UNDER REVISION

JADE
Computer Products
5351 WEST 144th STREET
LAWNDALE, CALIFORNIA 90260
(213) 679-3313

SERIAL/PARALLEL I/O BOARD

FEATURES:

* S-100 COMPATABLE

* TWO SERIAL I/O PORTS USING SOFTWARE - PROGRAMMABLE UARTS.

* ONE GENERAL PURPOSE LATCHED PARALLEL I/O PORT IDEAL FOR PRINTER INTERFACE OR CONTROL.

* ONE SERIAL PORT FUNCTIONS AS EITHER TTL OR RS232; THE OTHER SERIAL PORT FUNCTIONS AS EITHER RS232 OR THE CASSETTE INTERFACE (DESCRIBED BELOW).

* SWITCH - SELECTABLE, CRYSTAL-CONTROLLED BAUD RATES:
  75, 150, 300, 600, 1200, 2400, 4800, 9600.

* ON BOARD "KANSAS CITY STANDARD" CASSETTE INTERFACE USEABLE UP TO 1200 BAUD, ALLOWING STORAGE OF UP TO 180,000 BYTES ON A 30 MINUTE AUDIO CASSETTE. CRYSTAL CONTROLLED. NO ADJUSTMENTS NECESSARY.

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JADE PARALLEL/SERIAL I/O BOARD PARTS LIST

SEMICONDUCTORS

U1	LM324N
U2	75150P (8 Pin)
U3	75152N/9627
U4	74LS00
U5, U9	74LS163
U6	CD4013
U7	CD4011
U8	CD4070
U10	CD4029
U11, 15, 16, 17	74LS10
U12	CD4021
U13	CD4001
U14	CD4009
U18, U19	74LS02
U20, U21	AY51013A/TR1602B
U22	74LS138
U23	74LS86
U24, 26, 29	74LS125
U25, 27, 28, 30	81LS97
U31	74LS04
U32, U33	74LS174
VR1	LM340T-5/7805
VR2	LM340T-12/7812
VR3	LM320T-12/7912
CR1	1N3600

CAPACITORS

C1 Thru C6	2.7 mf. 30v dipped tantalum
C7, 9, 10, 11, 12, 14, 15, 17, 19, 23	0.1 mf disc. or monolythic
C8	2400 pf or .0024 mf ceramic disc.
C13	1.0 mf 10v. dipped tantalum
C16, C22	1000 pf or .001 mf ceramic disc.
C18	100 pf mica
C20	0.01 mf disc.
C21	.047 mf disc. or small mylar

RESISTORS

R1, 7, 19, 21, 22	10K 1/4 watt 5%	(brown, black, orange)
R2, R11	200 ohm	(red, black, brown)
R3, 4, 12, 20	100 K	(brown, black, yellow)
R5	20K	(red, black, orange)
R6, 14, 17	22 K	(red, red, orange)
R8	2.2K	(red, red, red)
R9	470 ohm	(yellow, violet, brown)
R10	330 ohm	(orange, orange, brown)
R15, R16	47K	(yellow, violet, orange)
R18, R23 Thru R27	1K	(brown, black, red)

SOCKETS

1	8 pin low-profile DIP socket
17	14 pin
9	16 pin
4	20 pin
2	40 pin

MISCELLANEOUS

1	Model 361 Heat Sink
1	MP024 crystal (2.4576 MHZ)
1	76TC02 (Grayhill) dipswitch
1	3 Position dipswitch
1	50 pin connector
2	8 Position dipswitch

1.1 INTRODUCTION

This manual contains the information required to assemble, test and operate the Serial/Parallel interface board with cassette (Kansas City Standard), RS232 compatible devices and TTL level devices.

Check the parts list against the parts received carefully before starting to assemble the board and inform us immediately if there are any discrepancies.

It is best that you follow the assembly procedure as outlined in section two. Read this section completely first. Use the best types of tools to insure good results. Use a low wattage soldering iron between 27 to 40 watts with a small tapered tip. Always keep the tip clean and moisture free from oxidized solder by wiping it clean on a moistened sponge. Use thin solder with a 60/40 ratio (60% tin/40% lead). When soldering a joint, apply the heat to the joint first then the solder to the joint, not the soldering iron tip, until the cracks are filled up. Then remove the soldering iron. Avoid too much solder. A good joint will have a bright shinny look instead of a dull appearance. Reheat the joint if it is dull and allow it to cool without moving the component while cooling. After the soldering is completed a flux residue is left on the board. With a small short brush or old toothbrush, scrub off the resin with alcohol. Afterwards carefully examine the board for "solder bridges" that connect some of the printed circuit conductive paths together. Scrape them off with a small pointed object.

