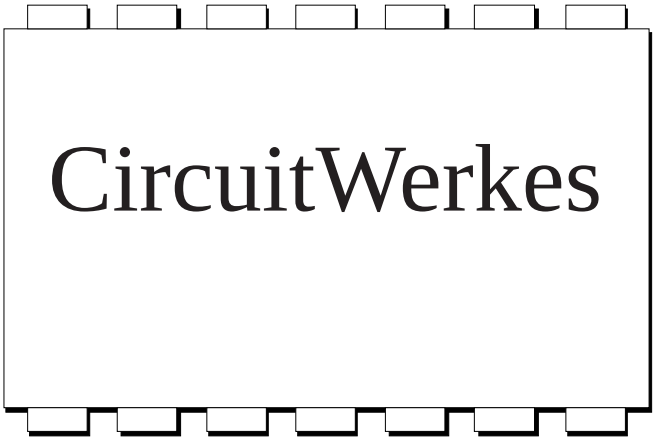
SubAudible Tone Decoder Model: Sub-03



Technical Manual

CircuitWerkes
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Notes:

The CircuitWerkes Subaudible Tone Decoder

Description

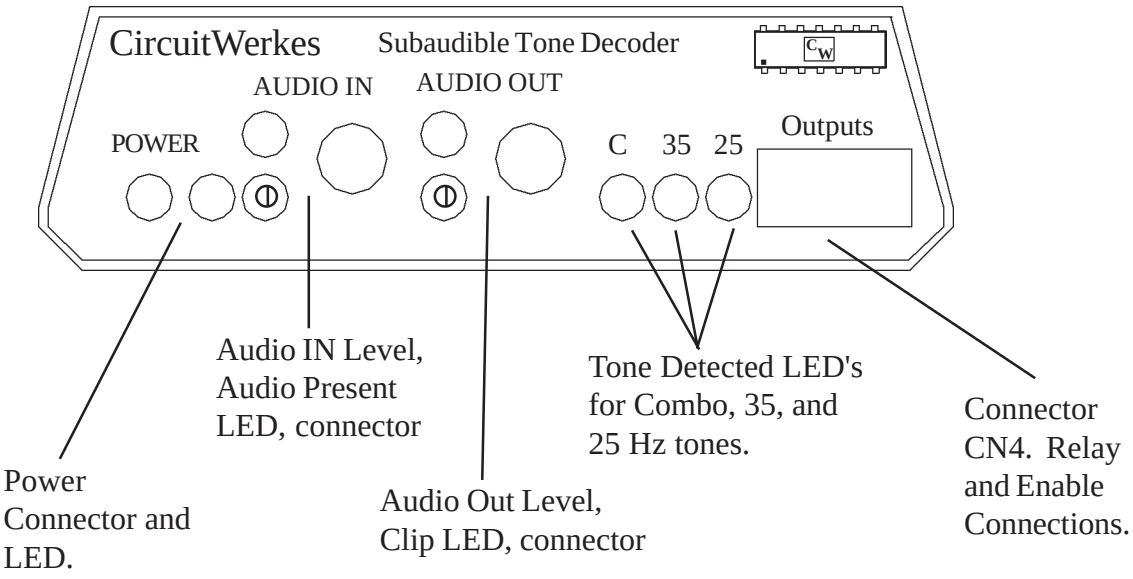
The CircuitWerkes Subaudible Tone Decoder provides a reliable and accurate solution for decoding subaudible tones from satellite, automation, or other sources of audio. The unit has dry relay contacts and an LED indicator for each of the standard three subaudible signals, 25HZ, 35Hz and the Combination of 25HZ and 35Hz.
The audio input can accept balanced or unbalanced audio at input levels of -20dBm to 0dBm.
The output is balanced transformerless and is easily capable of driving a 600 ohm load. Subaudible tones are typically attenuated by 30dB at the audio output and it is short-circuit protected.

