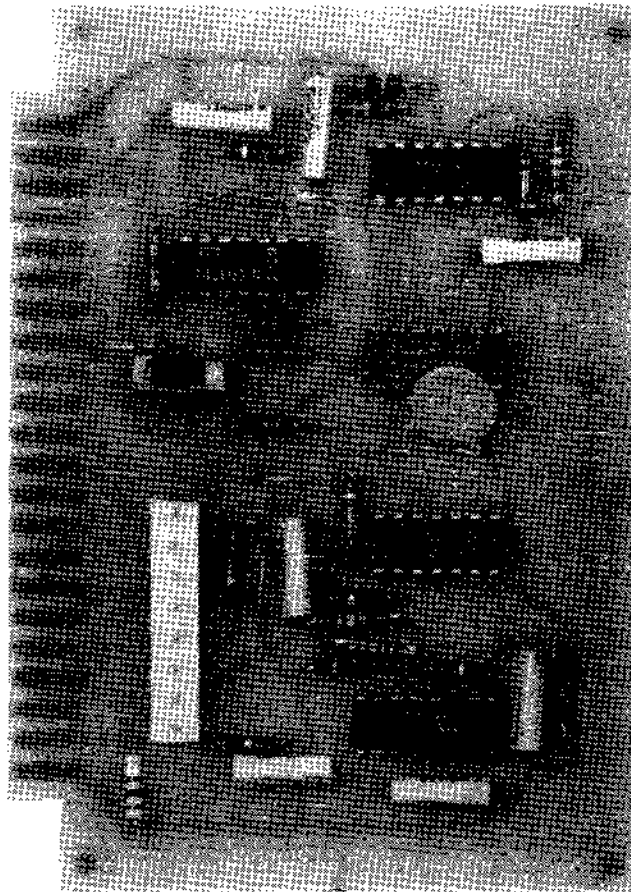


USER'S MANUAL

for the

CASSETTE INTERFACE KIT



SD SALES COMPANY

P.O. BOX 28810 • DALLAS, TEXAS 75228

STATEMENT OF LIMITED WARRANTY

If this kit does not function properly upon your completion of assembly, it may be returned to S.D. Sales for inspection and evaluation by our Engineering Department.

If the cause of mal or non-function is due to defective parts there will be no charge. If the cause is due to soldering, assembling, etc. of the kit, the charge for inspection, evaluation, and repair will not exceed 35% of the purchase price without your approval.

This warranty is made in lieu of all other warranties expressed or implied and is limited in any case to the repair or replacement of the module involved.



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INFORMATION FOR CASSETTE INTERFACE KIT

The cassette interface board is designed to interface a micro-processor with a cassette tape recorder so that serial digital data generated by the microprocessor can be stored on tape using an audio cassette recorder. The interface also allows the reverse operation of transferring the data back to the micro-processor from the cassette recorder. The circuit is based on the Kansas City standard code i.e. a "0" logic level is recorded as a 1200 Hz (cycles/sec) tone and a "1" logic level as 2400 Hz at a rate of 300 baud (bits/sec). Articles describing the Kansas City Standard are in the February and March issues of BYTE 1976, and Popular Electronics, March 1976.

Portions of the kit are assembled before shipment and the oscillator circuits are pretuned so that no further adjustments are required to operate at the proper frequencies. A +5.0 volt supply is required to power the circuit. Variations of supply voltage will not significantly affect the tuning of the 2400 Hz oscillator.

The circuit also has an auxiliary input feature. It allows the input of digital data to the microprocessor on the same input port as the cassette recorder data without having to disconnect the interface board. A switch is provided that allows the operator to select either the auxiliary input or the tape recorder input data.

A LED is provided on the interface board that indicates a logic "1" level on the output line to the microprocessor.

The transmitter circuit that converts the digital data to tone coded data for recording is phase coherent to the 2400 Hz oscillator. The receiver circuit contains a phase lock loop that locks onto the incoming tone data and generates a digital signal. This combination of circuits provides for high reliability and a very low error rate.

