Silencer Option Board for the DTMF-16

The Silencer option board for the DTMF-16 Touch-Tone Decoder is installed beside the DTMF-16 and gets its power, audio and other connections from the DTMF-16 board. The unit's goal in life is to pass high quality audio (from whatever source is feeding the DTMF-16) without undesired Touch-Tones.

Audio is passed from the DTMF-16's input to the Silencer, which is really a high quality audio delay line. The muting function is controlled in real time by the DTMF detector. Anything the DTMF-16 detects as a vaild DTMF tone causes the Silencer's audio output to mute *BEFORE* the tone makes it out of the delay. The result is a moment of silence whenever a tone is present. The audio input control allows adjustment for maximum SNR while avoiding distortion and the active balanced audio output is fully adjustable for matching levels at your location.

Getting Started Quickly

The Silencer-equipped DTMF-16 is fairly simple to connect to your application.

Audio IN: The incoming audio feed is connected to the 1/4" phone jack on the rear of the DTMF-16 board. The input jack is bridging, MONO UNBALANCED. Tip and Ring are the signal and ground connections respectively. A 2 conductor (mono) 1/4" plug works just fine. The audio input level is preset for 0dBm referenced audio that does not exceed +10dBm on peaks. The input is bridging at approximately 10k. Note that the audio MUST be referenced to ground rather than the minus (-) audio connection. The minus input feed should be left floating. If the input audio is wired incorrectly, there may be unusual audio effects which can manifest as an echo at the output.

Control Functions Out: The outputs of the DMF-16 that correspond to the Touch-Tone received appear on the unit's D-37 connector (mating connector and hood supplied) as shown on page 8 of the DTMF-16 manual. These outputs are high-current, Opto-coupled Darlington, open-collector affairs; typical usages are detailed on pages 7 & 9 of the DTMF-16 section of this manual.

Audio OUT: The balanced audio out (minus the undesired Touch-Tones) appears on pins 4 & 23 of the D-37 connector. The output impedence is less than 600 ohms and the output is comparable in level to the input (though not exactly matched). The ground pin of the D37 can be connected for a shielded, balanced cable run, if desired.

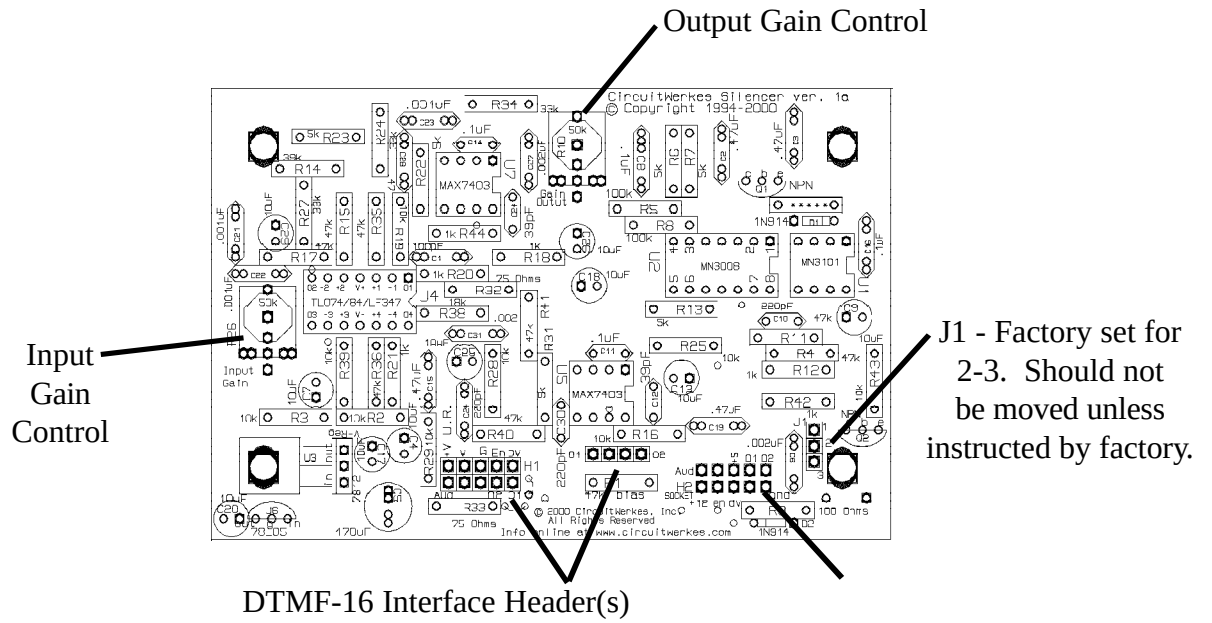
Audio adjustment: This proceedure is used to maximize Signal to Noise Ratio and avoid input clipping distortion.

