



## T24-HA

### Handheld Display Multiple Inputs

User Manual  
[www.mantracourt.co.uk](http://www.mantracourt.co.uk)

**ME mantracourt**  
Wireless Telemetry Range 2.4Ghz

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## Introduction / Overview

The T24-HA is an advanced handheld display. This allows wireless remote viewing of multiple inputs such as strain gauge or voltage etc using 2.4GHz radio.

The T24-HA also performs the function of optionally waking the remote devices when it is turned on and sending them to deep sleep mode when it is turned off.

The handheld can operate in two modes. The operation of the buttons and the automatic sleep/wake functions are dependant on these modes.

### Result Mode

This is the default mode in which multiple acquisition modules are used to create a result which is displayed. Currently the T24-HA only provides a **sum** of the remote devices but this function may be added to in future versions. Although the handheld usually shows the result (sum) there is an option of viewing the discrete values that make up the result.

### Item Mode

In this mode each acquisition device is treated as a separate reading and the handheld is used to cycle through the available items and the value of each can be viewed.

## Communications Overview

The T24 range of telemetry devices each have a factory set unique **ID**.

Data is shared between devices using **Data Provider** messages. A device generates these messages which can then be used by many other devices simultaneously.

These messages ( or packets ) of information contain a single value of data and each is identified by a **Data Tag**.

The **Data Tag** should be unique for each message.

### **ID** Identifies each device

Each device has a unique **ID** that is factory set. This is represented as a 6 character hexadecimal number consisting of the digits 0 to 9 and the letters A to F.

I.e. **FFD3BE**

### **Data Tag** Identifies each Data Provider message

A **Data Tag** consists of a 4 character hexadecimal number consisting of the digits 0 to 9 and the letters A to F. The **Data Tag** can be changed by the user but the factory default is to match the last 4 characters of the device **ID**.

I.e. An acquisition device of **ID FFC12B** would have a default **Data Tag** of **C12B**.

When a device consumes data (i.e. a handheld displaying data from an acquisition device) all it is doing is listening to all of the **Data Provider** messages and selecting the one it wants to use. It then extracts the data and displays it.

Some devices that use **Data Provider** messages also need to know the **ID** of the device providing the data. This is necessary if that device needs to specifically wake the data providing device as opposed to using a broadcast wake that will wake all devices on the same channel and using the same encryption key.

Pairing offers an automated method of hooking a provider and consumer of data together. However, some devices may require you to manually enter **Data Tag** and **ID** information so it would be beneficial to the user to understand the above mechanism.

## Getting Started

This section will show you how to get the device pair working out of the box.

You will require 2 X AA alkaline batteries for the handheld and a 3 Volt dc supply for the strain acquisition module(s) which may also be a pair of AA batteries.

To attach acquisition devices to the handheld we must first ensure that the appropriate devices are transmitting their values at a suitable rate such as the default of 3 per second. Then we can configure the handheld to use the data from these devices.

Initial configuration must be done with the **T24 Toolkit** software and a base station.

## Connecting Power

### T24-HA

Remove the two screws on the rear battery compartment. Insert two alkaline AA batteries. Refit the battery compartment cover. The handheld device is now switched on so should be turned off until the acquisition module is ready. To turn off just hold down the power key until the display shows **BUSY** then release it.

### Acquisition Module

Attach power supply as instructed in the acquisition module user manual. You may not want to actually connect an input signal yet as we can still establish communications between devices without this.

### T24-HA Operation

The handheld can operate in two modes and the button operation is dependant on these modes.

#### Item Mode

Up to 12 individual devices can be connected to and the user can step through each one in sequence. If **DoSleepWake** is set then the handheld will wake all configured devices when turned on and send them all to sleep again when turned off. NOTE: When the handheld wakes devices this achieved through the transmission of a broadcast wake. I.e. all devices on the same channel and with the same encryption key will wake.

#### Keys



Send the currently selected device to sleep.



Will attempt to wake the currently selected device.



Press the TARE key. This will toggle between gross and zeroed net mode. I.e. If the display shows gross then pressing the key will zero the display. Pressing the key when in net mode will return the display to gross mode. The Gross and Net modes are indicated as described below. Gross and Net are retained through power off.



Step to the next device.



If motion detection is activated then the reading must be steady to enable this key. Pressing this key with an unstable reading will do nothing. This transmits a Data Provider packet marked with a Data Tag held in **F1DataTag** and can also contain data as defined by **F1Data**. This can be used to trigger external actions such as a printout.



Press and hold the power key until the display shows **BUSY** then release the key. Can also be used, by giving a quick press, to reset the Auto-Sleep delay.

#### Result Mode

Up to 12 individual devices can be summed and the result displayed.

If **DoSleepWake** is set then the handheld will wake all configured devices when turned on and send them to sleep again when turned off. NOTE: When the handheld wakes devices this achieved through the transmission of a broadcast wake. I.e. all devices on the same channel and with the same encryption key will wake.

In this mode there is an option of retrieving a system zero value from an external source. This is activated by supplying the Data Tag to the **ExtZeroDataTag** parameter. When activated the value supplied by the Data Provider packet marked with this tag will be used as the system zero and will be subtracted from the sum of all contributing inputs.

Usually in this mode only the result is displayed (sum) but by holding the **Next** key for a configurable number of seconds will activate the ability to step through each contributing input using the **Next** key.

### Keys when viewing Result



No effect.



Will attempt to wake any sleeping devices.

**NOTE:** This uses a broadcast wake so any devices on the same channel with the same encryption key will wake.



Toggle between displaying gross sum or tared sum.



No effect unless held for a number of seconds to activate individual item view. This can be disabled. See Later



If motion detection is activated then the reading must be steady to enable this key. Pressing this key with an unstable reading will do nothing.

This transmits a Data Provider packet marked with a Data Tag held in **F1DataTag** and can also contain data as defined by **F1Data**. This can be used to trigger external actions such as a printout.



Toggles between on and off. Hold for 2 seconds to activate.

### Keys when viewing an individual item



No effect.



Will attempt to wake the currently selected device.



If sum was currently tared then this key will toggle between displaying gross or tared value of current device. If sum view was displaying gross then this key has no effect.

If an external system zero is used then only gross values actually supplied to the handheld can be displayed.



Selects next device to view.



If motion detection is activated then the reading must be steady to enable this key. Pressing this key with an unstable reading will do nothing.

This transmits a Data Provider packet marked with a Data Tag held in **F1DataTag** and can also contain data as defined by **F1Data**. This can be used to trigger external actions such as a printout.



Toggles between on and off. Hold for 2 seconds to activate.

### All Modes

#### Indicators

G The display is showing Gross weight.