Connections to the board are made through either a 22 pin edge connector or an eight pin Molex connector.

SPECIFICATIONS @ Vcc = 5.0V, T = 78°F

	Min.	Nominal	Max.
Supply Voltage - V	4.75	5.0	5.25
Supply Current - ma (no signal)		3.0	
Transmitter Freq. - Hz	2350	2400	2450
Bit Rate - Baud		300	
VCO Freq. (VCO in = 0V) Hz	980	1000	1020
VCO Freq. (VCO in = 5.0V) Hz	2744	2800	2856
Input from Tape Recorder			
Volts RMS	1.0	1.5	3.0
Size		3½"x4½"	

ASSEMBLY INSTRUCTIONS

CASSETTE INTERFACE KIT

First check the contents of the kit with the parts list provided. Note that portions of the kit have been preassembled. Also, the oscillator sections are already tuned to the Kansas City standard frequencies. No further adjustment should be necessary.

By referring to the identifiers on the circuit side of the P.C. Board and the enclosed layout diagram, install the components. Use a small tipped soldering iron and be careful to avoid solder bridges. A color code chart is also included.

Install the Following Resistors:

<input checked="" type="checkbox"/>	R1	- 100 Ohm	Brown - Black - Brown
<input checked="" type="checkbox"/>	R2	- 1 K Ohm	Brown - Black - Red
<input checked="" type="checkbox"/>	R5	- 33 K Ohm	Orange - Orange - Orange
<input checked="" type="checkbox"/>	R6	- 100 K Ohm	Brown - Black - Yellow
<input checked="" type="checkbox"/>	R7	- 1 MEG Ohm	Brown - Black - Green
<input checked="" type="checkbox"/>	R8	- 3.3 MEG Ohm	Orange - Orange - Green
<input checked="" type="checkbox"/>	R11	- 100 K Ohm	Brown - Black - Yellow
<input checked="" type="checkbox"/>	R12	- 100 K Ohm	Brown - Black - Yellow
<input checked="" type="checkbox"/>	R13	- 510 Ohm	Green - Brown - Brown
<input checked="" type="checkbox"/>	R14	- 10 K Ohm	Brown - Black - Orange
<input checked="" type="checkbox"/>	R15	- 10 K Ohm	Brown - Black - Orange
<input checked="" type="checkbox"/>	R16	- 10 K Ohm	Brown - Black - Orange
<input checked="" type="checkbox"/>	R17	- 10 K Ohm	Brown - Black - Orange
<input checked="" type="checkbox"/>	R18	- 10 K Ohm	Brown - Black - Orange

Install the Following Capacitors:

<input checked="" type="checkbox"/>	C1	- 0.0045 mF
<input checked="" type="checkbox"/>	C3	- 0.0045 mF
<input checked="" type="checkbox"/>	C4	- 0.0045 mF
<input checked="" type="checkbox"/>	C5	- 0.0045 mF
<input checked="" type="checkbox"/>	C6	- 0.0045 mF
<input checked="" type="checkbox"/>	C8	- 0.1mF

Install Jumper Wires Using Resistor Lead Wires:

<input checked="" type="checkbox"/>	J1
<input checked="" type="checkbox"/>	J2
<input checked="" type="checkbox"/>	J3

<input type="checkbox"/>	Install IC	Z2 - 4011
<input type="checkbox"/>	Install IC	Z3 - 4013
<input type="checkbox"/>	Install IC	Z5 - 74LS00

DETAILED CIRCUIT DESCRIPTION

TRANSMITTER

The 2400 Hz RC type oscillator is made up of 2 gates (configured as inverters) of Z4 and the main timing components R10 and C7. R9's value affects the oscillator frequency somewhat, but its primary purpose is to minimize the clamping effect of the COS/MOS protection diodes on input pins 8 and 9 of Z4. Without this resistance (R9) the oscillator would be less stable with changes in supply voltage and temperature.¹ The oscillator clocks 2 "D" type flip-flops with one being used as a divide by 2 (Q connected to the D input). Since this divide by 2 flip-flop toggles on the leading edge of the oscillator signal the resultant 1200 Hz output is phase coherent with the 2400 Hz clock.

