TB8100 base station

Installation and Operation Manual

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Contents

Preface

Scope of Manual

Welcome to the TB8100 base station system 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 Tait Dealer or Customer Service Organisation for more information.

Enquiries and Comments

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

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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".

Within this manual, four types of alerts are given to the reader: Warning, Caution, Important and Note. The following paragraphs illustrate each type of alert and its associated symbol.

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

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

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

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

Associated Documentation

TB8100 Installation Guide (a subset of this manual).

TB8100 Service Manual.

TB8100 Specifications Manual.

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

TB8100 Calibration Kit User's Manual and online Help.

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

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 (http://support.taitworld.com).

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 24VDC and 48VDC 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 12V PA, and L-band equipment (850MHz to 960MHz); 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] ■ minor corrections and additions

a. Refer to "Frequency Bands and Sub-bands" on page 16 for the actual frequency coverage in these bands.

1 Description

The TB8100 is a software-controlled base station system (BSS) 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 BSS 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 (optional)
- system inputs and outputs (via the optional system interface board fitted to the reciter).

The TB8100 BSS 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 modules or extra receivers.

1. Consult your nearest Tait Dealer or Customer Service Organisation for information on the most suitable equipment for your area and application.

1.1 The TB8100 BSS Modules

The modules which make up the TB8100 BSS 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

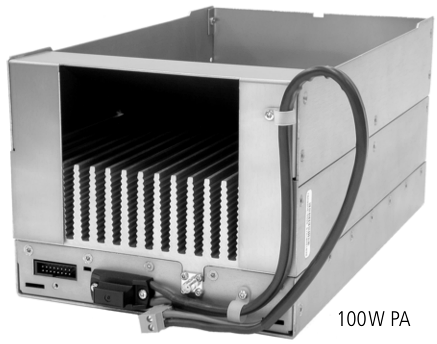
The receiver, exciter and digital control circuitry is located in the reciter module. It also incorporates an optional system interface board which provides standard system inputs and outputs.

Power Amplifier

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

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

5/50 W PA



100 W PA

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

Power Management Unit

The power management unit (PMU) provides the 28 VDC power supply for the modules in the TB8100 BSS. The input voltage can be AC, DC or both AC and DC, depending on the model. An auxiliary DC output is also available when the optional power supply board is fitted. 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 TB8100 front panel is mounted onto the subrack with two quick-release fasteners. It incorporates the cooling fans for the PA and PMU.

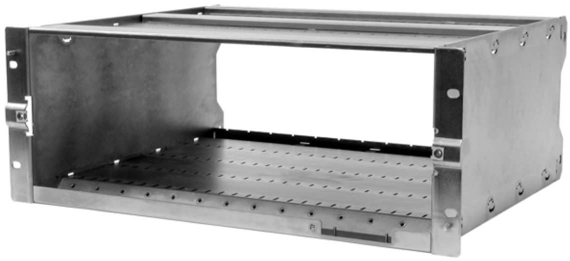
Control Panel

The TB8100 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 BSS. Three models are available: standard, dual base station, and Power Save.

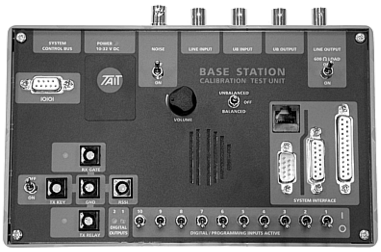
standard control panel shown

Subrack

The TB8100 4U subrack is made of passivated steel and is designed to fit into a standard 19 inch rack or cabinet.



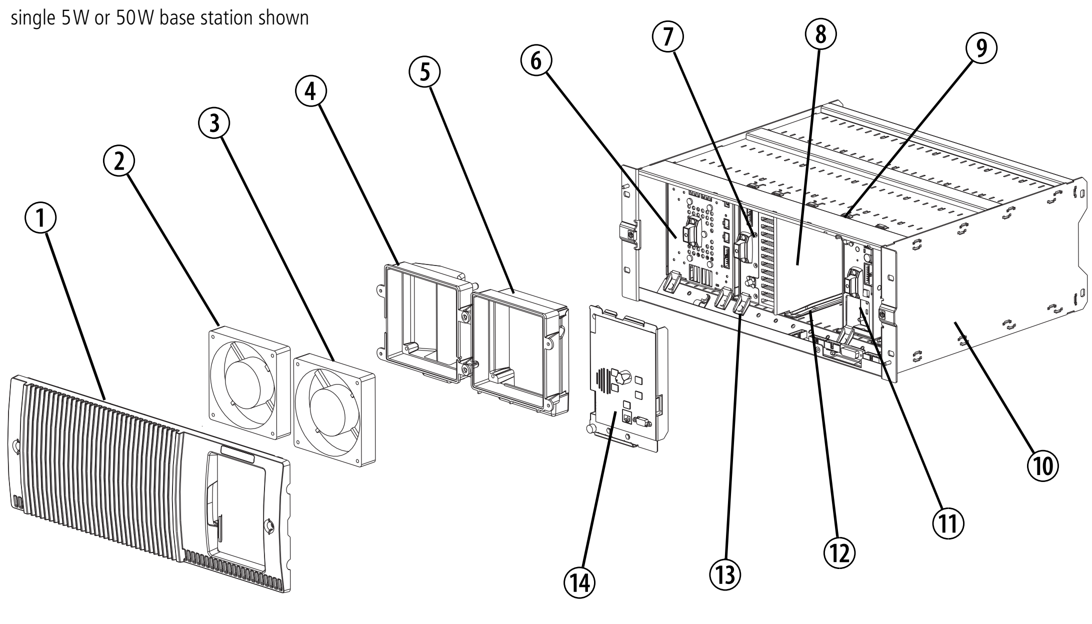
Calibration Test Unit The TB8100 calibration test unit (CTU) provides a selection of inputs and outputs which allows the TB8100 BSS to be connected to standard test equipment, and also to a PC running the Service Kit or Calibration Kit software. Refer to TN-778 for more details.



1.2 Mechanical Assembly

The main mechanical components of the TB8100 BSS are shown in the following illustrations.

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



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

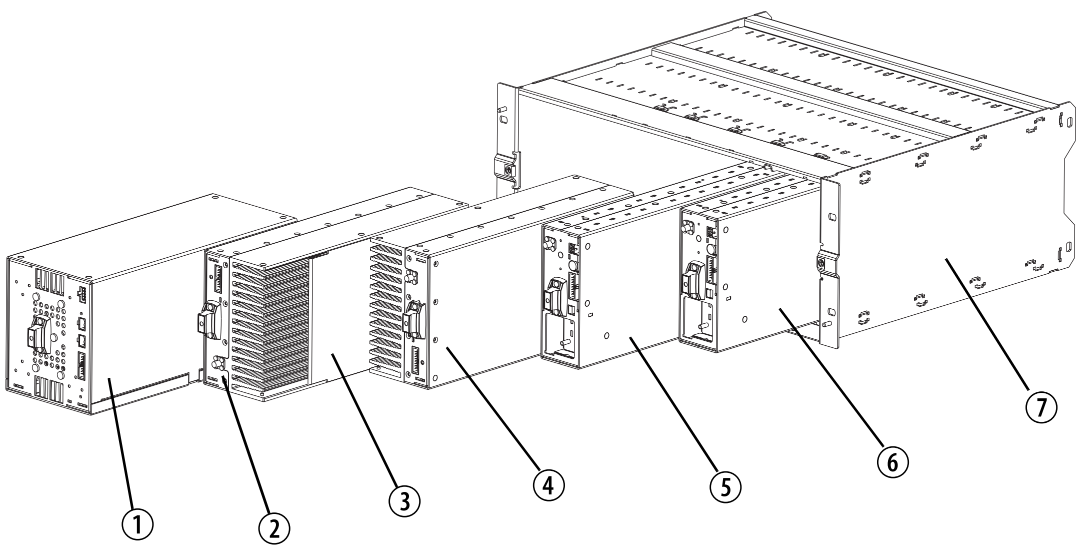
The front panel can be easily removed from the subrack by undoing two quick-release fasteners. Once the front panel is removed, the control panel can also be removed from the subrack by undoing a single screw. Refer to "Replacing Modules" on page 87 for more details.

Note 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 5W or 50W base station



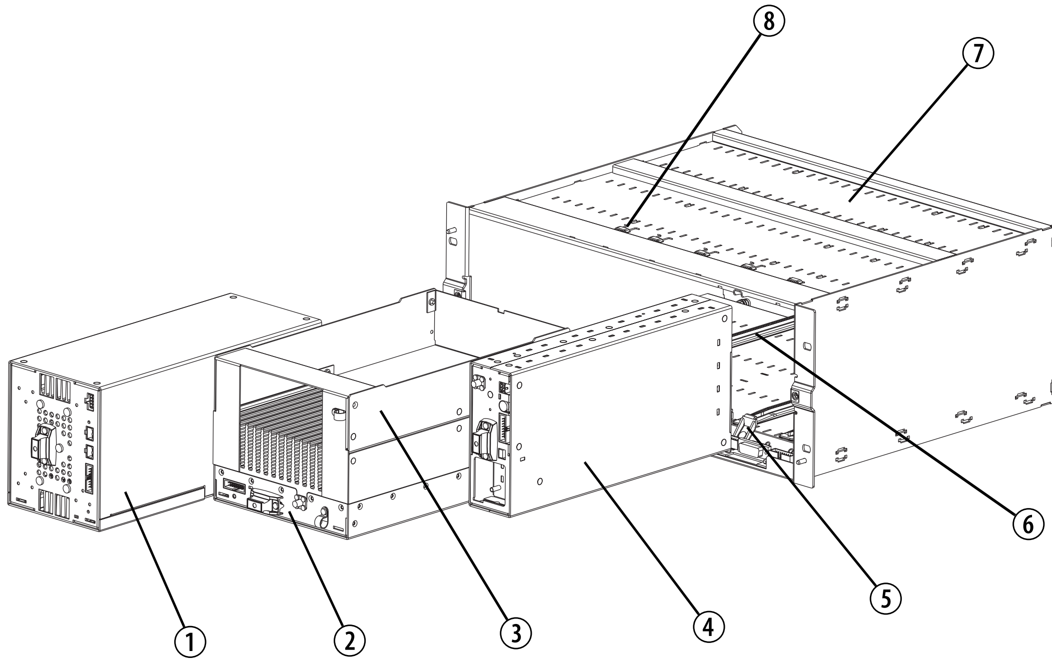
① PMU
② PA for base station 1
③ airflow separator
④ PA for base station 2
⑤ reciter for base station 1
⑥ reciter for base station 2
⑦ subrack

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.

Note 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

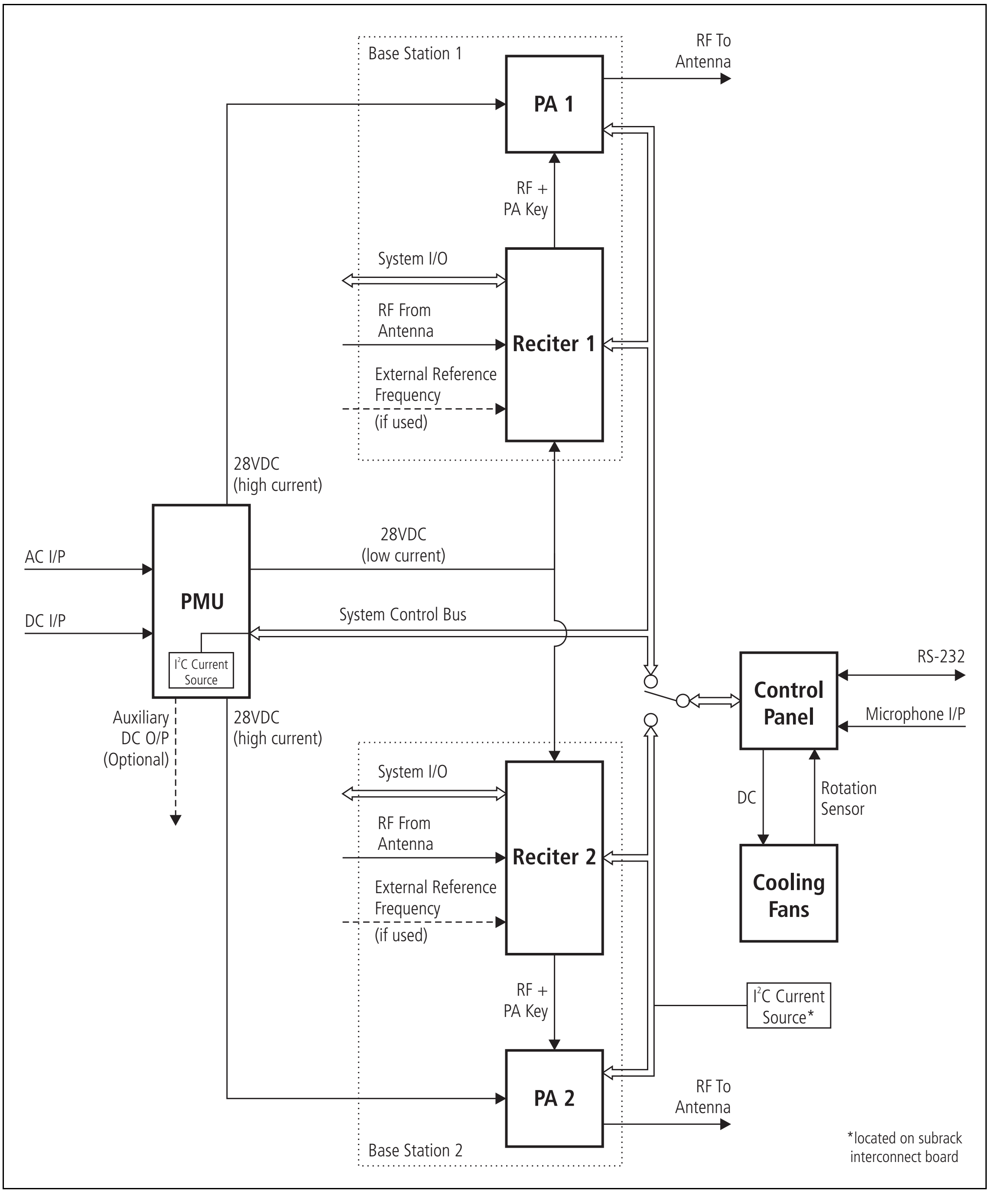
Figure 1.3 above shows the configuration for a typical single 100W base station. The PMU occupies its normal slot at the left end of the subrack, with the PA directly beside it. The single reciter occupies the slot immediately to the right of the PA.

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 TB8100 dual base station system 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 BSS is described in more detail in the following sections.

Figure 2.1 Dual base station system high level block diagram



Frequency Bands and Sub-bands

Much of the circuitry in the TB8100 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 = 400MHz to 520MHz H1 = 400MHz to 440MHz H2 = 440MHz to 480MHz H3 = 470MHz to 520MHz
UHF	K band	K4 = 762MHz to 870MHz[a]
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. 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 18 shows the configuration of the main circuit blocks, and the main inputs and outputs for power, RF and control signals.

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 70.1 MHz IF (intermediate frequency). A VCO (voltage controlled oscillator) provides a +17 dBm input to the mixer, and a diplexer terminates the mixer IF port in 50 Ω. 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 +20 dBm. This signal is then attenuated through a pad to +11 dBm. An 8 VDC 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.

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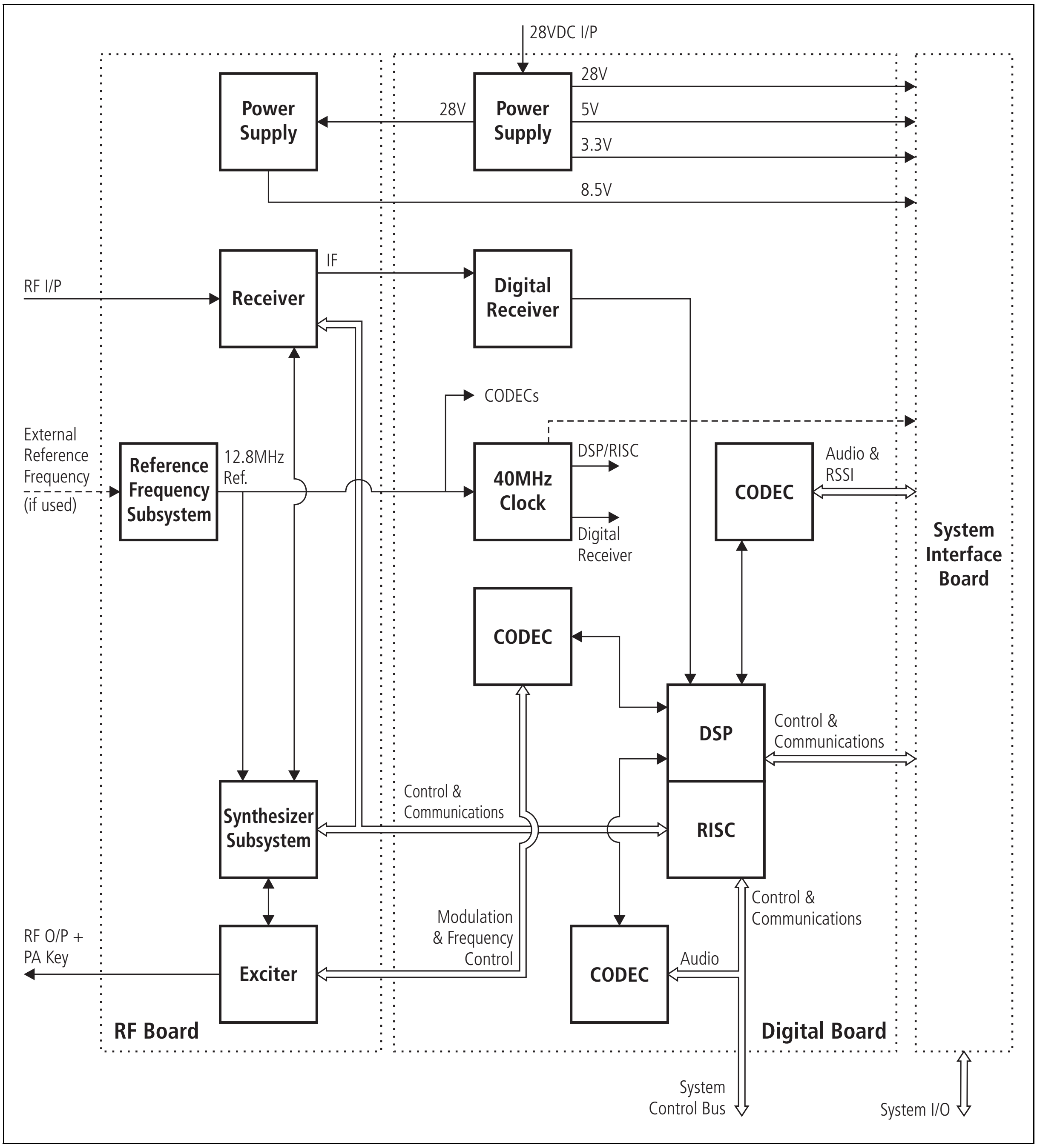
1. AGC is available in H-band reciters only. It can be disabled using the Service Kit software.

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 TB8100 BSS 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 operates off a +28 VDC (nominal) supply. 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 5.3V and 8.5V regulated supplies. This 5.3V supply is boosted to 23V and also provides a 3.3V regulated supply. The power supply on the digital board provides 3.3V and 5.3V regulated supplies. It is also fed through to provide a 2.5V supply.

2.2 PA

The TB8100 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 5W, 50W and 100W PAs are available for operation on 28VDC, while the 5W and 50W PAs are also available for operation on 12VDC. Figure 2.3 on page 21 shows the configurations of a 100W 28V PA and a 50W 12V 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 6W board. In the 100W model shown in Figure 2.3, the output from the 6W board is fed into a −3dB hybrid coupler on a separate splitter board and then to two 60W boards in quadrature. The outputs from these two boards are then combined by another −3dB hybrid coupler on a separate combiner board before being fed to the low-pass filter (LPF)/directional coupler board.

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

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 TB8100 subrack, either PA will turn on the fan when required.

Power Supply

The 100W PA operates off a 28VDC external power supply only, while the 5W and 50W PAs can operate off a 28VDC or 12VDC external power supply, depending on the model. The 12V 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 +10VDC.

Boost Regulator

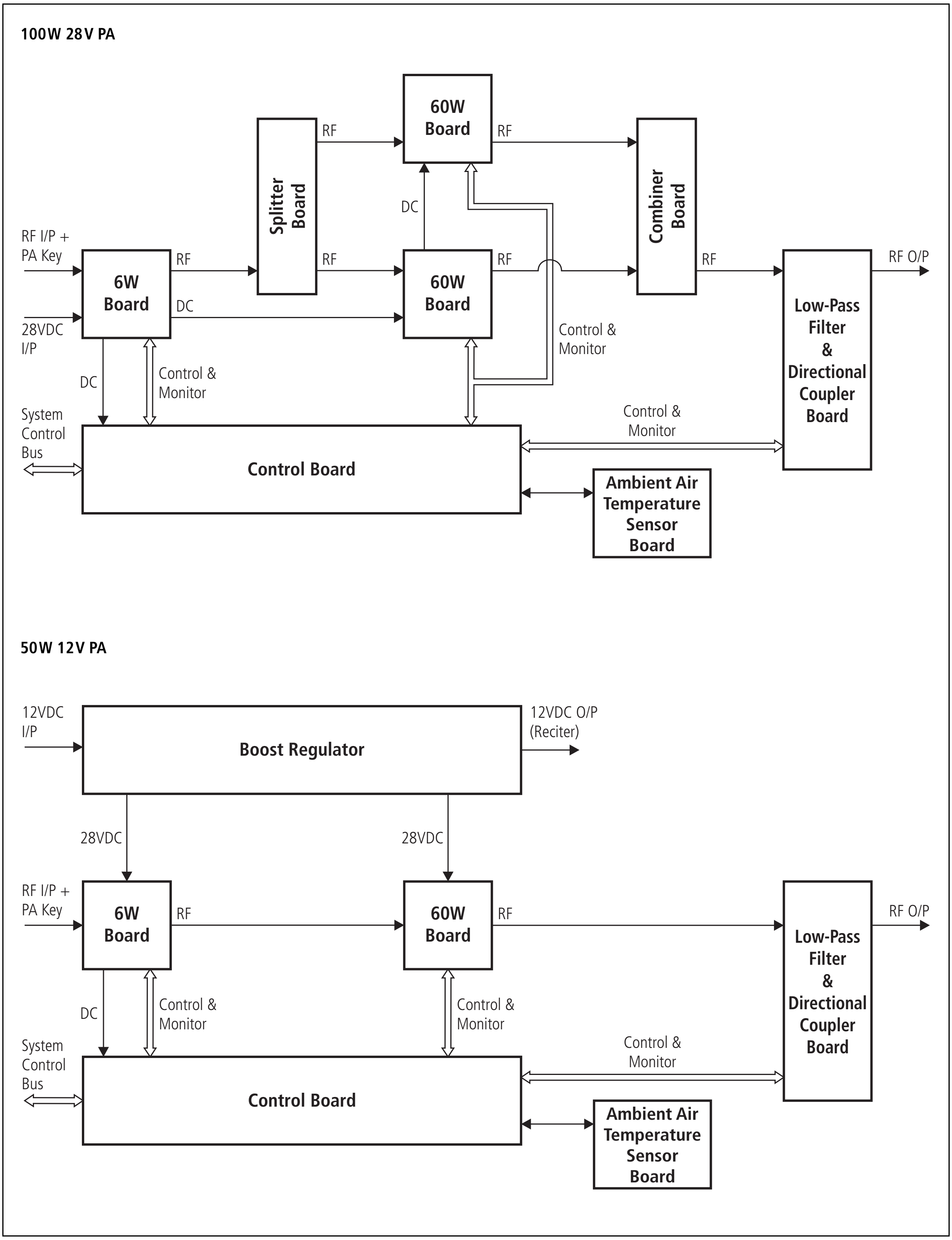
5W and 50W 12V PAs are fitted with a boost regulator board. Figure 2.3 on page 21 shows the configuration for a 50W PA, along with the main inputs and outputs for power, RF and control signals. Note that the 60W board is only fitted to the 50W PA.

The boost regulator board accepts an input of 12VDC 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 12VDC instead of the standard 28VDC 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 28VDC, and is then fed through an output filter to provide the 28VDC 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 startup voltage is 12VDC or higher. Once started, the boost regulator will operate down to 10.25VDC ±0.25V before it shuts down to prevent deep discharge of the battery.