<b>NET</b>	The display is showing Net weight.
<b>SIG LOW</b>	The radio signal from the acquisition module is low. The device is still functioning but the limit of the range may be near. Communications may start to deteriorate when this indicator is visible. Until ----- is displayed the communications is still OK and the display can be relied on for accuracy.. <b>Note:</b> Even with a degraded signal the display value will always be correct. <b>Note:</b> Even with a degraded signal the display value will always be correct.
<b>BATT LOW</b>	The batteries in the handheld are low and need to be replaced.
<b>REMOTE ERROR</b>	The acquisition module has an error that the handheld does not recognise.
<b>REMOTE BATT LOW</b>	The battery or supply to the acquisition module is low.
<b>Errors</b>	
Displayed on handheld LCD.	
<b>Error 1</b>	The acquisition module has a strain gauge input and is in shunt cal mode. An external device has placed the acquisition module in Shunt Calibration mode so rather than display a misleading reading this error is displayed instead. Modules such as the T24-SA support this error type.
<b>Error 2</b>	Input integrity error. The acquisition module has found a problem with the input. There may be open or short circuits. Rather than display a misleading reading this error is displayed instead. Only certain acquisition modules support this error such as the T24-SA.
<b>Overload</b>	A user settable value which when exceeded causes this message to be displayed.
<b>{Display Flashing}</b>	The motion detection has been enabled and the reading is deemed in motion or unstable.
<b>Other Functions</b>	
<b>System Zero</b>	If enabled, holding the Tare key for a number of seconds will perform a system zero.
<b>Pairing</b>	See Field Acquisition Module Replacement later

## **Configuration**

This section explains how to install software and connect the required devices together. Please note that you will need the **T24 Toolkit** software and a **T24-BS** base station to allow your computer to communicate with T24 telemetry devices.

## **Installation**

### **T24 Toolkit**

To configure the devices we must use the **T24 Toolkit** software application. This can be downloaded from our web site or may be shipped with your products.

Install this on a PC or laptop.

Run **setup.exe** and follow the prompts to install the software.

### **T24-BSu Base Station**

If you have a USB version of the base station (T24-BSu) then you just need to plug this into a USB socket on your PC. If you are using an alternative base station then please refer to the appropriate manual.

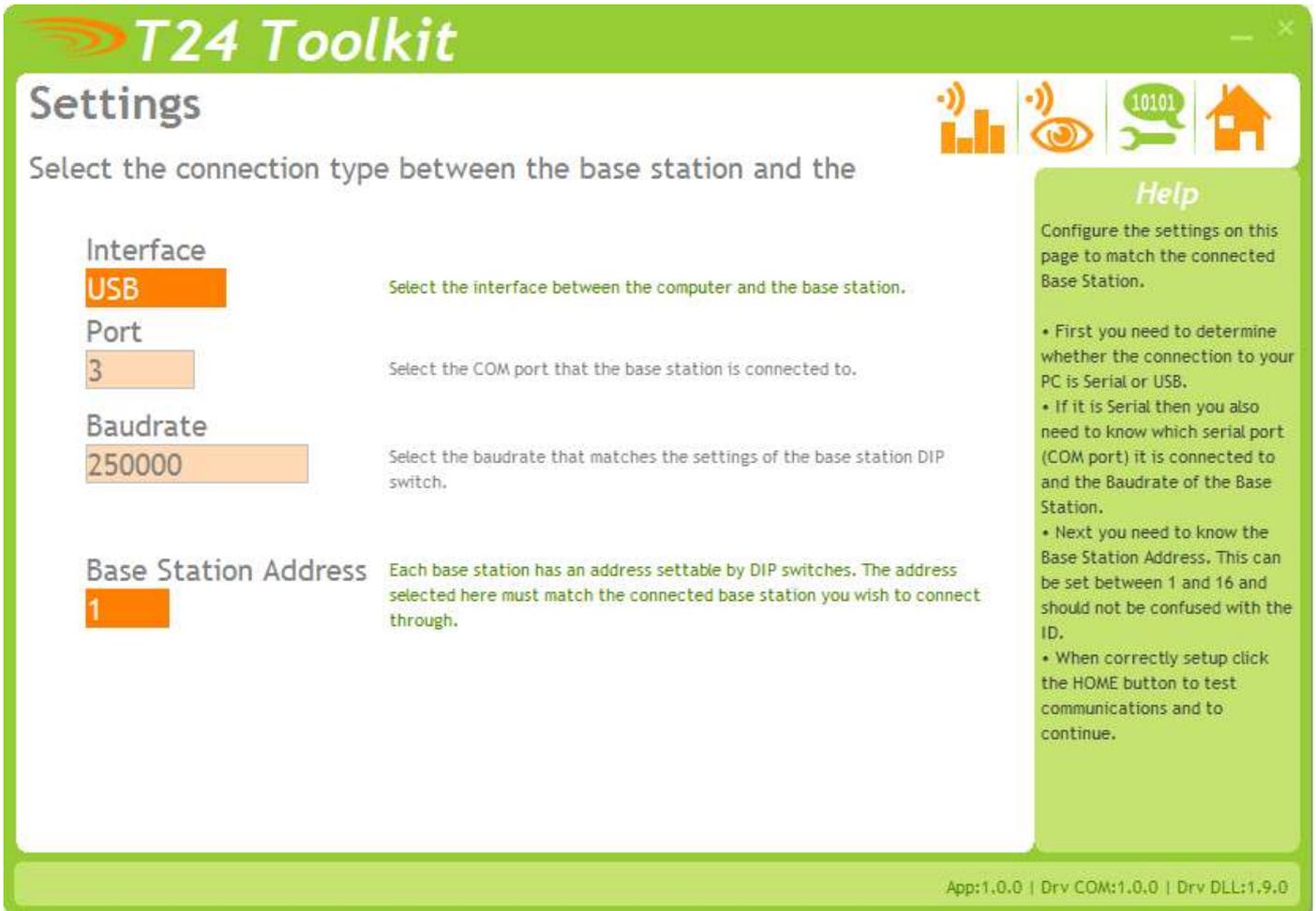
## T24 Toolkit

The T24 Toolkit provides a means of simple configuration of the T24-HA handheld and associated acquisition module along with useful tools to aid integration. Calibration of the acquisition modules is also provided.

Run the T24 Toolkit software application.

PLEASE NOTE: Depending on which acquisition module is selected the screenshots may vary slightly. This will generally be in naming of units and device descriptions. The screenshots shown are those shown when a T24-SA strain gauge acquisition module is connected.

### Setup Base Station Communications



Select **USB** as the interface and select **1** as the Base Station Address.

