DTMF232-2048 Owner's Manual

Overview

The DTMF232-2048 will decode DTMF audio signals (0-9, A-D, #, *), store them in non-volatile memory, and output the character via the on-board RS232 serial port. When there is a pause between tones of approximately 5 seconds, a marker character is inserted (a CR/LF for the RS232 output). Memory contents can be downloaded from the serial port or cleared. An LED shows if the EEprom is full (message also sent via RS232) and also blinks whenever a valid DTMF tone is detected.

Features

- In assembled and tested form.
- Wide power input voltage range (7 - 18 VDC)
- **2,048** number non-volatile EEprom memory rated for 10M Read/Write cycles
- New tones received are appended in memory.
- RS232 1200/2400/4800/9600,8,n,1 baud output
- True RS232 voltages. On-board DB9 Female connector.
- Simple one button operation
- Visual indicator (LED) tells you if the EEprom is full or when tones are detected

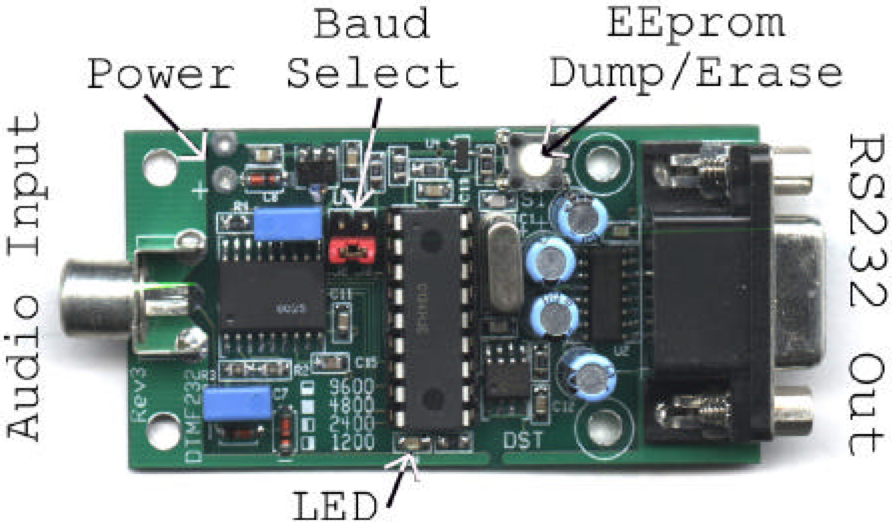
Hookup

The unit comes assembled tested before shipment. Because of high current consumption (approximately 13mA idle, 19mA when receiving tones) an external filtered DC power supply is recommended although the unit can be battery powered. The on-board regulator will accept voltage inputs ranging from 7 to 18 VDC. Please make sure your power connections are correct before powering the unit!

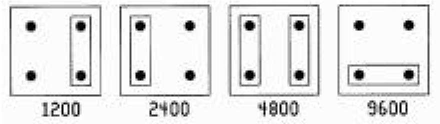
The user must hook up the audio input to the desired source. The on-board phono jack accepts line level audio input. Connect this jack directly to your audio source. DO NOT CONNECT A TELEPHONE LINE DIRECTLY TO THIS JACK! The voltage levels from a telephone line are too great to be used directly.

If you wish to hook this decoder to your phone line and a computer at the same time, you will need to do so using a 1:1 isolation transformer (also known as a 600:600 phone transformer). This will electrically isolate the two from each other. See schematic for a sample circuit.

Circuit Board Layout with Signal Power Connection Locations



Baud Rate Settings (note, only one jumper supplied)


1200
2400
4800
9600

RS232 Connection/Setting of Baud Rate

The on-board DB9F connector is configured as a standard, transmit only, PC serial port. All handshaking lines have been jumpered together. Communication is performed at 1200/2400/4800/9600 baud, 8 bits, no-parity, 1 stop bit. Configure the baud rate jumper to match your desired speed. For 9600 baud operation, no jumper is required, but you may place the jumper as shown for storage.

Operations

Hook up your audio and power supply and you're ready to decode tones! The on-board pushbutton functions both as an EEprom Dump button or an EEprom Erase button. If you wish to clear the EEprom of stored tones, press and hold the ***EEprom Dump/Erase*** Button until the LED lights. Release the button and the EEprom erasure will begin. **Erasure takes approximately 30 seconds.** The LED will extinguish when erasure is complete. The unit is now ready to decode and store more tones.

The Status LED

The LED status indicator can alert you to various conditions without needing to hook the DTMF232-2048 decoder to your computer. Whenever a valid DTMF tone is detected the LED will blink. This is helpful to determine if you have made your audio connections properly. The LED status indicator can also alert you if your EEprom is full. If you apply power to the unit or when you press the ***EEprom Dump/Erase*** button and the LED blinks, the EEprom is full.

Circuit Operation

Upon powerup, the microcontroller reads the ***BAUD Rate Selector Pins*** to determine what rate the data should be sent via the RS232 port. The microcontroller then searches the EEprom for the next available memory location, storing this address in RAM as the EEprom address pointer. If there are no further memory locations available, the microcontroller sends a **FULL** message to the serial port and blinks the LED. The decoder then loops through the main code section, waiting for either a button press, or a signal from the DTMF decoder IC that there is a tone waiting for decode.

If there is a valid tone present, the DTMF decoder IC raises its **Data_Valid** pin. The microcontroller turns on the LED, reads the 4 bit binary code present from the decoder, looks up the ASCII character value, sends it out the serial port, stores it in the available EEprom memory location and sets the Char_Found flag. The EEprom address pointer is then incremented to the next available location. The microcontroller then waits for the **Data_Valid** pin to go low, signaling the end of the current valid tone. When this happens the LED is turned off and the microcontroller loops through the main code again. If no other code is sensed in the next 5 seconds AND the Char_Found flag is set, a carriage return/linefeed is stored and sent out the serial port, and the flag is reset.

If the ***EEprom Dump/Erase*** button is pushed and released, the microcontroller resets the EEprom address pointer back to zero and begins incrementing by one, each time retrieving the EEprom contents and sending that character out the serial port. Once the address pointer points to an unused address location, the microcontroller stops the RS232 send and returns to the main menu. If the EEprom is full, the microcontroller sends a **FULL** message to the serial port and blinks the LED.

When the ***EEprom Dump/Erase*** button is pushed and held, the microcontroller begins to count. If 5 seconds pass and the button is still held down, the microcontroller resets the EEprom address pointer, turns on the LED, and starts to write a blank to each memory location in the EEprom. Once all the locations are blanked, the microcontroller turns off the LED and returns to the main program loop.

Hardware

The microcontroller is a PIC16C54. This microcontroller contains 32 bytes of RAM, 512 bytes of ROM code space, a 2 level stack, and 12 I/O pins. This CMOS device consumes 1mA.

The serial EEprom is a 24LC16B and provides non-volatile memory for storing decoded tones. It is rated for 10 million read/write cycles and has non-powered memory lifetime of > 40 years. In its active state (when it is being accessed), it draws approx. 1 mA of current at 5V. In standby mode, this current drops to 10 uA.

The DTMF decoding is performed by the 8870. This chip is capable of decoding all 16 DTMF tones and outputting the tone's number (0-15) via its 4 bit data port. A Data_Valid pin signals when there is a tone available for