TB9100 base station

Customer Service Software User's Manual

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Contents

Preface

Welcome to the TB9100 Customer Service Software User's Manual. This manual provides you with information about the Tait TB9100 Customer Service Software in PDF format. You can view it online or print it if you want a paper copy. It describes how to use Version 2.1x of the Customer Service Software.

- New users should begin at Part B: Getting Started.
- For explanations of essential concepts, look in Part A: Introduction.
- The rest of the manual assumes that you are familiar with Part C: Basic Tasks.

Associated Documentation

TB9100 product documentation is provided in PDF format on the product CD. Updates are made available on the Tait support web.

Online Help. The CSS also has online Help. It contains more or less the same information as this manual. To view it, start the CSS, then press F1 or click the Help icon on the toolbar. If you are in a dialog box, click the Help button. The Calibration Software also has online Help.

TB9100 Safety and Compliance Booklet (MBA-00012-xx). A printed booklet supplied with the base station.

TB9100 Installation and Operation Manual (MBA-00002-xx).

CTU Operation Manual (MBA-00013-xx). Instructions on using the calibration and test unit.

Encryption Key Loading Guide (MTA-00004-xx). Instructions on how to define encryption keys and load them into the analog gateway and other Tait P25 products.

Service Manual (service centers only).

TB9100 Product Catalog provides information about base station parts and modules.

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. The product CD includes technical notes that were available at the time of release. Look for new or updated technical notes on Tait's technical support website.

Typographical 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, the following types of alerts are used: Important, Note, and Tip. The following paragraphs illustrate each type of alert and its associated symbol.

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

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

Tip: This alert is used to draw your attention to ways of doing things that can improve your efficiency or effectiveness.

Publication Record

Version	Date	Description
MBA-00003-01	January 2005	First release. Describes version 01.00 of the CSS.
MBA-00003-02	January 2005	Describes version 01.01 of the CSS.
MBA-00003-03	March 2005	Describes version 01.10 of the CSS.
MBA-00003-04	August 2005	Describes version 01.2x of the CSS.
MBA-00003-05	December 2005	Describes version 2.0x of the CSS. This adds the analog gateway, encryption support, and a configurable preamble.
MBA-00003-06	May 2006	Describes version 2.1x of the CSS. This adds support for an antenna relay, configurable digital inputs and outputs, the ability to separately configure RF repeat and simplex/duplex voting.

Part A Introduction

The Customer Service Software (CSS) is a Windows-based software program that makes it easy to monitor and configure a Tait TB9100 base station. You can also use it to carry out diagnostic tests and to update the base station's firmware.

The CSS can also work with an analog gateway. Where the term 'base station' is used in this manual, it can often be taken to include the analog gateway as well.

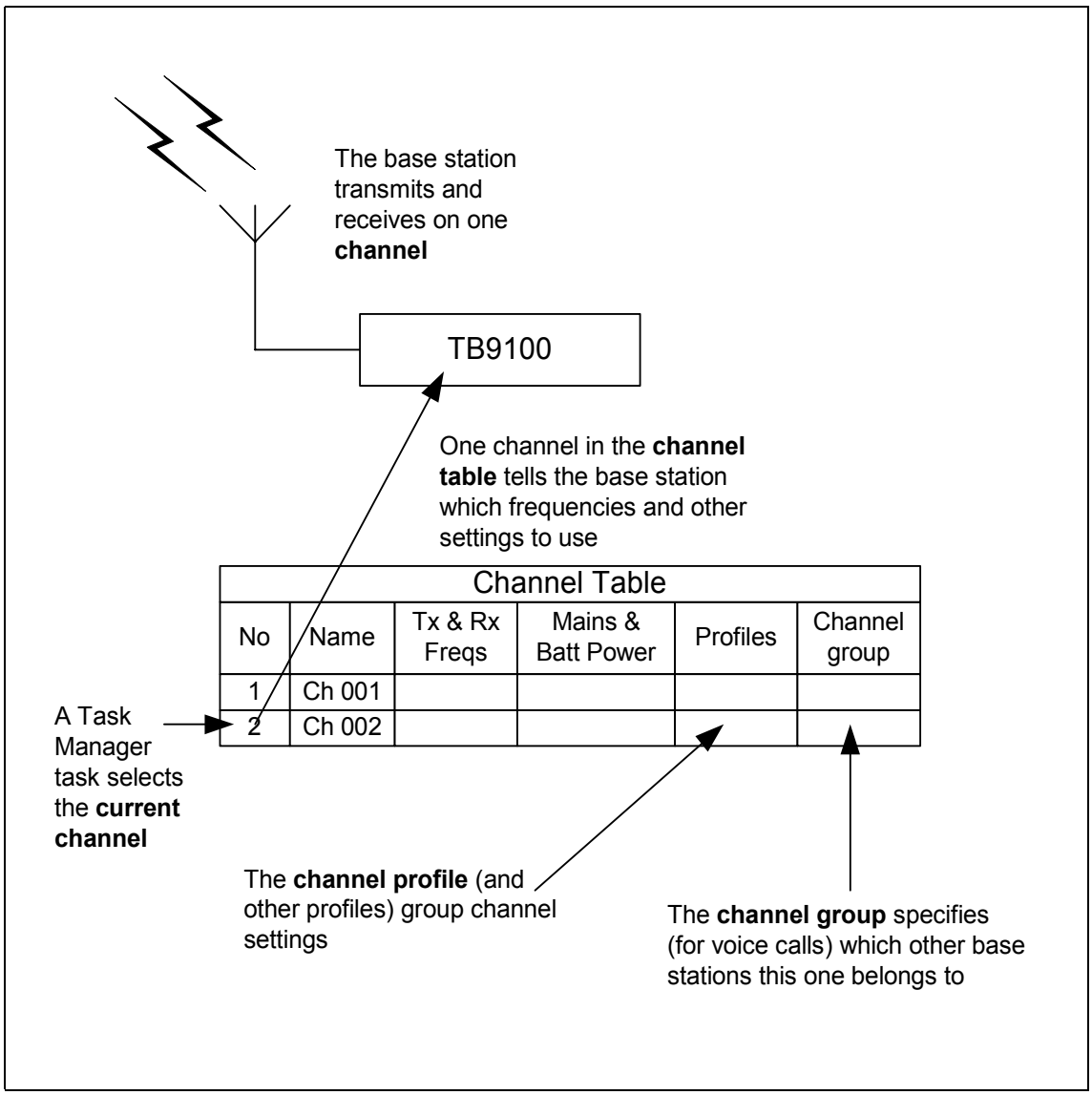
The introduction explains concepts that are fundamental to the base station and analog gateway. You need to understand them before you can use the CSS effectively.

Topics

Channels

A TB9100 base station consists of the equipment needed to operate on just one channel. However, using the CSS you can program up to 255 channels into a single base station. This is confusing, until you realize that 'channel' has different meanings. The one channel is the transmit and receive frequency pair and the 255 channels are different channel configurations, each with its own number and name. Task Manager selects one of these channel configurations and the base station operates according to the settings in it. These consist of a transmit and receive frequency pair and many other settings, grouped into a number of profiles. The presence of many channels means that base station operation can be modified in any of a large number of ways simply by changing to a channel with the desired settings.

Figure 1: Channel terminology



Channel table

Each base station has a channel table. This is the database that stores the channel configurations. It is a good idea to maintain a single channel table for your network of TB9100 base stations. This means that you can use almost the same configuration file for all base stations. To configure a new or replacement base station, all you need to do is copy the standard configuration file and make a few modifications, for example to the Task Manager statements that select the current channel. Working from one configuration file simplifies maintenance.

Current channel

The current channel is the channel that the base station is actually using. Task Manager action selects the current channel and Monitor > Interfaces > RF Interface displays it.

Note: If the base station is reset, it starts up on the channel that Task Manager selects on going to Run mode.

Profiles

Profiles are groups of settings that configure a base station interface.

Channel and signaling profiles

These profiles configure the RF interface. The channel profile determines which modes the receiver supports and (for analog mode) receiver gating and channel properties. The signaling profile determines the NAC, any subaudible signaling, and transmit tail timers.

Calling profile

The calling profile determines the properties of the analog line as a virtual radio: the mode it uses when transmitting, its individual ID, and the group or individual that calls are addressed to. The groups it listens to are determined by the group membership assigned to the calling profile. The calling profile also determines whether calls are encrypted and what key is used.

Channel group

The channel group specifies the group of base stations that this base station belongs to. It determines the multicast IP address that the digital line sends to and receives from. It also configures voting.

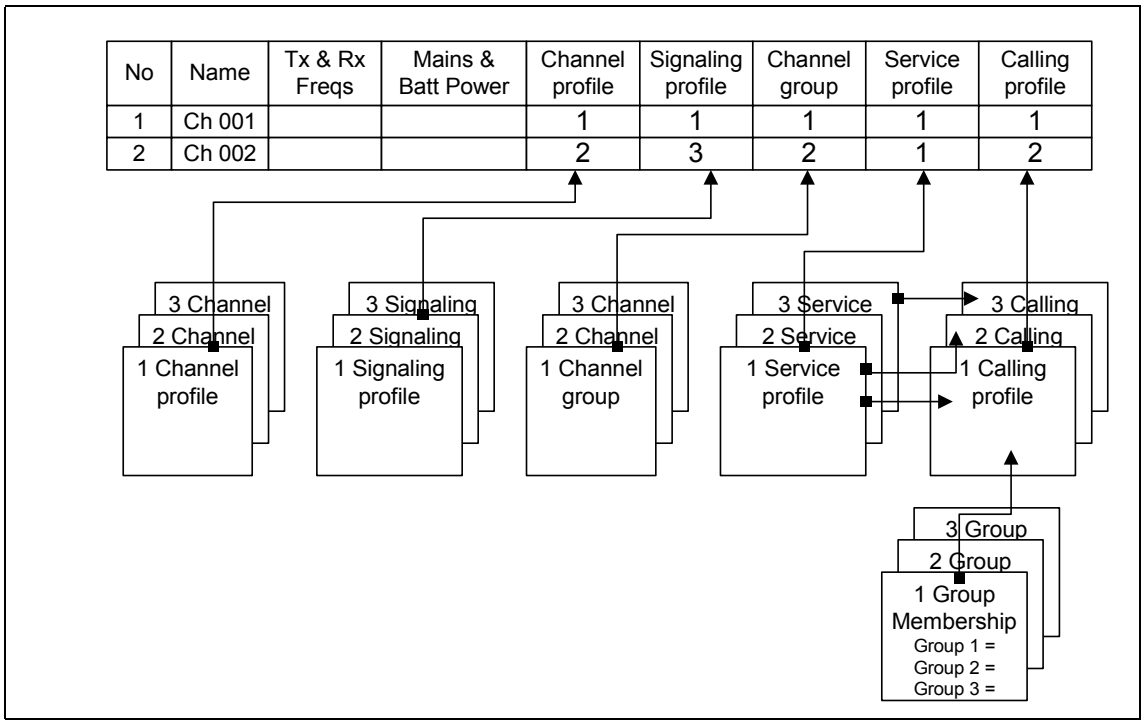
Service profile

The service profile determines which digital P25 services are allowed. One service profile can be applied to the RF input and another to the analog line input.

Assigning profiles to a channel

Each channel in the channel table must be assigned a set of profiles. Using profiles simplifies the work of defining channels. Channels have a large number of configuration settings. Instead of configuring them all each time you set up a channel, you configure sets of them in profiles. Whenever a different setting of a particular configuration parameter is needed, you create a new profile. In this way, you establish several profiles for each profile type, any of which can be selected when defining a channel. Figure 2 shows how different profiles are assigned to channel 2 in the channel table.

Figure 2: Profiles assigned to a channel in the channel table



Receiver Squelch

The TB9100 supports three basic types of squelch operation. In normal squelch, the receiver unmutes if the voice signal has the correct Network Access Code (NAC) or subaudible signaling. Selective squelch unmutes only if the voice signal is addressed to a specific group or individual. Monitor squelch unmutes to almost anything. In addition, for normal and selective squelch in analog FM mode, the receiver only unmutes if the voice signal exceeds the configured RSSI and/or SINAD levels. You set these levels in channel profiles (Receiver gating area).

The following describes the different types of squelch operation and how to configure the TB9100 for them.

Normal squelch

In digital P25 mode, the receiver accepts one particular NAC. When an incoming signal has that NAC, the receiver unmutes. In analog FM mode, the receiver is configured with subaudible signaling (see "Subaudible Signaling" on page 7). The receiver only unmutes if it detects the specified CTCSS tone or DCS code. You select the NAC, CTCSS, and DCS in signaling profiles.

Selective squelch

The base station as a whole does not apply selective squelch. The analog line can, in digital P25 mode. This is necessary, because analog console systems cannot understand P25 signaling. Accordingly, the analog line's calling profile lets you choose selective squelch.

In analog FM mode, selective squelch is achieved by MDC1200 or Selcall signaling. The analog line simply passes this signaling through. Selective squelch must be provided by the connected console system, only responding if a configured MDC1200 or Selcall address is received.

Monitor squelch

Monitor squelch is required so that the dispatcher can monitor the channel. For received analog FM signals, monitor squelch simply provides the demodulated output, irrespective of its subaudible signaling. For received digital P25 signals, monitor squelch provides any recognizable voice signal addressed to any group or individual. To set up monitor squelch, you use a calling profile with normal squelch and use Task Manager to lock the decoding of the NAC and subaudible signaling, so that these squelch mechanisms are bypassed.

Subaudible Signaling

In analog FM mode, the TB9100 base station can transmit and receive using subaudible signaling. Both CTCSS tones and DCS codes are supported. CTCSS attaches a subaudible tone to the carrier signal. DCS attaches a digital code. A receiver programmed with a particular tone or code will not unmute unless that tone or code is presented with the RF signal.

CTCSS tones and DCS codes are referred to collectively as subtones. Subtones make it possible for different groups of users to operate on the same channel without hearing or disturbing each other. The base station and the radios that use it need to be programmed with the same subtone(s).

Important: In some parts of the world, the use of subtones is regulated. You need to confirm with the regulatory authority in your region whether and how you can apply subtones.

Assigning subtones

You assign a receive and a transmit subtone to signaling profiles, then assign a signaling profile to a channel by editing the channel table. When the base station is operating on that channel, it opens the receiver gate to signals with the receive subtone and transmits using the transmit subtone.

Matching DCS codes

Matching the base station's DCS code to the code programmed into a group of radios can be tricky. This is because the polarity of a DCS code can become inverted. For example, a radio has a DCS code of 017 but the base station may need to be programmed with 050 (017 inverted). Use simple trial and error to see which code works.

Advanced options

When using DCS, the base station always transmits a DCS end tone for muting the receive audio, but transmitting a CTCSS reverse tone burst is optional and configurable.

RF Repeat Function

A repeater re-transmits what it has received on its RF interface. In the TB9100, this repeat function is enabled by default but it can be disabled or put under the control of the dispatcher. When the repeat function is enabled, a standalone TB9100 repeats what it receives, unless it is handling a call from the dispatcher or the maintainer at the control panel microphone.

Repeat function of a channel group

If the TB9100 is part of a channel group, the repeat function is modified. Instead of only repeating what it receives on its RF interface, the base station repeats the vote-winning signal out of all the valid RF signals that the base stations in the channel group receive. A distributed voting process (each base station has its own built-in voters) selects the signal to repeat. In effect, the channel group is a wide-area repeater; each base station in the channel group repeats the same signal.

If a dispatcher call is in progress, the channel group broadcasts it and does not repeat any radio calls. However, if the call group is duplex, the vote-winning radio call is forwarded to the dispatcher.

Configuring the repeat function

The repeat function can be enabled or disabled in the channel table.

Alternatively, the repeat function can be put under dispatcher control, so that the dispatcher can turn it on and off as needed. When a dispatcher command enables the repeat function, the dispatch equipment sends a tone remote function tone to an analog line. Task Manager detects the tone and enables the repeat, as well as propagating the command to the other members of the channel group so that they also enable repeat.

It is not possible to configure a base station in a channel group to only repeat its locally received RF; it can only repeat the vote winner.

Normally, all base stations in the channel group have the same repeat setting. However, it is possible to generally enable repeat yet disable it in individual base stations (for example, those on solar-powered sites) without disrupting channel group operation.

If pin 1 of the system interface is configured for antenna relay and the receive and transmit frequencies are the same, the base station will not attempt to repeat.

Task Manager

Task Manager is a powerful processing engine that adds intelligence to each base station, enhancing its flexibility and configurability. Part of the firmware running on the reciter's digital board, Task Manager is able to respond to various inputs or operating parameters. Task Manager monitors a wide range of base station parameters. If one of them changes, Task Manager can take appropriate action, for example by changing channel, setting the digital output, or locking a function. A locked function cannot operate.

What action (if any) Task Manager takes depends on the tasks it has been given. Using the CSS, you are able to define these tasks. Tasks are statements in a very simple programming language. Tasks say what action is to be carried out when a monitored parameter changes. All tasks have one of two forms:

IF input, THEN action

IF NOT input THEN action.

For example:

IF **Tone remote detected (550)** THEN **Go to Channel 3**.

This means that when the analog line receives a tone remote function tone of 550 Hz, the base station changes to channel 3.

To define a task, you combine an input with an action, using an intuitive set of drop-down menus. No programming expertise is required. The list of tasks, defined in this way, is the 'computer code' that Task Manager processes. In effect, this means that you can modify the base station's firmware-based operation without needing to compile new firmware.

Task Manager is essential for selecting a channel. Task Manager actions can select a channel whenever the base station enters Run mode, when a tone remote function tone is received from the console system, or when the combined value of selected digital inputs changes.

Task Manager is also essential for letting the other base stations in the channel group know that a dispatcher command has been received, so that they can respond accordingly.

Task Manager only operates when the base station is in Run mode.

Alarms

The base station monitors a large number of conditions. When a condition rises above or falls below a defined threshold, the base station generates an alarm and stores it in its log. Using the CSS, you can view the current status of all alarms (Monitor > Alarms > Status) and a log containing recent alarms (Monitor > Data Logging > System Log).

You can also disable any alarms that you do not want (Configure > Alarms > Control).

Most alarms indicate a fault condition, but some are generated by conditions external to the base station, such as mains power failure or high BER on the RF input.

The base station can send alarm (and other) messages to a central message collector.

All alarms are inputs into Task Manager. You can create tasks that tell the base station what to do when an alarm is triggered.

Data Logging

The TB9100 logs events such as alarms, calls, Task Manager actions, and signaling events in syslog format. The **system log** (up to 1000 records) stores events at level Notice and above. The **trace log** (up to 1000 records) stores events at Information level. Using the CSS, you can view these logs and save them to a file.

If the TaitNet P25 network is set up with a PC running syslog collector software, you can configure the base station to send syslog messages to it. In the CSS (Configure > Alarms > Logging), you specify the IP address of that PC and select a significance level. Messages with that level or higher are sent and messages below that level are not.

In addition, the CSS has its own log: Application.log (the log of the previous CSS session is Previous application.log). These log files are in the Log Files folder and you can view them in a text editor.

Analog Gateway

The CSS can configure and monitor analog gateways as well as TB9100 base stations. An analog gateway has a 4-wire E & M analog line and an IP/Ethernet digital line. The digital line is connected to the TaitNet P25 network and the analog line is connected to an analog console system. This provides the console system with a connection to one channel group.

The analog gateway makes it possible for legacy console systems to be used with Tait digital P25 infrastructure equipment. It also serves as an encryption/ decryption point.

Each base station also has a 4-wire E & M analog line and can therefore carry out gateway functions. However, in systems with encryption, analog gateways are normally preferred, so that encryption and decryption occur as close as possible to the end points of the message path.

Analog lines are only available in digital P25 mode if they are enabled by an analog line license. Additional licenses are required for MDC1200 signaling and for encryption.

The analog line could also be used to connect another base station, voting equipment, or recording equipment. Generally, this manual assumes that a console system is connected to the analog line and that the analog line is part of an analog gateway if encryption is used.

Configuration of the analog line determines the following:

- What type of signaling is used (E & M, keytone, tone remote function tones, MDC1200).
- Whether calls originating from the analog line are transmitted as analog FM or digital P25 calls.
- What source ID is given to calls originating from the analog line, when they are transmitted in digital P25 mode.
- Which calls are passed to the analog line (which individual ID and group IDs are assigned to the analog line).
- Whether calls are encrypted and which encryption key is used.

The last four settings are grouped as the calling profile.

From the point of view of the radio network, the analog line can be thought of as a logical radio. It is an end-point for calls. It has an individual ID and can belong to a number of talk groups.

Base Station Security

The security of the TB9100 is protected at the base station and at the CSS. The base station is protected through a password. The CSS is protected through access codes to privileges. Both protections are optional.

By default, the base station has no password, but you can use the CSS to give it one. The CSS then remembers the password. Each time you connect to the base station, the CSS must authenticate itself to the base station.

The CSS has three different privileges: Guest, Maintainer, and Administrator. When you start the CSS, you automatically have the Guest privilege. If access codes have been set, when you try to carry out an operation requiring the Maintainer or the Administrator privilege, you are asked for the corresponding access code. If access codes have not been set, you automatically have all privileges. An icon on the toolbar indicates your current privileges.

Access codes can be set at installation time or during any CSS session.

The following operations require Maintainer or Administrator privileges:

Operation	Maintainer	Administrator
Save configuration files	X	
Program base station configuration	X	
Change base station mode	X	
Perform diagnostics	X	
Change base station password		X
Reset base station	X	
Edit connections file	X	
Download firmware	X	
Enable additional features	X	
Change privilege access codes		X
Zeroize encryption keys	X	

All other operations only require Guest privilege.

Software Feature Enabler

The TB9100 base station has many capabilities, but some of them require a license before you can use them. Generally, base stations are delivered with one or more features already enabled. The CSS lets you enable (license) additional features that you require. The following features are available:

Default radio system The Default radio system feature makes it possible for the base station to transmit and receive analog FM transmissions.

P25 common air interface The P25 common air interface feature makes it possible for the base station to transmit and receive P25 digital voice transmissions.

Note: If neither of the above features are enabled, the base station can operate in Standby mode but not in Run mode.

Analog line The Analog line feature makes it possible for the base station to make digital P25 calls from the analog line and to pass received digital P25 calls to the analog line. This license is not needed for analog FM mode or for TSBKs.

Digital line The Digital line feature makes it possible for the base station to send and receive voice data streams over the digital line. This feature is not needed for CSS communications via the digital line.

Networked user data The Networked user data feature makes it possible for the base station to pass user data between its RF interface and an IP address, via the digital line. This feature does not require the Digital line feature to be enabled.

MDC1200 signaling The MDC1200 signaling feature makes it possible for console systems to use MDC1200 signaling to communicate with radios that are operating in P25 digital mode. (You do not need a license for this feature to use MDC1200 signaling in analog FM mode: the base station passes such signaling on transparently.)

Transmit enable The Transmit enable feature is normally licensed. Without it, the base station is unable to transmit. Analog gateways and receive-only base stations do not need this license.

Base encryption The Base encryption feature makes it possible for the analog gateway to encrypt and decrypt speech using the DES algorithm.

AES encryption The AES encryption feature makes it possible for an analog gateway with a Base encryption feature to also encrypt and decrypt speech using the AES algorithm.

Part B Getting Started

To establish a CSS session with a base station, you must first connect to it using the CSS software. If the CSS PC is physically connected to a TaitNet P25 network, you can connect to any base station in the network.

In a CSS session, you can monitor the base station and carry out diagnostic tests. You can also view the base station's configuration and modify it.

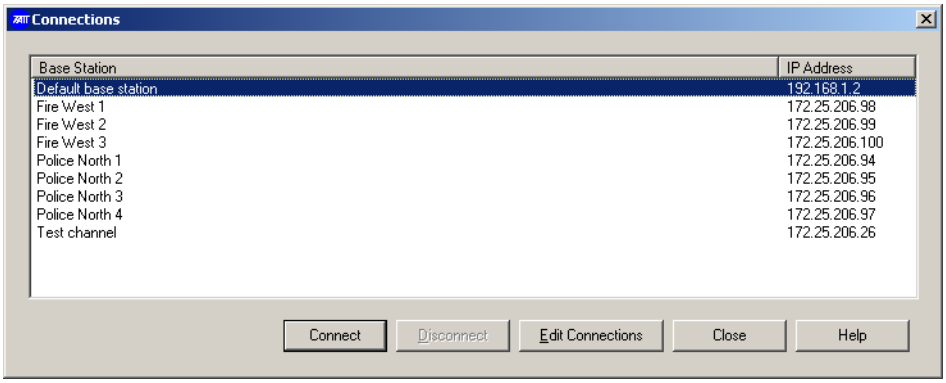
Topics

Connecting

The following instructions describe how to routinely connect a CSS to a base station. For more details, see "Connecting" on page 28 and for information about connecting to a base station for the first time, see the Installation and Operation Manual.

To connect to a base station

1. If the CSS is not already running, select Start > Programs > Tait Programming Applications > TB9100 CSS v2.02.01 > TB9100 CSS.
2. Make sure that the PC running the CSS is connected via an Ethernet cable to a hub on the TaitNet P25 network or directly to the TB9100's digital line.
3. On the toolbar, click the **Connect** icon. The Connections dialog box appears.



4. Select a row in the list of base stations. If the base station's IP address has not been changed, select 'Default base station.'
5. Click **Connect**.
   If you are asked for a base station password and one hasn't been set, just click OK.

   The CSS establishes a connection to the base station you specified. The Status bar displays 'Connected.'

You can now monitor the base station, conduct diagnostic tests, and read and modify the base station's configuration.

Monitoring Alarms

When you are connected to a base station, the CSS regularly polls the base station for alarms. If an alarm is detected, a flashing Alarms icon appears in the status bar. If the Alarms icon disappears, the CSS has detected that the alarm was cleared.

To monitor alarms

1. Check the status bar. If it has a flashing Alarms icon, click the Alarms button on the toolbar. This opens the Status form.

2. Look to see which LED is flashing red. A flashing LED means that the alarm is on. One problem can set off more than one alarm. A gray LED means that the alarm has been disabled (Configure > Alarms > Control) or that the function it monitors is unavailable.

Note: Many monitoring forms have an Alarm status LED, which indicates whether the module has any active alarms.

Monitoring the Base Station

Once you are logged on to a base station, you can monitor various aspects of it.

To view a monitoring form

1. On the toolbar, click **Monitor**. The navigation pane displays a menu of options.
2. In the navigation pane, click a subheading (for example 'Reciter').

   The main part of the CSS window displays information relevant to the subheading.

Options

- To view the current status of all base station alarms, select Monitor > Alarms > Status.
- To see what is happening at a base station interface, select an item under Interfaces.
- To see what is happening inside a base station module, select an item under Modules.
- To view the contents of a log that the base station has recorded, select an item under Data Logging.

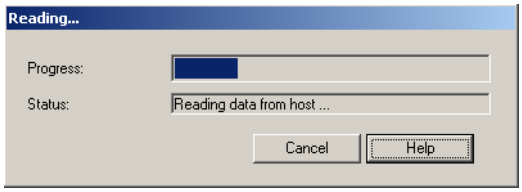
Viewing Configuration Settings

From the CSS, you can view a base station's configuration settings. This information must be read after you have logged in to the base station.

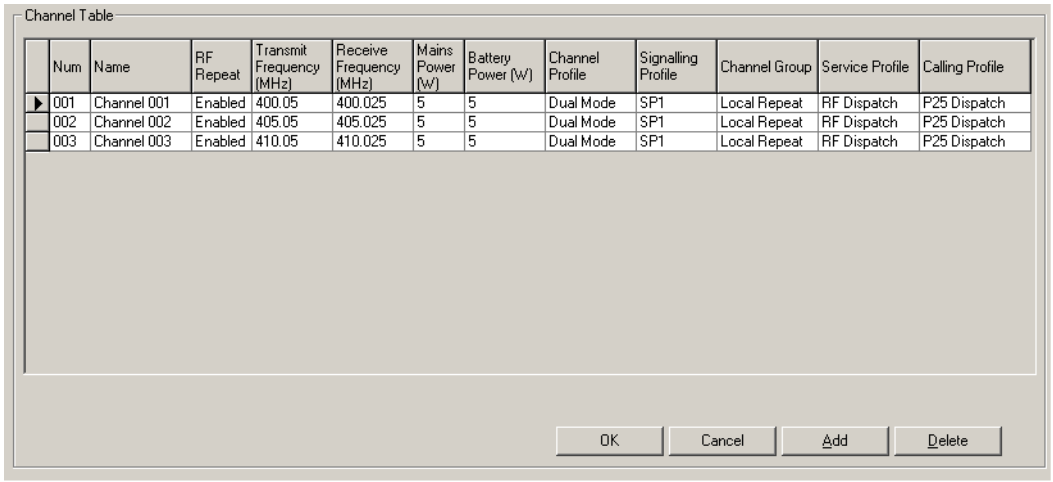
To view configuration settings

1. On the toolbar, click **Read**.

   The Reading dialog box displays progress.



2. On the toolbar, click **Configure**. The navigation pane displays a menu of options.
3. In the navigation pane, click a subheading (for example 'Channel Table'); the main part of the CSS window changes to display the corresponding form.



In this way, you can view any aspect of the base station's current configuration.

Diagnosing Problems

From the CSS, you can carry out a variety of tests on aspects of the base station you are logged on to. These can help you diagnose any problems you may be experiencing.

To carry out a diagnostic test

1. On the toolbar, click **Diagnose**. The navigation pane displays a menu of options.
2. In the navigation pane, click a subheading (for example 'Self Tests'); the main part of the CSS window changes to reflect your selection.
3.  If the rectangle beside the **Start Test** button is yellow and gray, click **Standby** on the toolbar to put the base station in standby mode.
4. Click **Start Test**. View the results of the test on-screen.
5. If necessary, click **Stop Test**.
6. Return the base station to Run mode.

Part C Basic Tasks

Before you can get down to the real work on a base station, you need to know how to carry out basic tasks such as setting up a connection, changing the base station's mode, or reading configuration information.

The Basic Tasks section explains in detail how to do these and other preliminary tasks.

Topics

Using the Customer Service Software

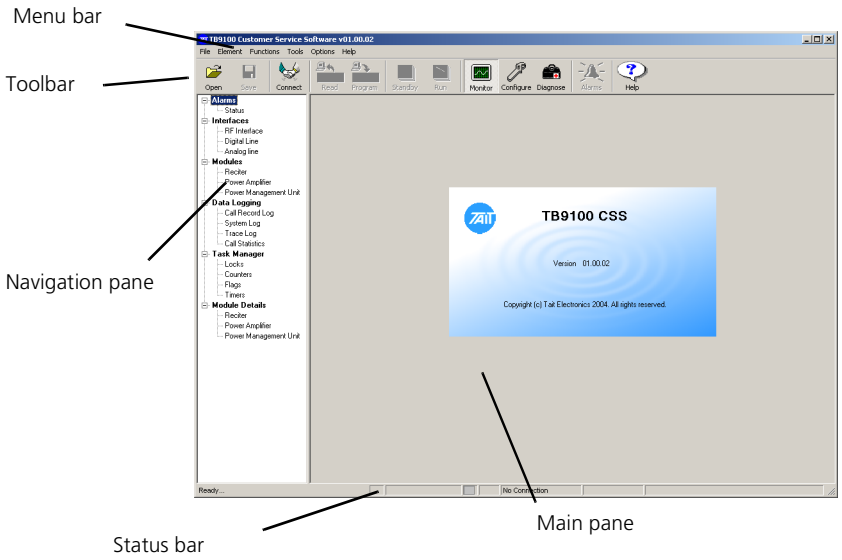
The following topics describe starting the CSS, the application window, the toolbar and the status bar.

Starting the CSS

To start the CSS software, select Start > Programs > Tait Programming Applications > TB9100 CSS v2.02.00 > TB9100 CSS.

Application window

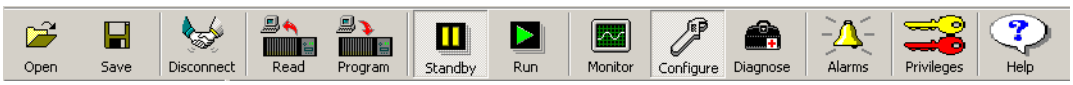
When you start the CSS, a splash screen appears, followed by the application window.



By default, the Monitor icon on the toolbar is selected and the navigation pane gives you options for monitoring. When you click an item in the navigation pane, the main pane displays the corresponding form.

Toolbar

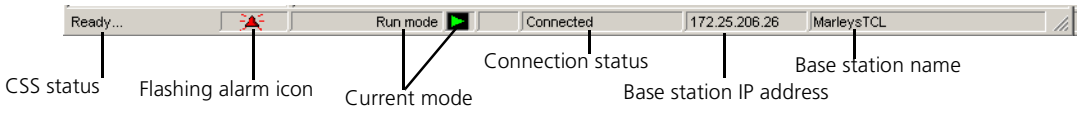
The toolbar gives you quick access to commonly used menu commands. For example, instead of selecting Functions > Configure, click the Configure icon on the toolbar.



Open	Lets you open a configuration file that is stored on the CSS computer.
Save	Saves the open configuration. When saving a configuration file for the first time, you are asked to give it a name.
Connect	Opens a dialog box that lets you connect to a base station. See also "Connecting" on page 28. If you are connected, this icon displays 'Disconnect.' Click it to disconnect from the base station.
Read	Reads in the configuration information of the base station you are connected to. See also "Working with Configurations" on page 34.
Program	Sends the whole set of configuration information in the CSS to the base station. The base station must be in Standby mode. Once the configuration has been programmed, the base station operates using that configuration. See also "Working with Configurations" on page 34.
Standby	Puts the connected base station into Standby mode.
Run	Puts the connected base station into Run mode.
Monitor	Displays the Monitoring navigation pane so that you can monitor the connected base station. See also "Monitoring the Base Station" on page 19.
Configure	Displays the Configuration navigation tree, so that you can view and edit configuration information. If a configuration is not already selected, you are first given the option of creating a new configuration, opening an existing one, or reading the base station's current configuration. See also "Viewing Configuration Settings" on page 20.
Diagnose	Displays the Diagnose navigation tree, so that you can carry out diagnostic tests on the connected base station. See also "Diagnosing Problems" on page 21.
Alarms	Turns red when any base station alarm is triggered. Click Alarms to display the current status of all base station alarms. See also "Monitoring Alarms" on page 141.
Privileges	Displays your current privileges. If the icon is disabled, you have Guest privilege. If the upper key is yellow, you have Maintainer privilege. If the lower key is red, you have Administrator privilege. Click Privileges to change privileges. See "Changing Privileges" on page 46.
Help	Displays a Help topic for the form you are currently in.

Status Bar

The status bar provides you with useful information that supplements the display in the main pane.



Panels in the status bar provide the following:

- CSS status information, for example whether the CSS is reading or programming a configuration. 'Ready' means that the CSS has completed the last user request and is ready to respond to another request.
- Flashing alarm icon (when an alarm is triggered).
- The mode that the base station is currently in (Run or Standby).
- Whether the CSS is connecting, connected, or not connected to a base station.
- The IP address of the base station.
- The name of the base station.

Base Station Operations

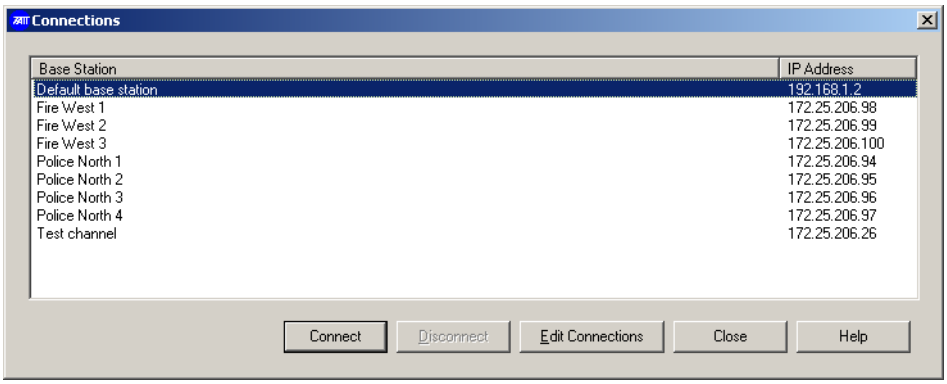
The CSS can connect to any base station in the TaitNet P25 network. Once connected, you can change the base station's operating mode or its password. If the base station is not operating correctly, you can reset it.

Connecting

Before you can work with a base station, you must connect to it. A connection establishes a communication session with the base station. Data can go back and forth, for example, to display monitoring information or to carry out a diagnostic test. However, a further step is necessary before you can work with configuration information: you must read the base station or open a configuration file, even to view the configuration forms.

To connect to a base station

1. Ensure that the CSS PC is connected physically to the base station. It can be connected by an Ethernet cable to a hub on the TaitNet P25 network or directly to the base station's digital line. For the direct connection, an ordinary or a crossover Ethernet cable can be used; the digital line supports both.
2. Ensure that the CSS PC has a suitable IP address and subnet mask. The network administrator can help you with this. You may need to vary the settings of your local area connection, depending on whether you are on site or in the office. See also "Connecting a Networked PC to a Base Station" on page 29. You may also need to tell the PC how to route to the TaitNet P25 network, see "Defining Routes for a Networked PC" on page 29.
3. Run the CSS software.
4. On the CSS toolbar, click **Connect**. The Connections dialog box appears and displays a list of base stations that you can connect to.



5. Click on the row with the base station name and IP address. If the base station is not in the list, click **Edit Connections** and add it. (See "Maintaining the Connection List" on page 39 for instructions).
6. Click **Connect**.

   If the CSS does not know the base station password, you are asked to supply it.

If the base station is new, don't enter anything; just click OK. This is because base stations are supplied with a null password. (When you make subsequent connections, you will not be asked for a password, because the CSS now knows that the base station password is null.)

If you want to set a base station password, wait till you are connected, and then select Element > Change Base Station Password. You can only set the password after you have connected to the base station.

Once the connection is established, 'Connected' appears in the CSS status bar. If there is a connection icon in the system tray, it indicates whether there is any network traffic. Hovering the mouse over it pops up information about the connection speed and the number of packets sent and received.

Note: The base station can only have a single CSS session at any one time. If you are connected, this prevents other CSS users from connecting.

Defining Routes for a Networked PC

You may need to define routes so that the PC uses the correct IP routing path to the TaitNet P25 network. Without a correct entry in the network routing table, the CSS will be unable to remotely connect to the base station. You can provide this using the 'route' command. The operating system Help gives assistance on the use of this command.

To define a route

1. Select Start > Run.
2. Enter cmd.
3. At the command line prompt, enter route print.
4. If the displayed list of persistent routes at the bottom of the output does not provide a route to the TaitNet P25 network, add one or more persistent routes in the format:

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

   For example:

   route -p add 172.16.16.0 mask 255.255.240.0 172.25.206.252

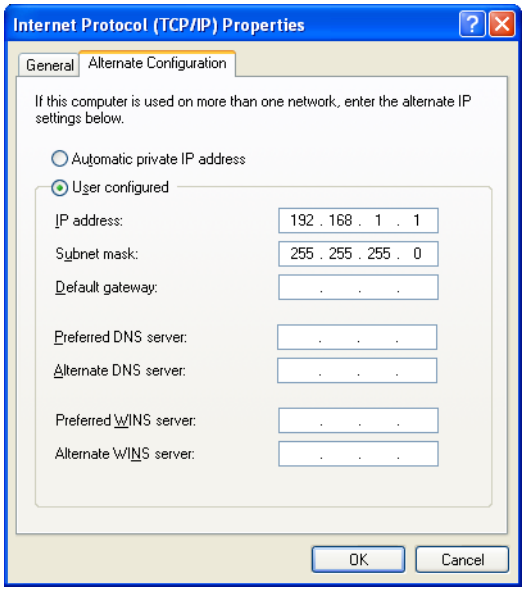
Connecting a Networked PC to a Base Station

You may want to temporarily disconnect a networked PC from its LAN in order to be able to establish a direct connection with the TB9100. A physical connection is needed as well as an alternate (Windows XP) or temporary (Windows 2000) IP address and subnet mask.

To connect from a PC with Windows XP professional

1. Remove the local area Ethernet connection and connect an Ethernet patch cable between the PC and the TB9100. (Either a straight through or crossover Ethernet patch cable may be used with the current TB9100 software.)
2. Click Start > Control Panel.
3. Double-click **Network Connections**.
4. Double-click the Local Area Network icon.
5. Click **Properties**.
6. Click Internet Protocol (TCP/IP), and then click **Properties**.

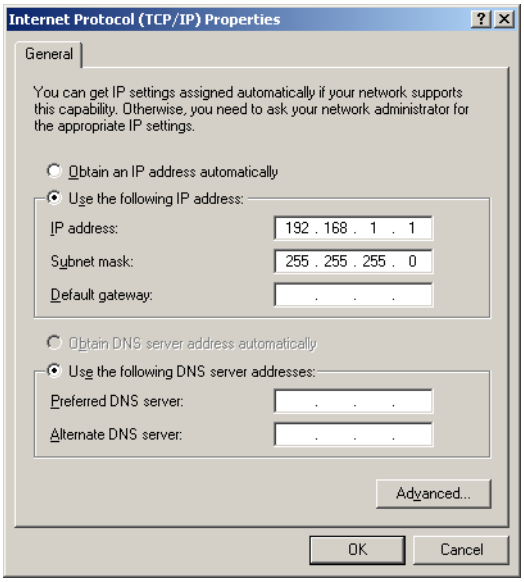
7. Click Alternate Configuration.
8. Select the User configured option, and then enter a number that is on the same subnet as the TB9100 base station. For example, if the TB9100 has IP 192.168.1.254, enter 192.168.1.1 for the PC.
9. Enter a suitable subnet mask, for example 255.255.255.0.



   The CSS should now be able to connect to any physically connected base station that is on the same subnet.
10. When you have finished the CSS session, re-connect the local area network cable to the PC. The PC then uses its normal TCP/IP properties.

To connect from a PC with Windows 2000

1. Remove the local area Ethernet connection and connect an Ethernet patch cable between the PC and the TB9100. (Either a straight through or crossover ethernet patch cable may be used with the current TB9100 software.)
2. Select Start > Settings > Network and Dialup Connections.
3. Double-click the Local Area Connection icon.
4. Click **Properties**.
5. Click I**nternet Protocol (TCP/IP)**, and then click **Properties**.
6. Note the current settings so that you can restore them later.
7. Select **Use the following IP address**, and then enter a number that is on the same subnet as the TB9100 base station. For example, if the TB9100 has IP 192.168.1.254, enter 192.168.1.1 for the PC.
8. Enter a suitable subnet mask, for example 255.255.255.0.



The CSS should now be able to connect to the base station.

9. When you have finished the CSS session, re-connect the local area network cable to the PC and then restore the original PC configuration. When you close the Network connection dialog box, the restored configuration is applied.

Troubleshooting Connection Problems

If your attempt to connect to a base station failed, consider these possible causes.

1. You have just switched the base station on and it is not yet ready. Try again.
2. Another CSS is connected to the same base station. A message is displayed indicating this.
3. Another CSS was connected to the same base station and the session did not complete properly. Wait one minute and try again.
4. You have just calibrated the base station. The base station is still in calibration mode and cannot respond to connection requests. Reset the base station.
5. You are attempting to connect to the wrong IP address. Check that you are using the correct IP address.
6. The base station is not yet using the IP address you are attempting to connect to. A previous session changed the base station's IP address. The base station configuration specifies the new address but the base station is still using the old IP address. Reset the base station.
7. The link to the base station is down. Use ping to check.
8. A router on the link uses network address translation. You need to connect using the router IP address, not the base station IP address.
9. The firewall is blocking access to the base station. Ask the system administrator to give you access.

Disconnecting

When you have finished working with a base station, click Disconnect on the toolbar. Alternatively, press F9 or select Element > Disconnect. You are now ready to connect to another base station.

If the base station is in Standby mode, you are reminded of this and asked to confirm that you want to proceed. This is to make sure that you do not inadvertently leave the base station out of service when you end a CSS session. You can select No to cancel disconnecting, and then change the base station's mode back to Run before disconnecting.

Changing Mode

Normally, the base station operates in Run mode. However, you must put the base station into Standby mode before you can carry out some functions.

- Run mode is used for normal operation.
- Standby mode takes the base station out of service. It is required if you want to program a configuration into the base station or carry out invasive diagnostic tests (for example to determine the lock range) on it. In Standby mode, the base station cannot repeat across its RF interface or send and receive on the digital line. This means that radios cannot talk to or hear each other. Dispatchers and radios also cannot talk to or hear each other. However, the control panel is still effective; the maintainer can talk to and hear radios. If the base station is in repeater mode, the maintainer can also talk to and hear any dispatcher connected to the analog line.

When you end a CSS session and the base station is in Standby mode, you are asked to confirm. This is so that you do not inadvertently leave the base station out of service.

To put a base station in Standby mode

1. Connect to the base station.

2. On the toolbar, click **Standby**. You are asked for confirmation.

   Once the base station has gone into Standby mode, the status bar displays the Standby icon. Functions such as programming a configuration into the base station are now enabled.

To put a base station in Run mode

1. If necessary, connect to the base station.

2. On the toolbar, click **Run**. The base station is now fully operational.

   If the base station cannot go into Run mode, the CSS displays an error code.

   Error codes 1 and 2: Check to see which alarms are displayed and take appropriate action.

   Error code 4: return the reciter to Tait.

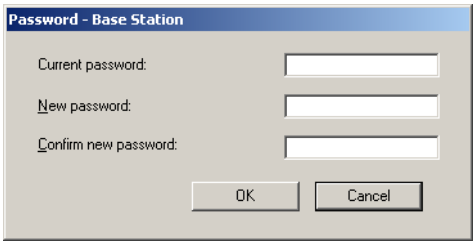
   Error code 10: The base station does not have the licenses that enable it to operate in Run mode. Obtain one or more licenses and use the Software Feature Enabler to let the base station operate in analog FM and/or digital P25 modes.

Assigning a Base Station Password

Each base station can be given a password to safeguard access to it. A CSS must know the password before it is able to connect to the base station. If you do not give the base station a password, any CSS can connect to it. If you assign or change a password, users of other CSS PCs will need it before they can connect to the base station.

To assign or change a base station password

1. Connect to the base station.
2. Select Element > Change Base Station Password.
3. If requested, provide the Administrator access code. The Password - Base Station dialog box appears.



4. If you are changing an existing password, enter that password. Otherwise leave the **Current password** box empty.

Note: If you have lost the base station password, contact your Tait dealer.

5. Enter the new password.
6. Re-enter the password in the next box.
7. Write down the new base station password and do not lose it: there is no other way to find out what a base station's password is.
8. Click **OK** to change the password and close the dialog box. The CSS sends the password to the base station and stores it in an encrypted form. It will use this password to authenticate itself when establishing a connection to the base station.
9. Inform any other CSS users of the password.

Resetting the Base Station

You can use the CSS to remotely reset the base station. This may become necessary if the base station stops functioning properly.

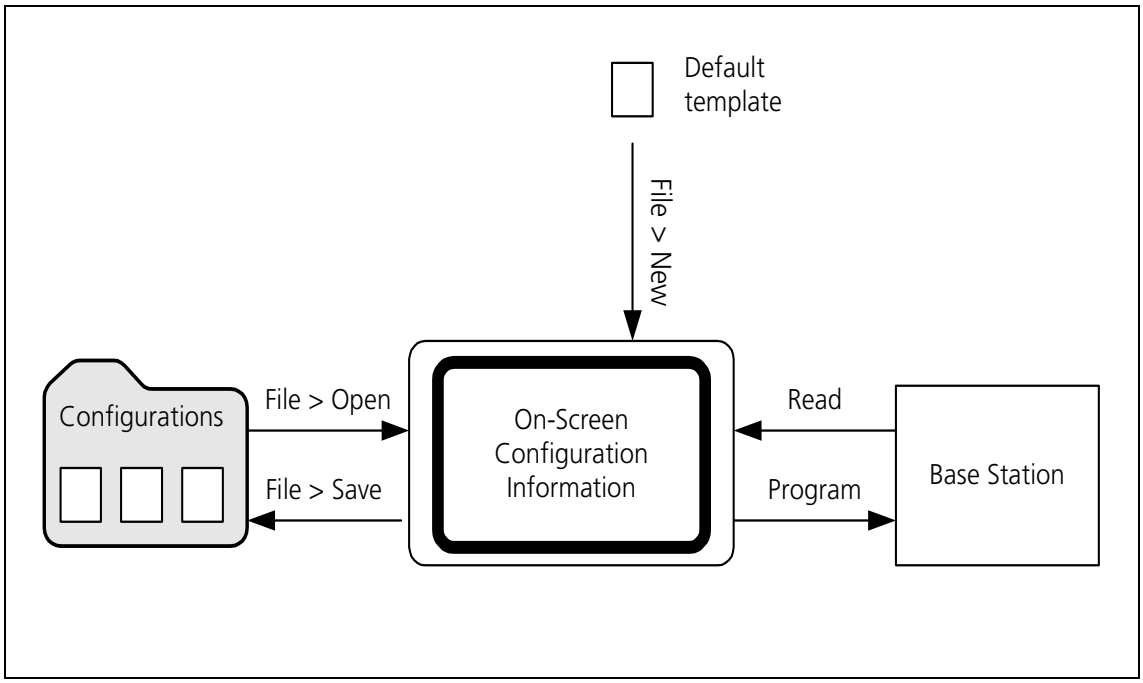
1. Select Element > Reset Base Station.
2. Wait for the base station to restart, and then connect to it again. If you attempt to connect before the control panel LEDs have been out for 10 seconds, the attempt will fail.

Working with Configurations

Base stations are programmed with many configuration settings. Using the CSS, you can view these settings, change them, and then program them into the base station.

- Configuration works differently from other CSS functions. Once you are logged on, you can monitor the base station but you can't yet view its configuration. First you must click the Read icon, which instructs the base station to supply its configuration information.
- Programming the base station with a new configuration can only be done when the base station is in Standby mode.
- It is a good idea to always save a configuration to file immediately before programming it into a base station.
- You can obtain configuration information from a base station, from a configuration file on disk, or from the default configuration template.

Figure 3: Obtaining and storing configuration information



Creating a New Configuration

You can create a new base station configuration from scratch, modify it, and save it as a new configuration. This means that you can define a configuration without being connected to a base station. This is a good way to learn how to use the configuration part of the CSS program. It also means that you can do all the work of configuring before a base station is delivered. When the base station arrives, you just open the configuration file and program it in. (This method completely overwrites the base station's current settings.)

To create a new configuration

1. Select File > New.

   The title bar displays Default.apt, indicating that the configuration is based on the default template and that you have not yet given the configuration a name and saved it.

2. Click **Configure** in the toolbar and make the desired configuration changes.

Reading a Base Station Configuration

Before you can view a base station's configuration settings, you must read them.

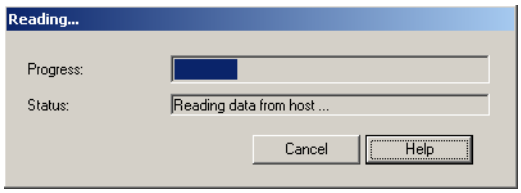
Note: Reading configuration settings overwrites any settings that the CSS has in memory. If you have opened a configuration file, save it first.

To read a configuration

1. Connect to the base station.
2. Click **Read**.

   The CSS reads the base station's configuration information.

   The **Reading** dialog box displays progress and gives you the option of canceling the process.



When reading the configuration is complete, click **Configure.** You can now view the current configuration settings, make any configuration changes, and save the configuration settings to a file. You can also put the base station into Standby mode and program it with the new settings.

Saving a Configuration

It is a good idea to regularly save your current configuration settings as you work on them. You should also save them just before you program them into a base station. In this way, you have a backup, in case the base station fails or its memory becomes corrupt.

To save configuration settings

1. After making any changes to configuration settings, click **OK** to confirm them.
2. Select File > Save or click **Save**.

   If the configuration settings are already named, they are saved. If not, the Save Configuration File dialog box appears and you must continue as follows:

3. Enter a name for the configuration file into the **File name** box.

4. If you want to save the configuration file somewhere other than in the Configurations folder, alter the default path.
5. Click **Save**. The name you provided appears on the title bar.

Programming a Configuration into a Base Station

To change a base station's configuration settings, you must make the changes using the CSS, and program them into the base station. Programming only affects the settings that you can view after clicking **Configure**.