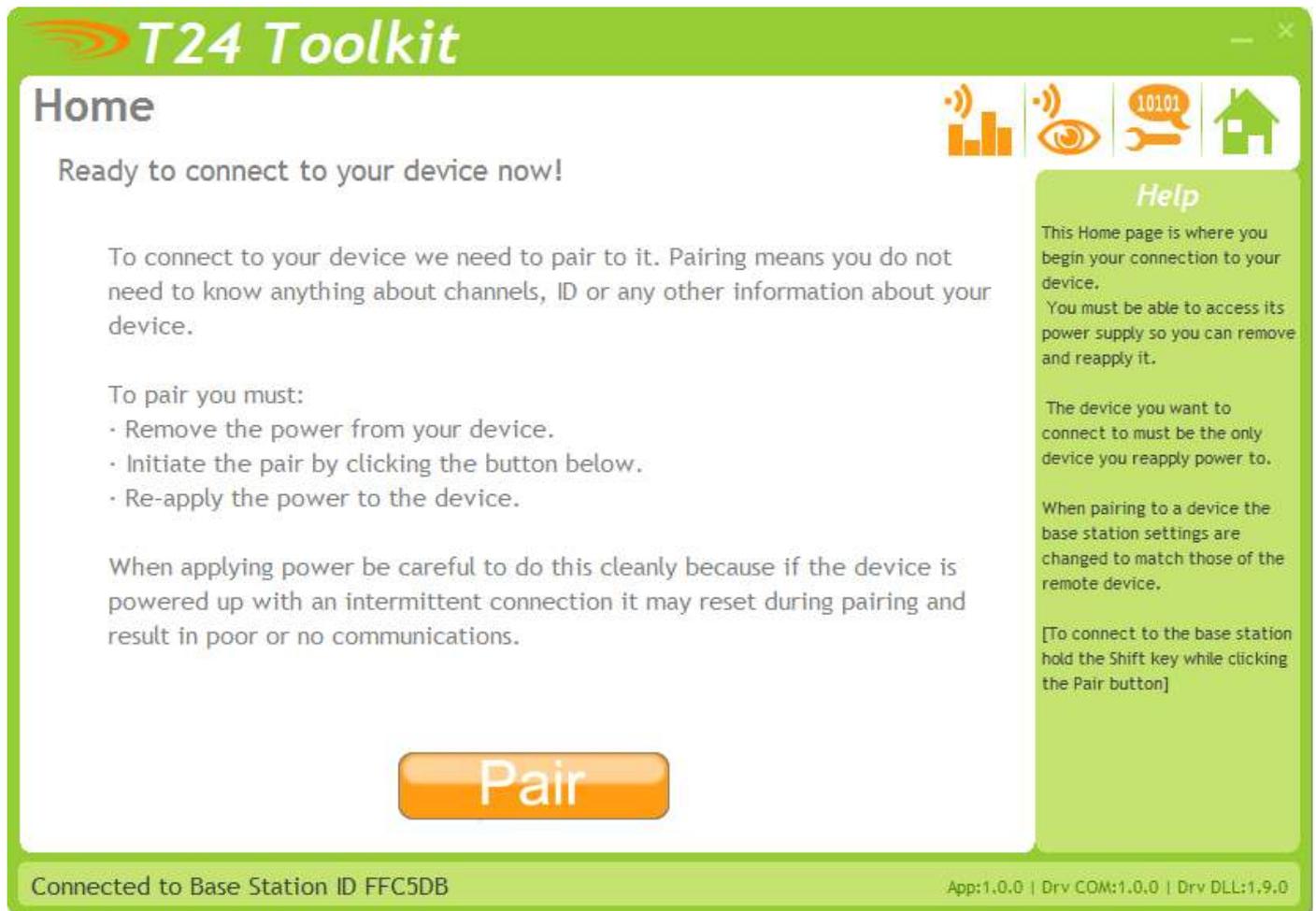
In the toolkit all items that can be changed by the user are coloured orange.

To change a value just click on the relevant orange item. You will then be presented with a new dialog window allowing you to change the value.

This may use a slider, text box or list to allow your new value to be entered.

Click the Home button to attempt communications with the base station.

If no communications can be established the toolkit will remain on this page. You will need to check that the base station is powered and that it is connected to the converter correctly.



We now have successful communications with the base station so we can now pair with our device or we can select the Spectrum Analyser mode or Data Provider Monitor mode.

To connect to our device we will pair. This is achieved by power cycling the device. Pairing removes the need to know the radio settings of the device you are connecting to and also ensures that it is in a suitable state for configuration.

#### Pairing Procedure

- Remove at least one battery from the handheld module.
- Click the Pair button on the toolkit.
- You now have 10 seconds to replace the handheld batteries.

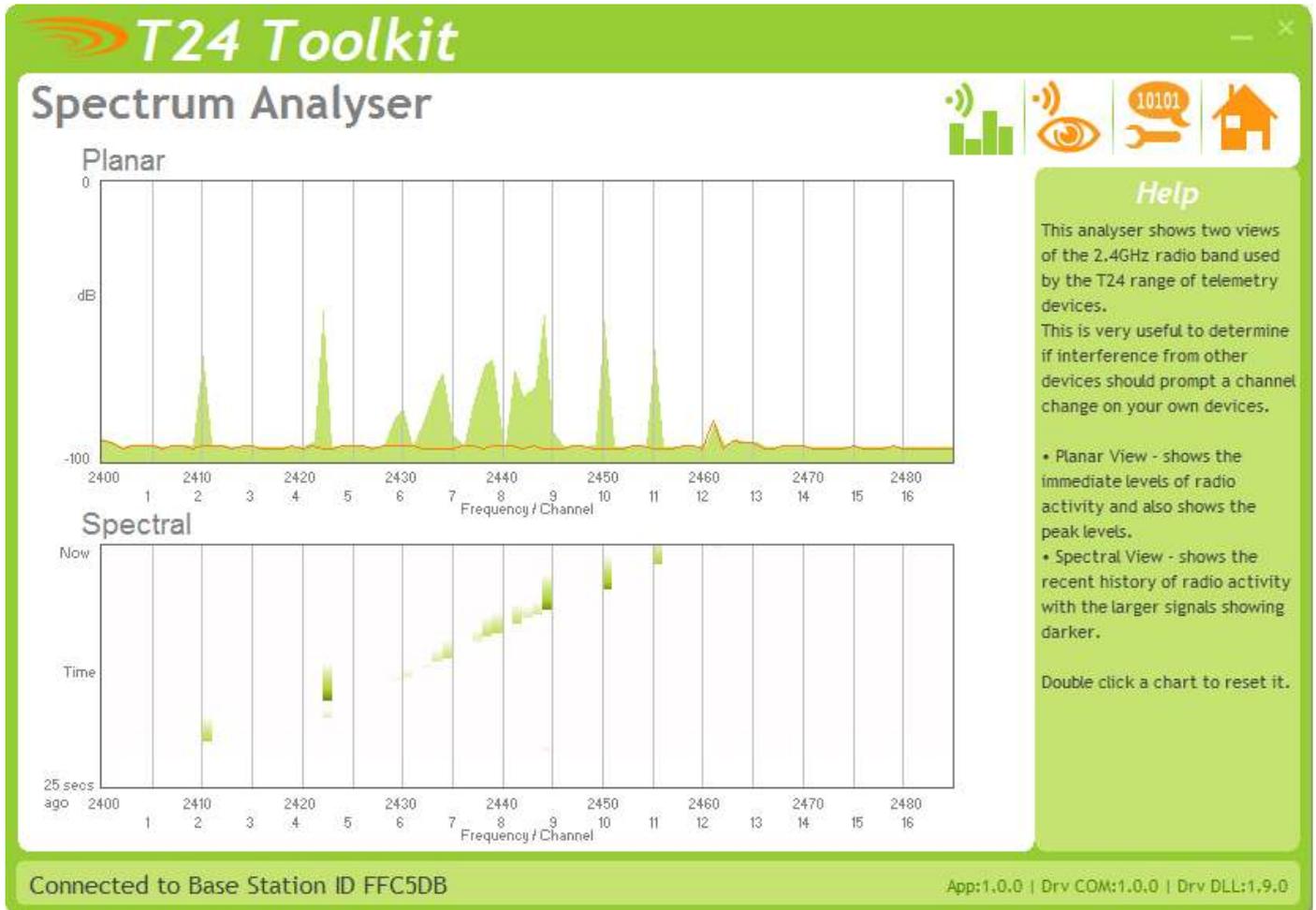
If you connect successfully the toolkit will change to the Information page.  
If the pairing fails try again.

