

# Expand Your KIM!

## ... Part 2: getting to the nuts and bolts

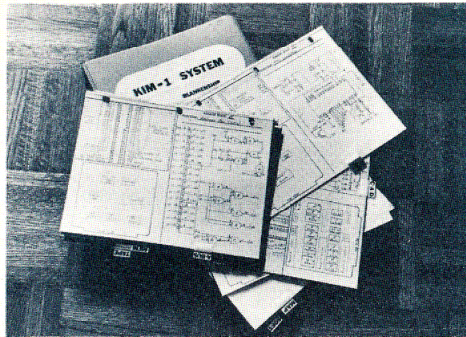


Photo 1. Complete documentation — very helpful.

Last month, I described my KIM-1 System. This article is dedicated to the laborious task of constructing the mainframe, cabinet and power supply. I say laborious because this part of the construction will use up the majority of the total time required by the project.

For the most part, I shall refrain from philosophical discussions at this point, as they will be more applicable if included with the discussions of the boards themselves.

book I'm keeping of all finalized material on my system. Documentation cannot be emphasized too much, and I encourage you to keep file folders and/or a notebook on all aspects of your system. As you begin to program, or if you should need to make repairs at a later date, you'll find complete documentation invaluable.

The mainframe (Photo 2) is made from light-gauge aluminum U-shaped tubing. Notice that some of the tubing is small enough to slide inside the others, and

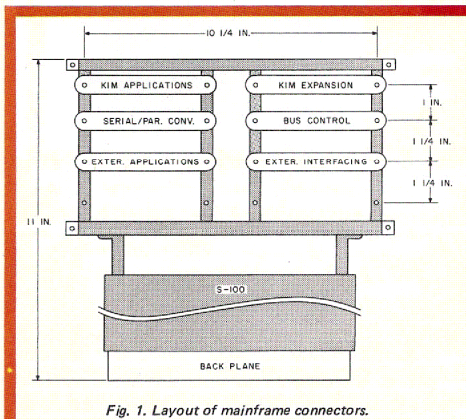


Fig. 1. Layout of mainframe connectors.

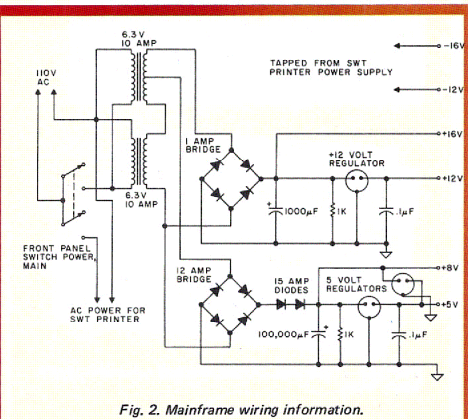


Fig. 2. Mainframe wiring information.



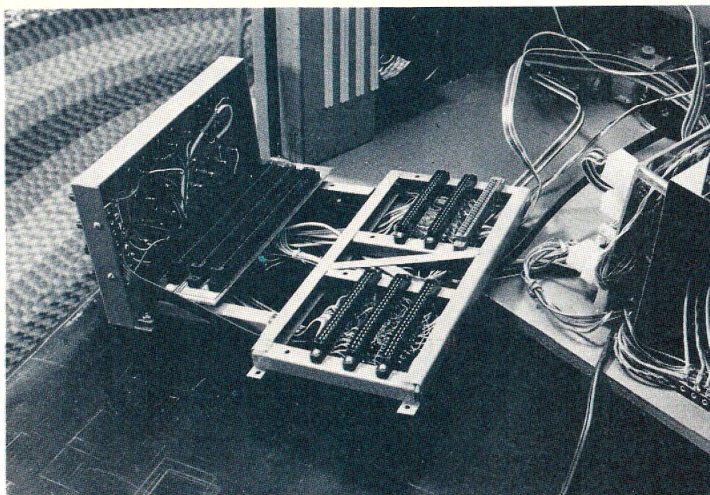


Photo 2. The mainframe is made from aluminum, epoxy and sheet metal screws. Photos by Thomas Snider

may be fastened together with epoxy and sheet metal screws.

My 44-pin connectors are spaced  $1\frac{1}{4}$  inches apart to allow room for wire-wrap sockets. The linear spacing of the 44-pin connectors matches that of the KIM board. Space has been left for two more sockets, in case my requirements alter in the future.

