

# T25-35SA

## Subaudible Tone Decoder

The Mueller Broadcast Design T25-35SA subaudible tone decoder provides a simple and reliable way to detect the 25 and 35 Hz control tones sent by many satellite-delivered program networks. It is entirely self-contained and only requires audio and control hookups to your satellite receiver and equipment to be controlled.

The input is balanced and bridging, with a minimum impedance of 9.2 Kohms. This input is a true differential configuration, meaning that it will not introduce noise or other unwanted signals into your satellite audio. It will work equally well with balanced and unbalanced lines.

The detection circuits are bandpass filters which have a very narrow passband. The unit will detect on frequencies which are up to 3 Hz off (assuming a minimum tone level of -10 dB from program level), but the notch efficiency will degrade severely at these extremes. Normal tone rejection at the output is at least -20 dB, with as high as -45 dB possible if the tones are exactly on frequency.

The input level is not critical. If the output is 0 dBm nominal, the circuits are in the middle of the +/- 6 dB operating window. An easily-adjusted gain control inside the box allows input levels of -15 to +10 dBm. It is set at 0 dBm input when shipped. The output is active balanced at 0 dBm (600 ohms) nominal. Unbalanced output connections are accommodated.

### WARRANTY INFORMATION

If this unit fails due to manufacturing defect within one year of purchase, we will either repair or replace (our option) your unit at no charge beyond return shipping. We reserve the right to utilize remanufactured parts and assemblies during repairs. Repaired units carry the balance of the original warranty. If you did not purchase this unit directly from us, be sure to include a copy of your invoice to establish the beginning of the warranty period. Units returned without proof of purchase will be serviced based on the ship date to the reseller. *We assume no liability whatsoever beyond the purchase price of the unit.*

### 30-day Return Guarantee

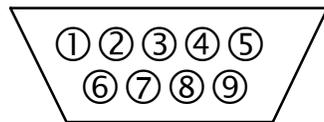
You have 30 days from date of purchase to determine whether this unit is suitable for your intended purpose, as we cannot predict every possible application or potential compatibility problem which may arise with other equipment. **If you keep the unit beyond the initial 30 day period, you will have made an affirmative determination of suitability for your application and further responsibility on our part is limited to replacement or repair under the warranty terms above.** If you decide that the unit is not suitable, return it within the 30 day period and we will refund your purchase price less shipping charges as shown on your invoice.

Technical support is available by phone from 10 AM until 6 PM Monday - Friday (central time) at 708-352-2166. Outside these times you can leave a message and we will call you back as soon as possible, usually within 24 hours. You may contact us by fax at 708-352-2170.

## T25-35SA Installation Instructions

### Wiring Connections:

All connections to the T25-35SA are made via the DB-9M connector on the rear panel. We supply the mating connector for this. The pin diagram below may help you identify which holes are which, and they are printed (in very tiny numbers) on the shell itself.



**View from rear  
of mating connector**

<u>PIN</u>	<u>FUNCTION</u>
1	Audio Input +
2	Audio Input -
3	Audio ground
4	Audio Output -
5	Audio Output + (n.c. on unbalanced units)
6	25+35 Hz Pulse
7	35 Hz Pulse
8	25 Hz Pulse
9	Pulse Common

**Audio input connections** are made to pins 1 (+) and 2 (-). If you are using an unbalanced input then connect the "hot" lead to pin 1 and the ground to pin 2.

**Audio output connections** are made to pins 4 (-) and 5 (+) for balanced output or pins 3 (GROUND) and 4 (-) for unbalanced output. **DO NOT CONNECT GROUND TO EITHER PIN 4 OR 5.** Leave the unused pin disconnected. **Note:** *Early units have unbalanced outputs and pin 5 is not connected.*

**Control output connections** are made on pins 6, 7, 8 and 9. Pin 9 is the relay contact common. Pin 8 closes to pin 9 on 25 Hz alone, pin 7 closes to pin 9 on 35 Hz alone, and pin 6 closes to pin 9 on 25 Hz and 35 Hz together.

The only "ground" connection to the electronics in this unit is through pin 3. If you experience noise or RF interference connect pin 3 to your shield ground. The third prong "safety ground" on the line cord is only connected to the metal chassis. The four relay contact closure pins are isolated from all other circuits.