Step 1. Reduce the audio output level control to -20dBm.
Step 2. With normal program (or preferrably, 1kHz tone) slowly increase the input pot until increased distortion is observed on a scope or meter. Do not exceed 0dBm output level while adjusting the input. Once the clipping point has been found, reduce the input gain control until the output is reduced by 10dB. That will give you the maximum audio throughput with 10dB of headroom.
Step 3. Adjust the output control for desired level being careful to avoid output clipping distortion on program peaks (set the peak output level 10dB or so below its clipping threshold).

Note: Most satellite programming is pre-limited so that peaks do not occur more than a few dB over normal program level. Finding the best balance of headroom vs. SNR will vary based on the service that you are using, but for satellite and RPU communications, 10dB is usually pretty safe.

The pages that follow contain a parts layout for the Silencer board and a schematic and short theory of operation. If you experience trouble with your Silencer-equipped DTMF-16 or need assistance, please feel free to call us at (352) 335-6555 or e-mail us at support@circuitwerkes.com.

Silencer PC Board Layout



The only user adjustments on the silencer board are input and output level adjust pots and the disable mode jumper J1. The input level adjust can be optimized for best S/N ratio when dealing with varying input levels such as applications where the input audio peaks at -10dBm (audio from an FCC registered telephone coupler like our AC). Jumper J1 is normally left off in DTMF-16s. If J2 is on pins 2-3, the Silencer's audio output will be muted anytime the DTMF-16 is disabled externally (by grounding pin 1 on the DB37). When J1 is OFF, audio will still pass through the Silencer board (unmuted) even while the DTMF-16 is externally disabled.

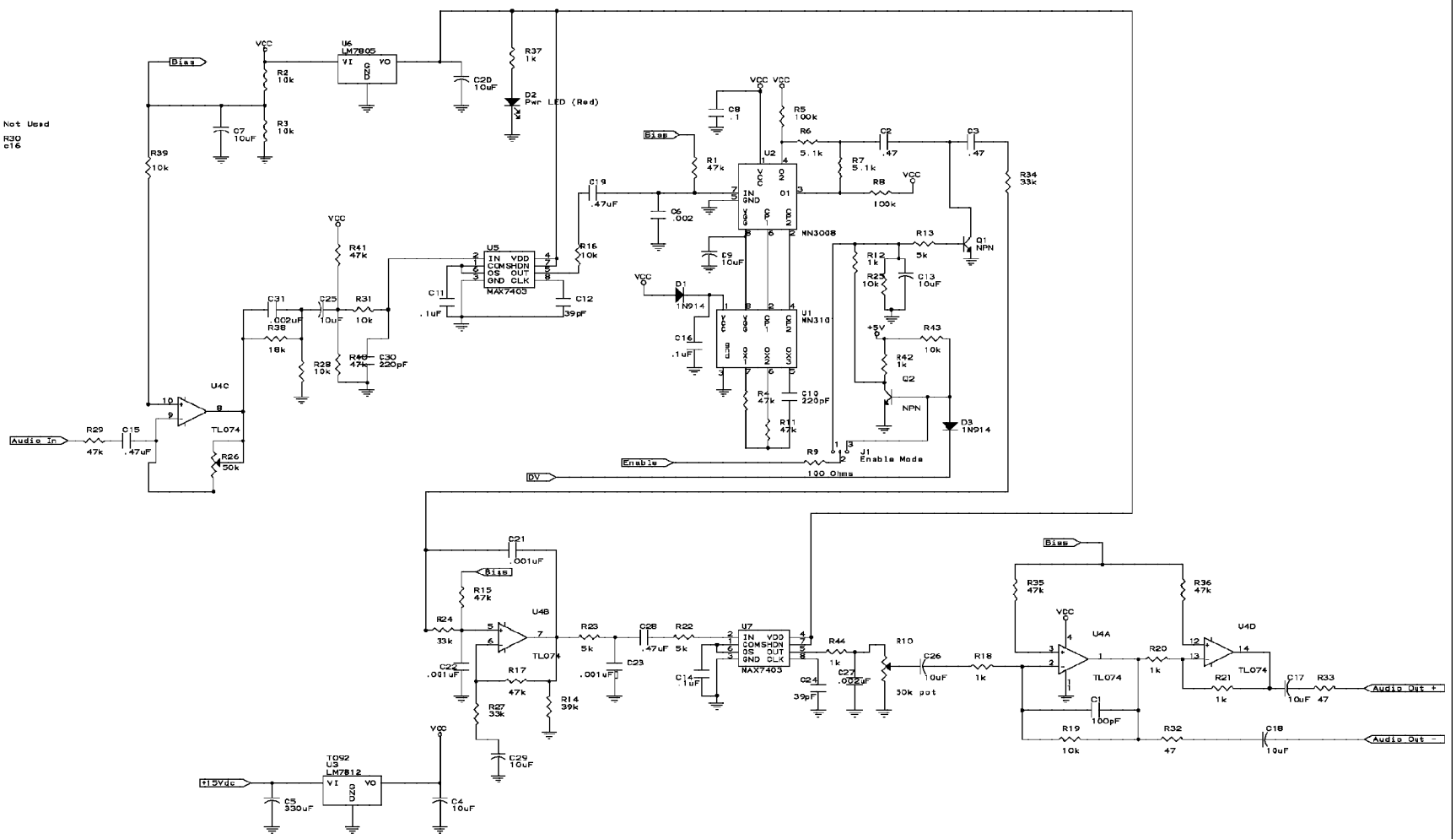
Connection to the DTMF-16 main board is made through a 10 conductor ribbon cable connected to header H1, and a two concuctor cable connecting header H2 to the access points for pins 4 & 23 on the D-37 connector.