1.2 GENERAL DESCRIPTION

The Serial/Parallel Interface Board has three independent input-output ports. Two of the input-output ports are for serial devices that receive and transmit 5, 6, 7, or 8 bit length data word serially from the external device and is read or written to by the computer as a normal parallel input or output. The two serial ports both may transmit or receive the serial word using the RS232 standard levels which are $\pm$12 volt voltage swing signals. Serial port A may also interface to the outside by a TTL signal levels. Serial port B may be used as a cassette or modem which uses the Kansas City Standard frequencies.

The rate at which the data is transmitted or received is called the Baud Rate and both devices can receive and transmit simultaneously (full duplex) at the following baud rates.

Baud Rate	Switch Setting (A,B)	Baud Rate	Switch Setting (A,B)
75	1	1200	5
150	2	2400	6
300	3	4800	7
600	4	9600	8

The two serial ports A and B are totally independent. Their baud rates are separately switch selectable. The operating modes are computer programmable for such things as word length, parity type, and the number of stop bits.

The data stream transmitting the serial data always starts off for each data word, called a byte if it is eight bits, by transmitting a start bit (a logic 1 level) then the 5 to 8 bit serial data word followed by 1 or 2 stop bits (1 logic 0) before the next word can be sent. These start and stop bits ensure the proper synchronization of the receiver, so that it will be able to sample the data stream properly. A parity bit is also selectable and is usefull for detecting errors in transmission. Even or odd parity or no parity is selectable. Even parity implies that there are an even number of logical 1 bits in the data stream and the parity bit, the odd parity implies that there are an odd number of logical 1 bits in the data and parity bit stream. The circuit automatically inserts a logic 0 or 1 into the bit stream at the parity bit position to insure that the even or odd parity is maintained.

To program the operation mode, lead the control register of the UART by using the selected port address plus 80 as the I/O Output address, then load the control word to that location by the processor.

UART CONTROL TABLE

Bit	8	7	6	5	4	3	2	1
	NP	TSB	NB2	NB1	EPS	X	X	X

The definition of these signals is as follows:
NP - A logic one will eliminate the parity bit from the transmitted and

and receiver character. The stop bits will immediately follow the last bit.

TSB - This bit will select the number of stop bits, 1 or 2, to be appended after the parity bit or last transmitted data bit if there is no parity. A logic 0 will insert 1 stop bit and a logic "1" will insert 2 stop bits.

NB2, NB1 - These two bits will be internally decoded to select either 5, 6, 7, or 8 data bits per character.

NB2	NB1	Bits/Character
0	0	5
0	1	6
1	0	7
1	1	8

EPS - The logic level on this pin sleects the type of parity which will be appended immediately after the data bits. It also determines the parity that will be checked by the receiver. A logic "0" will insert odd parity and a logic "1" will insert even parity.

The input and output address of the serial port is the same, to allow simple switching between reading from or writing to a port. The status sense and control address is related to the data address by adding 80 to the selected data address. The I/O uses only the eight least significant address bits of the computer. The following addresses may be selected by the three I/O devices on this board

ADDRESS BITS	8*	7	6	5	4	3	2	1	PORT	A	B	C
	0	0	0	0	0	0	0	0		0	1	3
	0	0	0	0	0	1	0	0		4	5	7
	0	0	0	0	1	0	0	0		8	9	11
	0	0	0	0	1	1	0	0		12	13	15
	0	0	0	1	0	0	0	0		16	17	19
	0	0	0	1	0	1	0	0		20	21	23
	0	0	0	1	1	0	0	0		24	25	27
	0	0	0	1	1	1	0	0		28	29	31

00 = port A
01 = port B
11 = port C

* A 1 bit will select the control sense latches for the particular I/O port addressed.

While the control word is an output operation to the device +80 address location, the status sense is an input operation to the device +80 location and is used to sense the status of the serial port. The following table indicates the meaning of the sense bits and their position in the data word.

