

TB8100 base station

Task Manager Programming Guide



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Associated Documentation

TB8100 Service Kit User's Manual (MBA-00010-xx) and online Help.
TN-947-AN TB8100 Base Station Computer Controlled Interface
Protocol

1 Introduction

This technical note aims to give guidance to system integrators who need to make use of Task Manager's more advanced capabilities. It complements the Service Kit online Help and manual, which provide detailed information on Service Kit forms and on individual Task Manager inputs and actions.

Task Manager is a powerful processing engine that adds intelligence to each base station, enhancing its flexibility and configurability. As part of the firmware running on the reciter's digital board, Task Manager is able to respond to various inputs or operating parameters. Task Manager monitors a wide range of base station parameters. If one of them changes, Task Manager can take appropriate action, for example by changing channel, setting the digital output, or disabling a configured function. What action (if any) Task Manager takes depends on the tasks it has been given. Using the Service Kit, you are able to define these tasks.

TB8100 base stations are fully functional without any Task Manager tasks. Many base stations do not need a single Task Manager task. Others may need a few tasks to carry out simple functions such as sending a regular alarm log to the Alarm Center or using the digital inputs and outputs. In a standard base station, Task Manager is able to process up to 20 tasks. For more complex applications such as scanning, the 'Advanced Profiles and Task Manager' license (TBAS020) is required. This makes it possible for Task Manager to process up to 200 tasks.

External computer equipment can carry out similar functions to Task Manager. Using the proprietary Tait computer-controlled interface (CCI) protocol, it can read the state of base station parameters and instruct the base station to carry out any of the actions that Task Manager can. For more details, see TN-947-AN.

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 **Receiving valid signal** THEN **Activate digital output 1**.
IF NOT **Receiving valid signal** THEN **Deactivate digital output 1**.

This example code works as follows. Task Manager continually monitors the receiver gate, along with many other base station parameters. When the receiver unmutes, the input 'receiving valid signal' becomes true. When Task Manager next processes its tasks, it executes the first task, which results in the action of activating digital output 1.

Similarly, when the call ends, the receiver gate mutes. The condition 'IF NOT receiving valid signal' becomes true. When Task Manager next processes its tasks, it executes the second task, which deactivates digital output 1.

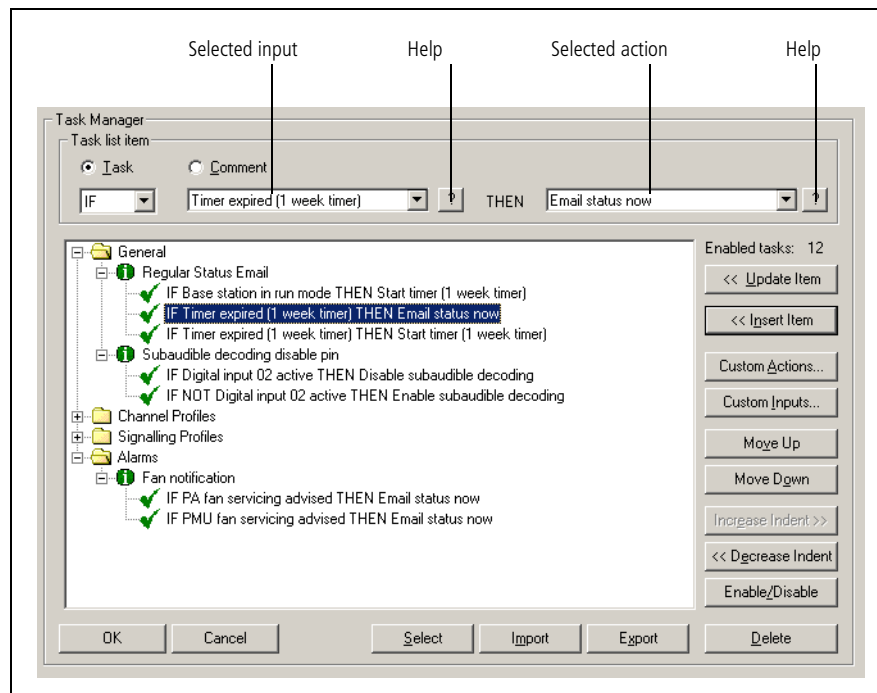
This simple code example shows how Task Manager can use a digital output pin to tell external equipment whether the receiver is unmuted.

Task Manager only operates when the base station is in Run mode. The Service Kit does not need to be connected for the tasks to be performed.

1.1 Creating Task Manager Tasks

To change the way Task Manager works, you add and modify tasks using the Service Kit, and then you program the changes into the base station. In effect, you are creating scripts that make the base station perform simple actions. This customizes the way the base station operates without modifying its firmware. [Figure 1](#) shows an example Task Manager form with its list of tasks. To create a task, you select an input and an action, each from a drop-down list, and then insert it into one of the folders or subfolders in the task list. Comments function as headings under which tasks are grouped. For more details on working with this form, see the Service Kit manual or online Help. Help buttons alongside the input and action boxes provide context-sensitive Help for the particular input or action that you have selected.

Figure 1 Task Manager form



1.2 Inputs

Task Manager inputs are binary in nature. They can only have two states: on or off, enabled or disabled, set or cleared. Inputs are of two main types, 'basic' and 'override.' For a list of all inputs, see [Table 1 on page 13](#).

Basic inputs

Basic inputs come from various parts of the base station. They include all alarms. At the beginning of the processing cycle (see [“How Task Manager works” on page 9](#)), basic inputs are latched; their state cannot change until the current processing cycle is completed.

Override inputs

Override inputs can only become true through a Task Manager override action. They are internal to Task Manager. When an override action occurs, the change is immediately available and can affect the processing of subsequent tasks in the list.

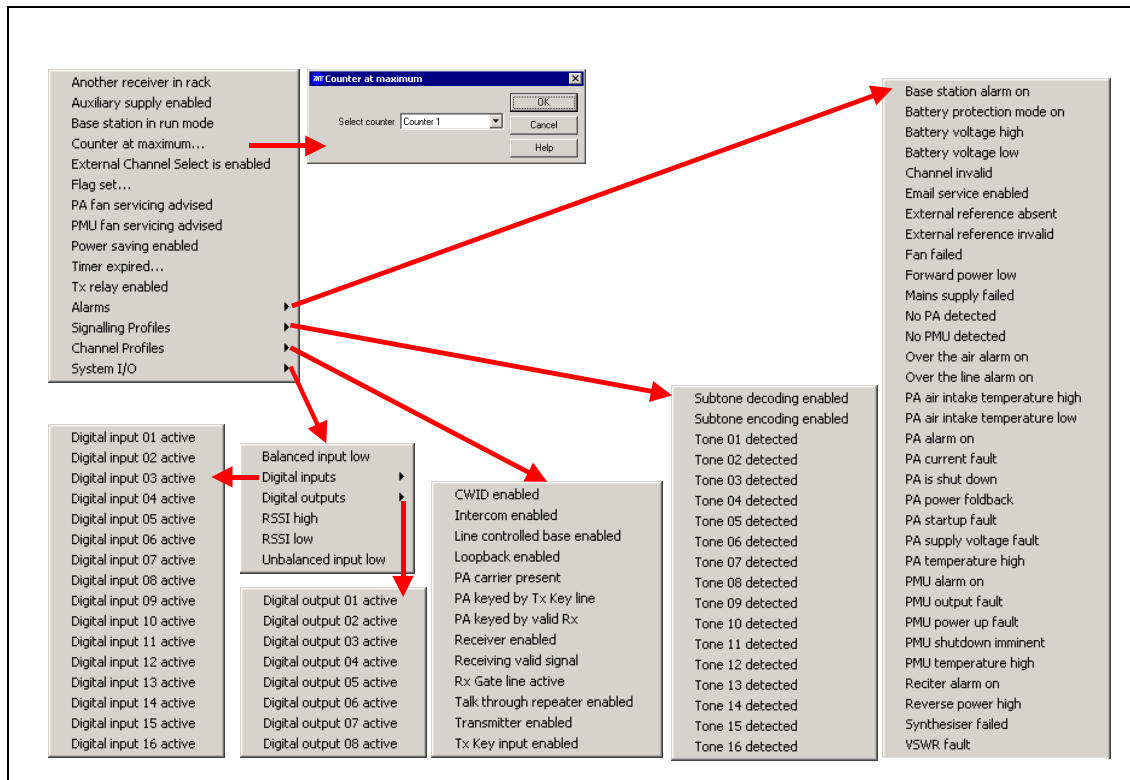
Other inputs

For counters, timers and flags, see [“Timers, Counters, and Flags” on page 8](#). The state of each digital output is also available as an input to Task Manager. For custom inputs, see [“Custom inputs” on page 17](#).

