NEW

Radiometrix

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Issue 1, 07 December 2007 **TDM2-433-9**

UHF Multi Channel Radio Modem

The TDM2 is a very simple 433MHz band radio data modem. It provides a medium ranged half duplex, transparent data link between a pair of 9600 baud RS232 ports without any additional interface circuitry.

Figure 1: TDM2-433-9

The TDM2 is a TDL2A radio module, combined with suitable interface circuits, power supplies and connectors, packaged in an attractive instrument case. In the simplest case, a pair of 'box modems' (with suitable aerials and power supplies connected, of course) can be connected directly to the serial ports of a pair of industrial PCs and the resulting wireless data link used without any further installation or programming.

Range of Features

- RS232 driver and DB9F connector for direct interface to PC serial port
- Serial modem baud rate at 9600bps (half-duplex)
- Addressable point-to-point
- 5 serial select wideband channels (in the 433.05 – 434.79MHz European band)
- Access to internal diagnostic/Test modes using HyperTerminal
- On board SMA antenna connector
- Signal LED for visual indication of valid code received
- Setup is simple as Plug-and-Play
- Set-up and configuration using HyperTerminal
- Conforms to EN 300 220-3 and EN 301 489-3
- Size: 94 x 107 x 33mm (excluding connectors)

Applications

- Handheld / portable terminals
- PDAs, organisers & laptops
- Industrial telemetry and telecommand
- In-building environmental monitoring and control
- Remote data acquisition system, data logging
- Fleet management, vehicle data acquisition

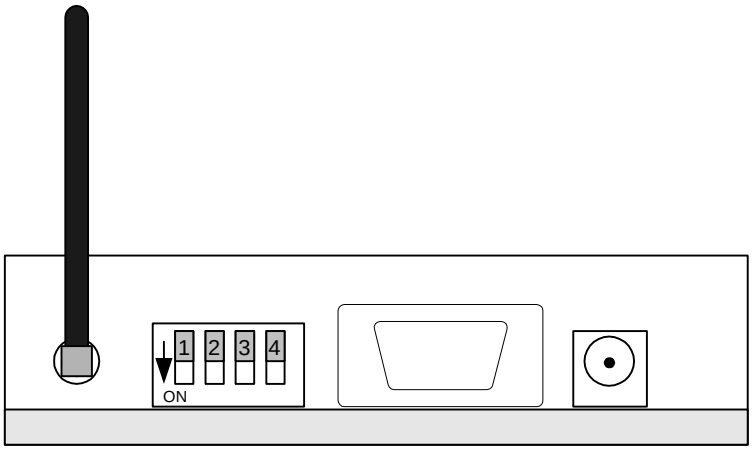

Figure 2: TDM2 (rear view)

***Looked at from the outside, the TDM2 presents**:*

9 way D-type	RS232 port	
SMA RF connector	Aerial	
2.1mm power jack	External power (9-15v)	
4 way DIP switch	Mode selection (see later)	(all on the rear of the case)
Slide switch	Internal battery 'on/off'	(in a recess, on the side of the case)
Three LED indicators	Power on	(green, on the left)
	Valid data receiving	(red, in the middle)
	Transmitting	(red, on the right)

Powering the TDM: The TDM2 radio modem requires a source of energy to operate. There are several options:

1. *External supply*. The TDM unit is intended to be supplied from a 9-15v DC supply (6-15v if the internal battery is not fitted). The basic unit requires up to 50mA, plus any extra current drain from the +5v output (pin 9 on the D-type). The supply can be fed in through the 2.1mm power jack (positive to centre connector) or through pin 1 of the 9 way D connector.
2. *Local +5v*. The user may also power the unit by applying a regulated +5v supply to pin 9 of the D-type. In this mode of operation the internal battery must be removed, and switch 2 set to 'on'. The supply must be clean, and ripple free, as this mode of operation bypasses the internal supply regulator
3. *There is provision for an internal PP3 battery*. This is intended as a backup power source, and for use during experimentation and set-up. A standard, high capacity alkaline battery will provide around 15 hours of continuous operation. (The use of rechargable batteries in this unit is not recommended at this time)

The internal battery is enabled by the recessed slide switch on the right of the case (slide switch backwards to enable the battery. To change the battery, the unit must be dis-assembled by removing the polymer 'feet' and removing the four assembly screws. The battery is retained to the pcb by a standard 'tie wrap'.

When an external supply exceeding 9v is fed to the unit (through the power jack or the D connector), the internal battery is not used (there are steering diodes in series with both power sources)

Connecting the TDM: This unit is connected to an RS232 serial port via a standard 9 way D connector. True (bipolar) RS232 levels are provided by this interface. The interface provides TXD/RXD, plus a basic CTS function (indicating that the radio is busy receiving a data burst). Other pins are used for functions specific to the TDM (mode and standby, power supplies).