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**NOTE:** Pairing with the toolkit will **not** change the radio configuration settings of the connected device.

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## Analyser



The analyser page is provided as a tool and will not normally be needed unless you plan to change channels and want to find the best channel to select, or to diagnose poor communications issues.

This page shows the radio signal levels detected across all the channels available to the T24 series of devices. Using this tool may help in detecting noisy areas and allow you to decide on which channels you may want to use.

The above charts show the traffic from a Wi-Fi network and it can be seen to be operating over channels 6 to 9 and it would be best (though not essential) to avoid using these channels.

## Data Provider Monitor

Data Tag	Total	Per sec	LQI	Value
C629	18	3	100	0.0160147
C623	58	10	100	0.0129487
C628	18	3	100	0.0218671
C62C	18	3	100	0.0152698
C627	17	3	100	0.0172869
C624	17	3	100	0.0130830

Select the devices you wish to log from the above list by checking them. Pressing the Start Logging button will allow you to select a filename to log the data to.

[View Last Log](#) [Start Logging](#)

Connected to Base Station ID FFC5DB App:1.0.0 | Drv COM:1.0.0 | Drv DLL:1.9.0

### Help

This page allows you to monitor Data Provider packets. Data Provider packets are what acquisition devices transmit periodically.

You have the option of logging these to a comma separated value (CSV) file.

T24 acquisition devices normally operate in low power mode and periodically transmit Data Provider packets. This page shows all detected Data Provider packets which may be useful for checking that a device is operational.

**NOTE:** When the toolkit connects to a device to enable configuration it will usually inhibit the transmission of Data Provider packets.

The Start Logging button will ask for a filename and proceed to log the received data to a CSV file in the following format:

**Data Tag, Elapsed mS, Value**

The View Last Log button will launch the application associated with CSV files and open the last logged file.

## Information

**T24 Toolkit**

### Information

Handheld Display  
Advanced

ID: FFC64D  
Model: T24-HA  
Firmware Version: 1.00  
Radio Module Firmware Version: 1.4  
Name: T24-HA

#### Help

Here you can view information about the device. You can also allocate a descriptive name to aid future identification.

Connected to T24-HA of ID FFC64D App:1.0.0 | Drv COM:1.0.0 | Drv DLL:1.9.0

Once successfully paired to a device this page is displayed. This page shows you information about the connected device.

#### Items you can change:

**Name** You can enter a short description which may help you recognise this device in the future.

## Mode and Communications

**Operational Mode**  
**Result Mode**  
 Select in which mode the handheld operates. In Item Mode each device you add will be individually viewable. In Result Mode you will see a sum of all added devices and optionally be able to see individual values.

**F1 Data Tag**  
**0000**  
 Enter the Data Tag to use when a data packet is sent when the F1 key is pressed. This data packet can be used to supply data

**Remote Data Tags and IDs**  
 Here is where you need to identify the remote acquisition devices that you wish to communicate with. Click the X button to remove an item or the P button to pair to an actual device. Alternatively just type in the required information.

	Data Tag	ID		Data Tag	ID		Data Tag	ID	
1	1234	FFC6F0	P	X	5	0000	000000	P	X
2	0000	000000	P	X	6	0000	000000	P	X
3	0000	000000	P	X	7	0000	000000	P	X
4	0000	000000	P	X	8	0000	000000	P	X
					9	0000	000000	P	X
					10	0000	000000	P	X
					11	0000	000000	P	X
					12	0000	000000	P	X

**Allow Next Key**  
**6**  
 When in Result Mode you can enable viewing of individual devices by holding the Next key for the number of seconds set here. Enter zero to disable.

**F1 Data**  
**Always Gross**  
 Select the type of data that is sent when the F1 key is pressed if the F1 Data Tag above is set.

**Help**  
 This is where you configure the basic operating mode of the device.  
 You can also attach remote devices by pairing rather than enter their ID and Data Tag information manually.

Connected to T24-HA of ID FFC64D  
 App:1.0.0 | Drv COM:1.0.0 | Drv DLL:1.9.0

This page allows you to set the operational mode of the device and configure which external acquisition devices the handheld will connect to.

### Items you can change:

- Operational Mode**  
 Select in which mode the handheld will operate.  
**Result Mode**  
 Up to 12 individual acquisition devices can be summed and displayed. Optionally the operator can view the individual device values (See Allow Next Key).  
**Item Mode**  
 Up to 12 individual devices can be connected to and the user can step through each one in sequence.
- Allow Next Key**  
 Only used in Result Mode. Usually in Result mode only the result (sum) of the individual devices is shown. By entering a non-zero value here this will define the number of seconds that the Next key needs to be held down to enable individual item values to be viewed. Once available the Next key will cycle between all the individual values and the result. This will remain available until the handheld is powered off. Each time the Next key is pressed the display will show a brief message indicating what will be displayed; **Input 1, Input 2, Result** etc
- F1 Data Tag**  
 The **F1** key can be used to trigger other devices such as a T24-SO device to provide printer services etc. This key will generate a Data Provider message which other devices can use. Set this value to non zero to enable this function and to define the Data Tag that will identify the message sent.  
 The content of the message is defined by the **F1 Data** parameter.  
 NOTE: If motion detection is configured then this key will have no effect while the reading is not steady.

- F1 Data Define what data is carried in the Data Provider message when the F1 key is pressed. Select **Always Gross** to transmit the gross value regardless of whether the Tare key has been pressed. Select **As Displayed** to transmit either the gross or net value depending on the currently displayed data.
- Remote Data Tags and IDs
- Data Tag Enter the Data Tag of the message to use for the specified input item.
- ID Enter the ID of the device used to supply the specified input item.  
**NOTE:** This is only necessary for **Item Mode** where individual items are to be woken using the **Wake** key as opposed to letting the handheld wake all devices. If you are not using Item mode then you are not required to enter the ID although it will be filled in automatically if you pair to a device to retrieve its settings.
- P Click this to give 5 seconds to perform pairing to automatically provide the Data Tag and ID from a specific device. Usually pairing is activated by removing and replacing the power supply.
- X Click this to reset the Data Tag and ID to zero (disabling the input item).