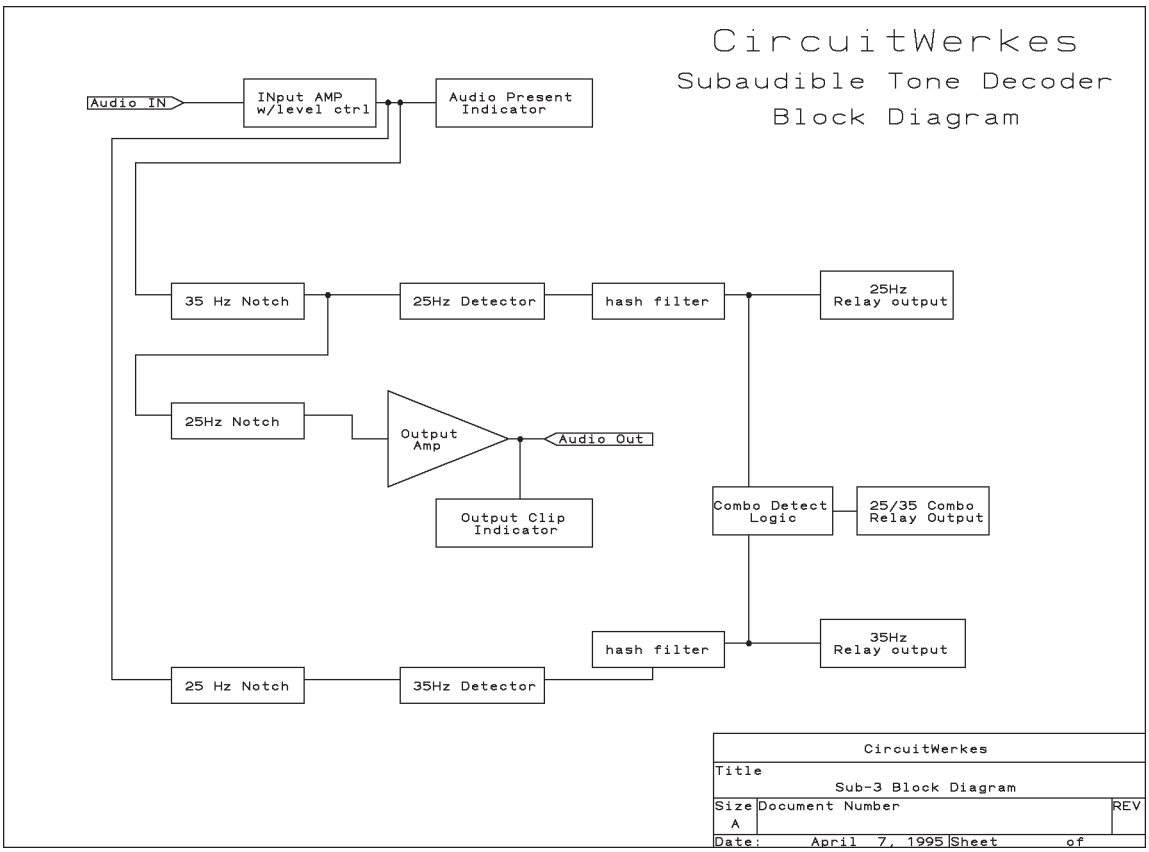
Installation

Connections to the Subaudible Tone decoder are fairly straight forward. Your audio passes through the decoder via the Audio In and Audio Out jacks. Relay outputs and the enable line are brought out to the ten conductor pin connector CN4. See page 3 for connection details. The mating connector for the 10 conductor pin connector is supplied with your Subaudible Decoder. The pins are crimped onto 20 to 26 AWG wire with a generic DB style connector crimper (available just about anywhere that computer connectors are sold...even Radio Shack).
Power is provided by the included "wall-wart." Optionally you can power your decoder with any supply of 12-18 Volts AC or DC.
The relay outputs are dry N.O. contacts capable of switching loads up to 10 watts. We recommend slave relays if you intend to switch heavy loads or high voltages.

Important Note regarding program content...
If your subaudible tone decoder is connected to a source that delivers more than one program and one or more of the programs delivered does not contain subaudible tone signalling you may encounter (easily resolved) problems. Any program that does NOT contain subaudible signalling tones probably DOES have subaudible content. Normal voice and background noise can easily set off your decoder's outputs if the audio is not (high pass) filtered. Programs that do contain subaudible signalling tones will always be prefiltered at their origination point before subaudible tones are injected, thus keeping the natural low frequency content of normal voice and noise from false tripping decoders down the line.
A good example would be an SCPC satellite receiver that you use for a couple of different network feeds. One of the networks uses subaudible tone signalling for starting local breaks, the other uses DTMF Tones. The network that uses DTMF tones probably does not filter out the subaudible portion of their program audio. If you have a limited number of inputs on your console or automation system, you may not wish to take up two inputs with audio from one source. Fortunately the CircuitWerkes Subaudible Tone Decoder features a jumperable ENABLE line. The ENABLE MODE jumper is located near the five transistors on the board (Q1-Q5). When the jumper is in the 1-2 position, the decoder is enabled and will respond to 25Hz and/or 35Hz information. When the jumper is in the 2-3 position, the decoder requires a low (with a 20mA sink capacity) on pin 2 of CN4 to enable it. If no jumper is installed, the decoder requires a TTL or CMOS high on pin 2 of CN4 to operate.