Theory of Operation:

Incoming audio is buffered by U4c and sent through a pre-emphasis network to U5, a MAX7430, switched capacitor filter. Input gain is set by the input level control pot in the feedback circuit of U4c. This pot is factory set for -10 peak audio in the DR-10/DS-8. The filter chip is configured to limit generation of aliasing noise in the next stage. U5 and U7 are 8 pole lowpass eliptical filters. The conditioned audio is fed to Analog delay chip U2. U1 generates the appropriate (approximately 21kHz) clock for U2's opeartion as a 50msec delay line. The delayed output has a 21kHz clock component that is virtually eliminated by switched capacitor lowpass filter U7. Before the audio gets to U7 it connects in an AC-coupled-only node to the mute circuit made up of q1, q2 and their associated components. When the DR-10/DS-8 detects a valid DTMF-tone, it activates the mute circuit on the Silencer. The muted circuit simply shunts the audio to ground for the duration of the incoming tone. Output from the delay goes to U4b which is configured as a Butterworth, low pass filter to reduce the possibility of aliasing noise being generated at the next stage, U7. The filtered, delayed audio from the output of U7's filter passes through the output gain control, r10, and is amplified by U4a and U4d. These opamp elements are set up to provide a balanced transformerless output. R32 and R33 limit output current. A 5 Volt regulator provides power for the MAX7430s while power for the rest of the active devices is provided by a 12 Volt regulator.

The Silencer 1a by CircuitWerkes

Audio Delay / Mute Board



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Rev: H	
Date: March 28, 2000	Sheet 1 of 1

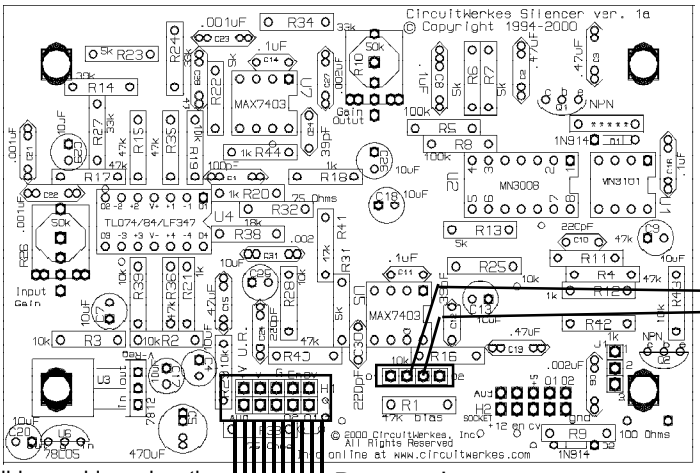
Installing the CircuitWerkes Silencer board in an existing DTMF-16c.

