IMSAI

MOTHERBOARD

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FUNCTIONAL DESCRIPTION

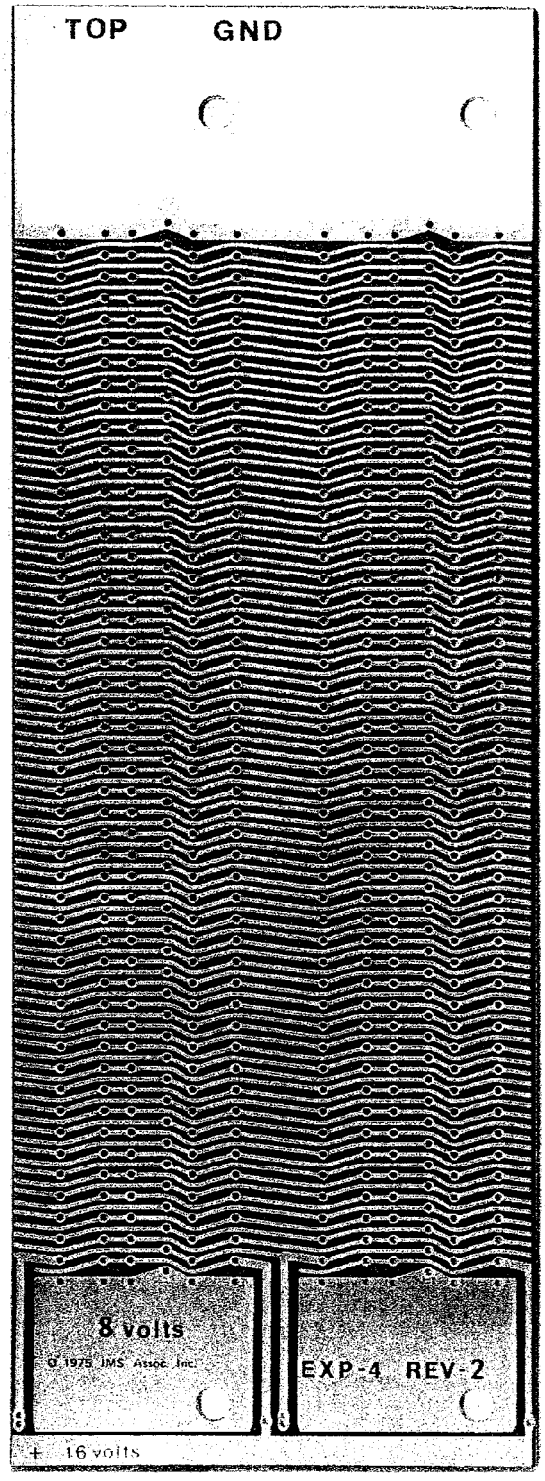
The IMSAI 8080 system Mother boards are available in three different length sections varying from a minimum of 4 printed circuit card connector positions. The basic system includes a Mother board with six connector positions on it. One is used for the front panel and the other five are available for the MPU and any combination of memory or I/O cards.

The card-to-card spacing on the Mother board is 3/4 inch except for the front position which is reserved for the front panel board or the parallel I/O board for the dedicated processor to accommodate mounting the card in the special front position in the cabinet.

