MAINTENANCE MANUAL
TONE INTERFACE MODULE
19D902546G1

TABLE OF CONTENTS

SPECIFICATIONS

Tables 1 through 4 depict the specifications of the Tone Interface Module as follows:

- Table 1 outlines the general specifications.
- Table 2 outlines the power drain specifications.
- Table 3 outlines the P1 connector interface.
- Table 4 outlines the jumper definition and default configurations.
- Tables 1 through 4 depict the specifications as it relates to the actual operation as part of the EDACS™ Simulcast System.

Table 1 - General Specifications

ITEM	SPECIFICATION
INPUT VOLTAGE	+5 VOLTS ± 10%
TEMPERATURE	0 TO +60 DEGREES C
DIMENSION	8.0 (L) BY 4.0 (W) IN
WEIGHT	10 OUNCES
DIGITAL/DATA TYPE	TTL

(Continued)

ERICSSON

Ericsson Inc.
Private Radio Systems
Mountain View Road
Lynchburg, Virginia 24502
1-800-528-7711 (Outside USA, 804-528-7711)

Printed in U.S.A.

SPECIFICATIONS

(Continued)

Table 2 - Power Specification

VOLTAGE	CONNECTOR POINT	TOLERANCE ±%	CURRENT DRAIN TYPICAL mA	CURRENT DRAIN MAXIMUM mA	CURRENT DRAIN STANDBY mA
+5	P1-A1 P1-C1 P1-A32 P1-C32	10	100	150	NA

Table 3 - Connector P1 Definition

CONNECTOR PIN	SIGNAL NAME	INPUT/ OUTPUT	ANALOG/ DIGITAL	LEVEL DIGITAL DC-VOLT AC-VRMS
P1-A1	5V	I/O	D	+5 V
P1-C1	5V	I/O	D	+5 V
P1-A2	GND	I/O	D	0 V
P1-C2	GND	I/O	D	0 V
P1-A3	300 HZ M IN T	I	A	-10 DBM
P1-C3	300 HZ M IN R	I	A	-10 DBM
P1-A4	2400 HZ M IN T	I	A	-10 DBM
P1-C4	2400 HZ M IN R	I	A	-10 DBM
P1-A12	300 HZ M T	I	D	RS-232C
P1-C12	300 HZ M R	I/O	D	0 V
P1-A14	2400 HZ M T	I	D	RS-232C
P1-C14	2400 HZ M R	I/O	D	0 V
P1-A16	300 HZ M OUT T	O	A	-10 DBM
P1-C16	300 HZ M OUT R	O	A	-10 DBM
P1-A18	2400 HZ M OUT T	O	A	-10 DBM
P1-C18	2400 HZ M OUT R	O	A	-10 DBM
P1-C20	GND	I/O	D	0 V
P1-A21	300 OUT	O	D	TTL
P1-C21	GND	I/O	D	0 V
P1-A22	2400 OUT	O	D	TTL
P1-C22	GND	I/O	D	0 V
P1-A30	TONE ALARM	O	D	TTL
P1-A31	GND	I/O	D	0 V
P1-C31	GND	I/O	D	0 V
P1-A32	5V	I/O	D	5 V
P1-C32	5V	I/O	D	5 V

SPECIFICATIONS

(Continued)

Table 4 - Jumper Definition And Configuration

JUMPER	SHORTING PLUG	POSITION	DESCRIPTION
JP1	PP1	2 & 3	CB 300 DETECT
JP2	PP2	2 & 3	CB 2400 DETECT
JP3	PP3	1 & 2 2 & 3	300 Hz NORMAL 300 Hz INVERTED
JP4	PP4	1 & 2 2 & 3	2400 Hz NORMAL 2400 Hz INVERTED

DESCRIPTION

The Tone Interface Module used at the transmit sites in the **EDAC®** Simulcast System provides the detection and filtering of the 2400 Hz frequency reference tone and the 300 Hz timing tone between the Universal Sync Module and the channel multiplexer (mux). The Tone Interface Module is physically located in the universal sync unit assembly at the transmit site. It resides in slot 4 (J4). At the control point, the 300 Hz timing tone and the 2400 Hz frequency reference tone originate in the master Universal Sync Module located in slot 5 of the Universal Sync Assembly. The Multitone Interface Module filters the signals to produce a smoothed sine wave for transmission. The circuit over which the 2400 Hz tone is transmitted between the control point and the transmit site must have a signal-to-noise ratio greater than 50 dB in order to keep the phase jitter within the system specifications. Therefore, a program channel is normally required to each site.