To program a configuration into a base station

1. If you have made any changes to the current form, click **OK** to confirm them.
2. Make sure that the current configuration settings displayed in the CSS are what you want.
3. Connect to the base station (if you aren't already).
4. Put the base station into Standby mode.
5. Select File > Save to create a copy of the configuration settings as a file in the Configurations folder.
6. Click **Program**.
7. If the configuration in the CSS has a different IP address or subnet mask to that of the base station, you are asked for confirmation. Click **Overwrite** to change the base station's IP address or subnet mask. Click **Keep Existing** to program the configuration into the base station but keep the base station's existing IP address and network mask.

   The Program dialog box appears and indicates the download progress. When the base station has successfully received all the configuration settings and programmed them in, the dialog box closes.

   If the download is not completely successful, programming is aborted and a message appears. Later, you can open the file you saved and try again.
8. If you changed the base station's IP address or subnet mask, reset the base station so that the new parameters take effect.
9. Return the base station to Run mode.

Synchronizing a Configuration File

Synchronizing a configuration file with the configuration on a base station makes sure that the file has the same settings as are in the base station itself.

Tip: Synchronizing a configuration file is the quickest way to make a base station's configuration available to the CSS.

To synchronize a configuration file

1. Select File > Open and open the configuration file for the base station.
2. Connect to the base station and click **Read** on the toolbar.
3. Save the file.

Handling Older Configuration Versions

If you read a base station configuration (or open a configuration file) and its version is older than the CSS, a warning appears. This is because the CSS and the base station communicate configuration and monitoring data based on a database with a defined structure. If the base station and the CSS have the same version, they share the same database structure.

Generally speaking, it is best to use a CSS with the same version as the base station that you intend connecting to. Use an older CSS whose version matches the base station, or upgrade the base station firmware to match the CSS.

If you continue to work with an older configuration, the following occurs.

Reading an older configuration

If you read a configuration from an older base station:

- The CSS displays new data items and gives them default values.
- The CSS cannot display data items that have been subsequently removed. You cannot view or change them.

Programming

If you program this configuration back into the base station, the following occurs.

- The base station cannot store or use new items. They are ignored.
- Data items that are no longer supported by the new CSS remain unchanged.

If you save the configuration, the CSS saves it in the new configuration version.

Handling Newer Configuration Versions

If you read a base station configuration (or open a configuration file) and its version is newer than the CSS, a warning appears. This is because the CSS and the base station communicate configuration and monitoring data based on a database with a defined structure. If the base station and the CSS have the same version, they share the same database structure.

Generally speaking, it is best to use a CSS with the same version as the base station that you intend connecting to. Install the new CSS and use it; you can have many different CSS versions on your PC at the same time.

If you continue to work with a newer configuration, the following occurs.

Reading a newer configuration

If you read a configuration from a newer base station:

- The CSS cannot display new data items.
- The CSS displays data items that the base station no longer supports and gives them default values.

Programming

If you program this configuration back into the base station, the following occurs.

- The base station cannot store or use the data items that it no longer supports. They are ignored.
- New data items remain unchanged.

If you save the configuration, the CSS saves it in the old configuration version.

Working With Different Base Station Options

There are many variants of the TB91900 base station, consisting of different combinations of its modules. The following gives some guidance on how the different combinations affect the use of the CSS. For information about these base station options, see the TB9100 Installation and Operation Manual.

Base Station With External Power Supply

When a base station is used with a third-party external power supply, a PMU is not required. The Alarm Status form will report 'No PMU detected.' You can disable this alarm (Configure > Alarms > Control). This stops the control panel alarm LED flashing because of this alarm. You can edit power configuration settings (Configure > Base Station > Miscellaneous) but these have no effect. PMU control tests also have no effect.

Receive-Only Base Station

A receive-only base station has no PA and the reciter has no Transmit enable license. The Alarm Status form will report 'No PA detected.' You can disable this alarm and all other PA alarms (Configure > Alarms > Control). This stops the control panel alarm LED flashing because of this alarm. PA control tests have no effect.

CSS Tools

The Tools menu gathers together less commonly used operations.

Maintaining the Connection List

Select Tools > Connections to open the Connections List dialog box. This is a simple text editor that lets you maintain the list of base stations that the CSS can connect to. This list is stored in the host information file (conncfg.dat).

To add a base station to the list

1. Select Tools > Connections.
2. In the Connection List, enter the name of the base station and its IP address. Make sure that the same base station name is programmed into the corresponding base station (Configure > Digital Line > Network Identity). Your entry should have the following format:

   Base station name = 172.25.206.26
3. If desired, copy the file containing the connection list to all your PCs that run CSS.

Alternatively, you can use any text editor to edit the file.

Firmware Download

You can use the CSS to update the firmware of base station modules. This is a two-stage process. First the CSS downloads the firmware to the base station (this can be done in Run mode and does not affect base station operation). Then the base station takes itself out of service and activates the downloaded firmware. After activation, the base station resets itself.

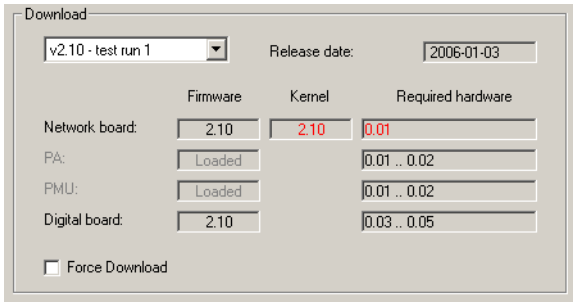
The base station is supplied with all necessary firmware, but it may become desirable to upgrade to a newer version. It is also possible to downgrade a module to an older firmware version to ensure compatibility with other base station modules. The CSS makes sure that the new firmware will not lead to incompatibility between firmware and hardware or between modules.

Firmware Download Form

The Firmware Download form (Tools > Firmware Download) displays information about the versions installed on the base stations and in the set of firmware that you select. It lets you initiate a download and monitors its progress.

Download

The Download area lets you select a set of firmware for downloading. It displays information about the firmware in the selected set and the hardware that it is compatible with.



The list box lets you select a set of firmware. The drop-down list displays the available firmware sets. (The CSS looks for firmware files in the folder specified by Options > File Folders.)

The rest of the Download area displays version numbers of the individual items of firmware in the selected set: Network board, digital board, power amplifier, and power management unit. It also shows the versions of hardware that the firmware can work with.

When you install the CSS, firmware for the different base station modules is copied into a folder that different CSS versions can access. A compatibility file is also copied over. Firmware versions are also available from the Tait support website.

Firmware

The version of the firmware in the set of firmware that you selected. 'Loaded' instead of a version number means that the firmware version in the selected set is the same as the firmware version already installed in the connected base station.

Kernel

The version of the network board's operating system kernel that is required for working with the network board firmware. A '-' means that there is no particular kernel version required. 'Loaded' means that the kernel version required is present on the connected base station. A red verion number means that the kernel version installed on the connected base station is incompatible with the network board firmware in the firmware set you selected. To upgrade the kernel, follow the instructions in TN-977b. This also upgrades the network board firmware.

Required hardware

The range of version numbers of hardware that is compatible with the corresponding firmware. Version numbers below the minimum or above the maximum displayed are not compatible.

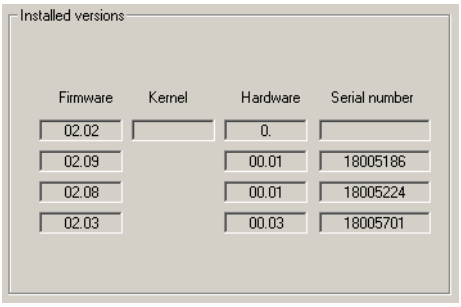
If the version numbers are displayed in red, the firmware version in the selected set is incompatible with the hardware or kernel version of the connected base station. You are unable to download.

Force download

When the Force download check box is selected and you click Download, all firmware files in the set are downloaded. When the check box is cleared, firmware files that display 'loaded' are not downloaded.

Installed Versions

The Installed Versions area displays the version numbers for firmware, kernel, and hardware that are currently installed in the connected base station. It also displays the serial numbers of each module.



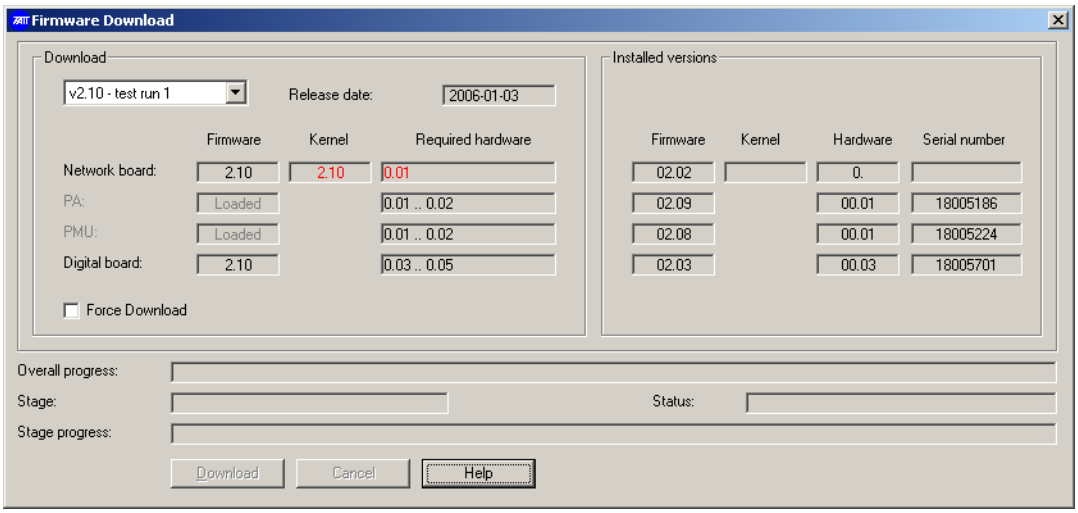
Downloading Firmware

A set of firmware files is copied into the CSS's Firmware Files folder at installation. More recent firmware can be obtained from the TaitWorld support site. You need to copy the file containing the set of firmware (firmware.exe) to the Firmware Files folder (the default location is C:\Program Files\Common Files\Tait Programming Applications\TB9100 CSS\Firmware Files) and run it to extract the individual firmware files.

Important: Save a backup copy of the base station configuration before downloading firmware. You will need this if the firmware download does not successfully complete on the first attempt.

To download new base station firmware

1. Run the CSS software and connect to the base station.
2. Read the base station's configuration and save it to a file, so that if necessary, you can restore it manually (see "Manually Updating the Configuration" on page 42).
3. Select Tools > Firmware Download. The Firmware Download dialog box appears.



The CSS obtains information about the base station's modules and displays it in the Current versions area.

4. Under **Download**, select the firmware file set you want to download. The version numbers of each firmware item in the set appear in the Download area. If the firmware item is already downloaded and activated, its display is disabled and shows 'Loaded.'
5. If Required hardware version numbers appear in red, the selected firmware is incompatible with the base station's current hardware. You cannot download the firmware.
6. If the Kernel version appears in red, you must first update the kernel. For instructions, see TN-977b.
7. If you want to download all items in the firmware file set, even if they are the same version as the firmware already on the base station, select the **Force download** check box.
8. Click **Download**.

   The CSS downloads firmware for the modules you selected. This is a background activity and can proceed while the base station is in Run mode. The bottom of the dialog box indicates progress.

   The base station sends its configuration to the CSS, which temporarily stores it. The base station then goes into Standby mode and activates the downloaded firmware by programming it into flash memory. The base station resets itself. The CSS waits 30 seconds for the base station to get up and running, then re-establishes the connection and loads the stored configuration back into the base station, adding any new data items used by the new firmware. The base station then begins operating with the new firmware and returns to Run mode.

Note: If the activation of a module fails, an alert informs you of this. If you have no backup of the current configuration, contact your Tait dealer. If you do have a backup, you can repeat the download procedure. When that is completed, you must manually restore the configuration, see "Manually Updating the Configuration" on page 42.

9. Re-open the Firmware Download form and verify that the base station has the new firmware versions.
10. Check the Release Notes for new data items added by the firmware upgrade. New data items are given default values designed to give safe, expected behavior, but in particular systems they may have undesirable effects. Check that they are appropriate and change them if necessary.
11. Save the configuration (do not overwrite the old configuration file) and program it back into the base station.

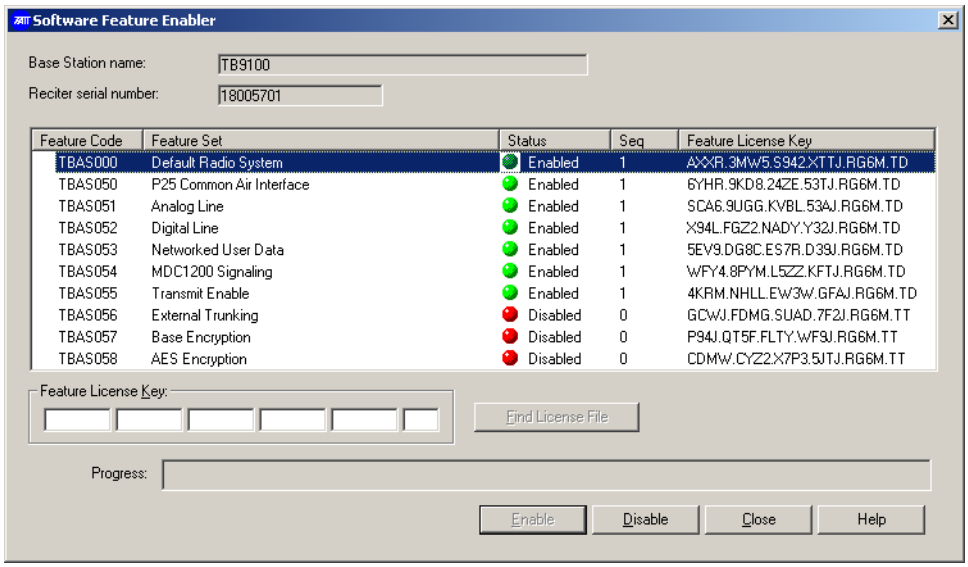
Manually Updating the Configuration

If you needed to repeat the download procedure, the base station's configuration is probably unusable and must be restored from backup.

1. Using the new CSS, open the backed-up configuration file. The CSS adds any new data items to the configuration, so that its database structure matches that of the new base station firmware.
2. Check the default settings of any new data items (information in the Release Notes) and change any that do not suit your system.
3. Save the configuration (do not overwrite the old configuration file) so that you have a backup and program the configuration back into the base station.

Working with the Software Feature Enabler

The software feature enabler (Tools > Software Feature Enabler) lets you enable additional features in the TB9100 base station you are connected to. The base station already has these features but it needs license keys to enable them. Each base station requires a unique license key for each feature. A license key for one base station cannot be used in another. The software feature enabler also displays the status of all features and lets you disable any that are enabled.



The form displays the name and reciter serial number of the base station you are connected to. Each row in the table displays information about a feature: the Feature code used to order a feature, its name, and whether it is enabled or disabled. The **Seq** column indicates how many times it has been enabled or disabled.

Determining the Feature Licenses You Need

To determine which feature licenses a base station requires, apply the following rules (full details are in the table below).

1. The base station must have a default radio system license.
2. If the base station will carry digital P25 speech over its RF interface, it needs a P25 common air interface license.
3. The base station needs a transmit enable license, unless it is receive-only.
4. If the base station will be networked with other base stations to form a channel group, it needs a digital line license.
5. If the base station uses its analog line and will carry digital P25 speech, it needs an analog line license. In this case, it also needs an MDC1200 signaling license (if the console system uses that type of signaling) and a base encryption license (if the analog line is an encryption/decryption point).

To determine which feature licenses an analog gateway requires, apply the following rules.

1. The analog gateway must have a default radio system license and a digital line license.

2. If the analog gateway will carry digital P25 speech, it needs an analog line license. It also needs an MDC1200 signaling license (if the console system uses that type of signaling) and a base encryption license (if the system uses encryption).

Feature License	Affected Interfaces	License Required for the Service?					
		Analog FM	Digital P25	TSBK	User Data[1]	Tone Remote	External Trunking
Default radio system[2]	All	Y	Y	Y	Y	Y	Y
P25 common air interface[2]	RF	N	Y	N	Y	Y	Y
Analog line[3]	Analog line	N	Y	N	n/a	N	n/a
Digital line	Channel group	Y	Y	Y	N	Y	Y
Networked user data[4]	Data gateway	n/a	n/a	n/a	Y	n/a	n/a
MDC1200[5]	Analog line	n/a	n/a	Y	n/a	n/a	n/a
Transmit enable	RF	Y	Y	Y	Y	n/a	Y
Base encryption[6]	Analog line	N	Y	N	n/a	n/a	N
AES encryption[7]	Analog line	N	Y	N	n/a	n/a	N
External trunking[8]	Digital line	N	N	N	n/a	n/a	Y

1.A user data service is not yet available
2.The base station or analog gateway cannot go into Run mode unless it has a default radio system license or a P25 common air interface license.
3.Applies to digital P25 speech only.
4.Not yet available. This license will determine whether the base station supports wide area data repeat and data gateway functionality. It is independent of the channel group license.
5.Determines whether ANI and the conversion between MDC1200 and TSBKs is supported.
6.Required for encryption at the analog line interface. Enables DES encryption and decryption.
7.Enables AES encryption in conjunction with the Base encryption feature license.
8.Only available for operation with external trunking equipment.

Enabling Additional Features

If you want a feature, obtain a license key from Tait for that feature, and then use the CSS to enable it.

To license a feature

1. Connect to the base station.
2. If you received the license key in a license file, copy that file (and any others that you received for other features or other base stations) to the CSS's license file folder (select Options > File Folders to see which folder the CSS uses).
3. Go into Standby mode, and then select Tools > Software Feature Enabler.
4. Click the feature to select it.
5. If you received a license file, click **Find License File**. This searches the license file folder for a license file for the current base station and the selected feature. If the CSS finds one, it displays the license key (in the feature's row and in the Feature License Key boxes), and increments the Seq column by 1.

6. If you don't have a license file, enter the license key into the Feature License Key boxes.
7. Click **Enable**. A 'Feature enabled' message appears. The license key appears in the feature's row and the Seq column is incremented by 1.

Disabling a Feature

Features are not normally disabled. However, disabling may be desirable in special circumstances, for example, if you are trying out the feature and decide not to purchase it.

Important: A disabled feature can only be re-enabled by purchasing a new license key. The original feature license key cannot be re-used.

Before disabling a feature, make sure that the base station configuration does not use it. Once a feature is disabled it does not work, even if you enable it in the CSS.

If the base station configuration requires a function but the software feature enabler has disabled it, a syslog message will be generated when the base station attempts to implement the function. For example, if you disable the P25 common air interface, but use a calling profile that tells the base station to handle dispatcher calls as digital P25 calls, the dispatcher will be unable to make calls. Each attempt produces a syslog message.

To disable a feature

1. Connect and log on to the base station with the Administrator access level.
2. Go into Standby mode, and then select Tools > Software Feature Enabler.
3. Check the **Reciter Serial Number** box to make sure that you are logged on to the correct base station.
4. Click the feature's row.
5. Click **Disable**.

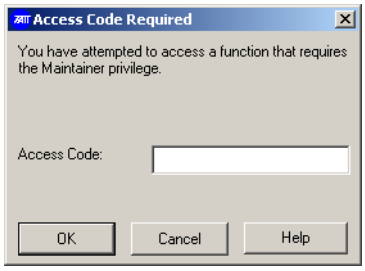
   The progress bar indicates how far the disabling has progressed. On completion, a new number appears in the **Feature License Key** column. Communicate this new number to Tait if you are entitled to a refund or if you want to re-enable the feature.

Working with Privileges

If access codes have been set, you must enter an access code to obtain the Maintainer or the Administrator privilege before you can carry out some functions. From the toolbar you can change privileges. Only the Administrator can change access codes.

Obtaining a Privilege

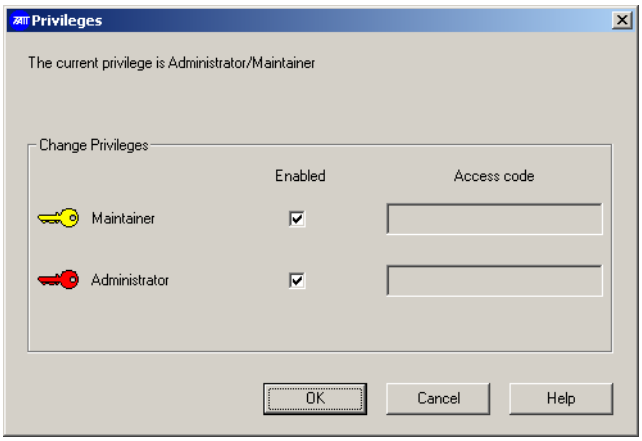
If you request a function that you don't currently have the privilege for, the Access Code Required dialog box appears, prompting you for an access code.



1. Enter the access code for the required privilege.
2. Click OK. The Privileges icon on the toolbar indicates the privileges you now have. A yellow key indicates Maintainer privilege. A red key indicates Administrator privilege.

Changing Privileges

The Privileges dialog box indicates which privileges are currently active and lets you enable or disable them. You may, for example, have enabled Administrator privilege in order to change a base station password, but now you want to return the CSS to Guest privilege, because a number of people have access to the CSS. The Guest privilege is always enabled and cannot be disabled.



If a row is disabled, the privilege has no access code and you automatically have this privilege. If you want the privilege to be controlled by an access code, select Tools > Change Privilege Access Codes.

To enable a privilege

1. On the toolbar, click **Privileges**.
2. Select the check box of the privilege you want to enable.
3. Alongside the check box, enter the corresponding access code.
4. Click OK.

To disable a privilege

1. On the toolbar, click **Privileges**.
2. Clear the check box of the privilege you want to disable.
3. Click OK.

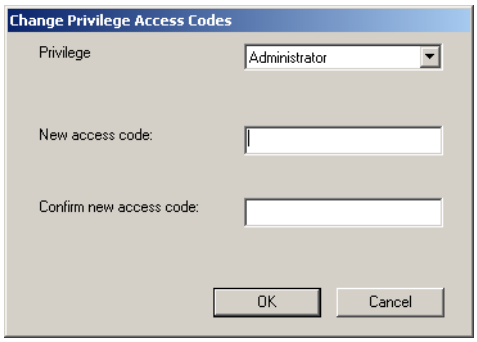
Setting up and Changing Privilege Access Codes

If access codes have not been set up, CSS users automatically have all privileges and they are not asked for access codes. If you want to increase security, you can set up access codes simply by entering them as described below.

If access codes have been set up (for example during installation), you can change them with Administrator privilege.

To set up or change an access code

1. Select Tools > Change Privilege Access Codes.
2. If the Access Code Required dialog box appears, supply the current Administrator access code. The Change Privilege Access Codes dialog box appears.



3. In the **Privilege** box, select the privilege whose access code you want to set up or change.
4. In the **New access code** box, enter the new access code.
5. In the **Confirm new access code** box, enter the same code again.
6. Click OK.

CSS Options

The Options menu lets you configure aspects of the CSS software.

Temperature Display

The CSS can display temperature in degrees Fahrenheit or Celsius.

Select Options > Settings and select the option you prefer.

File Folder Locations

The Default file locations area (Options > File Folders) specifies folders for configuration files, log files, license files, and firmware files. To modify a default location, click the button to the right of the box and select a folder.

Configuration files	When you save a configuration file for the first time, the folder specified in the Configuration files box is shown in the dialog box. You can select another folder if you want. (You already chose a folder for configuration files during installation.)
Firmware files	Specifies where the CSS will look for firmware files when you ask it to download new firmware into a base station. If you receive new firmware for a base station upgrade, copy it to this folder.
License files	Specifies where the CSS will look for license files when you ask it to enable additional features in a base station. If you receive a license file, copy it to this folder.

Part D Monitoring

The CSS lets you monitor the TB9100 base station. It can provide operational information about the various interfaces and modules. The CSS can also display data logs and details about the hardware and software of installed modules. Monitoring can take place while the base station is in Run mode; it has no effect on base station operation.

For information about monitoring alarms, see "Alarms" on page 139. For information about monitoring Task Manager, see "Monitoring Task Manager" on page 205.

To monitor a base station, connect to it, click **Monitor**, and select an item from the navigation pane.

Interfaces

- Monitoring the RF Interface
- Monitoring the Digital Line
- Monitoring the Analog Line

Modules

- Monitoring the Reciter
- Monitoring the Power Amplifier
- Monitoring the Power Management Unit

Data Logs

- Viewing Call Records
- Viewing the System Log
- Viewing the Trace Log
- Viewing Call Statistics
- Viewing the CSS Application Log

Module Details

- Viewing Reciter Information
- Viewing Power Amplifier Information
- Viewing Power Management Unit Information

Interfaces

The CSS can monitor the base station's interfaces. You must be connected to that base station.

Monitoring the RF Interface

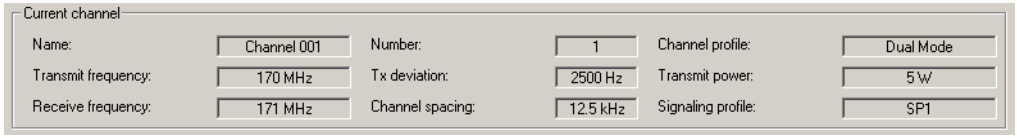
The RF Interface form (Monitor > Interfaces > RF Interface) shows you what the base station is currently doing. It displays:

- Details about the channel that the base station is currently operating on
- Operational information about the receiver
- Operational information about the transmitter

Current Channel

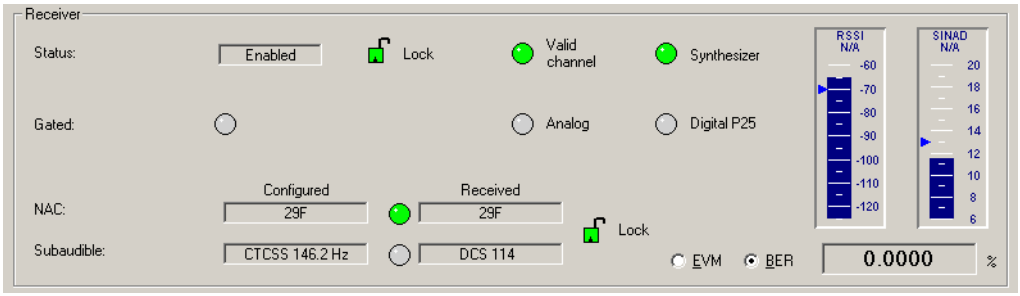
The Current channel area shows you which channel the base station is operating on and displays its main configuration settings. The choice of channel is the result of Task Manager action. If the channel name is Invalid channel, Task Manager has told the base station to operate on a channel that does not exist.

To view additional settings defined by the channel, look in the channel table (Configuration > Base Station > Channel Table) and in the profiles assigned to the channel.



Receiver

In the Receiver area, you can check that the receiver is enabled, see whether it is gated, and view information about the NAC or subaudible signaling. You can also view the RSSI, SINAD, and the digital P25 signal quality (EVM or BER).



Status

If the Status box displays Enabled, the receiver is able to function. If it displays Disabled, look at the items to the right to see what the problem is.

Item	Status	Meaning
Lock	Locked	Task Manager has locked the receiver. The receiver cannot operate.
Valid channel	Red	The currently selected channel does not exist or is corrupted.
Synthesizer locked	Flashing Red	The receiver is unable to operate on the configured frequency.

Note: It is possible in the configuration to disable the receiver (in the channel profile, clear both the analog and the digital receiver modes). This is not reflected in the status display, which still shows 'Enabled.'

Gated

When the Gated LED is green, the receiver has unmuted; a valid signal is being received. The LEDs alongside indicates whether that signal is analog FM or digital P25.

NAC

The two NAC boxes display the NAC that the receiver is configured with and the current or most recently received NAC. Alongside the Received NAC box, an LED tells you the following.

LED Color	Meaning
Green	The receiver has detected a matching NAC.
Red	The receiver has detected a NAC that is different from the one it is configured to receive.
Gray	The receiver is not currently detecting a NAC.

If the **Lock** padlock is locked, the receiver will unmute irrespective of the received signal's NAC. Task Manager has locked the decoding of subaudible signaling and the NAC.

Subaudible

The two Subaudible boxes display the configured and the received CTCSS tone or DCS code. The configured tone or code is specified in the signaling profile for the current channel. The receiver can only detect a CTCSS tone if it is the same as the configured one, but it can detect any DCS code. The form displays what the receiver is currently receiving (or has just received).

Alongside the **Received** box, an LED tells you the following about the received tone or code.

LED Color	Meaning
Green	The receiver has detected a valid code or the particular tone that it is configured to recognize.
Gray	The receiver is not currently detecting any subaudible signaling.

If the **Lock** padlock is locked, the receiver will unmute irrespective of the received signal's CTCSS tone or DCS code (and the received NAC). Task Manager has locked the decoding of subaudible signaling and the NAC.

RSSI

The RSSI gauge displays the current strength of the received signal in dBm. The equivalent numeric value appears under the gauge heading. If this value is red, it exceeds the maximum or has fallen below the minimum that the gauge can display. A pointer indicates the configured threshold for opening the receiver gate.

SINAD

The SINAD gauge displays the signal-to-noise ratio of the received signal in dB. The equivalent numeric value appears under the gauge heading. If this value is red, it exceeds the maximum or has fallen below the minimum that the gauge can display. A pointer indicates the configured threshold for opening the receiver gate.

EVM

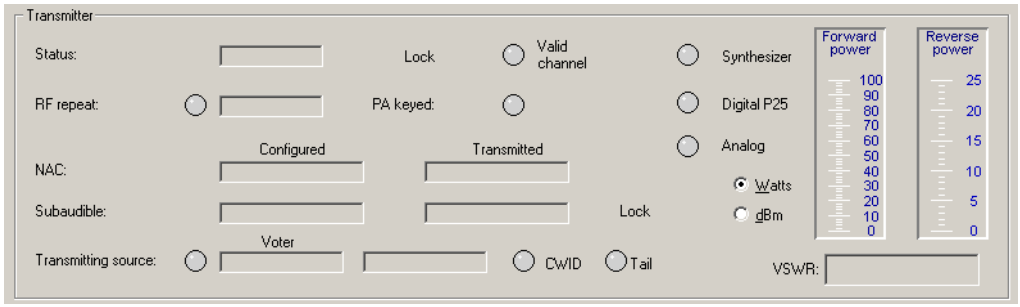
Click **EVM** and the box to the right displays the error vector magnitude of the received signal. This ranges between 200 (high quality) and 1000 (low quality).

BER

Click **BER** and the box to the right displays the estimated bit error rate of the received signal, expressed as a percentage.

Transmitter

In the Transmitter area, you can check that the transmitter is enabled, see whether it is keyed, view information about the NAC and the subaudible signaling, and see the source of what is being transmitted. You can also monitor the forward and reverse power.



Status

If the Status box displays Enabled, the transmitter is able to function. If it displays Disabled, look at the items to the right to see what the problem is.

Item	Status	Meaning
Lock	Locked	Task Manager has locked the transmitter. The transmitter is unable to function.
Valid channel	Red	The currently selected channel does not exist or is corrupted.
Synthesizer locked	Flashing Red	The transmitter is unable to operate on the configured frequency.

Note: It is possible in the configuration to disable the transmitter (clear the RF transmit check box). This is not reflected in the status display, which still shows 'Enabled.'

RF repeat

When the RF repeat LED is green, the base station will repeat the channel group's winning RF signal, which is not necessarily the RF signal received by this base station.

When the RF repeat LED is gray, the base station's RF repeat setting is currently disabled.

The box alongside indicates what last changed the RF repeat setting.

Reason	Description
Config	The configuration changed the setting. This occurs when the base station last changed channel.
Task Mgr	Task Manager action (Enable/Disable/Toggle RF repeat) changed the setting. This can only happen if the channel table puts RF repeat under dispatcher control. Such Task Manager actions are usually triggered by a dispatcher command.
Control channel	Trunking operation changed the setting. Beginning to operate as a control channel disables RF repeat. Ceasing to operate as a control channel (and therefore operating as a traffic channel) causes the base station to use the RF repeat setting in the channel table).

PA keyed

When the PA keyed LED is green, the transmitter is transmitting; carrier is present. The LEDs alongside indicate whether that signal is analog FM or digital P25.

The PA keyed LED turns green because one of the following occurs:

- A call (the **Transmitting source** LED is green and the Voter box indicates the origin of the call)
- A CWID transmission (**CWID** LED is green)
- A transmit tail (**Tail** LED is green)
- The Carrier button on the control panel has been pressed

NAC

The two NAC boxes display the NAC that the transmitter is configured with and the NAC that the transmitter is currently transmitting or has most recently transmitted. The configured NAC is specified in the signaling profile for the current channel.

Subaudible

The two Subaudible boxes display the CTCSS tone or DCS code that the transmitter is configured with and the CTCSS tone or DCS code that the transmitter is currently transmitting or has most recently transmitted. The configured tone or code is specified in the signaling profile for the current channel.

If the **Lock** padlock is locked, the transmitter does not send any subaudible signaling. Task Manager has locked the encoding of subaudible signaling.

Transmitting source

The Transmitting source LED is green if the transmitter is transmitting signal from a user. The **Voter** box shows where the signal came from.

Display	Description
FM - Line	An analog FM call received over the analog line
FM - IP	An analog FM call received over the digital line from another base station in the channel group The adjacent box displays the IP address of that base station.
FM - RF	An analog FM call received over the air interface
FM - Panel	An analog FM call received from the control panel microphone
P25 Voice - Line	A digital P25 call received over the analog line
P25 Voice - IP	An digital P25 call received over the digital line from another base station in the channel group The adjacent box displays the IP address of that base station.
P25 Voice - RF	An digital P25 call received over the air interface
P25 Voice - Panel	An digital P25 call received from the control panel microphone
P25 Data	A digital P25 data call.

CWID — The CWID LED displays green when the base station is currently transmitting its CWID.

Tail — In analog FM mode, the Tail LED displays green when the base station is transmitting its tail. This consists of the hang time (subaudible signaling but no audio) followed by the soft-off time (carrier only).

Forward power — Displays the measured forward power of the PA output. Click **Watts** or **dBm** to select the units used.

Reverse power — Displays the measured reverse power of the PA output. Click **Watts** or **dBm** to select the units used.

VSWR — Displays the Voltage Standing Wave Ratio of the PA's RF output.

Monitoring the Digital Line

To help in troubleshooting, the Digital Line form (Monitor > Interfaces > Digital Line) monitors operation that is related to the digital line. You can use the form for the following:

- Checking channel group settings when installing the system
- Observing voting operation during coverage tests
- Measuring network jitter when setting the transmit preamble
- Troubleshooting network link problems

The form displays information about the whole channel group, not just the base station you are connected to.

The following topics aim to help you get the most out of this useful form. Each describes how to monitor one operational aspect, even though all aspects are inter-related. A final topic gives reference information that is not already covered by previous topics.

Checking Channel Group Settings

If the system is not behaving as expected, check the channel group settings.

1. Select Monitor > Interfaces > Digital Line.
2. Under **Software feature enable**, check that the channel group box is checked. If not, the base station has no channel group license and is unable to be part of a channel group.
3. Confirm that the expected channel group is in use. The base station uses the channel group that is assigned to the current channel.
4. Under **Current channel group**, check the settings displayed. These are a subset of the settings in the Channel Groups dialog box (Configure > Digital Line > Channel Groups and click Edit).
5. Check the padlock symbol. If it is closed, Task Manager has locked channel group communications and the base station will not send anything to or receive anything from the channel group.
6. In the members table, check in the row for 'localhost' that the settings for channel group mode, RF repeat, and common uplink are as you want. These are additional channel group settings for the connected base station.

   Check also that these settings are the same in all rows of the table. All members of the channel group should have the same settings.

Monitoring the Network Link

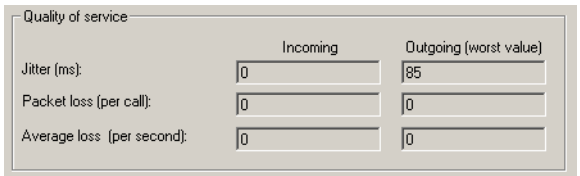
To monitor the base station's network link to other channel group members, select Monitor > Interfaces > Digital Line and view the Quality of Service area.

This area displays quality of service values for the current voice stream(s).

The **Incoming** boxes display values for the voice stream that the digital line is receiving.

The **Outgoing** boxes display the worst set of outgoing values. When the digital line sends a voice stream, each other member of the channel group receives it and measures its quality of service. These measured values are sent back to the connected base station using RTCP and made available to the CSS. The Outgoing boxes show only the worst values.

If the channel group is duplex, incoming and outgoing data can appear at the same time.



Jitter — The delay variation of RTP packets arriving at the connected base station (Incoming) or other channel group member (Outgoing). A high jitter is a sign that the network is congested.

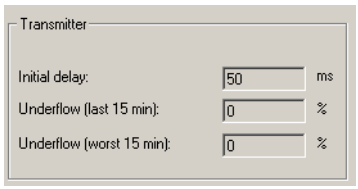
Packet loss (per call) — The number of packets lost in an over. Packet loss should be rare. Users will not notice a loss of up to 10 packets. Packet losses may be caused by inadequate linking bandwidth, cable faults, or power cycling of the switch or router.

Average loss

The average number of packets lost per second. Packet losses should be rare. Frequent packet loss indicates that there is something wrong with the linking infrastructure.

Monitoring the Transmit Buffer

If the jitter on the incoming voice stream is high, the transmit buffer may not be able to cope. To check the buffer, select Monitor > Interfaces > Digital Line and view the Transmitter area.



Initial delay

The configured length of time in milliseconds that the transmitter waits before beginning to transmit voice. This is the preamble duration that you set in the Network form (Configure > Digital Line > Network). If the base station transmits TSBKs, it uses a preamble duration of 100 ms and the display updates to reflect this.

Underflow (last 15 minutes)

The percentage of packets during the last 15 minutes that arrived late enough to cause a buffer underflow. If too many buffer underflows occur, the preamble should be lengthened (see "Configuring the Jitter Buffer" on page 112).

Underflow (worst 15 minutes)

The highest percentage of packets during any 15 minute period in the last 24 hours that arrived late enough to cause a buffer underflow. If too many buffer underflows occur, the preamble should be lengthened (see "Configuring the Jitter Buffer" on page 112).

Monitoring Channel Group Network Links

The members table in the Digital Line monitoring form (Monitor > Interfaces > Digital Line) displays information about the network links to each member of the channel group. Members are identified by IP address but the base station you are connected to is 'localhost.'

	Inbound			Outbound		Configuration			Statistics		
Member	BS Mode	Type	Impairment	Type	Source	CG Mode	RF repeat	Common uplink frequency	Jitter	Packet Loss	Average Loss
172.16.16.20	RUN	Idle	15	FM	Line	Duplex	False	False	10	0	0
172.16.16.9	RUN	P25	1	Idle	None	Duplex	True	False	8	0	0
localhost	RUN	Idle	15	Idle	None	Duplex	False	False	0	0	0

Jitter

The delay variation of RTP packets as they arrive at the channel group member. This value should be zero if the member is the vote winner.

Packet Loss

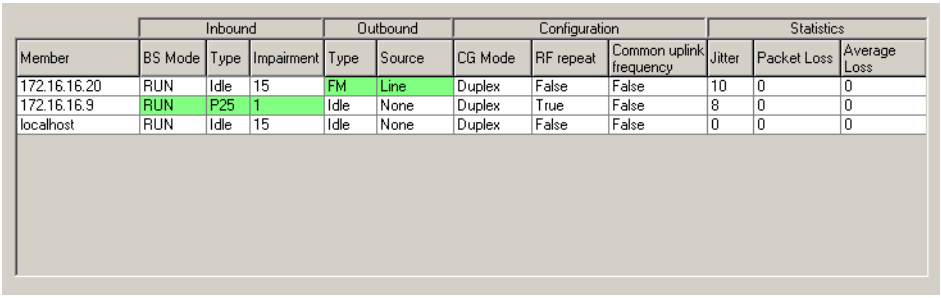
The number of packets lost on the link to the member during the last over. Packet loss should be rare. Users will not notice a loss of up to 10 packets. Packet losses may be caused by inadequate linking bandwidth, cable faults, or power cycling of the switch or router.

Average Loss

The average number of packets lost per second. Packet losses should be rare. Frequent packet loss indicates that there is something wrong with the linking infrastructure.

Monitoring Duplex Voting

The members table in the Digital Line monitoring form lets you monitor the distributed voting carried out by the members of the channel group. If the channel group mode is duplex, there can be two vote winners at the same time; one for the inbound and one for the outbound voice stream.



	Inbound			Outbound		Configuration			Statistics		
Member	BS Mode	Type	Impairment	Type	Source	CG Mode	RF repeat	Common uplink frequency	Jitter	Packet Loss	Average Loss
172.16.16.20	RUN	Idle	15	FM	Line	Duplex	False	False	10	0	0
172.16.16.9	RUN	P25	1	Idle	None	Duplex	True	False	8	0	0
localhost	RUN	Idle	15	Idle	None	Duplex	False	False	0	0	0

To monitor voting in a duplex channel group

1. Select Monitor > Interfaces > Digital Line and view the members table.
2. Check in the BS mode column that all members are in Run mode. A base station in Standby mode does not participate in voting.
3. Check that all members of the channel group are present. If a member is absent, its link may be down.
4. Look for the green cells in the Inbound and Outbound columns. They indicate which member won the vote.

   Data in other rows indicates other voice streams that lost the vote. If there is a common uplink frequency, this shows which other base stations are also able to provide coverage.
5. If desired, check to confirm that the voter is operating as expected.

   For the Inbound voice stream:

   - Type P25 always wins over type FM
   - The lowest impairment wins the vote, if the streams have the same type.

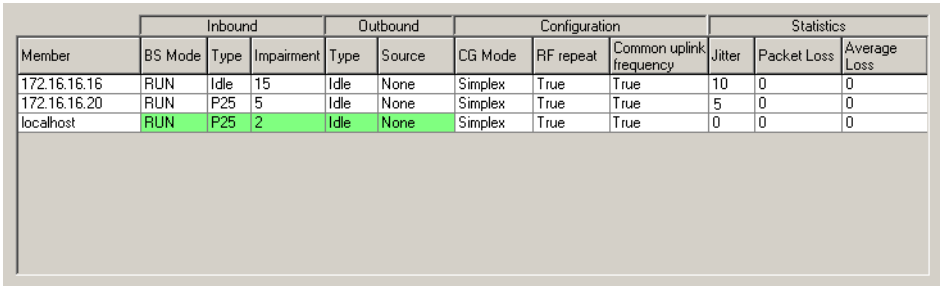
   For the Outbound voice stream:

   - Type P25 always wins over type FM
   - Microphone always wins over Line (control panel microphone wins over analog line)

In the above example, the green cells in the Outbound columns indicate that the analog line of the first channel group member is providing the outbound signal. The green cells in the Inbound columns indicate that a P25 call received by the second member is providing the inbound signal.

Monitoring Simplex Voting

The members table in the Digital Line monitoring form lets you monitor the distributed voting carried out by the members of the channel group. If the channel group mode is simplex, there can only be one vote winner at the same time. That vote winner is sent on the inbound and the outbound voice streams.



	Inbound			Outbound		Configuration			Statistics		
Member	BS Mode	Type	Impairment	Type	Source	CG Mode	RF repeat	Common uplink frequency	Jitter	Packet Loss	Average Loss
172.16.16.16	RUN	Idle	15	Idle	None	Simplex	True	True	10	0	0
172.16.16.20	RUN	P25	5	Idle	None	Simplex	True	True	5	0	0
localhost	RUN	P25	2	Idle	None	Simplex	True	True	0	0	0

To monitor voting in a simplex channel group

1. Select Monitor > Interfaces > Digital Line and view the members table.
2. Check in the BS mode column that all members are in Run mode. A base station in Standby mode does not participate in voting.
3. Look for the shaded row. This indicate which member won the vote.

   Data in other rows indicates other voice streams that lost the vote.
4. If desired, check to confirm that the voter is operating as expected.
   - Type P25 always wins over type FM
   - Outbound calls (Microphone or Line) win over Inbound calls
   - The lowest impairment wins the vote, if the streams have the same type.

The green cells in the above screen indicate that localhost has won the vote. The call it is receiving is P25 and has an impairment of 2. The second member of the channel group is also receiving a P25 call, but it has a higher impairment. The green cells cover both the Inbound and the Outbound columns, because there is only one winning voice stream in simplex channel groups.

Monitoring Trunking Operation

If the base station is connected to a trunking site controller, you can monitor its trunking operation as follows:

1. Select Monitor > Interfaces > Digital Line.
2. Under **Software feature enable**, check that External trunking is enabled. If not, the base station needs an External trunking feature license.
3. Under **External trunking controller**, the Connected LED indicates whether the base station is receiving heartbeat messages from the trunking site controller. The area displays the trunking site controller's IP address and the port number that the base station is configured to use when it sends messages to the trunking site controller.
4. If the **Control channel** LED is lit, the base station is receiving TSBKs from the site controller.
5. If the **Control channel** LED is gray, the base station is able to send and receive voice packets. It will do this to/from the IP address and port that is displayed under Current channel group.

Digital Line Form Details

This topic describes details on the Digital Line Form that are not covered by the task-based topics involving this form.

Software feature enable

The Software feature enable area (Monitor > Interfaces > Digital Line) indicates which software licenses the base station has that are relevant to the digital line.

Channel group — Indicates whether the base station has a digital line license. Without this license, voice cannot be sent and received across the digital line.

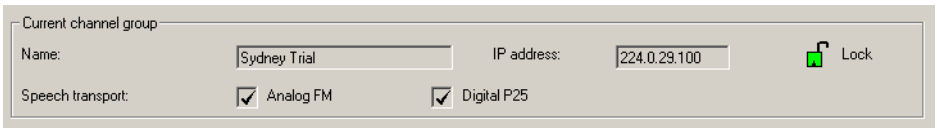
External trunking — Indicates whether the base station has an External trunking license. This license enables communications with an external site controller using the TCCP protocol.

External trunking controller

The External trunking controller area (Monitor > Interfaces > Digital Line) provides monitoring information when the base station is part of a trunking system.

Current channel group

The Current channel group area (Monitor > Interfaces > Digital Line) displays information about the channel group that the base station currently belongs to. Additional details are found in the members table for the row 'localhost' under the columns CG Mode, RF repeat, and Common uplink frequency.



Name — The name of the current channel group.

IP address — The IP address (normally multicast) of the current channel group. The base station's digital line sends voice streams to this address and (if the address is multicast) receives voice streams that have this address.

Lock — If the padlock is locked, Task Manager has locked the channel group. The base station does not participate in the channel group.

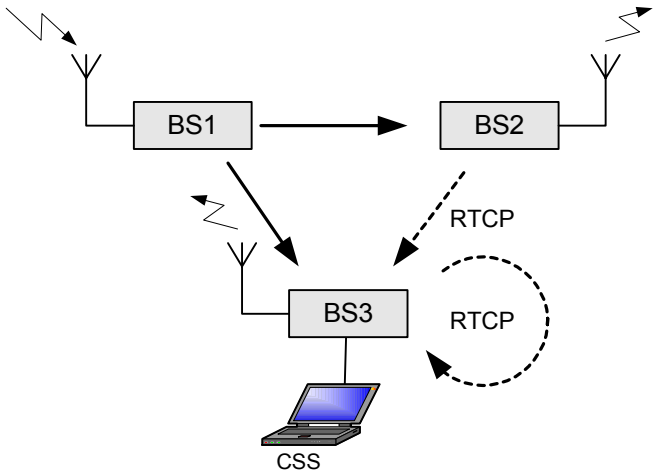
Speech transport — If **Analog FM** is selected, the digital line can send analog FM voice streams to the other base stations in the channel group. If **Digital P25** is selected, the digital line can send digital P25 voice streams.

Port — The port that channel group uses for communications to and from the digital line.

Members Table

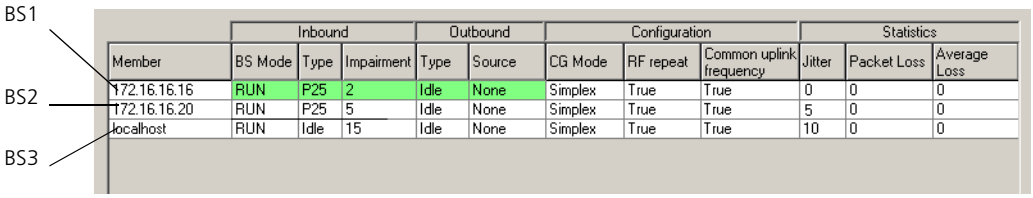
The table at the bottom of the Digital Line form differs from other CSS monitoring forms in that it functions more as a network monitor than a base station monitor. The table displays information for each member of the channel group: voting, quality of service, and channel group configuration.

The following example shows how this information is made available to the CSS. BS1 wins the vote and supplies the voice stream to BS2 and BS3. Using the RTCP protocol, BS2 supplies BS3 and BS3 supplies itself with quality of service information about the voice stream that they have just received.



Green cells indicate which member is providing the vote-winning voice stream. As that base station provides the voice stream directly, its quality of service data is perfect. The rows for the other base stations show quality of service data for the voice stream they receive. BS3 obtains via RTCP quality of service information about the voice streams that the other base stations received.

Note: It's not unusual for this table to briefly show two vote winners for the same (inbound or outbound) stream, or no vote winner at all. This is a transient artifact of the monitoring process (delays around the network and the slow update rate of the CSS monitoring screen) and does not indicate problems with voting. Do not rely on the table to give an accurate picture of the network operation for timescales of less than a second.



Member

The IP address of one of the members (base station or analog gateway) of the channel group. When the call is outgoing, this is the recipient base station. When the call is incoming, this is the source base station. 'Localhost' is the base station that the CSS is connected to.

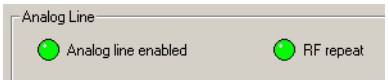
BS mode

The BS mode column indicates whether the members of the channel group are in Run mode or Standby mode. If a member is in Standby mode, it cannot send or receive on its digital line.

Inbound	The Inbound group of columns display information on inbound RF inputs (from radio to dispatcher) that is relevant to voter operation. This can help if the channel group is experiencing RF problems. A green background indicates that the voice stream won the (inbound) vote. *Type* is P25 (digital P25), FM (analog FM), or Idle (if no voice stream is present). P25 always wins the vote over FM. *Impairment* is a number between 0 and 15. It is the inverse of signal quality. The lowest impairment wins the vote, if the streams have the same *Type*. For digital P25 calls, the impairment is based on the EVM (error vector magnitude). For analog FM calls, it is based on the SINAD.
Outbound	The Outbound group of columns display information on outbound inputs (from dispatcher to radios) that is relevant to voter operation. *Type* is P25 (digital P25), FM (analog FM), or Idle (if no voice stream is present). P25 always wins the vote over FM. *Source* is Line (an analog line) or Mic (a control panel microphone). These can belong to any channel group member.
Configuration	The Configuration group of columns display information about configuration items relevant to voting behavior. *CG Mode* (channel group mode) specifies whether each member is configured to operate in simplex or duplex mode. Use this column to check that all the members of the channel group have the same setting. *RF repeat* indicates whether each base station in the channel group has enabled the repeat function. Normally, all base stations in a channel group have the same repeat function. Use this column to check that the base stations have the same repeat setting. The setting can be defined by the channel table or by Task Manager action. *Common uplink frequency* indicates whether the member's configuration tells it that it is using the same uplink frequency as other base stations in the channel group. This setting affects the way the base station votes.
Statistics	The Statistics group of columns provide information about the quality of service of the voice stream received by each member.
Jitter	The delay variation of RTP packets as they arrive at the channel group member. This value should be zero for the vote winner.
Packet Loss	The number of packets lost on the link to the base station during the last over. Packet loss should be rare. Users will not notice a loss of up to 10 packets. Packet losses may be caused by inadequate linking bandwidth, cable faults, or power cycling of the switch or router.
Average Loss	The average number of packets lost per second. Packet losses should be rare. Frequent packet loss indicates that there is something wrong with the linking infrastructure.

Monitoring the Analog Line

The Analog Line form (Monitor > Interfaces > Analog Line) shows you what is happening on the analog line. You can check that it is enabled, view information about the current calling profile, look at line levels, and view the current state of line signaling.