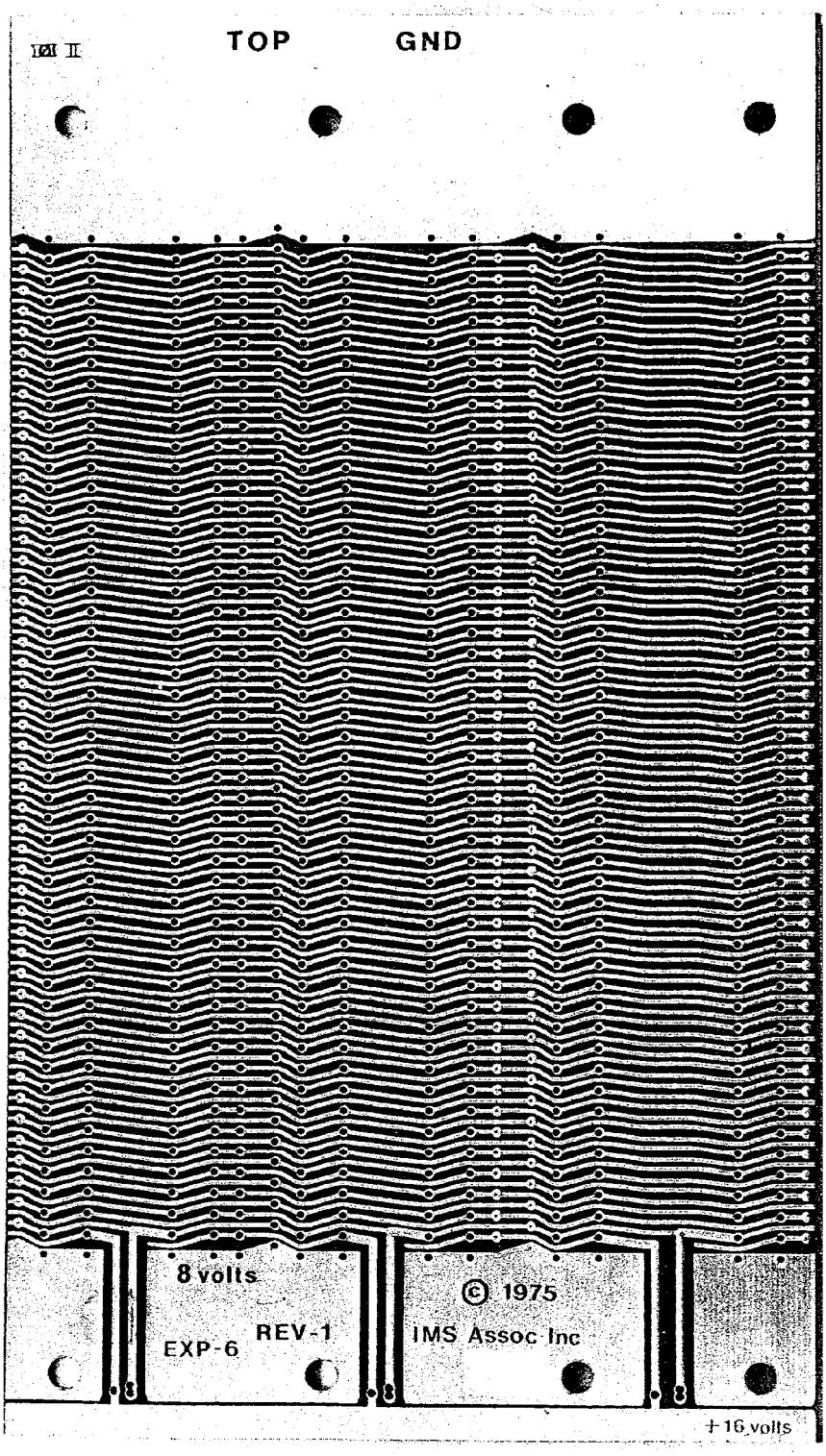
Additional sections of Mother board are available with positions for 4 connectors. These may be added to the system at a later date, and connected to the previous Mother board sections by jumpers between the sections soldered into provided holes. No jumper wire soldering is required if the full-length board is purchased.

The Mother board is 1/16 inch printed circuit board with double-sided plated-through holes. Each of the connector pins is connected by traces on both sides of the board. Heavy power traces are provided to handle the very large currents involved in a fully-loaded back plane. The two connectors supplied with the IMSAI system are high-quality gold-plated-contact connectors, for reliable contacts and long life.

