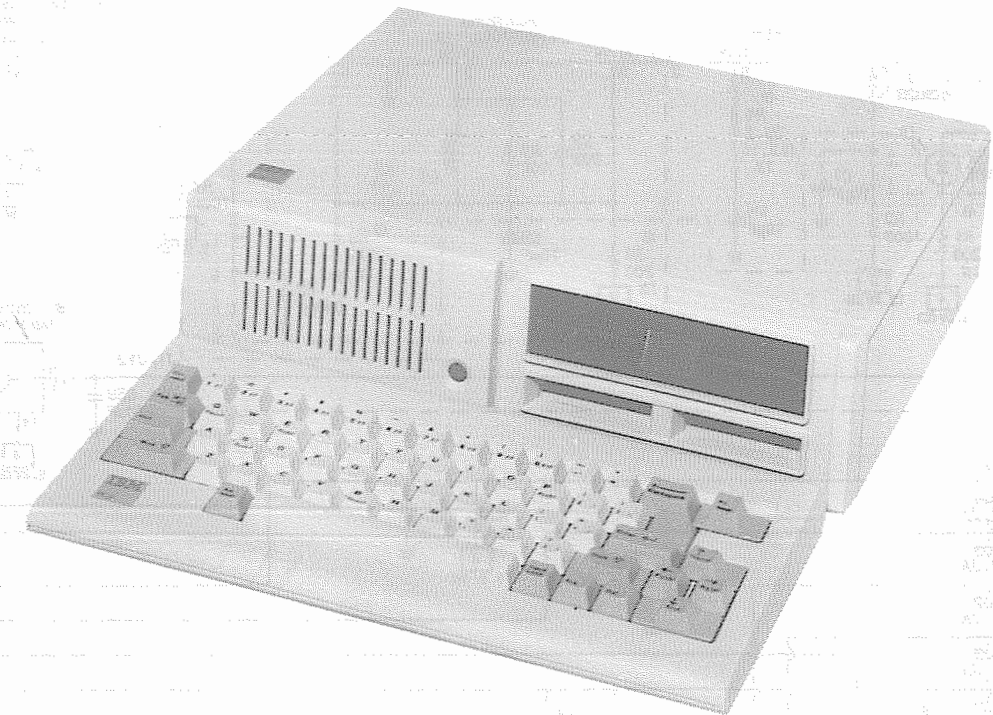


**DISK DRIVE
DISK DRIVE ADAPTER BOARD**

See Folder CSCS8-A

**KEYBOARD
MEMORY EXPANSION BOARD
POWER SUPPLY
SYSTEM BOARD**

IBM PCjr
MODEL 4860
CSCS8



CSCS8
IBM PCjr
MODEL 4860

PRELIMINARY SERVICE CHECKS

ENCLOSED

SAFETY PRECAUTIONS

See page 51

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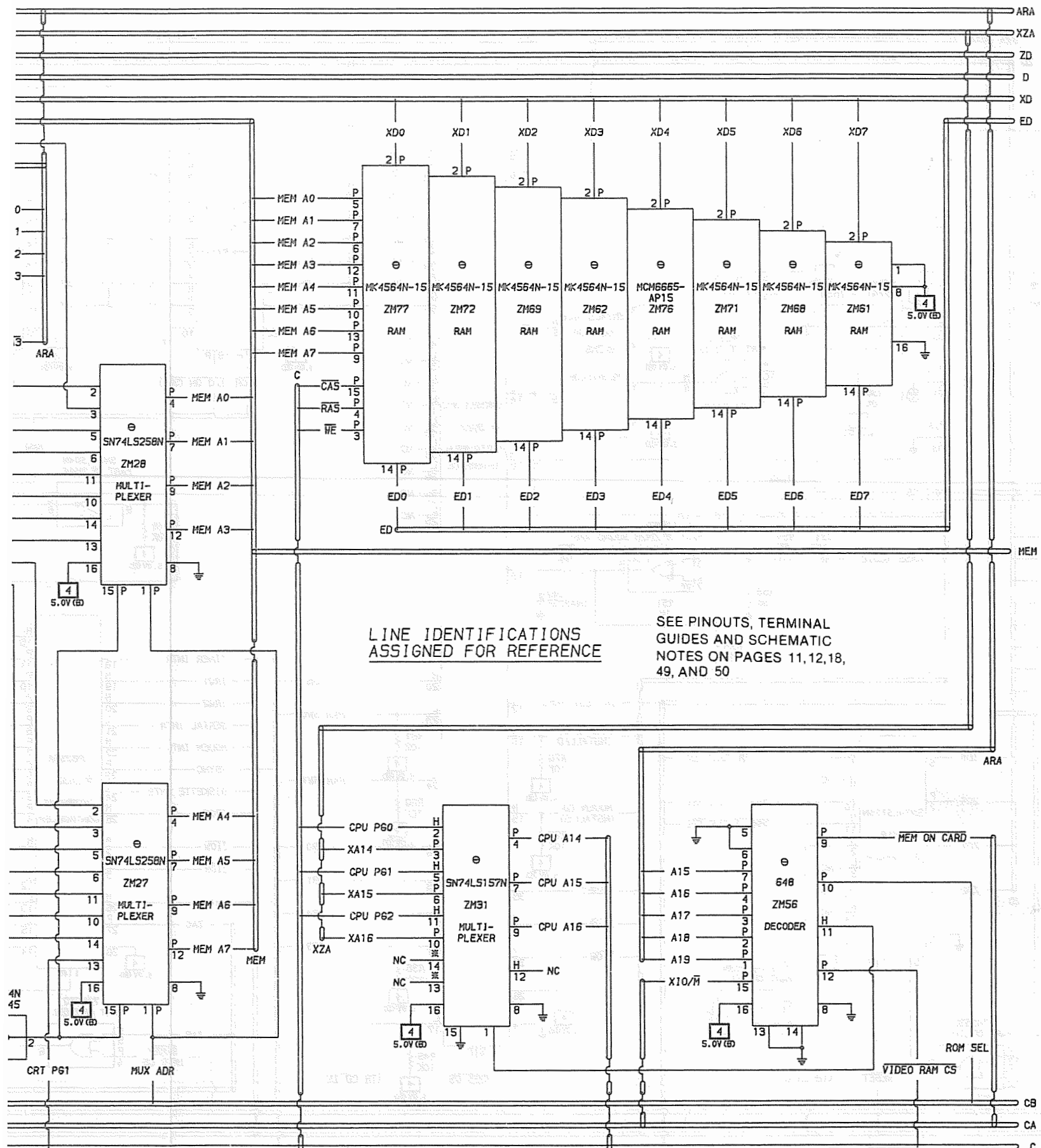


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The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed.

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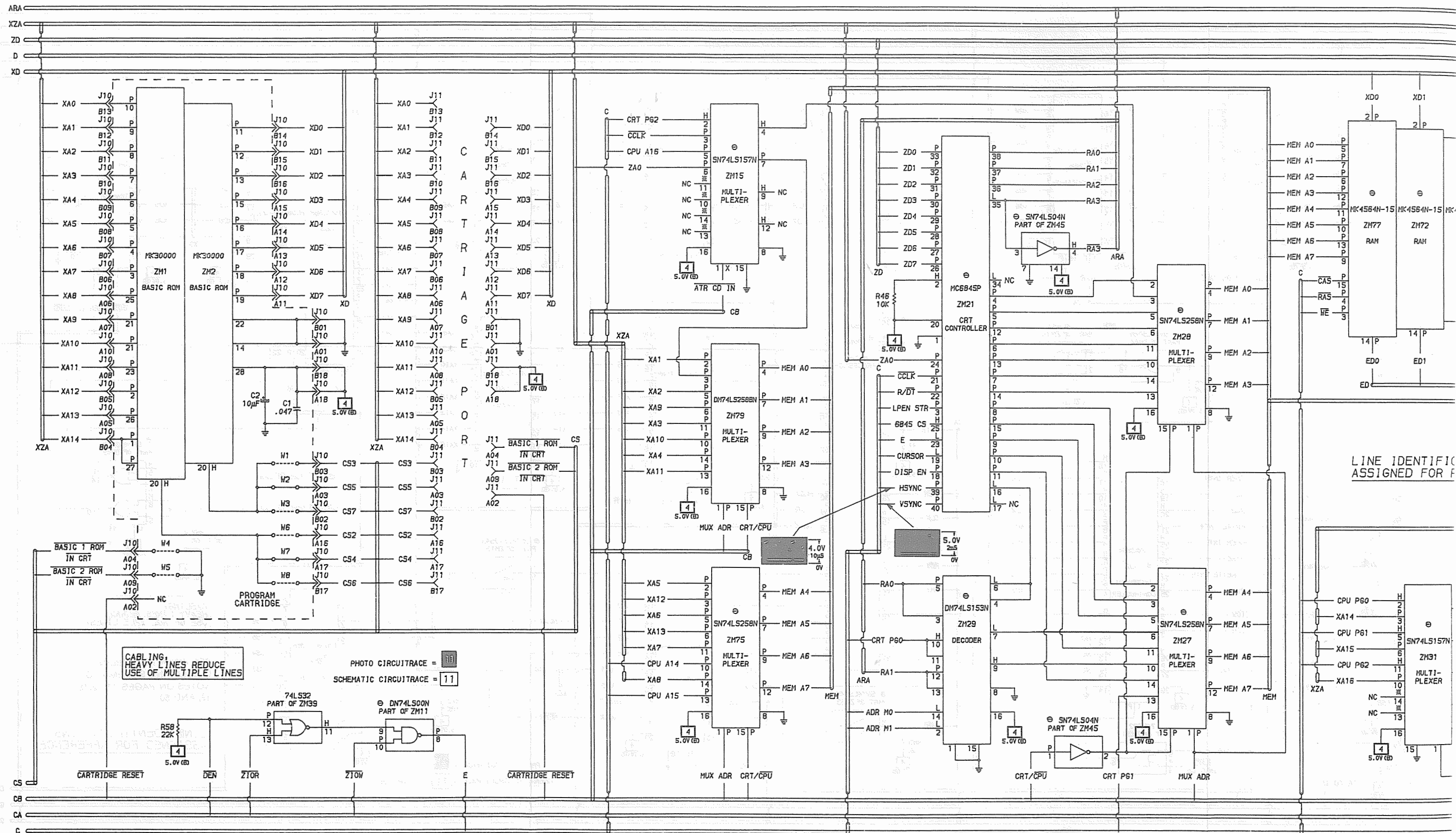


LINE IDENTIFICATIONS
ASSIGNED FOR REFERENCE

SEE PINOUTS, TERMINAL
GUIDES AND SCHEMATIC
NOTES ON PAGES 11,12,18,
49, AND 50

SYSTEM BOARD

IBM PCjr
MODEL 4860

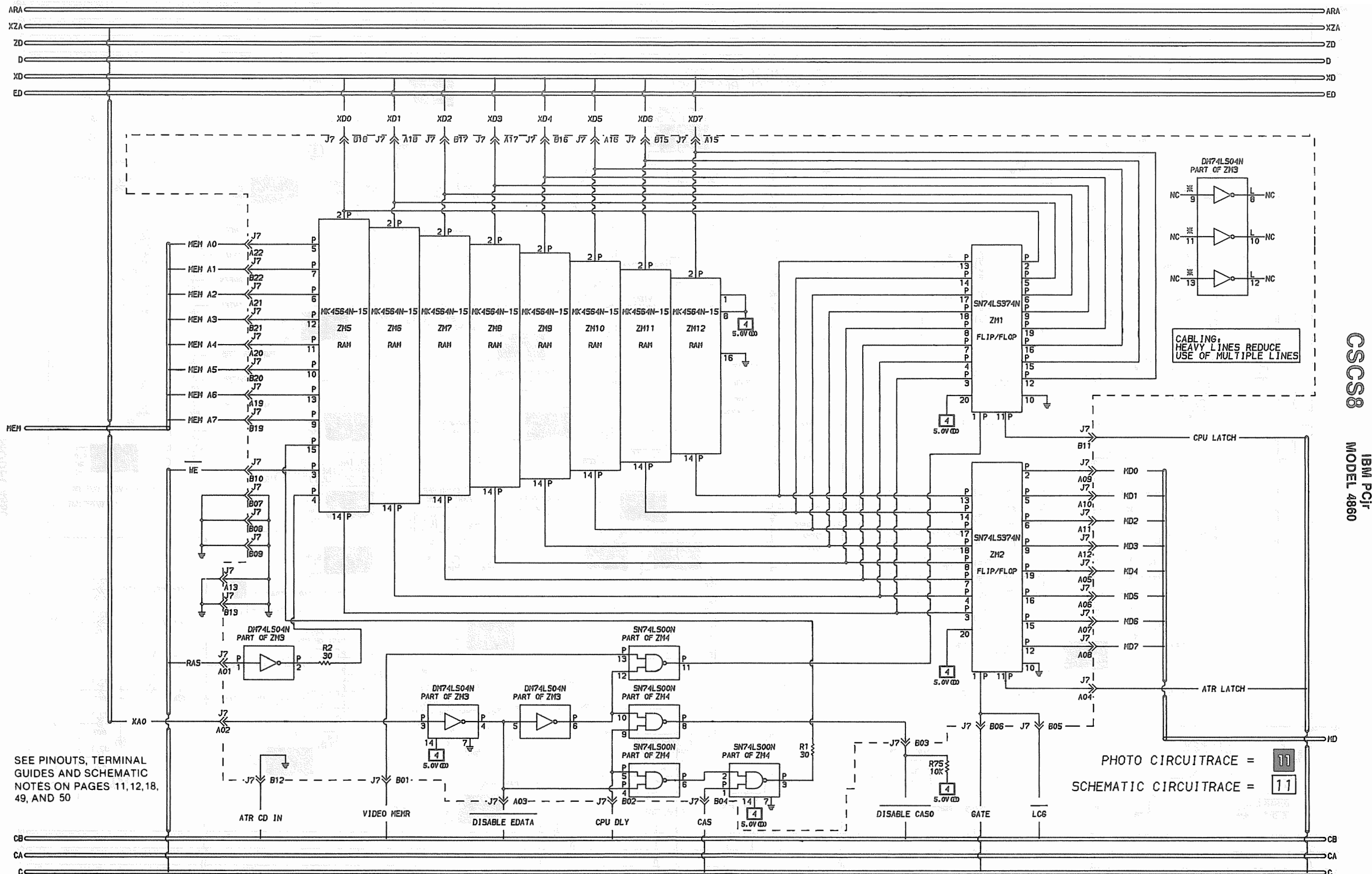


A PHOTOFAC STANDARD NOTATION SCHEMATIC

WITH CIRCUITRACE

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SYSTEM BOARD



CS8
IBM PCjr
MODEL 4860



PHOTOFACT STANDARD NOTATION S
WITH **CIRCUITRACE™**
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SYSTEM BOARD

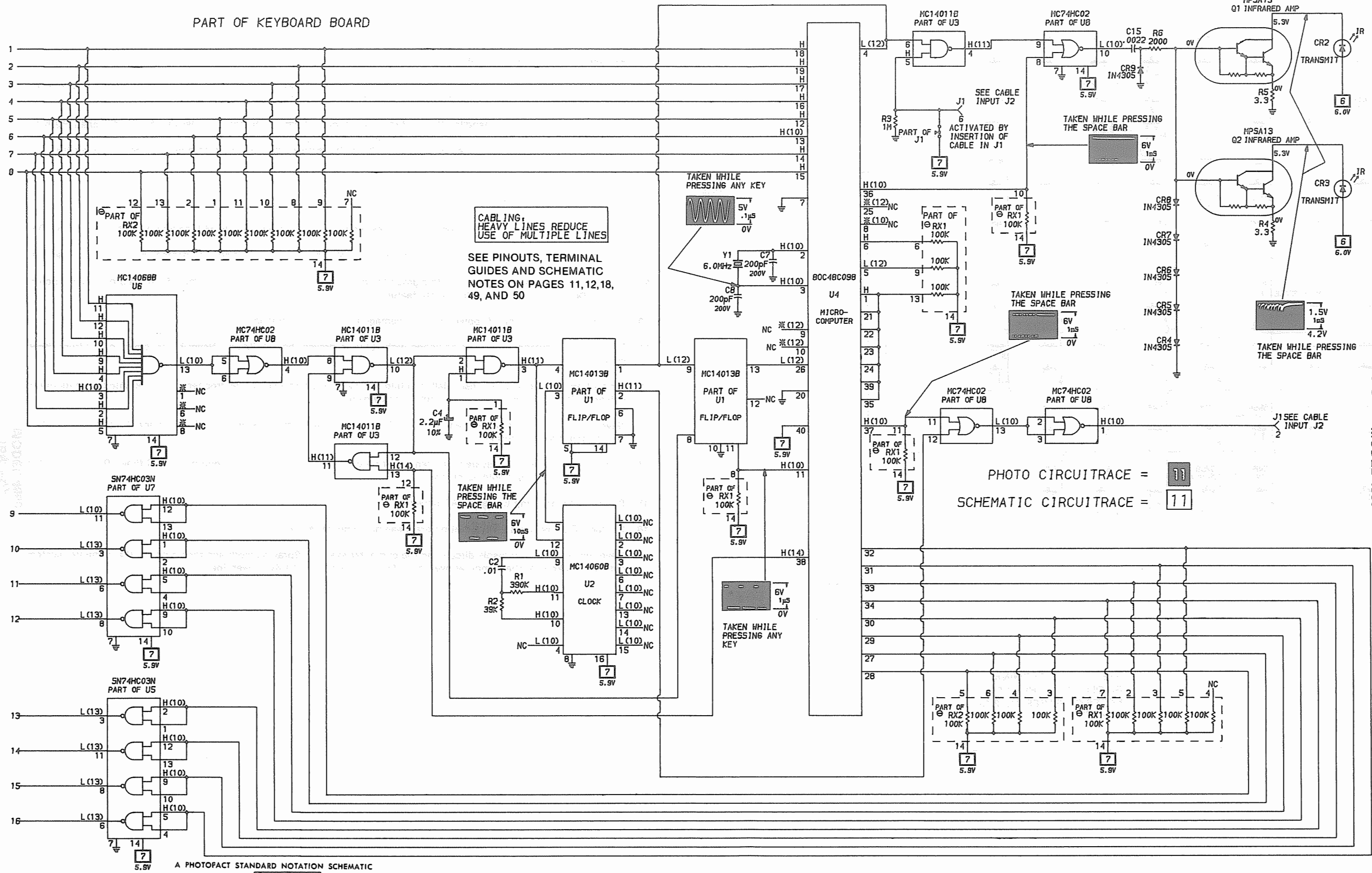


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LINE IDENTIFICATIONS
ASSIGNED FOR REFERENCE

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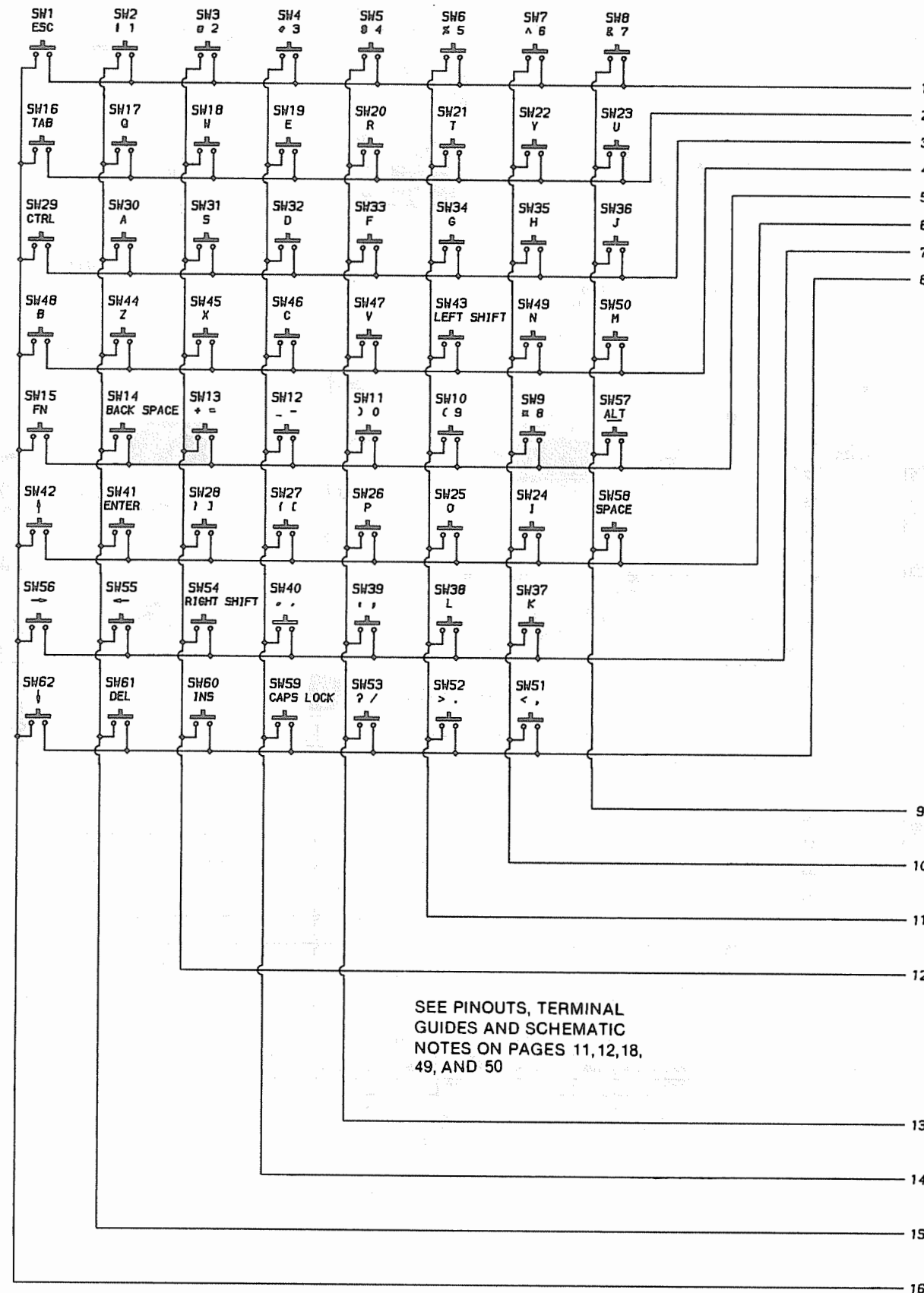


IBM PCjr
MODEL 4860

SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the computer system before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.
5. Use a grounded-tip, low voltage soldering iron.
6. Use an isolation (times 10) probe on scope.
7. Do not remove or install boards, floppy disk drives, printers, or other peripherals with computer system AC power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. This computer system is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The computer system cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.
13. Never expose the computer system to water. If exposed to water turn the unit off. Do not place the computer system near possible water sources.
14. Never leave the computer system unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
15. Do not allow anything to rest on AC power cord.
16. Unplug AC power cord from outlet before cleaning computer system.
17. Never use liquids or aerosols directly on the computer system. Spray on cloth and then apply to the computer system cabinet. Make sure the computer system is disconnected from the AC power line.

IBM PCjr
MODEL 4860



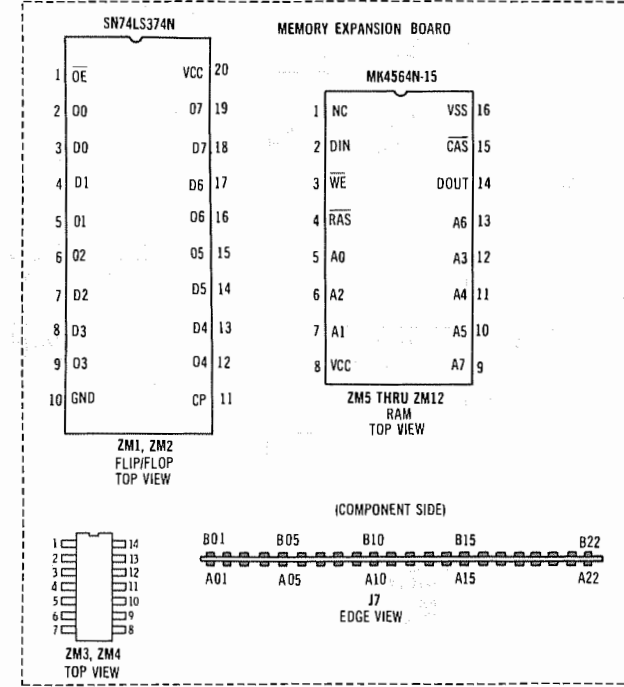
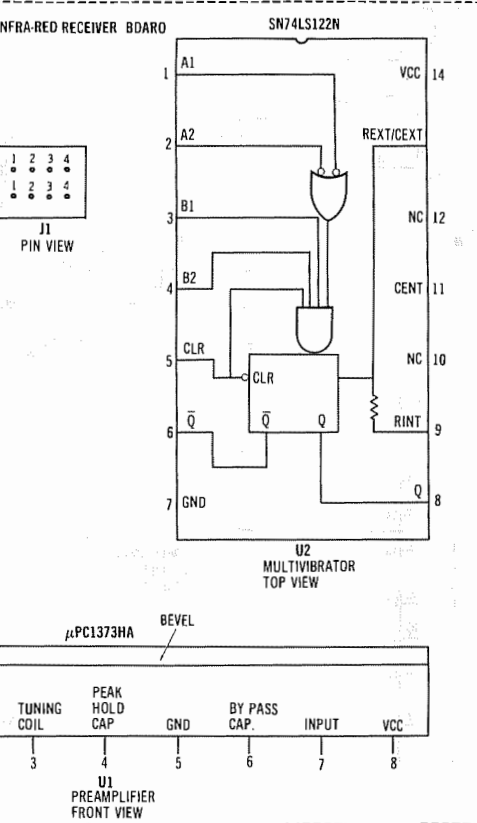
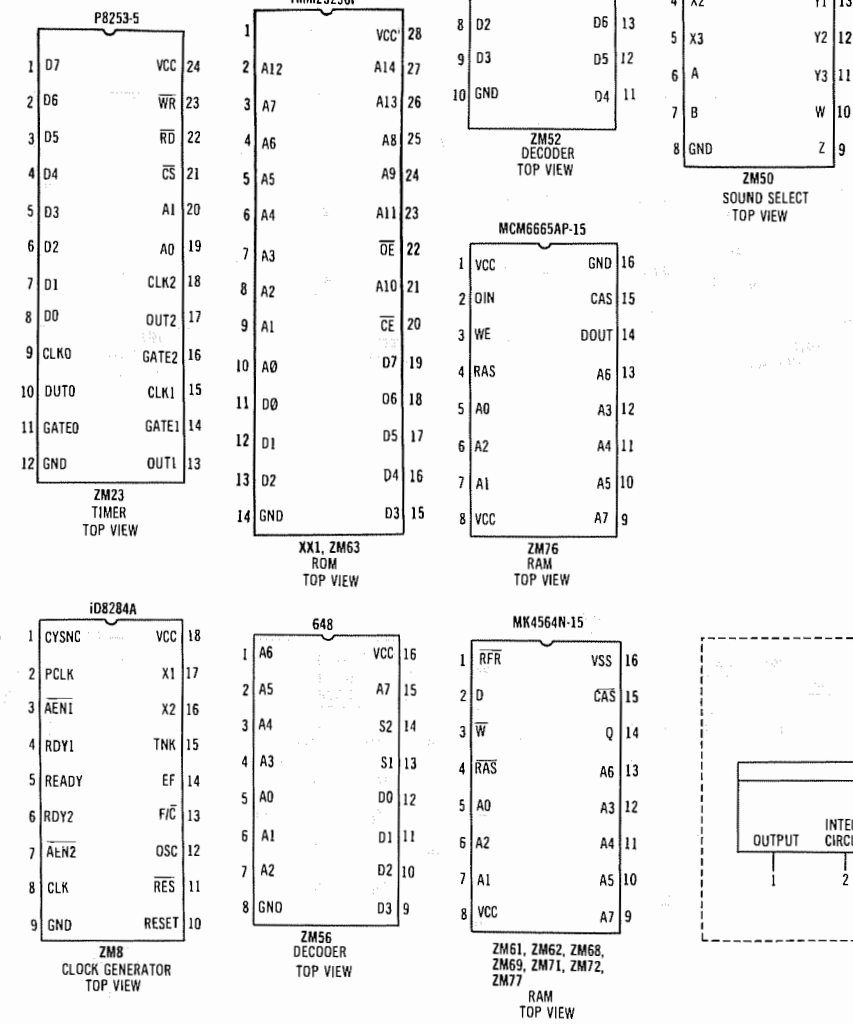
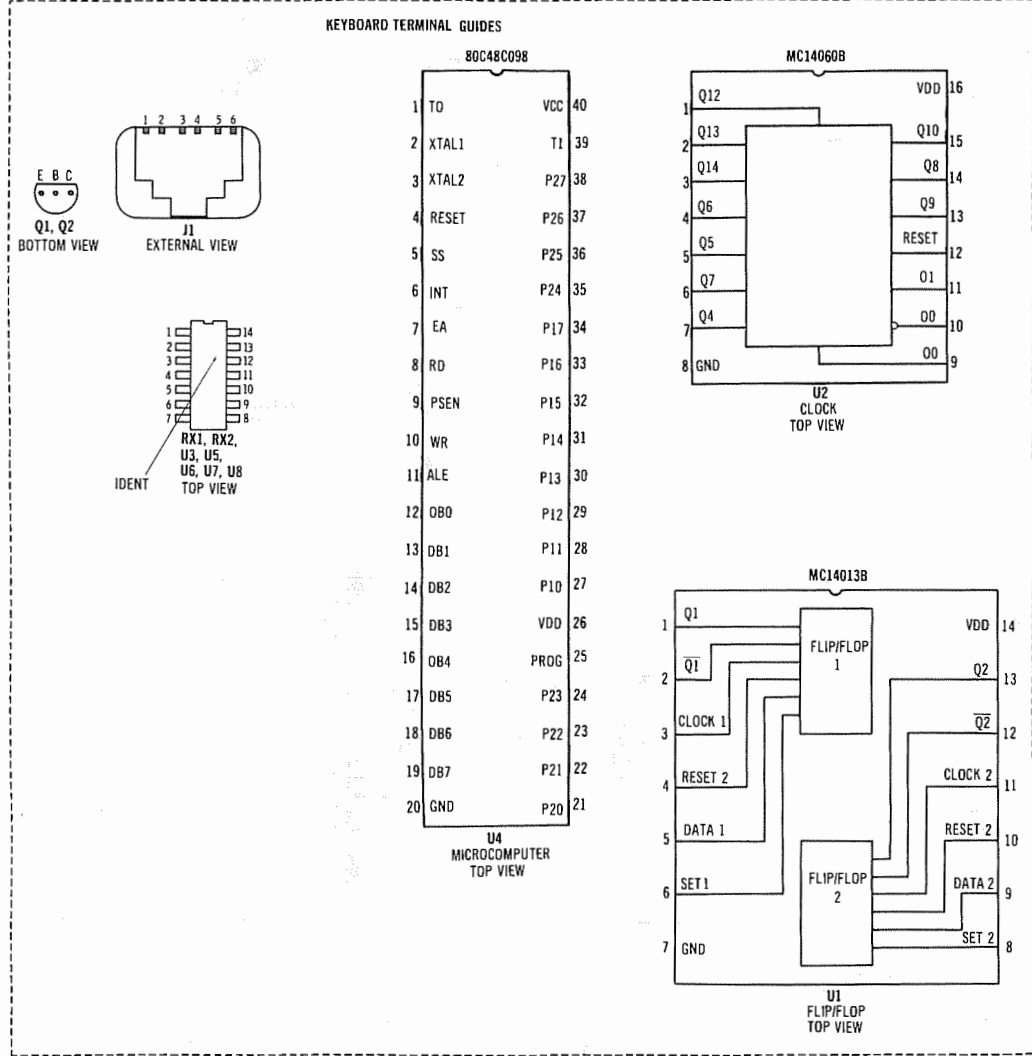
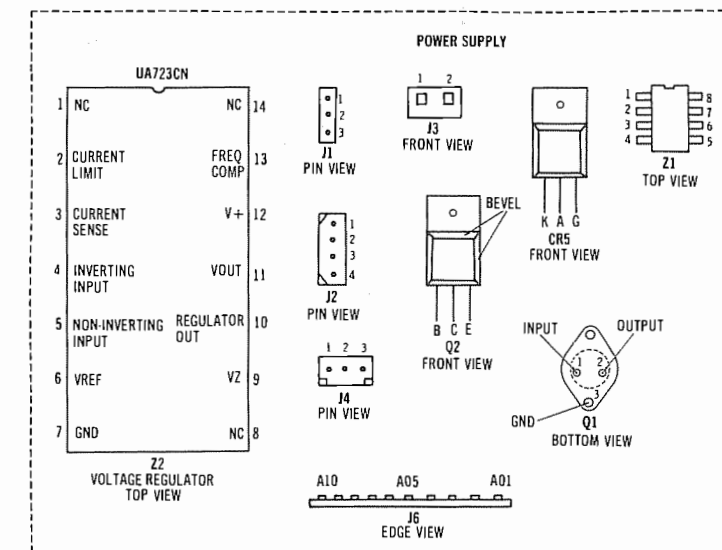
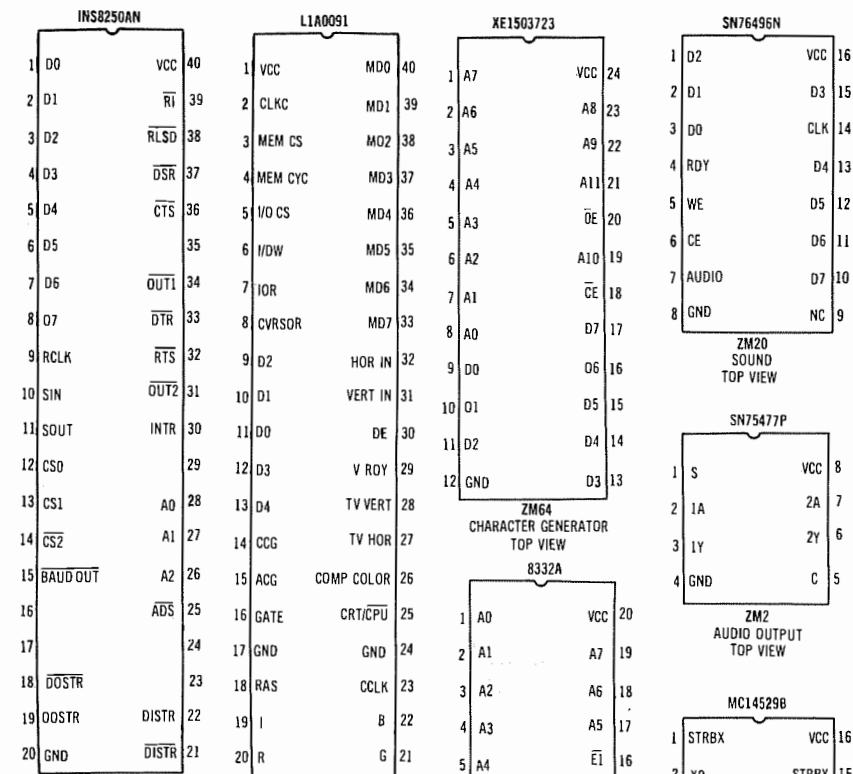
A PHOTOFAC STANDARD NOTATION SCHEMATIC
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KEYBOARD