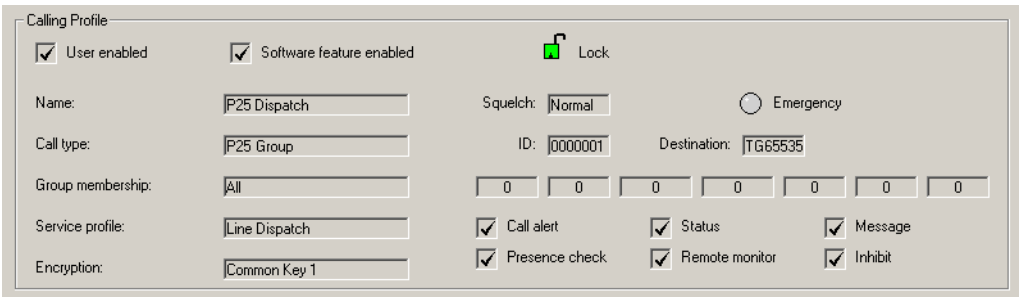
Analog line enabled — If the Analog line enabled LED displays red, the analog line is unable to function. Look at the first items under Calling profile for the reason.

RF repeat — When the RF repeat LED is green, the base station repeats the signal it receives, unless another signal with a higher priority is present at one of its interfaces. If the base station is part of a channel group, the signal it repeats may have been received by any of the channel group's base stations.

When the RF repeat LED is gray, the base station's repeat function is currently disabled. Signals from a receiver (at this base station or at any other base station in the channel group) can be sent to the analog line but not to the transmitter.

Calling profile

The Calling profile area displays details about the current calling profile. The calling profile is selected by the channel table or by function tone from the console system.



User enabled — If this check box is cleared, the current calling profile is disabling the analog line.

Software feature enabled — If this check box is cleared, the base station does not have a license enabling the analog line.

Lock — If the padlock icon is locked, Task Manager has locked the analog line.

Name — The name of the calling profile.

Squelch — Specifies what the analog line unmutes to. If the squelch is Normal, the base station switches any vote winner onto the analog line. If the squelch is Selective, the base station only switches the vote winner onto the analog line if it is addressed to the current calling profile's line ID or to a group listed in the current calling profile's group membership.

Emergency

When the Emergency LED is green, any calls that the analog line makes will be emergency calls. This is because the current calling profile configures them that way. **It does not mean that the base station is currently receiving an emergency call.**

Call type

Defines the type of call that the base station makes when the dispatcher initiates a call. (The analog line can always forward calls of any type.) If the call type is P25 group or P25 individual, the following boxes provide further information.

Item	Meaning
ID	The identity of the caller.
Destination	The individual or group ID that the call is made to.

Group membership

The name of the collection of groups assigned to the calling profile. Alongside are displayed the group IDs belonging to the collection.

Service profile

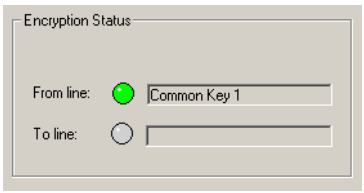
The service profile assigned to the calling profile. The check boxes alongside indicate which services are enabled at the analog line input. (The receiver input can have a different service profile, assigned to the channel.) For details about these services, see "Working with Service Profiles" on page 88.

Encryption

Displays the encryption key that is assigned to the current calling profile.

Encryption Status

The Encryption status area monitors the encryption of the input on the analog line input and the decryption of signals destined for the analog line output.



From line

The **From line** LED indicates whether encryption is proceeding normally. The box alongside indicates whether the call is clear, what key is being used, or what the encryption problem is.

LED	Box text	Encryption status
Grey		There is currently no speech.
Green	Clear	The input speech is not being encrypted.
Green	*Key name*	The speech is being encrypted using the named key.
Red	Key empty	There is no secure key data for the CKR that the key name is mapped to. The speech cannot be encrypted so it is not transmitted. Check that the key name is mapped to the correct CKR and that the secure key data for that CKR has been loaded.
Red	No license	The calling profile specifies an encryption key but the required encryption feature license is not present. The speech is transmitted clear.

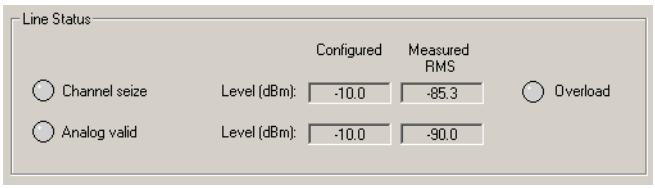
To line

The **To line** LED indicates whether there are any problems with decryption. The box alongside indicates whether the call is clear, what key is used for decryption, or what the decryption problem is.

LED	Box text	Encryption status
Grey		There is no speech output.
Green	Clear	The speech was not encrypted.
Green	*Key name*	The speech has been decrypted using the named key. If the key has not been named, the box displays the CKR number of the key.
Red	Clear	The speech is clear but should not be; the calling profile specifies an encryption key.
Red	*Key name*	The key used by the caller is not the key specified by the calling profile. The speech has been decrypted using the displayed key. If the key has not been named, the box displays the CKR number of the key.
Red	Key empty	The key that the calling profile selects has not been loaded or has been zeroized. No other key fits, so the speech cannot be decrypted.
Red	No key	The analog gateway does not have the key that was used to encrypt the speech. The call cannot be decrypted.
Red	No license	The encryption feature license is not present. If the speech is clear, it is provided to the analog line. If the speech is encrypted, it cannot be decrypted.

Line Status

The Line status area shows the status of line signaling and the levels of the line input and output.



The first row of controls displays information about the analog line input.

If the **Channel seize** LED is green, the analog line is receiving a signal that an analog input is present.

The **Level** boxes display the configured input level (the expected level of the line input) and the RMS level currently being measured.

If the **Overload** LED is red, the level is too high and is about to cause distortion in the DSP. It is acceptable for occasional speech peaks to trigger this LED, but if this happens regularly and often, too much gain is being applied and tone detection will not work properly. Enter a higher line level (Configure > Analog Line > General). If the **Overload** LED goes red at the beginning of the over, the HLGT is too high. Enter a higher line level or configure the console system to reduce the level of its HLGT output.

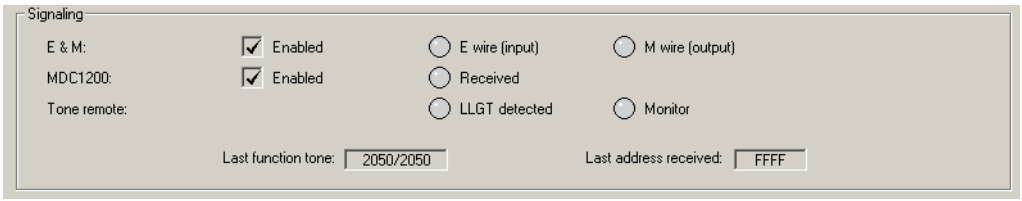
The second row of controls displays information about the analog line output.

If the **Analog valid** LED is green, the analog line is sending a signal that there is a valid output on the analog line.

The **Level** boxes display the configured and measured levels of the analog line output.

Signaling

The Signaling area shows the status of line signaling on the analog line. Check boxes indicate what is enabled in configuration and LEDs show what signaling is currently happening.



E & M

If the **Enabled** box is checked, the analog line is configured to recognize and use E & M signaling. If the **E Wire (input)** LED is green, the base station has detected that the E wire has been asserted. If the **M Wire (output)** LED is green, the base station has asserted the M wire.

MDC1200

If the **Enabled** box is checked, the analog line is configured to recognize MDC1200 signaling. If the **Received** LED is green, the base station has detected LLGT.

Tone remote

If the **LLGT detected** LED is green, the analog line is receiving low level guard tone. If the green **Monitor** LED lights briefly, the base station received a command to monitor its channel (not yet implemented).

Last function tone

Displays the frequency pair of the last function tone that was received. If a dual function tone was received, the two frequencies in the pair are different. If a single frequency tone was received, this is still displayed as a pair, but both frequencies are the same.

Last address received

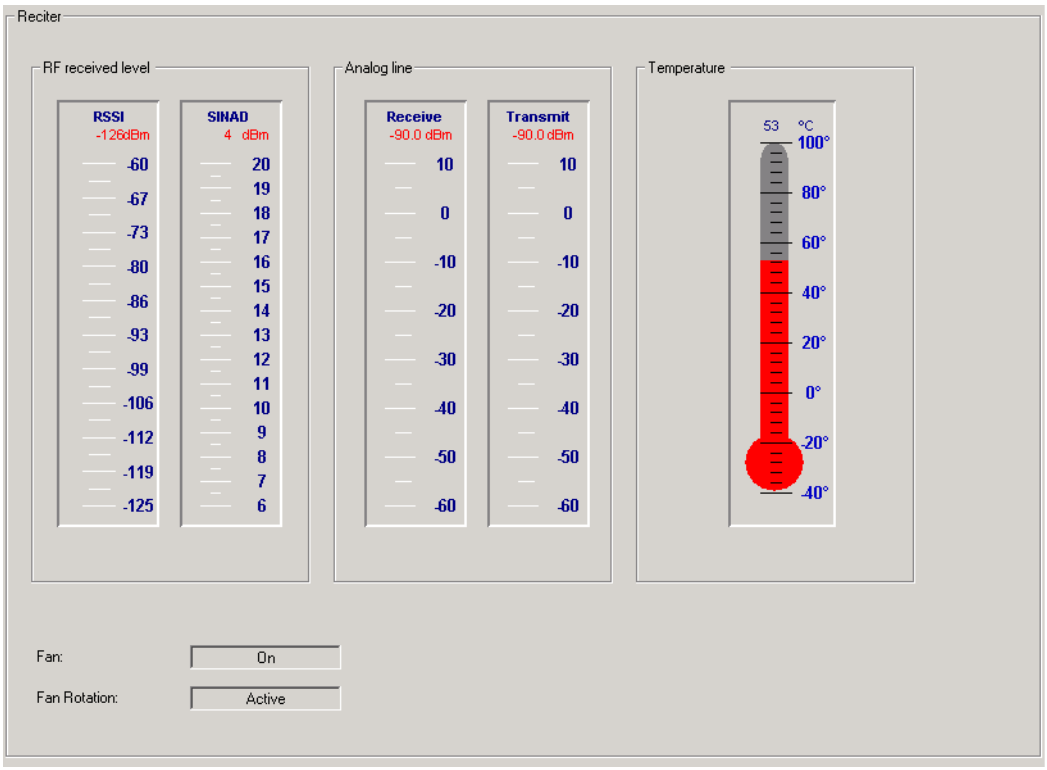
Displays the last MDC1200 address that was received. This is the destination address of a call initiated from the dispatcher.

Modules

The CSS lets you monitor operational details about individual modules. These details include temperatures, currents, voltages, and levels.

Monitoring the Reciter

The Reciter form (Monitor > Modules > Reciter) lets you monitor the RSSI and SINAD of the received RF signal and audio levels on the analog line. Each level is displayed graphically as a gauge. The equivalent numeric value appears under the gauge heading. If the value is red, it has exceeded the maximum or fallen below the minimum that the gauge can display.



RF received level — The RF received level area displays the RSSI and SINAD levels of the inbound RF signal. (If you want to know the equivalent RSSI in microvolts, see "Converting Between Microvolts and dBm" on page 101). The SINAD is only an estimation, obtained by measuring the out-of-band noise.

Analog line — The Analog line area displays the audio levels for the receive (line in) and transmit (line out) paths of the analog line.

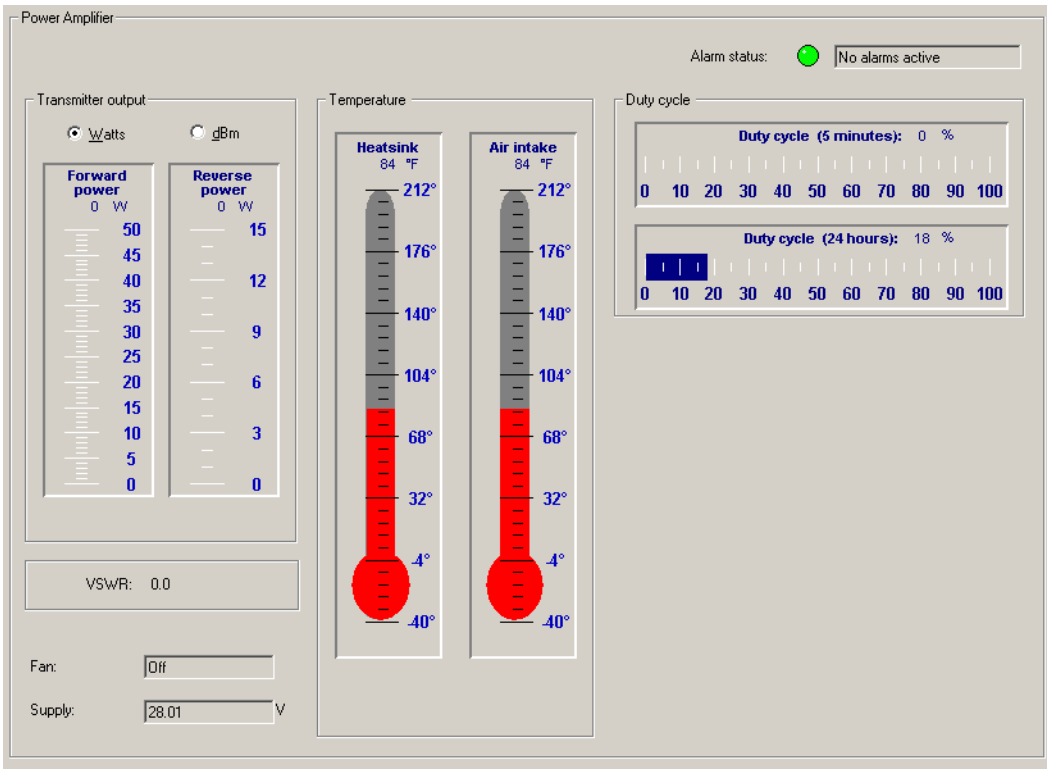
Temperature — The Temperature area displays a thermometer that shows the temperature measured at the reciter heatsink.

Fan — Displays whether the reciter has turned the fan on or off.

Fan rotation — Active means that the reciter has detected fan rotation. Inactive means that the fan has failed, if the **Fan** box displays On. This box does not apply if the reciter is fitted with a 2-wire fan.

Monitoring the Power Amplifier

The Power Amplifier form (Monitor > Modules > Power Amplifier) lets you monitor the levels of various parameters. Some levels are displayed graphically as a gauge or thermometer. The equivalent numeric value appears in or under the heading. If a value goes off the scale, it turns red.



To switch the temperature display between Celsius and Fahrenheit, select Options > Settings.

The first box in the form displays the internal name of the PA.

Alarm status

The Alarm status box indicates whether the PA has an alarm. If the LED is red, select Monitor > Alarms > Status to see which alarm is active.

Transmitter output

The Transmitter output area displays the forward and reverse power. Click the Watts or dBm option to view these parameters as watts or dBm.

Heatsink temperature

Displays the highest of the three temperatures measured at the PA driver, Final 1, and Final 2 transistors. (The 5 W PA has no final transistors and the 50W PA has no Final 2 transistor.)

Air intake temperature

This thermometer displays the temperature measured at the air intake to the PA heatsink.

Duty cycle

The Duty cycle area has two gauges.

The first indicates the average duty cycle over the past 5 minutes. 50% means that the PA was transmitting for 2.5 of the last 5 minutes. The display is updated once every minute.

The second indicates the average duty cycle over the past 24 hours. 25% means that the PA was transmitting for 6 of the last 24 hours. The display is updated once every hour.

VSWR — The VSWR displays the voltage standing wave ratio. If this is greater than 10:1, an alarm is triggered and the PA folds its output back to 10% of its capability. Only when the VSWR falls below 5:1 will the power output begin to recover.

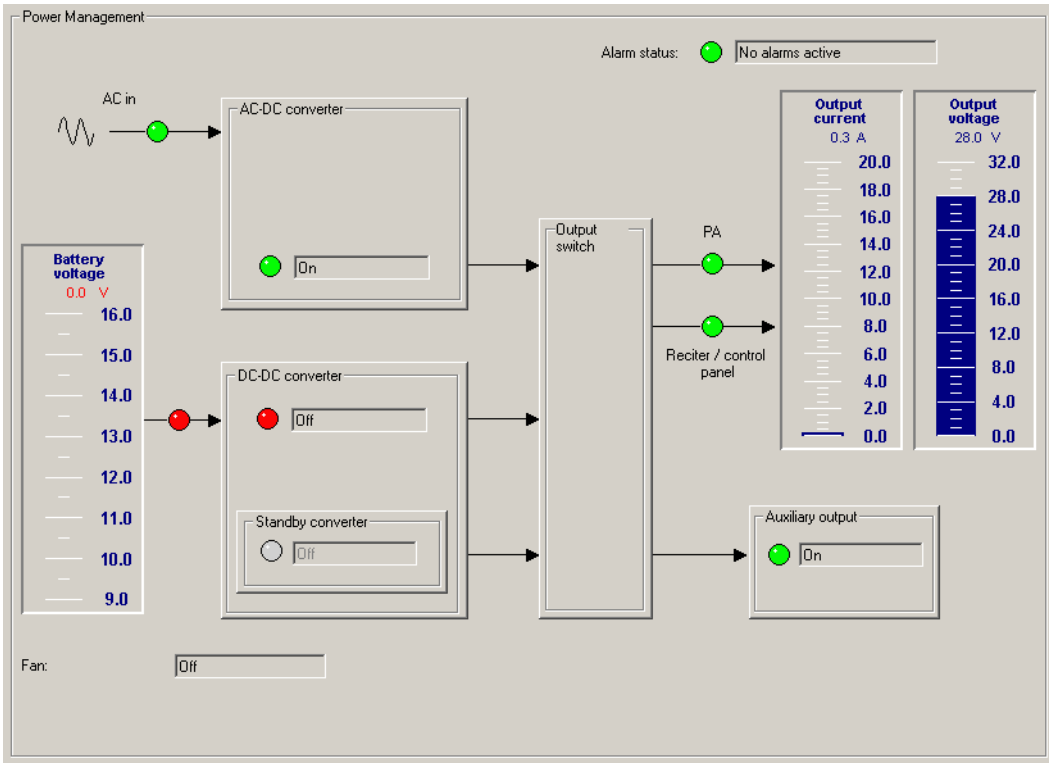
Fan — Indicates whether the fan is on.

Supply — Displays the voltage of the power that the PMU is supplying to the PA.

Monitoring the Power Management Unit

The Power Management form (Monitor > Modules > Power Management) lets you monitor the operation of the PMU. You can:

- Check the voltage of the battery and the current that the PMU outputs to the PA.
- See whether the base station is running on battery or mains power.
- Check the status of the PMU's inputs and outputs.



This form has gauges displaying the battery voltage, the output current, and the output voltage. Boxes represent different PMU submodules and LEDs indicate the status of power inputs and outputs.

Alarm status — The Alarm status box indicates whether there is a current alarm. If the LED is red and the box displays 'Alarms active', one or more PMU alarms have been triggered. Select Monitor > Alarms > Status to see which alarms are active.

Battery voltage gauge

The battery voltage gauge indicates the voltage of the DC power supply to the PMU (whether or not it is currently being used).

Power inputs

LEDs in the boxes in the middle of the form indicate the status of the different power inputs.

AC-DC converter

The LED in the AC-DC Converter box indicates the state of AC power.

LED	Text	Description
Green	On	AC power input is usable
Red	Off	AC power input is too low or too high
Gray	Off	Mains Failure test is running

The box label indicates the voltage the DC-DC converter is designed for (12, 24, or 48 V).

DC-DC converter

The LED in the DC-DC converter box indicates the state of the battery input, whether or not that input is currently being used.

LED	Text	Description
Green	On	Battery input is usable. The PMU can provide up to 500 W (or up to 40 W of power in low power mode).
Red	Off	Battery voltage is too low or too high.
Gray	Off	No battery power supply is fitted (the box is also disabled).

Standby converter

The LED in the Standby converter box indicates the state of the DC supply to the standby converter.

LED	Text	Description
Green	On	The standby DC supply has been turned on. The PMU is providing only 10 W of power to the exciter.
Red	Off	Battery voltage is too low or too high.
Gray	Off	No standby battery power supply is fitted.

Power outputs

The right-hand side of the form displays information about the PMU's power output to other TB9100 equipment in the rack frame.

PA

The PA LED displays green if the PMU is supplying power to the PA and gray if it is not. When the PMU is using mains power, it always supplies power to the PA. When it is using battery power, it supplies power unless it is in sleep mode and using the standby converter.

Reciter/control panel

The Reciter/control panel LED indicates the status of the power supply to the receiver and the control panel. Green means that it is supplying power. Gray means that it is not, because the PMU is in battery protect mode.

Auxiliary output

The Auxiliary output box has an LED that indicates the status of the auxiliary power output.

LED	Text	Description
Green	On	The auxiliary output power supply has been turned on.
Red	Off	There is a fault. This could be because there has been a current overdraw and the fuse is blown. On cooling, the fuse will automatically reset.
Gray	Off	No auxiliary power supply unit is fitted or the PMU has turned the output off.

The box label indicates the voltage that the auxiliary power submodule is designed to produce (12, 24, or 48 V).

Output current gauge

The Output current gauge shows how much current the PMU is supplying to the rest of the base station.

Output voltage gauge

The Output voltage gauge shows the voltage of the power that the PMU is supplying to the rest of the base station.

Fan

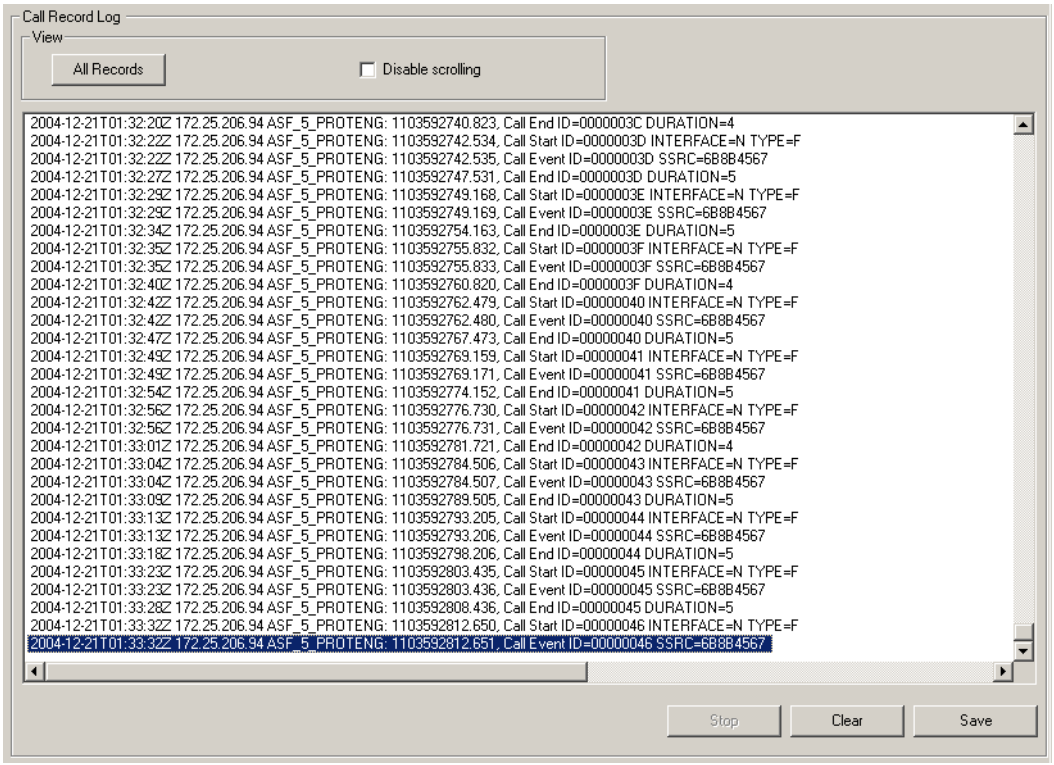
The Fan box displays whether the PMU fan is off or on.

Data Logs

The CSS can ask the TB9100 to provide records of various types of logged events so that it can display them and optionally let you save them to a file. In addition, the CSS has its own log.

Viewing Call Records

The CSS can display records of digital P25 calls that the connected base station has participated in.



Important: Viewing call records can cause voice drop-outs. When you click **All Records**, the base station sends all the entries in its log to the CSS. This may flood switched networks, which cannot prioritize voice packets. The result is that voice traffic does not arrive in time. To avoid this problem, configure the base station to send the data to a syslog collector. For details, see "Logging" on page 153.

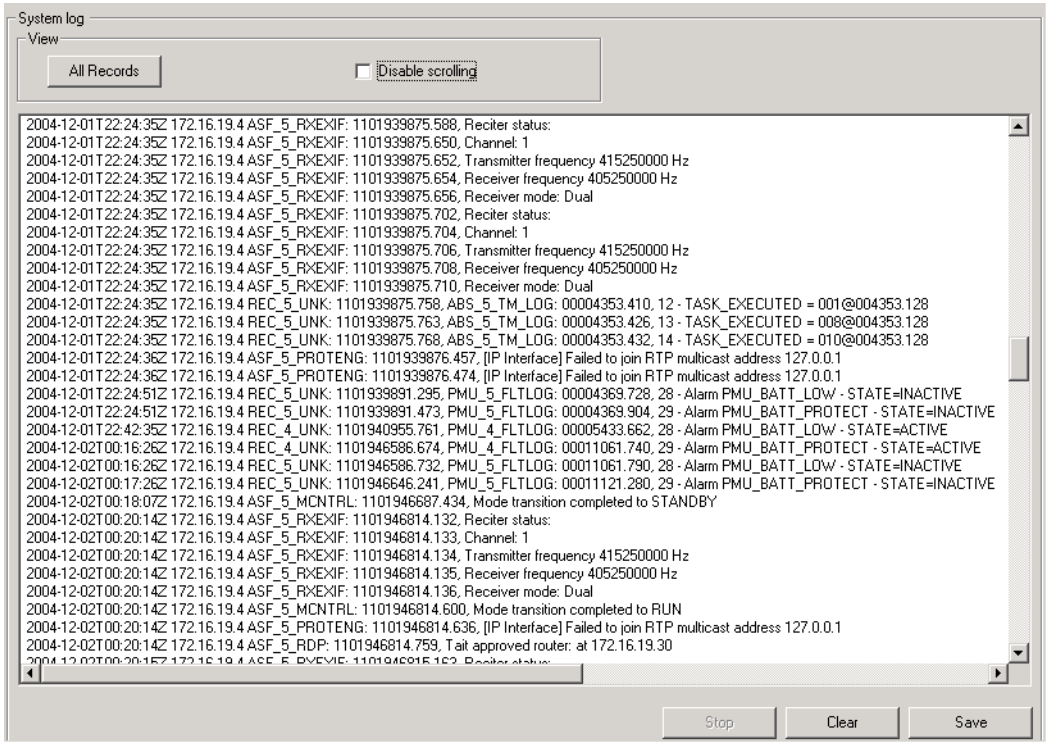
To view the call record log

1. Select Monitor > Data Logging > Call Record Log. The appropriate form appears, but displays no data.
2. Click **All Records** and the CSS asks the connected base station to supply all call records it has stored.
3. If you want to stop the displayed records from scrolling on the screen, select the **Disable scrolling** check box.

   A row of buttons on the bottom of the form lets you tell the CSS to stop asking for records, clear the display (new records will appear as calls are completed), or save the records you have obtained to a file.

Viewing the System Log

The CSS can ask the connected base station to provide records of events that lie above the level of Notice. The base station can store up to 1000 such events.



Important: Viewing the system log can cause voice drop-outs. When you click **All Records**, the base station sends all the entries in its log to the CSS. This may flood switched networks, which cannot prioritize voice packets. The result is that voice traffic does not arrive in time. To avoid this problem, configure the base station to send the data to a syslog collector. For details, see "Logging" on page 153.

To view the system log

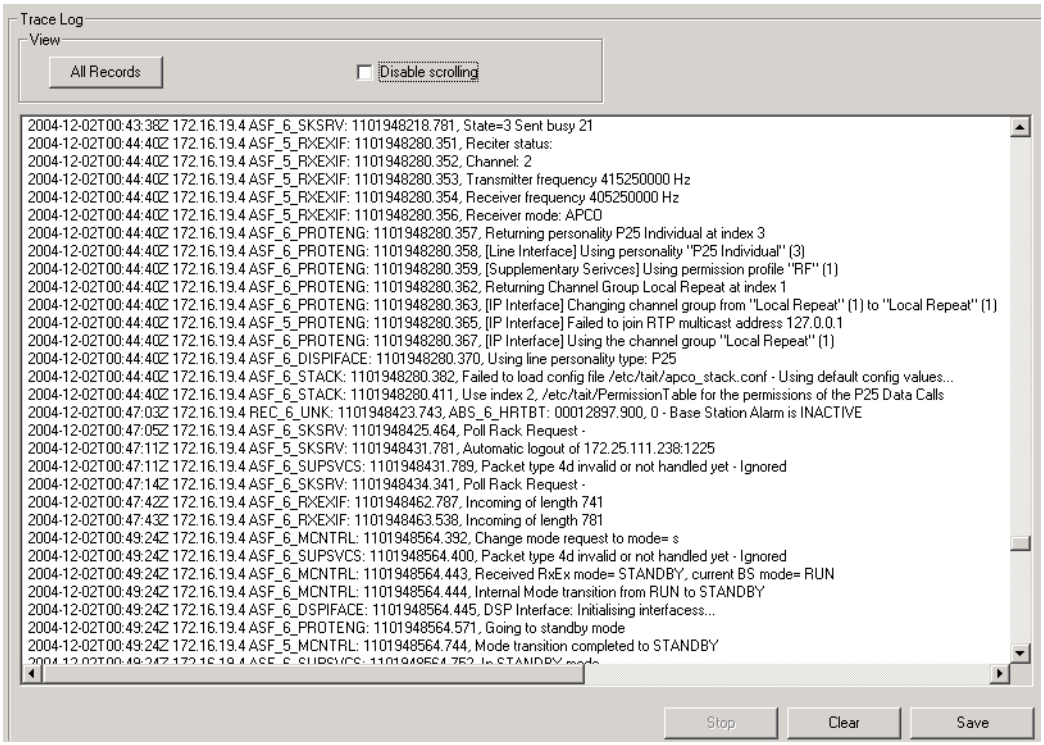
1. Select Monitor > Data Logging > System Log. The appropriate form appears, but displays no data.
2. Click **All Records** and the CSS asks the connected base station to supply records, beginning with the oldest.
3. If you want to stop the displayed records from scrolling on the screen, select the **Disable scrolling** check box.

   A row of buttons on the bottom of the form lets you tell the CSS to stop asking for records, clear the display (new records will appear as they are created), or save the records you have obtained to a file.

Viewing the Trace Log

The trace log provides information about the operation of the base station. Normally, you would look in the System log for such information. However, Tait may request that you look in the Trace log for particular items or that you save the trace log to a file and send it to them.

The trace log contains system log messages, call records, and additional messages with a severity level of Information. Information messages are Tait-internal and very detailed. The base station's trace log can store up to 1000 messages.



Important: Viewing the trace log can cause voice drop-outs. When you click **All Records**, the base station sends all the entries in its log to the CSS. This may flood switched networks, which cannot prioritize voice packets. The result is that voice traffic does not arrive in time. To avoid this problem, configure the base station to send the data to a syslog collector. For details, see "Logging" on page 153.

To view the trace log

1. Select Monitor > Data Logging > Trace Log. The appropriate form appears, but displays no data.
2. Click **All Records** and the CSS asks the connected base station to supply records beginning with the oldest.
3. If you want to stop the displayed records from scrolling on the screen, select the **Disable scrolling** check box.

   A row of buttons on the bottom of the form lets you tell the CSS to stop asking for records, clear the display (new records will appear as they are created), or save the records you have obtained to a file.

Viewing Call Statistics

The Call Statistics form (Monitor > Data Logging > Call Statistics) displays information about the current or most recent call and statistics about recent calls. Statistics are displayed separately for digital P25 calls and for analog FM calls.

Last / current Call

Information about the current call. If there is no current call, information about the most recent call.

Type	Whether the call was digital P25 or analog FM.
Duration	How long (in seconds) the call has been in progress.
Source ID	The ID of the sender (P25 calls only).
Destination ID	The ID of the intended receiver of the call (P25 calls only).

Calls

The Calls area displays statistics separately for analog FM and for digital P25 calls.

Last 15 minutes	The Last 15 minutes columns display call totals for the last completed 15-minute period. When the next 15 minute period completes, the display updates with the totals for that period.
Since reset	A column of totals that have accumulated since the base station was last reset.
RF	Calls that were initiated from the RF interface.
Line	Calls that were initiated from the analog line.
Network	Calls that were initiated from the digital line.
Microphone	Calls that were initiated from the control panel microphone.

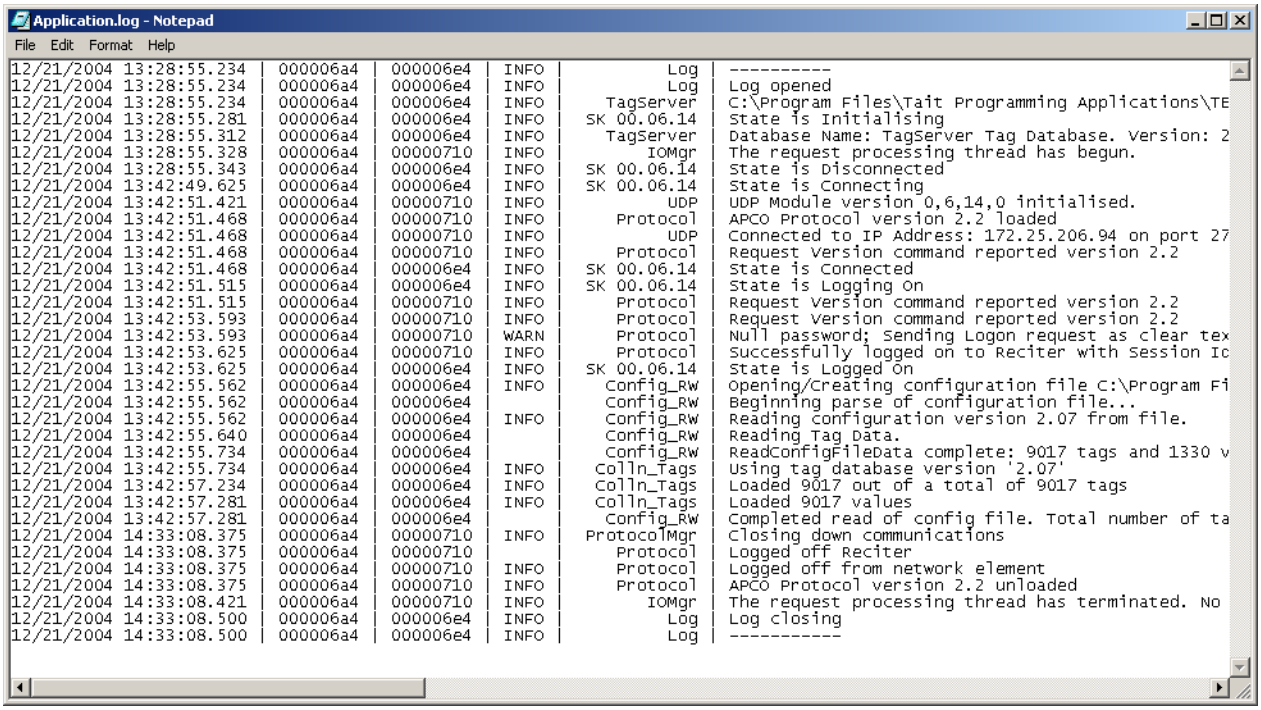
Viewing the CSS Application Log

The CSS maintains a log of events in a file. This log may provide useful information if there are problems with the CSS or in the communications between the CSS and a base station.

To view the Application log

1. Navigate to the Log Files folder. This is a subfolder of the main CSS folder.
2. Open Application.log in any text editor.

   A display similar to the following appears.

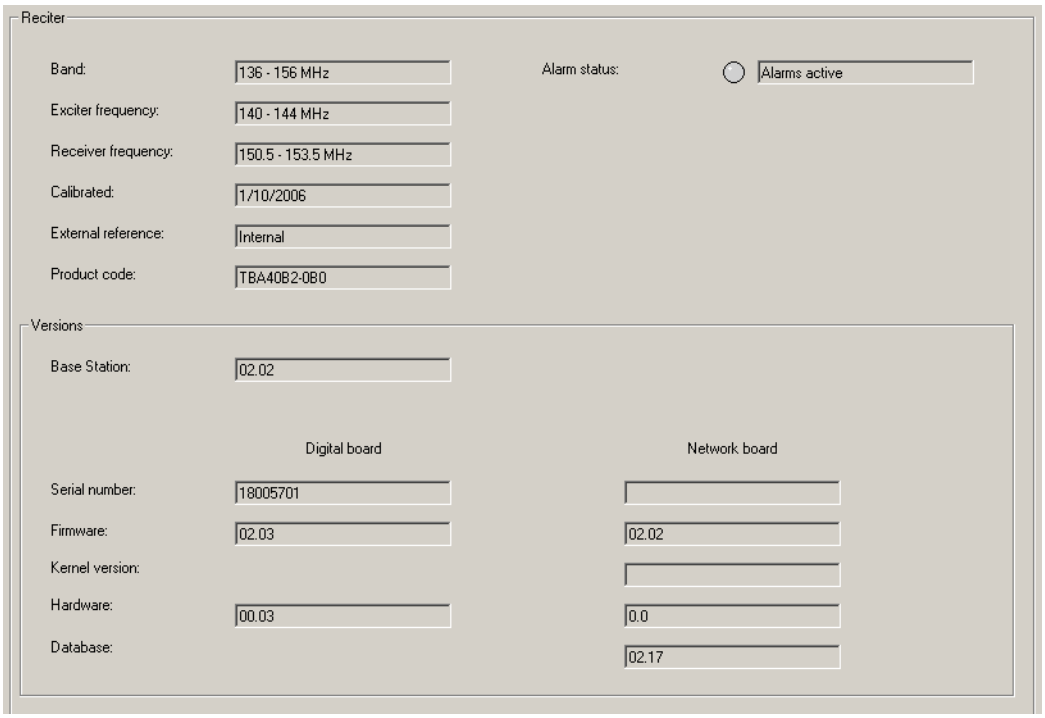


Module Details

The CSS can display details about the reciter, PA, and PMU of the base station you are logged on to. Items under the heading Module Details give you information about the module such as its frequency range and firmware version. To monitor the way the modules are operating, see "Modules" on page 67.

Viewing Reciter Information

The Reciter form (Monitor > Module Details > Reciter) lets you view information about the reciter module of the base station you are logged on to. Use it to confirm exactly what it is that you are dealing with.



Band — The RF frequency band of the reciter. This is the frequency range that the reciter is type-approved to operate in.

Alarm status — Indicates whether the reciter currently has any alarm conditions. If the LED is green, there are no active reciter alarms. If the LED is red, the text box displays 'Alarms active,' and there is at least one active alarm. To see which alarm is active, select Monitor > Alarms > Status.

Exciter frequency — The current switching range of the exciter, as recorded by the base station when it was last tuned using the Calibration Software. You can confirm the actual switching range using a diagnostic test (Diagnose > RF Interface > Synthesizers).

Receiver frequency — The current switching range of the receiver, as recorded by the base station when it was last tuned using the Calibration Software. You can confirm the actual switching range using a diagnostic test (Diagnose > RF Interface > Synthesizers).

Calibrated	The date when the reciter was last modified using the Calibration Software. (This includes adjusting the switching range and tuning the frequency response.)
External reference	Indicates whether the reference frequency is currently being provided by an external or an internal source.
Product code	The product code and name for the type of reciter.

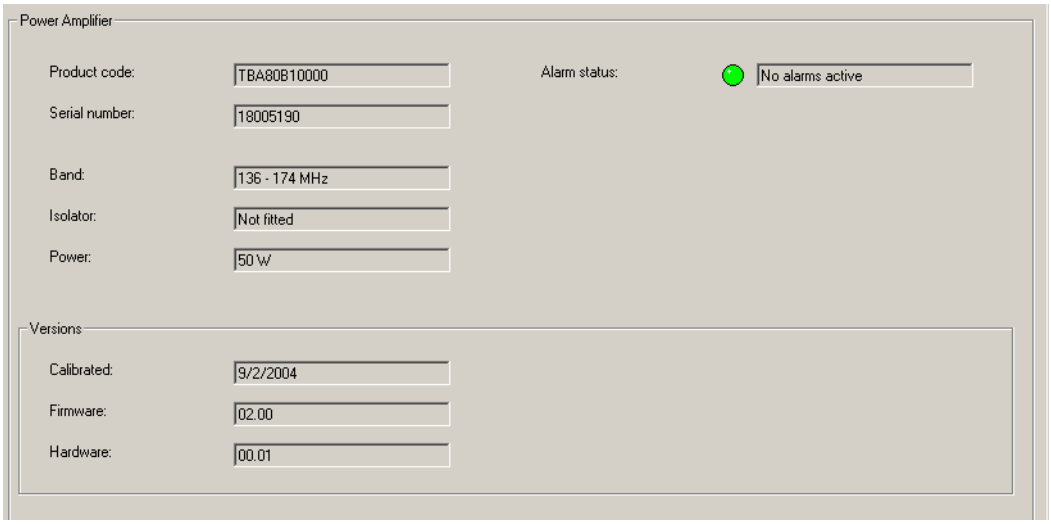
Versions

The Versions area (Monitor > Module Details > Reciter) displays version information for the reciter's digital and network boards.

Serial number	A unique identifier assigned to the board in the factory.
Firmware	The version number of the firmware currently installed on each board.
Kernel	The version number of the network board's operating system kernel.
Hardware	The version number of the hardware for each board. This version number is used to establish compatibility with firmware versions.
Database	The version number of the base station's database. The CSS communicates primarily with the reciter's network board. The CSS and the network board must use the same database version.

Viewing Power Amplifier Information

The Power Amplifier form (Monitor > Module Details > Power Amplifier) lets you view information about the PA module of the base station you are logged on to. Use it if you need to confirm exactly what it is that you are dealing with.



Product code	The product code and name for the type of PA.
Serial number	A unique identifier assigned to the PA in the factory.
Band	The RF frequency range that the PA is type-approved to operate in.

Isolator	Indicates whether the PA is fitted with an optional isolator.
Power	Specifies the RF power output rating of the PA. There are 5 W, 50 W, and 100 W variants.
Alarm status	Indicates whether the PA currently has any alarm conditions. If the LED is green, there are no active alarms. If the LED is red, the text box displays 'Alarms active,' and there is at least one active alarm. To see which alarm is active, select Monitor > Alarms > Status.

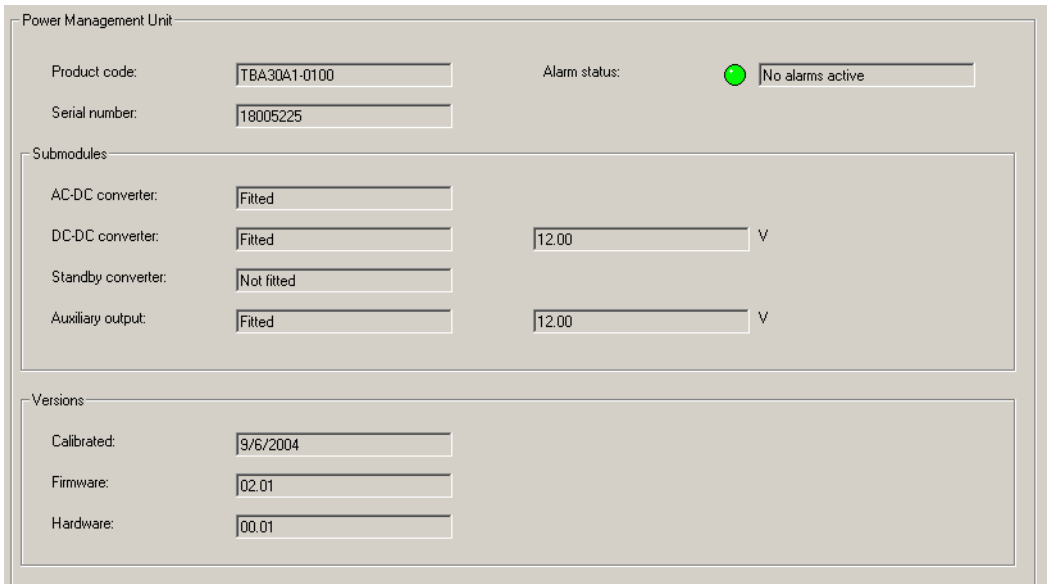
Versions

The Versions area (Monitor > Module Details > Power Amplifier) displays version numbers for aspects of the PA.

Calibrated	The date when the PA was last calibrated using the Calibration Software.
Firmware	The version number of the PA firmware.
Hardware	The version number of the PA hardware.

Viewing Power Management Unit Information

The Power Management Unit form (Monitor > Module Details > Power Management Unit) lets you view information about the PMU of the base station you are logged onto. Use it if you need to confirm exactly what it is that you are dealing with.



Product code	The product code and name of the PMU module.
Serial number	A unique identifier assigned to the PMU in the factory.

Alarm status	Indicates whether the PMU currently has any alarm conditions. If the LED is green, there are no active alarms. If the LED is red, the text box displays 'Alarms active,' and there is at least one active alarm. To see which alarm is active, select Monitor > Alarms > Status.

Submodules

The Submodules area (Monitor > Module Details > Power Management Unit) indicates which submodules the PMU is fitted with.

AC-DC converter	Indicates whether the PMU is fitted with an AC-DC converter submodule, so that it can use mains input.
DC-DC converter	Indicates whether the PMU is fitted with a DC-DC converter submodule, so that it can use DC power as an input. The box alongside indicates whether the submodule is designed for a 12, 24, or 48 V input.
Standby converter	Indicates whether the PMU is fitted with a standby converter submodule.
Auxiliary output	Indicates whether the PMU is fitted with a submodule that provides an auxiliary power output. The box alongside indicates whether the submodule is designed for a 12, 24, or 48 V output.

Versions

The Versions area (Monitor > Module Details > Power Management Unit) displays version numbers for aspects of the PMU.

Calibrated	Indicates when the PMU was last calibrated using the Calibration Software.
Firmware	The version number of the PMU firmware.
Hardware	The version number of the PMU hardware.

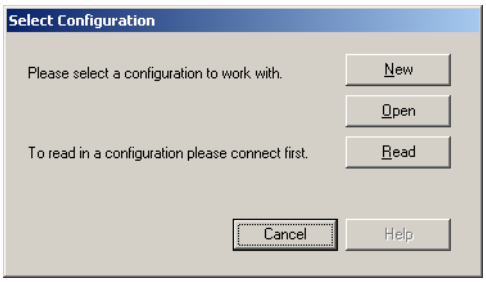
Part E Configuring

The CSS lets you configure the TB9100 base station.

Click **Configure**, choose a configuration, and select an item from the navigation pane.

Choosing a Configuration

If you click **Configure** and the CSS doesn't already have a configuration in memory, it asks you to choose one to work with.



- Click **New** to open a new configuration based on the default template.
- Click **Open** to select an existing configuration file.
- Click **Read** to read in the configuration of the base station you are connected to.

Base Station

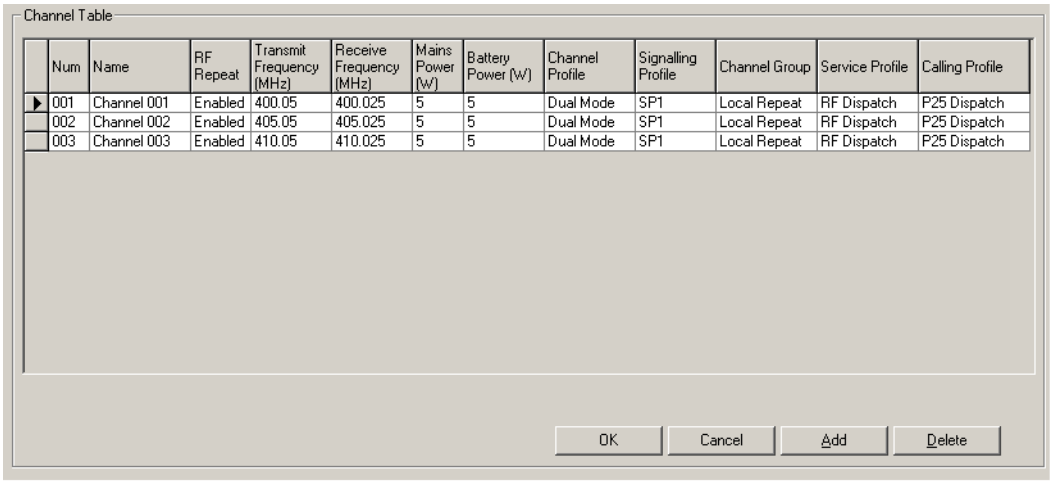
Under Base Station, the navigation pane groups items that apply to the base station as a whole and are not specific to a particular interface.

Working with the Channel Table

The Channel Table form (Configure > Base Station > Channel Table) lets you work with channels. You can view the configured channels, edit them, and add more channels.

Channel Table Details

The Channel Table form (Configure > Base Station > Channel Table) displays the channels defined in the channel table of the configuration file that you opened or the base station database that you read.



The form contains a table that displays a row for each channel. The row indicates the channel's number and name, the configured transmitter power output for mains and battery power, and the profiles that have been assigned to the channel.

An arrow at the left of one row indicates that it is selected; if you click **Add**, a copy of that row will be added. Use the mouse or the arrow keys to change your selection. When you make any changes to a row, the arrow changes to a pencil.

Important: The arrow does ***not*** define the current channel. To find out the channel that the base station is currently operating on, select Monitor > Interfaces > RF Interface.

The first two columns indicate the number and name of each channel. The other columns define the main characteristics of each channel. Frequencies and transmit output power you can edit directly. Profiles and the channel group are selected from a list. Click a cell and a drop-down list appears, showing the items that have been defined.

Num

The number of the channel. It is not editable, so that you do not break existing Task Manager statements. To replace a deleted channel, select the previous channel and click **Add**. This adds an entry to the channel with the number of the deleted channel.

Name

The name of the channel. When you create a channel, it is given a default name of the form 'Channel *nnn*' where *nnn* is the channel number. You can edit this name to reflect the channel's purpose or users.

RF repeat

The RF repeat column specifies whether the base station operates as a repeater. For an introduction to the Repeat function, see "RF Repeat Function" on page 8. For full details about how the RF repeat setting affects signal voting and switching, see the information on voting in the Technical Description section of the TB9100 Installation and Operation Manual.

Option	Description
Enabled	The base station operates as a repeater. It is able to transmit the signal received from its RF interface or the RF interface of other channel group members. It repeats the best RF signal received by the channel group, not necessarily the signal it receives on its own RF interface.
Disabled	The base station does not repeat received RF signals. It can only transmit what is provided by its analog line, its control panel microphone, or the analog line or control panel microphone of another channel group member.
DispatchControlled	The base station's repeat function is controlled by Task Manager action and not by configuration. This makes it possible for the dispatcher to turn the channel group's repeat function on and off, see "RF repeat actions" on page 197.

Transmit Frequency

The radio frequency that the channel transmits on.

Receive Frequency

The radio frequency that the channel receives on.

Mains Power

The RF power output in watts. This is the power that the channel is configured to provide when the base station is using mains power.

Note: If you specify an RF power of 100 W and the PA is rated at 50 W, it will run at 50 W. There is therefore no need to alter this value if you temporarily substitute an amplifier with lower power, for example, if there is a fault and you don't have a fully powered module on hand.

Battery Power

The RF power output in watts. This is the power that the channel is configured to provide when the base station is using battery power.

Channel Profile

The channel profile assigned to the channel. See "Profiles" on page 5 for an overview of the different profiles and their functions.

Signaling Profile

The signaling profile assigned to the channel.

Channel Group

The channel group that the base station is part of.

Service Profile	The set of services that the inbound channel will support.
Calling Profile	The calling profile used by the analog line.
Add	Inserts a copy of the selected channel immediately below that channel. For more information, see "Adding a Channel" on page 87.
Delete	Removes the selected row from the channel table.

Editing a Channel

Editing a channel is mostly about assigning the correct profiles to it.