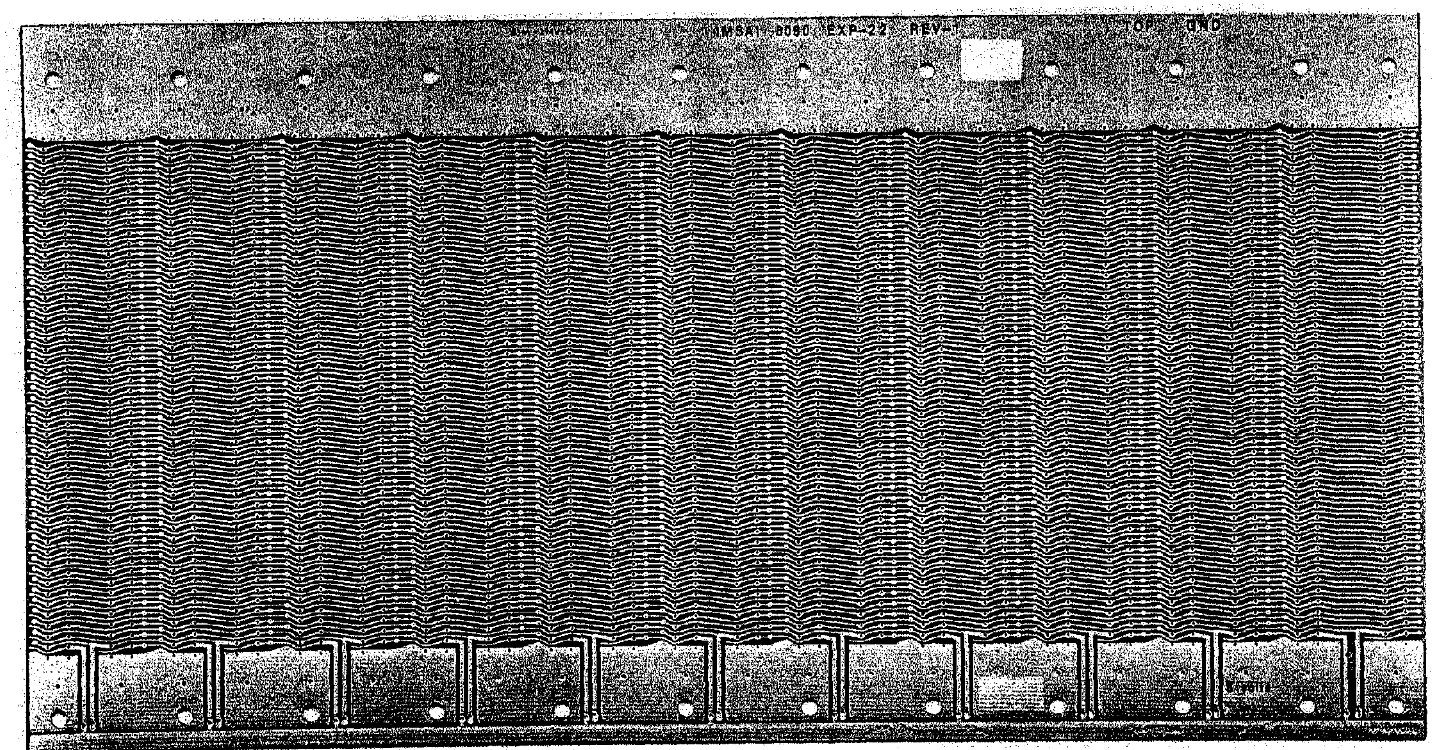
Trace spacing is tightly controlled on the board to avoid any close spots where shorts from solder bridges might tend to occur. The traces on Mother board are plated for better appearance and more reliable solder connections. A solder mask is provided on both sides of the Mother board.