Figure 2.3 PA high level block diagrams



2.3 PMU

The TB8100 PMU provides stable, low-noise 28 VDC outputs to power the TB8100 BSS. 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. The standby power supply card and auxiliary power supply board are optional. 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

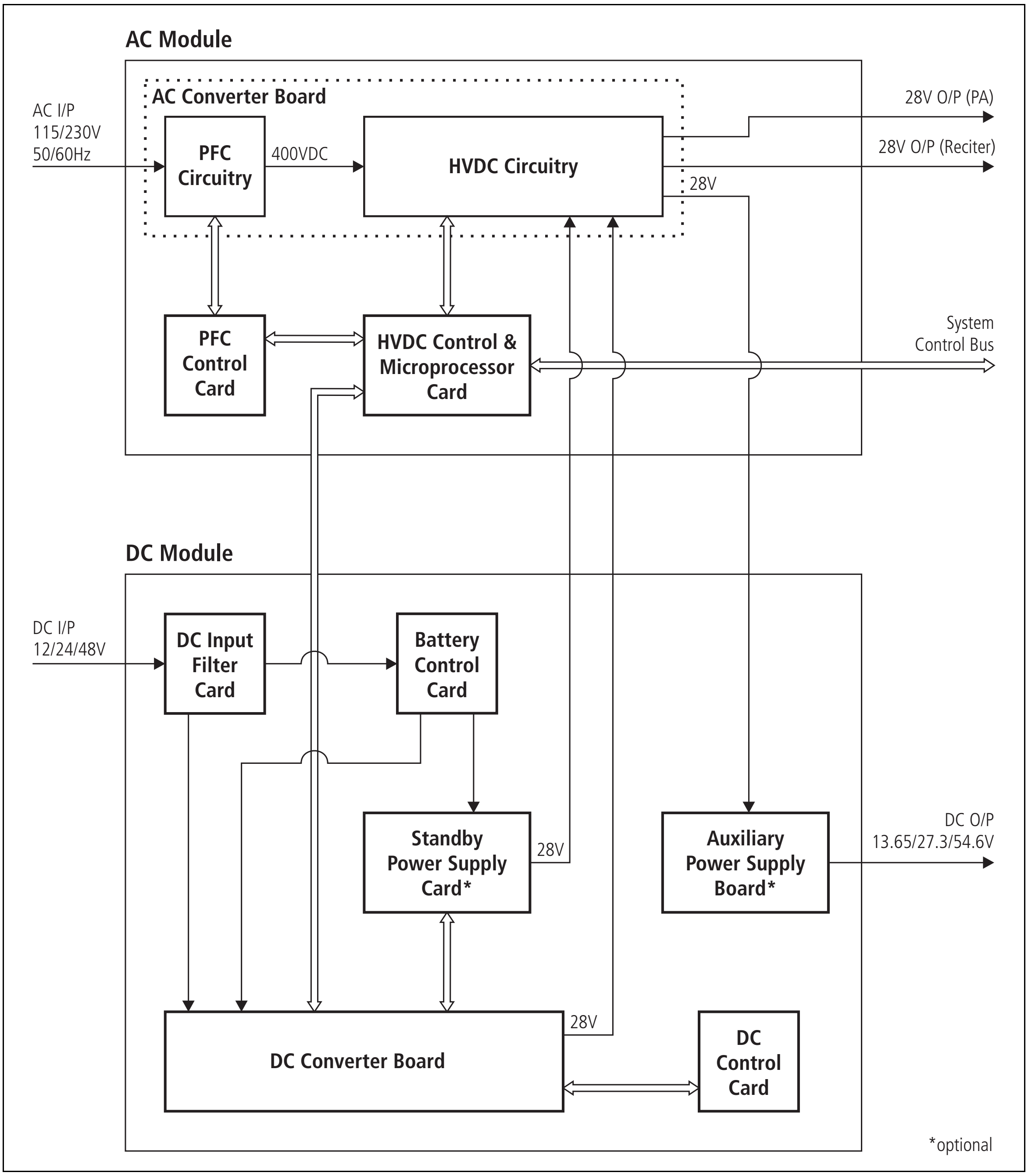
The DC module accepts an input of 12 VDC, 24 VDC or 48 VDC nominal (depending on the model). The input is fed through the DC input filter to the input of the power stage on the DC converter board. This circuitry provides PWM (pulse width modulation) conversion to produce the final DC output. It also 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 optional 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 must be fitted to enable the software-controlled power saving feature to operate. Refer to "Power Saving" on page 57 for more information.

Auxiliary Power Supply

This optional power supply board is mounted on the DC module. The input power is provided from the PA output of the HVDC circuitry on the AC converter board. It provides a high quality 13.65VDC, 27.3VDC or 54.6VDC output (depending on the model) to power external accessory equipment, or can be used to trickle-charge batteries. It can be configured using the Service Kit software to operate whenever mains voltage is available, or whenever the PA output is available.

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.

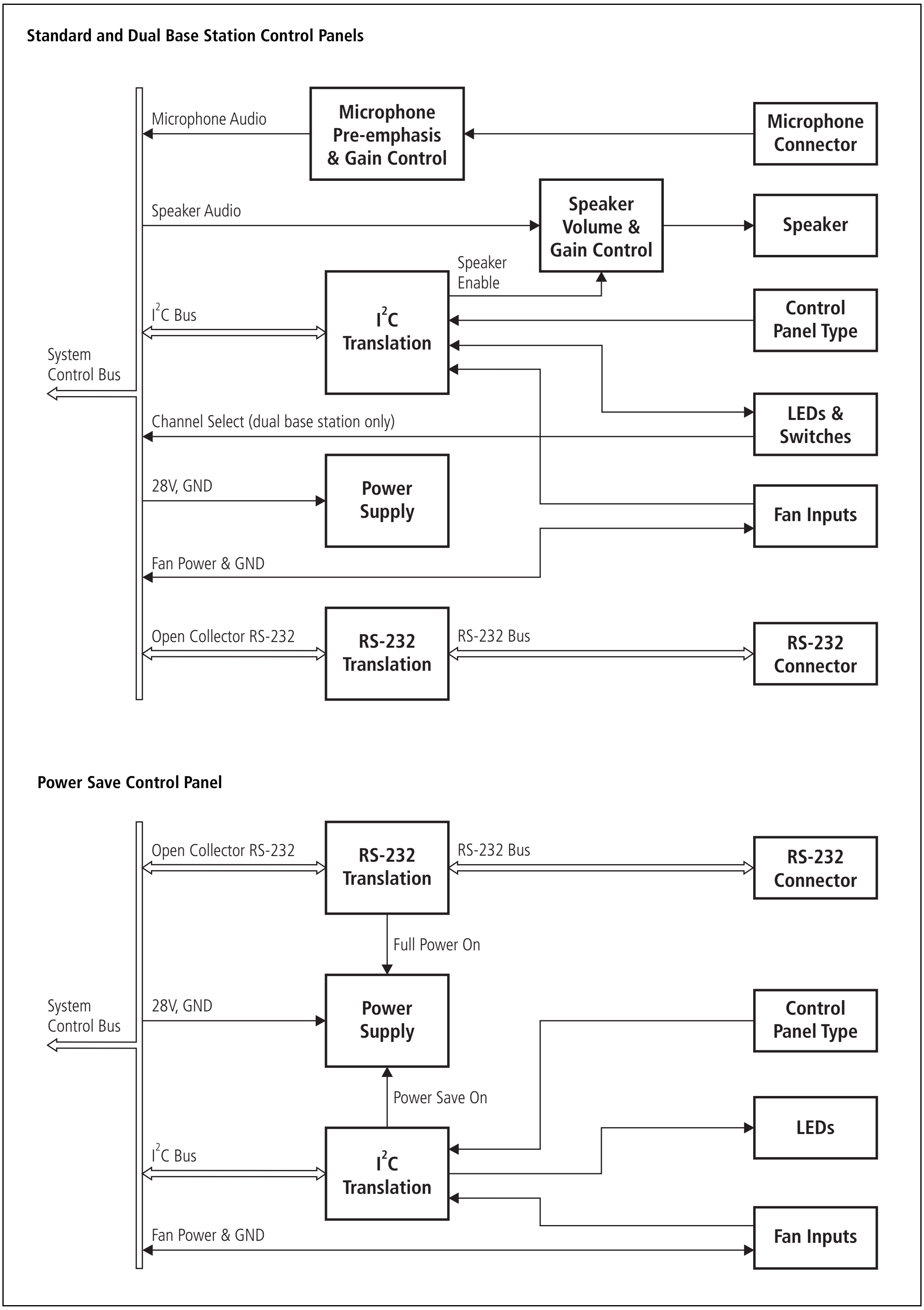
The operation of the cooling fan mounted on the front panel is determined by the temperature limits set in the PMU software.

Important In base station systems 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 BSS 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 TB8100 BSS. The circuitry for the operation of the control panel is located on a board mounted behind its front face. All communication between the BSS and the control panel is via the system control bus. Figure 2.5 on page 25 shows the configuration of the main circuit blocks, and the main inputs and outputs for power, audio and control signals for the standard, dual base station, and Power Save control panels.

Figure 2.5 Control panel high level block diagram



Control Circuitry

The control panel board translates:

- I^{2}C messages from the reciter into an appropriate response on the LEDs
- control panel key inputs and fan rotation inputs from both fans into appropriate I^{2}C messages
- RS-232 communications from the programming port into 0 V to 5 V open-collector signals which can feed from and drive up to six reciters.

Note When a reciter fitted with a TaitNet RS-232 system interface board is used in a TB8100 BSS, 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 122 for more details.

Audio Circuitry

The standard and dual base station control panels provide a volume knob to control the volume of the speaker. In addition, the control panel circuitry performs gain control so that the power output into a 16 Ω speaker is ≥0.5 W at the maximum position of the knob, with an input of 167 mV pp.

Power Supply

The control panel operates off a +28 VDC (nominal) power supply provided by the reciter. The power supply for the cooling fans mounted on the front panel is fed through the control panel.

3 Operating Controls

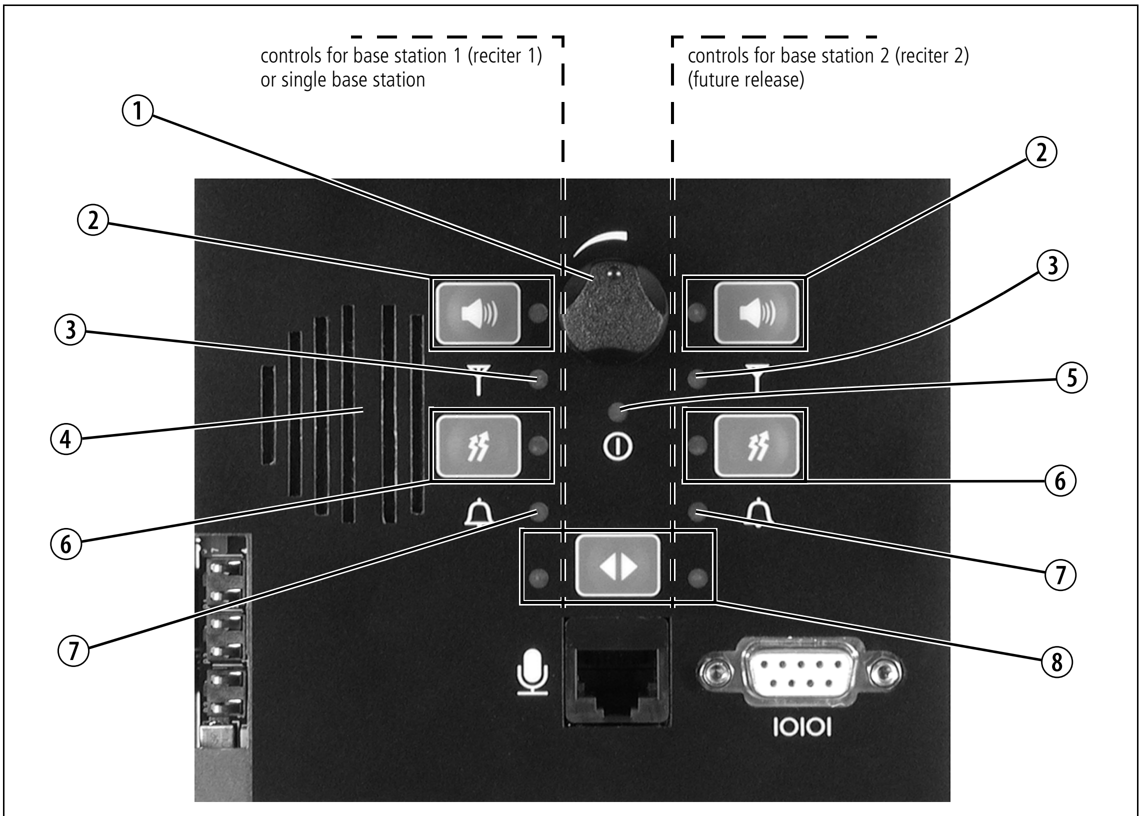
The TB8100 BSS has a number of hardware controls which are available to the user. These controls are located on the control panel, reciter and PMU. This chapter identifies and describes these controls.

3.1 Control Panel

3.1.1 Standard Control Panel

The operating controls on the standard control panel allow some manual control of one or two[1] base stations in a TB8100 BSS. These controls and their associated LED indicators are identified in Figure 3.1 below, and their functions are explained in the paragraphs which follow. Refer to "Connection" on page 103 for information on the connectors located on the control panel.

Figure 3.1 Operating controls on the standard control panel



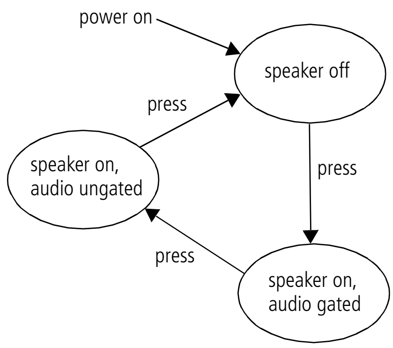
1. speaker volume
2. speaker button and LED
3. receive LED
4. speaker
5. power LED
6. carrier button and transmit LED
7. alarm LED
8. microphone channel button and LEDs

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.

1. Control of two base stations will be available in a future release.

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 its associated base station.

Speaker

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

Power LED

The green power LED is lit when the PMU is turned on and supplying power to the TB8100 BSS.

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.

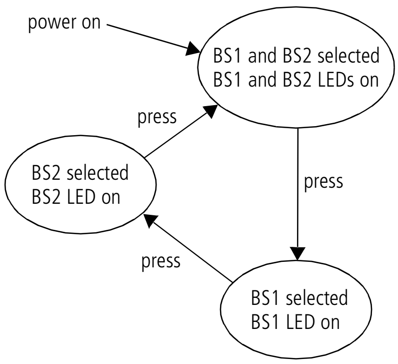
The red transmit LED is lit while its associated transmitter is transmitting.

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 TB8100 BSS 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.

Microphone Channel Button and LEDs

The microphone channel button selects which base station (BS) the microphone is connected to. At power-on both base stations are selected. Pressing the button once will connect the microphone audio to base station 1. Pressing the button a second time will connect the audio to base station 2. Pressing the button for a third time returns to the start of the sequence, with the microphone audio connected to both base stations.



The green LED is lit when the microphone audio is connected to its associated base station.

3.1.2 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 TB8100 BSS. These controls and their associated LED indicators are identified in Figure 3.2 on page 31, and their functions are explained in the paragraphs which follow. Refer to "Connection" on page 103 for information on the connectors located on the control panel.

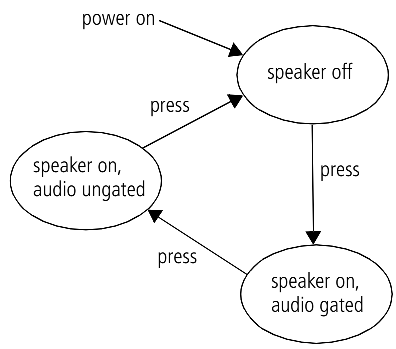
Note When you change base station, the LEDs on the control panel do not change. They continue to reflect the last changed status of the previous base station until you press a control panel button, or the reciter issues an instruction to update an LED. If one LED needs to change, the status of all LEDs is updated. To overcome this limitation, we recommend that you cycle through all three speaker modes immediately after changing base station, finally selecting the speaker mode you want. This forces the base station to refresh the control panel LED display.

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

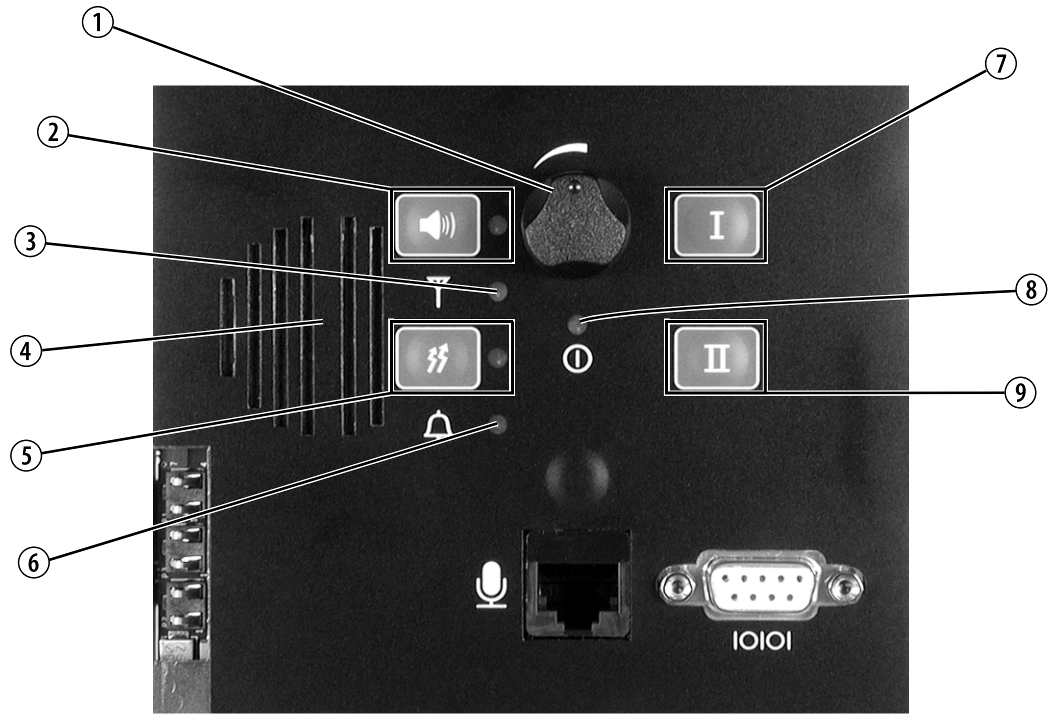
The control panel is fitted with a 0.5W speaker. Audio from either base station can be connected to this speaker.

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.

Figure 3.2 Operating controls on the dual base station control panel



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

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 TB8100 BSS 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

Pressing this button selects base station 1. Pressing the button again while base station 1 is selected has no effect. When the BSS is powered up, the control panel selects base station 1.

Power LED

The green power LED is lit when the PMU is turned on and supplying power to the BSS.

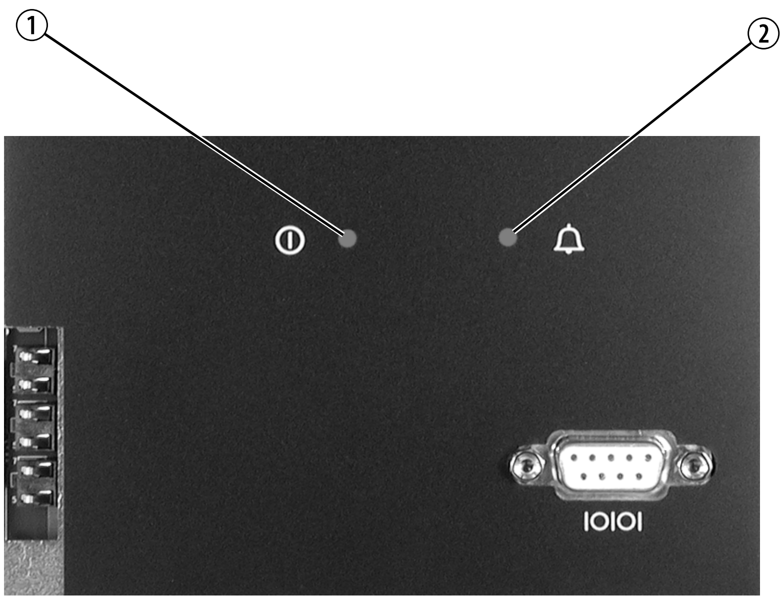
Base Station 2 Select Button

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

3.1.3 Power Save Control Panel

The indicator LEDs on the power save control panel are identified in Figure 3.3 below.

Figure 3.3 LED indicators on the power save control panel



① power LED ② alarm LED

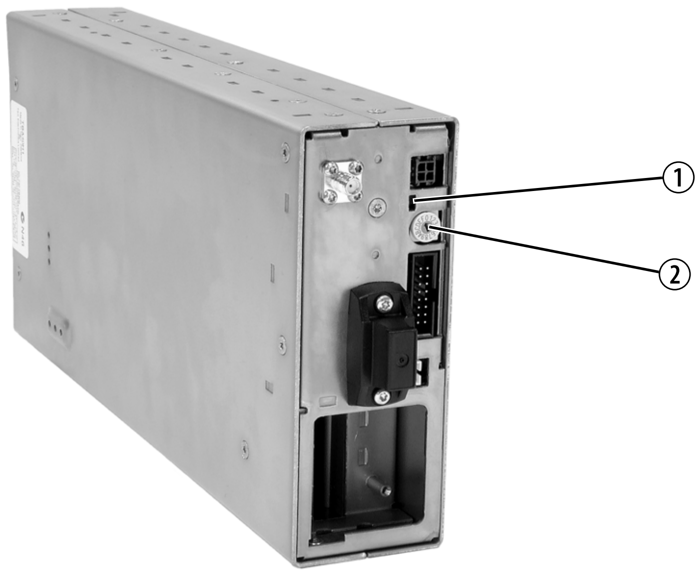
Indicator LEDs

The power LED and alarm LED behave in the same way as for the standard control panel. Refer to "Power Saving" on page 57 for information about the behaviour of the LEDs when in power saving mode.

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

Hex Switch

This switch is used to assign an identity number to each base station in the BSS[1]. For example, the reciters in a dual base station system would be numbered "1" and "2". The reciter with the lowest hex number becomes the "control" reciter. In a single base station system, the hex switch on the reciter is set to "1".

Indicator LEDs

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

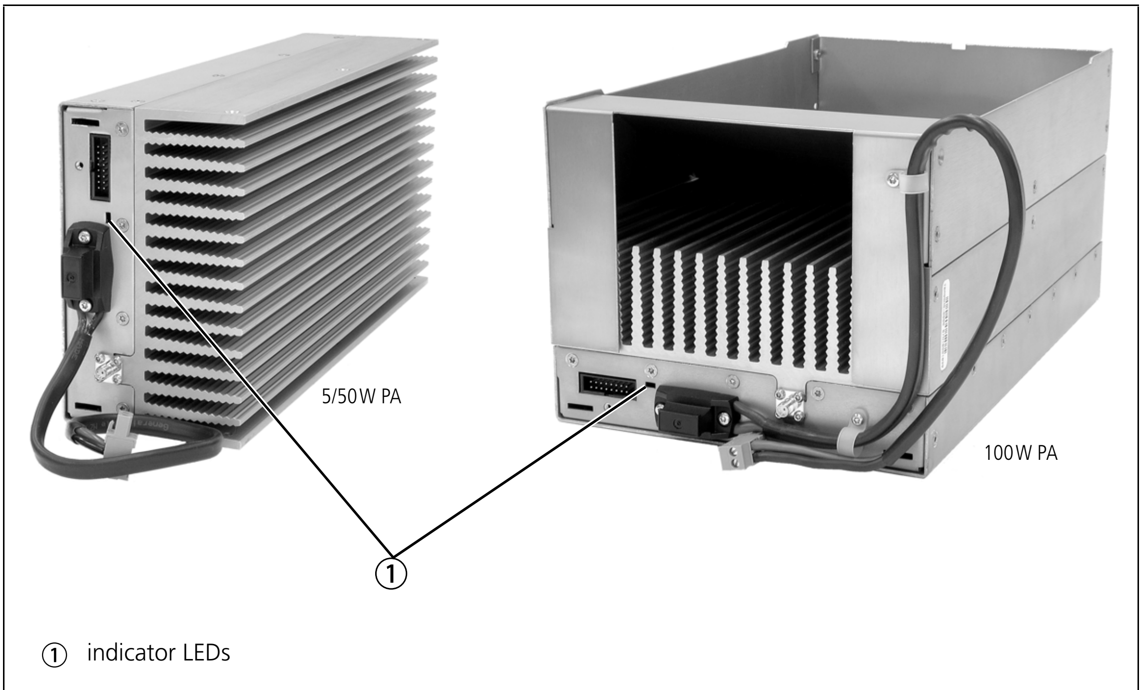
- steady green – the reciter is powered up
- flashing red – one or more alarms have been generated; you can use the Service Kit software to find out more details about the alarms.

