



T24-GW1
Modbus & ASCII Gateway

User Manual
mantracourt.com



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Wireless Telemetry Range 2.4Ghz

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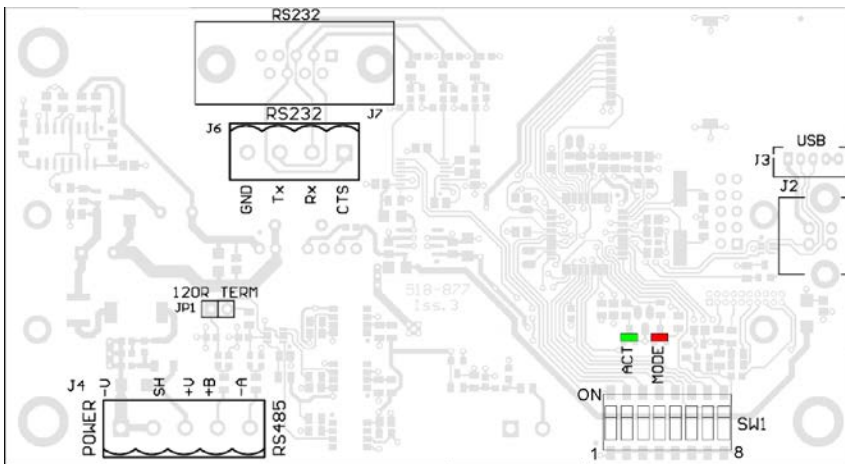
Introduction / Overview

The T24-GW1 is a gateway that provides a simple interface for users to gather data from up to 100 acquisition modules in a T24 network using either the standard Modbus RTU protocol or a simple ASCII protocol. Some simple commands are available to wake, sleep, and keep awake T24 acquisition modules.

The T24-GW will NOT act as a base station and cannot be used to configure T24 modules. It will support all acquisition devices that deliver a single value in their Data Provider packets. The T24-GW1 does not support the T24-SAf.

Connections

This diagram shows the available connections, switches and LEDs.



The interface baud rate can be selected from the DIP switches SW1.

SW1 Settings

Baud Rate

Switch positions 5 to 7 set whether serial or USB is used. If USB is not selected then the chosen switch settings control the baudrate for the serial interface.

	5	6	7
Baudrate / USB			
9600	On	Off	Off
19200	Off	On	Off
38400	On	On	Off
57600	Off	Off	On
115200	On	Off	On
230400	Off	On	On
460800	On	On	On

Whether the serial interface is RS485 or RS232 is selected by switch position 8.

	8
232/485	
RS232	Off
RS485	On

Power

The T24-GW1 requires an external power supply to be connected to J4 on the -V and +V pins.

LED Indication

Two LEDs indicate Power/Mode and Activity.

The red LED indicates mode and should flash at a 2Hz rate. If any errors are detected with the radio then the LED will remain lit.

The green LED flashes once for each packet received via radio.

RS232

The RS232 interface uses TX, RX and GND to connect to a PC, PLC etc and uses standard RS232 voltage levels.

The baudrate can be selected by setting the DIP switches stated above. NOTE: the T24-GW1 will require power cycling to utilise a baudrate change.

Example connection to a PC 9 way D serial connector.

PC 9 Way D Plug Pin	Signal Direction		Base Station Connection
3 (TX)	->	RX	J6 RX or J7 Pin 3
2 (RX)	<-	TX	J6 TX or J7 Pin 2
5 (Gnd)		GND	J6 GND or J7 Pin 5
8 (CTS)	<-	CTS	J6 CTS or J7 Pin 8

RS485

The RS485 interface (This is a 2 wire 485 interface and will not work with 4 wire 485 buses) uses TX, RX and GND to connect to a PC, PLC etc and uses standard RS485 voltage levels.

The baudrate can be selected by setting the DIP switches stated above. NOTE: the T24-GW1 will require power cycling to utilise a baudrate change.

Example connection

Depending on the RS485 interface or hardware the connections vary and are not standard therefore we can only show the connections to the T24-GW1. You must refer to the user manual regarding your RS485 connection to ascertain the correct connections.

