MAINTENANCE MANUAL
MULTI TONE INTERFACE MODULE
19D902515G1

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DESCRIPTION

Multi-Tone Interface Module 19D902515G1 plugs into Analog Processor Shelf #2 19D902544G1 and provides four (4) 300/600 Hz Low Pass filters, four (4) 2400 Hz Low Pass filters and conversion of RS232 input voltage levels to TTL output voltage levels. An RS232C, 300 Hz square wave clock at 5 Vpp on the input of a 300 Hz filter will produce a 300 Hz sine wave at 0.42 Vpp (± 20%) and at less than 33% distortion on the output.

An RS232C, 9600 Hz square wave clock at 5 Vpp on the input of a 2400 Hz filter will produce a 2400 Hz sine wave at 0.72 Vpp (±20%) and at less than 24% distortion.

RS232 to TTL conversion levels for RS232-H (High), RS232-L (Low), TTL-H (High) and TTL-L (Low) are as follows:

RS232-H	10 to 12 Volts
RS232-L	-10 to -12 Volts
TTL-H	3 to 5 Volts
TTL-L	0 to 0.8 Volts

ERICSSON

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Private Radio Systems
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1-800-528-7711 (Outside USA, 804-528-7711)

Printed in U.S.A.

SPECIFICATIONS

The following tables summarize the specifications of the Multi Tone Interface board.

Table 1 - General Specifications

TEMPERATURE	-30°C - +60°C
HEIGHT	5.58" (Typical)
DEPTH	5.96" (Typical)
WIDTH	1.42" (Typical)
WEIGHT	10 Oz. (Typical)
VOLTAGE	+5 Vdc ± 10%
CURRENT	0.1 Ampere Maximum
DIGITAL LEVELS	TTL And RS-232
AUDIO LEVELS	0 dB Maximum
CLOCK RATES	9600 Hz 2400/4800 Hz 300/600 Hz

Table 2 - Power And Ground Connections

CONNECTOR PIN	SIGNAL NAME	VOLTAGE ± 5%	CURRENT AMPS MAX
P1-3 P1-4 P1-53 P1-54	GND	0	0.1
P1-1 P1-2 P1-55 P1-56	+5V	+5V	0.1

Table 3 - P1 Connector Definition

CONNECTOR PIN	SIGNAL NAME	INPUT/ OUTPUT	LEVEL AC-dBm DC-VOLTS
P1-1	+5V		+5V
P1-2	+5V		+5V
P1-3	GND		0
P1-4	GND		0
P1-5	300HZIN	I	RS-232C
P1-6	GND		0
P1-7	300HZOUTsa	O	RS-232C
P1-8	300HZOUTsb	O	RS-232C
P1-9	300HZOUTsc	O	RS-232C
P1-10	300HZOUTsd	O	RS-232C
P1-11	300HZDL-INa	I	RS-232C
P1-12	300HZDL-INb	I	RS-232C
P1-13	300HZDL-INc	I	RS-232C
P1-14	300HZDL-INd	I	RS-232C
P1-15	300MOUT-Ta	O	0 dB
P1-16	300MOUT-Ra	O	0 dB
P1-17	300MOUT-Tb	O	0 dB
P1-18	300MOUT-Rb	O	0 dB
P1-19	300MOUT-Tc	O	0 dB
P1-20	300MOUT-Rc	O	0 dB
P1-21	300MOUT-Td	O	0 dB
P1-22	300MOUT-Rd	O	0 dB
P1-23	GND		0
P1-24	9.6KINA	I	RS-232C
P1-25	9.6KINB	I	RS-232C
P1-26	9.6KINC	I	RS-232C
P1-27	9.6KIND	I	RS-232C
P1-28	GND		0
P1-29	2400MOUT-Ta	O	0 dB
P1-30	2400MOUT-Ra	O	0 dB
P1-31	2400MOUT-Tb	O	0 dB
P1-32	2400MOUT-Rb	O	0 dB
P1-33	2400MOUT-Tc	O	0 dB
P1-34	2400MOUT-Rc	O	0 dB
P1-35	2400MOUT-Td	O	0 dB
P1-36	2400MOUT-Rd	O	0 dB
P1-53	GND		0
P1-54	GND		0
P1-55	+5V		+5V
P1-56	+5V		+5V