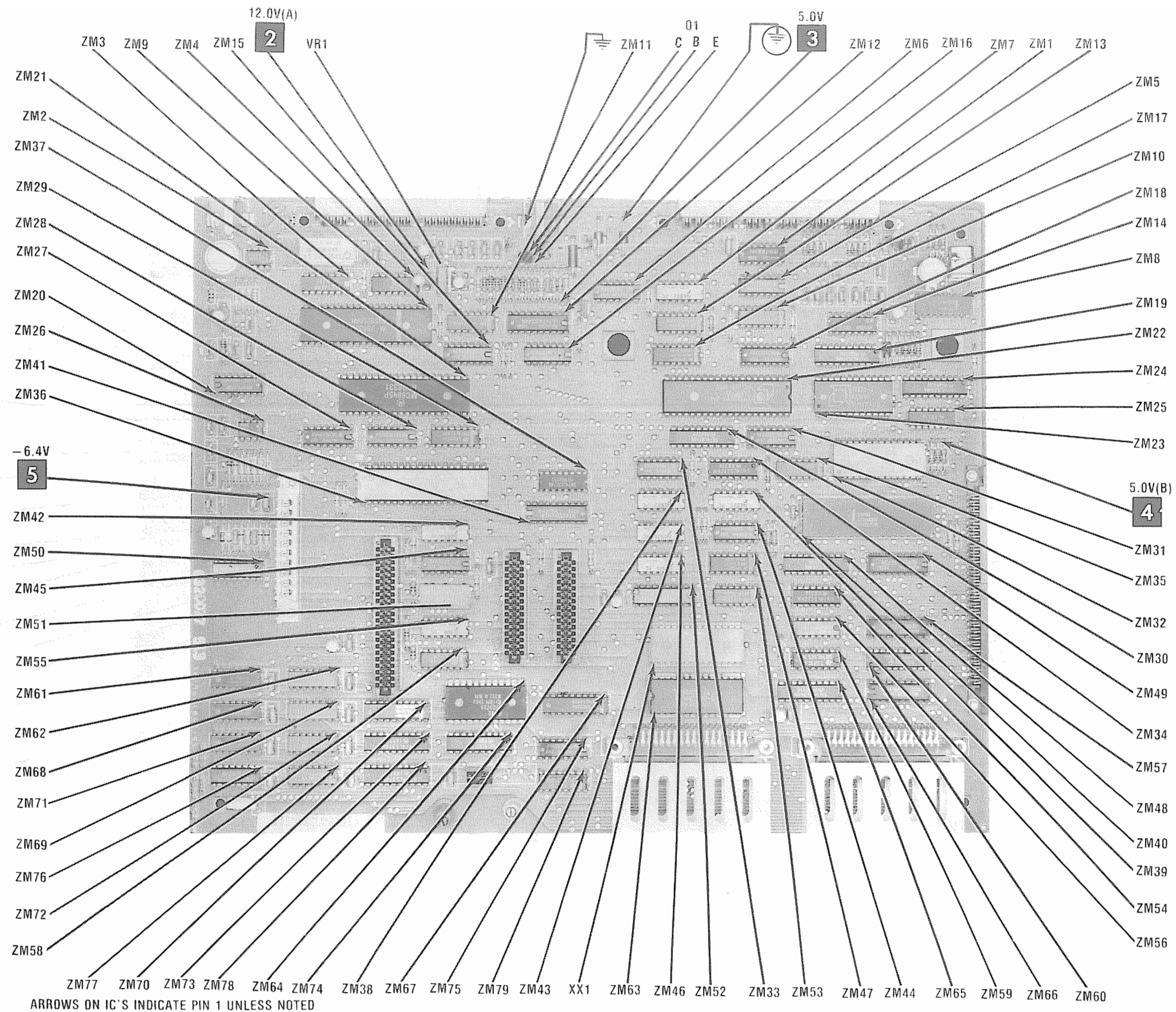
DM74LS153N



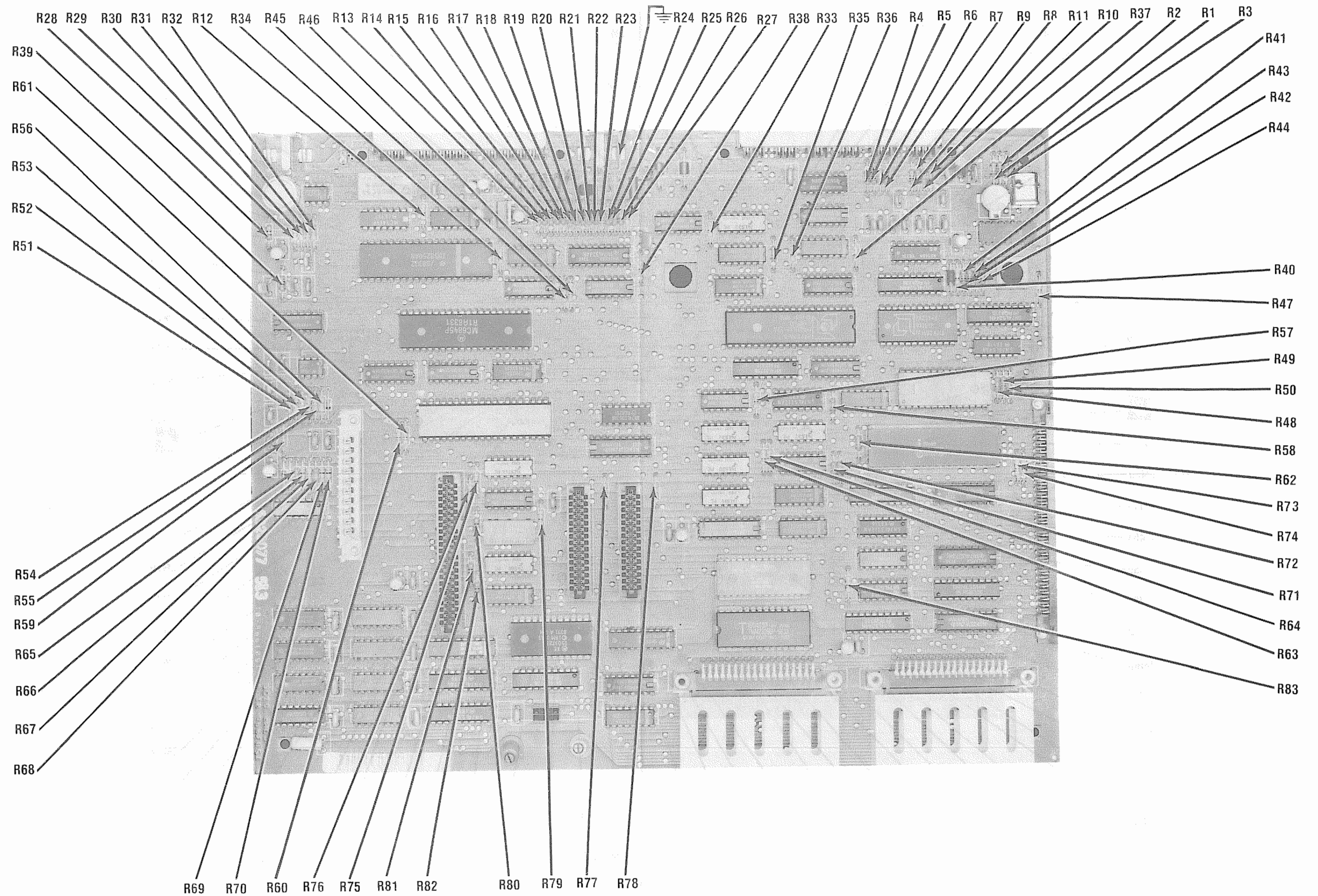
IC PINOUTS & TERMINAL GUIDES

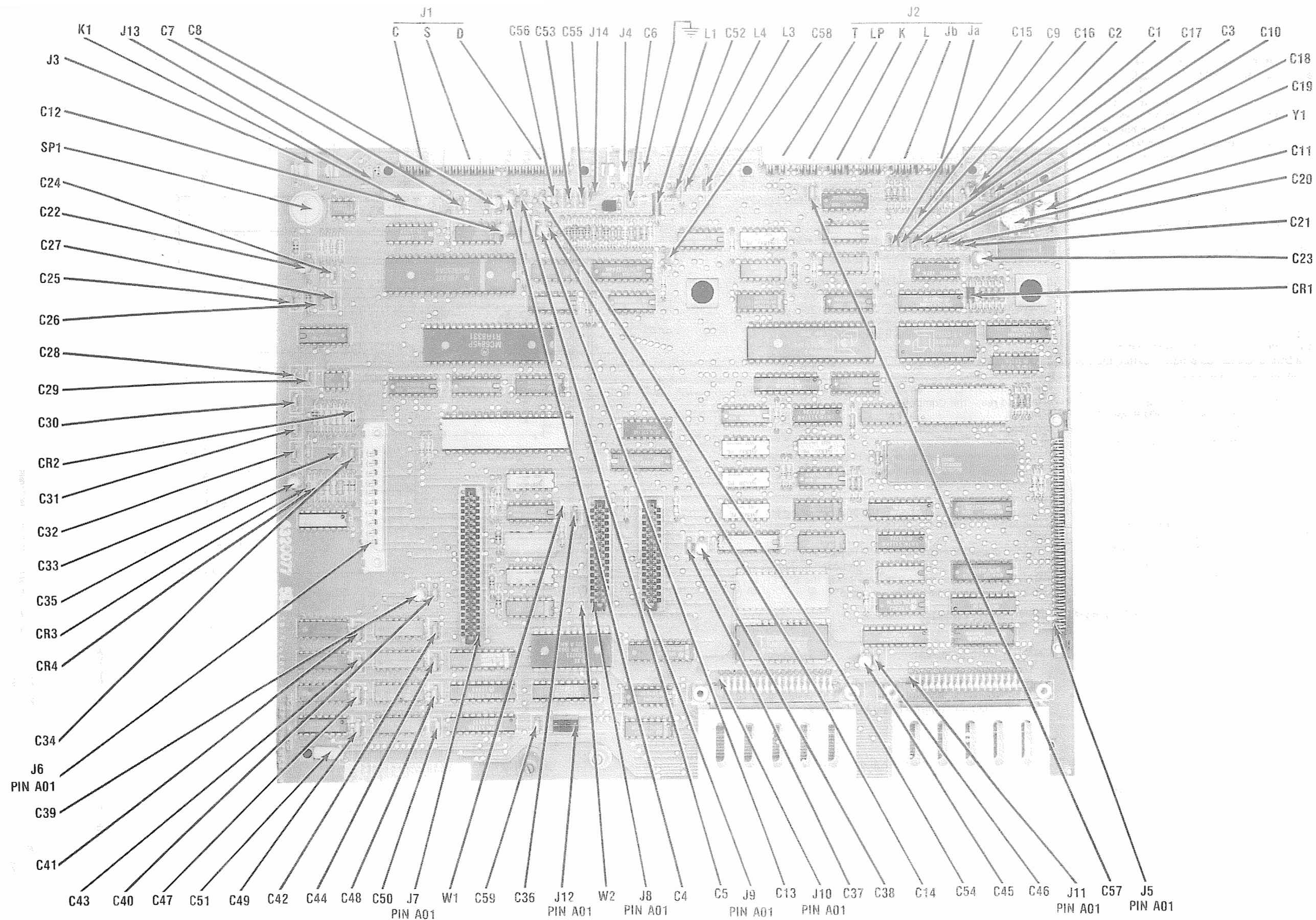


IBM PCjr
MODEL 4860



CSCS8
IBM PCjr
MODEL 4860





CSCS8
IBM PCjr
MODEL 4860

GENERAL OPERATING INSTRUCTIONS

BOOT UP

Insert a bootable diskette into the Disk Drive and turn On the Computer. The Computer will automatically boot up using the diskette in the Disk Drive. If a PC DOS (Personal Computer Disk Operating System) diskette is used, the Computer will display the date and time and ask for a new date and time. After the date and time have been entered, the version of DOS will be displayed on the Monitor screen along with an A> which indicates the DOS is running.

PC DOS

For a list of file names on the diskette in the current Disk Drive, type DIR and press the ENTER key.

To return to PC DOS from Basic, type SYSTEM and press the ENTER key.

To load a (System) program from a diskette while in DOS, type the program name and press the ENTER key.

A blank diskette must be formatted before it can be used to save information which is in memory. A formatted diskette must contain a DOS or a Start-up program before the Computer will boot up using that diskette.

Insert a diskette containing a "Format Program" into Disk Drive A. Type FORMAT and press the ENTER key. Follow the instructions on the Monitor screen to format the unformatted diskette. NOTE: Formatting a diskette will wipe out any programs previously placed on the diskette.

BASIC

When turned On, the Computer will come up in Cassette (ROM) Basic if there is not a bootable DOS diskette in the Disk Drive. The version of Basic and memory available will appear at the top of the screen. For additional information on Cassette I/O operations see the "Cassette Operation" section of the General Operating Instructions.

The manufacturer also supplies a Cartridge Basic that supports both Cassette and Disk Drive operation. The cartridge can be inserted into either one of the slots located on the front of the Computer. Type BASIC and press the ENTER key to go from DOS to Cartridge Basic. To return to DOS from Cartridge Basic, type SYSTEM and press the ENTER key.

To view a list and the names of programs on a diskette in the Drive, type FILES and press the ENTER key.

To load a program in Cartridge Basic from the diskette, type LOAD, the program name enclosed in quotes, and press the ENTER key.

To save a program, type SAVE, the program name enclosed in quotes and press the ENTER key.

To run a program from Basic mode, type RUN and press the ENTER key. To stop a program, press the Fn and BREAK (B) keys at the same time. NOTE: Some programs will disable or not recognize the Fn and BREAK keys to prevent the user stopping the program while it is running.

RESETTING COMPUTER

Press the CTRL, ALT, and DEL keys, all three at the same time, to reset the Computer.

CASSETTE OPERATION

To load a program from tape while in Cassette (ROM) Basic, type LOAD, the program name enclosed in quotes and press the ENTER key.

To save a program, type SAVE, the program name enclosed in quotes and press the ENTER key.

To load or save a program from and to tape while in any Disk Basic, type LOAD or SAVE. Then, enclosed in quotes, type CAS1: and the program name, and press the ENTER key. Example: SAVE "CAS1: program name"

DISASSEMBLY INSTRUCTIONS

CABINET TOP

Release three plastic clips at rear of cabinet top and remove top from Computer. Most components are now accessible for service.

DISK DRIVE REMOVAL

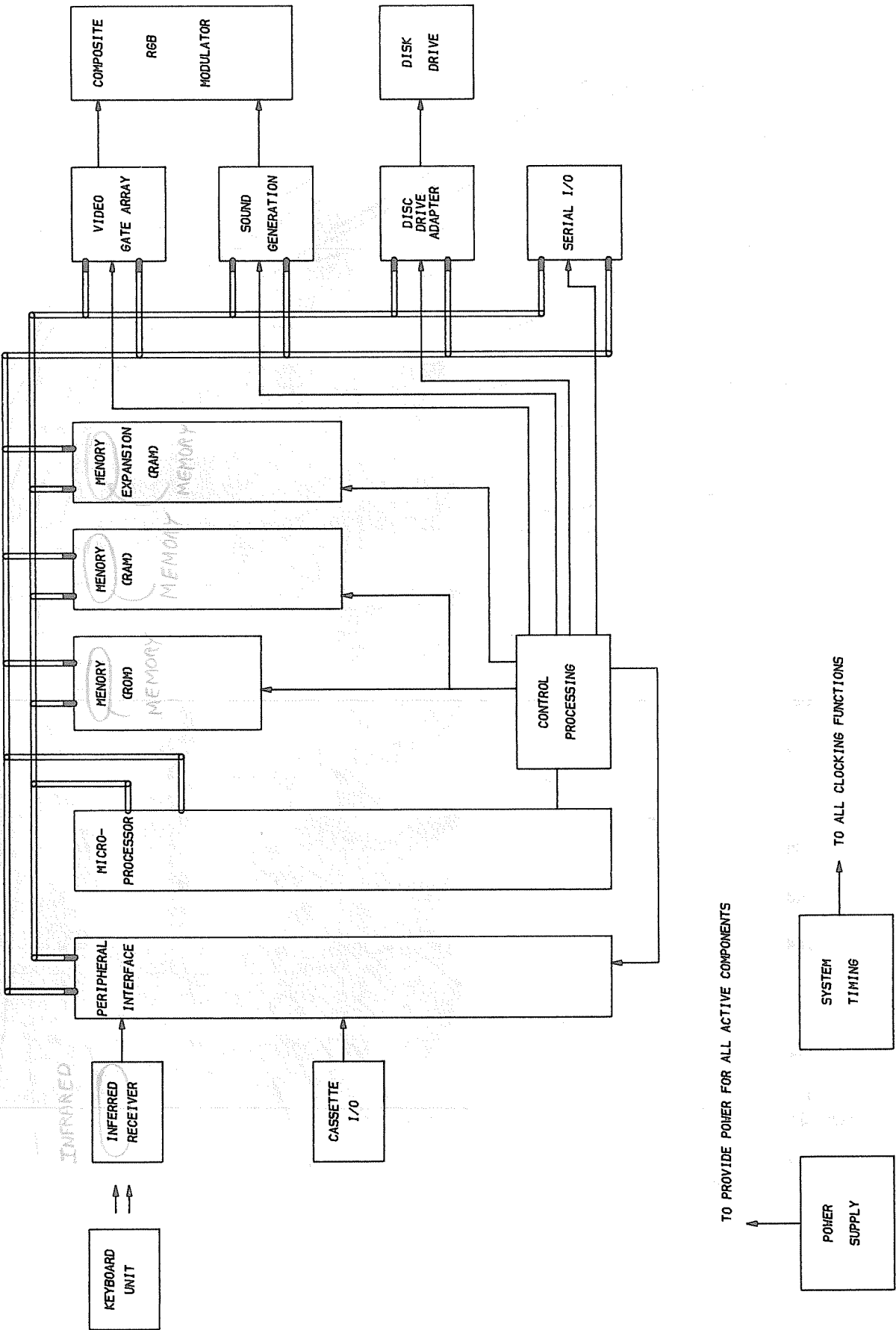
Disconnect the Disk Drive Interface Connector, Power Connector and Fan Connector. Release two plastic clips from cabinet bottom holding Disk Drive and remove Disk Drive from cabinet.

MAIN BOARD REMOVAL

Remove five screws holding System board to cabinet bottom. Release two plastic clips located on left side of System board and remove board from cabinet.

KEYBOARD

Turn the keyboard upside down and remove six screws from the bottom. Carefully lift the bottom cover off the keyboard. Note: The printed circuit board is not fastened down to the top cover. The board and keys will fall out of the top cover if it is not laying flat on the bench.



BLOCK DIAGRAM

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC ZM63	PIN NO.	IC ZM63	PIN NO.	IC ZM64	PIN NO.	IC ZM64	PIN NO.	IC ZM65	IC ZM66	IC ZM67	IC ZM68	IC ZM69	IC ZM70
1	P	17	P	1	P	13	P	1	L	P	P	H	H	P
2	P	18	P	2	P	14	P	2	P	P	P	P	P	P
3	P	19	P	3	P	15	P	3	P	P	P	P	P	P
4	P	20	P	4	P	16	P	4	P	P	P	P	P	P
5	P	21	P	5	P	17	P	5	P	P	P	P	P	P
6	P	22	L	6	P	18	L	6	P	P	P	P	P	P
7	P	23	P	7	P	19	P	7	P	P	P	P	P	P
8	P	24	P	8	P	20	L	8	P	P	P	H	H	P
9	P	25	P	9	P	21	L	9	P	P	P	P	P	P
10	P	26	P	10	P	22	P	10	L	L	L	P	P	L
11	P	27	P	11	P	23	P	11	P	P	P	P	P	P
12	P	28	H	12	L	24	H	12	P	P	P	P	P	P
13	P							13	P	P	P	P	P	P
14	L							14	P	P	P	P	P	P
15	P							15	P	P	P	P	P	P
16	P							16	P	P	P	L	L	P
								17	P	P	P			P
								18	P	P	P			P
								19	L	P	P			P
								20	H	H	H			H
PIN NO.	IC ZM71	IC ZM72	IC ZM73	IC ZM74	IC ZM75	IC ZM76	IC ZM77	IC ZM78	IC ZM79	IC XX1	PIN NO.	IC XX1		
1	H	H	P	H	P	H	H	P	P	P	21	P		
2	P	P	P	P	P	P	P	P	P	P	22	L		
3	P	P	P	P	P	P	P	P	P	P	23	P		
4	P	P	P	P	P	P	P	P	P	P	24	P		
5	P	P	P	P	P	P	P	P	P	P	25	P		
6	P	P	P	P	P	P	P	P	P	P	26	P		
7	P	P	P	P	L	P	P	P	P	P	27	P		
8	H	H	P	P	P	H	H	P	L	P	28	H		
9	P	P	P	P	P	P	P	P	P	P				
10	P	P	L	L	P	P	P	L	P	P				
11	P	P	P	P	P	P	P	P	P	P				
12	P	P	P	L	P	P	P	P	P	P				
13	P	P	P	P	P	P	P	P	P	P				
14	P	P	P	P	P	P	P	P	P	L				
15	P	P	P	P	P	P	P	P	P	P				
16	L	L	P	P	H	L	L	P	H	P				
17			P	P				P		P				
18			P	P				P		P				
19			P	P				P		P				
20			H	H				H		P				

LINE DEFINITIONS

A0 THRU A19	Address	INTR CS	Interrupt Chip Select
ACK	Acknowledge	IO/M	Input Output/Memory Status
AD0 THRU AD7	Address Data Bus	IOR	Input Output Read
ADDERSEL	Address Select	IOW	Input Output Write
AEN	Address Enable	IR TEST	Infra-red Test
ALE	Address Latch Enable	IR TEST EN	Infra-red Test Enable
AUDIO	Audio	IR TEST FREQ	Infra-red Test Frequency
AUDIO INPUT	Audio Input	IRQ1, 2, 7	Interrupt Request
BAUD CLK	Baud Rate Generator Clock	KYB LATCH	Keyboard Latch
BLUE	Blue	LPEN INPUT	Light Pen Input
CARTRIDGE RESET	Cartridge Reset	LPEN STRB	Light Pen Strobe
CAS	Column Address Strobe	MEM A0 THRU A7	Memory Address
CASS AUDIO	Cassette Audio	MEMR	Memory Read
CHAR LATCH	Character Latch	MEMW	Memory Write
CLK	Clock	MODEM INTR	Modem Interrupt
COMP SYNC DRV	Composite Sync Driver	MODEM/FLOPPY	CS Modem/Floppy Chip Select
COMPOSITE VIDEO	Composite Video	MOTOREN	Motor Enable
CPU	Central Processor Unit	MUX ADR	Multiplexed Address
CPU A14 THRU A14	CPU Address Lines	NMI	Nonmaskable Interrupt
CPU DLY	CPU Delay	NMI CS	Nonmaskable Interrupt Chip Select
CPU LATCH	CPU Latch	PB0	Port Bit 0-Timer 2 Gate/Speaker
CS2 THRU CS7	Chip Select	PB1	Port Bit 1-Speaker Data
DATA	Data	PB3	Port Bit 3-Cassette Motor Off
DIRECTION	Head Direction	PB4	Port Bit 4-Disable Beeper and Cassette Motor Relay
DR SEL 1 THRU 3	Drive Select	PCLK	Peripheral Clock
DRVEN	Drive Enable	RAM CS	Ram Chip Select
DISKETTE INTR	Disk Interrupt	RAS	Row Address Strobe
DISPEN	Display Enable	RD	Read
DT/R	Data Transmit/Receive	RDY	Ready
EIA CARRIER DET	Carrier Detection	READ DATA	Read Data
EIA CTS	Clear to Send	RESET	Reset
EIA DSR	Data Set Ready	ROM SEL	Rom Select
EIA DTR	Data Terminal Ready	SELECT HEAD 1	Select Head 1
EIA RTS	Request to Send	SERIAL SOUND CS	Serial Sound Chip Select
EIA RX DATA	Receive Data	STEP	Stepper Motor
EIA TX DATA	Transmit Data	TIMER CS	Timer Chip Select
GAME IO CS	Game Input Output Chip Select	TIMER INTR	Timer Interrupt
GAME/INTR CS	Game/Interrupt Chip Select	TRACK 00	Track 00 Sensor
GREEN	Green	VIDEO MEMR	Video Memory Read
HLDA	Hold Acknowledge	VIDEO RAM CS	Video RAM Chip Select
HOR OUT DRV	Horizontal Output Drive	V SYNC	Vertical Sync
HRQ	Hold Request	WE	Write Enable 90
HSYNC	Horizontal Sync	WR	Write
INDEX	Index Sensor	WRITE DATA	Write Data
INTA	Interrupt Acknowledge	WRITE PROTECT	Write Protect Sensor
INTEN	Interrupt Enable	XA0 THRU XA16	Address

CS CS8
MODEL 4860
IBM PCjr

SCHEMATIC NOTES

- Circuitry not used in some versions
- Circuitry used in some versions
- See parts list

⊕ Ground

⊕ Ground

⏏ Chassis

Voltages, Logic Readings, and Waveforms taken in Power Up mode (IBM BASIC), unless noted.

Voltages, Logic Readings and Waveforms on keyboard taken with batteries installed (keyboard cable not used).

DISK DRIVE AND DISK DRIVE ADAPTOR BOARDS:

Voltages, Logic Readings, and Waveforms were taken while running the following program and during the period when the Head is not moving unless noted.

10 OPEN "SAMS DAT" FOR OUTPUT AS #1

20 FOR X = 1 TO 300

30 PRINT #1, "THIS IS A TEST"

40 NEXT X

50 CLOSE #1

60 GOTO 10

Waveforms and voltages taken from ground, unless noted otherwise.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on 0 reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7 cm. width with DC reference voltage given at the bottom line of each waveform.

Time in μ sec. per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltages maintained as shown at input.

Voltages measured with digital meter, no signal.

Controls adjusted for normal operation.

Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

Electrolytic capacitors are 50 volts or less, 20% unless noted.

Resistors are 1/2W or less, 5% unless noted.

Value in () used in some versions.

Measurements with switching as shown, unless noted.

Logic Probe Display

L = Low

H = High

P = Pulse

* = Open (No light On)

(1) Probe indicates H if diskette is write protected.

(2) Probe indicates L if diskette is write protected.

(3) Probe indicates P when Head Position motor is operating.

(6) Probe indicates H when Head is moving in and L when Head is moving out from the center of the diskette.

(7) Probe indicates L when Head is moving in and H when Head is moving out from the center of the diskette.

(8) Probe indicates H when the Head is on Track 00 and L when off track 00.

(9) Probe indicates L when the Head is on track 00 and H when off track 00.

(10) Probe indicates P while holding SPACE bar down.

(11) Probe indicates L while holding SPACE bar down.

(12) Probe indicates H while holding SPACE bar down.

(13) Use a scope with $\times 10$ probe, DC input and check for logic low while holding SPACE bar down. (A Logic Probe may cause pulses to appear).

(14) Probe indicates a pulse when a key is first pressed and a pulse again when the key is released.

(15) Probe indicates P when Head is moving toward the center of the diskette.