### Initial Checkout:

Once your audio and control connections are made, apply power to the unit. The

front panel LED's show the status of the unit. The two green LED's (+12 volts DC and - 12 volts DC) indicate whether the voltage regulators are working. The two red LED's (25 Hz Detect and 35 Hz Detect) light whenever the unit detects the subaudible tone(s). The yellow Output Pulse LED lights when the unit is issuing a pulse to one of the three "Pulse" outputs. At this point, with no audio input, only the two green power supply LEDs should be lit.

As shipped, this unit expects a 0 dBm (600 ohms) nominal input level. If your input levels are higher or lower than this, remove the cover (there are two screws on each side of the enclosure) and check the LEVEL CHECK LED on the circuit board. Under normal conditions, with program material present, this LED should be green with red flashes. It should not go dark except during program pauses of two seconds or more. If it is dark most of the time, or never flashes red, turn the INPUT LEVEL control clockwise until this condition is observed. If the LED is red all the time or just occasionally flashes from red to green, turn the INPUT LEVEL control counter-clockwise. This is the only adjustment necessary for proper operation. If everything is adjusted properly, the nominal output level should be 0 dBm.

### **Normal Operation:**

This unit will detect any 25 Hz and 35 Hz audio frequencies which are present in the program material. Several safeguards have been designed into the unit to prevent false tripping. The red Detect LED must stay lit until the yellow Output Pulse LED lights in order to get a pulse output. The state of the detector is latched at the moment the yellow LED lights and any further changes in the state of either the 25 or 35 Hz detectors is ignored. Under certain conditions, a brief trip of either detector will cause the yellow light to flash, but the Detect LED usually goes dark before the output is latched. In this case, there will be no pulse output given by the unit. In order to cause an output pulse, the tone must be present for at least 1/4 second. An occasional flicker of the Detect lights (especially the 35 Hz LED) is normal if the network programming contains significant low frequency components and the network is not properly high-pass filtering the program audio. This can also occur if impulse noise ("pops") is present on your satellite audio.

The normal sequence for a valid tone is (1) DETECT LED lights, (2) 250 millisecond delay, (3) OUTPUT PULSE LED lights / Relay Contact Closure issued for approximately 250 milliseconds, (4) RESET, ready for next tone, red and yellow LEDs dark. This final step will not occur until tones are no longer present.

Some satellite receivers have a high-pass filter in the audio path or have poor low frequency response characteristics. Switch out any high-pass filtering if your receiver has it. It will suppress the 25 Hz and 35 Hz tones in the program audio. This unit cannot compensate for poor audio response, but if the tones are present, an additional sensitivity adjustment may recover the tones if they are not too far "down". See Setup and Alignment instructions for more details on this.

## SETUP & ALIGNMENT INSTRUCTIONS

### T25-35SA Subaudible Tone Decoder

This unit uses underdamped bandpass filters to achieve quick response. There are two such filters in series monitoring for each tone, the output of the last one being rectified to drive a schmitt trigger. When the tone level increases to the trip point, the trigger provides an output to both U8 (a 4528 timer) and U7 (a 4 to 16 decoder). When the timer expires (about 250 milliseconds), it lights the OUTPUT PULSE LED (I1, front panel) and latches the tone detect signal into U7, which then provides an output to the relays depending on which tone state is latched. Further changes in detector state are ignored. The other half of U8 provides a 250 millisecond output pulse. The unit will wait until there is a "no tone" condition before it resets. The delay is provided to allow both tones to detect if they are sent together, plus to give a measure of false triggering protection. If a tone detector trips, it must remain tripped for at least this long to cause an output pulse. If the detector LED goes out before the output pulse is issued, the **Output** LED will light, but no pulse is issued. Most sources of false trips last only for a few tens of milliseconds.

The Mueller Broadcast Design T25-35 subaudible tone decoder has no user adjustments. All setup adjustments are on the PC board and have been preadjusted to provide proper operation in most situations. The tone decoders have been set to trip at -10 dB or higher with a nominal program input level of 0 dBm. If your input level requirements are not 0 dBm, a simple internal adjustment will allow the unit to function properly.