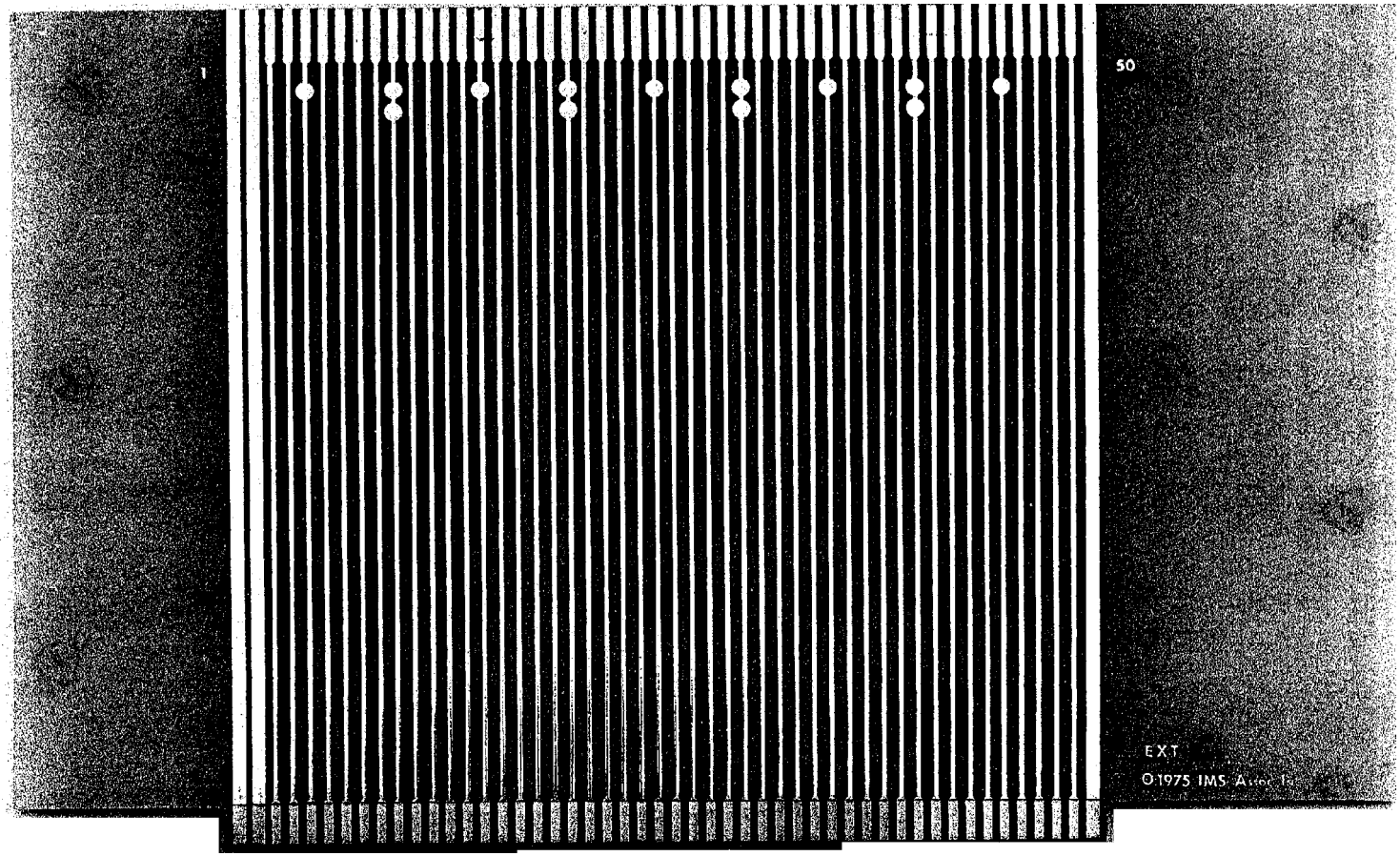
EXP-4



EXP-6



EXP-22 Rev. 1



EXT (EXTE''DER BOARD)

Mother Board
Parts List

EXP-4

ITEM	IMSAI PART #	QUANTITY	DESCRIPTION/IDENTIFYING MARKS
PC Board	92-0000004	1	4-Slot Printed Circuit Board
Washer	21-3330001	8	#6 Sholder Fiber Washer
Spacer	21-4600001	4	6-32x¼" Threaded Spacer
Nut	21-3120001	4	6-32 Nut
Screw	20-3701002	4	6-32x3/4" Nylon Screw

EXP-6

PC Board	92-0000005	1	6-Slot Printed Circuit Board
Washer	21-3330001	16	#6 Shoulder Fiber Washer
Spacer	21-4600001	8	6-32x¼" Threaded Spacer
Nut	21-3120001	8	6-32 Nut
Screw	20-3701002	8	6-32x3/4" Nylon Screw

EXP-22

PC Board	92-0000006	1	22-Slot Printed Circuit Board
Wahser	21-3330001	48	#6 Shoulder Fiber Washer
Spacer	21-4600001	24	6-32x¼" Threaded spacer
Nut	21-3120001	24	6-32 Nut
Screw	20-3701002	24	6-32x3/4" Nylon screw

MOTHER BOARD

ASSEMBLY INSTRUCTIONS

The Mother board appears to be the simplest of all the boards to assemble. The solder mask minimizes the chances of shorting adjacent traces. However, it is imperative that extra care be taken during assembly to avoid excess solder shorting adjacent pins. Because a short on the Mother board is extremely hard to locate and correct when it is between the board and the connector, it is worth the builder's time to give special attention to making certain that no such shorts occur. Use only as much solder as required for a good joint. If too much solder is used, either the pool of solder can short to an adjacent pin on the top side or the solder can leak through and form a ball on the backside which can also short to an adjacent pin.