CIRCUIT AND FUNCTIONAL DESCRIPTION

300 Hz TTL/RS-232 CONVERSION

A 300 Hz TTL signal is applied to the input **300HZIN** at P1-5. This input is further connected to the inputs of Maxim 232 Line Driver module (MAX 230) U5, Pins 4,5,14 and 15. Each input connects through a driver to an RS-232 output as follows:

Inputs	Outputs	
U5, Pin 2	300HZOUTa (300HZOUTsa)	P1-7
Pin 3	300HZOUTb (300HZOUTsb)	P1-8
Pin 1	300HZOUTc (300HZOUTsc)	P1-9
Pin 20	300HZOUTd (300HZOUTsd)	P1-10

300 Hz LOW PASS FILTERS

There are four RS-232, 300 Hz inputs to four low pass filter circuits. Each low pass filter passes 300 Hz and interfaces to a 2-wire line through a transformer as follows:

Inputs	Transformer	Outputs	
300HZDL-INa	T1	300MOUT-Ta	P1-14
		300MOUT-Ra	P1-16
300HZDL-INb	T2	300MOUT-Tb	P1-17
		300MOUT-Rb	P1-18
300HZDL-INc	T3	300MOUT-Tc	P1-19
		300MOUT-Rc	P1-20
300HZDL-INd	T4	300MOUT-Td	P1-21
		300MOUT-Rd	P1-22

2400 Hz CONVERSION

9600 Hz

There are four RS-232, 9600 Hz inputs to the Multi Tone Interface Module as follows:

P1, Pin 24 (9.6KINA)
P1, Pin 25 (9.6KINB)
P1, Pin 26 (9.6KINC)
P1, Pin 27 (9.6KIND)

Each of these inputs is connected to the input of an RS-232 Receiver (U1-A, Pin 1, U1-B, Pin 4, U1-C, Pin 10 and U1D, Pin 13 respectively). These receivers convert the RS-232 inputs to TTL levels at U1-A, Pin 3, U1-B, Pin 6, U1-C, Pin 8 and U1-D, Pin 11 respectively. The outputs from the RS-232 receivers are connected to the inputs of Schmitt trigger inverters at U6-A, Pin 1, U6-B, Pin 3, U6-C, Pin 5 and U6-D, Pin 9 respectively.

2400 Hz

The output of each inverter (U6-A, Pin 2, U6-B, Pin 4, U6-C, Pin 6 and U6-D, Pin 8 respectively) is connected to an input of counter circuits U2, Pins 1 and 13 and U3, Pins 1 and 13 respectively. Counter circuits U2 and U3 divide the 9600 Hz signal by 4 to produce 2400 Hz on outputs U2 and U3, Pins 4 and 10 respectively.

The 2400 Hz outputs from the counting circuits are connected to the inputs of RS-232 Line Driver U4, Pins 5, 4, 14 and 15 respectively. Each line driver converts the TTL input level back to an RS-232 output level at U4, Pins 2, 3, 1, and 20 respectively. Each of these outputs is connected to the input of a low pass filter

Each low pass filter passes 2400 Hz and interfaces to a 2-wire line through a transformer as follows:

Inputs	Transformer	Outputs	
2400HZA	T5	2400MOUT-Ta	P1-29
		2400MOUT-Ra	P1-30
2400HZB	T6	2400MOUT-Tb	P1-31
		2400MOUT-Rb	P1-32
2400HZC	T7	2400MOUT-Tc	P1-33
		2400MOUT-Tc	P1-34
2400HZD	T8	2400MOUT-Td	P1-35
		2400MOUT-Rd	P1-36

TEST AND SERVICE

TEST EQUIPMENT REQUIRED

The equipment required to test the Multi Tone Interface Module:

1. Tektronix 2430A/IR Digital Storage Scope or equivalent.
2. Audio/Digital Function generator, HP 3312A or equivalent.
3. Power Supply, Power Design Inc. TP325 or equivalent.
4. VOM, Fluke 8050A or equivalent.
5. Test Probe, EZ Ball or equivalent.
6. Test Resistor Load, Quantity of 8, 604 Ohm, 1%, 1/4 watt resistor.

STATIONARY TTL/RS-232 LEVEL CONVERSION TEST

The following Table 4 shows the stationary TTL/RS-232C level conversions to be verified. The term **"Stationary"** indicates that the level is to be injected or measured without the presence of an oscillating clock or data train. The following definitions are used to describe the levels.