Input Menus

[Figure 2](#) gives an overview of the drop-down menus that allow you to select an input. The main menu contains general items and the submenus group inputs that relate to Alarms, signalling profiles, channel profiles, and system I/O.

Figure 2 Input menus



1.3 Actions

Task Manager actions are similarly binary in nature. They can turn a digital output on or off, set or clear a flag, enable or disable a function. They trigger an action but cannot provide any parameters that configure that action. Actions are of two main types, ‘override’ and ‘do now’. These actions have different effects.

Override actions

Override actions enable, disable, or toggle a configured base station function. As most of these functions are enabled by default, the main use of override actions is to let you turn off a function such as talk through repeater, power saving, or even the receiver as a whole.

Override actions work by changing the state of a system flag, which is a particular kind of Task Manager variable. System flags can only be changed by an override action. Their status is made available at the end of the processing cycle to other software processes, influencing their logic. The status of system flags is displayed in Monitor > Base Station > System Flags.

Each override action has a corresponding system flag. When an override action is carried out (for example **Enable power saving**), it ‘enables’ (turns on) the equivalent system flag (in this case, the ‘Power save’ system flag). Enabling this flag makes the equivalent override input (in this case, **Power saving enabled**) become true. Any tasks with that input will be processed.

‘Do Now’ actions

‘Do now’ actions are carried out immediately after the task is processed. Task Manager does not wait until the end of the processing cycle before making the action available externally. If another ‘do now’ action is processed while the first is still being carried out, it has no effect. If, for example, a task list has two tasks with the action **Send CWID now**, and both are executed, only one CWID will be sent.

Other actions

There are actions based on the state of counters, timers and flags, see “[Timers, Counters, and Flags](#)” on page 8. There are also custom actions, see “[Custom actions](#)” on page 18. Channel actions and digital output actions do not behave quite like override or like do now actions. The result of these actions is immediately available internally to Task Manager, but is only made available externally at the end of the processing cycle. Consider, for example, a task list with the following:

```
IF Input A THEN Go to channel 5  
IF Input A THEN Make current channel the default  
IF Input B THEN Go to channel 6
```

The first task sets the (internal) channel number to 5. The second task makes channel 5 the default (even though the base station is still operating externally on its previous channel). The third task changes the internal channel number to 6. At the end of the processing cycle, the base station changes to channel 6. It does not try to change to channel 5.

The situation is similar with digital output actions:

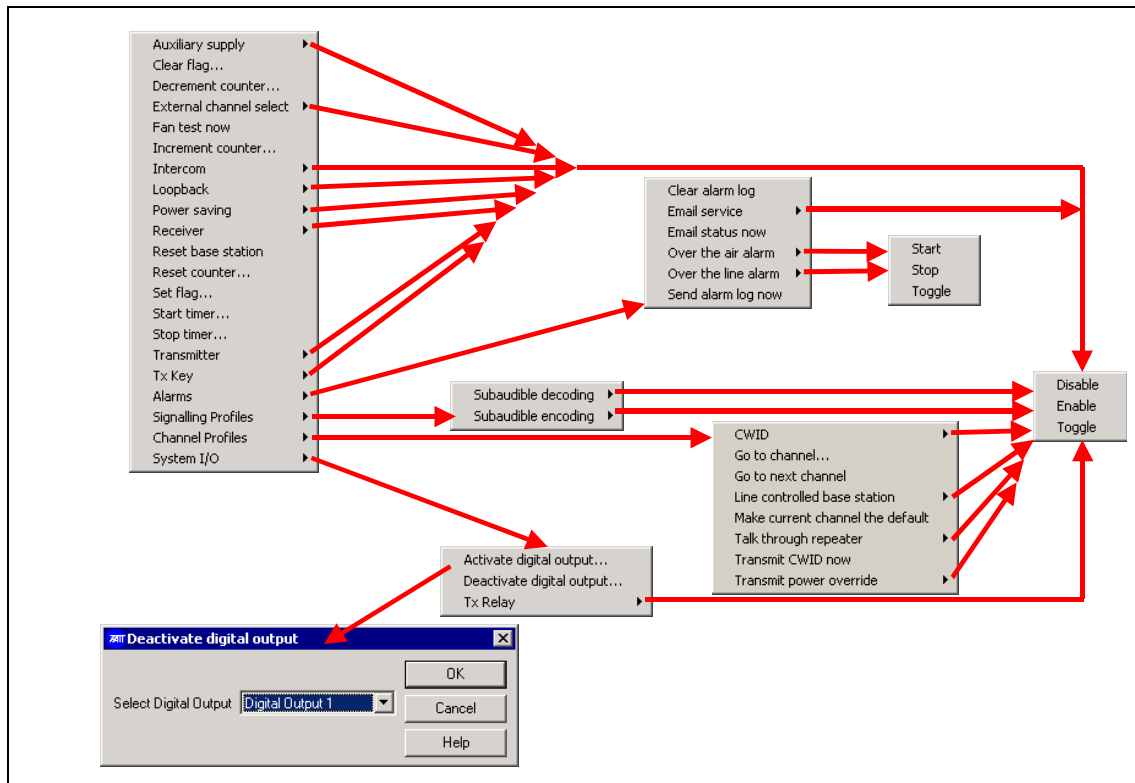
```
IF Input A THEN Activate digital output 1  
If digital output 1 active THEN Send CWID now  
If Input B Then Deactivate digital output 1
```

In this example, the CWID will be sent, but digital output 1 will not in fact be activated.

Action Menus

[Figure 3](#) gives an overview of the drop-down menus that allow you to select an action. The main menu contains general items and the submenus group actions that relate to Alarms, signalling profiles, channel profiles, and system I/O.

Figure 3 Action menus



1.4 Timers, Counters, and Flags

Timers, counters, and flags enhance Task Manager’s capabilities. Actions can set them and inputs can read them. They are exclusively internal to Task Manager and can only affect the state of Task Manager inputs.

Task Manager monitors their state and can trigger an action if a timer expires, a counter reaches its maximum, or a flag is set or cleared. The Service Kit can monitor the current state of all timers, counters, and flags.

Timers

Timers can be considered as a number of 10 ms intervals that must elapse before the timer reaches its maximum and the input ‘Timer expired’ is triggered. Tasks can start and stop timers. When a timer is started, it returns to the beginning of its timing period. Stopping a timer halts timing, so that the timer cannot expire and cause any actions.

Timers can be used to add a delay between an event and the desired resulting action. They can also be used to repeatedly toggle a function on and off, for example to impose a duty cycle on it. If the on time and the off time are unequal, two timers are needed.