The other D flip-flop may have its D input level changed (from digital data coming in) at any time in relation to the 2400 Hz clock. However, the flip-flop's output will not reflect the new input level until the next leading edge of the 2400 Hz clock occurs i.e. the output may only change states on the leading edge of the clock.

The state of this flip-flop determines which output gate (the one passing the 2400 Hz to the output, or the one passing the 1200 Hz to the output) will be enabled and which will be gated off. Since the flip-flop may only change states on the leading edge of the 2400 Hz clock the transitions from a 2400 Hz tone to a 1200 Hz tone and visa versa, being fed to the tape recorder, are phase coherent to the primary 2400 Hz source. R11 and R12 serve as summing resistors for each of the two frequencies and combined with C6 form an RC filter to roll off the upper harmonics present in the square waves. C5 serves as a DC blocking capacitor to prevent the DC offset present across C6 from being fed into the tape recorder.

1

RCA ICAN 6267 Astable and Monstable Oscillators Using RCA COS/MOS Digital Integrated Circuits by J.A. Dean and J.P. Rupley.

RECEIVER

The basic receiver section consists of a phase lock loop (PLL), Z1, followed by a Schmitt trigger formed by Z2, R7, and R8.

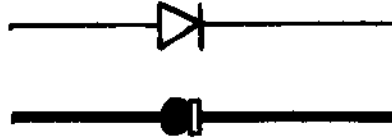
The PLL locks onto the signal from the tape recorder and produces an output voltage that is proportional to the incoming frequency. Since only two frequencies are present (1200 Hz and 2400 Hz) the PLL output switches between a relatively low voltage level and a higher voltage level. NOTE: These levels are NOT the typical "0" and "1" COS/MOS bit levels. The Schmitt trigger then uses this output to produce a clean square wave with the normal "0" and "1" bit levels.

Z5 serves as a TTL buffer driven by selectable gates. One gate may be selected that takes the Schmitt trigger output, which is a reflection of the tape data, and sends it on to the microprocessor or a UART, if one is used. Selecting the other gate allows data (such as from a keyboard) at the Auxiliary input to be passed through the Cassette Interface without modification and into the microprocessor or UART. When either gate is selected the other is disabled.

SOLDERING INSTRUCTIONS

For construction of this kit we recommend use of a 25 or 30 watt soldering iron with a pencil tip and .031 diameter rosin core solder. Acid core solder, soldering guns, and large soldering irons should NEVER be used for electronic component installation. Please use extreme care during construction to avoid solder bridges between the etched circuits. The majority of complaints we receive concerning our kits are the results of bridges. Should these occur during construction, they are easily removed using commercially available solder wick or desoldering tools. Components are mounted on the side of the P.C. Board which has no circuit track.

- () Install switch S1 unless remote operation is desired in which case Pin #7 and Pin #15 (on 22 pin connector) go to either side of a SPDT switch. The center pole should connect to ground. (see S1 in the schematic diagram)
- () If desired Install Molex connector with short pins in P.C. Board.
- () Install LED in D1 position. Note the cathode end is indicated by a small extension on the LED leads as shown below.



