



## Specification For The MSB Design DTMF Tester DTMF-1

### Introduction

The DTMF-1 provides a means of generating DTMF digits, in various forms, for use in testing apparatus for conformity to specifications involving such tones. Single digits or strings of digits can be output, and the twist and deviation in frequency of these digits can be selected by the user from the front panel controls. In addition, there is provision for the insertion of a pause, itself variable, between output of the third and fourth digits in a string of digits.

Entry of digits is via a front panel keypad, allowing entry of numbers, star, hash, and the letters A to D. There is also a last number redial facility. Output is via a selectable impedance network, and the line is monitored via a built in loudspeaker, so that call progress can be observed.

Let's look in more detail at the unit :-

### Front Panel Controls

As soon as the unit has been plugged into the mains, and switched on, you will notice that the front panel LED display is illuminated. Do not panic if only one of the displays is illuminated - we will see why later.

Looking at the front panel controls from top left, we firstly have a rotary switch used to select the twist of the generated digits. This has four positions, the first three selecting a set amount of twist, and the last position selecting the control below, which is a variable control allowing user selectable amounts of twist. Next along is a five position rotary switch which is used to select the frequency deviation of the generated digits. As well as the choice of four deviation patterns there is a fifth position which selects no deviation at all.

The next control is a six position rotary switch, used to select the length of pause inserted between the third and fourth digits. There is a choice of five intervals, plus no interval at all i.e. no pause.

Moving to the next row down, we have already looked at the variable twist control, so the next along is the output level control. In addition to being able to vary the output level, the control has a switched position to select a fixed level. Next along is a four position rotary switch that selects the output impedance of the unit.

On the bottom row you will see two toggle switches, and the first refers to the LED display. In the twist position the display shows the levels of the individual tones. In the o/p position the bottom display shows the actual output level at the output terminals, and the upper display is turned off. This explains the possibility of only one display being illuminated, as described earlier.

The two 4mm terminals are connected in parallel with pins 2 and 5 on the line jack socket, and carry the output of the unit. The keypad is used to select the digits, and includes all of the numbers plus star, hash, and the letters A to D. The 'L' key is the last number redial key and this will repeat the last number entered.

Finally, for the front panel, there is a built in loudspeaker monitoring the output to the line, and its volume can be adjusted via the control below the speaker.

## Twist

The **twist** of the output digits refers to the relative levels for the two individual tones making up a digit. Selecting an amount of twist will determine the amount by which the higher frequency tone is greater in level than the fixed lower frequency tone.

**Selecting** either 1,2 or 3 will correspond to the higher frequency tone being 1dB, 2dB or 3dB greater than the lower frequency tone.

The **variable control**, when selected, will allow the twist to be varied between +5dB and -5dB.

The actual levels of the tones are displayed by the front panel LED display. Do note that these levels are those generated internally, and do not reflect the actual levels obtained at the output terminals. They are for relative purposes only, but do accurately portray the relative levels of the two tones. You will notice that when the set amounts of twist are selected the displays will reflect the twist selected, and when the variable control is selected you can set the amount of twist by comparing the two levels in the display.

## Deviation

The deviation refers to the difference in the required frequency of a tone and the actual measured frequency. This can be selected, to preset limits, via this front panel control.

The rather cryptic legend by the control refers to the following :-

HHLH - high frequency raised, low frequency raised  
HLLL - high frequency lowered, low frequency lowered  
HLLL - high frequency raised, low frequency lowered  
HLLH - high frequency lowered, low frequency raised  
None - no deviation

Therefore we can select a worst case scenario for the deviation conditions via this control. The actual amount of frequency deviation preset is normally 1.5%, but this can be changed to suit a customers requirements, either at the time of ordering, or at a recalibration period.

## Sequence Pause

When a string of digits is output they are normally transmitted one after the other, with an inter-digit time of 100mS. However, using this control you can select a pause in transmission after the third digit. This pause can be selected from 2S to 4S in half second increments. If you do not want a pause then select 'Off'.

## Output

The output tones are presented at the 4mm terminals and the line jack socket, both being connected in parallel. The line jack socket uses pins 2 and 5 for this purpose. The level of output can be selected via the rotary control on the front panel. It is variable from -50 dBV to 0 dBV; in addition there is a switched position on the control which will select a preset output level of -10dBV.

The output is measured at the output terminals and after the impedance networks, so reflects the actual output conditions. The bottom LED display shows the output when the toggle switch marked 'o/p - twist' is set to o/p.

