

TB9100 base station
P25 CG console gateway

Customer Service Software User's Manual



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Preface

Welcome to the TB9100 Customer Service Software User's Manual. This manual provides information about the Tait TB9100 Customer Service Software in PDF format. You can view it online or print it to obtain a paper copy. It describes how to use Version 3.05 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

The current set of TB9100 product documentation is provided in PDF format on the product CD. Updates are made available on the Tait support web. Print copies of the documentation are available on request.

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.

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, and then click Open on the list of commands that pops up'. 'Monitor > Module Details > Channel Module' means 'click the Monitor icon on the toolbar, then in the navigation pane find the Module Details group, and select Channel Module 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.
MBA-00003-07	March 2007	Describes version 3.05 of the CSS. This adds support for the digital fixed station interface, for the P25 Console Gateway, for RF linking, for the channel coordinator, for monitoring the TCCP interface, and for centralized voting. Updates to feature licenses.

Part A Introduction

The Customer Service Software (CSS) is a Windows-based software program that makes it easy to monitor and configure Tait P25 network elements (Tait TB9100 base stations and P25 Console Gateways). The CSS can also carry out diagnostic tests and update firmware.

The introduction explains fundamental concepts. You need to understand them before you can use the CSS effectively.

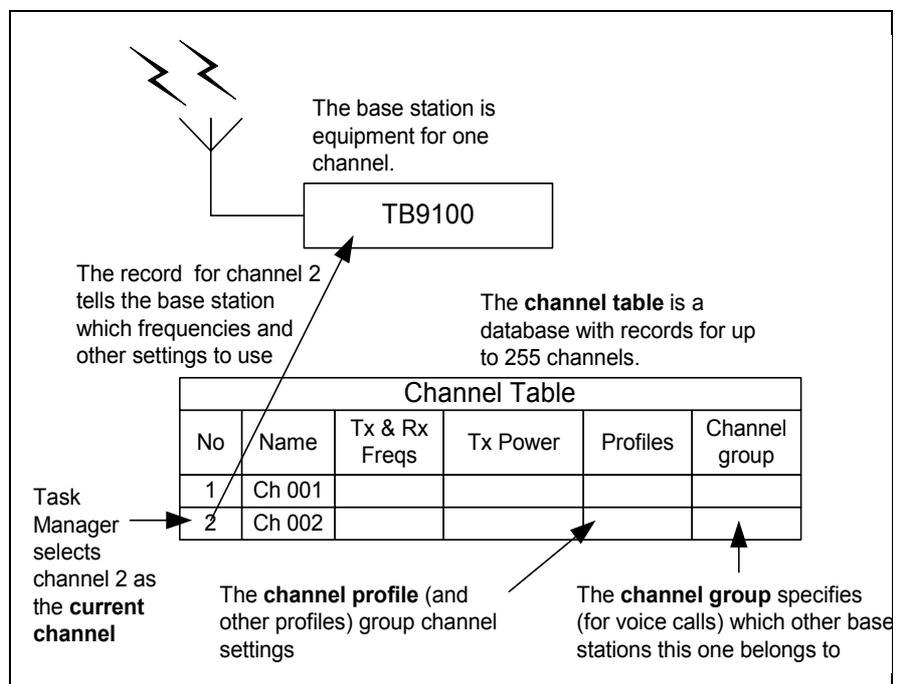
Topics

- [Channels](#)
- [Profiles](#)
- [Receiver Squelch](#)
- [Subaudible Signaling](#)
- [RF Repeat Function](#)
- [Task Manager](#)
- [Alarms](#)
- [Data Logging](#)
- [Analog Line](#)
- [Network Element Security](#)
- [Software Feature Licensing](#)

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 the whole network of TB9100 base stations. This means that almost the same [configuration file](#) can be used 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 operating on. Task Manager action or dispatcher command can select the current channel and Monitor > Interfaces > RF Interface displays it.

Channels in the P25 Console Gateway

The P25 Console Gateway also has a channel table and a current channel. This specifies which channel group the gateway belongs to and which calling profile it uses by default.

Profiles

Profiles are groups of settings that configure a network element 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 SU: 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 network elements that this network element belongs to. It determines the multicast IP address that the network element sends to and receives from. It also configures voting.

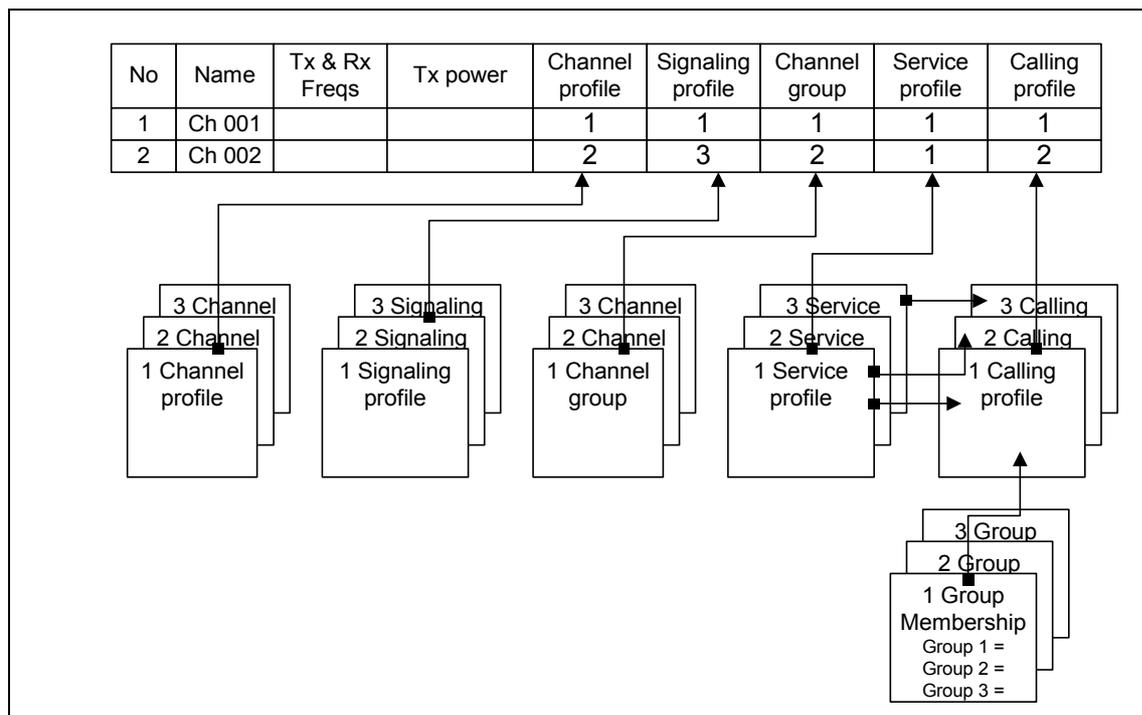
Service profile

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, 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 could be 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 6](#)). 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, in the analog line’s calling profile you can choose selective squelch.

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

Monitor squelch

Monitor squelch lets the dispatcher 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, define 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 SUs 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. Confirm with the relevant regulatory authority 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 SUs can be tricky. This is because the polarity of a DCS code can become inverted. For example, a SU 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 base station, 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 voting process (each base station has its own built-in voter) 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 SU calls. However, if the channel group is duplex, the vote-winning SU 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. If the dispatch equipment connects via the analog line, the command is a tone remote function tone. A Task Manager task is needed to detect the tone and enable the repeat. If the dispatch equipment is digital and connected via a DFSI, the dispatch command operates directly. For dispatcher control of RF repeat in channel groups, see the TaitNet P25 System Manual.

It is not possible to configure a base station in a channel group to repeat only locally received RF; it must 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 network element, enhancing its flexibility and configurability. Part of the firmware running on the channel module's digital board, Task Manager is able to respond to various inputs or operating parameters. Task Manager monitors a wide range of network element 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 network element 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 network element's firmware-based operation without needing to compile new firmware.

Task Manager is often used 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 only operates when the network element is in Run mode.

Alarms

The network element monitors a large number of conditions. When a condition rises above or falls below a defined threshold, the network element 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). Disabled alarms are disabled in the Alarm status form and do not turn on the control panel alarm LED. However, they still generate a syslog message (at the level of Notice) and are inputs into Task Manager.

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

The network element 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 network element 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. The CSS can view these logs and save them to a file.

If the TaitNet P25 digital network is set up with a PC running syslog collector software, you can configure the network element to send syslog messages to the syslog collector. In the CSS (Configure > Alarms > Logging), 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 Line

The analog line is a 4-wire E & M interface that is usually used to connect analog dispatch equipment to a single TB9100 base station or to a P25 Console Gateway that is part of a channel group. It can also be used to connect another base station, external voting equipment, or recording equipment.

TB9100 base stations and P25 Console Gateways have an analog line. Console Gateways are used if the analog line is to serve as an encryption/decryption point.

If a network element will use its analog line in digital P25 mode, it needs an analog line license. Additional licenses are required for MDC1200 signaling and for encryption. A P25 Console Gateway only needs an additional license for AES encryption.

Install-time configuration of the analog line determines the following:

- The type of signaling that is used (E & M, keytone, tone remote function tones, MDC1200).
- The expected characteristics of keytone and tone remote function tones

Calling profiles (assigned to channels but also selectable by the dispatcher) determine the operating configuration:

- 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 (applies only to P25 Console Gateways).

From the point of view of the radio network, the analog line can be thought of as a logical P25 subscriber unit. It is an end-point for calls. It has an individual ID and can belong to a number of talk groups.

Network Element Security

Security is protected at the network element and at the CSS. The network element is protected through a password. The CSS is protected through access codes to privileges. Both protections are optional.

By default, the base station or P25 Console Gateway 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 the network element, the CSS must authenticate itself.

The CSS has three different privileges: Guest, Maintainer, and Administrator. On starting 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, the CSS asks 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 configuration	X	
Change mode	X	
Perform diagnostics	X	
Change network element password		X
Reset network element	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 Licensing

The TB9100 base station and the P25 Console Gateway have many capabilities, but some of them require a license before you can use them. Without any licenses at all, these network elements can communicate with the CSS but can only operate in Standby mode. Using the CSS, you can enable (license) the additional features that are required.



Note: Licensing a feature allows the use of that feature. However, you often need to also enable the feature in configuration using the CSS before that feature becomes operative. The CSS will let you enable or configure a feature even if you do not have a license for it, but the feature will not work.

The following features are available:

Default Radio System

The default radio system feature allows the base station to transmit and receive analog FM transmissions.

P25 Common Air Interface

The P25 common air interface feature allows the base station to transmit and receive P25 digital voice transmissions.



Note: If neither of the above features are licensed, the network element cannot operate in Run mode.

Analog Line

The analog line feature allows the base station or P25 Console Gateway to make digital P25 speech calls from the analog line and to pass received digital P25 calls to the analog line. This feature is not needed for analog FM mode, for tone remote signaling, or for [TSBKs](#).

Networking with Distributed Voter

The networking with distributed voter feature enables channel group services. It allows the network element to send and receive voice data streams from other channel group members and to function as a distributed or a satellite voter.

Packet Data (reserved)

The packet data feature allows a network element to pass packet data to a destination IP address on the network. (Not currently supported). Packet data that is handled by a trunking site controller does not need this license.

MDC1200 Signaling on Analog Line

The MDC1200 signaling on analog line feature allows the conversion between MDC1200 signaling and P25 TSBKs. Console systems can then use MDC1200 for ANI and other subscriber signaling to and from SUs that are operating in P25 digital mode. (In analog FM mode, network elements pass MDC1200 on transparently and do not need this feature.)

Transmit Enable

Base stations normally have the transmit enable feature. This allows the reciter to provide a signal for transmitting. Receive-only base stations do not need this feature. P25 Console Gateways cannot be licensed to transmit.

External Trunking Interface

The external trunking interface feature allows a base station to become a trunking master, functioning as an interface between the trunking site controller and the channel group. The availability of this feature license is restricted.

P25 Base Encryption and Key Loading

The P25 base encryption and key loading feature allows the P25 Console Gateway to encrypt and decrypt speech using the DES algorithm.

***P25 AES
Encryption***

The P25 AES encryption feature allows a P25 Console Gateway with a base encryption feature to also encrypt and decrypt speech using the AES algorithm.

***SNMP (External
Trunking)***

The SNMP (external trunking) feature allows the base station to accept SNMP requests from a SNMP network manager. The base station can then provide information from its management information base (MIB) to an external management system. The availability of this feature license is restricted.

***Digital Fixed
Station Interface***

The digital fixed station interface feature allows a DFSI connection to a digital dispatch system (fixed station host), in conventional systems. The base station or P25 Console Gateway can then be an interface between its channel group and a digital dispatch system.

***Networking with
Centralized Voter***

The networking with centralized voter feature allows the network element to act as a central voter within its channel group. This feature also allows voice networking. Only network elements that will centrally vote (normally the central voter and its backup) need this feature. The other members of the channel group only need the networking with distributed voter feature.

***Simulcast
Transmitter***

The simulcast transmitter feature (not currently supported) will be required in base stations that have transmitters and belong to a simulcast network.

Part B Getting Started

To establish a CSS session with a base station, connect to it using the CSS software. If the CSS PC is physically connected to a TaitNet P25 digital network, you can connect remotely 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 and modify its configuration.

The CSS can work with TB9100 base stations and with P25 Console Gateways.

Topics

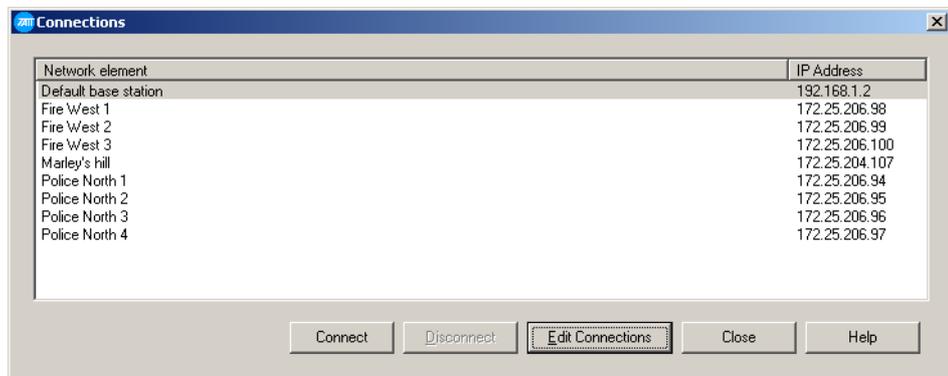
- [Connecting](#)
- [Monitoring Alarms](#)
- [Monitoring the Base Station](#)
- [Viewing Configuration Settings](#)
- [Diagnosing Problems](#)

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 network element 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 *vn.nn.nn* > TB9100 CSS, where *n.nn.nn* is the current CSS version number.
2. Make sure that the PC running the CSS is connected via an Ethernet cable to a hub on the TaitNet P25 digital network or directly to the base station’s Ethernet interface.
3. On the toolbar, click the **Connect** icon. The Connections dialog box appears.



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

The CSS establishes a connection to the selected network element. The Status bar displays 'Connected.'

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

Monitoring Alarms



When the CSS is connected to a base station, it 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.

The Status form is divided into several sections, each with a list of alarms and their status (indicated by green LEDs):

- Power Amplifier:** No PA detected, Invalid PA firmware, Calibration invalid, Fan failed, Forward power low, H/W configuration invalid, Power foldback, Reverse power high, Shutdown, VSWR high.
- Current:** Driver high, Final 1, Imbalance, Final 2.
- Supply voltage:** Low, High.
- Temperature high:** Driver, Final 1, Final 2.
- Power Management:** No PMU detected, Invalid PMU firmware, Fan failed, Mains supply failed, Power up fault, Shutdown imminent, Temperature high.
- Battery:** Protection mode, Voltage low, Voltage high.
- Output:** Current high, Voltage low, Voltage high.
- Reciter:** Channel invalid, Network board calibration invalid, Network board configuration invalid, Digital board calibration invalid, Digital board configuration invalid, Power up failure, Temperature high.
- System:** Air intake temperature: Low, High; BER: BER high; External reference: Absent, Invalid; Network: Network user traffic, QoS jitter, QoS lost packets; Synthesiser out of lock: Digital, Exciter, Receiver.

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 the CSS is connected 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 'Channel Module'). 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 see the voting behavior and configuration settings of all channel group members, select Monitor > Channel Group > Status.
- To view the contents of a log that the base station has recorded, select an item under Data Logging.

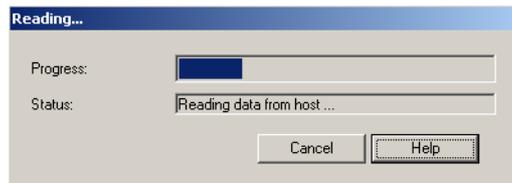
Viewing Configuration Settings

From the CSS, you can view a base station's configuration settings. Connect to the base station and then instruct the CSS to read the configuration.

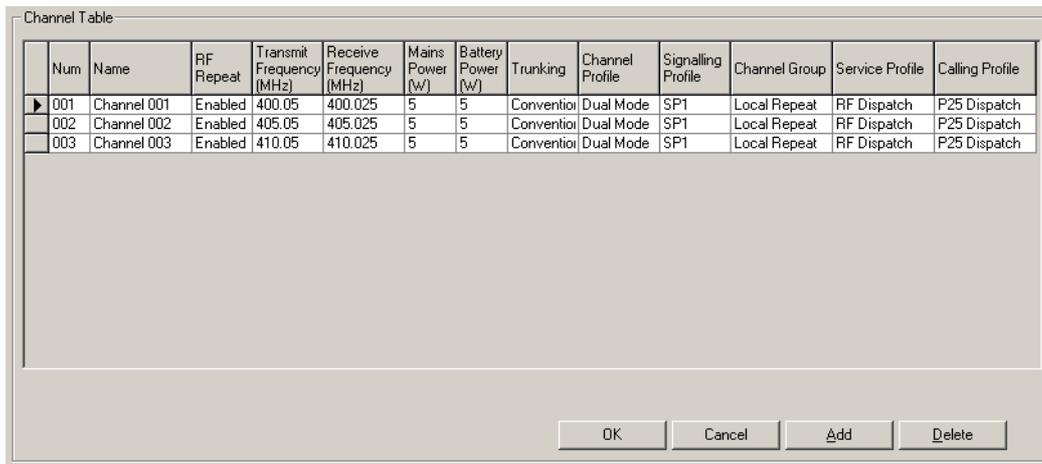
To view configuration settings

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.



The image shows a dialog box titled "Channel Table" containing a table with the following data:

Num	Name	RF Repeat	Transmit Frequency (MHz)	Receive Frequency (MHz)	Mains Power (W)	Battery Power (W)	Trunking	Channel Profile	Signalling Profile	Channel Group	Service Profile	Calling Profile
001	Channel 001	Enabled	400.05	400.025	5	5	Conventio	Dual Mode	SP1	Local Repeat	RF Dispatch	P25 Dispatch
002	Channel 002	Enabled	405.05	405.025	5	5	Conventio	Dual Mode	SP1	Local Repeat	RF Dispatch	P25 Dispatch
003	Channel 003	Enabled	410.05	410.025	5	5	Conventio	Dual Mode	SP1	Local Repeat	RF Dispatch	P25 Dispatch

At the bottom of the dialog box are four buttons: "OK", "Cancel", "Add", and "Delete".

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 connected to. These can help 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 getting down to the real work on a TB9100 base station or P25 Console Gateway, you need to know how to carry out basic tasks such as setting up a connection, changing mode, and reading configuration information.

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

Topics

- [Using the Customer Service Software](#)
- [Network Element Operations](#)
- [Working with Configurations](#)
- [Working With Different Network Elements](#)
- [CSS Tools](#)
- [CSS Options](#)

Using the Customer Service Software

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

Starting the CSS

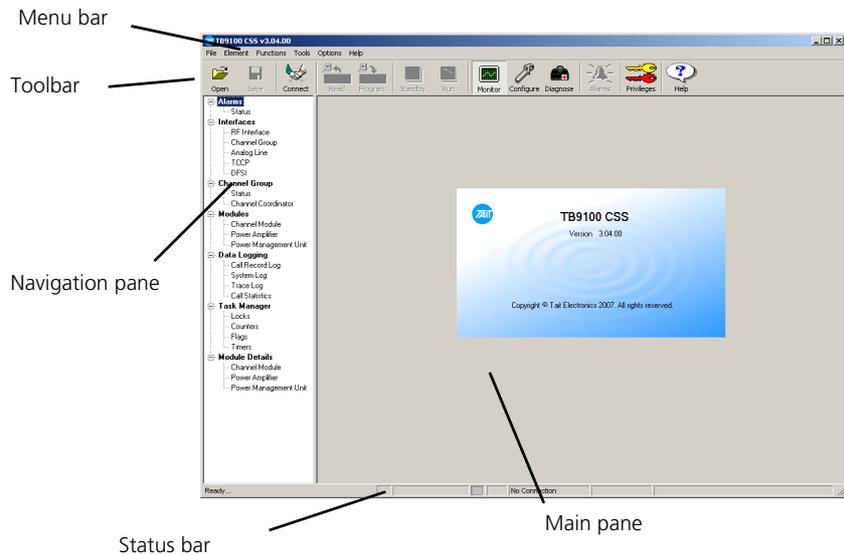
To start the CSS software, select Start > Programs > Tait Programming Applications > TB9100 CSS *vn.nn.nn* > TB9100 CSS, where *n.nn.nn* is the current CSS version number.



Tip: Run multiple instances of the CSS software (supported in version 3.00 and above) on your PC and use them for example to simultaneously monitor alarms at several network elements.

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 displays options for monitoring. Click an item in the navigation pane and the main pane displays the corresponding form.

Toolbar

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



Open	Opens a dialog box that 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 network element. See also “Connecting” on page 28 . If you are connected, this icon displays ‘Disconnect.’ Click it to disconnect from the network element.
Read	Reads in the configuration information of the network element 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 network element. The network element must be in Standby mode. Once the configuration has been programmed, the network element operates using that configuration. See also “Working with Configurations” on page 34 .
Standby	Puts the connected network element into Standby mode.
Run	Puts the connected network element into Run mode.
Monitor	Displays the Monitoring navigation pane so that you can monitor the connected network element. 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 network element’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 network element. See also “Diagnosing Problems” on page 21 .
Alarms	Turns red when any network element alarm is triggered. Click Alarms to display the current status of all network element alarms. See also “Monitoring Alarms” on page 143 .
Privileges	Displays the current privileges. If the keys have the background color, 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 47 .
Help	Displays a Help topic for the current form.

Status Bar

The status bar provides 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 network element is currently in (Run or Standby).
- Whether the CSS is connecting, connected, or not connected to a network element.
- The IP address of the network element.
- The name of the network element.

Network Element Operations

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

Connecting

Before you can work with a network element, the CSS must connect to it. A connection establishes a communication session with the network element. 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 network element or open a [configuration file](#), even to view the configuration forms.

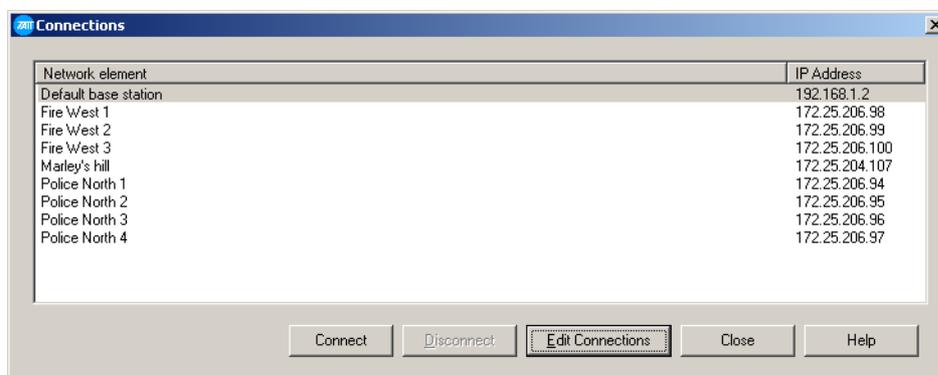
To connect to a network element

1. Make sure that the CSS PC is connected physically to the network element. It can be connected by an Ethernet cable to a hub on the TaitNet P25 digital network or directly to the network element's Ethernet line. For the direct connection, an ordinary or a crossover Ethernet cable can be used; the Ethernet interface supports both.
2. Make sure that the CSS PC has a suitable IP address and subnet mask. The network administrator can help 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 Network Element](#)” on page 29. You may also need to tell the PC how to route to the TaitNet P25 digital network, see “[Defining Routes for a Networked PC](#)” on page 29.
3. Run the CSS software.



Important: If the PC is running multiple instances of the CSS, make sure that you do not connect a second CSS to the same network element. The network element allows this but it is not supported and it is likely to cause problems.

4. On the CSS toolbar, click **Connect**. The Connections dialog box appears and displays a list of network elements that you can connect to.



5. Click on the row with the network element name and IP address. If the network element 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 network element password, it asks you to supply it.

If the network element is new, don't enter anything; just click OK. This is because network elements are supplied with a null password. (When you make subsequent connections, the CSS does not ask for a password, because it now knows that the network element password is null.)

To set a network element password, wait till you are connected, and then select Element > Change Network Element Password. You can only set the password once the CSS is connected to the network element.

Once the connection is established, 'Connected' appears in the CSS status bar. If there is a connection icon in the system tray of the operating system, 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 network element 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 digital network. Without a correct entry in the network routing table, the CSS will be unable to remotely connect to the network element. To define a route, use 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 digital network, add one or more persistent routes in the format:

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

For example:

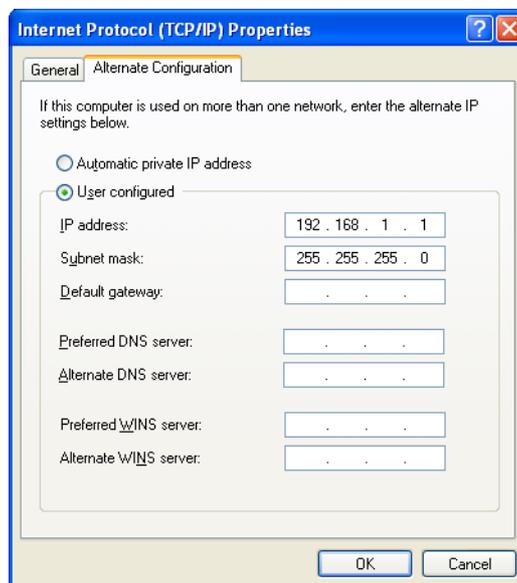
```
route -p add 172.16.16.0 mask 255.255.240.0 172.25.206.252
```

Connecting a Networked PC to a Network Element

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 network element. 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.



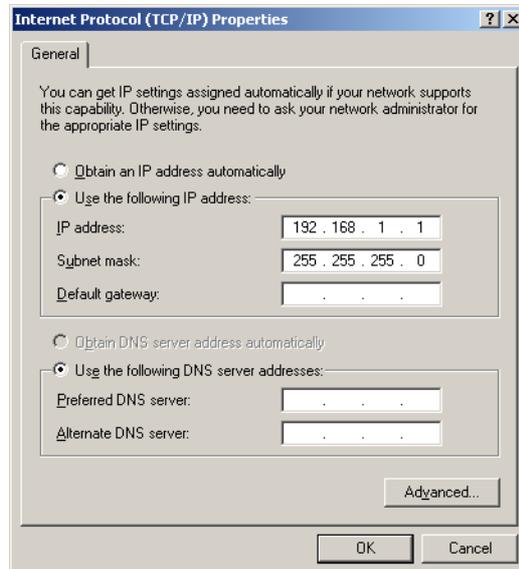
The CSS should now be able to connect to any physically connected network element that is on the same subnet.

10. Once the CSS session is finished, 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 **Internet 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 or P25 Console Gateway. For example, if a 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 network element.

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 the attempt to connect to a network element failed, consider these possible causes.

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

Disconnecting

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

If the network element is in Standby mode, the CSS reminds you of this and asks you to confirm that you want to proceed. This is to make sure that you do not inadvertently leave the network element out of service after a CSS session. Select No to cancel disconnecting, and then change the network element's mode back to Run before disconnecting.

Changing Mode

Normally, the network element operates in Run mode. However, some functions are only available in Standby mode.

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

If the network element is still in Standby mode when you end a CSS session, you are asked to confirm. This is so that you do not inadvertently leave the network element out of service.

To put a network element in Standby mode

1. Connect to the network element.
2. On the toolbar, click **Standby**. You are asked for confirmation.



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

To put a network element in Run mode

1. If necessary, connect to the network element.
2. On the toolbar, click **Run**. The network element is now fully operational.