To edit a channel

1. In the channel table (Configure > Base Station > Channel Table), click in the row that defines the channel. An arrow appears at the left of the row indicating that it is selected.
2. If desired, click in the **Name** cell and edit the channel's name.
3. If necessary, alter the receive frequency and the transmit frequency.

Important: Do not assign a prohibited frequency to the transmitter. For example, 406.0-406.100 MHz is reserved internationally for distress beacons.

Note: The CSS does not check whether the base station can operate on the frequency pair you enter.

For simplex applications, you can make the receive and transmit frequencies the same. The base station automatically increases the transmit frequency by 25 kHz when it is not transmitting, to avoid desensitizing the receiver.

4. In the **Main Power** and **Battery Power** columns, specify values for the transmitter's RF output power when powered by mains and DC respectively.
5. In the **Channel Profile** column, select the channel profile you want the base station to belong to. (Click in the cell, then click the arrow that appears. A list of the defined channel profiles appears.) The channel profile determines a whole range of settings, including switching behavior and (for analog mode), receiver gating and channel spacing.
6. In the **Signaling Profile** column select the channel profile you want the base station to belong to. This defines the use of NAC (for digital P25 mode), subaudible signaling (for analog FM mode), and tail timers.
7. In the **Channel Group** column, select the channel group that you want the base station to belong to. This determines the multicast address on the TaitNet P25 network that it sends voice to and listens to.
8. In the **Service Profile** column, select a the service profile that defines the set of services that you want the channel to support.
9. In the **Calling Profile** column, select a calling profile that you want to apply to the analog line (dispatcher commands that use MDC1200 can change this selection or override some of its settings.)
10. Click **OK** to confirm your changes and close the form.

Note: If you are editing a large number of channels, periodically click **OK**, and then (on the toolbar) **Save**. A computer failure will result in the loss of data stored only in volatile memory.

Adding a Channel

You can add a channel to the channel table.

1. Select Configure > Channels and Profiles > Channel Table.
2. Click on a channel similar to the one you want to add. A black triangle appears to the left of the row.
3. Click **Add**. This inserts a copy of the selected channel immediately below that channel. The inserted channel is given the next available number and an equivalent name, for example, if the next available channel number is 008, the name is Channel 008.
4. If desired, click the **Num** column heading to sort the new channel into numerical order.
5. Edit the values in the channel row as needed (see "Editing a Channel" on page 86).

Selecting an Operating Channel

Once a number of channels are defined in the channel table, you need to select at least one channel that the base station will operate on. There is no default channel; until one has been specified, the base station cannot operate.

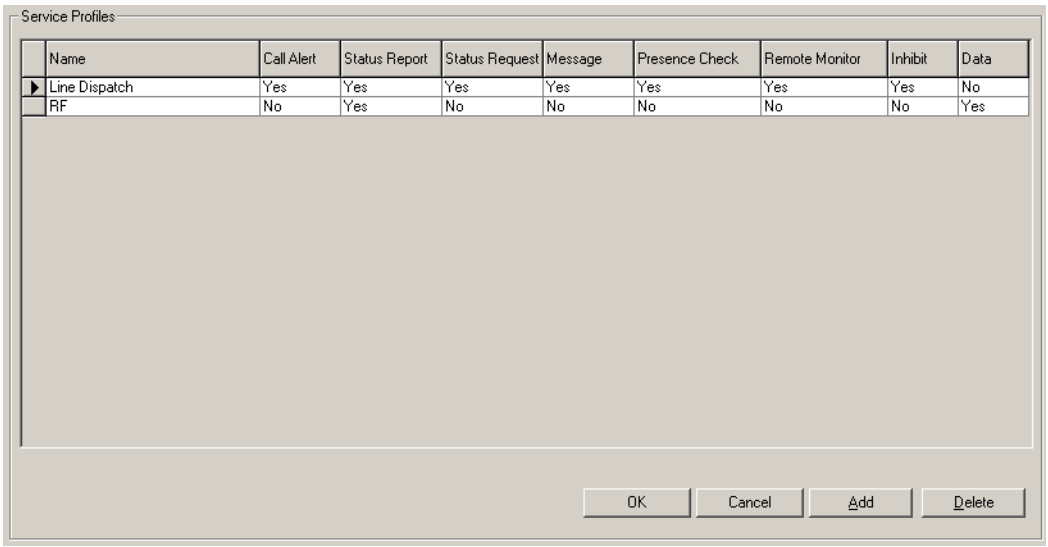
You have the following options.

Option	Method
Automatic channel selection	Set up a Task Manager statement such as IF **Base station in Run mode** THEN **Go to channel** 2. The result is that every time the base station transitions from Standby mode to Run mode, it goes to the specified channel.
Dispatcher selects channel	Set up Task Manager statements such as IF **Tone remote detected** 550 THEN **Go to channel** 2. When the analog line receives a 550 Hz function tone from the console system, the base station switches to that channel.
Dispatcher selects channel (other base station)	If the base station is part of a channel group and the console system is connected to another base station in the channel group, you must set up Task Manager statements such as IF **Function code 5 received** THEN **Go to channel** 2. For more details, see "Propagating Tone Remote Commands to the Channel Group" on page 123.
Digital input value	The channel can also be selected indirectly by means of the digital inputs. The settings of a specified number of digital inputs have a computed value (displayed in Diagnose > Line Interfaces > System Interface). Set up Task Manager statements such as IF **Digital input value 2** THEN **Go to channel** 2. Equipment can be connected to the reciter's DB9 socket that is able to switch the digital inputs on and off, changing the channel.

Working with Service Profiles

The Service Profiles form (Configure > Base Station > Service Profiles) displays a list of available service profiles. A service profile indicates which additional services are permitted. Emergency alert is always permitted, so does not appear. All acknowledgements are also always permitted. Service profiles apply when the base station is operating in digital P25 mode. They do not affect MDC1200 signaling in analog FM mode. Tait recommends that all services are normally enabled. Consoles and radios can allow or disallow services to the end user. However, services can be disabled at the base station to prevent pirate radios from using them on the TaitNet P25 network.

A service profile can be selected by a channel in the channel table and/or by a calling profile. When a service profile is selected by a channel, it controls the behavior of the inbound RF channel. If a service is enabled, the inbound channel supports that service. When a service profile is selected by a calling profile, it controls the behavior of the analog line in. If a service is enabled, the analog line lets the analog console system use that service. The console system sends a MDC1200 signal, which is converted into the digital P25 equivalent (see "Additional Services" on page 125).



The profiles display Yes or No for each service. Yes means that the service is enabled, No that it is disabled. The following describes briefly what each service is.

Name — The name of the service profile.

Call Alert — Call alert (also known as paging) is a message that asks the radio user to call the sender. It may for example trigger a persisting message on the target radio such as a repeating tone and flashing display.

Status Report — A status report is a message that the radio sends, perhaps in response to a status request.

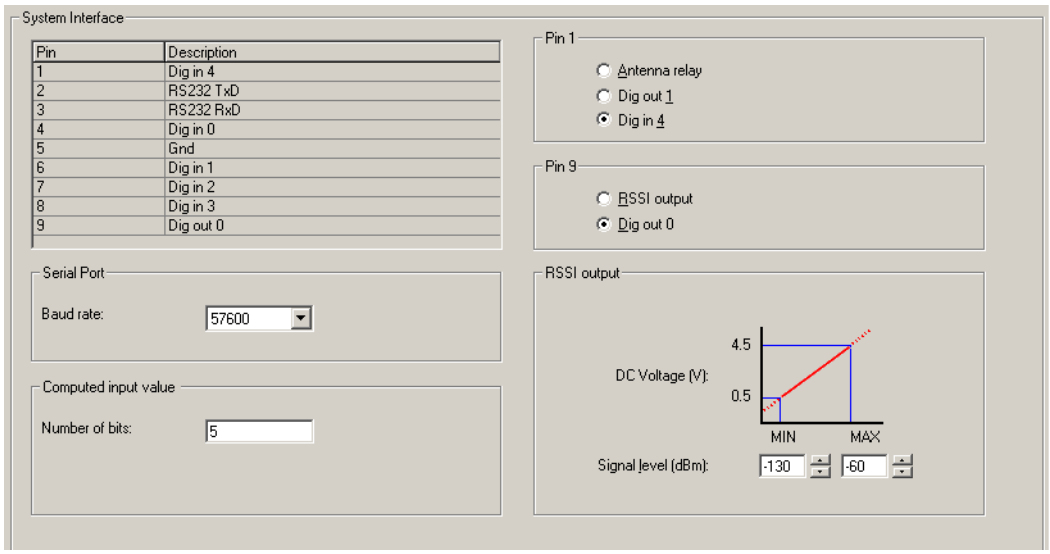
Status Request — A status request is a message that requests a status report.

Message — A message is a free-form text string.

Presence Check	A presence check is a message that checks out a given radio. If the radio responds, it is within communications range and its RF circuitry is functioning. The operator is not disturbed.
Remote Monitor	A remote monitor message causes the radio to initiate a call by itself. It allows the sender to listen to what is going on at the radio's location.
Inhibit	An inhibit message disables the destination radio, for example if it is reported stolen. When the Inhibit service is enabled, the Uninhibit service is also enabled.
Data	The data service (not currently supported) involves the sending and receiving of data rather than voice.

Configuring the System Interface

The System Interface form (Configure > Base Station > System Interface) lets you configure the operation of digital inputs and outputs and the serial port. These all connect to the DB9 labeled DIG on the rear of the reciter. To monitor the current status of the digital inputs and outputs, or to carry out diagnostic tests on them, select Diagnose > Line Interfaces > System Interface.



Pin assignments

The unnamed table displays the functions assigned to each pin on the DIG DB9 connector. The display reflects the choices made for Pins 1 and 9.

Serial port

Baud rate	The default baud rate setting is 57,600 bit/s and is not normally changed. For Calibration Software operation it must be at this speed. The setting is ignored when the serial port provides raw C4FM data and a baud rate of 19,200 is used instead.

Computed input value

Number of bits

Tells the base station how many bits (digital inputs) to use in calculating the digital input value. Digital input 0 provides the least significant bit. Four digital inputs are always available. If you configure Pin 1 as Dig in 4, a fifth digital input is also available. Inputs are assigned the value 0 when they are low and 1 when they are high. To monitor the current computed input value, select Diagnose > Line Interfaces > System Interface.

The digital input value can be used as an input in Task Manager statements (see "Digital input value" on page 189). Task Manager can for example select the channel number to use based on the computed input value.

Pin 1

The three option buttons let you specify one of three functions for Pin 1.

Function	Description
Antenna relay	Select this option in simplex applications to provide a signal that drives an antenna relay. For details, see "Antenna Relay Operation" on page 91.
Dig out 1	Configures pin 1 as a digital output. Select this option if you need a digital output.
Dig in 4	Configures pin 1 as a digital input. Select this option to make a fifth bit available for the computed input value or to make a fifth digital input available.

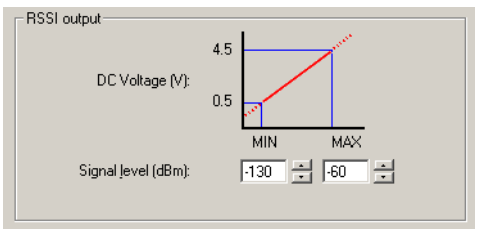
Pin 9

The two option buttons let you specify one of two functions for Pin 9.

Function	Description
RSSI output	Configures pin 9 to output a voltage proportional to the received signal strength. For more details, see "RSSI Output" on page 90.
Dig out 0	Configures pin 9 as a digital output. You can also configure pin 1 as a digital output.

RSSI Output

The TB9100 can provide an RSSI output on pin 9 of the DB9 labeled DIG. This is used for external voting or in systems with two base stations for redundancy.



To enable and configure the RSSI output

1. Select Configure > Base Station > System Interface.
2. Under **Pin 9**, click **RSSI output**.
3. Under **RSSI output**, enter into the **Signal level** boxes the minimum and the maximum signal strengths that the base station needs to deal with. The RSSI output will be 0.5 V at the minimum signal strength, increasing linearly up to 4.5 V at the maximum signal strength.

Antenna Relay Operation

For simplex applications, the base station can be set up with an antenna relay, enabling the receiver and transmitter to share the same antenna. Before the transmitter keys up, the base station activates the relay, disconnecting the receiver and connecting the transmitter to the antenna. It then powers the transmitter up. After it powers the transmitter down, it opens the relay again, so that it is ready to receive.

If the transmit and receive frequencies are equal, the base station automatically increases the transmitter frequency by 25 kHz when the base station is not transmitting, to minimize stray coupling.

Important: Check the specifications of the antenna relay to make sure that it closes its contacts within 20 ms of activating the antenna relay driver. Otherwise, transmissions can begin before the contacts have closed. This can damage the PA. It will also burn the relay contacts.

If the base station will operate with an antenna relay, you must configure pin 1 of the DB9 labeled DIG as an antenna relay driver. Selecting this function for the pin also instructs the base station to operate with built-in timing delays (see "Start Timing Delays" on page 92 and "End Timing Delays" on page 93) to ensure that the PA begins its output after the relay contacts have closed and that the relay contacts close only after the PA has ceased its output.

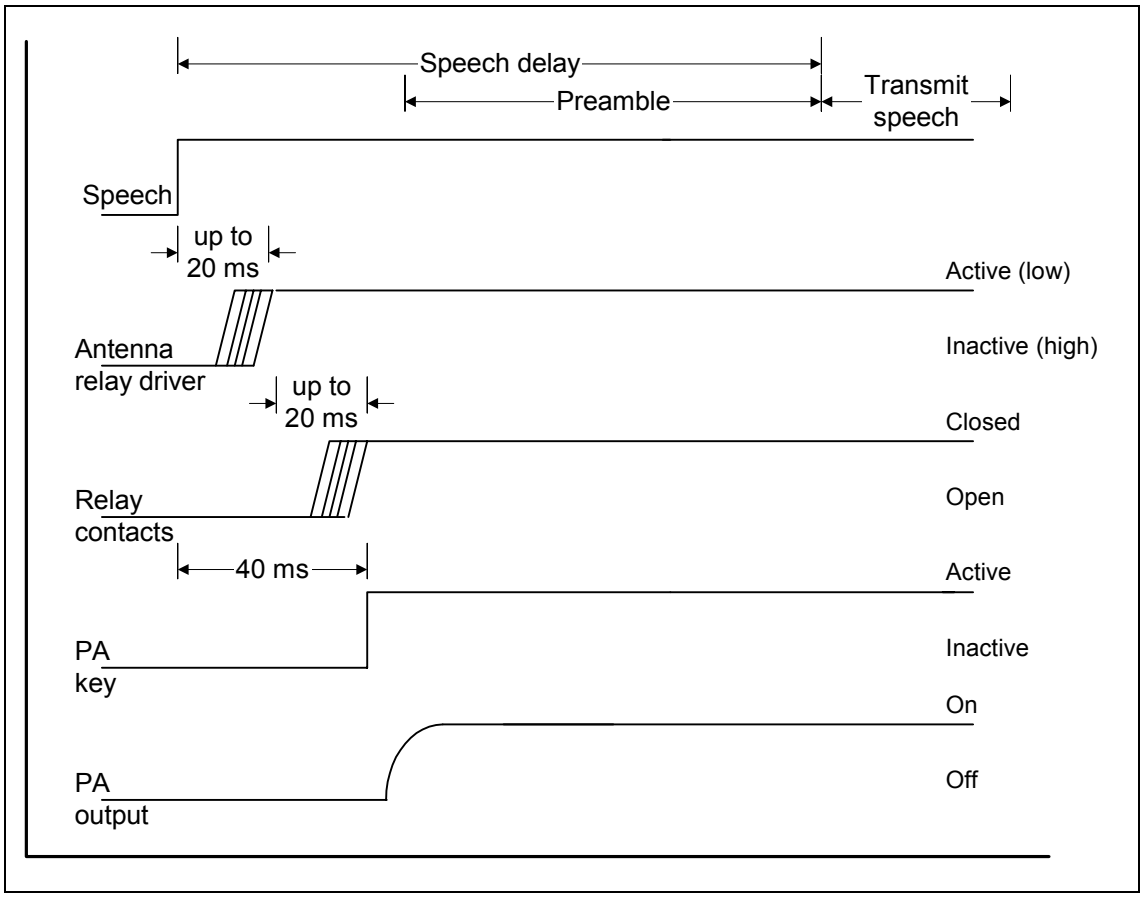
To enable the operation of an antenna relay

1. Select Configure > Base Station > System Interface.
2. Under **Pin 1**, click **Antenna relay**.
3. In the channel table, make sure that RF repeat is disabled in all channels. Using an antenna relay when RF repeat is enabled will result in relay chatter. When the base station receives a signal, it switches to transmit so that it can repeat it. The result is that it can no longer see the signal. As there is nothing to transmit, it switches back to receive, which causes it to switch to transmit again, and so on.
4. Program these settings into the base station.

Start Timing Delays

The diagram below shows timings for the start of an over. The base station asserts the antenna relay driver at least 20 ms before the PA becomes active, to allow time for the relay contacts to close.

Figure 4: Antenna relay timing diagram for the beginning of an over



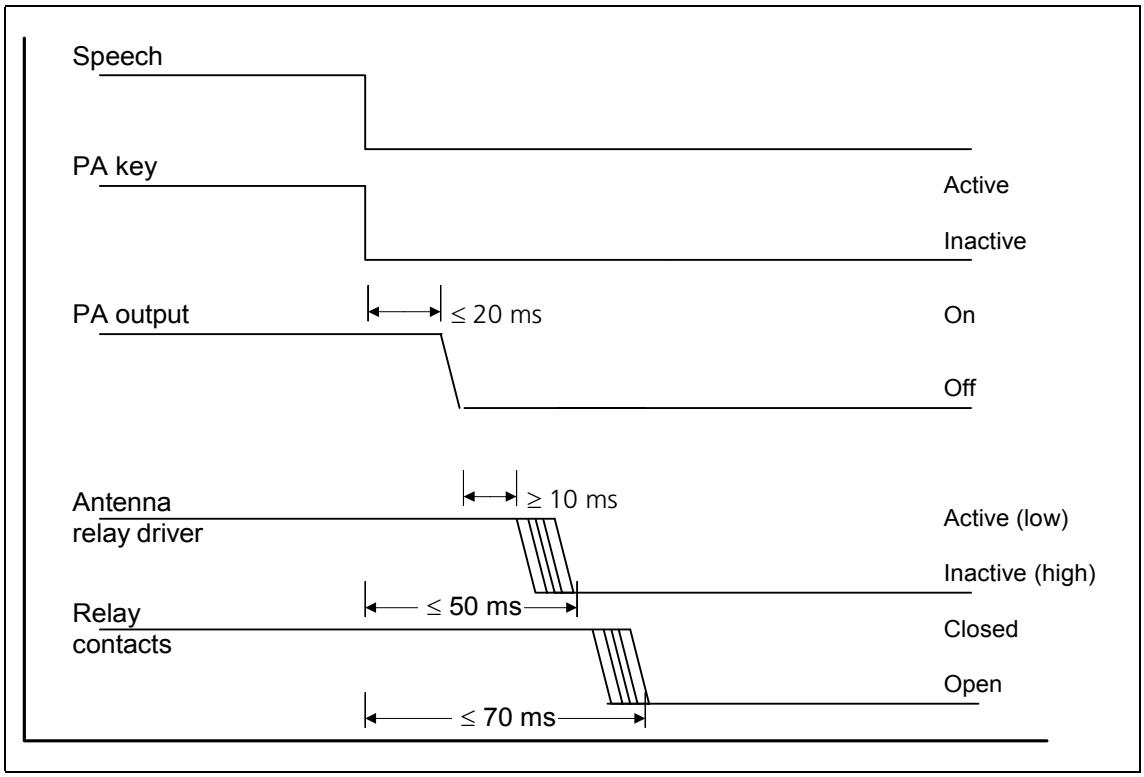
When the voter begins providing output for transmitting, the base station waits for 20ms before activating the antenna relay line (Pin 1). It then waits a further 20ms for the antenna relay to close before activating the PA key signal, which instructs the PA to begin transmitting. In digital P25 mode, it transmits the full preamble before beginning to transmit speech (speech transmission only begins after the antenna relay delay and the preamble time).

Note: The configured preamble duration is unaffected up to a maximum of 260 ms. Increasing the preamble duration beyond 260 ms has no effect on a base station with an antenna relay.

End Timing Delays

The diagram below shows timings for the end of an over. After the PA key goes inactive at the end of an over, the PA output can continue for up to 20 ms, if the keying duration was very short. The base station makes sure that the PA output has been off for at least 10 ms before de-activating the antenna relay driver.

Figure 5: Antenna relay timing diagram for the end of an over

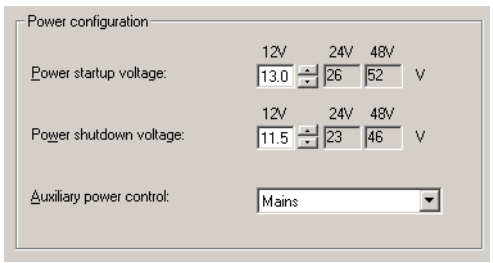


Configuring Miscellaneous Items

The Miscellaneous form (Configure > Base Station > Miscellaneous) gathers together a number of settings.

Minimum battery voltages

The Power configuration area (Configure > Base Station > Miscellaneous) defines the lowest possible voltages for the DC power input to the PMU.



Three pairs of voltages are displayed, corresponding to the PMU's different DC-DC converter options (a nominal 12 V, 24 V, or 48 V input). The voltages that apply have a white background and can be edited. If there is no AC power

and the battery voltage falls below the value in the relevant **Power shutdown voltage** box, the base station shuts down. If the voltage rises above the value in the **Power startup voltage** box and the PMU is fitted with a standby module, the base station re-starts.

Note: Base stations with a 12 V PA and no PMU cannot have their shutdown and startup voltages adjusted; these voltages are fixed in hardware.

Auxiliary power control

If the PMU is fitted with an auxiliary power supply unit, you need to configure it to suit the way it will be used. Generally, its output can be used to charge batteries or to power other site equipment. If it is used to charge batteries, configure it to be on when mains power is on. If it is used to power other site equipment, use Task Manager to turn it on and off.

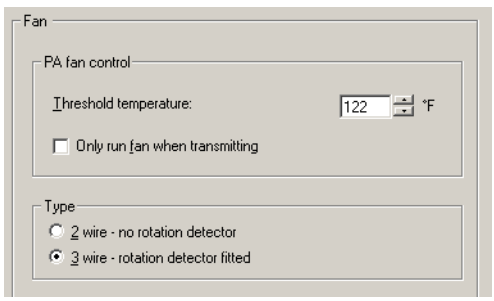
Caution: *While the auxiliary power output can be used for more than one purpose at once, this is not generally recommended. It can result in a short-circuit and equipment damage. The output is floating. If it is connected to a negatively earthed battery and to positively earthed auxiliary equipment, a short-circuit will result.*

In the Power configuration area (Configure > Base Station > Miscellaneous), the Aux power control box specifies what controls the auxiliary output. Select one of the following options.

Option	Description
Task Manager	The Task Manager action **Unlock Auxiliary Supply** will turn the output on. You need to define suitable tasks for your system and application so that the auxiliary power output is turned on when it is needed and turned off when it needs to be off. See "Auxiliary supply lock" on page 196.
Mains	Output is provided only when the PMU uses AC mains power. This option is suitable for re-charging the batteries used for the PMU's DC power input. The Task Manager action **Unlock Auxiliary Supply** is not used. If the base station has a DC only PMU, this setting never turns the auxiliary power on.

Configuring Fan Settings

The Fan area (Configure > Base Station > Miscellaneous) gathers together fan-related settings. These specify how the base station monitors its PA and PMU fan and when the PA fan is turned on. The operation of the reciter fan is not configurable.



PA Fan Control

The PA Fan Control area determines when the PA fan is turned on. The settings can be adjusted to meet user requirements based on the transmit duty cycle and whether the site facility is air-conditioned. Strike a balance between lengthening fan life and reducing the PA operating temperature.The settings you choose should also help avoid extreme temperature swings. Bear in mind that the PA is designed to run at full duty cycle at up to +60°C ambient operating temperature into any transmit VSWR load.

Note: While the PA fan on/off thresholds are user-configurable, the PMU fan has fixed on/off thresholds controlled by PMU firmware.

Threshold temperature

If the temperature at the driver, final 1, or final 2 stages exceeds the threshold temperature, the fan is turned on (but only when the PA is transmitting, if the check box below is selected). When the temperature at all three parts of the PA falls 5°C below the threshold, the fan is turned off.

Tip: To monitor all PA temperature values, select Diagnose > Power Amplifier > Control Tests.

Only run fan when transmitting

When this check box is selected, the fan will only operate if the PA is transmitting and any one of the monitored PA temperatures exceeds the threshold.

Note: Fans used in the TB9100 must have the correct wiring. Power and ground (2-wire fans) or power, ground and rotation detect (3-wire fans). Both fans in the front panel should be of the same type.

Type

Specify whether the PA and PMU fan type is 2-wire or 3-wire. If you select 3-wire, the base station will use the third wire as a rotation detector. If it has turned the fan on but does not detect rotation, it activates the 'Fan failed' alarm.

Emulating T800 Fan Operation

In Tait T800 series base stations, the fan is usually turned on and off based on the state of the transmitter's RF output. To emulate this, follow these steps:

1. Select Configure > Base Station > Miscellaneous.
2. Set the threshold temperature to a value that is lower than the usual site ambient temperature.
3. Select the **Only run fan when transmitting** check box.

With these settings, the PA fan turns on with RF output and cools the PA as soon as it begins working. It turns off when the RF output stops. The PA does not turn on if its temperature is below the threshold. This is an improvement compared with the T800 and lengthens fan bearing life.

External clock reference frequency (if fitted)

The External clock reference frequency (if fitted) area (Configure > Base Station > Miscellaneous) lets you specify the frequency of an external reference frequency source. If an external source is connected to the reciter, select the appropriate option to tell the base station what the source's frequency is.

Control panel

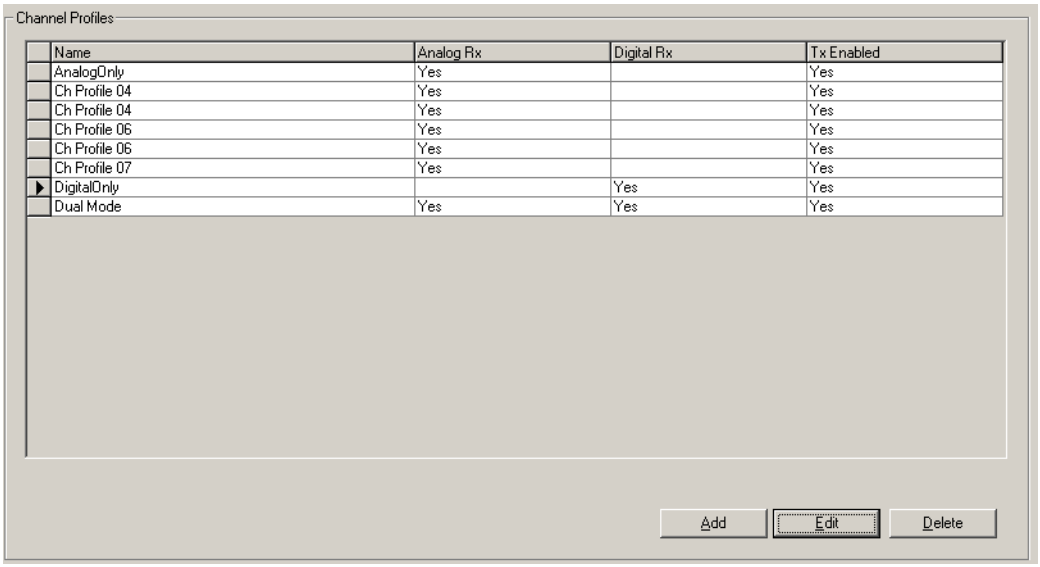
The Enable check box in the Control panel area enables the speaker and microphone. Disabling them may be desirable for security reasons. Before using them, a maintainer on site must first modify the configuration.

RF Interface

The behavior of the RF interface is determined by the channel profile and the signaling profile that are assigned to the current channel in the channel table. You can also configure the sending of a morse code station ID.

Working with Channel Profiles

The Channel Profiles form (Configure > Base Station > Channel Profiles) lets you view the profile list, add a new profile, or edit an existing one.



The form displays a row of information for each profile. An arrow appears alongside the profile selected on the form. To sort the display by a particular column, click the column heading.

The **Name** column indicates the name of the profile.

The **Analog Rx** and **Digital Rx** columns show you whether the profile lets the base station receive analog FM, digital P25, or both (dual mode).

If the **Tx Enabled** column displays No, the base station cannot transmit if its channel is assigned that profile.

For more detail about these columns, and about other profile details, see "Editing a Channel Profile" on page 98.

Buttons along the bottom of the form let you add a new profile, edit the selected profile, or delete the selected profile.

Adding a Channel Profile

The base station requires at least one channel profile but you can define up to 16 of them. One is needed for each combination of parameter variations that the base station needs to provide. For example, the base station may need to operate normally in mid-band but sometimes in wideband. In addition, conditions may sometimes be noisy, so different receiver gating settings are sometimes required. For these options you need four profiles, one for each combination of settings.

The following instructions do not deal with all configuration items. For more detailed information about the individual items, see "Editing a Channel Profile" on page 98.

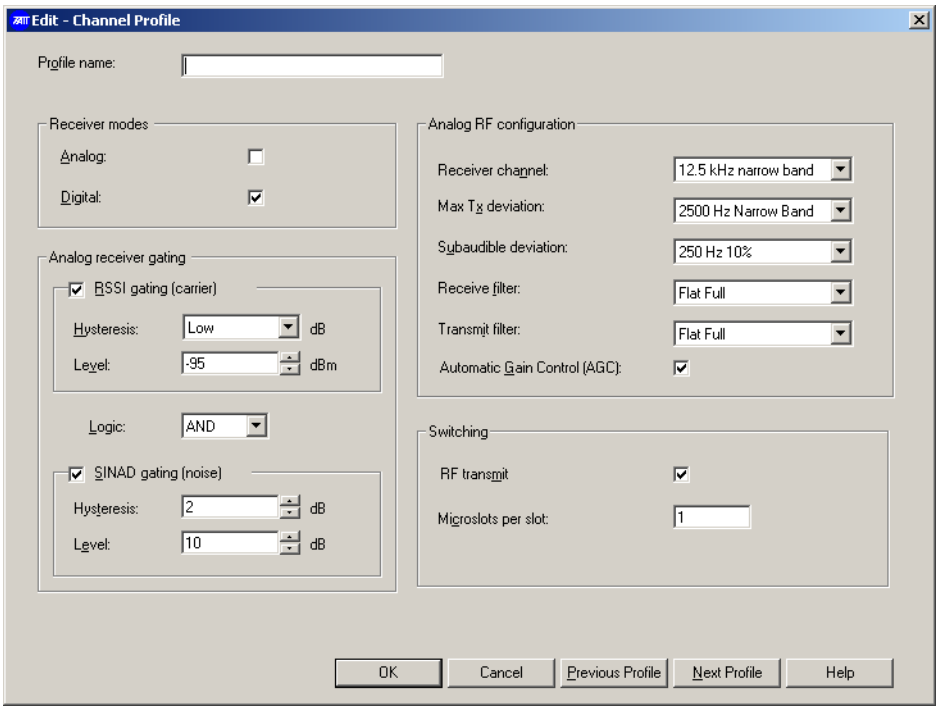
Tip: Set up a test profile and assign it to a channel. Use this channel when testing your system before commissioning.

To add a channel profile

1. Select Configure > Base Station > Channel Profiles. The Channel Profiles form appears.
2. Click a profile, and then click **Add**. A copy of the profile appears in the row below.
3. Click **Edit**. The Edit Channel Profile dialog box appears. (When you add the first profile, this happens automatically.)
4. In the **Profile name** box, enter a suitable name for the profile.
5. Under **Receiver modes**, select both the Analog and Digital check boxes to enable the base station to receive in both analog FM and digital P25 modes. Alternatively, select one or the other check box for single-mode operation.
6. Under **Receiver gating**, set the criteria for receiver squelch. You can have gating based on RSSI as well as SINAD and choose whether one or both criteria must be met. These criteria apply to analog FM mode only. For more details, see "Analog Receiver Gating" on page 99.
7. Under **Analog RF configuration**, specify the following properties for the RF channel.
   a. The receiver channel bandwidth and the maximum transmit deviation.
   b. The deviation applied to subaudible signaling if the base station will transmit with CTCSS or DCS.
   c. The type of filter used on the receive and transmit paths.
   d. Whether automatic gain control is applied.
8. Select the **RF transmit** check box to enable the transmitter.
9. Click **OK** to confirm your changes and close the dialog box, returning you to the Channel Profiles form.

Editing a Channel Profile

The Edit Channel Profile dialog box lets you view the details of the selected channel profile and modify them.



Profile name — Specifies the name of the profile. If you edit this name, ensure that the new name is unique.

Previous Profile — Displays the previous profile in the list, without requiring that you leave the dialog box. This confirms any changes you have made to the current profile, which means they cannot be undone.

Next Profile — Displays the next profile in the list, without requiring that you leave the dialog box. This confirms any changes you have made to the current profile, which means they cannot be undone.

Receiver modes

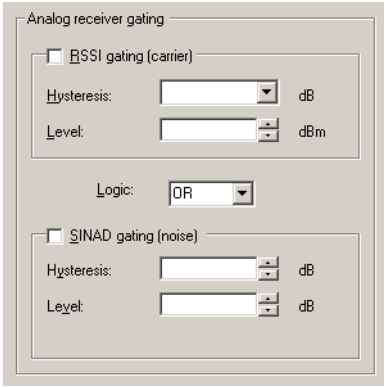
The Receiver modes area lets you specify which modes the base station can operate in response to signals that it receives over the air interface. You must select at least one mode. If you select both modes, the base station functions as a dual mode receiver. If it finds frame synchronization, it operates in digital mode. If not, it operates in analog mode.

Analog — The base station can receive analog FM signals.

Digital — The base station can receive digital P25 signals.

Analog Receiver Gating

In the Edit Channel Profile dialog, the Analog receiver gating area configures the way receiver gating (also known as receiver squelch) operates when the base station is receiving in analog FM mode.



You can have analog gating based on:

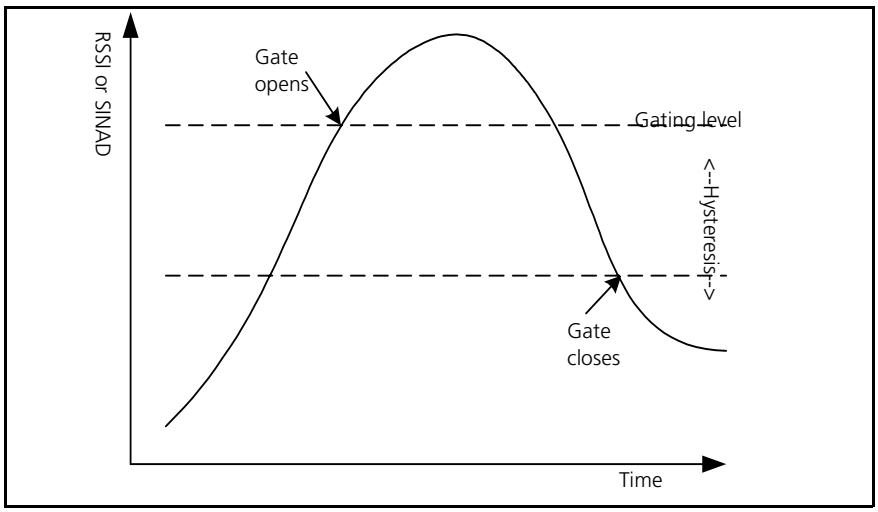
- RSSI
- SINAD
- RSSI and SINAD
- RSSI or SINAD

RSSI gating operates more quickly and is suitable for repeater links. SINAD gating takes longer but is more immune to noise interference and is suitable for the repeater itself or for a line-connected base station.

Note: Gating in digital P25 mode is not configurable. The receiver unmutes when frame synchronization is achieved. If the signal subsequently deteriorates so that forward error correction is unable to compensate for errors, the voice stream is discontinued.

If analog gating is set at low levels for a dual mode receiver, breakthrough of the digital P25 signal can occur in analog mode. The signal is good enough to unmute the receiver but not to achieve frame synchronization.

Tip: If possible, add subaudible signaling to dual mode receivers. This prevents the analog receiver from briefly unmuting to a digital signal until frame synchronization is detected.



RSSI Gating (carrier)

Enables gating based on the base station's measurement of the received signal strength. This is also known as Carrier gating. This method is not recommended for low signal levels. If the level is set low (for example -118 dBm) and the hysteresis is set to High, the gate may stay open permanently.

SINAD Gating (noise)

Enables gating based on the estimated SINAD (obtained by measuring the out-of-band noise). This is also known as noise gating.

Logic

When both RSSI and SINAD gating options are enabled, a drop-down list box lets you specify the gating logic.

Option	Description
AND	The receiver gate opens when both RSSI and SINAD values reach the required level. Similarly, it only closes when both RSSI and SINAD fall below the required level minus their respective hysteresis.
OR	The receiver gate opens when just one of the RSSI or SINAD values reaches the required level. Similarly, it closes when either RSSI or SINAD falls below the required level minus the hysteresis.

Tip: Select OR and set the RSSI level high (for example -100 dBm). This gives you quick gating when the signal level is high. When the signal level is low, gating occurs based on SINAD. This is slower but more accurate.

Level

The two Level boxes define the level (of RSSI or SINAD) required to enable receiver gating and pass the received audio. The RSSI level is in dBm. For equivalent values in microvolts, see "Converting Between Microvolts and dBm" on page 101.

Hysteresis

The two Hysteresis boxes specify how far the RSSI or SINAD must fall below the level set in the corresponding Level box to disable receiver gating and mute the received audio.

The Hysteresis box for RSSI gating provides the options Low, Medium, and High. Typically, these options correspond to hysteresis values of 1–2, 2–5, and 5–10 dB respectively. The actual hysteresis varies with the RSSI gating level (see below).

Set the hysteresis level you want, test TB9100 operation, and adjust the setting as appropriate.

Note: SINAD dB hysteresis is a recovered audio level measurement. It does not correlate to RF dBm levels.

Table 1: Typical hysteresis values for the different hysteresis options

Gating Level	Low	Medium	High
-119 dBm	0.8	3.5	5
-118 dBm	1.1	3.4	5.9
-117 dBm	1.3	3.8	5.4
-116 dBm	1.9	3.9	6
-115 dBm	2.2	4.7	6.4
-114 dBm	2.4	4.7	6.4
-110 dBm	2.9	5.6	7.4
-105 dBm	3.4	6.1	8.1
-100 dBm	3.8	6.8	8.7
-95 dBm	4.1	6.8	8.6
-90 dBm	4.7	7	9.2

Converting Between Microvolts and dBm

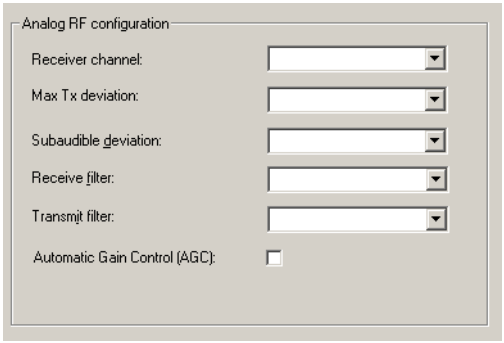
The following table lets you convert displayed levels in dBm into microvolts.

Level in Microvolts	Level in dBm	Level in Microvolts	Level in dBm
0.10	-126.99	10.00	-86.99
0.20	-120.97	12.50	-85.05
0.25	-119.03	15.00	-83.47
0.30	-117.45	17.50	-82.13
0.40	-114.95	20.00	-80.97
0.50	-113.01	30.00	-77.45
0.60	-111.43	40.00	-74.95
0.80	-108.93	50.00	-73.01
1.00	-106.99	60.00	-71.43
1.50	-103.47	70.00	-70.09
2.00	-100.97	80.00	-68.93
2.50	-99.03	90.00	-67.90
3.00	-97.45	100.00	-66.99
4.00	-94.95	150.00	-63.47
5.00	-93.01	200.00	-60.97
7.50	-89.49	250.00	-59.03

Analog RF Configuration

In the Edit Channel Profile dialog, the Analog RF configuration area lets you specify the nominal channel spacing for the receiver and the transmitter. No hardware modification is necessary when the RF configuration is changed.

Note: Your country may use Narrow band, Mid band and Wide band to refer to different channel spacings. Make sure that the option you select has the correct value.



Receiver channel

Specifies the receiver's nominal channel spacing. The available options are expressed both as a description (for example, Mid Band) and as the kHz value of the nominal channel spacing.

Option	Equivalent Rx IF Bandwidth
12.5 kHz Narrow Band	7.5 kHz
20 kHz Mid Band	12 kHz
25 kHz Wide Band	15 kHz

Note: The **Receiver channel** box does not determine the actual spacing between channels. It determines the receiver IF bandwidth. For example, 20 kHz Mid Band sets the receiver IF bandwidth to 12 kHz. Normally, you would select this option if the channels in your band plan have a 20 kHz channel spacing. However, your band plan may be irregular, or you may want to specify (when you enter frequencies into the channel table) a greater spacing between channels, for example, 50 kHz.

Max Tx deviation

Specifies the highest deviation that the transmit channel is permitted to have. The available options correspond to the following channel spacings:

Option	Channel Spacing
2500 Hz Narrow Band	12.5 kHz
4000 Hz Mid Band	20 kHz
5000 Hz Wide Band	25 kHz

Note: The **Max Tx deviation** box does not determine the actual spacing between channels. For example, 4000 Hz Mid Band sets the maximum transmit deviation to 4 kHz. Normally, you would select this option if the channels in your band plan have a 20 kHz channel spacing.

However, your band plan may be irregular, or you may want to specify (when you enter frequencies into the channel table) a greater spacing between channels, for example, 50 kHz.

Subaudible deviation

Specifies the deviation that CTCSS or DCS signaling will cause to the carrier frequency. Options are specified both absolutely in Herz and relatively as a percentage of the selected Max Tx deviation. Gain will be applied to the CTCSS signaling to cause the deviation specified. If you subsequently alter the Max Tx deviation, the Herz value of the subaudible deviation will alter, but not its percentage.

Adding subaudible deviation reduces speech deviation correspondingly. This prevents over-deviation by ensuring that the total transmit deviation is not increased by the addition of subaudible signaling. In the TB8100, you can choose not to reduce the speech deviation, but this option is not currently available in the TB9100.

Receive filter

The Receive filter drop-down lists let you select an audio filter (see table below) that will be applied to received analog FM signals.

Audio filter	Description
Flat full	Passes audio evenly across the audio spectrum.
Flat speech	Passes only speech frequencies.
De pre emph speech	Passes audio in the speech range, de-emphasizing (attenuating) higher frequencies (receive filter) or pre-emphasizing them (transmit filter).
De pre emph full	Passes all audio, de-emphasizing (attenuating) higher frequencies (receive filter) or pre-emphasizing them (transmit filter).

Transmit filter

The Transmit filter drop-down lists let you select an audio filter (see table above) for the transmit path.

Automatic gain control (AGC)

Specifies whether automatic gain control is applied at the RF stage. AGC provides enhanced high signal handling capabilities and receiver intermodulation protection. When signal levels are high, however, the minimum sensitivity may be degraded.

AGC is normally enabled, but Tait recommends disabling it when:

- The anticipated receive signal strength is < -107 dBm (1 microvolt) and strong interfering signals (> -30 dBm (7000 microvolts)) are anticipated at the receiver input.
- TIA/EIA or AS-4295 RF performance testing is being carried out.

Switching

The Switching area lets you disable the transmitter.

RF transmit

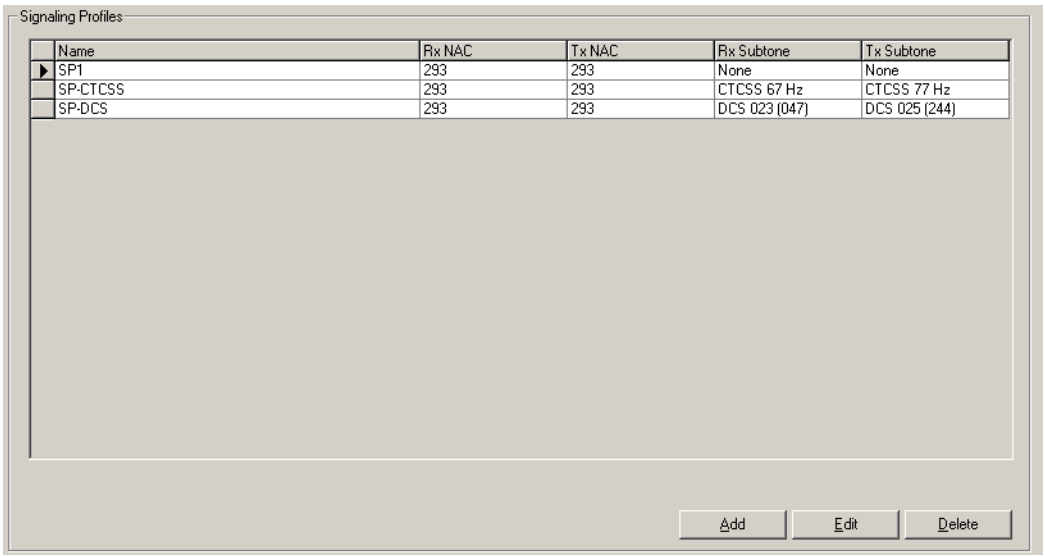
Clear this check box if you want to disable the transmitter. A base station with a disabled transmitter and receiver can still function as a gateway between the analog line interface and the channel group that it belongs to.

Microslots per slot

This parameter affects the transmission of status symbols. Most base stations will use the default value of 1. Trunking control channel operation requires more microslots. This sets up a slotted structure on the downlink. When there is only one microslot per slot, all status symbols are set to "idle" or "busy". Busy means that a signal is being received that would gate the receiver. When there is more than one microslot per slot, a status symbol is transmitted at every microslot boundary (every 7.5 ms) but they are set to "Unknown," except at the slot boundary.

Working with Signaling Profiles

The Signaling Profiles form displays a list of the current signaling profiles.



For each profile, the display shows you the NACs that are used for receiving and transmitting in digital P25 mode and the subaudible signaling that is used in analog FM mode.

Buttons along the bottom of the form let you add a copy of, edit, or delete the selected profile.

Adding a Signaling Profile

The base station requires at least one signaling profile. You can define up to 16 of them. The signaling profile defines the NACs that the base station uses and recognizes, the subaudible signaling and the tail timers. For more detailed information about the individual items in the profile, see "Editing a Signaling Profile" on page 105.

Tip: Set up a test profile and assign it to a channel. Use this channel when testing your system before commissioning.

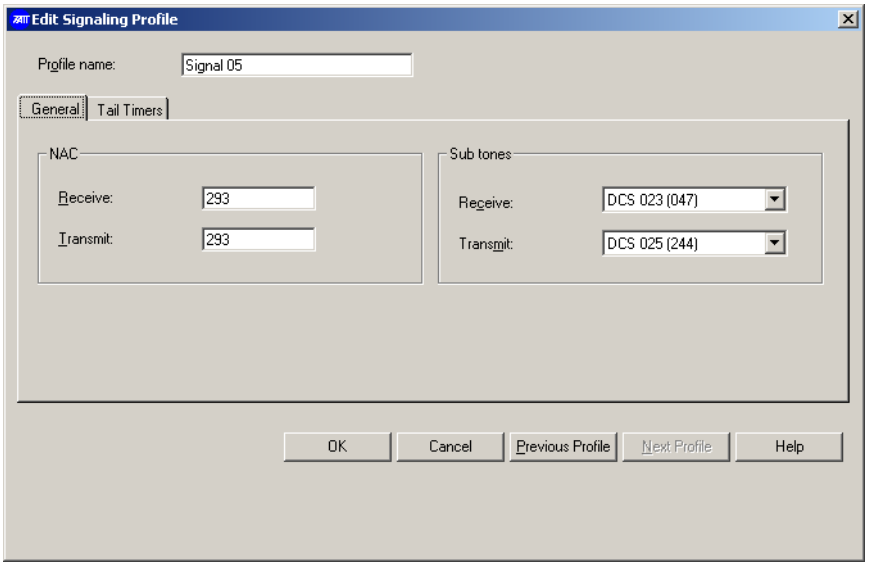
To add a signaling profile

1. Select Configure > Base Station > Signaling Profiles. The Signaling Profiles form appears.
2. Click a profile, and then click **Add**. A copy of the profile appears in the row below.

3. Click the profile, and then click **Edit**. The Edit Signaling Profile dialog box appears.
4. In the **Profile name** box, enter a suitable name for the profile.
5. Under **NAC** enter the network access codes that the base station will operate on in digital P25 mode. In some circumstances, you need to enter different values for transmitting and receiving.
6. Under **Subtones**, select the CTCSS tones or DCS codes that the base station will use when operating in analog FM mode.
7. In the **Tail Timers** tab, configure the way that audio, signaling, and carrier end at the end of analog FM transmissions.
   a. If the network uses CTCSS signaling and the radios are configured to respond to reverse tone bursts, you can enable and configure reverse tone bursts at the end of transmissions.
   b. You can enable a hang timer and specify the length of time that the base station continues to transmit carrier and subaudible signaling after audio has ceased.
   c. You can enable a soft-off timer and specify the length of time that the base station continues to transmit carrier after audio and subaudible signaling have ceased.
8. Click **OK** to confirm your changes and close the dialog box. The profile you defined appears in the Signaling Profiles form.

Editing a Signaling Profile

The Edit Signaling Profile dialog box lets you view the details of the selected signaling profile and modify them.



Profile name — Specifies the name of the profile. This name is used in the Channel Table and Signaling Profile forms.

Previous Profile — Displays the previous profile. This means you don't need to return to the list of profiles.

Next Profile — Displays the next profile in the list.

General tab

In the Edit Signaling Profile dialog box, the General tab specifies the network access codes that the receiver recognizes and the transmitter applies. Network access codes only apply to digital P25 mode; in analog FM mode, the specified subtones are used.

NAC

The NAC area lets you specify what network access code the base station uses. NACs are always entered and displayed as hexadecimal numbers.

Receive

Specifies the network access code that the base station recognizes. You can select an ordinary code (the default is 0x293) or choose one of the special values reserved by the P25 standard.

Hexadecimal value	Description
F7E	The receiver unmutes when a digital signal with any NAC is received.
F7F	The receiver unmutes when a digital signal with any NAC is received. The transmitter uses the received NAC. The base station puts the received NAC in the signal it sends on the digital line, which tells the other base stations in the channel group to use that NAC when transmitting.
Any other 3-digit value	The receiver unmutes. The transmitter uses its own NAC (see below). The base station puts 0xF7E in the signal it sends on the digital line, which tells the other base stations in the channel group to use their own NAC when transmitting.

Note: Do not use the special NAC values F7E or F7F unless your system requires it. TB9100 receivers are highly sensitive in both analog and digital modes and can occasionally falsely detect digital P25 signals. The result is that spurious noise is repeated. In dual mode, the analog FM signal can drop out for up to 180 milliseconds. If the receiver is set to unmute only to a particular NAC value, the likelihood of false detections is greatly reduced.

Transmit

Specifies what NAC the base station uses when transmitting. In most circumstances, this will be the same as the receive NAC.

Hexadecimal value	Description
F7E	Reserved for receivers and not permitted.
F7F	
Any other 3-digit value	The transmitter normally includes this value when transmitting. Only radios configured with this NAC, with F7E or with F7F will unmute. However, this value is overridden by the received NAC if the receiver NAC is F7F. If the receiver is at another base station, the received NAC is sent on the digital line for use by the transmitter.

Subtones

The Subtones area lets you specify subaudible signaling that the base station will use in analog FM mode. The base station supports CTCSS frequencies and DCS codes. CTCSS attaches a subaudible tone to the carrier signal. DCS attaches a digital code. A receiver configured with a particular tone or code will not unmute unless that tone or code is presented with the RF signal.

If the radios transmitting to or receiving from the base station are configured with inverted DCS codes, you need to program the base station with the equivalent normal DCS code. For details, see "Configuring the Base Station for Inverted DCS Codes" on page 107.

Note: If you select a transmit DCS code, the base station will always transmit a DCS end tone for muting the receive audio. However, transmitting a CTCSS reverse tone burst is optional and configurable.