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC ZM38	IC ZM39	IC ZM40	PIN NO.	IC ZM40	PIN NO.	IC ZM41	IC ZM42	IC ZM43	IC ZM44	IC ZM45	IC ZM46	IC ZM47	IC ZM48
1	P	P	L	21	L	1	H	*	L	P	P	P	P	L
2	P	P	P	22	P	2	P	*	P	P	P	P	P	P
3	H	P	P	23	*	3	P	*	*	P	L	*	P	P
4	P	P	P	24	H	4	P	*	P	P	H	*	P	P
5	P	P	P	25	P	5	P	H	P	P	*	*	P	P
6	H	P	P	26	P	6	P	L	H	P	L	*	H	P
7	L	L	P	27	P	7	P	L	L	L	L	L	P	L
8	H	H	P	28	P	8	P	P	L	P	P	*	L	P
9	H	H	P	29	P	9	P	P	*	H	P	*	P	P
10	H	P	P	30	L	10	L	H	*	L	P	*	H	L
11	H	H	P	31	L	11	*	P	*	*	P	*	H	P
12	*	P	P	32	P	12	P	P	*	L	L	P	H	P
13	*	H	P	33	H	13	P	H	*	*	*	P	H	P
14	H	H	P	34	P	14	P	H	H	H	H	H	H	P
15			P	35	P	15	P							P
16			P	36	P	16	P							P
17			L	37	P	17	P							P
18			P	38	P	18	P							P
19			P	39	P	19	P							L
20			L	40	H	20	H							H

PIN NO.	IC ZM49	IC ZM50	IC ZM51	IC ZM52	IC ZM53	IC ZM54	IC ZM55	IC ZM56	IC ZM57	IC ZM58	IC ZM59	IC ZM60	IC ZM61	IC ZM62
1	L	H	P	P	P	P	P	P	L	P	P	L	H	H
2	P	L		P	P	L	P	P	P	P	H	P	P	P
3	P	*		P	P	H	P	P	P	P	P	P	P	P
4	P	*	P	P	L	H	P	P	P	P	P	P	P	P
5	P	*		P	H	P	P	L	P	P	P	P	P	P
6	P	L	P	P	H	P	P	L	P	P	H	P	P	P
7	P	L	L	P	L	P	L	P	P	L	P	P	P	P
8	P	L	P	P	H	L	P	L	P	P	L	P	H	H
9	L	L		P	H	P	P	P	P	P	H	P	P	P
10	L	L	P	L	L	H	P	P	L	P	P	L	P	P
11	P	L		P	P	H	P	H	P	P	H	P	P	P
12	P	L	P	P	P	L	P	P	P	P	P	P	P	P
13	P	L		P	P	P	P	L	P	H	H	P	P	P
14	P	L	H	P	H	P	H	L	P	H	P	P	P	P
15	P	H		L		P		P	P		L	P	P	P
16	P	H		L		H		H	P		H	P	L	L
17	L			P					P			P		
18	P			P					P			P		
19	P			P					P			P		
20	H			H					H			L		

IBM PCjr
MODEL 4860

SYSTEM BOARD

PIN NO.	IC ZM22	PIN NO.	IC ZM22	PIN NO.	IC ZM23	PIN NO.	IC ZM24	IC ZM25	IC ZM26	IC ZM27	IC ZM28	IC ZM29
1	L	21	H	1	P	13	P					
2	L	22	L	2	P	14	H					
3	L	23	L	3	P	15	P					
4	L	24	L	4	P	16	H					
5	H	25	L	5	P	17	P					
6	P	26	H	6	P	18	P					
7	L	27	P	7	P	19	P					
8	P	28	P	8	P	20	P					
9	P	29	P	9	P	21	P					
10	H	30	P	10	P	22	H					
11	L	31	P	11	H	23	P					
12	P	32	P	12	L	24	H					
13	P	33	P									
14	L	34	P									
15	H	35	L									
16	L	36	P									
17	L	37	L									
18	H	38	L									
19	L	39	L									
20	H	40	L									

PIN NO.	IC ZM30	IC ZM31	IC ZM32	PIN NO.	IC ZM33	IC ZM34	IC ZM35	IC ZM36	PIN NO.	IC ZM36	PIN NO.	IC ZM37
1	H	H	P	17	L				21	P	1	L
2	H	H	P	18	P				22	P	2	P
3	P	P	H	19	H				23	*	3	P
4	P	P	P	20	H				24	L	4	P
5	H	H	P	21	L				25	P	5	P
6	H	P	P	22	H				26	L	6	P
7	P	P	P	23	P				27	L	7	P
8	P	L	P	24	L				28	P	8	L
9	H	P	P	25	H				29	P	9	P
10	L	P	P	26	H				30	P	10	P
11	H	H	P	27	P				31	P	11	P
12	L	H	L	28	H				32	P	12	H
13	P	*	L						33	P	13	P
14	P	*	L						34	P	14	*
15	L	L	L						35	P	15	H
16	H	H	H						36	P	16	H
17	P											
18	P											
19	H											
20	H											

COMPUTER SELF TESTS AND DIAGNOSTICS

SELF TEST

The Computer does a self test every time it is turned On. It will test the RAM and display the amount of RAM tested in the lower right hand corner of the Display Screen. If a problem is found the word ERROR and a letter will be displayed under the RAM reading on the Display Screen and two beeps will be heard. Use the following chart to determine the meaning of the error message:

LETTER DISPLAYED	PROBLEM
B	Keyboard or Keyboard Remote Receiver
C	Cassette
E	Modem
H	Disk Drive

Note: Do not press any keys on the keyboard until the self test is finished or a keyboard error will appear.

DIAGNOSTIC TESTS

The Computer has diagnostic tests included in ROM. To view the Test Menu hold the CTRL and ALT keys down and press the INS key. Each test is identified by a number or a letter under a symbol representing the device being tested. Each test is selected by pressing the INS key to move the cursor to the number or letter of the test desired and pressing the ENTER key. Hold the FN key down and press the BREAK key to stop a test and go to menu. While the menu is displayed the RAM is tested continuously and the section of the RAM being tested is displayed at the bottom of the menu. If the number or letter under the symbol is blinking, it means that item is installed in the computer. If an item is installed, but its number or letter is not blinking, there is a problem with that item. The following is a description of each test:

TEST 1: This test is for the Disk Drive. Insert a BLANK diskette into the Disk Drive and close the door. Press the ENTER key to start the test. A diagram of the Disk Drive will appear on the screen and a diskette will be shown being inserted and removed from the Disk Drive. The diskette will then be shown as broken indicating any information on it has been destroyed. This is a warning to insert only a BLANK diskette into the Disk Drive. The program then asks for input from the keyboard. Type the letters MPNP and press the ENTER key. The Computer then performs a test on the Disk Drive and returns to Menu with a message under the number 1. Use the following chart to determine the meaning of the message:

MESSAGE	MEANING
*	Disk Drive is working properly
A	No Disk Drive Adapter installed
B	Defective Disk Drive Adaptor or Disk Drive
C	Diskette is write protected. Use a diskette that is not write protected
D	No diskette was inserted or drive door was not closed
?	Test was interrupted before completed by pressing the FN and BREAK keys

TEST 4: This test is for the Television or 40 Column Monitor Display. When the test is run a different display will appear on the screen each time the ENTER key is pressed. Refer to the IBM "Guide to Operations" manual for pictures of what each screen should look like. When the test is finished the Menu will appear on the screen with a message under the number 4. Use the following chart to determine the meaning of each message.

MESSAGE	MEANING
*	Video circuits are working properly
B	Defective video circuit
?	Test was interrupted before completed by pressing the FN and BREAK keys

TEST 8: This test is the same as the 40 column test (4) except the alpha numeric displays are 80 column. The messages that appear under the number 8 on the menu screen are the same as test 4 except the addition of the message A. Message A means not enough memory installed. This test requires 128K of RAM.

TEST 5: This test is for the Light Pen. When this test is run the screen should turn white with a yellow block on the upper left corner. A different shade should show within a few inches of where the light pen is pressed on the white area of the screen. To restore the screen to one shade, press the light pen on the yellow block in the upper left corner. Hold the FN key and press the BREAK key to return to the menu. An * under the number 5 means the Light Pen test is completed.

TEST 6: This test is for the Joysticks. A joystick must be attached to run this test. When the test is run two large boxes will appear on the screen with two small boxes above each large box. The small boxes represent the joystick buttons. The large box will have an * in it if the joystick is connected. The small boxes should get smaller when the button it represents is pressed. The * should move inside the large box when the control stick is moved. Use the FN and BREAK keys to go back to the menu. Use the following chart to determine the meaning of the messages that appear under the number 6 on the menu screen.

MESSAGE	MEANING
*	Joystick test completed
A	No joystick connected
B	Joystick defective
C	Joystick circuits defective

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COMPUTER SELF TESTS AND DIAGNOSTICS (Continued)

TEST 9: This test will check the internal beeper in the Computer and the external sound system. When the test is started a beep should be heard from the internal beeper and the external sound (from the television speaker or Monitor display speaker) at the same time. The symbol of a speaker will then appear on the Monitor screen. A total of five speaker symbols will be on the screen before the test is completed. Each time the speaker symbol appears, press the ENTER key. A low tone that goes up to a high tone should be heard for the first three speaker symbols. A motorboating sound should be heard for the fourth speaker symbol and a noise burst should be heard for the fifth and last speaker symbol. After the noise burst, the menu screen will appear with an * under the number 9, indicating the sound test was completed. A question mark will appear if the test was interrupted by pressing the FN and BREAK keys.

TEST J: This test checks the keyboard. When the test is run a rectangle box representing the keyboard will appear on the screen with a figure of a man above the box. Each time a key is pressed the character the key represented will appear at the top of the screen. The figure will jump down and place a white box at the location of the key that was pressed. When all the keys have been checked, use the FN and BREAK keys to return to the menu.

TEST K: Reserved for future use.

TEST G: This test checks the Modem. When the test is run the words "Testing Modem" will appear on the screen. The test will take about 3 minutes to complete, then the menu will appear with a message under the letter G. Use the following chart to determine the meaning of the message:

MESSAGE	MEANING
*	Modem operating properly
A	No modem installed
B	Modem defective
C	Dial tone was detected, disconnect the phone line and rerun the test
D	Modem defective

TEST A: Note: This test appears on a second menu screen. This test will check the Printer. The screen will be blank during the Printer test. When the test is run the Printer will start printing. The printout should match the sample given on page 6-116 of the IBM "Guide to Operations" manual. When the test is completed the second menu screen will appear with a message under the letter A. Use the following chart to determine the meaning of the message:

MESSAGE	MEANING
*	Printer test completed
A, D or E	Printer interface or printer defective
B	Printer out of paper
C	Printer defective

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC ZM1	IC ZM2	IC ZM3	IC ZM4	IC ZM5	IC ZM6	IC ZM7	IC ZM8	IC ZM9	PIN NO.	IC ZM9	PIN NO.	IC ZM10	IC ZM11
1	P	H	L	L	H	H	P	L	*	21	H	1	H	H
2	P	L	L	*	H	H	P	P	P	22	L	2	H	*
3	P	H	H	L	L	L	P	P	P	23	H	3	H	L
4	L	L	L	H	H	L	P	P	P	24	L	4	L	P
5	H	H	L	H	L	H	P	P	P	25	L	5	H	P
6	L	H	H	L	H	H	H	H	P	26	P	6	L	P
7	L	L	L	L	L	L	L	H	P	27	P	7	L	L
8	L	H	H	H	L	P	H	P	P	28	P	8	P	P
9	P		L	L	H	P	P	L	P	29	*	9	P	H
10	L		L	H	H	P	H	L	H	30	L	10	P	P
11	H		H	L	L	P	H	H	H	31	H	11	L	H
12	*		L	H	H	P	P	P	H	32	L	12	P	P
13	*		L	H	H	H	P	L	P	33	H	13	P	L
14	H		H	H	H	H	H	*	H	34	H	14	H	H
15								L	P	35	L	15		
16								P	P	36	H	16		
17										37	H			
18								H	P	38	H			
19									L	39	H			
20									L	40	H			

PIN NO.	IC ZM12	IC ZM13	IC ZM14	IC ZM15	IC ZM16	IC ZM17	IC ZM18	IC ZM19	IC ZM20	IC ZM21	PIN NO.	IC ZM21
1	L	P	H	L	P	P	H	H	P	L	21	P
2	P	P	*	H	P	P	H	H	P	H	22	P
3	P	P	H	P	H	P	L	P	P	H	23	L
4	L	L	H	H	L	P	*	H	P	P	24	P
5	P	P	H	P	L	P	P	P	P	P	25	H
6	P	P	H	P	H	P	H	H	H	P	26	*
7	P	L	*	P	L	H	L	*	*	P	27	*
8	L	P	H	L	P	L	L	H	L	P	28	P
9	P	P	L	H	P	H	H	H	L	P	29	P
10	L	L	L	*	P	H	L	L	*	P	30	P
11	P	P	H	*	P	H	H	H	P	P	31	P
12	L	L	L	H	P	H	P	*	P	P	32	P
13	P	P	H	*	P	H	P	L	P	P	33	*
14	P	H	H	*	H	H	H	P	P	P	34	L
15	P		*	L		H	L	H	P	L	35	L
16	L		H	H		H	H	P	H	L	36	P
17	P										37	P
18	P							H		L	38	P
19	L							H		L	39	P
20	H							H		H	40	P

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LOGIC CHART

KEYBOARD

PIN NO.	U1	U2	U3	U4	PIN NO.	U4	PIN NO.	U5	U6	U7	U8
1	L(12)	L(10)	H	H	21	H	1	H(10)	*	H(10)	H(10)
2	H(11)	L(10)	L(12)	H(10)	22	H	2	H(10)	H	H(10)	L(10)
3	L(10)	L(10)	H(11)	H(10)	23	H	3	L(13)	H(10)	L(13)	L(10)
4	H(11)	L(10)	H(11)	L(12)	24	H	4	H(10)	H	H(10)	H(10)
5	H	L(10)	H	L(12)	25	*(12)	5	H(10)	H	H(10)	L(10)
6	L	L(10)	L(12)	H	26	L(12)	6	L(13)	*	L(13)	L(10)
7	L	L(10)	L	L	27	H(10)	7	L	L	L	L
8	L(12)	L	H(10)	*(10)	28	H(10)	8	L(13)	*	L(13)	H(10)
9	L(12)	L(10)	H(11)	*(12)	29	H(10)	9	H(10)	H	H(10)	H(11)
10	L	H(10)	L(12)	*(12)	30	H(10)	10	H(10)	H	H(10)	L(10)
11	H(10)	H(10)	H(11)	H(10)	31	H(10)	11	L(13)	H	L(10)	H(10)
12	H(11)	H(11)	L(12)	H	32	H(10)	12	H(10)	H	H(10)	H(11)
13	L(12)	L(10)	H(14)	H(10)	33	H(10)	13	H(10)	L(10)	H(10)	L(10)
14	H	L(10)	H	H	34	H(10)	14	H	H	H	H
15		L(10)			35	H					
16		H		H	36	H(10)					
17				H	37	H(10)					
18				H	38	H(14)					
19				H	39	H					
20				L	40	H					

MEMORY EXPANSION BOARD

PIN NO.	IC ZM1	IC ZM2	IC ZM3	IC ZM4	IC ZM5	IC ZM6	IC ZM7	IC ZM8	IC ZM9	IC ZM10	IC ZM11	IC ZM12
1	P	P	P	P	H	H	H	H	H	H	H	H
2	P	P	P	P	P	P	P	P	P	P	P	P
3	P	P	P	P	P	P	P	P	P	P	P	P
4	P	P	P	P	P	P	P	P	P	P	P	P
5	P	P	P	P	P	P	P	P	P	P	P	P
6	P	P	P	P	P	P	P	P	P	P	P	P
7	P	P	L	L	P	P	P	P	P	P	P	P
8	P	P	L	P	H	H	H	H	H	H	H	H
9	P	P	*	P	P	P	P	P	P	P	P	P
10	L	L	L	P	P	P	P	P	P	P	P	P
11	P	P	*	P	P	P	P	P	P	P	P	P
12	P	P	L	P	P	P	P	P	P	P	P	P
13	P	P	*	P	P	P	P	P	P	P	P	P
14	P	P	H	H	P	P	P	P	P	P	P	P
15	P	P			P	P	P	P	P	P	P	P
16	P	P			L	L	L	L	L	L	L	L
17	P	P										
18	P	P										
19	P	P										
20	H	H										

FOR LOGIC CHART NOTES
SEE SCHEMATIC NOTES ON PAGE 18

TEST EQUIPMENT

Test Equipment listed by Manufacturer illustrates typical or equivalent equipment used by SAMS' Engineers to obtain measurements and is compatible with most types used by field service technicians.

TEST EQUIPMENT (COMPUTERFACTS)

Equipment Name	B & K Precision Equipment No.	Sencore Equipment No.	Simpson Equipment No.
OSCILLOSCOPE	1570A,1590A,1596	SC61	454
LOGIC PROBE	DP51		
LOGIC PULSER	DP101		
DIGITAL VOM	2830	DVM37,DVM56,SC61	463,467,470,474,467E
ANALOG VOM	277		260-7,160,165, 260-6XL,260-7P, 260-6XLP
ISOLATION TRANSFORMER	TR110,1604,1653,1655	PR57	
FREQUENCY COUNTER	1803,1805	FC71,SC61	710
COLOR BAR GENERATOR	1211A,1248,1251,1260	CG25,VA62	431
RGB GENERATOR	1260		
FUNCTION GENERATOR	3020		420A,420D
HI-VOLTAGE PROBE VOM/DMM Accessory probes	HV-44	HP200	248 00168,00411,00749
TEMPERATURE PROBE	TP-28		IR-10,00760,00758; 383,389,388
CRT ANALYZER	467,470	CR70	

TROUBLESHOOTING

POWER SUPPLY

Note: Use an isolation transformer when servicing the Power Supply. Disconnect connectors J1 and J2 on the Power Supply and unplug the Power Supply from the Computer to avoid possible damage to the Computer and Disk Drive from high voltages that may be produced while servicing the Power Supply. To provide a load for the Power Supply, connect a 18 ohm 20 watt resistor from pin 1 (12V) to pin 2 (ground) of connector J2 and a 47 ohm 5 watt resistor from pin 4 (5V) to pin 3 (ground) of connector J2.

Unplug the Power Transformer from the Power Supply and check for 19.0V AC from pin 1 to pin 3 of Plug J4. If 19.0V AC is missing check the Power Transformer cords for possible open circuits and check the windings for continuity. If the Power Transformer checks good check Fuse F1. If F1 is bad check for possible shorts at the 12V Regulator (Q1) and Switch Transistor (Q2). If F1 is good, apply AC power and check for 17.3V AC from the cathode of Diode CR7 to the cathode of Diode CR8. If 17.3V AC is missing check Coil L2 and Connector J4. If 17.3V AC is present, check for 22.0V at pin 1 of the 12V Regulator (Q1). If 22.0V is missing, check the Power Switch (S1) and Diodes CR7 thru CR10. If 22.0V is present, check for 12.0V at pin 1 of Connector J2. If 12.0V is missing, check Regulator Q1. If 12.0V is present at pin 1 of Connector J2, check for 5.0V at pin 4 of Connector J2. If 5.0V is missing check the voltages and components associated with pins 1 thru 14 of the Voltage Regulator IC (Z2). If 5.0V is present at pin 4 of Connector J2, check for -6.4V at pin A10 of Connector J6. If -6.4V is missing, check the waveform at the collector of the Switch Transistor (Q2). Note: The frequency of the waveforms shown on the Power Supply will increase as the load on the 5.0V source (pin 4 of connector J2) is increased. If the waveform is present at Transistor Q2, check Transformer L1, Diode CR1 and Electrolytic C2. If the waveform is missing check the voltages, waveforms and components associated with pins 4 thru 7

and 10 thru 13 of IC Z2, pins 5, 6 and 7 of IC Z1 and Transistor Q2. If the -6.4V is present at pin A10 of Connector J6 remove the 120V AC power and plug the Power Supply board back into the Computer. Apply 120V AC power and check for 5.0V at pin 3 of the Regulator IC (VR1). If 5.0V is missing, check IC VR1.

MICROPROCESSOR (CPU) OPERATION

Verify the system clock is working by checking for a frequency of 4.7727MHz at pin 8 of the Clock Generator IC (ZM8). If the clock signal is missing check the 14.31818MHz Crystal (Y1), Clock Trimmer Capacitor (C11) and Clock Generator IC (ZM8).

Verify the reset circuit is working by checking the logic reading at pin 21 of the Microprocessor IC (ZM40) while turning the Computer On. The logic reading should be High when the Computer is turned On, then immediately go Low and stay Low. If the logic reading is not correct at pin 21 of IC ZM40, check the logic reading at pin 11 of IC ZM8 while turning the Computer On. The logic reading should be Low when the Computer is turned On, then immediately go High and stay High. If the logic reading is not correct at pin 11 of IC ZM8, check Electrolytic C23, Diode CR1 and Resistor R40. If the logic reading is correct at pin 11 of IC ZM8 and not correct at pin 21 of IC ZM40 check IC ZM8.

To check the data and address lines (pins 2 thru 16 and 35 thru 39 of IC ZM40), turn the Computer Off and remove IC ZM40. Turn the Computer On and check for a logic open on the data and address lines (pins 2 thru 16 and 35 thru 39) of the IC ZM40 socket. If any line checks logic High or Low, check the IC's connected to the defective line. With IC ZM40 removed pins 1, 17, 18, 21, 22 and 31 of IC ZM40 socket should read logic Low, pins 24, 26 thru 29, 32, 33 and 40 of IC ZM40 socket should read logic High and pin 19 should read pulses. If any of the pins do not read correct, check the IC's connected to the defective pin.

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TROUBLESHOOTING (Continued)

VIDEO

No video on a Monitor connected to the Composite Video Connector (J4). Check the waveforms at pins 13, 15 and 17 of the Video Driver IC (ZM12). If any of the waveforms are missing, check the Video Gate Array IC (ZM36). If the waveforms are good check the waveforms at pins 3, 5 and 7 of IC ZM12. If the waveforms are missing at pins 3, 5 and 7 of IC ZM12, check IC ZM12. If the waveforms are good at pins 3, 5 and 7 of IC ZM12, check the waveform at the Composite Video Jack (J4). If the waveform is missing check the Video Amp Transistor (Q1) and Resistors R18, R20, R22, R23 and R25.

VIDEO SYNC

No vertical sync on a Monitor connected to the Composite Video Connector (J4). Check the waveform at pin 40 of the CRT Controller IC (ZM21). If the waveform is missing check IC ZM21. If the waveform is present check for pulses at pin 28 of the Video Gate Array IC (ZM36). If pulses are missing at pin 28 of IC ZM36, check ZM36. If pulses are present at pin 28 of IC ZM36, check the waveform at pin 10 of IC ZM6. If the waveform is missing, check Buffer IC (ZM24). If the waveform is good at pin 10 of IC ZM6, check the vertical waveform at pin 11 of IC ZM6. If the waveform is not correct at pin 11 of IC ZM6, check IC ZM6.

No horizontal sync on a Monitor connected to the Composite Video Connector (J4). Check the waveform at pin 39 of IC ZM21. If the waveform is missing check IC ZM21. If the waveform is present, check the waveform at pin 2 of Video Driver IC (ZM12). If the waveform is missing at pin 2 of IC ZM12, check the Video Gate Array IC (ZM36).

No vertical or horizontal sync on a Monitor connected to the Composite Video Connector (J4). Check the waveform at pin 11 of IC ZM6. If the waveform is missing check IC ZM6. If the waveform is good at pin 11 of IC ZM6, check Resistor R21 and the Video Driver IC (ZM12).

COLOR

No color. Type in and run the following Basic program:

```
10 CLS: KEY OFF
20 DATA 12,10,9
30 SCREEN 0,1
40 FOR Y = 1 TO 3
50 READ C: COLOR C,0,0
60 FOR X = 1 TO 320
70 PRINT CHR$ (219);
80 NEXT X: NEXT Y
90 GOTO 90
```

The program will produce three high intensity red, green and blue horizontal bars on the Monitor screen. While the program is running, check the waveform at pin 23 of the Video Gate Array IC (ZM36), check the waveform shown in Figure 8 at pins 20, 21 and 22 and the waveform shown in Figure 9 at pin 26 of IC ZM36.

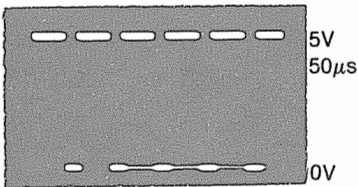


Figure 8

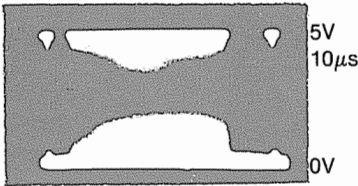


Figure 9

If any of the waveforms are missing check IC ZM36. If the waveforms are good at IC ZM36, check for the waveform shown in Figure 8 at pins 3, 5 and 7 and the waveform shown in Figure 9 at pin 16 of the Video Driver IC (ZM12). If any of the waveforms are missing, check IC ZM12.

Colors are not correct. Check for a frequency of 4.7727MHz at pin 8 of the Clock Generator IC (ZM8). If the frequency is not correct, check the adjustment of the Clock Trimmer Capacitor (C11), see "Miscellaneous Adjustments". If the adjustment does not provide the correct frequency, check the Crystal (Y1) and Trimmer Capacitor C11.

VIDEO HIGH INTENSITY

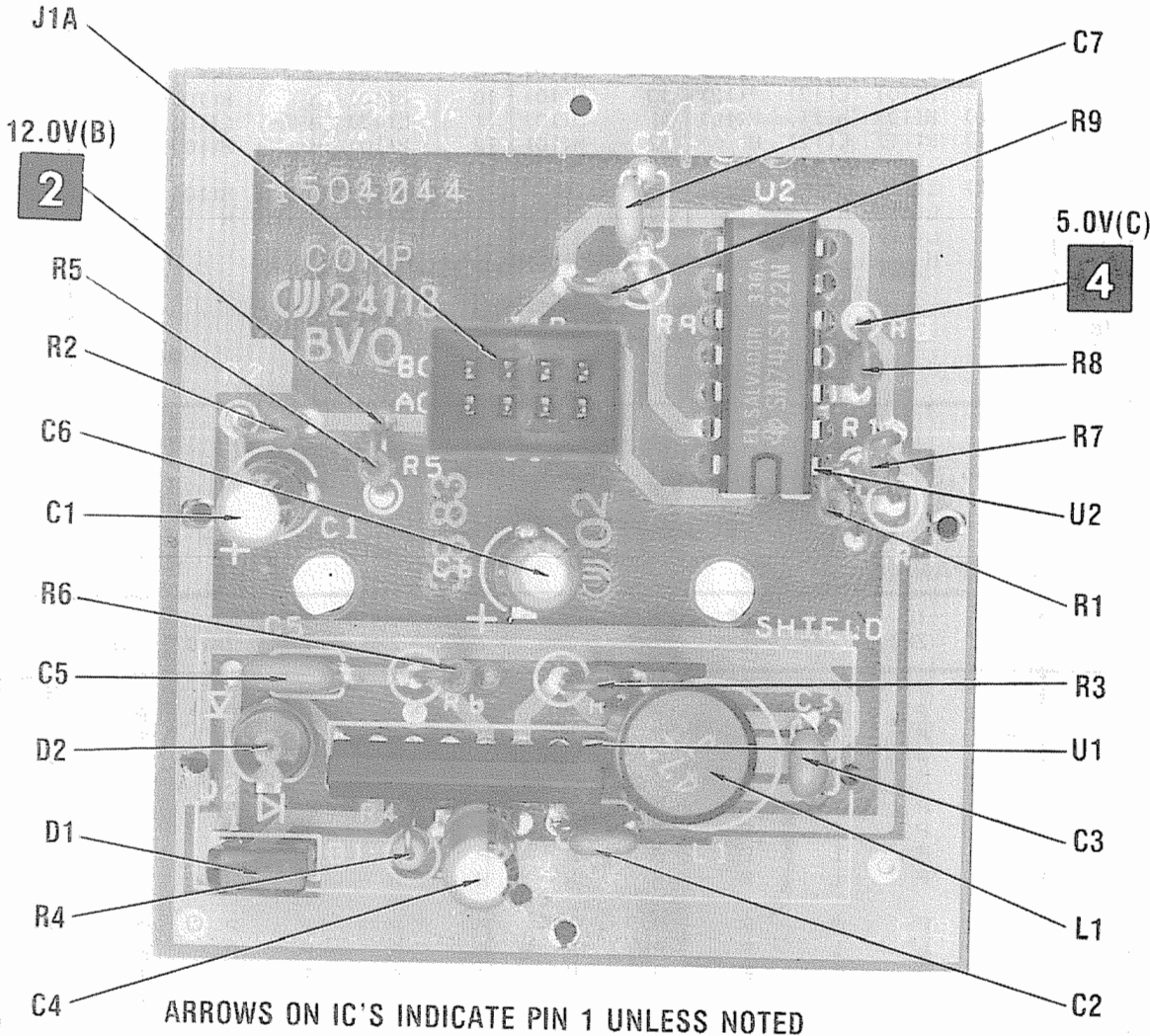
High intensity feature does not work. Type in and run the following Basic program:

```
10 COLOR 15,0
20 PRINT "SAMS"; GOTO 20
```

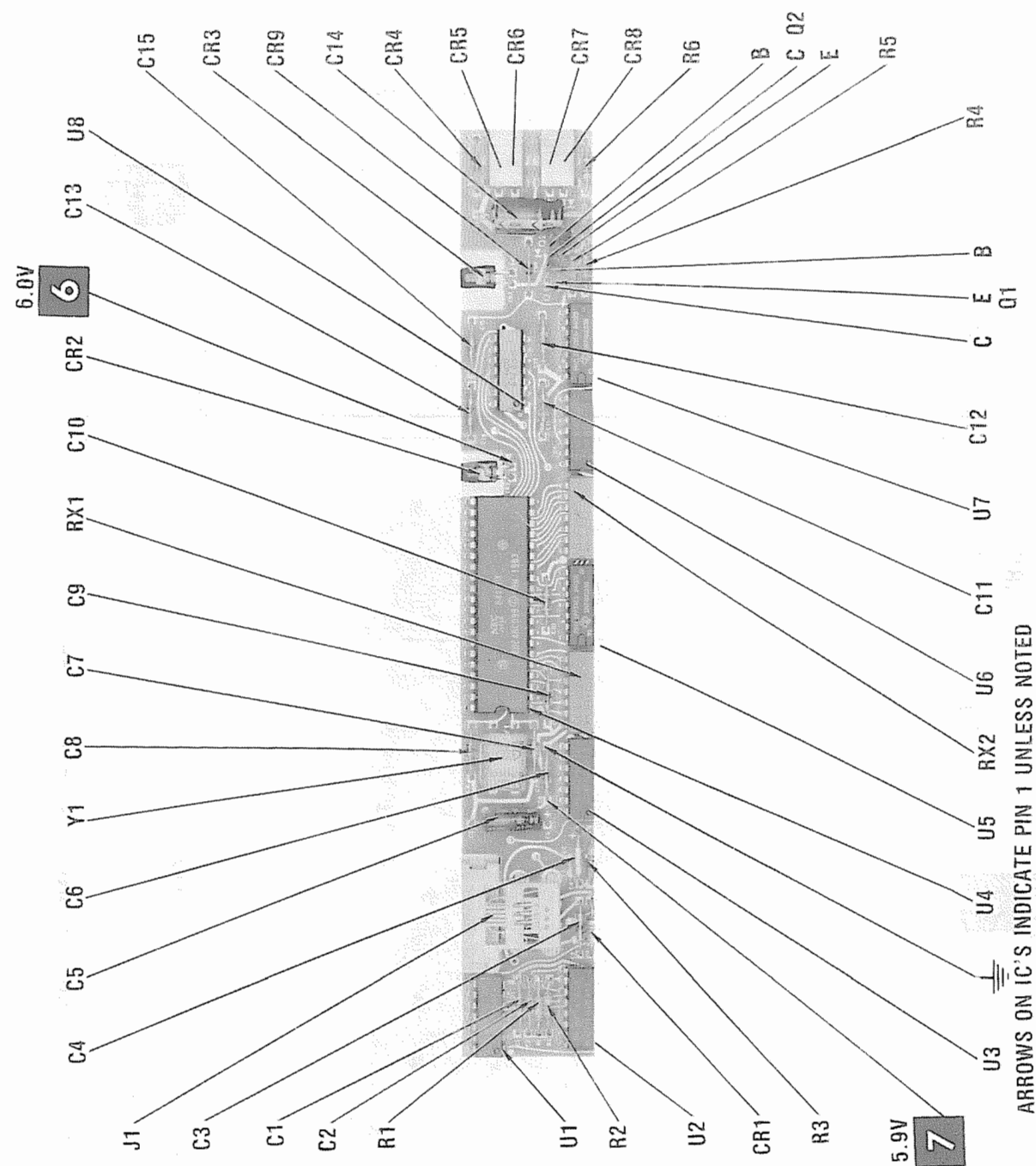
While the program is running, check for pulses at pin 19 of the Video Gate Array (ZM36). If pulses are missing check IC ZM36. If pulses are present at pin 19 of IC ZM36, check for pulses at pin 12 of the Video Driver IC (ZM12). If pulses are missing at pin 12 of IC ZM12, check IC ZM12. If pulses are present at pin 12 of IC ZM12, check Resistors R17 and R19.