If the network element 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 channel module to Tait.

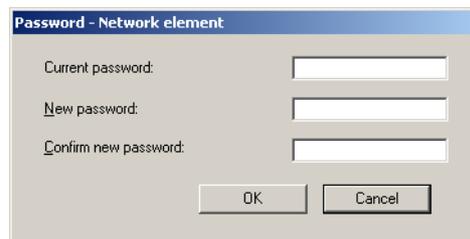
Error code 10: The network element does not have the licenses that enable it to operate in Run mode. Obtain one or more licenses and use the Software Feature Enabler to let the network element operate in analog FM and/or digital P25 modes.

Assigning a Network Element Password

Each network element can be given a password to safeguard access to it. A CSS must know the password before it is able to connect to the network element. If you do not give the network element 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 network element.

To assign or change a network element password

1. Connect to the network element.
2. Select Element > Change Network Element Password.
3. If requested, provide the Administrator access code. The Password - Network Element dialog box appears.



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



Note: If the network element password is lost, contact your Tait dealer.

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

Resetting the Network Element

The CSS can remotely reset the network element. This may become necessary if the network element stops functioning properly.

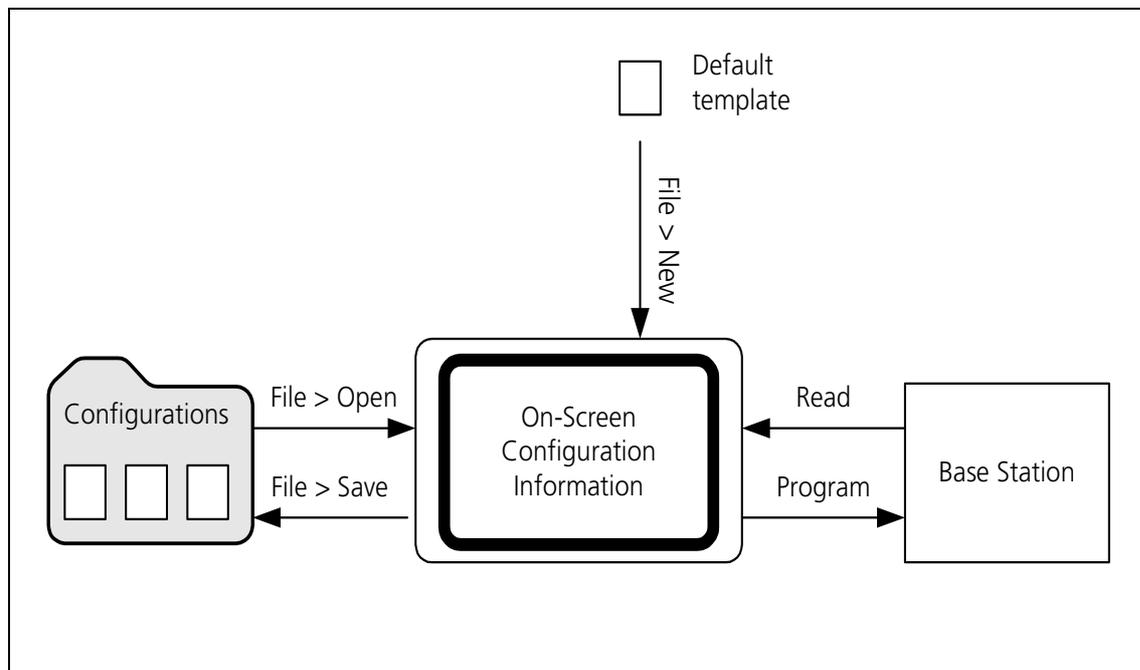
1. Select Element > Reset Network Element.
2. Wait for the network element to restart, and then connect to it again. Attempts to connect before the control panel LEDs have been turned off for at least 10 seconds will fail.

Working with Configurations

Network elements are programmed with many configuration settings. Using the CSS, you can view these settings, change them, and then program them into the network element.

- Configuration works differently from other CSS functions. Once you are connected to a network element, you can monitor it but you can't yet view its configuration. First you must click the Read icon, which instructs the network element to supply its configuration information.
- Programming the network element with a new configuration can only be done when the network element is in Standby mode.
- It is a good idea to always save a configuration to file immediately before programming it into a network element.
- The CSS can obtain configuration information from a network element, 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 network element 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 network element. 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 network element is delivered. When the network element arrives, you just open the configuration file and program it in. (This method completely overwrites the network element's current settings.)

To create a new configuration

1. Select File > New.
2. Click **Configure** in the toolbar and make the desired configuration changes.
3. Select File > Save As, give the configuration a name, and save it.

Reading a Network Element Configuration

Before you can view a network element's configuration settings, the CSS must read them.



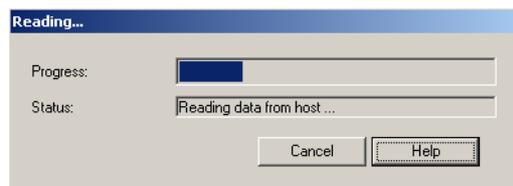
Note: If the CSS has an open [configuration file](#), save it first; reading a configuration overwrites any configuration that the CSS has in memory.

To read a configuration

1. Connect to the network element.
2. Click **Read**.

The CSS reads the network element's configuration information.

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



Once 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 network element 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. Save them just before you program them into a network element. This gives you a backup, in case the network element fails or the configuration is corrupted.

To save configuration settings

1. After making any changes to configuration settings, click **OK** to confirm them.
2. Click **Save** on the toolbar.

If the configuration settings are already named, they are saved. If not, the Save File As dialog box appears. Continue as follows:

3. Enter a name for the configuration file into the **File name** box.
4. To save the configuration file somewhere other than in the Configurations folder, navigate to another folder.
5. Click **Save**. The file name appears on the CSS title bar.

Programming a Configuration into a Network Element

Any configuration changes made using the CSS only take effect once they have been programmed into the network element. Programming only affects the settings that you can view after clicking **Configure**.

To program a configuration into a network element

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 network element (if you aren't already).
4. Put the network element 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 network element, you are asked for confirmation. Click **Overwrite** to change the network element's IP address or subnet mask. Click **Keep Existing** to program the configuration into the network element but keep the network element's existing IP address and network mask.

The Program dialog box appears and indicates the download progress. When the network element 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 network element's IP address or subnet mask, reset the network element so that the new parameters take effect.
9. Return the network element to Run mode.

Synchronizing a Configuration File

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



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

To synchronize a configuration file

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

Handling Older Configuration Versions

If you read a network element configuration (or open a configuration file) and its version is older than the CSS, a warning appears. This is because the CSS and the network element communicate configuration and monitoring data based on a database with a defined structure. If the network element 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 network element that you intend connecting to. Use an older CSS whose version matches the network element, or upgrade the network element 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 network element:

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

Programming

If you program this configuration back into the network element, the following occurs.

- The network element 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 network element configuration (or open a configuration file) and its version is newer than the CSS, a warning appears. This is because the CSS and the network element communicate configuration and monitoring data based on a database with a defined structure. If the network element 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 network element 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 network element:

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

Programming

If you program this configuration back into the network element, the following occurs.

- The network element 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 Network Elements

The CSS can monitor, configure, and carry out diagnostic tests on different TaitNet P25 network elements. Network elements include various types of TB9100 base station and P25 Console Gateways. These in turn consist of various module combinations. The following gives some guidance on how to use the CSS with different module combinations.

Single-channel Base Station

For a subrack with a PMU and a single reciter and PA, there are no special considerations.

P25 Console Gateway

The P25 Console Gateway has a channel table and profiles, like a TB9100 base station. It has no RF interface, so forms that monitor, configure, or diagnose that interface have no effect. There is no PA. Like a TB9100, the gateway operates on a channel that is selected by Task Manager action. The channel specifies the channel group that the gateway belongs to and the default calling profile.

PMU

If present, the PMU is associated with channel module 1 (the right-most reciter or gateway module in the subrack, looking from the front). When the CSS is connected to another channel module, it cannot monitor, configure, or diagnose the PMU. The Alarm Status form will report 'No PMU detected' and other PMU alarm LEDs will be gray. Power configuration settings (Configure > Base Station > Miscellaneous) are editable, but have no effect. PMU control tests also have no effect.

- Disable the 'No PMU detected' alarm for channel modules other than channel module 1.
- Make sure that any Task Manager actions involving the PMU are programmed into channel module 1.
- If there is no PMU, disable the 'No PMU detected' alarm on all channel modules.

PA

Receive-only base stations and P25 Console Gateways have no PA. The Alarm Status form will report 'No PA detected' and other PA alarms will be gray. PA control tests have no effect.

- Disable the 'No PA detected alarm (Configure > Alarms > Control). This stops the control panel alarm LED flashing because of this alarm.

Fan alarms

Fan alarms are passed from the fan via the control panel to the channel module that is currently selected on the control panel. The CSS cannot monitor fan alarms if it is connected to a different channel module. The display of fan states in Diagnostic forms will only be correct for the currently selected channel module.

- Make sure that any Task Manager actions involving the fans are programmed into channel module 1.
- Disable the 'Fan failed' alarm for any fan that is not fitted.
- Disable the PA 'Fan failed' alarm for all channel modules, except (if it has a PA) reciter 1.
- Disable the PMU 'Fan failed' alarm for all channel modules, except (if there is a PMU) channel module 1.
- We recommend that you select channel 1 on the network element's control panel, so that fans can be remotely monitored by connecting a CSS to channel module 1. (Other channel modules can be selected during on-site monitoring and diagnostics.)

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 for maintaining the list of network elements that the CSS can connect to. This list is stored in the host information file (conncfg.dat).

To add a network element to the list

1. Select Tools > Connections.
2. In the Connection List, enter the name of the network element and its IP address. The entry should have the following format:
Network element name = 172.25.206.26
3. To avoid confusion, make sure that the same name is programmed into the network element (Configure > Channel Group > Network Identity).
4. If desired, copy the file containing the connection list to other PCs that run CSS.

Alternatively, use any text editor to edit the conncfg.dat file.

Firmware Download

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



Note: The CSS cannot update the network board's operating system kernel and some of its firmware. These items must be updated using TFTP, see TN- 977b.

The network element 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 network element modules. The release notes contain a compatibility table indicating the hardware versions that are compatible with any particular firmware version. The CSS also prevents the downloading of firmware that would lead to incompatibility between firmware and hardware or between modules.



Important: For security reasons, upgrading or downgrading network board firmware zeroizes any stored encryption keys. Before upgrading the firmware in a gateway module, make sure that you will be able to immediately re-load these keys.

Firmware Download Form

The Firmware Download form (Tools > Firmware Download) displays information about the versions installed on the network elements and in the set of firmware that you select. You can initiate a download and monitor its progress.

Download

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

	Firmware	Kernel	Required hardware
Network board:	2.24	2.10	0.01
PA:	96.31		0.01 .. 0.02
PMU:	Loaded		0.01 .. 0.02
Digital board:	2.23		0.03 .. 0.06
Crypto module:	1.01		

Force Download

In the list box, 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.)

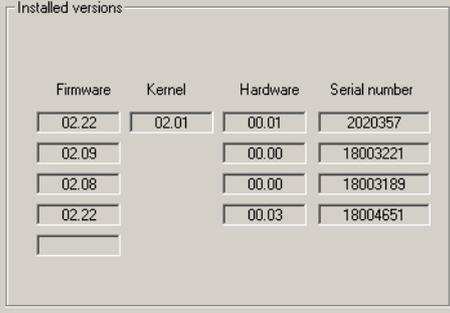
The rest of the Download area displays version numbers of the individual items of firmware in the selected set: Network board, power amplifier, power management unit, digital board, and crypto module (P25 Console Gateway only). It also shows the versions of hardware that the firmware can work with.

When you install the CSS, firmware for the different network element 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 network element. |
| 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 network element. A red version number means that the kernel version installed on the connected network element 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 | <p>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.</p> <p>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 network element. You are unable to download.</p> |
| Force download | Enable the Force download check box to repeat the download of a firmware version. 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 network element. It also displays the serial numbers of each module, so that you can check that you are connected to the correct modules.



Firmware	Kernel	Hardware	Serial number
02.22	02.01	00.01	2020357
02.09		00.00	18003221
02.08		00.00	18003189
02.22		00.03	18004651

Downloading Firmware

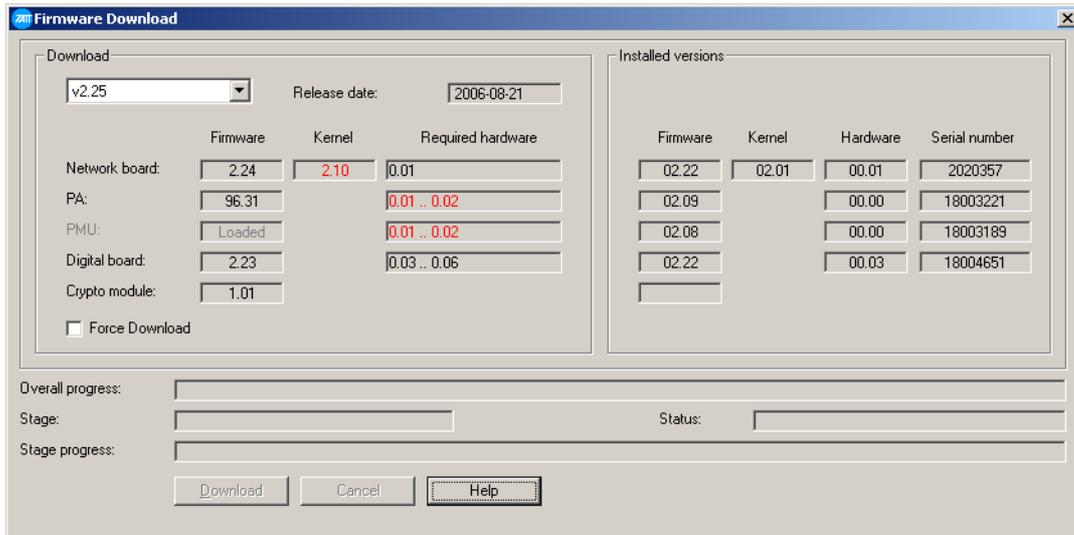
A set of firmware files is copied into the CSS's Firmware Files folder at installation. More recent firmware can be obtained from the Tait support site. Copy the file containing the set of firmware (firmware.exe) to the Firmware Files folder (the default location is C:\Program Files\Common Files\Tait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



Important: Save a backup copy of the network element configuration before downloading firmware. This is a precautionary measure; the backup may be needed if the firmware download does not successfully complete on the first attempt.

To download new network element firmware

1. Run the CSS software and connect to the network element.
2. Read the network element's configuration and save it to a file, so that if necessary, you can restore it manually (see [“Manually Updating the Configuration”](#) on page 43).
3. Select Tools > Firmware Download. The Firmware Download dialog box appears.



The CSS obtains information about the network element'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 version numbers in the Required Hardware column appear in red, the selected firmware is incompatible with the network element'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. Click **Download**.

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

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

8. When the CSS asks you whether to overwrite the network identity or keep the existing network identity, choose overwrite, otherwise the network element will have a default identity instead of its identity in your network.

Once the stored configuration is loaded, the network element 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, repeat the download procedure. When that is completed, you must manually restore the configuration, see [“Manually Updating the Configuration”](#) on page 43.

9. Re-open the Firmware Download form and verify that the network element 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 network element.
12. If you upgraded the network board firmware or kernel, re-load any encryption keys. (A firmware upgrade zeroizes any stored encryption keys.)

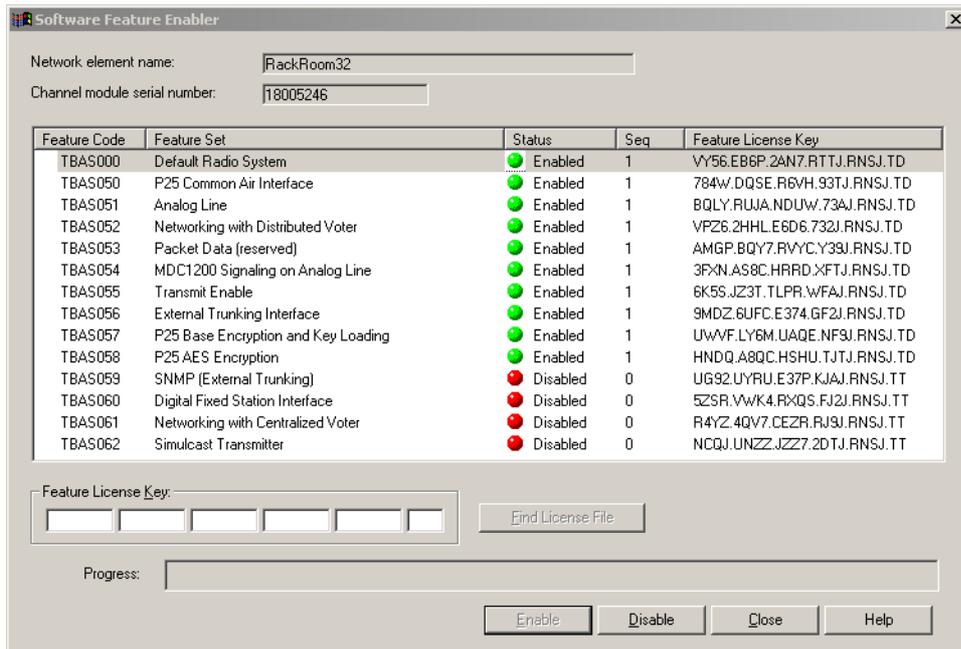
Manually Updating the Configuration

If you needed to repeat the download procedure, the network element's configuration is probably unusable and must be restored from backup. After repeating the download, follow these steps.

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 network element firmware.
2. Check the default settings of any new data items (information in the Release Notes) and change any that do not suit the system.
3. Save the configuration (do not overwrite the old configuration file) so that you have a backup.
4. Program the configuration back into the network element.

Working with the Software Feature Enabler

Use the software feature enabler (Tools > Software Feature Enabler) to enable additional features in the network element you are connected to. For a description of these features, see [“Software Feature Licensing” on page 13](#). The network element already has these features but it needs license keys to enable them. Each network element requires a unique license key for each feature. A license key for one network element cannot be used in another. The software feature enabler displays the status of all features. You can disable any that are enabled.



The form displays the name of the network element you are connected to and its channel module serial number. 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 Required

To determine which feature licenses you need, apply the following rules (full details are in the table below).

To determine feature licenses for a TB9100 base station

The default radio system license is always included. The transmit enable license is also included, unless the base station is a fill-in receiver.

1. If the base station will handle digital P25 speech calls, obtain the P25 common air interface license.
2. If the base station will be part of a channel group but not the central voter or its backup, obtain a networking with distributed voter license.
3. If the base station will use its analog line and carry digital P25 speech, obtain an analog line license. If the console system uses MDC1200 signaling, obtain an MDC1200 signaling on analog line license as well.
4. If the base station will be the channel group's interface to a digital dispatch system, obtain a digital fixed system interface license.
5. If the base station will interface the channel group to a trunking site controller, obtain an external trunking interface license. In addition, all channel group members will require the SNMP (external trunking) license.
6. If the base station will operate as the central voter or the standby central voter, obtain a networking with centralized voter license.

To determine feature licenses for a P25 Console Gateway

The default radio system, analog line, networking with distributed voter, and P25 base encryption and key loading licenses are always included.

1. If the console system uses MDC1200 signaling, obtain an MDC1200 signaling on analog line license.
2. If the network uses AES encryption, obtain a P25 AES encryption license.
3. If the Console Gateway will be connected to a digital dispatch system, obtain a digital fixed station interface license.

Feature License	Affected Interfaces	License Required for the Service?			
		Analog FM	Digital P25	TSBK	Channel ¹ control
Default radio system ²	All	Y	Y	Y	Y
P25 common air interface ²	RF	N	Y	N	n/a
Analog line ³	Analog line	N	Y	N	N
Networking with distributed voter	Channel group	Y	Y	Y	Y
MDC1200 signaling on analog line ⁴	Analog line	n/a	n/a	Y	n/a
Transmit enable	RF	Y	Y	Y	n/a
External trunking interface ⁵	TCCP	Y	Y	Y	Y
P25 base encryption and key loading ⁶	Analog line	N	Y	N	n/a
P25 AES encryption ⁷	Analog line	N	Y	N	n/a
SNMP (external trunking)	SNMP	n/a	n/a	n/a	n/a
Digital fixed station interface	DFSI	Y	Y	Y	Y
Networking with centralized voter	Channel group	Y	Y	Y	n/a

- 1.Channel control includes the ability to carry out the following: Repeat enable/disable, channel change, encryption defeat, monitor
- 2.The base station or P25 Console 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.Determines whether ANI and the conversion between MDC1200 and TSBKs is supported.
- 5.Only available for operation with external trunking equipment.
- 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.

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 network element.
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 network elements) to the 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 network element 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.



Note: Many features also have a configuration setting that enables or disables them. Often, the default setting is 'enabled.'

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 network element configuration does not use it. Once a feature is disabled it does not work, even if the CSS configuration enables it.

If the network element configuration requires a function but the software feature enabler has disabled it, a syslog message will be generated when the network element attempts to implement the function. For example, if you disable the P25 common air interface, but use a calling profile that tells the network element 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 to the network element.
2. Go into Standby mode, and then select Tools > Software Feature Enabler.
3. Check the **Channel module serial number** box to make sure that the CSS is connected to the correct network element.
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, asking for an access code.

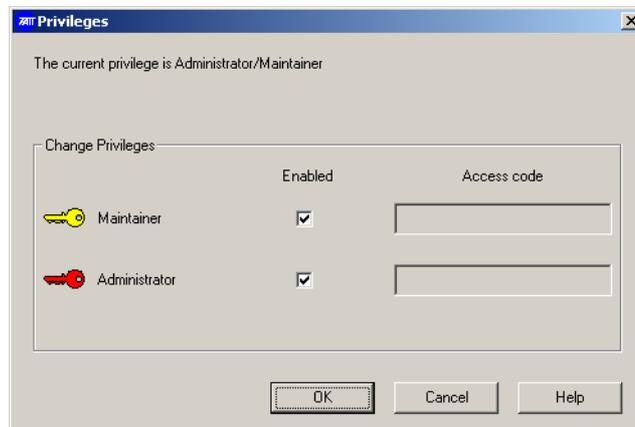


1. Enter the access code for the required privilege.
2. Click OK. The Privileges icon on the toolbar indicates the privileges you now have. A yellow key indicates Maintainer privilege. A red key indicates Administrator privilege.



Changing Privileges

The Privileges dialog box indicates which privileges are currently active. You can enable or disable privileges. You may, for example, have enabled Administrator privilege in order to change a network element 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, set up access codes 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 for which you want to set up or change an access code.
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

Using the Options menu you can 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	Specifies the default location that the CSS looks in when opening configuration files and saves to when saving them. (This may have been chosen during installation.)
Firmware files	Specifies where the CSS will look for firmware files when you ask it to download new firmware into a network element. If you receive new firmware for a network element 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 network element. If you receive a license file, copy it to this folder.

Part D Monitoring

The CSS can monitor Tait P25 network elements. 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 network element is in Run mode; it has no effect on the element's operation.

For information about monitoring alarms, see ["Alarms" on page 141](#). For information about monitoring Task Manager, see ["Monitoring Task Manager" on page 209](#).

To monitor a base station or P25 Console Gateway, connect to it, click **Monitor**, and select an item from the navigation pane.

Interfaces

- [Monitoring the RF Interface](#)
- [Monitoring the Channel Group Interface](#)
- [Monitoring the Analog Line](#)
- [Monitoring the TCCP Interface](#)
- [Monitoring the DFSI Interface](#)

Channel Group

- [Monitoring Channel Group Status](#)
- [Monitoring the Channel Coordinator](#)

Modules

- [Monitoring the Reciter or Gateway Module](#)
- [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 or Gateway Module Information](#)
- [Viewing Power Amplifier Information](#)
- [Viewing Power Management Unit Information](#)

Interfaces

The CSS can monitor the network element's interfaces. You must be connected to that network element.

Monitoring the RF Interface

The RF Interface form (Monitor > Interfaces > RF Interface) shows what the receiver and transmitter 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

Most information in this form is not relevant to the P25 Console Gateway.

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 > Network Element > Channel Table) and in the profiles assigned to the channel.

The 'Current channel' form displays the following configuration settings:

Name:	Channel 001	Number:	1	Channel profile:	Dual Mode
Transmit frequency:	170 MHz	Tx deviation:	2500 Hz	Transmit power:	5 W
Receive frequency:	171 MHz	Channel spacing:	12.5 kHz	Signaling profile:	SP1

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).

The 'Receiver' form displays the following status and configuration information:

- Status: Enabled Disabled Lock
- Valid channel: Valid channel Invalid channel
- Synthesizer: Synthesizer Invalid
- Gated: Gated Analog Digital P25
- NAC: Configured 29F Received 29F Lock
- Subaudible: CTCSS 146.2 Hz DCS 114 Lock
- Signal Quality: EVM BER: 0.0000 %
- RSSI: N/A (Scale: -60 to -120)
- SINAD: N/A (Scale: 6 to 20)

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 indicate 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 monitors NAC detection.

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 monitors the detection of subaudible signaling.

LED Color	Meaning
Green	The receiver has detected a valid DCS code or the particular CTCSS 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, DCS code, or 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.

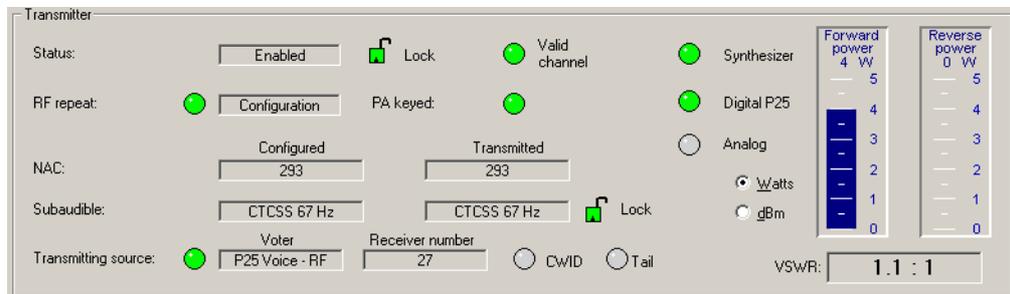
- SINAD The SINAD gauge displays the signal-to-noise ratio of the received signal in dB. The equivalent numeric value appears under the gauge heading. If this value is red, it exceeds the maximum or has fallen below the minimum that the gauge can display. A pointer indicates the configured threshold 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, RF repeat is enabled and the transmitter will repeat any vote-winning RF signal that the base station or channel group receives.

When the RF repeat LED is gray, the RF repeat setting is currently disabled.

The box alongside indicates the cause of the current RF repeat setting.

Reason	Description
Config	The RF repeat setting was selected by configuration.
RF link	The base station is configured as a linking transceiver. This disables local RF repeat. However, network repeat is still enabled.
Trunking	Trunking operation caused the current setting. Beginning to operate as a control channel disables RF repeat. Beginning to operate as a traffic channel causes the base station to use the RF repeat setting in the channel table. If the base station is 'down', RF repeat is disabled.
Dispatch local	A dispatch command enabled or disabled RF repeat. This command was from a locally connected digital dispatch console or from a Task Manager action (Enable/Disable/Toggle RF repeat). The Task Manager action can implement a local or a remote dispatch command. This can only happen if the channel table has put RF repeat under dispatcher control.
Dispatch remote	A dispatch command enabled or disabled RF repeat. This command was from a digital dispatch console connected to another channel group member. This can only happen if the channel table has put RF repeat under dispatcher control and the channel group configuration enables collective control of RF repeat.

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 when 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.

Voter The Voter box shows where the signal being transmitted came from.

Display	Description
FM - Line	An analog FM call received over the analog line or DFSI
FM - IP	An analog FM call received over the digital line from another channel group member.
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 or DFSI
P25 Voice - IP	An digital P25 call received over the digital line from another channel group member.
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.

Receiver number The receiver number of the network element that provided the signal being transmitted.

