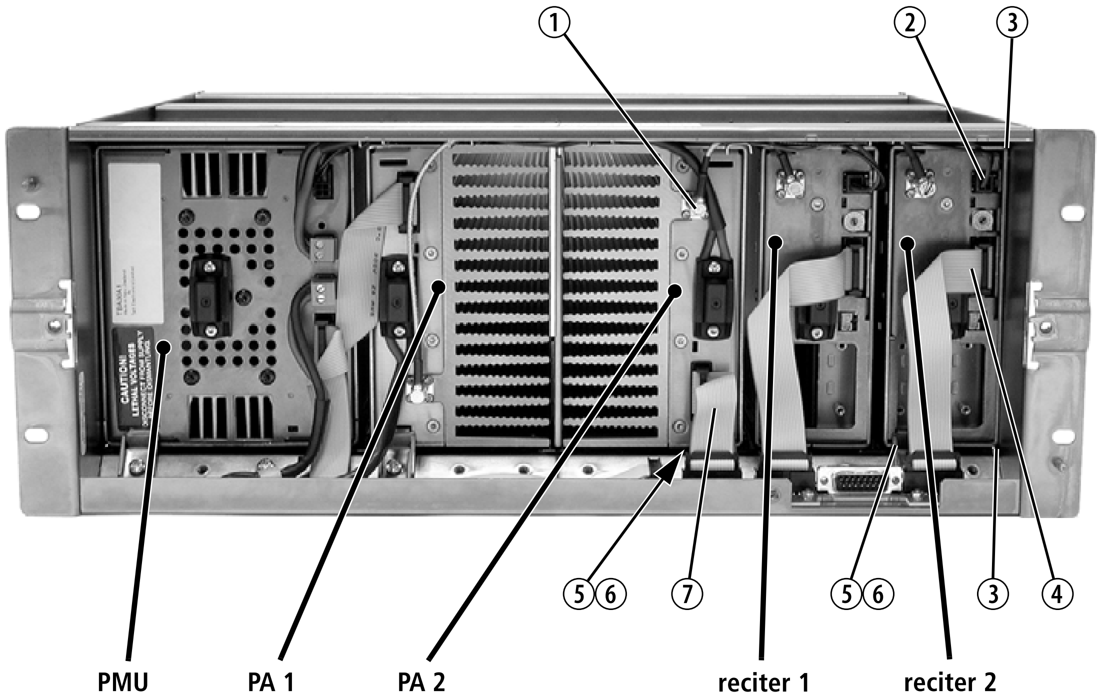
Cooling Fans

The cooling fans have a long service life and have no special maintenance requirements. You can use the Service Kit to configure the base station to generate an alarm if either of the cooling fans fails. Refer to the Service Kit and Alarm Center documentation for more details.

Appendix A - Adding a Second Reciter

The parts required to add a second reciter or base station to a subrack are identified below. For a full list of spare parts available for the subrack, refer to the service manual.

Parts required to add a second reciter or base station - front view



	Description	Part Number
①	RF coaxial cable - reciter to 5/50W PA (short)	219-02862-XX
②	DC power cable - PMU to dual reciters[a]	219-02860-XX
③	top rail guide (also used in bottom corner)	307-02053-00 307-02053-01[b]
④	system control bus ribbon cable - reciter to subrack interconnect board	219-02858-XX
⑤	module retaining clamp	303-50102-XX
⑥	M4x10mm pan head Pozidriv screw	345-00050-07
⑦	system control bus ribbon cable - 5/50W PA to subrack interconnect board	219-02861-XX

a. Later subracks have this cable fitted as standard.

b. Subracks produced from late 2008 onwards have wider slots than earlier subracks. Guide rail 307-02053-01 is designed for these wider slots and will not fit older subracks with narrow slots.

Glossary

This glossary contains an alphabetical list of terms and abbreviations related to the base station. For information about trunking, mobile, or portable terms, consult the glossary provided with the relevant documentation.