At the transmit site, the 2400 Hz and the 300 Hz tones are sent through a limiter on the Tone Interface Module, and sent to the master Universal Module which produces the master 9600 Hz clock. An alarm is generated by the Tone Interface Module if either the 2400 Hz or 300 Hz tones are missing

CIRCUIT AND FUNCTIONAL DESCRIPTION

The Tone Interface Module of the simulcast system is used to perform the filtering and detection of the 300 Hz and 2400 Hz tones used for synchronizing the 9600 baud data. The Tone Interface Module is located in slot 4 (J4) of the universal sync unit assembly of the simulcast system. It is used only at the transmit site.

The Tone Interface Module is used to limit (U1) the 300 Hz and 2400 Hz tones from the channel multiplexer. The squarewaves are sent to the Universal Sync Module in order to recreate the 9600 Hz data sampling clock and to provide the time sync function. A dual monostable multivibrator (U4) is used to detect the presence of the 300 Hz and 2400 Hz tones/squarewaves. An **OR** gate (U6A) is used to provide an alarm output if either tone is removed.

A general block diagram of the Tone Interface Module is shown in Figure 1.

CONNECTORS AND SYSTEM INTERFACE

There are three connectors on the Tone Interface Module. Connector P1 is used to mate the Tone Interface Module to the universal sync unit assembly. The Tone Interface Module plugs into slot 4 (J4) of the universal sync unit. A description of the various signals, data, and clocks used between the Tone Interface Module and the universal sync unit is summarized in Table 3.

Connectors JP1 or JP2 are used to configure the detection circuitry for 300 Hz and 2400 Hz tones and JP3/JP4 are used to select the polarity of the 300/2400 output signals. Table 4 depicts the jumper definition.

TONE INTERFACE MODULE

300 HZ M IN T/ 300 HZ M IN R (Pin 3A, 3C) and 2400 HZ M IN T/ 2400 HZ M IN R (Pin 4A, 4C) tones are received from the multiplexer at the transmit site, are transformer (T1, T2) coupled, filtered and limited (U1A,U1B) to produce the time sync and frequency sync tones [300 IN (Pin 21A), 2400 IN (Pin 22A)].

TONEALARM is a TTL output from the Tone Interface Module to the Subsystem Alarm Module of the universal sync assembly. It is used to indicate the absence of the 300 Hz or 2400 Hz tone

POWER DISTRIBUTION AND FILTERING

The +5 volt power supply used by the Tone Interface Module is derived from the simulcast power supplies (+5). The +5 volt power input is used to power all active components on the Tone Interface Module. The active components include operational amplifier U1, RS-232C receiver, U2, inverter, U3, one shot, U4, and **NAND** gate, U6. A power bypass capacitor, C2, is used on the Tone Interface Module to filter any power noise transients or spikes from affecting circuit operation and module performance.

TONE LIMITING/DETECTION FROM CHANNEL MULTIPLEXER

The 300 Hz and 2400 Hz tones are received from the channel multiplexer at the transmit site. 300 HZ M IN T, 300 HZ M IN R, 2400 HZ M IN T, 2400 HZ M IN R, (P1-A3, C3, A4, C4). The tone limiter function is performed by operational amplifier U1 and inverter, U3. The 300 Hz tone enters transformer T1 as a sine wave. The secondary side of T1 is input to operational amplifier U1A. Diode CR1 serves the function of a hard limiter to prevent negative voltage excursions below ground. Resistor R1 provides the nominal 600 ohm line terminating impedance. The RC network of R2 and C1 provide a high frequency noise rolloff to noise components in the received channel multiplexer tone audio. The rollover frequency is located at 1600 Hz. Operational amplifier U1 is operating in an open loop configuration as a hard limiter (comparator). Operational amplifier U1, thereby converts the 300 Hz sine wave to a 300 Hz squarewave. Capacitor C3 stabilizes the amplifier output. Schmitt Inverter U3B buffers the 300 Hz squarewave to the Universal Sync Module. Schmitt Inverter U3A buffers the 300 Hz squarewave to the alarm circuitry.