The board should be checked with an ohmmeter carefully both before and after assembly to insure that it will operate properly. While the chance that incomplete etching during manufacture left two traces shorted is extremely slight, the ohmmeter check before assembly is worth while simply because it would be so difficult to correct such a problem after a socket is soldered in place over it.

To test the board, either a simple ohmmeter or a battery connected to a buzzer or a light bulb and test leads are all that is required. Each pair of adjacent traces should be checked with the continuity tester to be sure that there is no connection between them. Should any adjacent traces be found to be electrically connected during this pre-assembly check, careful inspection of the board should reveal the short. Any imcompletely-etched copper or other metallic path between the two traces shold be removed with a sharp knife, such as an X-acto knife.

After each connector is soldered in, the continuity check should be made again to make certain that during assembly no shorts were created. If any are discovered, steps should be taken to remove them before further assembly. In most cases, this short will have been caused by too much solder having been applied and may be removed simply by removing the excess solder. If an Extender board is available, a simple tester may be made from it by temporarily connecting all the pins on the front side, except pin 1, together, connecting all the pins on the back side, except pin 100, together and then connecting the continuity tester between the two sides of the Extender board. If this extender board is inserted in the socket as it is being soldered, the continuity tester will indicate immediately any short between any two adjacent traces.

SOCKET INSERTION

The 100 pin edge connectors are symmetrical so that they may be inserted either way. The connector stands off the board slightly supported by raised feed at each end. Each connector should be checked during assembly to make sure that it is seated properly and that the Mother board near the center of the connector is neither pushed further toward the connector nor lifted away before the connector is soldered in place to prevent the Mother board from bowing.

The Mother board is not completely symmetrical and the connectors must be inserted from the top side. The top side is the side on which the +8 volt foil is broken every 2 connectors to allow the 2 traces for + and -16 volts to extend from the 16 volt bus at the end of the board into the connector pins. The back side of the board has both the very heavy ground bus and the 1 inch wide 8 volt foil area continuous for the full length of the board. The +16 volt trace is the .2 inch trace on the edge of the board alongside the +8 volt bus on the front side, that is, the side where the +8 is broken to allow for the pairs of +16 volt traces to extend into the pins. The -16 volt bus is the .2 inch wide trace along the edge of the board on the back side underneath the +16 volt bus. NOTE: Before mounting any connectors, locate the front of the Mother board. The connector for the front panel (CPA board) needs to be mounted in the first position at the front of the Mother board. Notice that the spacing between the first and second positions at the front of the Mother board is wider than the spacing between any two of the other connector positions.

The suggested procedure for inserting and soldering a connector is to insert the connector in place, seat the two ends firmly against the feet and solder the two pins on each end.

Next, the position of the center of the Mother board next to the connector should be checked and either pushed further toward the connector or pulled away so that the gap between the connector and the Mother board is uniform all the way across. Then the two pins in the center of the connector should be soldered.

One final check should be made to make sure that the gap is uniform all the way across the connector and the remaining pins in the connector should be soldered.

Care should be taken to check each connector after solder to make sure that every pin was soldered because it is easy to miss a pin and not see it during a quick inspection. After the last connector is soldered in place and the board checked you are ready to install the power connections and mount the board in the cabinet.

See MAINFRAME ASSEMBLY section for connecting the Mother board to the Power Supply and mounting the Mother board in the chassis.

Mother Board

USER GUIDE

With the proper care taken during assembly, the Mother board should be the most reliable board in the system. The only attention the user will typically put on the Mother board, is when he desires to add more card slot positions. Either 4 slot extension Mother Boards may be added to the original 6 slot Mother Board, or the 6 slot board may be replaced by a new 22 slot board.

If 4 slot extension(s) are used, the extension(s) should be assembled according to instructions for assembling the original Mother board. Then the original Mother board must be removed from the cabinet and jumpered to the new section by the use of short wire jumpers between the connection points provided in each trace.

The power buses should be connected with a much heavier wire. The two boards can then be reassembled into the cabinet.

Care should be taken when inserting jumpers that each goes between the corresponding lines on the two sections of Mother board.