A B C D E F G H I K L N P R S T U V W

A

access level There are three different levels of access to a base station: Administrator, User, and Read-only. The User access level has a configurable access profile; the Administrator decides which functions that access level can carry out.

action An action is the second part of a Task Manager task. It specifies what the base station must do when the first part (the input) becomes true.

active Digital outputs are active when the base station pulls their voltage low and current is flowing. Digital inputs are active when external equipment is pulling them to ground. All base station digital inputs and outputs are open collector.

ADC Analog-to-Digital Converter. A device for converting an analog signal to a digital signal that represents the same information.

Alarm log The alarm log is a list of the last 50 alarms that the base station generated. This list is stored in the base station. To view it, select Monitor > Alarms > Reported Alarms.

Alarm Center Alarm Center is a utility provided with the Service Kit that is able to receive, store, and display alarms from any number of base stations with dial-up connections. Participating base stations need an Alarm Reporting license. Alarm Center also routes emailed messages to the email server.

alarm notification Alarm notification is the process by which the base station passes on information about an alarm condition. It can notify alarms over the air, over the line, via email, or to an Alarm Center. It can also activate a digital output. If the Service Kit is logged on to the base station, it is automatically notified of any alarms.

air intake temperature The temperature of the air as measured at the PA's air intake.

anti-kerchunking Anti-kerchunking is a base station configuration that discourages users from kerchunking.

B

balanced line A balanced line has two wires carrying equal and opposite signals. It is typically used in a line-connected base station for connecting to the despatcher console. The system interface identifies the balanced line in as Rx+ and Rx–, and the balanced line out as Tx+ and Tx–.

BCD BCD (binary coded decimal) is a code in which a string of four binary digits represents a decimal number.

C

Calibration Kit The Calibration Kit is a utility for defining the switching ranges of the receiver and the exciter and for flattening the receiver response across its switching range. It can also be used to calibrate various parts of the reciter and the PA circuitry.

CCDI2 CCDI2 (computer controlled data interface version 2) is a proprietary Tait command protocol used between computer equipment and a Tait radio.

channel A channel is:

- A frequency pair (or just a single frequency in a simplex system).
- A set of configuration information that defines the frequency pair and other settings. Also referred to as a channel configuration. Generally, 'channel' has this meaning in the Service Kit.

channel profile A channel profile is a named set of configuration items relating to the base station's RF configuration, transmitter power output and power saving modes. Like the signalling profile, it can be applied to any channel. Together, these profiles define most configuration items.

channel spacing Channel spacing is the bandwidth that a channel nominally occupies. If a base station has a channel spacing of 12.5 kHz, there must be a separation of at least 12.5 kHz between its operating frequencies and those of any other equipment.

channel table The channel table is the base station's database of channel configurations. To view it, select Configure > Base Station > Channel Table.

CODEC An IC which combines analog-to-digital conversion (coding) and digital-to-analog conversion (decoding).

configuration file A configuration file consists of all the configuration settings needed for a base station, stored as a file in the configurations folder. Configuration files have the extension *.t8c.

connection A connection is a named group of settings that the Service Kit uses when establishing communications with a base station.

control bus The control bus is used for communications between modules in a base station. It is an I^2C bus, a bi-directional two-wire serial bus which is used to connect integrated circuits (ICs). I^2C is a multi-master bus, which means that multiple chips can be connected to the same bus, and each one can act as a master by initiating a data transfer.

control panel The control panel is an area at the front of the base station with buttons, LEDs and other controls that let you interact with the base station.

CTCSS CTCSS (continuous tone controlled squelch system), also known as PL (private line), is a type of signalling that uses subaudible tones to segregate groups of users.

custom action A custom action is a user-defined Task Manager action that consists of more than one pre-defined action.

custom input A custom input is a user-defined Task Manager input that consists of a combination of pre-defined inputs.