1. This feature will be available in a future release.

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



Indicator LEDs

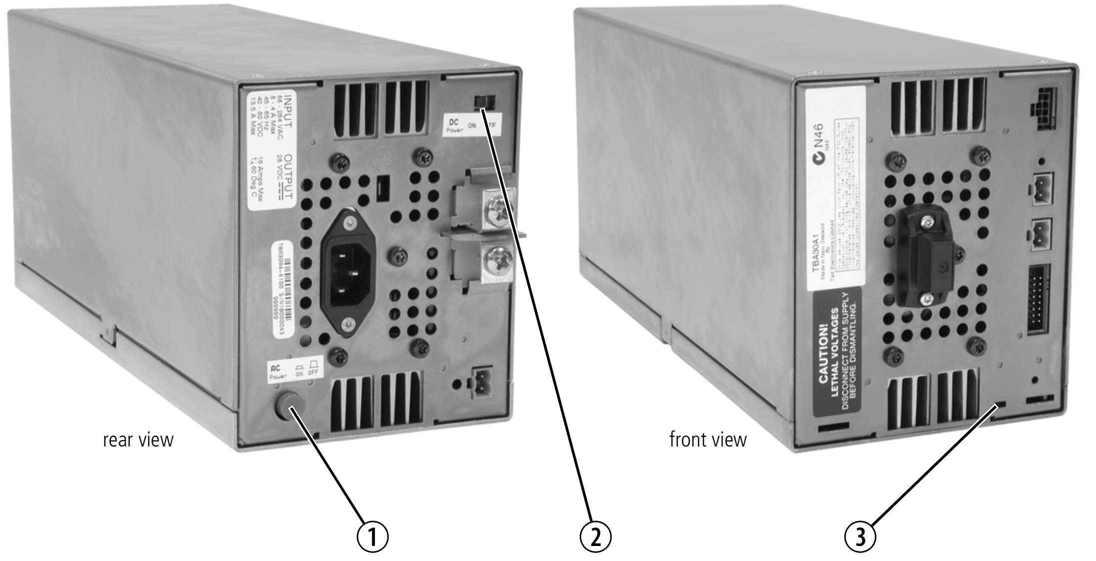
These LEDs provide the following information about the state of the PA:

- 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.

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.

DC Module On/Off Switch

This switch turns the DC output from the PMU on and off. It is recessed to prevent the DC module being accidentally switched off, thus disabling the battery back-up supply.

Note that this switch disables only the control circuitry - the DC input is still connected to the power circuitry.

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.

Refer to “Indicator LEDs” on page 53 for more detailed information.

4 Functional Description

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

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

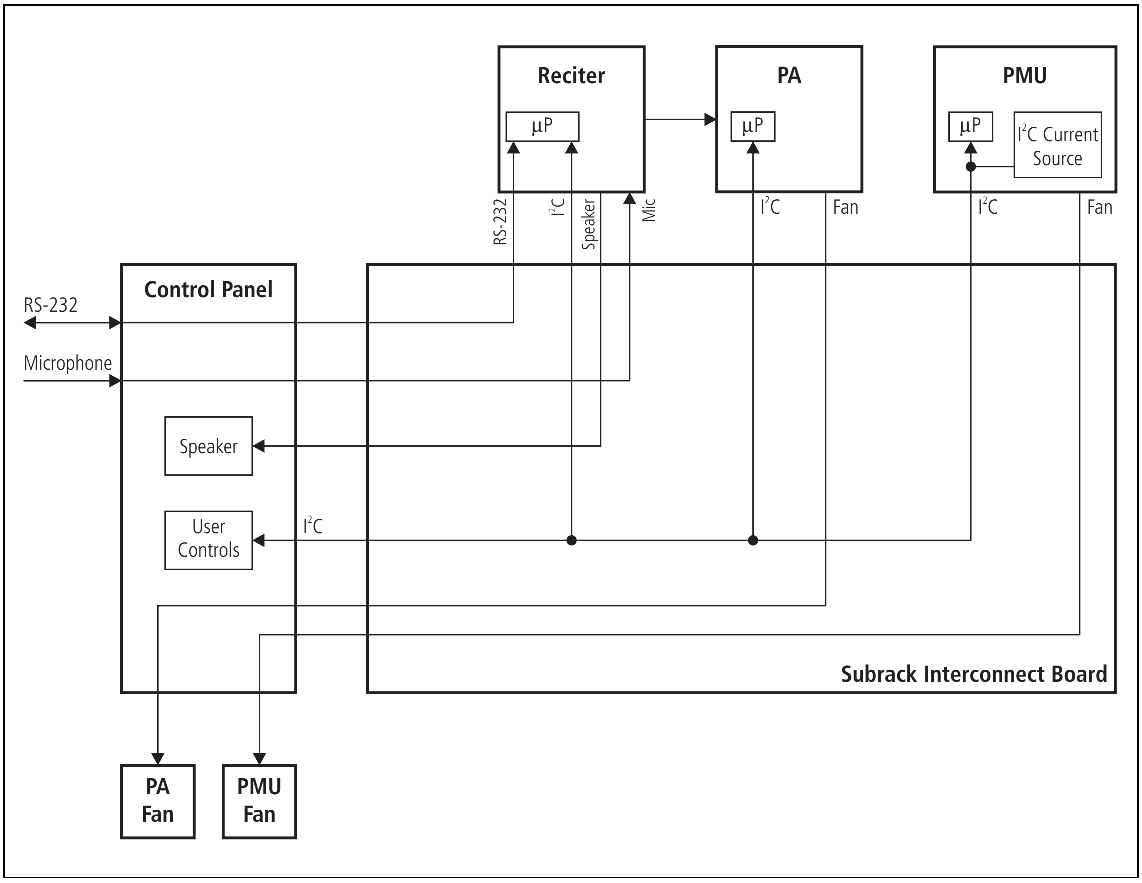
Unless stated otherwise, the circuit descriptions are based on a single 50W base station system. Power Saving is an optional feature, enabled by a specific hardware and software configuration.

4.1 Base Station System Overview

4.1.1 Single Base Station System

The single base station system comprises a reciter, a PA, and a PMU. The standard control panel and single base station subrack interconnect board are used in this type of system. Figure 4.1 below illustrates the main communication paths. Note that the fans have power supplied from the relevant module, with the rotation sensor alarm signal interfaced into the control panel. This signal is processed via the reciter.

Figure 4.1 Single base station system communication paths

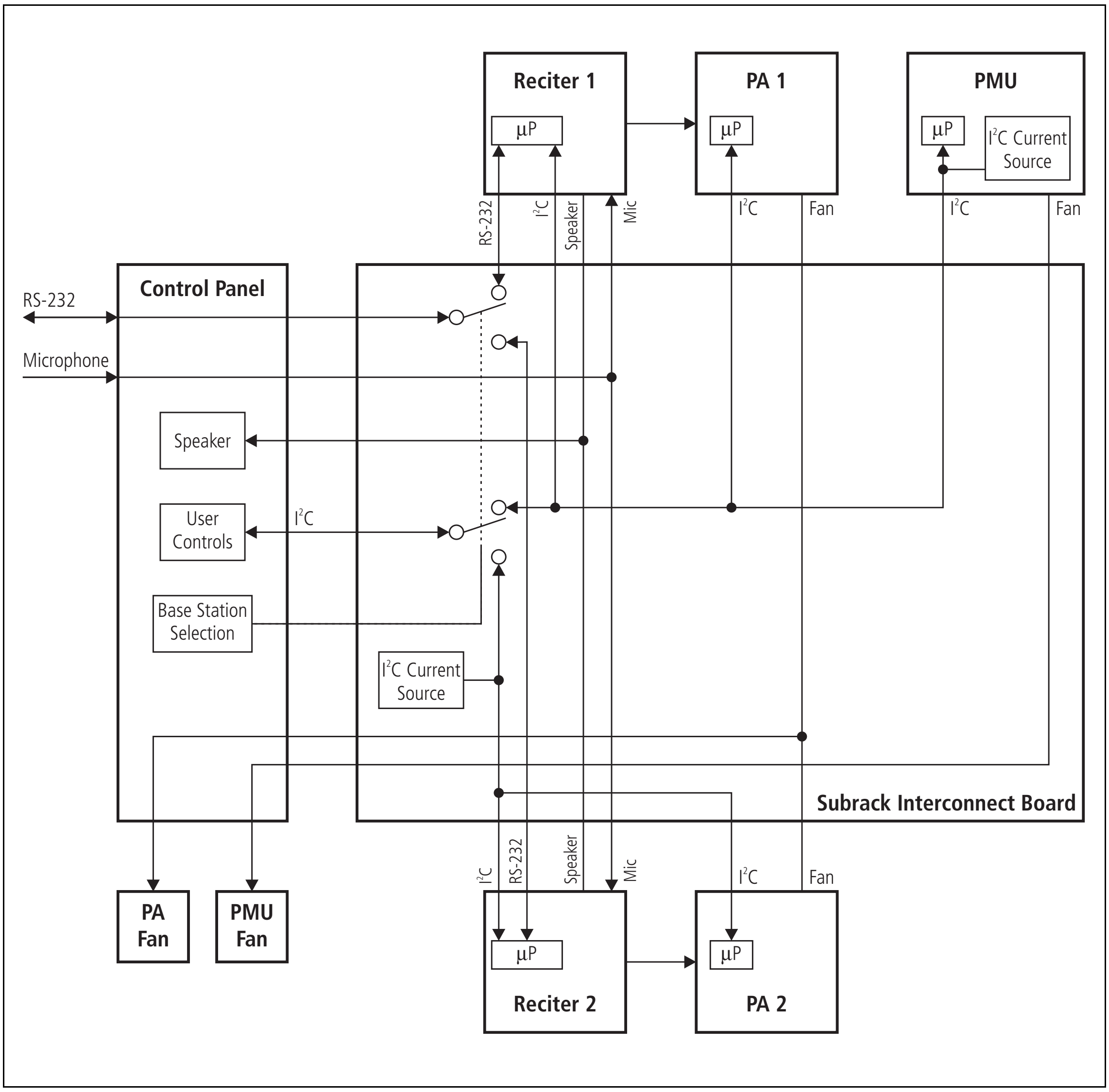


4.1.2 Dual Base Station System

In a dual base station system the second base station's reciter and PA are isolated from the first base station's reciter, PA, and PMU. This is achieved through the use of the dual base station subrack interconnect board and the dual base station control panel. 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 The dual base station subrack interconnect board has a set of switches which must be set according to the type of base station system in the subrack. Refer to "Replacing the Subrack Interconnect Board" on page 98 for details of the switch settings.

Figure 4.2 Dual base station system communication paths



The dual base station control panel imposes a number of constraints on the operation of a TB8100 BSS. These are listed below.

Subrack

- The front panel LEDs, switches, and RS-232 interface are controlled by the currently selected base station.

Note When you change base station, the LEDs on the control panel do not change. They continue to reflect the last changed status of the previous base station until you press a control panel button, or the reciter issues an instruction to update an LED. If one LED needs to change, the status of all LEDs is updated. To overcome this limitation, we recommend that you cycle through all three speaker modes immediately after changing base station, finally selecting the speaker mode you want. This forces the base station to refresh the control panel LED display.

- The second base station does not communicate with the PMU, but the PMU does provide power to it.
- Email alarm outputs are only possible from the currently selected base station[1].
- PA and PMU fan rotation detection should be turned off. This is not supported by the system control bus, which can be switched IN/OUT based on the currently selected base station. Refer to "Fan Signals" on page 43 for more information on fan operation.

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.
- In the Configure > Base Station > Miscellaneous form for base station 2, the **Power configuration** areas will display voltages of zero, and error messages will be displayed when you leave the form.
- All fan faults will not be detected, displayed, or acted on (if disabled).
- The display of fan states in Diagnostic forms may be incorrect.
- 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.

Recommended Service Kit Settings

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

- Disable the fan alarm for the PA on base stations 1 and 2.
- Disable the fan alarm for the PMU on base station 1.
- Disable Alarm Center and Email on base stations 1 and 2.
- Disable the "No PMU detected" alarm on base station 2.

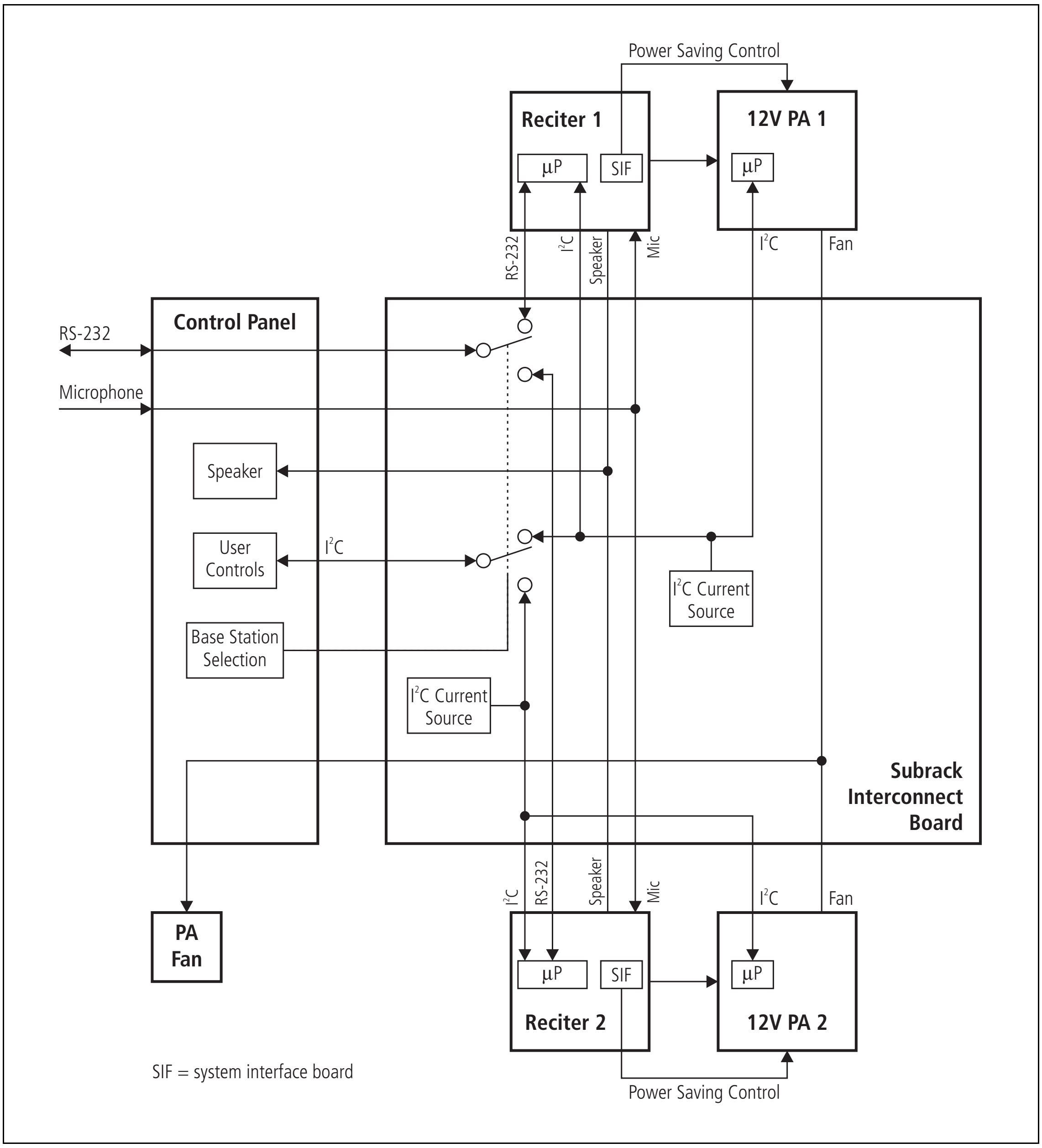
---

1. Email alarm outputs are available from both base stations if both reciters are fitted with a TaitNet RS-232 system interface board (refer to "TaitNet RS-232" on page 122 for more details).

4.1.3 Single and Dual 12V PA Base Station Systems

The TB8100 platform also supports the operation of one or two 12V PA base stations in one subrack. Figure 4.3 below shows the main communication paths in a dual 12V PA base station system. The 12V PA base station system 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.

Figure 4.3 Dual 12V PA base station system communication paths



A single or dual base station control panel is fitted, according to the type of system. However, both single and dual 12V PA base stations use the dual base station 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.

Note The dual base station subrack interconnect board has a set of switches which must be set according to the type of base station system in the subrack. Refer to "Replacing the Subrack Interconnect Board" on page 98 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 124). For details on Power Saving in a 12V PA base station, refer to "12V PA Operation" on page 60.

Constraints

The dual base station control panel imposes the same constraints on the operation of a dual 12V PA BSS as those described in "Service Kit" on page 40, 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.

4.2 System Control Bus

The system control bus, see Figure 4.4 on page 44, provides the communications link between the modules in the TB8100 BSS. 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 TB8100 subrack. It has not been designed for use outside the subrack or to interconnect two subracks.

I^2C Signals

The TB8100 BSS 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 TB8100 BSS 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.

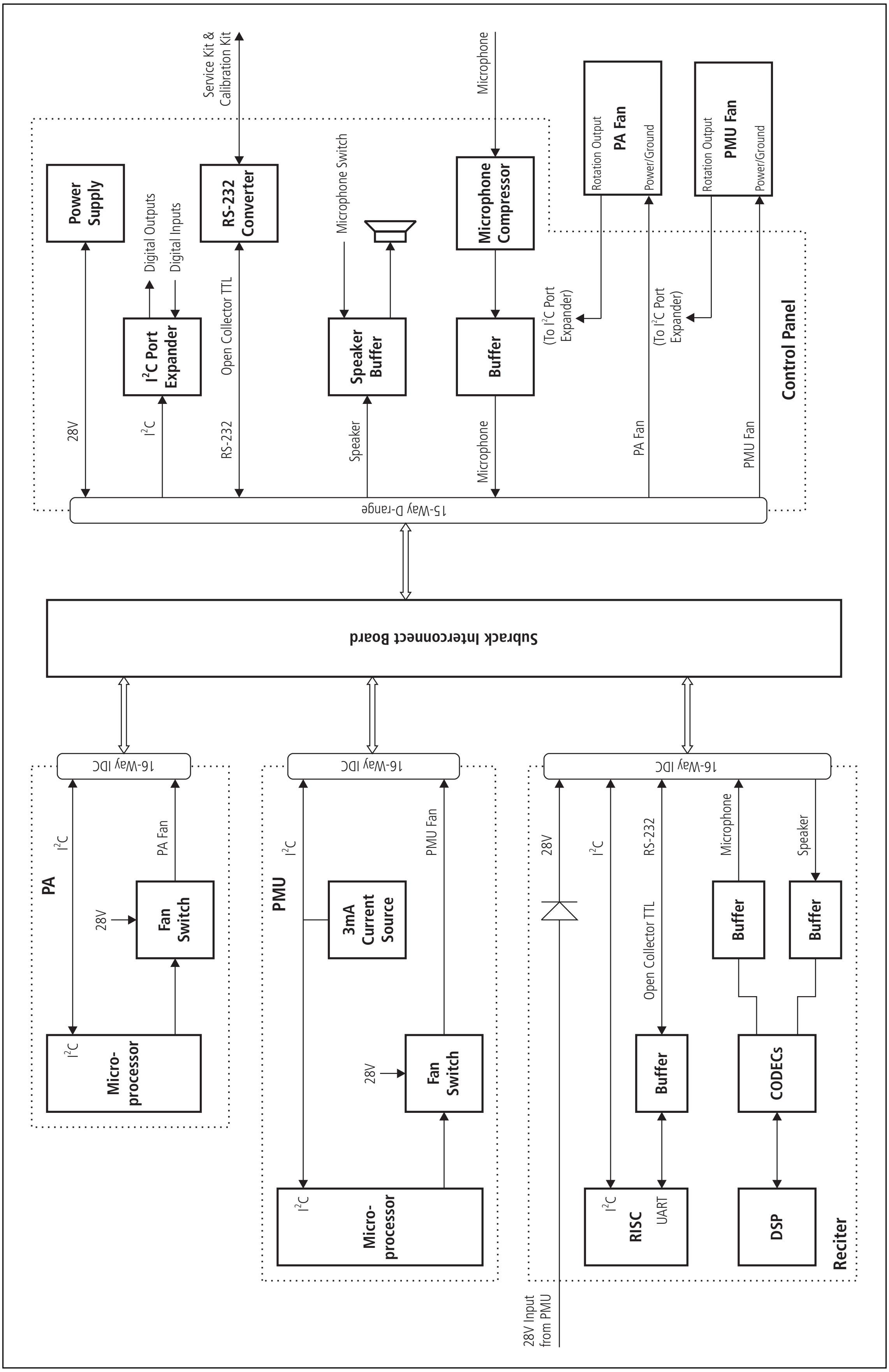
Because RS-232 is a peer-to-peer physical interface, the control panel converts RS-232 to open collector logic. Open collector logic allows a single control panel to communicate with one or more reciters. This same logic level conversion is also performed in the Calibration Test Unit when the control bus interface is connected directly to the reciter.

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.

Figure 4.4 System control bus high level block diagram



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. We therefore recommend that you disable all fan failure alarms (refer to "Dual Base Station System" on page 38).

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.

The audio output impedance of each reciter is fixed at approximately 2k ohms. If two reciters are in the same subrack, either or both can drive audio onto the bus. The system control bus will sum the two audio outputs together and both will be passed through to the speaker. The summed audio levels will vary, depending on the number of reciters in the subrack. The volume range of the control panel speaker has been configured so that the maximum number of reciters will still drive the speaker to the required audio level.

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.

The audio output from the control panel's microphone is distributed to the microphone audio inputs of each reciter. The low audio output impedance of the control panel is not affected by the number of reciters connected as the microphone audio inputs have a high input impedance.

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 TB8100 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	Standard and 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
PSU back-up	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 TB8100 BSS, either from the RF input to the system interface, or from the system interface to the RF output.

Figure 4.10 on page 68 shows the four main components of a single 50 W VHF base station system: the reciter, PA, PMU and control panel. Figure 4.11 on page 69 and Figure 4.12 on page 70 provide the same information for UHF systems.

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 15 for more detailed circuit descriptions of the individual sub-systems that make up the BSS.

The following sections explain the basic operation of the base station system 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 system to power its various sub-systems. The high level block diagrams in Figure 4.5 on page 50 show the power distribution paths in single and dual base station systems, while Figure 4.9 on page 67 provides more detailed information on a typical single base station system. Also refer to "Circuit Description" on page 15 for more detailed circuit descriptions of the individual sub-systems that make up the BSS.

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.

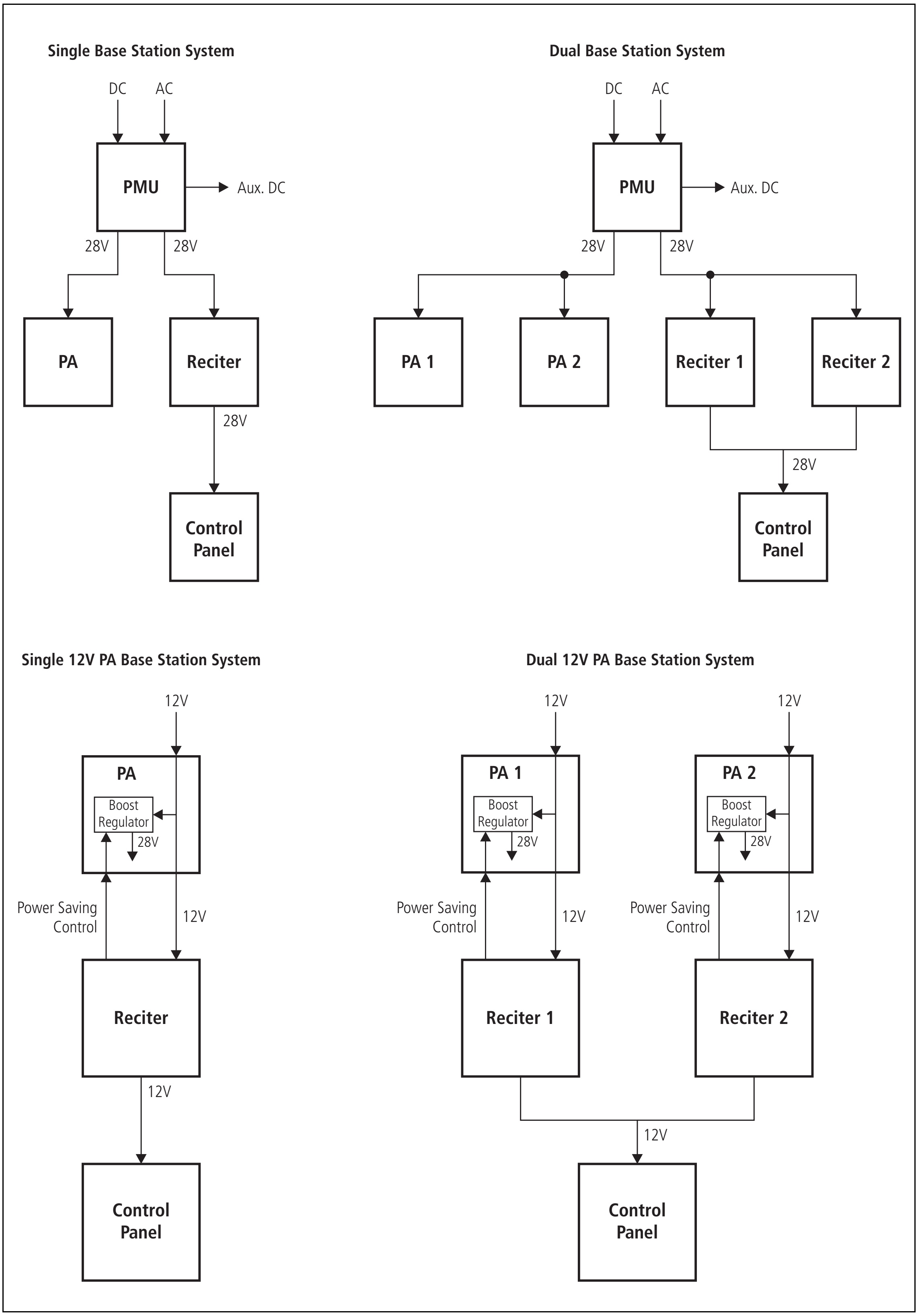
When a DC module is fitted, a high efficiency standby card can be used to power up the receiver circuitry. If required, the high power but low efficiency converters can then be disabled, saving considerable power during periods of no channel activity, by using the standby card to power the reciter more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

Figure 4.5 TB8100 BSS power distribution high level block diagrams



Reciter Power Control Signals

The power control signals PWD_EX, PWD_RX and PWR_ON (refer to Figure 4.9 on page 67) 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.