Bits	8	7	6	5	4	3	2	1
	TBMT	PE	FE	DAV	X	X	X	X

The definitions of these acronyms follows:

TBMT - The transmitter buffer is empty is designated by a logic "1" when the data bits holding register may be loaded with another character.

PF - This line goes to a logic "1" if the received characters parity does not agree with the selected parity. Indicating a transmission error.

FE - This line goes to a logic "1" if the received character has no vaild stop bit.

DAV - This line goes to a logic "1" when an entire character has been received and transferred to the receiver holding register inside the UART. This same signal is used to interrupt the computer if the computer is an interrupt driven machine. This signal is reset when the port is read by the computer.

The two serial ports both have two modes of interfacing to the outside world. Port A may interface to an audio cassette recorder using the Kansas City interface standard which uses 1.2khz as a "space" frequency or 1 level, and 2.4kc as the "mark" or zero level. There is a modulator and a demodulator on the board that converts the serial bit stream to these "carrier" frequencies so they may be recorded on an audio cassette recorder for data storage purposes. The interface may also be amplified externally and connected to the phone for use as a modem, by means of a low power microphone/amplifier and small speaker amplifier. This same port, port A, may be used by an RS232 compatible serial device. RS232 specifies the signal amplitudes of $\pm$12V logic swing to be used over long wires. Switch S1A selects between the RS232 or cassette recorder. Devices such as remote teletype or CRT terminals can use these serial interfaces more reliably than a parallel cable because it avoids all the cross coupling and pick up of long parallel lines and is a smaller and simpler connection.

Serial port B is a general purpose serial interface that can be used as an RS232 or TTL interface levels. The mode is switch selectable by switch S1B for the ports. The cassette interface will only operate at the following baud rates due to the fact that past 1200 baud the bits rates are faster than the cassette carrier frequencies.

Cassette Baud Rates	RS232/TTL Baud Rate
75	-
150	-
300	-
600	-
1200	-

These rates are selectable by switches S3, for port A and switch S4 for port B.

The third I/O port is for a general purpose parallel port. It has standard TTL levels and supplies the handshake signals required to control data transfer to and from the external device. The output port is latched, the input port is not. Such a port can be used to control printers, sensor, or control machinery, with the proper power drivers and sensors for each type of application. This is, after all only the communication port and not a specialized controller.

The I/O ports are connected to the external world through the 50 pin molex interface plug on top of the module. The pin designations and its use are listed in the following table:

I/O Plug Designations

Pin

1 Data Acknowledge - 1 level resets parallel input port to zero
2 Bit 4 - Out - Output bit for parallel port
3 Bit 1 Out - Output bit for parallel port (leasts significant bit)
4 Bit 3 Out - Output bit for parallel port
5 Bit 2 Out - Output bit for parallel port
6 Bit 7 Out - Output bit for parallel port
7 Bit 5 Out - Output bit for parallel port
8 Bit 6 Out - Output bit for parallel port
9 Bit 8 Out - Output bit for parallel port

I/O Plug Designations (continued)

Pin

10 Data Rdy - 1 level when output port is loaded
11 Interrupt Acknowledge - 0 level when input port is read
12 Bit 1 In - Input bit 1 for parallel port
13 Bit 3 In - Input bit 4 for parallel port
14 Bit 4 In - Input bit 4 for parallel port
15 Bit 7 In - Input bit 7 for parallel port
16 Bit 2 In - Input bit 2 for parallel port
17 Bit 5 In - Input bit 5 for parallel port
18 Bit 8 In - Input bit 8 for parallel port
19 Bit 6 In - Input bit 6 for parallel port
20 Interrupt Request - Parallel port input request 0 Level
21 Grnd

22 +5V regulated

23
34 blank

35 Serial port A RS232 Output signal
36 Serial port A RS232 Out ground return
37 Serial port B RS232 Output signal
38 Serial port B RS232 Output ground return
39 Serial port A TTL Output signal
40 Serial port A TTL Output signal ground return
41 Serial port A TTL Input signal
42 Serial port A TTL Input signal ground return
43 Serial port A RS232 Input signal
44 Serial port A RS232 Input signal ground return
45 Serial port B RS232 Input signal
46 Serial port B RS232 Input signal ground
47 Serial port B Cassette Output signal
48 Serial port B Cassette Output ground return
49 Serial port B Cassette Input signal
50 Serial port B Cassette Input ground return