CWID CWID (**C**ontinuous **W**ave **ID**entification) is a method of automatically identifying the base station using a Morse code. Continuous wave means transmission of a signal with a single frequency that is either on or off, as opposed to a modulated carrier.

D

DAC Digital-to-Analog Converter. A device for converting a digital signal to an analog signal that represents the same information.

DCS DCS (digital coded squelch), also known as DPL (digital private line), is a type of subaudible signalling used for segregating groups of users. DCS codes are identified by a three-digit octal number, which forms part of the continuously repeating code word. When assigning DCS signalling for a channel, you specify the three-digit code.

DDC Digital Down Converter. A device which converts the digitised IF signal of the receiver down to a lower frequency (complex baseband) to suit the DSP.

de-emphasis De-emphasis is a process in the receiver that restores pre-emphasized audio to its original relative proportions.

duty cycle Duty cycle is used in relation to the PA. It is the proportion of time (expressed as a percentage) during which the PA is operated. The PA can be operated continuously.

E

EIA — Electronic Industries Alliance. Accredited by the American National Standards Institute (ANSI) and responsible for developing telecommunications and electronics standards in the USA.

EMC — Electromagnetic Compatibility. The ability of equipment to operate in its electromagnetic environment without creating interference with other devices.

ETSI — European Telecommunications Standards Institute. The non-profit organization responsible for producing European telecommunications standards.

F

flag — A flag is a programming term for a "yes/no" indicator used to represent the current status of something. The base station has a set of system flags that are read and set by Task Manager. There is also a separate set of flags that you can use in your own Task Manager tasks.

frequency band — The range of frequencies that the equipment is capable of operating on.

front panel — The cover over the front of the base station containing fans for the PA and PMU.

G

gating — Gating is the process of opening and closing the receiver gate. When a valid signal is received, the receiver gate opens.

H

hiccup mode — Many power supplies switch off in the event of a short-circuit and try to start again after a short time (usually after a few seconds). This "hiccup"-type of switching off and on is repeated until the problem is eliminated.

hysteresis — Hysteresis is the difference between the upper and lower trigger points. For example, the receiver gate opens when the upper trigger point is reached, but will not close until the level falls to the lower trigger point. An adequate hysteresis prevents the receiver gate from repeatedly opening and closing when the level is about that of the trigger point.

Hysteresis mode A mode of PMU operation designed to save power. The PMU is mainly turned off, but switches back on intermittently to maintain output voltage when the output current is low.

I

inactive Digital outputs are inactive if the base station is doing nothing to them. They are floating, open collector outputs. Digital inputs are inactive when they are open circuit.

Intercom mode Intercom mode makes it possible for the operator at the dispatch centre and the servicing technician at the base station to communicate with each other over the line. It connects the base station microphone to line out.

isolator An isolator is a passive two-port device which transmits power in one direction, and absorbs power in the other direction. It is used in a PA to prevent damage to the RF circuitry from high reverse power.

K

kerchunking Kerchunking is transmitting for a second or less without saying anything in order to test the base station. This results in a 'kerchunk' sound.

L

line-controlled base station A TB8100 is a line-controlled base station when it receives audio (sending it out via its system interface), transmits audio received over its system interface, and its transmitter is keyed via the Tx Key line.

logging on Once you have connected to a base station, you can log on. This establishes communications between the Service Kit and the base station.

N

navigation pane The navigation pane is the left-hand pane of the Service Kit application window. It displays a hierarchical list of items. When you click an item, the main pane displays the corresponding form.

O

operating range Operating range is another term for switching range.

P

PA The PA (power amplifier) is a base station module that boosts the exciter output to transmit level.

PMU The PMU (power management unit) is a module that provides power to the base station.

pre-emphasis Pre-emphasis is a process in the transmitter that boosts higher audio frequencies to improve the audio quality.