See the *Installation Instructions* for connection information.

The **input level** adjustment (R59) sets the gain of the unit. It is properly adjusted when the **level check** LED (I6) glows green most of the time with program input. If it only flickers between green and off, increase the gain with R59. If it is red all of the time or is mostly red with green flickers, reduce the gain with R59. Properly adjusted, the output of the unit will be 0 dBm nominal. The remainder of the adjustments on the board deal with the frequency and output tone rejection of the detectors, as well as the trip points of I6. Do not adjust these controls unless you have the following equipment available:

Audio Signal Generator.

Audio (AC) voltmeter accurate from 10 Hz through 1 KHz.

Oscilloscope.

The T25-35SA will both detect and notch out 25 and 35 Hz tones. The rejection of the tones at the output is at least 20 dB, with 50 dB possible if the tones are exactly on frequency. Since the passband of each detector is +/- 3 Hz, you should not have to adjust them. If it becomes necessary, here is how to do it.

Connect the audio generator to the input, the AC voltmeter to the output.

- 1) Feed a 1 KHz tone to the input at 0 dBm. Adjust **Input Level** (R59) for 0 dBm (600 ohms) at the output.
- 2) Change frequency to 25 Hz and reduce the input level to -15 dBm.
- 3) Adjust **25 Hz Tune** (R11) for minimum 25 Hz output read on the AC voltmeter.
- 4) Adjust **25 Hz Null** (R9) for minimum 25 Hz output read on the AC voltmeter.
- 5) Repeat step 3 and 4 until at least a 30 dB null is obtained.
- 6) Connect the oscilloscope to the anode (opposite of the stripe) of D1 (marked **25 test** on the parts locator). Adjust **25 Hz Peak** (R25) for a maximum indication on the scope. If the sinewave clips, reduce **25 Hz Sense** (R27) until the clipping disappears.
- 7) Adjust **25 Hz Sense** until the front-panel **25 Hz Detect** LED (I3) illuminates, and then one turn more.
- 8) Change frequency to 35 Hz.
- 9) Adjust **35 Hz Tune** (R10) for minimum 35 Hz output read on the AC voltmeter.
- 10) Adjust **35 Hz Null** (R24) for minimum 35 Hz output read on the AC voltmeter.
- 11) Repeat step 9 and 10 until at least a 30 dB null is obtained.
- 12) Connect the oscilloscope to the anode (opposite of the stripe) of D2 (marked **35 test** on the parts locator). Adjust **35 Hz Peak** (R26) for a maximum indication on the scope. If the sinewave clips, reduce **35 Hz Sense** (R28) until the clipping disappears.
- 13) Adjust **35 Hz Sense** until the front-panel **35 Hz Detect** LED (I2) illuminates, and then one turn more.
- 14) Recheck the 25 Hz output. It should still be 30 dB or more down.
- 15) Change frequency to 1 KHz and feed your nominal input level to the unit.
- 16) Adjust the **Input Level** (R59) control so that it is halfway between where the **Level Check** LED (I6) turns green and then red. There is a 6-8 dB "window".

**DO NOT ADJUST R60 or R61!**

[If you did adjust R60 or R61, after aligning the unit as above, feed a 1 KHz tone to the input and adjust the INPUT LEVEL control until you get a 0 dBm output from the unit. Reduce the input level 6 dB. Adjust R61 (Min. Adjust) until the LEVEL CHECK LED just goes out. Increase the input level by 12 dB (+6 dBm output level). Adjust R60 (Max. Adjust) until the LEVEL CHECK LED just changes from green to red. These controls only affect the trip points of the LEVEL CHECK LED and should never have to be moved.]

If you experience difficulty detecting network tones, and the **Level Check** LED is indicating green most of the time, the tones are at a level below -10 dB from program level. Adjust **R27 (25 Hz Sense)** or **R28 (35 Hz Sense)** clockwise (1 dB per turn) to compensate for the lower level.

If you have difficulty with this unit, please contact us. Our hours are 10 AM-6 PM, central time. Phone: (708) 352-2166. Fax: (708) 352-2170.

## TROUBLESHOOTING

Please try this first but call for technical support if you cannot solve the problem.