CONSTRUCTION

1. Unpack Printed Circuit Buard and the integrated circuit sockets. Leave resistors capacitors, switches and all parts.
2. Take the layout sheet and using it as a guide place the sockets into their appropriate locations.
   Note that all sockets have a notch at one end these should be oriented in the direction shown by the semicircle marker on the printed circuit board opposite the end of the socket. The orientation is also shown on the layout sheet. Be careful to put it according to the notch for it will serve as a device insertion orientation so that the device won't be inserted backwards. The sockets go on the side which has the identification "JADE COMPUTER PRODUCTS" written on it. Now double check that all the sockets are oriented in the proper direction and that they are the proper size sockets. The layout diagram also has the number of pins of each socket. If you have problems with this, do it with one socket at a time then solder them in. Put the board down and push down to ensure that the sockets are all the way in. Now solder one pin on each end, of each socket, while putting a small pressure on the socket. Do not solder more than two pins per socket yet. After soldering all the sockets this way lift up and check to see if all the sockets are seated flat on the board. If they are not flat heat up the soldered pin of that socket and push the socket in properly. After all the sockets are in place, carefully solder the rest of the socket pins. Avoid excessive solder just enough to fill the socket pin to printed circuit hole. The component side of the board is labelled "JADE COMPUTER PRODUCTS". Plase one socket at a time into the socket board with the notch facing the semicircle guide at one end of the socket holes. Becareful that the socket is the right size and not too small for the socket holes. Holding the socket and the board, flip the board over and solder two pins at diagnally opposite ends of the socket. Now check to see if the socket is perperly seated on the board, if its not, reheat the joints while pushing the socket toward the board. Once the socket is properly seated solder the rest of the pins down. Use the layout sheet for a double check on device socket size and orientation. Solder all the sockets down following the same rules.

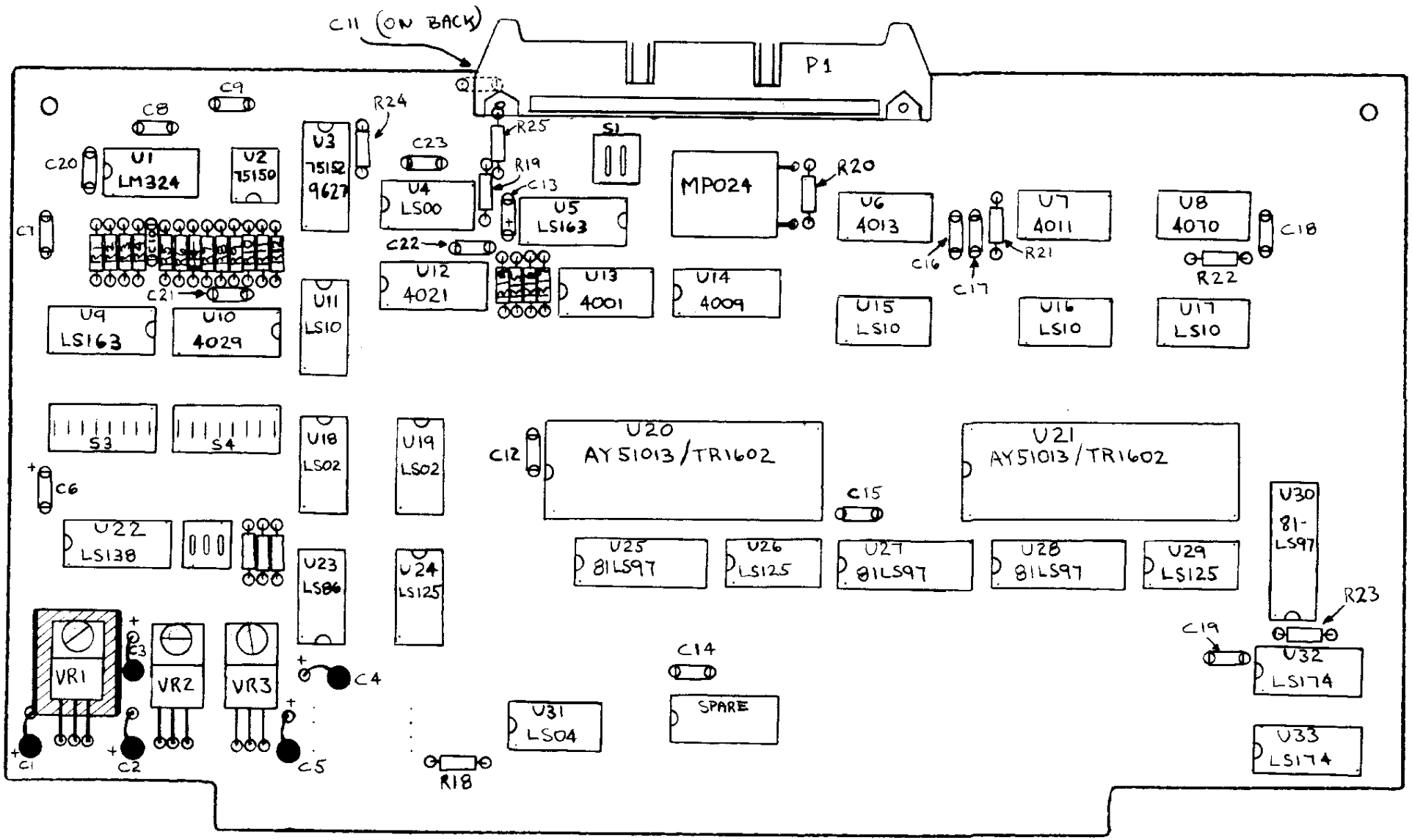
After the sockets are soldered in place, solder the switches to the board with the lettering on the switches <u>right side up</u>. The position of the switches is shown on the layout sheet.