TTL-H	3 to 5 Volts
TTL-L	0 to 0.8 Volts
RS232-H	10 to 12 Volts
RS232-L	-10 to -12 Volts

Table 4 - Stationary Level Test

INPUT POINT	INPUT LEVEL	OUTPUT POINT	OUTPUT LEVEL
J1-5	TTL-H	P1-7	RS232-L
		P1-8	RS232-L
		P1-9	RS232-L
		P1-10	RS232-L
	TTL-L	P1-7	RS232-H
		P1-8	RS232-H
		P1-9	RS232-H
		P1-10	RS232-H

300 Hz FILTER TEST

The following test verifies the operation of a 300 Hz low pass filter.

1. Connect a 604 ohm load resistor across the output of the filter in question.

   Example: P1-15 (300MOUT-Ta) and P1-16 (300MOUT-Ra).

2. Apply an RS-232C squarewave clock at 300 Hz (5 Vpp) on the input of the filter in question.

   Example: P1-11 (300HZDL-IN5).

3. Using the scope, measure across the output for a 300 Hz sine wave at 0.42 Vpp ± 20% and at less than 33% distortion.

2400 HZ FILTER TEST

The following test verifies the operation of a 2400Hz low pass filter.

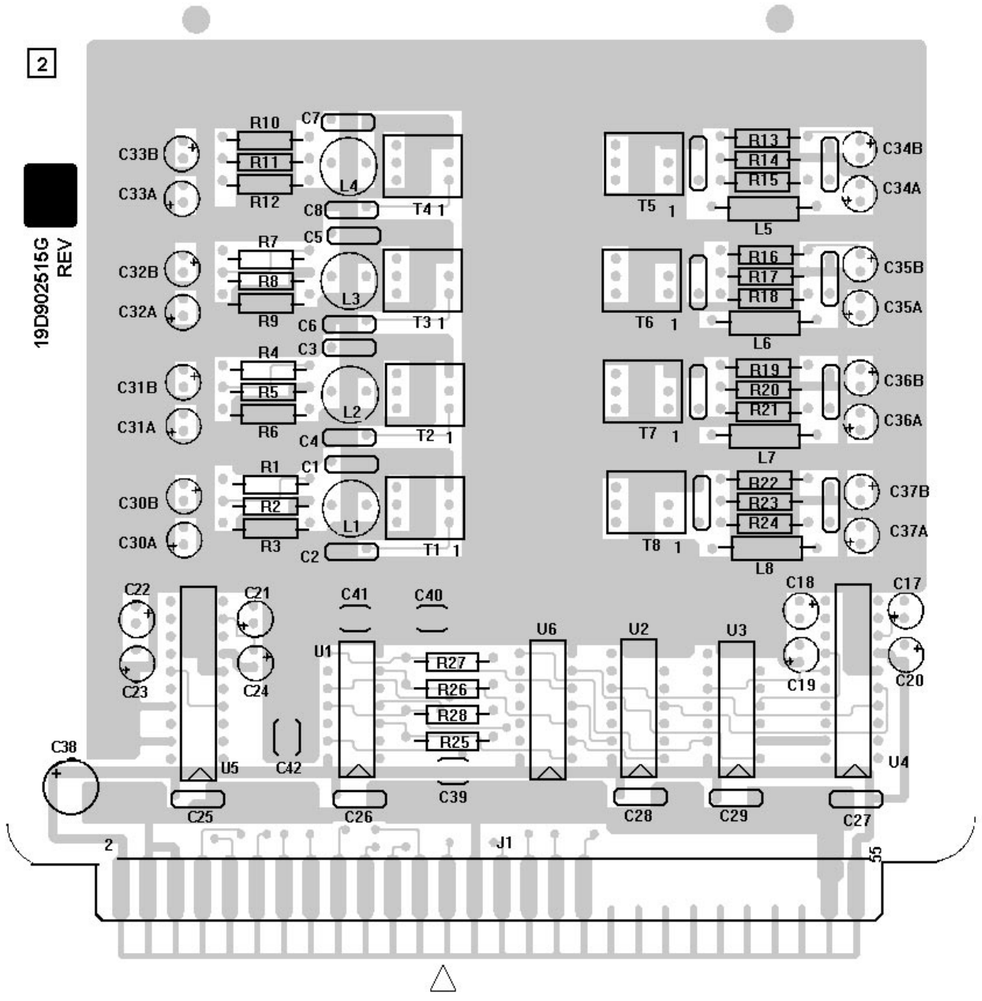
1. Connect a 604 ohm load resistor across the output of the filter in question.