### SYMPTOM

### TRY THIS

NO AUDIO OUTPUT

Check your wiring connections. The DB-9 connector is usually reliable, but the pins can sometimes seem locked into the connector and not be making a good contact. See if the LEVEL CHECK LED (on the PC board) is glowing. Make sure the INPUT LEVEL control (on the PC board) is properly adjusted.

MISSING TONES  
NO DETECT LED

Be sure the LEVEL CHECK LED is glowing green all the time during programming. It should flash red on program peaks. Adjust INPUT LEVEL control until this condition is observed. Be sure 25 Hz and 35 Hz tones are on the program audio being sent to the unit.

MISSING TONES  
DETECT LED LIGHTS

See above. Be sure the DETECT LED is staying ON for the entire duration of the tone. If it blinks off at any time, the tone level is right at the detection threshold. Increase the 25 Hz SENSE or 35 Hz SENSE controls one turn at a time clockwise (1 dB per turn) until a solid indication is given by the DETECT LED, then one more.

FALSE TRIGGERING

Input levels are too high or program audio is not properly highpass filtered at the source. Adjust the INPUT LEVEL control counterclockwise until the LEVEL CHECK LED is green most of the time with frequent red flashes. Output level should be approximately 0 dBm into 600 ohms. If levels are OK then adjust 25 Hz SENSE or 35 Hz SENSE one turn counterclockwise until false triggering stops. This may cause detection problems if the network audio is not properly filtered at the source. Reducing detector sensitivity can only correct for very high tone levels.