The resistors are mounted according to the parts list identification markings in the location shown by the assembly drawings and the board markings reference. Capacitors are mounted the same way except in the case of the electrolitic devices which are polarized. The end marked with the "+" should always point to the printed circuit board hole marked with the same "+" marking. The regulators should be served down with the nuts and bolts supplied with the +5V regulator mounted on top of the heatsink.

After all the components and sockets are mounted clean the board off with alcohol and carefully inspect the board for solder bridges or bad solder joints. Test the regulators before inserting any integrated circuits to be sure they work. Insert the board into the computer motherboard and check the regulator outputs with a voltmeter or oscilloscope to see if the voltages are in tollerance and not noisy. After the voltages are checked turn off the power and remove the board.

Stuff the sockets with the proper devices according to the assembly diagram, being careful to have the notched end of the device pointed toward the sockets notched end as shown in the assembly diagram. After inserting all the devices inspect the sockets to be sure no pins were bent or missed their socket holes. If they did, remove the device, straighten its pins with a long nose plier and then try to insert it carefully.

Using the layout sheet and the markings on the printed circuit board insert the resistors and capacitors on the board and solder their leads. Be careful with these parts for an error could be very messy to correct, and cause damage to the board while removing parts. Use the list of materials as a guide to the component markings before inserting and soldering these parts down. Tantalum capacitors are polarized and must be inserted with the end marked with "+" in the direction shown on the printed circuit and the layout sheet. Save these for the end and BE CAREFUL.