KEYBOARD

Keyboard remote does not work, Keyboard works properly when connected to the Computer with a cable. Check for 5.9V at pin 40 of the Microcomputer IC (U4) and at pin 5 of IC U3. If either voltage is missing check the switches that are part of Connector J1 for good connections. If the voltages check good, check the waveform at pin 8 and check for a logic Low at pin 9 of IC U8 while pressing the SPACE bar. If the waveform is missing check IC U4. If the logic reading is not correct at pin 9 of IC U8, check IC U3. If the waveform and logic reading is correct at IC U8, check for pulses at pin 10 of IC U8 while pressing the SPACE bar. If pulses are missing check IC U8. If pulses are present at pin 10 of IC U8 check the voltages, waveforms and components associated with Infrared Amp Transistors (Q1 and Q2).



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Computer power On self test does not come up with a keyboard error when the keyboard cable is not used, but keyboard is dead (does not work with remote or cable).

Note: The waveforms shown on the keyboard schematic will not agree until a key is pressed. The keyboard has an automatic standby circuit (IC's U1, U2, U3, U6 and U8) that turns the Microcomputer IC (U4) Off whenever a key is not being pressed to conserve the batteries.

Check for a logic High at pin 13 of Flip/Flop IC (U1) while holding a key down (when the key is released a pulse should appear at pin 38 of IC U4 and cause pin 13 to go logic Low again). If pin 13 of IC U1 does not go logic High when holding a key down check for a logic High at pin 13 of IC U6 while holding a key down. If pin 13 of IC U6 does not go logic High check IC's U5, U7 and U6. If pin 13 of IC U6 does go logic High, check for a logic Low at pin 4 of IC U8 while holding a key down. If the reading at pin 4 of IC U8 is not correct, check IC U8. If the reading is correct at pin 4 of IC U8, check for a logic Low at pin 3 of IC U3 while holding a key down. Pin 11 of IC U3 should go logic Low to latch pin 3 of IC U3 Low until the key is released. A pulse appears at pin 38 of IC U4 to release the latch, by making pin 11 of IC U3 go logic High again. If pin 3 of IC U3 does not go logic Low, check IC U3. If pin 3 of IC U3 goes logic Low, check the waveform at pin 5 of Clock IC (U2) while holding a key down. If the waveform is missing, check Capacitor C2, Resistors R1 and R2 and IC U2. If the waveform is present at pin 5 of IC U2, check for a logic High at pins 1 and 13 of Flip/Flop IC (U1) while holding a key down. If the reading is not correct at pin 1 or 13 of IC U1, check IC U1.

If pin 13 of IC U1 checks logic High when a key is held down, check the waveforms at pins 3 and 11 of IC U4. If the waveform is missing at pin 3 of IC U4, check the 6.0MHz Crystal (Y1), Capacitors C7 and C8 and IC U4. If the waveform is missing at pin 11 of IC U4, check IC U4. If the waveforms are present at pins 3 and 11 of IC U4, check for pulses at pin 37 of IC U4 while holding a key down. If pulses are missing at pin 37 of IC U4, check IC's U4, U5 and U7. If pulses are present at pin 37 of IC U4, check for pulses at pin 1 of IC U8 while holding a key down. If pulses are missing, check IC U8.

One key is erratic or does not work. Check the key for continuity while holding the key down (the key should measure about 50 ohms). If the continuity is not good, clean the key and recheck it.

One group of keys do not work. Check IC's U4 thru U7.

Wrong character appears on the Monitor screen when a key is pressed. Check the Character Generator IC (ZM64), on the System board.

KEYBOARD INFRARED RECEIVER

Computer self test (on power up) comes up with Error B when the keyboard cable and keyboard are not being used. Note: Do not use the keyboard cable when performing the following tests. Check for a momentary High logic reading at pin 13 and pulses at pin 12 of IC ZM11 on the system board about 5 seconds after turning the Computer On. If the reading is not correct at pin 13 of IC ZM11, check Flip/Flop IC (ZM18). If the reading is not correct at pin 12 of IC ZM11, check Peripheral Interface IC (ZM22). If the readings are correct at pins 12 and 13 of IC ZM11, check for a burst of

pulses at pin 11 of IC ZM11 about 5 seconds after turning the Computer On. If the pulses are missing, check Capacitor C59 and IC ZM11. If the pulses are present at pin 11 of IC ZM11 check for a burst of pulses at pin 1 of Preamplifier IC (U1) on the Infrared Receiver board about 5 seconds after turning the Computer On. If the pulses are missing, check the Infrared Diodes D1 and D2 and check the voltages and components associated with pins 1 thru 8 of IC U1. If pulses are present at pin 1 of IC U1, check for a burst of pulses at pin 6 of Multivibrator IC (U2) about 5 seconds after turning the Computer On. If the pulses are missing, check Capacitor C7, Resistors R8 and R9 and IC U2. If pulses are present at pin 6 of IC U2, check for a burst of pulses at pin 6 of IC ZM10 on the System board about 5 seconds after turning the Computer On. If the pulses are missing and pin 2 of IC ZM10 checks a logic High, check IC ZM10. If pulses are present at pin 6 of IC ZM10, check for a pulse at pin 1 of Flip/Flop IC (ZM5) about 2 seconds after turning the Computer On and again after 3 more seconds and check for a pulse at pin 5 of IC ZM5 about 5 seconds after turning the Computer On. If the pulses are missing at pin 1 of IC ZM5, check IC ZM39. If the pulse is missing at pin 5 of IC ZM5, check IC ZM5. If the readings are correct at IC ZM5 check IC ZM22.

INTERNAL BEEPER

No sound from the internal beeper. Check for pulses at pin 17 of Timer IC (ZM23). If pulses are missing, check IC ZM23. If pulses are present, type in and run the following Basic program:

```
10 OUT 97,15
```

Check for a logic High at pin 19 of Peripheral Interface IC (ZM22). If the logic reading is not correct check IC ZM22. If the logic reading is correct at pin 19 of IC ZM22, check for pulses at pin 8 of IC ZM1. If pulses are missing, check IC ZM1. If pulses are present at pin 8 of IC ZM1, check for pulses at pin 3 of Audio Output IC (ZM2). If pulses are missing, check IC ZM2. If pulses are present at pin 3 of IC ZM2, check Resistor R28 and Speaker SP1.

EXTERNAL SOUND

No sound from Television or Monitor speaker. Type in and run the following Basic program. Note: This program will run only with Cartridge Basic installed.

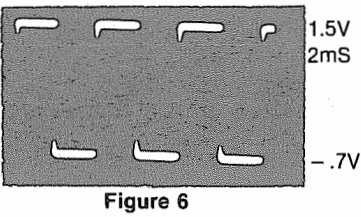
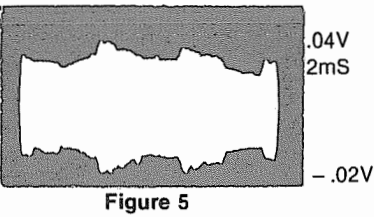
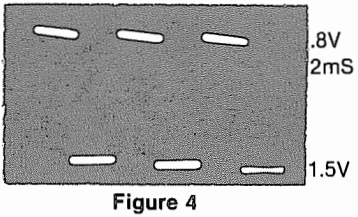
```
10 BEEP OFF: SOUND ON
20 SOUND 222,222,15,2: GOTO 20
```

While the program is running, check for a logic High reading at pins 23 and 24 of Peripheral Interface IC (ZM22). If either reading is not correct, check IC ZM22. If pins 23 and 24 of IC ZM22 read logic High, check for the waveform shown in Figure 4 at pin 7 of the Sound IC (ZM20). If the waveform is missing check Capacitor C26, Resistor R39 and IC ZM20. If the waveform is good, check for the waveform shown in Figure 5 at pin 6 of the Sound Amp IC (ZM26). If the waveform is missing at pin 6 of IC ZM26, check Capacitor C35 and the Sound Selector IC (ZM50). If the waveform is present at pin 6 of IC ZM26, check for the waveform shown in Figure 6 at pin 7 of IC ZM26. If the waveform is missing at pin 7 of IC ZM26, check Capacitor C30, Resistor R52 and IC ZM26.

CSCS8

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TROUBLESHOOTING (Continued)



CASSETTE

Programs can not be saved to cassette. Type in and run the following Basic program:

10 SAVE "CASSETTE": GOTO 10

While the program is running, check for pulses at pin 17 of the Timer IC (ZM23). If pulses are missing, check IC ZM23. If pulses are present at pin 17 of IC ZM23, check for pulses at pin 2 of IC ZM16. If pulses are missing, check IC ZM16. If pulses are present at pin 2 of IC ZM16, check for pulses at pin 11 of IC ZM13. If pulses are missing, check IC ZM13. If pulses are present at pin 11 of IC ZM13, check Capacitors C7 and C24, Resistors R29 thru R32 and check pin A03 of Connector J1 for good connections.

Cassette motor does not turn On. Run the above program and check for a logic Low at pin 21 of the Peripheral Interface IC (ZM22). If the reading is not correct, check IC ZM22. If the reading is correct at pin 21 of IC ZM22, check for a logic High at pin 4 of IC ZM16. If the reading is not correct at pin 4 of IC ZM16, check IC ZM16. If the logic reading is correct at pin 4 of IC ZM16, check for a logic Low at pin 6 of IC ZM2. If the reading is not correct check IC ZM2. If the reading is correct check Relay K1 and check pins A03 and A04 of Connector J1 for good connections.

Program can not be loaded from cassette. Inject a 1000 hertz square wave from a Function Generator at pin A02 of Connector J1. Type in and run the following program:

10 OUT 97,5

Check for a .2V peak to peak waveform at pin 3 of IC ZM26. If the waveform is not correct or missing, check Relay K1 contacts from pin 4 to pin 8 and check Capacitor C31 and Resistors R53 and R54. If the waveform is correct at pin 3 of IC ZM26, check for a 10V peak to peak waveform at pin 1 of IC ZM26. If the waveform is not correct check IC ZM26 and Resistors R51 and R55. If the waveform is correct at pin 1 of IC ZM26, check for a 5V peak to peak waveform at pin 13 of IC ZM13. If the waveform is not correct check Diode CR2 and Resistor R56. If the waveform is correct at pin 13 of IC ZM13, check IC ZM13.

SERIAL PORT

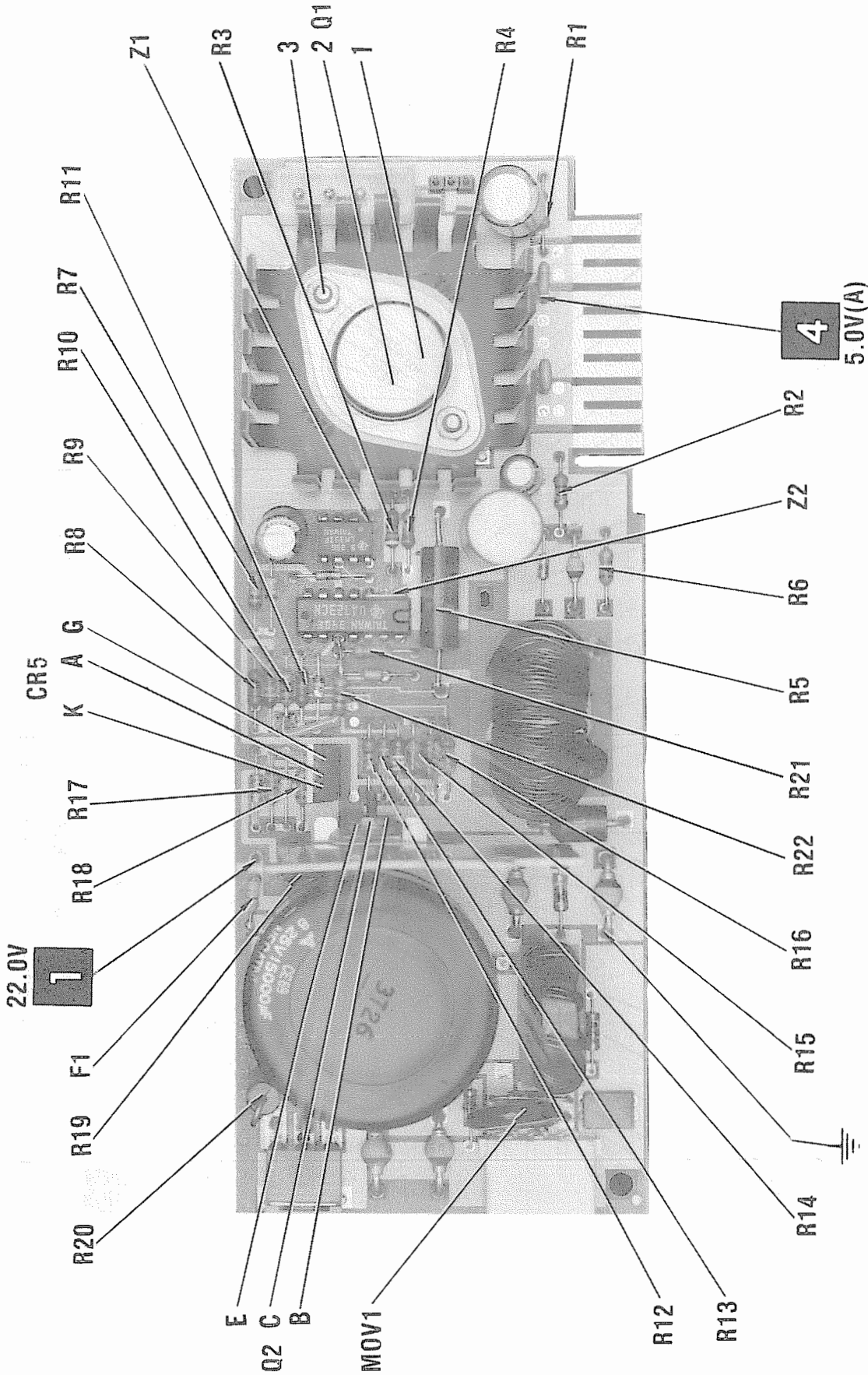
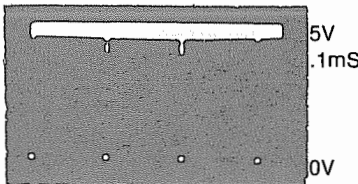
Turn the Computer Off and disconnect any equipment connected to the Serial Port and remove the Internal Modem (if installed) before performing any of the following tests. Type in and run the following Basic program:

10 OUT 763,131
20 OUT 760,117: OUT 761,1
30 OUT 763,3
40 OUT 764,0: OUT 764,15
50 OUT 760,255: GOTO 40

The program sets the baud rate to 300 baud and causes pulses to appear at pins 11, 31, 32, 33 and 34 of the Serial Interface IC (ZM9). While the program is running, check the frequency of the baud clock (1.7985MHz) at pin 16 of IC ZM9. If the baud clock frequency is not correct or the signal is missing check Frequency Divider IC (ZM25). If the baud clock is working properly check for the waveform shown in Figure 7 at pin 15 of IC ZM9. If the waveform is not correct, check IC ZM9. If the waveform is correct at pin 15 of IC ZM9, check for pulses at pins 11, 32 and 33 of IC ZM9 and pins 6, 8 and 11 of IC ZM4. If pulses are missing at pin 11, 32 or 33 of IC ZM9, check IC ZM9. If pulses are present at pins 11, 32 and 33 of IC ZM9 and missing at pins 6, 8 or 11 of IC ZM4, check IC ZM4. To check the Input Buffer IC (ZM3), use a Logic Pulser to inject pulses at the input pins (1, 4, 10 and 13) of IC ZM3 while checking for output pulses with a logic probe at the corresponding output pins (3, 6, 8 and 11) of IC ZM3. To check the Interrupt Request pin (pin 30) of IC ZM9, type in and run the following Basic program:

10 OUT 764,15: OUT 761,15
20 OUT 760,255: GOTO 10

While the program is running, check for pulses at pin 30 of IC ZM9. If pulses are missing check IC ZM9.



ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

TROUBLESHOOTING (Continued)

CARTRIDGE RESET

Computer does not reset when a cartridge is plugged into the Right (J11) or Left (J10) cartridge slot. Check the logic reading at pin 11 of the Clock Generator IC (ZM8) while inserting a cartridge into either the right or left slot. The logic reading should go from High to Low, then back to High as the cartridge is inserted into the slot. If the reading is not correct check pins A01 and A02 of Connectors J10 and J11 for dirty contacts and check the copper foil on the cartridge that shorts pins A01 and A02 together when the cartridge is inserted into the slot.

JOYSTICKS

To check the joysticks, type in and run the following Cartridge Basic program:

```
10 STRIG ON
20 PRINT "JOYSTICK A, X POSITION = "; STICK(0)
30 PRINT "JOYSTICK A, Y POSITION = "; STICK(1)
40 PRINT "JOYSTICK B, X POSITION = "; STICK(2)
50 PRINT "JOYSTICK B, Y POSITION = "; STICK(3)
60 PRINT "JOYSTICK A, BUTTON 1 = "; STRIG(1)
70 PRINT "JOYSTICK A, BUTTON 2 = "; STRIG(5)
80 PRINT "JOYSTICK B, BUTTON 1 = "; STRIG(3)
90 PRINT "JOYSTICK B, BUTTON 2 = "; STRIG(7)
100 FOR T= 1 TO 300: NEXT T: PRINT
110 CLS: GOTO 20
```

The numbers that appear for the joystick X and Y positions should vary between 0 and 255 while the joystick is being operated. The number - 1 should appear for the joystick buttons whenever they are pressed. If the joystick position and button controls are not working, check for pulses at pins 6 and 8 of IC ZM7 while the above program is running. If pulses are missing at pins 6 or 8 of IC ZM7, check IC ZM7. If pulses are present at pins 6 and 8 of IC ZM7 check Buffer IC (ZM19).

The buttons are working and the position controls are not working. Check Capacitors C9, C10, C17, C18 and C20, Resistors R6, R7, R10, R11 and R41 thru R44 and Joystick Interface IC (ZM14). The position controls are working and the buttons are not working. Check Capacitors C15, C16, C19 and C21, Resistors R4, R5, R8 and R9 and IC ZM19.

LIGHT PEN

Light Pen does not work. Disconnect the Light Pen and type in and run the following Basic program:

```
10 OUT 987,0
20 FOR T= 1 TO 300: NEXT T
30 PRINT (INP(986) AND 6)
40 GOTO 10
```

When the program is running the number 4 will appear on the Monitor screen. The number 4 should change to 6 with a Logic Pulser and change to 0 when pin 14 of Buffer IC ZM37 (Light Pen switch input) is grounded. If the correct numbers appear on the screen, check the Light Pen, Light Pen connector (section L or J2) and the CRT Controller IC (ZM21).

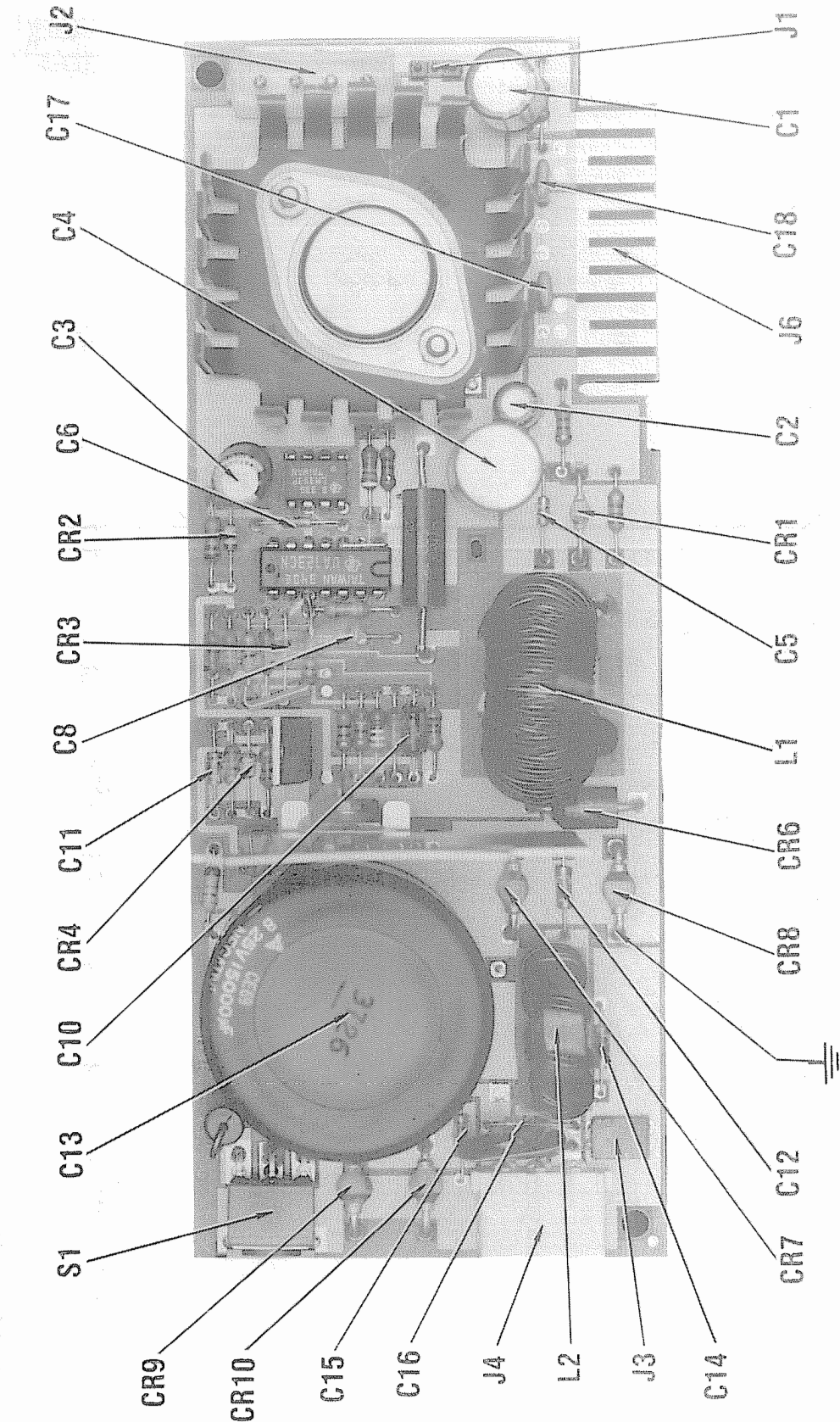
The number 4 on the screen changes when pin 14 of IC ZM37 is grounded but does not change when pulses are injected at pin 2 of IC ZM11. While the program is running check for a logic High at pin 11 and pulses at pin 12 of Decoder IC (ZM17). If either reading is not correct check IC ZM17. If the readings are correct at pins 11 and 12 of IC ZM17, check for pulses at pin 3 of IC ZM11 while injecting pulses at pin 2 of IC ZM11. If pulses are missing at pin 3 of IC ZM11, check IC ZM11. If pulses are present at pin 3 of IC ZM11, check for pulses at pin 9 of IC ZM5 while the above program is running and pulses are being injected at pin 2 of IC ZM11. If pulses are missing at pin 9 of IC ZM5, check IC ZM5. If pulses are present at pin 9 of IC ZM5 check Buffer IC (ZM37) and Transceiver IC (ZM41).

The number 4 changes when pulses are injected at pin 2 of IC ZM11 but does not change when pin 14 of IC ZM37 is grounded. Check IC's ZM37 and ZM41.

MISCELLANEOUS ADJUSTMENTS

SYSTEM CLOCK

Connect the input of a Frequency Counter to pin 8 of the Clock Generator IC (ZM8) on the System Board. Adjust the Clock Trimmer (C11) for a frequency of 4.7727MHz.

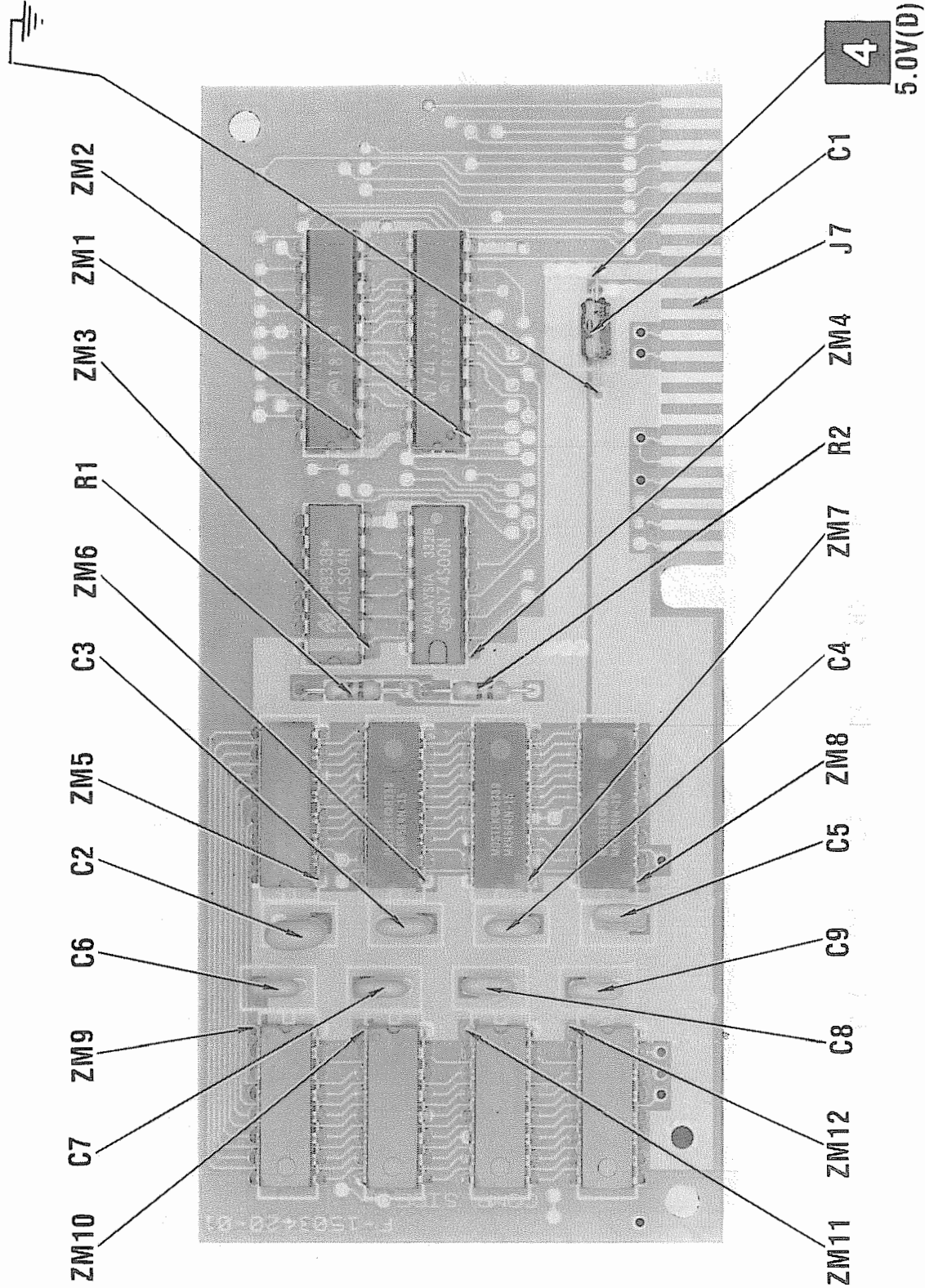


PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFG. PART No.	REPLACEMENT DATA					ZENITH PART No.
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	
INFRARED RECEIVER BOARD								
U1	uPC1373HA		74LS122	NTE74LS122	ECG74LS122			905-352
U2	uPC1373H SN74LS122N							
KEYBOARD								
CR1	1N5817		GE-504A	NTE116	ECG116	SK3311	WEP154	212-76-02
CR4 thru CR9	1N4305		GE-514	NTE519	ECG519	SK3100/519	WEP925/519	103-131
Q1, 2	MPSA13		GE-64	NTE46	ECG46	SK9442	WEP971/172	121-Z9024
U1	MC14013B		GE-4013	NTE4013B	ECG4013B	SK4013B	WEP4013B/4013B	905-186
U2	MC14060B			NTE4060B	ECG4060B	SK4060B		HE-443-958
U3	MC14011B		GE-4011	NTE4011B	ECG4011B	SK4011B	WEP4011B/4011B	221-Z9133
U4	80C48C098							
U5	SN74HC03N							
U6	MC14068B							
U7	SN74HC03N							
U8	MC74HC02			NTE4068B	ECG4068B	SK4068B		
MEMORY EXPANSION BOARD								
ZM1, M2	SN74LS374N		74LS374	NTE74LS374	ECG74LS374			HE-443-863
ZM3	DM74LS04N		74LS04	NTE74LS04	ECG74LS04	SK74LS04		HE-443-755
ZM4	SN74LS00N		74LS00	NTE74LS00	ECG74LS00	SK74LS00		HE-443-728
ZM5 thru ZM12	MK4564N-15		4164-15	NTE4164	ECG2164			



ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED.

IBM PCjr
MODEL 4860

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

MISCELLANEOUS

ITEM No.	PART NAME	MFR. PART No.	NOTES
D2	INFRARED RECEIVER BOARD		Receiver, Infrared
	LED		
	KEYBOARD		
CR3	LED		Transmit, Infrared
CR4	LED		Transmit, Infrared
SW1	Switch		Key
Thru	Crystal		6MHz
SW62			
Y1	POWER SUPPLY BOARD		Fan Power
M1	Motor		
S1	Switch		
K1	SYSTEM BOARD	0447-0150-90 (1)	Cassette
	Relay		
	Ferrite Bead		
	Ferrite Bead		
	Ferrite Bead		
	Beeper		
	Crystal		
SP1	Delay Line		14.31818MHz
Y1			
ZM51			

(1) Number on unit.