Configuring the Base Station for Inverted DCS Codes

DCS codes can be expressed as a normal or an inverted code. For each inverted code, there is an equivalent normal code. For example 023 inverted is the same as normal 047 and vice versa. In the Edit Signaling Profile dialog box, the Receive and Transmit drop-down lists indicate for each normal code the equivalent inverted DCS code, by displaying it alongside in brackets. If the radios are programmed with inverted DCS codes, you configure the base station with the equivalent normal code. You can ascertain that code by looking up a table or by following this procedure.

To program the base station with an inverse DCS code

1. Note the inverted DCS code that the radio is programmed to transmit with, for example 023.
2. In the **Receive** drop-down list, scroll down until you find that code in the list of normal codes. The inverse equivalent (in this example, 047) is in brackets beside it. Note this code.
3. In the **Receive** drop-down list, scroll down again until you find the code you noted (in this example, 047). Select it. When you program this configuration into the base station, the receiver will unmute to the radio's inverse DCS code (in this example, 023, which is the same as the normal code 047).

Tail Timers tab

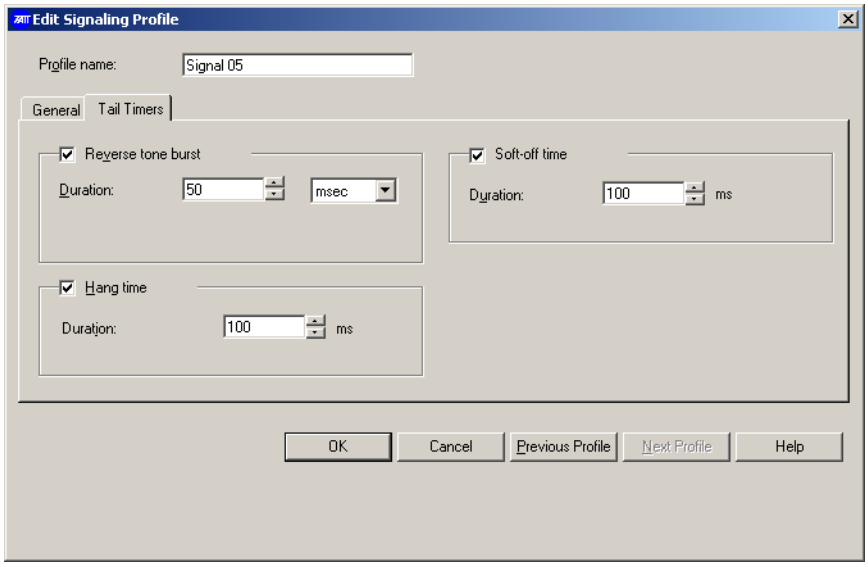
In the Edit Signaling Profile dialog box, the Tail Timers tab lets you configure tail timers that the transmitter users.

In analog FM mode, different tail timers give you power and flexibility in tail timing. The total tail time is the sum of the hang time and the soft-off time.

Tail timers are used to:

- eliminate squelch tail (the 'tish' sound caused when the CTCSS detector doesn't immediately re-mute the user's radio when carrier ceases)
- prevent users on different subtones from taking control of the repeater during a temporary lull in the conversation

In digital P25 mode, tail timers are not used.



Reverse tone burst

The base station can send a reverse tone burst at the end of each transmission. This applies only to analog FM transmissions with a CTCSS tone. The reverse tone burst consists of the same tone, but is 180 degrees out of phase with it. In suitable radios, this quickly mutes the receiver.

Note: Transmissions with a DCS subtone have an equivalent: the DCS end tone. This consists of a 134 Hz tone that lasts 180 ms and is not configurable.

In the Edit Signaling Profile dialog box, Tx Timers tab, the **Reverse tone burst** check box enables the sending of reverse tone bursts.

Duration

The Duration box specifies the length of the tone burst. You can specify this in milliseconds or in cycles. If the burst has too many cycles, it comes back into phase with the original subtone and the radio may detect it again, re-opening the receiver gate. Specifying the duration in cycles for different CTCSS frequencies can help prevent this.

Hang time

The hang time is the length of time at the end of each analog FM transmission when the base station continues to transmit subaudible signaling after Tx keying has ceased. During the hang time, radios in the talk group that uses the subaudible signaling can initiate a call but other radios cannot.

In the Edit Signaling Profile dialog box, Tx Timers tab, the **Hang time** check box enables this timer and the **Duration** box specifies the length of the hang time.

Soft-off time

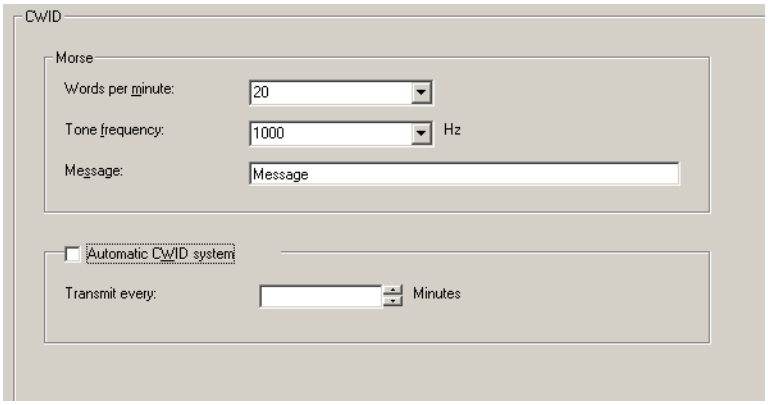
The base station can also send only carrier (carrier without modulation of any kind) at the very end of each analog FM transmission.

In the Edit Signaling Profile dialog box, Tx Timers tab, the **Soft-off time** check box enables the feature for analog FM transmissions and the **Duration** box specifies the length of time that only carrier is transmitted.

Configuring the CWID

The CWID form (Configure > Base Station > CWID) lets you configure the way the base station broadcasts its identity using Morse code and set up the automatic sending of the CWID. In the USA, the FCC requires that base stations broadcast their identity.

Tip: Transmit using CWID before your radio system is commissioned; if there are any other users of the frequencies you have been assigned, this gives them advance warning.



The Morse area defines what the base station broadcasts and the Automatic CWID system area lets you enable and configure the regular sending of identity broadcasts.

Morse

The Morse area (Configure > Base Station > CWID) lets you specify a unique ID for the base station. The speed of transmission and the tone used can also be configured, but you should not need to alter the default settings.

The settings in this area apply to the automatic CWID transmission and to any CWID transmissions triggered by Task Manager action.

Words per minute — Specifies the speed of Morse code transmission. The 5-letter word PARIS is used to establish the number of words per minute. This word corresponds to 50 dots.

Tone frequency — The frequency of the tone used to transmit the Morse code.

Message — Enter into this box up to 30 characters to be transmitted as the station ID. You can enter any character or digit that the international Morse code alphabet supports (A-Z, 0-9, and punctuation marks). These characters will be transmitted using the International Morse Code convention. You can also enter spaces. They result in a silence equivalent in duration to seven dots.

Automatic CWID system

The Automatic CWID system area (Configure > Base Station > CWID) lets you enable and configure the automatic sending of the base station's CWID according to the configuration in the Morse area.

Important: If automatic CWID is enabled, calls that are in progress when a CWID is due for transmission will be interrupted. A future release will allow the base station to delay the CWID transmission until the Tx tail.

Select the check box to enable the system.

Transmit every

Specifies the interval in minutes from the end of one CWID transmission to the start of the next. For example, if the interval is one minute and the transmission takes 20 seconds, the CWID will be transmitted every one minute 20 seconds.

Tip: Use the Task Manager action **Transmit CWID now** to set up identity broadcasts in ways that the Transmission interval area does not permit.

Digital Line

This section lets you define the name and identity of the base station on the TaitNet P25 network. You also set up the channel groups that the base station can belong to. The channel group assigned to the current channel is the one that the base station currently belongs to.

Network

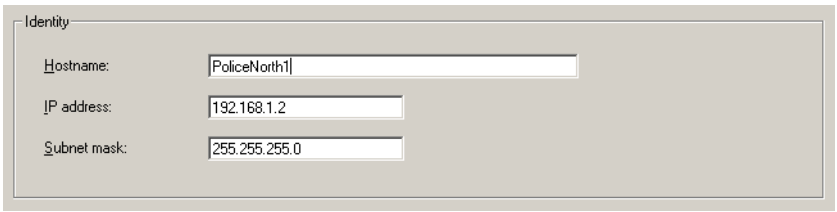
The Network form (Configure > Digital Line > Network) lets you view or change the base station's network settings. These settings are normally only changed at installation time. It also lets you configure the transmit jitter buffer.

Setting the Network Identity

Each base station has a unique name and IP address. The default settings provided by the factory must be changed when the base station is installed.

Important: See the Installation and Operation manual for instructions on changing the network identity. If you give the base station an unknown IP address or subnet mask, the CSS will be unable to connect to it.

When you program a configuration into a base station, the CSS checks whether the IP address and subnet mask are the same as that of the base station. If there is a difference, you are given the choice of overwriting these items or keeping the existing ones, while updating the rest of the configuration. If you do change the IP address and subnet mask, the changes only take effect when the base station is reset.



Base station name

The name of the base station. This is the human-readable equivalent of the IP address of the base station and appears on the status bar when you are connected. The default name is TB9100 but you should make sure that each base station on the network has a unique name. It is a good idea to use the same name as you enter into the connection list (Tools > Connections). A blank name is not permitted.

This name is a hostname and has all the restrictions that apply to hostnames (for example, you cannot use spaces).

IP address

The unicast IP address of the base station in dotted quad format. The default address when the base station leaves the factory is 192.168.1.254. This address is used for example in communications with the CSS.

There should be a line in the connections list (Tools > Connections) that contains the name of the base station and its IP address, so that this CSS knows what IP address to connect to. The names programmed into the base stations should be the same as the names in the connection lists.

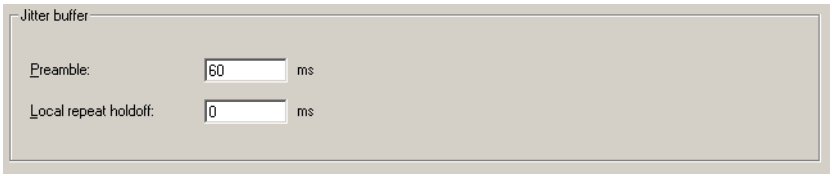
Subnet Mask

The subnet mask for the router that the base station is connected to. Enter the mask required by the IP addressing plan for the network.

Note: IYou may also need to specify a gateway address. At present, the base station uses Proxy ARP (RFC 1027) to find out which host on the LAN will forward packets destined for the network. The routers recommended by Tait support this protocol. Some networks may use different routers, or not use a local router at all. In these circumstances, it is necessary to set a gateway address in the base station. Tait's intention is to make the gateway address configurable in the CSS in a future release. Currently, however, the gateway address is set as one of the environmental variables of the network board's Linux operating system. See TN-977b for instructions or contact Tait for advice and assistance.

Configuring the Jitter Buffer

The TB9100 has jitter buffers to accommodate the variation in the delay of speech, but only the RF jitter buffer is configurable. Two timers configure its operation. The optimal settings depend on the system design and are important for the operation of radio scanning and voting.



Preamble

Specifies the length of time that the base station transmits a preamble before beginning to transmit the call. The preamble consists of a high deviation test pattern. While the preamble is transmitted, arriving voice packets are stored in the jitter buffer. The longer the preamble, the greater the voice delay. The minimum preamble duration is 40 ms. For signaling messages (TSBKs), the base station applies a minimum preamble of 100 ms.

Generally speaking, the aim is to keep the preamble as short as possible (to minimize the voice delay) but as large as necessary to ensure reliable subscriber unit scanning and voting, to support base station re-voting, and to fill the jitter buffer sufficiently to prevent speech dropouts, because the transmitter ran out of data to transmit.

The maximum available preamble duration is 300 ms. If the base station has an antenna relay, the effective maximum is 260 ms; entering a preamble larger than 260 ms will not lengthen the preamble.

Local repeat hold-off

Specifies the length of time that the base station waits before beginning to transmit the preamble, if it is repeating the RF signal that it received. This value makes it possible for the locally repeating base station to begin transmitting at the same time as the other base stations in the channel group. It is of importance if the base stations re-vote (are using a common uplink frequency) and if the receiving radios are scanning or voting.

The combined duration of the local repeat hold-off and the preamble and the Hold-off time should not exceed 200 ms, to limit the speech delay.

Jitter Buffer Settings for Common System Designs

The following offers general guidance on the settings to choose for common system designs.

Radio voting

In this system design, subscriber units scan the channels in the channel group and vote on the best signal. Set the **Preamble** to a long enough value (for example, 150 ms) to allow the radios to scan the channels and vote on the best signal before the call itself begins (avoiding late entry is particularly important with encrypted speech). The **Local repeat hold-off** should be the (average) network delay. Not only does this present signals to the scanning radios at the same time, it also allows the base stations to seamlessly vote if they use a common uplink frequency.

Single repeater

Set the **Preamble** to the minimum of 40 ms and the **Local repeat hold-off** to 0.

Radio scanning

In this system design, subscriber units scan the channels in the channel group until they find a signal. Once a signal is detected, scanning ceases. Set the **Preamble** to a sufficiently long value to allow the radios to scan the channels in the list. If the uplink frequency is not common between base stations, the **Local repeat hold-off** can be set to 0, as there is no terminal voting or base station re-voting.

No radio scanning or voting

In this system design, the main consideration is that the preamble is long enough to fill the jitter buffer sufficiently to prevent buffer underruns and the consequent drop-out of speech. In most situations, setting the **Preamble** to 40 ms (for jitter originating in the base station and its interface) plus an allowance for jitter originating in the routers should be sufficient. Otherwise follow these steps.

1. Monitor the digital line and note the jitter for incoming calls.
2. Select Configure > Digital Line > Network.
3. Under **Jitter Buffer**, enter into the **Preamble** box the jitter value you noted plus 40 ms.
4. Monitor the jitter buffer (Monitor > Interfaces > Digital Line.) If underflows occur, increase the initial delay.

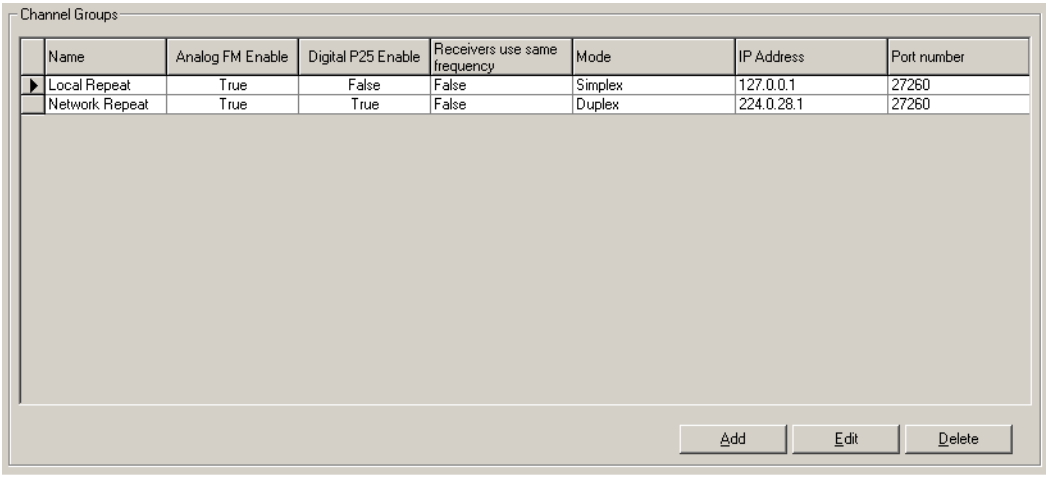
If the channel group does not use a common uplink frequency, the **Local repeat hold-off** can be set to 0.

Working with Channel Groups

The Channel Groups form (Configure > Digital Line > Channel Groups) displays information about the channel groups that the base station can be part of. It lets you add channel groups and edit them.

For details about the other columns in the table, see "Editing a Channel Group" on page 115.

At any particular time, the base station is a member of the channel group specified by the current channel in the channel table.

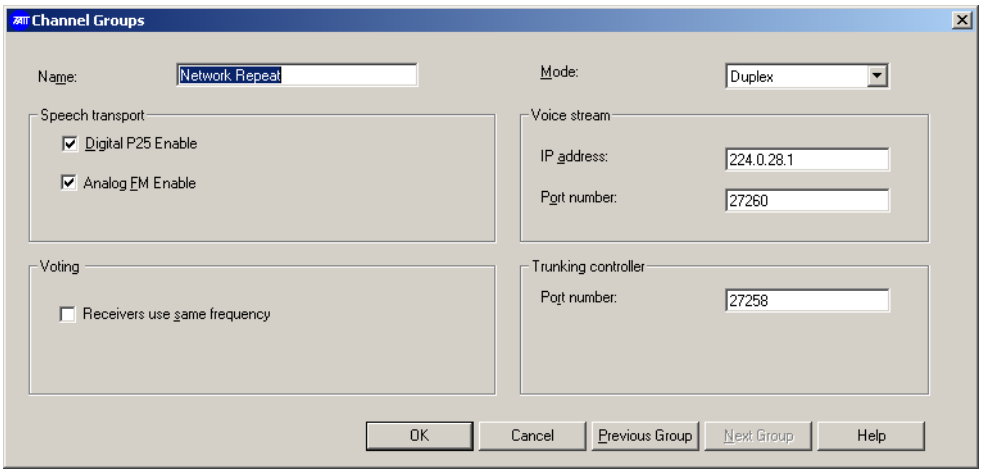


Adding a Channel Group

1. Select Configure > Digital Line > Channel Groups.
2. Click **Add**.
3. Click **Edit**. The Channel Groups dialog box appears.
4. If desired, edit the name of the group.
5. Under **Speech transport**, specify which call types the digital line will send.
6. Under **Voting**, select the **Receivers use same frequency** check box, if the receivers in the channel group use the same frequency.
7. Under **Voice stream**, enter into the **IP address** box the multicast IP address for the channel group. Generally, you can use the default port number.
8. Click **OK**.

Editing a Channel Group

In the Channel Groups form (Configure > Digital Line > Channel Groups), select a channel group, and then click **Edit** to modify it.



Important: When you edit a channel group, make sure that all base stations in the channel group have the same channel group settings.

Name — The name of the channel group. Each channel group must have a unique name.

Mode — The channel group can operate in duplex or in simplex mode. All base stations and analog gateways in the channel group must have the same mode setting. Here, simplex and duplex apply to the digital line; the base stations' RF interface is always duplex. A duplex channel group makes it possible for a radio user to get through to the dispatcher, even when the dispatcher is talking. A simplex channel group places less load on the linking infrastructure.

Mode	Description
Duplex	A duplex channel group has an inbound (radio to dispatcher) and an outbound (dispatcher to radio) stream. The base station votes each stream separately; it selects the best inbound RF signal for presenting to any analog lines and control panel speakers. It selects the best outbound signal from the control panel microphones, the analog line input(s), and (if repeat is enabled) the output from the inbound voter. The outbound signal is broadcast over the RF interfaces. In a duplex channel group, the channel group is able to forward a radio call to the dispatcher while the dispatcher is talking. However, the maintainer cannot talk to dispatchers via the control panel. A duplex channel group can support only one analog gateway, as it is unable to provide a voted stream from one gateway to another.
Simplex	A simplex channel group has a single stream and each base station has only one voter. The voter selects a winner from all the signals that the base station receives on its interfaces and sends them to the outgoing interfaces. Because a simplex channel group has only one stream, its linking infrastructure requires less bandwidth. Radio calls cannot be provided to the analog line if the dispatcher is talking.

Speech transport

The Speech transport area lets you specify which types of call can be passed to the channel group along the base station's digital line. Normally, both types are enabled, but analog FM can be disabled if the bandwidth of the linking infrastructure is insufficient to support it. Either may be disabled to assist with troubleshooting. The settings in this area have no effect on data calls.

Digital P25 enable — Enables the base station to send digital P25 voice over its digital line. The digital P25 voice stream is in the form of IMBE packets, which are compressed and low bandwidth.

Analog FM enable — Enables the base station to send analog FM voice over its digital line. The analog FM voice stream is in the form of G.711 packets, which are uncompressed and require a 64 kbit/s bandwidth.

Voting

Receivers use same frequency — Select this check box if the receivers in the channel group operate on the same frequency. This tells the base station that simultaneous calls are probably from the same radio. If the check box is enabled, when the base station has won the vote, it periodically asks the other base stations in the channel group to re-vote. If the radio has moved, giving a different receiver better reception, that receiver takes over the call. If the check box is cleared, simultaneous calls are treated as if they come from different terminals and the vote winner does not request a re-vote.

Voice stream

IP address — Specifies the IP address (normally multicast) that the base station belongs to as a member of the channel group. The base station sends its voice stream to this IP address and (if the address is multicast) accepts any voice stream that is addressed to this IP address. If there are only two base stations in the channel group, the unicast IP address of the other base station can be used. If the base station is part of a trunking system, enter the IP address of the site controller.

Port number — The port number that the base stations in the channel group use for the voice stream. Generally, the the default port number is used. If the base station is part of a trunking system, enter the port number that the site controller uses for sending and receiving the voice stream.

Trunking controller

When the base station is part of a trunking system, it uses the IP address and port number specified here for TCCP control communications with the site controller. See TN-1141 for details.

Analog Line

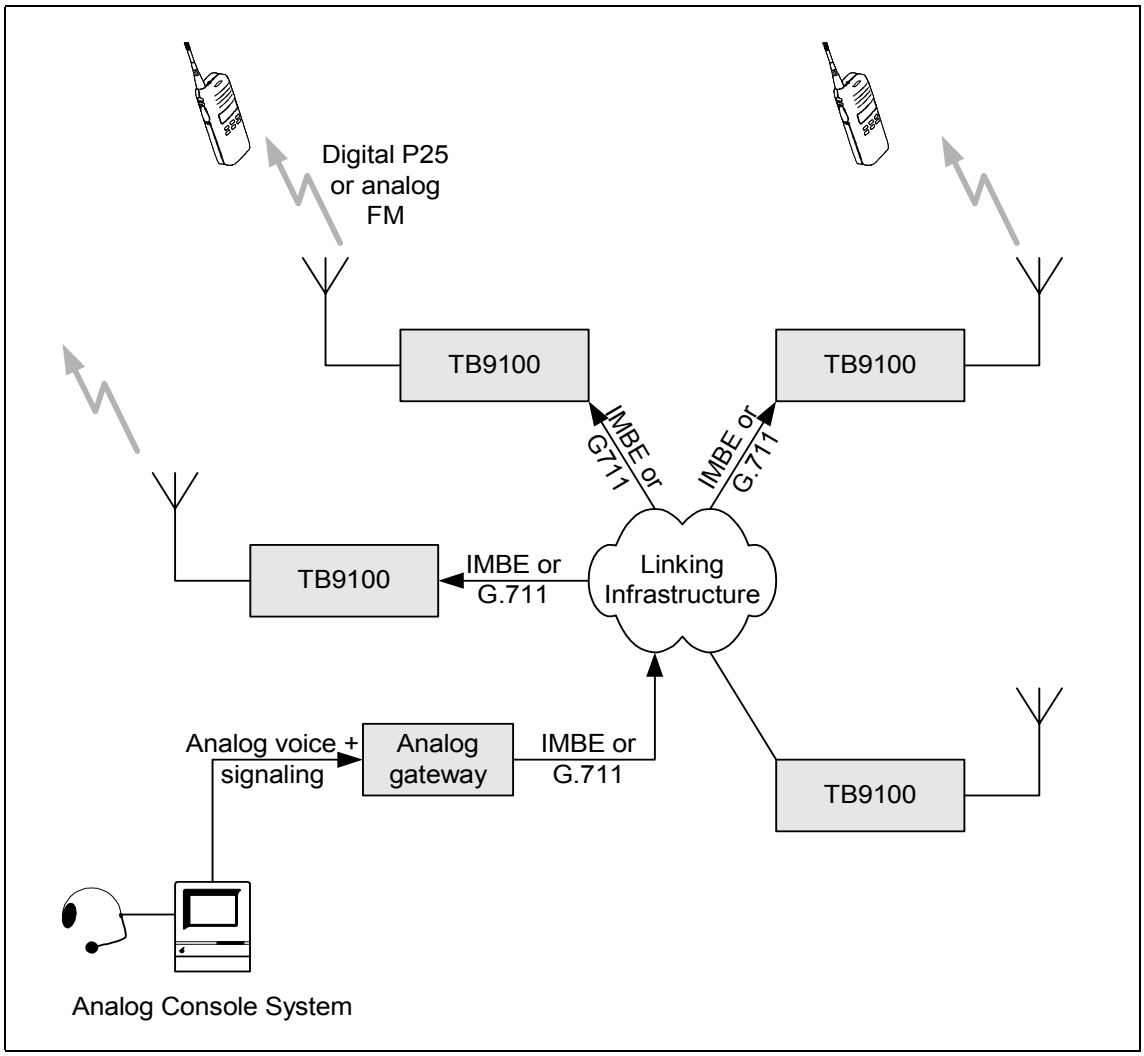
An analog line can belong to an analog gateway or to a TB100 base station. Its behavior is determined by the current calling profile. A calling profile is assigned to the current channel in the channel table. This functions as the default calling profile. A dispatcher command can select a different calling profile.

Line levels for the audio and for MDC1200 output must be set. The types of signaling used by the console system must be enabled and configured.

Interfacing to the Console System

An analog gateway connects the console system to a channel group. The channel group is a set of TB9100 base stations that operate as a single logical channel. If a base station is used to carry out the gateway function, the console system is still connected to the whole channel group, not just to that base station. The channel group and its analog line function as follows. In outbound communications, the console output generally wins the vote and is transmitted over all the base stations in the channel group, as shown below.

Figure 6: Interfacing a channel group to a console system



For inbound communications, a radio making a call must win the vote. If it does, it is repeated by the base stations in the channel group (unless the repeat function is disabled). The call is also sent on the analog line to the console input, provided it is addressed to an ID that the analog line interface is configured to receive.

This section describes the following

- Signaling options that the analog line supports (and how to enable and configure them)
- Dispatcher commands that use tone remote signaling (and how to configure the base station for them)
- How to propagate tone remote commands to the channel group
- How to map MDC1200 signaling to the equivalent P25 signaling (so that the analog console system can make use of the channel group's P25 capabilities)

Signaling Options

The TB9100 analog line supports E & M, keytone, single and dual tone remote function tones, and MDC1200 signaling.

E & M Line

In a traditional analog system, the E & M lines are used for Tx Key and Rx Gate signals. Tx Key tells the base station to transmit. Rx Gate tells the console system that the receiver has unmuted.

In the TB9100 base station or analog gateway, things are more complicated. A Tx Key signal doesn't necessarily key the transmitter. The base station is part of a channel group and any request from the analog line to transmit is voted on and may lose the vote to a signal on another input. Similarly, an Rx Gate signal does not necessarily mean that the receiver has unmuted. It does indicate that there is a valid audio signal, but this might have been received by any of the base stations in the channel group or have come from the control panel microphone. Accordingly, at the analog line interface, we use the terms 'Channel seize' instead of Tx Key and 'Analog valid' instead of Rx Gate.

Channel seize indicates that there is a signal on the analog line and asks the voter to vote on it. Analog valid indicates that there has been a vote and that the winner is on the analog line out. Channel seize can be conveyed by the E-line, by a digital input (in a future release), or by LLGT. If MDC1200 signaling is used, channel seize can be configured to occur some time after LLGT begins, so that MDC1200 signaling is not included in the voice stream.

To configure the E & M Lines for Channel seize and Analog valid

1. Select Configure > Base Station > System Interface
2. Select the E & M check box.

Keytone

With this type of signaling, the dispatcher can only control the transmitters of the channel group. When the console system sends a keytone, the base station presents the audio on the analog line at the voter. If the audio wins the vote, it is transmitted by the base stations in the channel group. When the keytone stops, the channel group stops transmitting.

To configure keytone signaling

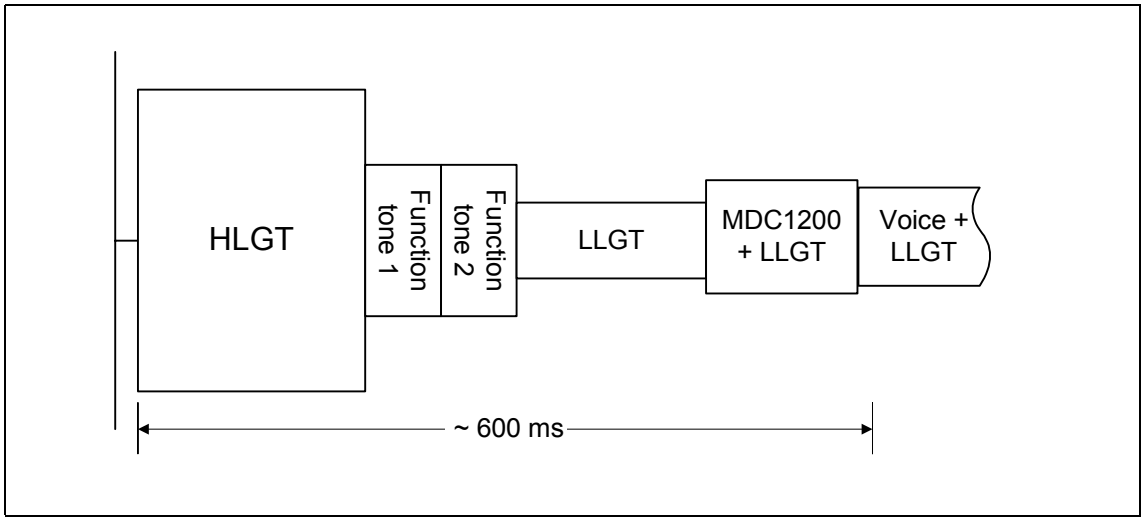
1. Select Configure > Analog Line > Tone Remote Options.
2. In the **Guard tone frequency** box, select the keytone frequency.
3. In the **LLGT level** box, select a minimum level for the keytone. In the **HLGT level** box, make sure that level selected exceeds the actual keytone level.
4. Enable the notch filter.

Tone Remote Function Tones

The analog line supports the use of single and dual-tone tone remote signaling from console to base station. If the analog line is to be used with digital P25 mode, the base station needs an analog line license. The tones are carried on the audio line in. The base station can respond to a tone remote function tone by selecting a calling profile or by carrying out Task Manager actions. The selected calling profile overrides the calling profile assigned to the current channel. In turn, some settings in the calling profile can be overridden by MDC1200 signaling. Before you configure the base station's tone remote signaling, you need to know what tones it will receive from the console system and what actions these are intended to trigger.

Tone remote signaling consists of a high level guard tone (HLGT), followed by one or two function tones, then low level guard tone (LLGT), accompanied by audio.

Figure 7: Tone remote signaling



To configure tone remote signaling

1. Select Configure > Analog Line > Tone Remote Options.
2. Adjust the parameters in the form as needed so that they conform with the tone remote signaling that the console system produces. Enable the notch filter.
3. Select Configure > Analog Line > Tone Remote Mapping.
4. Specify whether the console system uses single tone or dual tone signaling and clear the Hide Task Manager actions check box.

   The form now displays 16 or 256 tones, depending on whether you selected single tone or dual tone signaling. By default, these all have the action Task Manager.
5. For each function tone that is to select a calling profile, assign the correct calling profile (You have to create the calling profiles first. See "Working with Calling Profiles" on page 130.)
6. For each other function tone that is to be used, create Task Manager tasks with that tone number as an input. These actions tell the base station to carry out the function intended by the dispatcher. See "Tone Remote Commands" on page 121.
7. As necessary, propagate the commands received as function tones to the other base stations in the channel group.

   For more information, see "Propagating Tone Remote Commands to the Channel Group" on page 123.

MDC1200

The TB9100's analog line supports the use of MDC1200 signaling (also known as Stat Alert). In analog FM mode, the base station passes all MDC1200 signaling transparently between dispatch console and radio and also between radios. In P25 digital mode, if the base station has a MDC1200 license, and MDC1200 signaling is enabled (Configure > Analog Line > General. Select the MDC1200 check box), it is able to convert MDC1200 signaling to P25 signaling and vice versa. The base station with the analog line to the console system must be configured to enable each MDC1200 feature and to map MDC1200 addresses to P25 IDs. This enables analog console systems to make use of P25 features that are unavailable to tone remote signaling. The other base stations in the channel group do not need to be configured; the P25 signaling is propagated as part of the voice stream.

You can use MDC1200 for caller identification (ANI), for additional services such as call alert and radio check, and for selective calling. The use of MDC1200 for repeater control is not supported; use tone remote function tones instead. If MDC1200 is available, Tait recommends that you use voice alert in preference to tone remote for individual calls.

Many MDC1200 messages require an acknowledgement and can be retried until an acknowledgement is received. The number of retries is determined by the console system. The retry rate, also determined by the console system, may need to be reduced to take account of the slower response when the message and its response need to be converted to P25.

Tone Remote Commands

The base station can be set up to respond in a default manner to input from the dispatch console on the analog line. However, the dispatcher needs to be able to operate in different ways, for example to converse first with one group of users and then with another, or to converse first on one channel, and then on another. Analog console systems have a standard command set for carrying out such tasks. In analog systems, each command is communicated as a single or dual function tone via a tone panel to the base station. In TaitNet P25 networks, the function tones are handled directly by a base station at its analog line interface. The effect of dispatcher commands is necessarily different, as we are dealing with a dual mode system and with a channel group rather than a single channel. The base station configuration determines the effect of a function tone. Two basic mechanisms are available: the function tone can select a calling profile or change the channel. The calling profile defines the 'line personality', and the channel change defines how the base station as a whole operates. The channel change also assigns the default calling profile for that channel.

This section shows you how to configure a TB9100 base station and its channel group to enable the dispatcher to make use of the command set. For simplicity, separate instructions are given for each command, even though commands will be combined, for example selecting digital P25 mode as well as the group to speak to and the groups to listen in on. The instructions assume that the console system is already set up so that an appropriate equipment control (for example, button) is mapped to a single or dual function tone. For information about this, see the console system documentation.

Select Mode

If the channel group supports both analog FM and digital P25 users, the dispatcher needs to be able to select which mode the analog line uses when initiating a call. Configuring the base station for Select mode commands is done by defining calling profiles, each with the required mode, then assigning function tones to those profiles.

Selecting a calling profile not only assigns the mode, but many other properties or the analog line as well. This means that the dispatcher may need several different calling profiles (you can define up to 16).

To set up commands for selecting analog FM or digital P25 modes

1. Set up calling profiles for the different modes: one for Analog FM and one for each group or individual that the dispatcher wants to call in digital P25 mode.
2. Assign the calling profile to be used as the default to the channel or channels that the base station will normally use
3. Assign the calling profiles to the function tones that the console system will use (Configure > Analog Line > Tone Remote Mapping)
4. Make sure that the channel profiles assigned to the channel(s) that the base station uses support receiving both analog FM and digital P25 (otherwise the dispatcher will be able to talk to the radios but the base station will not be able to receive their reply).
5. Assign the function tones to suitable controls on the console system. Activating these controls will select the corresponding calling profile.

Note: When the console transmits in one mode, it can still receive calls in the other mode. To reply, the dispatcher must first select the mode used by the caller.

Change channel

If the dispatcher needs to communicate with users on a different frequency pair, or to change other operating parameters of the base stations in the channel group, the base stations can be configured to respond to a dispatcher command by changing channel. This is done through Task Manager.

To set up a command for changing channel

1. Create a Task Manager statement with the function tone as input and a change channel command as action.

   For example: IF Tone remote detected (550) THEN Go to channel 5.

2. Configure the other base stations in the channel group with the equivalent Task Manager statement. See "Propagating Tone Remote Commands to the Channel Group" on page 123.

Note: The dispatcher should not use the change channel command when the base station is transmitting. The change to the new channel's calling profile will not take place until the analog line commences a new transmission.

Monitor

Most console systems have a command for monitoring the channel. To set up the TB9100 to respond to a Monitor command, you need a calling profile with normal squelch and (optionally) a Task Manager task that disables (locks) the checking for NAC and subaudible signaling. This makes it possible for the dispatcher to hear digital P25 calls using a different NAC and analog FM calls with different (or no) subaudible signaling.

To set up a command for monitoring

1. Copy the existing calling profile and change its squelch setting to Normal.
2. Assign the calling profile to the function tone sent by the console's Monitor button.
3. Optionally set up Task Manager tasks such as the following:

   IF **Tone remote detected (550)** THEN **Lock subaudible/NAC decoding**

   IF **Tone remote detected (750)** THEN **Unlock subaudible/NAC decoding**

Note: This disables normal squelch at the receiver, not just at the analog line. If RF repeat is enabled, the base station or channel group will repeat the monitored signals, provided they win the vote.

4. Configure the other base stations in the channel group similarly, and propagate the dispatcher command to them (see "Propagating Tone Remote Commands to the Channel Group" on page 123).

Enable/Disable RF Repeat

The dispatcher can enable and disable the RF repeat function of the channel group.

To set up commands for enabling and disabling RF repeat

1. In the channel table, set the **RF repeat** column to DispatchControlled.
2. Set up Task Manager tasks such as the following:

   IF **Tone remote detected (550)** THEN **Enable RF repeat**

   IF **Tone remote detected (750)** THEN **Disable RF repeat**

3. Configure the other base stations in the channel group similarly, and propagate the dispatcher command to them (see "Propagating Tone Remote Commands to the Channel Group" on page 123).

Calling Groups

To set up a command for calling a group

1. Set up a calling profile and select the call type P25 group. Enter the group ID in the Destination field.
2. Set up a group membership with that group included. This ensures that the dispatcher can listen to the group.
3. Select Configure > Analog Line > Tone Remote Mapping and assign the calling profile you created to the function tone that the console produces when the button is pressed.

Calling Individuals

You have a limited ability to use tone remote signaling to make calls to an individual ID. A calling profile is needed for each individual ID and only 16 calling profiles are available for individual and group calling.

To set up a command for calling an individual

1. Set up a calling profile and select the call type P25 individual. Enter the individual ID in the Destination field. Note: the analog line will automatically listen to calls addressed to the Line ID in the calling profile.
2. Select Configure > Analog Line > Tone Remote Mapping and assign the calling profile you created to the function tone that the console produces when the button is pressed.

Propagating Tone Remote Commands to the Channel Group

For a dispatcher function tone command to control base station operation and not just the properties of the analog line, it must have the desired effect in all the base stations of the channel group. Only in this way can a channel group function as a single logical channel. Task Manager tasks are used to propagate dispatcher commands to the channel group. When the connected base station receives a function tone, Task Manager sends an equivalent function code to the other base stations in the channel group. When the other base stations receive that function code, Task Manager carries out the appropriate action.

To propagate a 'Go to channel 5' command

1. In the connected base station or analog gateway, set up the Task Manager statement:

   IF **Tone remote detected (550)** THEN **Go to channel 5**

   IF **Tone remote detected (550)** THEN **Send function code 0**

   Note: You can select any function code between 0 and 255 as the equivalent of a tone remote function tone.

2. In each of the other base stations in the channel group, set up the following Task Manager statement:

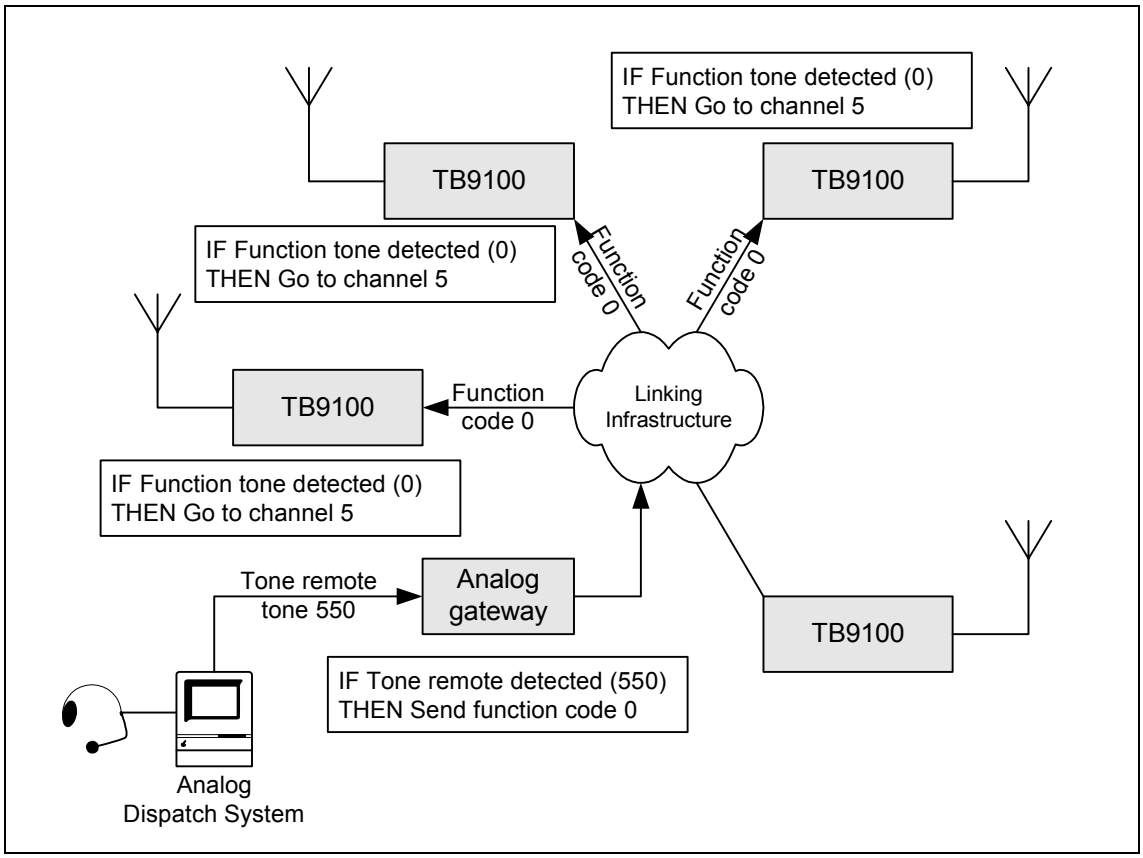
   IF Function code received (0) THEN Go to channel 5.

   When they receive the message from the base station, they also make channel 5 their operating channel.

Note: The base stations can be set up to go to different channel numbers, but the new channels must fit together: for example they must all have the same receiver mode.

Figure 8 shows how the propagation works.

Figure 8: Propagating a 'Go to Channel' command



MDC1200 Functions

The following provides a brief description of each supported MDC1200 signaling type, explains how the base station handles the conversion between it and the P25 equivalent, and provides instructions on configuring the base station to support that signaling type when operating in digital P25 mode.

Caller Identification

The most common use of MDC1200 signaling is to provide the called party with the identity of the caller. In analog systems, radio equipment can send a MDC1200 message containing the ID of the caller. This ID can be displayed on the receiving radio or console system. The feature is known as ANI (automatic number identification) or PTT ID. Console systems can also send ANI messages.

ANI

In digital P25 mode, the TB9100 can take the source ID of an incoming P25 call, convert it into a MDC1200 ANI message with an equivalent MDC1200 address, and send it to the dispatch console. For outgoing calls, the analog line uses the line ID specified by its current calling profile as its ANI.

To configure the analog line for caller identification on incoming calls

1. If possible, set up the analog line for trailing ANI (Configure > Analog Line > General). This adds the ANI message at the end of the over, reducing the delay at the start of the over).
2. If desired, modify the default mapping of P25 addresses to MDC1200 addresses (Configure > Analog Line > MDC1200 Address Table). This mapping converts the source addresses of digital P25 calls it receives into equivalent MDC1200 ANIs.

To configure the dispatcher's caller identification

1. Ascertain the dispatch console's MDC1200 address. This is a 4-digit hexadecimal number.
2. Convert the number into decimal, and enter it into the **Line ID** box of all the analog line's calling profiles. (This assumes that the MDC1200 Address Table maps the MDC1200 individual IDs 1-EFFF to 1-61439 P25. This is the default mapping. You are entering the P25 address that will be converted into the console's MDC1200 address.)

   The line ID will be used as the console's caller identification on outgoing digital P25 calls.

Note: Many radios will send status messages to a dispatcher ID that is derived from the talk group they currently belong to. You don't need to configure the analog line for them. The base station automatically switches them onto the analog line, if the current group membership includes the talk group. The MDC1200 destination ID is calculated from the calling profile's Line ID and not from the actual destination ID of the status messages.

Emergency ANI

This is similar to ANI, except that the message format is slightly different and the associated call is an emergency call.

Outbound calls: When the analog line receives a MDC1200 emergency ANI message, it makes the following call an emergency call (overriding the setting in the current calling profile).

Inbound calls: When the channel group receives a P25 emergency call, the analog line produces an MDC1200 emergency ANI message.

Additional Services

MDC1200 can also be used to provide a range of services additional to ordinary voice calls. If these are to be converted to or from their digital P25 equivalent, the current service profile must enable them. Messages on the analog line (in MDC1200 format) must be enabled in the service profile attached to the calling profile. Messages arriving from a receiver in the channel group must be enabled in the service profile attached to the current channel of the base station receiving the message.

Call alert

The dispatcher can send a call alert message to a radio. The radio acknowledges the message and may provide a tone or LED indication that the user is to call back. The radio sends a call alert to the dispatcher, if the service profile assigned to the current channel enables it. The base station can convert a MDC1200 call alert message into a P25 call alert supplementary service and vice versa.

To configure the base station for call alert

1. In the service profiles assigned to the calling profiles that the dispatcher will use, enable Call Alert.
2. If radios are to send call alert messages to the dispatcher, make sure that the service profiles assigned to the channels used enable Call Alert.

Radio check

The radio check message lets the dispatcher test whether a radio is powered up and within range.

To configure the base station for radio check

- Set the Presence Check column to Yes in the service profiles assigned to each calling profile that the dispatcher uses (Configure > System > Service Profiles).

Emergency alarm

The dispatcher can receive an emergency alarm message from radios. This is also known as emergency alert or man down. Receiving this message may cause an alarm indication on the console system.

No base station configuration is necessary for this message; it is not possible to disable this function.

Radio disable/radio enable

The dispatcher can disable or enable radios (P25 refers to this as inhibit or uninhibit), provided the radios support the feature and have it enabled.

To configure the base station for disabling and enabling radios

- In the service profiles assigned to the calling profiles that the dispatcher uses, set the **Inhibit** column to Yes.

Remote monitor

The dispatcher can remotely monitor P25 radios on the network. The console system sends the MDC1200 message, which is converted to the equivalent P25 message. The individual address of the radio is converted from MDC1200 to P25 format.

To configure the base station for remote monitor

- In the service profiles assigned to the calling profiles that the dispatcher uses, set the Remote Monitor column to Yes.

Status update and status request

The dispatcher can request status information from a radio and the radio can send an update on its status.

Call Addressing

MDC1200 can also be used in analog systems to address calls to particular individual radios. The TB9100 can turn the request for an analog call to a MDC1200 individual address to a P25 individual call to an equivalent P25 individual or group.

Voice Alert

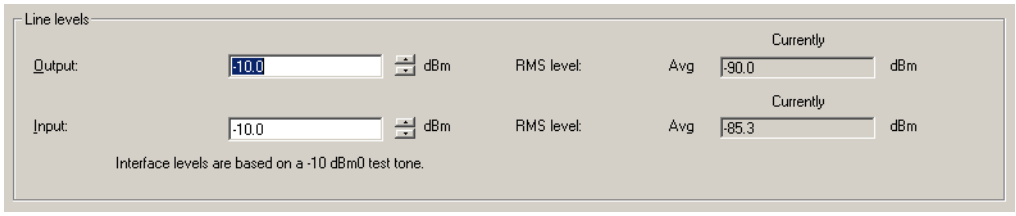
In analog systems, the MDC1200 voice alert message (also known as selective call) is used to signal a particular individual address. Only the radio with that address listens to the call; other radios do not unmute. When the TB9100 receives a voice alert message on its analog line, it can handle the call as a P25 individual call, mapping the MDC1200 address to a P25 individual ID.

General Analog Line Settings

The General form (Configure > Analog Line > General) lets you set levels for the analog line. You can also enable MDC1200 signaling, set its level, select configuration options and monitor the signaling received.

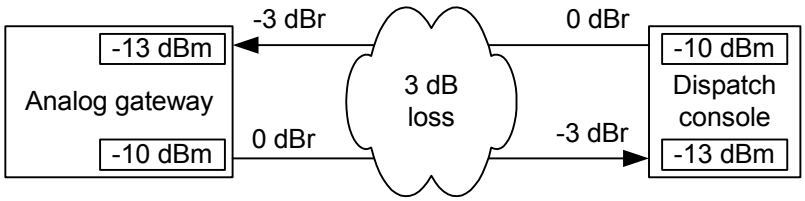
Setting Line Levels

You set line levels in the General form (Configure > Analog Line > General) To help you, the form displays the current line levels at the analog line interface. These are measured in the digital domain and adjusted to represent the actual values at the interface pins.



Levels need to be set correctly so that the line output level does not exceed acceptable limits and so that the signal arriving at the base station switch is neither so strong that it risks exceeding the maximum value nor so weak that signal quality is affected. The levels that you enter are the absolute levels in dBm that a -10 dBm0 test tone would have at the line interface.

The levels you set should implement the network level plan. In the following level plan for a very simple network, a dispatch console is directly connected to a base station along lines with a 3 dB loss. The plan specifies 0 dBr for each output. This is achieved by setting line levels in both the dispatch console and the base station at -10 dBm for the output and -13 dBm for the input.



Output

The Output box specifies a nominal line level for the analog line output. When the base station is receiving an analog FM signal at 60% maximum deviation, it applies a gain so that it outputs audio at this level. Enter a value based on the level plan for the network. For example, if the level plan specifies -0 dBr at the analog line output, enter -10 dBm. This results in an average power level at the transmission reference point of -10 dBm, allowing 10 dB for speech peaks. You can verify the accuracy of the setting by using RF test equipment to supply a signal at 60% deviation, and reading the output in the RMS level box.

Note: The output level is currently limited to a maximum of -10 dBm. This is to ensure compliance with telecommunication company requirements.

Input

The Input box specifies the line level that the base station expects on the analog line input. When the base station receives audio at this level, it applies a gain so that it transmits at 60% maximum deviation, when in analog FM mode. Enter a value based on the level plan for the network. For example, if the level plan specifies -3 dBr at the analog line input, enter -13 dBm. Audio sent from the transmission reference point at -10 dBm will arrive at the analog line interface at -13 dBm. You can verify the accuracy of the setting by looping back the analog line and using the base station's own ability to send a 1 kHz test tone, measuring the maximum deviation using RF test equipment.

Using Deviation Measurements to Set the Input Line Level

Traditionally, technicians use transmitter deviation measurements to set line levels. While line levels in a TB9100 can be correctly set without measuring the deviation, some may still wish to use this method.

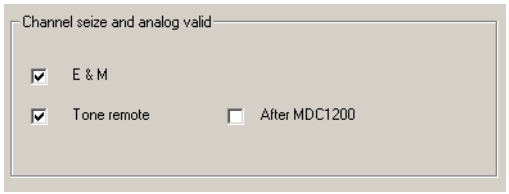
To set the input line level

1. Apply a 1 kHz tone at the required reference level at the line input.
2. Set the base station to analog FM mode. (In digital P25 mode, the C4FM modem uses fixed deviation patterns that represent specific symbols. The deviation cannot be used for setting the line level.)
3. Adjust the input level (Configure > Analog Line > General) until the deviation is 60% of peak.

Note: After the line level is set, you can also check for a transmitted tone in P25 mode. However, you must first change the tone frequency to 500 Hz; the IMBE vocoder does not reproduce fundamental tones above about 500 Hz.

Channel seize and analog valid

The General form (Configure > Analog Line > General) lets you specify which signaling methods can be used by the analog line.



E & M

This check box enables E & M signaling. When the E line goes low, the base station interprets this as a channel seize. When the base station puts a valid signal on the analog line, it asserts its M line.