The subaudible Tone Decoder's Front Panel is shown below.





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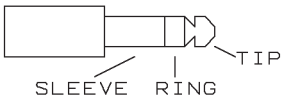
Sub-3 Subaudible Tone Decoder
Audio In/Out Wiring

Input

1/4" TRS (phone) PLUG



Tip is Balanced (or Unbalanced) + In

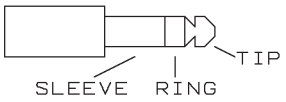
Ring is Balanced - in.

Sleeve is audio ground and should be connected to your source's ground.

If your input is unbalanced you must tie ring and sleeve together for proper operation.

Output

1/4" TRS (phone) PLUG



Tip is Balanced Out +.

Ring is Blanced Out -.

Sleeve is left floating and may be tied to ground on the other end.

Do NOT Connect minus (-) Output to Ground!

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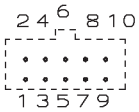
Relay Output and Enable Connections.

Front view of Sub-3 Interface Connector

CN4



Pin Assignments

1 - Ground
2 - Enable Mode
3 - n/c
4 - n/c
5&6 - Combo Tone Relay Contacts
7&8 - 35Hz Tone Relay Contacts
9&10- 25Hz Tone Relay Contacts

ENABLE MODE JUMPER (located near transistors Q1-Q5)

1&2 shorted - Decoder enabled

2&3 shorted - External low on pin 2 of CN4 required to enable decoder.

No jumper - external high on pin 2 of CN4 required to enable decoder.

Factory default for the Enable mode jumper is pins 1&2 shorted, decoder continuously enabled.