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 Channel Group Interface

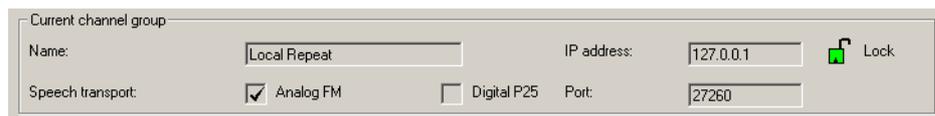
To help in troubleshooting, the Channel Group form (Monitor > Interfaces > Channel Group) monitors the network element's operation as part of a channel group. Use the form for the following:

- Checking channel group settings when installing the system
- Monitoring network link operation and measuring network jitter
- Checking for transmit buffer underflows

Checking Channel Group Settings

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

1. Select Monitor > Interfaces > Channel Group.
2. Check that the **Software feature enable** check box is selected. If it is cleared, the network element does not have a networking feature license and is unable to be part of a channel group.
3. Under **Current channel group**, check the settings displayed. These are a subset of the settings in the Channel Groups dialog box (Configure > Channel Group > Channel Groups and click Edit).



Current channel group			
Name:	Local Repeat	IP address:	127.0.0.1  Lock
Speech transport:	<input checked="" type="checkbox"/> Analog FM	<input type="checkbox"/> Digital P25	Port: 27260

- Confirm that the expected channel group is in use. The network element uses the channel group that is assigned to the current channel.
- Check that the required types of voice stream can be sent to the channel group. If **Analog FM** is selected, the digital line can send analog FM voice streams to other channel group members. If **Digital P25** is selected, the digital line can send digital P25 voice streams.
- Check that the **IP address** is correct. This is the (normally multicast) address of the current channel group. The network element sends voice streams to this address and (if the address is multicast) receives voice streams that have this destination address.
- The **Port** is not normally changed from the default.
- Check that the padlock symbol is open. If it is closed, Task Manager has locked channel group communications and the network element will not send anything to or receive anything from the channel group.

Monitoring the Network Link

To monitor the network element's network link to other channel group members, select Monitor > Interfaces > Channel Group and view the Quality of Service area. This area displays quality of service values for the current incoming voice stream.

Quality of service	
Incoming	
Jitter (ms):	9
Packet loss (per call):	0
Average loss (per second):	0

- Jitter** The delay variation of RTP packets arriving at the connected network element. 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

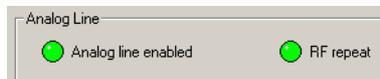
If the jitter on the incoming voice stream is high, the transmit buffer may not be able to cope. To check the buffer, select Monitor > Interfaces > Channel Group and view the Transmitter area.

Transmitter	
Initial delay:	50 ms
Underflow (last 15 min):	0 %
Underflow (worst 15 min):	0 %

- Initial delay** The configured length of time in milliseconds that the transmitter waits before beginning to transmit voice. This is the preamble duration that is set in the Network form (Configure > Channel Group > 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, lengthen the preamble (see [“Configuring the Jitter Buffer” on page 122](#)).
- 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, lengthen the preamble (see [“Configuring the Jitter Buffer” on page 122](#)).

Monitoring the Analog Line

The Analog Line form (Monitor > Interfaces > Analog Line) indicates 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

The RF repeat LED only has meaning if the CSS is connected to a base station. 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 an analog 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 network element 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 network element switches any vote winner onto the analog line. If the squelch is Selective, the network element 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.

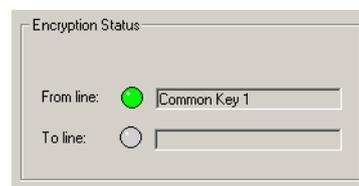
- Emergency When the Emergency LED is green, any calls that the analog line makes will be emergency calls. This is because the current calling profile configures them that way. **It does not mean that the base station is currently receiving an emergency call.**
- Call type Defines the type of call that the channel group makes when the dispatcher initiates a call. (The analog line can always forward incoming 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 96](#).
- 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	<i>Key name</i>	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. Speech is transmitted clear.

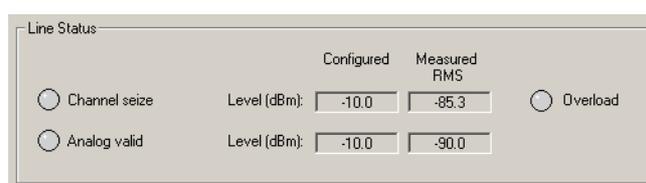
To line

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	<i>Key name</i>	The speech has been decrypted using the named key. If the key has no name, the CKR number is displayed.
Red	Clear	The speech is clear but should not be; the calling profile specifies an encryption key.
Red	<i>Key name</i>	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 no name, its CKR number is displayed.
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 P25 Console 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. Configure the console system to reduce the level of its HLGT output.

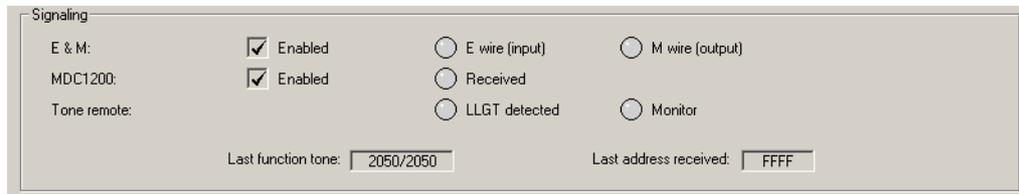
The second row of controls displays information about the analog line output.

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

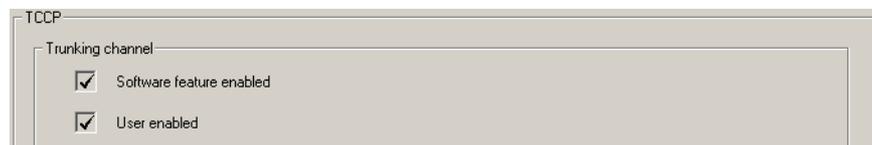
The Signaling area shows the status of line signaling on the analog line. Check boxes indicate what is enabled in configuration and LEDs show what signaling is currently happening.



- | | |
|-----------------------|---|
| 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 network element has detected that the E wire has been asserted. If the M Wire (output) LED is green, the network element 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 analog line has detected incoming MDC1200. |
| 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 analog line received a dispatcher command to monitor the channel. |
| 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. |

Monitoring the TCCP Interface

Using the TCCP form (Monitor > Interfaces > TCCP) you can monitor the operation of the interface between the trunking site controller and a channel group. In a channel group, only the master base station has a TCCP interface. Connect the CSS to the master base station for full details. If you connect to another channel group member, only the Channel area provides information.



Software feature enabled

If this check box is cleared, the base station does not have a license enabling the TCCP interface. Only the master base station needs this license.

User enabled

If this check box is cleared, a TCCP interface is not enabled in the base station configuration (Configure > Channel Group > Trunking).

External trunking controller

The external trunking controller area monitors the connection to the trunking controller.



Site controller

A green LED indicates that the base station is receiving heartbeat messages from the trunking site controller. There is a TCCP connection.

IP address

The IP address of the trunking site controller.

Configured listening port

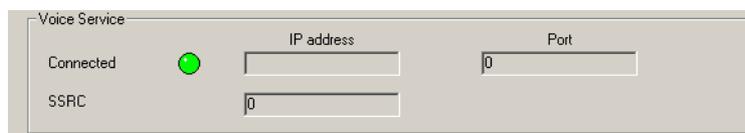
The port that the base station is listening to for TCCP communications. This port is defined by configuration.

Talking port

The port that the base station sends its control service communications to. The base station obtains this port number from the site controller's requesting packet.

Voice service

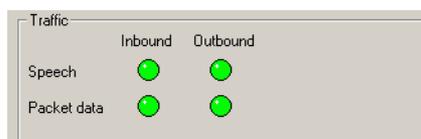
The Voice service area monitors the voice service that is established for traffic channels by the TCCP connection. (If the base station has a DFSI connection, the Voice service and Traffic areas will display voice service information, but this should not be relied upon. Use the DFSI form instead.)



IP address	The IP address that the base station is configured to send voice streams to. This can be the trunking controller or another device.
Port	The UDP port that the base station sends voice streams to. The base station obtains the port number from the trunking controller's connection message.
SSRC	The SSRC (synchronization source) currently being used. The SSRC is a large number specified by the trunking controller in its connection message. It uniquely identifies voice streams sent from the master base station.

Traffic

The Traffic area indicates the types of communication that the voice service is carrying.



Speech	A green LED indicates that the TCCP interface is carrying speech. Inbound speech is from a SU to the trunking controller, outbound speech is from the trunking controller to one or more SUs.
Packet data	A green LED indicates that the TCCP interface is carrying packet data.

Channel

The Channel area indicates the operational state of the base station. This area also displays information when the CSS is connected to base stations other than the master.



Channel type	Displays the operational state of the base station.
--------------	---

Display	Description
Control channel	The base station is functioning as (part of) a trunking control channel.
Traffic channel	The base station is functioning as (part of) a traffic channel.
Conventional	The base station is operating in conventional mode. Configuration has not permitted a TCCP connection (Configure > Channel Group > Trunking).
Down	The base station is down. Either the trunking controller has taken the channel out of service or it has not yet received any trunking controller communications.
Isolated control channel	The base station is still (part of) a control channel but has lost its TCCP connection to the trunking controller.
Isolated traffic channel	The channel continues to function as (part of) a traffic channel but has lost its TCCP connection to the trunking controller.
Standby	The base station is in Standby mode.

Connected

A green LED indicates that the base station is part of a channel group that is connected to a trunking controller. More precisely, the master base station is receiving heartbeat messages from the trunking controller and this base station is functioning as (part of) a traffic channel or a control channel. A gray LED indicates that the channel group has lost its TCCP connection or never had one.

Monitoring the DFSI Interface

Using the DFSI form (Monitor > Interfaces > DFSI) you can monitor the operation of the interface between digital dispatch equipment and a channel group. The CSS must be connected to the channel group member with the DFSI (digital fixed station interface).

DFSI

Software feature enabled

User enabled

Software feature enabled

If this box is cleared, the network element does not have a license enabling the DFSI.

User enabled

If this box is cleared, the DFSI is not enabled in configuration (Configure > Channel Group > Network).

Control service

The Control service area monitors the control service provided by the DFSI.

Control service

Connected 

IP address

Configured listening port

Talking port

Connected	A green LED indicates that the DFSI is active. The network element has received a connect message and has responded to it. It is able to receive and action control commands from the FSH.
IP address	The IP address of the FSH control service.
Configured listening port	The port on which the network element is listening for DFSI communications. This port is defined by configuration.
Talking port	The port that the network element sends its control service communications to. The network element obtains this port number from the FSH.

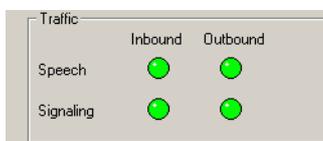
Voice service

The Voice service area monitors the voice service provided by the DFSI. (If the network element has a TCCP connection, the Voice service and Traffic areas will display voice service information, but this should not be relied upon. Use the TCCP form instead.)

IP address	The IP address that the network element sends voice streams to. Depending on the configuration, this could be the control service IP address or a different unicast or multicast address.
Port	The UDP port that the network element sends voice streams to. It obtains this port number from the connection message.
SSRC	The SSRC (synchronization source) currently being used. The SSRC is a large number specified by the FSH in its connection message. It uniquely identifies voice streams sent from the channel group master to the FSH.

Traffic

The Traffic area indicates the types of communication that the DFSI is carrying.



Speech	A green LED indicates that the DFSI is carrying speech. Inbound speech is from a SU to the FSH, outbound speech is from the FSH to one or more SUs.
Signaling	The LED lights green briefly to indicate that a TSBK was sent or received.

Channel Group

The CSS can monitor information about the whole channel group. Status information is provided by the channel group member that the CSS is connected to and is displayed in tables, with one row of information for each channel group member. The CSS also displays status information about the channel coordinator of the member that the CSS is connected to.

Monitoring Channel Group Status

The Channel Group Status form (Monitor > Channel Group > Status) displays status information in two tables. The first table displays voting information and the second displays configuration information relevant to channel group operation.

Monitoring Channel Group Voting

The Group Status area (Monitor > Channel Group > Status) monitors the voting of the channel group. If voting is centralized, connect the CSS to the central voter; satellite voters do not indicate who is winning the vote.

Host name	Voting	CG mode	RF repeat	Rcvr num	RF Rx Type	RF Rx Impairment	RF Rx %	Line in Type	Line in Src	Skew
DVVBS12	Distributed	Simplex	True	12		15	0			0
DVVBS24	Distributed	Simplex	True	24		15	0			0
DVVBS27	Distributed	Simplex	True	27	P25	1	100			0

Green cells indicate the voice stream that has won the vote or been selected. If the channel group is duplex, there can be a winning inbound (subscriber) stream and an outbound (dispatcher) stream.

Host name The name of the channel group member.

Voting The type of voting taking place at each channel group member.

Display	Description
distributed	Voting is distributed among all channel group members. If one member has this voting type, all others should have the same type.
central voter	Voting is centralized at this channel group member. All other channel group members should display 'satellite' or 'satellite (central).' Only one member should display 'central voter' at any one time.
satellite	This channel group member has acknowledged that another channel group member is the central voter. This member plays a supporting role to the central voter.
distributed (central)	This channel group member is currently operating as a distributed voter but is configured for central voting. It is therefore a candidate central voter but something (for example, one member is version 2.2x) is preventing central voting.

Display	Description (Continued)
satellite (central)	This channel group member is currently operating as a satellite voter but is configured for central voting. Another channel group member is acting as the central voter. This is the expected voting type for a back-up central voter.
switched	There is no RF voting, but the channel group member still selects or prioritizes voice streams. This setting is appropriate if the channel group receivers do not have a common uplink frequency.
(blank)	The member is in Standby mode. Normal voting and switching does not operate. However, the control panel can still receive and make calls. These calls will only be visible in the table if the CSS is connected to this member or to the central voter.

A cell with a colored background indicates that a dispatcher command has modified the member's voting behavior. (Not currently supported.)

Display	Description
green	The dispatcher has selected the member's receiver. This receiver's signal will always win the vote. If this receiver has no signal, the channel group votes as it is configured to do.
red	The dispatcher has disabled the member's receiver. The receiver's signal cannot win the vote.

CG Mode Displays the mode of the channel group.

Display	Description
duplex	The channel group can simultaneously handle an inbound (subscriber to dispatcher) and an outbound (dispatcher to subscriber) voice stream.
simplex	The channel group provides a single voted or selected stream at any one time. If the dispatcher is talking, subscribers cannot be heard.

RF repeat Indicates whether the member currently repeats the vote-winning output or not. This can be set by configuration, by dispatcher command, or by Task Manager action.

Rcvr num Displays the receiver number of the channel group member. This number is used by digital dispatch equipment, when the dispatcher selects or disables a receiver. It is also used in voting. Voice streams from members with a lower receiver number win the vote (or are selected) when other things are equal.

RF Rx Type Displays whether the call is digital P25 or analog FM.
If this and the two adjacent cells have a green background, the RF stream is winning the vote.

- RF Rx Impairment Displays the impairment value of the received signal. 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 RF Rx Type. For digital P25 calls, the impairment is based on an internal measure similar to EVM (error vector magnitude). For analog FM calls, it is based on an internal measure similar to SINAD.

- RF Rx % Displays the percentage of the time during the current call that this receiver won the vote.

- Line In Type Displays the type of call coming from the line in. This can be digital P25 or analog FM.

- Line In Src Displays the source of the call coming from the 'line in.' This can be DL (the DFSI), the analog line, or the control panel.

- Monitor Displays the source of a call when the dispatcher issues a monitor command. For example RF 5 indicates that the call came from the RF interface at receiver number 5.

- Skew The milliseconds of skew in the voice stream as it arrives at the central voter. The central voter always has a skew of 0. A skew of 20 means that the voice stream from that member is arriving at the central voter 20 ms later than the equivalent voice stream from the central voter. The central voter can only measure skew and compensate for it in digital P25 mode.

Monitoring Channel Group Configuration

The Group Status form (Monitor > Channel Group > Status) helps you check that all members of the channel group have a consistent configuration. This is particularly useful during network installation. Many settings need to be the same for all channel group members.

Host name	IP address	Rcvr num	Chan	Tx freq	Rx freq	BS mode	RFSS i/f
DVWBS12	172.16.34.12	12	1	487 MHz	475 MHz	Conventional	Analog line
DVWBS24	172.16.32.24	24	1	445 MHz	449 MHz	Conventional	
DVWBS27	localhost	27	7	457 MHz	447 MHz	Conventional	

The information displayed in this table is passed from other channel group members to the connected member using the RTCP protocol. The connected member supplies the information to the CSS.

- Host name The name of the channel group member. Check that each name is unique.

- IP address The IP address of the channel group member.

- Rcvr num The receiver number of the channel group member. This number is used by digital dispatch equipment, when the dispatcher selects or disables a receiver. It is also used in voting. Voice streams from members with a lower receiver number win the vote (or are selected) when other things are equal. Make sure that each channel group member has a unique number.

Chan	The member's current operating channel. Normally, all members are set up to operate on the same channel number. If the channel group is set up to handle channel change commands from the dispatcher, monitor this column when testing these commands.
Tx Freq	The transmit frequency of the member's current channel. 0.000002 MHz means that the base station is Version 2.x. These base stations do not put their transmit frequency in RTCP messages.
Rx Freq	The receive frequency of the member's current channel. 0.000002 MHz means that the base station is Version 2.x. These base stations do not put their receive frequency in RTCP messages.
BS Mode	The current mode of the channel group member.

Display	Description
Control channel	The base station is functioning as part of a trunking control channel.
Traffic channel	The base station is functioning as part of a traffic channel.
Conventional	The base station is operating in conventional mode. Configuration has not permitted a TCCP connection (Configure > Channel Group > Trunking).
Down	The base station is down. Either the trunking controller has taken the channel out of service or it has not yet received any trunking controller communications.
Isolated control channel	The base station is still part of a control channel but has lost its TCCP connection to the trunking controller.
Isolated traffic channel	The channel continues to function as part of a traffic channel but has lost its TCCP connection to the trunking controller.
Standby	The base station is in Standby mode. A CSS has taken it out of service

RFSS I/F Indicates whether the member is providing an interface to the channel group.

Display	Description
None	There is no channel group interface other than the RF interface and the control panel.
TCCP	The member has an active TCCP interface to a trunking site controller.
Analog line	The member has an active analog line interface, for example to analog dispatch equipment. (By default, all analog lines are active. To 'deactivate' an unused analog line so that it does not appear in this column, select Configure > Analog Line > Calling Profiles and disable its calling profiles.)
DFSI	The member has an active digital fixed station interface, for example to digital dispatch equipment.

Monitoring the Channel Coordinator

The Channel Coordinator form (Monitor > Channel Group > Channel Coordinator) monitors the operation of the channel coordinator in the channel group member that the CSS is connected to. The form displays the current state of the variables that are coordinated and indicates who is responsible for that state and what caused it. For more information about the channel coordinator, see the TaitNet P25 System Manual.

	Configuration	Collective	State	Originator	Cause
RF repeat	Enabled	True	Enabled	Local	Configuration
Channel number		False	6	Local	Task manager
Voter control			Normal	Local	Configuration
Monitor		True	False	Local	Configuration

Configuration Displays the configured setting for RF repeat.

Display	Description
Enabled	The entry in the channel table for the current channel enables RF repeat. RF repeat is enabled and cannot be disabled by collective control or by dispatcher command.
Disabled	The entry in the channel table for the current channel disables RF repeat. RF repeat is disabled and cannot be enabled by collective control or by dispatcher command.
DispatchControlled	The entry in the channel table for the current channel places RF repeat under dispatcher control. Dispatcher commands and collective control can determine the RF repeat state.

Collective ‘True’ means that the variable is under collective control; the coordinator will send channel control commands to and respond to commands from other channel group members.

State

The current state of the variables under the control of the channel coordinator.

Variable	State	Description
RF repeat	Enabled	Repeat is enabled. The base station transmits streams from SUs over the RF interface.
	Disabled	Repeat is disabled. The base station does not transmits streams from SUs over the RF interface.
Channel number	nnn (for example 3)	The number of the channel that the member is currently operating on.
Voter control	Normal	Normal voter operation.
	Selected	A dispatcher command has selected this network element's receiver as the vote winner.
	Disabled	A dispatcher command has prevented this network element's receiver from winning the vote.

Originator

The network element responsible for the present state of the variable.

Display	Description
Local	The channel group member that the CSS is connected to is responsible for the present variable state.
<i>nnn</i> (for example 3)	The channel group member with receiver number <i>nnn</i> is responsible for the present variable state.

Cause

The cause of the present state of the variable.

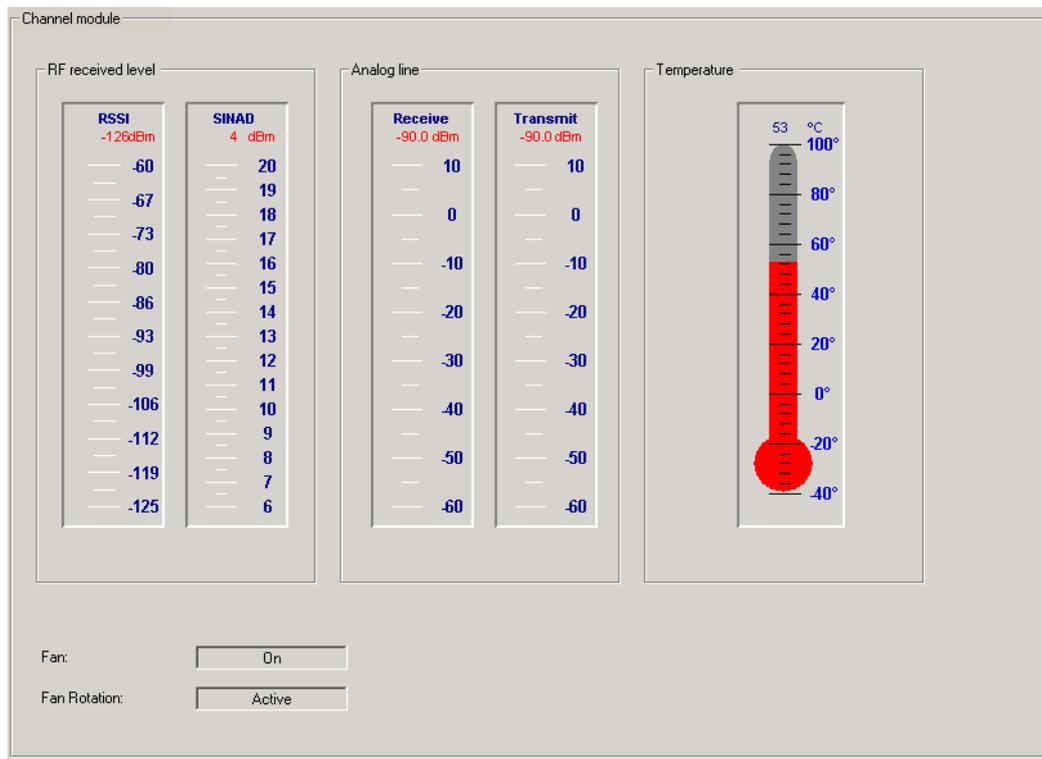
Display	Description
Configuration	The present state of the variable is due to the local configuration.
Task Manager	The present state of the variable is due to Task Manager action, triggered for example by an analog dispatch console command.
DFSI	The present state of the variable is due to a command from a digital dispatch command, received over the local DFSI interface.
power up	The present state of the variable resulted from power up.
IP	The present state of the variable resulted from a command sent over IP from another network element

Modules

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

Monitoring the Reciter or Gateway Module

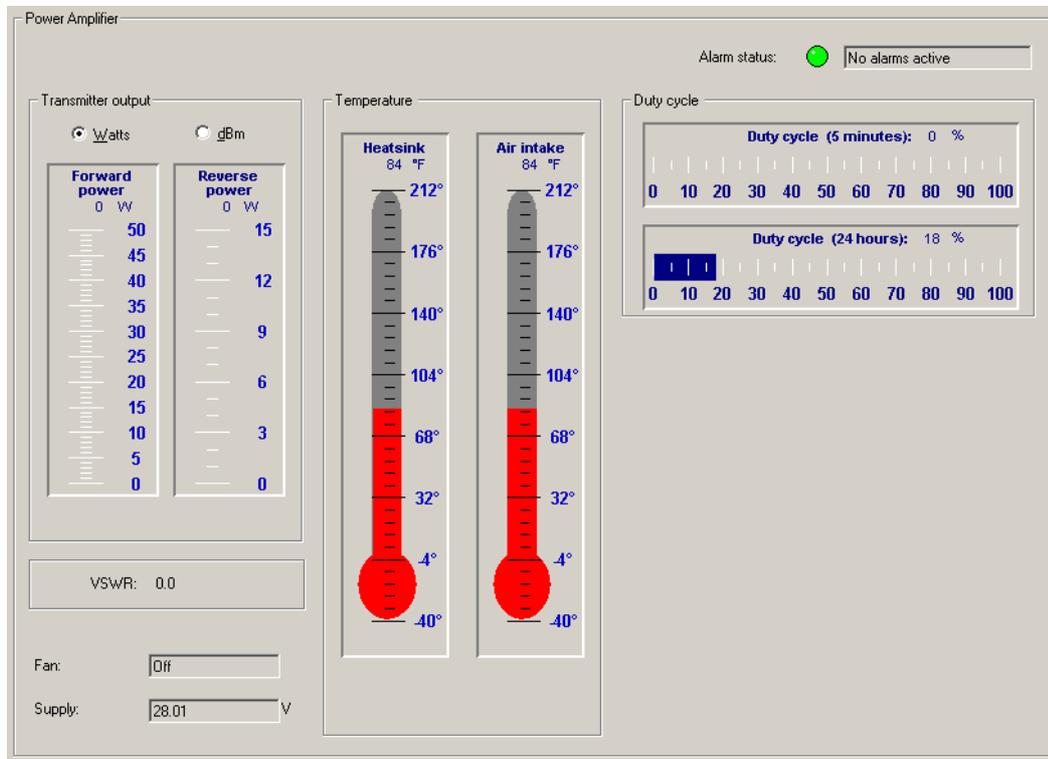
The Channel Module form (Monitor > Modules > Channel Module) monitors the [RSSI](#) and [SINAD](#) of the received RF signal and audio levels on the analog line. Each level is displayed graphically as a gauge. The equivalent numeric value appears under the gauge heading. If the value is red, it has exceeded 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. (For the equivalent RSSI in microvolts, see [“Converting Between Microvolts and dBm” on page 108](#)). 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 channel module heatsink.
- Fan** Displays whether the channel module has turned the fan on or off.
- Fan rotation** Active means that the channel module has detected fan rotation. Inactive means that the fan has failed, if the **Fan** box displays On. This box does not apply if the channel module is fitted with a 2-wire fan.

Monitoring the Power Amplifier

The Power Amplifier form (Monitor > Modules > Power Amplifier) monitors the levels of various PA 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.

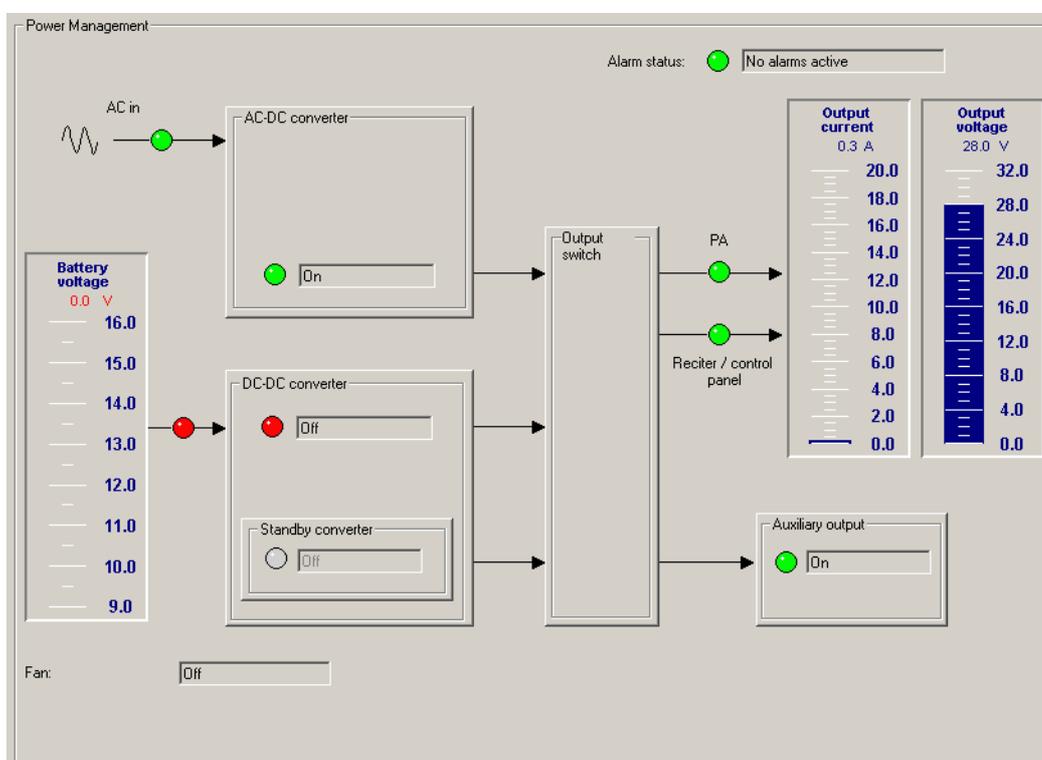
Alarm status	The Alarm status box indicates whether the PA has an alarm. If the LED is red, select Monitor > Alarms > Status to see which alarm is active.
Transmitter output	The Transmitter output area displays the forward and reverse power. Click the Watts or dBm option to change the units of the display.
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	<p>The Duty cycle area has two gauges.</p> <p>The first gauge 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.</p> <p>The second gauge 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.</p>

- 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) monitors the operation of the PMU. You can:

- Check the voltage of the battery and the current that the PMU outputs to the PA.
- 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. If a submodule is not fitted, the box alongside the LED is disabled.