   Example: P1-29 (2400MOUT-Ta) and P1-30 (2400MOUT-Ra).

2. Apply an RS-232C squarewave clock at 9600 Hz (5 Vpp) on the input of the filter in question.

   Example: P1-24 (2400HZMDL-IN5).

3. Using the scope, measure across the output for a 2400 Hz sine wave at 0.72 Vpp ± 20% and at less than 24% distortion.



(19D902515, Rev. 9)
(19D902514, Component Side Marking, Rev. 2)
(19D902514, Component Side, Rev. 1)

MULTI TONE INTERFACE MODULE

19D902515G1

MULTI TONE INTERFACE
19D902515G1
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A700004P7	Polyester: 0.68 uF ± 10%, 40 VDCW.
C2	162B3688P422K	Ceramic: .47 uF ±10%, 50 VDCW.
C2A	19A701534P7	Tantalum: 10 uF ±10%, 16 VDCW.
C3	19A700004P7	Polyester: 0.68 uF ± 10%, 40 VDCW.
C4	162B3688P422K	Ceramic: .47 uF ±10%, 50 VDCW.
C5	19A700004P7	Polyester: 0.68 uF ± 10%, 40 VDCW.
C6	162B3688P422K	Ceramic: .47 uF ±10%, 50 VDCW.
C7	19A700004P7	Polyester: 0.68 uF ± 10%, 40 VDCW.
C8	162B3688P422K	Ceramic: .47 uF ±10%, 50 VDCW.
C9	T644ACP322K	Ceramic: .022 uF ±10%, 50 VDCW.
C10	162B3688P422K	Ceramic: .47 uF ±10%, 50 VDCW.
C11	T644ACP322K	Ceramic: .022 uF ±10%, 50 VDCW.
C12	162B3688P422K	Ceramic: .47 uF ±10%, 50 VDCW.
C13	T644ACP322K	Ceramic: .022 uF ±10%, 50 VDCW.
C14	162B3688P422K	Ceramic: .47 uF ±10%, 50 VDCW.
C15	T644ACP322K	Ceramic: .022 uF ±10%, 50 VDCW.
C16	162B3688P422K	Ceramic: .47 uF ±10%, 50 VDCW.
C17 thru C24	199D109X9016CA1	Tantalum: 10 uF ±10%, 16 VDCW.
C25 thru C29	162B3688P410K	Ceramic: .1 uF ±10%, 50 VDCW.
C30 thru C37	19A701534P7	Tantalum: 10 uF ±10%, 16 VDCW.
C38	99A703314P1	Capacitor: 100 uF.
C39 thru C42	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1 thru L4	35F2211	Inductor: 100 mH, ±20%.
L5 thru L8	35F2205	Inductor: 10 mH, ±20%.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	H212CRP210C	Carbon film: 1K ohms ±5%, .25 w.
R2	19A701250P176	Metal film: 604 ohms ±1%, .25 w.
R3	CF-.25-100-5%	Carbon film: 100 ohms ±5%, 25 w.
R4	H212CRP210C	Carbon film: 1K ohms ±5%, .25 w.
R5	701250P176	Metal film: 604 ohms ±1%, .25 w.
R6	CF-.25-100-5%	Carbon film: 100 ohms ±5%, 25 w.
R7	H212CRP210C	Carbon film: 1K ohms ±5%, .25 w.
R8	701250P176	Metal film: 604 ohms ±1%, .25 w.
R9	CF-.25-100-5%	Carbon film: 100 ohms ±5%, 25 w.
R10	H212CRP210C	Carbon film: 1K ohms ±5%, .25 w.
R11	701250P176	Metal film: 604 ohms ±1%, .25 w.
R12	CF-.25-100-5%	Carbon film: 100 ohms ±5%, 25 w.
R13	H212CRP210C	Carbon film: 1K ohms ±5%, .25 w.
R14	701250P176	Metal film: 604 ohms ±1%, .25 w.
R15	CF-.25-100-5%	Carbon film: 100 ohms ±5%, 25 w.
R16	H212CRP210C	Carbon film: 1K ohms ±5%, .25 w.
R17	701250P176	Metal film: 604 ohms ±1%, .25 w.
R18	CF-.25-100-5%	Carbon film: 100 ohms ±5%, 25 w.
R19	H212CRP210C	Carbon film: 1K ohms ±5%, .25 w.
R20	701250P176	Metal film: 604 ohms ±1%, .25 w.
R21	CF-.25-100-5%	Carbon film: 100 ohms ±5%, 25 w.
R22	H212CRP210C	Carbon film: 1K ohms ±5%, .25 w.
R23	701250P176	Metal film: 604 ohms ±1%, .25 w.
R24	CF-.25-100-5%	Carbon film: 100 ohms ±5%, 25 w.
		- - - - - - - - - - TRANSFORMER - - - - - - - - - -
T1 thru T8	FM34-M	Transformer, 600 ct.
		- - - - - - - - - INTEGRATED CIRCUIT- - - - - - - -
U1	MC1489AN	Linear, Receiver, 14 pins.
U2 and U3	SN74LS393N	LSTTL, Counter, 14 pins.
U4 and U5	MAX230CPE	Integrated Circuit.
U6	74LS14	Integrated Circuit.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
18	TELLAB#10.0900	Panel, front.
19	N80P9005B6	Screw: No. 4-40.
23	A7141225P2	Nut: No. 4.
24	N404P11B6	Lockwasher: No. 4.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