The 2400 Hz tone enters transformer T2 as a sine wave. The secondary side of T2 is input to operational amplifier U1B. Diode CR2 serves the function of a hard limiter to prevent negative voltage excursions below ground. Resistor R3 provides the nominal 600 ohm line terminating impedance. The RC network of R4 and C4 provide a high frequency noise rolloff to noise components in the received channel multiplexer tone audio. The rollover frequency is located at 1600 Hz. Operational amplifier U1 is operating in an open loop configuration as a hard limiter (comparator). Operational amplifier U1, thereby converts the 2400 Hz sine wave to a 2400 Hz squarewave. Capacitor C3 stabilizes the amplifier output. Schmitt Inverter U3D buffers the 2400 Hz squarewave to the Universal Sync Module. Schmitt Inverter U3C buffers the 2400 Hz squarewave to the alarm circuitry.

ALARM GENERATION

The alarm generation circuitry consists of RS-232C receiver, U2, inverter, U3, jumpers JP1 and JP2, one-shot, U4, and **NAND** gate, U6. The 300 Hz and 2400 Hz squarewaves enter RS-232C receivers, U2A and U2B. The outputs of the receivers are sent to jumpers JP1 and JP2 for selection. Jumpers JP1 and JP2 can be configured for control point squarewave detection or transmit site tone detection. The jumpered selected outputs are sent to one-shots U4A and U4B for 300 Hz and 2400 Hz detection, respectively. The dual one shot is a monostable, retriggerable one shot. As long as the tones are present at the "A" inputs, the "Q" outputs are set. If either the 300 Hz or 2400 Hz disappears for a predetermined time period (3 milliseconds), then the appropriate "Q" output is cleared. This will thereby generate an active high alarm output on the **NAND** gate, U6A, as **TONEALARM**.

MAINTENANCE

The Tone Interface Module has jumpers that must be configured for the nominal mode of operation (see Table 4).

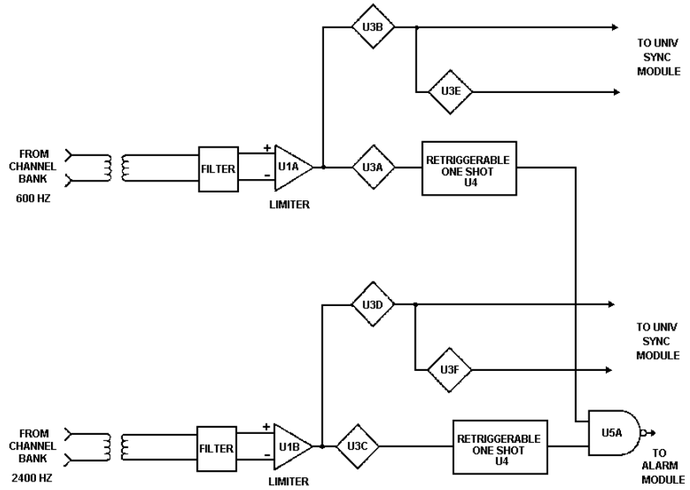


Figure 1 - Tone Interface Module Clock Diagram For 300 Hz And 2400 Hz Circuitry

TEST AND SERVICE

The equipment required to test the Tone Interface Module:

1. Extender Card
2. Tektronix R5223 Digital Storage Scope or equivalent
3. Triplett Model 630-PL Type 5 or equivalent
4. Test Cables as required
5. HP 8116 Pulse/Function Generator or equivalent

To test the Tone Interface Module:

1. Configure the jumpers for the desired mode of operation.
2. Install the Tone Interface Module as part of the operational simulcast system.
3. Verify the presence of +5 volt power (5V).
4. Transmit Site:
   a. Verify the presence of 300 HZ M IN T/R, 2400 HZ M IN T/R.
   b. Verify the presence of 300 IN and 2400 IN.
   c. Verify alarm detection by removing jumpers PP1 and PP2 alternatively.