## Zero Settings

**T24 Toolkit**

### Zero Settings

**Power On Auto Zero**  
0.0  
The device can automatically zero the display on power up to tare away any unwanted readings. Here you can enter a limit above which the auto zero will not operate. Set to zero to disable.

**Zero Indication Band**  
0.0  
You can enter a value here below which zero will be displayed. When the input does exceed this value the correct value will be displayed. This can be used to hide unwanted display changes after zeroing without affecting the reading when above this level.

**Allow System Zero**  
10  
A system zero can be performed by holding the Tare key down for a number of seconds. If you would like this function enabled just enter the number of seconds to hold the key for. Enter zero to disable.

**Perform System Zero**  
You can perform a system zero now by [Clicking Here](#) or remove any existing system zero by [Clicking Here](#) NOTE: the handheld must already be configured with the correct acquisition devices and valid communications must be established. This will perform the same action as when the Tare key is held and performing system zero via the keypad has been enabled.

[Advanced](#)

**Help**  
Adjust power on zero and the the zero indication band.

Connected to T24-HA of ID FFC64D  
App:1.0.0 | Drv COM:1.0.0 | Drv DLL:1.9.0

Here you can adjust settings that affect the display of zero.

### Items you can change:

#### Power On Auto Zero

Here you can determine whether the T24-HA performs automatic zero when it is powered on.

Enter zero to disable this function.

If you enter a non-zero value then when the handheld is first turned on it checks the value read from the acquisition module. If this falls within  $\pm$  of this value then the display will be altered so this reads zero.

**Example:** A strain gauge acquisition module (T24-SA) is calibrated in Kgs and measures the weight of boxes on a platform. The weight of the platform itself has been removed using system zero on the acquisition module.

Sometimes there is debris on the platform which you do not want to see when viewing the weight of boxes that will be placed on the platform later.

The minimum weight of a box is 5 Kg so you could set the Power On Auto Zero to 2 Kg.

When you turn on the handheld, if the weight on the platform is between -2 and +2Kg then the handheld will tare this weight off and so read zero.

#### Zero Indication Band

Using this setting you can mask tiny changes in input after you press the Tare button.

Entering zero will disable this function.

Entering a non-zero value will provide a band within which the display will always read zero.

Once the reading exceeds this value the real weight will be displayed as no taring is taking place.

**Example:** You are adding boxes to a platform and you press tare between adding each one so you can see the weight of each box.

Without this setting activated each time you tare the display will be around zero but not exactly zero (By setting the display resolution you may hide this difference) by setting a small value here such as 0.2Kg the display will show a stable zero while actual weight is fluctuating less than  $\pm 0.2\text{Kg}$ .

Allow System Zero

Entering a non-zero value here will enable system zero to be performed by holding down the Tare key for a number of seconds.

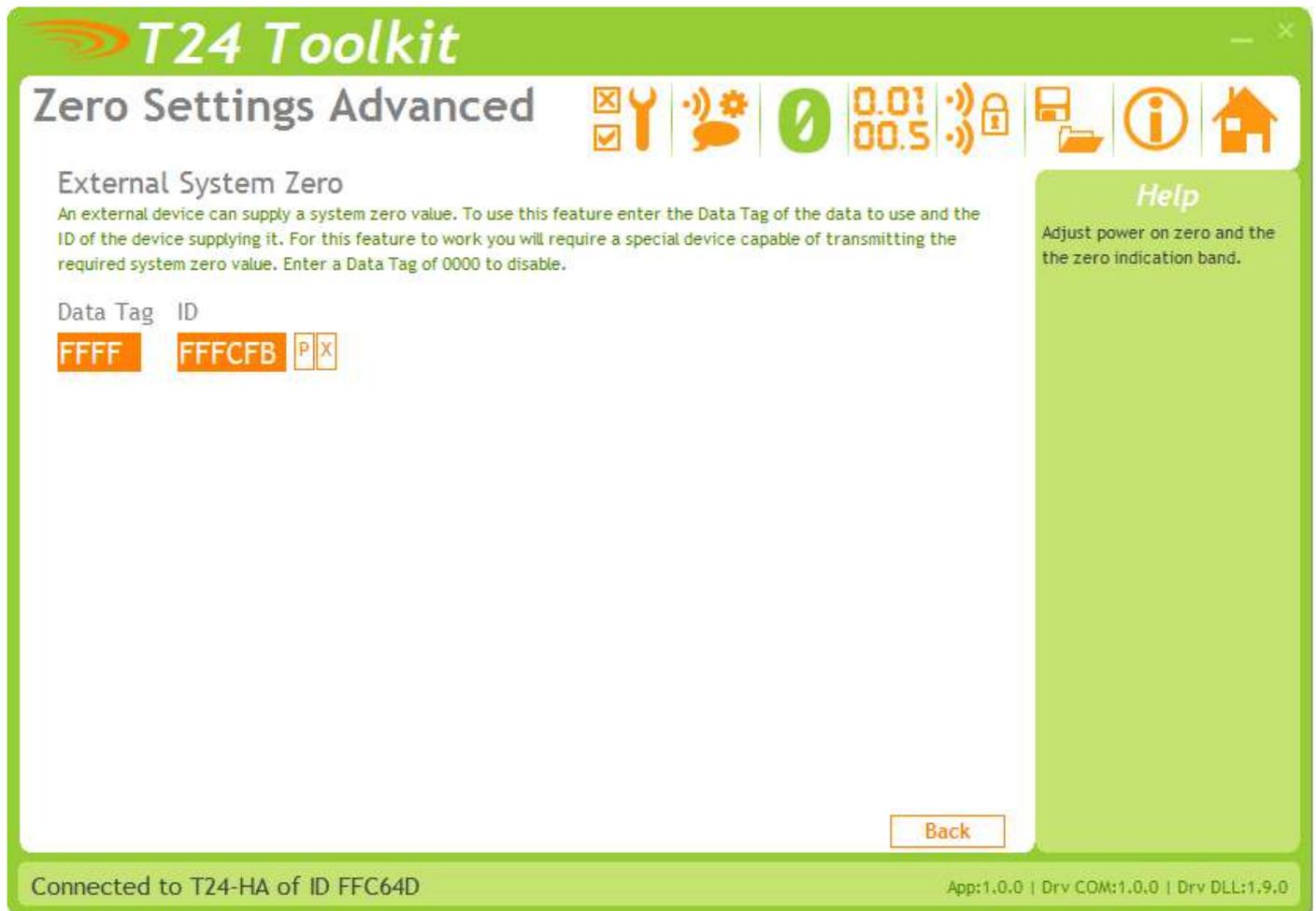
The value entered here represents the number of seconds the key needs to be held.