A timer can have a maximum value of 0 ms, which means that it expires instantly.

Short timers may not be accurate. A 10 ms timer will expire at the next 10 ms interval ('tick'). This could in practice be anywhere between 1 and 10 ms after a task starts the timer, depending on how long Task Manager takes to process its tasks. However, if there are overruns, it could take significantly longer than 10 ms. Tait therefore recommends that you avoid short timers (<50 ms) if the task list has more than 10 enabled tasks.

Counters

Counters cannot go past maximum value or roll over (start again after reaching the maximum). Actions can increment or decrement them. Only when they reach the maximum can they trigger actions.

Flags

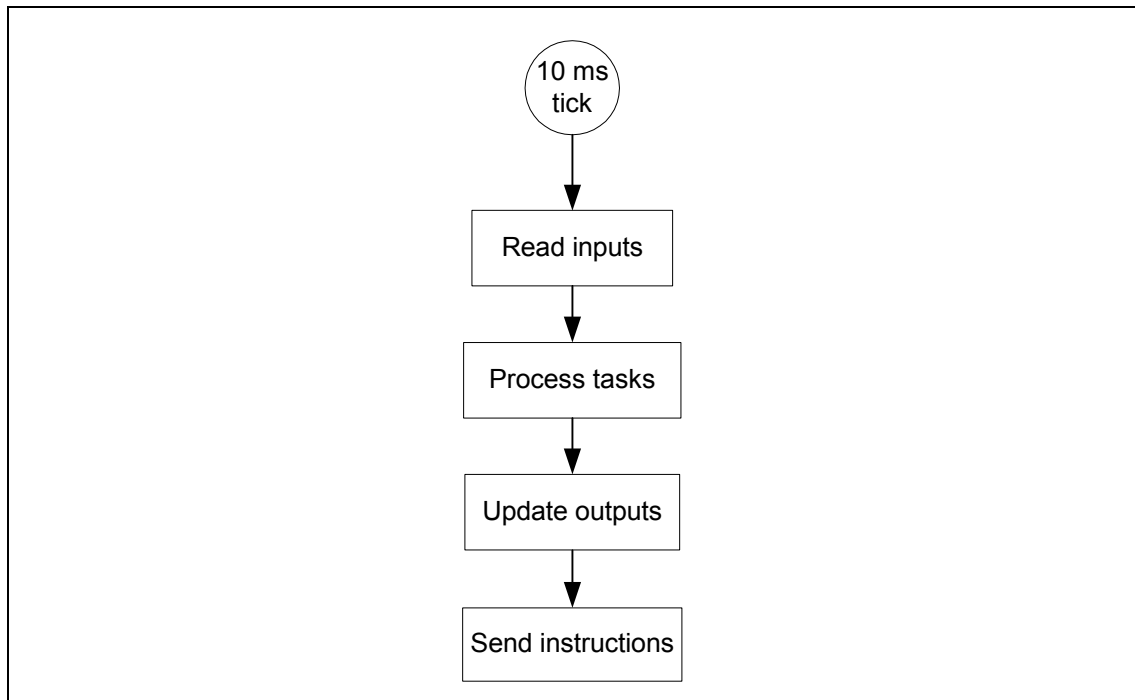
Tasks can set a flag, and the setting of a flag can be an input to an action. This is a useful method of making visible a particular status. It is important to distinguish these flags from system flags. These flags are internal to Task Manager, can be given a meaningful name, and are available for use in tasks. They play no role at all until tasks are created that set them or read them. System flags affect the logic of software processes in the reciter and have fixed names. They also have a default setting that is re-established on entry into Run mode.

2 How Task Manager works

Basic description

The basic Task Manager concept is shown in [Figure 4](#). A Task Manager 'tick' occurs every 10 milliseconds. At each tick, Task Manager begins processing the tasks in its task list. First it reads the state of the inputs, then it processes the tasks in its list, beginning with the first and ending with the last. If the input of a task has not changed, nothing happens. If the input has changed, processing the task causes the previous state of an output to be overwritten. Finally, once the tasks in the list have been processed, Task Manager carries out the actions by sending instructions to other software processes running on the base station.

Figure 4 Task Manager processing cycle



Actions triggered by events

It is important to emphasise that Task Manager only executes an task action if the task input changes from false to true. In other words, tasks are triggered by events, not states. Take, for example, the following task:

IF **digital input 01 active** THEN **Increment counter 1**.

The counter does not increment by 1 every 10 ms when digital input 1 is active. It only increments when digital input 1 changes from being inactive to active.

The situation is similar with inverted inputs, for example:

IF NOT **digital input 01 active** THEN **Increment counter 1**.

The counter does not increment by 1 every 10 ms when digital input 1 is inactive. It only increments when the input part of the task becomes true, that is, when digital input 1 changes from active to inactive.

Tasks processed in order

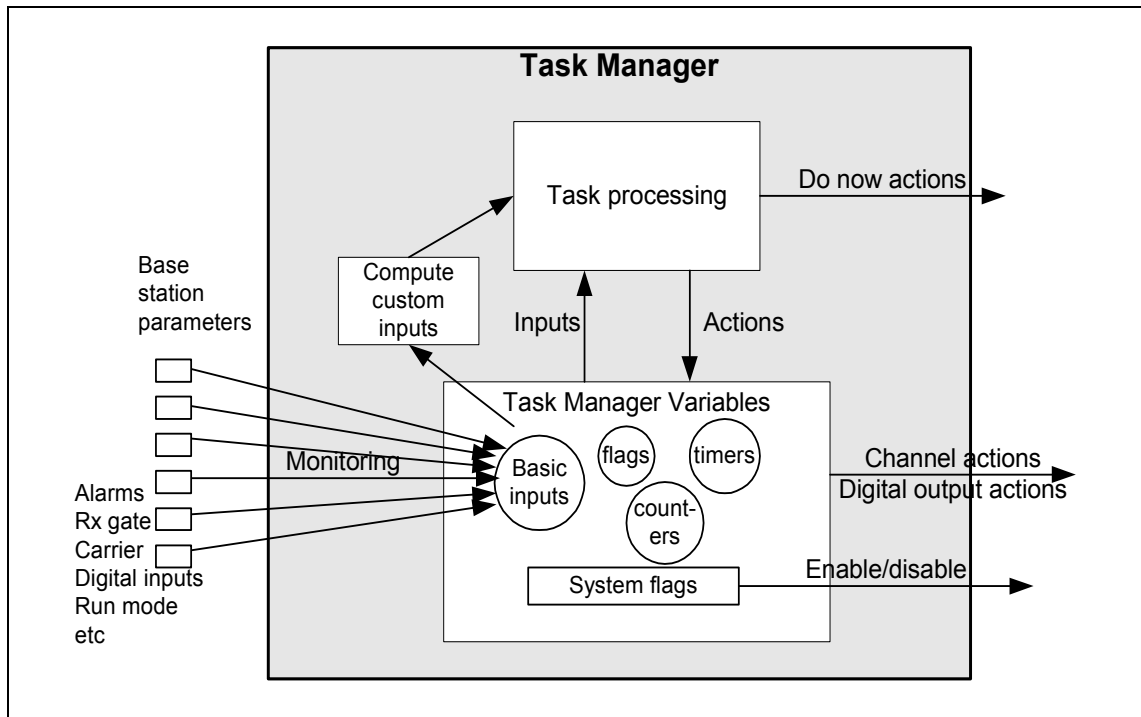
Task Manager processes its tasks strictly in order. It begins with the first task in the task list with a changed input and ends with the last. This means that tasks in the General folder are processed first and tasks in the Alarms folder last. Statements within profile folders (for example the folder for the default channel folder) are only processed if that profile is referenced by the current channel.

