HASCOM International Pty Ltd

End of Train Monitor (ETM) Monitor/Repeater
User Notes
Version 2

Revision	Date	Author
A	17th October 2013	Chris King, HASCOM International Pty Ltd

HASCOM International
4 Lacrosse Rise
Sorrento
Western Australia, 6020
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1 Description

HASCOM's ETM Monitor/Receiver is a custom designed hardware device. The unit connects to a standard two way mobile radio, such as the Motorola GM339, and receives transmissions from an End of Train Monitor (ETM) unit. The transmissions are output on the serial port and/or retransmitted via the radio after a short delay.

Illustration 1: Front Panel

Illustration 2: Rear panel

2.0 Connections

2.1 Radio

Signals to radio, 9 way D-Type male:

Pin	Signal	Wire	Example: Motorola GM300	Example: Trio M Series (Analog mode)
1	Squelch input	White	Pin 8, COR/CSQ	Pin 1, CD
2	PTT output (open collector, 100mA max)	Yellow or Orange	Pin 3, Microphone PTT	Pin 7, Tx enable
3	Transmit audio	Blue	Pin 5, Flat transmit audio	Pin 3, Tx signal input
4	Receive audio	Green	Pin 11, Discriminator output	Pin 2, Rx signal output
5	+'ve supply to modem	Red or Brown	Pin 13, Switched +12v	*External power positive*
7	RSSI in			
8	Rx Audio level monitor point	N/C		
6 & 9	Ground	Black and/or Screen	Pin 7, Ground	Pin 5, Signal ground *External power ground*

Note1: +'ve supply to modem is protected by an internal, self-resetting 100mA

fuse.

GM300, Note A: Pin 8 (CSQ) may need to be configured with the RSS to perform the squelch indication function on 16 channel radios.

GM300, Note B: Receive audio should not be de-emphasized. See radio internal jumper JU551 (Position A). The level to the modem should be ideally be 230 mV rms (approx 325 mV p-p) but must be within the range 100 - 1000 mV rms.

GM300, Note C: Transmit audio should be routed to the limiter. See radio internal jumper JU701 (Position A). This level should be adjusted to give the correct level at the receiving radio, see note 2. (The GM300 specification says the level should be set to 180 mV rms (approx. 250 mV p-p) for 60% deviation.)

2.2 PC

RS232 to PC, 9 way D-Type female, DCE:

Pin	Signal
1 (DCD)	N/C
2 (Rx)	Data output from modem
3 (Tx)	Data input to modem
4 (DTR)	Linked to Pin 6 (DSR)
5 (Gnd)	Ground
6 (DSR)	Linked to Pin 4 (DTR)
7 (RTS)	Flow control input to modem
8 (CTS)	Flow control output from modem
9 (RI)	N/C

3.0 Operation

3.1 Boot loader

When the unit is first powered up it goes in to a boot loader mode. This mode can be identified by the 2 "Tx" LEDs flashing alternatly with the 2 "Rx" LEDs. During boot loader mode, new firmware can be uploaded to the device. The exact procedure to update the firmware is documented with the new firmware release files available from HASCOM.

After a few seconds, the device will automatically exit the boot loader mode and comense normal operation.

To manually invoke the boot loader mode during normal operation, hold down the "Config Mode" button for at least 3 seconds. The unit will enter boot loader mode and remain in boot loader mode for 30 seconds before returning to normal operation.

3.2 Configuration mode

The ETM Monitor/Receiver has simple configuration which is achieved by holding down the 'config mode' press button at power up and keeping it pressed until the bootloader exits. User input is via the RS232 port at 9600 baud, 8 data bits, no parity & 1 stop bit. Any standard serial terminal software (such as Hyper Terminal) can be used. The ETM Monitor/Receiver name, firmware version and serial number will be displayed followed by a simple question and answer procedure. Each question has the valid responses shown in brackets and the default (if only Enter is pressed) shown in square brackets.

Prompt:

> **ETM Monitor/Repeater v2.00.01, compiled 12:19:24 Oct 17 2013**
> **Copyright (c) 2004-2013, HASCOM International Pty Ltd**
> **http://www.hascom.com.au**
> **S/N "131017-001"**

Current configuration:

> **Current config: monitor (binary)**

Question:

Mode; Monitor, Repeater, Both or Test tone (M/R/B/T) [M]?