- 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** The battery voltage gauge indicates the voltage of the DC power supply to the PMU. The LED alongside indicates the state of the power supply.

LED	Description
Green	DC power input is usable
Red	DC power input is off (or too low or too high)
Gray	No battery power supply is fitted

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 off (or too low or too high)
Gray	Off	Mains Failure test is running

DC-DC converter The LED in the DC-DC converter box indicates the state of the battery input.

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 off (or too low or too high).
Gray	Off (disabled)	A DC-DC converter is not fitted.

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 is on.
Red	Off	Battery voltage is off (or too low or too high).
Gray	Off (disabled)	No standby battery power supply is fitted. (AC-only PMUs do not have standby converters.)

PA The PA LED displays green if the PMU is supplying power to the PA.

Channel module/control panel The Channel module/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	The PMU has turned the output off.
Gray	Off (disabled)	An auxiliary power output submodule is not fitted.

Output current gauge

The Output current gauge shows how much current the PMU is supplying to the subrack.

Output voltage gauge

The Output voltage gauge shows the voltage of the power that the PMU is supplying to the subrack.

Fan

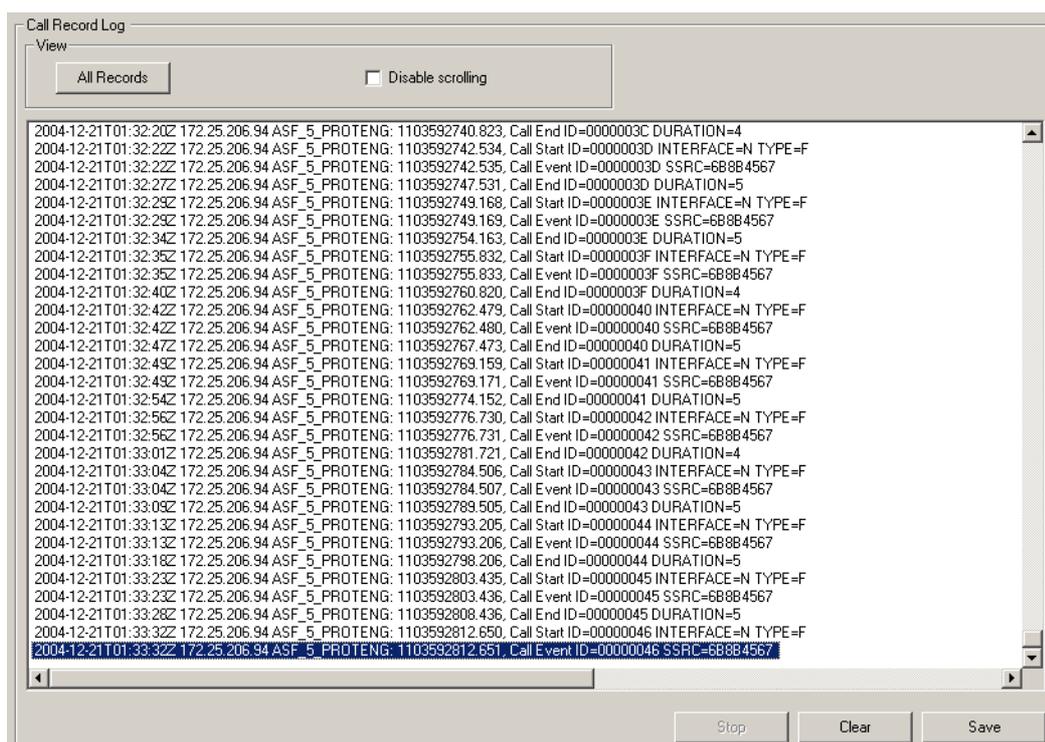
The Fan box displays whether the PMU fan is off or on.

Data Logs

The CSS can ask the connected network element to provide records of various types of logged events. You can view them and 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 network element has participated in.



Important: Viewing call records can cause voice drop-outs. When you click **All Records**, the network element 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 network element to send call records to a syslog collector. For details, see [“Logging to a Syslog Collector”](#) on page 155.

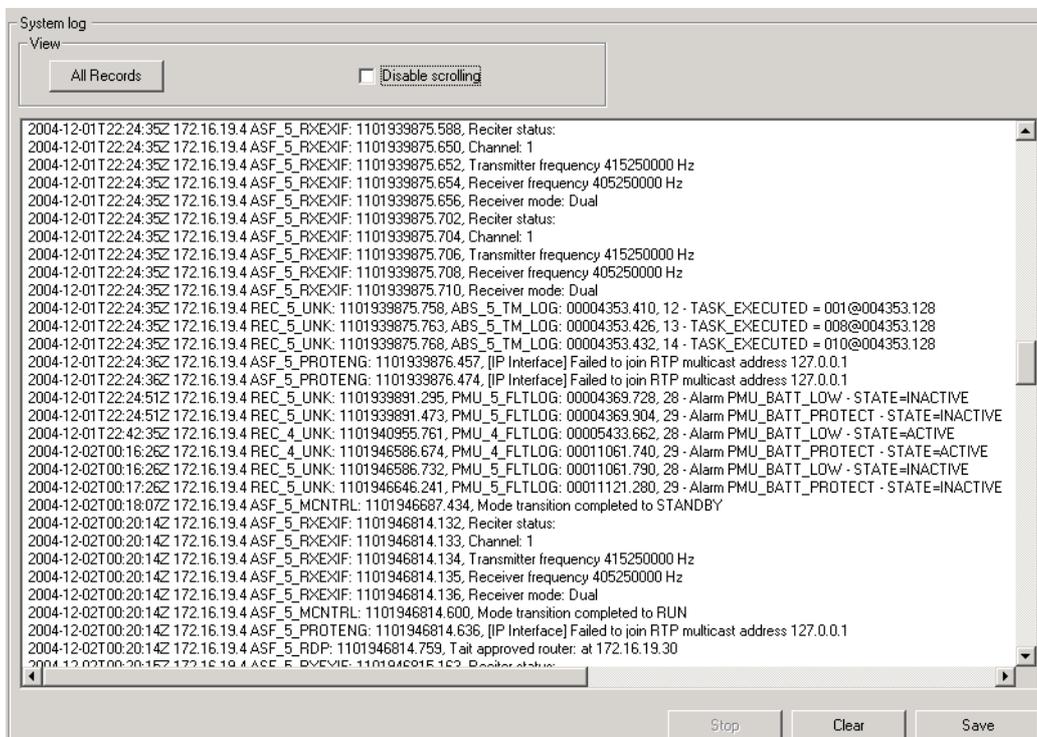
To view the call record log

1. Select Monitor > Data Logging > Call Record Log. The appropriate form appears, but displays no data.
2. Click **All Records**. The CSS asks the connected network element to supply all call records it has stored.
3. To stop the records from scrolling on the screen as the CSS receives them, select the **Disable scrolling** check box.
4. To update the display with new call records, click **All Records** again. The network element only sends call records that have not already been supplied. To view only new call records, click **Clear** before clicking **All Records**.

Using the buttons on the bottom of the form, you can tell the network element to stop supplying records, clear the display, or save the records to a file.

Viewing the System Log

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



Important: Viewing the system log can cause voice drop-outs.

When you click **All Records**, the network element 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 network element to send the data to a syslog collector. For details, see [“Logging to a Syslog Collector” on page 155](#).

To view the system log

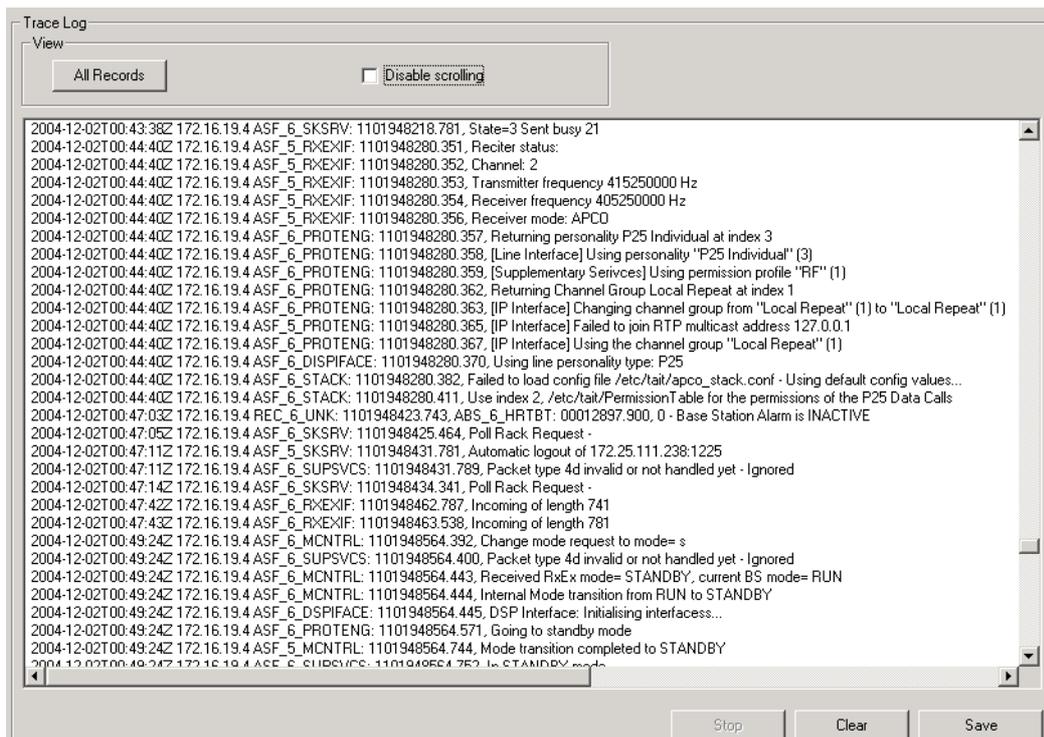
1. Select Monitor > Data Logging > System Log. The appropriate form appears, but displays no data.
2. Click **All Records**. The CSS asks the connected network element to supply records, beginning with the oldest.
3. To stop the records from scrolling on the screen as the CSS receives them, select the **Disable scrolling** check box.
4. To update the display with new records, click **All Records** again. The network element only sends records that have not already been supplied.

Using the buttons on the bottom of the form, you can tell the network element to stop supplying records, clear the display, or save the records to a file.

Viewing the Trace Log

The trace log provides information about the operation of the network element. 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 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 network element'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 network element 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 network element to send the data to a syslog collector. For details, see [“Logging to a Syslog Collector” on page 155](#).

To view the trace log

1. Select Monitor > Data Logging > Trace Log. The appropriate form appears, but displays no data.
2. Click **All Records**. The CSS asks the connected network element to supply records, beginning with the oldest.
3. To stop the records from scrolling on the screen as the CSS receives them, select the **Disable scrolling** check box.
4. To update the display with new records, click **All Records** again. The network element only sends records that have not already been supplied.

Using the buttons on the bottom of the form, you can tell the network element to stop supplying records, clear the display, or save the records 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.

Call Statistics

Last / current call

Type:

Duration:

Source ID:

Destination ID:

Calls (totals)

	P25		FM	
	Last 15 minutes	Since reset	Last 15 minutes	Since reset
RF:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Line:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Network:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Microphone:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

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 network element 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 another channel group member.
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 network element.

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.

```

Application.log - Notepad
File Edit Format Help
12/21/2004 13:28:55.234 000006a4 000006e4 INFO Log -----
12/21/2004 13:28:55.234 000006a4 000006e4 INFO Log Log opened
12/21/2004 13:28:55.234 000006a4 000006e4 INFO TagServer C:\Program Files\Tait Programming Applications\TE
12/21/2004 13:28:55.281 000006a4 000006e4 INFO SK 00.06.14 State is Initialising
12/21/2004 13:28:55.312 000006a4 000006e4 INFO TagServer Database Name: TagServer Tag Database. Version: 2
12/21/2004 13:28:55.328 000006a4 00000710 INFO IOMgr The request processing thread has begun.
12/21/2004 13:28:55.343 000006a4 000006e4 INFO SK 00.06.14 State is Disconnected
12/21/2004 13:42:49.625 000006a4 000006e4 INFO SK 00.06.14 State is Connecting
12/21/2004 13:42:51.421 000006a4 00000710 INFO UDP UDP Module version 0,6,14,0 initialised.
12/21/2004 13:42:51.468 000006a4 00000710 INFO Protocol APCO Protocol version 2.2 loaded
12/21/2004 13:42:51.468 000006a4 00000710 INFO UDP Connected to IP Address: 172.25.206.94 on port 27
12/21/2004 13:42:51.468 000006a4 00000710 INFO Protocol Request Version command reported version 2.2
12/21/2004 13:42:51.515 000006a4 000006e4 INFO SK 00.06.14 State is Connected
12/21/2004 13:42:51.515 000006a4 000006e4 INFO SK 00.06.14 State is Logging On
12/21/2004 13:42:51.515 000006a4 00000710 INFO Protocol Request Version command reported version 2.2
12/21/2004 13:42:53.593 000006a4 00000710 INFO Protocol Request Version command reported version 2.2
12/21/2004 13:42:53.593 000006a4 00000710 WARN Protocol Null password; Sending Logon request as clear tex
12/21/2004 13:42:53.625 000006a4 00000710 INFO Protocol Successfully logged on to Reciter with Session Id
12/21/2004 13:42:53.625 000006a4 000006e4 INFO SK 00.06.14 State is Logged On
12/21/2004 13:42:55.562 000006a4 000006e4 INFO Config_Rw Opening/Creating configuration file c:\Program Fi
12/21/2004 13:42:55.562 000006a4 000006e4 Config_Rw Beginning parse of configuration file...
12/21/2004 13:42:55.562 000006a4 000006e4 Config_Rw Reading configuration version 2.07 from file.
12/21/2004 13:42:55.640 000006a4 000006e4 Config_Rw Reading Tag Data.
12/21/2004 13:42:55.734 000006a4 000006e4 Config_Rw ReadConfigFileData complete: 9017 tags and 1330 v
12/21/2004 13:42:55.734 000006a4 INFO Colln_Tags Using tag database version '2.07'
12/21/2004 13:42:57.234 000006a4 INFO Colln_Tags Loaded 9017 out of a total of 9017 tags
12/21/2004 13:42:57.281 000006a4 INFO Colln_Tags Loaded 9017 values
12/21/2004 13:42:57.281 000006a4 Config_Rw Completed read of config file. Total number of ta
12/21/2004 14:33:08.375 000006a4 00000710 INFO ProtocolMgr Closing down communications
12/21/2004 14:33:08.375 000006a4 00000710 INFO Protocol Logged off Reciter
12/21/2004 14:33:08.375 000006a4 00000710 INFO Protocol Logged off from network element
12/21/2004 14:33:08.375 000006a4 00000710 INFO Protocol APCO Protocol version 2.2 unloaded
12/21/2004 14:33:08.421 000006a4 00000710 INFO IOMgr The request processing thread has terminated. No
12/21/2004 14:33:08.500 000006a4 000006e4 INFO Log Log closing
12/21/2004 14:33:08.500 000006a4 000006e4 INFO Log -----
  
```

Module Details

The CSS can display details about the [channel module](#), [PA](#), and [PMU](#) of the network element it is connected to. Items under the heading Module Details display information about the module such as its frequency range and firmware version. To monitor the way the modules are operating, see “[Modules](#)” on [page 74](#).

Viewing Reciter or Gateway Module Information

The Channel Module form (Monitor > Module Details > Channel Module) displays information about the [channel module](#) of the network element you are connected to. Use it to confirm exactly what it is that you are dealing with.

Channel module

Band: 148 - 174 MHz

Exciter frequency: 168.9 - 176.9 MHz

Receiver frequency: 171 - 174 MHz

Calibrated: 1/18/2006

External reference: Internal

Product code: TBA40B3-PA00

Crypto module:

Alarm status: Alarms active

Versions

Base Station: 02.22

	Digital board	Network board
Serial number:	18004651	2020357
Firmware:	02.22	02.22
Kernel version:		02.01
Hardware:	00.03	00.01
Database:		02.26

- 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 channel module currently has any alarm conditions. If the LED is green, there are no active channel module 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 network element when it was last tuned using the Calibration Software. You can confirm the actual switching range using a diagnostic test (Diagnose > RF Interface > Synthesizers). K4 band exciters have two sub-bands but the CSS can only display the switching range of one sub-band. However, the exciter can always operate in either sub-band. To have the CSS display the other sub-band, select it using the calibration software.

Receiver frequency	The current switching range of the receiver, as recorded by the network element 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 channel module.
Crypto module	The status of the firmware crypto module in the channel module. Gateway modules usually need a crypto module so that they can be an encryption and decryption point for dispatcher communications. Base stations cannot normally have a crypto module; they are crypto-denied.

Display	Description
Not fitted	A firmware crypto module is not present and cannot be loaded, as the reciter is crypto-denied.
(blank)	A firmware crypto module is not present, but can be loaded by a CSS firmware download. The channel module is crypto-capable.
1.01	The version number of the firmware crypto module.

Versions

The Versions area (Monitor > Module Details > Channel Module) displays version information for the channel module'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 network element's database. The CSS communicates primarily with the channel module'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) displays information about the PA module of the base station you are connected to. Use it if you need to confirm exactly what it is that you are dealing with.

Power Amplifier

Product code: TBA80B10000 Alarm status: ● No alarms active

Serial number: 18005190

Band: 136 - 174 MHz

Isolator: Not fitted

Power: 50 W

Versions

Calibrated: 9/2/2004

Firmware: 02.00

Hardware: 00.01

- 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 internal [isolator](#) (not currently available.)
- 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) displays view information about the PMU if you are connected to the channel module in position 1 of the subrack. Use it if you need to confirm exactly what it is that you are dealing with.

The screenshot shows a web interface for the Power Management Unit. It is divided into several sections: Product code (TBA30A1-0100), Serial number (18005225), Alarm status (No alarms active, indicated by a green LED), Submodules (AC-DC converter: Fitted, DC-DC converter: Fitted with a 12.00 V output, Standby converter: Not fitted, Auxiliary output: Fitted with a 12.00 V output), and Versions (Calibrated: 9/6/2004, Firmware: 02.01, Hardware: 00.01).

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**

You can use the CSS to configure TB9100 base stations and P25 Console Gateways.

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

- [Choosing a Configuration](#)

Network Element

- [Working with the Channel Table](#)
- [Working with Service Profiles](#)
- [Configuring the System Interface](#)
- [Configuring Miscellaneous Items](#)

RF Interface

- [Working with Channel Profiles](#)
- [Working with Signaling Profiles](#)
- [Configuring the CWID](#)
- [Enabling RF Linking](#)

Channel Group

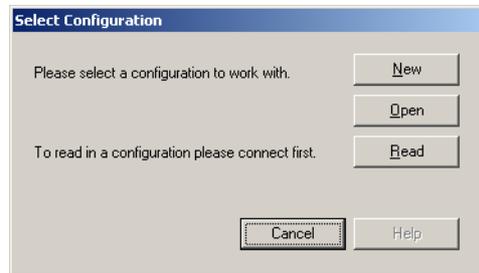
- [Network](#)
- [Working with Channel Groups](#)
- [Trunking](#)

Analog Line

- [General Analog Line Settings](#)
- [Working with Calling Profiles](#)
- [Encryption](#)
- [Defining Group Memberships](#)
- [Mapping Tone Remote Commands](#)
- [Setting Tone Remote Options](#)
- [Mapping MDC1200 Addresses](#)

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 network element you are connected to.

Network Element

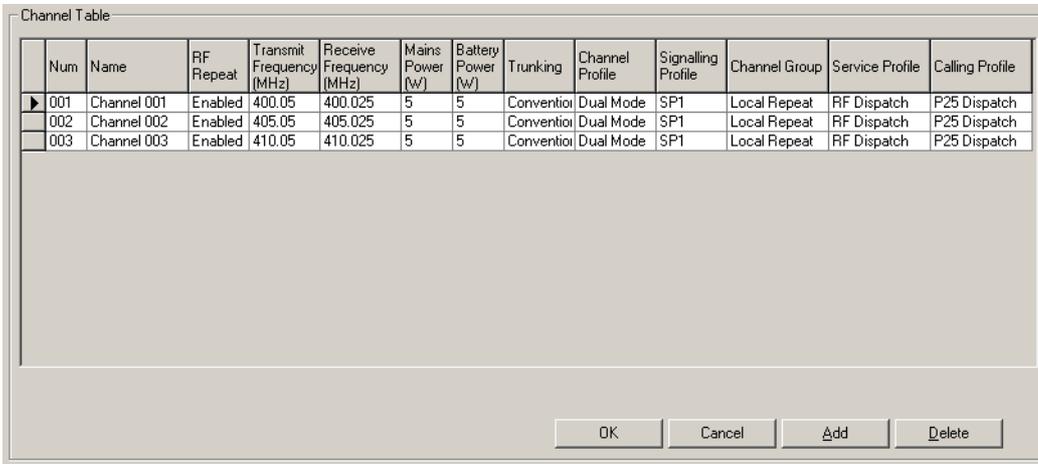
Under Network Element, the navigation pane groups items that apply to the network element as a whole and are not specific to a particular interface.

Working with the Channel Table

In the Channel Table form (Configure > Network Element > Channel Table), you can view the configured [channels](#), edit them, and add more channels.

Channel Table Details

The Channel Table form (Configure > Network Element > Channel Table) displays the channels defined in the [channel table](#) of the configuration file that you opened or the network element database that you read.



Num	Name	RF Repeat	Transmit Frequency (MHz)	Receive Frequency (MHz)	Mains Power (W)	Battery Power (W)	Trunking	Channel Profile	Signalling Profile	Channel Group	Service Profile	Calling Profile
▶ 001	Channel 001	Enabled	400.05	400.025	5	5	Conventio	Dual Mode	SP1	Local Repeat	RF Dispatch	P25 Dispatch
002	Channel 002	Enabled	405.05	405.025	5	5	Conventio	Dual Mode	SP1	Local Repeat	RF Dispatch	P25 Dispatch
003	Channel 003	Enabled	410.05	410.025	5	5	Conventio	Dual Mode	SP1	Local Repeat	RF Dispatch	P25 Dispatch

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.

- ▶ The arrow at the left of one row indicates that that row is selected; if you click **Add**, a copy of that row will be added. Use the mouse or the arrow keys to change the 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 network element 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 7](#).

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 this base station's or another channel group member's dispatcher interface or control panel microphone.
DispatchControlled	The repeat function is under dispatcher control. The DFSI gateway can automatically pass dispatcher commands on to the channel group to enable or disable repeat. If the dispatch equipment is connected via the analog line, Task Manager actions are needed to implement the commands and propagate them to the channel group. For more details, see " RF repeat actions " on page 201 and the TaitNet P25 System Manual.

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.

Trunking Select Conventional for non-trunked operation or Trunked if the channel is to be part of a trunked system. This setting specifies how the channel operates. The network element needs to behave differently, depending on whether its channel group is controlled by a trunking site controller or a dispatcher.

Channel Profile The [channel profile](#) assigned to the channel. See "[Profiles](#)" on [page 4](#) 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 network element 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 95 .
Delete	Removes the selected row from the channel table. (To restore a row with the deleted channel number, select the row above and click Add).

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 > Network Element > 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 configured frequency pair.

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 **Trunking** column, specify whether the channel is part of a conventional or a trunked system.
6. In the **Channel Profile** column, select the channel profile you want the network element 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.
7. 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.
8. In the **Channel Group** column, select the channel group that you want the network element to belong to. This determines the multicast address on the TaitNet P25 digital network that it sends voice to and listens to.
9. In the **Service Profile** column, select a the service profile that defines the set of services that you want the channel to support.
10. 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.)
11. Click **OK** to confirm the changes and close the form.



Note: If you are editing a large number of channels, periodically click **OK**, and then (on the toolbar) **Save**. Otherwise you could lose a lot of data if there is a computer failure.

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 94).

Selecting the Operating Channel

Different methods can be used to select the channel that a network element operates on. For each method, you need to configure the network element.

Selection at Run mode

The configuration contains a Task Manager task that instructs the network element to go to a channel on the transition to Run mode, for example:

IF Network Element in Run mode THEN Go to Channel Channel 001

Normally, the network element is shipped with this channel selection method. (This Task Manager task can be deleted. Once the network element has operated on a channel, it remembers that channel even through a reset.)

Selection by digital inputs

The operating channel can be selected by an external device that is able to toggle the state of the network element's digital inputs. You must specify how many digital inputs are involved and create Task Manager tasks that instruct the network element to go to a channel when the combination of digital input states produces the required digital input value.

1. In the System Interface form (Configure > Network Element > System Interface), specify the number of bits to use in computing an input value.
2. Create Task Manager tasks that select the channel based on the digital input value, for example:

IF Digital input value 1 THEN Go to Channel Channel 001

IF Digital input value 2 THEN Go to Channel Channel 002

IF Digital input value 3 THEN Go to Channel Channel 003

Selection by dispatcher command (Analog dispatch equipment)

Dispatcher commands can select the current channel. The dispatch equipment sends a function tone. You need to set up Task Manager statements such as the following:

IF Tone remote detected 550 THEN Go to channel 2

When the analog line receives a 550 Hz function tone, the network element switches to that channel. If the network element is part of a channel group, configure all channel group members for collective control of the channel number.

We recommend that you delete the Task Manager task that selects a channel on transition to Run mode. Then a network element will return to its previous channel after a reset. This is the channel that the dispatcher expects to be on.

Selection by dispatcher command (digital dispatch equipment)

Dispatcher commands can select the current channel. The dispatch equipment sends a channel select command over the DFSI interface. If the network element is part of a channel group, configure all channel group members for collective control of the channel number.

We recommend that you delete the Task Manager task that selects a channel on transition to Run mode. Then a network element will return to its previous channel after a reset. This is the channel that the dispatcher expects to be on.

Other Methods

Any Task Manager input can be used to select a channel. A SU user could for example make a call using a special NAC to change channel.

Working with Service Profiles

The Service Profiles form (Configure > Network Element > 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 network element 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 SUs can allow or disallow services to the end user. However, services can be disabled at the base station to prevent pirate SUs from using them on the TaitNet P25 digital 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.

Name	Call Alert	Status Report	Status Request	Message	Presence Check	Remote Monitor	Inhibit	Data
▶ Line Dispatch	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
RF	No	Yes	No	No	No	No	No	Yes

Buttons: OK, Cancel, Add, Delete

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 SU user to call the sender. It may for example trigger a persisting message on the target SU such as a repeating tone and flashing display.
Status Report	A status report is a message that the SU 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 SU. If the SU 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 SU to initiate a call by itself. It allows the sender to listen to what is going on at the SU's location.
Inhibit	An inhibit message disables the destination SU, 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

In the System Interface form (Configure > Network Element > System Interface), you can 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 channel module.

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.

The screenshot shows the 'system interface' configuration window. It contains the following elements:

- Pin Table:**

Pin	Description
1	Digital input 4
2	RS232 TxD
3	RS232 RxD
4	Digital input 0
5	Gnd
6	Digital input 1
7	Digital input 2
8	Digital input 3
9	Digital output 0
- Serial Port:** Baud rate: 57600
- Computed input value:** Number of bits: 5
- Pin 1:** Radio buttons for Antenna relay, Digital output 1, and Digital input 4 (selected).
- Pin 9:** Radio buttons for RSSI output and Digital output 0 (selected).
- RSSI output:** A graph showing DC Voltage (V) on the y-axis (0.5 to 4.5) and Signal level (dBm) on the x-axis (MIN to MAX). A red line indicates a linear relationship. Below the graph, Signal level (dBm) is set to -130 (MIN) and -60 (MAX).