Perform System Zero

This section allows the user to apply or remove a system zero.

This will require that the acquisition modules are configured, attached to the handheld and the entire system is ready for zeroing.

## Zero Settings Advanced



This advanced section allows the use of a specially configured external device to supply the system zero value for the handheld to use.

Example:

The same handheld is used with a truck that picks up different trailers and is required to display the sum of 4 strain gauges connected to each trailer (Using T24-SAs).

Because each trailer will have a different system zero requirement we would add a further device to each trailer set to transmit the system zero value. It is the Data Tag that is entered here.

Note: On all trailers the acquisition module sets share the same Data Tags.

### Items you can change:

**Data Tag** Enter the **Data Tag** of the message to use for the external system zero.

- ID** Contains the ID of the device used to supply the external system zero. This is only necessary to provide a visible record of the remote device and is shown to keep compatibility with the **Mode and Communications** page.  
You do not need to enter anything here although it will be filled in automatically if you perform a pair to retrieve data.
- P** Click this to give 5 seconds to perform pairing to automatically provide the Data Tag and ID from a specific device. Usually pairing is activated by removing and replacing the power supply.
- X** Click this to reset the Data Tag and ID to zero (disabling the external system zero function).

## Display Format

**Format & Resolution**  
000.0001 Here you can define how the value will be displayed and where the decimal point will appear. By including a non zero value this will define the resolution of the displayed value. i.e. the smallest step size of value changes. To select from some predefined values [Click Here](#)

**Leading Zero Suppression**  
No Choose to suppress leading zeroes or to show them.

**Overload Limit**  
1000000 Enter a value above which OVERLOAD will be displayed instead of the normal reading.

**Motion Band**  
0 Enter a value band that the display value must stay within for the Motion Time to be considered steady. Unsteady or 'in motion' values will be indicated by a flashing display. Enter zero to disable.

**Motion Time**  
1 Enter a time in seconds within which the displayed value must not change more than the Motion Band set above.

**Help**  
Alter the display format and resolution.  
Optionally apply leading zero suppression.  
Optionally display an overload warning.

Advanced

Connected to T24-HA of ID FFC64D App:1.0.0 | Drv COM:1.0.0 | Drv DLL:1.9.0

Here you can adjust the display.

### Items you can change:

#### Format & Resolution

Here you can define how the values are displayed on the LCD. There are 7 digits available and you can define where the decimal point is shown by entering text where a zero indicates a numeric digit position.

When the data is being displayed the number of decimal places you define may be overridden as the display will always show the correct number of integer digits.

Example: If you set the format to 000.0000 and the value to display is 1000.1234 the display will show 1000.123

You can also define the resolution, which is the block size of changes to the display.

Example: If you enter the format as 000.0005 the display will only change in steps of 0.0005 which can be used to mask noisy digits at high resolutions.

#### Leading Zero Suppression

This can be turned on or off and will suppress leading zeroes when on.

Example: If the display reads 000.123 with leading zero suppression turned off it will display 0.123 when turned on.

#### Overload Limit

You can enter a limit here above which **Overload** will be shown on the display instead of the actual value.

Enter zero to disable this feature.

Advanced	This opens the advanced page where you can scale the displayed data.
Motion Band	By entering a non-zero value here you activate the motion detection. If, within the Motion Time, the displayed value changes by more than the amount entered the reading will be deemed in motion or unstable and the display will flash. The F1 key will be disabled while the reading is in motion.
Motion Time	Enter a time in seconds over which the motion detection operates.

## Display Format Advanced Settings

**T24 Toolkit**  
Display Format Advanced

**Display Update Rate**  
300  
You can modify the update rate of the display in milliseconds. The default is 300 for approximately 3 updates per second.

**Custom Display Scaling**

At Low Input Value of 0.0 — Display Should Read 0.0

At High Input Value of 1.0 — Display Should Read 1.0

To configure custom display scaling just enter a low and high pair of values indicating what you would like displayed for a given input value. (NOTE: This will be applied to all views, i.e Sums and individual values)

To display the input value without scaling [Click Here](#)

[Back](#)

**Help**  
Alter the display format and resolution.  
Optionally apply leading zero suppression.  
Optionally display an overload warning.

Connected to T24-HA of ID FFC64D App:1.0.0 | Drv COM:1.0.0 | Drv DLL:1.9.0

Here you can adjust the display update rate and also scale the displayed data. This may be used, for example, to convert the data from a T24-SA calibrated in Kgs so that the handheld display shows Lbs.

### Items you can change:

**Display Update Rate** Enter the interval in milliseconds between display updates. The default is 300 milliseconds. i.e. 3 updates per second.

**Custom Display Scaling** This can be used to change the displayed value to a different unit or to otherwise scale it. You simply enter the original and required values at a low and high point.  
Example: If a T24-SA was supplying data in Kgs and you wanted to show tonnes. You would keep both the low points at zero. Enter **At High Input Value** of 1000 and **Display Should Read Value** of 1.



## Save and Restore



Here you can save the device settings to a file on your PC so that they can be later loaded back into the same or different device.

### Items you can change:

- |                   |   |
|-------------------|---|
| Save              | Click this button to open a file dialog window to allow you to select a filename and location to save the configuration file to. All configuration information including calibration data will be saved to the file. The file extension is tcf.                             |
| Restore           | Click this button to open a file dialog window to allow you to select a filename and location of a previously saved file to load into the connected device. All configuration information <b>including</b> calibration data will be overwritten. The file extension is tcf. |
| Advanced Settings | Click this button to enter the Advanced Settings Page. Here are settings which do not normally require changing.  |

## Advanced Settings

**Waker Duration (mS)**  
 Select how long the handheld will wait to wake the paired device. The default is 12 seconds (12000 mS).

**Do Sleep Wake**  
 Whether the handheld will wake and sleep the paired devices as it is turned on and off. The default is YES.

**Auto Off Delay (m)**  
 The handheld will power off if no button is pressed within this time. Enter zero to disable this function. The default is 5 minutes.

**Keep Awake Interval (S)**  
 Paired devices need to be kept awake. Enter the interval in seconds to transmit Keep Awake messages. The default is 5 seconds.

**Pair Wait Duration (S)**  
 This determines how long to wait in seconds when pairing a device to the handheld. The default is 5 seconds.

**Item Duration (S)**  
 Select how long an individual input is displayed before reverting to Result display. The default is 10 seconds.

**Message Duration (mS)**  
 Select how long the item messages will be displayed before showing values. i.e. INPUT 4. The default is 600mS.

**Help**  
 These are advanced settings and do not normally require changing.

Connected to T24-HA of ID FFC64D App:1.0.0 | Drv COM:1.0.0 | Drv DLL:1.9.0

You should not normally need to change these settings.