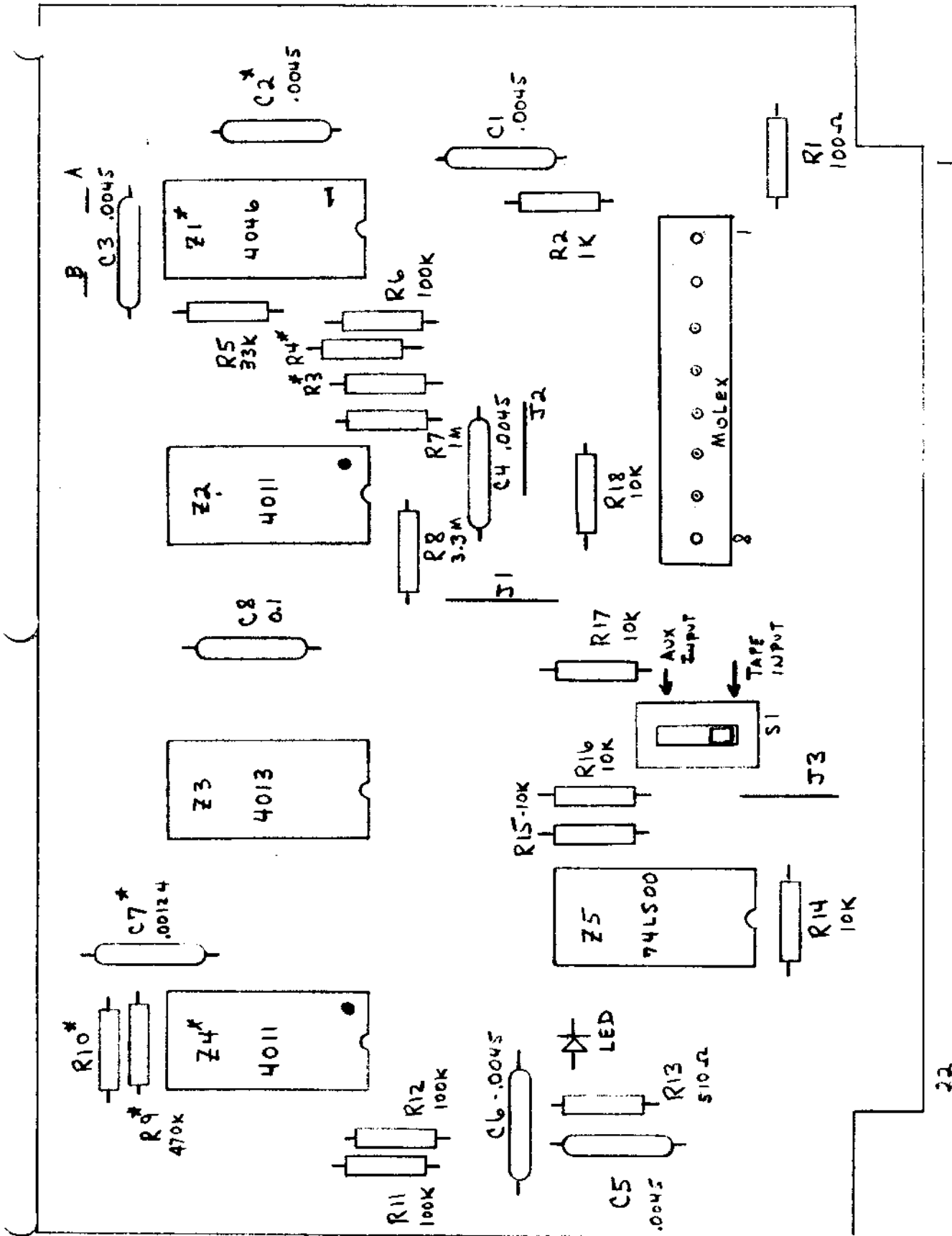
PIN ASSIGNMENTS

<u>22 Pin Connector</u>	<u>Molex Connector</u>	
#1	Ground	#2
#2	Tone Data in From Recorder	#1
#22	#5 VDC	#3
#5	Digital Data In From Micro Processor	#4
#7	Input Selector Switch For	N/A
#15	Mounting External to P.C. Board	
#9	Auxiliary Digital Data Input (sends data direct to Micro Processor)	#6
#11	Digital Data Out to Micro Processor From Tape Recorder Or Auxiliary Input	#7
#20	Tone Coded Data Out to Tape Recorder	#8