TONE INTERFACE MODULE
19D902546G1
ISSUE 2

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C5	T644CP310K	Polyester: .010 µF ±10%. 50 VDCW.
C6 and C7	19A701534P3	Tantalum: 0.47 µF ±20%, 35 VDCW.
C8 and C9	162B3688P422K	Ceramic: 0.22 µF ±10%, 50 VDCW; sim to Erie 8131-M050-W5R-224K.
C10 and C11	19A701534P7	Tantalum: 10 µF ±20%, 16 VDCW.
C12 thru C14	T644ACP410K	Polyester: 0.1 µF ±10%, 50 VDCW.
C15 and C16	19A703314P1	Electrolytic: 100 µF -10 +50%,10 VDCW; sim to Panasonic LS Series.
C17 and C18	19A701534P1	Tanatalum: 10µF ±20%, 16 VDCW.
		- - - - - - - - - - JACKS - - - - - - - - - -
J1 thru J4	19A7048552P2	Connector: 3 Pin Male Header.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19A701865P173	Coil. RF.
L2	19A701885P161	Coil. RF.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	19B801587P1	Connector: Right Angle, 64 Male Contacts; sim to AMP 532505-2.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19A701250P176	Metal film: 604 ohms ±1%, 2/4 w.
R2		H212CRP310C
		Deposited carbon: 10k ohms ±5%, 1/4 w.
R3	19A701250P176	Metal film: 604 ohms ±1%, 1/4 w.
R4	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
*R5	H212CRP347C	Deposited carbon: 47K ohms ±5%, 1/4 w.
R6	H212CRP247C	Deposited carbon: 4.7K ohms ±5%, 1/4 w.
R7	H212CRP322C	Deposited carbon: 22K ohms ±5%, 1/4 w.
R8 and R9	H212CRP210C	Deposited carbon: 22K ohms ±5%, 1/4 w.
R10 and R11	19A701250P176	Metal film: 604 ohms ±1%, 1/4 w.
R12 and R13	19A701250P301	Metal film: 10K ohms ±1%, 1/4 w
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T1 thru T4	344A3074P1	Transformer.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

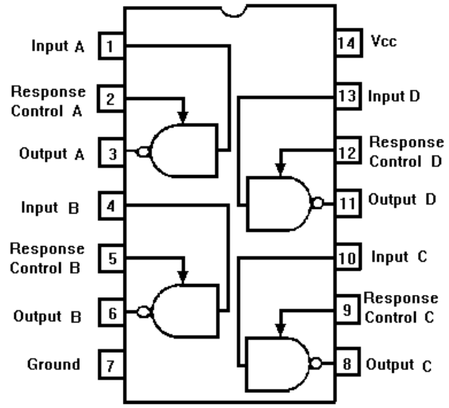
SYMBOL	PART NO.	DESCRIPTION
P1	19A701422P1	Cotter Pin.
		- - - - - - INTEGRATED CIRCUITS - - - - - -
U1	19A701789P2	Linear: Dual Op Amp; sim to LM358.
U2	19A116704P2	Digital: Quad Line Receiver; sim to 1489.
U3	19A700037P313	Digital: Hex Schmitt-Trigger Inverter; sim to 74LS14.
U4	19A700037P354	Digital: Dual Retriggerable Monostable; sim to 74LS123.
U5	19A700037P302	Digital: Quad 2-Input NAND gate with OC outputs; sim to 74LS01.
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	VER-0210243G	Card Handle.

PRODUCTION CHANGES

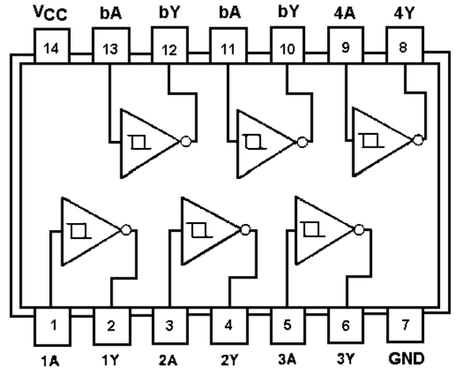
Changes in the equipment to improve or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - TONE INTERFACE MODULE
To eliminate relay chatter on some units. R5 was 22k ohms (H212CRP322C).

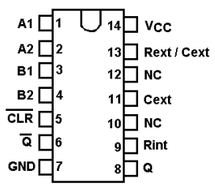
RS-232 RECEIVER U2
MC1489AN



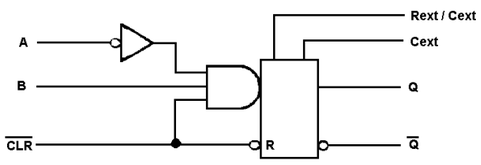
HEX INVERTER U3
SN74LS14N



ONE SHOT MULTIVIBRATOR U4
SN74LS123N



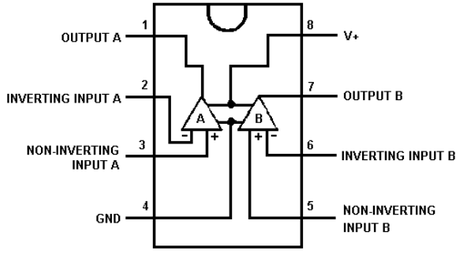
logic diagram (each multivibrator)