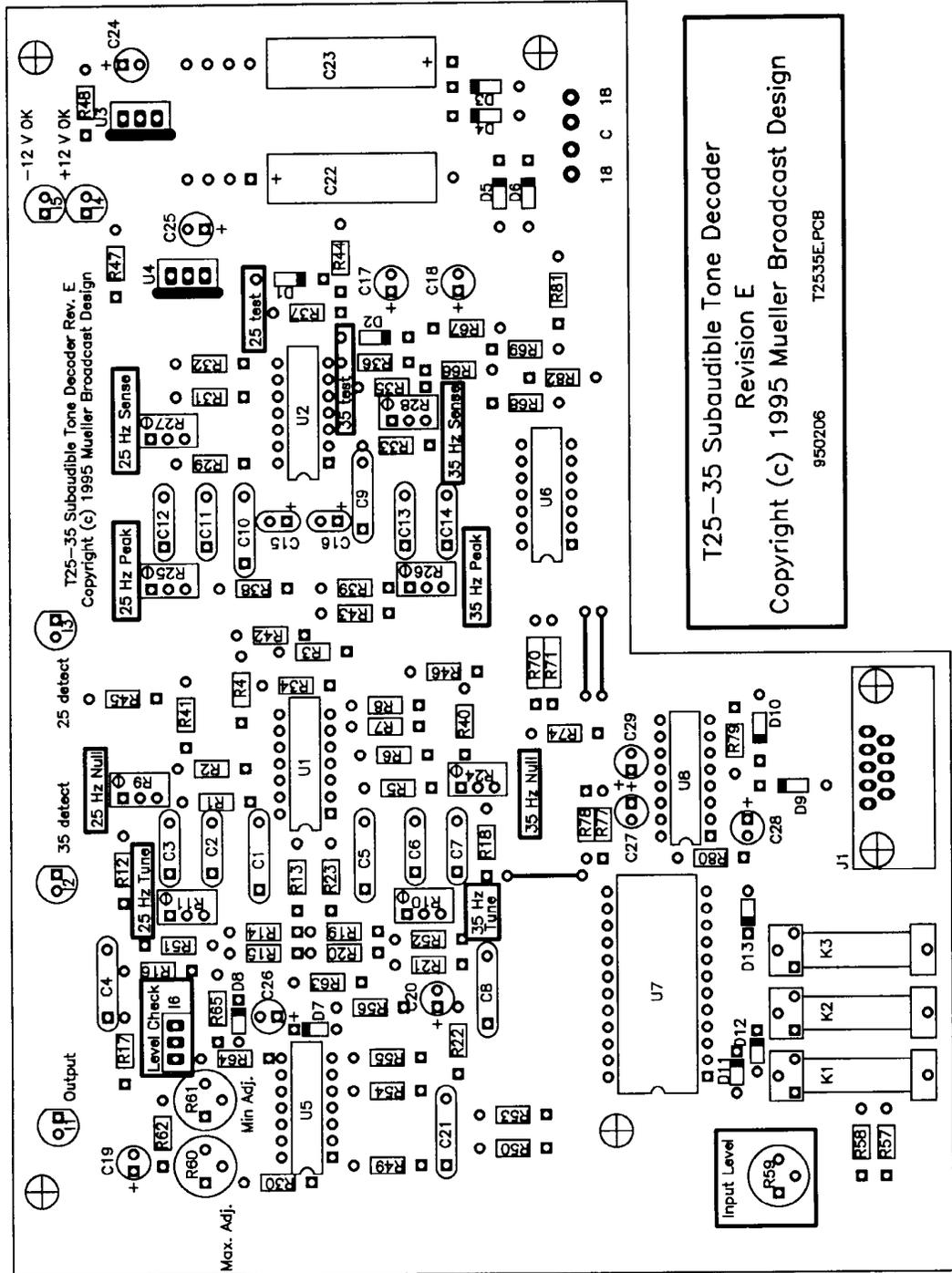
POOR REJECTION

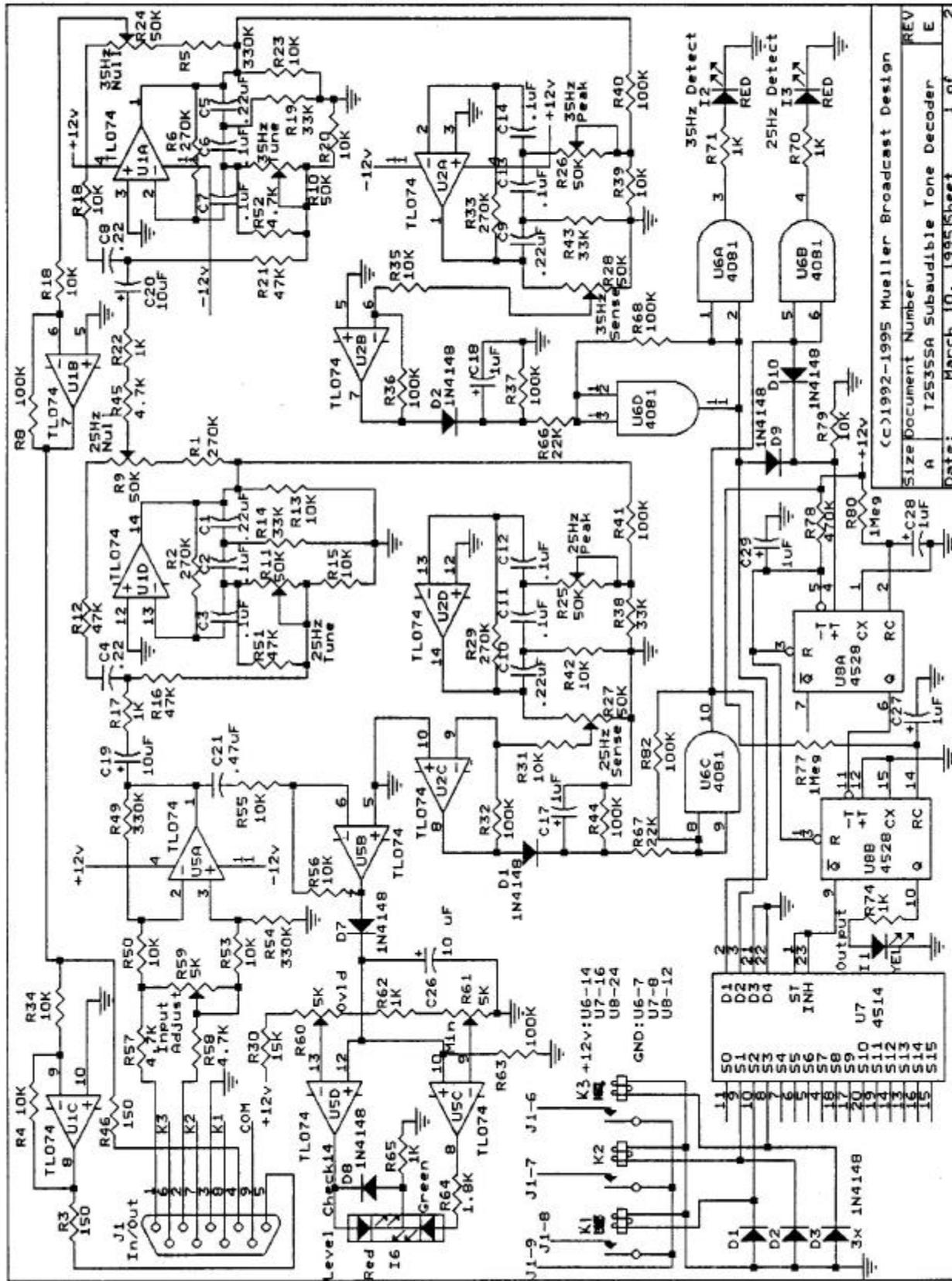
This is caused by the network tones being off frequency with respect to the T2535. If you can, measure the frequency of the tones being sent by the network and then align the unit to these frequencies. Normal tone rejection is -20 dB or better. DO NOT ADJUST THE DETECTOR TUNING UNLESS YOU ARE EXPERIENCING LITTLE OR NO TONE REJECTION AT THE OUTPUT.