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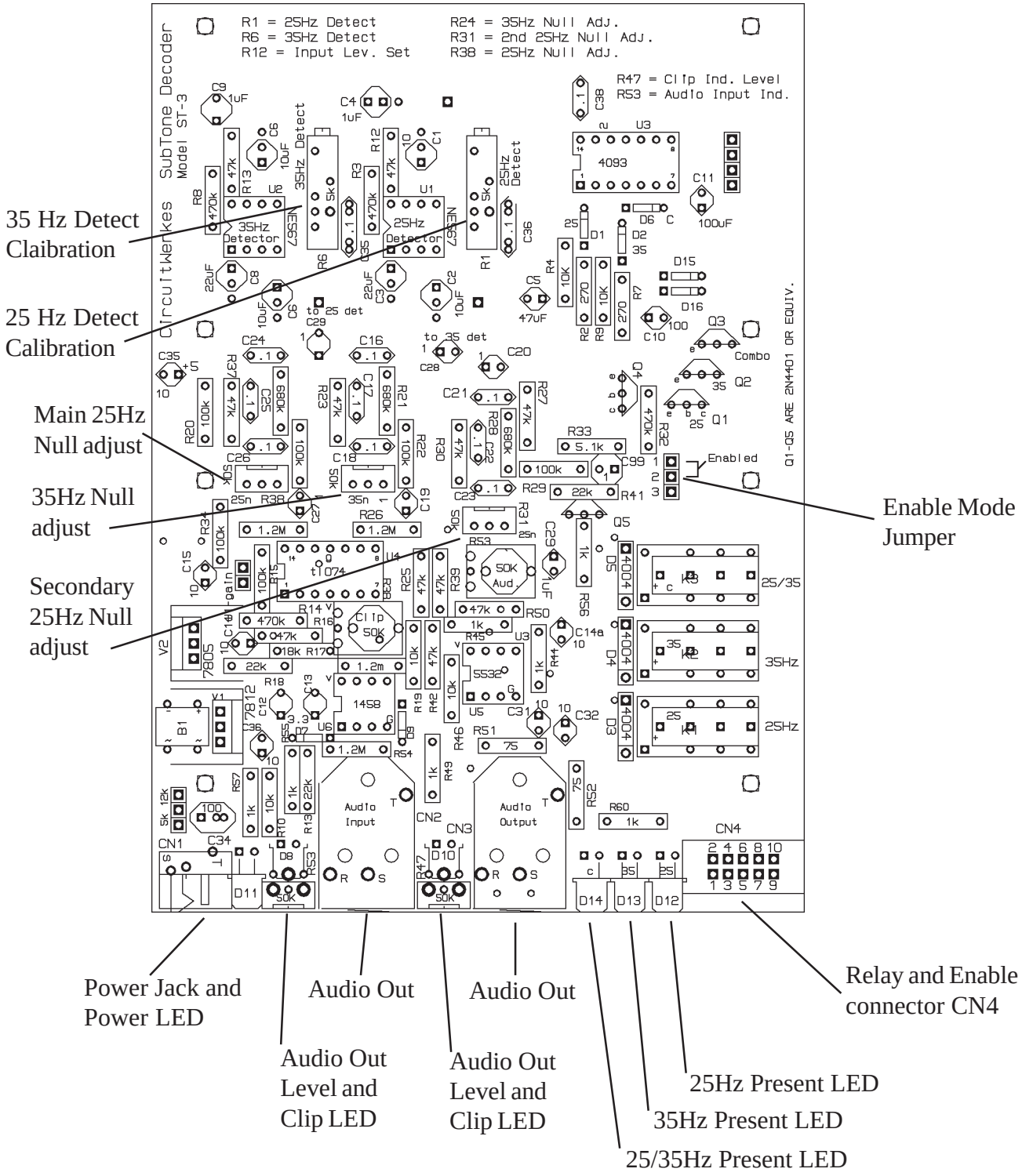