FUNCTION TABLE

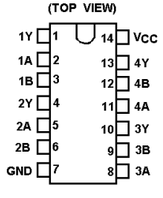
INPUTS			OUTPUTS	
CLEAR	A	B	Q	$\overline{Q}$
L	X	X	L	H
X	H	X	L†	H†
X	X	L	L†	H†
H	L	↑	⊓	⊔
H	↓	H	⊓	⊔
↑	L	H	⊓	⊔

OPERATIONAL AMPLIFIER U1
LM3558

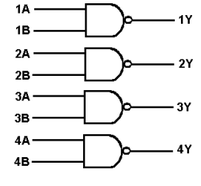


NAND U5
MC74LS01N

(TOP VIEW)



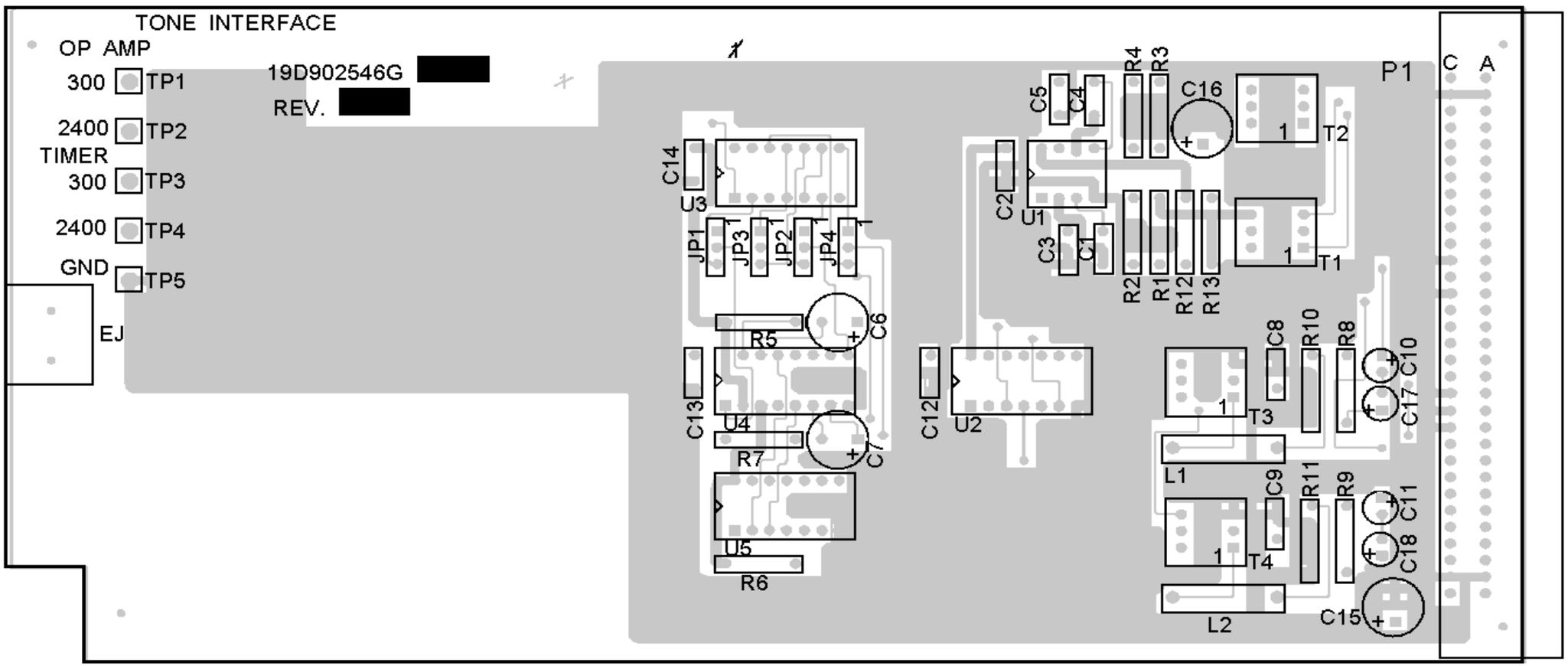
logic diagram (positive logic)