Pin assignments

The unnamed table displays the functions assigned to each pin on the DIG DB9 connector at the rear of the channel module. 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 network element 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. To make a fifth digital input available, configure Pin 1 as Digital input 4. 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 193). 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 99.
Digital output 1	Configures pin 1 as a digital output. Select this option if you need a digital output.
Digital input 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.

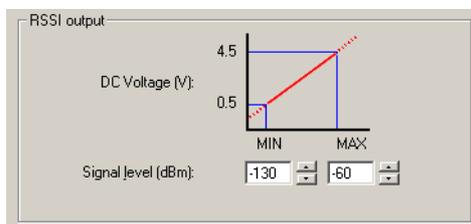
Pin 9

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 99.
Digital output 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 > Network Element > 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, so that the receiver and transmitter can share the same antenna. For details, see the installation instructions that come with the Tait TBAA03-15 Relay Coaxial Assembly kit.

To enable the operation of an antenna relay

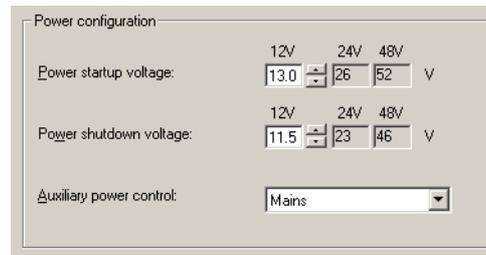
1. Select Configure > Network Element > System Interface.
2. Under **Pin 1**, click **Antenna relay**.
3. In the channel table, make sure that RF repeat is disabled in all channels. Using an antenna relay when RF repeat is enabled will result in relay chatter. When the base station receives a signal, 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.

Configuring Miscellaneous Items

The Miscellaneous form (Configure > Network Element > Miscellaneous) gathers together a number of settings.

Minimum battery voltages

Use the Power configuration area (Configure > Network Element > Miscellaneous) to adjust the minimum voltages for the DC power input to the PMU. You cannot adjust these voltages below limits fixed in hardware.



	12V	24V	48V	
Power startup voltage:	13.0	26	52	V
Power shutdown voltage:	11.5	23	46	V
Auxiliary power control:	Mains			

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 the battery voltage falls below the value in the relevant **Power shutdown voltage** box and there is no AC power, the PMU shuts down. (If there is AC power, a battery protection mode alarm is raised, indicating that the loss of AC power will result in shutdown.)

If the battery voltage rises above the value in the **Power startup voltage** box, the PMU re-starts. (For full details, see the TB9100/P25 CG Installation and Operation Manual.)



Note: Network elements with no PMU or with a PMU that has no standby converter 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.



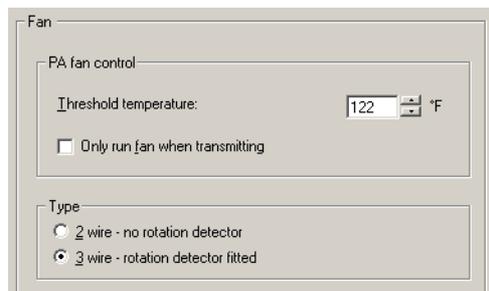
Important: While the auxiliary power output can be used for more than one purpose at once, this is not generally recommended. It can result in a short-circuit and equipment damage. The output is floating. If it is connected to a negatively earthed battery and to positively earthed auxiliary equipment,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

In the Power configuration area (Configure > Network Element > 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 200 .
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 network element has a DC only PMU, this setting never turns the auxiliary power on.

Configuring Fan Settings

The Fan area (Configure > Network Element > Miscellaneous) gathers together fan-related settings. These specify how the network element 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. 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 network element 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.

Configuring the Fan to Turn on with the PA

You can configure the PA fan to turn on when the PA begins transmitting. Follow these steps:

1. Select Configure > Network Element > 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 normally turns on with RF output and cools the PA as soon as it begins working. It turns off when the RF output stops. However, if the PA temperature is below the threshold, the fan does not turn on.

External clock reference frequency (if fitted)

Use the External clock reference frequency (if fitted) area (Configure > Network Element > Miscellaneous) to specify the frequency of an external reference frequency source. If an external source is connected to the reciter, you must select the appropriate option so that the reciter knows what the 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 > RF Interface > Channel Profiles) displays the list of profiles. You can add a new profile, or edit an existing one.

Name	Analog Rx	Digital Rx	Tx Enabled
AnalogOnly	Yes		Yes
Ch Profile 04	Yes		Yes
Ch Profile 04	Yes		Yes
Ch Profile 06	Yes		Yes
Ch Profile 06	Yes		Yes
Ch Profile 07	Yes		Yes
▶ DigitalOnly		Yes	Yes
Dual Mode	Yes	Yes	Yes

Buttons: Add, Edit, Delete

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 105](#).

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 four profiles are needed, 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 105](#).



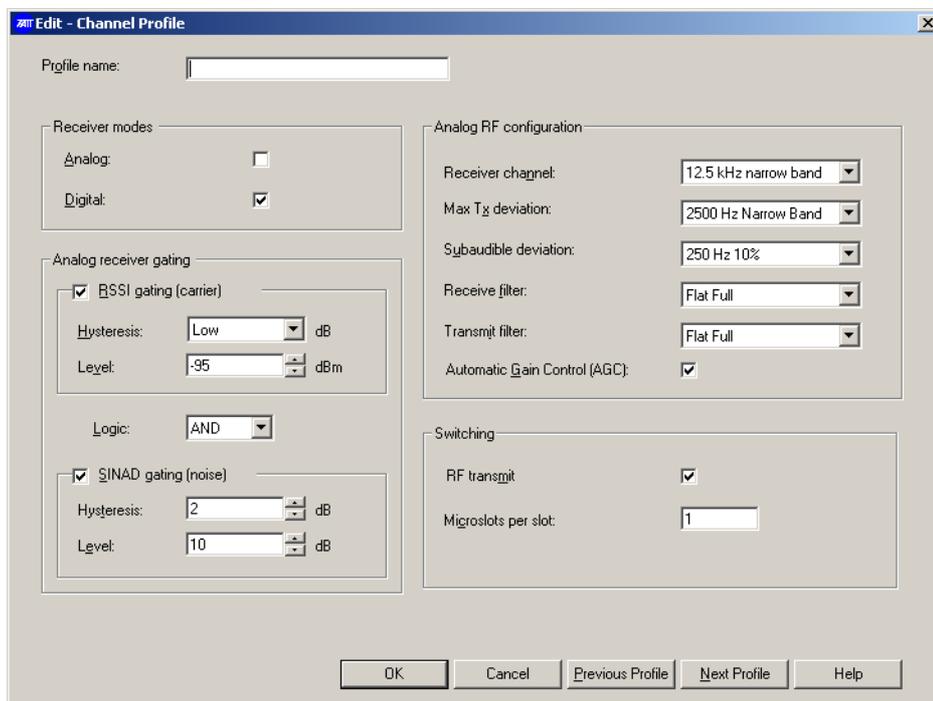
Tip: Set up a test profile and assign it to a channel. Use this channel when testing the system before commissioning.

To add a channel profile

1. Select **Configure > RF Interface > 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.
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 **Analog 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 106](#).
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 the changes and close the dialog box, returning you to the Channel Profiles form.

Editing a Channel Profile

Use the Edit Channel Profile dialog box to view the details of the selected channel profile and modify them.



Profile name	Specifies the name of the profile. If you edit this name, make sure 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.

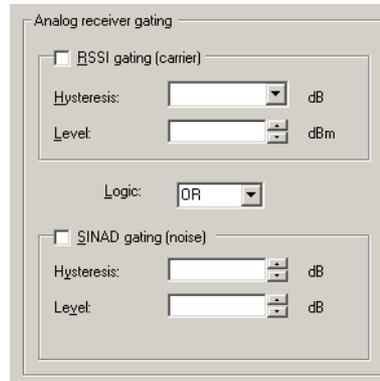
Receiver modes

The Receiver modes area specifies which modes the base station receiver can operate in. You must select at least one mode. If both modes are selected, the base station functions as a dual-mode receiver. In dual mode, if the receiver achieves frame synchronization, it operates in digital mode. Otherwise, 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.



Analog gating can be 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.

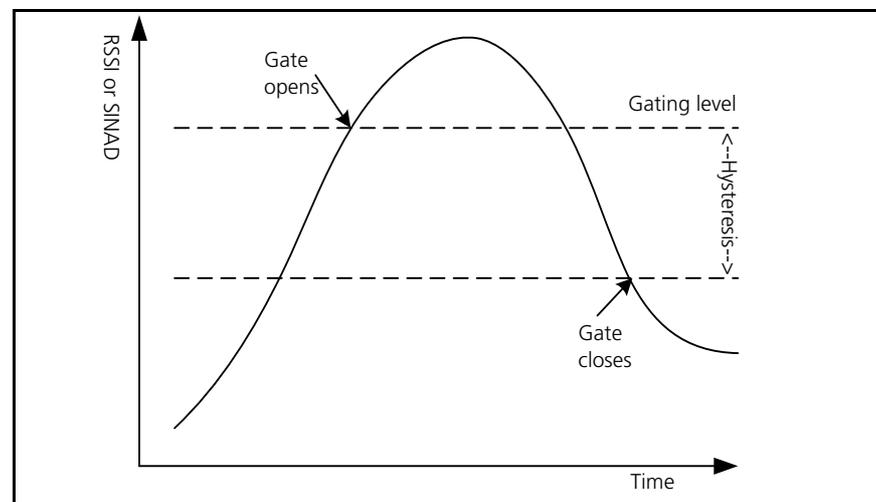


Note: Gating in digital P25 mode is not configurable. The receiver unmutates when frame synchronization is achieved. If the signal subsequently deteriorates so that forward error correction is unable to compensate for errors, the voice stream is discontinued.

If analog gating is set at low levels for a dual-mode receiver, breakthrough of the digital P25 signal can occur in analog FM 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 provides options for 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 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 108](#).

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).

Choose a hysteresis level, and then test TB9100 operation, adjusting 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

Use the following table to 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, use the Analog RF configuration area to 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 the band plan have a 20 kHz channel spacing.

However, the band plan may be irregular, or you may want to specify (when entering 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)

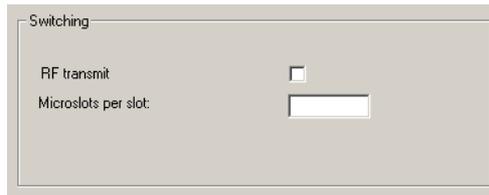
Specifies whether automatic gain control is applied at the RF stage. AGC provides enhanced high signal handling capabilities and receiver intermodulation protection. When signal levels are high, however, the minimum sensitivity may be degraded.

AGC is normally enabled, but Tait recommends disabling it in the following situations:

- The expected 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

In the Switching area, you can disable the transmitter.



RF transmit Clear this check box 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 In conventional systems, most base stations will use the default value of 1 microslot per slot. With this setting, all status symbols are set to 'idle' or 'busy.' Busy means that a signal is being received on the uplink so that SUs should not transmit.

In trunking control channel operation, more microslots per slot are required. This sets up a slotted structure on the downlink. Status symbols are transmitted at every microslot boundary (every 7.5 ms) but they are set to "Unknown," except at the slot boundary. We recommend 6 microslots per slot. This allows a SU to read the status symbol and transmit a TSBK before the next slot boundary, so that its status symbol is 'idle' and the next slot is available to other SUs.

Some SU signaling on the control channel uses multiple block trunking packets. Examples are requests for telephone interconnect calls and responses to authentication requests during registration. These will overlap into the next slot if there are only 6 microslots per slot. If SUs use a lot of this signaling, increasing the number of microslots per slot beyond 6 could increase control channel efficiency.

Working with Signaling Profiles

The Signaling Profiles form displays a list of the current [signaling profiles](#).

Name	Rx NAC	Tx NAC	Rx Subtone	Tx Subtone
▶ SP1	293	293	None	None
SP-CTCSS	293	293	CTCSS 67 Hz	CTCSS 77 Hz
SP-DCS	293	293	DCS 023 (047)	DCS 025 (244)

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 transmits with and unmutes to, 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 113](#).



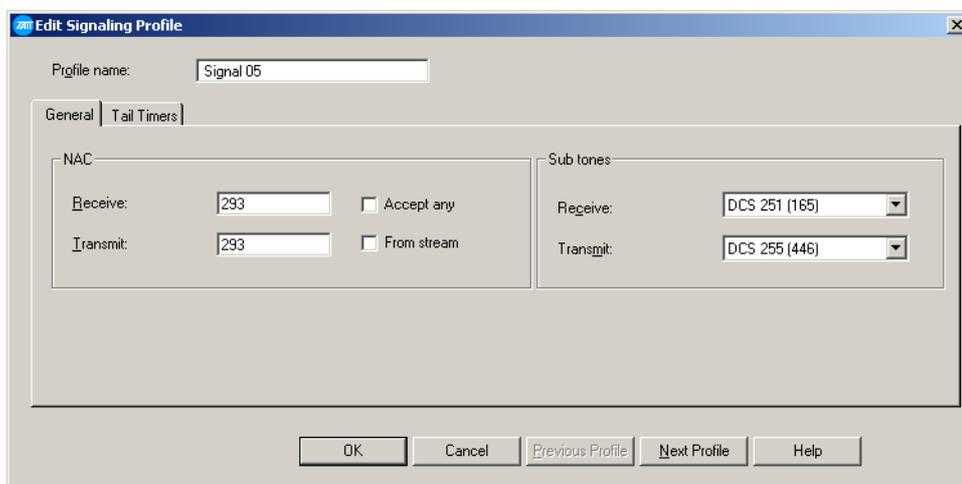
Tip: Set up a test profile and assign it to a channel. Use this channel when testing the system before commissioning.

To add a signaling profile

1. Select **Configure > RF Interface > 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. Some systems require different values for transmitting and receiving.
6. If you want the base station to unmute to any NAC, select the **Accept any** check box.
7. For community repeater operation or to enable digital dispatch equipment to specify the transmit NAC, select the **From stream** check box.
8. Under **Subtones**, select the CTCSS tones or DCS codes that the base station will use when operating in analog FM mode.
9. 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 SUs are configured to respond to reverse tone bursts, 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.
10. Click **OK** to confirm the changes and close the dialog box. The new profile appears in the Signaling Profiles form.

Editing a Signaling Profile

Use the Edit Signaling Profile dialog box to 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

Use the NAC area to specify the network access codes that the base station sends and receives. NACs are always entered and displayed as hexadecimal numbers. For more information, see the TaitNet P25 System Manual.

Receive Specifies the network access code that the base station unmutes to. Enter a hexadecimal value (the default is 0x293). F7E and F7F are special values reserved by the P25 standard.

Accept any Select this check box and the base station will unmute to any NAC. This is the equivalent of entering F7E or F7F. The NAC in the Receive box then has no effect.



Note: Only select this check box if your application requires it. TB9100 receivers are highly sensitive in both analog and digital modes and can occasionally falsely detect digital P25 signals. If the receiver is set to unmute only to a particular NAC value, the likelihood of false detections is greatly reduced. If not, spurious noise can be repeated. Furthermore, if the TB9100 receiver is set to dual mode, the false detection of a digital P25 signal can cause an analog FM call to drop out for up to 180 milliseconds.

Transmit	Specifies the NAC that the base station uses when transmitting. The configured transmit NAC can be overridden by the NAC in the voice stream if the From stream check box is selected (see below). Enter a hexadecimal value (the default is 0x293). F7E and F7F are special values reserved for receivers by the P25 standard and are not permitted.
From stream	Select this check box and the transmitter will transmit using the NAC in the voice stream instead of the configured NAC. The NAC could be supplied by the calling SU (community repeater operation) or by the digital dispatch console. If the stream does not specify a NAC (or if it specifies F7E or F7F), the transmitter uses the configured transmit NAC.

Subtones

Use the Subtones area to specify the 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 SUs 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 114](#).



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 SUs are programmed with inverted DCS codes, configure the base station with the equivalent normal code. To ascertain that code, look up a table or follow this procedure.

To program the base station with an inverse DCS code

1. Note the inverted DCS code that the SU 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 SU's inverse DCS code (in this example, 023, which is the same as the normal code 047).

Tail Timers tab

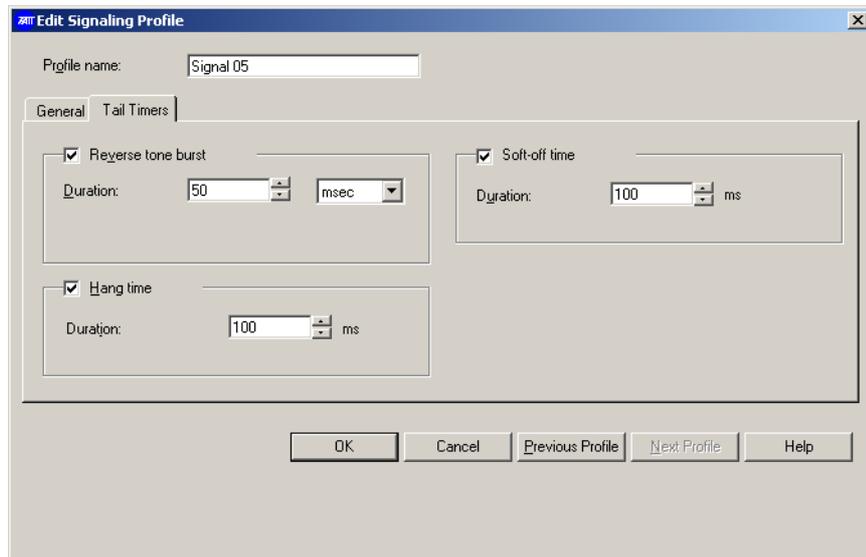
In the Edit Signaling Profile dialog box, use the Tail Timers tab to configure tail timers that the transmitter uses in analog FM mode.

Two tail timers give you flexibility in configuring 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 SU when carrier ceases)
- prevent users on different [subtones](#) from taking control of the repeater during a temporary lull in the conversation

Tail timers are not used in digital P25 mode.



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 SUs, 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 SU 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, SUs in the talk group that uses the subaudible signaling can initiate a call but other SUs 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

In the CWID form (Configure > RF Interface > CWID) you can 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 the radio system is commissioned; if there are any other users of the frequencies you have been assigned, this gives them advance warning.

In the Morse area, you define what the base station broadcasts and in the Automatic CWID system area, you can enable and configure the regular sending of identity broadcasts.

Morse

Use the Morse area (Configure > RF Interface > CWID) to 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

In the Automatic CWID system area (Configure > RF Interface > CWID) you can enable and configure the automatic sending of the base station's CWID according to the configuration in the Morse area. The licensing authority may require that the base station regularly identifies itself.



Important: Automatic CWID is likely to cause problems in a digital P25 system. Consider using Task Manager instead. You can use the Task Manager actions **Transmit CWID now** or **Lock automatic CWID** to set up identity broadcasts in ways that automatic CWID does not permit. For example, Task Manager could carry out this action only if there is no call in progress.

If automatic CWID is enabled, calls that are in progress when a CWID is due for transmission will be interrupted. The CWID transmission is analog FM, irrespective of the base station's configuration. If the CWID is transmitted during a dispatcher call, the dispatcher is given no indication that the call has been interrupted. A CWID that takes a long time could completely replace a dispatcher call.

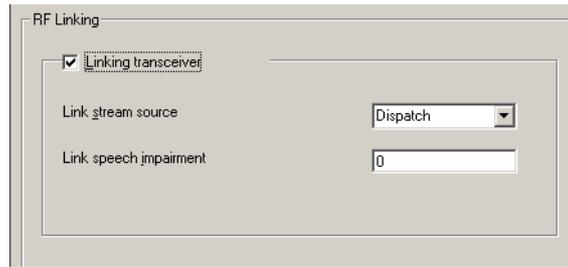
Select the Automatic CWID system check box to enable the regular sending of the base station CWID.

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.
----------------	---

Enabling RF Linking

If the connected base station is to be a dedicated linking transceiver, use the RF Linking form to enable and configure RF linking. Otherwise, leave the Linking transceiver check box cleared.

A linking transceiver forms one end of an RF link that joins a channel group to a remote base station or channel group. As an RF link cannot carry voting and switching information, each linking transceiver must be configured to give the streams it receives fixed information about the source and quality of the stream. The other members of the channel group use this information to make voting and switching decisions. For information about RF linking, see the TaitNet P25 System Manual.



Linking transceiver

Select the Linking transceiver check box and the TB9100 modifies its operation to suit the role of linking transceiver. The TB9100 then does the following.

- It uses the channel group interface's voting and switching rules at the RF interface.
- It flags calls received on the RF interface with a source derived from configuration instead of indicating the actual original source. The configuration can specify 'subscriber' or 'dispatch.'
- It puts a configured value for impairment into received voice streams, instead of inserting a value based on signal quality. (Impairment values are only included in subscriber streams.) Otherwise, calls received over the RF link would almost always win the vote, irrespective of the signal quality of the originally received signal.
- It does not re-transmit any calls received on the RF link. This is to prevent a signal from being endlessly received and repeated. RF repeat only happens if the signal was received by another channel group member. For this to work, the linking transceiver must be configured with a receiver number unique to the channel group.

Link stream source

The Link stream source box specifies whether the linking transceiver will flag the streams it provides to the channel group as coming from a dispatcher (line interface) or a subscriber (SU). Select the appropriate option based on your system design. The channel group that the linking transceiver belongs to will use this information when voting and selecting voice streams.

Link speech impairment

The Link speech impairment box specifies an impairment value. This is only used if the Link stream source box above specifies 'subscriber' (Impairment is only used in voting voice streams from a subscriber.) The channel group that the linking transceiver belongs to will use this information when voting. Select a value between 0 and 15. If the value is lower than that of other subscriber streams received by the channel group, the link stream will win the vote. If the value is higher, the link stream will lose.

Channel Group

Using the CSS, you can define the identity of the network element and configure its behavior as part of a channel group. You can also enable and configure the network element's DFSI interface to digital dispatch equipment, or its TCCP connection to a trunking controller.

Network

The Network form (Configure > Channel Group > Network) displays the network element's network settings. These settings are normally only changed at installation time. You can also enable a DFSI connection, configure the voice service for the DFSI or for trunking, and configure the transmit jitter buffer.

Setting the Network Identity

Each Tait P25 network element has a unique name and IP address. The default settings provided by the factory must be changed when the network element is installed.



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

When you program a configuration into a network element, the CSS checks whether network identity (IP address, subnet mask, and receiver number) is the same as that of the network element. 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 network identity, the changes only take effect when the network element is reset.

Identity	
Hostname:	TB9100
IP address:	192.168.1.2
Subnet mask:	255.255.255.0
Receiver number:	1

Hostname

The name of the network element. This is the human-readable equivalent of the network element's IP address and appears on the status bar when you are connected. The default name is TB9100 but you should make sure that each base station and P25 Console Gateway on the network has a unique name. It is a good idea for this name to be the same as the name in 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 network element in dotted quad format. The default address when the network element leaves the factory is 192.168.1.2. This address is used for example in communications with the CSS.

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

Subnet Mask

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



Note: You may also need to specify a gateway address. At present, Tait P25 network elements use 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 network element. Tait intends 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.

Receiver number

The receiver number uniquely identifies the network element as a member of the channel group. You need to assign unique receiver numbers to all channel group members (including P25 Console Gateways). Assign lower numbers to members that are closer to the center of the network. If there is a central voter, give it the lowest receiver number (for example, 1). Receiver numbers must be in the range 1–255. 0 is a special case. The DFSI uses the receiver number 0 to address commands to all receivers.

Voice streams contain the receiver number of the member originating the stream. Voting and switching use the receiver number when selecting a vote winner. (If other things are equal, the voice stream from the channel group member with the lower receiver number wins.) CSS monitoring forms need receiver numbers before they can indicate where the transmitting source came from or who is winning the vote. The DFSI uses receiver numbers to address commands to individual members of a channel group.

Enabling a DFSI Connection

The channel group member that acts as a gateway between the channel group and the digital dispatch console must have a DFSI connection.



DFSI - Local connection

Control service port number:

Voice service

Use DFSI control service IP address

IP Address:

Loopback speech

To enable and configure a DFSI connection

1. Select Configure > Channel Group > Network.
2. Select the **DFSI - Local connection** check box.
3. In the **Control service port number** box, specify the port number that the gateway member will listen to control service messages on. This can usually be left at the default of 7000.
4. Configure the voice service (see [“Configuring the Voice Service” on page 121](#)).

Configuring the Voice Service

The channel group master can provide a voice service between the channel group and a digital dispatch console or a trunking controller.

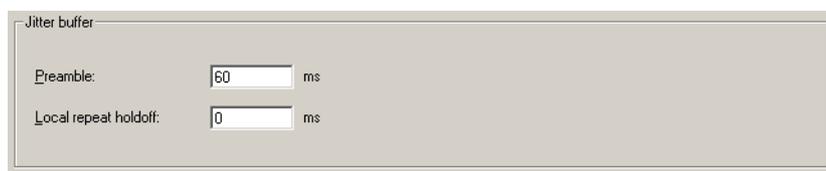
The screenshot shows a configuration window with two main sections. The top section is titled 'Local connection' and contains a checkbox labeled 'DFSI - Local connection' which is unchecked. Below it is a text field labeled 'Control service port number:' with the value '7000' entered. The bottom section is titled 'Voice service' and contains three items: a checkbox labeled 'Use DFSI control service IP address' which is checked, a text field labeled 'IP address:' with the value '0.0.0.0' entered, and a checkbox labeled 'Loopback speech' which is unchecked.

The following items let you configure that service.

- | | |
|-------------------------------------|---|
| Use DFSI control service IP address | Select this check box if you want the channel group master to send voice streams to the IP address of the digital dispatch console. Otherwise clear the check box and enter the destination IP address into the box below. |
| IP address | Specifies the IP address that the master sends voice streams to. This can be a multicast address. The master uses the port specified for the voice service in the digital dispatch console's connect message. |
| Loopback speech | Select this check box if the dispatch equipment using the DFSI needs to receive the voice streams that it sends. For example, dispatch equipment could use the loopbacked voice streams to make one dispatcher's voice available to other dispatch positions. |

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. The size of the jitter buffer is defined by two timers (preamble and transmit holdoff). While these timers run, the buffer fills. These timers are important for the operation of SU scanning and voting. They have no effect on P25 Console Gateways. For recommended settings for different system designs, see the TaitNet P25 System Manual.



Jitter buffer

Preamble: 60 ms

Local repeat holdoff: 0 ms

Preamble

Specifies the length of time that the base station transmits a preamble before beginning to transmit the call itself. In digital P25 mode, the preamble consists of a high deviation test pattern. In analog FM mode, the preamble is carrier only. While the preamble is transmitted, arriving voice packets are stored in the jitter buffer. The longer the preamble, the larger the jitter buffer and the greater the voice delay. A preamble cannot be shorter than 40 ms, even if you enter a smaller value. 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 required by the system design.

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.

Transmit holdoff

Specifies the length of time that the base station may wait before beginning to transmit the preamble. The purpose of this timer is to allow all the transmitters in the channel group to begin transmitting at about the same time. This is important if the receiving SUs are scanning or voting. (SU scanning works best if the base stations can all begin transmitting within approximately +/- 10 ms of each other.)

In channel groups with distributed voting, the transmit holdoff is only applied if the call originated locally (at the RF, line, or microphone interface). If voting is centralized, the transmit holdoff is always applied.

For single repeaters, leave the transmit holdoff at the default of 0ms.