First remove the four nuts that hold the case together. Gently remove the top cover and set it aside, being careful to push the power and DTMF LEDs through the front panel. You will need the four nuts again when re-assembling.

The Silencer board is installed on plastic standoffs above the DTMF-16 board in the orientation shown below. Use the four 1/4" machine screws provided to secure the Silencer board to the stand-offs. Connect the boards with the two supplied cables as shown below. The ribbon cable simply jumpers the two multi-pin headers directly across to each other.

The two-conductor audio lead is connected (polarity is unimportant) to the 8 pin (2x4) header strip on the DTMF-16 labelled "Hex Data & Misc I/O." It is important to make the connection to the pins marked 04 & 23. If you DTMF-16 has jumper pins that connecting 04 & 23 to the db & da pins, the jumpers must be removed.

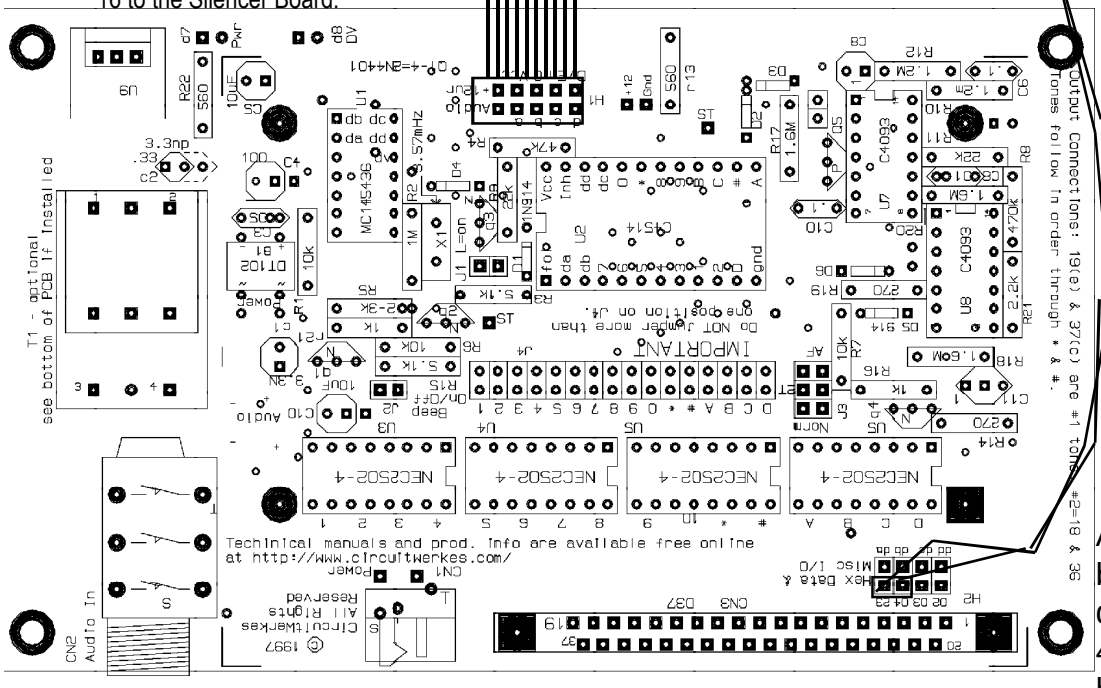
If your audio levels are not satisfactory, drop the output level and adjust the input level to just below the distortion point on incoming audio peaks. Then you can adjust the output level control for appropriate llevels into your equipment.



The audio out port on the Silencer is connected to the DTMF-16 board with the supplied two-conductor cable.

Ten-conductor ribbon cable makes the necessary connections from the DTMF-16 to the Silencer Board.

Be sure the connectors mate properly with the pins on both boards.



Audio from the Silencer board is routed to the db-37 connector's pins 4 & 23 by way of this header on the DTMF-16

Back (connector side) of the DTMF-16 Decoder.