positive logic: $Y = \overline{A \cdot B}$ or $Y = \overline{A} + \overline{B}$

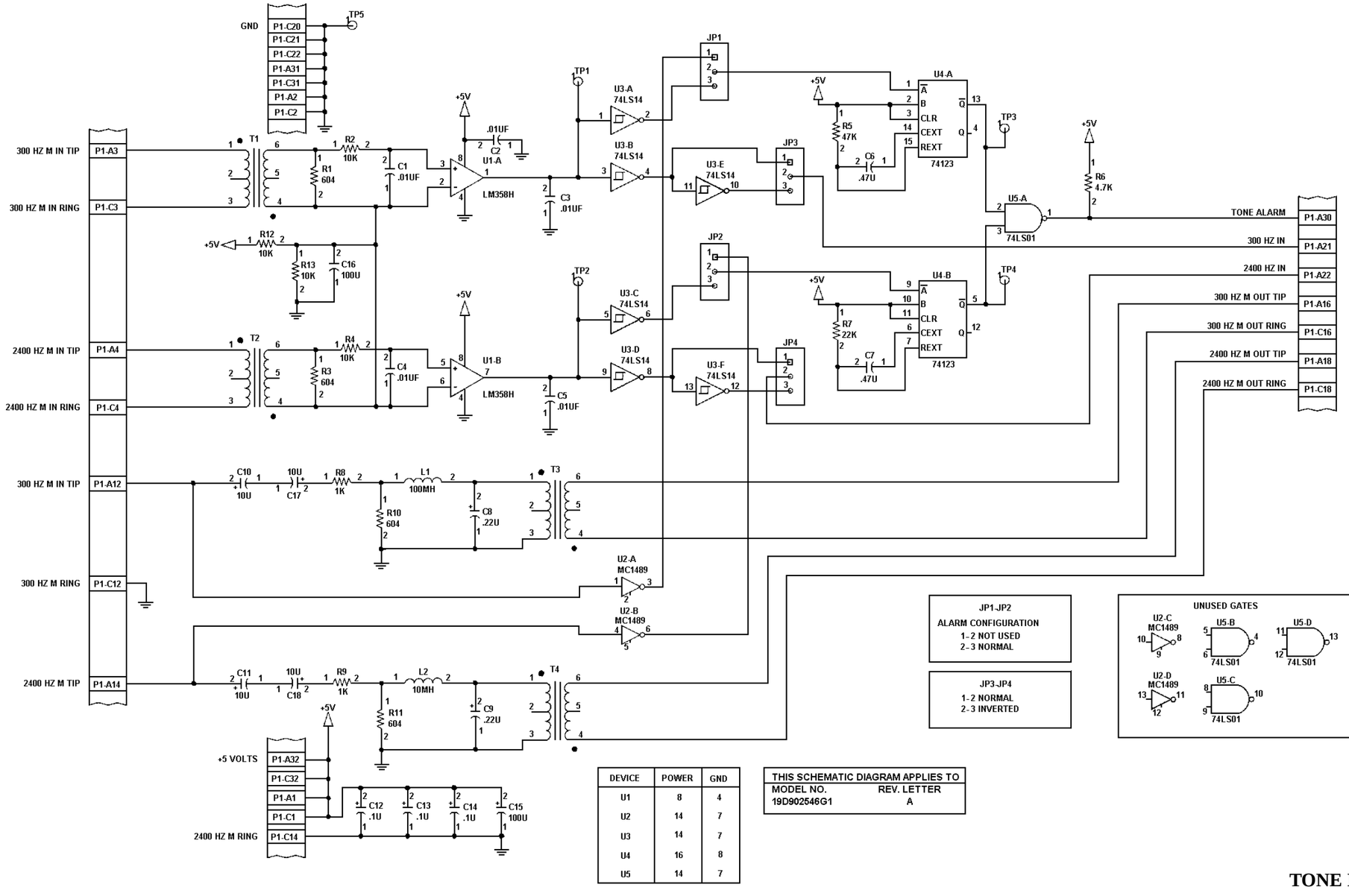
INPUTS		OUTPUTS
A	B	Y
H	H	L
L	X	H
X	L	H

COMPONENT SIDE



(19D902545, Rev. 1)
(19D902545, Component side, Rev. 1)

TONE INTERFACE BOARD
19D902546G1



DEVICE	POWER	GND
U1	8	4
U2	14	7
U3	14	7
U4	16	8
U5	14	7

THIS SCHEMATIC DIAGRAM APPLIES TO	
MODEL NO.	REV. LETTER
19D902546G1	A

TONE INTERFACE BOARD
19D902546G1

(19D902891, Sh. 1, Rev. 3A)