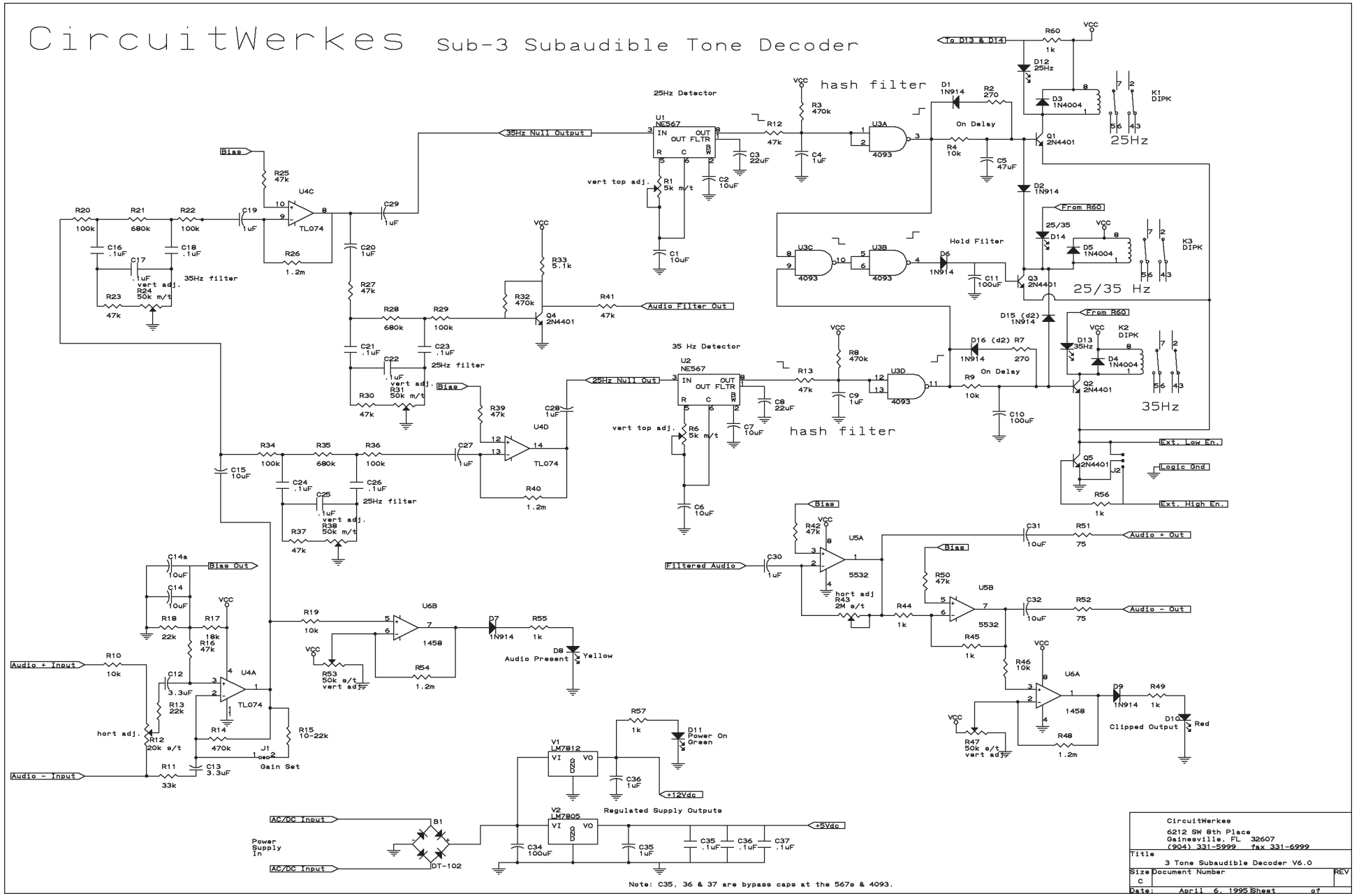
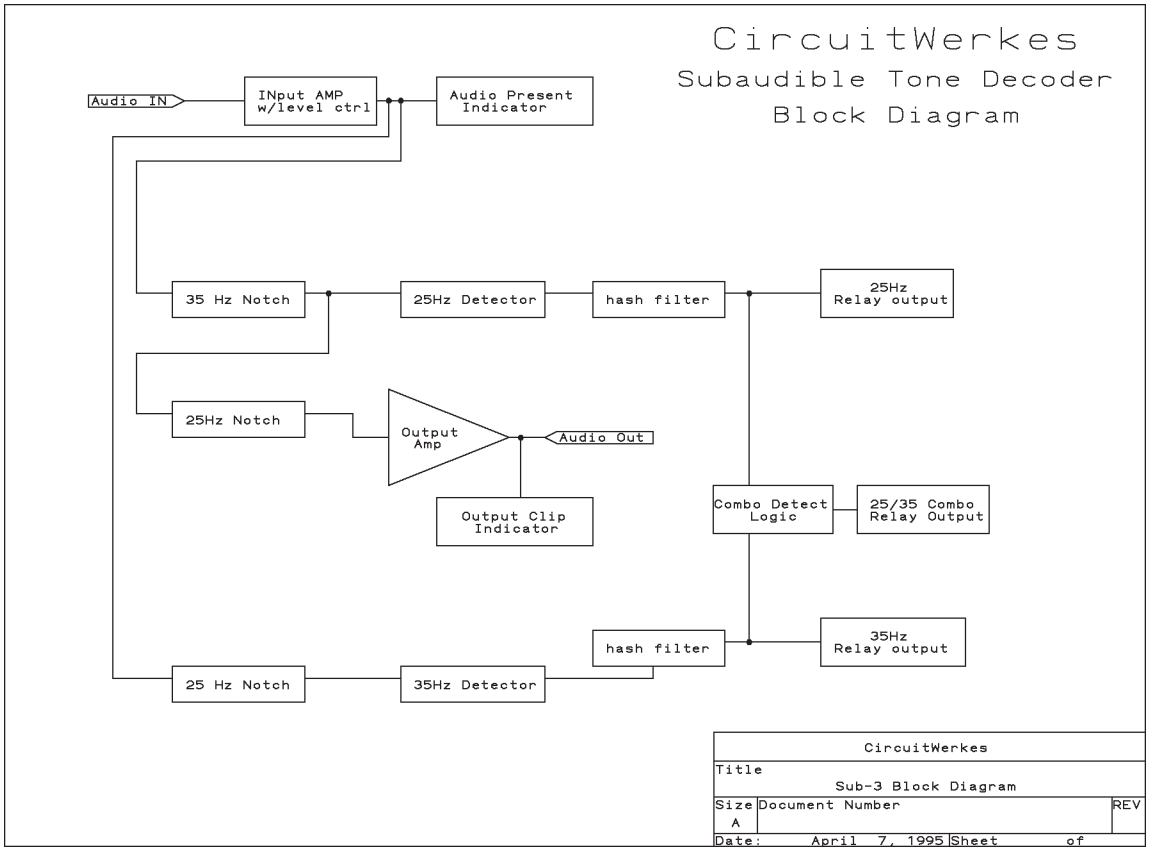
SUB-3 PC Board Layout