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 53. Figure 4.6 on page 52 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.

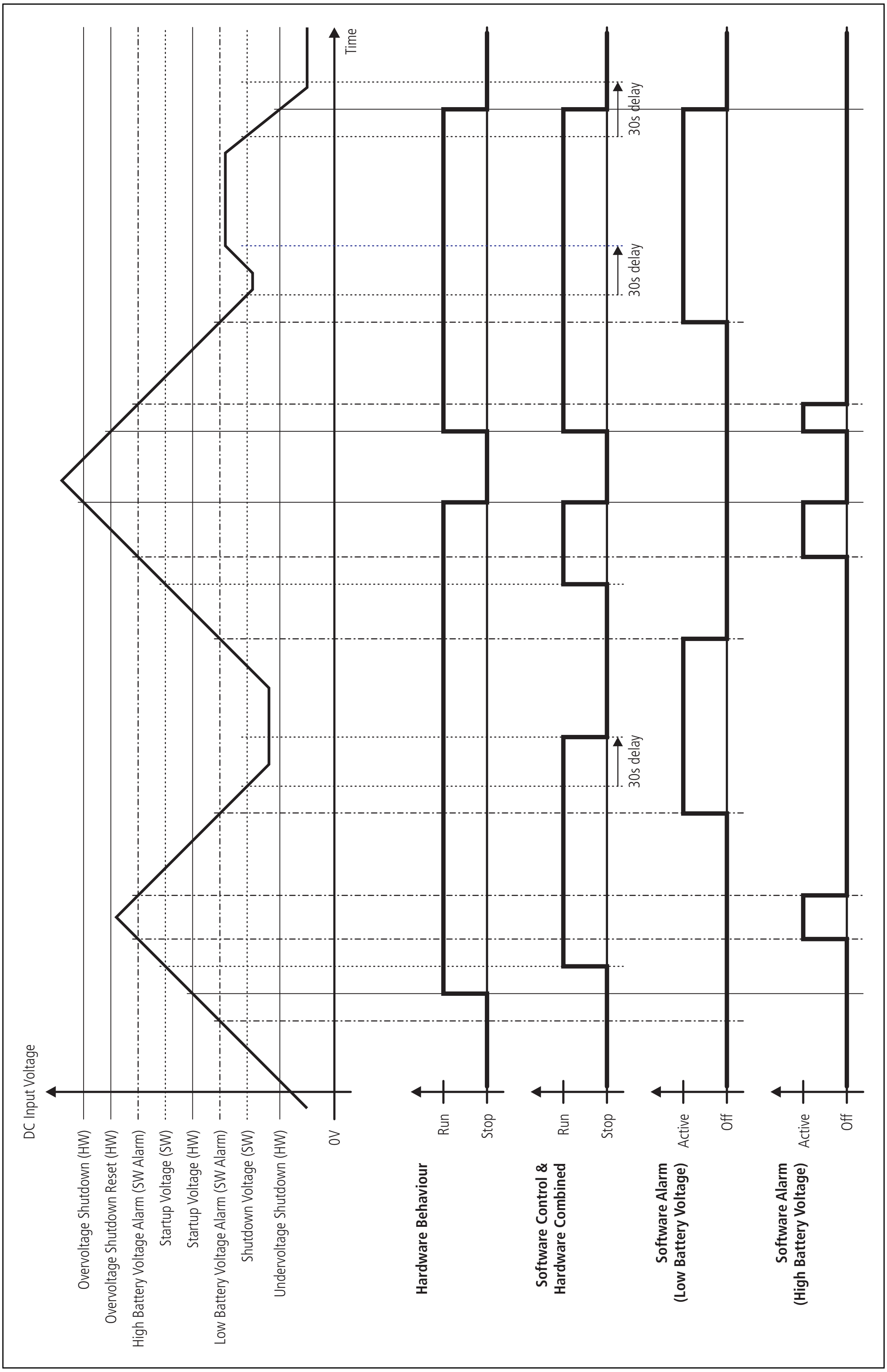
To set the alarms, run the Service Kit and select Configure > Alarms > Thresholds. In the Thresholds form, enter the required minimum and maximum values in the **PMU battery voltage** fields.

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 shutdown.

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.

Figure 4.6 PMU alarm thresholds and voltage limits when operating on DC



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	 12V to 15.0V 10V to 13.5V	 23.9V to 30V 20V to 27V	 47.8V to 60V 40V to 54V
Battery Protection (Fail-safe) Limits Startup Voltage Undervoltage Shutdown Overvoltage Shutdown Overvoltage Shutdown Reset	 11.7V ±0.3V 9.5V ±0.3V 18.1V ±0.3V 17.1V ±0.3V	 23.4V ±0.5V 19V ±0.5V 36.2V ±0.5V 34.2V ±0.5V	 46.8V ±1V 38V ±1V 72.4V ±1V 68.4V ±1V

a. The information in this table is extracted from the TB8100 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. Only available if the standby power supply card is fitted.

Indicator LEDs

The indicator LEDs on the front panel are used to indicate the state of the PMU and its microcontroller. 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 54.

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 microcontroller 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 TB8100 BSS. Refer to Figure 4.13 on page 71 for more information.

The reciter RISC is the central command and control entity in a base station system. 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 TB8100 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 TB8100 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 follows:

PMU Temperature	Duty Cycle
<65°C (<149°F)	Increases with increasing current draw
65°C to 75°C (149°F to 167°F)	On two minutes, off one minute
>75°C (>167°F)	Always on

Fans used in the TB8100 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 "Dual Base Station System" on page 38 for information on the constraints of fan rotation detection in dual base station systems.

4.8 Power Saving

TB8100 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 optional hardware items are needed to maximise the amount of power that the base station can save. The TBA2010 Power Save Control Panel (for further information, see "Power Save Control Panel" on page 32) 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 initialises 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 49 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 49 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 10V power rail on, and then waits for 20–30ms 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.

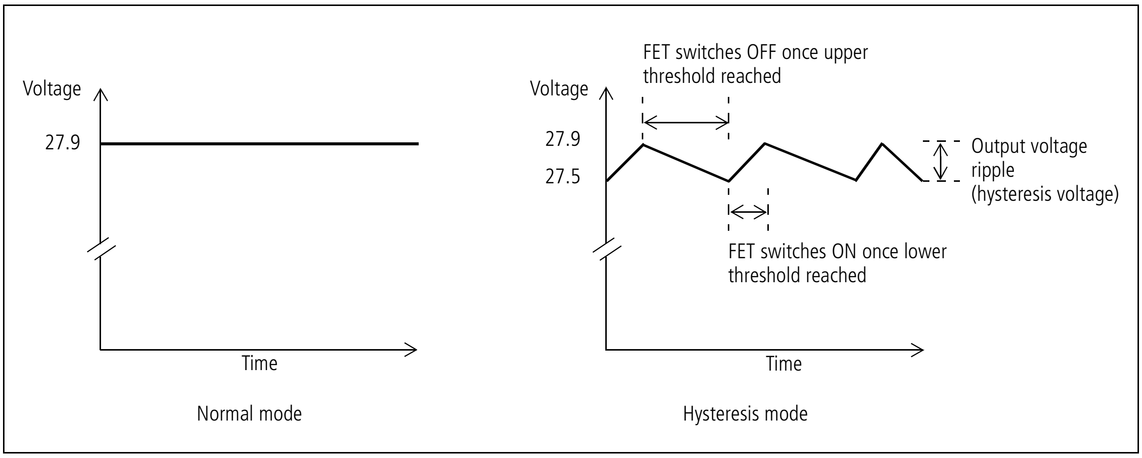
PMU Hysteresis Mode

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 1–15A, 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 4.7 on page 59 illustrates the output voltages for the PMU DC converter in both normal and Hysteresis modes.

Figure 4.7 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 28V 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 67 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.

Note 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 system interface board (TBA10L0).

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.

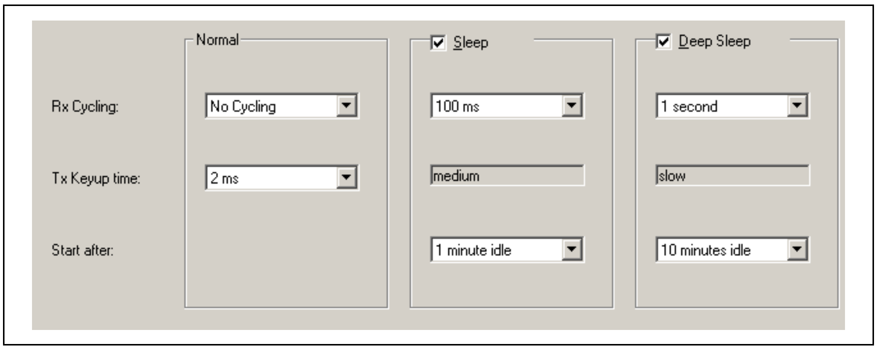
Note The standard and dual base station control panels cannot shut themselves down, but their LEDs (except the Power LED) also flash in Sleep and Deep Sleep modes.

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 124 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.



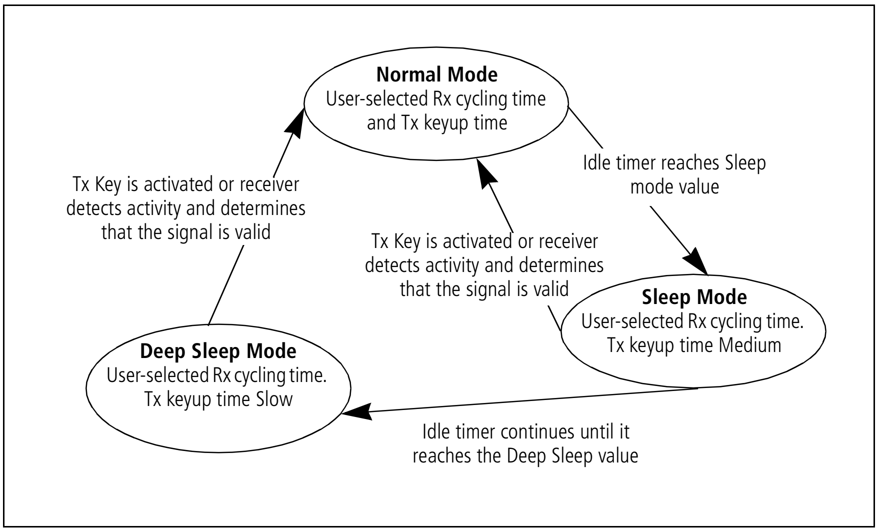
Once the base station's Power Saving Modes licence is enabled, you can use the Service Kit to enable and configure its Sleep and Deep Sleep modes (see the Service Kit online Help for details).

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 4.8. 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 4.8 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 TB8100 Specifications Manual.

Table 4.3 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 4.4 Power Saving measures selected by Tx keyup time

Power Saving Mode	Tx Keyup Time	PMU	PA
		28 V 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 TB8100 Specifications Manual for further details.

Further Considerations

- Hysteresis mode is only available if a standby power supply card is fitted and the auxiliary power output has not been turned on by Task Manager action.
- Auxiliary power is not available in Sleep or Deep Sleep modes.
- 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.

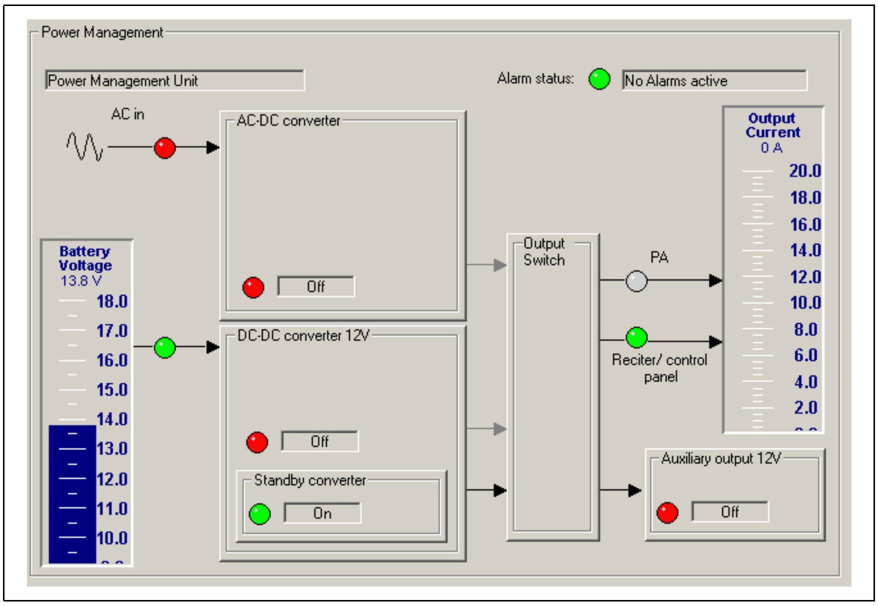
4.8.4 Using the Service Kit with Power Save Base Stations

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.

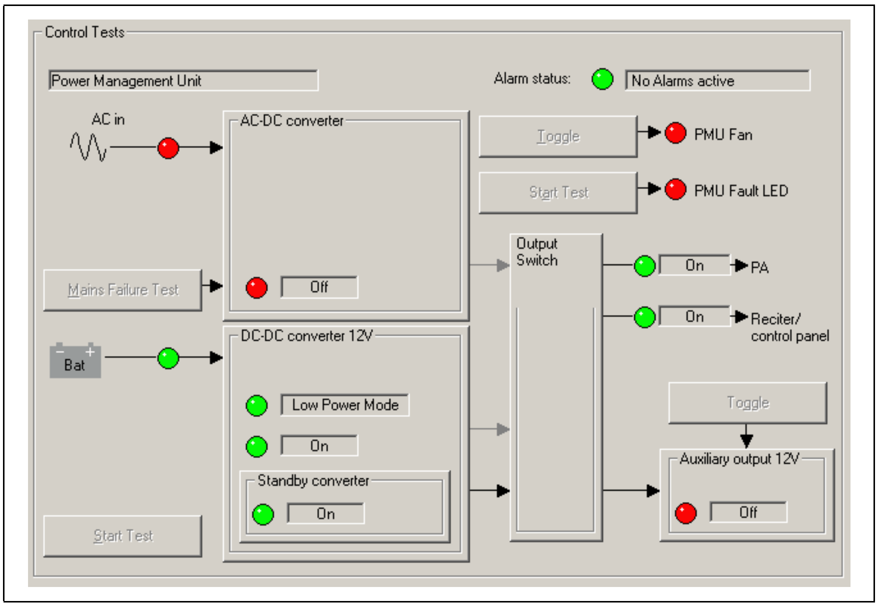
Important Displaying any PA monitoring or diagnostic screen turns the PA on. The PA stays on until the screen is closed. Make sure that you do not waste power by leaving any of these screens on.

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 20 dB, and the receiver cycling time is 100 ms, 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 100 ms to check whether the SINAD is good enough.
4. The SINAD is too low, so the receiver cycles off.
5. 100 ms 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 120 ms out of every 220 ms, instead of for about 20 ms out of every 120 ms.

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.

Note 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 320 ms out of every 420 ms (a subaudible check can take up to 230 ms). The only way to minimise the effects of this is to set a very long receiver cycling time, such as 5 seconds.