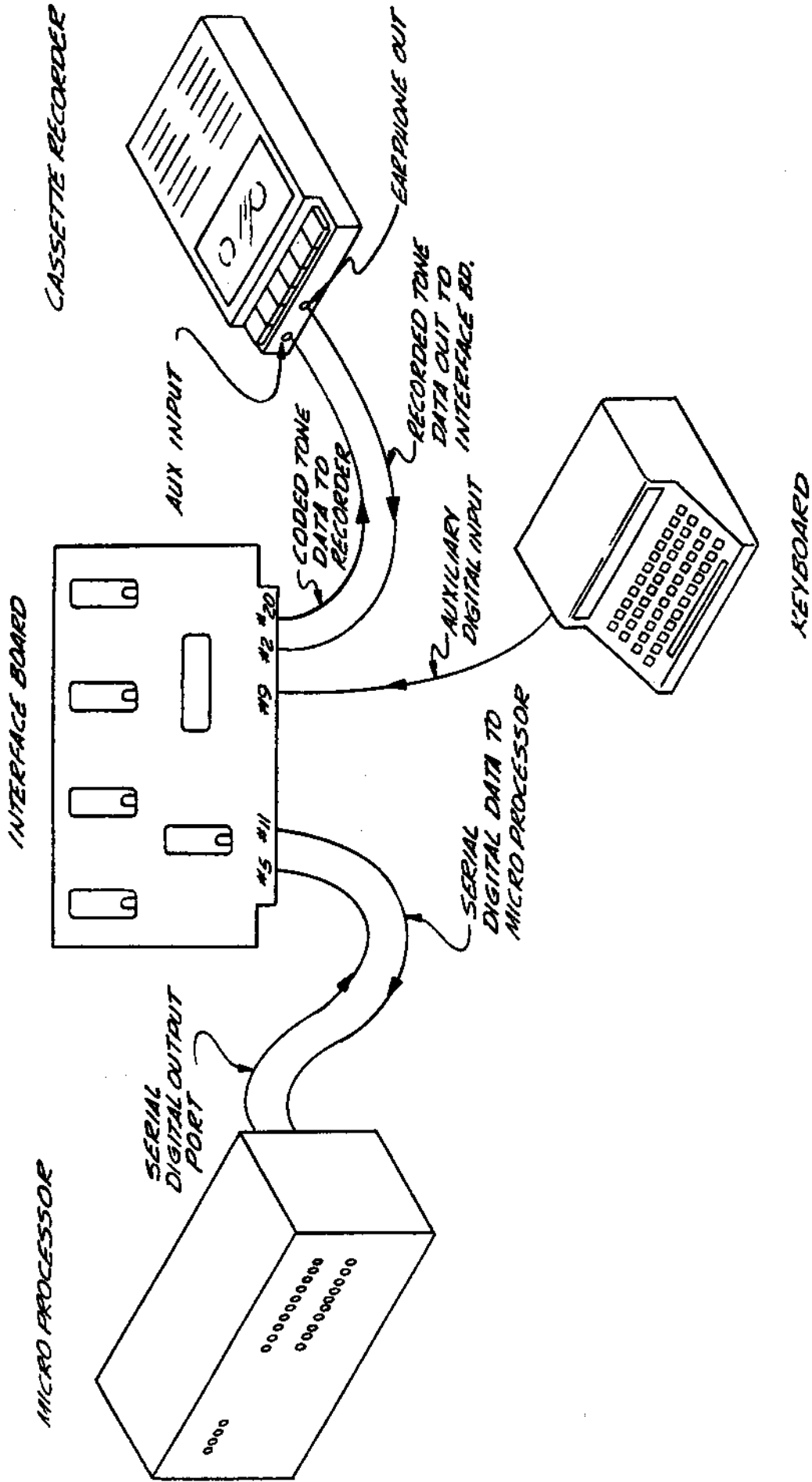
Connect +5 VDC Supply to either pin #22 of the 22 pin pin connector or pin #3 of the Molex connector and other connections as shown in pin assignments and board is ready for use. The operating frequencies are sensitive to supply voltage and have been tuned up for +5.0 Volt supply. The LED will glow to indicate a "1" bit level output.