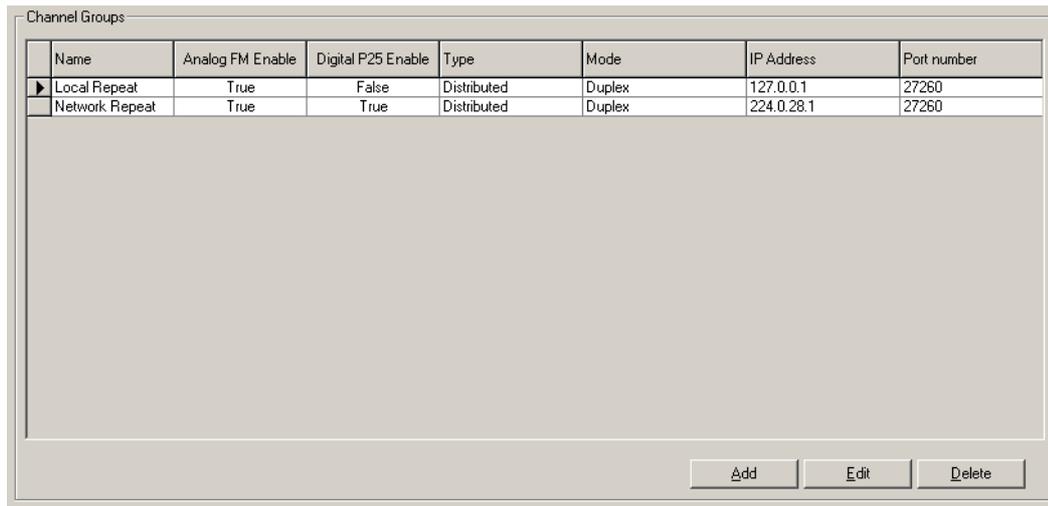
The combined duration of the transmit holdoff and the preamble should not exceed 200ms, to limit the speech delay.

Working with Channel Groups

The Channel Groups form (Configure > Channel Group > Channel Groups) displays information about the channel groups that the network element can be part of. You can add channel groups and edit them.

For details about the other columns in the table, see “[Editing a Channel Group](#)” on page 124.

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



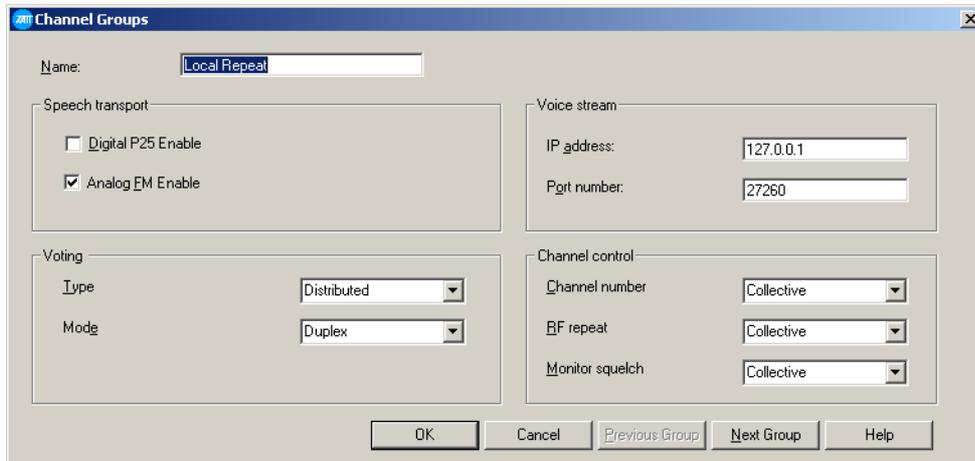
Name	Analog FM Enable	Digital P25 Enable	Type	Mode	IP Address	Port number
Local Repeat	True	False	Distributed	Duplex	127.0.0.1	27260
Network Repeat	True	True	Distributed	Duplex	224.0.28.1	27260

Adding a Channel Group

1. Select Configure > Channel Group > 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 can send.
6. Under **Voting**, select the type of voting. Voting can be distributed among all channel group members, centralized at one member, or there can be switching only. See the TaitNet P25 System Manual for an explanation of these options.
7. Under **Voting**, specify the voting mode (simplex or duplex). See the TaitNet P25 System Manual for an explanation of these options.
8. 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.
9. Under **Channel control**, specify whether dispatcher commands only affect the channel group member that the dispatch equipment is connected to (Individual), or whether they affect the whole channel group (Collective).
10. Click **OK**.

Editing a Channel Group

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



Important: When editing a channel group, make sure that all channel group members have compatible channel group settings. Check these settings in the Group Status form (Monitor > Channel Group > Status).

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

Speech transport

In the Speech transport area you can specify which types of call can be passed to the channel group along the network element'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 network element to send digital P25 voice to the channel group. The digital P25 voice stream is in the form of IMBE packets, which are compressed and low bandwidth.

Analog FM enable Enables the network element to send analog FM voice to the channel group. The analog FM voice stream is in the form of G.711 packets, which are uncompressed and require a bandwidth of 64 kbit/s.

Voting

The Voting area configures the way the network element handles voting. See the TaitNet P25 System Manual for a more detailed explanation of voting and its options.

Type Voting can be distributed among all channel group members, centralized at one member, or there can be switching only.

Type	Description
Switched	Select Switched if the receivers in the channel group do not operate on the same frequency. Simultaneous calls cannot be from the same SU and should not be voted on. If there is more than one voice stream, the switch makes the streams available and interfaces play out the stream with the highest priority.
Distributed	Select Distributed if you want distributed voting in the channel group. In distributed voting, each channel group member votes using the same algorithm and with the same results. Also select this option if the channel group is to have central voting but this member is not to be a central voter.
Central	Select Central if you want this channel group member to be the central voter. Other members will not vote their RF streams or switch any streams, but will send them to the central voter. The central voter sends a voted RF stream back to all members of the channel group for repeating. The member will only take over as central voter after ensuring that all other channel group members are in agreement.

Mode The channel group can operate in duplex or in simplex mode. All channel group members should have the same mode setting.

Mode	Description
Duplex	The channel group can simultaneously handle an inbound (SU to dispatcher) and an outbound (dispatcher to SU) call.
Simplex	The channel group handles only one call at a time. It selects the call with the highest priority. Dispatcher calls always win over subscriber calls.

Voice stream

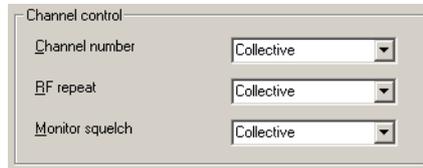
Use the Voice stream area to set the IP address and port for sending voice streams to and receiving them from the channel group.

IP address Specifies the IP address (normally multicast) that the channel group member belongs to. The member 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 the channel group has only two members, the unicast IP address of the other member can be used.

Port number The port number that the network elements in the channel group use for the voice stream. Generally, the default port number is used.

Channel control

The Channel control area determines whether channel control commands are applied to the individual network element or to the whole channel group. These settings apply to dispatcher commands received over the analog line or the DFSI interface. Generally, the same setting is used for all channel commands.



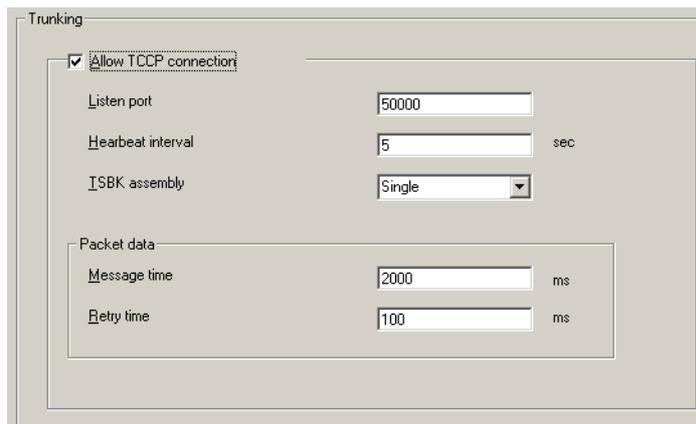
The image shows a 'Channel control' configuration window with three dropdown menus, all set to 'Collective':

- Channel number: Collective
- RF repeat: Collective
- Monitor squelch: Collective

- | | |
|-----------------|--|
| Channel number | If Collective is selected, a channel change command is propagated to the channel group. If Individual is selected, a channel change command only affects the network element with the interface to the dispatch equipment. |
| RF repeat | If Collective is selected, a command to enable or disable RF repeat is propagated to the channel group. The channel table must specify that RF repeat is DispatchControlled. If Individual is selected, the command only affects the network element with the interface to the dispatch equipment. |
| Monitor squelch | If Collective is selected, a Monitor command is propagated to the channel group. If Individual is selected, the command only affects the network element with the interface to the dispatch equipment. (The Monitor command is not currently supported.) |

Trunking

Use the Trunking form (Configure > Channel Group > Trunking) to enable and configure the channel group master's TCCP interface to the site controller. This is required for control channels and for traffic channels.



The image shows a 'Trunking' configuration window with the following settings:

- Allow TCCP connection
- Listen port: 50000
- Heartbeat interval: 5 sec
- ISBK assembly: Single
- Packet data section:
 - Message time: 2000 ms
 - Retry time: 100 ms

- | | |
|-----------------------|---|
| Allow TCCP connection | Select this check box to allow the trunking site controller to establish a TCCP connection to the base station. |
| Listen port | Tells the base station which UDP port to listen to on the TCCP interface. |

- Heartbeat interval Specifies the interval between heartbeat messages that the base station sends over TCCP to the site controller.
- TSBK assembly Specifies how many TSBKs can be sent in one outbound signaling packet.

Option	Description
Single	Outbound signaling packets contain a single TSBK. This is the default setting and will be suitable for most systems. It is the best setting where coverage is marginal.
Double	Outbound signaling packets can contain up to two TSBKs.
Triple	Outbound signaling packets can contain up to three TSBKs. This may bring performance improvements in busy sites with lots of call requests and registrations. More TSBKs can be transmitted per framesync and NID. However, SUs will take longer to find the control channel and noise will have a greater impact on channel efficiency.

Packet data

Durations for the following packet data timers are configurable.

- Message time If the message time elapses and the confirmed data message is still undelivered, the master discards the message.
- Retry time The retry time is used in the following ways.
 For confirmed data, the master waits until the retry time elapses. If a confirmation has not been received, it sends the message again. This is repeated until the message time has elapsed.
 For unconfirmed data, the master waits until the retry time has elapsed before sending the next message.

Analog Line

TB100 base stations and P25 Console Gateways have an analog line. The behavior of the analog line is determined by the current calling profile. The calling profile assigned to the current channel is 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.

General Analog Line Settings

In the General form (Configure > Analog Line > General), you can 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

Line levels are set 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.

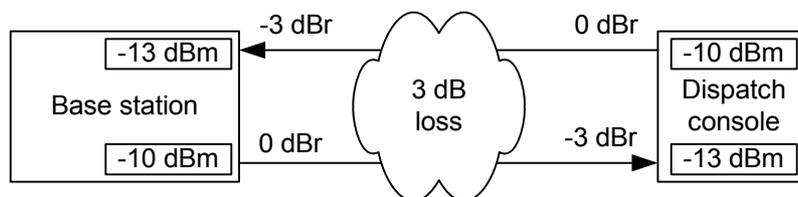


Line levels				
Output:	<input type="text" value="-10.0"/> dBm	RMS level	Avg	<input type="text" value="90.0"/> dBm
Input:	<input type="text" value="-10.0"/> dBm	RMS level	Avg	<input type="text" value="85.3"/> dBm

Interface levels are based on a -10 dBm0 test tone.

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 network element 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 a 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 network element 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

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

A screenshot of a configuration window titled "Channel seize and analog valid". It contains three checkboxes: "E & M" (checked), "Tone remote" (checked), and "After MDC1200" (unchecked).

- E & M This check box enables E & M signaling. When the E line goes low, the network element interprets this as a channel seize. When the network element 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 network element 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 network element waits when it receives LLGT for enough time to receive one or more MDC1200 tone bursts before seizing the channel.

Setting MDC1200 Options

Use the General form (Configure > Analog Line > General) to set configuration options for MDC1200 signaling.



- MDC1200 The MDC1200 check box enables MDC1200 signaling across the analog line, provided the network element has an MDC1200 signaling on analog line license.



Important: MDC 1200 signaling must be sent to the network element 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 the 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 network element 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.

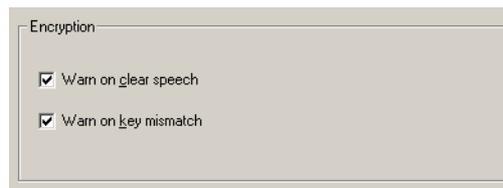
Option	Description
Leading	The ANI message is supplied to the console at the beginning of the over. As this information is not available until after the P25 voice stream has begun, the network element must wait for it before forwarding voice on the analog line.
Trailing	The ANI message is supplied to 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) specifies 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 digital P25 transmission is passed to the analog line. Clear the check box if the 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) displays the list of calling profiles. You can add a new profile and edit an existing profile. A calling profile defines the properties of calls that the dispatcher makes and receives. Think of the analog line as equivalent to a SU; the calling profile defines the identity and behavior of that SU. 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.

Name	Enable	Squelch	Call Type	Group Membership	Line Id	Destination	Service Profile	Encryption	Emergency
FM	<input checked="" type="checkbox"/>	Normal	FM	None	1	1	None	Clear	No
P25 Dispatch	<input checked="" type="checkbox"/>	Normal	P25Group	TIA Standard	1	65535	Line Dispatch	Clear	No

The form displays a row of information for each profile.

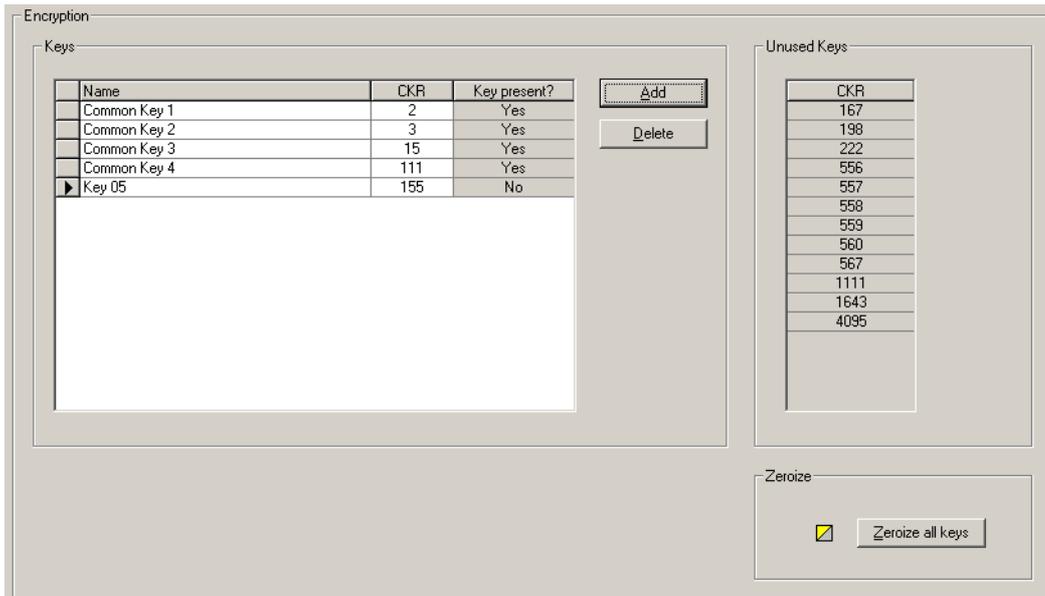
To create a new profile, click **Add**, and then click in each column as needed to edit it. To delete a profile, select it and click **Delete**.

- 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 network element switches any winning voice stream onto the analog line. If the squelch is Selective, the network element only switches a voice stream 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 network element 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	<p>Defines the individual ID of the analog line (digital P25 calls only). The network element 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.</p> <p> 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 SUs send Status Messages to an individual ID that is derived from the talk group assigned to the SU's current channel. To derive this ID, the SU adds 0xFE00 to the talk group. For example, talk group FFFF becomes individual ID 0xFFEFFF. Talk group 0x000A becomes individual ID 0xFE00A. These additional line IDs mean that Status Messages from these SUs 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.</p>
Destination	<p>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 SUs 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 network element will not respond to communications from other group members.</p> <p>If the call type is P25 individual, enter a 7-digit individual ID.</p> <p>This setting is overridden when the dispatch console uses MDC1200 signaling.</p>
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	<p>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.</p> <p>The encryption setting has no effect on analog FM calls.</p>
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

In the Encryption form (Configure > Analog Line > Encryption) you can set up encryption keys. The Unused keys area displays the [CKR](#) numbers of key data that has been loaded into the P25 Console Gateway but not associated with a key name. Use the Keys area to 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 as is 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 to be associated with the key. Enter the CKR of secure key data that has been or will be loaded into the P25 Console Gateway. If the CSS is connected to a P25 Console 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 P25 Console 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

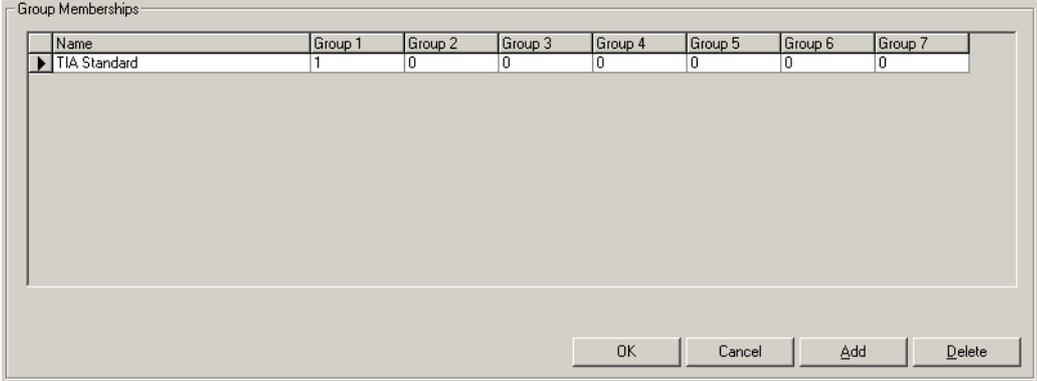
Click **Zeroize all keys** to remove all the secure key data that has been loaded by a key fill device. Zeroize all keys before loading new key data, to make sure that all obsolete key data is removed. Zeroize all key data when sending a gateway module for repair, to maintain security.

Defining Group Memberships

The Group Membership Table form (Configure > Analog Line > Group Memberships) lists sets of groups. You can add new group memberships or edit existing ones.

The network element only switches digital P25 calls to the analog line if they are to groups that are in the current group membership. The current calling profile selects the current group membership. The group membership has no effect on the RF interface.

You can enter up to ten sets of groups, each containing up to seven P25 group IDs.



Name	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
TIA Standard	1	0	0	0	0	0	0

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 network element 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 the changes and close the form.

Mapping Tone Remote Commands

The Tone Remote Mapping form indicates what actions function tones trigger. You can 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 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.

Tone 1 (Hz)	Action
550	FM
650	P25 Dispatch
750	Task Manager
850	Task Manager
950	Task Manager
1050	Task Manager
1150	Task Manager
1250	Task Manager
1350	Task Manager
1450	Task Manager
1550	Task Manager
1650	Task Manager
1750	Task Manager
1850	Task Manager
1950	Task Manager
2050	Task Manager

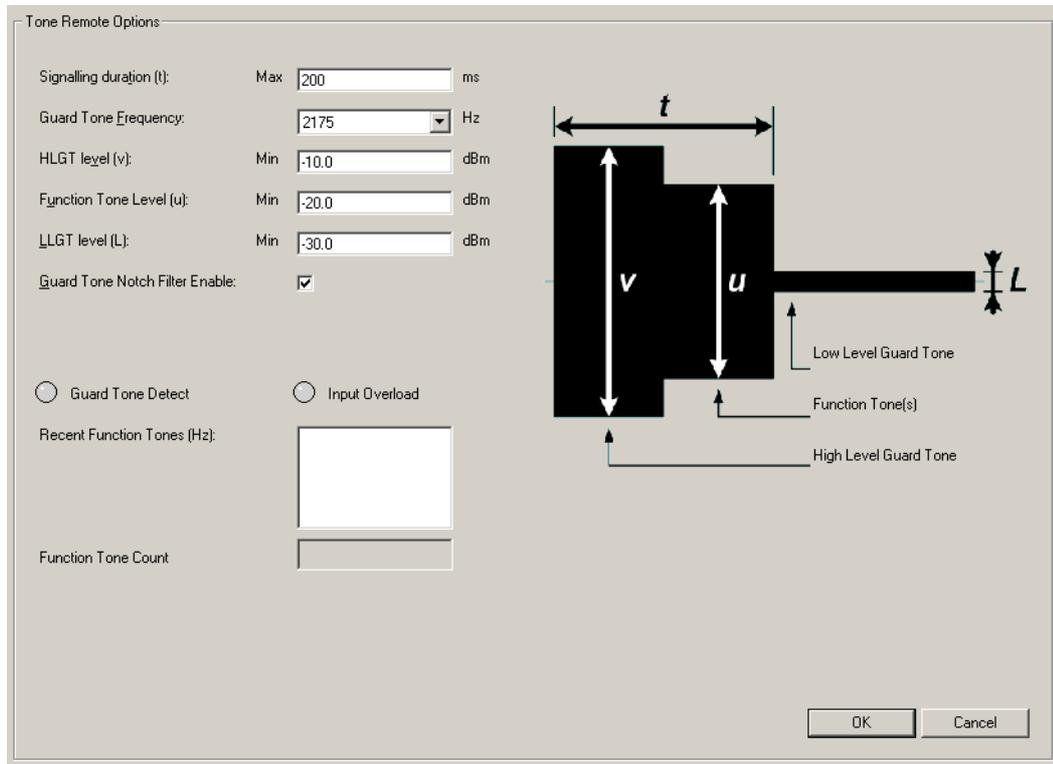
To map a function tone to a calling profile

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 the P25 Console Gateway or base station. 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 can be ascertained from the console system documentation, others may depend on the console system configuration. The console system and the network element 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 SUs, 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 network element to detect the tone. |
| Function tone level | Single tone or dual tone function tones must exceed this minimum level for the network element to detect them. |
| LLGT level | LLGT must exceed this minimum level and be less than the minimum HLGT level for the network element to detect the tone. |
| Guard tone notch filter | When this check box is enabled, the network element removes the LLGT from the audio before sending it to the voter. Normally, the notch filter is enabled. |

Monitoring Controls

Once the tone remote options are set up, 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 SU calls the dispatcher, the analog line converts the SU'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.

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 there is a 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 to map P25 group addresses or No to map 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.

We recommend using group and individual addresses between 1 and 9999. However, valid group addresses are 1-65535 (0xFFFF) and individual addresses 1-16777215 (0xFFFFFFFF). 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 the 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.

SU Numbering Example

The following example shows how a county Sheriff's department could number its SUs.

	P25 Start Address	P25 End Address	MDC1200 Start Address	MDC1200 End Address
Officer handportables	1	99	0001	0099
In-vehicle mobiles	201	299	0201	0299
Talkgroups	1	20	9001	9020

Officer 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 network element's alarms. Many alarms have thresholds that you can alter to suit the application. Unwanted alarms can be disabled.

You can run multiple instances of the CSS software (supported in version 3.00.xx and above) and use them for example to simultaneously monitor alarms at several network elements.

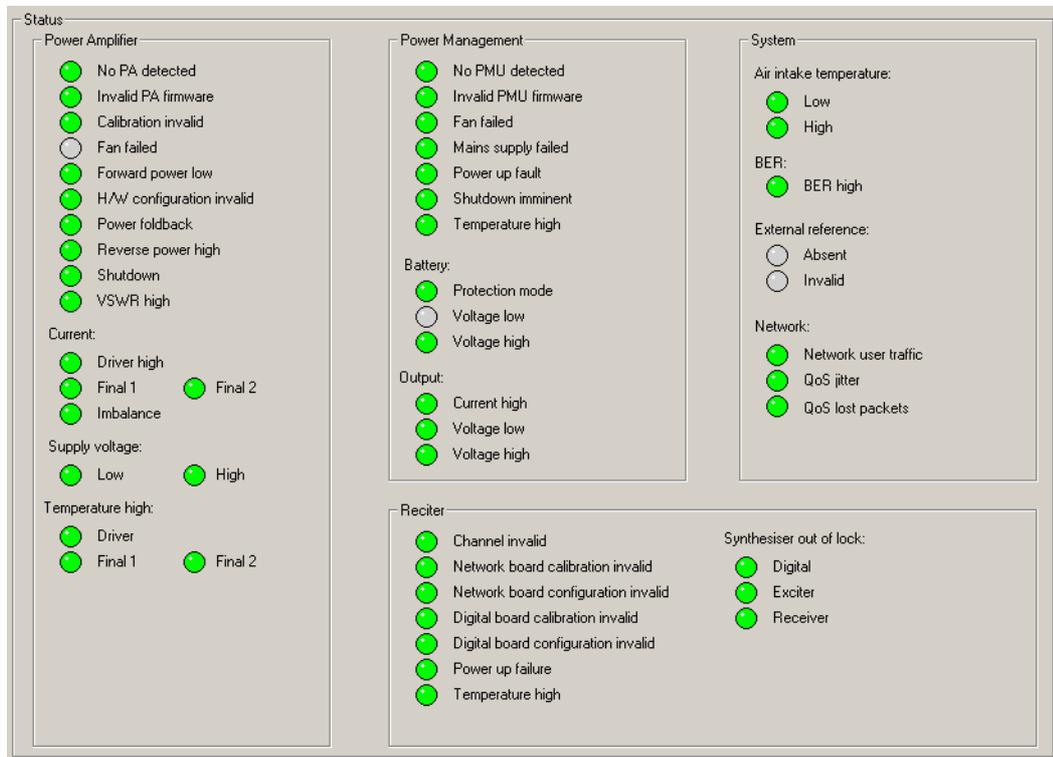
To view a list of recent alarms, display the system log (Monitor > Data Logging > System Log).

Topics

- [Monitoring Alarms](#)
- [Disabling Unwanted Alarms](#)
- [Altering Network Element Alarm Thresholds](#)
- [Altering Network Alarm Thresholds](#)
- [Logging to a Syslog Collector](#)
- [Configuring the SNMP Agent](#)

Monitoring Alarms

The Status form (Monitor > Alarms > Status) shows the current status of alarms in the base station or P25 Console Gateway. The CSS must be connected to one of these network elements before it can display any 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.

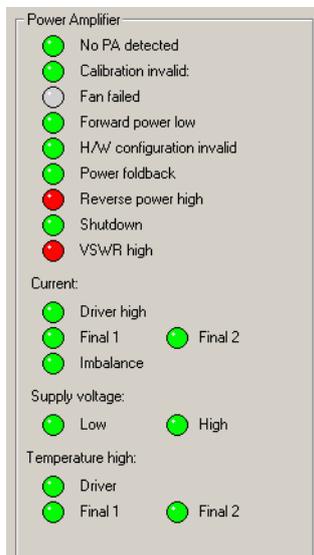
Alarms are triggered when a monitored condition crosses a defined threshold. Some thresholds are fixed and built into the module firmware. Others are configurable in Configure > Alarms > Element Thresholds and Network Thresholds. Some parameters such as high voltage and high reverse power have two thresholds. When the configurable threshold is crossed, the network element generates an alarm. When the built-in threshold is crossed, the network element 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 that the CSS is connected 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. The reciter has no associated PA. You should disable this alarm.
2. The network element 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 PA 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	<p>The PA has detected a fault condition and has reduced its power output to a minimal level to prevent damage.</p> <p>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.</p>
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	<p>The VSWR is above the configured threshold. A normal VSWR is $\leq 2:1$. 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.</p> <p>Check for a load mismatch on the PA's RF output.</p>

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.



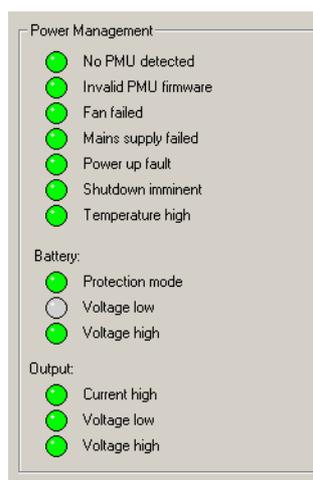
Note: The base station is not type-approved for operation when the supply voltage is outside the specified range.

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. The CSS must be connected to the channel module in position 1 of the subrack.



No PMU detected The channel module is unable to detect the PMU on the [control bus](#). Only the channel module in position 1 can communicate with the PMU. If the channel module is in position 1, the fault may be in the communication path and the PMU itself is still operating satisfactorily. However, in this case the system loses 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 PMU firmware.
2. Return the PMU to Tait.

Fan failed The PMU told the channel module that its fan is on, but the channel module cannot detect fan motion. The network element 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 A battery is currently being used to power the network element and its voltage has fallen below the configured power shutdown voltage. The PMU will stop operating 30 seconds after activating this alarm.

The main value of this alarm is as a syslog message, sent to the network's alarm center just before the PMU shuts 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. The network element is operating on mains power, but the battery voltage is below the configured power shutdown voltage. If mains power fails, the PMU will shut down to protect the battery.