## **SPECIFICATIONS**

INPUT LEVEL:	-20 to +10 dBm
INPUT IMPEDANCE:	9.4 to 14.4 KOhms, depending on setting of input level control
OUTPUT LEVEL:	0 dBm (600 ohms) nominal, balanced
OUTPUT IMPEDANCE:	150 ohms (unbalanced) 300 ohms (balanced)
OUTPUT CLIP LEVEL:	+24 dBm, 600 ohm load
FREQUENCY RESPONSE:	50 Hz - 50 KHz +/- 1 dB
DISTORTION:	less than 0.05% THD (50 Hz - 15 KHz)
HUM AND NOISE:	-80 dB or better, 50 - 15 KHz
SUBAUDIBLE TONE REJECTION:	-20 dB or better, depending on tone frequency accuracy
MINIMUM TONE DETECT LEVEL:	-25 dB from "0 VU" program level
MINIMUM TIME FOR TONE DETECT:	100 milliseconds at -15 dB tone level
MINIMUM TIME FOR TONE DECODE:	250 milliseconds for relay closure
POWER SUPPLY:	120 Volts AC, 60 Hz, 10 watts

[Specifications subject to change without notice.]

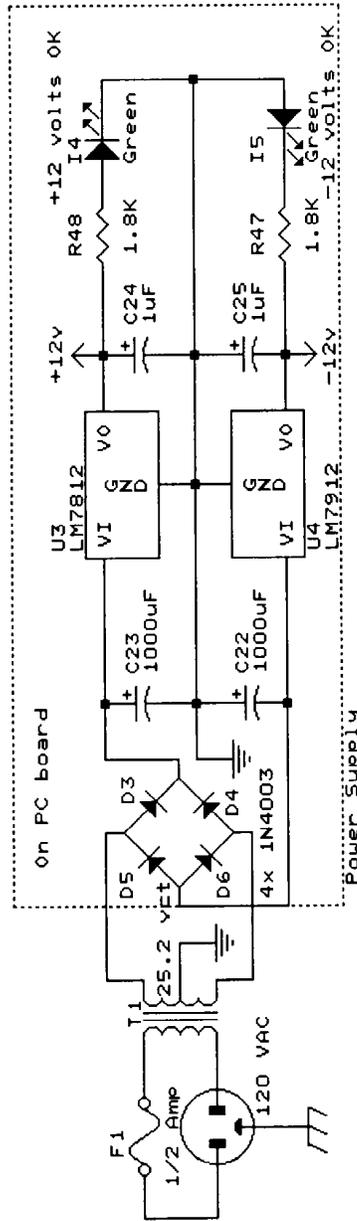




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 Date: March 10, 1995 Sheet 1 of 2

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613 S. LaGrange Rd  
LaGrange, IL 60525



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Size	Document Number
A	T2535 Power Supply & Case
Date:	February 23, 1995
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