Tone remote

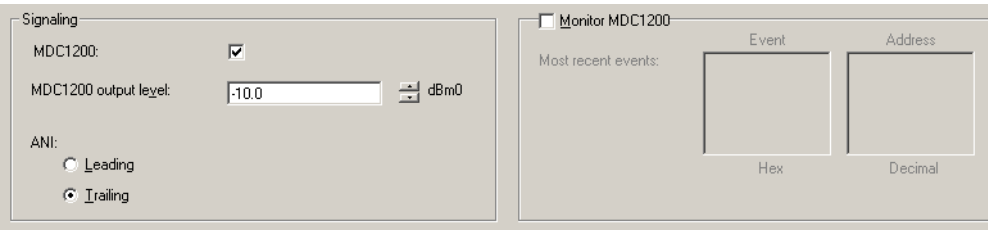
This check box enables the use of tone remote signaling for channel seize. When the base station receives LLGT (keytone), it interprets this as a channel seize. The LLGT must have the properties specified by Configure > Analog Line > Tone Remote Options.

After MDC1200

This check box only applies when tone remote signaling is enabled. Select this check box and the base station waits when it receives LLGT for enough time to receive one or more MDC1200 tone bursts before seizing the channel.

Setting MDC1200 Options

The General form (Configure > Analog Line > General) lets you set configuration options for MDC1200 signaling.



MDC1200

The MDC1200 check box enables MDC1200 signaling across the analog line, provided the base station or analog gateway has an MDC1200 license.

Important: MDC 1200 signaling must be sent to the analog gateway/base station before digital P25 voice transmission can begin. This is an inherent characteristic of the MDC 1200 and digital P25 standards and necessarily increases the end-to-end delay, or causes the start of the call to be lost, or to interfere with the MDC 1200 signaling. Which of these outcomes occurs will depend on the dispatch equipment. Sending guard tone, a single function tone, and the PTT ID takes at least 280 ms.

Make sure that you include the MDC 1200 signaling time when calculating the end-to-end delay of the system. You may be able to configure your dispatch equipment to achieve a balance of initial voice loss and end-to-end delay.

MDC1200 output level

Defines the level of MDC1200 signaling in dBm0. This applies only to MDC1200 signaling that the base station has generated from P25 signaling. -10 dBm0 corresponds to the level that MDC1200 is normally sent over the air (60% deviation).

ANI

Specifies for incoming digital P25 calls when the MDC1200 ANI message is added to the voice stream sent on the analog line. The setting you choose must match the setting of the console system.

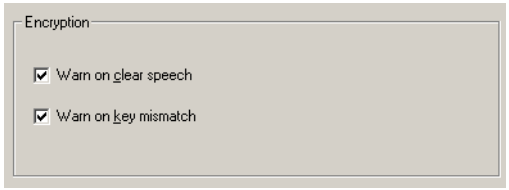
Option	Description
Leading	The ANI message is supplied to the console at the beginning of the over. As this information is not available until after the P25 voice stream has begun, the base station or analog gateway must wait for it before forwarding voice on the analog line.
Trailing	The ANI message is supplied to the console at the end of the over. Delay is minimized, but the identity of the caller is not available until the end of the over.

Monitor

Enable the Monitor check box to monitor any MDC1200 commands coming from the console system. The MDC1200 code for this command appears in hexadecimal in the **Events** box and the MDC1200 value of any destination addresses appears in the **Address** box.

Enabling Encryption Warnings

The General form (Configure > Analog Line > General) lets you specify whether warnings about encryption are sent on the analog line.



Warn on clear speech

When this check box is selected, a single beep (1500 Hz) is sent on the analog line at the end of the over whenever a clear transmission is passed to the analog line. Clear the check box if your system doesn't use encryption.

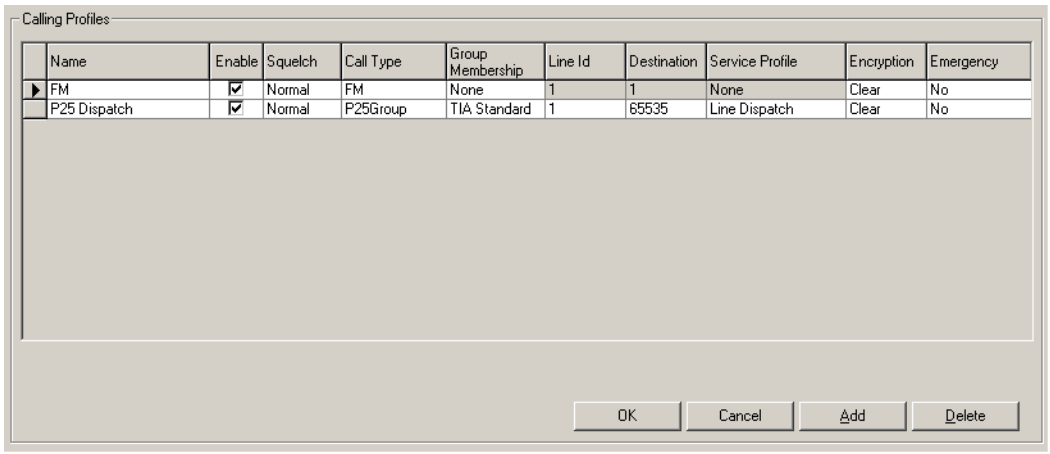
Warn on key mismatch

When this check box is selected, three beeps (500 Hz) are sent on the analog line at the end of the over if there is a mismatch between the received call and the current calling profile. A mismatch occurs if the call uses a key other than the one selected in the current calling profile, if the selected key is missing, or if the current calling profile specifies clear communications but the call uses a key. If any key matches the key used by the call, that call is decrypted. The dispatcher may need to change to a calling profile that uses the key used by the caller, so that the caller can decrypt the reply.

Working with Calling Profiles

The Calling Profiles form (Configure > Analog Line > Calling Profiles) lets you view the list of profiles, add a new profile, and edit an existing profile. A calling profile defines the properties of calls that the dispatcher makes and receives. You can think of the analog line as equivalent to a radio; the calling profile defines the identity and behavior of that radio. Included in the calling profile is a service profile, which specifies what services the analog line supports, and a group membership, which specifies the groups it belongs to and therefore can listen in to.

By default, the analog line uses the calling profile specified by the current channel. Dispatcher commands can select a different calling profile. If the console system uses MDC1200 signaling, aspects of the calling profile can be overridden.



The form displays a row of information for each profile.

To create a new profile, click **Add**, and then click in each column as needed to edit it. To delete a profile, select it and click **Delete**.

Name — The name of the profile.

Enable — The Enable column contains a check box. When this check box contains a tick, the profile is enabled. When the check box is cleared, the profile is disabled. This has the effect of disabling the analog line interface, if the current channel or a dispatcher command has selected this calling profile.

If the analog line is not used, it may be desirable to disable the current calling profile to prevent unauthorized access to the channel group. You may want to disable the analog line temporarily. You can also set up a disabled calling profile and assign it to a channel in order to be able to disable the analog line interface through channel selection.

Squelch — Specifies what the analog line unmutes to. If the squelch is Normal, the base station switches any vote winner onto the analog line. If the squelch is Selective, the base station only switches the vote winner onto the analog line if it is addressed to the current calling profile's line ID or to a group listed in the current calling profile's group membership. The Squelch setting has no effect on analog FM calls.

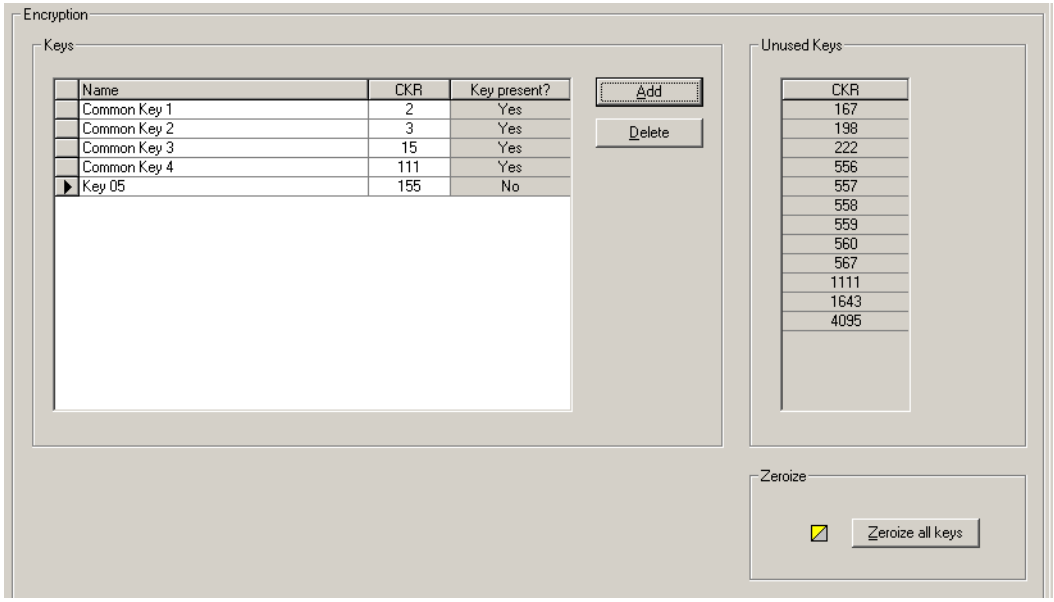
Call Type — Specifies the type of call for dispatcher-initiated calls. The base station turns the audio on the analog line into the specified type (P25 group, P25 individual, or analog FM). The analog line can always pass calls of any type to the console. If you select analog FM, inapplicable columns are not editable.

If the console uses MDC1200 signaling, this setting can be overridden as follows. If the Call type column specifies analog FM, the channel group makes an analog FM call. If the Call type column specifies P25 group or P25 individual, the channel group makes a P25 call of the type specified by the MDC1200 signaling. The line ID and destination addresses specified by the calling profile are overridden.

Group Membership	Selects one of the available sets of group IDs and assigns them to the console. Calls to these groups will be routed over the analog line to the console.
Line ID	Defines the individual ID of the analog line (digital P25 calls only). The base station will pass incoming individual calls with this destination ID to the analog line. The Line ID is also used as the source ID of all outgoing calls.  **Note:** The analog line has additional IDs that are derived from the groups in the current group membership. This is done to support the way Status Messages are implemented. Some radios send Status Messages to an individual ID that is derived from the talk group assigned to the radio's current channel. To derive this ID, the radio adds 0xFEF000 to the talk group. For example, talk group FFFF becomes individual ID 0xFFEFFF. Talk group 0x000A becomes individual ID 0xFEF00A. These additional line IDs mean that Status Messages from these radios are passed to the analog line. If the analog line uses MDC1200, it converts the configured Line ID (not the received ID) to MDC1200 and passes it on to the console system.
Destination	Defines the unit or group ID that the call will be sent to (digital P25 calls only). If the selected call type is P25 group, enter a 5-digit group ID. 65535 (FFFF in hexadecimal) is a special group ID that sends the call to all radios on the system. This is also known as an unaddressed voice call. If you enter a group ID, make sure that the group membership profile assigned to the channel and to the analog line includes that group, otherwise the base station will not respond to communications from other group members. If the call type is P25 individual, enter a 7-digit individual ID. This setting is overridden when the dispatch console uses MDC1200 signaling.
Service Profile	Selects one of the available service profiles that specifies which services are available to the dispatch console (digital P25 calls only). The services the dispatch console is able to receive are determined by the service profile assigned to the current channel of the base station receiving the transmission.
Encryption	Specifies the analog line's encryption behavior. If 'Clear' is selected, the analog line does not encrypt calls and does not expect to have to decrypt them. Click in the column to display a drop-down list of keys. The key list comes from the Encryption form (Configure > Analog Line > Encryption). If a key is selected, the analog line encrypts outbound digital P25 calls using the secure key data for that key. It always decrypts inbound P25 calls if it has the key, but may sound a warning if a call does not use the expected key. The encryption setting has no effect on analog FM calls.
Emergency	Specifies whether calls that the dispatcher makes are emergency calls (digital P25 calls only). This setting is overridden when the console uses MDC1200 signaling.

Encryption

The Encryption form (Configure > Analog Line > Encryption) is used for setting up encryption keys. The Unused keys area displays the CKR numbers of key data that has been loaded into the analog gateway but not associated with a key name. The Keys area lets you define keys, by giving them a name and a CKR. These keys are then available for assigning to calling profiles. You can also delete named keys from the keys list and zeroize all keys.



Keys

The Keys area contains a table consisting of up to 16 rows, each containing a named key and a CKR number. Click on a column header to sort the table by that column. An arrow to the left of the table indicates which row is currently selected.

Name — The name of the key. When you add a row to the Keys table, the CSS gives it a default name. You can leave this name or edit it to make it more meaningful, for example 'Common key 1' or 'Police February.' The name appears in a drop-down list in the Calling profiles form. Calling profiles refer to keys by name only.

CKR — The CKR that you want associated with the key. You need to enter the CKR of secure key data that has been or will be loaded into the analog gateway. If you are connected to the analog gateway, the Unused keys area displays a list of CKRs that have not yet been assigned a name in the Keys table.

Key present? — If the CSS is connected to the analog gateway, this column indicates whether secure key data (the key ID, algorithm ID and key variable) is present for the CKR. For encryption to work, the secure key data must be present. If the column displays No, check that you entered the correct CKR number when naming the key.

Add — Adds a new row to the Keys table.

Delete — Deletes the selected row from the Keys table. This has no effect on the underlying secure key data.

Unused keys

The Unused keys area displays the CKR numbers of keys that have been loaded but not yet named.

Zeroize

Click **Zeroize all keys** to remove all the secure key data that has been loaded by a key fill device. You can use this to remove obsolete key data from the analog gateway, before loading new key data. You should also zeroize all key data to maintain security when sending the analog gateway or the reciter for repair.

Defining Group Memberships

The Group Membership Table form (Configure > Analog Line > Group Memberships) lets you define sets of groups. At any particular time, the dispatcher belongs to one set of digital P25 groups and can listen to their calls. (The analog line belongs to a calling profile, which specifies one row in the group membership table. Calls to a group in the set are switched to the analog line, calls to other groups are not.) The analog gateway itself always receives and transmits irrespective of the group address.

You can enter up to ten sets of groups, each containing up to seven P25 group IDs.

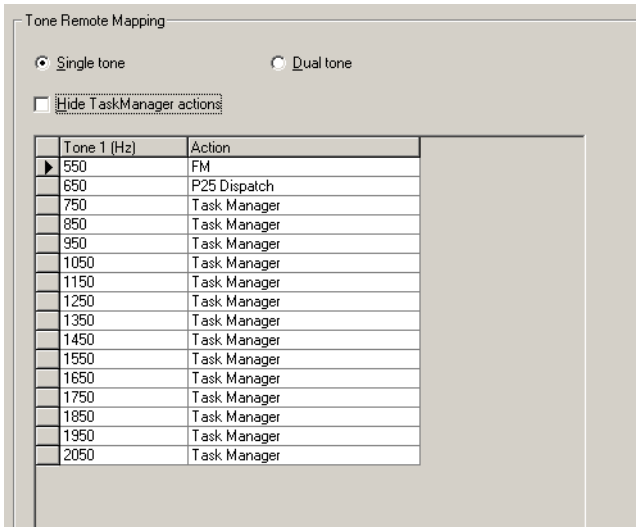
To add a set of groups

1. Click **Add**. A new row appears in the table.
2. In the **Name** column, enter a suitable name or description for the set of addresses.
3. Enter a P25 group ID into the Group 1 column. These are 4-digit hexadecimal numbers.

   Note: If you enter nothing (leave the columns empty), one group is still specified: 65535 (0xFFFF). The base station will always pass calls to the group address 65535 on to the analog line.
4. Repeat for subsequent group columns until you have entered all the groups that the dispatcher needs to listen to. The special group ID
5. Click **OK** to confirm your changes and close the form.

Mapping Tone Remote Commands

The Tone Remote Mapping form lets you map tone remote function tones to calling profiles. By default, all function tones can trigger Task Manager actions. If you map a tone remote function tone to a calling profile, when the console sends the function tone, the base station's analog line switches to that calling profile. If you want the function tone to do something other than select a calling profile, create an appropriate Task Manager statement with **Tone remote detected (nnn)** as the input.



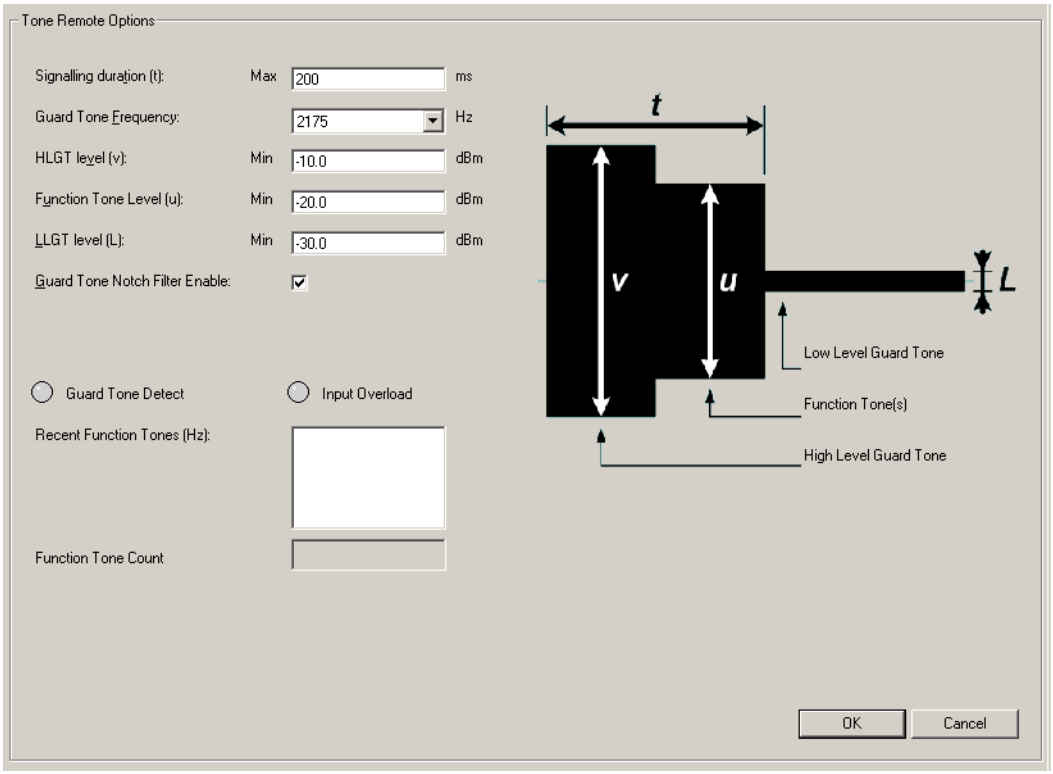
To map a function tone to a calling profile

1. Select Configure > Analog Line > Tone Remote Mapping.
2. Select **Single tone** or **Dual tone**, based on the kind of function tones that the console system will produce. This configures the analog line for the detection of single-tone or dual-tone function tones. If you select Single tone, one tone column is displayed. If you select Dual tone, there are two columns.
3. If necessary, clear the **Hide Task Manager actions** check box.
4. In the row displaying the function tone frequency (or combination of frequencies, for dual function tones), click in the **Action** column. An arrow button appears.
5. Click the arrow to drop down a list of the available calling profiles together with the item 'Task Manager.'
6. In the list, click the calling profile you want.

Setting Tone Remote Options

Console systems can use a variety of frequencies and levels for the tone remote control of base stations. In the Tone Remote Options form (Configure > Analog Line > Tone Remote Options), you specify the parameter values that the connected equipment uses. A graph of tone remote signaling shows you visually the meaning of the parameters. Some values you can ascertain from the console system documentation, others may depend on the console system configuration. The console system and the base station must have compatible settings.

The Tone Remote Options form also has some monitoring items. You can use them to confirm that tone remote detection is working properly.



Signaling duration	The maximum time that the analog line will listen for HLGT and function tones. This time begins when the analog line detects HLGT. Any function tones received after this time has elapsed are not detected.
Guard tone frequency	The frequency that the console system uses for the guard tone. HLGT and LLGT use the same frequency. If the console system is going to use MDC1200 with analog FM radios, this frequency should be well above 2100 Hz, so that the notch filter does not remove significant amounts of energy from the MDC1200 signaling.
HLGT level	HLGT must exceed this minimum level for the base station to detect the tone.
Function tone level	Single tone or dual tone function tones must exceed this minimum level for the base station to detect them.
LLGT level	LLGT must exceed this minimum level and be less than the minimum HLGT level for the base station to detect the tone.
Guard tone notch filter	When this check box is enabled, the base station removes the LLGT from the audio before sending it to the voter. Normally, the notch filter is enabled.

Monitoring Controls

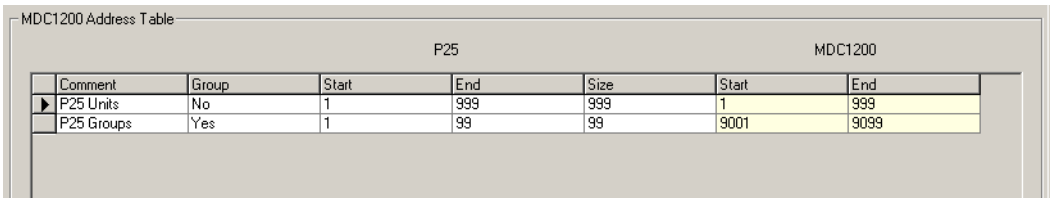
Once you have set up the tone remote options, you can confirm that the analog line is correctly detecting and decoding them. Send some tone remote signaling from the console system and check the display of the following monitored items.

Guard tone detect	Displays green when the analog line recognizes HLGT or LLGT.
Input overload	Displays red if the level exceeds the limit that the analog line can handle. If overloads occur, the analog line cannot correctly detect tones.
Recent function tones	Displays the frequencies of the last four function tones detected by the analog line interface. If the analog line detects a function tone, its characteristics lie within the limits of the parameters defined in this Tone Remote Options form.
Function tone count	Displays the number of function tones that have been detected. When you send a number of function tones from the console system, check that the count increments by that number.

Mapping MDC1200 Addresses

The MDC1200 Address Table (Configure > Analog Line > MDC1200 Address Table) tells the analog line how to convert individual and group numbers from P25 to MDC1200 and vice versa. For example, when the dispatch console calls a group, the analog line converts the destination MDC1200 address to its P25 equivalent, which the channel group uses over the air. Similarly, when a radio calls the dispatcher, the analog line converts the radio's P25 address to the equivalent MDC1200 address, which the dispatch console displays as the caller ID.

The default mappings will suffice in most circumstances. If necessary, the existing rows in the table can be modified or further rows can be added. All mappings involve a number conversion, so that the MDC1200 numbers displayed on the dispatch console can be highly similar to the equivalent P25 numbers.


MDC1200 Address Table

			P25			MDC1200	
	Comment	Group	Start	End	Size	Start	End
▶	P25 Units	No	1	999	999	1	999
	P25 Groups	Yes	1	99	99	9001	9099

In the default mappings, the first table row maps P25 individual addresses between 1 and 999 to MDC1200 addresses 0001–0999. The second row maps P25 talkgroup addresses between 1 and 99 to 9001–9099.

Adding an Address Mapping

If you need to map additional addresses to the ones already mapped, follow these steps.

1. Select Configure >Analog Line > MDC1200 Address Table.
2. Click **Add**. A new row appears in the table.
3. In the **Comment** column, enter a name or remark to identify the block of addresses.
4. In the **Group** column, select Yes if you are mapping P25 group addresses or No if you are mapping P25 individual addresses.
5. Under **P25**, enter into the **Start** column the lowest P25 address in the block. Enter into the **End** column the highest address in the block.

Tait recommends that you use group and individual addresses between 1 and 9999. However, valid group addresses are 1-65535 (0xFFFF) and individual addresses 1-16777215 (0xFFFFFF). Generally, you can't include addresses that have already been mapped, but you can re-use addresses from a block of group addresses in a block of individual addresses and vice versa. This is because a P25 group address is not identical to a P25 individual address with the same number; they have different byte sizes.

The size of the block is calculated and appears in the **Size** column.

6. Under **MDC1200**, enter into the **Start** column the beginning of the equivalent MDC1200 block of addresses. MDC1200 addresses must normally be in the range 1-9999. You can't include addresses that have already been mapped. The end of the MDC1200 address range is automatically calculated and appears in the **End** column.

Note: Some analog console systems will not allow Radio Enable/ Radio Disable, Radio Check, Radio Monitor or Status Report (Status Request) if the hexadecimal MDC1200 radio address has an E or F in it. For assistance with mapping addresses with this or other similar special requirements, contact Tait.

7. Click **OK** to confirm your changes and close the form.

Tip: To shift a range, edit the address in the P25 or MDC 1200 **Start** column. To change the size of a range, edit the P25 size or the P25 address in the **End** column.

Radio Numbering Example

The following example shows how a county Sheriff's department could number its radios.

	P25 Start Address	P25 End Address	MDC1200 Start Address	MDC1200 End Address
Officers' radios	1	99	0001	0099
Vehicles	201	299	0201	0299
Talkgroups	901	920	0901	0920

Officers' handportables, in-vehicle mobiles, and talkgroups each have their own number range. This example uses the default mapping and results in MDC1200 numbers that are highly similar to the P25 numbers.

Part F Alarms

The CSS can monitor the current status of a base station's alarms. Many alarms have thresholds that you can alter to suit the application. Unwanted alarms can be disabled.

To view recent alarms, display the system log (Monitor > Data Logging > System Log).

Topics

Monitoring Alarms

The Status form (Monitor > Alarms > Status) shows the current status of alarms in the base station. The CSS must be connected to a base station before it can display the alarms.

LED-like icons indicate the status:

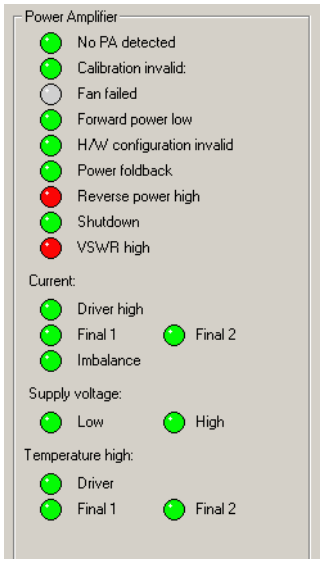
- Red (flashing) means that the alarm is active.
- Green means that the monitored condition is OK and that there is no alarm.
- Gray means that the alarm has been disabled or that the monitored condition is not available; for example, Final 2 alarms are gray if there is no Final 2 stage.

Alarms are triggered when a monitored condition crosses a defined threshold. Some thresholds are fixed and built into the module firmware. Others are configurable in Configure > Alarms > Base Station Thresholds and Network Thresholds. Some parameters such as high voltage and high reverse power have two thresholds. When the configurable threshold is crossed, the base station generates an alarm. When the built-in threshold is crossed, the base station responds by protecting itself against damage.

Tip: Use Task Manager to configure an automatic response to alarms. In general, each alarm has an equivalent Task Manager input. When the alarm occurs, Task Manager executes any tasks with that alarm as an input.

Power Amplifier

The Power Amplifier area shows the alarm status of the PA associated with the reciter you are logged on to. When a fault is no longer active, any actions (for example, inhibiting transmission) are reversed.



No PA detected

The reciter cannot obtain a response from a PA over the control bus. The PA may still be operating but the system has lost the ability to monitor PA alarms, carry out diagnostics, change configuration, or detect PA fan failure.

1. No PA is installed.
2. Your system uses a third party PA which does not use the control bus and cannot respond to the reciter.
3. The control cable or exciter cable is not connected.
4. The PA is faulty and unable to communicate with the exciter.

Invalid PA firmware

The firmware in the PA is invalid.

1. Use the CSS to download the firmware.
2. Return the PA to Tait.

Calibration invalid

This alarm can only be triggered on startup, when the PA carries out self-tests. It indicates that settings stored in firmware have values outside acceptable limits. In response, the base station disables the transmitter. Re-calibrate the PA using the Calibration Software or send it to a service center for repair.

Fan failed

The PA told the reciter that its fan is on, but the reciter cannot detect fan motion. The base station takes no action when this alarm occurs, but it will act if the PA temperature becomes too high.

The fan has failed. Replace it.

Forward power low

The PA forward power output is below the configured minimum limit. If the VSWR is also raised, check for a load mismatch. Otherwise, there may be a fault in the output driver(s).

H/w configuration invalid

The PA has an invalid hardware configuration. Either the driver is not present or the configuration says that there is a Final 2 output stage but no Final 1, which is impossible.

Power foldback

The PA has detected a fault condition and has reduced its power output to a minimal level to prevent damage.

Check the other alarms to see what fault condition or conditions have caused this. If the fault condition clears, the PA automatically returns to its previous power output level and the alarm changes to green.

Reverse power high

The PA's reverse power is above the configured maximum. Check for a load mismatch. With a resolution of only 1 W, this alarm is not sensitive if the power output is lower than 20 W. Check the VSWR fault alarm instead.

Shutdown

The PA has detected a fault condition and has disabled the transmitter to prevent damage. Check the other alarms to see what fault condition or conditions have caused this.

VSWR high

The VSWR is above the configured threshold. A normal VSWR is ≤ 2:1. A high VSWR automatically means reduced output power. If the VSWR increases to 10:1 or more, the PA folds back its power output to a minimal level. If the VSWR returns to 5:1 or less, the PA recovers.

Check for a load mismatch on the PA's RF output.

Current

The Current group of alarms detects excessive or inappropriate current draw. If an alarm shows red, the PA needs servicing.

Alarm	Description
Driver high	The driver is drawing excessive current. A fixed limit has been exceeded.
Final 1	The Final 1 output stage is drawing excessive current. A fixed limit has been exceeded.
Final 2	The Final 2 is drawing excessive current. A fixed limit has been exceeded.
Imbalance	One of the final stages is drawing significantly more current than the other.

Supply voltage

The PA can detect whether its power supply voltage is too high or too low.

Supply voltage low

The PA supply voltage is 26 V or less, probably because the battery is running low. The fault condition disappears when the voltage exceeds 26.1 V.

Supply voltage high

The PA supply voltage is 29 V or more.

1. The third party power supply is incorrectly configured.
2. A voltage regulator has failed.

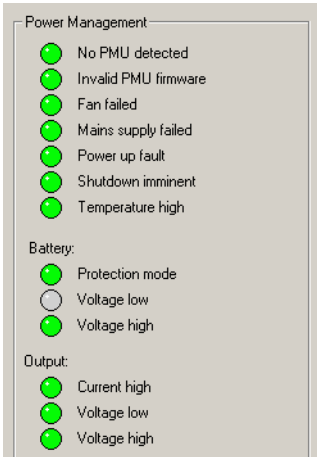
Note: The base station is not type-approved for operation when the supply voltage is outside the specified range.

Temperature high This group of alarms shows whether the temperature in the driver, Final 1, or Final 2 output stage has exceeded the configured threshold. If a temperature exceeds a built-in limit, the PA folds back its power output until the temperature is within the normal range.

To see the actual temperatures, select Diagnose > Modules > PA Control Tests.

Power Management Unit

The Power Management Unit area shows the alarm status of the PMU that supplies the base station with power.



No PMU detected — The reciter is unable to detect the PMU on the control bus. There may be a fault or the PMU may still be operating satisfactorily. However, the system has lost the ability to monitor PMU alarms, carry out diagnostics, change configuration, or detect PMU fan failure.

Invalid PMU firmware — The firmware in the PMU is invalid.

1. Use the CSS to download the firmware.
2. Return the PMU to Tait.

Fan failed — The PMU told the reciter that its fan is on, but the reciter cannot detect fan motion. The base station takes no action when this alarm occurs, but it will act if the PMU temperature becomes too high.

The fan has failed. Replace it.

Mains supply failed — The mains power supply to the PMU is absent or its voltage is outside acceptable limits. The PMU is using DC power from its battery source.

Power up fault — The PMU has detected an internal error and will reset itself. If the reset is successful, the alarm will clear.

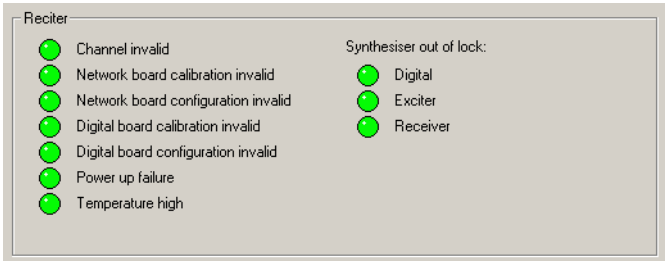
Shutdown imminent — This alarm only appears if the PMU has a DC-DC converter and a Standby converter. A battery is currently being used to power the base station and its voltage has fallen to the absolute minimum. The PMU will stop operating 30 seconds after activating this alarm.

The main value of this alarm is as an input for Task Manager actions. You can, for example, have the base station send the alarm log just before shutting down.

Temperature high	One of the PMU temperature sensors has detected a temperature that is above the fixed limit.
Battery	The PMU measures the voltage of its battery input.
Battery protection mode	Battery protection mode is on. This happens when a base station is operating on mains power, but the battery voltage is still below the configured minimum. Battery protection mode requires a PMU with a standby converter.
Battery voltage low	The battery voltage is below the configured minimum. This minimum may have been set to alert you to the risk of damage to the battery from overdischarge. If the voltage falls below a fixed minimum, the PMU automatically shuts down to protect the battery and base station equipment. If mains power fails when the PMU is in battery protection mode, the base station shuts down instead of using battery power. This protects the battery. 1. The system has been operating on battery power; the battery has become flat and mains is restored. No action required. 2. The battery is not being charged. Check the PMU's auxiliary output line, if it is being used for charging. 3. The battery is flat. Replace it. 4. The minimum battery voltage is set too high.
Battery voltage high	The PMU's battery voltage is higher than the configured maximum. The base station takes no action until the voltage reaches the fixed maximum, when it shuts down.
Output	The PMU measures the voltage and the amperage of its DC output to the PA and to the reciter.
Output current high	The PMU is providing more than 15 A of current and is automatically limiting its output, lowering the output voltage. There is a short circuit or the PMU is faulty.
Output voltage low	The PMU's DC output (nominally 28 V) is lower than the fixed minimum of 24 V.
Output voltage high	The PMU's DC output (nominally 28 V) is higher than the fixed maximum of 32 V.

Reciter

The Reciter area shows the Alarm status of the reciter.



Channel invalid

(Rare) The base station has received an instruction to select an invalid channel number and has stopped transmitting and receiving.

The channel could be invalid for one of the following reasons:

1. The current channel definition no longer exists.
2. Task Manager has selected a channel that no longer exists.
3. The channel definition has an invalid index to other information. For example, it specifies channel profile 3 when there is no such profile.

Network board calibration invalid

The base station cannot operate properly because the analog line has not been calibrated, or because the calibration procedure has not been properly completed, deleting the old calibration value, but not storing a new value. This alarm is not triggered when the analog line goes out of calibration.

- Use the Calibration Software to calibrate the analog line.

Network board configuration invalid

The configuration data has become corrupted. Open the corresponding configuration file stored on the CSS PC and program it into the base station.

Digital board calibration invalid

The base station cannot operate properly because the digital board does not have valid calibration settings. This could be because a calibration procedure has not been properly completed, deleting the old calibration value, but not storing a new value. This alarm is not triggered when the reciter goes out of calibration.

1. Use the Calibration Software to adjust the frequency setup.
2. Use the Calibration Software to fully calibrate the reciter.
3. Calibrate the reciter TCXO.
4. Replace the reciter.

Digital board configuration invalid

The configuration data has become corrupted. Open the corresponding configuration file stored on the CSS PC and program it into the base station.

Power up failure

The reciter has failed one or more of its initialization self-tests and has gone into Failure mode. The transmitter and receiver are disabled and any system interface outputs are deactivated.

Note: This alarm will not show if the reciter cannot communicate with the CSS.

1. Reset the base station. This may clear the fault.
2. Send the reciter to a Service Center.

Temperature high

The temperature of the reciter has exceeded the built-in threshold of 162.5 deg F (72.5 deg C). To see more details about the reciter and its fan, select Monitor > Modules > Reciter.

1. The reciter fan has failed.
2. The reciter is not fitted with a fan and the combination of ambient temperature and duty cycle is too high for operation without a fan.

Synthesizer out of lock

The reciter has three different synthesizer alarms.

Synthesizer out of lock: Digital

One or more of the DSP and sampling clocks is out of lock. In response, the base station disabled the receiver and the transmitter.

1. The base station is configured for an external reference of a particular frequency, but the actual frequency of the external reference is different.
2. The master synthesizer is unable to lock onto the frequency. The base station will run, but the accuracy of its receive and send frequencies cannot be guaranteed. Send the reciter for repair.

Synthesizer out of lock: Exciter

The exciter synthesizer is unable to lock on to the frequency it is configured to operate at. In response, the base station disabled the transmitter.

1. Check that this frequency is within the exciter's RF frequency range.
2. Do a diagnostic test to determine the reciter's switching range, and then check that the frequency is within the exciter's switching range.
3. If the frequency is outside the switching range, use the Calibration Software to alter the switching range. Otherwise send the reciter for repair.

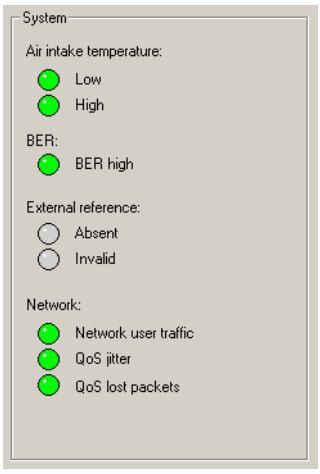
Synthesizer out of lock: Receiver

The receiver synthesizer is unable to lock onto the frequency it is configured to operate at. In response, the base station disabled the receiver.

1. Check that this frequency is within the receiver's RF frequency range.
2. Do a diagnostic test to determine the lock range, and then check that the frequency is within that range.
3. If the frequency is outside the lock range, use the Calibration Software to alter the switching range. Otherwise send the reciter for repair.

System

The System area displays alarms that are triggered by system conditions. These alarms do not indicate base station faults. You can set a threshold for these alarms if this is appropriate for your system. For example, set a suitable BER threshold to provide an alarm indicating problems with the linking infrastructure.



Air intake temperature

The base station is normally fitted with a sensor that measures the air temperature at the PA fan intake and determines whether it is above or below the configured limits.

Air intake temperature low

The temperature is below the configured minimum. The base station is not designed for operation below the default minimum.

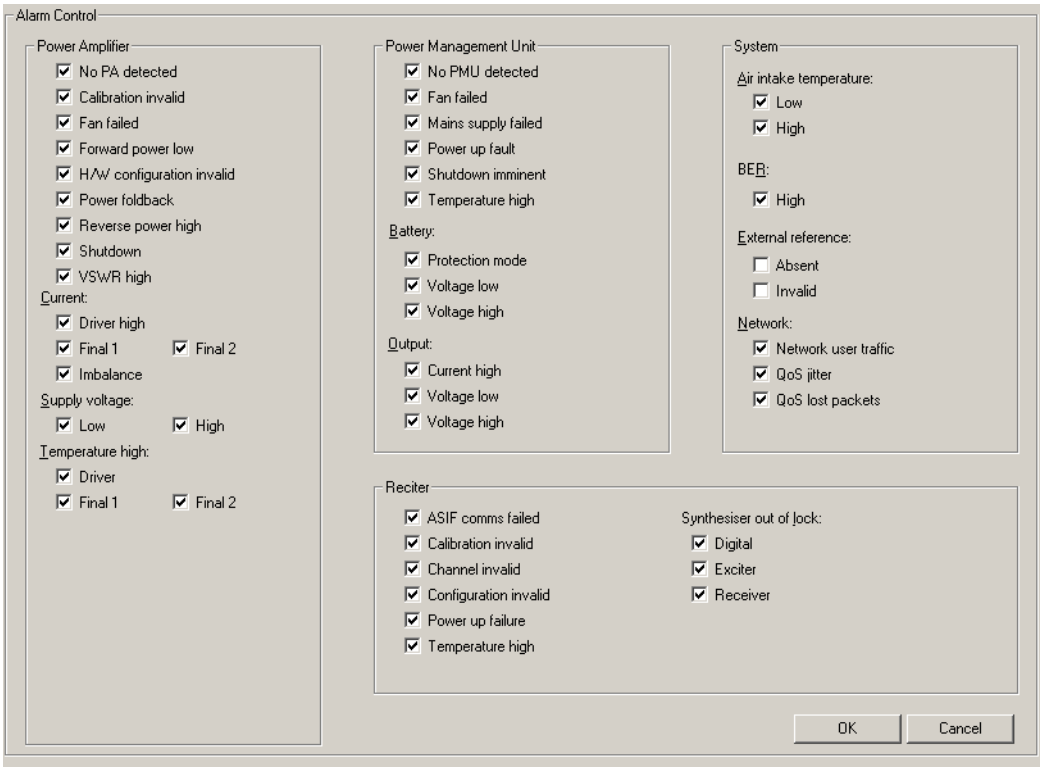
Air intake temperature high	The temperature has exceeded the configured maximum. The PA can sustain full-powered continuous operation at an air intake temperature of up to 60° C. Fan operation and PA power foldback are unaffected by this alarm; it is the heatsink temperature, not the air intake temperature, that turns a base station fan on or folds back PA power.
BER	The base station estimates the BER, based on the amount of forward error correction it is carrying out on the digital RF it receives. If the estimate lies above the threshold set in Configure > Alarms > Network Thresholds, the alarm is triggered.
BER high	A high BER indicates that the quality of the received signal is poor, for example because the radio user is almost outside the base station's coverage area.
External Reference	The base station can detect whether an external reference is present and whether it is usable.
External reference absent	The base station cannot detect an external reference frequency source. It is now using its own source. 1. There is no external reference source. Many applications do not need one. You can disable the alarm (Configure > Alarms > Control). 2. The source has become unplugged. 3. The source is not working. An external reference is critical for simulcast applications and for K-band operation.
External reference invalid	An external reference frequency is connected to the base station, but the base station cannot lock on to its channel frequency using that reference. It is now using its own source. 1. The base station is configured (Configure > Base Station > Miscellaneous) to expect a 10 MHz frequency, but the source is 12.8 MHz (or vice versa). 2. The reference source is faulty.
Network	Most network alarms give early warning that the network is becoming congested.
Network user traffic	Packets are taking too long to traverse the network. The Maximum round trip delay threshold has been exceeded.
QoS jitter	The voice stream sent by this base station is experiencing a delay variation greater than the configured threshold when it arrives at one or more of the other base stations in the channel group.
QoS lost packets	The number of packets lost has exceeded one or more of the configured thresholds.

Disabling Unwanted Alarms

You can disable any of the base station's alarms. Some alarms may not be appropriate for your system.

If you disable an alarm, it is disabled in the Alarm status form and it does not turn on the control panel alarm LED. However, the alarm still generates a syslog message, which the base station stores in its log and optionally sends to a syslog collector, but that message is downgraded to the level of Notice. In addition, any Task Manager tasks with that alarm as an input are still processed.

For detailed information about individual alarms, see "Monitoring Alarms" on page 141.



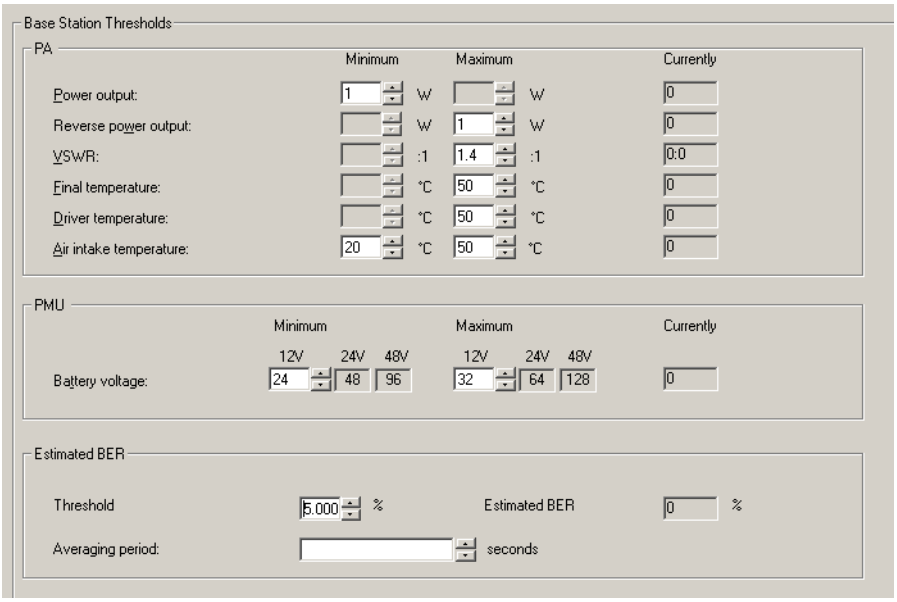
To disable unwanted alarms

1. Select Configure > Alarms > Control.
2. Clear the check boxes of the alarms to be disabled.
3. Click **OK**.

Altering Base Station Alarm Thresholds

The Base Station Thresholds form (Configure > Alarms > Base Station Thresholds) lets you alter thresholds for base station alarms.

Some alarm thresholds are fixed; they are built in to the base station and cannot be changed. Others have default values and you may want to adjust them to better reflect your system's operating conditions or monitoring procedures. This can be important if an alarm is used as an input in Task Manager tasks.



The Minimum column displays lower thresholds. The Maximum column displays upper thresholds. Most parameters have only one threshold. The read-only Currently column displays the current value of the parameter to help you select a suitable threshold.

To adjust a threshold, edit its value or click one of the adjacent arrows, and then click **OK** to confirm your changes and close the form. When the current value of a parameter goes above the maximum or below the minimum, the base station triggers the corresponding alarm. The alarms that these thresholds apply to are described in "Monitoring Alarms" on page 141. The equivalent Task Manager inputs are described in "Alarm Inputs" on page 184.

PA

Power output

The minimum value defines the lower limit for the PA forward power output. When the output falls below this limit, the base station triggers the alarm Forward power low and the Task Manager input PA forward power low becomes true.

Reverse power output

The maximum value defines the upper limit for the PA's reverse power. When the reverse power exceeds this limit, the base station triggers the alarm Reverse power high and the Task Manager input Reverse power high becomes true.

When using a 5 W PA, or any PA set to 20 W or less, disable this alarm and use the VSWR alarm instead. The resolution of the reverse power measurement is only 1 W, so the reverse power alarm would only trigger if there is a serious antenna fault. VSWR has a better precision and reliably detects load failure.

VSWR

The Maximum column defines the upper limit for the VSWR. When the VSWR exceeds this limit, the base station triggers the alarm VSWR high and the Task Manager input VSWR fault becomes true. The hysteresis is fixed at 0.2. For example, if the threshold is 1.5:1, when the VSWR falls to 1.3:1, the alarm is cleared and the Task Manager input becomes false.

Final temperature

The Maximum column defines the upper limit for the operating temperature at the Final 1 and Final 2 stages of the PA. When the temperature exceeds this limit, the base station triggers one of the Temperature high alarms and the Task Manager input PA temperature high becomes true.

Driver temperature

The Maximum column defines the upper limit for the operating temperature at the driver stage of the PA. When the temperature exceeds this limit, the base station triggers one of the Temperature high alarms and the Task Manager input PA temperature high becomes true.

Air intake temperature

The Maximum column defines the upper limit for the air intake temperature that is measured at the PA. When the temperature exceeds this limit, the base station triggers the Air intake temperature high alarm and the Task Manager input PA air intake temperature high becomes true.

The Minimum column defines the lower limit for the air intake temperature that is measured at the PA. When the temperature falls below this limit, the base station triggers the Air intake temperature low alarm and the Task Manager input PA air intake temperature low becomes true.

PMU

Battery voltage

The Minimum column defines the lower limit for the battery voltage that is supplied to the DC-DC converter. Different limits apply, depending on which nominal voltage the DC-DC converter is designed for. When the voltage falls below the relevant limit, the base station triggers the Battery voltage low alarm and the Task Manager input Battery voltage low becomes true.

The Maximum column defines the upper limit for the battery voltage that is supplied to the DC-DC converter. Different limits apply, depending on which nominal voltage the DC-DC converter is designed for. When the voltage exceeds the relevant limit, the base station triggers the Battery voltage high alarm and the Task Manager input Battery voltage high becomes true.

Both the upper and lower limits have a hysteresis of 0.1 V.

Estimated BER

This area lets you set the alarm threshold for the bit error rate of the RF input. The BER is an estimate, because it is computed from the number of errors in the signal fixed by forward error correction.

Threshold

Defines the percentage bit error rate above which the BER high alarm is triggered. The default is 5%, which is about the limit at which forward error correction can still resolve errors.

Estimated BER

Displays the current measured BER.

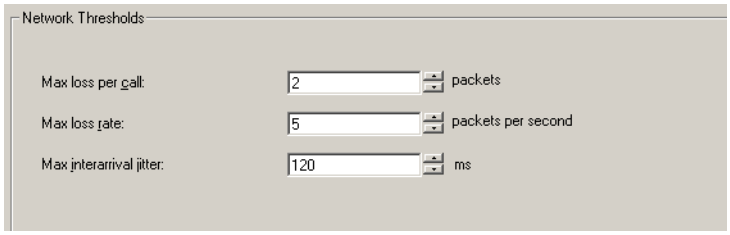
Averaging period

The time in seconds over which the BER is averaged. The default is 7 seconds (approximately one over).

Altering Network Alarm Thresholds

The Network Thresholds form (Configure > Alarms > Network Thresholds) lets you modify the thresholds, mostly for measures of the quality of service of the network link to other base stations in the channel group. Generally, you can leave defaults as they are. When a threshold is exceeded, an alarm condition results. The aim of adjusting them is to ensure that alarms trigger before the quality of service deteriorates under network load, giving you some advance warning.

Tip: Select Monitor > Interfaces > Digital Line to view current values for quality of service measures. These can help in the setting of appropriate thresholds.



Max loss per call

The maximum allowable number of packets lost in one over. It is designed for detecting a sudden acute loss of service. The base station calculates the packets lost from a jump in the sequence number from one packet to the next. You can select up to 50, which is roughly equivalent to a gap of one second. If the threshold you set is exceeded, the base station raises the QoS lost packets alarm.

Max loss rate

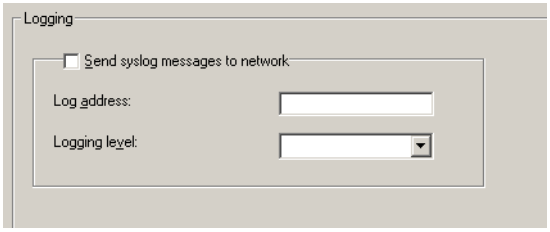
The maximum number of packets lost per RTCP interval (one second). If this is exceeded, the base station raises the QoS lost packets alarm. The maximum loss rate is designed for detecting a longer-term chronic degradation in quality of service.

Max interarrival jitter

The maximum allowable jitter for packets arriving at the network interface. The jitter is calculated for each over and if it exceeds this threshold, the base station raises the QoS jitter alarm.

Logging

The Logging form (Configure > Alarms > Logging) lets you enable and configure the sending of some or all system log messages to a central syslog collector. Messages are sent in the syslog format.



Send syslog messages to network

Select this check box to have the base station send its log messages over the digital line.

Note: Syslog messages can cause voice drop-outs. A switched network does not have QoS and so cannot give voice packets priority. If the base station's logging level is low (Notice or Trace), syslog messages may combine with voice to exceed the available bandwidth, causing voice drop-outs. See the Network Installation Guide for guidance on bandwidth allocation and syslog bandwidth requirements.

Log address

Enter the IP address of a host running syslog collector software. Use dotted decimal notation. The base station will send its log messages to this address.

Logging Level

Select the lowest level of messages to be sent to the log address. All messages at or above this level will be sent. The different syslog message levels are as follows:

Level	Description
Emergency	Alarm conditions that make the base station unusable.
Alert	Alarm conditions that require immediate action to prevent failure.
Critical	Alarm conditions that indicate a trend towards failure, for example, high temperature.
Error	Alarm conditions that indicate an error within the base station's interfaces.
Warning	Events that do not affect behavior, but that may be of significance to operators or maintainers.
Notice	Events that may be helpful to operators or maintainers.
Trace	Tait-internal messages.

The advantage of selecting 'Error' is that the base station only sends messages if there is a problem. The loading on the linking infrastructure is minimal.

The advantage of selecting 'Notice' is that you do not lose the system log if the base station resets. The whole system log is sent to the syslog collector. If the base station resets, its system log is cleared.