Battery voltage low The battery voltage is below the configured alarm threshold. This threshold may have been set to alert you to the risk of damage to the battery from overdischarge. If the voltage falls further to below the configured shutdown voltage, the PMU automatically shuts down to protect the battery and the modules in the subrack.

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 network element 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 channel module.

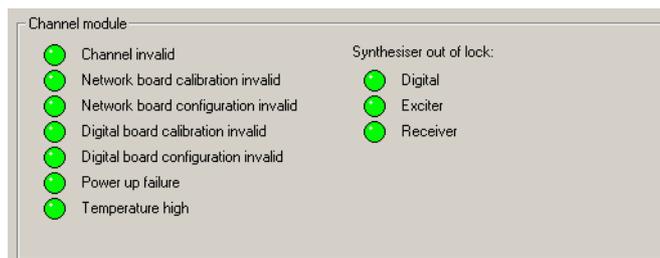
Output current high The PMU is providing more than 15 A of current and is automatically limiting its output, lowering the output voltage. There is a short circuit or the PMU is faulty.

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.

Channel Module

The Channel module area shows the Alarm status of the channel module.

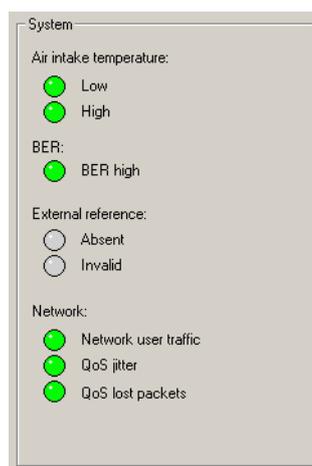


Channel invalid	<p>(Rare) The network element has received an instruction to select an invalid channel number and has stopped operating.</p> <p>The channel could be invalid for one of the following reasons:</p> <ol style="list-style-type: none"> 1. The current channel definition no longer exists. 2. 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	<p>The network element 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.</p> <ul style="list-style-type: none"> ■ Use the Calibration Software to calibrate the analog line.
Network board configuration invalid	<p>The configuration data has become corrupted. Open the corresponding configuration file stored on the CSS PC and program it into the network element.</p>
Digital board calibration invalid	<p>The network element 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.</p> <ol style="list-style-type: none"> 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	<p>The configuration data has become corrupted. Open the corresponding configuration file stored on the CSS PC and program it into the network element.</p>
Power up failure	<p>The channel module 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.</p> <div style="margin-bottom: 10px;">  <p>Note: This alarm will not show if the channel module cannot communicate with the CSS.</p> </div> <ol style="list-style-type: none"> 1. Reset the network element. This may clear the fault. 2. Send the channel module to a Service Center.
Temperature high	<p>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 > Channel Module.</p> <ol style="list-style-type: none"> 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	<p>The channel module has three different synthesizer alarms.</p>

Synthesizer out of lock: Digital	<p>One or more of the DSP and sampling clocks is out of lock. In response, the base station disabled the receiver and the transmitter.</p> <ol style="list-style-type: none"> 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	<p>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.</p> <ol style="list-style-type: none"> 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	<p>The receiver synthesizer is unable to lock onto the frequency it is configured to operate at. In response, the base station disabled the receiver.</p> <ol style="list-style-type: none"> 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 network element faults. Set a threshold for these alarms if this is appropriate for the system.



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	
BER high	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 estimated BER is greater than 5%, the alarm is triggered. A high BER indicates that the quality of the received signal is poor. This alarm is useful when the base station is used for RF linking. It indicates that something is wrong with the link. For other applications, we recommend disabling the alarm, so that it is not triggered every time an SU user calls from almost outside the base station's coverage area.
External Reference	
External reference absent	The base station can detect whether an external reference is present and whether it is usable. The base station did not detect an external reference frequency source. It is now using its own source. <ol style="list-style-type: none"> 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. <ol style="list-style-type: none"> 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	
Network user traffic	Most network alarms give early warning that the network is becoming congested. Packets are taking too long to traverse the network. The Maximum round trip delay threshold has been exceeded.
QoS jitter	The incoming voice stream has a delay variation greater than the configured threshold.
QoS lost packets	The number of lost packets in the incoming voice stream has exceeded one or more of the configured thresholds (see “Max loss rate” on page 154 and “Max interarrival jitter” on page 154).

Disabling Unwanted Alarms

You can disable any of the network element's alarms. Some alarms may not be appropriate for the system.

If you disable an alarm, it is disabled in the Alarm status form and in any diagnostics forms where it appears. It also does not turn on the control panel alarm LED or result in a SNMP trap. However, the alarm still generates a syslog message, which the network element stores in its log and optionally sends to a syslog collector. Disabling an alarm disables its syslog message 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 143](#).

The screenshot shows the 'Alarm Control' dialog box with the following sections and their contents:

- Power Amplifier:**
 - No PA detected
 - Calibration invalid
 - Fan failed
 - Forward power low
 - H/W configuration invalid
 - Power foldback
 - Reverse power high
 - Shutdown
 - VSWR high
- Current:**
 - Driver high
 - Final 1 Final 2
 - Imbalance
- Supply voltage:**
 - Low High
- Temperature high:**
 - Driver
 - Final 1 Final 2
- Power Management Unit:**
 - No PMU detected
 - Fan failed
 - Mains supply failed
 - Power up fault
 - Shutdown imminent
 - Temperature high
- Battery:**
 - Protection mode
 - Voltage low
 - Voltage high
- Output:**
 - Current high
 - Voltage low
 - Voltage high
- System:**
 - Air intake temperature:**
 - Low
 - High
 - BEB:**
 - High
 - External reference:**
 - Absent
 - Invalid
 - Network:**
 - Network user traffic
 - QoS jitter
 - QoS lost packets
- Reciter:**
 - ASIF comms failed
 - Calibration invalid
 - Channel invalid
 - Configuration invalid
 - Power up failure
 - Temperature high
- Synthesiser out of lock:**
 - Digital
 - Exciter
 - Receiver

Buttons: OK, Cancel

To disable unwanted alarms

1. Select Configure > Alarms > Control.
2. Clear the check boxes of the alarms to be disabled.
3. Click **OK**.

Altering Network Element Alarm Thresholds

The Network Element Thresholds form (Configure > Alarms > Element Thresholds) displays all configurable alarm thresholds.

Some alarm thresholds are fixed; they are built in to the network element and cannot be changed. Others have default values that can be adjusted to better reflect the system's operating conditions or monitoring procedures. This can be important if an alarm is used as an input in Task Manager tasks.

Network element thresholds			
PA			
	Minimum	Maximum	Currently
Power output:	3 W	W	N/A W
Reverse power output:	W	10 W	N/A W
VSWR:	:1	2.0 :1	N/A :1
Final temperature:	°F	194 °F	N/A °F
Driver temperature:	°F	176 °F	N/A °F
Air intake temperature:	-4 °F	122 °F	N/A °F
PMU			
	Minimum	Maximum	Currently
Battery voltage:	12V 24V 48V 11.0 22 44	12V 24V 48V 15.0 30 60	N/A V

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 the changes and close the form. When the current value of a parameter goes above the maximum or below the minimum, the network element triggers the corresponding alarm. The alarms that these thresholds apply to are described in “Monitoring Alarms” on page 143. The equivalent Task Manager inputs are described in “Alarm Inputs” on page 188.

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	<p>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.</p> <p>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.</p>

PMU

Battery voltage	<p>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 network element triggers the Battery voltage low alarm and the Task Manager input Battery voltage low becomes true.</p> <p>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 network element triggers the Battery voltage high alarm and the Task Manager input Battery voltage high becomes true.</p> <p>Both the upper and lower limits have a hysteresis of 0.1 V.</p>
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Altering Network Alarm Thresholds

The Network Thresholds form (Configure > Alarms > Network Thresholds) displays thresholds that are mostly for measures of the quality of service of the network link to other channel group members. 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 some advance warning.



Tip: Select Monitor > Interfaces > Channel Group to view current values for quality of service measures. These can help in the setting of appropriate thresholds.

Network Thresholds	
Max loss per call:	2 packets
Max loss rate:	5 packets per second
Max interarrival jitter:	120 ms

- | | |
|-------------------------|---|
| Max loss per call | The maximum allowable number of packets lost in one over. This threshold is designed for detecting a sudden acute loss of service. The network element 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 more packets are lost than the selected number, the network element 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 network element 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 network element raises the QoS jitter alarm. |

Logging to a Syslog Collector

You can use the Logging form (Configure > Alarms > Logging) to 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 network element 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 network element'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 TaitNet P25 System Manual 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 network element 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 network element 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 network element'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.

Select 'Warning' to minimize the loading on the linking infrastructure. The network element only sends messages if there is a problem.

Select 'Notice' to make sure that you do not lose the system log. All system log messages are sent to the syslog collector. If the network element resets, its system log is cleared, but the syslog collector still has its log of messages.

Also select 'Notice' if you want to set the syslog collector up to respond when a network element fails. Each network element sends a 'heartbeat' message at level 'Notice' to the syslog collector. If a network element fails, the syslog collector no longer receives the heartbeat and can raise the alarm.

Select 'Trace' to provide the syslog collector with the maximum detail possible. This is not normally needed.

Configuring the SNMP Agent

Use the SNMP form (Configure > Alarms > SNMP) to configure the operation of the SNMP agent within the base station. This is only needed if the network has an SNMP-based network management system. The SNMP agent is designed for base stations in trunked networks with external site controllers. An SNMP (external trunking) feature license is required.

The screenshot shows a web-based configuration form for the SNMP agent. The form is titled "SNMP" and has a "Traps" section. It contains five input fields: "Recipient address" (0.0.0.0), "Port number" (162), "Community name" (public), "Contact", and "Location".

- | | |
|-------------------|--|
| Recipient address | The IP address of the network management system to which SNMP traps are sent. If this box is empty, no SNMP messages are sent. |
| Port number | The port number that SNMP messages are sent to. |
| Community name | The community name that must be included in SNMP get requests. The base station's SNMP agent will only accept SNMP messages that have this community name. |
| Contact | Standard MIB-II data item that will be returned on a GET request for the OID 'SysContact.' You can specify the person to be contacted when a SNMP trap occurs. |
| Location | Standard MIB-II data item that will be returned on a GET request for the OID 'SysLocation.' You can specify the location of the network element. |

Part G Diagnosing

Using the CSS, you can carry out diagnostic tests on the base station or P25 Console Gateway and its modules. For many tests, the network element 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 network element status before, during, and after the test. Often you can combine different tests.

Some diagnostic tests check aspects of the network element. Others provide a simple function (for example, looping back the analog line) that facilitates setting up or trouble-shooting the network element's interface to external equipment.

Topics

- [Carrying Out Diagnostic Tests](#)

RF Interface

- [Receiver Tests](#)
- [Measuring Received Signal Levels](#)
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Line Interfaces

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Modules

- [PA Control Tests](#)
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- [Control Panel Tests](#)

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 network element uses its existing settings such as frequency and level, unless you entered different values. When a test comes to an end or is stopped, the network element 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 network element reverts to the frequency it was previously configured for.

Some tests can only be carried out when the network element 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 network element. 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 network element'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 network element 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, navigate to other forms to view monitoring screens or check the network element'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

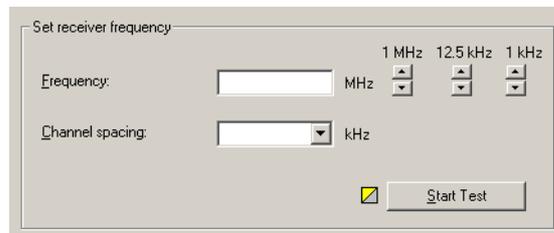
The CSS can carry out a variety of tests on the connected base station's RF interface. You can receive on any frequency and bandwidth, scan the switching range and display the signal strength, test synthesizer lock ranges, and transmit carrier, FM, or C4FM.

Receiver Tests

In the Receiver form (Diagnose > RF Interface > Receiver) you can carry out various tests on the TB9100 receiver.

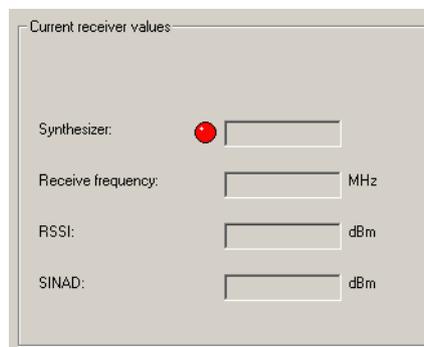
Testing Receiver Operation

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 SU to transmit a signal.
2. Select Diagnose > RF Interface > Receiver. In the **Frequency** box, enter the frequency for receiving 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.

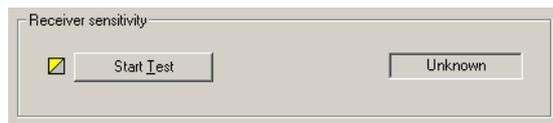
6. If desired, modify the receive frequency by clicking the up or down arrows. (You can repeat this as often as you want.)

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.

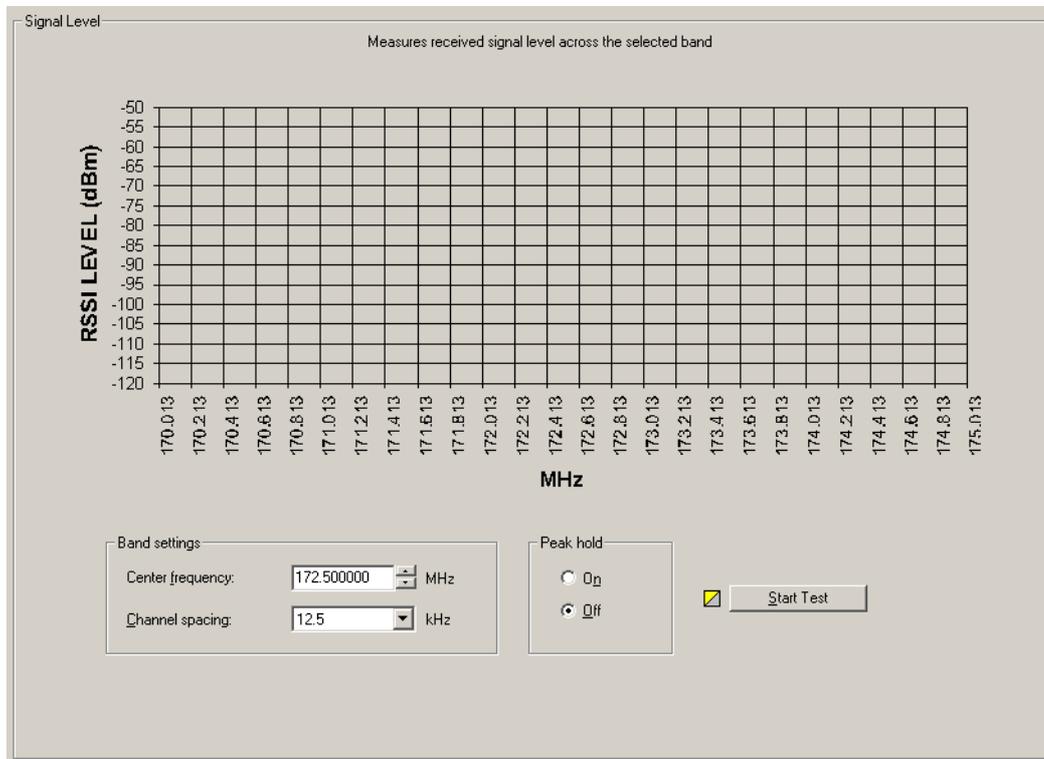


1. Disconnect the receive antenna and connect a 50 ohm load.
2. Select Diagnose > RF Interface > Receiver.
3. On the toolbar, click Standby.
4. Click **Start Test**. The box alongside indicates whether the receiver passed or failed the test. The test is carried out at the frequency and channel spacing 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 recalibrate 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 indicates what signals are out there; it does not determine the receiver's sensitivity.

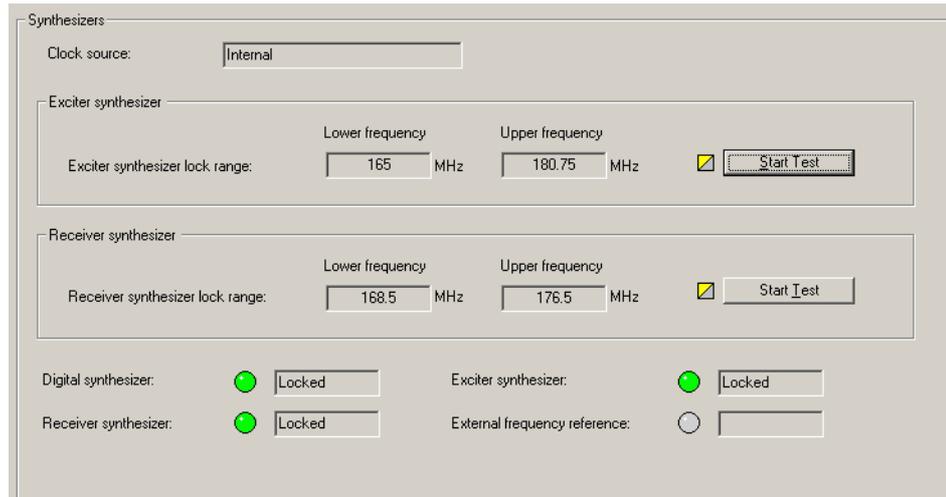
To measure signal levels

1. Select Diagnose > RF Interface > Signal Level.
2. In the **Center frequency** box, specify the middle frequency of the band to be tested. 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, the test will measure the signal levels of the different channels in the band.
4. Under **Peak hold**, select On and the display will show the strongest signal received on any pass. This means signals from infrequent users are more likely to be included. Select Off and the display will only show 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 specified center frequency. 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 > RF Interface > 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.



Note: K-band base stations have two exciter synthesizers, each covering a different band. The diagnostic test will show the range of one synthesizer but the exciter will also be able to operate on frequencies within the range of the other synthesizer. When the reciter was last calibrated, the synthesizer to be displayed was chosen.

5. Click **Stop Test**. The exciter and receiver frequencies revert to what they were before the start of the test.

Transmission Tests

In the Transmission form (Diagnose > Power Amplifier > Transmission) you can 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.

The screenshot shows the Transmission control panel with the following settings:

- Carrier:** Transmitter frequency: 170.000000 MHz, Power: 5 W (36.99 dBm). A "Stop Test" button is visible.
- FM:** Deviation: 2.5 kHz, Modulation level: 10%, Modulation frequency: 1000 Hz. A "Start Test" button is visible.
- C4FM:** Test pattern: C4FM_V52BER. A "Start Test" button is visible.
- Transmitter output:** Forward Power: 4 W, Reverse Power: 0 W. A VSWR of 1.4 is displayed.

- Carrier** The Carrier area initially displays values from the current channel configuration. You can configure and start a test transmission.
- Transmitter output** The Transmitter output area displays forward and reverse power gauges. You can choose whether to view the values as watts or dBm. Underneath is the [VSWR](#).
- FM** In the FM area, you can 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 111), 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 provides a graphical display of the forward and reverse power and the VSWR.

5. If desired, modulate the carrier using FM (see “[FM Test](#)” on page 167) or C4FM (see “[C4FM Test](#)” on page 167).
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, run a Carrier test, and 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 166).
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, run a Carrier test, and 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 166).
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 167), but select a different test pattern. The results obtained 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

In the Miscellaneous form, you can 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

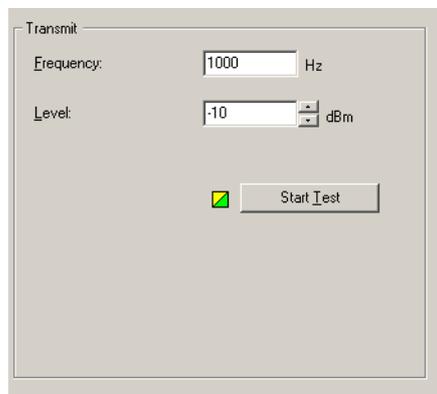
Using the CSS, you can carry out a range of tests on the analog and digital lines, the digital inputs and output, the E & M lines, and the serial port.

Analog Line Tests

Using the CSS, you can carry out transmit and loopback tests on the analog line. You can also monitor line levels.

Sending a Test Tone

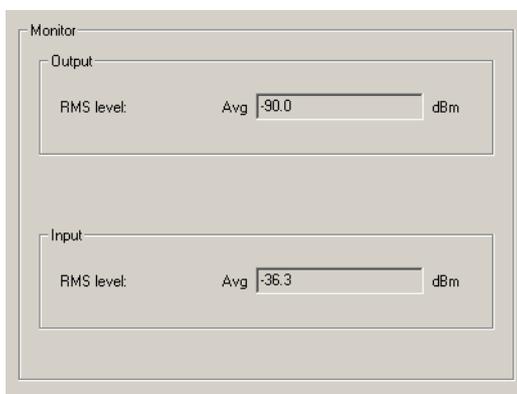
The channel module can output an audio test tone. Use this to test the channel module's ability to output audio on its analog line or to set up and configure the interface from external equipment to the network element.



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 network element is sending the test tone.
6. Adjust the external equipment as required.
7. Click **Stop Test** to end the test.

Monitoring Line Levels

The channel module can measure the mean levels of the current analog line input and output and display them on the CSS.



Use this diagnostic tool in the following situations:

- Troubleshooting: the measurement shows whether audio is arriving at the network element.
- Adjusting the audio output of other equipment such as a console.



Note: To avoid transmitting the test audio input, put the base station into Standby mode.

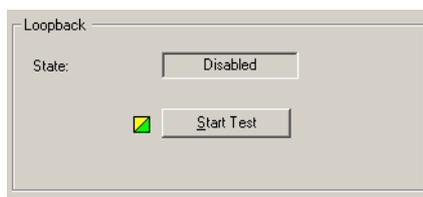
To monitor audio levels

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 network element sends and receives on the analog line. Levels are measured over a window of 500 ms and updated twice a second. The network element 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). Once 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 from the connected network element to routers and other network elements in the TaitNet P25 digital network. You can also obtain an estimate of link delays and 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 network element 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.



Note: The response time for a first ping may be long, if the network element needs to send an ARP request to obtain information about the destination IP address. A second ping carried out a short time later will give a more accurate estimate of the link delay, as the information will be cached.

System Interface Tests

The System Interface form (Diagnose > Line Interfaces > System Interface) displays the current state of all digital inputs and outputs. You can toggle the digital outputs and the M-wire output to help you test any equipment connected to them. This can be done on site or on the bench when the network element is connected to a CTU.

The **Digital inputs** area displays the current settings of digital inputs.

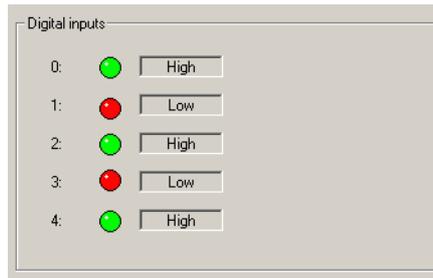
In the **Digital outputs** area, you can toggle the digital outputs. The pin number of each output is displayed.

The area below displays the current state of the E line and M line. You can 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 channel module.



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.



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 before the test.
3. Click the digital output's **Toggle** button to change its state.

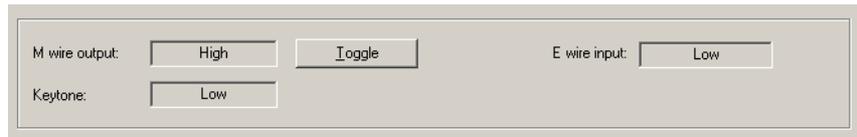
When the output is high, its LED is green. When it is low, the LED is red.

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 before the test.

Testing the E & M Lines

The network element can be configured to use the E & M lines on the RJ45 connector to carry channel seize and analog valid signals (Configure > Network Element > System Interface).

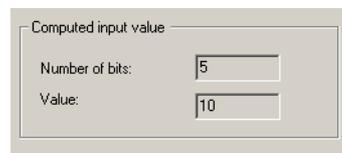


To test the E & M lines

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 network element is using to compute its input value as well as the computed value itself. The former is a configurable item (Configure > Network Element > System Interface) and the latter can be used as a Task Manager input to trigger desired actions such as changing channel.



Modules

Using the CSS, you can carry out various tests on network element modules. You can toggle fans, simulate a mains failure, and test the controls on the control panel.

PA Control Tests

In the PA Control Tests form (Diagnose > Modules > PA Control Tests), you can test the PA fan and front panel fault LED.

The screenshot shows the 'PA Control Tests' interface. It is divided into several sections:

- Current fault LED:** A radio button labeled 'Off' is selected. Below it is a green checkmark icon and a 'Start Test' button.
- Fan:** A red indicator light is shown next to the word 'Off'. To the right is a 'Toggle Fan' button. Below this is a 'Time until autostop' field with the value '0', a green checkmark icon, and a 'Start Test' button.
- Current temperature:** This section contains four thermometers with scales from -40 to 212 degrees Fahrenheit.
 - PA air intake temperature:** 84 °F
 - Final 1 temperature:** 82 °F
 - PA driver temperature:** 82 °F
 - Final 2 temperature:** °F

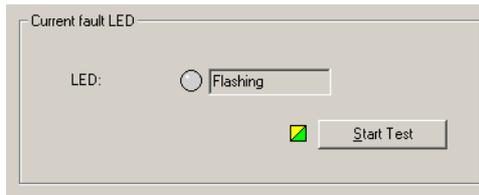
The PA Control Tests form provides information about the PA that is useful before you carry out any tests.

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.

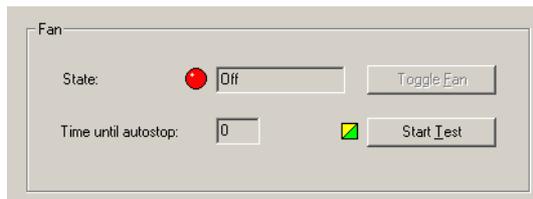
Testing the Fan

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.

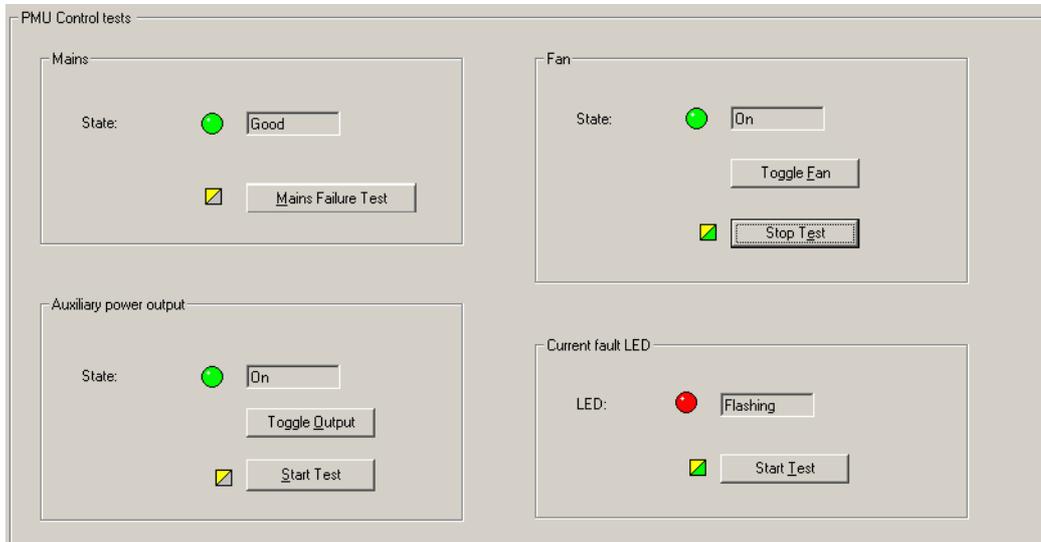


To test the fan

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

In the PMU Control Tests form, you can simulate a mains failure. You can also check that the fan, the fault LED, and the auxiliary output are working.



Simulating Mains Failure

Simulating a mains failure tests the network element'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 network element.