WIRING DATA

Shielded Hook-up Wire	Use BELDEN No. 8401 or 8421 (Single-Conductor)
	8208 (Two-Conductor)
General-use Unshielded Hook-up Wire	Use BELDEN No. 8529 (Solid) Available in 13 Colors
	8522 (Stranded) Available in 13 Colors
300-Ohm Input Lead	Use BELDEN No. 8225
75-Ohm Input Lead	Use BELDEN No. 8241

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFR. PART No.	REPLACEMENT DATA				
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.
CR1 CR2 CR3 CR4 CR5 CR6 CR7 thru CR10	POWER SUPPLY BOARD		GEZD-6.2 GEZD-5.1 C122B	NTE580 NTE5013A NTE5010A NTE5462	ECG5013A ECG5010A ECG5462	SK6A2/5013A SK5A1/5010A SK9291/5462	WEP1414/5013 WEP1411/5010 WEP6252/5462
Q1	GEA114B (1)			NTE1914 NTE260 NTE943M NTE923D	ECG1914 ECG260 ECG943M ECG923D	SK9331/1914 SK3979/260 SK9278 SK3165/923D	WEP2331/923D
Q2	1N753A						
Z1	1N4625						
Z2	30709K (1)						
	S2800A						
	80S0030 (1)						
	GEA15A (1)						
	UA7812KM						
	2N6040						
	LM393P						
	UA723CN						

(1) Number on unit.

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
SYSTEM BOARD								
CR1 CR2,3 CR4 Q1 VR1	1N4001		GE-504A	NTE116	ECG116	SK3311	WEP154	212-76-02
	1N4305F		GE-514	NTE519	ECG519	SK3100/519	WEP925/519	103-131
	5230A		GEZD-4.7	NTE5009A	ECG5009A	SK4A7/5009A	WEP1409/5009	103-279-09
	2N3904		GE-123AP	NTE123AP	ECG123AP	SK3854/123AP	WEP736/123A	121-Z9000A
	LM340T-5		GEVR-102	NTE960	ECG960	SK3591/960		221-Z9043
XX1 ZM1	MK38050N-25							
	SN74LS08N		74LS08	NTE74LS08	ECG74LS08	SK74LS08		HE-443-780
ZM2 ZM3	74LS08		74LS08	NTE74LS08	ECG74LS08	SK74LS08		HE-443-780
	SN75477P							
ZM4	MC1489P			NTE75189	ECG75189	SK5189/75189		HE-443-795
	SN75189			NTE75189	ECG75189	SK5189/75189		HE-443-795
ZM5	DS1488N			NTE75188	ECG75188	SK5188/75188		HE-443-794
	MC1488P			NTE75188	ECG75188	SK5188/75188		HE-443-794
ZM6	SN75188			NTE75188	ECG75188	SK5188/75188		HE-443-794
	SN74LS74AN		74LS74A	NTE74LS74A	ECG74LS74A	SK74LS74A		HE-443-730
ZM7	74LS74		74LS74A	NTE74LS74A	ECG74LS74A	SK74LS74A		HE-443-730
	SN74LS86N		74LS86	NTE74LS86	ECG74LS86	SK74LS86		HE-443-891
ZM8	74LS86		74LS86	NTE74LS86	ECG74LS86	SK74LS86		HE-443-891
	74LS32		74LS32	NTE74LS32	ECG74LS32	SK74LS32		HE-443-875
ZM9 ZM10	ID8284A							
	8284A							
ZM11	INS8250AN							
	DM74LS51N		74LS51	NTE74LS51	ECG74LS51	SK74LS51		HE-443-728
ZM12	74LS51		74LS51	NTE74LS51	ECG74LS51	SK74LS51		HE-443-728
	DM74LS00N		74LS00	NTE74LS00	ECG74LS00	SK74LS00		HE-443-791
	74LS00		74LS00	NTE74LS00	ECG74LS00	SK74LS00		HE-443-791
	SN74LS244N		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
	74LS244		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
R1 R4 R5 R6 R9	INFRARED RECEIVER BOARD 200 1½ 1/4W Metal Film 38.3 1½ 1/4W Metal Film 12.1 1½ 1/4W Metal Film 200 1½ 1/4W Metal Film 221K 1½ 1/4W Metal Film 267K 1½ 1/4W Metal Film	14-2-104 (2) 14-2-104 (2) 14K470 (2)		
RX1 RX2	KEYBOARD Resistor Network (1) Resistor Network (1)			
MOV1 R3 R4 R5 R8 R9 R11 R14 R15	POWER SUPPLY BOARD VDR 97.6K 1½ 1/4W Carbon Film 1000 1½ 1/4W Carbon Film .05 1½ 2W WW 1000 1½ 1/4W Carbon Film 28.7K 1½ 1/4W Carbon Film 2150 1½ 1/4W Carbon Film 4990 1½ 1/4W Carbon Film 1101 1½ 1/4W Carbon Film			

(1) Contains 13 each 100K resistors.
(2) On unit Part Number.

COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
L1 L2	POWER SUPPLY BOARD Switching Line Choke			

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
L1	INFRARED RECEIVER BOARD Choke (4.7mH)	

FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F1	POWER SUPPLY BOARD 5A 2½			

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFG. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
ZM65	SN74LS244N 74LS244		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
ZM66	SN74LS245N 74LS245		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
ZM67	DM74LS245N		74LS245	NTE74LS245	ECG74LS245	SK74LS245		HE-443-885
			74LS245	NTE74LS245	ECG74LS245	SK74LS245		HE-443-885
ZM68, 9	MK4564N-15 4164		4164-15	NTE4164	ECG2164			
ZM70	DM74LS374N	4164-15	NTE4164	ECG2164				
ZM71, 2	MK4564N-15 4164	74LS374	NTE74LS374	ECG74LS374	HE-443-863			
		4164-15	NTE4164	ECG2164	HE-443-863			
ZM73	SN74LS374N 74LS374	4164-15	NTE4164	ECG2164	HE-443-863			
		74LS374	NTE74LS374	ECG74LS374	HE-443-863			
ZM74	SN74LS273N		74LS273	NTE74LS273	ECG74LS273	SK74LS273	HE-443-805	
ZM75	SN74LS258N 74LS258		74LS258A	NTE74LS258	ECG74LS258	SK74LS258		
			74LS258A	NTE74LS258	ECG74LS258	SK74LS258		
ZM76	MOM665AP15 4164		4164-15	NTE4164	ECG2164			
ZM77	MK4564N-15 4164		4164-15	NTE4164	ECG2164			
		4164-15	NTE4164	ECG2164				
ZM78	SN74LS374N 74LS374	74LS374	NTE74LS374	ECG74LS374	ECG74LS374			HE-443-863
		74LS374	NTE74LS374	ECG74LS374	ECG74LS374			HE-443-863
ZM79	DM74LS258BN 74LS258	74LS258A	NTE74LS258	ECG74LS258	SK74LS258	SK74LS258		

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFG. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
ZM13	DM74LS125AN		74LS125A	NTE74LS125A	ECG74LS125A	SK74LS125A		HE-443-811
ZM14	74LS125		74LS125A	NTE74LS125A	ECG74LS125A	SK74LS125A		HE-443-811
	NE558N			NTE926	ECG926	SK7721/926		
	NE558			NTE926	ECG926	SK7721/926		
ZM15	SN74LS157N		74LS157	NTE74LS157	ECG74LS157	SK74LS157		HE-443-799
	74LS157	74LS157	NTE74LS157	ECG74LS157	SK74LS157	HE-443-799		
ZM16	SN74LS04N		74LS04	NTE74LS04	ECG74LS04	SK74LS04		HE-443-755
	74LS04		74LS04	NTE74LS04	ECG74LS04	SK74LS04		HE-443-755
ZM17	DM74LS138N		74LS138	NTE74LS138	ECG74LS138	SK74LS138		HE-443-877
	74LS138		74LS138	NTE74LS138	ECG74LS138	SK74LS138		HE-443-877
ZM18	SN74LS175N		74LS175	NTE74LS175	ECG74LS175	SK74LS175		HE-443-752
	74LS175	74LS175	NTE74LS175	ECG74LS175	SK74LS175	HE-443-752		
ZM19	SN74LS244N		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
	74LS244		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
ZM20	SN76496N							
ZM21	MC6845P							
	MC6845							
ZM22	AM8255A-5PC		8255A-5					HE-443-906
	P8255A-5		8255A-5					HE-443-906
	8255A-5							
	P8253-5							
ZM23	8253-5							
ZM24	SN74LS244N		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
	74LS244		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
ZM25	SN74LS93N		74LS93	NTE74LS93	ECG74LS93	SK74LS93		HE-443-839
	74LS93		74LS93	NTE74LS93	ECG74LS93	SK74LS93		HE-443-839
ZM26	LM358N			NTE928M	ECG928M	SK3692/928M		
	LM358		NTE928M	ECG928M	SK3692/928M			
ZM27	SN74LS258N		74LS258A	NTE74LS258	ECG74LS258	SK74LS258		
	74LS258		74LS258A	NTE74LS258	ECG74LS258	SK74LS258		
ZM28	SN74LS258N		74LS258A	NTE74LS258	ECG74LS258	SK74LS258		
	74LS258		74LS258A	NTE74LS258	ECG74LS258	SK74LS258		

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFG. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
ZM29	DM74LS153N		74LS153	NTE74LS153	EOG74LS153	SK74LS153		HE-443-805
ZM30	74LS153		74LS153	NTE74LS153	EOG74LS153	SK74LS153		HE-443-805
ZM31	SN74LS273N		74LS273	NTE74LS273	EOG74LS273	SK74LS273		HE-443-799
	74LS273		74LS273	NTE74LS273	EOG74LS273	SK74LS273		HE-443-799
	SN74LS157N		74LS157	NTE74LS157	EOG74LS157	SK74LS157		HE-443-799
ZM32	74LS157		74LS157	NTE74LS157	EOG74LS157	SK74LS157		
ZM33	IP8259A		74LS04	NTE74LS04	EOG74LS04	SK74LS04		HE-443-755
	8259A		74LS04	NTE74LS04	EOG74LS04	SK74LS04		HE-443-755
	SN74LS04N		74LS112	NTE74LS112A	EOG74LS112A			
	74LS04		74LS112	NTE74LS112A	EOG74LS112A			
	SN74LS112AN		74LS112	NTE74LS112A	EOG74LS112A			
ZM34	74LS112		74LS112	NTE74LS112A	EOG74LS112A			
ZM35	DM74LS74AN		74LS74A	NTE74LS74A	EOG74LS74A	SK74LS74A		HE-443-730
	74LS74		NTE74LS74A	EOG74LS74A	SK74LS74A	HE-443-730		
	L1A0091							
ZM36	SN74LS367		74LS367A	NTE74LS367	EOG74LS367	SK74LS367		HE-443-857
ZM37	74LS367		74LS367A	NTE74LS367	EOG74LS367	SK74LS367		HE-443-857
ZM38	74LS32		74LS32	NTE74LS32	EOG74LS32	SK74LS32		HE-443-875
	74LS32		NTE74LS32	EOG74LS32	SK74LS32	HE-443-875		
	ID8088							
ZM41	SN74LS245N		74LS245	NTE74LS245	EOG74LS245	SK74LS245		HE-443-885
ZM42	74LS245		74LS245	NTE74LS245	EOG74LS245	SK74LS245		HE-443-885
ZM43	74LS74A		74LS74A	NTE74LS74A	EOG74LS74A	SK74LS74A		HE-443-730
	74LS74		NTE74LS74A	EOG74LS74A	SK74LS74A	HE-443-730		
	74LS20		NTE74LS20	EOG74LS20	SK74LS20	HE-443-798		
	SN74LS04N		NTE74LS04	EOG74LS04	SK74LS04	HE-443-755		
ZM44	74LS04		74LS04	NTE74LS04	EOG74LS04	SK74LS04		HE-443-755
ZM45	SN74LS04N		74LS04	NTE74LS04	EOG74LS04	SK74LS04		HE-443-755
	74LS04		NTE74LS04	EOG74LS04	SK74LS04	HE-443-755		
	74LS15		NTE74LS15	EOG74LS15	SK74LS15	HE-443-755		
ZM46								

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA						
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.	
ZM47	DM74LS138N 74LS138 INS82LS05N		74LS138 74LS138	NTE74LS138 NTE74LS138	EOG74LS138 EOG74LS138	SK74LS138 SK74LS138		HE-443-877 HE-443-877	
ZM48	SN74LS244N 74LS244		74LS244 74LS244	NTE74LS244 NTE74LS244	EOG74LS244 EOG74LS244	SK74LS244 SK74LS244		HE-443-791 HE-443-791	
ZM49	SN74LS373N 74LS373		74LS373 74LS373	NTE74LS373 NTE74LS373	EOG74LS373 EOG74LS373	SK74LS373 SK74LS373		HE-443-867 HE-443-867	
ZM50	MC14529B			8332A 28L22	NTE4529B	EOG4529B			
ZM52									
ZM53	DM74LS02N 74LS02		74LS02 74LS02	NTE74LS02 NTE74LS02	EOG74LS02 EOG74LS02	SK74LS02 SK74LS02		HE-443-779 HE-443-779	
ZM54	SN74LS112AN 74LS112		74LS112 74LS112	NTE74LS112A NTE74LS112A	EOG74LS112A EOG74LS112A	SK74S00 SK74LS00		HE-443-26 HE-443-728	
ZM55	74S00 74LS00		74S00 74LS00	NTE74S00 NTE74LS00	EOG74S00 EOG74LS00				
ZM56	648 24S10			74LS373 74LS373 74LS00 74LS00	NTE74LS373 NTE74LS373 NTE74LS00 NTE74LS00	EOG74LS373 EOG74LS373 EOG74LS00 EOG74LS00		SK74LS373 SK74LS373 SK74LS00 SK74LS00	HE-443-867 HE-443-867 HE-443-728 HE-443-728
ZM57	SN74LS373N 74LS373								
ZM58	DM74LS00N 74LS00								
ZM59	SN74LS257N 74LS257		74LS257 74LS257	NTE74LS257 NTE74LS257	EOG74LS257 EOG74LS257	SK74LS257 SK74LS257		HE-443-802 HE-443-802	
ZM60	SN74LS244N 74LS244		74LS244 74LS244	NTE74LS244 NTE74LS244	EOG74LS244 EOG74LS244	SK74LS244 SK74LS244		HE-443-791 HE-443-791	
ZM61,2	MK4564N-15 4164		4164-15 4164-15	NTE4164 NTE4164	EOG2164 EOG2164	SK74LS244 SK74LS244		HE-443-791 HE-443-791	
ZM63	TMM23256P								
ZM64	XE1503723 MK34000								

PRELIMINARY SERVICE CHECKS

PREVENTATIVE MAINTENANCE

ENVIRONMENT

Computers perform best in a clean, cool area that is below 80 degrees Fahrenheit and free of dust and smoke particles. Even though home Computers are not affected by cigarette smoke as much as commercial Computers are affected, it is better to maintain a smoke-free area around the Computer. Do not block cabinet vents of any of the Computer system; Computer, Monitor, Printer, or other power devices.

ELECTRICAL POWER

Variations in the line voltage can affect the Computer. Try to avoid these fluctuations by using an AC receptacle that is on a power line not used by appliances or other heavy current demand devices. A power-surge protector, power-line conditioner, or non-interruptable power supply may be needed to cure the problem. **Do not** switch power On and Off frequently.

KEYBOARD

Liquids spilled into the Keyboard can ruin it. Immediately after a spill occurs, disconnect the Computer power plug from AC power outlet. Then, if circuitry or contacts are contaminated, disassemble the Keyboard and carefully rinse the Keyboard printed circuit board with distilled water and let it dry. Use a cotton swab to clean between the keys. Use a non-abrasive contact cleaner and lint-free wipers on accessible connectors and contacts.

DISK DRIVES

Clean the read/write heads of the Disk Drives about once a month or after 100 hours usage. Use only an approved head cleaning kit.

Handle carefully to preserve proper disk head alignment. A sudden bump or jolt to the Disk Drives can knock the disk head out of alignment. If the disk drive must be transported, place an old disk in slot and close door during transport.

Store disks in their protective covers and never touch the disk surface. Observe the disk handling precautions usually found on the back of disk protective covers.

PRINTERS

Carefully vacuum the Printer regularly. Wipe surface areas clean using a light all-purpose cleaner. Do not oil the machine. The oil will collect abrasive grit and dust. The dust will act as a blanket. This can cause components to overheat and fail.

STATIC ELECTRICITY

Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials, and maintain good humidity in the Computer environment.

MONITOR

Use an isolation transformer with any Monitor that does not come as part of the system since some Monitors use a HOT chassis (chassis connected to one side of the AC line). The face of the Monitor should never be left on for long periods of time at high brightness level except when pattern is being changed periodically. Use caution when cleaning anti-glare screens, to preserve the glare-reduction feature.

This data provides the user with a time-saving service tool which is designed for quick isolation and repair of Computer malfunctions.

Check all interconnecting cables for good connection and correct hookup before making service checks.

Disconnect all peripherals except the Monitor from the Computer to eliminate possible external malfunctions.

Replacement or repair of the Power Supply board, System board, Disk Drive Adapter board, Memory Expansion board, Keyboard, or connectors may be necessary after the malfunction has been isolated.

TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT

Digital Volt/Ohm Meter
Logic Probe
Frequency Counter
Monitor with audio input
Disk Drive Tester or Test Program

TOOLS

Low Wattage Soldering Iron
Desoldering Equipment
Contact Cleaner (non spray type)
Phillips Screwdriver
Flat Blade Screwdriver
1/4" Socket
IC Insertion and Removal Tools 24, 28 and 40 pin

REPLACEMENT PARTS

CR1	Diode	GEA114B On Unit	F1	Fuse	5A
CR2	Diode	1N753A	L2	Coil	
CR3	Diode	1N4625	S1	Power Switch	
CR4	Diode	30709K On Unit	XX1	IC, ROM	
CR5	Diode	S2800A	ZM40	Microprocessor	
CR6	Diode	80S0030 On Unit		8088	
CR7	Diode	GEA15A On Unit	ZM63	IC, ROM	
thru			ZM64	IC, Character	
CR10				Generator	
				Four AA Batteries (for keyboard)	



Howard W. Sams & Co., Inc.

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The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed.

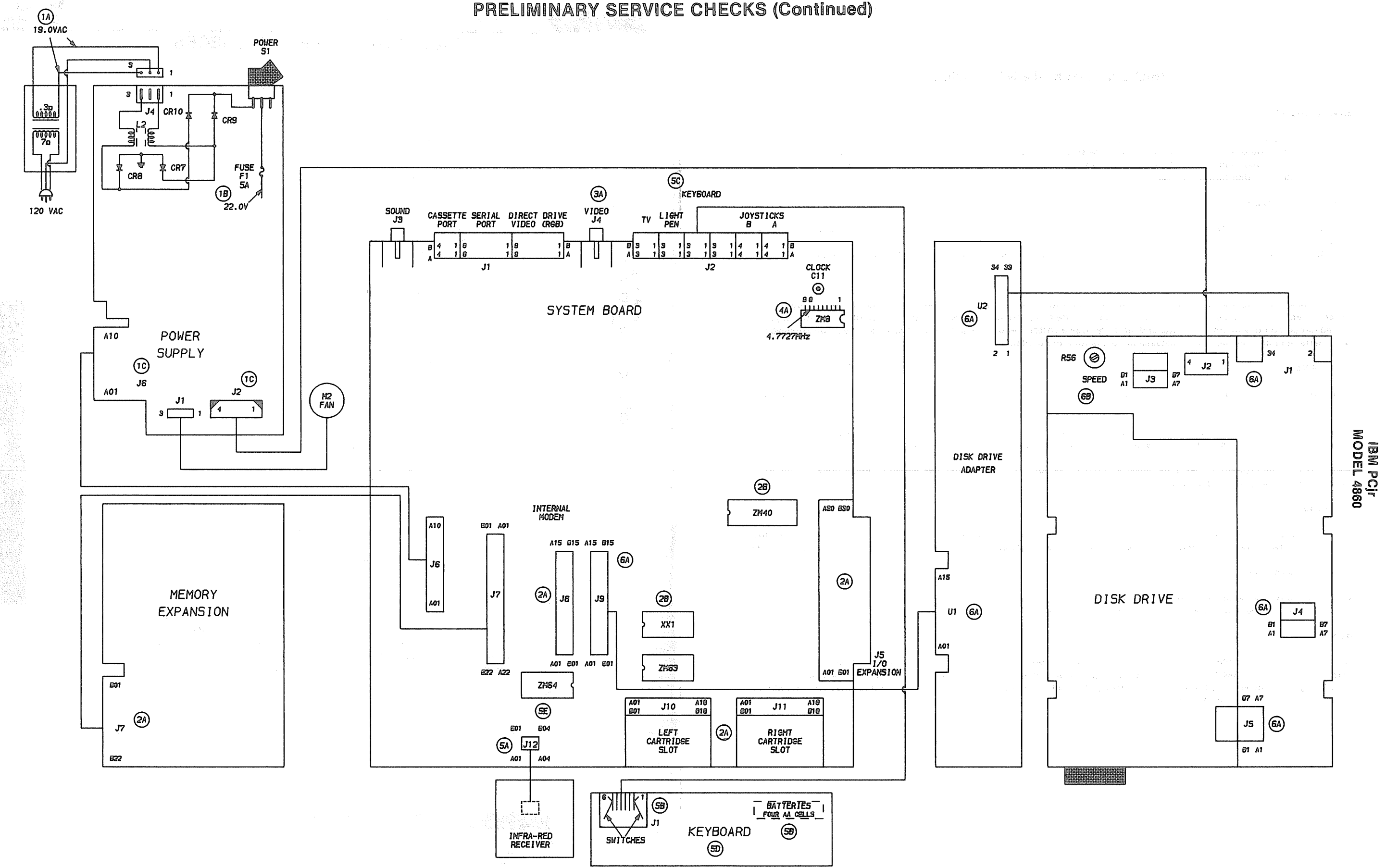
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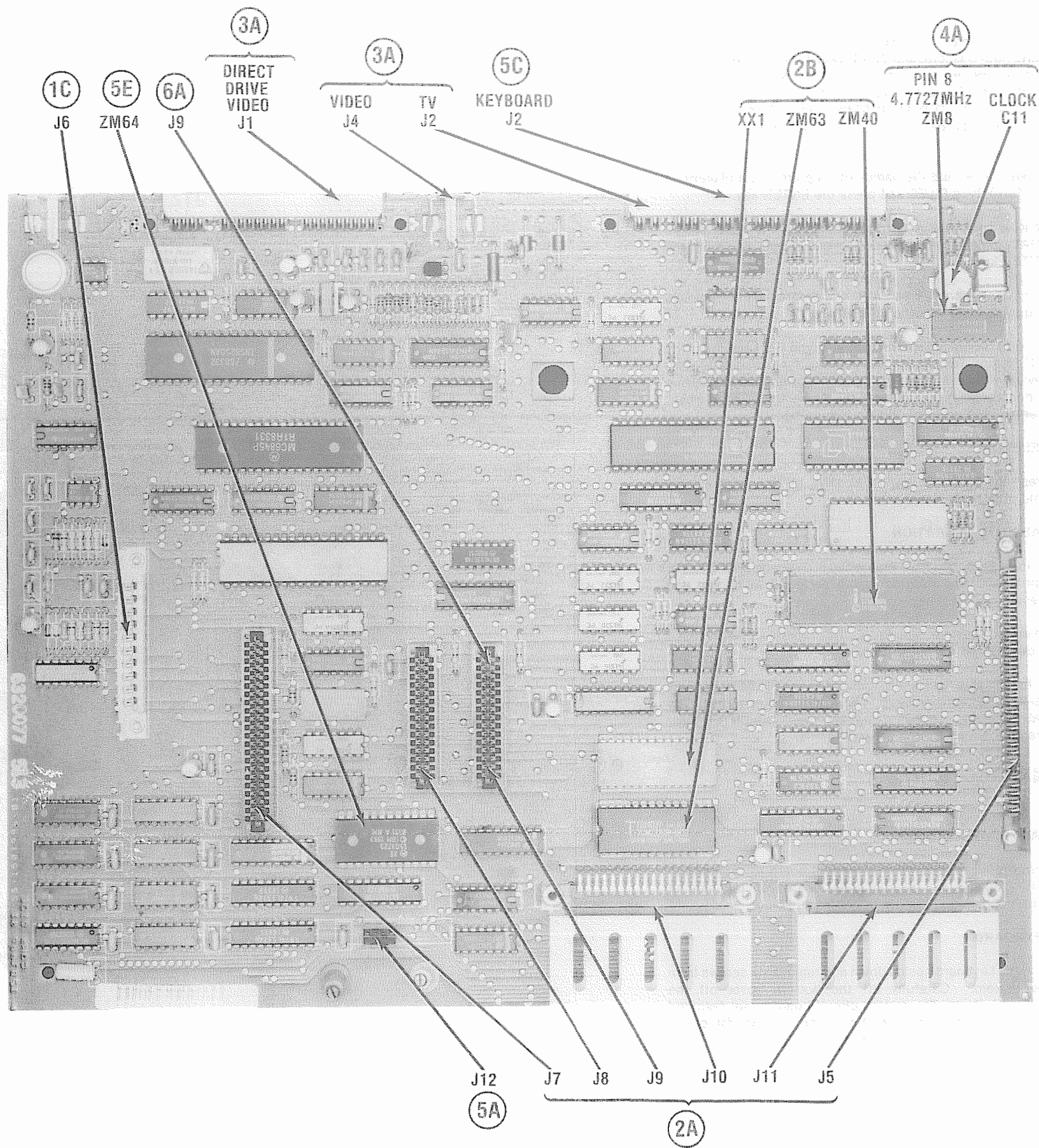
PRELIMINARY SERVICE CHECKS (Continued)



INTERCONNECTING DIAGRAM

INTERCONNECTING DIAGRAM

PRELIMINARY SERVICE CHECKS (Continued)



PRELIMINARY SERVICE CHECKS (Continued)
GENERAL OPERATING INSTRUCTIONS

BOOT UP

Insert a bootable diskette into the Disk Drive and turn On the Computer. The Computer will automatically boot up using the diskette in the Disk Drive. If a PC DOS (Personal Computer Disk Operating System) diskette is used, the Computer will display the date and time and ask for a new date and time. After the date and time have been entered, the version of DOS will be displayed on the Monitor screen along with an A> which indicates the DOS is running.

PC DOS

For a list of file names on the diskette in the current Disk Drive, type DIR and press the ENTER key.

To return to PC DOS from Basic, type SYSTEM and press the ENTER key.

To load a (System) program from a diskette while in DOS, type the program name and press the ENTER key.

A blank diskette must be formatted before it can be used to save information which is in memory. A formatted diskette must contain a DOS or a Start-up program before the Computer will boot up using that diskette.

Insert a diskette containing a "Format Program" into Disk Drive A. Type FORMAT and press the ENTER key. Follow the instructions on the Monitor screen to format the unformatted diskette. NOTE: Formatting a diskette will wipe out any programs previously placed on the diskette.

BASIC

When turned On, the Computer will come up in Cassette (ROM) Basic if there is not a bootable DOS diskette in the Disk Drive. The version of Basic and memory available will appear at the top of the screen. For additional information on Cassette I/O operations see the "Cassette Operation" section of the General Operating Instructions.

The manufacturer also supplies a Cartridge Basic that supports both Cassette and Disk Drive operation. The cartridge can be inserted into either one of the slots located on the front of the Computer. Type BASIC and press the ENTER key to go from DOS to Cartridge Basic. To return to DOS from Cartridge Basic, type SYSTEM and press the ENTER key.

To view a list and the names of programs on a diskette in the Drive, type FILES and press the ENTER key.

To load a program in Cartridge Basic from the diskette, type LOAD, the program name enclosed in quotes, and press the ENTER key.

To save a program, type SAVE, the program name enclosed in quotes and press the ENTER key.

To run a program from Basic mode, type RUN and press the ENTER key. To stop a program, press the Fn and BREAK (B) keys at the same time. NOTE: Some programs will disable or not recognize the Fn and BREAK keys to prevent the user stopping the program while it is running.

RESETTING COMPUTER

Press the CTRL, ALT, and DEL keys, all three at the same time, to reset the Computer.

CASSETTE OPERATION

To load a program from tape while in Cassette (ROM) Basic, type LOAD, the program name enclosed in quotes and press the ENTER key.

To save a program, type SAVE, the program name enclosed in quotes and press the ENTER key.

To load or save a program from and to tape while in any Disk Basic, type LOAD or SAVE. Then, enclosed in quotes, type CAS1: and the program name, and press the ENTER key. Example: SAVE "CAS1: program name"

DISASSEMBLY INSTRUCTIONS

CABINET TOP

Release three plastic clips at rear of cabinet top and remove top from Computer. Most components are now accessible for service.

DISK DRIVE REMOVAL

Disconnect the Disk Drive Interface Connector, Power Connector and Fan Connector. Release two plastic clips from cabinet bottom holding Disk Drive and remove Disk Drive from cabinet.

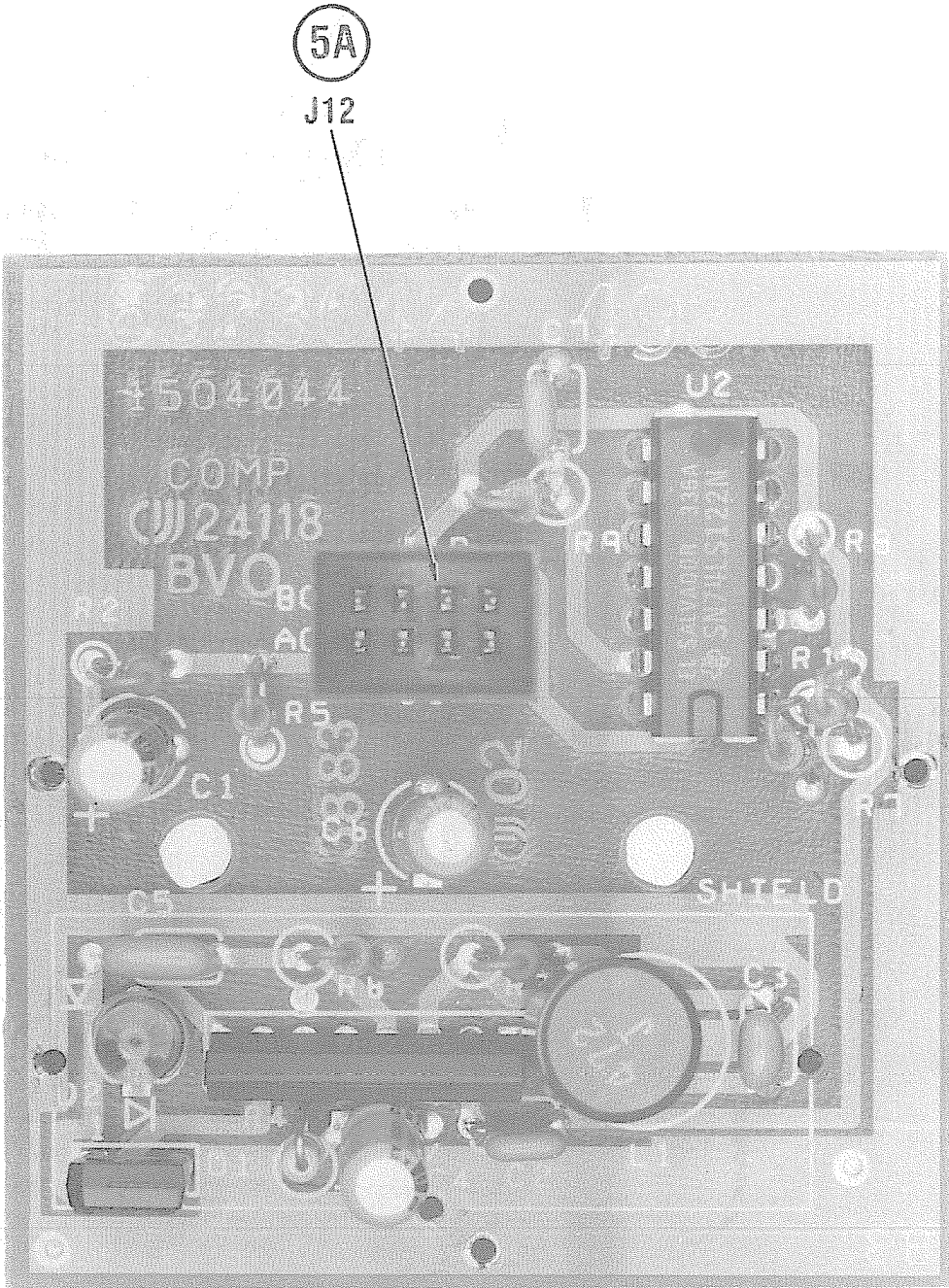
MAIN BOARD REMOVAL

Remove five screws holding System board to cabinet bottom. Release two plastic clips located on left side of System board and remove board from cabinet.