More detailed description

Figure 5 shows in more detail the way Task Manager operates.

Task Manager monitors external base station parameters and updates information about their state. This information consists of the basic inputs, which are most of the inputs into the Task processing engine (there are system flags, flags, counters, and timers as well). When the 10 ms ‘tick’ occurs, Task Manager starts processing the task list. First it latches the basic inputs so that they do not change during the processing cycle (if for example, an alarm occurs during task processing, it will not be processed until the next processing cycle). Then Task Manager processes the combinatorial logic of any custom inputs, so as to determine whether the custom input has changed state. Next it starts going through the task list, from top to bottom. (An optimisation means that it in fact only processes tasks with changed inputs.) It executes each task, carrying out the required action.

Figure 5 Task Manager operation



‘Do now’ actions are immediately made available to external software processes. All other actions initially only set Task Manager variables. The new state of these variables is immediately available internally. Later, when processing the task list is completed, these new variable states are sent to external software processes, changing channel, setting digital outputs, or enabling/disabling their operation.

For example:

IF *digital input 01 active* THEN *Enable power saving*
IF *Power saving enabled* THEN *Set flag (1)*

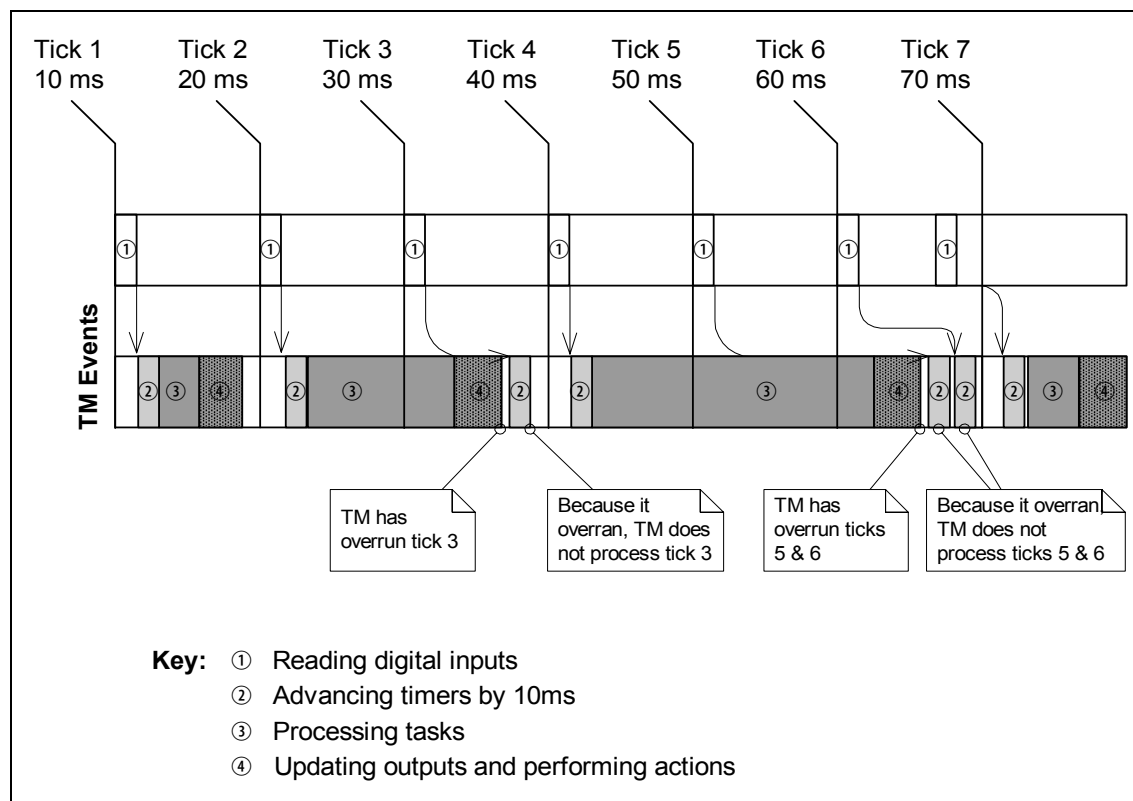
In this case, the first task has the override action of enabling power saving. This changes a system flag. The new state of the Power saving system flag is immediately available as a Task Manager input, which happens to be the input of the very next task on the list. Accordingly, Flag 1 will be set. Only after the processing of the task list is complete does Task Manager instruct the base station to enable power saving.

The important point to note is that the input 'power saving enabled' became true, even though Task Manager had not yet issued an instruction to the base station to enable power saving.

2.1 Overruns

If the inputs to more than about 10 tasks have become true since the last 10 ms tick, Task Manager may be unable to process its task list within 10 ms, so that overruns occur, as shown in Figure 6. Complex custom inputs may also add to the time that Task Manager needs. If there is an overrun, Task Manager skips the processing of the task list but still does the following essential things. Immediately after each tick it reads the state of digital inputs. It also makes sure that it advances timers by the required number of 10 ms ticks once it has finished the previous processing cycle. The result is that tasks triggered by a timer may occur later than expected. In Figure 6, a timer that should have expired at tick 5 will not expire till well after tick 6 and will only be processed after tick 7. Of course, this is only of concern where exact timing is required.

Figure 6 Task Manager Overruns



2.2 Transition Into and Out of Run mode

When the base station goes into Run mode, Task Manager starts operating. The input 'Base station in Run mode' becomes true and any tasks with that input are processed. In addition, other tasks are processed. This happens because Task Manager sets the previous state flag of all tasks to 'unknown,' so that Task Manager sees a transition from 'unknown' to the default setting, which can be false or true. So, for example, tasks with 'IF receiver enabled' as an input will be processed, because Task Manager sees a transition from 'unknown' to 'true.' However, tasks with 'IF NOT receiver enabled' will not be processed.

The transition to Run mode also sets all system flags to their defaults. If, for example, a Task Manager override has disabled subaudible decoding, and then the base station goes out of and back into Run mode, subaudible decoding will be re-enabled (most system flags are enabled by default). [Table 1](#) lists all Task Manager inputs, indicating whether they are 'external' (basic) or 'internal' (a system flag, counter, timer or flag) and displaying the default settings of internal inputs.

When the base station goes out of Run mode into Standby mode, Task Manager stops operating. Task Manager variables (for example the system flags) are frozen but can be read by other processes. However, in a recent optimisation (version 3.00), Task Manager does carry out one processing cycle after the base station goes into Standby mode. This makes it possible for it to process tasks with the input 'IF NOT base station in Run mode,' for example to set a digital output while in Standby mode:

IF NOT *Base station in Run mode* THEN *Activate digital output 1*
IF *Base station in Run mode* THEN *Deactivate digital output 1*

Table 1 Task Manager inputs

Classification	Input	Type	Default
General	Another receiver in rack	External	n/a
	Auxiliary Supply Enabled	Internal	Disabled
	Base station in run mode	External	n/a
	Counter at maximum (<i>ident</i>)	Internal	0
	External channel select enabled	Internal	Enabled
	Flag set (<i>ident</i>)	Internal	n/a
	Power saving enabled	Internal	Enabled
	Syslog service enabled	Internal	Enabled
	Timer expired (<i>ident</i>)	Internal	0
	Tx relay enabled	Internal	Enabled

Table 1 Task Manager inputs (Continued)