4. Verify that the network element is still operating.
5. To end the test, click **End Test**.

Testing the Fan

You can ask the network element 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 network element 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 network element 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

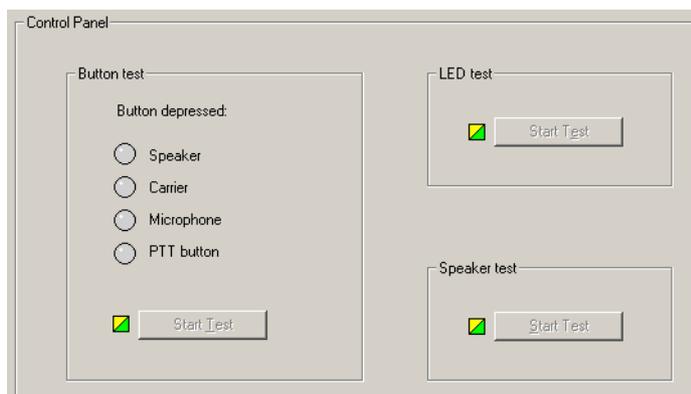
You can test that the fault LED on the front of the PMU is able to light up. (This LED is only visible when the front panel is removed.)

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

In the Control Panel form (Diagnose > Modules > Control Panel), you can carry out tests to verify that the controls on the front of the network element are working. You must be at the site.

Before starting a test, make sure that the CSS is connected to the same network element (channel) that the control panel currently selects. For example, if the channel button on the control panel has selected 1, you must be connected to reciter 1 or gateway module 1.



To test control panel buttons

1. Under **Button test**, click **Start Test**. This disables all control panel functions. The network element will now pass control panel inputs to the CSS.
2. Press a button on the control panel.
3. Check that the corresponding LED in the CSS form turns green.
4. Repeat steps 2 and 3 for each other button to be tested.
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 network element will now pass 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. (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 provides a 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](#)
- [Working With the Task List](#)
- [Inputs](#)
- [Actions](#)
- [Task Manager Examples](#)
- [Customizing Task Manager](#)
- [Monitoring Task Manager](#)

Introduction to Task Manager

Task Manager operates like this. When the network element 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 program the changes into the network element. In effect, you are creating scripts that make the network element perform simple actions. This customizes the way the network element operates without modifying its firmware. Task Manager can perform many functions that previously required expensive external equipment.

Task Manager Rules

Before writing your own sets of tasks, you need to know the following rules that define how Task Manager processes tasks.

- A task is only carried out if its input changes. For example, when the network element is in Run mode, the task IF Network element in Run mode THEN Increment counter 1 is not carried out. Counter 1 only changes when the network element 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**

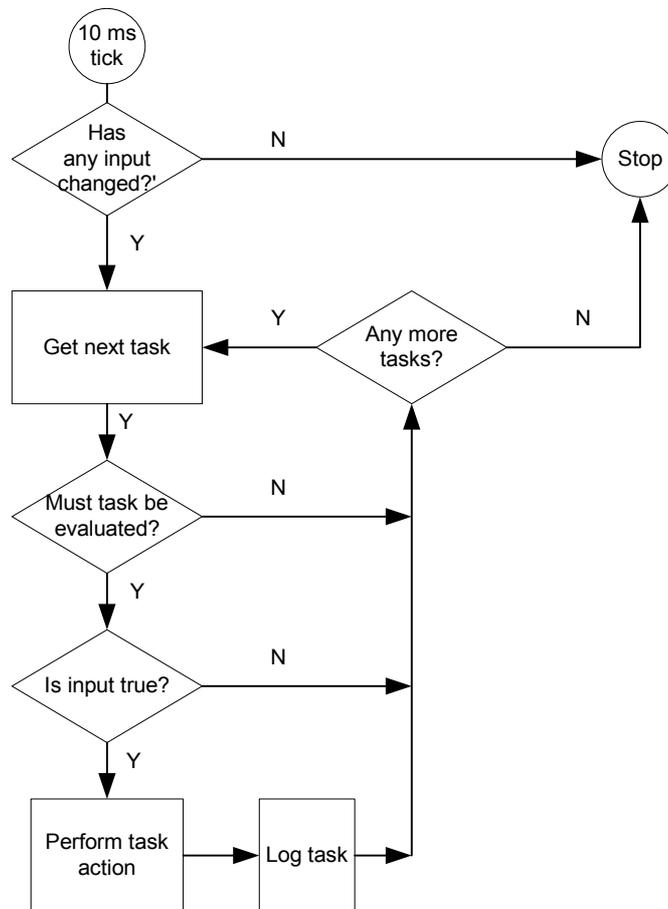
IF NOT **Analog received** THEN **Set digital output low**

- 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 network element 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 network element. 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 network element 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 network element 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 network element 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 network element'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, existing inputs or actions can be combined to form custom inputs or actions.

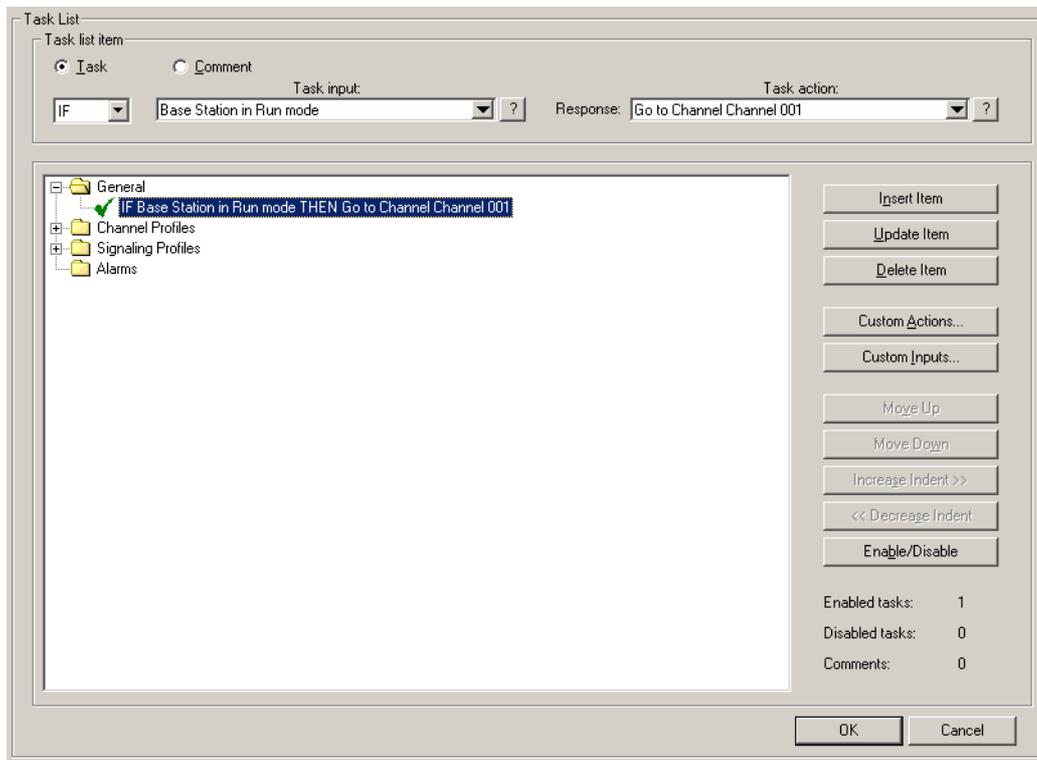
A custom input combines up to eight different inputs. It becomes true when the combination becomes true, according to the rules of the Boolean logic that you specify for the combination.

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) displays the list of tasks that Task Manager processes. You can 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.



In the **Task list item** area, you can create or edit tasks and comments. To edit an existing item, click it in the task list. Click one of the special Help icons to display information about the input or action currently displayed.

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.

Use the buttons to the right to maintain the tasks in the list. For example, you can insert a newly created item or delete 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 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 186 .
Delete Item	The Delete button deletes the current task list item.
Custom Actions	Opens the Custom Actions form, where you can define a combination of existing actions.
Custom Inputs	Opens the Custom Inputs form, where you can define a 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	Adds or removes 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. Use the Enable / Disable button to disable a task so that it has no effect, or toggle it between enabled and disabled.
Enabled tasks	Displays the total number of enabled Task Manager tasks. You can have up to 200 enabled tasks.
Disabled tasks	Displays the total number of disabled Task Manager tasks. The total number of tasks (enabled and disabled) must not exceed 400.
Comments	Displays the total number of Task Manager comments. The task list can have up to 100 comments.

Adding a Task

To make full use of the network element'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 the 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 network element's ability to operate properly. Make sure that the choices made 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 before commissioning the network element. 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 > Task Manager > Task List**.
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, for 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 defining 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 > Task Manager > Task List.
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. Enter 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 the 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. (When the network element 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

Any alarm can be a Task Manager input. This makes it possible to individually configure the network element's response to any alarm. For information about alarms, see [“Monitoring Alarms” on page 143](#). 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.

Network element alarm on

This input becomes true when any 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 147](#).

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 147](#).

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 147](#).

Channel invalid

This input becomes true when the ‘Channel invalid’ alarm is triggered. For information about this alarm, see [“Channel invalid” on page 148](#).

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 150](#).

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 150](#).

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 144](#) for the PA or [“Fan failed” on page 146](#) 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 150](#).

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 148](#).

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 148](#).

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 150](#).

Network board QoS Jitter

This input becomes true when the QoS jitter alarm is triggered. For more information, see [“QoS jitter” on page 150](#).

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 150](#).

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 144](#).

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 146](#).

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 150](#).

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 149](#).

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 145](#).

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 144](#).

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 145](#).

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 145](#).

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 145](#).

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 146](#).

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 146](#).

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 147](#).

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 146](#).

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 146](#).

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 147](#).

Reciter alarm on

This input becomes true when any alarm in the channel module 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 145](#).



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 148](#) and [“External reference invalid” on page 150](#).

VSWR fault

This input becomes true when the 'VSWR high' alarm is triggered. For information about this alarm, see [“VSWR high” on page 145](#).

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 network element is configured to recognize (digital input, E & M, or tone remote).

Tone remote detected

The Tone remote detected (nnn) input becomes true when the network element detects function tone number nnn on its analog line. To select this input, 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.

Network element in Run mode

The **Network element in Run mode** input becomes true when the network element goes into Run mode. This occurs on startup and when the CSS tells a network element in Standby mode to change to Run mode.

Use this input for tasks to be included in Task Manager's initialization routine, to start timers, and to lock functions that will only operate under particular circumstances.



Important: The inverse of this input (IF NOT **Network element in Run mode**) must not be used; when the network element is not in Run mode, Task Manager is not operating.

Example

```
IF Network element in Run mode THEN Lock transmitter  
IF Network element 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 network element changes channel to the channel in the channel table with the name *nnn*.

Channel changed

The **Channel changed** input becomes true when the network element 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 network element 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 network element 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 network element 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 network element 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 > Network Element > Miscellaneous) is set to Task Manager, the auxiliary power output is also on.

Channel group unlocked

The channel group is unlocked when the network element 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 network element functioning that affects the wider network.

Function code received

The **Function code received (nn)** input becomes true when the network element receives the function code nn from another channel group member. This input makes it possible for channel group members that are not connected to an analog console system to act on dispatcher wildcard commands. See the TaitNet P25 System Manual for details.



Important: Do not use function codes for changing channel, enabling/disabling RF repeat, or monitoring. Use collective channel control instead.

Example

IF **Function code received (02)** THEN **Lock subaudible/NAC decoding.**

Function code sent

The **Function code sent (nnn)** input becomes true when Task Manager instructs the network element to send function code nnn to the channel group.



Important: Do not use function codes for changing channel, enabling/disabling RF repeat, or monitoring. Use collective channel control instead.

Vote won by Analog line

The **Vote won by Analog line** input becomes true when the network element's voter (switch) 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 network element's voter (switch) 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 network element's voter (switch) 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.



Note: If the base station receives a particular NAC and the previous call used the same NAC, the action is not triggered. The NAC of the previous call must have been different to trigger the action. In other words, Task Manager requires a transition from one NAC to another, not merely a transition from silence to a NAC. Users can ensure that the NAC triggers a Task Manager action by first sending a different NAC.

RF repeat

The **RF repeat** input becomes true when RF repeat is enabled in the base station. This can occur as a result of a dispatcher command (received via the DFSI gateway or implemented using the Task Manager action Enable/Disable/Toggle RF repeat). It can also occur when the base station changes channel or transitions to Run mode, if this enables RF repeat.

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 network element 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 network element 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 was 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 network element 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 network element to do. There is often a group of actions relating to a particular network element function. For example, Task Manager can lock, unlock, or toggle the automatic transmission of a network element 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 network element's current channel.

Go to channel

The **Go to channel** action instructs the network element 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 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 network element will only ever change to channel 006.



Important: Make sure that Task Manager actions do not ask the network element to change channel more often than once every 500 ms.

Go to next channel

The **Go to next channel** action instructs the network element to operate on the next valid channel in the channel table. If the network element 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 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 network element will move two channels down the channel table.

If the network element 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 network element to change channel more often than once every 500 ms.

Go to previous channel

The **Go to previous channel** action instructs the network element to operate on the previous valid channel in the channel table. If the network element 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 reset).

In network elements with a complex set of Task Manager tasks, it is important 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 network element will move two channels up the channel table.

If the network element 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 network element 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 the digital output line 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 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 the digital output line 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 network element 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 network element 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 network element. No analog voice can pass between the console and the network element. 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 > Network Element > Miscellaneous) is set to Task Manager, locking the auxiliary supply turns it off and unlocking it turns it on.

Example

IF Network element in Run mode THEN Unlock auxiliary supply

This task turns the auxiliary output on whenever the network element enters Run mode.

Channel group lock

Task Manager can lock the current channel group. This disconnects the network element 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 a 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. If the control of RF repeat is set to Collective (see [“RF repeat” on page 126](#)), this action will be passed on to the other members of the channel group.

You can create tasks with this action in the P25 Console Gateway, even though it has no RF capability. The action has no effect on the console gateway itself, but if collective channel control is enabled, the action is passed on to the other channel group members.

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 channel group members. This action is needed in order to propagate a dispatcher wildcard command to the channel group. See the TaitNet P25 System Manual for details.



Important: Do not use function codes for changing channel, enabling/disabling RF repeat, or monitoring. Use collective channel control instead.

Example

IF **Tone remote detected (550)** THEN **Send Function Code 5**

Statements of this type make it possible for wildcard commands received over the analog line to be relayed to the other channel group members, so that all can, for example, unmute to any signal rather than to a particular NAC or subaudible tone or code.

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, the CWID could be 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 network element using Configure > Task Manager > Custom Actions.

Task Manager Examples

Task Manager makes it possible for you to build complex functions into a base station or P25 Console Gateway. Here are some examples of to give 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 the 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 Network element 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) lists the existing custom inputs. Click an input to see what combination of standard inputs it 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.)

The screenshot shows the 'Custom Inputs' configuration window. On the left, there is a list of custom inputs with the header 'Custom Input Name' and one entry, 'Custom Input 01'. Below this list are three buttons: 'Add', 'Rename', and 'Delete'. An arrow points from the list to the right-hand configuration area. This area is divided into three columns: 'Not', 'Inputs', and 'Logic'. It displays a logic tree for 'Custom Input 01'. The tree starts with four inputs: 1. 'Fan failed' (with a 'Not' checkbox), 2. 'PA temperature high', 3. 'PMU temperature high', and 4. 'VSWR fault'. Each input has a dropdown menu. Lines connect these inputs to 'OR' gates. The first two inputs are connected to one 'OR' gate, and the next two to another. These two 'OR' gates are then connected to a final 'OR' gate, which represents the overall logic for the custom input. Below the logic tree are eight more input rows, each with a 'Not' checkbox and a dropdown menu.

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 206.)

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 desired logical combination of inputs. (For information about the effect of the different options, see [“Truth Table” on page 206.](#))
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) displays the list of existing custom actions. Click a custom action to see what combination of standard actions 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.

Custom Actions

Custom Action Name

Custom Action 01

Actions

1: Go to Channel Channel 003

2: Disable CWID

3: Increment Counter(Counter 1)

4:

5:

6:

7:

8:

Add Rename Delete

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. We recommend 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 the unit of time for the entered number.

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 network element is behaving unexpectedly, check to see whether Task Manager has locked any functions. Alternatively, have a look at the system log; it records any actions that Task Manager carries out. You can also view the current state of timers, counter, and flags.

Viewing Locks

The Locks form (Monitor > Task Manager > Locks) shows whether Task Manager has locked any functions.



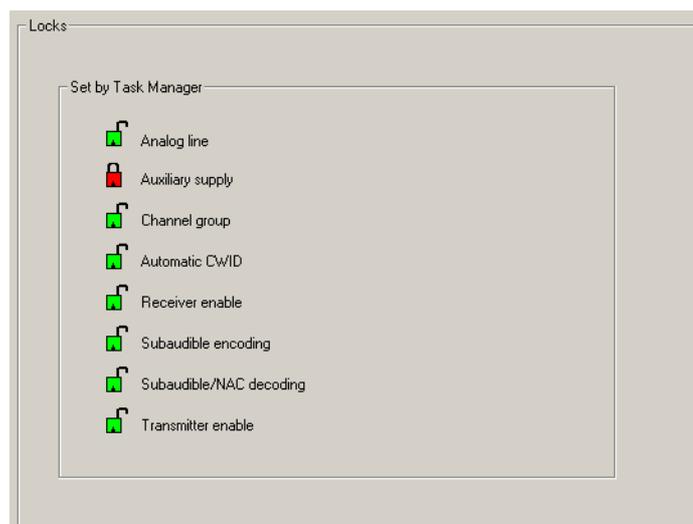
If the function is locked, the form displays a red locked padlock.



If the function is unlocked, the form displays a green open padlock.

When the network element 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 network element 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 > Network Element > 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 network element 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 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 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 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 it is cleared.

TaitNet P25 Glossary

This glossary contains an alphabetical list of terms and abbreviations related to the TaitNet P25 network, the CSS, the TB9100 base station, and the P25 Console Gateway.

A

administrator	A special type of access to CSS functions, used for activities such as changing passwords.
access code	A password required to gain access to a set of privileges.
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 network element's channel group interface sends and receives the analog signal as G. 711 speech packets.
analog valid	Analog valid is a signal that indicates that the TB9100 base station or P25 Console Gateway 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 with a numerical identifier or alphanumeric label of the caller.
antenna relay	A DC-powered device that switches the antenna as needed between the base station's receiver and transmitter. With an antenna relay, a simplex base station only needs one antenna.
APCO	The Association of Public Safety Communications Officials in the United States. The APCO Project 25 standards committee defined the P25 digital radio standard. The standard is often referred to as APCO or P25.

ARP	ARP (Address Resolution Protocol) is a IP protocol used to map IP network addresses to the hardware addresses used by a data link protocol.
B	
Base station	A radio receiver and transmitter that is located in a specific place (at a site) that enables a two-way radio to communicate with a dispatcher or over a larger range with other two-way radios. Specifically, Tait TB9100 equipment in a subrack.
Battery protection mode	A PMU enters battery protection mode when it has AC power but its DC power is below the configured power shutdown voltage. In battery protection mode, the PMU will shut down to protect the battery if it loses AC power.
BCD	BCD (binary coded decimal) is a code in which a string of four binary digits represents a decimal number.
bearer network	Telecom equipment that is used to carry user data.
BER	Bit Error Rate. A measure of the quality of digital transmission, expressed as a percentage. The BER indicates the proportion of errors to correctly received digits in a received signal.
C	
C4FM	Compatible Four-level Frequency Modulation. A modulation scheme defined in the P25 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 may be 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 SU on the network.
central voting	Voting that is centralized at one member of the channel group.

channel	<p>A channel is:</p> <ol style="list-style-type: none"> 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). ‘Channel’ has this meaning in the CSS.
channel coordinator	A software module within the reciter or gateway module that propagates dispatcher channel control commands to the channel group. The channel coordinator also ensures that all channel group members have consistent states so that they work together properly.
channel group	A channel group is a single logical channel consisting of a set of base stations. P25 Console Gateways can also be members. The members of a channel group are linked by an IP network and share a common multicast IP address.
channel module	Channel module is a common term used to refer to reciters and gateway modules. TB9100 base stations have reciters and P25 Console Gateways have gateway modules.
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 or P25 Console Gateway to accept the signal on the analog line as an input into the channel group. An asserted E-line, LLGT, or LLGT following MDC1200 signaling can function 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.
community repeater	Repeater that is shared by several user groups.
CODEC	A device 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 or P25 Console Gateway, 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 and P25 Console Gateways that the CSS can connect to.
control bus	The control bus is used for communications between 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 or P25 Console Gateway with buttons, LEDs and other controls that let a maintainer interact with the network element.
conventional network	Conventional networks are systems that do not have centralized management of channel access. System operation is entirely controlled by system end users.
CRTP	Compressed RTP.
crypto module	Module for securely storing encryption keys and for encrypting and decrypting signals.
CSS	Customer Service Software. Tait PC-based software for monitoring, configuring, and diagnosing a Tait TB9100 base station or P25 Console Gateway.
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 (Continuous Wave Identification) 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 an encryption algorithm selected by the P25 standard.
DDC	Digital Down Converter. A device which converts the digitized IF signal of the receiver down to a lower frequency (complex baseband) to suit the DSP.
DFSI	The Digital Fixed Station Interface connects digital dispatch equipment with a base station or channel group. It is defined in the Project 25 TIA standard.
digital input value	A value that the TB9100 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 one or more SU users.
distributed voting	Voting for the best RF signal that is carried out separately by each channel group member using the same voting algorithm.
dotted quad	A method for writing IPv4 addresses. The form is DDD.DDD.DDD.DDD where DDD is an 8-bit decimal number.
downlink	The transmission path from fixed equipment to SUs.
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.
duplex	Providing transmission and reception in both directions simultaneously.
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 transmitting.

E

E & M	A pair of wires used for DC signaling. For example, the signal to set up a call is often sent from the 'M' (mouth) end of a wire to the other 'E' (ear) end by grounding the wire.
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 software feature license that can be enabled or disabled using the Software Feature Enabler.
Feature Code Sequence Number	Number that indicates how many times a software feature license has been enabled or disabled.
Feature license key	A set of digits purchased from Tait that is required to enable a software feature license.
FEC	Forward Error Correction. A method of encoding data so that the receiving end is able to correct transmission errors.
fill-in receiver	An additional receiver placed within the coverage area of a base station to receive SU transmissions that are too weak to be received by that base station.
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 network element 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 TB9100 base station containing fans for the PA and PMU.
FSH	Fixed Station Host.
function code	A value that Task Manager can send to the channel group that can serve as an input to Task Manager actions at other channel group members.
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 TB9100 base station is in analog FM mode, G. 711 speech is sent and received on the channel group interface.
gating	Gating is the process of opening and closing the receiver gate. When a valid signal is received, the receiver gate opens, letting the signal through.
group call	A group call is a call that is sent to more than one SUs simultaneously.
H	
heartbeat message	A message whose purpose is to indicate to the receiver that the sender is operational.
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.
HLGT	High level guard tone. A tone that announces the beginning of tone remote signaling.
hostname	The unique name by which a network element is known on the network.
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.

impairment A measure of signal quality used in channel group voting. Impairment is inversely related to signal quality. The lowest impairment (0) indicates the highest signal quality. The highest impairment (15) indicates the worst signal quality.

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 SU. An inhibited SU 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

kernel The kernel is the core executable of an operating system.

key ID The Key ID is the identifier for an encryption key variable.

key fill device A device such as a Motorola KVL3000+ for defining encryption keys and transferring them into P25 equipment.

keytone A signaling tone that accompanies voice on the analog line and is used to key the transmitter. Also referred to as LLGT.

key variable The key variable is a parameter used by the encryption algorithm to encrypt or decrypt a message.

L

LAN	Local Area Network
LDU	Link Data Unit. Voice calls are sent over the CAI as a series of LDUs.
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 in analog PMR to provide subscriber signaling.
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 refers to a group of hosts rather than a single host. These hosts will all accept packets with this IP address.
mute	A mute prevents audio from being passed to the radio's speaker.

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.
NAT	NAT (network address translation) allows the use of a single IP address for a whole network of computers. A NAT sits between the public Internet and the network it serves, and works by rewriting IP addresses and port numbers in IP headers on the fly so the packets all appear to be coming from (or going to) the single public IP address of the NAT device instead of the actual source or destination.
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.

network element A network element is any device that is network-connected. A TaitNet digital network consists of a number of network elements. The TB9100 base station and the P25 Console Gateway are network elements designed and manufactured by Tait.

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.

outbound Outbound describes the direction of a signal: from a fixed station over the air interface to a SU.

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 endorsed by the TIA and intended for digital public safety radio communications systems.

P25 Console Gateway A Tait network element that acts as a gateway between an analog dispatch console and a channel group.

PA The PA (power amplifier) is a base station module that boosts the exciter output to the required 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 in the TB9100 base station that provides power to the subrack and monitors power conditions. P25 Console Gateways can also have a PMU.

preamble A well-defined signal that is transmitted at the beginning of digital P25 calls to facilitate downlink voting and to allow the transmit buffer to fill.

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

privileges A set of access rights to CSS functions. There are Guest, Maintainer, and Administrator privileges.

program	The act of sending a configuration data set from the CSS to the TB9100 base station or P25 Console Gateway.
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 SU that keys the transmitter.
Q	
QoS	Quality Of Service. A router feature that gives real-time data such as voice calls priority over other data.
R	
receiver number	A unique number assigned to the members of a channel group and used by the DFSI interface.
reciter	The reciter is a module of a TB9100 base station that provides both receiver and exciter functionality.
repeater talkaround	Repeater talkaround allows the SU user to bypass repeater operation and so communicate directly with other SUs. 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 computer. A type of microprocessor that recognizes a relatively limited number of instructions. The reciter's digital board and network board both have RISC microprocessors.
router	A router is an internetwork packet switch that switches data packets from an input interface to an output interface. The interfaces can be of different types.
RS-232	A protocol for serial communications between DTE (data terminal equipment) and DCE (data communications equipment).
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 TB9100 base station or P25 Console Gateway.

Rx Receiver.

S

satellite voter A channel group member that has delegated voting activity to a central voter.

SAW filter Surface Acoustic Wave filter. A band pass filter that can be used to filter both RF and IF frequencies. A SAW filter uses the piezoelectric effect to turn the input signal into vibrations that are turned back into electrical signals in the desired frequency range.

selectivity The ability of a radio receiver to select the wanted signal and reject unwanted signals on adjacent channels (expressed as a ratio).

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.

simplex Able to provide transmission and reception only in one direction at a time.

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.

site 1. The base station equipment at a particular location. This includes power supplies, transmitters, receivers, network interfaces and controllers. 2. The location of that 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, have the correct NAC.

SSRC	Synchronization source. The SSRC is a large number specified by the trunking controller in its connection message. It uniquely identifies voice streams sent from the master base station.
Standby mode	Standby mode is a mode of operation in which active service is suspended so that special operations can be carried out, such as programming in a new configuration or carrying out invasive diagnostic tests.
SU	Abbreviation for subscriber unit. This is the term used in the APCO P25 standard documents for a two-way radio (generally a mobile or a portable radio) conforming to the CAI specifications.
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 SU monitoring.
switching range	The switching range is the range of frequencies (about 10 MHz) that the radio 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. TB9100 base stations and P25 Console Gateways can send messages such as alarms to an IP address on the TaitNet P25 digital network. The base station's logs store messages in the syslog format.
syslog collector	A program that can receive, display, and log syslog messages from many devices.
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 P25-compliant base station consisting 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 network element 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 must become true before the network element carries out the second part.
Task Manager	Task Manager is a part of the network element firmware that carries out tasks in response to inputs. These tasks are formulated using the CSS.
TCCP	Trunking Channel Control Protocol. A proprietary protocol operating over IP for the exchange of channel control messages between a TB9100 base station and a trunking site controller.
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.
tone remote function tone	An audio tone used for signaling to a TB9100 base station or P25 Console Gateway on the analog line.
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 an inhibited SU to normal functioning.
UDP	User Datagram Protocol. A simple protocol on top of IP for sending streams of data.
uplink	The transmission path from SUs to fixed equipment.
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 unmutes to. A signal is valid, for example, when it is strong enough to be decoded and when it has the specified NAC.
vocoder	Voice encoder/decoder. A processing element that compresses/decompresses the digital voice signal.
voice stream	A digitized voice signal that passes through the main switch.
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.
VPN	Virtual private network. A private communications network used to communicate confidentially over a non-private network.
VSWR	Voltage Standing Wave Ratio (VSWR) is the ratio of the maximum peak voltage anywhere on the transmission line to the minimum value anywhere on the transmission line. A perfectly matched line has a VSWR of 1:1. A high ratio indicates that the antenna subsystem is poorly matched.

W

watchdog	A watchdog circuit checks that the system is still responding. If the system does not respond (because the firmware has locked up), the circuit generally resets the system.
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Z

zeroize	To zeroize one or more encryption keys is to render them useless by overwriting the key data with zeros.
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