JPS-01 COMPONENT LAYOUT

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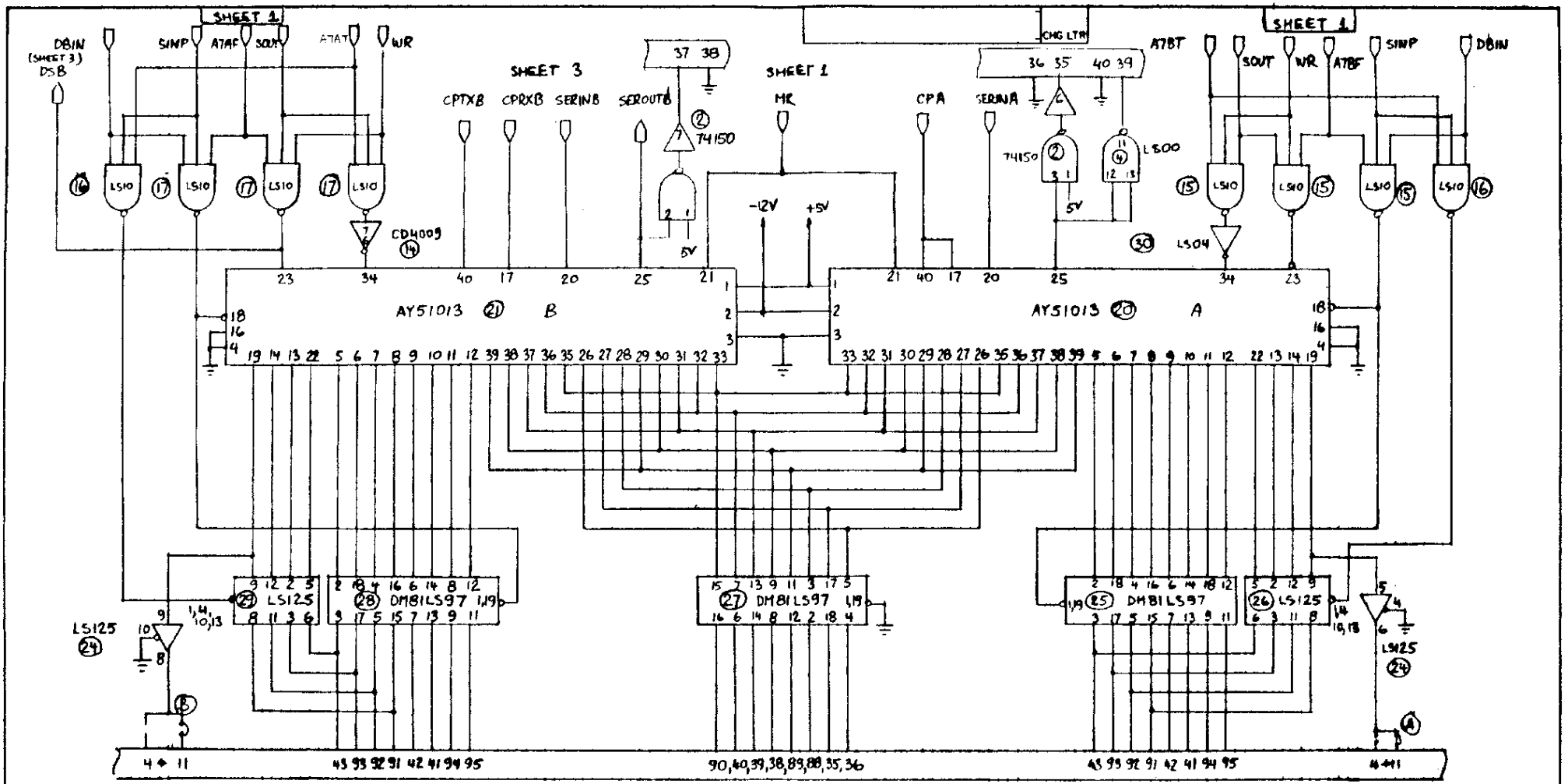