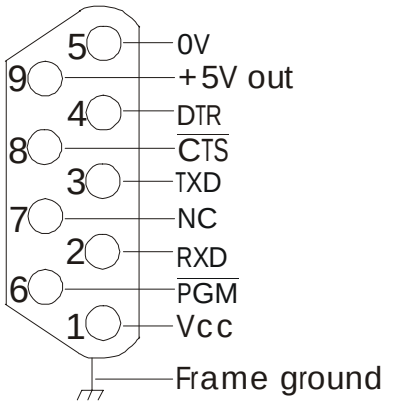

Figure 3: TDM2 DB9 Serial Port pin outs

Serial interface

The TDM2 serial interface operates at 9600 baud only, with 1 start, 8 data and 1 or 2 stop bits

Pin	Name	Function
1	Vcc	Raw supply voltage input (9-15v.)
2	RXD	RS232 data out
3	TXD	RS232 data in
4	DTR	Pull low to disable unit. (Pin function enabled by switch 1)
5	0V	Supply ground
6	$\overline{\text{PGM}}$	Pull low to enter program mode. (Pin function enabled by switch 4)
7	N/C	No connection
8	CTS	Low = Unit has valid data in rx buffer
9	+5V out	Regulated supply output. 200mA max. (independent of DTR switching) (Pin function enabled by switch 2)

Notes:

1. Pins 4 and 6 have internal pullups to +5v, pin 3 has a pulldown to 0V
2. All ' Input' pins (3,4,6) will tolerate true +/- RS232 levels. No extra buffering is required.
3. The RX_busy (CTS, pin 8) circuitry incorporates a pulse lengthening monostable, to eliminate the strobing or 'flashing' seen with TDL2A modules during streaming data, as the buffer fills and empties.
4. A simple addressing structure is included in the datastream. Units may be programmed onto one of eight addresses (all units are supplied set to default addr=0)
5. A version is available in a robust extruded aluminium housing. Contact Radiometrix Sales for details

Don't forget the aerial: The TDM2 is a wireless device, and will not function without a suitable aerial. The supplied part (a high quality 433MHz band helical type) is attached to the SMA connector on the rear of the casing. Use sufficient (but not excessive) torque to tighten the screw collar. Finger-tight is correct.

Alternative aerials may be connected to this connector via a length of RF coax. Contact technical support for advice.

A good first demonstration can be had by:

- Set up a pair of PCs, with serial (RS232) ports.
- Connect them together with a null modem (pins 2/3 swap over) cable.
- Run terminal emulator (ie: Hyperterminal) programs on both computers. (Port settings 9600 baud, 1+8+1, local echo)
- At this point you have a simple 'teletype' link between the machines. Anything typed on one is seen on the other.
- Now replace the null modem cable with a pair of TDM2 radio modems. You will see no change. The radio link seamlessly replaces the cable.

Configuring the interface: A 4 way DIP switch is located in a recess on the rear of the case. As supplied, all switches are 'off' ('up'). These switches control certain interface functions:

Switches

SW No.	Name	Function
1	DTR_en	Switch 'on' to enable pin 4 switching (otherwise unit is always on)
2	+5v/pin 9	Switch 'on' to enable the +5v external supply pin
3	Setup	Switch 'on' to force unit into setup/program mode
4	Ext setup en	Switch 'on' to enable pin 6 (N_PGM)

Indicators: On the front of the hosing are three LED indicators:

1) **Power**: Green, on the left. Unit is powered when lit
2) **Transmit**: Red, in the centre When lit, the unit's transmitter is on, and it is sending a data packet
3) **Receive**: Red, on the right When lit, the unit has received a valid data packet, and is outputting it

NOTES:

1) It ought to be emphasised that the TDM2 is a very simple, easy to use, device. It is also relatively unsophisticated. The data rate is limited to 9600 baud, the link is half duplex, and although there is a simple addressing structure, there is no provision for extensive data buffering, FEC, or acknowledge/re-transmit error handling protocols. Inside the box, the TDM2 is simply a TDL2A radio module with necessary interface circuits, power supplies and connectors.
2) The TDM2 provides a half duplex link: Provided no two devices attempt to transmit at one time (a 'low' on RX_busy may be used as a primitive 'CTS' indication) no further restrictions on data transmission need be made, as all transmit timing, valid data identification and datastream buffering is conducted by the unit. There is no 'transmit enable' pin. Sync and framing words in the packet prevent the receiver outputting garbage in the absence of signal or presence of interference.
3) At the edge of it's range, or in the presence of other interferers, there will be packets (of 1-3 bytes each) lost, or occasionally corrupted. If a greater degree of data fidelity is needed, then the user ought to introduce another layer of data handling. In our own tests we have used the Z-modem file transfer protocol with great success. In simpler, control type, applications these data errors will be of lesser significance.

