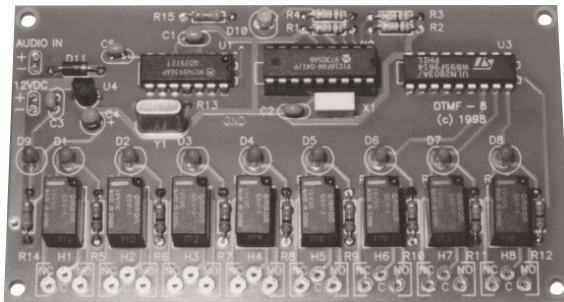


DTMF-8

DTMF decoder board with eight relays



Description

DTMF-8 is an inexpensive, self contained, DTMF (dual tone multiple frequency) decoder board which permits users to control remotely, via radio or other audio producing source, the on or off state of eight devices. For larger applications several DTMF-8 boards can be attached to the same control audio source to control dozens of devices. DTMF-8 supports four modes of operation. These mode settings control how the DTMF-8 behaves. Password support is also available for increased protection from unauthorized entry. All information is stored in non-volatile eeprom memory.

Specifications

Dimensions:	4 1/2" x 2 1/2" x 9/16"
Weight:	1.8 oz.
Input voltage:	12.0 to 14.0 volts DC (250ma max.)
Operating temperature:	-10° to +70° C
Microprocessor:	Microchip PIC16F84-04I/P (4 MHz)
DTMF receiver:	Motorola MC145436AP
Audio input impedance:	100K ohm
Audio input level:	0.1V to 5.0V peak to peak
Relay driver:	ULN2803 (eight open collector outputs 500ma max. each)
Relays:	Omron G5V-1-DC12 (sealed)
Relay contact rating:	1 amp @ 12 volts DC, 1/2 amp @ 120 volts AC
Relay contact life:	5,000,000 operations
Modes:	4
Factory default mode:	Mode 1, no password
Password length:	0 to 9 digits
Valid password digits:	0123456789ABC*#

Operation

DTMF-8 has LED's to indicate the board status. The green LED shows the presence of power and will remain on while power is supplied to the circuit. The eight red LED's indicate which respective relays are active (on). The yellow LED blinks during the four second power-up sequence and then will light whenever a valid DTMF digit is being decoded.

Even though DTMF-8 behaves differently for each of the four modes the optional password procedure is the same. The password must be entered for each operation before DTMF-8 accepts a command. For example, DTMF-8 has been programmed for Mode 1 with 6 password digits 123ABC. To turn on relay 1 the user needs to send 123ABC1*. If the user wanted to turn off relay 1 he or she would enter 123ABC1#. Alternatively, if no password is programmed a simple 1* would turn on relay 1.

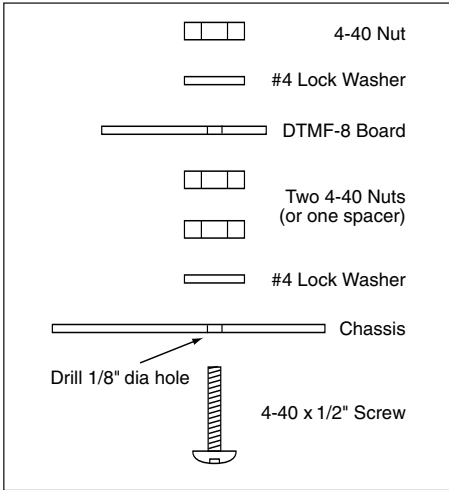
Installation

The following is the list of DTMF-8 circuit board pads (places to solder wires to). Please follow common electronic safety precautions when soldering. The relay contacts (C / NO and C / NC) are rated at a maximum of 1 amp at 12 volts DC and 1/2 amp at 120 volts AC.

Pad	Attach To
12VDC +	Regulated +12 to +14 volt supply, able to deliver 250ma of current
12VDC GND	Ground from power supply
Audio In +	Line level audio source (e.g. from a radio)
Audio In GND	Ground from audio source
C	Common connection for each relay
NO	Normally open connection for each relay
NC	Normally closed connection for each relay

Board Mounting Details

Mount the DTMF-8 board into a shielded enclosure like Radio Shack's 270-238 or LMB's 136 to protect it from RF. For each of the four mounting holes be sure to use two 4-40 nuts or one 1/4" spacer between the DTMF-8 board and chassis to prevent the bottom of the DTMF-8 board from shorting to the chassis.



Programming

Programming DTMF-8 is a simple procedure which allows you to configure the board to behave the way that closely meets your application requirements. The custom programming information is stored in permanent non-volatile eeprom memory so the programming steps only need be done once but DTMF-8 can be re-programmed anytime by following the same programming steps described.