PC / PLC Connection	Signal Direction		Base Station Connection
Refer to RS485 Device User Manual		A	J4 -A
Refer to RS485 Device User Manual		B	J4 +B
Refer to RS485 Device User Manual		GND	J4 SH

NOTE: There are two connectors for RS485, J4 and J5. This is to facilitate easy daisy chaining of devices if required.

Serial Limitations

- When using RS232 or RS485 you should use the fastest baudrate possible. At lower rates data can be lost because it can arrive from the radio faster than the gateway station can send it serially.

Communications Overview

T24 Communication

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.

MODBUS Communication

The T24-GW1 operates on Modbus RTU communication 8,N 1 (8 data bits, No Parity, 1 stop bit). The following Modbus Function codes are supported

- Function 03 'Read Holding Registers'
- Function 06 'Write Single Register'
- Function 16 ' Write Multiple Registers'

The gateway has a single modbus address, 1 is the default address but this can be changed via register 41001 or via the T24-Toolkit.

Control Registers

41001 - Read / Write

Set the MODBUS slave device ID, device ID will be 1 as default. Valid values 0-255.

41004 - Read / Write

Set to the T24 RF channel the gateway is working on. Valid values 1-16.

41005 - Read / Write

Set to the number of cells to be programmed into the table of data tags default = 0. Valid values 0-100

41006 - Read / Write

Set the Time out Value (seconds), if a channel does not update with in the timeout time the value register will be set to either the default value or last value received, see page 14. Valid values 0-255.

41007 - Read / Write

Set the Sleep time (seconds), this is the period for which the gateway will sleep any device it sees after the broadcast sleep register (41002) has been set to 1. The T24-GW1 will only sleep devices listed in the Data Tag registers. Valid Values 0-255.

41008 - Read / Write

This register Enables or disables the functionality to keep awake the devices specified in Data Tag Registers. Valid values 0 or 1.

Commands

Writing a 1 to the following registers will execute the following commands:

41002 - Read / Write

Set to 1 to perform broadcast sleep to all devices, it will set back to zero when the sleep timer vale has been reached.

41003 - Read / Write

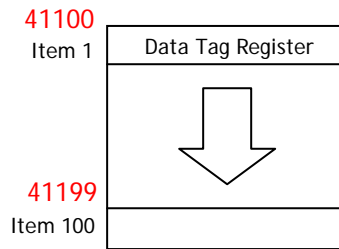
Set to 1 to perform broadcast wake to all devices, it will set back to zero when the waker duration has been reached, the default waker duration is 12 seconds but can be set using the T24-Toolkit, see page 14.

41009 - Read / Write

Set to 1 to perform module save to save all the current settings and data tags in the device. It will set back to zero once the save is complete.

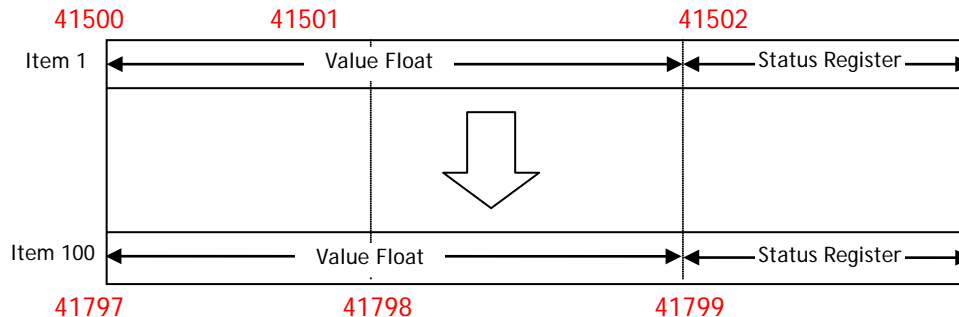
Data Tag Holding Registers

41100 - 41199 - 100 registers containing the unique data tags of the devices to be read from. Each data tag is a 2 byte HEX code unique to each acquisition module. The data tag registers can be written to singularly and as a block. These are the same data tags that can be configured via the T24-Toolkit