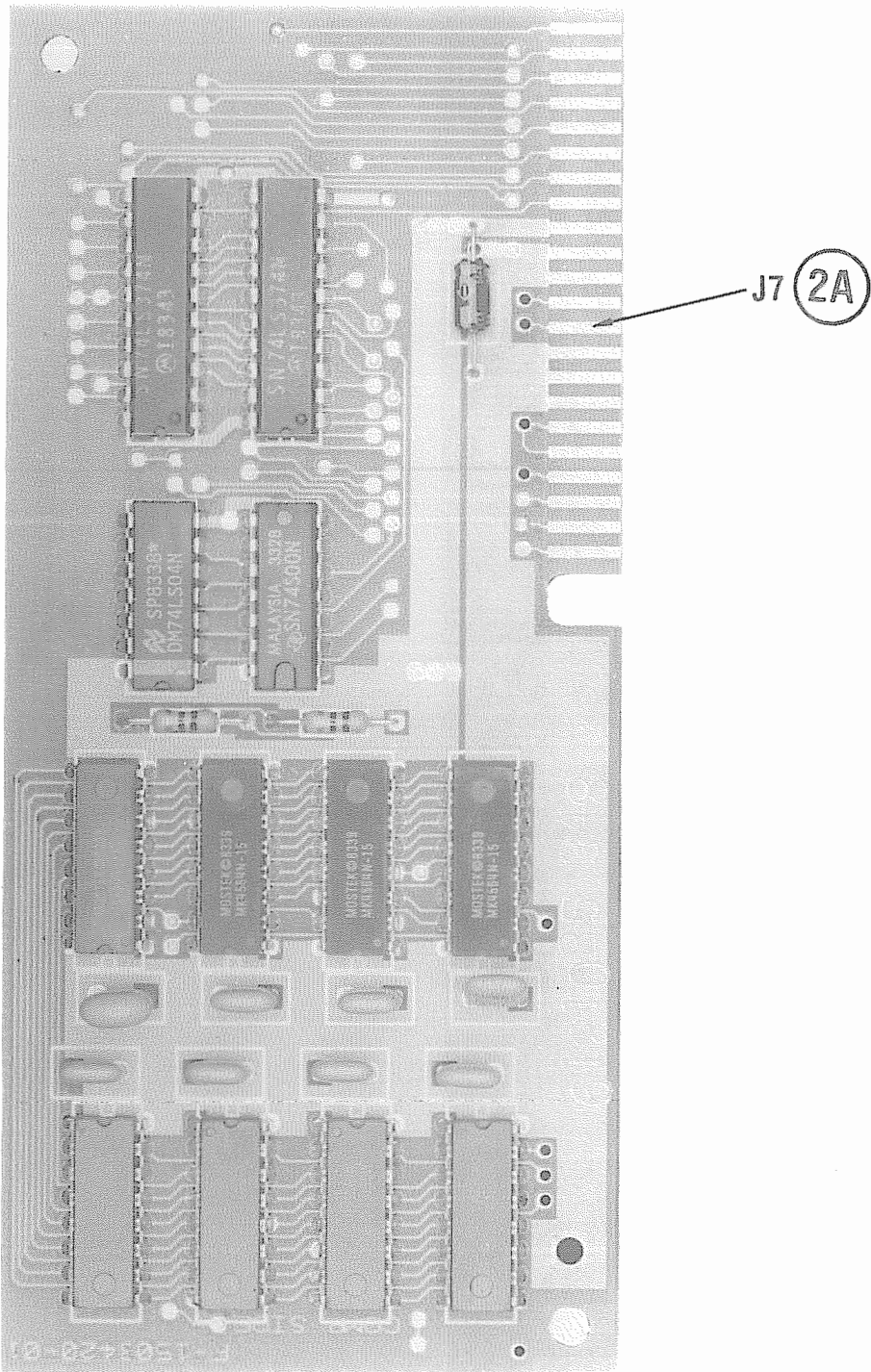
KEYBOARD

Turn the keyboard upside down and remove six screws from the bottom. Carefully lift the bottom cover off the keyboard. Note: The printed circuit board is not fastened down to the top cover. The board and keys will fall out of the top cover if it is not laying flat on the bench.

PRELIMINARY SERVICE CHECKS (Continued)



IBM PCjr
MODEL 4860



COMPUTER SELF TESTS AND DIAGNOSTICS

SELF TEST

The Computer does a self test every time it is turned On. It will test the RAM and display the amount of RAM tested in the lower right hand corner of the Display Screen. If a problem is found the word ERROR and a letter will be displayed under the RAM reading on the Display Screen and two beeps will be heard. Use the following chart to determine the meaning of the error message:

LETTER DISPLAYED	PROBLEM
B	Keyboard or Keyboard Remote Receiver
C	Cassette
E	Modem
H	Disk Drive

Note: Do not press any keys on the keyboard until the self test is finished or a keyboard error will appear.

DIAGNOSTIC TESTS

The Computer has diagnostic tests included in ROM. To view the Test Menu hold the CTRL and ALT keys down and press the INS key. Each test is identified by a number or a letter under a symbol representing the device being tested. Each test is selected by pressing the INS key to move the cursor to the number or letter of the test desired and pressing the ENTER key. Hold the FN key down and press the BREAK key to stop a test and go to menu. While the menu is displayed the RAM is tested continuously and the section of the RAM being tested is displayed at the bottom of the menu. If the number or letter under the symbol is blinking, it means that item is installed in the computer. If an item is installed, but its number or letter is not blinking, there is a problem with that item. The following is a description of each test:

TEST 1: This test is for the Disk Drive. Insert a BLANK diskette into the Disk Drive and close the door. Press the ENTER key to start the test. A diagram of the Disk Drive will appear on the screen and a diskette will be shown being inserted and removed from the Disk Drive. The diskette will then be shown as broken indicating any information on it has been destroyed. This is a warning to insert only a BLANK diskette into the Disk Drive. The program then asks for input from the keyboard. Type the letters MPNP and press the ENTER key. The Computer then performs a test on the Disk Drive and returns to Menu with a message under the number 1. Use the following chart to determine the meaning of the message:

MESSAGE	MEANING
*	Disk Drive is working properly
A	No Disk Drive Adaptor installed
B	Defective Disk Drive Adaptor or Disk Drive
C	Diskette is write protected. Use a diskette that is not write protected
D	No diskette was inserted or drive door was not closed
?	Test was interrupted before completed by pressing the FN and BREAK keys

TEST 4: This test is for the Television or 40 Column Monitor Display. When the test is run a different display will appear on the screen each time the ENTER key is pressed. Refer to the IBM "Guide to Operations" manual for pictures of what each screen should look like. When the test is finished the Menu will appear on the screen with a message under the number 4. Use the following chart to determine the meaning of each message.

MESSAGE	MEANING
*	Video circuits are working properly
B	Defective video circuit
?	Test was interrupted before completed by pressing the FN and BREAK keys

TEST 8: This test is the same as the 40 column test (4) except the alpha numeric displays are 80 column. The messages that appear under the number 8 on the menu screen are the same as test 4 except the addition of the message A. Message A means not enough memory installed. This test requires 128K of RAM.

TEST 5: This test is for the Light Pen. When this test is run the screen should turn white with a yellow block on the upper left corner. A different shade should show within a few inches of where the light pen is pressed on the white area of the screen. To restore the screen to one shade, press the light pen on the yellow block in the upper left corner. Hold the FN key and press the BREAK key to return to the menu. An * under the number 5 means the Light Pen test is completed.

TEST 6: This test is for the Joysticks. A joystick must be attached to run this test. When the test is run two large boxes will appear on the screen with two small boxes above each large box. The small boxes represent the joystick buttons. The large box will have an * in it if the joystick is connected. The small boxes should get smaller when the button it represents is pressed. The * should move inside the large box when the control stick is moved. Use the FN and BREAK keys to go back to the menu. Use the following chart to determine the meaning of the messages that appear under the number 6 on the menu screen.

MESSAGE	MEANING
*	Joystick test completed
A	No joystick connected
B	Joystick defective
C	Joystick circuits defective

CSCS8
IBM PCjr
MODEL 4860

PRELIMINARY SERVICE CHECKS (Continued)
COMPUTER SELF TESTS AND DIAGNOSTICS (Continued)

TEST 9: This test will check the internal beeper in the Computer and the external sound system. When the test is started a beep should be heard from the internal beeper and the external sound (from the television speaker or Monitor display speaker) at the same time. The symbol of a speaker will then appear on the Monitor screen. A total of five speaker symbols will be on the screen before the test is completed. Each time the speaker symbol appears, press the ENTER key. A low tone that goes up to a high tone should be heard for the first three speaker symbols. A motorboating sound should be heard for the fourth speaker symbol and a noise burst should be heard for the fifth and last speaker symbol. After the noise burst, the menu screen will appear with an * under the number 9, indicating the sound test was completed. A question mark will appear if the test was interrupted by pressing the FN and BREAK keys.

TEST J: This test checks the keyboard. When the test is run a rectangle box representing the keyboard will appear on the screen with a figure of a man above the box. Each time a key is pressed the character the key represented will appear at the top of the screen. The figure will jump down and place a white box at the location of the key that was pressed. When all the keys have been checked, use the FN and BREAK keys to return to the menu.

TEST K: Reserved for future use.

TEST G: This test checks the Modem. When the test is run the words "Testing Modem" will appear on the screen. The test will take about 3 minutes to complete, then the menu will appear with a message under the letter G. Use the following chart to determine the meaning of the message:

MESSAGE	MEANING
*	Modem operating properly
A	No modem installed
B	Modem defective
C	Dial tone was detected, disconnect the phone line and rerun the test
D	Modem defective

TEST A: Note: This test appears on a second menu screen. This test will check the Printer. The screen will be blank during the Printer test. When the test is run the Printer will start printing. The printout should match the sample given on page 6-116 of the IBM "Guide to Operations" manual. When the test is completed the second menu screen will appear with a message under the letter A. Use the following chart to determine the meaning of the message:

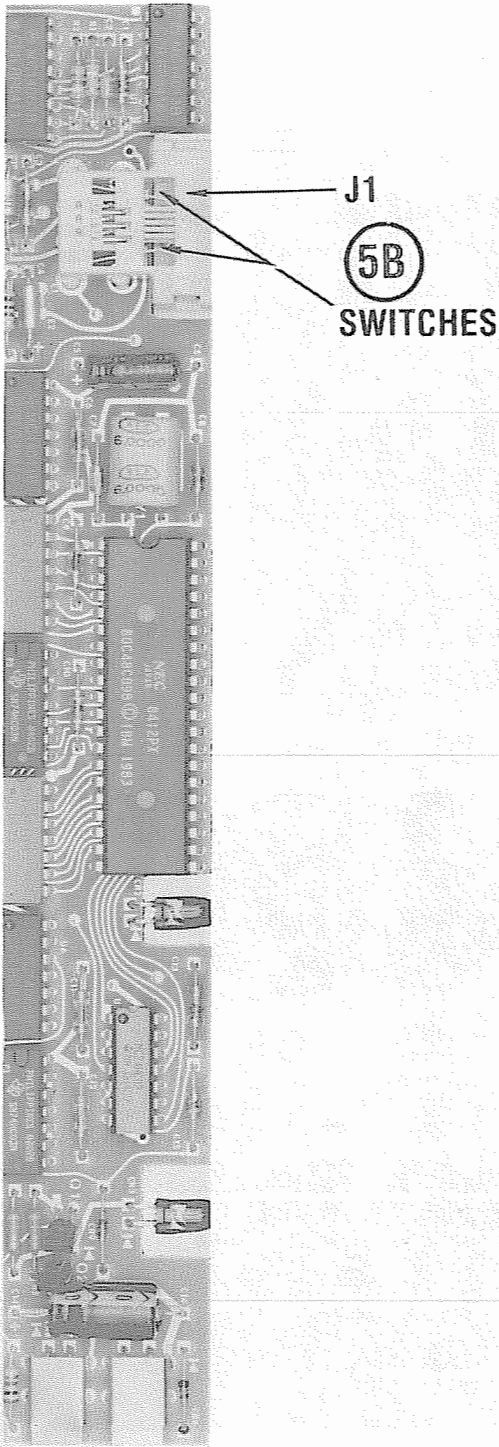
MESSAGE	MEANING
*	Printer test completed
A, D or E	Printer interface or printer defective
B	Printer out of paper
C	Printer defective

MISCELLANEOUS ADJUSTMENTS

SYSTEM CLOCK

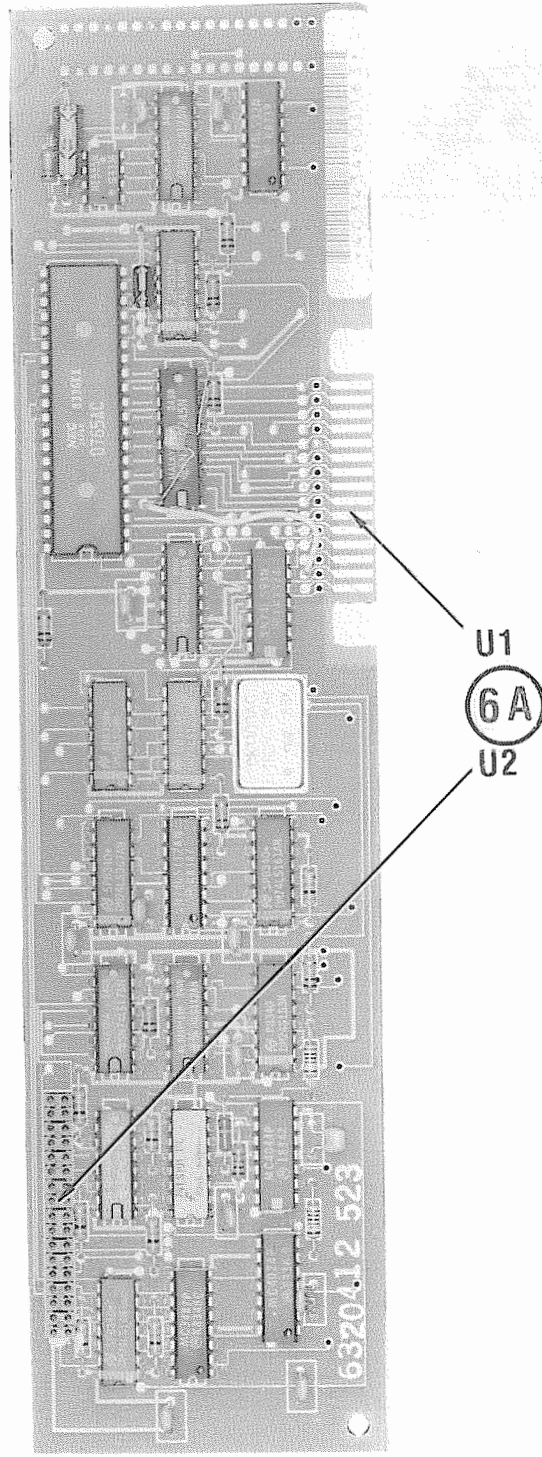
Connect the input of a Frequency Counter to pin 8 of the Clock Generator IC (ZM8) on the System Board. Adjust the Clock Trimmer (C11) for a frequency of 4.7727MHz.

PRELIMINARY SERVICE CHECKS (Continued)



IBM PCjr
MODEL 4860

PRELIMINARY SERVICE CHECKS (Continued)



DISK DRIVE ADAPTER BOARD

PRELIMINARY SERVICE CHECKS (Continued)

SERVICE CHECKS

SEE INTERCONNECTING DIAGRAM AND PHOTOS TO MATCH THE NUMBER IN THE CIRCLES WITH THOSE IN THE FOLLOWING DATA FOR SERVICE CHECKS TO BE PERFORMED.

- 1

POWER SUPPLY DEAD

(A) Unplug the Power Transformer from the power supply and check for 19.0VAC from pin 1 to pin 3 of plug J4. If 19.0VAC is missing, check the Power Transformer leads for open circuits and check the windings for continuity.

(B) If the Power Transformer is good, check for 22.0V at Fuse F1. If 22.0V is missing, check the Fuse (F1), Power Switch (S1), Coil L2 and Diodes CR7 thru CR10.

(C) If 22.0V is present, check connectors J2 and J6 for good connections.
- 2

SYSTEM BOARD

(A) Computer dead, Power Supply checks good. Turn the Computer Off. Remove the Disk Drive Adapter board (Connector J9), Memory Expansion board (Connector J7), Internal Modem board (Connector J8), any board connected to the I/O Expansion port (Connector J5), and any cartridges in the two front cartridge slots (Connectors J10 and J11). Turn the Computer back On. If the Computer starts working, turn the Computer Off and reinstall the boards, one at a time, and recheck the Computer operation until the defective board is found.

(B) If the Computer is still dead with the above boards removed, check the Microprocessor IC (ZM40) and ROM IC's (ZM63 and XX1) by substitution.
- 3

VIDEO

(A) No video. Check the connector being used (J1-Direct Drive Video, J2-TV or J4-Video) for good connections and check the cable for possible open circuits.
- 4

VIDEO COLOR

(A) Colors are not correct. Check for a frequency of 4.7727MHz at pin 8 of the Clock Generator IC (ZM8) on the System board. If the frequency is not correct check the adjustment of the Clock Trimmer (C11). See "Miscellaneous Adjustments".
- 5

KEYBOARD

(A) Keyboard remote does not work. If the message ERROR B appears on the Monitor screen when the Computer is turned On, check the Infra-Red Receiver board Connector (J12).

(B) If no error message appears on the Monitor screen and the keyboard works when the keyboard cable is used, check the keyboard batteries and check the switches that are part of the keyboard Connector J1, for good connection.

(C) Keyboard does not work with the keyboard cable connected, works properly on remote. Check the keyboard cable and connectors for good connections.

(D) One key does not work or is erratic. Clean the key and recheck it.

(E) Wrong character appears on the Monitor screen when a key is pressed. Check the Character Generator IC (ZM64) on the System Board by substitution.
- 6

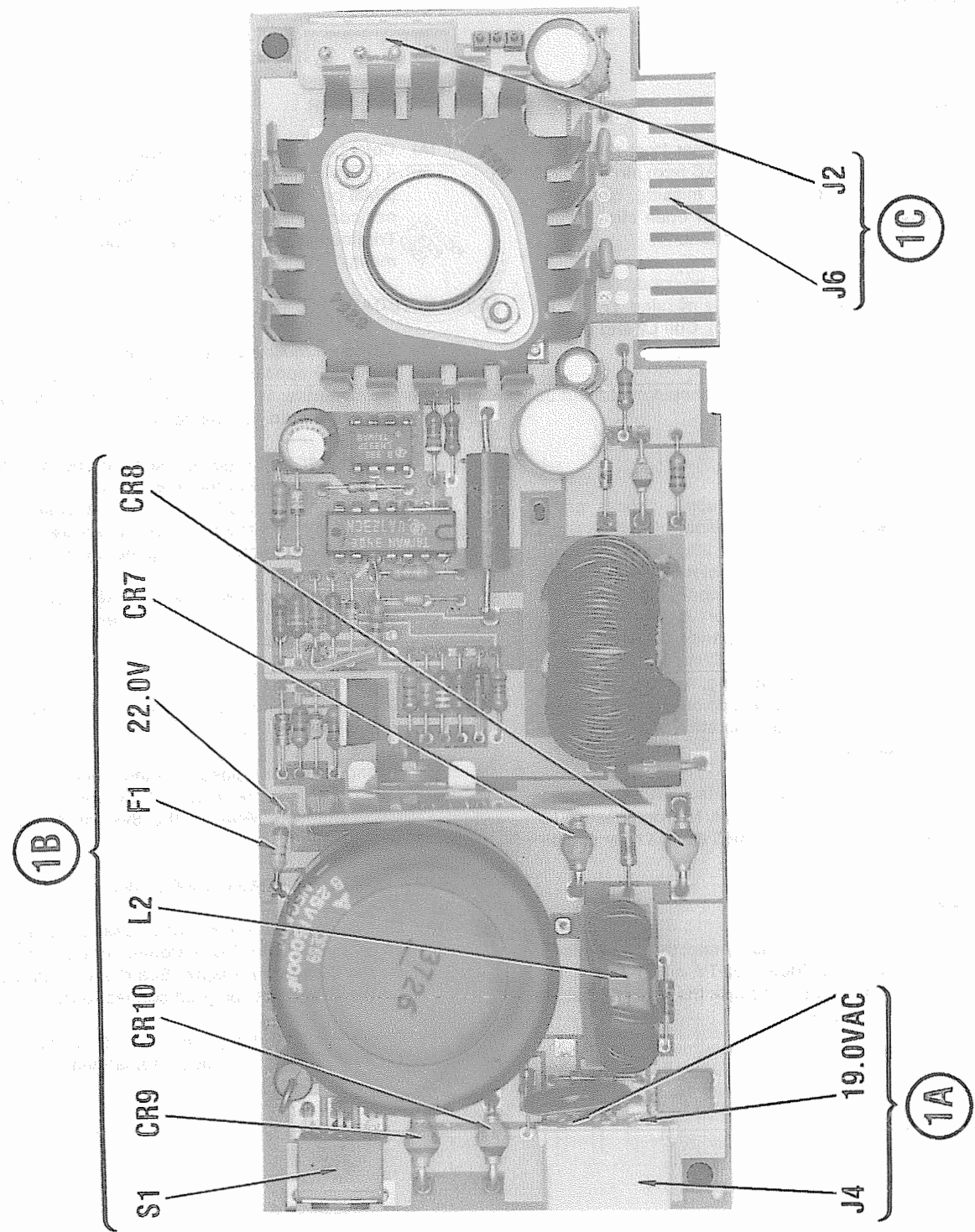
DISK CONTROLLER AND DISK DRIVE

(A) Disk Drive operation is erratic. Check Connector J9 on the System Board, Connectors U1 and U2 on the Disk Drive Adapter Board and J1 thru J5 on the Disk Drive for good connections.

(B) Check the Speed adjustment (R56) on the Disk Drive. See "Miscellaneous Adjustments".

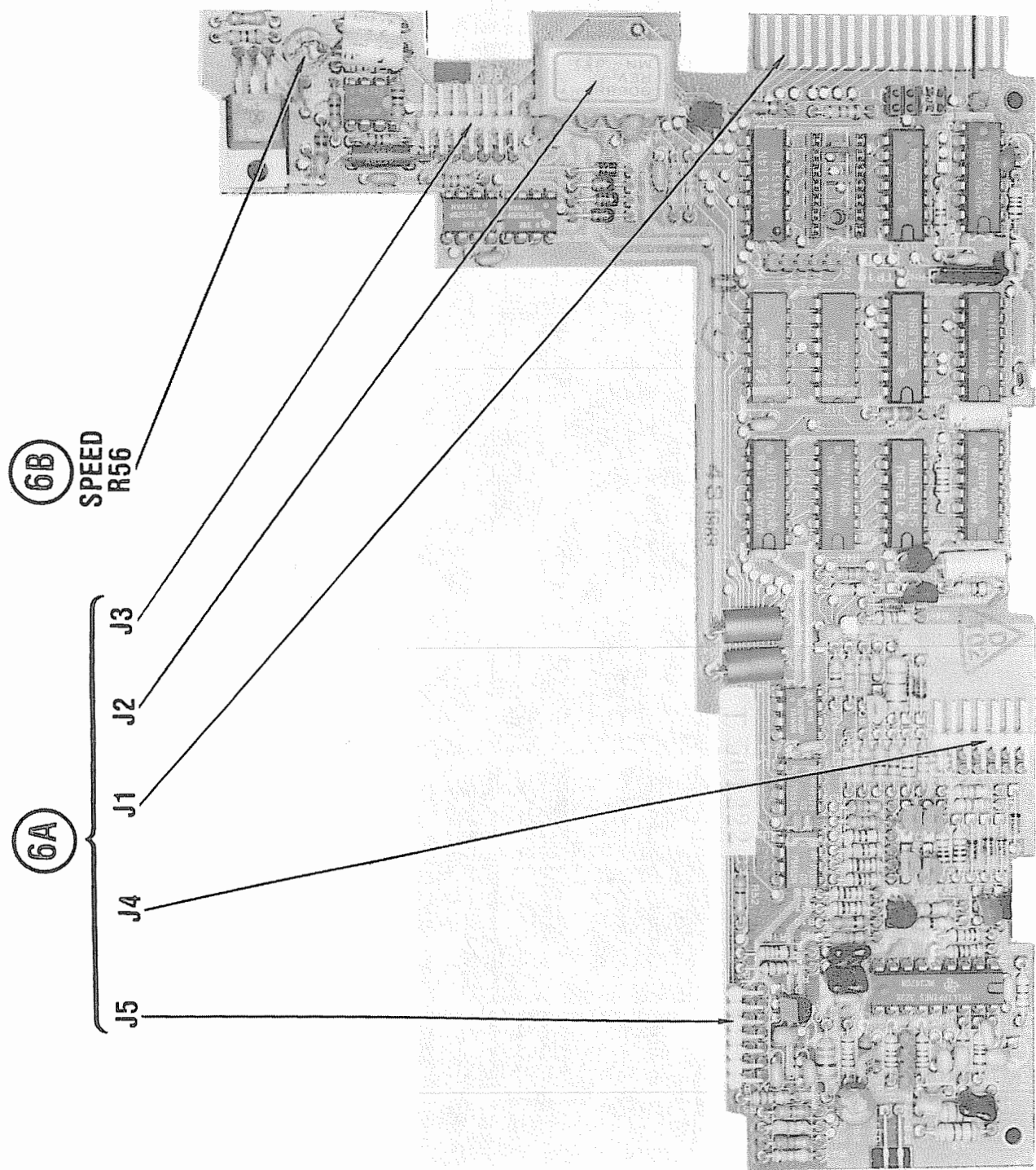
CSCS8 IBM PCjr
MODEL 4860

PRELIMINARY SERVICE CHECKS (Continued)



POWER SUPPLY BOARD
VIII

PRELIMINARY SERVICE CHECKS (Continued)



DISK DRIVE BOARD

IBM PCjr
MODEL 4860

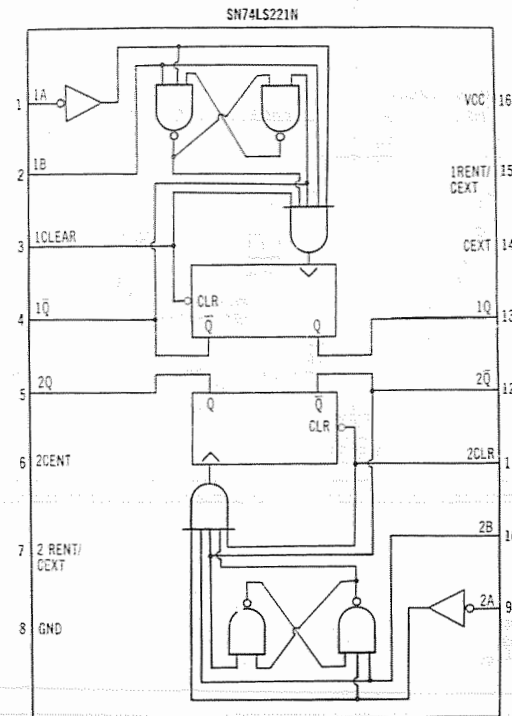
**DISK DRIVE
DISK DRIVE ADAPTER BOARD**

**KEYBOARD
MEMORY EXPANSION BOARD
POWER SUPPLY
SYSTEM BOARD**

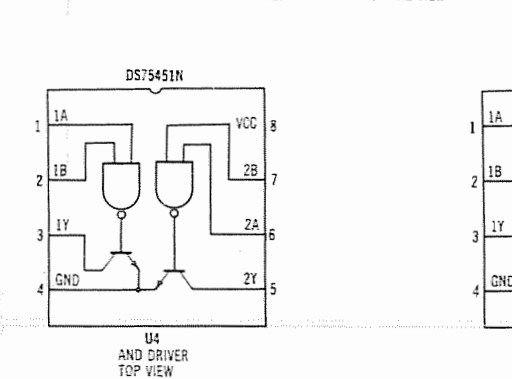
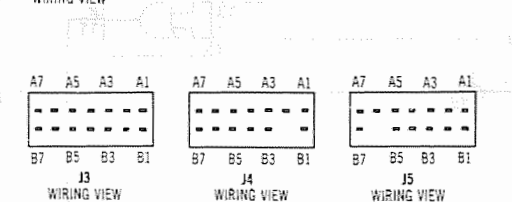
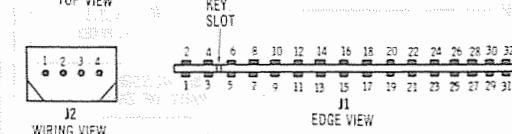
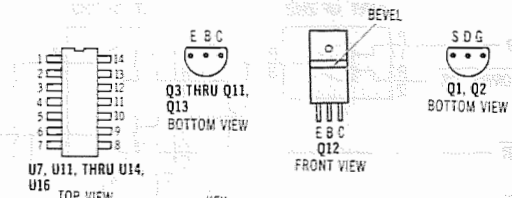
See Folder CSCS8

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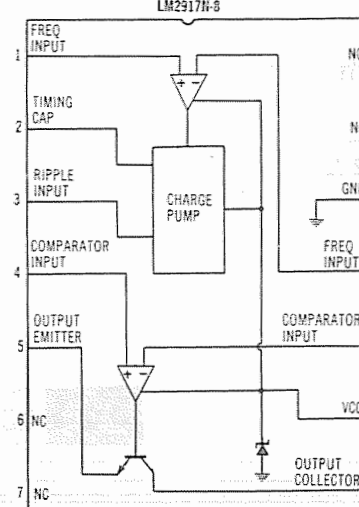