To select the mode and optional password (factory default setting is Mode 1 with no password) attach a DTMF generator (e.g. an HT) to DTMF-8's "audio input" and follow these steps:

(Note: entering a digit indicates the pressing then releasing of a digit on a DTMF keypad).

- 1) Apply power to DTMF-8. The green LED will light indicating there is power.
- 2) For four seconds the yellow LED will blink. Within that four second window press # to enter the programming mode. While in the programming mode the yellow LED will remain on except when a valid DTMF digit is being decoded.
- 3) Select the desired mode (see the list of modes on the following page) by pressing 1, 2, 3, or 4. If mode 1 or 2 was selected jump to step 6.
- 4) If mode 3 was selected then select the number of relays that will be latched. Valid entries are 1-7. e.g. pressing 6 means relays 1-6 will be latched (like in mode 1), and relays 7 and 8 will be momentary (like in mode 2). Jump to step 6.
- 5) If mode 4 was selected then select the default "on" relay at power-up. Valid entries are 1-8.
- 6) Now press the total number of password digits desired. Valid entries are 0-9. If no password is desired press 0 and jump to step 8.
- 7) Enter each digit of the password. It will be the number of password digits requested in step 6. Valid password digits are: 0123456789ABC*#.
- 8) You're done! The programmed information is stored. The yellow LED will turn off.

DTMF-8 modes of operation:

Mode 1	<p>All eight relays are latched. Program mode: Press 1. Relays are turned on (*) or off (#) and remain in that state. e.g. 4* turns on relay 4, 4# turns the relay 4 off.</p>
Mode 2	<p>All eight relays are momentary. Program mode: Press 2. The relay is in the on state while the corresponding DTMF tone is being received and in the off state when the DTMF tone is absent. This is useful for controlling devices like pan and tilt cameras. e.g. While 7 is being pressed relay 7 is on.</p>
Mode 3	<p>Mix of mode 1 and mode 2. Program mode: Press 3 followed by the number of relays to be latched (1-7). The remaining relays are momentary. e.g. After the user programs 3 for this mode and enters 2 then relays 1 and 2 are latched (like in mode 1), and relays 3-8 are momentary (like in mode 2).</p>
Mode 4	<p>All eight relays are latched and mutually exclusive. Program mode: Press 4 followed by the relay number that will turn on by default whenever the DTMF-8 is powered up (1-8). This mode is for simplified control of latched relays (no need for * or #). The relays are mutually exclusive which means only one of the eight relays will be on. An example application for this is video camera switching where only one source can be selected at a time. e.g. Pressing 8 turns on relay 8. Then pressing 1 turns off relay 8 and turns on relay 1.</p>

Multiple DTMF-8's

The DTMF-8 is designed to control eight devices (via relays) but it is possible to control more devices by attaching multiple boards to the same incoming audio source and setting a password (more of a board ID in this case) for each board. For example an Amateur Television (ATV) repeater may have eight video sources to select from. In addition the ATV repeater transmitter has to be turned on and off as well as the lights in the repeater room. The project will require two DTMF-8 boards. The first board (board 1), which handles the repeater transmitter and lights, will be programmed for Mode 1 with a one digit password of A. The second board (board 2), which handles the video source selection, will be programmed for Mode 4, default relay is eight, and a one digit password of B. To turn on the ATV transmitter (which is attached to board 1, relay 1) A1* is entered. To switch to the outdoor camera (video source 6) B6 is entered. The two boards ignore each others commands. The important rule to remember for multiple DTMF-8's is that passwords (board ids) must start with 9, 0, A, B, or C to avoid conflicts. It's possible hundreds of DTMF-8 boards could be attached using this technique. Some valid board ids (passwords) are A1, A2, C1234, 0111112, etc.

Trouble Shooting Tips

Problem	Solution
Green LED off (won't power up)	<ul style="list-style-type: none">• Check Power supply output (12 - 14 VDC)• Check polarity of supply to DTMF-8 board
Unable to program or yellow LED doesn't change state when DTMF tone is applied	<ul style="list-style-type: none">• Check DTMF "audio in" polarity• Increase volume of DTMF audio• Decrease volume of DTMF audio (possible over driving audio input)

Warranty & Service

If the product fails to perform as described in our product description or specification, within 90 days from the date of shipment to the buyer, we will repair or replace the product and/or accessories originally supplied. Failure due to improper installation, misuse, abuse or accident is not covered by this warranty. Incidental and consequential damages are not covered by this warranty.

The buyer must obtain a Return Material Authorization by calling (248) 524-1918, and shipping the defective product to Intuitive Circuits LLC, 2275 Brinston, Troy, MI 48083, freight prepaid. After the warranty expires, we will promptly supply an estimate for the repair cost.

Intuitive Circuits, LLC

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Troy, MI 48083

Voice: (248) 524-1918

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<http://www.icircuits.com>