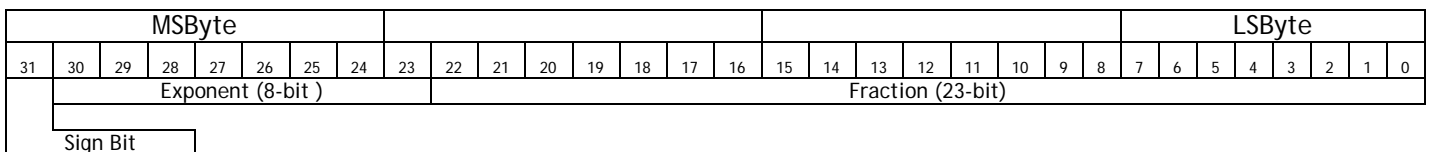
Value & Status Registers

41799 - 41500 - 300 registers containing the values from each acquisition module as well as the status and LQI (Link Quality Indicator). The 4 Byte floating point values from each acquisition module are contained within two consecutive registers followed by a single register containing the LQI and status of the same acquisition modules. The data tag registers and value registers correspond such that the values and status from the data tag specified in register 41100 are contained within 41500 to 41502 and the value and status for the data tag specified in register 41199 are contained within registers 41797 to 41799.



When reading registers containing the floating point data the register pairs must be read at the same time otherwise incorrect values could result because of partial updates during reading.

The two register presents a numeric value from n to n and consist of a 4 byte 32 bit float in IEEE 754 format.



The byte containing the sign and exponent is sent first, with the LS byte of the mantissa being last. The value of the number is thus

$$(-1)^{\text{Sign}} * 2^{(\text{Exponent}-127)} * 1.\text{Mantissa}$$

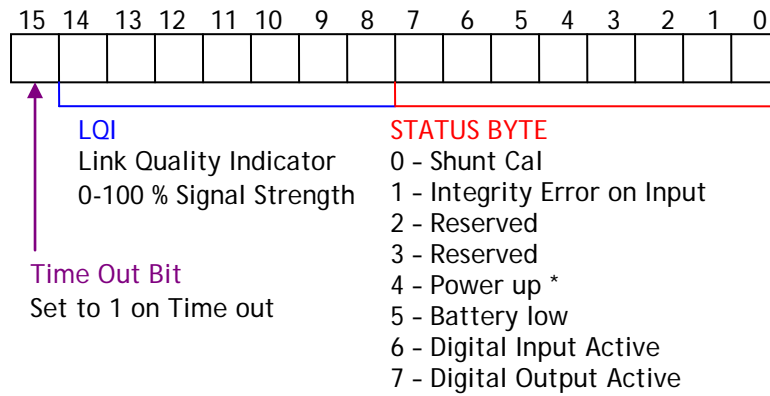
Note the 'assumed 1' before the mantissa. The exception to this is the special value 0.0, which is represented as 4 zeroes.

The precision of this format is to 7 digits.

eg. a floating-point number of -12345.678 is represented as - [hex] C640E6B6

The order in which the Bytes are presented can be changed from MSB (as above) to LSB using the Modbus Data Format setting in the T24 toolkit, see page 14.

The status register contains the status byte, LQI and Time Out indicator in the format shown below:



* - This flag is set if the module has had power interrupted i.e. is running due to battery change not woken from sleeping

ASCII Communication

The T24-GW1 ASCII mode provides a very simple interface for gathering data from T24 devices. When a packet is received from any acquisition module on the same RF channel an ASCII string is sent from the gateway in the format:

DataTag=Value,LQI,B,E <CR>

DataTag - The four digit datatag of the module that the reading has come from

Value - an ASCII representation of the module reading

LQI - Link quality indicator between 0 - 100

B - Set to 1 if low battery error

E - Set to 1 if integrity error

Example: FE56=123.156,100,0,0 <CR>

Commands

Sending ASCII commands to the gateway will cause the gateway to handle the request but no feedback on the result is available. The commands will act on all acquisition devices on the same RF channel as the gateway.

SLEEP <CR> - Sleep all modules that data providers are received from for the sleep duration period. The sleep duration is set in the T24-Toolkit, see page 14.

WAKE <CR> - Wake all modules that request to wake for the wake duration period. Acquisition modules transmit wake requests every 5 seconds. The wake duration is set in the T24-Toolkit, see page 14.