Figure 4.9 TB8100 BSS power distribution

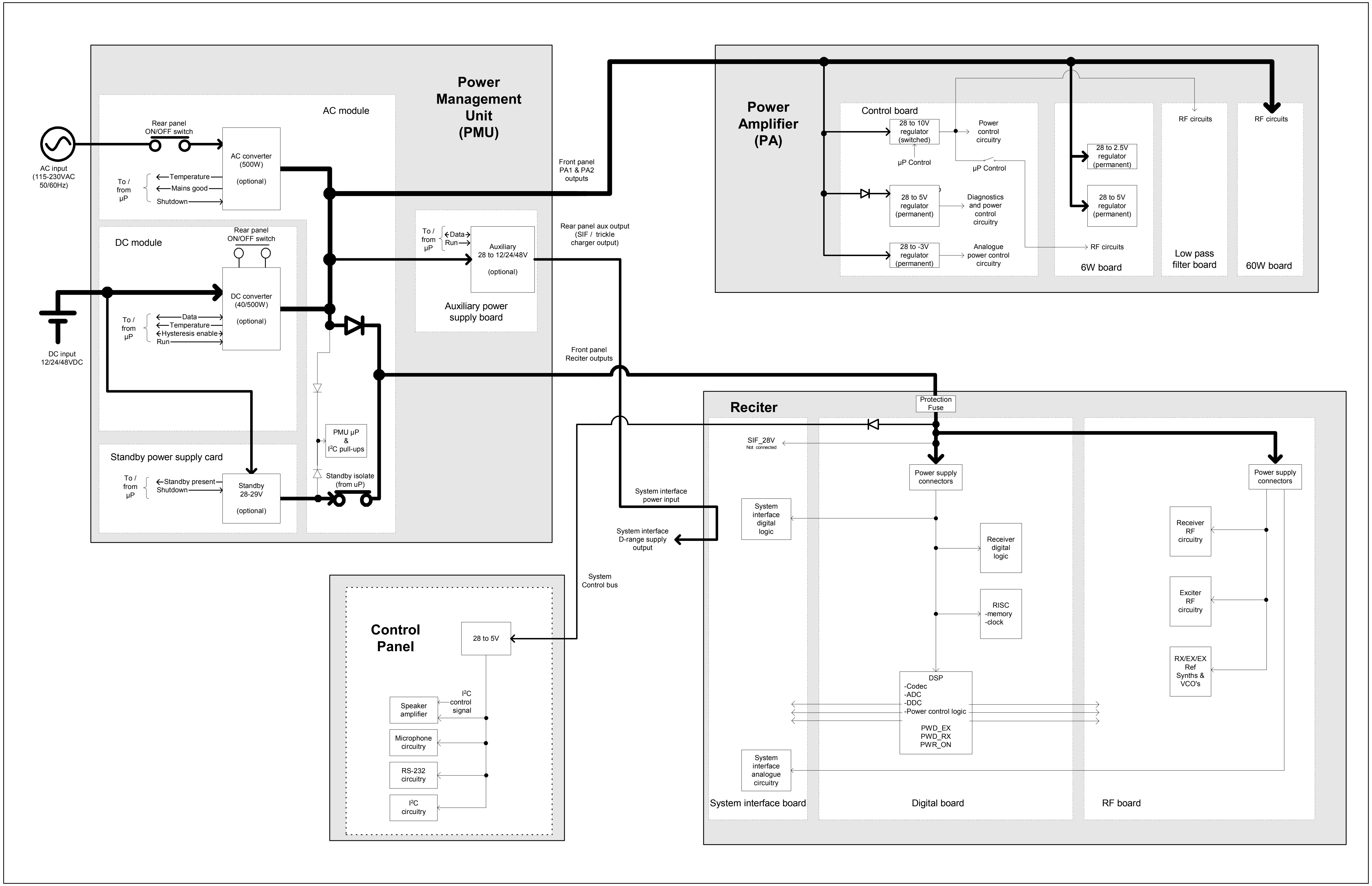


Figure 4.10 TB8100 BSS VHF signal path

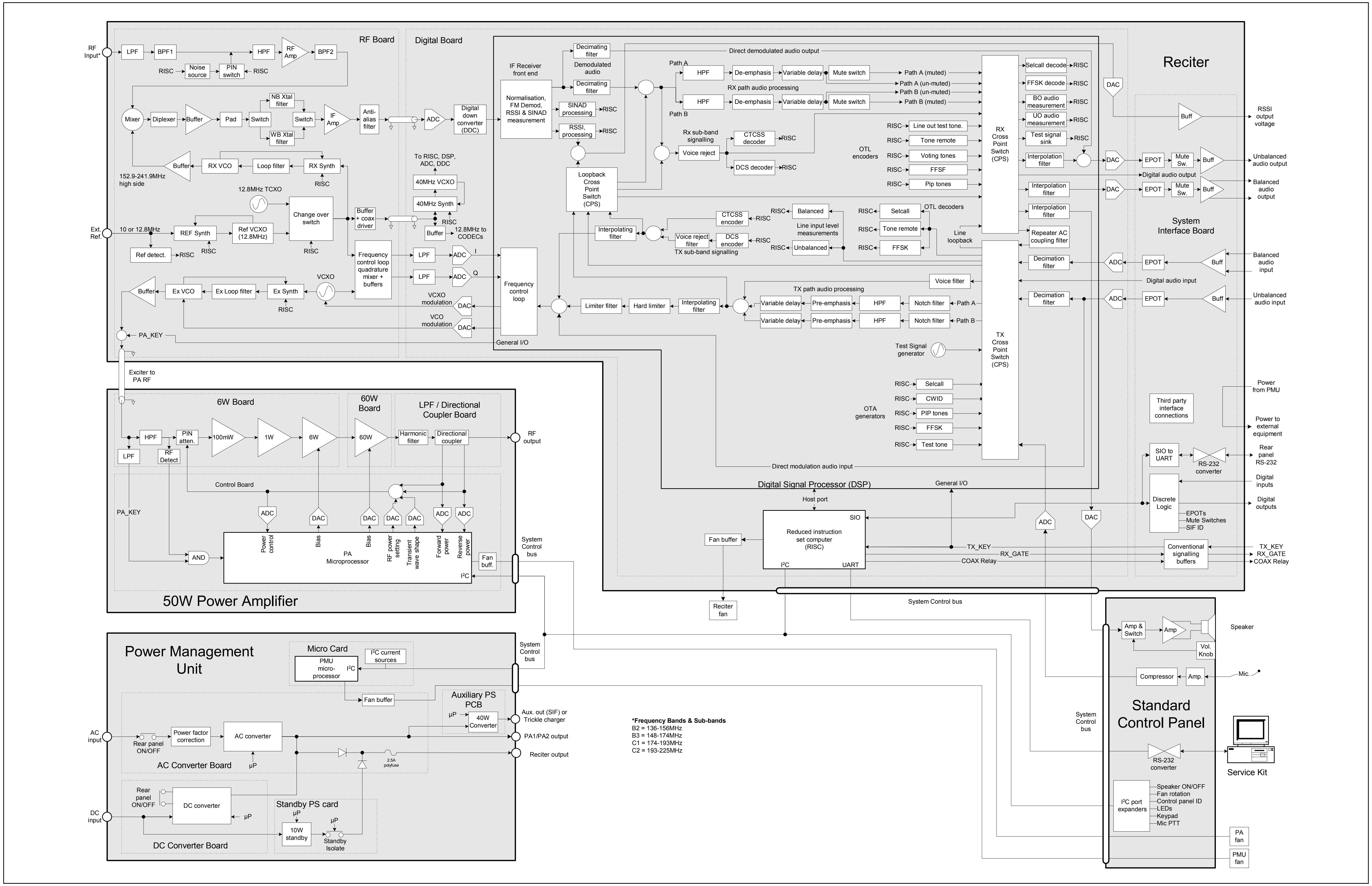


Figure 4.11 TB8100 BSS UHF signal path - H band and K band

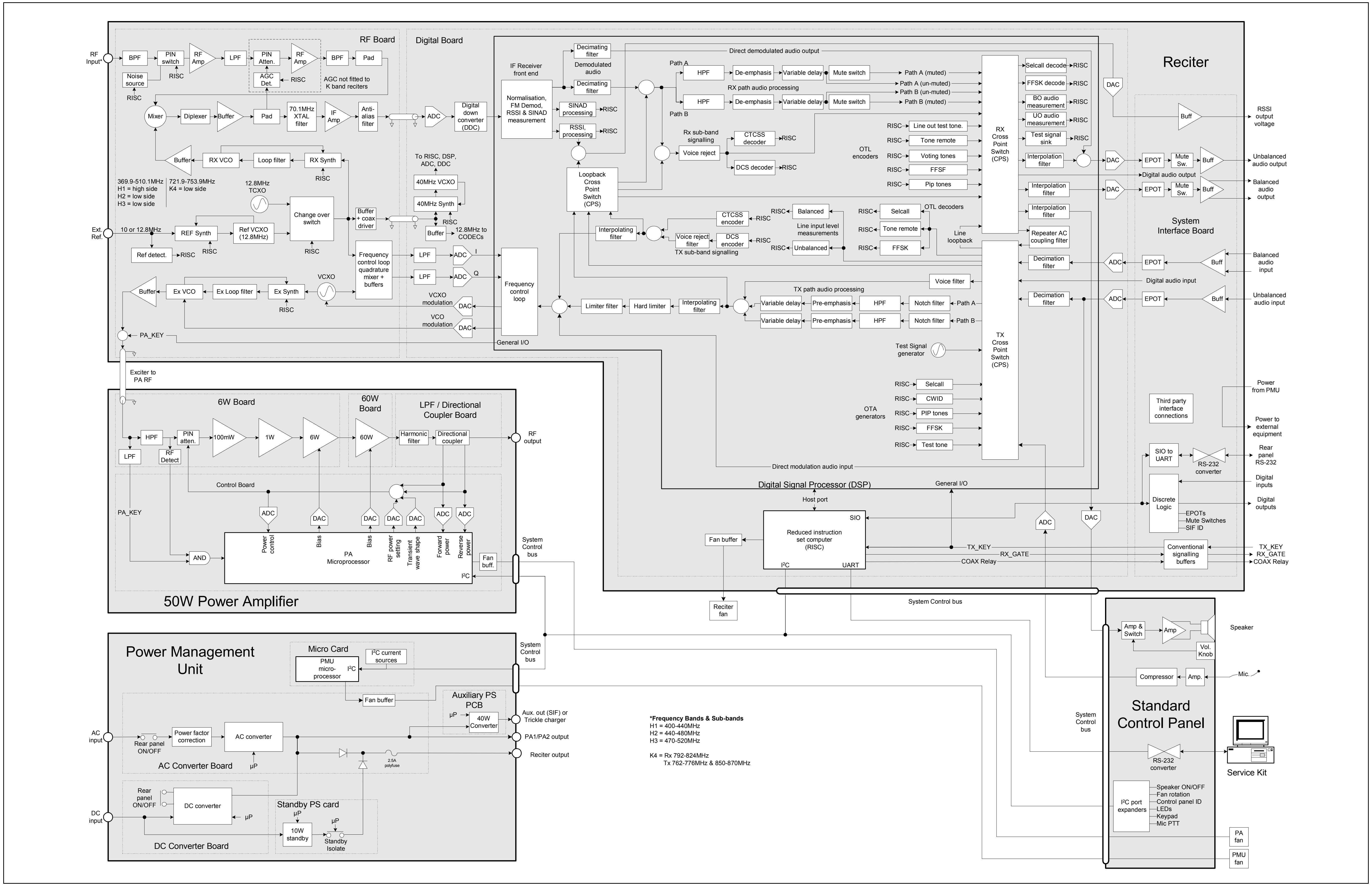


Figure 4.12 TB8100 BSS UHF signal path - L band

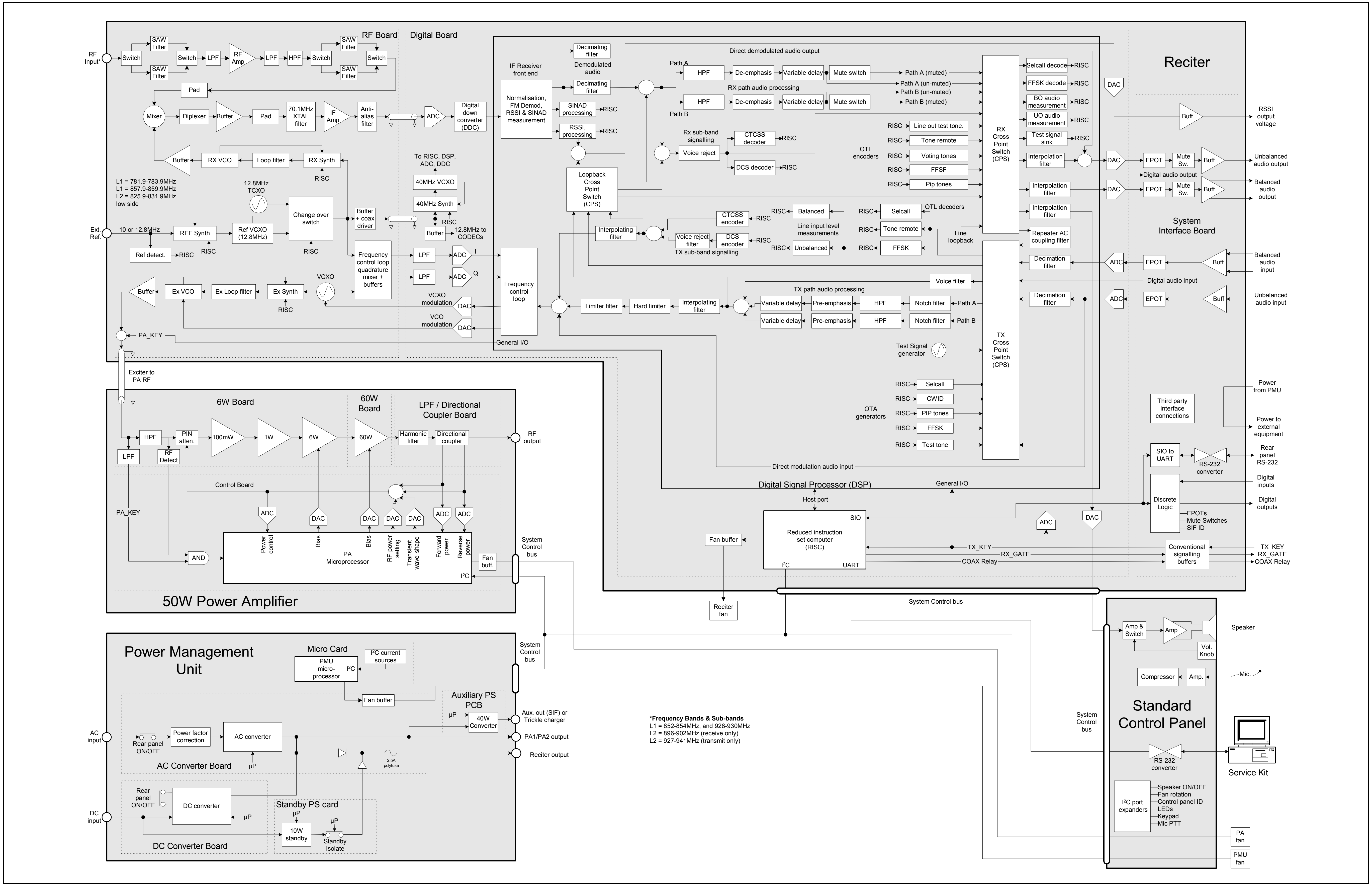
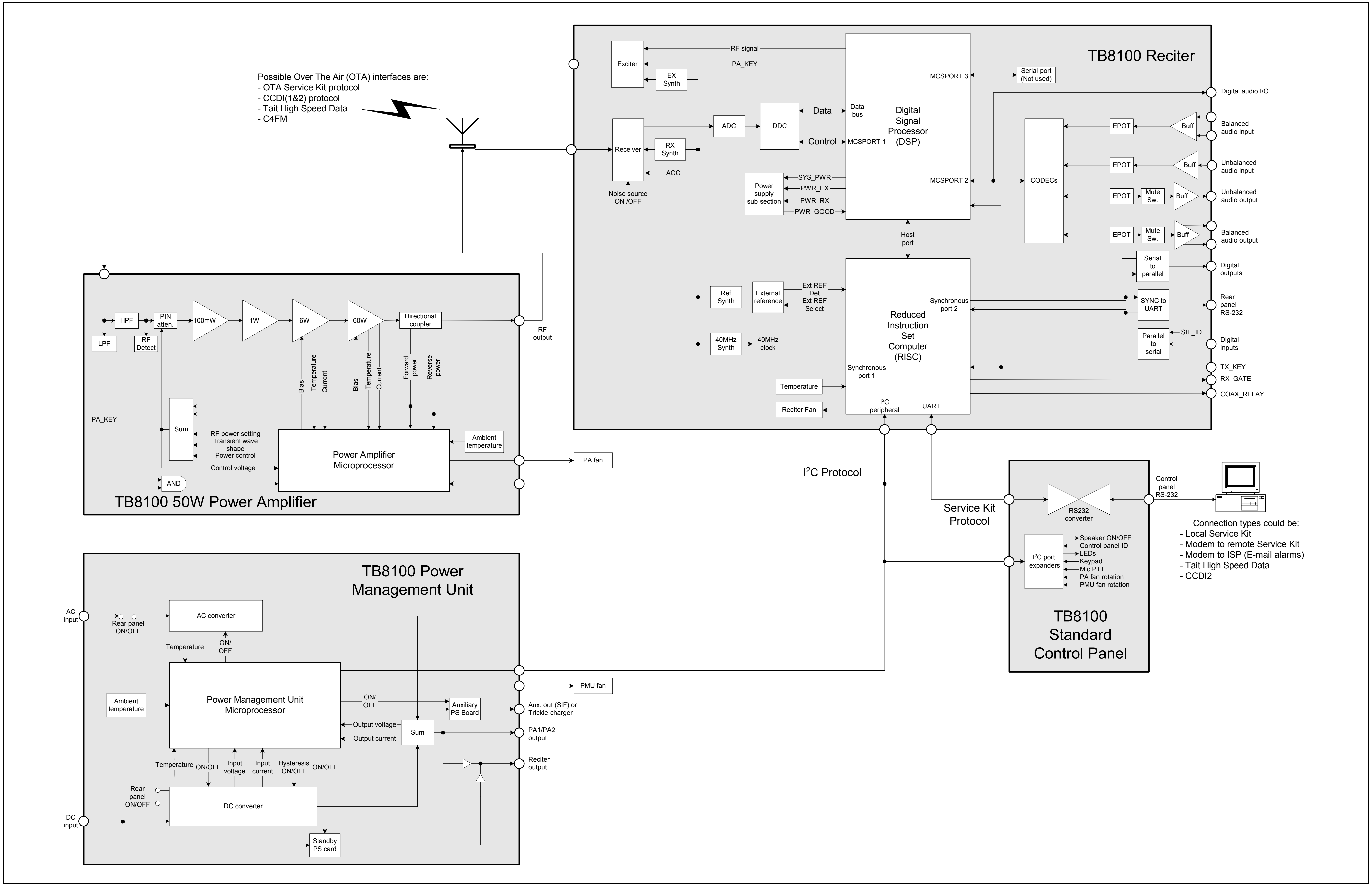


Figure 4.13 TB8100 BSS data, control and monitoring path



5 Installation

This chapter describes how to install the TB8100 BSS 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 TB8100 BSS must be installed so that the rear of the PMU is located in a service access area. The PMU must be connected to the mains supply source by trained 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 nearest Tait Dealer or Customer Service Organisation immediately.

All servicing should be carried out only when the PMU is powered through a mains isolating transformer of sufficient rating. We **strongly recommend** that the mains power to the whole of the repair and test area is supplied via an earth leakage circuit breaker.

5.1.2 Explosive Environments

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

5.1.3 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.

5.1.4 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).

5.2 Equipment Safety

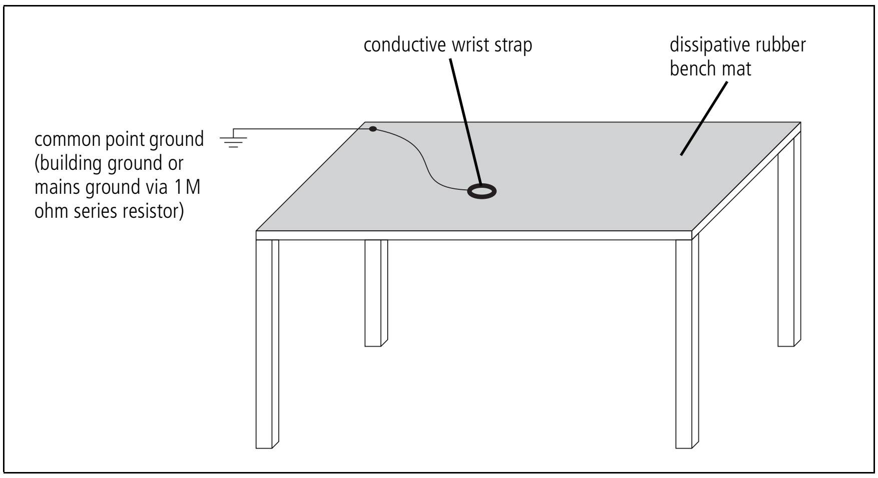
5.2.1 ESD Precautions

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

We recommend you purchase an antistatic bench kit from a reputable manufacturer and install and test it according to the manufacturer's instructions. Figure 5.1 shows a typical antistatic bench set-up.

You can obtain further information on antistatic precautions and the dangers of electrostatic discharge (ESD) from standards such as ANSI/ESD S20.20-1999 or BS EN 100015-4 1994.

Figure 5.1 Typical antistatic bench set-up



5.2.2 Antenna Load

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

To protect the PA output stage from load transients (i.e. switching or removing the load), we recommend that you fit an isolator 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 or combining equipment between the isolator and the PA.

5.2.3 Equipment Grounding

To ensure safe operation the TB8100 BSS equipment must be correctly grounded as described in these installation instructions.

5.2.4 Installation and Servicing Personnel

The TB8100 BSS 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 FCC Compliance[1]

This device complies with part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

5.3.3 Unauthorised Modifications

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

1. Refer to the TB8100 Specifications Manual for more information on the compliance standards to which the TB8100 BSS equipment has been tested and approved.

5.3.4 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. Its intended purpose is for radio communication in Private Mobile Radio (PMR) services or Public Access Mobile Radio (PAMR) services.

Important This product can be programmed for frequencies or emissions that may make its use illegal. A license must be obtained before this product is used. All license requirements must be observed. Limitations may apply to transmitter power, operating frequency, channel spacing, and emission.

Declaration of Conformity

Brief Declarations of Conformity appear on page 143. You can download the formal Declaration of Conformity from http://eudocs.taitworld.com/. You can also obtain a signed and dated paper copy of the Declaration of Conformity from Tait Europe Ltd.

5.4 Environmental Conditions

5.4.1 Operating Temperature Range

The operating temperature range of the TB8100 BSS 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 $100\mu g/m^3$.

5.5 Grounding and Lightning Protection

5.5.1 Electrical Ground

The TB8100 BSS 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 101 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 103 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 organisation 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 TB8100 BSS:

- 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
- 0.25 in or 6 mm flat blade screwdriver for the fasteners used to secure the front panel to the subrack
- 8 mm AF spanner for the SMA connectors.

You can also obtain the TBA0ST2 tool kit from your nearest Tait Dealer or Customer Service Organisation. It contains the basic tools needed to install, tune and service the TB8100 BSS.

5.7 Ventilation

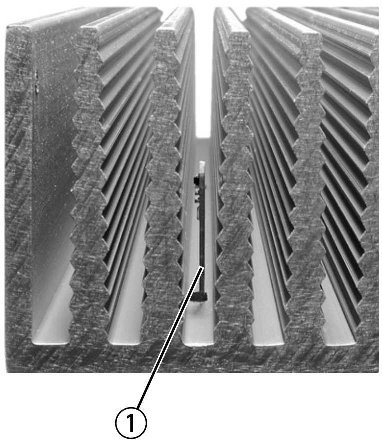
Always ensure there is adequate ventilation around the TB8100 BSS. **Do not** operate it in a sealed cabinet. You **must** keep the ambient temperature within the specified range, and we **strongly** recommended that you ensure that the cooling airflow is not restricted.

Important 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 BSS, 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 TB8100 BSS 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.



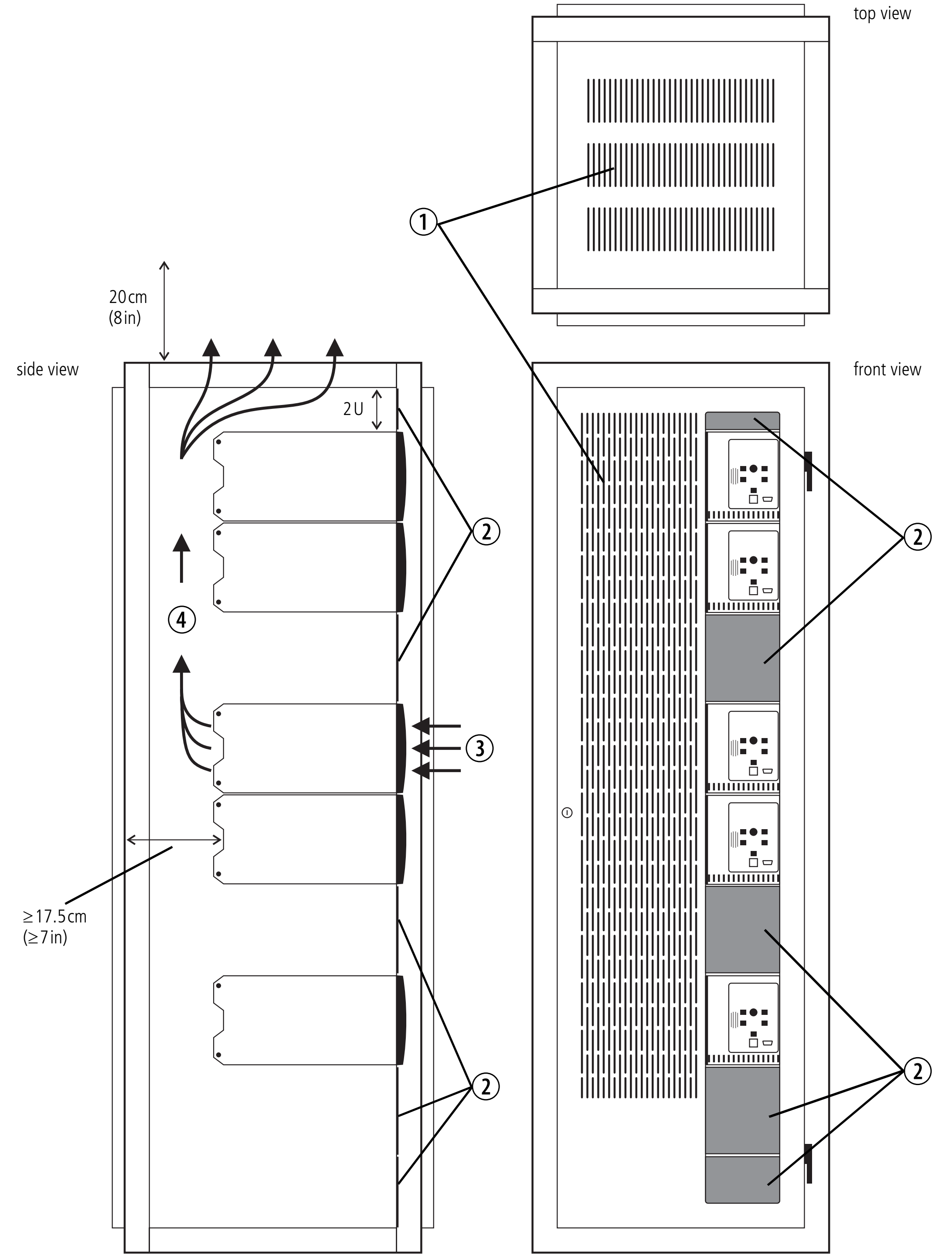
Important If the sensor board is to provide accurate ambient temperature readings, it must have forced airflow and must not come into contact with the metal of the heatsink fins. **Do not stack PAs with the fins together.** It is possible for the fins on one heatsink to slide between the fins on the 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 5.2 on page 79.

The cooling airflow for the TB8100 BSS 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 BSS 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.

Figure 5.2 Typical cabinet ventilation requirements



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

To allow enough cooling airflow through a cabinet-mounted BSS, 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 6 x 85 mm (0.25 x 3.3 in) 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.

Note 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 the TB8100 BSS is installed in a rack or cabinet with other equipment with different ventilation requirements, we recommend that the TB8100 be positioned below this equipment.

Auxiliary Extractor Fans

The TB8100 BSS 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 120 mm (4.75 in) fans, each capable of extracting 160 m^3 per hour (94.2 CFM), 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 TB8100 BSS airflow requirements described above.

5.8 Installing the Base Station System

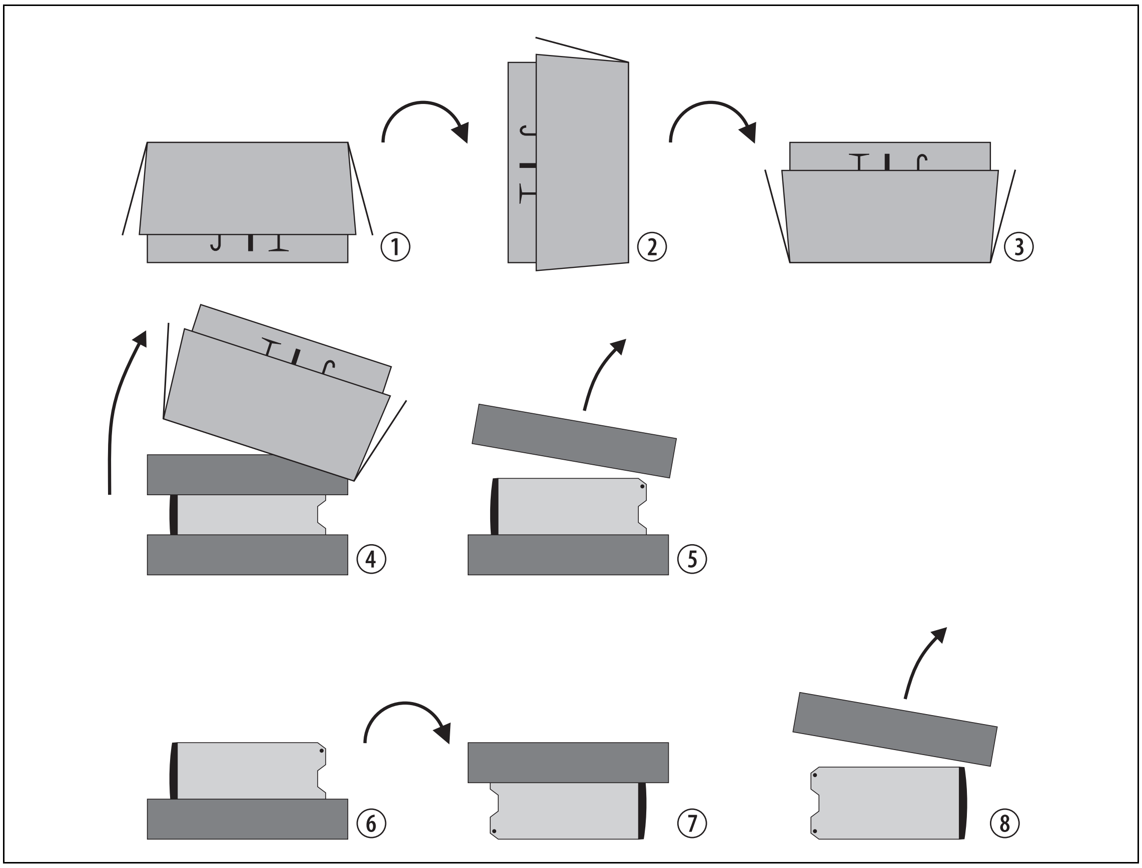
Caution **A TB8100 subrack complete with modules can weigh up to 28kg (62lb), or up to 30kg (66lb) complete with packaging. We recommend that, once the equipment is out of the carton, you remove the modules from the subrack before moving the equipment again. Otherwise, have another person help you with the lifting. In all cases follow safe lifting practices.**

5.8.1 Unpacking the Equipment

Unpacking the TB8100 BSS

The TB8100 BSS 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 BSS.

Figure 5.3 Unpacking the TB8100 BSS



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 BSS ⑤.

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

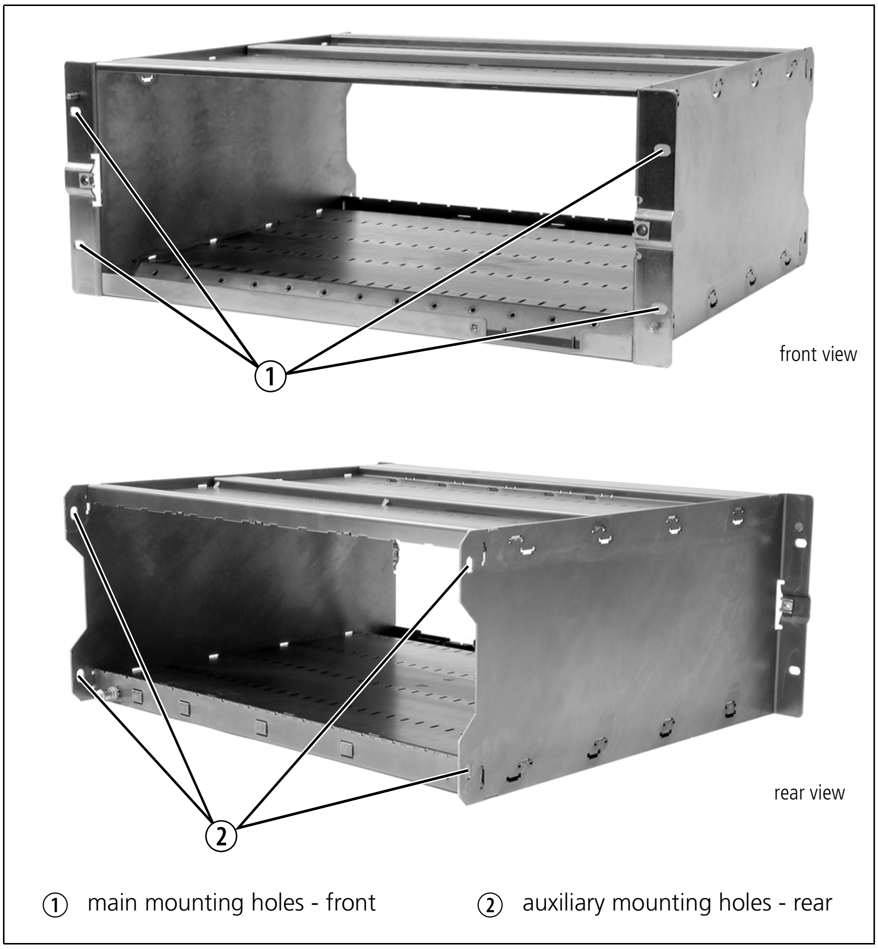
Disposal of Packaging

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.