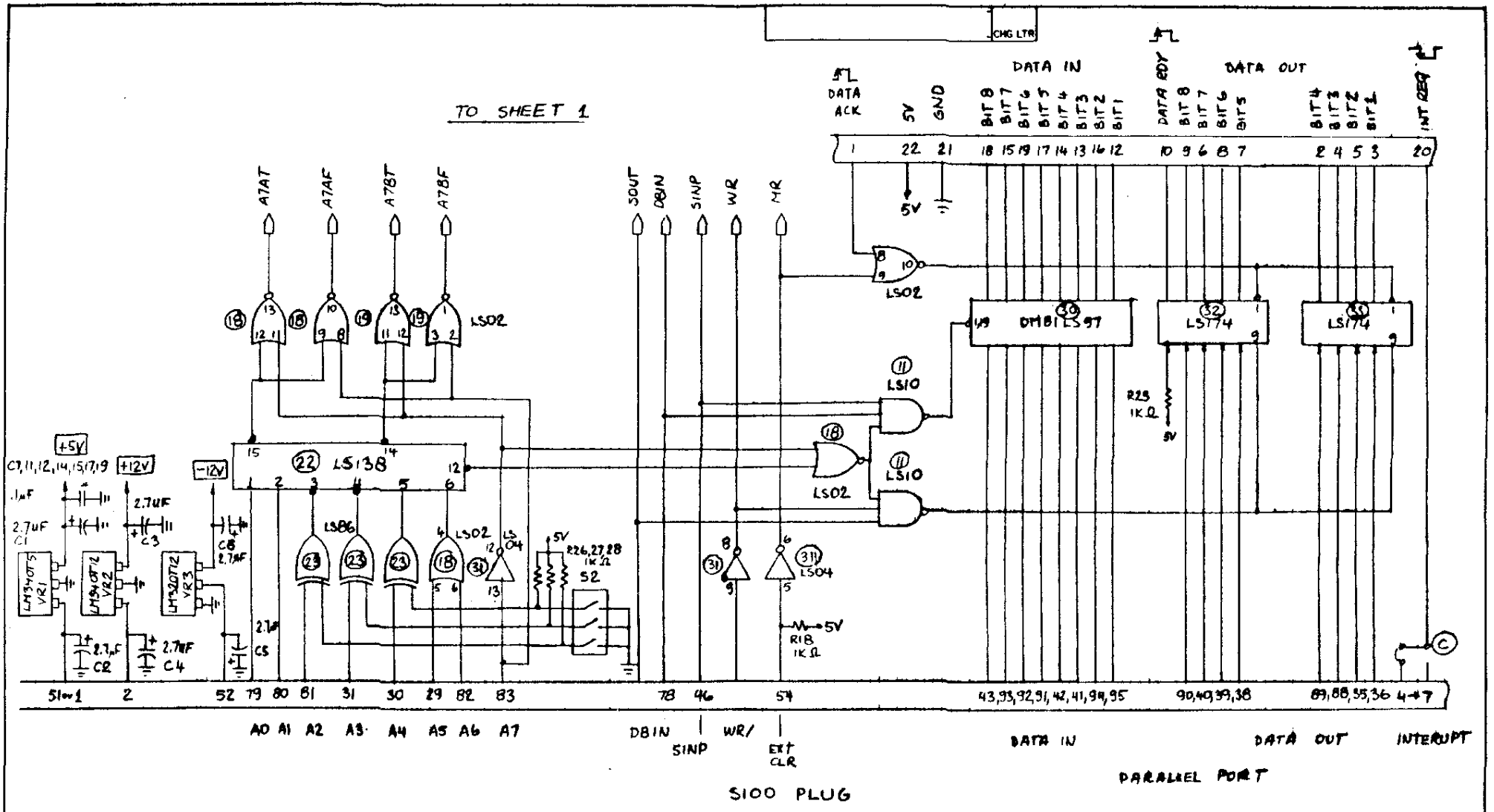
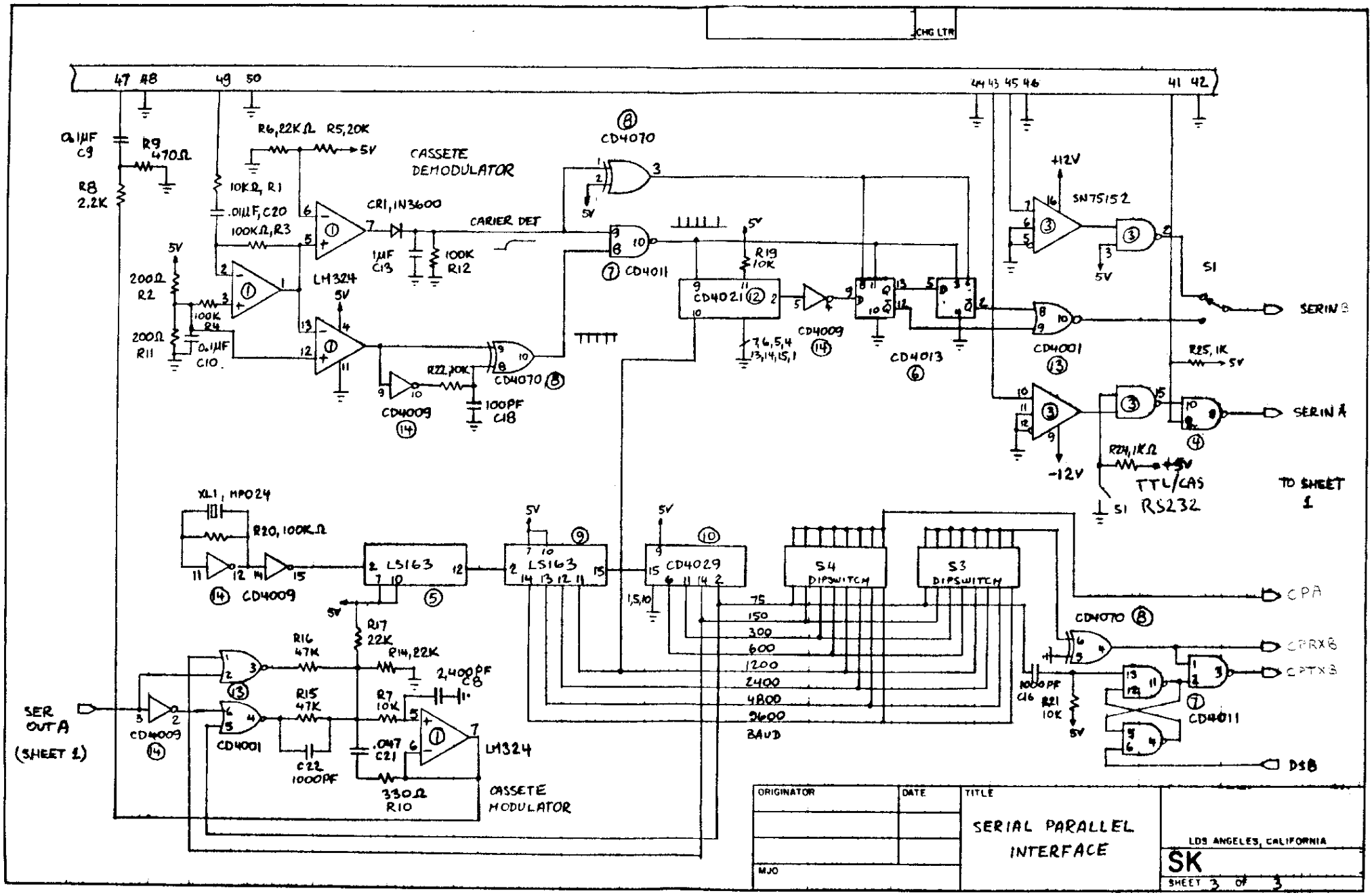