STAYAWAKE <CR> - Issue a stay awake packet to all modules seen for 5 seconds following this command being executed.

NOTE: When using RS485 interface issuing commands while the T24-GW1 is outputting is not possible as the RS485 bus is only half duplex.

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-GW1 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.

General Pages

Setup Base Station Communications

T24 Toolkit

Settings

Select the connection type between the base station and the

Interface
USB Select the interface between the computer and the base station.

Port
1 Select the COM port that the base station is connected to.

Baudrate
115200 Select the baudrate that matches the settings of the base station DIP switch.

Base Station Address Each base station has an address.
1 If you connect using USB the address must be 1.

- A T24-BSu has a fixed address of 1.
- A T24-BSi has a settable address via DIP switches so ensure these are set to 1 if using the USB interface.

Help

Configure the settings on this page to match the connected Base Station.

- First you need to determine whether the connection to your PC is Serial or USB.
- If it is Serial then you also need to know which serial port (COM port) it is connected to and the Baudrate of the Base Station.
- Next you need to know the Base Station Address. This can be set between 1 and 16 and should not be confused with the ID.
- When correctly setup click the HOME button to test communications and to continue.

Connected to Base Station of ID FFC5DB on channel 1 App: 1.0.82 | Drv COM: 1.1 | Drv DLL: 2.0

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.



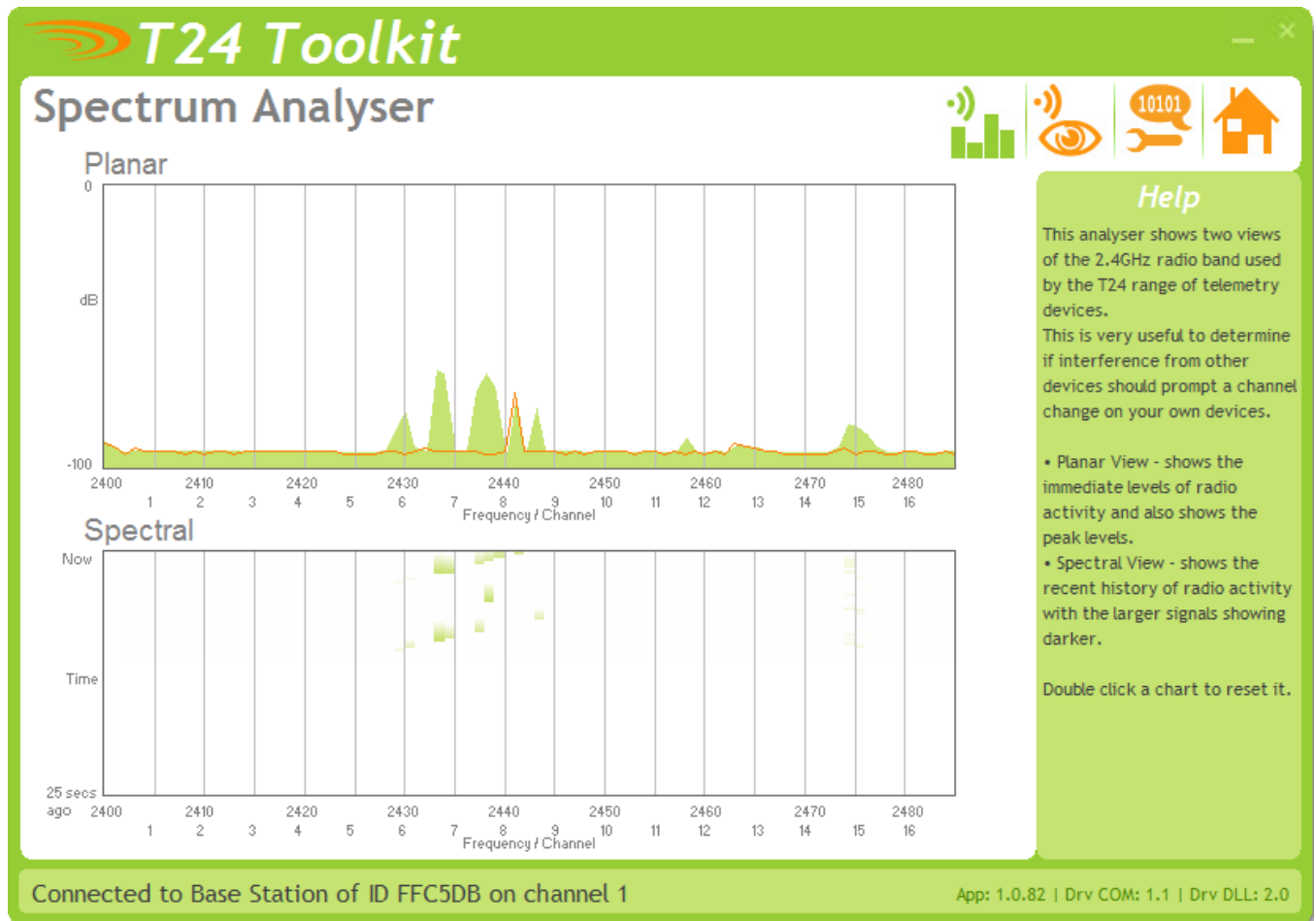
We now have successful communications with the base station so we can now pair with our device or we can select the Spectrum Analyser mode or Data Provider Monitor mode.