If errors are found when reading the recorded data the volume control on the tape recorder may need to be turned up. Refer to your computer operating instructions to format the proper 300 Baud (Bit/Sec) data stream.

TOP VIEW (COMPONENT SIDE)



* PREINSTALLED



INTERCONNECTION DIAGRAM
 CASSETTE INTERFACE C23307TA

CASSETTE INTERFACE

PARTS LIST

RESISTORS

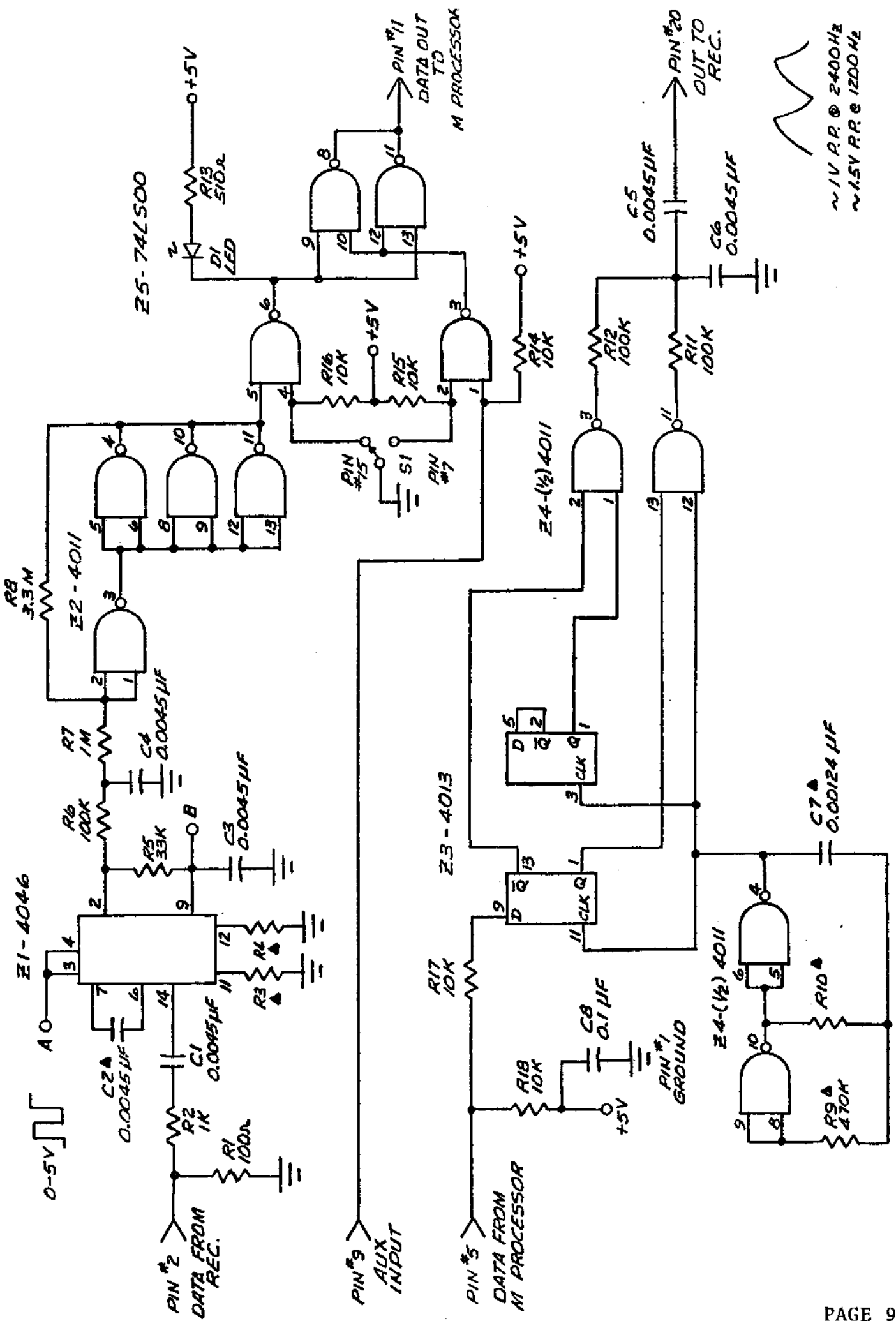
QUANTITY	VALUE	
1	100 OHM	R1
1	1K	R2
3	Selected	R3,R4,R10
1	33 K	R5
3	100 K	R6,R11,R12
1	1 MEG	R7
1	3.3 MEG	R8
1	470 K	R9
5	10 K	R14,R15,R16,R17,R18
1	510 OHM	R13