You need to select 'Notice,' if you want to set the syslog collector up to respond if a base station fails. Each base station sends a 'heartbeat' message at level 'Notice' to the syslog collector. If a base station fails, the syslog collector no longer receives the heartbeat and can raise the alarm.

You can select 'Trace' to provide the syslog collector with the maximum detail possible. This may be useful during system installation.

Part G Diagnosing

Using the CSS, you can carry out diagnostic tests on the base station and its modules. For many tests, the base station must be in Standby mode. However, you can view any diagnostic form in Run mode.

Generally a diagnostic form displays relevant information, so that you can monitor base station status before, during, and after the test. Often you can combine different tests.

Some diagnostic tests check aspects of the base station. Others provide you with a simple function (for example, looping back the analog line) that facilitates setting up or troubleshooting the base station's interface to external equipment.

Topics

RF Interface

Line Interfaces

Modules

Carrying Out Diagnostic Tests

Most diagnostic tests are carried out in a similar way. The following gives general instructions on how to do it.

When you start a test, the base station uses its existing settings such as frequency and level, unless you enter different values. When you stop a test or it comes to an end, the base station always returns to the configuration it was in before the test began. For example, after making a test transmission at a manually selected frequency, the base station reverts to the frequency it was previously configured for.

Some tests can only be carried out when the base station is in Standby mode. Colors in the square alongside the Start test button indicate the supported modes: yellow means Standby mode and green means Run mode. Hover the mouse over the square and a tooltip specifies the supported modes.

To carry out a diagnostic test

1. Connect to the base station. You can be remotely connected, but you do need to be on site to test the control panel and the speaker.
2. Click **Diagnose**.
3. In the navigation pane, select an item. The corresponding form appears.
4. In the form, check the base station's current status.
5. If the rectangle alongside the **Start Test** button is yellow and gray, click **Standby** on the toolbar.
6. Click **Start Test**.

   This either carries out the test or it enables other buttons on the form so that you can carry out a test. The item in the navigation pane turns red and the Start Test button changes to Stop Test.

   During the test, the base station will respond to any faults that occur (if, for example, the PA overheats, it will fold the power back) but there will be no alarm notification, because Task Manager is not active in Standby mode.
7. If desired, you can navigate to other forms to view monitoring screens, check the base station's configuration. Some tests also allow you to simultaneously carry out other tests.
8. If necessary, click **Stop Test** to end the test (some tests end automatically). Selecting Run mode or disconnecting the CSS also ends the test.

RF Interface

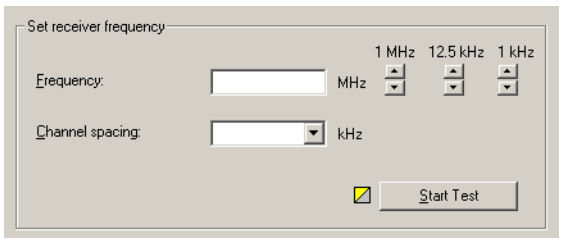
The CSS lets you carry out a variety of tests on the connected base station's RF interface. You can receive on any frequency and bandwidth, scan the switching range and display the signal strength, test synthesizer lock ranges, and transmit carrier, FM, or C4FM.

Receiver Tests

The Receiver form (Diagnose > RF Interface > Receiver) lets you carry out various tests on the TB9100 receiver.

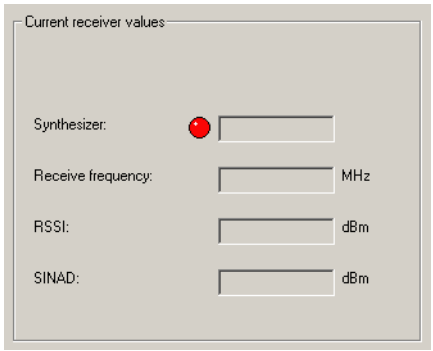
Testing Receiver Operation

The Set receiver frequency test provides a quick way to check that the receiver is operating. You manually set the receiver frequency and do not need to alter the base station's configuration. The test can be carried out on analog FM or digital P25 transmissions.



1. Connect an RF source to the reciter or arrange for a suitable radio to transmit a signal.
2. Select Diagnose > Reciter > Receiver. In the **Frequency** box, enter the frequency you want to receive on. Alternatively, use the arrow buttons to shift the frequency up or down.
3. In the **Channel Spacing** box, select a value from the drop-down list.
4. On the toolbar, click Standby.
5. Click **Start Test**.

   The Current receiver values area displays information about the received signal.



The Synthesizer LED indicates whether the receiver synthesizer managed to lock onto the frequency. The Receive frequency box displays the receiver's

current operating frequency. The current RSSI and SINAD are also displayed.

Note: The SINAD is approximate and is obtained by measuring the out-of-band noise. This value should not be relied upon to make calibrated measurements.

Note: The speaker may not give any indication that a signal has been received.

6. If desired, modify the receive frequency by clicking the up or down arrows. (You can repeat this as often as you want.)

   The End Test button turns into a disabled Starting Test button until the new frequency has been tested. The form now displays the new values.

7. Click **Stop Test** when you are finished.

Testing Receiver Sensitivity

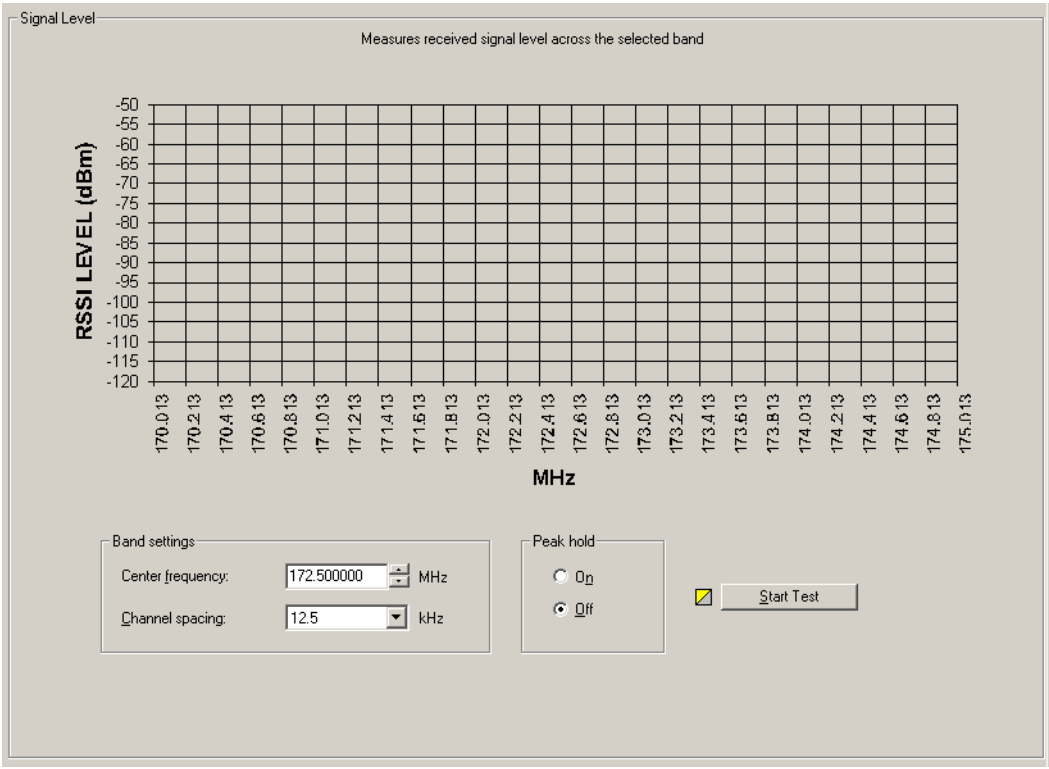
You can carry out a basic test of the receiver's sensitivity without using test equipment. The test only works if a 50 ohm load is connected to the receiver's RF input and no RF signal is being received. You can set this up by connecting up a test set and switching its RF off.

1. Disconnect the receive antenna and connect a 50 ohm load.
2. Select Diagnose > RF Interface > Receiver.
3. On the toolbar, click Standby.
4. Click **Start Test**. The box alongside indicates whether the receiver passed or failed the test. The test is carried out at the frequency and channel spacing defined by the current channel.

   If the test result is 'fail' and the receiver was not receiving any RF, the receiver front end is not properly tuned and/or the RSSI calibration is inaccurate. Use the calibration software to tune the receiver front end and re-calibrate the RSSI.

Measuring Received Signal Levels

You can measure the strength of RF signal that the base station receives across a band of frequencies. A bar graph displays the results.



This test lets you see what signals are out there; it does not determine the receiver's sensitivity.

To measure signal levels

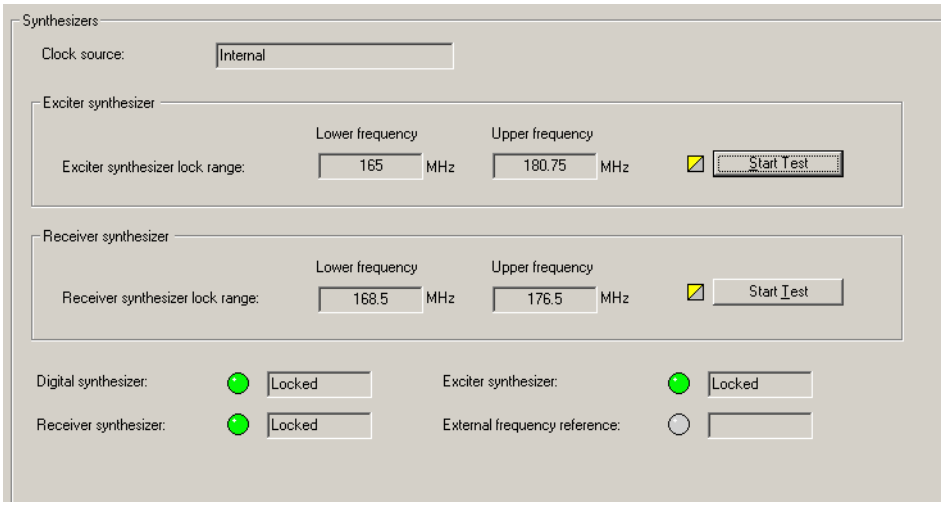
1. Select Diagnose > Reciter > Signal Level.
2. In the **Center frequency** box, specify the middle frequency of the band you want to test. This can be any frequency within the receiver's switching range.
3. In the **Channel spacing** box, select a value from the drop-down list. This specifies the size of the step from one frequency to the next. If this corresponds to the channel spacing, you will measure signal levels of the different channels in the band.
4. Under **Peak hold**, select On if you want the display to show the strongest signal received on any pass. This means signals from infrequent users are more likely to be included. Select Off if you want to see only the results of the most recent pass.
5. On the toolbar, click **Standby**.
6. Click **Start Test**. The base station sets the receiver to a frequency, measures the RSSI, increments the frequency by the value in the Channel spacing box, measures its RSSI and so on for 101 steps below and above the center frequency you specified. Once it has completed a pass over all 101 frequencies, it begins the next pass. You can leave the test running as long as you wish.

7. Click **End Test** to stop the test.

   The graph displays the measured RSSI values and annotates the x-axis with the correct frequency values. The data is automatically saved to a file (signal_level_log.csv) in the LogFiles folder. You can open this file in a spreadsheet program.

Determining Synthesizer Lock Ranges

You can test the reciter's synthesizers to determine the range of frequencies that the receiver and the exciter can operate on. Use these tests to check that the reciter is calibrated correctly for the channels that it will operate on.



The **Clock source** box indicates whether the reference frequency is internal or external to the base station.

The bottom group of boxes with LEDs indicate the lock status of various parts of the reciter in its current operation.

To test the exciter or receiver lock range

1. Select Diagnose > Reciter > Synthesizers.
2. On the toolbar, click Standby.
3. Click **Start Test** in the Exciter synthesizer or Receiver synthesizer area.

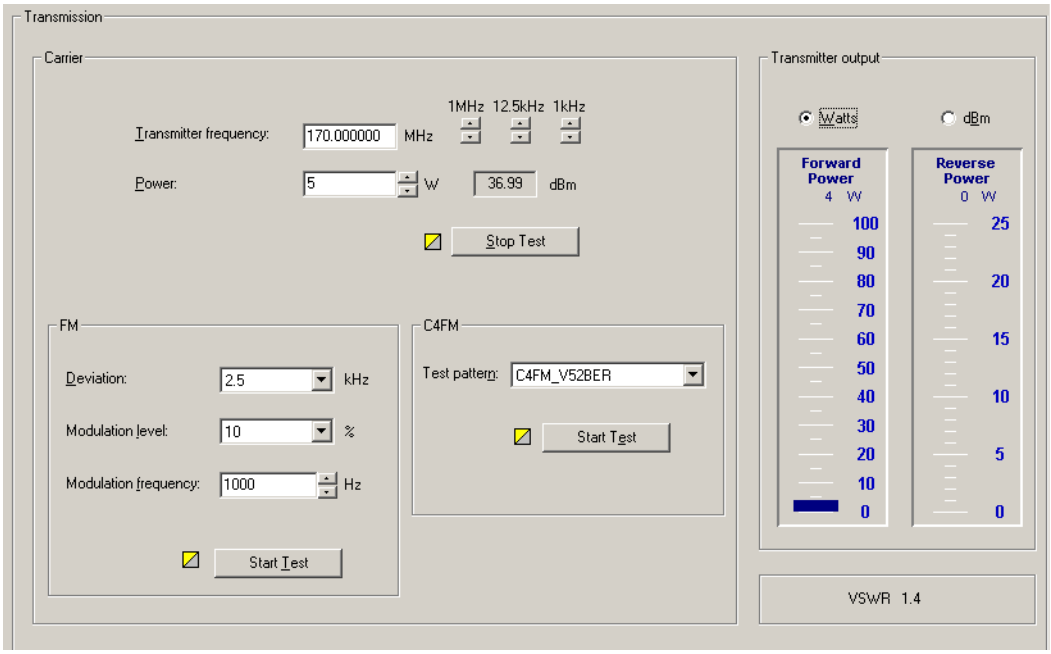
   The exciter or receiver checks all the channel frequencies in the band that the base station is type-approved to operate in.
4. In the **Lower Frequency** and **Upper Frequency** boxes, view the results of the test. These values report the range within which the synthesizer is able to lock onto the specified frequency.

   Note: The reported ranges are conservative. In fact, the base station will be able to transmit and receive outside the range, but with reduced transmit output and receive sensitivity.
5. Click **Stop Test**. The exciter and receiver frequencies revert to what they were when you started the test.

Transmission Tests

The Transmission form (Diagnose > Power Amplifier > Transmission) lets you set up and start a carrier-only test transmission. If desired, you can modulate the carrier by starting a FM test or a C4FM test while this carrier test is running.

Tip: Alternatively, test the transmitter by pressing the Carrier button on the control panel. This transmits using the current configuration.



Carrier

The Carrier area lets you configure and start a test transmission. Initially, it displays values from the current channel configuration.

Transmitter output

The Transmitter output area displays forward and reverse power gauges, and lets you choose whether to view the values as watts or dBm. Underneath is the VSWR.

FM

The FM area lets you configure and start FM modulation, once a Carrier test is running.

Note: If the current channel profile disables the transmitter (see "RF transmit" on page 103), you can still carry out a carrier test and a FM test, but not a C4FM test.

Carrier Test

To test the base station's ability to transmit carrier, follow these steps.

1. Select Diagnose > RF Interface > Transmission Tests.
2. In the **Transmitter frequency** box, enter a frequency or use the arrows to increment or decrement the current frequency.

Important: Do not select a prohibited frequency. For example, 406.0-406.100 MHz is reserved internationally for distress beacons.

3. In the **Power** box, specify the RF output power that the test will run at. The box to the right displays the equivalent power in dBm.

Important: Check the transmit frequency and RF power output before beginning the test. In the TB9100, the transmission test does not default to the currently configured frequency and power. Make sure you do not inadvertently transmit on someone else's frequency.

4. Wait until the base station is not busy, to avoid interrupting a conversation, go to Standby mode, and then click **Start Test**.

   The PA outputs an RF signal on the RF Out N-connector. The **Transmitter output** area gives you a graphical display of the forward and reverse power and the VSWR.

5. If desired, you can modulate the carrier using FM (see "FM Test" on page 163) or C4FM (see "C4FM Test" on page 163).

6. Click **Stop Test** at any time to end the test.

FM Test

To test the base station's ability to transmit carrier modulated with analog FM, you run a Carrier test, then start an FM test to add analog FM modulation to the carrier. Follow these steps.

1. Under **Carrier**, start a Carrier test (see "Carrier Test" on page 162).
2. Under **FM**, configure FM modulation as follows.
   a. In the **Deviation** box, select a maximum transmit deviation.
   b. In the **Modulation level** box, specify what percentage of the maximum deviation the test tone will have.
   c. In the **Modulation frequency** box, specify the frequency of the tone that will modulate the test signal.
3. Under **FM**, click **Start Test**.

C4FM Test

To test the base station's ability to transmit carrier modulated with C4FM, the digital P25 standard's modulation scheme, you run a Carrier test, then start a C4FM test to add C4FM modulation to the carrier. Follow these steps.

1. Under **Carrier**, start a Carrier test (see "Carrier Test" on page 162).
2. Under **C4FM**, click **P25_Conformance1011 Hz** in the **Test pattern** box. This defines a fixed pattern of bits which are transmitted using C4FM and which result in a test tone of 1011 Hz at the receiver vocoder. The receiving radio must be configured for the default NAC (0x293).
3. Under **C4FM**, click **Start Test**.

Conformance Tests

To make test transmissions in order to test the base station's transmitter or another receiver for conformance to the P25 standard, follow the instructions for a C4FM test ("C4FM Test" on page 163), but select a different test pattern. The results you obtain can be compared with the results on the factory test sheet.

The following test patterns are available:

Option	Description
C4FM_V52BER	A standard transmitter test pattern used to check a receiver's BER.
C4FM_ModulationFidelity	Standard Transmitter C4FM Modulation Fidelity Pattern. The transmitter output is sent directly to test equipment to check the accuracy of the base station's radio modem.
P25_ConformanceSilence	Standard Silence Test Pattern. Used for testing a receiver. When this pattern is decoded, there should be no sound from the receiver.
P25_Conformance1011Hz	Standard Tone Test Pattern. Presents a 1011 Hz tone at the receiver vocoder. The default NAC is embedded in the test pattern so the receiver must be configured with this NAC.
P25_StdDeviation	Transmits the dibits 11 and 01 using the C4FM modulation scheme. The test is used to measure the bandwidth used when transmitting the dibits with the greatest frequency offset.
P25_LowDeviation	Transmits the dibits 10 and 00 using the C4FM modulation scheme. The test is used to measure the bandwidth used when transmitting the dibits with the least frequency offset. With this test pattern, a standard frequency counter can be used to measure the frequency of the transmitter's carrier.
SerialInput	Transmits the bit pattern received on the base station's antenna to the serial input.

For more details about these tests, see the Project 25 standards document TIA-102.CAAA-A

Providing Raw C4FM Data

The Miscellaneous form lets you tell the base station to start providing output from the receiver as raw C4FM data.

1. Select Diagnose > RF Interface > Log C4FM.
2. In the Log box, specify whether the data is sent to a syslog collector (at severity level Trace) or to the serial port. The serial port baud rate is set to 19,200 for the duration of the logging, overriding the configured setting.
3. Click **Start log**.

Line Interfaces

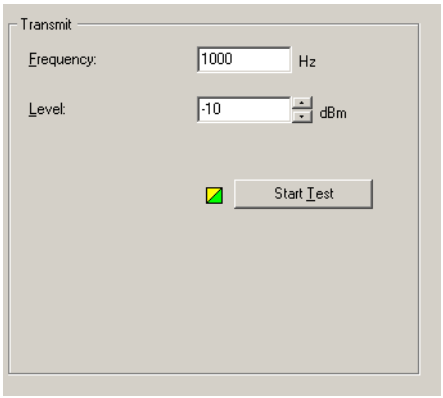
The CSS lets you carry out a range of tests on the analog and digital lines, the digital inputs and output, the E & M lines, and the serial port.

Analog Line Tests

The CSS lets you carry out transmit and loopback tests on the analog line. You can also monitor line levels.

Sending a Test Tone

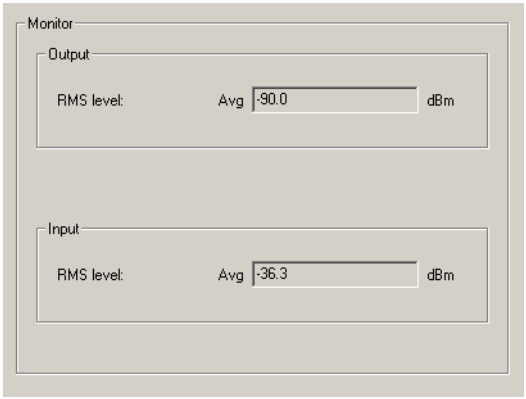
The reciter can output an audio test tone. You can use this to test the reciter's ability to output audio on its analog line or to set up and configure the interface from external equipment to the base station.



1. Select Diagnose > Line Interfaces > Analog Line.
2. Under **Transmit**, enter the desired test tone frequency into the **Frequency** box.
3. In the **Level** box, enter a level in dBm.
4. Click **Start Test**.
5. View the **Monitor** area to verify that the base station is sending the test tone.
6. Adjust the external equipment as required.
7. Click **Stop Test** to end the test.

Monitoring Line Levels

The reciter can measure the mean levels of the current analog line input and output and display them on the CSS.



You can use this diagnostic tool in the following situations:

- Troubleshooting: the measurement shows you whether audio is arriving at the base station.
- Adjusting the audio output of other equipment such as a console.

Note: If you don't want audio input during the test to be transmitted, put the base station into Standby mode.

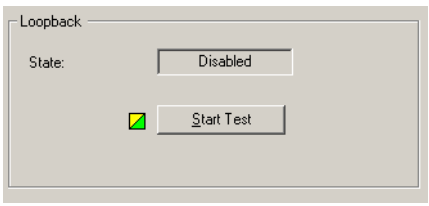
To monitor audio levels

1. Make sure that the analog line is connected.
2. Select Diagnose > Line Interfaces > Analog Line.

   The bars display the average levels for audio that the base station sends and receives on the analog line. Levels are measured over a window of 500 ms and updated twice a second. The base station cannot actually measure values at the analog line interface: it measures them in the digital domain and compensates for calibration and line level adjustment effects.

Looping Back Audio

You can loop audio back on the analog line (this simply connects the audio in line to the audio out line). When the audio is looped back, you can, from the dispatch console end of the audio line, check on line levels or check that the line works in both directions.



To loop back the analog line

1. Make sure that the analog line is connected.
2. Select Diagnose > Line Interfaces > Analog Line.

3. On the toolbar, click **Standby**.
4. In the Loopback area, click **Start test**. The **State** box now displays Enabled.
5. When you have finished testing the analog line, click **Stop test**. The **State** box now displays Disabled.

Testing Connections

The CSS supports the use of the ping command to test whether there is an IP connection to any entity with an IP address. In this way, you can test the IP/Ethernet links to routers and other base stations in the TaitNet P25 network. You can also use multicast IP addresses to check the membership of a channel group.

To carry out a ping test

1. Select Diagnose > Line Interfaces > Connections.
2. In the **Destination IP address** box, enter the IP address of the destination host. Use dotted decimal notation, for example 172.25.206.26.
3. Click **Ping**.

   The CSS instructs the base station to send a ping command to the IP address you entered. Responses are displayed in the large **Response** box and the number of responses in the small **Responses** box below.

System Interface Tests

The System Interface form (Diagnose > Line Interfaces > System Interface) lets you work with digital inputs and outputs. You can view the current state of all digital inputs and toggle the digital output to help you test any equipment connected to it. This can be done on site or on the bench when the base station is connected to a CTU.

The **Digital inputs** area displays the current settings of digital inputs.

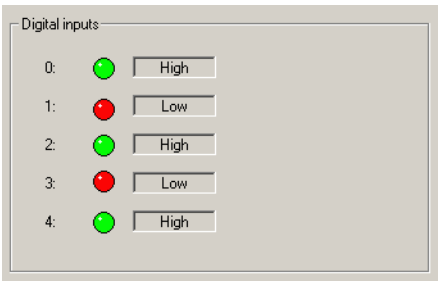
The **Digital outputs** area lets you toggle the single digital output.

The area below displays the current state of the E line and M line and lets you toggle the M line output.

The **Computed input value** area displays the binary number that is currently set by the digital input lines. This value is used as a Task Manager input.

Testing Digital Inputs

The Digital inputs area displays the current state of all digital inputs to the reciter.



A digital input can be high (green LED) or low (red LED).

To test a digital input

1. Select Diagnose > Line Interfaces > System Interface.
2. Using the equipment connected to the digital input, toggle the state of that input.

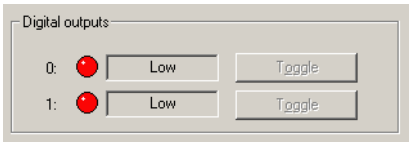
Digital Input	Pin number
0	4
1	6
2	7
3	8
4	1

Note: If digital input 4 is not available (through configuring pin 1 as an output), ignore its display.

3. In the **Digital inputs** area, check that the state of that input changed.

Testing Digital Outputs

If the system interface is configured to provide a digital output, you can toggle that output between high and low. Pin 9 can provide digital output 0 and pin 1 can provide digital output 1. Use this test to make sure that the output is working and to check that any equipment attached to that output responds as intended.



To test a digital output

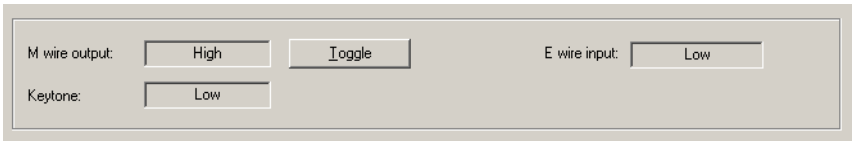
1. Select Diagnose > Line Interfaces > System Interface.
2. Click **Start Test**. This enables the Toggle buttons in the **Digital outputs** area. This area now displays the output states as they were when you started the test.
3. Click the digital output's **Toggle** button to change its state.

   When the output is high, its LED is green. When it is low, the LED is red.
4. Check the response of any attached equipment.

When you have finished testing the outputs, click **Stop Test**. This returns all digital outputs to the state they were in when you started the test.

Testing the E & M Lines

The base station can be configured to use the E & M lines on the RJ45 connector to carry channel seize and analog valid signals (Configure > Base Station > System Interface).

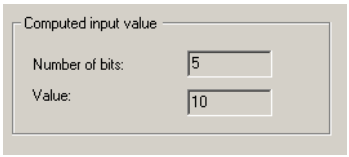


To test the E & M lines

1. Select Diagnose > Line Interfaces > System Interface.
2. Click **Start Test**.
3. Using the equipment (for example the Tait CTU) connected to the E line, toggle the state of that input.
4. In the **E wire input** box, check that the state of the E line changed.
5. Click the **Toggle** button alongside the M wire output box.
6. Check the equipment to verify that the state of the M line changed.

Viewing the Computed Input Value

The Computed input value area (Diagnose > Line Interfaces > System Interface) indicates the number of bits that the base station is using to compute its input value as well as the computed value itself. The former is a configurable item (Configure > Base Station > System Interface) and the latter can be used as a Task Manager input to trigger desired actions such as changing channel.

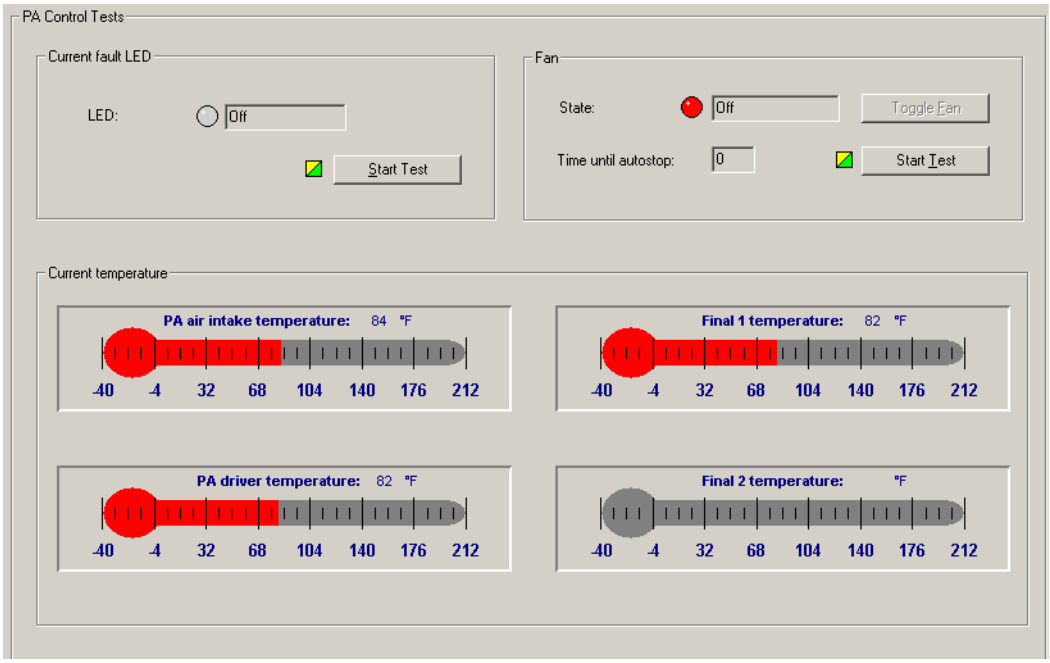


Modules

The CSS lets you carry out various tests on base station modules. You can toggle fans, simulate a mains failure, and test the controls on the control panel.

PA Control Tests

The PA Control Tests form (Diagnose > Modules > PA Control Tests) lets you test the PA fan and front panel fault LED.



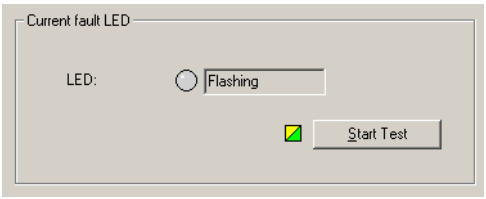
The PA Control Tests form provides you with information about the PA before you carry out any tests.

LED	Indicates whether the PA has any current faults.
State	Indicates whether the fan is currently active.
Current temperature	The Current temperature area displays four thermometers that monitor the four PA temperature sensors.

Testing the PA Fault LED

You can test that the LED on the front of the PA is able to light up. (This LED is only visible when the front panel is removed.)

1. Select Diagnose > Modules > PA Control Tests.



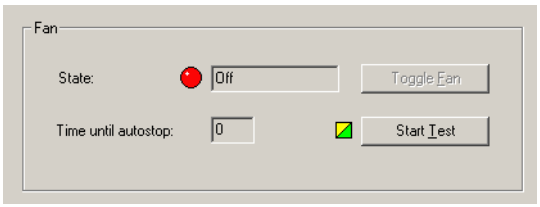
2. Click **Start Test**. This uncouples the fault LED from the PA's operational logic and flashes the LED on and off continuously.
3. Verify that the PA fault LED is in fact flashing.
4. Click **Stop Test** to end the test.

Testing the Fan

You can ask the base station to turn the PA fan on and off. This tests the fan and its control circuitry.

Test the fan after fixing a fan problem or fitting a new fan. When you fit a fan, use this test to verify that the fan is correctly connected, so that the PA (and not the PMU) activates it.

Note: The base station can detect the motion of 3-wire fans and will raise an alarm if the fan does not operate.

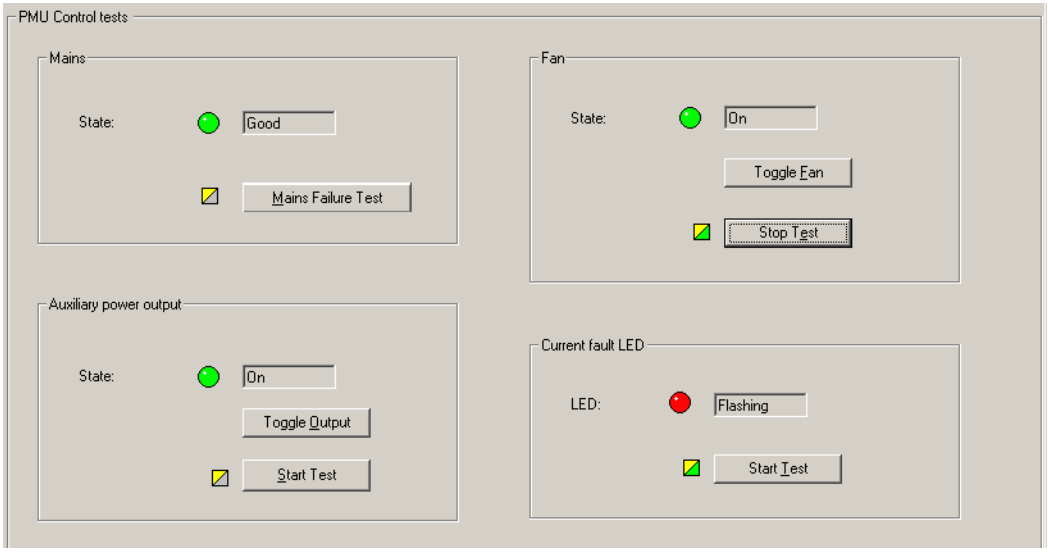


To test the fan

1. Select Diagnose > Modules > PA Control Tests.
2. Click **Start Test**. This uncouples the fan from the base station's control but leaves it in its current state.
3. Click **Toggle Fan**. If the fan was off, this should turn it on.
4. Check that the fan is operating. A 5-second timer counts down. When it expires, the test ends and control of the fan reverts to the base station.

PMU Control Tests

The PMU Control Tests form lets you simulate a mains failure. You can also check that the fan, the fault LED, and the auxiliary output are working.



Simulating Mains Failure

The Control Tests form lets you simulate a mains failure so that you can test the base station's battery backup and the PMU's DC-DC converter. The test can only be run if there is a DC power supply.

To simulate mains failure

1. On the toolbar, select Standby.
2. Select Diagnose > Modules > PMU Control Tests.
3. Click **Mains Failure Test**.

   The State LED should go off, indicating that mains power is no longer available to the base station.
4. Verify that the base station is still operating.
5. To end the test, click **End Test**.

Testing the Fan

You can ask the base station to turn the PMU fan on and off; this tests the fan and its control circuitry.

Test the fan after fixing a fan problem or fitting a new fan. When you fit a fan, use this test to verify that the fan is correctly connected, so that the PA and not the PMU activates it.

Note: The base station can detect the motion of 3-wire fans and will raise an alarm if the fan does not operate.

To test the fan

1. Select Diagnose > Modules > PMU Control Tests.
2. Click **Start Test.**
3. Click **Toggle Fan**.
4. The State LED should change from On to Off, or from Off to On.

   After ten seconds, the test automatically ends and the base station takes back control of the fan.

Testing the Auxiliary Power Output

If the PMU is fitted with an auxiliary power supply submodule, you can test the PMU's ability to switch its auxiliary output on and off.

Note: The auxiliary power output must be on. If it is configured to be on only when the PMU uses mains power, make sure that the PMU is not using battery power.

To test the auxiliary power output

1. Select Diagnose > Modules > PMU Control Tests.
2. Go into Standby mode.
3. Under **Auxiliary power output**, click **Start Test**.
4. Click **Toggle output**.

   The state of the LED should change.
5. Click **Stop Test**.

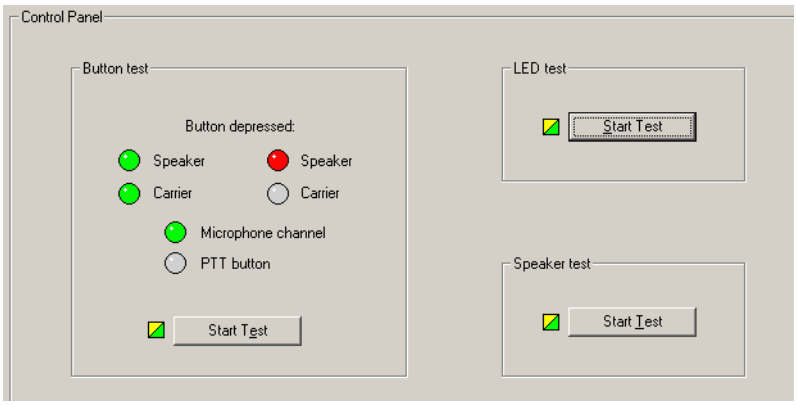
Testing the PMU fault LED

You can test that the fault LED on the front of the PMU is able to light up. (This LED is only visible when the front panel is removed.)

1. Select Diagnose > Modules > PMU Control Test.
2. Click **Start Test** to the left of the PMU fault LED. This uncouples the LED from the PMU's operational logic.
3. Check that the PMU LED flashes on and off. (The control panel LED should also light up, unless all PMU alarms are disabled.)
4. Click **Stop Test** to restore the LED's connection with the PMU.

Control Panel Tests

The Control Panel form (Diagnose > Modules > Control Panel) lets you carry out tests to verify that the controls on the front of the base station are working. You need to be at the base station site to carry out these tests.



To test control panel buttons

1. Under **Button test**, click **Start Test**. This disables all control panel functions. The base station will now pass control panel inputs to the CSS.
2. Press a button on the control panel.

Note: The right-hand Speaker and Carrier buttons are currently not used.

3. Check that the corresponding LED in the CSS form turns green.
4. Repeat steps 2 and 3 for each other button you want to test.
5. Click **Stop Test** to conclude the test.

To test the microphone's PTT button

1. Under **Button test**, click **Start Test**. This disables all control panel functions. The base station will now pass any control panel inputs to the CSS.
2. Press the PTT button on the microphone.
3. Check that the PTT button LED in the CSS form turns green.
4. Click **Stop Test** to conclude the test.

To test the control panel LEDs

1. Under **LED test**, click **Start Test**.
2. Check that each of the control panel LEDs is going on and off in a recognizable sequence.

Note: The Power LED is not affected by this test.

3. Click **Stop Test** to conclude the test.

To test the speaker

1. Under **Speaker test**, click **Start Test**.
2. Turn up the volume and listen to confirm that a 700 Hz test tone at 0 dBm is coming from the speaker.
3. Click **Stop Test** to conclude the test.

Part H Task Manager

The CSS is your window into Task Manager. You can view the list of tasks, create new tasks from the available list of inputs and actions, and create custom inputs and actions.

You can also monitor recent Task Manager actions and disable any tasks that may be causing problems.

Topics

Introduction to Task Manager

Task Manager operates like this. When the base station is in Run mode, Task Manager processes its task list every 10 ms. If a task's input has become true, its action is calculated. Once Task Manager has completed processing its task list, it makes the results available to other firmware processes. When the next 10 ms interval is reached, Task Manager begins again with the next processing cycle.

To change the way Task Manager works, you add new tasks or modify existing tasks, and then you program the changes into the base station. In effect, you are creating scripts that make the base station perform simple actions. This customizes the way the base station operates without modifying its firmware. Task Manager can perform many functions that previously required expensive external equipment.

Task Manager Rules

If you are going to be writing your own sets of tasks, be aware of the following rules that define the way Task Manager processes tasks.

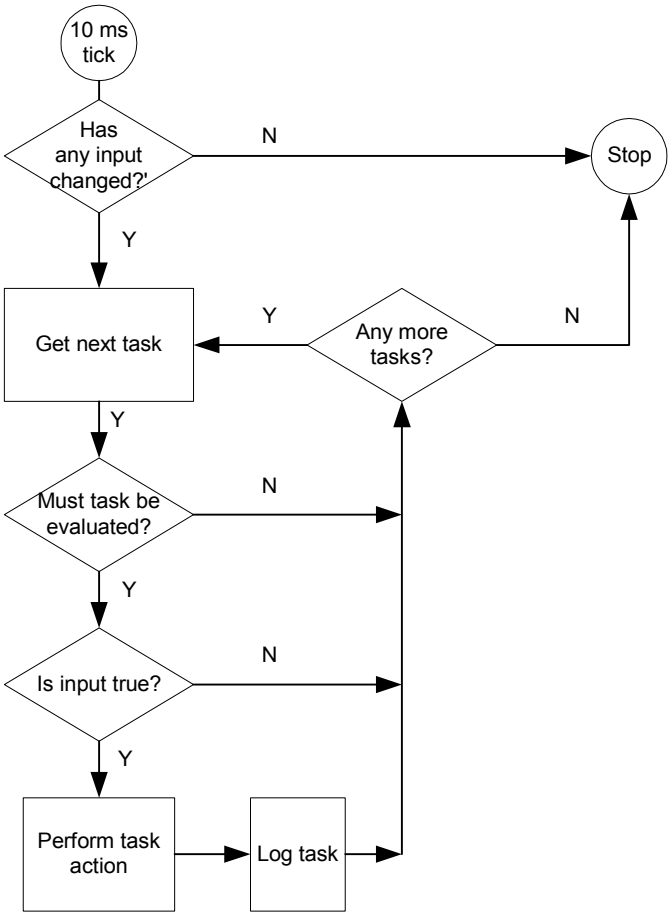
- A task is only carried out if its input changes. For example, when the base station is in Run mode, the task IF base station in Run mode THEN Increment counter 1 is not carried out. Counter 1 only changes when the base station goes into Run mode, because it is only then that the input changes from false to true.
- Tasks often need to be created in pairs. For example, if you want to set the digital output high in response to an input, you also need to set it low when that input becomes false. Otherwise the output goes high and always stays high.

  IF **Analog received** THEN **Set digital output high**
  IF NOT **Analog received** THEN **Set digital output low**
- Tasks are evaluated in the order of the task list.
- External inputs (for example, alarms) never change in the middle of processing the task list. Changes to these inputs are queued until Task Manager finishes processing the task list. For example, if an alarm is triggered while Task Manager is in the middle of the task list, the equivalent alarm input does not change until the beginning of the next processing cycle.
- Internal inputs (for example, locks) can change in the middle of processing the task list. For example, if a task unlocks automatic CWID, a task later in the list with the input 'IF automatic CWID unlocked' will be processed in the same processing cycle.
- Tasks that are in the General folder are always processed if their input becomes true. Tasks that are in a channel profile or signaling profile folder are only processed if the current channel uses that profile.

Processing Cycle

To help reduce the amount of processing that Task Manager must do, the base station does some additional processing when an input is changed. All Task Manager tasks with that input are flagged "must be evaluated" and a flag "an input has changed" is set. This processing is done as soon as the input changes.

At the 10 ms tick, Task Manager begins its processing cycle. First it checks the flag "an input has changed." If no input has changed, it stops and waits for the next 10 ms tick. If at least one input has changed, it goes through the task list. First it checks whether a task has been flagged "must be evaluated." If it has, Task Manager processes that task, determining the action to be taken. This is made available to other software processes as soon as the whole task list has been processed.



Input Types

Task Manager inputs are of two main types, 'basic' and 'lock.' Tasks are processed differently, depending on the kind of input they have. You need to understand these differences if you are creating complex sets of tasks.

Basic inputs

Basic inputs come from various parts of the base station. They include all alarms. While basic inputs can become true at any time, Task Manager will only process them in the course of the regular 10 ms processing cycle. For example, if an input becomes true in the middle of a processing cycle, Task Manager won't process tasks with that input until the next processing cycle. This is because it only learns of the change after the completion of the first cycle.

Lock inputs

Lock inputs such as 'Receiver unlocked' can only become true through a Task Manager lock action. They are internal to Task Manager. Most become true automatically each time the base station enters Run mode.

Action Types

Task Manager actions are of two main types, 'lock' and 'do now'. These actions have different effects.

Lock actions

Lock actions lock, unlock or toggle a base station function. By default, functions are unlocked (except for the Auxiliary Supply). When Task Manager locks a function, that function cannot operate. The lock status of these functions is displayed in Monitor > Task Manager > Locks.

Task Manager tasks can have lock actions as an input. When Task Manager unlocks a function (for example automatic CWID), the equivalent input (in this case **Automatic CWID unlocked**) becomes true and any tasks with that input will be processed.

'Do now' actions

'Do now' actions issue a command to the base station to do something immediately, for example to change channel or send the alarm log. This is a one-off action which has no continuing effect on the base station's status. A 'do now' action cannot be re-triggered until the original action is completed. For example, Task Manager cannot carry out the action **Transmit CWID now** when the base station is still transmitting the CWID from a previous **Transmit CWID now** action.

Custom Inputs and Actions

A task can only have one input and one output. However, you can combine existing inputs or actions to form your own custom inputs or actions.

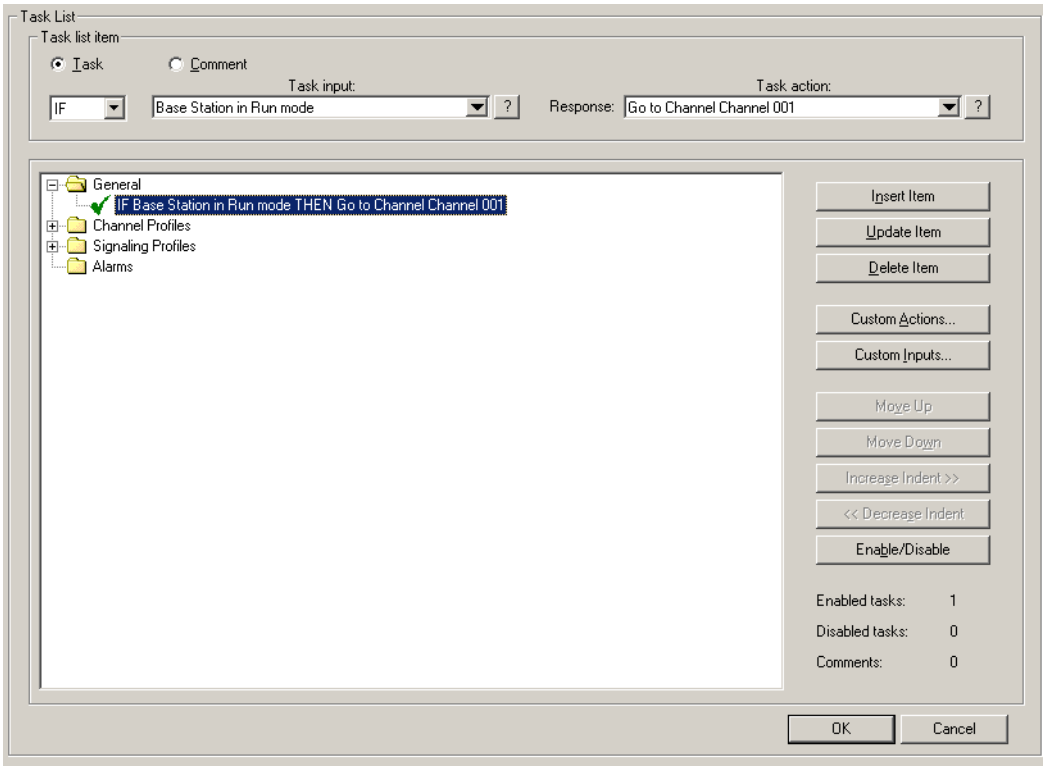
A custom input combines up to eight different inputs. It becomes true when the combination becomes true, according to the rules of the Boolean logic that you specify for the combination.

Similarly, a custom action can combine up to eight actions. When a task with a custom action is processed, all its constituent actions are carried out.

You can also use counters, timers, and your own flags when defining tasks.

Working With the Task List

The Task List form (Configure > Task Manager > Task List) lets you work with the task list that the Task Manager processes. You can view the task list, add new tasks, modify existing ones, and rearrange the order and structure of tasks. Generally, a set of tasks is headed by a comment indicating their nature and purpose. Comments have no effect on Task Manager processing.



The **Task list item** area lets you edit a selected item, which can be a task or a comment. When a task is selected, you can click one of the special Help icons to display information about the task's input or action. The area also indicates the total number of enabled tasks.

The task list displays tasks in folders. Double-click a folder (or click its +/- icon) to open or close it. An open folder displays the tasks and comments that belong to it. Tasks generally have a tick; this means that they are enabled; tasks with a cross have been disabled. Click an item to select it; it appears inside the Task List Item area.

The folders group related tasks. Tasks in a folder for a particular profile (for example, the default channel profile, or Signaling profile 1) are only processed if the current channel uses that profile.

The buttons to the right lets you maintain the tasks in the list. For example, you can add an item or modify the selected item.

Maintaining the Task List

In Task Manager forms, the buttons to the right of the task list help you maintain the task list. To use some buttons, you must first select a task list item by clicking it.

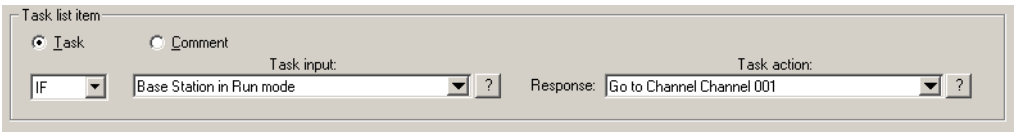
<<Update Item	Saves changes you made to the selected item and updates the display in the Task List.
<<Insert Item	Inserts the task displayed in the Task list item area just below the selected item in the task list. See also "Adding a Task" on page 182.
Delete Item	The Delete button deletes the current task list item.
Custom Actions	Opens the Custom Actions form, where you can define your own combination of existing actions.
Custom Inputs	Opens the Custom Inputs form, where you can define your own combination of existing inputs.
Move Up / Move Down	Shift the selected item up or down one line. Use these buttons to rearrange the order of tasks and comments in the task list.
Increase Indent / Decrease Indent	Let you add or remove an indent from a selected task. Indents have no effect on Task Manager processing; they help to make tasks easier to read and understand. You can only indent tasks that are under a comment.
Enable / Disable	By default, tasks are enabled; when an input condition becomes true, Task Manager processes the task. The Enable / Disable button lets you disable a task so that it has no effect, or toggle it between enabled and disabled.
Enabled	Displays the total number of enabled Task Manager statements. You can have up to 200 enabled tasks.
Disabled	Displays the total number of disabled Task Manager statements. The total number of statements (enabled and disabled) must not exceed 400.
Comments	Displays the total number of Task Manager comments. You can have up to 100 comments.

Adding a Task

To make full use of the base station's capabilities, you need to add your own tasks to the list that Task Manager processes. This enables Task Manager to respond to events in a way that is tailored to your system. However, the set of actions must be well thought out to operate in exactly the way you want.

Important: It is possible to create tasks that undermine the base station's ability to operate properly. Make sure that the choices you make are appropriate. Be particularly careful with powerful actions such as **Lock transmitter**.

Important: While Tait has carefully tested each input and each action, it is not possible to test the enormous number of possible combinations of inputs and actions. Thoroughly test any tasks you add before commissioning the base station. If you are uncertain about anything, refer to your supplier.



You can add a task anywhere in the task list. The order of tasks in the task list represents the order that they are processed in.

Note: Tasks in a channel profile or a signaling profile folder will only be processed if the current channel has that profile assigned to it.

To define a task

1. Select Configure > Base Station > Task Manager.
2. In the task list, click a task or comment below which you want to add the task. Alternatively, click a folder.
3. Select **Task** in the Task list item area.
4. In the drop-down text box, select IF.

   Alternatively, if you want the task to be processed when the input condition goes from true to false, select IF NOT. For example, tasks with the input 'IF NOT **Rx Gate valid**' will be processed when the base station stops receiving a RF signal that fulfils all the gating requirements.
5. Position the mouse cursor over the next drop-down box and click to open the list of available inputs.
6. Select an input from the list. It appears in the box.
7. In the same way, select an action from the drop-down list of the last drop-down text box.
8. Click **<<Insert Item**. The task appears in the task list.
9. If necessary, use the buttons on the right to move the task up or down, or to indent it.

Adding a Comment

When you define a set of tasks, you need to provide a comment that names them and indicates what they are for and how they work. You may also want to add further comments on individual tasks.

To add a comment

1. Select Configure > Base Station > Task Manager.
2. In the task list, click the task above which you want to add the comment. Alternatively, click a folder.
3. In the Task list item area, select the **Comment** option.
4. Inter the text of the comment into the box below.
5. Click **<<Insert Item**. The comment appears in the task list.
6. If necessary, use the buttons on the right to move the comment up or down, or to indent tasks under it.
7. Click **OK** to confirm your changes and close the form.

Disabling a Task

You can disable any task in the task list. This is an easy way to stop Task Manager doing something you don't want it to do. (When the base station is in Standby mode, Task Manager is disabled and no tasks are executed.)