Once digits have been entered at the keypad, the way they are output is determined by the three position front panel toggle switch marked 'Burst - Cont. - Single'. Taking the Burst setting to start with, this is the normal position, and in this mode the digits entered at the keypad will be output in sequence after a small delay, to allow input of the whole string. This is covered further in the section named INPUT. In the Single position the digit is output as soon as the input to the keypad has been made. This allows single digits to be input without having to wait to complete a string of digits. In the middle position, marked 'Cont.' for continuous, if a keypad is held down the tone associated with that digit will be output for the duration of the keypress.

## Impedance

As mentioned above, the output impedance can be selected as follows :-

- 50 ohm - this is simply a resistor of 50 ohms
- 600 ohm - this is a resistor of 600 ohms
- Complex 1 - this is a network consisting of a parallel combination of a 620 ohm resistor and a 310nF capacitor, all in series with a 600 ohm resistor
- Complex 2 - this is similar to Complex 1 except for the values; the parallel resistor and capacitor are 1k ohm and 220nF and the series resistor is 300 ohms.

## Display

The front panel display consists of two LED displays, which can be switched to either show the output of the unit or the individual levels of the tones making up a digit. The selection between these two states is made via the front panel toggle switch marked 'o/p - twist'.

When set to twist, the upper display will show the level of the lower frequency band of the digit and the lower display will show the level of the upper frequency band. These levels do not refer to the actual level at the output terminals but an internal level, and are used to observe the relative levels of the two frequencies that make up a digit. As with the output the levels are measured in dBV.

When the switch is set to o/p the upper display blanks, as it is not relevant, and the lower display shows the level at the output terminals, this being the combined upper and lower band tones that make up a digit. The reading is made at the output terminals, and again is in dBV.

## Number Entry

Number entry is done via the front panel keypad. All ten numerals plus STAR, HASH and letters A to D can be input. However, there are limitations to the entry and output. Firstly, the way that the number is output is determined by the position of the front panel toggle switch discussed in the OUTPUT section.

Let us consider for the moment that this switch is set to 'Burst'. In this mode the output is a string of digits as entered at the keypad. In order to allow time to enter these digits the string is not output until a delay of approximately 2 seconds has elapsed after the last digit. In other words, if you enter the digits slowly, as long as you do not leave a gap of more than this time you can continue to enter digits without them being output. Once you have stopped entering digits the delay will time-out and the number will be output. Once this has happened you can automatically retransmit the number by pressing the 'L' key - last number redial. This is also subject to a short delay before transmission.

Now it is important to note that, although it is possible to include the letters A to D in the output string, so doing will inhibit the last number redial. The effect is a bit variable, but basically, if you include a letter in the number string then the whole string is transmitted, but on redial only the numbers up to the letter are retransmitted, the rest of the string being terminated. Subsequent use of the redial facility is then sometimes corrupted, and I can only advise switching off the unit and then on again to reset everything. This situation arises from the dialler chip, which is used in telephone handsets. It has this facility to prevent the redialling of credit card PIN numbers and other information which contains letters.

## Specification

DTMF Digits	Numbers 0 - 9, *, #, letters A - D
Twist	1dB, 2dB, 3dB and variable -5dB to +5dB
Deviation	1.5% frequency deviation, selectable from HHLH, HLLL, HHLL, HLLH and no deviation. Custom versions available.
Pause	Between 3rd and 4th digits, selectable from 2S to 4S in 0.5S increments, plus no pause.
Output	4mm screw terminals, pins 2 & 5 of line jack socket. Level variable from -50dBV to 0dBV, preset -10dBV. Digits transmitted in normal string, individual digits, or continuous dual tone. Output is monitored by loudspeaker with variable volume control. Digit burst period = 100mS and inter-digit pause = 100mS.
Impedance	Selectable from the following networks:-  50 ohm resistive 600 ohm resistive ( 620 ohm // 310 nF ) + 600 ohm ( 1k ohm // 220nF ) + 300 ohm
Display	Two LED displays can be switched to show either the individual tone levels or the output at the terminals of a digit.
Input	Via a keypad; entry in the 'Burst' mode allows entry of a string of digits before transmission; entry in the 'Single' mode transmits each digit as it is entered; holding a key in the 'Continuous' mode transmits a tone for the duration of the keypress. Pressing the 'L' key redials the last string of digits. It is inhibited when the string contains a non-numeric character.

The unit is housed in a steel / aluminium enclosure, with all switches and connectors on the front and rear panels. It is mains powered, via an IEC connector on the rear panel. Enclosure dimensions are 425mm x 260mm x 95mm.