Classification	Input	Type	Default
Alarms	(all alarms)	External	n/a
	Over the air alarm on	Internal	Disabled
	Over the line alarm on	Internal	Disabled
Channel Profile	CWID enabled	Internal	Enabled
	Intercom enabled	Internal	Enabled
	Line controlled base enabled	Internal	Enabled
	Loopback enabled	Internal	Disabled
	PA carrier present	External	n/a
	PA keyed by Tx Key line	External	n/a
	PA keyed by valid Rx	External	n/a
	Receiver enabled	Internal	Enabled
	Receiving valid signal	External	n/a
	Rx Gate line active	External	n/a
	Talk through repeated enabled	Internal	Enabled
	Transmitter enabled	Internal	Enabled
	Tx Key input enabled	Internal	Enabled
Transmit power overridden	Internal	Disabled	
Signalling Profile	Subtone decoding enabled	Internal	Enabled
	Subtone encoding enabled	Internal	Enabled
	Tone 01 detected – Tone 16 detected	External	n/a
System I/O	Balanced input low	External	n/a
	Digital Input 01 active – Digital Input 16 active	External	n/a
	Digital Output 01 active – Digital Output 08 active	Internal	Deactivated
	RSSI high	External	n/a
	RSSI low	External	n/a
	Unbalanced input low	External	n/a

3 Tips For Programming Task Manager Tasks

Pay attention to the following when you create sets of Task Manager tasks:



Important

Do not create the task:

IF **Base station in Run mode** THEN **Reset base station**

This results in an inoperable base station. Be careful with any tasks using powerful actions such as **Reset base station**.

Create tasks for events, not states

Make sure that your thinking is oriented to events and not states when you create tasks. Tasks are triggered by events. An action only occurs if the input changes from false to true.

Inverses are always available

It may appear that there is no suitable input for a task, when the inverse of an input fits exactly. For example, there is no input 'Balanced input receiving signal,' but you can use 'IF NOT balanced input low,' and configure the threshold between not receiving a signal and receiving one in the Thresholds form.

Tasks often need to be in pairs

When you create a task to carry out an action, you often need to create an opposite task to reverse that action.

IF **digital input 1 active** THEN **disable subaudible encoding**
IF NOT **digital input 1 active** THEN **enable subaudible coding**

If you only have the first task, subaudible signalling would be disabled the first time digital input 1 goes active and would continue to be disabled indefinitely, even if digital input 1 is turned on and off.

IF **receiving valid signal** THEN **start timer 1**
IF NOT **receiving valid signal** THEN **stop timer 1**

Do now actions, on the other hand, are usually standalone:

IF **Tone 2 detected** THEN **Reset base station**

Order can be important

If a task changes a system flag, a counter, a timer, or a flag, the new state is available immediately. Other Task Manager variables are also available immediately. Other task actions do not cause a change until Task Manager performs its actions at the end of the processing cycle.

A task that uses a system flag, a counter, or a flag as an input will be processed in the current processing cycle if it comes after the action that sets it but not if it comes before.

For example, in the following pair of tasks, making the digital line active causes a counter to reach its maximum, which in turn enables loopback:

```
IF Digital input 1 active THEN Increment counter 1  
IF Counter at maximum (counter 1) THEN Enable loopback
```

If the order of these two tasks was reversed, loopback would be not be enabled in the same 10 ms processing cycle. However, the next processing cycle would register that the counter had reached its maximum and the task would be processed.

You probably need tasks for the initialisation process

Your Task Manager code needs to be able to handle power outages and transitions to Standby mode and back to Run mode, as well as the initial start-up. The Task Manager input **Base station in Run mode** can be used for any tasks you need to carry out the initialisation process. A power outage results in a return to default settings, not to the settings that Task Manager has established during its operation. Check that the default settings of system flags and the inputs derived from them are as you want (see [Table 1 on page 13](#)). For example if you want the talk-through repeater function to be normally disabled, you need a task to change the start-up default:

```
IF Base station in Run mode THEN Disable talk through repeater
```

In trunking systems, you can enable auxiliary power in Run mode, but disable it in Standby mode:

```
IF Base station in Run mode THEN Enable auxiliary supply  
IF NOT Base station in Run mode THEN Disable auxiliary supply
```

This turns off the trunking equipment when you take the base station out of service.

3.1 Laying Out Your Code

Folders

Tasks must be inserted into one of the available folders. It is not necessary to put an alarm task in the Alarms folder or a General task in the General folder. Occasionally, you may want to put a general task in the Alarms folder to ensure that it is processed at the end of the processing cycle.

You cannot put a task in the top-level Channel Profiles or Signalling Profiles folder, these can only contain folders for each defined profile. Tasks in a profile folder are only processed if the current channel uses that profile.

Using comments

Comments are used as titles for the tasks indented underneath them. The title should describe the purpose or the function of the group of tasks. This will help future maintainers.

- Using indenting** Indenting a task assigns it to the comment above. Indenting a comment lets you create a subheading for the tasks that follow.
- Hiding code** Folders and comments have a little box alongside that displays a + or a -. Click on the box to display or hide the item's subfolders or assigned tasks. Hiding items stops the screen getting too cluttered.
- Disabling tasks** You can disable tasks in the task list that you do not want to be processed. This lets you, for example, maintain a common task list for all base stations in the system, as part of a master configuration file. Simply disable the tasks not applicable to each particular base station.

3.2 Enhancements

Task Manager has a number of additional features that help to increase the power of its task statements.

- Profile Folders** Putting Task Manager tasks in a profile folder means that they are only available if the current channel uses that profile. This means that it is possible to set up a base station to switch between two (or more) sets of Task Manager tasks. Set up two channels with the same frequency information, but assign different channel profiles. Place different sets of Task Manager tasks into the different profiles. Then set up General Task Manager tasks to switch between channels. For example:

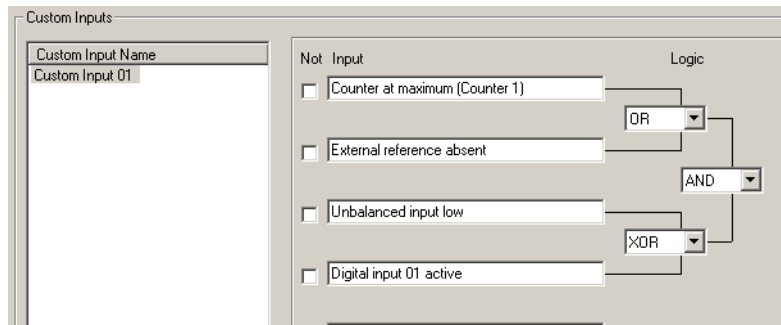
```
IF Tone 1 detected THEN Go to channel Repeater
IF Tone 2 detected THEN Go to channel LineCtrl
```

Where Repeater and LineCtrl are the names of two channels in the channel table.

Using the channel profiles in this way can save you from having to use lots of combinational logic. However, it does take ~300 ms to change channel. During this time, tasks that run in profile folders are not available.

- Custom inputs** You cannot create entirely new inputs, but you can combine a number of existing inputs to form a custom input. You select the inputs and specify the combinational logic that will be used to make the custom input true or false when the states of the various inputs are combined. For example, you might create a custom input using a number of minor alarms that will trigger sending a status message to the Alarm Center.

Custom inputs are specified as a logic tree as shown below. Evaluation is done from left to right.



The above custom input is evaluated in this way. First, **Counter at maximum (1)** is OR'ed with **External reference absent** and then **Unbalanced input low** is XOR'ed with **Digital input 01 active**. Finally, the results of those two operations is AND'ed.