IMSAI 8080 BUS SIGNAL LIST

1	+8v
2	+16v
3	XRDY
4	VI Ø
5	VI 1
6	VI 2
7	VI 3
8	VI 4
9	VI 5
10	VI 6
11	VI 7
12	
13	
14	
15	
16	
17	
18	STATUS DSBL
19	CCDSBL
20	**
21	SS
22	ADDR DSBL
23	DO DSBL
24	Ø2
25	Ø1
26	PHLDA
27	PWAIT
28	PINTE
29	A 5
30	A 4
31	A 3
32	A 15
33	A 12
34	A 9
35	DO 1
36	DO Ø
37	A 10
38	DO 4
39	DO 5
40	DO 6
41	DI 2
42	DI 3
43	DI 7
44	SMI
45	SOUT
46	SINP
47	SMEMR
48	SHLTA
49	CLOCK (2 MHz)
50	GND

51	+8v
52	-16v
53	SSW DSB
54	EXT CLR
55	*
56	
57	
58	
59	
60	
61	
62	
63	
64	
65	
66	
67	
68	MWRITE
69	****
70	***
71	RUN
72	PRDY
73	PINT
74	PHOLD
75	PRESET
76	PSYNC
77	PWR
78	PDBIN
79	A Ø
80	A 1
81	A 2
82	A 6
83	A 7
84	A 8
85	A 13
86	A 14
87	A 11
88	DO 2
89	DO 3
90	DO 7
91	DI 4
92	DI 5
93	DI 6
94	DI 1
95	DI Ø
96	SINTA
97	SWO
98	SSTACK
99	POC
100	GND

* reserved for chassis ground
** reserved for memory unprotect
*** reserved for memory protect
**** reserved for protect status

BUS DEFINITION

Front Side

No.	SYMBOL	NAME	FUNCTION
5	V11	Vectored Interrupt Line # 1	
6	V12	Vectored Interrupt Line #2	
7	V13	Vectored Interrupt Line #3	
8	V14	Vectored Interrupt Line #4	
9	V15	Vectored Interrupt Line #5	
10	V16	Vectored Interrupt Line #6	
11	V17	Vectored Interrupt Line #7	
12 to 17	UNUSED		
18	$\overline{\text{STATUS DSBL}}$	STATUS DISABLE	Allows the buffers for the 8 status lines to be tri-stated
19	$\overline{\text{CC DSB}}$	COMMAND CONTROL DISABLE	Allows the buffers for the 6 output command/control lines to be tri-stated
20	UNPROT	UNPROTECT	Reserved for input to the memory protect flip-flop on a given memory board
21	SS	SINGLE STEP	Used by Front Panel to disable input buffer while panel drives bidirectional data bus

BUS DEFINITION

Front Side

No.	SYMBOL	NAME	FUNCTION
22	$\overline{\text{ADDR DSBL}}$	ADDRESS DISABLE	Allows the buffers for the 16 address lines to be tri-stated
23	$\overline{\text{DO DSBL}}$	DATA OUT DISABLE	Allows the bidirectional data bus drivers for the 8 data lines to be tri-stated for both input and output data buses
24	ø2	Phase 2 Clock	
25	ø1	Phase 1 Clock	
26	PHLDA	Hold Acknowledge	Processor control output signal which appears in response to the HOLD signal; indicates that the data and address bus will go to the high impedance state on the 8080. Note: $\overline{\text{ADDR DSBL}}$ and $\overline{\text{DO DSBL}}$ must be driven to tri-state the system bus
27	PWAIT	WAIT	Processor control output signal which acknowledges that the processor is in a WAIT state
28	PINTE	INTERRUPT ENABLE	Processor control output signal indicating interrupts are enabled: may be set or reset by EI and DI instruction and inhibits interrupts from being accepted by the CPU if it is reset

BUS DEFINITION

Front Side

No.	SYMBOL	NAME	FUNCTION
29	A5	Address Line #5	
30	A4	Address Line #4	
31	A3	Address Line #3	
32	A15	Address Line #15	
33	A12	Address Line #12	
34	A9	Address Line #9	
35	DO	Data Out Line #1	
36	DO0	Data Out Line #0	
37	A10	Address Line #10	
38	DO4	Data Out Line #4	
39	DO5	Data Out Line #5	
40	DO6	Data Out Line #6	
41	D12	Data In Line #2	
42	D13	Data In Line #3	
43	D17	Data In Line #7	
44	SM1	M1	Status output signal that indicates that the processor is in the fetch cycle for the first byte of an instruction
45	SOUT	OUT	Status output signal which indicates that the address bus contains the address of an output device and the data bus will contain the output data when $\overline{PWR}$ is active