5.8.2 Mounting the Subrack

Caution **We recommend that you remove the modules from the subrack before lifting it (refer to "Replacing Modules" on page 87), or have another person help you with the lifting.**

Figure 5.4 Subrack mounting points



1. Remove the front panel, as described in "Preliminary Disassembly" on page 88.

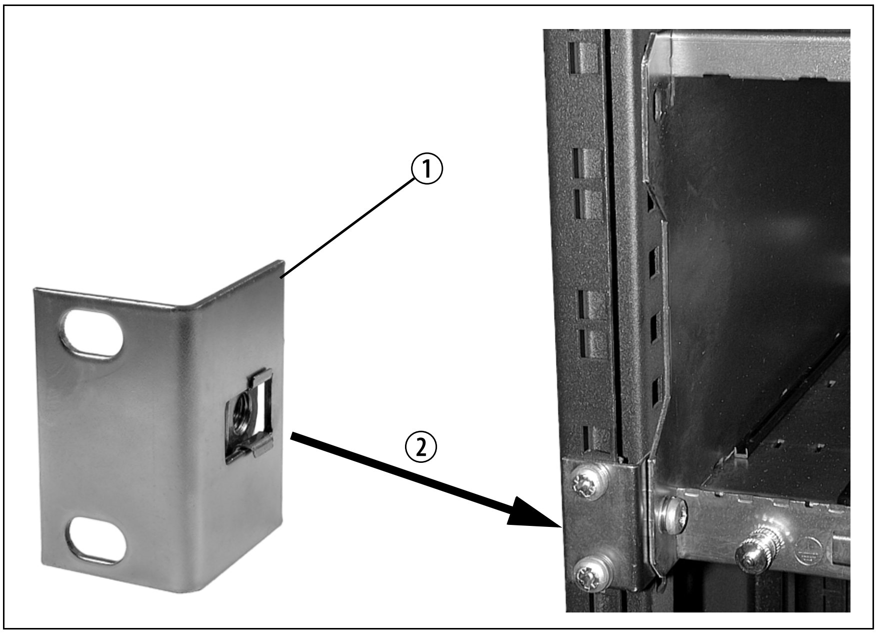
2. Fit the subrack into the cabinet or rack and secure it firmly with an M6 (or 0.25 in if you are using imperial fittings) screw, flat and spring washer in each of the four main mounting holes ①, as shown in Figure 5.4 on page 82.

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

5.8.3 Auxiliary Support Bracket

TBA2140 auxiliary support brackets can be fitted to the rear of the TB8100 subrack to provide additional mounting security. Figure 5.5 below shows a standard TBA2140 bracket ① fitted in a typical Tait Electronics cabinet ②. If you are not using a Tait cabinet, you may have to make your own brackets to suit your installation.

Figure 5.5 Auxiliary support bracket



Important You **must** fit the auxiliary support brackets if you intend to transport a cabinet fitted with a fully built-up TB8100 BSS.

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

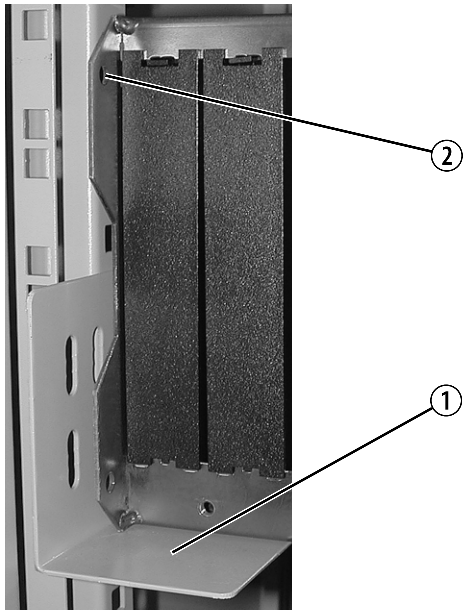
- when the installation is in an area prone to earthquakes
- when third party equipment is installed hard up underneath the TB8100 BSS subrack.

5.8.4 Optional Slide Mounting Rails

You can also use TBA2141 slide mounting rails ① when mounting the TB8100 BSS in a cabinet, as shown in Figure 5.6 below. These rails will support the BSS while you slide it into the cabinet.

However, you must still secure the BSS to the cabinet with four M6 (0.25 in) screws through the main mounting holes on the front of the subrack, as shown in Figure 5.4 on page 82.

Figure 5.6 Optional slide mounting rail - rear view



Important The slide mounting rails are not suitable for transporting a cabinet fitted with a fully built-up TB8100 BSS. In this case, you must also fit the TBA2140 auxiliary support brackets to the upper set of rear mounting holes ②.

5.8.5 Cabling

General

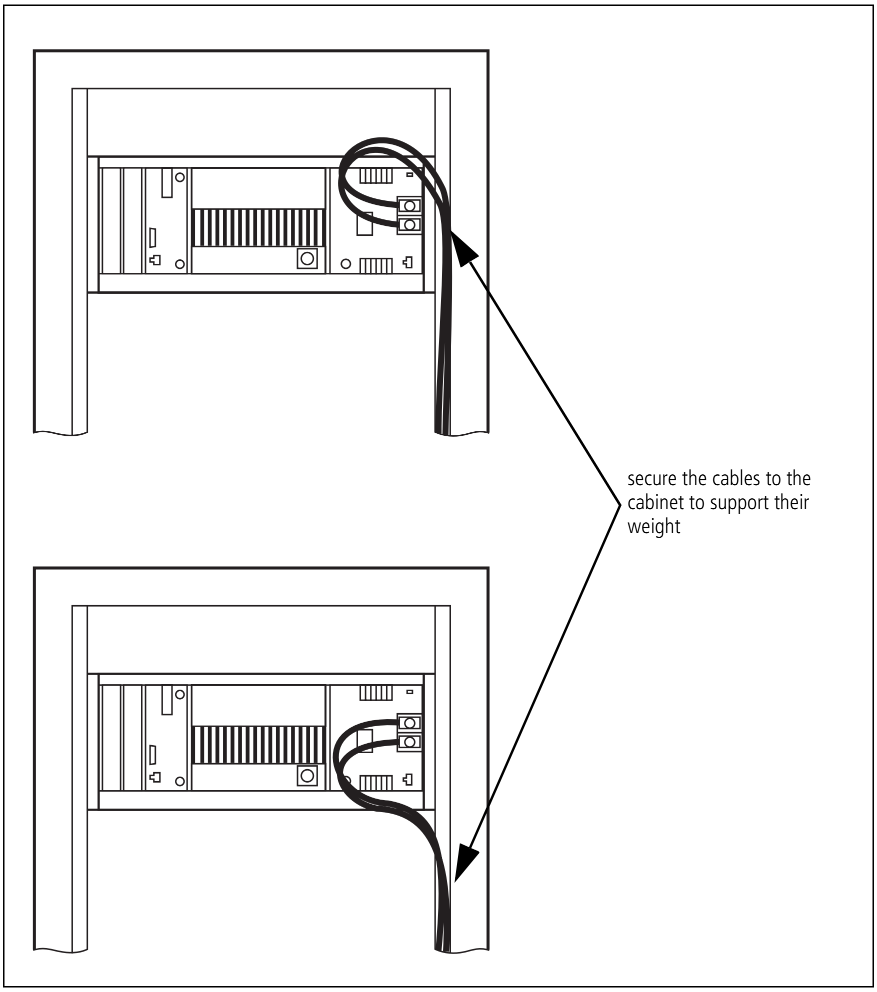
We recommend that you try to route all cables to and from the TB8100 BSS along the side of the cabinet so the cooling airflow is not restricted.

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

Figure 5.7 DC power cabling



6 Replacing Modules

Caution **The TB8100 PA and PMU weigh between 4.6kg (10.1lb) and 5.8kg (12.8lb) each. Take care when handling these modules to avoid personal injury.**

Important 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.

6.1 Saving the Base Station's Configuration

Before replacing a module in the TB8100 BSS, 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.

6.2 Preliminary Disassembly

Hot-pluggable Modules

The reciter, PA and control panel are hot-pluggable and can be removed from the TB8100 BSS without powering down the whole BSS. These modules can also be removed without disrupting the system control bus communications with the other modules in the BSS.

Important In base station systems 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 BSS to transmit or the speaker to be actuated incorrectly.

In a dual base station system, 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 BSS, carry out the instructions in “Disconnect the Power” below.

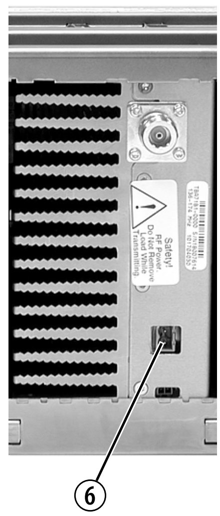
Important Before removing a PA, disconnect the DC input and RF input first, followed by the RF output (and DC output on the 12V PA). After refitting the PA, reconnect the RF output (and DC output on the 12V PA) first, followed by the RF input, and then the DC input.

Disconnect the Power

1. Turn off the AC ① and DC ② switches at the rear of the PMU.

PMU

12 V PA



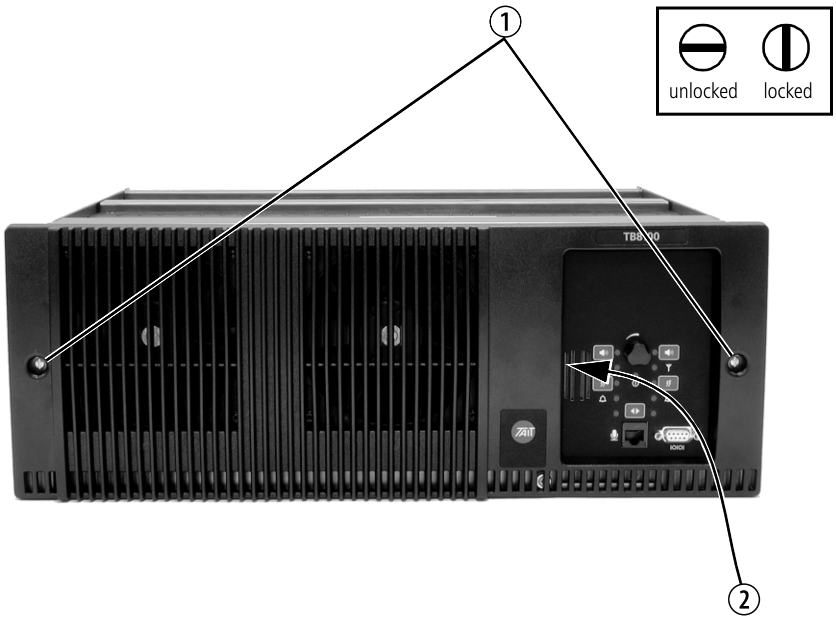
2. Also at the rear of the PMU disconnect the mains ③ and battery ④ supply leads, and the auxiliary DC supply lead ⑤ (if fitted).

3. If the base station is using a 12V PA, disconnect the battery supply lead ⑥.

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 ② 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.



6.3 Replacing the Control Panel

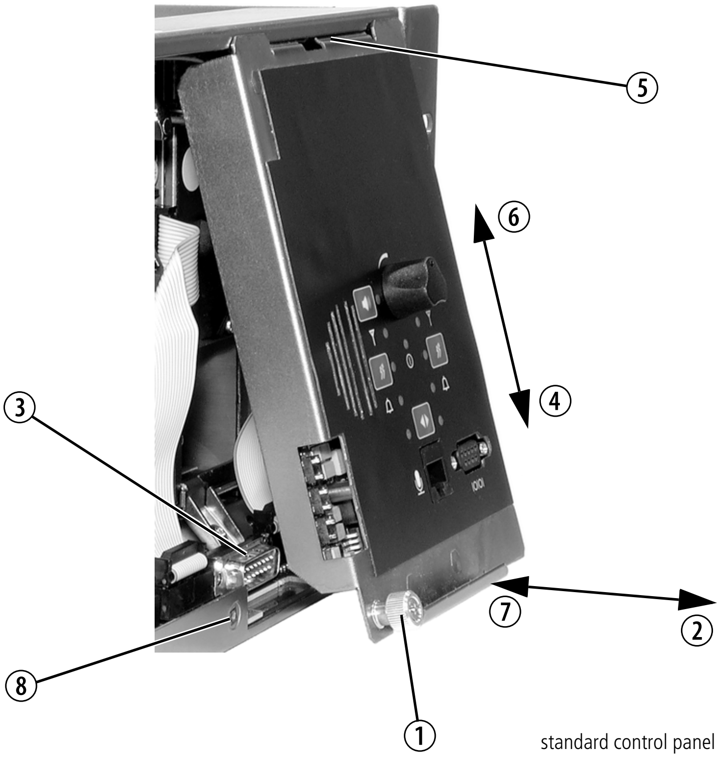
Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 88.

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.



standard 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 101.

6.4 Replacing the Reciter

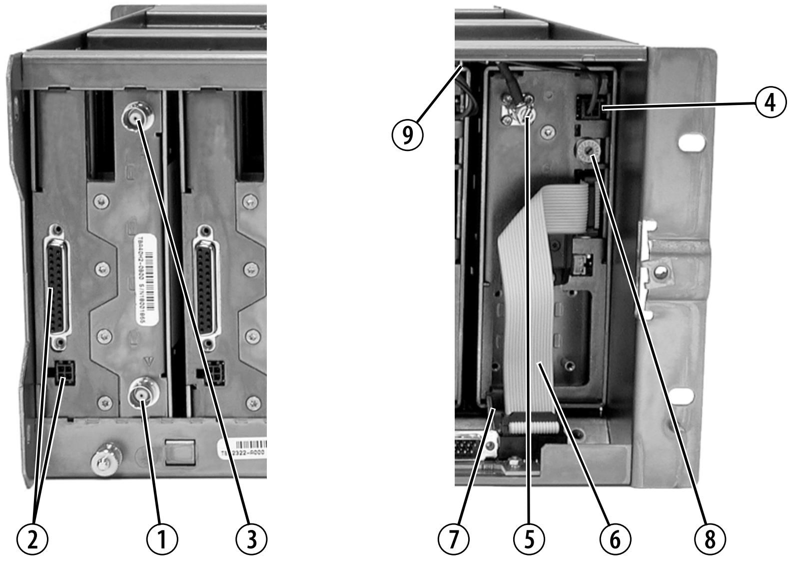
Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 88, and remove the control panel, as described in "Replacing the Control Panel" on page 89.

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.

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. Ensure that you set its hex switch ⑧ to the same number as the original reciter.

2. Reconnect all the front and rear panel cables previously disconnected. Ensure the front panel cables are retained by the cable retaining clips ⑨ in the top of the subrack.

Important **Do not** force the system control bus behind the reciter handle as this may damage the ribbon cable.

Note 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 sub-rack until it reaches the end of its travel.

3. Tighten the nut on the SMA connector to a torque of 0.9 Nm (8 lbf·in).

4. Refit the control panel, as described in "Replacing the Control Panel" on page 89.

5. Carry out the instructions in "Final Reassembly" on page 101.

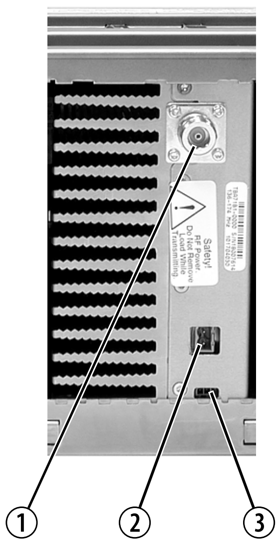
6.5 Replacing the Power Amplifier

Important 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.

Removal

1. If you have not already done so, carry out the instructions in “Preliminary Disassembly” on page 88. If necessary, remove the control panel, as described in “Replacing the Control Panel” on page 89.

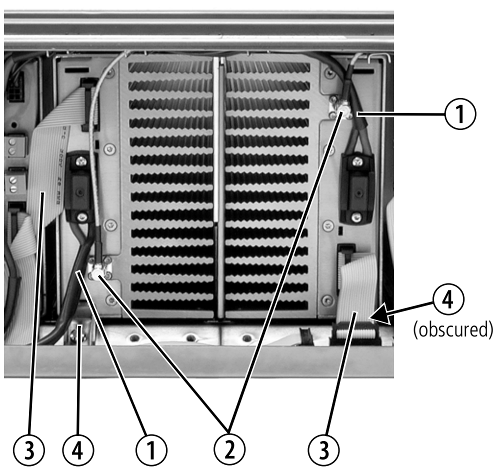
2. At the rear of the PA, unplug the RF output cable ①. **12 V PA only:** also unplug the battery supply lead ②, and Power Saving control cable ③ (if fitted).

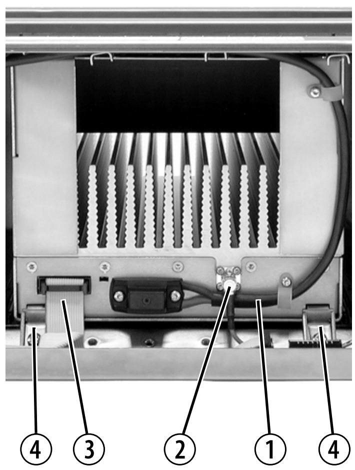


3. At the front of the PA, unplug the DC input cable (DC output cable on the 12V PA) ① and the RF input cable ②, and move both cables to one side. Unplug both ends of the system control bus ③ and remove it.

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.

Note 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 sub-rack until it reaches the end of its travel.

3. Tighten the nut on the SMA connector to a torque of 0.9 Nm (8 lbf·in).

4. If necessary, refit the control panel, as described in "Replacing the Control Panel" on page 89.

5. Carry out the instructions in "Final Reassembly" on page 101.

6.6 Replacing the Power Management Unit

Important You must disconnect the AC and DC power cables before removing the PMU from the subrack.

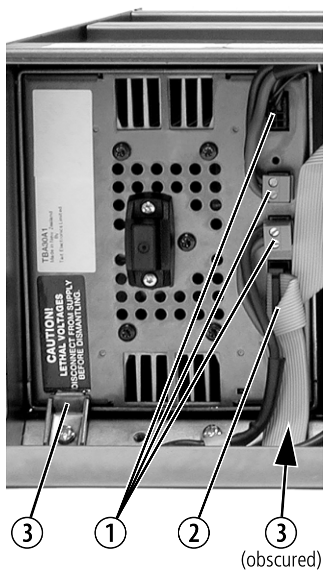
Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 88.

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 5.7 on page 85. Ensure the front panel cables are retained by the cable retaining clips in the top of the subrack.

Note 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 sub-rack until it reaches the end of its travel.

3. Carry out the instructions in "Final Reassembly" on page 101.

6.7 Replacing the Front Panel Fans

Unless otherwise indicated, the following instructions refer to Figure 6.1 on page 96.

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 88.
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.

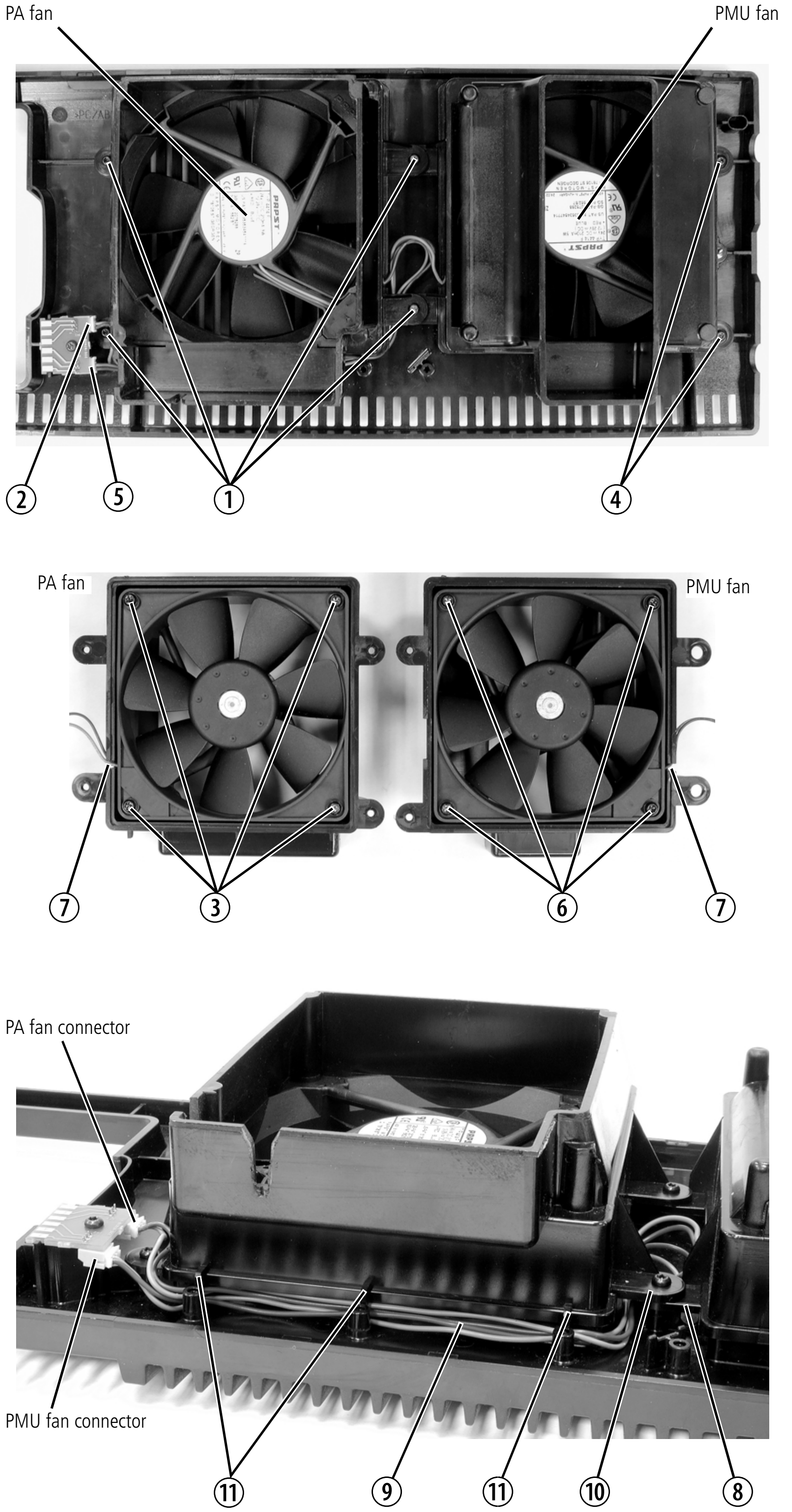
   c. Refit the fours screws labelled ①.

5. Carry out the instructions in "Final Reassembly" on page 101.

Important 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 TB8100 BSS, check that the PMU fan runs first, followed by the PA fan. Each fan will run for about five seconds.

Important 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 6.3 on page 101 for more details.

Figure 6.1 Replacing the front panel fans



100 W base station front panel shown

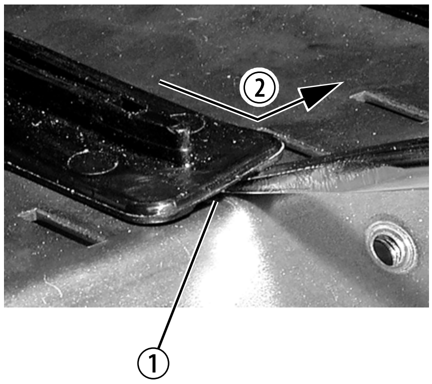
6.8 Replacing the Module Guide Rails

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.

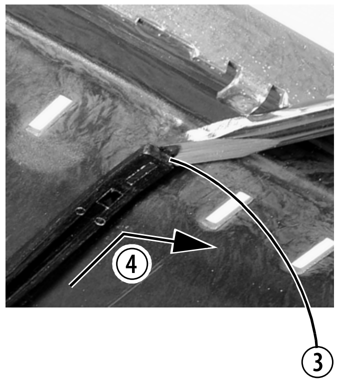
Removal

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.

6.9 Replacing the Subrack Interconnect Board

There are two types of subrack interconnect board available, as described in the following table.

Interconnect Board	Description
single base station	for single base stations with PMU
dual base station	■ for dual base stations with PMU ■ for single and dual base stations with 12V PA

Figure 6.2 on page 99 shows the two types of board, and “Switch Settings” on page 100 explains the settings for the switches on the dual base station board.