Sub-3 Subaudible Tone Decoder Schematic





Theory of Operation

Incoming audio is buffered and level controlled by U4a and its associated components. Three nodes are fed by this first buffer section, the input audio presence indicator, the 35Hz notch section and the main 25Hz notch section.

The audio input presence indicator is comprised of opamp U6b (operated as a comparator), reference-set pot R53, a yellow LED and associated components. When the audio level exceeds the preset comparator reference level, the comparator changes states and illuminated the LED.

The 35Hz notch section is a twin-tee bridge circuit, the exact center frequency of which is set by multiturn pot R24. Buffer U4c feeds the 25 Hz detector section and a secondary 25Hz notch filter (of the same design) which in turn feeds the balanced output amps comprised of U5 and its associated components. Another comparator-LED circuit hangs off the end of the output amp and is set to illuminate when the audio output level approaches clipping.

The main 25Hz filter section is constructed just like the other two notch sections and in turn feeds the 35Hz detector section.

The outputs of the two detector sections feed through hash filters (to eliminate some extraneous falsing). The hash filters are simple RC filters on Schmitt trigger inputs of U3a (25Hz detector) and U3d (35Hz detector). The outputs of the hash filters feed an AND gate (U3c and U3b) directly and the relay driver circuits for their respective relays through an RC delay filter. If both tones are detected simultaneously, the and gate circuit fires the combo tone relay and defeats the relay drivers of the individual tone outputs. If only a single tone is detected, its relay output folows.

Alignment

Levels.

Audio levels can be adjusted with the front panel audio pots (Input and Output). Start with the Input levels and feed the unit with normal program audio. Adjust the input until the input audio presence LED flashes with about 50% duty cycle with the incoming audio. Output audio should be adjusted for desirable levels into your console or automation.

Filters and Detectors.

The filter sections and detectors are tuned at the factory with standard reference tones and should not need further adjustment by the user. However, if the need arises to tune these circuit sections you will need a scope or analog audio level meter that has good display characteristics at low audio frequencies, a signal generator or known accurate 25Hz and 35Hz signal source, and an accurate frequency counter if your signal source is a continuously adjustable device (most are). The frequency counter can be left hung across the signal source for fine tuning the frequency of the signals being fed during the alignment process. The audio level of the tone source should be between -10 and 0 dBm. If the signal is unbalanced, be sure to tie ring and sleeve on the input connector to the unbalanced source's shield.

To Tune the filter sections set the generator or signal source for the operating frequency of the filter being tuned and adjust the associated multiturn pot for minimum audio (the null point) at the test point for the filter you are adjusting.

Main 25Hz filter - adjust R38 - test point is pin 3 of U2.

35 Hz filter - adjust R24 labelled "35n" - test point is U1 pin 3.

Secondary 25Hz - adjust R31 - test point is the main audio output.

The detectors should not be aligned unless the filter sections have been aligned first.

The detector alignment process is the same for both detectors. First set the signal source for the operating frequency of the detector you will be tuning, then find the turn-on point of the detector in each direction of rotation of the multiturn detector's alignment pot. Set the pot for half way between thee two points.

R1 is the 25Hz detector adjustment; R6 is the 35Hz detector adjustment.

REPAIR OR SERVICE INFORMATION

In the event of the need for service or repair, call CircuitWerkes at (352) 331-5999 or 335-6555 for a Return Merchandise Authorization number (RMA). Then carefully package the unit along with a note of the problem and send it to the address below. Clearly indicate the RMA number on the outside of the box. We cannot accept returns without an RMA. Be sure to include your address (not a PO box), telephone number and best time to call.

CircuitWerkes
ATTN: CUSTOMER SERVICE DEPT.
3716 SW 3rd Place
GAINESVILLE, FL 32607

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