R

reciter The reciter is a module of a base station that acts as receiver and exciter.

reverse tone burst Reverse tone bursts can be used with CTCSS. When reverse tone bursts are enabled, the phase of the generated tones is reversed for a number of cycles just before transmission ceases. If the receiver is configured for reverse tone burst, it responds by closing its gate.

RSSI RSSI (Received Signal Strength Indicator) is a level in dBm or volts that indicates the strength of the received signal.

Run mode Run mode is the normal operating mode of the base station.

S

SAW filter Surface Acoustic Wave filter. A band pass filter that can be used to filter both RF and IF frequencies. A SAW filter uses the piezoelectric effect to turn the input signal into vibrations that are turned back into electrical signals in the desired frequency range.

selectivity The ability of a radio receiver to select the wanted signal and reject unwanted signals on adjacent channels (expressed as a ratio).

sensitivity The sensitivity of a radio receiver is the minimum input signal strength required to provide a usable signal.

signalling profile A signalling profile is a named set of configuration items related to signalling that can be applied to any channel. Items include subaudible signalling and transmit timers.

SINAD SINAD (Signal plus Noise and Distortion) is a measure of signal quality. It is the ratio of (signal + noise + distortion) to (noise + distortion). A SINAD of 12 dB corresponds to a signal to noise ratio of 4:1. The TB8100 can provide an approximate SINAD value while in service by comparing the in-band audio against out-of-band noise. This value should not be relied upon to make calibrated measurements.

Sleep mode Sleep mode is a power saving state in which a part of the base station is switched off, and then periodically switched on again.

Standby mode Standby mode is a mode of base station operation in which active service is suspended so that special operations can be carried out, such as programming the base station with a new configuration.

status message A status message is a set of information about the base station that can be emailed. It identifies the base station, indicates the current operating channel, lists the status of all alarms, and gives the current values of a number of other monitored parameters. It also contains the alarm log.

subaudible signalling Subaudible signalling is signalling that is at the bottom end of the range of audible frequencies. The base station supports CTCSS and DCS subaudible signalling.

subtone A subtone (subaudible signalling tone) is a CTCSS tone or a DCS code.

switching range The switching range is the range of frequencies (about 10MHz) that the equipment is tuned to operate on. This is a subset of the equipment's frequency band.

system flag System flags are binary indicators that are read and set by Task Manager. Generally, they are used to disable or enable configured base station functions.

system interface The system interface is the set of inputs to and outputs from the base station (excluding power and RF), provided by a board inside the reciter. A range of different boards are available for different applications.

T

TB8100 Base Station A Tait TB8100 base station consists of the equipment necessary to receive and transmit on one channel. Generally, this means a reciter, a PA, and a PMU. Often abbreviated to TB8100 or base station.

Talk Through Repeater A TB8100 is a talk through repeater when its audio path is configured to pass the audio it receives on to the transmitter.

Task Manager Task Manager is a part of the base station firmware that carries out tasks in response to inputs. These tasks are formulated using the Service Kit.

template file

A template file contains configuration information that can be used to create a new base station configuration. Template files have the extension *.t8t.

test set

A communications test set. It is used to analyze the performance of radio equipment.

transmit lockout

The transmit lockout feature prevents the base station from transmitting for a time once the transmit timer has expired. It is designed to prevent users from monopolizing the base station.

U

Unbalanced line

An unbalanced line has one wire earthed. It is typically used for short connections, for example, between a base station and a repeater on the same site. The system interface identifies the wires of unbalanced lines with Rx audio, Tx audio, and Audio Ground. Audio Ground is common to line-in and line-out.

V

valid signal

A valid signal is a signal that the receiver responds to by opening the receiver gate. A signal is valid for example when it is stronger than a minimum level and when it has the specified subtone.

VSWR

Voltage Standing Wave Ratio (VSWR) is the ratio of the maximum peak voltage anywhere on the transmission line to the minimum value anywhere on the transmission line. A perfectly matched line has a VSWR of 1:1. A high ratio indicates that the antenna subsystem is poorly matched.