The Imsai motherboard mounts on an extension of the tubular frame and leaves enough space for piggy-backing the Dazzler in the front slot. The backplane

bolts to the mainframe, thus eliminating many wiring problems. Since the wires run under the frame, spacers are required when mounting to the cabinet base. Note the spacers on the bolts where the backplane is attached. This allows the backplane to mount flush, providing more stability. The front-to-back measurements should not exceed 11 inches if you use my cabinet dimensions.

The wiring of the frame is tedious and complex. Keep all the wires as short and as neat as possible. With the number of connections neces-

sary, don't expect it to be a work of art (see Photo 3).

Fig. 1 shows the layout of the 44-pin connectors. Fig. 2 provides all the information necessary to complete the wiring. I chose it as the most efficient means of supplying the large amount of information required.

The power supply transformers will mount under the steel bracket that holds the printer (see Photo 3). The heat sinks for the 5 V regulators and rectifiers mount on the left side of the bracket

(see Photo 5 in last month's article), while the printer electronics mount on the right side. The would-be wasted space under the keyboards holds the filter capacitors and 12 V regulator. A complete schematic of the power supply is shown in Fig. 3.

The cabinet is made up of a plywood base  $19 \times 28\frac{3}{4}$  inches and two sides of  $1 \times 12$  inch shelving. The sheet aluminum front panel was bent to shape first, and then the sides cut to match. That might be less than scientific, but much easier than the other way around. The sides are grooved  $\frac{1}{4}$  inch deep on all edges except the bottom to allow the metal panels to slide in place. For ease in cutting, the grooves extended to each edge of the board, and the undesired gaps were later filled in with plastic wood. Fig. 4 shows an expanded view of the cabinet. The dimensions are only included as general guidelines, and can be changed to fit your personal tastes.

A  $1 \times 2$  inch wood strip across the top front edge holds the sides together firmly, and also provides a good looking termination point for the sheet metal.

I chose to paint all the wood parts dark blue and all the metal parts light blue. The combination is attractive, and I recommend it.

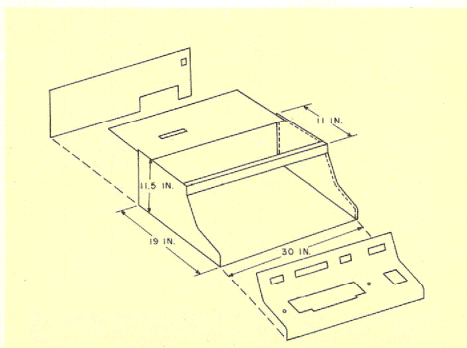


Fig. 4. Expanded view of cabinet.

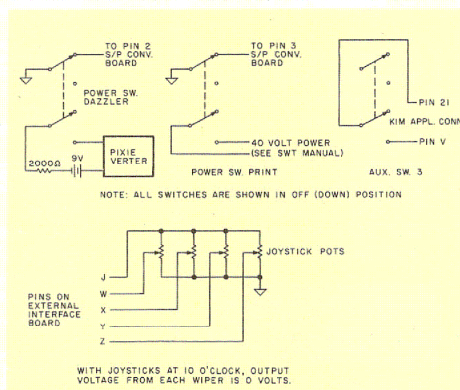


Fig. 5. Miscellaneous circuits.



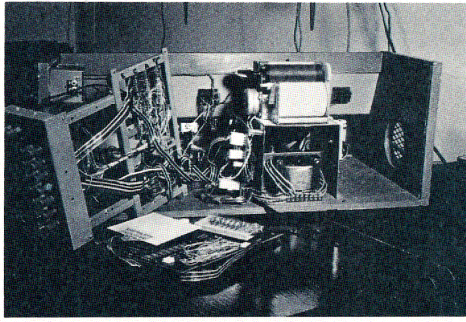


Photo 3. All wires on the mainframe should be as short and neat as possible.

One suggestion: If you mount the power supply components on the base before the sides and front panel are assembled, you can avoid a lot of frustration due to cramped working conditions under the keyboard.

There are several other items that are worthy of comment. A section of 2 x 4 inch wood block provides a mounting surface for edge guides to insure separation of the S-100 boards (see Photo 2 top center).