Custom inputs are not allowed directly in other custom inputs. One way around this is for the custom input to set and clear a flag. This makes it possible to combine more than eight items in a custom input. For example:

- Custom input 1 combines eight alarms
- Custom input 2 combines another four alarms
- When custom input 1 becomes true, it sets Flag 1
- When custom input 2 becomes true, it sets Flag 2.
- Custom input 3 combines Flag 1 and Flag 2.

Note You cannot export and import custom inputs and custom actions. If the Task Manager code uses these input and action types intensively in a system with many base stations, Tait recommends that you save the whole configuration file and use it as the basis of new configurations for the other base stations.

Custom actions

You can combine a number of actions into a custom action. This can simplify the code.

For example, you could set up custom actions for enabling and disabling CTCSS. Each custom action contains all of the actions required to enable or disable the function.

The 'Enable CTCSS' custom action consists of:

- Enable subaudible decoding**
- Enable subaudible encoding**
- Set flag (CTCSS_Active)**

The 'Disable CTCSS' custom action consists of:

- Disable subaudible decoding**
- Disable subaudible encoding**
- Clear flag (CTCSS_Active)**

With these custom actions, you only need two tasks to use a digital input to enable and disable CTCSS:

```
IF digital input (02) active THEN Enable CTCSS  
IF NOT digital input (02) active THEN Disable CTCSS
```

4 Simple Task Manager Functions

The following section gives some example Task Manager code fragments. These let you carry out simple functions. They can also serve as building blocks in more complex applications.

4.1 Responding To a Digital Input

Digital inputs have no built-in function; you construct tasks that determine the base station's response to their activation or deactivation. Here are some suggestions.

Subtone Decode Disable Pin

When digital input # is active, the base station disables the decoding of subaudible signalling.

```
IF Digital input # active THEN Disable subaudible decoding  
IF NOT Digital input # active THEN Enable subaudible decoding
```

Cancel Alarms Pin

When the digital input is activated, Task Manager action ceases to dial up an Alarm Center to send alarm logs and status messages.

```
IF Digital input # active THEN Disable alarm service  
IF NOT Digital input # active THEN Enable alarm service
```

External alarm response

If the digital input is wired to (for example) the site facility's door alarm, the dispatcher can be alerted to the triggering of this alarm.

```
IF Digital input # active THEN Start over the line alarm  
IF NOT Digital input # active THEN Stop over the line alarm
```

4.2 Setting Digital Outputs

Digital outputs also have no built-in function in the base station; they are under the control of Task Manager so that you can determine their function.

4.3 Controlling the Auxiliary Power Output

In the default configuration setting, the auxiliary power output at the rear of the PMU is automatically turned on when mains power is on. Task Manager is not involved. However, you can configure the auxiliary power output to be under the control of Task Manager (Configure > Base Station > Miscellaneous). This is the only way to turn the auxiliary power output on, if the base station only uses DC power.

4.4 Alarm Notification

Alarms are notified only by Task Manager action. These actions can be triggered at regular intervals, using a timer, and/or in response to alarms (**Base station alarm on** for any alarm, a custom input for up to eight alarms.)

Enabling Email/ Alarm Log

If your system has an Alarm Center, Task Manager action can send the alarm log (**Send alarm log now**) or send the alarm log together with the status of all alarm parameters (**Email status now**). Tasks can do this at regular intervals (for example, once a week) and/or in response to an alarm.

IF **Base station in Run mode** THEN **Start timer (1 week timer)**
IF **Timer expired (1 week timer)** THEN **Email status now**
IF **Timer expired (1 week timer)** THEN **Start timer (1 week timer)**

Note that the base station has a configurable minimum interval between one sending of the alarm log or status message and another, to prevent flooding the Alarm Center with calls.

Suppose, for example, the minimum interval is 30 minutes, and the following task is set up:

IF **Reverse power high** THEN **Email status now**

If the reverse power alarm is triggered, the base station will dial out to the Alarm Center and send its alarm log and status message. If the fault is intermittent and the alarm continues to go on and off, the base station will not dial out again until 30 minutes after the previous dial-out. It will then send the alarm log and status as they currently are, not as they were when the alarm was triggered for a second time. In other words, items for sending to the Alarm Center are not queued.

Enabling over-the-air or over-the-line pips

Alarms can also be notified by sending pips over the air or down the line.

IF **Base station alarm on** THEN **Start over the air alarm**
IF NOT **Base station alarm on** THEN **Stop over the line alarm**

Temporarily cancelling alarm logging

It may be useful to be able to temporarily stop sending alarms to the Alarm Center, for example if testing or commissioning is generating frequent alarms.

```
IF Tone 02 detected THEN Disable email service  
IF Tone 03 detected THEN Enable email service
```

4.5 Disabling a Configured Function

Task Manager can disable a number of configured base station functions. It does this by changing the state of the relevant system flag. The Service Kit displays all system flags (Monitor > Task Manager > System Flags).

For example:

```
IF Digital input 03 active THEN Disable talk through repeater  
IF NOT Digital input 03 active THEN Enable talk through repeater
```

4.6 Changing Channel

The current operating channel is generally selected by the configuration (set the default channel in Configure > Base Station > General) or by hardware (you switch digital inputs after enabling and configuring hardware channel selection in Configure > Base Station > System Interface).

Task Manager offers additional methods for selecting the current operating channel. If the base station has an Advanced Profiles and Task Manager feature license, these methods can be used to change any channel setting. Simply create channels and profiles with the configurations desired and use Task Manager tasks to change from one to another.

Make sure that your Task Manager code gives the expected result after power outages and transitions out of and back into Run mode.

Selecting a different channel

Task Manager has actions that can select a different channel from that specified by the configuration: **Go to channel nn** and **Go to next channel**.

```
IF Tone 03 detected THEN Go to channel Channel 004  
IF Tone 04 detected THEN Go to channel Channel 003
```

These actions do not work if hardware channel selection is enabled.

Shifting channel selection between hardware and configuration

Task Manager can shift the control of channel selection between the digital inputs and the configuration. You must have enabled and configured hardware channel selection and selected a default channel using the Service Kit.

Task Manager controls the system flag H/W channel select. This flag is enabled by default, which means that hardware channel selection will work. If you disable this flag, control of channel selection reverts to software, and the channel configured as the default becomes the current operating channel.

IF *Tone 03 detected* THEN *Disable external channel select*
IF *Tone 04 detected* THEN *Enable external channel select*

Tip Alternatively, use the digital inputs to instruct the base station to use the software-selected channel. Simply set the digital inputs to select channel number 000.

Shifting channel selection between Task Manager and hardware

Task Manager change channel actions override the default channel selected by the configuration, but they do not override hardware channel selection. If hardware channel selection is enabled, the base station continues to operate on the channel selected by hardware, even if Task Manager processes a change channel action. However, the Task Manager action does change the internal 'software channel number.' If hardware channel selection is subsequently disabled, the base station will change to the channel specified by the latest Task Manager action.

For example

IF *Base station in Run mode* THEN *Go to channel Channel 002*
IF *Base station in Run mode* THEN *Start timer (Timer 01)*
IF *Timer (Timer 01) expired* THEN *Disable external channel select*

In this example, the base station will operate initially using the channel defined by the digital inputs, for example Channel 001, even though Task Manager has selected Channel 002. The base station does remember Channel 002 as its 'software channel number.' Once the timer expires, Task Manager disables hardware channel selection and the base station changes to Channel 002.

Changing the default channel

You can use Task Manager to change the default channel. This is the equivalent of changing the configuration. The new default channel appears in the General form (Configure > Base Station > General).

Monitoring the current channel

For all the above channel selection methods, the Channel form (Monitor > Monitoring > Channel) displays the channel currently in use.