To disable a task

1. In any Task Manager form, click a task.
2. Click **Enable/Disable**. The tick at the beginning of the task turns into a cross.

Tip: Disable a comment to disable all tasks indented under that comment.

Inputs

An input is anything that Task Manager monitors. When the state of that input changes from false to true, Task Manager executes tasks with that input. IF NOT tasks are executed when the state of the input changes from true to false.

To select an input

1. In the **Task list item** area, click in the **Task input** box. A menu with several submenus appears.
2. Click on an item in the menu or submenu.

To obtain Help on the input of a task

1. In the task list, click the task. The task appears in the **Task list item** area.
2. Click the Help button beside the **Task input** box.

Alarm Inputs

You can select any alarm as a Task Manager input. This makes it possible to individually configure the base station's response to any alarm. For information about base station alarms, see "Monitoring Alarms" on page 141. All alarms are basic inputs. Even if an alarm is disabled in the Alarm Control form, tasks with that alarm as an input will be processed.

Base station alarm on

This input becomes true when any base station alarm is triggered.

Battery protection mode on

This input becomes true when the PMU is operating in battery protection mode, triggering the 'Battery protection mode' alarm. For information about this alarm, see "Battery protection mode" on page 145.

Battery voltage high

This input becomes true when the 'Battery voltage high' alarm is triggered. For information about this alarm, see "Battery voltage high" on page 145.

Battery voltage low

This input becomes true when the 'Battery voltage low' alarm is triggered. For information about this alarm, see "Battery voltage low" on page 145.

Channel invalid

This input becomes true when the 'Channel invalid' alarm is triggered. For information about this alarm, see "Channel invalid" on page 146.

External reference absent

This input becomes true when the 'External reference absent' alarm is triggered. For information about this alarm, see "External reference absent" on page 148.

External reference invalid

This input becomes true when the 'External reference invalid' alarm is triggered. For information about this alarm, see "External reference invalid" on page 148.

Fan failed

This input becomes true when the PA or PMU 'Fan failed' alarm is triggered. For information about these alarms, see "Fan failed" on page 142 for the PA or "Fan failed" on page 144 for the PMU.

Invalid channel selected

This input becomes true when Task Manager has selected a channel that is invalid.

Network board alarm on

This input becomes true when any network board alarm is triggered.

Network board BER high

This input becomes true when the BER high alarm is triggered. For information about this alarm, see "BER high" on page 148.

Network board invalid calibration

This input becomes true when the Calibration invalid alarm is triggered. For more information, see "Digital board calibration invalid" on page 146.

Network board invalid configuration

This input becomes true when the Configuration invalid alarm is triggered. For more information, see "Digital board configuration invalid" on page 146.

Network board network usage traffic fault

This input becomes true when the Network user traffic alarm is triggered. For more information, see "Network user traffic" on page 148.

Network board QoS Jitter

This input becomes true when the QoS jitter alarm is triggered. For more information, see "QoS jitter" on page 148.

Network board QoS lost packets

This input becomes true when the Lost packets alarm is triggered. For more information, see "QoS lost packets" on page 148.

No PA detected

This input becomes true when the 'No PA detected' alarm is triggered. This occurs when the module fails or control bus communications are disrupted. For information about this alarm, see "No PA detected" on page 142.

No PMU detected

This input becomes true when the 'No PMU detected' alarm is triggered. This occurs when the module fails or control bus communications are disrupted. For information about this alarm, see "No PMU detected" on page 144.

PA air intake temperature high

This input becomes true when the 'Air intake temperature high' alarm is triggered. For information about this alarm, see "Air intake temperature high" on page 148.

PA air intake temperature low

This input becomes true when the 'Air intake temperature low' alarm is triggered. For information about this alarm, see "Air intake temperature low" on page 147.

PA alarm on

This input becomes true when any PA alarm is triggered.

PA current fault

This input becomes true when any of the PA's current alarms are triggered. This happens if any part of the PA is drawing excessive current, or if one final stage uses significantly more current than the other. For information about these alarms, see "Current" on page 143.

PA forward power low

This input becomes true when the 'Forward power low' alarm is triggered. For information about this alarm, see "Forward power low" on page 142.

PA is shut down

This input becomes true when the PA's 'Shutdown' alarm is triggered. For information about this alarm, see "Shutdown" on page 143.

PA power foldback

This input becomes true when the PA's 'Power foldback' alarm is triggered. For information about this alarm, see "Power foldback" on page 143.

PA supply voltage fault

This input becomes true when one of the PA's power supply voltage alarms is triggered. This happens if the voltage is too high or too low. For more information, see "Supply voltage" on page 143.

PA temperature high

This input becomes true when the one or more of the PA's 'Temperature high' alarms is triggered. For information about this alarm, see "Temperature high" on page 144.

PMU alarm on

This input becomes true when any PMU alarm is triggered.

PMU mains supply failed

This input becomes true when the PMU's 'Mains supply failed' alarm is triggered. For information about this alarm, see "Mains supply failed" on page 144.

PMU output failed

This input becomes true when one of the PMU's output alarms is triggered, because the voltage is high or low or the current is high. For information about these alarms, see "Output" on page 145.

PMU power up fault

This input becomes true when the PMU's 'Power up fault' alarm is triggered. For information about this alarm, see "Power up fault" on page 144.

PMU shutdown imminent

This input becomes true when the PMU's 'Shutdown imminent' alarm is triggered. For information about this alarm, see "Shutdown imminent" on page 144.

PMU temperature high

This input becomes true when the PMU's 'Temperature high' alarm is triggered. For information about this alarm, see "Temperature high" on page 145.

Reciter alarm on

This input becomes true when any reciter alarm is triggered.

Reverse power high

This input becomes true when the 'Reverse power high' alarm is triggered. For information about this alarm, see "Reverse power high" on page 143.

Note: Use the VSWR fault input instead of the Reverse power high input if the transmit power is set to less than 20 W or if the base station has a 5 W PA. The resolution of the reverse power measurement is 1 W; only a very serious antenna fault would trigger the reverse power high alarm if the power setting is low.

Synthesizer failed

This input becomes true when a synthesizer goes out of lock or the external frequency reference is invalid and the corresponding alarm is triggered. For information about these alarms, see "Synthesizer out of lock" on page 146 and "External reference invalid" on page 148.

VSWR fault

This input becomes true when the 'VSWR high' alarm is triggered. For information about this alarm, see "VSWR high" on page 143.

Analog Line Interface

Analog line inputs are concerned with the state of the analog line interface.

Channel seized

The Channel seized input becomes true when the analog interface receives a channel seize signal. This signal must be received by the means that the base station is configured to recognize (digital input, E & M, or tone remote).

Tone remote detected

The Tone remote detected (nnn) input becomes true when the base station detects function tone number nnn on its analog line. To select this input, you must specify a frequency (Tone 1) for a single tone or a frequency pair (Tone 1 and Tone 2), depending on whether the analog line is configured for single tone or dual tone.

Base station in Run mode

The **Base station in Run mode** input becomes true when the base station goes into Run mode. This occurs on startup and when you tell a base station in Standby mode to change to Run mode.

Use this input for tasks you want included in Task Manager's initialization routine, to start timers, and to lock base station functions that you only want to operate under particular circumstances.

Important: The inverse of this input (IF NOT **Base station in Run mode**) must not be used; when the base station is not in Run mode, Task Manager is not operating.

Example

IF **Base station in Run mode** THEN **Lock transmitter**
IF **Base station in Run mode** THEN **Lock receiver**

This example could be used to configure a backup base station with everything locked but ready to go into operation when needed.

Channel

The **Channel nnn** input becomes true when the base station changes channel to the channel in the channel table with the name *nnn*.

Channel changed

The **Channel changed** input becomes true when the base station changes from one channel to another.

Digital I/O

Digital I/O inputs are concerned with the state of the digital inputs and outputs.

Digital input (n) high

The **Digital input (n) high** input becomes true when digital input n goes high.

Pin 1 can be configured as digital input 4, as an antenna relay driver, or as digital output 1. The Task Manager input 'Digital input 4 high' reflects the state of pin 1, no matter how it is configured. It can therefore be used to modify base station operation depending on the state of the antenna relay driver.

Example

As the base station digital inputs float high, you probably want to create statements that trigger when the input is pulled low.

IF NOT **Digital input (2) high** THEN **Go to channel 2**.

Digital input value

The **Digital input value nn** input becomes true when the setting of one or more digital inputs is changed so that the binary equivalent of those settings equals nn. Low is read as '1' and high as '0'.

Example

IF **Digital input value 3** THEN **Go to channel 3**

Digital output high

The **Digital output high (output n)** input becomes true when the base station sets digital output n high. This can only happen through the Task Manager actions Set digital output high and Toggle digital output.

Locks

Lock inputs only change through Task Manager lock actions. All lock inputs become true when the base station enters Run mode. A lock input also becomes true when its function is unlocked after having been locked.

The auxiliary power supply is an exception to the above.

Analog line unlocked

The analog line is unlocked when the base station enters Run mode and when Task Manager unlocks the analog line after having previously locked it.

Automatic CWID unlocked

The automatic sending of a CWID is unlocked when the base station enters Run mode or when Task Manager unlocks the channel group after having previously locked it.

Auxiliary supply unlocked

On entering Run mode, the auxiliary supply is locked. The auxiliary supply is unlocked when Task Manager unlocks it. If the Auxiliary power control box (Configure > Base Station > Miscellaneous) is set to Task Manager, the auxiliary power output is also on.

Channel group unlocked

The channel group is unlocked when the base station enters Run mode or when Task Manager unlocks the channel group after having previously locked it.

Receiver unlocked

The receiver is unlocked when the base station enters Run mode or when Task Manager unlocks the receiver after having previously locked it.

Subaudible encoding unlocked

The encoding of subaudible signaling is unlocked when the base station enters Run mode or when Task Manager unlocks this function after having previously locked it.

Subaudible/NAC decoding unlocked

The decoding of subaudible signaling and the NAC is unlocked when the base station enters Run mode or when Task Manager unlocks this function after having previously locked it.

Transmitter unlocked

The transmitter is unlocked when the base station enters Run mode or when Task Manager unlocks the transmitter after having previously locked it.

Network

Network inputs are concerned with base station functioning that affects the wider network.

Function code received

The **Function code received (nn)** input becomes true when the base station receives the function code nn from another base station in its channel group over the digital line. This input makes it possible for the base stations in a channel group that are not connected to an analog console system to act on dispatcher commands. See "Propagating Tone Remote Commands to the Channel Group" on page 123.

Example

IF **Function code received (02)** THEN **Go to Channel 2**.

Function code sent

The **Function code sent (nnn)** input becomes true when Task Manager instructs the base station to send function code nnn on the digital line. It does not become true when the base station automatically informs the channel group that it has received a function tone.

Vote won by Analog line

The **Vote won by Analog line** input becomes true when the base station's voter declares the signal on the analog line to be the best and the channel group repeats that signal.

Vote won by Digital line

The **Vote won by Digital line** input becomes true when the base station's voter declares the signal received on the digital line to be the best and the channel group repeats that signal.

Vote won by Control panel

The **Vote won by Control panel** input becomes true when the base station's voter declares the signal received from the control panel microphone to be the best and the channel group repeats that signal.

Vote won by RF

The **Vote won by RF** input becomes true when the base station's voter declares the signal received from the base station's own receiver to be the best and the channel group repeats that signal.

RF interface

RF interface inputs are concerned with the state of things at the base station's RF interface.

Analog received

The **Analog received** input becomes true when the base station starts receiving an analog FM signal on its RF interface.

Analog transmitted

The **Analog transmitted** input becomes true when the base station starts transmitting an analog FM signal on its RF interface.

APCO received

The **APCO received** input becomes true when the base station recognizes, through detecting frame synchronization, that it is receiving a digital P25 digital signal on its RF interface.

APCO transmitted

The **APCO transmitted** input becomes true when the base station begins transmitting a digital P25 signal on its RF interface.

PA carrier present

Whenever the reciter tells the PA to start transmitting, the **PA carrier present** input becomes true.

Received NAC

The **Received NAC nnn** input becomes true when the base station begins receiving a digital transmission with a NAC of nnn. While the base station can only detect the subaudible signaling that it is configured for, it can detect any NAC. This means that you can set up any action to be triggered by receiving a particular NAC.

Rx Gate valid

The **Rx Gate valid** input becomes true when the criteria for unmuting the receiver are met. **Rx Gate valid** becomes true even if the receiver signal does not win the vote. **Rx Gate valid** becomes true for analog FM and for digital P25 signals.

Subaudible tone detected

The **Subaudible tone detected** input becomes true when the base station detects the subaudible tone that is configured for the current channel. The base station is only able to detect the one subaudible tone that it is configured for.

Task Manager

Inputs under the Task Manager heading are concerned with special aspects of Task Manager: Custom inputs, flags, timers, and counters.

Counter at maximum

The **Counter at maximum (Countername)** input becomes true when the particular named counter reaches the maximum value set for it in Configure > Task Manager > Counters.

The counter value changes through Task Manager actions such as **Increment counter**. Counter values are read at the beginning of a processing cycle. If the counter value changes during the processing cycle, it is immediately available; any subsequent tasks will use the new input. When the base station enters Run mode, all counters are reset to 0.

Example

IF **Counter at maximum (LightTrigger)** THEN **Set digital output low**.

Custom Inputs

The Custom Inputs submenu contains all the custom inputs that have been defined for the base station using Configure > Task Manager > Custom Inputs.

Flag set (flagname)

The **Flag set** (***flagname***) input becomes true when Task Manager sets the corresponding flag. *Flagname* represents any name that you assigned to the flag in Configure > Task Manager > Flags. The state of flags is read at the beginning of a processing cycle. If a flag state changes during the processing cycle, it is immediately available; any subsequent tasks will use the new input. When the base station enters Run mode, each flag is cleared, unless a Task Manager task explicitly sets it.

Timer expired

A timer can only be started by the Task Manager action **Start timer**. It expires when the timer's maximum time has elapsed. This time was entered in Configure > Task Manager > Timers.

Example

IF Timer expired **(CWID timer)** THEN **Transmit CWID now**.

This input can be used to set up regular actions such as transmitting the CWID.

Trunking

Trunking inputs can be used when the base station is part of a trunking system and is connected to an external trunking site controller.

Control channel

The **Control channel** input becomes true when a base station enters Run mode and is handled by the trunking controller as a control channel or when a base station, operating as a traffic channel, takes over the control channel function when the previous control channel fails. This input makes it possible for Task Manager to modify base station operation to suit control channel operation.

The **Control channel** input becomes false when a traffic channel enters Run mode. The input IF NOT **Control channel** can be used to configure base station operation specifically for traffic channel operation.

Example

IF **Control channel** THEN **Go to channel 1**
IF NOT **Control channel** THEN **Go to channel 2**

Site controller present

The **Site controller present** input becomes true when a base station enters Run mode and receives heartbeat messages from an external trunking site controller. This input makes it possible for Task Manager to modify base station operation to suit trunking operation.

The **Site controller present** input becomes false if the base station loses contact with its site controller. The input IF NOT **Site controller present** can be used to configure base station operation when site controller communications fail.

Actions

An action is something that Task Manager instructs the base station to do.

There is often a group of actions relating to a particular base station function. For example, Task Manager can lock, unlock, or toggle the automatic transmission of a base station identity, or set, clear, or toggle a flag.

To select an action

1. In the **Task list item** area, click in the **Task action** box. A menu with several submenus appears.
2. Click on an item in the menu or submenu.

To obtain Help on the output of a task

1. In the task list, click the task. The task appears in the **Task list item** area.
2. Click the Help button beside the **Task action** box.

Channel Actions

Channel actions make it possible to change the base station's current channel.

Go to channel

The **Go to channel** action instructs the base station to change channel and operate according to the configuration defined by the channel with the name specified in the action. It stays on that channel until another Task Manager action changes channel (for example following a base station reset).

The actual change of operating channel happens at the end of a processing cycle. This means, for example, that if the task list has a **Go to channel channel 005** action followed by a **Go to channel channel 006** action, the base station will only ever change to channel 006.

Important: Make sure that Task Manager actions do not ask the base station to change channel more often than once every 500 ms.

Go to next channel

The **Go to next channel** action instructs the base station to operate on the next valid channel in the channel table. If the base station was on Channel 001, it changes to Channel 002. It stays on that channel until a Task Manager action changes channel (for example following a base station reset).

The actual change of operating channel happens at the end of a processing cycle. This means, for example, that if the task list has two **Go to next channel** actions, the base station will move two channels down the channel table.

If the base station is already operating on the last channel in the channel table, the action takes it to the first channel.

Important: Make sure that Task Manager actions do not ask the base station to change channel more often than once every 500 ms.

Go to previous channel

The **Go to previous channel** action instructs the base station to operate on the previous valid channel in the channel table. If the base station was on Channel 002, it changes to Channel 001. It stays on that channel until a Task Manager action changes channel (for example following a base station reset).

In base stations with a complex set of Task Manager tasks, you need to understand exactly how this action works. It is not a 'do now' action; the actual change of operating channel happens at the end of a processing cycle. This means, for example, that if the task list has two **Go to previous channel** actions, the base station will move two channels up the channel table.

If the base station is already operating on the first channel in the channel table, the action takes it to the last channel.

Important: Make sure that Task Manager actions do not ask the base station to change channel more often than once every 500 ms.

Digital output actions

Task Manager actions can set the digital outputs high or low or toggle them between the two states.

Set digital output high

The **Set digital output high** action sets the selected digital output line high.

The actual setting of the digital output doesn't happen till the end of a processing cycle. So the task list can set the digital output high or low many times, but the output line will only ever be set in the way that the last action in the task list specifies.

When you select this action, a dialog box pops up so that you can select which digital output line you want to use. The Task Manager action will only have an effect if the relevant system interface pin has been configured as a digital output.

Set digital output low

The **Set digital output low** action sets the selected digital output line low.

The actual setting of the digital output doesn't happen till the end of a processing cycle. So the task list can set the digital output high or low many times, but the output line will only ever be set in the way that the last action in the task list specifies.

When you select this action, a dialog box pops up so that you can select which digital output line you want to use. The Task Manager action will only have an effect if the relevant system interface pin has been configured as a digital output.

Example

IF **Counter at maximum (LightTrigger)** THEN **Set digital output low**.

Toggle digital output

The **Toggle digital output** action changes the state of the selected digital output line. If it was low, it become high. If it was high, it becomes low.

The actual setting of the digital output doesn't happen till the end of a processing cycle. So the task list can change the state of the digital output many times, but the output line will only ever be set in the way that the last action in the task list specifies.

When you select this action, a dialog box pops up so that you can select which digital output line you want to use. The Task Manager action will only have an effect if the relevant system interface pin has been configured as a digital output.

Fan test now

The 'do now' action **Fan test now** instructs the base station to run the fans for 5 seconds, irrespective of the temperature. If the fans are already running, this has no effect.

Locks

Lock actions lock, unlock or toggle a base station function. By default, functions are unlocked (except for the Auxiliary Supply). When Task Manager locks a function, that function cannot operate. If Task Manager unlocks a function, it is free to operate. (However, for the function to actually operate, it may need to be licensed and to be enabled in configuration.)

Generally speaking, if you create a task that locks a function, you need to create at least one equivalent function that unlocks it again.

The current status of Task Manager locks is displayed in Monitor > Task Manager > Locks.

Each lock action has an equivalent lock input. When Task Manager unlocks a function (for example automatic CWID), the equivalent input (in this case **Automatic CWID unlocked**) becomes true and any tasks with that input will be processed.

Analog line lock

Task Manager can lock the analog line. This disconnects the dispatch console from the base station. No analog voice can pass between the console and the base station. Physical signaling on the E line is recognized, but the channel cannot be seized.

Automatic CWID lock

Task Manager can lock the automatic transmission of a CWID. This stops the base station from transmitting its CWID as configured in Configure > RF Interface > CWID. It does not affect the ability of Task Manager to send a CWID using the action **Transmit CWID now**.

Auxiliary supply lock

If the Auxiliary power control box (Configure > Base Station > Miscellaneous) is set to Task Manager, locking the auxiliary supply turns it off and unlocking it turns it on.

Example

IF **Base station in Run mode** THEN **Unlock auxiliary supply**

This task turns the auxiliary output on whenever the base station enters Run mode.

Channel group lock

Task Manager can lock the current channel group. This disconnects the base station from its channel group so that it cannot receive a voice stream or function code from other channel group members.

Changing channel group (by changing channel) has no effect on the lock.

Example

IF **Tone remote detected (650)** THEN **Lock Channel Group**.
IF **Tone remote detected (850)** THEN **Unlock Channel Group**.

This pair of tasks makes it possible for the dispatcher to instruct the base station to disconnect itself from the channel group, so that dispatcher communications only use that base station, and then to re-connect the base station, as needed.

Receiver lock

Task Manager can lock the receiver. This prevents the base station from receiving any RF signals.

Subaudible encode lock

Task Manager can lock the encoding of subaudible signaling. When encoding is locked, transmissions do not contain any subaudible signaling.

The transmission of the NAC cannot be locked, because it is not possible to send P25 digital transmissions without a NAC.

When decoding is unlocked, the transmitter behaves according to the current signaling profile.

Subaudible/NAC decode lock

Task Manager can lock the decoding of subaudible signaling and the NAC. When decoding is locked, the receiver unmutes irrespective of the subaudible signaling or the NAC that the received signal contains.

When decoding is unlocked, the receiver behaves according to the current signaling profile.

Transmitter lock

Task Manager can lock the transmitter. This prevents the base station from sending any RF signals.

RF repeat actions

If the RF Repeat setting of the current channel (in the channel table) is set to DispatchControlled, Task Manager can enable, disable, or toggle the base station's RF repeat function.

Example

IF **Tone remote detected (550**) THEN **Enable RF repeat**
IF **Tone remote detected (650**) THEN **Disable RF repeat**

Send function code

The **Send function code** action sends the defined function code over the digital line to all base stations in the current channel group. This action is needed in order to inform the channel group when a base station receives a tone remote function tone.

Example

IF **Tone remote detected (550**) THEN **Send Function Code 5**

Statements of this type make it possible for commands received over the line interface to be relayed to the other base stations in the channel group, so that all can, for example, change channel.

Task Manager

Outputs under the Task Manager heading are concerned with special aspects of Task Manager: counters, custom outputs, flags and timers.

Counter actions

Task Manager actions make it possible to increment or decrement a counter value, or to reset the value to 0. Before creating statements with these actions, set up one or more counters in Configure > Task Manager > Counters.

Increment counter

The **Increment counter (nn)** action adds one to counter nn. When a counter reaches its specified maximum, it triggers actions with the input **Counter at maximum (nn)**. Further Increment counter actions have no effect.

Decrement counter

The **Decrement counter** action subtracts one from the current value of the counter specified. If the counter is at 0, Decrement counter actions have no effect.

Reset counter

The Reset counter action sets the value of the counter specified to zero, so that it must begin counting anew.

Flag actions

Task Manager actions can set or clear flags. Before creating statements with flag actions, name one or more flags in Configure > Task Manager > Flags.

Set flag

Task Manager can set or clear any of 16 numbered flags. A flag can only have one of two states: set or cleared. The state of a flag can be used as an input in other tasks.

Clear flag

Task Manager can set or clear any of 16 numbered flags. A flag can only have one of two states: set or cleared. The state of a flag can be used as an input in other tasks.

Toggle flag

Task Manager can set or clear any of 16 numbered flags. Toggling a set flag clears it. Toggling a cleared flag sets it. The state of a flag can be used as an input in other tasks.

Timer actions

Task Manager can start or stop timers. Before creating statements with timer actions, set up one or more timers in Configure > Task Manager > Timers.

Start timer

Task Manager can start or stop any of its 16 timers. When a timer is started, it is re-initialized, then it begins to count up from zero to the maximum set in Configure > Task Manager > Counters and Timers. When it has reached that maximum, it expires. You can create tasks that are executed when a timer expires.

Stop timer

Task Manager can start or stop any of its 16 timers. When a timer is stopped, it ceases to count up, so it does not expire. If it is re-started, it starts counting up again from 0. You can create tasks that are executed when a timer expires.

Transmit CWID now

The 'do now' action **Transmit CWID now** instructs the base station to immediately transmit the CWID message defined in the CWID form. This action enables you to configure CWID transmissions in a way that is not otherwise possible. For example, you could have the CWID transmitted more than once a minute or at every transmit tail.

Transmit CWID now is not affected by the Task Manager Automatic CWID lock.

Custom Actions

The Custom Actions submenu contains all the custom actions that have been defined for the base station using Configure > Task Manager > Custom Actions.

Task Manager Examples

Task Manager makes it possible for you to build complex functions into the base station. Here are some examples of to give you an idea of what can be done.

Important: While Tait has carefully tested Task Manager, no guarantee can be given that these examples will work correctly for your system. Make sure that you thoroughly test any set of Task Manager tasks before commissioning the system.

Scanning Repeater

Task Manager makes it possible for a stand-alone TB9100 to function as a scanning repeater.

The set of Task Manager statements below works like this. When the TB9100 goes into Run mode, the ChangeChannel timer starts. When that timer stops, Task Manager instructs the TB9100 to go to the next channel in the channel table. If the TB9100 receives a call that wins the vote, it stops scanning. When the call ends, a second timer (OnChannel) is started. This timer stops the base station scanning long enough to give the called party time to respond.

IF **Base station in Run mode** THEN **Start timer (ChangeChannel)**
IF **Vote won by RF** THEN **Stop timer (ChangeChannel)**
IF **Vote won by RF** THEN **Stop timer (On Channel)**
IF NOT **Vote won by RF** THEN **Start timer (On Channel)**
IF Timer expired **(ChangeChannel)** THEN **Go to next channel**
IF Timer expired **(ChangeChannel)** THEN **Start timer (ChangeChannel)**
IF Timer expired **(On Channel)** THEN **Go to next channel**
IF Timer expired **(On Channel)** THEN **Start timer (ChangeChannel)**

Important: Set the **ChangeChannel** timer to at least 350 ms. Changing channels too quickly can put excess load on the firmware and cause it to miss its deadlines. The consequences could include the firmware protection mechanisms restarting the base station.

Give the On Channel timer a suitable value (for example, 5 seconds), to give the called party time to respond before the base station changes channel.

A small variation on this set of statements can make the base station stay on its home channel until an external signal triggers the scanning.

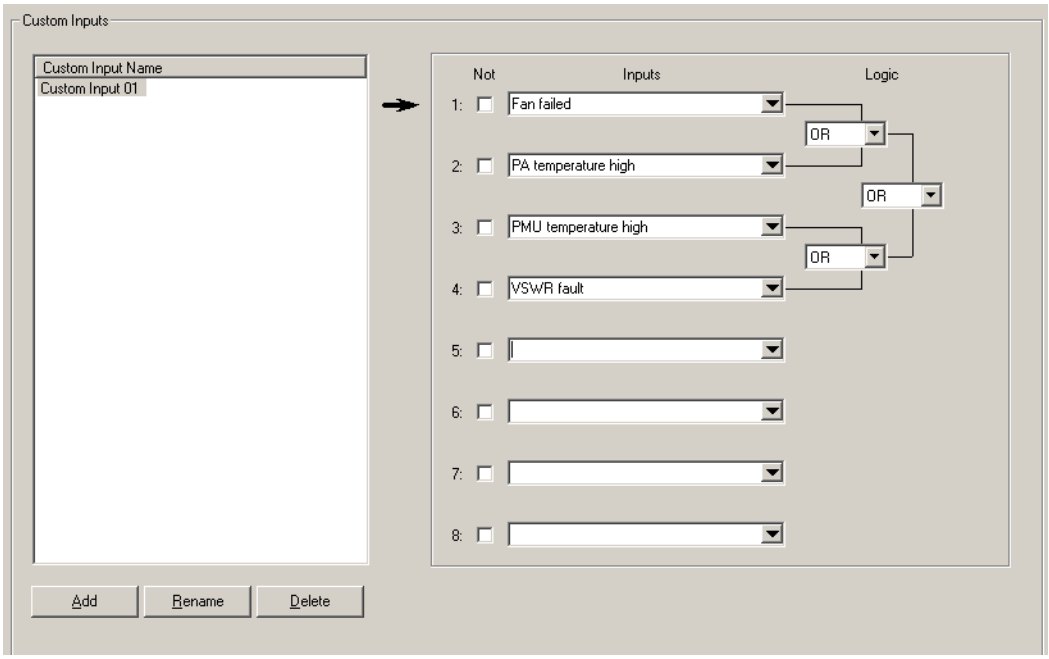
Customizing Task Manager

Customizing Task Manager adds to its power and flexibility. There are several options available. You can create custom inputs or actions and define timers, counters, and flags. You can then use them to create tasks that will be executed when the custom input becomes true, the timer expires, the counter reaches its maximum, or the flag is set.

Working With Custom Inputs

The Custom Inputs form (Configure > Task Manager > Custom Inputs) lets you work with custom inputs. It lists the existing custom inputs and lets you see what combination of standard inputs each consists of. You can also create new custom inputs and edit or rename existing ones.

A custom input is a user-defined Task Manager input that consists of a combination of standard inputs. Custom inputs make it possible to define tasks that will be processed when a combination of inputs becomes true. (A Task Manager task can only have one input.)



Viewing a Custom Input

1. Click an item in the Custom Input Name column.
2. View the display in the rest of the form. It shows the standard inputs used to create the custom input, whether they are negated, and the logic of their combination. The standard truth table determines the outcome for the different states of any pair. (See "Truth Table" on page 202.)

   The Logic column shows graphically how the standard inputs will be combined. First the input is negated, if its Not check box is selected. Then it is combined with the adjacent input to which it is joined by a line. The result of that combinatorial operation is combined with the input or result that it is joined to, and so on, until the final result is obtained. In this way, up to

eight standard inputs can be combined to produce an input that can only be true or false.

Defining a Custom Input

1. Click **New**.
2. Edit the name that appears in the Custom Input Name column.
3. Click in an **Input** box and select an input from the list.
4. If you want the negative of the input to contribute to the custom input's logic, select the **Not** check box alongside.
5. Repeat steps 3 and 4 for all the standard inputs that will go to make up the custom input. The Input boxes that you choose will determine the order in which the standard inputs are combined.
6. Under the **Logic** heading, select the appropriate options in the drop-down boxes to give the logical combination of inputs that you want. (For information about the effect of the different options, see "Truth Table" on page 202.)
7. Click **OK**.

Truth Table

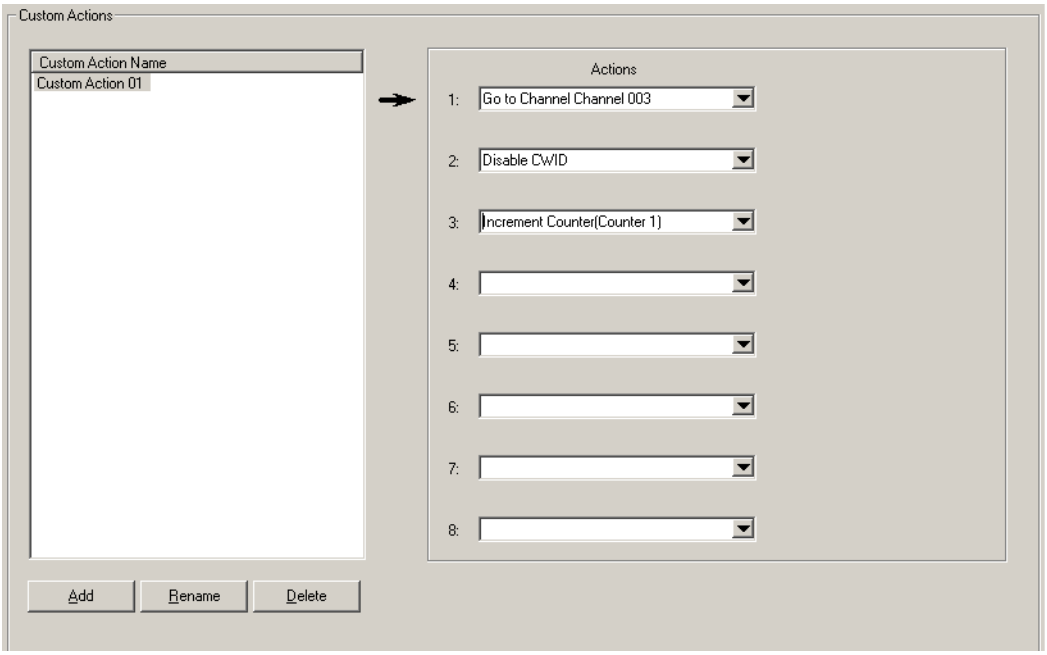
The truth table below displays the possible individual values for input A and input B, and the result when you combine those values using each of the six available logic operators. So, for example, if A is true and B is false and we combine A and B using XOR, the result is true.

A	B	AND	NAND	XOR	XNOR	OR	NOR
false	false	false	true	false	true	false	true
false	true	false	true	true	false	true	false
true	false	false	true	true	false	true	false
true	true	true	false	false	true	true	false

Working With Custom Actions

The Custom Actions form (Configure > Task Manager > Custom Actions) lets you work with custom actions. It displays the list of existing custom actions. If you select a custom action, it displays the set of standard actions that it consists of. You can also create new custom actions and edit or rename existing ones.

A custom action is a user-defined Task Manager action that consists of more than one standard action. It saves you writing several different tasks with the same input.



Viewing a Custom Action

1. Click an item in the Custom Action Name column.
2. View the Standard Actions column. It lists the standard actions that the custom action consists of.

Defining a Custom Action

1. Click **New**.
2. Edit the name that appears in the Custom Action Name column.
3. Click in the first row of the Standard Actions column and select an action from the list.
4. Repeat step 3 for all the standard actions that will go to make up the custom action.
5. Click **OK**.

Defining Counters, Timers, and Flags

Counters, timers, and flags make it possible for Task Manager to do such things as respond to three presses of PTT or to email a status message once a week.

Note: Short timers may not be accurate. This is because it may take Task Manager longer than 10 ms to process its tasks, causing it to miss the next instruction to go through its task list. Tait recommends that you avoid short timers (< 50 ms) if the task list has more than 10 enabled tasks.

To define a counter

1. Select Configure > Task Manager > Counters.
2. If desired, enter a suitable name for the counter into the **Name** box.
3. In the **Maximum** box, enter the highest number that the counter can reach.

   When the counter reaches its maximum, the input **Counter at maximum** becomes true for that counter and any tasks containing it are processed.

To define a timer

1. Select Configure > Task Manager > Timers.
2. If desired, enter a suitable name for the timer into the **Name** box.
3. In the **Units** box, specify what unit of time the number you entered represents.

   When the timer reaches its maximum, the input Timer expired becomes true for that timer and any tasks containing it are processed.

To define a flag

1. Select Configure > Task Manager > Flags.
2. If desired, enter a suitable name for the flag into the **Name** box.
3. Click **OK**.

Monitoring Task Manager

The items under Monitor > Task Manager provide options for monitoring Task Manager. If the base station is behaving unexpectedly, you can check to see whether Task Manager has locked any base station functions. Alternatively, have a look at the system log; it records any actions that Task Manager carries out. You also can view the current state of timers, counter, and flags.

Viewing Locks

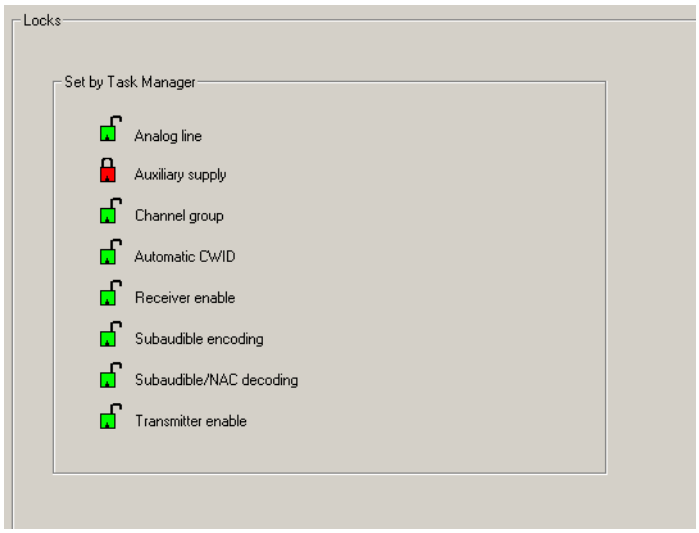
The Locks form (Monitor > Task Manager > Locks) shows you whether Task Manager has locked any base station functions.

If the function is locked, the form displays a red locked padlock.

If the function is unlocked, the form displays a green open padlock.

When the base station enters or re-enters Run mode, all functions (except for the auxiliary supply) are unlocked. A function can only be locked through Task Manager action.

The Locks form is an important place to check, if the base station is not behaving as expected.



Analog line — When the analog line is locked, the analog line cannot be used.

Auxiliary supply — By default, the auxiliary supply is locked.

Locking or unlocking the auxiliary supply only has an effect if the auxiliary supply is configured to be under the control of Task Manager (Configure > Base Station > Miscellaneous). In this case, when the auxiliary supply is locked, the auxiliary power output is turned off. When the auxiliary supply is unlocked, it is on and supplying power.

Channel group — When the channel group is locked, the base station cannot input or output a voice stream over its digital line.

Automatic CWID — When automatic CWID is locked, the base station cannot automatically transmit a continuous wave ID (Morse code). However, Task Manager can still initiate the sending of the CWID using the action **Transmit CWID now**.

Receiver	When the receiver is locked, it is unable to pass any received audio.
Transmitter	When the transmitter is locked, it is unable to transmit.
Subaudible encode	When the encoding of subaudible signaling is locked, subaudible signaling is not added to the transmitted signal. (The encoding of the NAC cannot be locked.)
Subaudible/NAC decode	When the decoding of subaudible signaling and the NAC is locked, subaudible signaling and the NAC are not decoded, which means that the receiver unmutes to any CTCSS tone, DCS code, or NAC.

Viewing Timers

The Timers form (Monitor > Task Manager > Timers) displays the current state of any timers that you configured for Task Manager.

The Name column lists the timers. A bar graph shows how far each timer has progressed towards its maximum value, which is displayed in the Maximum column.

Viewing Counters

The Counters form (Monitor > Task Manager > Timers) displays the current state of any counters that you configured for Task Manager.

The Name column lists the counters. A bar graph shows how far each counter has progressed towards its maximum value, which is displayed in the Maximum column.

Viewing Flag States

The Flags form (Monitor > Task Manager > Timers) displays the current state of any custom flags that you configured for Task Manager.

Each of the possible flags has an LED alongside it. A flashing red LED means that the flag is set. A green LED means that is is cleared.

Glossary

This glossary contains an alphabetical list of terms and abbreviations related to the TB9100 base station.

A

administrator A special type of access to CSS functions, used for activities such as changing passwords.

ADC Analog-to-Digital Converter. A device for converting an analog signal to a digital signal that represents the same information.

AES AES (Advanced Encryption Standard) is an encryption algorithm that uses keys of up to 256 bits.

AGC Automatic Gain Control. A device that optimizes signal level.

Algorithm ID The Algorithm ID is an identifier that specifies an encryption algorithm (for example, DES or AES).

analog FM mode A mode of operation in which the RF interface transmits and receives analog FM signal. The digital line sends and receives the analog signal as G. 711 speech packets.

analog valid Analog valid is a signal that indicates that the base station is presenting a valid output on the analog line. This output can originate from an analog FM or from a digital P25 call. The M-line carries the analog valid signal.

ANI Automatic Number Identification. A service that provides the receiver of a call the number of the caller.

APCO The Association of Public Safety Communications Officials in the United States. The APCO Project 25 standards committee defined a digital radio standard. The standard is often referred to as APCO or P25.

B

Base station In general, a radio receiver and transmitter that is located in a specific place (at a site) that allows portable and mobile radio terminals to communicate over a larger range. Specifically, Tait TB9100 equipment in a subrack.

BCD BCD (binary coded decimal) is a code in which a string of four binary digits represents a decimal number.

BER Bit Error Rate. A measure of the quality of digital transmission, expressed as a percentage. The BER indicates the proportion of errors in a transmission.

C

C4FM Compatible Four-level Frequency Modulation. A modulation scheme defined in the CAI standard for 12.5 kHz bandwidth.

CAI Common Air Interface. The over-the-air data formats and protocols defined by the APCO P25 committee.

Calibration Software The TB9100 Calibration Software 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 TB9100 modules.

call A complete exchange of information between two or more parties. A call requires a receive signal path and a transmit signal path. In trunked systems, a call is a conversation, made up of a number of overs, but in conventional systems, a call is an over.

calling profile A group of configuration settings that defines the properties of the TB9100 analog line, which can be regarded as equivalent to a radio on the network.

channel A channel is:
1. A path through which signals can flow.
2. In the RF domain, a frequency pair (or just a single frequency in a simplex system).
3. A set of configuration information that defines the frequency pair and other related settings (a channel configuration). Generally, 'channel' has this meaning in the CSS.

channel group A channel group is a single logical channel consisting of a set of base stations. The base stations are linked by an IP network and share a common multicast IP address.

channel profile A channel profile is a named group of configuration settings that help to define the properties of a channel. Each channel in the channel table must have a channel profile assigned to it.

channel seize Channel seize is a signal received at the analog line interface, requesting the base station to accept the analog signal as an input into the channel group. The base station can be configured to acknowledge an asserted E-line, LLGT, or LLGT following MDC1200 signaling as a channel seize signal.

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.

CKR The CKR (common key reference) is a number used by the key fill device and by the CSS to indirectly refer to an encryption key without using its Key ID or Algorithm ID.

circuit domain The part of the base station processing functionality that processes speech signal as a continuous stream of bits – a digital circuit. The opposite of packet domain.

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 *.apc.

connection list A connection list contains the names and IP addresses of base stations that the CSS can connect to.

control bus The control bus is used for communications between base station modules in a subrack. It is an I2C bus, a bi-directional two-wire serial bus which is used to connect integrated circuits (ICs). I2C is a multi-master bus, which means that multiple chips can be connected to the same bus, and each one can act as a master by initiating a data transfer.

control panel The control panel is an area at the front of the base station with buttons, LEDs and other controls that let you interact with the base station.

CRTP Compressed RTP.

CSS Customer Service Software. Tait PC-based software for monitoring, configuring, and diagnosing a Tait TB9100 base station.

CTCSS CTCSS (continuous tone controlled squelch system), also known as PL (private line) is a type of signaling 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 set of pre-defined inputs that are combined using Boolean logic.

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 signaling used for segregating groups of users. DCS codes are identified by a three-digit octal number, which forms part of the continuously repeating codeword. When assigning DCS signaling for a channel, you specify the three-digit code.

de-emphasis De-emphasis is a process in the receiver that restores pre-emphasized audio to its original relative proportions.

DES DES (Data Encryption Standard) is the encryption algorithm selected by the P25 standard. Generally, P25 traffic uses the DES-OFB mode.

digital input value A value that the base station computes from the state of a configured number of digital inputs. The digital input value is an input into Task Manager.

digital P25 mode A mode of operation in which the RF interface transmits and receives digital signal as defined by the APCO P25 CAI. The digital line sends and receives IMBE speech packets.

dispatcher A dispatcher is a person who gives official instructions by radio to a fleet.

dotted quad A method for writing IPv4 addresses. The form is DDD.DDD.DDD.DDD where DDD is an 8-bit decimal number.

DSP Digital Signal Processor.

dual mode The ability to operate as a transceiver in two different ways: analog FM and P25 digital. Dual mode equipment can be configured to support either mode or to switch between modes from one over to another.

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.

E

EIA Electronic Industries Alliance. Accredited by the American National Standards Institute (ANSI) and responsible for developing telecommunications and electronics standards in the USA.

encryption The coding of voice (or data) into unintelligible forms for secure transmission.

EMC Electromagnetic Compatibility. The ability of equipment to operate in its electromagnetic environment without creating interference with other devices.

ETSI European Telecommunications Standards Institute. The non-profit organization responsible for producing European telecommunications standards.

F

FCC Federal Communications Commission. The FCC is an independent United States government agency that regulates interstate and international radio communications.

Feature Code Code that identifies a feature license that can be enabled or disabled using the Software Feature Enabler.

Feature Code Sequence Number Number that indicates how many times a feature license has been enabled or disabled.

Feature license key A set of digits purchased from Tait that is required to enable a feature license.

FEC Forward Error Correction.

FFSK Fast Frequency Shift Keying. A modem encoding scheme for carrying data on FM radios.

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 flags that Task Manager can set and clear.

FLASH Electrically block erasable and programmable read-only memory.

FM Frequency Modulation. Often used as an adjective to denote analog radio transmission.

frequency band The range of frequencies that the equipment is capable of operating on.

front panel The cover over the front of the base station containing fans for the PA and PMU.

G

G. 711 The name of the ITU standard that defines how speech is digitally encoded (64 kbit, A-law or u-law). When the base station is in analog mode, G. 711 speech is sent and received on the digital line interface.

gating Gating is the process of opening and closing the receiver gate. When a valid signal is received, the receiver gate opens.

group call A group call is a call that involves more than two radios simultaneously.

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.

hub A unit for connecting hosts together. It sends all incoming ethernet packets to all the other hosts.

hysteresis Hysteresis is the difference between the upper and lower trigger points. For example, the receiver unmutes when the upper trigger point is reached, but will mute again until the level falls to the lower trigger point. An adequate hysteresis prevents the receiver gate from repeatedly muting and unmuting when the level varies around the trigger point.

I

IMBE Improved Multiband Excitation. A voice compression technology patented by Digital Voice Systems, Inc and used in the vocoders of P25 radios.

inbound Inbound describes the direction of a signal: from a subscriber unit over the air interface to the fixed station.

inhibit A control command that can be sent across the CAI to inhibit a radio. An inhibited radio appears to the user as if it is powered off.

IP Internet Protocol. IP is a protocol for sending data packets between hosts.

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

key ID The Key ID is the identifier for a key variable.

key variable The key variable is a parameter used by the encryption algorithm to encrypt or decrypt a message.

L

LAN Local Area Network

LED Light Emitting Diode. Also the screen representation of a physical LED.

LLGT Low level guard tone. One of a set of tones used to remotely control base stations.

M

MDC1200 MDC1200 is a proprietary signaling protocol developed by Motorola and used to enhance basic communications in analog PMR.

monitor The Monitor function unmutes the receiver, so that the user can hear all traffic on a channel.

multicast group The group of hosts associated with a specific IP multicast address.

multicast IP address An IP address that addresses a group of hosts rather than a single host.

mute A mute controls the circumstances under which a received signal is passed to the radio's speaker. When a mute is active, the radio's speaker only unmutes under certain conditions, determined by the type of signaling operating on a channel and the squelch threshold.

N

NAC Network Access Code. The 12 most significant bits of the network identifier information that precedes every packet sent on the CAI. The NAC identifies which network the data belongs to, allowing base stations and mobiles to ignore packets belonging to interfering networks.

navigation pane The navigation pane is the left-hand pane of the CSS application window. It displays a hierarchical list of items. When you click an item, the main pane displays the corresponding form.

normal squelch A type of squelch operation in which the receiver unmutes on any signal with the correct NAC (digital P25) or subaudible signaling (analog FM).

O

octet A set of 8 bits.

operating range Operating range is another term for switching range.

outbound Outbound describes the direction of a signal: from a fixed station over the air interface to a subscriber unit.

over A single transmission, which begins when a user presses PTT and ends when the user stops pressing.

P

P25 Project 25. A suite of standards and requirements intended for digital public safety radio communications systems.

PA The PA (power amplifier) is a base station module that boosts the exciter output to transmit level.

packet domain The speech processing area that deals with speech data that has been collected up into a packet. IP networks convey packets. The opposite of circuit domain.

PCB Printed Circuit Board

PMU The PMU (power management unit) is a module that provides power to the base station.

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

program The act of sending a configuration data set from the CSS to the base station.

Project 25 A project set up by APCO (the Association of Public Safety Communications Officials International), together with other US governmental organizations, to develop standards for interoperable digital radios to meet the needs of public safety users.

PSTN Public Switched Telephone Network: The public telephone network.

PTT Push To Talk. The button on a radio terminal that keys the transmitter.

Q

QoS Quality Of Service.

R

reciter The reciter is a module of a TB9100 base station that acts as receiver and exciter.

repeater talkaround Repeater talkaround allows the radio user to bypass repeater operation and so communicate directly with other radios. While repeater talkaround is active, all transmissions are made on the receive frequency programmed for the channel.

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.

RISC Reduced instruction set chip. The name used for the control processors in the reciter's digital board and network board.

RS-232 A serial communications protocol.

RSSI RSSI (Received Signal Strength Indicator) is a level that indicates the strength of the received signal.

RTP RTP (Real Time Protocol) is an Internet protocol that supports the real-time transmission of voice and data.

Run mode Run mode is the normal operating mode of the base station.

Rx Receiver.

S

selective squelch A type of squelch operation in which the receiver unmutes only on signals that are explicitly addressed to that receiver. This can be done through a talk group ID or unit ID (digital P25) or through MDC1200 signaling (analog FM).

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

signaling profile A signaling profile is a named set of configuration items related to signaling that can be applied to any channel. Items include subaudible signaling and transmit timers.

SINAD SINAD (Signal plus Noise and Distortion) is a measure of signal quality. It is the ratio of (signal + noise + distortion) to (noise + distortion). A SINAD of 12 dB corresponds to a signal to noise ratio of 4:1. The TB9100 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.

site 1. The base station electronics at a particular location. This includes power supplies, transmitters, receivers, network interfaces and controllers. 2. The location of that electronic equipment.

SMR Specialized Mobile Radio. A communications system used by police, ambulances, taxis, trucks and other delivery vehicles.

squelch Squelch is a feature of radio equipment. It ensures that the speaker only unmutes when a valid signal is received. To be valid, it must, for example, exceed a certain signal strength.

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 a new configuration into the base station.

subaudible signaling Subaudible signaling is signaling that is at the bottom end of the range of audible frequencies. The TB9100 base station supports CTCSS and DCS subaudible signaling.

subtone A subtone (subaudible signaling tone) is a CTCSS tone or a DCS code.

supplementary service A term used in the P25 standards. It refers to a group of services that is additional to the basic service that a telecommunications network provides. Examples include encryption and radio unit monitoring.

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.

syslog protocol syslog is a standard protocol used for the transmission of event notification messages across IP networks. Base stations can send messages such as alarms to an IP address on the TaitNet P25 network. The base station's logs store messages in the syslog format.

T

TaitNet Brand name for any PMR network designed and manufactured by Tait Electronics Limited.

TaitNet P25 network A set of Tait base stations interconnected by an IP network that can carry voice and data traffic.

TB9100 Base Station A Tait TB9100 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 TB9100 or base station.

Task action A task 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.

Task input A task input is the first part of a Task Manager task. It specifies what the must become true before the base station carries out the second part.

Task Manager Task Manager is a part of the TB9100 base station firmware that carries out tasks in response to inputs. These tasks are formulated using the CSS.

TCP Transmission Control Protocol. A complex protocol on top of IP for sending reliable streams of data with flow control.

TELCO Telephone company.

TIA Telecommunications Industry Association

toggle The term toggle is used to describe the switching between two states. If something is on, toggling it turns it off. If it is off, toggling it turns it on.

tone A tone is a sound wave of a particular frequency.

TSBK A TSBK (trunking signaling block) is an over-the-air message format used in digital P25 mode for setting up trunked calls and for supplementary services such as messaging and status updates.

Tx Transmitter.

U

uninhibit A control command that can be sent across the CAI to restore and inhibited radio to normal functioning.

UDP User Datagram Protocol. A simple protocol on top of IP for sending streams of data.

UTC Coordinated Universal Time (word order from French). An international time standard that has replaced Greenwich Mean Time.

V

valid signal A valid signal is a signal that the receiver responds to by unmuting the receiver. A signal is valid, for example, when it is stronger than a minimum level and when it has the specified NAC.

vocoder Voice encoder/decoder. A processing element that compresses/decompresses the digital voice signal.

VoIP Voice over IP. The name for the technology that puts speech signals in packets and then routes them over an IP backbone network.

voting Voting is the systematic sampling of a group of channels for the channel with the greatest signal strength. Voting provides wide-area coverage and ensures that as the user moves throughout the coverage area the strongest channel is always available for a call. The TB9100 has an internal voter, which decides which base station input is passed to the switch for distribution to the configured and enabled outputs.

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.

Z

zeroize To zeroize is to render one or more keys useless by overwriting the key data with zeros.

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