A metal box for holding the Pixie-Verter is mounted

above this block. Two phono jacks on the rear provide the video and rf outputs. Two more jacks on the front provide the video inputs and connections to a power switch on the front panel.

The construction described in this article should keep you busy till later, when I'll cover the bus control board and modifications to the SD Sales 4K memory board. A word to those who like to get a step ahead: Don't expect the KIM to operate until the bus control board is in place. ■

Fig. 2. Mainframe wiring information (continued on following pages).

#### BUS CONTROL BOARD

Pin	Name	Connects	Comments
1	AB0	IN	From KIM E-A (Expansion Connector, Pin A)
2	AB1	IN	From KIM E-B
3	AB2	IN	From KIM E-C
4	AB3	IN	From KIM E-D
5	AB4	IN	From KIM E-E
6	AB5	IN	From KIM E-F
7	AB6	IN	From KIM E-H
8	AB7	IN	From KIM E-J
9	AB8	IN	From KIM E-K
10	AB9	IN	From KIM E-L
11	AB10	IN	From KIM E-M
12	AB11	IN	From KIM E-N
13	AB12	IN	From KIM E-P
14	AB13	IN	From KIM E-R
15	AB14	IN	From KIM E-S
16	AB15	IN	From KIM E-T
17	Lower 8K enable	To KIM A-K	Enables KIM on-board Memory when addressed.
18	RAM R/W	To S-100 68	Simulates MWRITE.
19	Ready	To KIM E-2	Low level puts processor in Hold.
20	Q2 clock	From KIM E-4	The KIM clock is used
		To S-100 24	for all external timing.
		To S/P converter board 22	
		To External Interfacing Board K	
21	+5 volts (Req)	From S/P converter board A	
22	Ground	From S/P converter board E	
A	AB0	OUT	To S-100 79, Ext. Int. 1
B	AB1	OUT	To S-100 80, Ext. Int. 2
C	AB2		To S-100 81, Ext. Int. 3
D	AB3		To S-100 31, Ext. Int. 4
E	AB4		To S-100 30, Ext. Int. 5
F	AB5		To S-100 29, Ext. Int. 6
H	AB6		To S-100 82, Ext. Int. 7
J	AB7		To S-100 83, Ext. Int. 8
K	AB8		To S-100 84
L	AB9		To S-100 34
M	AB10		To S-100 37
N	AB11		To S-100 87
P	AB12		To S-100 33
R	AB13		To S-100 85
S	AB14		To S-100 86
T	AB15		To S-100 32
U	I/O enable	To S 100 45, 46	High level indications I/O operation.
		To Ext. Int. 13	
V	Interrupt enable	To KIM A-J	Low level indicates page FF accessed.
W	W/R	From KIM E-V	
		To S-100 78	Simulates PDBIN.
		To Ext. Int. 14	

X	Sync	From KIM E-1	
Y	Hold Request	From S/P converter board 20	Puts processor in Hold during carriage return.
		From S-100 74	Hold request from Dazzler.
Z	Hold Acknowledge	To S-100 26	High level indicates Dazzler may proceed.