Pairing Procedure

- Remove power from the T24-GW1 module.
- Click the Pair button on the toolkit.
- You now have 10 seconds to re-apply power to the T24-GW1 module.

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

NOTE: The act of Pairing with the toolkit will not change the radio configuration settings of the connected device. The settings will only change if you change them yourself within the toolkit.



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.

T24 Toolkit

Information



Gateway Module

ID: **FFCBF0**
Model: **T24-GW1**
Firmware Version: **1.00**
Radio Module Firmware Version: **2.1**
Name:

Help

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

Pressing F1 or double-clicking the module image will display the T24-GW1 manual if it can be located.

Connected to T24-GW1 of ID FFCBF0 on channel 8 App: 1.2.5 | Drv COM: 1.7 | Drv DLL: 2.6

This page shows you information about the connected device.

Items you can change:

Name You can enter a short descriptive name (11 characters) which may help you recognise this device in the future.

T24 Toolkit
Channel and Encryption

Channel
01 You can select 1 of 16 channels

Encryption Key
00000000000000000000000000000000 The encryption key is 32 hex characters long. Characters allowed are 1234567890ABCDEF

Help
Here you can change the channel and encryption key for the connected device.
NOTE: The device will need power cycling before these changes take effect. If you power cycle the device you will need to click the HOME button and pair the device again with this application.

NOTE: Changing the channel and key will not affect the device until it has been power cycled.
If you have a handheld device and one or more acquisition devices and you want to change the channel and keys for all you could do either of the following:

- Connect this toolkit to each of the devices in turn and change the channel and key settings.
- Connect to just the handheld device and set the channel and key as required. Next using the pair function in the handheld connect to each acquisition device to change its settings to match those of the handheld.
- Connect to one device and change its channel and key as required. Click the Home button and then re-pair to that device. The base station will now match its settings to that device. Return to this page and click the Advanced button. From here you will be able to quickly change the settings of multiple devices to match the base station just by pairing with each one in turn.

Advanced

Connected to T24-GW of ID FFCBF0 on channel 1 App: 1.2.5 | Drv COM: 1.7 | Drv DLL: 2.6

Here you can change the channel and encryption key for the module.

NOTE: Early acquisition module do not yet utilise the encryption keys so these should be left at all zeros.

Items you can change:

Channel Select a channel between 1 and 16. The default is channel 1. You can use the Spectrum Analyser mode to determine a good clean channel to use.
NOTE: Channel 16 is used to negotiate pairing so avoid this channel if possible.

Encryption Key Only devices with identical encryption keys can communicate. You can isolate groups of devices on the same channel or just use the key to ensure the data cannot be read by somebody else.

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 **including** 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.

General Settings

General Configuration

Mode
ASCII Select the protocol mode. Either Modbus RTU or ASCII.

Always Wake
No Choose whether the gateway wakes ALL sleeping modules on the same RF channel.

Always Keep Awake
No Choose whether the gateway will automatically keep awake data providing modules.

Wake Duration
12 Enter the duration in seconds to look for modules to wake after a WAKEUP command has been issued to the gateway.