U10, U18
FLIP/FLOP
TOP VIEW

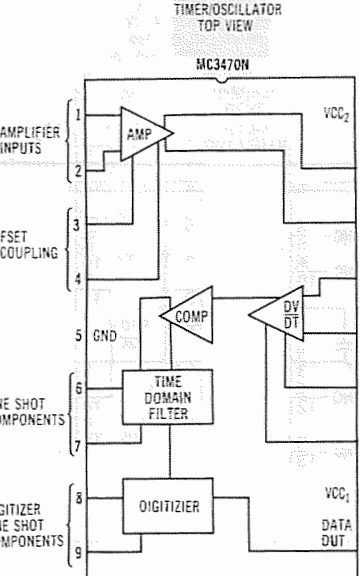


U4 AND DRIVER
TOP VIEW

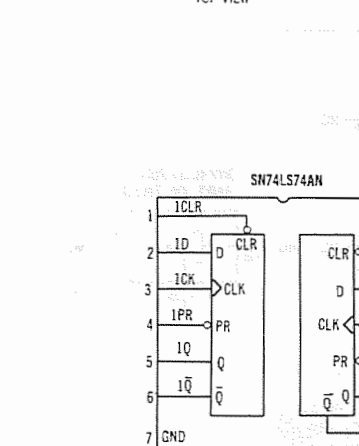
U3, U5,
U15A, U15B
NAND DRIVER
TOP VIEW



U1
TIMER/OSCILLATOR
TOP VIEW



U2
FLOPPY READ AMP
TOP VIEW



U9, U17
FLIP/FLOP
TOP VIEW

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MODEL 4860
CSCS8-A

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IBM PCjr
MODEL 4860

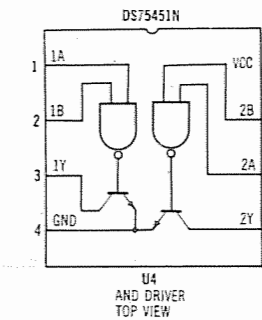
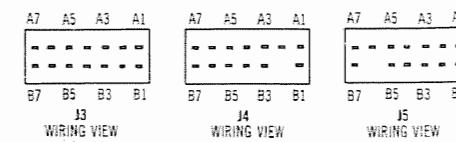
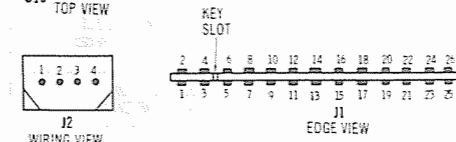
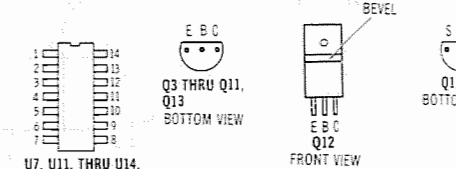
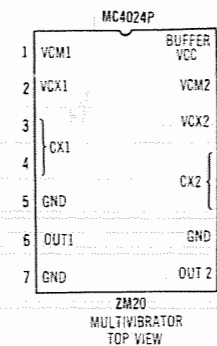
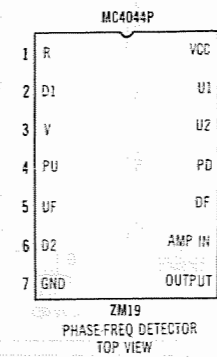
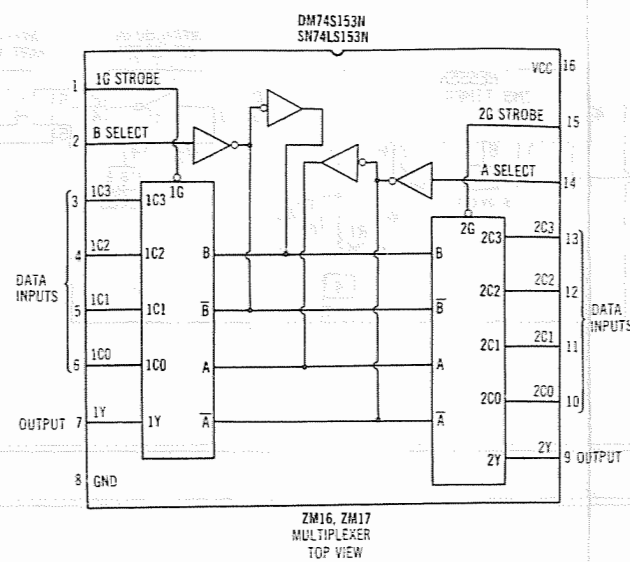
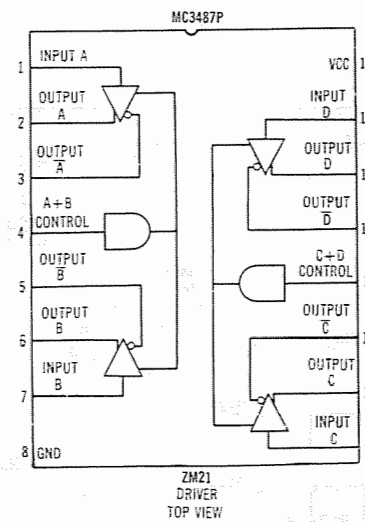
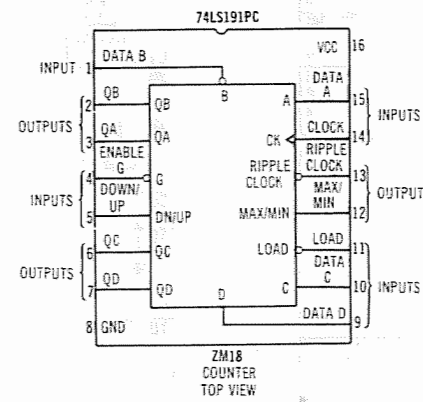
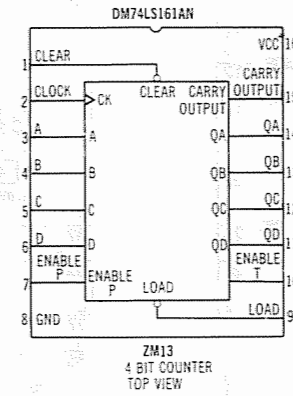
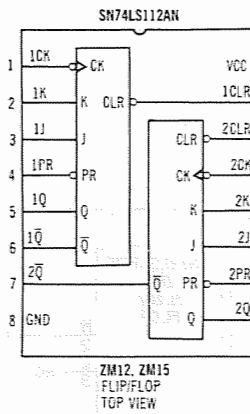
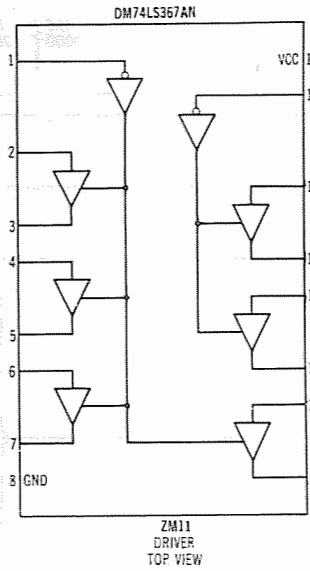
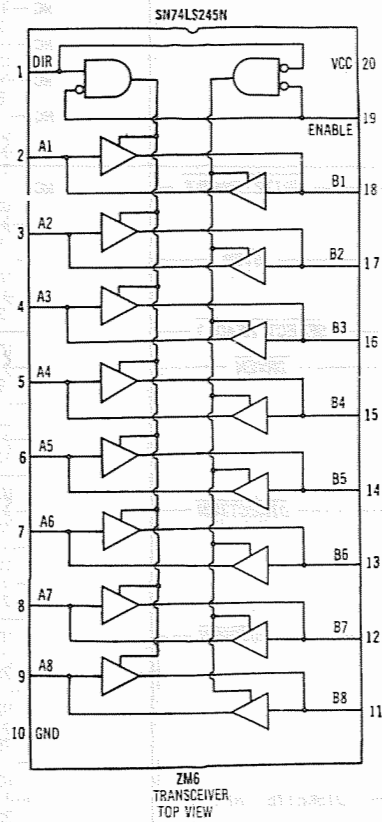
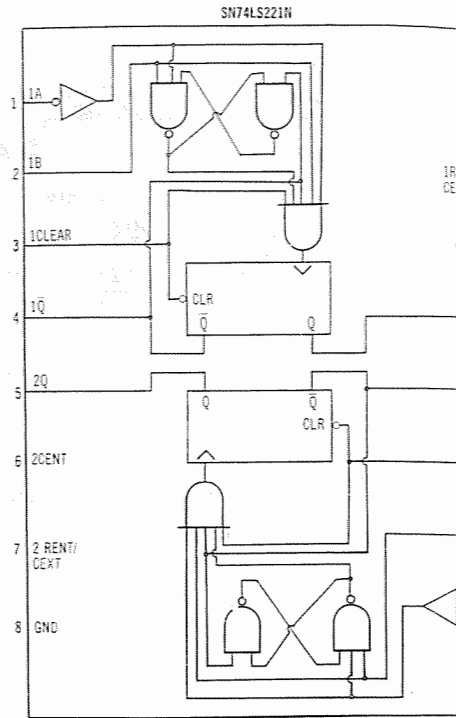
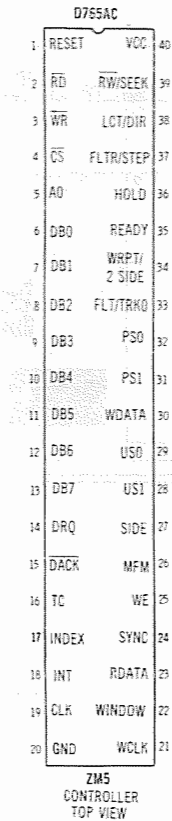
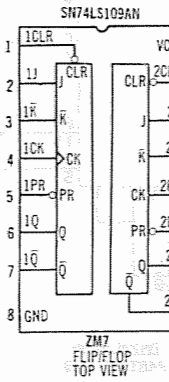
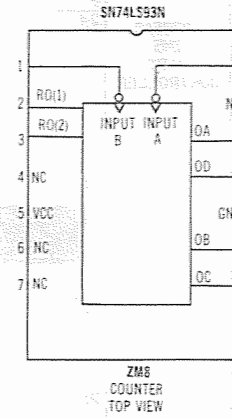
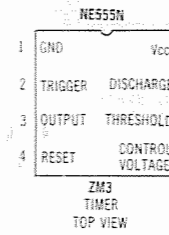
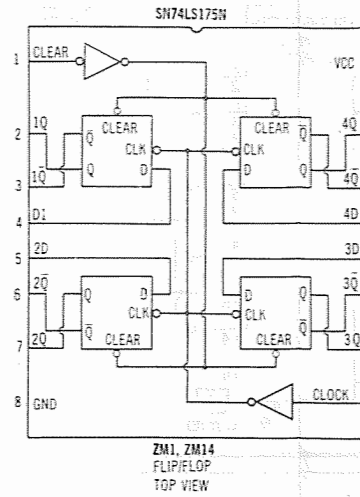
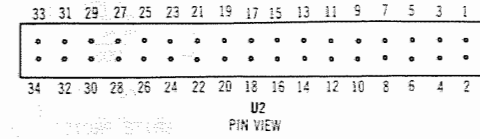
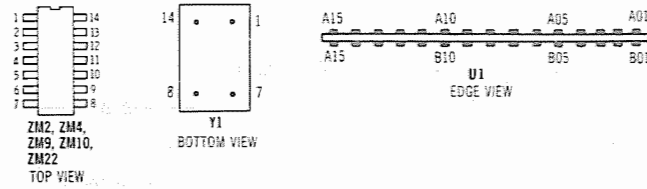
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IC PINOUTS & TERMINAL GUIDES



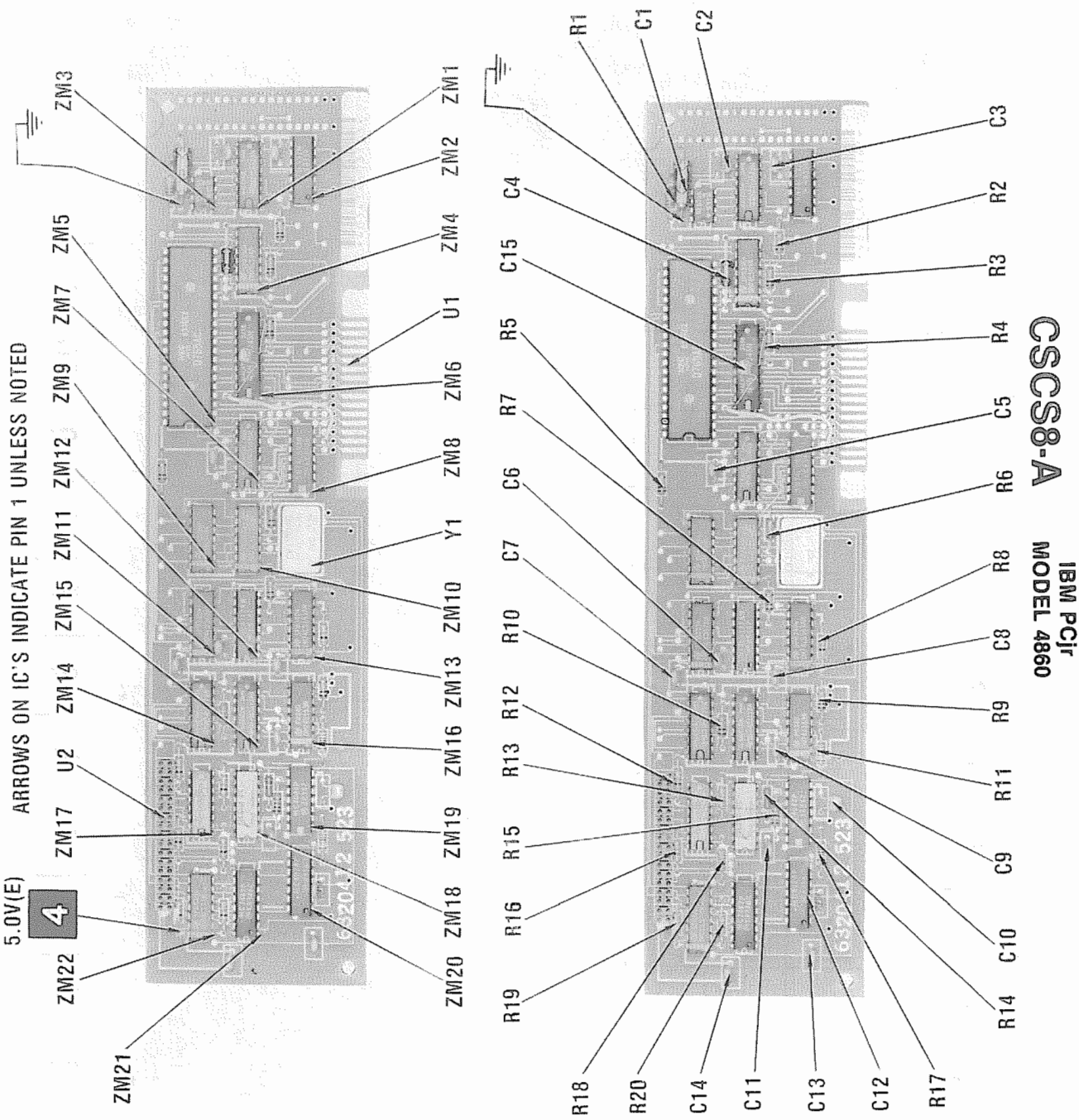


LOGIC CHART (Continued)

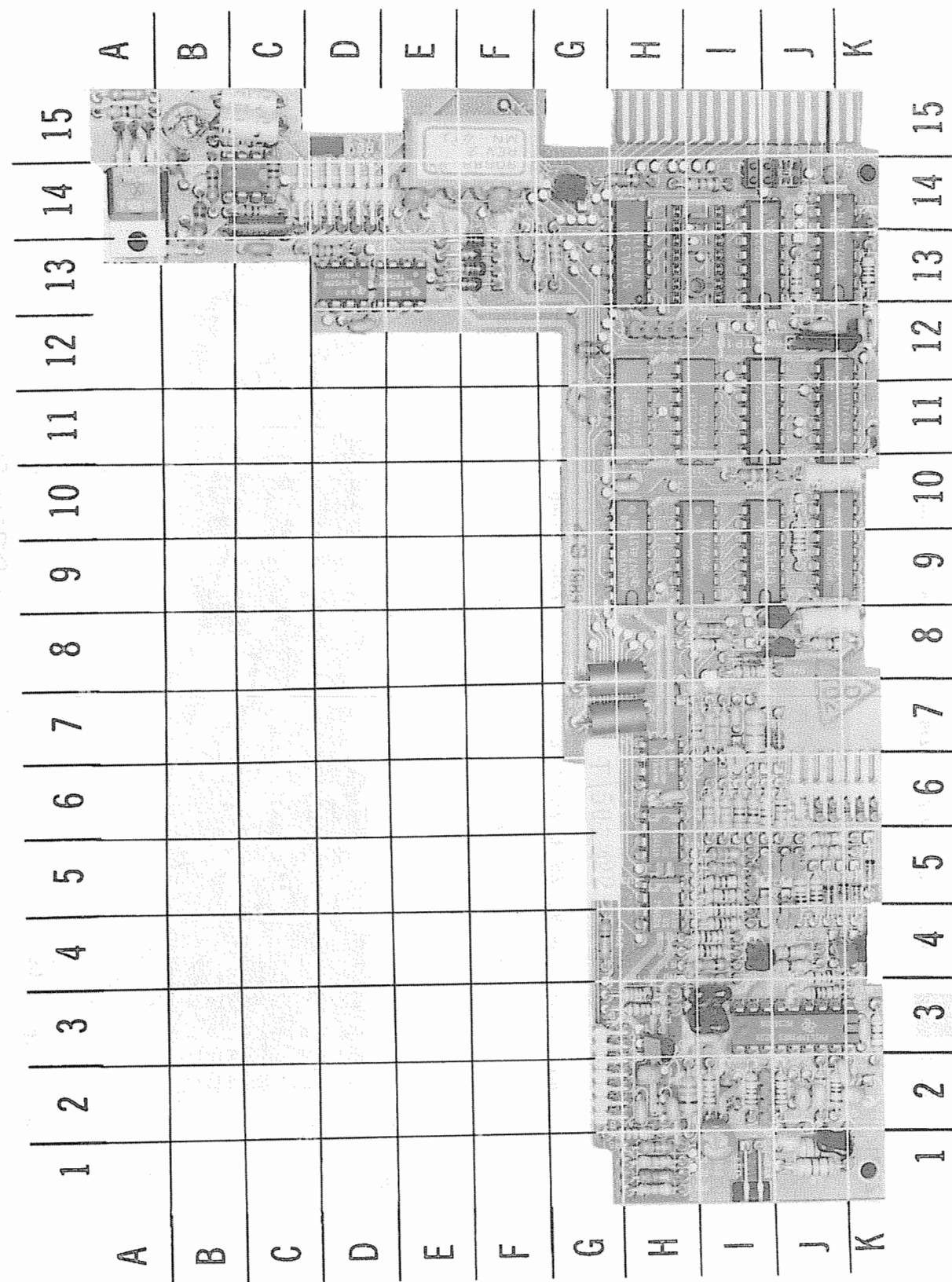
DISK DRIVE ADAPTER BOARD

PIN NO.	IC ZM1	IC ZM2	IC ZM3	IC ZM4	IC ZM5	PIN NO.	IC ZM5	PIN NO.	IC ZM6	IC ZM7	IC ZM8	IC ZM9	IC ZM10
1	H	P	L	H	L	21	P	1	P	H	P	L(8)	H
2	H	P	P	L	P	22	P	2	P	H	L	L(3)	P
3	L	P	P	P	P	23	P	3	P	L	L	P	P
4	P	P	P	P	P	24	P	4	P	P	*	P	H
5	P	P	H	H	P	25	P	5	P	H	H	P	P
6	P	P	L	L	P	26	H	6	P	P	*	P	P
7	P	L	L	P	P	27	L	7	P	P	*	L	L
8	L	P	H	P	P	28	P	8	P	L	P	L(3)	H
9	P	P		P	P	29	P	9	P	P	P	P	*
10	P	P		H	P	30	P	10	L	P	L	L(3)	*
11	P	H		L	P	31	P	11	P	H	P	P	H
12	P	P		L	P	32	P	12	P	P	P	P	*
13	P	P				33	L	13	P	L	*	P	*
14	L	H		H	L	34	L(1)	14	P	P	P	H	H
15	H				L	35	H	15	P	P			
16	H				L	36	P	16	P	H			
17					P	37	P	17	P				
18					P	38	L(15)	18	P				
19					P	39	L(3)	19	L				
20					L	40	H	20	H				

PIN NO.	IC ZM11	IC ZM12	IC ZM13	IC ZM14	IC ZM15	IC ZM16	IC ZM17	IC ZM18	IC ZM19	IC ZM20	IC ZM21	IC ZM22
1	L	P	H	P	P	L	*	*	P	H	H	P
2	P	P	*	P	P	P	*	P	P	H	H	P
3	P	P	*	P	P	P	*	P	P	H	L	P
4	P	P	*	P	H	P	*	L	P	H	L	P
5	P	P	*	P	P	P	*	H	P	L	H	H(9)
6	P	P	*	P	P	P	*	P	P	L	L	L(8)
7	P	P	H	P	P	P	L	P	L	L	L	L
8	L	L	L	L	L	L	L	L	H	H	L	L(1)
9	P	P	H	P	P	P	P	*	*	L	L(3)	H(2)
10	P	H	H	H	P	P	P	*	P	*	H(3)	P
11	P	P	P	P	P	P	P	H	P	*	P	P
12	P	H	P	P	P	P	P	P	P	*	P	L
13	H	P	P	P	P	P	L	P	P	*	P	*
14	*	H	P	H	H	P	L	P	H	H	P	H
15	L	H	P	H	H	L	L	P			P	
16	H	H	H	H	H	H	H	H			H	



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IBM PCjr
MODEL 4860



DISK DRIVE BOARD

A Howard W. Sams GRIDTRACE™ Photo

LOGIC CHART

DISK DRIVE

PIN NO.	IC U3	IC U4	IC U5	IC U7	IC U8	IC U9	IC U10
1	P	H	*	P	H(15)	H	L
2	P	P	*	L(3)	L(15)	L(15)	P(2)
3	P	P	L	H(2)	P	H(3)	H
4	L	L	L	H(3)	P	H	P
5	P	P	P	H	P(2)	H(6)	P
6	P	H	H	L(1)(3)	P	L(7)	P
7	P	P	P	L	L	L	P
8	H	H	H	H(9)	P	P	L
9				L(8)	P	P	P(2)
10				L(7)	H	H	H
11				L(3)	L	P	H
12				H(3)	L(3)	P	P
13				H	H(3)	P	P
14				H	H	H	P
15							P
16							H

PIN NO.	IC U11	IC U12	IC U13	IC U14	IC U16	IC U17	IC U18
1	H	L	L	P	H(9)	H	L(3)
2	L(1)	*	H	P(2)	L(7)	L(3)	H
3	H(2)	*	H	P	H(2)	H(3)	H
4	H	L(3)	H(6)	H(3)	L(1)	H	H(3)
5	L(7)	H(6)	H(6)	H(3)	P	H(6)	L(3)
6	H(9)	H(6)	L(3)	L(3)	P	H(7)	H(3)
7	L	L	L	L	L	L	*(3)
8	P	*	H(3)	L(8)	H(9)	L(7)	L
9	P	*	L(7)	H(9)	*(8)	H(6)	H(3)
10	H	L	H(6)	H(9)	H(2)	H	H
11	P	L(1)(3)	H(3)	P	L(1)	H(3)	H
12	P	P	H(6)	P	P	H(3)	H(3)
13	H	P(2)	L(7)	P	P	H	L(3)
14	H	H	H	H	H	H	H(3)
15							*(3)
16							H

Logic Probe Display

L = Low

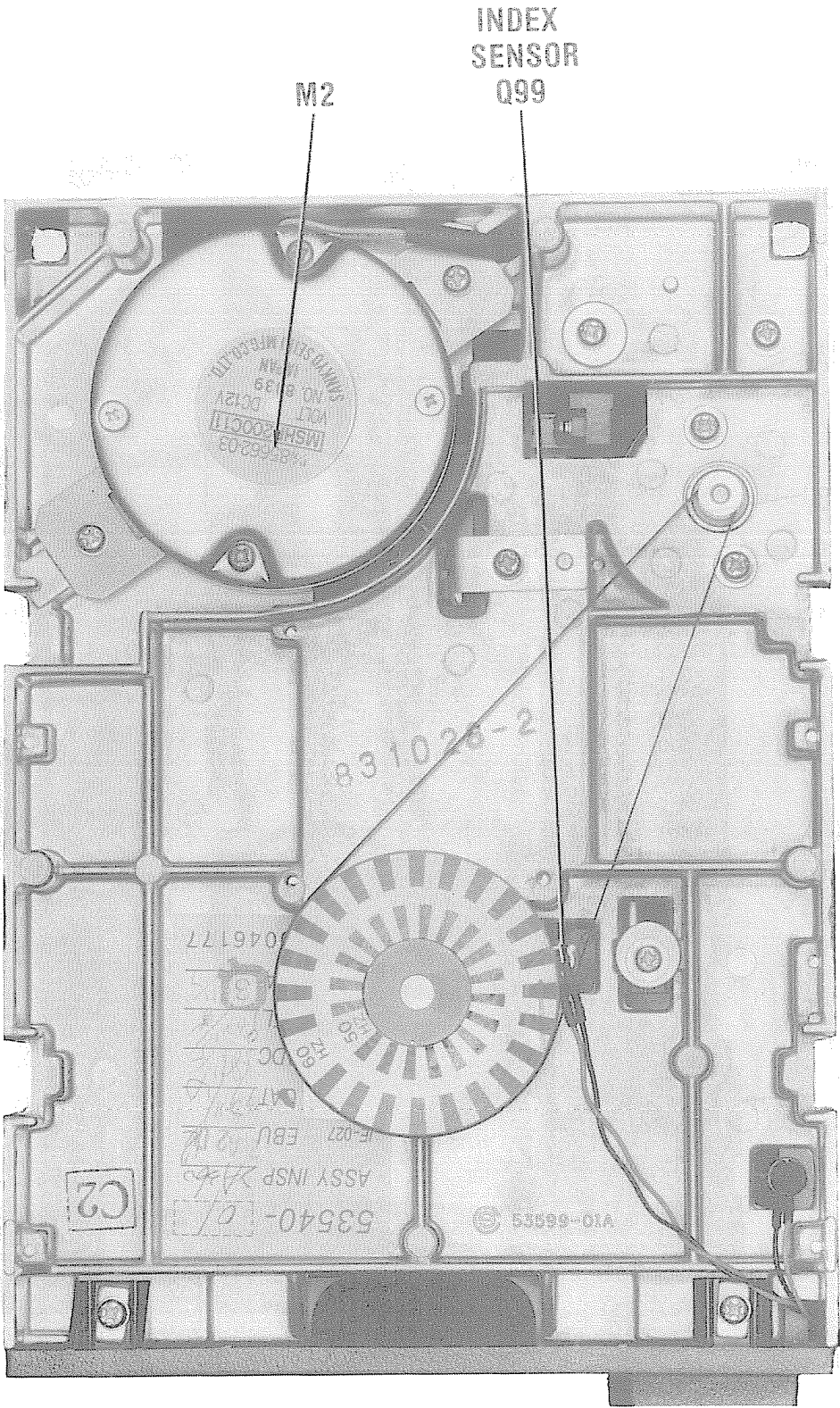
H = High

P = Pulse

* = Open (No light On)

- (1) Probe indicates H if diskette is write protected.
- (2) Probe indicates L if diskette is write protected.
- (3) Probe indicates P when Head Position motor is operating.
- (6) Probe indicates H when Head is moving in and L when Head is moving out from the center of the diskette.
- (7) Probe indicates L when Head is moving in and H when Head is moving out from the center of the diskette.

- (8) Probe indicates H when the Head is on Track 00 and L when off track 00.
- (9) Probe indicates L when the Head is on track 00 and H when off track 00.
- (10) Probe indicates P while holding SPACE bar down.
- (11) Probe indicates L while holding SPACE bar down.
- (12) Probe indicates H while holding SPACE bar down.
- (13) Use a scope with $\times 10$ probe, DC input and check for logic low while holding SPACE bar down. (A Logic Probe may cause pulses to appear).
- (14) Probe indicates a pulse when a key is first pressed and a pulse again when the key is released.
- (15) Probe indicates P when Head is moving toward the center of the diskette.



DISK DRIVE GridTrace LOCATION GUIDE

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24
K-3	J-1	J-1	J-2	J-2	J-2	I-3	I-3	I-3	I-2	I-7	C-13	C-15	C-15	C-14	J-8	J-10	K-13	J-12	H-2	H-2	F-13	F-14	E-14
C25	C26	C28	C29	C30	C31	C32	C33	C34	C35	C36	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	J1	J2	J3
H-2	H-7	D-12	H-8	H-10	K-12	K-2	K-11	H-6	B-15	B-14	K-5	J-5	J-7	K-5	J-5	J-7	F-13	F-13	F-13	F-13	I-15	F-15	D-14
J4	J5	L1	L2	L3	L4	L5	LED1	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	R1	R1	R3
R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R23	R24	R25	R26	R27	R28	R29
J-6	G-2	J-1	H-2	G-7	G-8	I-1	K-4	K-4	I-4	J-4	J-4	I-6	J-5	J-5	J-8	J-8	H-3	A-14	G-14	J-5	I-6	J-5	
R30	R31	R32	R33	R34	R35	R36	R37	R38	R39	R40	R41	R42	R43	R44	R45	R46	R47	R48	R49	R50	R51	R52	R53
I-7	I-7	I-7	I-6	I-6	I-5	I-6	I-5	I-6	J-9	I-10	H-1	H-1	G-13	I-8	I-8	I-8	K-13	J-13	I-14	H-1	G-4	B-14	
C-15	C-14	B-15	A-15	A-15	H-1	H-1	D-13	G-13	I-1	I-7	H-14	B-14	C-14	I-2	I-2	I-2	H-12	H-12	H-12	H-12	J-14	C-14	J-3
U3	U4	U5	U7	U8	U9	U10	U11	U12	U13	U14	U15A	U15B	U16	U17	U18	VR1							
H-5	H-5	H-6	H-9	I-9	J-9	J-9	H-11	I-11	J-11	K-11	E-13	D-13	H-13	J-13	K-13	I-8							

TROUBLESHOOTING DISK DRIVE ADAPTER BOARD

NOTE: The Disk Drive Adapter troubleshooting guide assumes that the Disk Drive and Disk Drive cables and connectors have been checked and are working properly.

DISK CONTROLLER CLOCK AND DIVIDERS

Verify that the 16.0MHz clock is working properly by checking for a frequency of 16.0MHz at pin 3 of IC ZM10. If the frequency is not correct or the signal is missing check Oscillator Y1, IC ZM10 and Resistor R7. Verify that the Dividers are working properly by checking the waveforms at pins 8, 11, 12 and 14 of Counter IC (ZM8) and pin 10 of Flip/Flop IC (ZM7). If the waveform is missing at pin 14 of IC ZM8, check IC ZM7. If the waveform is good at pin 14 and missing at pin 8, 11 or 12 of IC ZM8, check IC ZM8. If the waveform is good at pins 8, 11 and 12 of IC ZM8 and missing at pin 10 of IC ZM7 check IC ZM7.