ORIGINATOR	DATE	TITLE	
		SERIAL/PARALLEL INTERFACE	LOS ANGELES, CALIFORNIA
			SHEET 1 OF 5



ORIGINATOR	DATE	TITLE
		SERIAL / PARALLEL INTERFACE
MJO		LOS ANGELES, CALIFORNIA
		SHEET 2 OF 3


CHG LTR
47 48 49 50
44 43 45 46 41 42
0.1μF C9
R9 470Ω
R8 2.2K
R6, 22KΩ R5, 20K
5V
CASSETE DEMODULATOR
10KΩ, R1
.01μF, C20
100KΩ, R3
CR1, IN3600
CARIER DET
1μF C13
100K R12
LM324
200Ω R2
100K R24
0.1μF C10
200Ω R11
CD4070 (8)
CD4011 (7)
R19 10K
CD4021 (12)
7,6,5,4 13,14,15,1
CD4009 (14)
CD4013 (6)
CD4001 (13)
+12V
SN75152
-12V
S1
SERIN B
SERIN A
R25, 1K
R24, 1KΩ
TTL/CAS
RS232
TO SHEET 1
XL1, MPO24
R20, 100KΩ
LS163 (5)
LS163 (9)
CD4029 (10)
S4 DIPSWITCH
S3 DIPSWITCH
75
150
300
600
1200
2400
4800
9600
BAUD
CPA
CPRXB
CPTXB
DSB
R17 22K
R16 47K
R14, 22K
2,400PF C8
R15 47K
R7 10K
.047 C21
C22 1000PF
330Ω R10
LM324
CASSETE MODULATOR
SER OUT A
(SHEET 1)
1000PF C16
R21 10K
ORIGINATOR
DATE
MJO
TITLE
SERIAL PARALLEL INTERFACE
LOS ANGELES, CALIFORNIA
SK
SHEET 3 OF 3
STL Form 5238 (Rev 2-99)