Removal

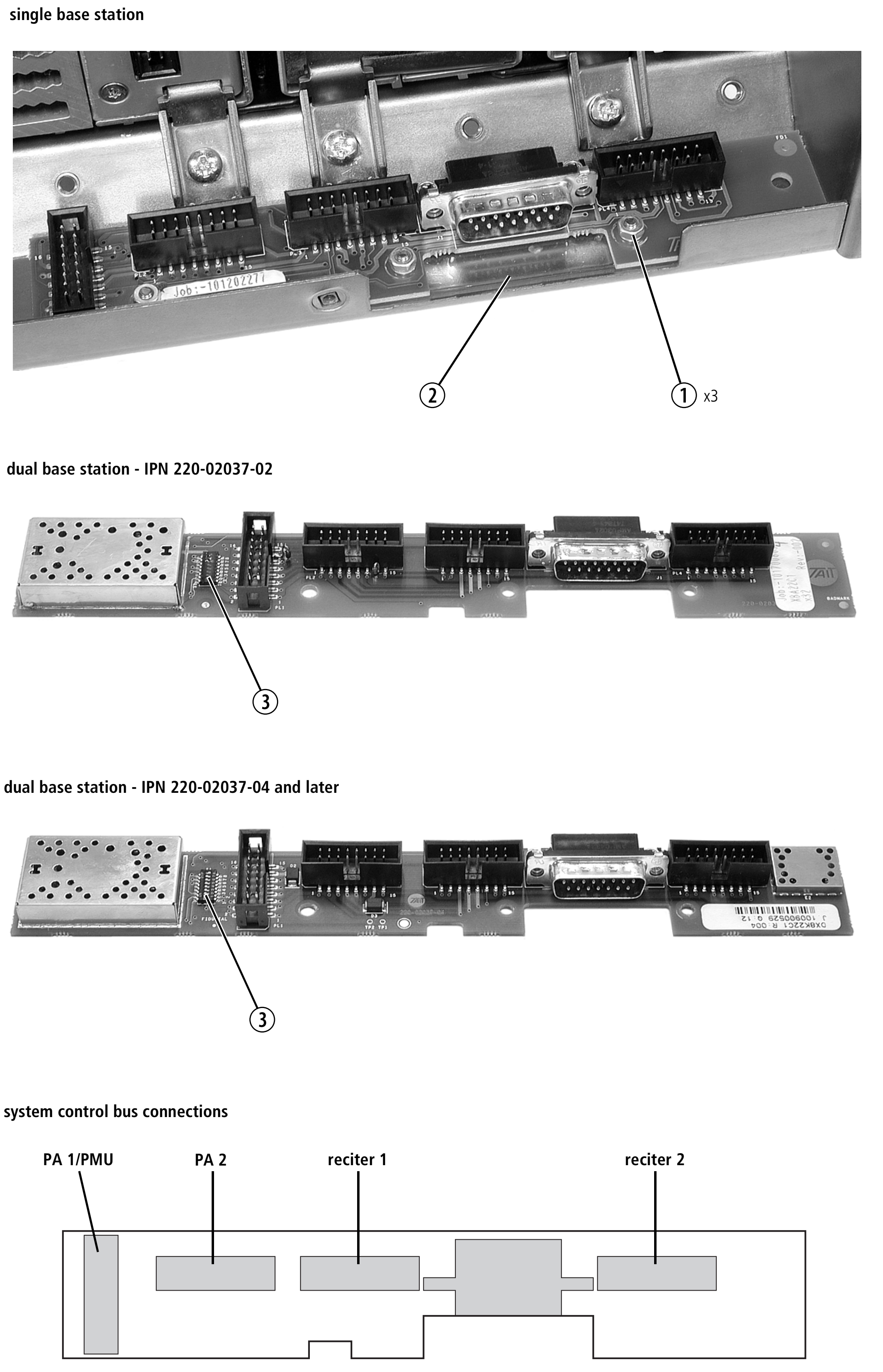
1. If you have not already done so, carry out the instructions in “Preliminary Disassembly” on page 88, and remove the control panel, as described in “Replacing the Control Panel” on page 89.
2. Disconnect any system control bus cables.
3. Remove the M3 nuts and spring washers ① securing the interconnect board to the subrack, as shown in Figure 6.2.
4. 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. Refit the board and secure with the M3 nuts and spring washers.
3. If you have fitted a dual base station interconnect board, set the switches of S1 ③ as described in “Switch Settings” on page 100.
4. Reconnect the system control bus cables as shown in Figure 6.2.

Note The system control bus connections shown in Figure 6.2 apply to all single and dual base station systems.

Figure 6.2 Replacing the subrack interconnect board



Switch Settings

You must set the switches 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 6.1 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 6.2 gives the switch settings for newer boards with the part number 220-02037-04 and later. These boards can be used with dual base stations using a PMU, and with single or dual 12V PA base stations.

Table 6.1 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 6.2 Switch S1 settings - IPN 220-02037-04 and later

Switch	Function	Dual Base Station with PMU	Single or Dual Base Station with 12V PA
		State	State
1	CH1 select button active	on	single - off dual - on
2	CH2 select button active	on	single - off dual - on
3	independent CH1 and CH2 channels	Tait use only - leave on	Tait use only - leave on
4	channel 1 I^2C_CLK pullup	off	on
5	channel 1 I^2C_DATA pullup	off	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

6.10 Final Reassembly

Important You must refit the correct type of front panel to your TB8100 BSS. There are several small but important differences between the front panel for a 5W or 50W BSS and the front panel for a 100W BSS. These differences are in the duct for the PA fan and are described in the following paragraphs.

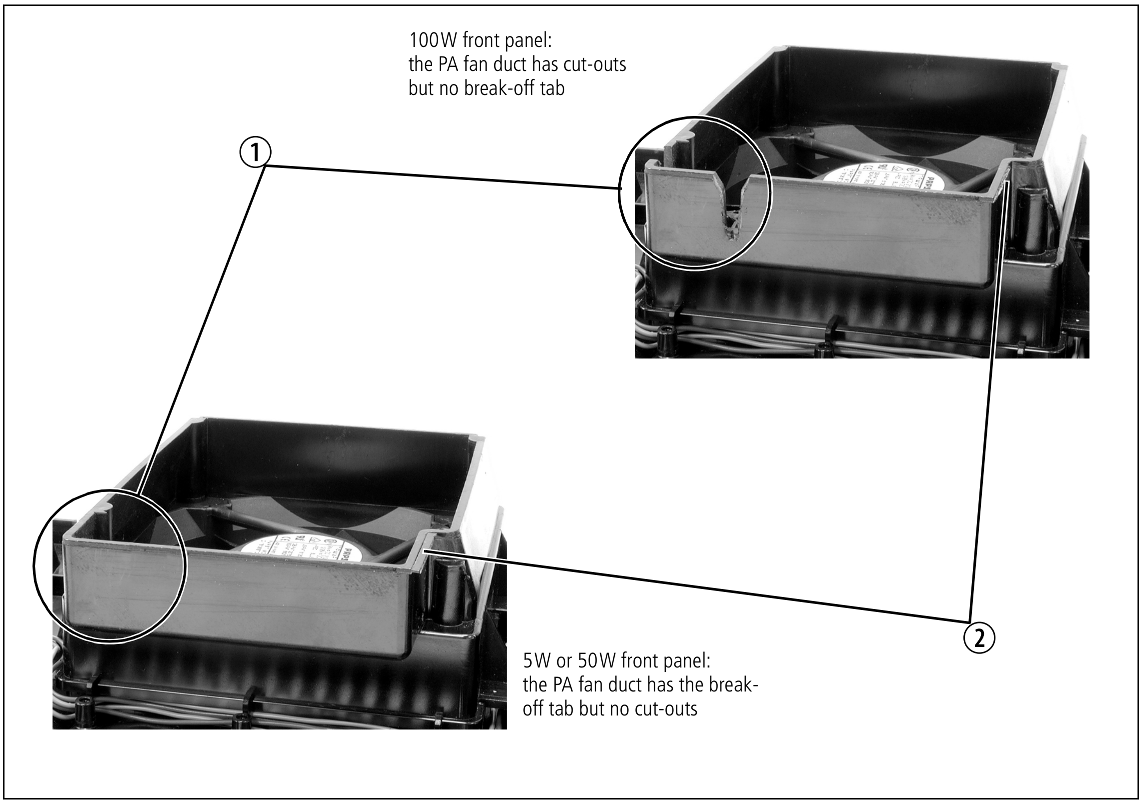
5W or 50W Front Panel

The PA fan duct does not have the cut-outs ① required for the 100W 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 100W BSS or you will damage these cables and possibly the front panel itself.

100W Front Panel

Do not fit this front panel to a 5W or 50W BSS. 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 6.3 Identifying the correct front panel

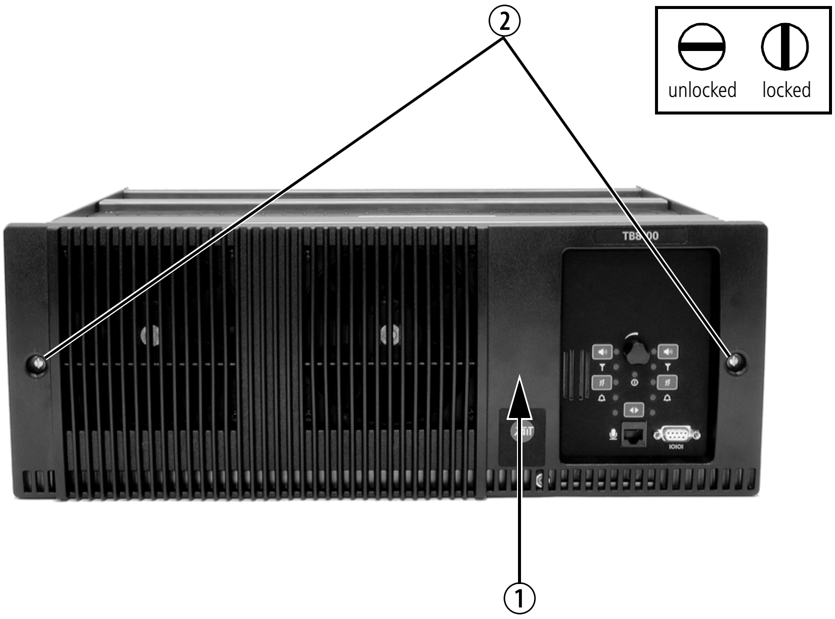


1. Before fitting the front panel, ensure that all cables are secured and positioned correctly so they are clear of the fan ducts (refer to Figure 7.1 on page 104 and Figure 7.3 on page 106). Otherwise the panel may not fit properly, or you may damage the cables.

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.



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.

Important 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.

7 Connection

Once the TB8100 BSS hardware is 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 TB8100 BSS.

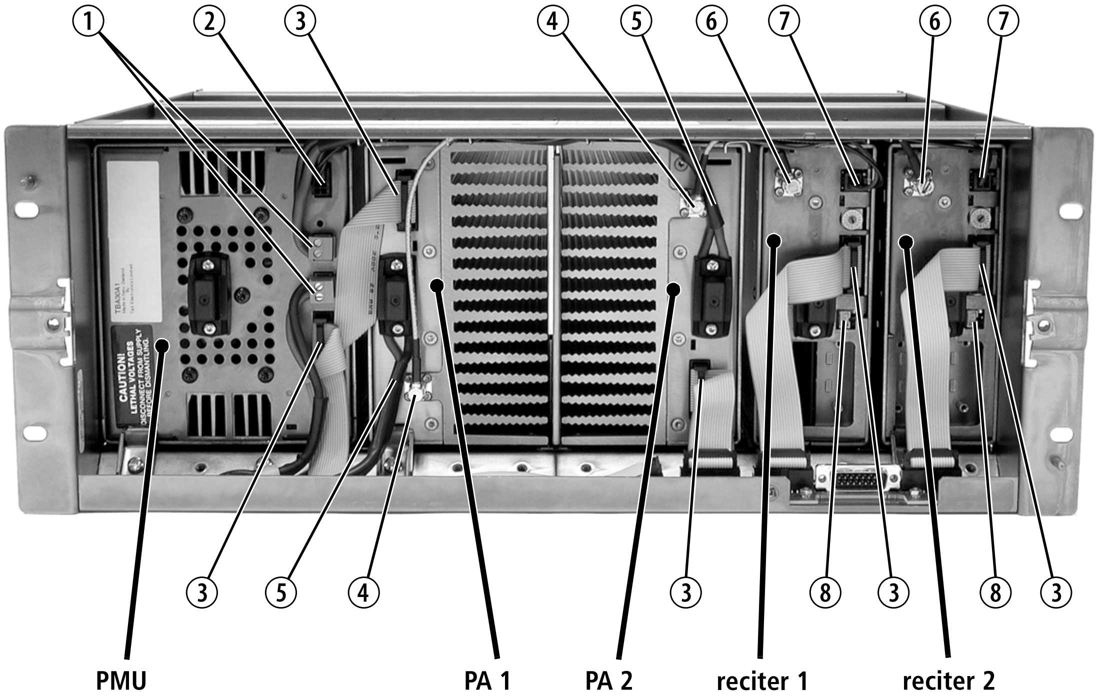
7.1 Overview of Inputs and Outputs

This section identifies the main input and output connections for the TB8100 BSS.

- Figure 7.1 on page 104 identifies the connections at the front of a dual base station, and Figure 7.4 on page 107 identifies those at the rear.
- Figure 7.2 on page 105 identifies the connections at the front of a dual 12V PA base station, and Figure 7.5 on page 108 identifies those at the rear.
- Figure 7.3 on page 106 identifies the connections at the front of a single 100W base station.
- Figure 7.6 on page 108, and Figure 7.7 and Figure 7.8 on page 109 identify the connections on the standard, dual base station, and Power Save control panels.

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

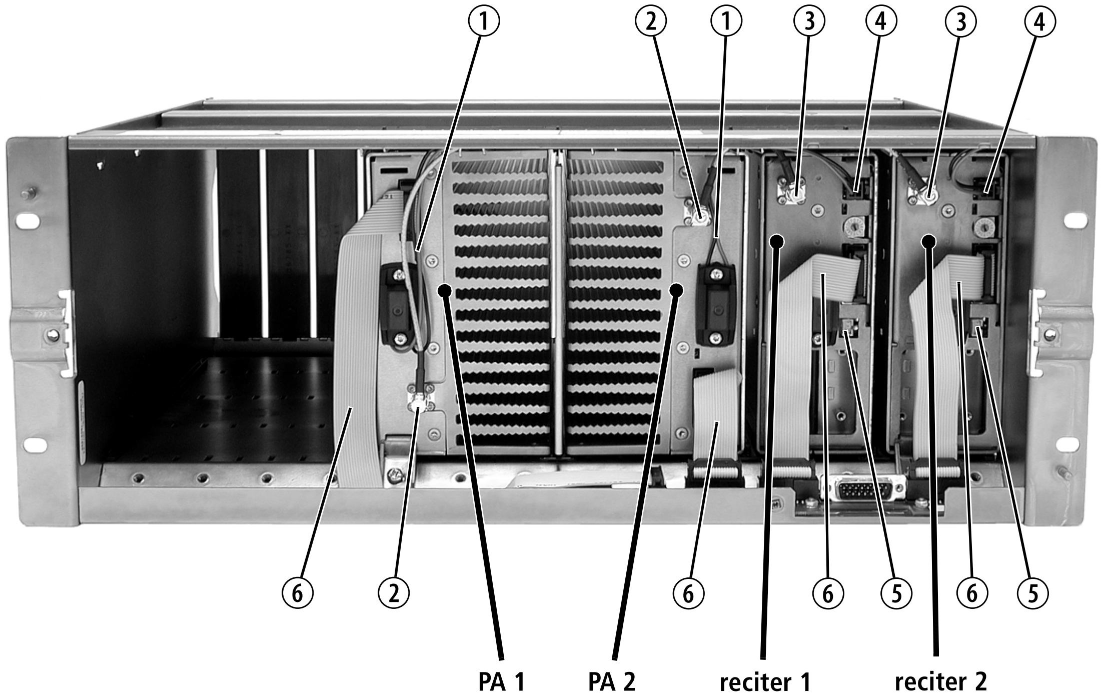
Figure 7.1 Dual 5W or 50W base station inputs and outputs - front view



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)

Important In base station systems 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 BSS to transmit or the speaker to be actuated incorrectly.

Figure 7.2 Dual 5W or 50W 12V PA base station inputs and outputs - front view



① 12VDC output for reciter

② RF input from reciter

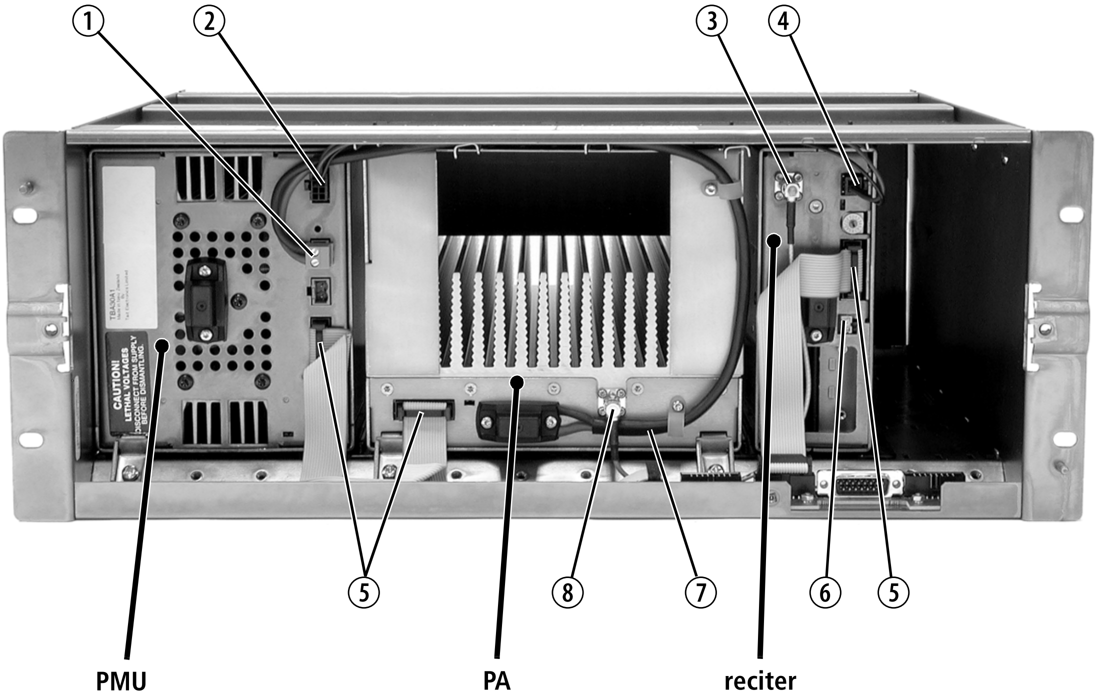
③ RF output to PA

④ 12VDC input from PA

⑤ DC output (for optional reciter fan only)

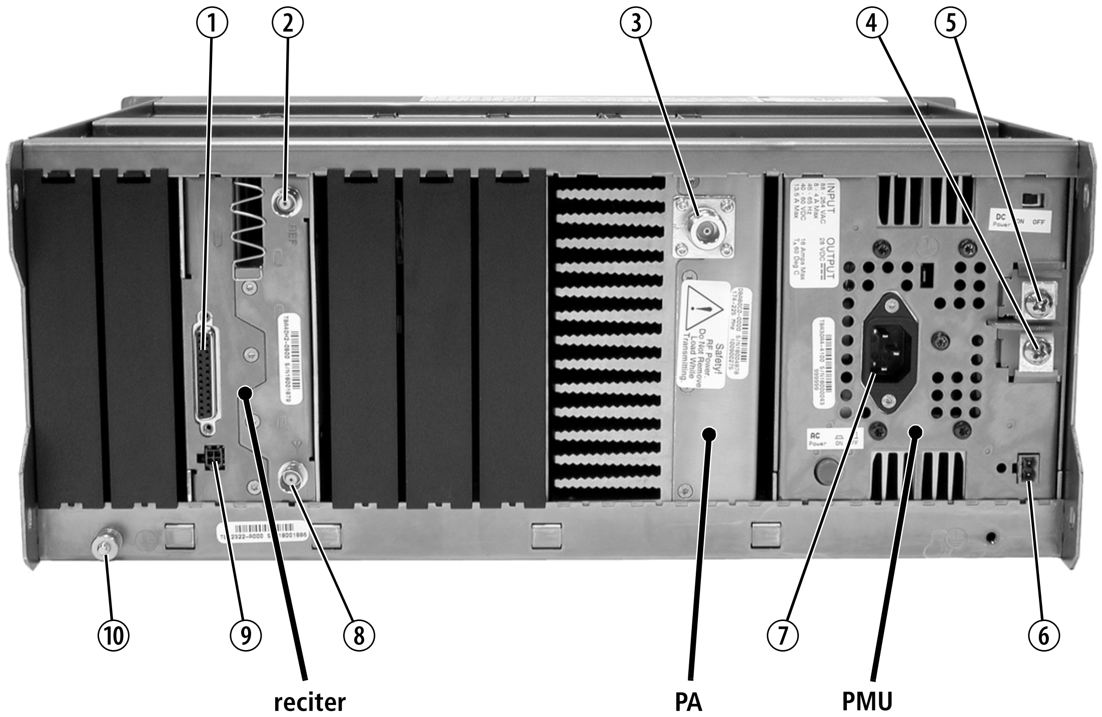
⑥ system control bus

Figure 7.3 Single 100W base station inputs and outputs - front view



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

Figure 7.4 Single 5W or 50W base station inputs and outputs - 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

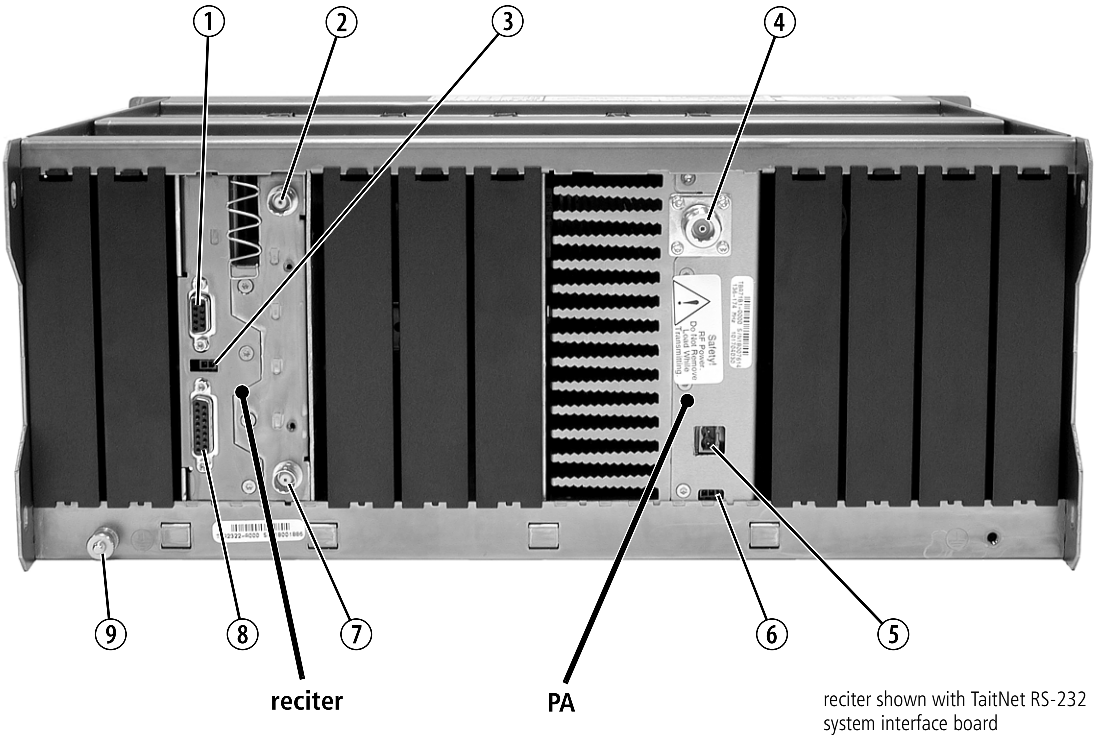
⑧ RF input (from antenna)

⑨ auxiliary DC input for system interface[a]

⑩ subrack ground connector

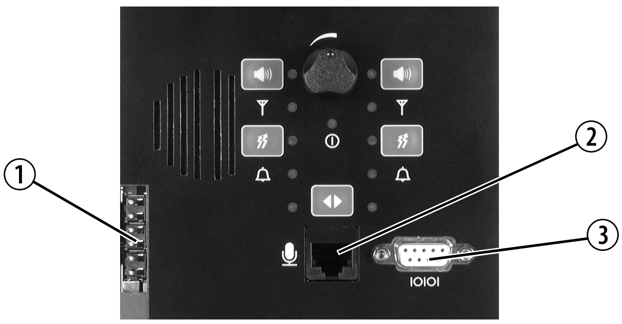
a. Older system interface boards use the 4-way connector shown in the photograph, while the TaitNet RS-232 board and all other boards manufactured after March 2005 use a 2-way connector. Refer to “Reciter Auxiliary DC Input from PMU” on page 113 for more details.