Sleep Duration
10 Enter the duration in seconds to look for modules to send to sleep after a SLEEP command has been issued to the gateway.

Modbus Mode Settings

Node
001 Select the node for Modbus communications.

Timeout
10 Enter the timeout in seconds. If no data is received from a module within this time a timeout will be indicated in the module status.

Timeout Action
Use Default Select whether to also change the module value when a timeout occurs.

Default Value
-999.0 Enter the value to report on timed out modules if the Timeout Action above specifies it.

Data Format
MSB First Choose byte order for float data.

Help
 This page allows to to configure the general settings for the gateway.

Connected to T24-GW1 of ID FFCBF0 on channel 8 App: 1.2.5 | Drv COM: 1.7 | Drv DLL: 2.6

Here you can set how the device is configured to operate.

Items you can change:

Mode	Defines which serial interface the gateway is operating on. <ul style="list-style-type: none"> • Modbus • ASCII
Always Wake	If set to Yes the gateway will wake ALL sleeping modules on the same RF channel.
Always Keep Awake	If set to Yes the gateway will automatically keep awake data providing modules.
Wake Duration	The duration in seconds to look for modules after a WAKEUP command has been issued.
Sleep Duration	The duration in seconds to look for modules to send to sleep after a SLEEP command has been issued.
MODBUS ONLY Settings	
Node	Is the MODBUS station number or node address of the T24-GW1
Timeout	The time in seconds that if no data is received from a module the gateway will indicate as timed out.
Timeout Action	Defines what value will be reported in the register when a timeout occurs. <ul style="list-style-type: none"> • Use Default - the value specified as default value will be reported. • Use Last Value - the last value received from the device will be

reported

Default Value

This is the value that will be reported in the MODBUS register if an acquisition module as timed out AND the Timeout Action is set to Use Default.

Data Format

In Modbus mode the data from the value register can be displayed in two formats:

- MSB - Most Significant Byte First
- LSB - Least Significant Byte First

Define Inputs

This is where you define all the data tags of the modules supplying data to this gateway. If using Modbus mode this is mandatory but if using ASCII mode it is optional. In ASCII mode if the populate this list you will see data from only those modules listed. If there are no modules listed you will see data from all modules delivering data on the same RF channel as this gateway.

Channel	Data Tag	Value	Low Batt	Error	LQI
1	C4E4	-0.005519			100
2	C4E3	20.175	Low Batt		100

NOTE: Changes made to the list will not be saved until you leave this page. The values shown are not real-time. Click Refresh to update.

Help
This is where you define which devices are supplying data to this gateway. The remote devices are defined by their Data Tags.

Connected to T24-GW1 of ID FFCBF0 on channel 8
App: 1.2.5 | Drv COM: 1.7 | Drv DLL: 2.6

This is where you define which acquisition devices are to be providing data to this module when in Modbus mode.

You can add the channels by entering the Data Tag of the acquisition modules you want to receive data from. The list will show the last value delivered by each channel or the word **Timeout!** if no data has arrived for longer than the T24 Timeout setting.

The LQI (Link Quality Indicator) provides a measurement of the RF reception for the last packet received from each input. The Low Batt and Error marks display if a module has an integrity or low battery alert.

Items you can change:

- | | |
|----------------|--|
| Add Button | Clicking this will allow you to specify a new Data Tag to add. |
| Clear Button | This clears ALL the currently configured channels. |
| Edit Button | Changes the display to show a simple list of Data Tags. This allows quick bulk entry of tags from an external source. You can simply paste a list of tags into the list or type them manually. |
| Refresh Button | Refreshes the list. |

NOTE: When using this page ensure you are in Modbus mode for values to be updated live.

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.

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-SO held at chest height pointing towards the T24-SA.

T24-GW1

Parameter	Minimum	Typical	Maximum	Units
External Supply voltage Range	9	12	32	Volts
Average Operational Current	-	65*	500	mA
Operating Temperature Range	-40	-	65	Deg C
Storage Temperature Range	-40	-	65	Deg C
Reverse polarity Protection		-	-32	Volts

* At 12 Volt nominal Supply

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 é 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

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.



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

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