4.7 Selecting Profiles

Generally, the base station uses the channel profile and the signalling profile that are assigned to the current operating channel. However, Task Manager can override the channel table's selection of channel and/or signalling profiles and then its own tasks select the profiles used. This gives greater flexibility in the assigning of profiles and a greater number of combinations of assigned profiles and other channel settings.

Enabling Task Manager selection of profiles

The system flags TM signalling profile and TM channel profile are disabled by default. When they are disabled, the base station uses the profiles assigned to the current operating channel.

When these system flags are enabled, control of profile selection is passed to Task Manager. If Task Manager does not select a profile, the base station uses the default profile. If a Task Manager task selects a profile, the base station uses that profile.

Disabling the Task Manager selection of profiles can be used to pass the control of profiles back to the channel table. If a Task Manager task selects a profile, the base station 'remembers' that profile, and if control subsequently passes back to Task Manager, that profile will be used.

Selecting channel profiles

Here is an example set of Task Manager tasks:

```
IF Base station in Run mode THEN Enable TM channel profile selection  
IF Digital input 01 active THEN Select channel profile (Ch prof 2)  
IF Digital input 02 active THEN Select channel profile (Ch prof 3)
```

Selecting signaling profiles

Here is an example set of Task Manager tasks:

```
IF Base station in Run mode THEN Enable TM signalling profile selection  
IF Digital input 03 active THEN Select signalling profile (Sig prof 2)  
IF Digital input 04 active THEN Select signalling profile (Sig prof 3)
```

Monitoring profiles

You can monitor the base station and see which profiles it is currently using. The Channel form (Monitor > Monitoring > Channel) displays the profiles currently in use, even if they are selected by Task Manager, not the current channel. You cannot tell from this form whether Task Manager has selected the profile, but you can select Monitor > Task Manager > System Flags. If the TM signalling profile or the TM channel profile flag is enabled, Task Manager has selected the corresponding profile.

4.8 Remote Control Using a Radio

If the base station has an Advanced Profiles and Task Manager feature license, you can program radio to transmit using different subaudible signaling and use each CTCSS tone or DCS code to carry out a different action.

The following example controls the talk through repeater function:

```
IF Tone 02 detected THEN Disable talk through repeater  
IF Tone 03 detected THEN Enable talk through repeater
```

5 Task Manager Application Examples

Task Manager makes it possible for you to build complex functions into the base station. Here are some examples of to give you an idea of what can be done.



Important

While Tait has carefully tested Task Manager, no guarantee can be given that these examples will work correctly for your system. Make sure that you thoroughly test any set of Task Manager tasks before commissioning the system.

5.1 Repeater Changeover

A line-controlled base station is connected to a console that provides tone on idle. The following Task Manager tasks automatically convert the TB8100 to a talk-through repeater if the line fails. When the line is re-established, the TB8100 reverts to line-controlled operation.

```
IF Base station in Run mode THEN Disable talk through  
repeater
```

This disables the base station's talk through repeater mode whenever it enters Run mode.

```
IF Balanced input low THEN Enable talk through repeater  
IF Balanced input low THEN Disable line-controlled base  
station  
IF Balanced input low THEN Start over the air alarm
```

If the line fails, the input line level falls below the prescribed minimum. This triggers Task Manager actions that switch off the line-controlled base station mode, enable the talk through repeater mode, and start sending alarm pips over the air.

```
IF NOT Balanced input low THEN Disable talk through repeater
```


IF NOT **Balanced input low** THEN **Enable line-controlled base station**

IF NOT **Balanced input low** THEN **Stop over the air alarm**

When the line is re-established, Task Manager actions re-establish the line-controlled base station function and stop the alarm.

5.2 Data and Speech Service

A repeater needs to relay speech as well as data. The speech needs to be pre-emphasised while the data needs the full band from < 50 Hz to 3000 Hz. Speech is sent with a CTCSS tone.

The base station needs to be able to automatically change between repeating pre-emphasised audio and repeating full band audio.

To achieve this, follow these steps:

1. Set up Channel 1 as a speech repeater. The channel profile (Signal Path tab) is set to De-emph Speech Band / Pre-emph Speech Band.
2. Set up Channel 2 as a data repeater. The channel profile (Signal Path tab) is set to Flat Full Band.
3. Set Timer 1 to 150 milliseconds, corresponding to the time that the base station needs to decode subaudible signalling.
4. Create two custom inputs:
Data Chan Detected, which consists of Timer 1 expired AND Tone 1 NOT detected.
Speech Chan Detected, which consists of Timer 1 expired AND Tone 1 detected.
5. Create the following Task Manager tasks for Channel 1:

IF **Receiving valid signal** THEN **Start timer 1**

IF NOT **Receiving valid signal** THEN **Stop timer 1**

IF **Data Chan Detected** THEN **Go to channel 002**

Receiving a valid signal on Channel 1 starts a timer. If no subaudible signalling is detected when the timer expires, the custom input Data Channel Detected becomes true and Task Manager instructs the base station to go to channel 002.

6. Create the following Task Manager tasks for Channel 2

IF **Receiving valid signal** THEN **Start timer 1**

IF NOT **Receiving valid signal** THEN **Stop timer 1**

IF **Speech Chan Detected** THEN **Go to channel 001**

Receiving a valid signal on Channel 2 starts a timer. If subaudible signalling is detected before the timer expires, the custom input Speech Channel Detected becomes true and Task Manager instructs the base station to go to channel 001.

5.3 Base Station with Automatic Charging

If the battery voltage goes low, the base station operates on lower power, starts the generator and sends transmitter pips. As soon as the battery voltage is back to normal, transmitter power is increased. The generator continues for one hour (or until a high battery voltage alarm is triggered). This ensures that the battery is properly charged.

To set this up, follow these steps:

1. Set up Channel 1 at 100 watts for mains power and 60 watts for battery power.
2. Set up Channel 2 as a low battery channel, with only 25 watts output power.
3. Set up Timer 1 as Generator On timer with a duration of one hour.
4. Set up a custom action End of Charging with the following actions:

**Deactivate Digital Output 1 AND
Stop timer 1 (*Generator On timer*)
Stop over the air alarm**

5. Set up the following Task Manager tasks:

IF Battery voltage low THEN Go to channel 002
IF NOT Battery voltage low THEN Go to channel 001

When the battery voltage is low, this switches operation to Channel 002, which has a reduced PA output power.

IF Battery voltage low THEN Activate Digital Output #1.
IF Battery voltage low THEN Start over the air alarm
IF Battery voltage low THEN Start timer #1.

When the battery voltage is low, a digital output is set, which starts the generator. Additional actions turn on over the air pips and start a timer that will turn the generator off.

IF Battery voltage high THEN End of Charging
IF Timer #1 expired THEN End of Charging

These two tasks stop the generator when the battery voltage gets too high or when the Generator On time expires.

5.4 Base Station that Controls Landing Lights

A small private airport does not have full time air traffic control. When landing at night, the pilot needs to switch on the runway lights. Pilots have VHF radios without CTCSS, Selcall, or any other signalling. The pilot presses PTT three times within two seconds to switch on the lights.