### Items you can change:

- Waker Duration** When the handheld is turned on it may attempt to wake the paired acquisition modules. This setting allows you to adjust the time it will wait to wake the remote devices in milliseconds. The default is 12000.
- Do Sleep Wake** You can select whether the handheld wakes the remote acquisition modules on power up and sends them to sleep on power down. Select No to disable this function. The default is Yes.
- Auto Off Delay** Here you can specify the delay in minutes after which the handheld will automatically turn off after no button is pressed. Enter zero to disable this function. The default is 5 minutes. The On/Off key can be used to reset this by giving a quick press. This may be more suitable than using the Tare key!
- Keep Awake Interval** While the handheld is retrieving data from the acquisition module it periodically sends out a **Keep Awake** packet. This will stop the acquisition module from going to sleep while the handheld is in use. The default is 5 seconds.
- Pair Wait Duration** Here you can set the duration that the handheld will wait to achieve successful pairing when it is turned on in Pairing mode. The default is 5 seconds.
- Item Duration** Used when in Result Mode and the Next key has been enabled to allow viewing of discrete inputs. Enter a time in seconds that the individual item value will be displayed for before the display is automatically switched back to showing the result.

## Message Duration

Each time the Next key is used to step through available items the display shows a brief description of the data about to be displayed. **Input 1, Input 2, Result** etc  
The time you enter here in milliseconds is the time that this message will be displayed before the actual value is shown.

## Installation

### Overview

Radio performance at microwave wavelengths is very dependent upon the operating environment; any structure within the operating region of the radios will give rise to three effects:

**Obscuration.** Obscuration will result in reduced range and occurs when an obstruction masks the line-of-sight between radios.

**Aberrations to the horizontal and vertical space patterns.** Distortion of these patterns may occur if structures or objects are placed in the near or intermediate field of the antenna. The effect will be to distort the coverage patterns, adversely affecting range and link quality.

**Reflection.** Any object placed in line-of-sight of the transmit antenna will result in signals arriving at the receiver by an indirect path. Degradation of performance due to reflection (multipath effects) appears as reduced range or poor link quality.

Any of the above will cause poor RSSI figures, an increase in the packet loss rate and in extreme cases complete loss of signal. Fortunately, if consideration is given to these effects at the integration stage then a good quality link will be obtained.

#### **Guidelines for product design:**

When selecting materials for product enclosures, preference should be given to fibreglass, light coloured ABS or Polypropylene; at the wavelength of 2.4GHz radio other materials will adversely affect the signal by attenuation, refraction or change in polarisation.

If the application demands that the radio is fitted inside a metal enclosure then ensure that the specified clearances are maintained around the antenna and design in a fibreglass RF window at least as large as the clearance dimensions but ideally as large as possible.

RAD24i radios fitted inside a product should be oriented so that the chip antenna will be vertical when the product is in its normal operating position.

#### **Guidelines for installation:**

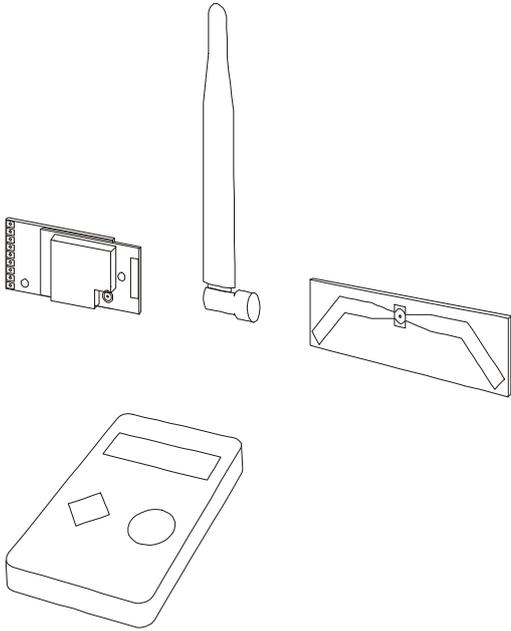
When planning installations ensure that line-of-sight between nodes is maintained and that objects or structures are kept at least one metre away from antennae wherever possible.

To avoid poor link quality between a RAD24i radio and a handheld device ensure that the RAD24i is mounted so that the chip antenna is vertical. Improvement may also be obtained by altering the height above ground of the RAD24i; a small increase or reduction in antenna elevation will often improve reception.

Range underwater is only a decimetre or so depending on packet rate. Best performance underwater is obtained by using low packet rates and immersing water-proofed antennae rather than water-tight enclosures containing the antennae.

### **Antenna Orientation**

For the maximum range the acquisition module and the T24-HA should be orientated as shown. The sensitivity to the radio transmission will be reduced if the acquisition module is oriented in a vertical or portrait position.



# Specifications

## General Radio

	Min	Typical	Max	Units
License		License Exempt		
Modulation method		MS (QPSK)		
Radio type		Transceiver (2 way)		
Data rate		250		K bits/sec
Radio Frequency	2.4000		2.4835	GHz
Power		1		mw
Range RAD24i (Integrated antenna)			120 (400)	Metres (feet) *
Range RAD24e (External antenna)			200 (650)	Metres (feet) *
Channels (DSSS)		16		

\* Maximum range achieved in open field site with T24-SA at a height of 3 metres above ground and T24-HA held at chest height pointing towards the T24-SA.

## T24-HA

Electrical	Min	Typical	Max	Units
Power Supply voltage	2.4	3.0	3.6	V dc

Power Supply	Min	Typical	Max	Units
Active		35	40	mA
Low power mode		120	160	uA
Estimated Battery life using 2Ahr batteries:				
Standby mode (Powered off)		1.5		Years
Continuous operation		40		Hours

Environmental	Min	Typical	Max	Units
IP rating		IP65		
Operating temperature range	-10		+50	C
Storage temperature	-40		+85	C
Humidity	0		95	%RH

Physical	
Hand Held Dimensions	90 x 152 x 34mm

## **Field Acquisition Module Replacement**

The following technique can be employed if an acquisition device needs replacing in the field. It is good practice to calibrate all acquisition modules in absolute units such as Kg. By doing this it is easy to send a replacement to a customer. If the calibration is more complex then a copy of the configuration can be made using the Toolkit and the settings can then be uploaded to the replacement module before shipping to the customer.

Configure the replacement acquisition device to match the original in terms of calibration.

Once a customer has received the replacement device and connected it to replace the original the following procedure could be instructed.

Use the built in pairing function to retrieve the **Data Tag** and **ID** of the replacement device.

