

DTMF decoder kit with 8 outputs and Morse transpond

Features

- 8 output DTMF decoder with 4 on board BT47 style 12V relays and 4 open collector outputs
- Each output can be turned on, off, pulsed, toggled or interrogated
- 4 digit ID (PIN) access control with programmable ID (ID can be turned off)
- Morse transpond confirmation (transpond can be turned off)
- 2 second Morse transpond delay (delay can be turned off)
- 0.5 second Morse start delay after TX key to allow for link establishment and CTCSS
- Status LEDs for each relay
- Screw terminal connections for power, radio/phone interface and relay contacts
- Optional case available but not included (PCB can mount inside lid or on base)
- Opto coupled radio keying interface
- Test mode makes it easy to get started
- Can save output states for recovery after power loss.

Specification

Size (without case): 89 x 56 x 15mm
 Supply voltage: 12 to 14V DC
 Supply current: 10mA + 30mA per active relay
 Audio input: 10mV RMS to 2V RMS
 Morse audio output: maximum 2.3V p-p into 10K load
 TX keying output: Active low, maximum sink current 50mA
 Relay contacts rated: 1A @ 24V DC
 Case options: With mounting flange (as photo), Hammond 1591XXBFLBK
 Without mounting flange, Hammond 1591XXBBK

Instructions for use

The decoder is controlled by a 4 digit ID followed by an output selection digit and an action digit/symbol, for example (with the default ID of 1234)

12341*	would turn on output 1	(1 ON)
12341#	would turn off output 1	(1 OFF)
123410	would pulse output 1 on for 0.5 seconds	(1 P)
12341A	would toggle output 1	(1 ON or 1 OFF)
123419	would request the current on or off state of output 1	(1 ON or 1 OFF)

In brackets is the Morse transpond confirmation of the action or request

Use 2, 3, 4, 5, 6, 7, 8 for the other outputs

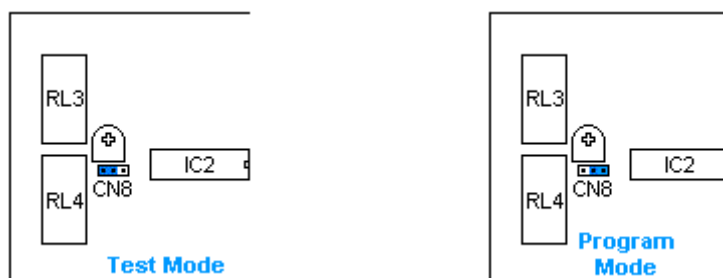
If the ID has been set to 0000 then no ID is needed and for example 1* would turn on output 1

Test Mode

Fit the supplied jumper to the 3 pin header CN8 on the centre pin and the pin nearest the relays, power-up the decoder and relays 1 to 4 will pulse in sequence for 0.5 seconds each.

The decoder is now in test mode, DTMF tones will directly control the 8 outputs. If you press button 1 on your DTMF source, relay 1 will turn on until you release the button, 2 will turn on relay 2 etc. DTMF button 9 will generate a beep at the Morse output. If you hold the button for more than 2 seconds the decoder will reset and pulse relays 1-4 again.

This mode makes it easy to check all the hardware is working and that you have a suitable DTMF input level. **Make sure TX output is disconnected from any radio when in test mode.**



Programming

Do not alter the ID until you have the decoder working in your application!

To change the 4 digit ID fit the supplied jumper to the 3 pin header CN8 on the centre pin and the pin nearest the PIC processor IC (see above drawing), power-up the decoder, send it a new 4 digit ID from your DTMF source, power-down the decoder, remove the jumper. On next power-up the ID will be changed.

When programming the ID you can add a fifth digit which controls various options as follows:-

xxxx0	the decoder works as standard (factory supplied default)
xxxx1	turns off transpond
xxxx2	transpond is on but without 2 second transpond delay
xxxx4	store on, enables saving of output condition for recovery after power loss
xxxx5	store on, with transpond off
xxxx6	store on, with transpond on but without 2 second delay

If you do not require the 4 digit ID then program the ID as 0000x

Radio / Mobile Phone interface

The radio/phone interface has been designed to provide good ground isolation from the decoder. It uses an opto-coupled TX keying output to break the ground connection, with the radio/phone ground (labelled R.GND for 'Radio GND' on the PCB) AC coupled.

There are 4 connections provided on screw terminals, A/F input from your receiver or Mobile phone, Morse output to your transmitter or Mobile phone, TX keying to your transmitter (not used for Mobile phones) and Ground.

When adjusting the DTMF input sensitivity (RV2) it is important to note that the DTMF tone level must not be too high as distortion will prevent decode, a maximum level measured at pin 3 of IC1 would be 775mV RMS, but aim for a maximum of 500mV p-p. The minimum input sensitivity at the A/F input screw terminal is 10mV RMS.

When adjusting the Morse output tone level (RV1) you may find that the variable is very close to the (minimum) anti-clockwise end of travel but still has far too much level, add a series resistor of say 100K to the Morse output in this case.

The Darlington configuration of the TX keying output means the minimum TX keying ON voltage will be 0.8V, if your radio will not accept this you can replace R13 with a wire link, the minimum ON voltage will then be 0.2V but the maximum current will be reduced to 0.5mA. Alternatively you can drive a relay from the TX keying output and use its contacts to key your radio.

Connecting additional relays

4 additional relays can be connected to CN10, these simply connect between the output pins and the relay positive pin (R+).

CN10 pin 1 = Relay positive (labelled R+ for 'Relay +' on the PCB)
CN10 pin 2 = Output 8
CN10 pin 3 = Output 7
CN10 pin 4 = Output 6
CN10 pin 5 = Output 5
CN10 pin 6 = Ground (not used)

The relay coil resistance should not be lower than 120 ohms.

Back EMF protection diodes are implemented inside the ULN2803A Darlington driver IC, therefore are not required to be added. Keep connections less than 150mm long

Assembly

When assembling the kit, fit all the resistors first, followed by the diode, IC's, capacitors, connectors, variable resistors, LEDs and finally the relays.

On first testing after assembly use a current limited power supply (if you have one) set at 12V DC with the current limit set at 25mA. The decoder should draw about 10mA. Next try test mode detailed above having first increased the current limit to 100mA.

List of components included in the kit

IC1	HT9170B
IC2	PIC16F627A (programmed)
IC3	ULN2803A
IC4	78L05
TR1	BC184L
D1	1N4001
XT1	3.579MHz
R1, 3, 5, 13	10K
R2	33K
R4, 8, 9, 10, 11	4K7
R6	470R
R7	330K
R12	1K
VR1	10K variable
VR2	20K variable
C1	470nf (marked 474)
C2, 6, 7, 13	100nf X7R (marked 104)
C3	not fitted
C4, 5	22pf
C8, 9, 10	1uF Tantalum
C11, 14, 15, 16, 17	1nf (marked 102)
C12	22uf 16V non polarised
C18	47uF 25V
RL1, 2, 3, 4	BT47 12V relay 1A @ 24V contacts
CN1, 2, 3, 4	3 way interlocking terminal block
CN5, 6, 7	2 way interlocking terminal block
CN8	3 pins
CN9	not fitted
CN10	6 pins
OP1	FOD617C
LE1, 2, 3, 4	3mm LED

Other items:-

cstech.co.uk 8 channel DTMF decoder PCB issue A (**Gold plated**)

Crystal insulator pad (fitted to crystal legs)

1 x Jumper



Document revised 19.10.11