W

Watchdog

A watchdog circuit checks that the system is still responding. If the system does not respond (because the firmware has locked up), the circuit resets the system.

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8.1. Licensee's right to use the Software and Documentation will commence when the Designated Products are supplied by Tait to Licensee and will continue for the life of the Designated Products with which or for which the Software and Documentation are supplied, unless Licensee breaches this Agreement, in which case this Agreement and Licensee's right to use the Software and Documentation may be terminated immediately upon notice by Tait.

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8.3. Licensee acknowledges that Tait made a considerable investment of resources in the development, marketing, and distribution of the Software and Documentation and that Licensee's breach of this Agreement will result in irreparable harm to Tait for which monetary damages would be inadequate. If Licensee breaches this Agreement, Tait may terminate this Agreement and be entitled to all available remedies at law or in equity including immediate injunctive relief and repossession of all non-embedded Software and associated Documentation. Licensee shall pay all Tait costs (on an indemnity basis) for the enforcement of the terms of this Agreement.

Section 9 CONFIDENTIALITY

Licensee acknowledges that the Software and Documentation contain proprietary and Confidential Information valuable to Tait and are Tait trade secrets, and Licensee agrees to respect the confidentiality of the information contained in the Software and Documentation.

Section 10 LIMITATION OF LIABILITY

10.1. In no circumstances shall Tait be under any liability to Licensee, or any other person whatsoever, whether in Tort (including negligence), Contract (except as expressly provided in this Agreement), Equity, under any Statute, or otherwise at law for any losses or damages whether general, special, exemplary, punitive, direct, indirect, or consequential arising out of or in connection with any use or inability of using the Software.

10.2. Licensee's sole remedy against Tait will be limited to breach of contract and Tait sole and total liability for any such claim shall be limited at the option of Tait to the repair or replacement of the Software or the refund of the purchase price of the Software.

Section 11 GENERAL

11.1. COPYRIGHT NOTICES. The existence of a copyright notice on the Software will not be construed as an admission or presumption of publication of the Software or public disclosure of any trade secrets associated with the Software.

11.2. COMPLIANCE WITH LAWS. Licensee acknowledges that the Software may be subject to the laws and regulations of the jurisdiction covering the supply of the Designated Products and will comply with all applicable laws and regulations, including export laws and regulations, of that country.

11.3. ASSIGNMENTS AND SUBCONTRACTING. Tait may assign its rights or subcontract its obligations under this Agreement, or encumber or sell its rights in any Software, without prior notice to, or consent of, Licensee.

11.4. GOVERNING LAW. This Agreement shall be subject to and construed in accordance with New Zealand law and disputes between the parties concerning the provisions hereof shall be determined by the New Zealand Courts of Law. Provided however Tait may at its election bring proceedings for breach of the terms hereof or for the enforcement of any judgment in relation to a breach of the terms hereof in any jurisdiction Tait considers fit for the purpose of ensuring compliance with the terms hereof or obtaining relief for breach of the terms hereof.

11.5. THIRD-PARTY BENEFICIARIES. This Agreement is entered into solely for the benefit of Tait and Licensee. No third party has the right to make any claim or assert any right under this Agreement, and no third party is deemed a beneficiary of this Agreement. Notwithstanding the foregoing, any licensor or supplier of third-party software included in the Software will be a direct and intended third-party beneficiary of this Agreement.

11.6. SURVIVAL. Sections 4, 5, 6.3, 7, 8, 9, 10, and 11 survive the termination of this Agreement.

11.7. ORDER OF PRECEDENCE. In the event of inconsistencies between this Agreement and any other Agreement between the parties, the parties agree that, with respect to the specific subject matter of this Agreement, this Agreement prevails.