Figure 7.5 Single 5W or 50W 12V PA base station inputs and outputs - rear view



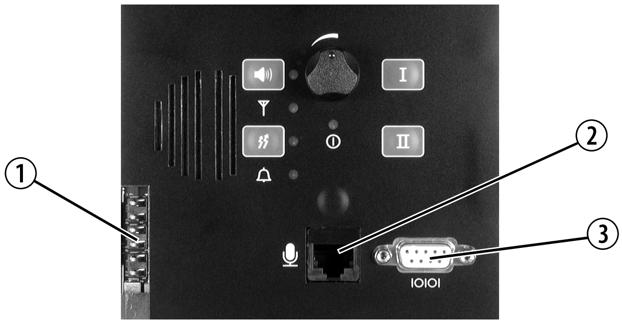
1. RS-232 connector
2. external reference frequency input
3. auxiliary DC input for system interface
4. RF output (to antenna)
5. 12VDC input
6. Power Saving control input
7. RF input (from antenna)
8. TaitNet system interface connector
9. subrack ground connector

Figure 7.6 Standard control panel inputs and outputs



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

Figure 7.7 Dual base station control panel inputs and outputs



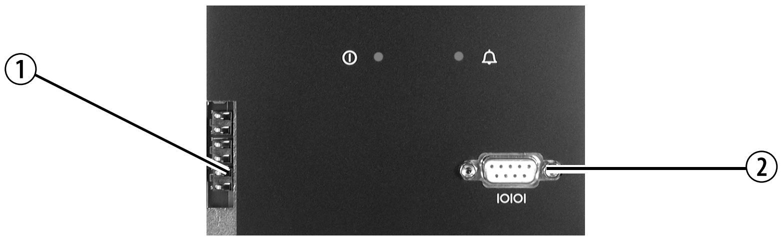
① DC outputs for fans mounted on front panel; also used for fan rotation detectors (if fitted)

② microphone connector

③ RS-232 programming port

Note 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 7.8 Power Save control panel inputs and outputs



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

② RS-232 programming port

Note When a reciter fitted with a TaitNet RS-232 system interface board is used in a TB8100 BSS, 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 122 for more details.

Note If high-power HF equipment is located close to the TB8100 BSS, 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 BSS.

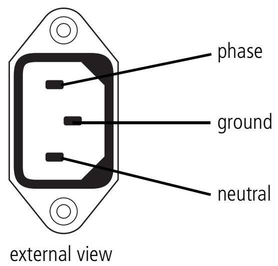
7.2 Power Supply Connections

7.2.1 AC Power

The TB8100 PMU is designed to accept a mains input of 88 to 264 VAC at 45 to 65 Hz. We recommend that a standard 3-wire grounded outlet is 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.

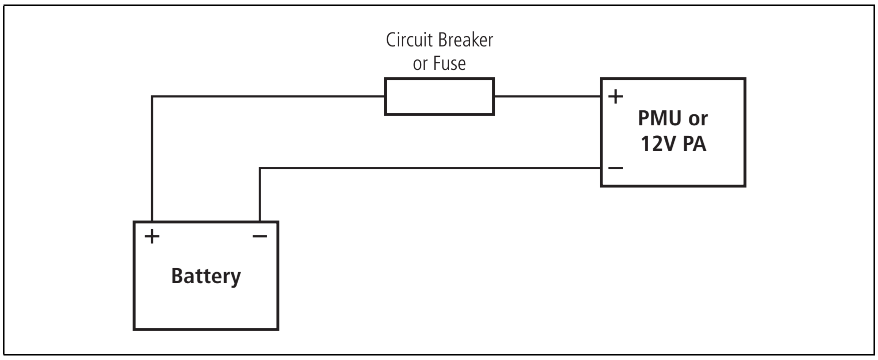
Nominal Supply Voltage	Current Requirement	Circuit Breaker/Fuse Rating
115 VAC	8 A	10 A
230 VAC	4 A	6 A

Your TB8100 BSS 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.



7.2.2 DC Power

Figure 7.9 Recommended DC power connection



DC Power with PMU The TB8100 PMU is designed to accept a nominal 12 VDC, 24 VDC or 48 VDC 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 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	Recommended Wire Gauge[a]
12VDC	60A	2AWG / 35mm^2
24VDC	30A	5AWG / 16mm^2
48VDC	15A	8AWG / 8mm^2

a. 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.

DC Power with 12V PA

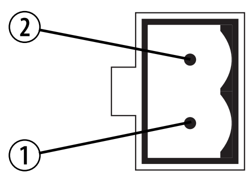
The TB8100 12V PA is designed to accept a nominal 12VDC input with negative ground. There is a minimum DC startup threshold to prevent damaging a battery which has little capacity left.

You must connect the DC supply from the battery to the PA via a fuse or DC-rated circuit breaker with 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	Recommended Wire Gauge[a]
12VDC	15A to 18A	8AWG / 8mm^2

a. 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.



2-way connector - external view

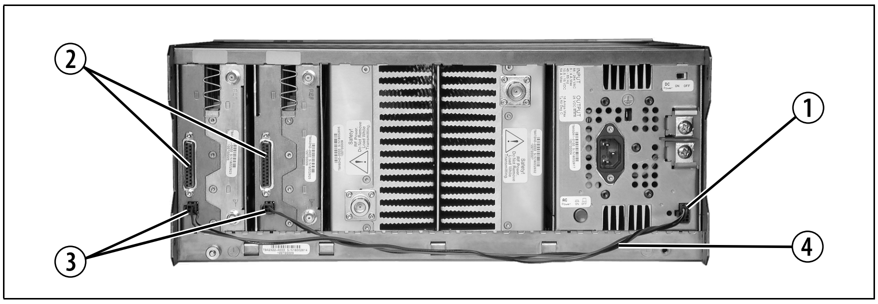
Pin	Description
1	+V input
2	ground

7.2.3 Auxiliary DC Power

PMU Auxiliary DC Output

The PMU can provide an auxiliary DC output when it is fitted with the optional auxiliary power supply board. This board is available with an output of 13.65VDC, 27.3VDC, or 54.6VDC (depending on the model), and is current limited to 3A, 1.5A or 750mA respectively. This optional 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 cables ④ are described in "Auxiliary DC Power Supply Connections" on page 114.

Figure 7.10 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:

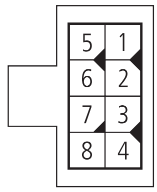
IF **Digital input 01 active** THEN **Enable auxiliary supply**.

Refer to the Service Kit documentation for more details.

We do not recommend connecting two or more auxiliary power supply boards in parallel to increase the current supply to external equipment. In this situation, the auxiliary board with the highest voltage will try to supply all the current required, until it goes into current limit and the voltage reduces to the level where another board will begin to supply power. Running an auxiliary board continuously in current limit will reduce its life span and reliability. Also, if one auxiliary board fails or is switched off when a base station is powered down for some reason, the remaining auxiliary boards will be unable to supply the required current and will go into current limit, possibly causing the external equipment to shut down.

It is, however, acceptable to connect two or more auxiliary power supply boards in parallel (e.g. for redundancy), as long as the current consumption of the external equipment is less than the rating of one board. This means that, even if only one auxiliary board is functioning, it will still be able to supply the current requirements of the external equipment.

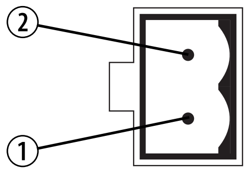
Two different types of auxiliary DC output connector have been fitted to the PMU. The pin allocations for the 8-way connector fitted to PMUs manufactured before August 2004 are given in the following table. Note that pins 1 to 4 and pins 5 to 8 on this connector are linked.



8-way connector - external view

Pin	Description	Links
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.



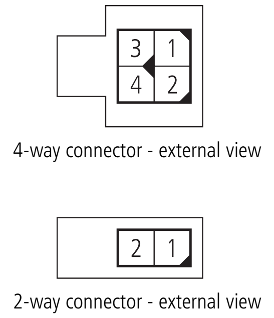
2-way connector - external view

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 116 for the pin allocations for +AUX_V on each system interface board.



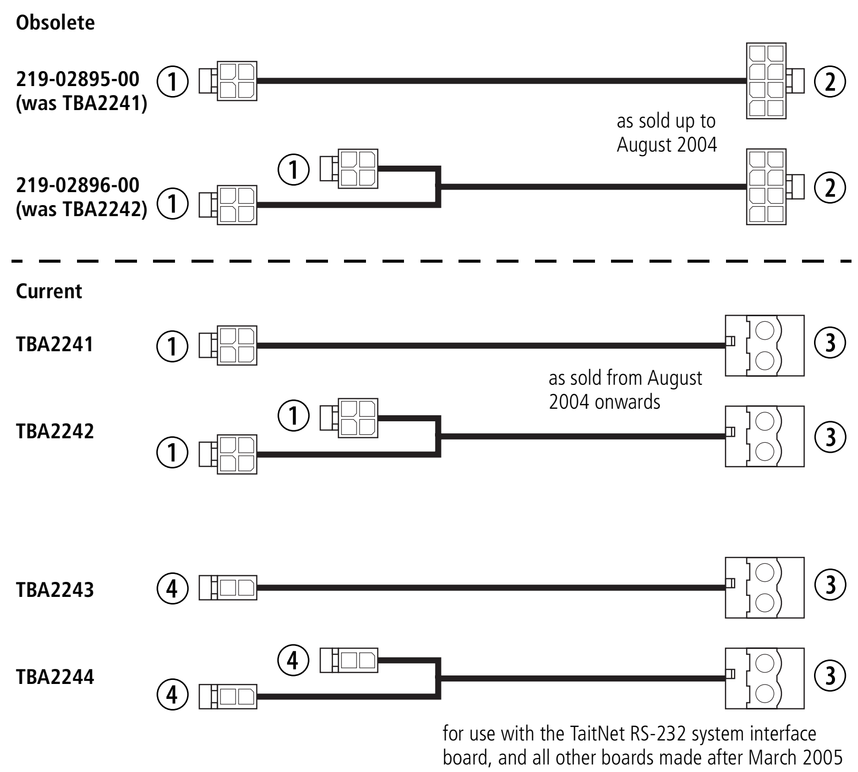
Pin	Description	Links
1	+V input	
2	ground	
3	+V input	
4	ground	

The DC output from the PMU is 13.65VDC, 27.3VDC, or 54.6VDC (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 Connections

Figure 7.11 below shows the standard Tait auxiliary DC power cables available. Details of the individual connector types are also provided in case you want to make up your own cables.

Figure 7.11 Auxiliary DC power cables



① 2x2-way Molex 43025-0400/ crimp socket 43030-0001 female

② 2x4-way Molex 43025-0800/ crimp socket 43030-0001 female

③ Phoenix MVSTBR2.5HC/2-ST/5.08 female

④ 2x1-way Molex 43025-0200/ crimp socket 43030-0001 female

Note that the PMU connector used in the TBA2241 and TBA2242 cables was changed in August 2004 to match the change of connector in the PMU. The old cables are still available under Tait part numbers 219-02895-00 (single) and 219-02896-00 (double). Contact your nearest Tait Dealer or Customer Service Organisation for details on the full range of wiring kits available.

7.3 RF Connections

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

To protect the PA output stage from load transients (i.e. switching or removing the load), we recommend that you fit an isolator 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 or combining equipment between the isolator and the PA.

The RF input to the TB8100 BSS 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 7.4 on page 107).

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.

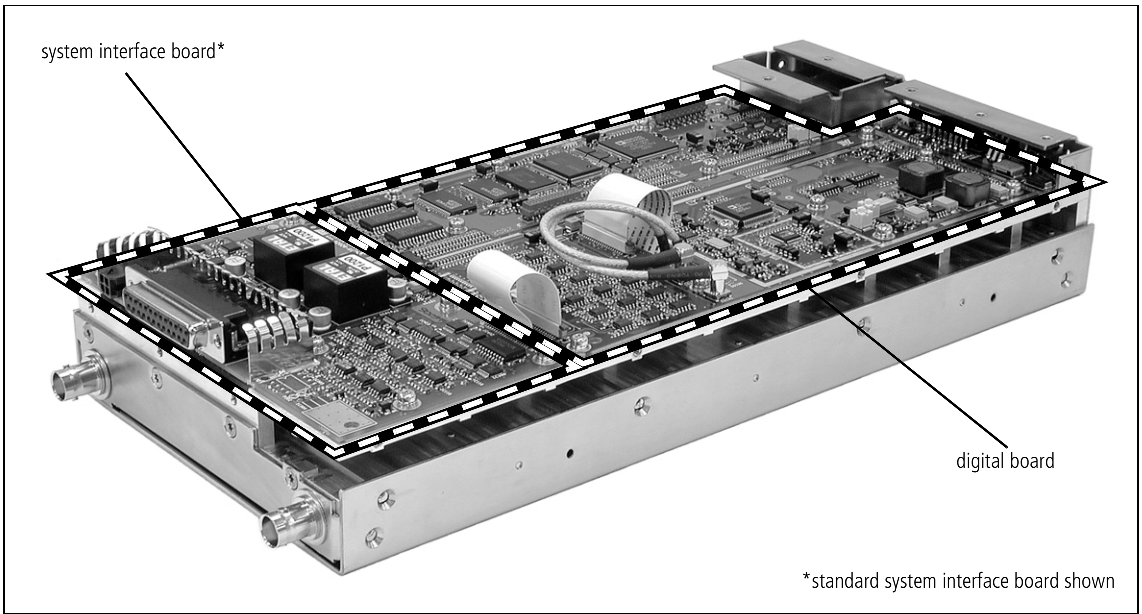
7.4 System Connections

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 7.12 System interface board



7.4.1 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 118, 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.

The digital interface signals supported by the TB8100 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**.

Note 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.

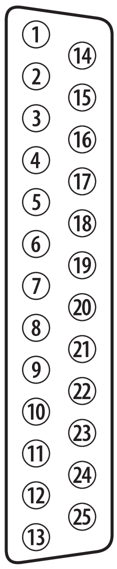
7.4.2 System Interface Connections

Standard

The standard system interface board is fitted to reciters bearing the product code TBA4xxx-0A0x. If purchased separately, it has the product code TBA10A0. It provides the following:

■ non-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 4-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 113.



external view

Pin	Signal Name	Signal Type	Notes
1	Rx line out +	audio output	non-isolated AC coupled 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	non-isolated AC coupled 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
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	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 should not be used for any other Task Manager function.

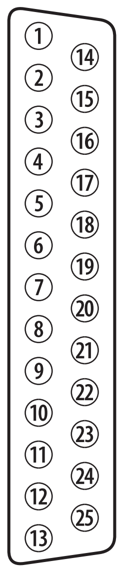
b. On version 1 and later system interface boards, digital inputs 3, 4, 5, and 6 may also be configured as outputs using a Task Manager statement. For more details refer to “Digital Interface” on page 117 and to the Service Kit documentation.

Isolated

This system interface board is fitted to reciters bearing the product code TBA4xxx-0B0x or TBA5xxx-0B0x. If purchased separately, it has the product code TBA10B0. It is the same as the standard model, except that 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 4-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 113.



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
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	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 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.

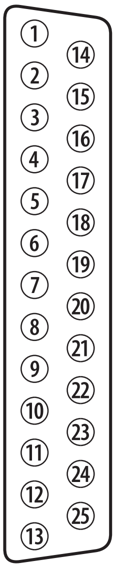
b. On version 1 and later system interface boards, digital inputs 3, 4, 5, and 6 may also be configured as outputs using a Task Manager statement. For more details refer to "Digital Interface" on page 117 and to the Service Kit documentation.

Isolated E&M

This system interface board is fitted to reciters bearing the product code TBA4xxx-0C0x or TBA5xxx-0C0x. If purchased separately, it has the product code TBA10C0. 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 4-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 113.



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	audio ground	ground	
5	Tx audio in	audio input	
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
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
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 should not be used for any other Task Manager function.

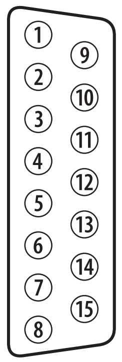
b. On version 1 and later system interface boards, digital inputs 3, 4, 5, and 6 may also be configured as outputs using a Task Manager statement. For more details refer to "Digital Interface" on page 117 and to the Service Kit documentation.

TaitNet

This system interface board is fitted to reciters bearing the product code TBA4xxx-0T1x. If purchased separately, it has the product code TBA10T1. 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 4-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 113.



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	
7	Tx line in +	audio input	transformer isolated line
8	Tx line in –		
9	+AUX_V	power output	from auxiliary DC input
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	5V logic
15	ground	ground	

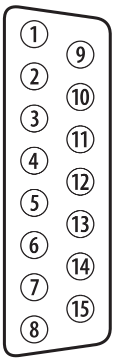
a. If a base station with a 12V PA is configured for Deep Sleep, digital out 1 is dedicated to Power Saving control and should not be used for any other Task Manager function.

TaitNet RS-232

This system interface board is fitted to reciters bearing the product code TBA4xxx-0L0x or TBA5xxx-0L0x. If purchased separately, it has the product code TBA10L0. It is designed for use with MPT trunking systems, and also for use with multiple base station 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

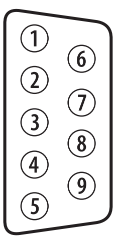
It is fitted with a 15-way female D-range connector (TaitNet), a 9-way female D-range connector (RS-232), and a 2-way auxiliary DC input connector. The pin allocations for the D-ranges are listed in the following tables, and the pin allocations for the DC input connector are provided in "Reciter Auxiliary DC Input from PMU" on page 113.



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	
7	Tx line in +	audio input	transformer isolated line
8	Tx line in –		
9	+AUX_V	power output	from auxiliary DC input
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	5V 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 should not be used for any other Task Manager function.



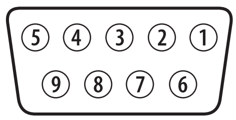
external view

Pin	Description	Links
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	

The rear-mounted RS-232 serial port facilitates the connection of multiple base stations to a Service Kit or Alarm Center using an APS (asynchronous port switch) and modem or radio modem. Refer to TN-906 for more details on using an APS with TB8100 base stations.

7.5 Service Kit Connections

The TB8100 Service Kit is connected to the BSS 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 BSS. 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.



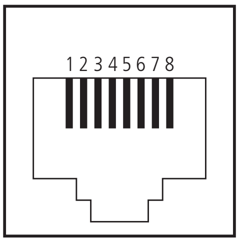
external view

Pin	Description	Links
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	

Note When a reciter fitted with a TaitNet RS-232 system interface board is used in a TB8100 BSS, 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 122 for more details.

7.6 Microphone Connection

You can connect a microphone to the TB8100 BSS via the standard RJ45 socket on the control panel. If a standard TB8100 microphone has not been supplied with your BSS, 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

7.7 12V PA Power Saving Control Connection

To enable Power Saving in the 12V 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 57.

Note 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.

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 7.13 on page 125.

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.

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

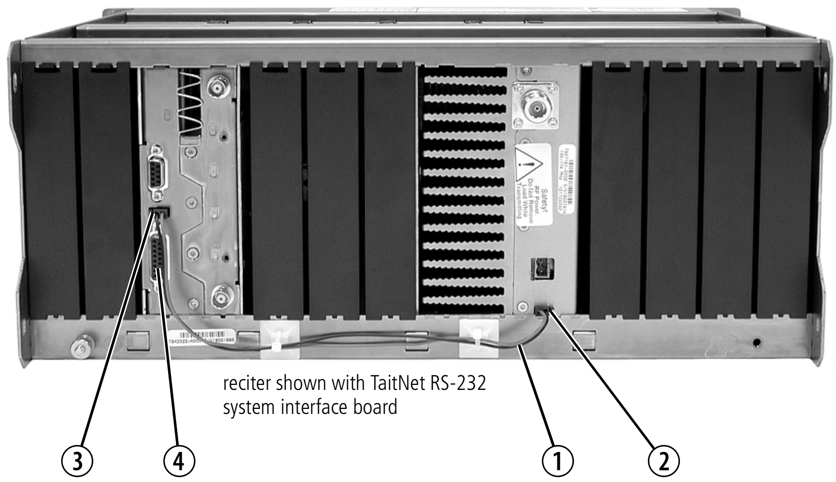
2. On the D-range plug that is fitted to the system interface connector ④ on the reciter, link digital out 1 to +AUX_V.

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.

Figure 7.13 Fitting the Power Saving control cable to a 12V PA



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

	Pin	Signal Name	Signal Type	Notes
2 1 external view	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.

8 Preparation for Operation

Once the TB8100 BSS has been installed and connected, it is time to prepare it for operation. The main procedures required to ensure your BSS 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.

8.1 Tuning

If you have not already done so, you must tune the TB8100 BSS reciter modules before operating them in your radio system. To do this you will need to use the Calibration Kit software included on the Product CD, plus the TB8100 calibration test unit (CTU).

Refer to the Calibration Kit documentation for full details on the tuning procedures.

8.2 Configuration

Software

The TB8100 BSS 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 BSS 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.

Note The BSS 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.

Hardware

Each base station in a TB8100 BSS must be assigned an identity[1]. This identity is used to identify the base station to the Service Kit and Calibration Kit software, and to the control panel.

You set the identity of each base station with the hex switch on the front panel of its reciter (refer to Figure 3.4 on page 33). For example, the reciters in a dual base station system would be numbered “1” and “2”. The reciter with the lowest hex number becomes the “control” reciter. In a single base station system, set the hex switch on the reciter to “1”.

Note Reciters and PAs are normally numbered from left to right when facing the front of the BSS (refer to Figure 7.1 on page 104). In a single base station system, fit the reciter and PA into the positions allocated for “reciter 1” and “PA 1”. These positions also correspond to the layout of the controls on the control panel (refer to Figure 3.1 on page 28).

8.3 Applying Power

1. Before turning the TB8100 BSS on:
   - check that the PMU is turned off (refer to Figure 3.6 on page 35)
   - **12 V PA only:** check that the battery supply lead is disconnected (refer to “Replacing the Power Amplifier” on page 92)
   - remove the front panel (refer to “Preliminary Disassembly” on page 88)
   - check that all looms and cables at the front and rear of the BSS are fitted correctly (refer to “Overview of Inputs and Outputs” on page 103)
   - 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 101).
2. Apply power by turning on the PMU, or by connecting the battery supply lead to the 12V PA.
3. Check that the BSS 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 BSS)
   - check that the power and microphone channel LEDs on the standard control panel turn on after about five seconds, and all other LEDs remain off (refer to “Control Panel” on page 28)
   - at this point you can also safely press the speaker and microphone channel buttons and check that they are operating correctly.

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1. This feature will be available in a future release.

8.4 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 TB8100 BSS is operating correctly.

Note You may wish to have the Service Kit software running during these tests so that you can monitor the performance of the BSS.

1. Ensure that the BSS is correctly connected to an appropriate antenna and that all RF connectors are secure.

1. Plug the microphone into the RJ45 socket on the control panel (refer to "Control Panel" on page 28).

2. Select the base station you wish to transmit on with the microphone channel button.

3. Turn on the speaker audio for the selected base station with the speaker button.

4. 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.

5. 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).

9 Maintenance Guide

The TB8100 BSS 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 BSS. 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 TB8100 BSS remotely by using the Service Kit and Alarm Center software provided with the equipment. You can use the Service Kit to configure the BSS 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 BSS 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, if you are using battery back-up, you should check the batteries regularly in accordance with the manufacturer's recommendations.

Ventilation

The TB8100 BSS 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 78 to ensure a long life and trouble-free operation for your BSS.

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 BSS to generate an alarm if either of the cooling fans fails. Refer to the Service Kit and Alarm Center documentation for more details.

Glossary

This glossary contains an alphabetical list of terms and abbreviations related to the TB8100 base station system. 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 licence. 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.

BSS A BSS (base station system) is a subrack containing at least one TB8100 base station.

C

Calibration Kit The TB8100 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. The TB8100 base station does not support CCDI2.

CCI CCI (computer controlled interface) is a proprietary Tait command protocol used between computer equipment and a Tait radio. The TB8100 base station supports CCI (refer to TN-947-AN).

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 BSS.

control bus The control bus is used for communications between modules in a base station system. 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 BSS with buttons, LEDs and other controls that let you interact with the BSS.

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.

de-emphasis De-emphasis is a process in the receiver that restores pre-emphasised 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 TB8100 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 organisation 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 BSS 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 systems interface), transmits audio received over its systems interface, and its transmitter is keyed via the Tx Key line.

logging on
Once you are connected to a BSS, you log on to a base station. This establishes communications between the Service Kit and a particular 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 BSS.

pre-emphasis Pre-emphasis is a process in the transmitter that boosts higher audio frequencies.

R

reciter The reciter is a module of a TB8100 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.

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.

S

sensitivity The sensitivity of a radio receiver is the minimum input signal strength required to provide a useable signal.

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 TB8100 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 10 MHz) 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 TB8100 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.

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 monopolising 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 line to the minimum value anywhere on the 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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CE ⓘ Directive 1999/5/EC Declaration of Conformity

da **Dansk**

Undertegnede Tait Electronics 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.taitworld.com/

de **Deutsch**

Hiermit erklärt Tait Electronics 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.taitworld.com/

el **Ελληνικός**

Με την παρουσα Tait Electronics Limited δηλωνει οτι TBAB1, TBAC0 & TBAH0 συμμορφωνεται προσ τισ ουσιωδεισ απαιτησεισ και τισ λοιπεσ σχετικεσ διαταξεισ τησ οδηγιασ 1999/5/ΕΚ.
βλέπε και: http://eudocs.taitworld.com/

en **English**

Tait Electronics 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.taitworld.com/

es **Español**

Por medio de la presente Tait Electronics 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.taitworld.com/

fi **Suomi**

Tait Electronics 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.taitworld.com/

fr **Français**

Par la présente, Tait Electronics 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.taitworld.com/

it **Italiano**

Con la presente Tait Electronics 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.taitworld.com/

nl **Nederlands**

Hierbij verklaart Tait Electronics 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.taitworld.com/

pt **Português**

Tait Electronics 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.taitworld.com/

sv **Svensk**

Härmed intygar Tait Electronics 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.taitworld.com/