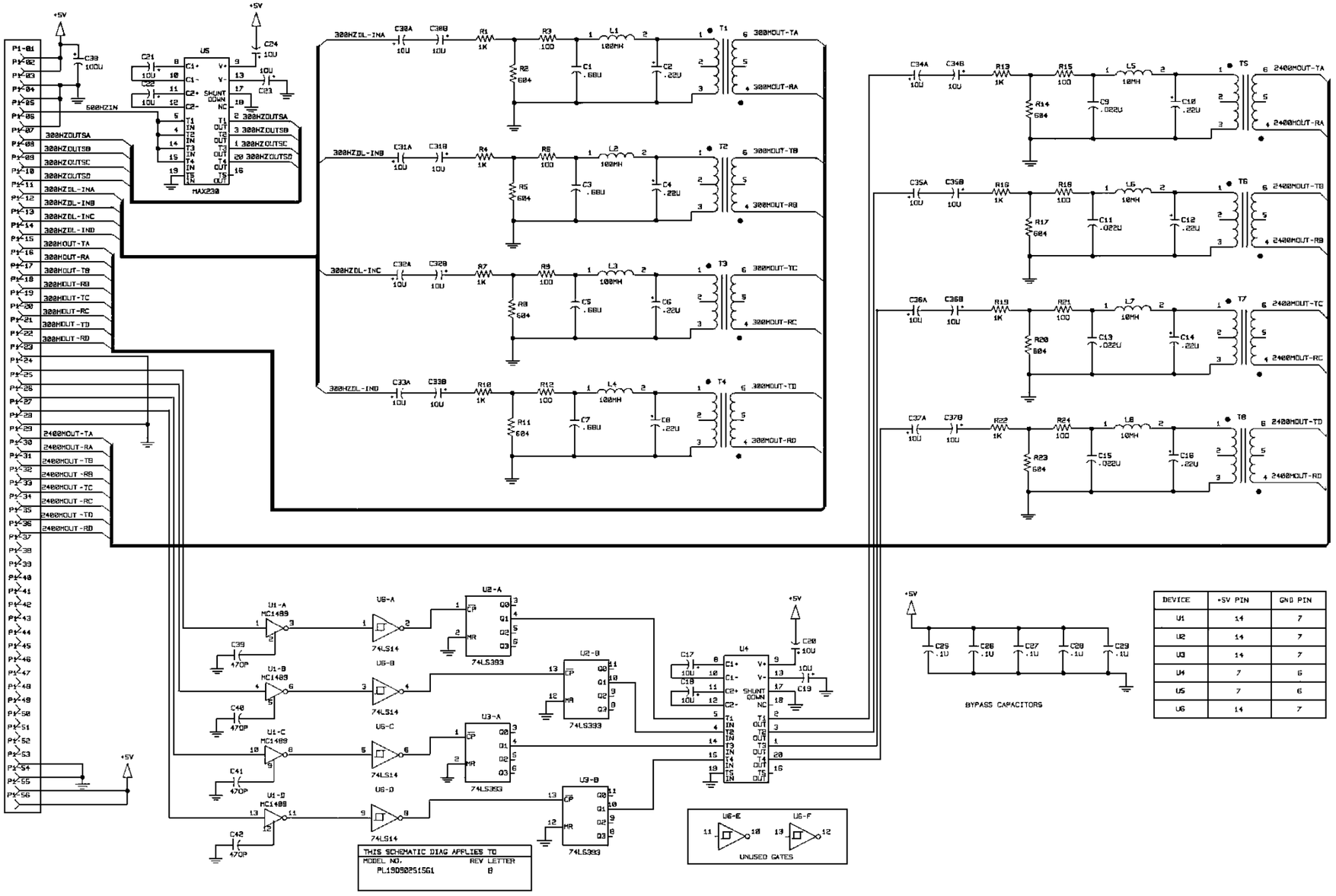
Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for the dewscriptions of parts affected by these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