11.8. SECURITY. Tait uses reasonable means in the design and writing of its own Software and the acquisition of third-party Software in order to limit Security Vulnerabilities. While no software can be guaranteed to be free from Security Vulnerabilities, if a Security Vulnerability is discovered, Tait will take the steps specified in Section 6 of this Agreement.

11.9. EXPORT. Licensee will not transfer, directly or indirectly, any Designated Product, Documentation or Software furnished hereunder or the direct product of such Documentation or Software to any country for which New Zealand or any other applicable country requires an export license or other governmental approval without first obtaining such license or approval.

11.10. SEVERABILITY. In the event that any part or parts of this Agreement shall be held illegal or null and void by any court or administrative body of competent jurisdiction, such determination shall not affect the remaining terms which shall remain in full force and effect as if such part or parts held to be illegal or void had not been included in this Agreement. Tait may replace the invalid or unenforceable provision with a valid and enforceable provision that achieves the original intent and economic effect of this Agreement.

11.11. CONSUMER GUARANTEES. Licensee acknowledges that the licenses supplied in terms of this agreement are supplied to Licensee in business, and that the guarantees and other provisions of prevailing consumer protection legislation shall not apply.

11.12. WHOLE AGREEMENT. Licensee acknowledges that it has read this Agreement, understands it and agrees to be bound by its terms and conditions. Licensee also agrees that, subject only to the express terms of any other agreement between Tait and Licensee to the contrary, this is the complete and exclusive statement of the Agreement between it and Tait in relation to the Software. This Agreement supersedes any proposal or prior agreement, oral or written, and any other communications between Licensee and Tait relating to the Software and the Designated Products.

Directive 1999/5/EC Declaration of Conformity

da **Dansk**

Undertegnede Tait Limited erklærer herved, at følgende udstyr TBAB1, TBAC0 & TBAH0 overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
Se endvidere: http://eudocs.taitradio.com/

de **Deutsch**

Hiermit erklärt Tait Limited die Übereinstimmung des Gerätes TBAB1, TBAC0 & TBAH0 mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG.
Siehe auch: http://eudocs.taitradio.com/

el **Ελληνικά**

Η Tait Limited δηλώνει ότι το TBAB1, TBAC0 & TBAH0 συμμορφώνεται προς τις ουσιώδεις απαιτήσεις και τις λοιπές σχετικές διατάξεις της Οδηγίας 1999/5/ΕΚ.
Βλέπε επίσης: http://eudocs.taitradio.com/

en **English**

Tait Limited declares that this TBAB1, TBAC0 & TBAH0 complies with the essential requirements and other relevant provisions of Directive 1999/5/EC.
See also: http://eudocs.taitradio.com/

es **Español**

Por medio de la presente Tait Limited declara que el TBAB1, TBAC0 & TBAH0 cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
Vea también: http://eudocs.taitradio.com/

fi **Suomi**

Tait Limited vakuuttaa täten että TBAB1, TBAC0 & TBAH0 tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Katso: http://eudocs.taitradio.com/

fr **Français**

Par la présente, Tait Limited déclare que l'appareil TBAB1, TBAC0 & TBAH0 est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.
Voir aussi: http://eudocs.taitradio.com/

it **Italiano**

Con la presente Tait Limited dichiara che questo TBAB1, TBAC0 & TBAH0 è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Vedi anche: http://eudocs.taitradio.com/

nl **Nederlands**

Hierbij verklaart Tait Limited dat het toestel TBAB1, TBAC0 & TBAH0 in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/ EG.
Zie ook: http://eudocs.taitradio.com/

pt **Português**

Tait Limited declara que este TBAB1, TBAC0 & TBAH0 está conforme com os requisitos essenciais e outras provisões da Directiva 1999/5/CE.
Veja também: http://eudocs.taitradio.com/

sv **Svensk**

Härmed intygar Tait Limited att denna TBAB1, TBAC0 & TBAH0 står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/ 5/EG.
Se även: http://eudocs.taitradio.com/