Configuring the TDM2

In order to use all the functions embedded in the on board TDL2A modem, the user must be aware of the setup /programming facility, which allow different addresses and frequency channels to be set up, and if necessary accesses diagnostic test modes.

As supplied, the TDM2 is set to address zero, and channel zero. To change these presets, it is necessary to enter setup/program mode.

The TDM2 is programmed through the same RS232 port that is used for sending/receiving data. An RS232 terminal emulator (such as Aterm or HyperTerminal) is an ideal tool.

To enter program mode either switch 3 is temporarily turned 'on', or pin 6 of the D connector is pulled low (providing switch 4 is 'on'). In this mode the radio link is disabled, but characters sent (at 9600 baud, as normal) to the unit are echoed back on the RXD pin.

Connect the TDM2 to the PC serial port using a serial straight through cable.

The HyperTerminal should be set with the following settings.
9600 baud RS232, 8 bit data, no parity, 1 start bit, 1 or 2 stop bits. No flow control.

The unit will only respond to certain command strings:

ADDR0 to **ADDR7** <CR><LF>	These commands set up one of 8 unique addresses. A TDi2 will only communicate with a unit set to the same address.
CHAN0 to **CHAN4** <CR><LF>	These commands select one of 5 preset channels

A TDM2 will only communicate with a another TDM2 set to the same address and the same channel.

Address and channel numbers are stored in volatile memory. On power-up the TDM2 reverts to the default in EEPROM (as supplied this is always address 0 and Channel 0)

SETPROGRAM <CR>	Writes the current set address into EEPROM as the new default. A tilda character (~, ascii 126dec) sent by the unit indicates end of EEPROM write sequence

Following commands are normally only used for factory diagnostics:

NOTONE <CR>	Transmit unmodulated carrier
LFTONE <CR>	Transmit carrier modulated with 8KHz squarewave
HFTONE <CR>	Transmit carrier modulated with 16KHz squarewave
# <CR>	Transmitter off

A Carriage Return '<CR>' (00Dhex) should be entered after each command sequence to execute it.

Releasing the 'setup' pin to high state (or turning off switch 3) returns the unit to normal operation

Condensed specifications

Frequency	433.925MHz – CHAN0 (default channel) 433.285MHz – CHAN1 433.605MHz – CHAN2 434.245MHz – CHAN3 434.565MHz – CHAN4
Frequency stability	±10kHz
Channel width	320kHz
Number of channels	1 of 5, user programmed
Supply *Voltage* *Current*	6 – 15V 30mA transmit 27mA receive/idle (plus up to 10mA in to RS232 port) 20uA disabled
Interfaces	
User *Power* *Mode* *RF* *Indicators*	9pin D type 2.1mm connector 4 position DIP switch SMA Power on (green LED) Sending (red LED) Receiving (red LED)
Size	94 x 107 x 33 mm (excluding connectors) The case is an ergonomic ABS moulding, designed by HCP A version is available in a robust extruded aluminium housing. Contact Radiometrix Sales for details
Operating temperature	-20 ˚C to +70 ˚C (Storage -30 ˚C to +70 ˚C)
Spurious radiations	Compliant with ETSI EN 300 220-3 and EN 301 489-3
Transmitter	
Output power	10dBm (10mW) ±1dB (A 25mW (+14dBm) power output AUS/NZ version is available)
Modulation type	16kbps bi-phase FSK
FM peak deviation	+/-25kHz (nominal)
Adjacent channel TX power	<-37dBm
TX spurious	<-45dBm
Receiver	
Sensitivity	-105dBm for 1% BER
image	-40dB
spurious / adjacent channel	-60dB
Blocking	-80dB nominal, 75dB worst case
LO re-radiation	<-60dBm
Modem	
Baud rate	9600baud (transparent, half duplex (a 4800 baud version, TDM2-433-4 , is available to special order)
Format	1 start, 8 data, 1 stop, no parity
Radio channel data rate	16kbps peak
Coding	Biphase
Packet length	3 bytes
Buffers	32 byte FIFO
Flow control	None (‘RX busy’ pin provided)
Addressing	1 of 8, user programmed
Data latency	14ms (first byte into TX, to first byte out of RX)

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The Intrastat commodity code for all our modules is: 8542 6000

R&TTE Directive

After 7 April 2001 the manufacturer can only place finished product on the market under the provisions of the R&TTE Directive. Equipment within the scope of the R&TTE Directive may demonstrate compliance to the essential requirements specified in Article 3 of the Directive, as appropriate to the particular equipment.
Further details are available on The Office of Communications (Ofcom) web site:
http://www.ofcom.org.uk/radiocomms/ifi/

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