REV. A - MULTITONE INTERFACE MODULE 19D902515G1
To improve operation changed the value of R25 through R28 from 1k ohm to 470 ohms and added C39 through C42. The added parts are:

C39 - 19A700233P1, Ceramic: 100 pF ±20%, 50VDCW.
thru
C42

REV. B - To improve zero crossing stability of 300 Hz and 2400 Hz reference signals deleted R25 through R28 and changed C39 through C42.

REV. C - To improve low frequency data response and system tolerance to group delay. C1, C3, C5 and C7 changed.

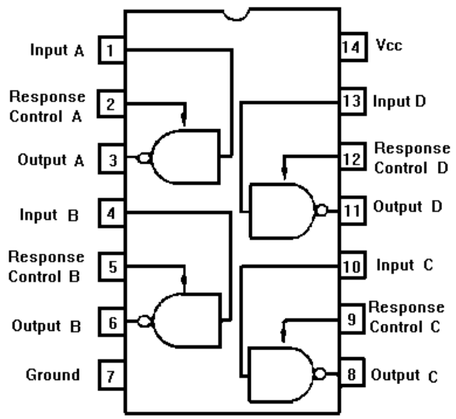


DEVICE	+5V PIN	GND PIN
U1	14	7
U2	14	7
U3	14	7
U4	7	6
U5	7	6
U6	14	7

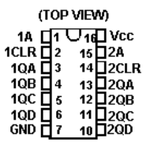
MULTI TONE INTERFACE MODULE

19D902515G1
(19D902890, Sh. 1, Rev. 4)

RS-232 RECEIVER U1
MC1489AN

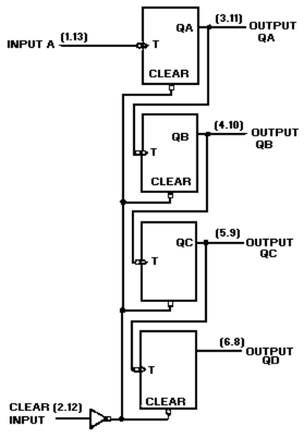


LSTTL COUNTER U2, U3
SN74LS393N

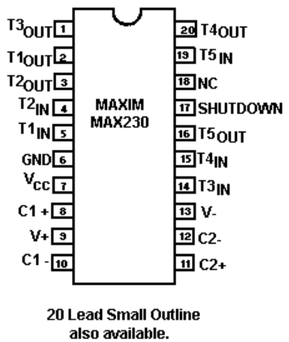


COUNT SEQUENCE
(EACH COUNTER)

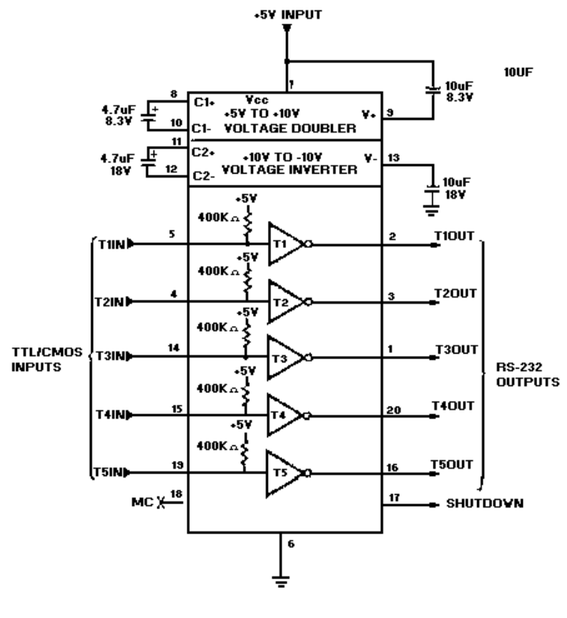
COUNT	OUTPUT Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H



RS-232 LINE DRIVERS U4, U5
MAX230



20 Lead Small Outline
also available.



HEX SCHMITT TRIGGER INVERTER
74LS14 U6