BUS DEFINITION

Front Side

No.	SYMBOL	NAME	FUNCTION
46	SNIP	INP	Status output signal which indicates that that the address bus contains the address of an input device and the input data should be placed on the data bus when PDBIN is active
47	SMEMR	MEMR	Status output signal which indicates that the data bus will be used for memory read data
48	SHLTA	HLTA	Status output signal which acknowledges a HALT instruction
49	$\overline{\text{CLOCK}}$	CLOCK	2 MHz clock signal
50	GND	GROUND	

Back Side

No.	SYMBOL	NAME	FUNCTION
51	+8V	+8 volts	Unregulated input to 5v regulators
52	-16V	-16 volts	Negative unregulated voltage
53	$\overline{\text{SSW DSB}}$	SENSE SWITCH DISABLE	Disables the data input buffers so the input from the sense switches may be strobed onto the bi-directional data bus
54	$\overline{\text{EXT CLR}}$	EXTERNAL CLEAR	Clear signal for I/O devices (front panel switch closure to ground)

BUS DEFINITION

Back Side

No.	SYMBOL	NAME	FUNCTION
55	CGND	CHASSIS GROUND	
56 to 67	UNUSED		
68	MWRT	MEMORY WRITE	From the Front Panel indicates that the current data on the Data Out Bus is to be written into the memory location currently on the address bus
69	$\overline{PS}$	PROTECT STATUS	Reserved to indicate the status of the memory protect flip-flop on the memory board currently addressed
70	PROT	PROTECT	Reserved for input to the memory protect flip-flop on the memory board currently addressed
71	RUN	RUN	Indicates that the RUN/STOP flip-flop is set to run on the front panel
72	PRDY	READY	Processor command/ control input that controls the run state of the processor; if the line is pulled low the processor will enter a wait state until the line is released

BUS DEFINITION

Back Side

No.	SYMBOL	NAME	FUNCTION
73	$\overline{\text{PINT}}$	INTERRUPT REQUEST	The processor recognizes an interrupt request on this line at the end of the current instruction or while halted. If the processor is in the HOLD state or the Interrupt Enable flip-flop is reset, it will not honor the request
74	$\overline{\text{PHOLD}}$	HOLD	Processor command input signal which requests the processor to enter the HOLD state; allows an external device to gain control of address and data buses as soon as the processor has completed its use of these buses for the current machine cycle
75	$\overline{\text{PRESET}}$	RESET	Processor command input; while activated the content of the program counter is cleared and the instruction register is set to 0
76	PSYNC	SYNC	Processor control output provides a signal to indicate the beginning of each machine cycle
77	$\overline{\text{PWR}}$	WRITE	Processor control output used for memory write or I/O output control; continued next page.

BUS DEFINITION

Back Side

No.	SYMBOL	NAME	FUNCTION
77	$\overline{PWR}$	WRITE	Con't.: data on the data bus is stable while the $\overline{PWR}$ is active
78	PDBIN	DATA BUS IN	Processor control output signal indicates to external circuits that the data bus is in the input mode
79	A0	Address Line #0	
80	A1	Address Line #1	
81	A2	Address Line #2	
82	A6	Address Line #6	
83	A7	Address Line #7	
84	A8	Address Line #8	
85	A13	Address Line #13	
86	A14	Address Line #14	
87	A11	Address Line #11	
88	DO2	Data Out Line #2	
89	DO3	Data Out Line #3	
90	DO7	Data Out LIne #7	
91	D14	Data In Line #4	
92	D15	Data In Line #5	
93	D16	Data In Line #6	
94	D17	Data In Line #1	
95	D10	Data In Line #0	

BUS DEFINITION

Back Side

No.	SYMBOL	NAME	FUNCTION
96	SINTA	INTA	Status output signal to acknowledge signal for INTERRUPT request
97	SWO	WO	Status output signal indicates that the operation in the current machine cycle will be a WRITE memory or output function
98	SSTACK	STACK	Status output signal indicates that the address bus holds the pushdown stack address from the Stack Pointer
99	$\overline{POC}$	Power-On Clear	
100	GND	GROUND	