Select the mode of operation for the unit. In Monitor mode the unit receives transmissions from the radio and outputs them on the serial port. In Repeater mode the unit receives transmissions from the radio and re-transmits them via the radio after a short delay. If Both is selected, the unit will perform both functions simultaneously.

Test tone is a special case. If it is selected the unit will activate the radios PTT and transmit a contineous 1200 Hz tone. This is to aid with level adjustments, no configuration changes will be made.

Question (if Monitor or Both mode is selected):

Monitor output; Binary or ASCII (B/A) [B]?

Select the monitor output format on the serial port. See Monitor output format below.

Question (if Repeater or Both mode is selected):

Repeater delay in 1/10 sec (2-255) [10]?

Set the delay from receiving a transmission to re-transmitting it via the radio. This value is in 1/10 of a second, i.e. 13 would be 1.3 seconds.

Question (if Repeater or Both mode is selected):

mS of preamble (0-2000) [200]?

Set the preamble time for the radio. This is the period of time from when the radio's Press To Talk (PTT) is activated to when the data transmission starts. This is required to allow the transmitting and receiving radios to settle. The time may need to be varied depending on the radios used, RF repeaters, etc.

New configuration:

Current config: repeater with 10 * 1/10 Sec delay and 200mS of preamble

Question:

Again (Y/N) [Y]?

If you are happy with the new configuration settings, press N and the unit will commence normal operation. Otherwise press Y and answer the questions again. If you toggle power to the unit at this time, the original configuration will be kept.

3.3 Monitor output format

Reference:
Recommended Guidelines , Considerations and Radio Frequency Requirements for Train Information Systems

To understand the Monitor output, an understanding of the protocol as detailed in the above document is required.

The ETM Monitor/Receiver outputs 9 bytes of data per received block. These bytes can either be output in raw binary format or in ASCII format terminated by a carriage return.

An example of an ASCII output might be:

782C54751884009E4D<cr>

Turned in to bits this is (Note: Least significant byte is transmitted first)**:**

4D	9E	00	84	18	75	54	2C	78
01001101	10011110	00000000	10000100	00011000	01110101	01010100	00101100	01111000

Broken up in to fields, assuming this is a Basic Block (message type 000)**:**

010011011001111000-000000-1-0-0-00100000110-0001110-10101010100001011-000-11-11-000

Each fields meaning:

[000]	Stuffing added by the ETM Monitor/Receiver
11	Chaining bits, this is first and last block
11	Device battery condition, battery OK
000	Message type, Rear unit of one-way system
1010101010000101011	Unit address code, 87307
0001110	Rear brake pipe pressure, 14 psig
00100000110	Discretionary information, manufacturer specific
0	Motion, not moving
0	Marker light battery, OK
1	Marker light status, on
[000000]	Stuffing added by the ETM Monitor/Receiver
010011011001111000	Basic block BCH code

Note: The ETM Monitor/Receiver at no time verifies the BCH code for blocks. To ensure end to end integrity of the data it is the responsibility of the host application to verify the BCH code.

3.4 Audio Level Adjustment

For correct operation, the transmit and receive audio levels must be set to suit the attached radio. To set the levels follow these steps:

1. Setup a test configuration with an ETM Monitor/Receiver receiving data from an ETM and acting as a repeater.
2. Connect a 'scope to the Rx Audio level monitor point (pin 8). Adjust the level using a small flat blade screwdriver inserted in to the **Rx audio level adjust** opening. This level should be set to 230 mVrms (permissible range 100-1000 mVrms). Note: turning clockwise increases the level.
3. With a 'scope connected to the Tx audio line (pin 3), adjust the level using a small flat blade screwdriver inserted in to the **Tx audio level adjust** opening. This level should be set as specified by the radio manufacturer. Note: turning clockwise increases the level.

Appendix A - Contact information

Company name: **HASCOM International Pty Ltd**

ABN: **18 150 118 755**

Address: **4 Lacrosse Rise**
Sorrento
Western Australia
6020

Email: **hascom@hascom.com.au**

Website: **http://www.hascom.com.au**