#### SERIAL/PARALLEL CONVERTER BOARD

Pin	Name	Connects	Comments
A	+5 Regulated	To KIM A-A To Ext. Int. 12 To S/P converter board M To PIA Applications F	Pins A through H connect also to power supply by ribbon cable. Allow two wires each for +5, +8 and ground due to high current levels.
B	+8	To S-100 1, 51	
C	-15	To S-100 52	
D	-12	To PIA Applications D To S/P converter board Z To Ext. Int. H	
E	Ground	To PIA applications Z To KIM A-1 To Ext. Int. L To S/P interface board Y and 21 To S-100 50, 70	
F	+12	To Ext. Int. 10	
H	+15	To PIA Applications E To S-100 2	
J	Echo		
K	Xmit		
L	RCVE		
M	+5		
N	Parity		
P	B7 (MSB)	To SWTP keyboard pins of same name by way of ribbon cable	
R	B6		
S	B5		
T	B4		
U	B3	To SWTP keyboard pins of same name by way of ribbon cable.	
V	B2		
W	B1 (LSB)		
X	KP		
Y	Ground		
Z	-12		
1	RST	From KIM E-7	Used to reset UART.
2	Dazzler OFF	To S-100 99	Turns Dazzler off whenever an ASCII key is depressed to prevent possible noise generation from interfering with ASCII transfer. (Full discussion in later articles.)
		To front panel switch POWER, DAZ	When switch is in off position, this point is shorted to ground. This switch (DPDT) also connects a 9 V battery through a 2000 Ohm resistor to the Pixie-Verter when on (see Fig. 5).
3	Print OFF	To front panel switch POWER, Print	When switch is off, this point is shorted to ground, thus disabling transfers to printer. This switch (DPDT) also disables the 40 V solenoid power when off as indicated in the SWTP Printer manual (see Fig. 5).
6	TTY PRNT	From KIM A-U To Backplane	If S/P board is removed, a standard TTY may be connected to KIM by way of backplane.
7	TTY KYBD	From KIM A-T To Backplane	
8	PRNT RTRN	From KIM A-S To Backplane	
9	KYBD RTRN	From KIM A-R To Backplane	
12	B2		
13	B1		
14	B0 (LSB)		
15	B4	These pins connect SWTP Printer connector J-4 to pins of same name by way of ribbon cable.	Male connector for end of this cable is included in SWTP Printer Kit.
16	B3		



17	B6 (MSB)
18	B5
19	Data Ready
20	Data Accept
21	ground

#### EXTERNAL INTERFACING BOARD

Pin	Name	Connects	Comments
9	RAM R/W	From KIM E-Z	Used to control write to output ports for D/A conversion.
15	DB7	From KIM E-8 To S-100 90, 43	
16	DB6	From KIM E-9 To S-100 40, 93	
17	DB5	From KIM E-10 To S-100 39, 92	
18	DB4	From KIM E-11 To S-100 38, 91	Because of Tri-state buffering the KIM bidirectional bus may be connected to both S-100 data buses.
19	DB3	From KIM E-12 To S-100 89, 42	
20	DB2	From KIM E-13 To S-100 88, 41	
21	DB1	From KIM E-14 To S-100 35, 94	
22	DB0	From KIM E-15 To S-100 36, 95	
A	A/D, D	From Backplane	When selected, these analog inputs are read digitally as memory locations.
B	A/D, C	From Backplane	
C	A/D, B	From Backplane	
D	A/D, A	From Backplane	
E	D/A, B	To Backplane	These outputs are analog signals from processor accessible ports.
F	D/A, A	To Backplane	This output is Joystick voltage reference (see Fig. 5 for connections).
J	Ref Voltage	To Joysticks	The sense switches, when down, short these pins to ground.
M	SS7 (MSB)	From sense switch 7	
N	SS6	From sense switch 6	
P	SS5	From sense switch 5	
R	SS4	From sense switch 4	
S	SS3	From sense switch 3	
T	SS2	From sense switch 2	
U	SS1	From sense switch 1	
V	SS0 (LSB)	From sense switch 0	
W	JSRV	From wiper, right hand, vertical joystick port.	See Fig. 5.
X	JSRH	From wiper, right hand, horizontal joystick port.	
Y	JSLV	From wiper, left hand, vertical joystick port.	
Z	JSLH	From wiper, right hand, horizontal joystick port.	

#### PIA APPLICATIONS BOARD

Pin	Name	Connects	Comments
A	IRQ	To KIM E-4	
H	PB5	To KIM A-16	
J	BB7	To KIM A-15	
K	PA0	To KIM A-14	
L	PB4	To KIM A-13	
M	PB3	To KIM A-12	
N	PB2	To KIM A-11	
P	PB1	To KIM A-10	
R	PB0	To KIM A-9	Each of these pins also connects to backplane jack of same name.
S	PA7	To KIM A-8	
T	PA6	To KIM A-7	
U	PA5	To KIM A-6	
V	PA4	To KIM A-5	
W	PA1	To KIM A-4	
X	PA2	To KIM A-3	
Y	PA3	To KIM A-2	

#### KIM APPLICATIONS CONNECTOR

Pin	Name	Connects	Comments
L	Audio IN	To Backplane	Use grounded shielded cable for these connections.
M	Audio out Lo	To Backplane	
V	KB Row 3	To Aux. switch 1	When switch is in the up position these two pins are shorted together, putting KIM into TTY mode (see Fig. 5).
21	KB col A	To Aux. switch 1	