CAPACITORS

6	0.0045 mF	C1,C2,C3,C4,C5,C6
1	0.00124	C7
1	0.1	C8

I.C.'S

1	4046	Z1
2	4011	Z2,Z4
1	4013	Z3
1	74LS00	Z5
1	SPDT	PC Mount Switch, S1
1	CZ 33077A	PC Board
1	LED	MV50, D1
1	8 Pin	Molex Connector



~1V P.P. @ 2400 Hz
 ~1.5V P.P. @ 1200 Hz

Δ, 1977

SCHEMATIC
 CASSETTE INTERFACE CZ33077

▲ R3, R4, R9, R10, C2, C7
 PRE-INSTALLED



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RESISTOR VALUE CODING

TOLERANCE	NONE	20%
COLOR BAND	SILVER . . .	10%
	GOLD	5%



COLOR BAND 1
is FIRST DIGIT

BROWN	=	1
RED	=	2
ORANGE	=	3
YELLOW	=	4
GREEN	=	5
BLUE	=	6
VIOLET	=	7
GRAY	=	8
WHITE	=	9

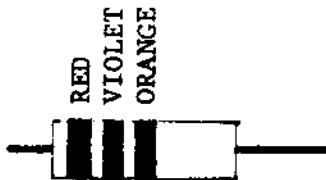
COLOR BAND 2
is SECOND DIGIT

BLACK	=	0
BROWN	=	1
RED	=	2
ORANGE	=	3
YELLOW	=	4
GREEN	=	5
BLUE	=	6
VIOLET	=	7
GRAY	=	8
WHITE	=	9

COLOR BAND 3
is MULTIPLIER

BLACK	=	0
BROWN	=	1
RED	=	2
ORANGE	=	3
YELLOW	=	4
GREEN	=	5
BLUE	=	6
VIOLET	=	7
GRAY	=	8
WHITE	=	9

EXAMPLES:



RED VIL ORN
is a 2 7 and 3 Zeros,
which is to say 27,000 ohms
or 27K ohms ± 20%



BRN BLK BLK
is a 1 0 and 0 Zeros,
which is to say 10 ohms ± 5%

"Innovations in Digital Applications"



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Dear Customer,

According to our records you were shipped a cassette interface kit from us during the past two months. We recently discovered that a piece of test equipment used to pre-tune the kits is defective and the transmitter sections that were tuned using this equipment may be out of specifications.

If R10 in your kit is a 150K resistor, and you are having trouble reading back into your computer tapes recorded using the kit, the transmitter section may be out of tune. Replace R10 with the 130K resistor enclosed in this letter. This may help the operation of the kit. If you still have a problem, return it and we will retune it to specification.

If you have access to a scope or frequency counter, select R10 to give you a frequency of 2400 Hz $\pm 5\%$ on pin #4 of Z4.

We apologize for the inconvenience.

Sincerely,

S.D. SALES