1. Wire Digital Output #6 to control the lights.
2. Give Counter #1 a maximum of 3.
3. Give Timer #1 a maximum of 2 seconds.
4. Give Timer #2 a maximum of 30 minutes
5. Set up the following Task Manager tasks:

```
IF Receiving valid signal THEN Start timer (Timer 1)
IF Receiving valid signal THEN Increment counter (Counter 1)
IF Timer expired (Timer 1) THEN Reset counter (Counter 1)
    This set of tasks detects three presses of PTT, provided they occur
    before Timer #1 expires.
IF Counter at maximum (Counter 1) THEN Start timer (Timer 2)
IF Counter at maximum (Counter 1) THEN Activate Digital
Output 6
IF Counter at maximum (Counter 1) THEN Reset counter
(Counter 1)
    This set of tasks starts the lights timer, turns the lights on, and re-starts
    the counter for detecting three presses of PTT.
IF Timer expired (Timer 2) THEN Deactivate Digital Output 6
    This task turns the lights off when the 30 minutes has elapsed.
```

5.5 Scanning Repeater

In a two-repeater site, Task Manager makes it possible for either repeater to turn into a scanning repeater if the other repeater fails. The scanning repeater handles both channels, providing a complete backup system.

When a repeater fails, the other starts scanning. It changes to a channel, waits a few 100ms, checks the received signal, and, if nothing is there, it goes to the next channel. If there is a signal, it will just repeat it as usual, complete with all the signalling and line output requirements for that channel. Here a single base station is providing the same service but with a poorer throughput.

```
IF Base station in Run mode THEN Start timer (ChangeChannel)
IF Receiving valid signal THEN Stop timer (ChangeChannel)
IF Receiving valid signal THEN Stop timer (On Channel)
IF NOT Receiving valid signal 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)**

The channel change time is currently ~300ms. The CTCSS decode time is ~150ms. Hence it takes about 450ms to scan a channel with CTCSS tones. Tait therefore recommends that you set the ChangeChannel timer to 500ms. The OnChannel timer needs to be long enough to make sure that the conversation has ended.

This example is a straightforward scanner. It will search through all the channels in the channel table looking for activity. A small variation on this can make it stay on its home channel until an external signal triggers the scanning.

5.6 Improvements to Alarm Center Dial-Out

Task Manager can prevent a base station dialling out to the Alarm Center when an alarm triggers briefly and is then cleared.

Alarm dial-out only if alarm continues for one minute

This example set of tasks ensures that there is an alarm dial-out only if the alarm is still active when a one-minute timer expires. A flag is used to prevent the timer being repeatedly restarted if an alarm is chattering.

To set this up, follow these steps:

1. Set up the flag **Timer running**.
2. Set up the timer **Alarm timer** with a maximum of 1 minute.
3. Create the custom input **Alarm still on**. It consists of:
Timer expired (Alarm timer) AND **Base station alarm on**
4. Create the following tasks in the General folder.

IF **Base station alarm on** THEN **Set flag (Timer running)**
IF **Flag set (Timer running)** THEN **Start timer (Alarm timer)**
IF **Timer expired (Alarm timer)** THEN **Clear flag (Timer running)**
IF **Alarm still on** THEN **Email status now**.

Alarm dial-out if alarm continues for one minute or is triggered three times within a minute

This example improves on the previous set of tasks by ensuring that there still is an alarm dial-out if an alarm triggers briefly but repeatedly.

To set this up, follow these steps:

1. Set up the flag **Timer running**.
2. Set up the timer **Alarm timer** with a maximum of 1 minute.
3. Set up the counter **Alarm counter** with a maximum of 3.

4. Create the custom input **Alarm still on**. It consists of:
Timer expired (Alarm timer) AND **Base station alarm on**
5. Create the custom action **Start over**. It consists of:
Clear flag (Timer running)
Stop timer (Alarm timer)
Reset counter (Alarm counter)
6. Create the following tasks in the General folder.

IF **Base station alarm on** THEN **Set flag (Timer running)**
 IF **Base station alarm on** THEN **Increment counter (Alarm counter)**
 IF **Flag set (Timer running)** THEN **Start timer (Alarm timer)**
 IF **Timer expired (Alarm timer)** THEN **Clear flag (Timer running)**
 IF **Alarm still on** THEN **Email status now.**
 IF **Counter at maximum (Alarm counter)** THEN **Email status now**
 IF **Timer expired (Alarm timer)** THEN **Start over**
 IF **Counter at maximum (Alarm counter)** THEN **Start over**

6 Specifications

The following are the maximum parameter values and maximum number of items that Task Manager supports.

Item	Maximum
Tasks and comments (lines in task list)	500
Enabled tasks (with Advanced Profiles and Task Manager feature license)	200
Enabled tasks (without Advanced Profiles and Task Manager feature license)	20
Custom inputs	20
Custom actions	20
Timers	16
Maximum timer duration	7 days or 168 hours
Counters	16
Counter maximum	200,000
Flags	16
Log of recent task actions	40 tasks

7 Testing and Debugging

Any Task Manager applications you create should be thoroughly tested before going live. It may be helpful to set up the base station on the bench with a CTU. This makes it easy to toggle digital inputs, read digital output, feed noise into the receiver, and so on. The following are some tips to help you.

Viewing the Log

The Recent Actions form displays the Task Manager log. This displays the last 40 tasks that were actioned. The log is cleared on entering Run mode. You may therefore want to save the log to a file before going into Standby mode or turning the base station off.



Note If you modify the base station's task list, the Service Kit will not correctly display tasks that were actioned beforehand.

Checking System Flag states

The System Flags form displays the current status of all system flags. This shows you what base station functions Task Manager has disabled or re-enabled.

Viewing flags/counters/timers

There are monitoring forms for flags, counters, and timers. They display the current status of each group of items.

Optimising Service Kit display

The Service Kit polls the base station for updates. If the polling interval is long, you will not see Task Manager changes until well after they have occurred. You might want to temporarily reduce the polling interval while you are testing and debugging (Select Tools > Configure Connections, select the connection and click Edit).

Using flags for debugging

When debugging, you can add tasks that set or clear flags, and then view the state of the flag to see if the condition to perform an action is present or not.

For example:

```
IF Tx Relay enabled THEN Set flag 1  
IF NOT Tx Relay enabled THEN Clear flag 1
```

If you run out of flags, use a counter with a maximum value of '1', or a digital input that is not present on your system interface.

Shortening timers

When testing timers, you can speed up the evaluation time by reducing timer durations.

Printing the task list

To print the list of tasks and other Task Manager information, from the Service Kit select File > Print. Select Base station - Task Manager, and, if appropriate, other categories such as Task Manager - Custom Actions.

8 Troubleshooting

If Task Manager is behaving in an unexpected way, check the following list.

Missing a toggled input

If an external input is toggled twice during a processing cycle, the change might not be seen. For example, if an input becomes true and then false again within the processing cycle, tasks with that input may not be processed. At the beginning of each 10 ms processing cycle, basic inputs are latched. By the time the next processing cycle processes the task, its input has become false again.

Outputs only change once

Actions (setting system flags, setting the channel number, 'do now' actions) are only sent to other external TB8100 software processes at the end of the processing cycle. This means that tasks can carry out an external action several times, causing several internal changes, but there will only be a single external action, at the end of the processing cycle.

Action can trigger other actions without ever becoming visible itself

External actions have an immediate effect internally. This means that their new value is immediately available to subsequent tasks in the task list. For example, an action could disable the receiver system flag, and this could trigger a second action. If a third action enabled the receiver system flag, the results of the second action would become visible, but the receiver would never actually be disabled.

Flag does not clear when expected

It can happen that a flag does not clear when expected. If the flag is set at the beginning of the processing cycle, cleared at its end, and then set again at the beginning of the next cycle, tasks with 'IF flag n set' as their input do not know that the input has changed and so are not processed.

Task in channel profiles not actioned until an external channel change

Task Manager only processes tasks in profiles that are assigned to the current channel. If Task Manager changes channel, a change in the profile assignment only occurs once the channel has actually changed. This takes about 300 ms. It does not occur as soon as Task Manager has set the new channel internally.

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