- Using the handheld view the item that is being replaced. In **Result Mode** the ability to view individual items **must** have already been enabled and activated.
- This will display ----- if the original device is unavailable.
- Power off the handheld using the Power key.
- Ensure that new acquisition module is not powered for at least 10 seconds.
- We need to turn on the handheld in pairing mode. To do this we start with it turned off, then press and hold the power key then press and hold the Tare key. Now both keys are held down until PAIRING is seen on the display. The keys can now be released.
- Now apply power to the new acquisition module within 10 seconds.
- If successful the handheld will pair to the acquisition module and the display will show a numeric value. If the display shows Failed or ----- then the pairing failed.
- The system zero may require resetting. If enabled this may be achieved by holding the Tare key down for a number of seconds. See **Zero** page of the Toolkit section.

## Approvals

### CE



Complies with EMC directive. 2004/108/EC  
The Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive,  
1999/5/EC,

#### European Community, Switzerland, Norway, Iceland, and Liechtenstein

- English: This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
- Deutsch: Dieses Gerät entspricht den grundlegenden Anforderungen und den weiteren entsprechenden Vorgaben der Richtlinie 1999/5/EU.
- Dansk: Dette udstyr er i overensstemmelse med de væsentlige krav og andre relevante bestemmelser i Direktiv 1999/5/EF.
- Español: Este equipo cumple con los requisitos esenciales así como con otras disposiciones de la Directiva 1999/5/EC.
- Français: Cet appareil est conforme aux exigences essentielles et aux autres dispositions pertinentes de la Directive 1999/5/EC.
- Íslenska: Þessi búnaður samrýmist lögboðnum kröfum og öðrum ákvæðum tilskipunar 1999/5/ESB.
- Italiano: Questo apparato è conforme ai requisiti essenziali ed agli altri principi sanciti dalla Direttiva 1999/5/EC.
- Nederlands: Deze apparatuur voldoet aan de belangrijkste eisen en andere voorzieningen van richtlijn 1999/5/EC.
- Norsk: Dette utstyret er i samsvar med de grunnleggende krav og andre relevante bestemmelser i EU-direktiv 1999/5/EC.
- Português: Este equipamento satisfaz os requisitos essenciais e outras provisões da Directiva 1999/5/EC.
- Suomalainen: Tämä laite täyttää direktiivin 1999/5/EY oleelliset vaatimukset ja on siinä asetettujen muidenkin ehtojen mukainen.
- Svenska: Denna utrustning är i överensstämmelse med de väsentliga kraven och andra relevanta bestämmelser i Direktiv 1999/5/EC.

This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

### FCC



Family: RAD24

Models: i and e for internal and external antenna variants. For antenna T24-ANTA and T24-ANTB

FCC ID:VHARAD24

This device complies with Part 15c of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**CAUTION:** If the device is changed or modified without permission from Mantracourt Electronics Ltd, the user may void his or her authority to operate the equipment.

## Industry Canada



Models: i and e for internal and external antenna variants. For antenna T24-ANTA and T24-ANTB  
IC:7224A-RAD24

This apparatus complies with RSS-210 - Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment RSS.

## OEM / Reseller Marking and Documentation Requirements

### FCC

The Original Equipment Manufacturer (OEM) must ensure that FCC labelling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the contents as shown:

Contains FCC ID:VHARAD24

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

The acquisition modules have been tested with T24-ANTA and T24-ANTB. When integrated in OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas other than T24-ANTA and T24-ANTB must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

Acquisition modules have been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Changes or modifications not expressly approved by Mantracourt could void the user's authority to operate the equipment.

In order to fulfil the certification requirements, the OEM must comply with FCC regulations:

1. The system integrator must ensure that the text on the external label provided with this device is placed on the outside of the final product.
2. The acquisition modules with external antennas may be used only with Approved Antennas that have been tested by mantracourt.

### IC

Labelling requirements for Industry Canada are similar to those of the FCC. A clearly visible label on the outside of the final product enclosure must display the following text:

Contains Model RAD24 Radio (2.4 GHz), IC:7224A-RAD24

Integrator is responsible for its product to comply with RSS-210 - Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment RSS.

### CE

The T24 series has been certified for several European countries.

If the acquisition module is incorporated into a product, the manufacturer must ensure compliance of the final product to the European harmonized EMC and low-voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive.

Furthermore, the manufacturer must maintain a copy of the T24 device user manual documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.

#### OEM Labelling Requirements

The 'CE' marking must be affixed to a visible location on the OEM product.



The CE mark shall consist of the initials “CE” taking the following form:

- If the CE marking is reduced or enlarged, the proportions given in the above graduated drawing must be respected.
- The CE marking must have a height of at least 5mm except where this is not possible on account of the nature of the apparatus.
- The CE marking must be affixed visibly, legibly, and indelibly.

## Declaration of Conformity

We, Mantracourt Electronics Limited  
The Drive  
Farringdon  
Exeter  
Devon EX5 2JB

declare under our sole responsibility that our products in the **T24 Radio Telemetry Product Range** to which this declaration relates are in conformity with the appropriate standard EN 300 328 following the provisions of the Radio and Telecommunications Terminal Equipment Directive **1999/5/EC**, FCC CFR Title 47 part 15c BS EN 61000-4-2 and BS EN 61000-4-3 following the provisions of the EMC Directive **2004/108/EC** and Low Voltage Directive **2006/95/EC**.

December 2007



Brett James  
Development Manager  
Mantracourt Electronics Limited.

FCC ID:VHARAD24



## Worldwide Regional Approvals

Region	Product Conforms To
Europe	CE
USA	FCC
Canada	IC
Australia	To Be Determined
China	To Be Determined
Japan	To Be Determined

### Important Note

Mantracourt does not list the entire set of standards that must be met for each country. Mantracourt customers assume full responsibility for learning and meeting the required guidelines for each country in their distribution market. For more information relating to European compliance of an OEM product incorporating the T24 range of modules, contact Mantracourt, or refer to the following web site: [www.ero.dk](http://www.ero.dk)

### Warranty

All Telemetry products from Mantracourt Electronics Ltd., ('Mantracourt') are warranted against defective material and workmanship for a period of (1) one year from the date of dispatch.

If the 'Mantracourt' product you purchase appears to have a defect in material or workmanship or fails during normal use within the period, please contact your Distributor, who will assist you in resolving the problem. If it is necessary to return the product to 'Mantracourt' please include a note stating name, company, address, phone number and a detailed description of the problem. Also, please indicate if it is a warranty repair.

The sender is responsible for shipping charges, freight insurance and proper packaging to prevent breakage in transit.

'Mantracourt' warranty does not apply to defects resulting from action of the buyer such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorised modification.

No other warranties are expressed or implied. 'Mantracourt' specifically disclaims any implied warranties of merchantability or fitness for a specific purpose. The remedies outlined above are the buyer's only remedies. 'Mantracourt' will not be liable for direct, indirect, special, incidental or consequential damages whether based on the contract, tort or other legal theory.

Any corrective maintenance required after the warranty period should be performed by 'Mantracourt' approved personnel only.



CE

In the interests of continued product development, Mantracourt Electronics Limited reserves the right to alter product specifications without prior notice.

DESIGNED & MANUFACTURED IN THE UK

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