WILL NOT READ

Verify that the disk controller clock and dividers are working properly see "Disk Controller Clock and Dividers". Insert a diskette containing data in the Disk Drive. Type in and run the following program to keep the Drive running and put the Disk Controller IC (ZM5) in read mode.

```
10 OUT 242,1: OUT 242,129
20 S = INP(244)
30 OUT 245,74: S = INP(244)
40 OUT 245,2: S = INP(244)
50 FOR X = 1 TO 7
60 S = INP(245): S = INP(244)
70 NEXT X
80 GOTO 10
```

While the program is running, check for pulses at pins 1, 2, 3 and 24 of the Disk Controller IC (ZM5). If pulses are missing at pin 1 of IC ZM5, check IC's ZM1 and ZM2. If pulses are missing at pins 2 or 3 of IC ZM5, check IC ZM2. If pulses are missing at pin 24 of IC ZM5, check IC ZM5. If pulses are present at pins 1, 2, 3 and 24 of IC ZM5, check for a logic Low drive enable signal at pin 3 of Driver IC (ZM21). If pin 3 of IC ZM21 is not correct, check IC ZM21. If the reading is correct at pin 3 of IC ZM21, check for index pulses at pin 17 of IC ZM5. If pulses are missing at pin 17, check IC ZM22. If pulses are present at pin 17 of IC ZM5, check for pulses at pin 2 of IC ZM22. If pulses are missing at pin 2 of IC ZM22, check IC ZM22. If pulses are present at pin 2 of IC ZM22, check for pulses at pin 9 of Tri-State Buffer (ZM11). If pulses are missing at pin 9 of IC ZM11, check IC ZM11. If pulses are present at pin 9 of IC ZM11, check the waveforms at pins 3 and 6 of Multivibrator IC (ZM20). If the waveforms are missing, check Capacitors C10, C11 and C12, Resistors R11, R14, R15 and R17 and IC's ZM19 and ZM20. If the waveforms are good at pins 3 and 6 of IC ZM20, check the waveforms at pins 3, 6 and 7 of Counter IC (ZM18). If the waveforms are missing at pin 3, 6 or 7 of IC ZM18, check IC ZM18. If the waveforms are good at pins 3, 6 and 7 of IC ZM18, check the waveforms at pins 3 and 4 of IC ZM22 (the waveform at pin 4 should look like the waveform on pin 3). If the waveform is missing at pin 3 of IC ZM22, check IC ZM10. If the waveform is good at pin 3 and missing at pin 4 of IC ZM22, check IC ZM22. If the waveforms are good at pins 3 and 4 of IC ZM22, check the waveforms at pins 7 and 9 of Multiplexer IC (ZM16). If either waveform is missing at pin 7 or 9 of IC ZM16, check IC ZM16. If the waveforms at pins 7

and 9 of IC ZM16 check good, check for pulses at pin 15 of 4 Bit Counter IC (ZM13). If pulses are missing at pin 15 of IC ZM13, check IC's ZM12 and ZM13. If pulses are present at pin 15 of IC ZM13, check for pulses at pin 11 of IC ZM9. If pulses are missing at pin 11 of IC ZM9, check IC's ZM9 and ZM15. If pulses are present at pin 11 of IC ZM9, check Disk Controller IC (ZM5).

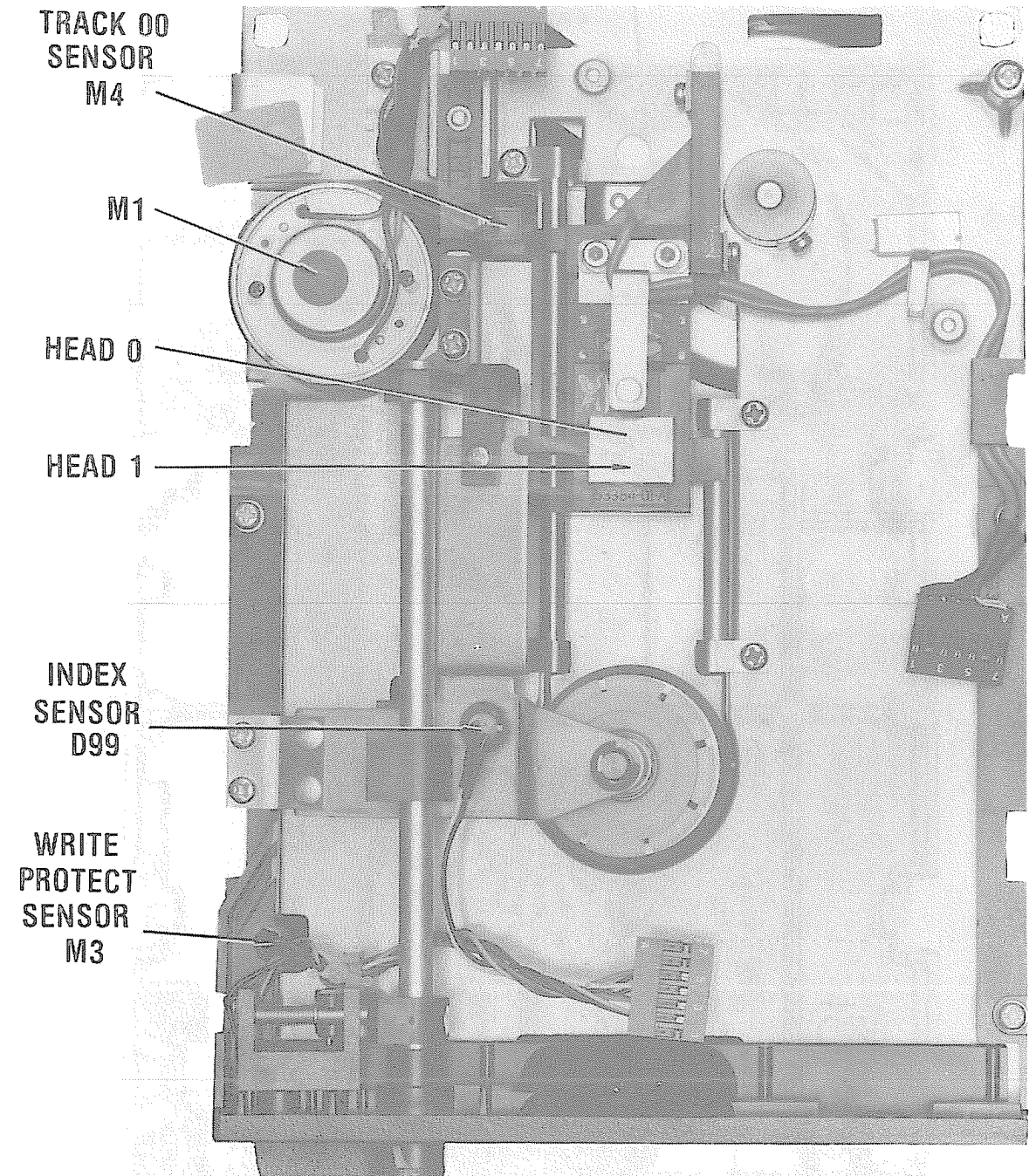
WILL NOT WRITE

Verify that the disk controller clock and dividers are working properly see "Disk Controller Clock and Dividers". Insert a BLANK Diskette that is not write protected in the Disk Drive. Type in and run the following Basic program which writes continuously to the Diskette and displays a number on the upper left corner of the Monitor screen. The number should be 0 when the Diskette is not write protected and change to 2 when a write protected Diskette is inserted into the Drive.

```
10 OUT 242,1: OUT 242,129
20 S = INP(244)
30 OUT 245,77: S = INP(244)
40 OUT 245,2: S = INP(244)
50 OUT 245,1: S = INP(244)
60 OUT 245,12: S = INP(244)
70 OUT 245,12: S = INP(244)
80 OUT 245,0: S = INP(244)
90 S = INP(245): S = INP(244)
100 PRINT INP(245) AND 2: S = INP(244)
110 FOR X = 1 TO 5
120 S = INP(245): S = INP(244)
130 NEXT X: CLS: GOTO 10
```

While the program is running, check for pulses at pins 1, 2 and 3 of the Disk Controller IC (ZM5). If pulses are missing at pin 1 of IC ZM5, check Flip/Flop IC (ZM1). If pulses are missing at pins 2 or 3 of IC ZM5 check IC ZM2. If pulses are present at pins 1, 2 and 3 of IC ZM5, check for a logic Low write protect signal at pin 34 of IC ZM5 (with a non write protected Diskette in the drive). If pin 34 of IC ZM5 does not read logic Low, check IC ZM22. If pin 34 of IC ZM5 reads logic Low, but the number on the Monitor screen is not 0, check IC ZM5. Insert a write protected Diskette in the Drive and check for a logic High at pin 34 of IC ZM5. If the logic reading is not correct at pin 34 of IC ZM5, check IC ZM22. If the logic reading is correct at pin 34 of IC ZM5 but the number on the Monitor screen does not change to 2, check IC ZM5. If the write protect circuit checks good, check for index pulses at pin 17 of IC ZM5. If pulses are missing at pin 17 of IC ZM5, check IC ZM22.

If the reading is correct at pin 17 of IC ZM5, check for pulses at pins 25, 30, 31 and 32 of IC ZM5. If pulses are missing at pin 25, 30, 31 or 32 of IC ZM5 check IC ZM5. If pulses are present at pins 25, 30, 31 and 32 of IC ZM5, check for pulses at pins 3, 5, 7 and 11 of Tri-State Buffer IC (ZM11). If pulses are missing at pins 3 or 11 of IC ZM11, check Resistor R2 and IC's ZM14 and ZM11. If pulses are missing at pin 5 or 7 of IC ZM11, check IC ZM11. If pulses are present at pins 3, 5, 7 and 11 of IC ZM11, check for pulses at pins 9 thru 12 of Multiplexer IC (ZM17). If pulses are missing at pins 10, 11 or 12 of IC ZM17, check Flip/Flop IC (ZM14). If pulses are present at pins 10, 11 and 12 of IC ZM17 and missing at pin 9 of IC ZM17, check IC ZM17. If pulses are present at pin 9 of IC ZM17, check for pulses at pin 8 of IC ZM4. If pulses are missing at pin 8 of IC ZM4, check IC's ZM4 and ZM14.



MECHANICAL TOP

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Run the program and check for the number 16 on the Monitor screen. If the number is not correct, check for a logic High at pin 1 of IC ZM9 while the program is running. If the reading is not correct at pin 1 of IC ZM9, check IC ZM22. If the reading is correct at pin 1 of IC ZM9, check for pulses at pins 2 and 3 of IC ZM9. If pulses are missing at pin 2 of IC ZM9, check the Disk Controller IC (ZM5). If pulses are present at pin 2 and missing at pin 3 of IC ZM9, check IC ZM9. If pulses are present at pins 2 and 3 of IC ZM9, check IC ZM5.

TROUBLESHOOTING (Continued)

CONTINUOUS OPERATION OF DISK DRIVE

To keep the Disk Drive running continuously in the read mode, type in and run the following Basic program:

```
10 OUT 242,1: GOTO 10
```

POWER SUPPLY

Power is supplied to the Disk Drive from the Computer power supply. Check for 12V at Pin 1 of Connector J2 and 5V at Pin 4 of Connector J2. If either voltage is missing, check the Computer power supply and the connecting cable. See POWER SUPPLY in the Troubleshooting section of the Computer folder for Computer power supply troubleshooting information. If 12V is present at Pin 1 of Connector J2 and 5V is present at Pin 4, check Choke Coils L4 and L5 on the Disk Drive PC Board.

WILL NOT READ

Insert a diskette containing data in the Disk Drive. Type in and run the program given under "Continuous Operation of Disk Drive" to make the drive run continuously in the read mode. Check for a logic High at pin 6 of IC U8 to verify that the Disk Drive is in the read mode.

NOTE: When troubleshooting the read circuit, pulses will appear at pin 10 of Read Amp IC (U2) when the Disk Drive is turned On even though data is not being read from the diskette. To determine if data pulses are present at pin 10 of IC U2, move the handle on the front of the drive unit open and then closed with a diskette containing data inserted and the drive running. Connect a scope to Test Point TP5 and observe the waveform. If the scope is synchronized to the data pulses, there will be a noticeable shift in the waveform when the handle is opened. If there is no change, data pulses are probably missing at pin 10 of IC U2.

If data pulses are present at pin 10 of IC U2, check for pulses at pin 11 of IC U11. If the data pulses are missing at pin 11 of IC U11, check for a logic High at pin 13 of IC U11. If pin 13 of IC U11 is logic High, check IC U11. If the data pulses are missing at pin 10 of IC U2, check for data pulses at pins 14 and 15 of IC U2. If data pulses are present at both pins 14 and 15 of IC U2, check IC U2 and its associated components. If the data pulses are missing at either pin 14 or pin 15 of IC U2, check for pulses at pins 1 and 2 of IC U2. If pulses are present at pins 1 and 2 of IC U2, check IC U2 and Coils L1 and L2. If the data pulses are missing at pin 1 of IC U2, check Diodes CR1, CR2, CR4 and CR5 and the resistance of the read/write heads. A problem may exist in the head switching circuit which includes Transistors Q7 and Q8. If the problem appears to be in the head switching circuit, see the "Disk Drive Will Not Switch Sides" section of this Troubleshooting guide.

WILL NOT WRITE

Verify that the write protect circuit is functioning properly, see "Write Protect Does Not Function". If the write protect circuit is working properly, insert a BLANK Diskette that is not write protected in the drive. Type in and run the following Basic program, which writes continuously to the Diskette or use a Disk Drive Tester that can write continuously to the Diskette. Note: if the following program does not work (pulses should appear at pins 22 and 24 of connector J1), check the index detector circuits, see "Index Detector".

DISK DRIVE

```
10 OUT 242,1: OUT 242,129
20 S = INP(244)
30 OUT 245,77: S = INP(244)
40 OUT 245,2: S = INP(244)
50 OUT 245,1: S = INP(244)
60 OUT 245,12: S = INP(244)
70 OUT 245,12: S = INP(244)
80 OUT 245,0: S = INP(244)
90 FOR X = 1 TO 7
100 S = INP(245): S = INP(244)
110 NEXT X
120 GOTO 10
```

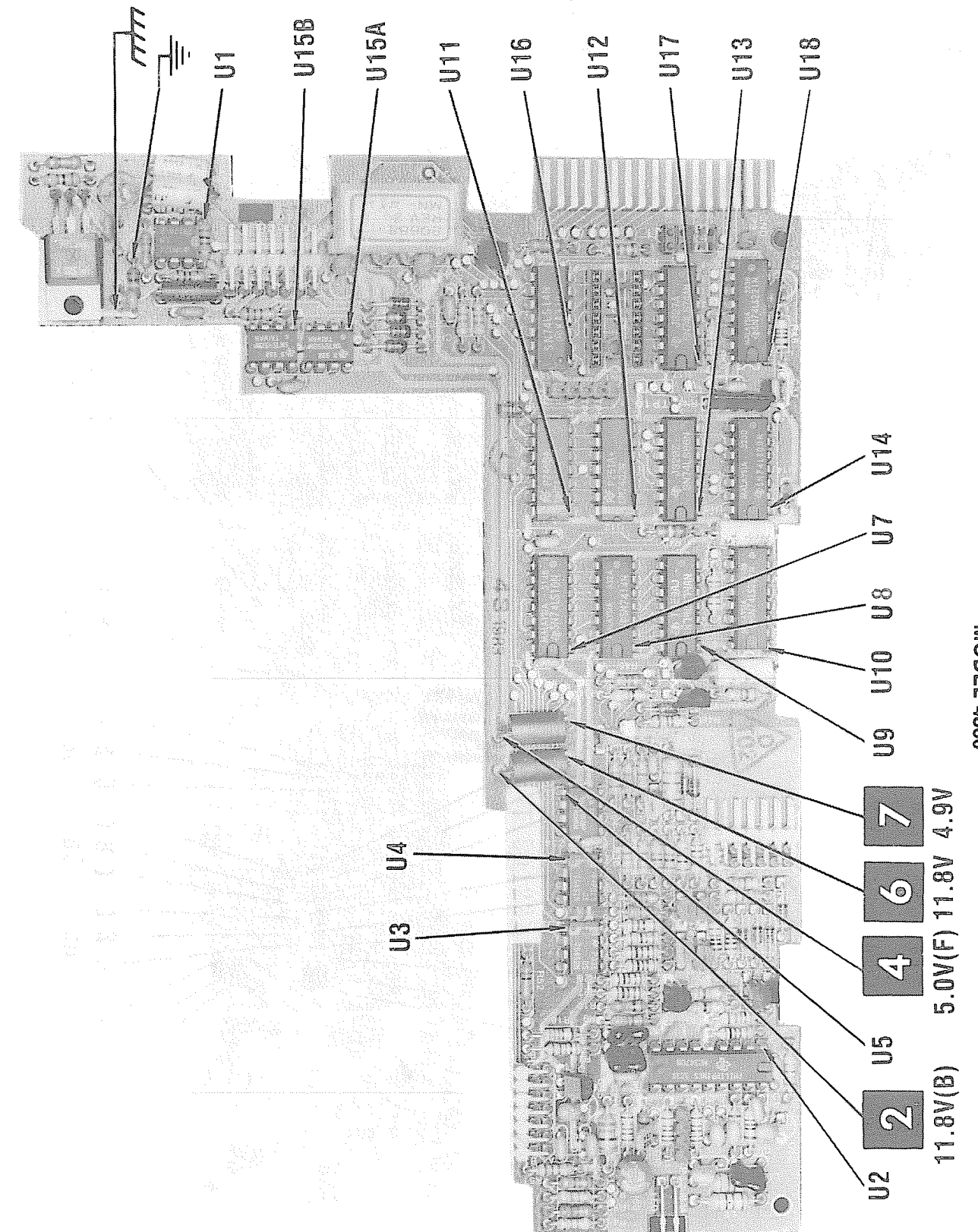
With the program running, check for pulses at pin 13 of IC U12. If the pulses are missing at pin 13 of IC U12, check for pulses at pin 12 and a logic Low at pin 11 of IC U12. If the readings are correct on pins 11 and 12 of IC U12, check IC U12. If the pulses are present at pin 13 of IC U12, check for the write data pulses at the collectors of Write Amp Transistors (Q4 and Q5). If data pulses are missing at the collectors of either transistor, check for data pulses at the base of the Transistor. If the data pulses are present at the base of the Transistor, check the Transistor. If the data pulses are missing at the base of either Transistor, check for pulses at pins 1 and 7 of Write Driver IC (U3). If data pulses are present at pins 1 and 7 of IC U3, check IC U3 and Resistors R28 and R29. If the data pulses are missing at pins 1 and 7 of IC U3, check for the write data at pin 11 of Flip/Flop IC (U9). If the write data is present at pin 11 of IC U9, check IC U9. If the write data is missing at pin 11 of IC U9, check IC U8 and check pin 22 of Connector J1 for good contact.

If the write data pulses are present at the collectors of Transistors Q4 and Q5, check Diodes CR1, CR2, CR4 and CR5 and check the resistance of the read/write heads. A problem may exist in the head switching circuit which includes Transistors Q7 and Q8. If the problem appears to be in the head switching circuit, see the "Disk Drive Will Not Switch Sides" section of this Troubleshooting guide.

WRITE PROTECT DOES NOT FUNCTION

If a write protected disk is being written on, use the following procedure to check the write protect circuit. Insert a BLANK write protected Diskette in the Disk Drive. Type in and run the program given under "Continuous Operation of Disk Drive". Check for a logic Low reading at pin 3 of IC U11. If pin 3 of IC U11 is not logic Low, check for a logic High at pin 2 of IC U11. If pin 2 of IC U11 is logic High, check IC U11. If pin 2 of IC U11 is not logic High, check for a logic High at pin 11 of IC U16. If pin 11 of IC U16 is logic High, check IC U16. If pin 11 of IC U16 is not logic High, check the write protect Phototransistor, Capacitor C21 and Resistor R42.

If the error message "the diskette is write protected" is displayed on the Monitor screen and the diskette being used is not write protected, use the following procedure to check the write protect circuit. Type in and run the program given under "Continuous Operation of Disk Drive" to keep the Disk Drive running continuously. Insert a diskette that is not write protected into the Disk Drive and close the handle. Run the program and check for a logic High at pin 3 of IC U11. If pin 3 of IC U11 is not logic High, check for a logic Low at pin 2 of U11. If pin 2 of IC U11 is logic Low, check IC U11. If pin 2 of IC U11 is not logic Low, check for a logic Low at pin 11 of IC U16. If pin 11 of IC U16 is logic Low, check IC U16. If pin 11 of IC U16 is not logic Low, check the write protect LED and Phototransistor.



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ADJUSTMENTS (Continued)

INDEX SENSOR ADJUSTMENT

The Index Sensor should be adjusted only after the Radial Head Alignment has been checked. Connect the Channel A input of a dual-trace scope to TP1A, Channel B input to TP1B, and the scope ground to TP2. Connect the scope external trigger input to TP7. Set the voltage range of both channels to 50 millivolts/division and set the sweep time to 50 μ S. Set the external trigger input to trigger on the positive edge of the index pulse. Set the scope to the add mode with Channel B inverted.

Connect the Disk Drive to the Disk Drive Tester. Apply power to the Disk Drive and insert the Alignment Diskette. Select Side 0 of the Alignment Diskette. Step the head to Track 01 and confirm that the timing between the start of the sweep and the first peak of the index burst is 400 μ S \pm 200 μ S. See Figure 1. Select Side 1 of the Alignment Diskette and check the index burst timing in the same manner.

If the index burst timing is not within tolerance, turn the Disk Drive on its side and slightly loosen the index sensor mounting screw. Move the index sensor so that the index burst occurs within tolerances. Tighten the sensor mounting screw and verify that the sensor position has not changed. When tightening the screw, do not exceed 3.5 lbs. in torque.

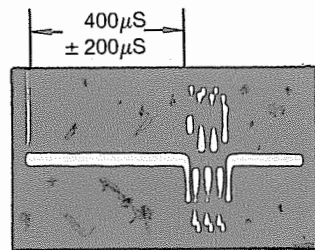


Figure 1

READ CIRCUIT ADJUSTMENT

Connect the input of a scope to TP5. Set the scope voltage to the 2 volt range, DC input, and sweep time to 1 μ S. Insert the Alignment Diskette into the Drive. Turn the Drive On and step the Head to track 00 to read the 125kHz (2F) pattern on the Alignment Diskette. If the Phase Control (R63) is out of adjustment the second pulse in the scope waveform will appear to be two pulses out of phase with each other (see Figure 10). Adjust the Phase Control (R63) until the two out of phase pulses are in phase and appear as one pulse (see Figure 11).

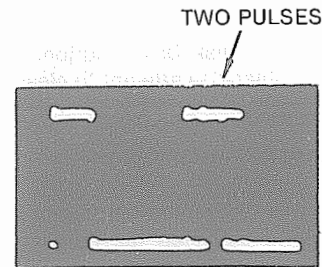


Figure 10

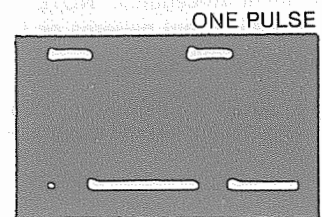


Figure 11

AZIMUTH CHECK

Connect the Channel A input of a dual-trace scope to TP1A, Channel B to TP1B, scope ground to TP2, and the external trigger input to TP7. Set the scope to the add mode with Channel B inverted, AC input, voltage range to 50 millivolts/division, sweep time to .5mS and external trigger on positive slope.

Connect the Disk Drive to the Disk Drive Tester. Apply power to the Disk Drive and install the Alignment Diskette. Select Side 0 of the Diskette. Step the head to Track 34 and compare the waveform displayed on the scope with the pattern shown in Figure 3. The amplitude of bursts 1 and 4 must be equal to or less than the amplitude of bursts 2 and 3.

No adjustment is provided for head azimuth. If the displayed waveform is out of tolerance, it may be necessary to replace the Head Carriage assembly.

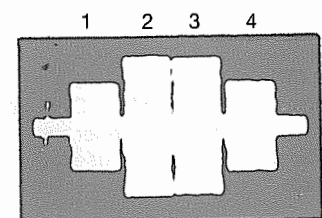


Figure 3

TROUBLESHOOTING (Continued)

DISK DRIVE

ERASE HEAD

Verify that the erase heads are not open by checking the erase head resistance at pins A3 to A4 of Plug J4 for HEAD 0 and at pins B3 to B4 of Plug J4 for HEAD 1. Type in and run the program given in the "Will Not Write" section of this Troubleshooting guide. With the program running, check for pulses at the collector of Erase Switch Transistor (Q6). If the pulses are present at the collector of Transistor Q6, check Diodes CR3 and CR6. The problem may be in the head switching circuit which includes Transistors Q7 and Q8. See the "Disk Drive Will Not Switch Sides" section of this Troubleshooting guide.

If the pulses are missing at the collector of Transistor Q6, check for pulses at the base of Q6. If pulses are present at the base of Q6, check Transistor Q6. If the pulses are missing at the base of Q6, check for pulses at pin 7 of Write Driver IC (U3). If pulses are present at pin 7 of IC U3, check IC U3. If the pulses are missing from pin 7 of IC U3, check Flip/Flop IC (U9). NOTE: If there are no pulses at pin 11 of U9, the write data will also be missing. If the pulses are missing at pin 11 of IC U9, check IC U8.

DISK DRIVE MOTOR MALFUNCTION

If the Disk Drive will not run, check for 12V at pin 1 of Connector J2 and 5V at pin 4 of J2. If either voltage is missing, check Connector J2 and the cable for good connections. Also check the power supply for proper operation. If the voltages are normal, type in and run the program given under "Continuous Operation of Disk Drive". Check for a logic Low at pin 16 of Connector J1. If pin 16 of J1 is not logic Low, check for a good connection at pin 16 of J1. Also check the drive interface cable. If pin 16 of Connector J1 is logic Low, check for approximately 9.1V at pin 5 of Frequency/Voltage Converter IC (U1). If the voltage at pin 5 of IC U1 is low, check Drive Motor Switch Transistor (Q13) for a collector to emitter short. If Transistor Q13 is good, check IC U1. If there is approximately 9.1V at pin 5 of IC U1, check Motor Output Transistor (Q12). Also check for an open Drive Motor Winding.

If the Disk Drive spindle speed is not correct, perform the "Spindle Speed Adjustment" procedure in the Adjustments section. If the spindle speed cannot be correctly adjusted, connect a scope to pin 1 of IC U1. Connect the scope ground lead to Test Point TP9 and set the scope time base to 1mS. Check for the 8V peak-to-peak tach signal at pin 1 of IC U1. If the tach signal is missing, check for an open Drive Motor tach winding. If the tach signal is present at pin 1 of IC U1, check IC U1 and its associated components.

If the Drive Motor runs continuously, check Transistor Q13 for a possible open condition. Also check Resistor R65 in the base circuit of Transistor Q13.

HEAD POSITION (STEPPER) MOTOR

If the Head Position (Stepper) Motor (M2) is not operating properly, check for continuity across each motor winding. Remove the plug from Connector J3 and measure between pins B6 and A5, pins B6 and A7, pins B6 and A6, and pins B6 and B7 of the plug. Also check Connector J3 for good connections. Use the following program which will step the head back and forth or connect the Disk Drive to a Disk Drive Tester which can step the head.

```
10 OUT 242,1: OUT 242,129
20 S = INP(244)
30 GOSUB 170
40 OUT 245,7: S = INP(244)
50 OUT 245,1: S = INP(244)
60 GOSUB 170
70 GOSUB 170
80 FOR T = 1 TO 500: NEXT T
90 TR = 15
100 OUT 242,129
110 GOSUB 170
120 OUT 245,15: S = INP(244)
130 OUT 245,1: S = INP(244)
140 OUT 245,TR: S = INP(244)
150 FOR T = 1 TO 400: NEXT T
160 GOTO 10
170 OUT 245,8: S = INP(244): S = INP(245): S = INP(244)
180 S = INP(245): S = INP(244): RETURN
```

Use a test mode that will step the head back and forth continuously and check for pulses at pins 3 and 5 of Driver ICs (U15A and U15B). If the pulses are missing at any of the driver outputs, check the inputs (pins 2 and 6) of the affected Driver IC. If the pulses are present, make sure that pins 1 and 7 of each IC are logic High. If pins 1 and 7 are logic High, check the appropriate IC. Also check Diodes CR7, CR8, CR9 and CR10. If pins 1 and 7 of IC U15A and IC U15B are not logic High, check ICs U8 and U13.

If the pulses are missing at pins 2 and 6 of both ICs U15A and U15B, check for the clock signal at pin 4 of IC U18. If the pulses are missing at pin 4 of IC U18, check for pulses at pin 1. If the pulses are present at pin 1, check IC U18. If the pulses are missing at pin 1 of IC U18, check for pulses at pins 4 and 5 of IC U14. If pulses are present at both pins 4 and 5 of IC U14, check IC U14. If the pulses are missing at pin 4 of IC U14, check ICs U7 and U8. If the pulses are missing at pin 5 of IC U14, check IC U18.

If the pulses are missing at pins 2 and 6 of IC U15A but are present at pins 2 and 6 of IC U15B, check for pulses at pin 2 of Flip/Flop IC (U17). If the pulses are present at pin 2 of IC U17, check IC U17. If the pulses are missing at pin 2 of IC U17, check for pulses at pin 5 of IC U13. If the pulses are present at pin 5 of IC U13, check IC U13.

If the pulses are missing at pins 2 and 6 of IC U15B but are present at pins 2 and 6 of IC U15A, check for pulses at pin 12 of IC U17. If the pulses are present at pin 12 of IC U17, check IC U17. If the pulses are missing at pin 12 of IC U17, check for pulses at pin 9 of IC U13. If pulses are present at pin 9 of IC U13, check IC U13. If the pulses are missing at pin 5 or pin 9 of IC U13, check IC U17. Also make sure that the clock signal is present at pin 4 of IC U18.

If the head will not move in the opposite direction after reaching one extreme of its travel, check the logic level at pin 5 of IC U9 while attempting to step the head back and forth. If the logic level at pin 5 of U9 does not change, check the logic level at pin 2 of IC U8. If the logic level at pin 2 of U8 changes while attempting to move the head back and forth, check U9. If the logic level at pin 2 of IC U8 does not change, check U8.

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TROUBLESHOOTING (Continued)

DISK DRIVE

INDEX DETECTOR

Type in and run the program given under "Continuous Operation of Disk Drive", insert a Diskette into the Drive and check for pulses at pin 8 of IC U11. If the pulses are present at pin 8 of IC U11, check pin 8 of Connector J1 for a good connection. Also check the drive interface cable. If pulses are not present at pin 8 of IC U11, check for pulses at pin 9 of IC U11. If the pulses are present at pin 9 of IC U11, check IC U11. If the pulses are missing at pin 9 of IC U11, check for pulses at pin 13 of IC U16. If pulses are present at pin 13 of IC U16, check IC U16. If there are no pulses at pin 13 of IC U16, check the index detector LED and Phototransistor. Also check pins A4, A5, B4 and B5 of Connector J5 for good connections.

DISK DRIVE WILL NOT SWITCH SIDES

Disconnect the interface cable from the Disk Drive and apply power to the drive. Check for a logic Low at the collec-

tor of Head Switching Transistor (Q7). If the collector of Transistor Q7 is not logic Low, check for a logic High at pin 5 of Driver IC (U4). If pin 5 of IC U4 is logic High, check Transistor Q7 and Resistor R35. If pin 5 of IC U4 is logic Low, check for approximately 1.6V at pin 7 of IC U4. If the reading is normal at pin 7 of IC U4, check IC U4. The collector of Head Switching Transistor (Q8) should be approximately 12V. If the collector of Q8 is low, check Transistor Q8 for a possible short.

Turn Off the Disk Drive. Connect pin 3 of IC U8 to ground. Turn the Disk Drive On again and check for a logic Low at the collector of Transistor Q8. If the collector of Transistor Q8 is not logic Low, check for a logic High at pin 3 of Driver IC (U4). If pin 3 of IC U4 is logic High, check Transistor Q8 and Resistor R37. If pin 3 of IC U4 is logic Low, check for a logic High at pin 2 of IC U4. If pin 2 of IC U4 is logic High, check IC U4. If pin 2 of IC U4 is logic Low, check IC U8. The collector of Transistor Q7 should be approximately 12V. If the collector of Q7 is low, check Transistor Q7 for a short.

SCHEMATIC NOTES

- Circuitry not used in some versions
- Circuitry used in some versions
 - See parts list
- ⊕ Ground
- ⏏ Chassis
- ▽ Common tie point

Waveforms and voltages taken from ground, unless noted otherwise.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on 0 reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7 cm. width with DC reference voltage given at the bottom line of each waveform.

Time in μ sec. per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Voltages, Logic Readings, and Waveforms were taken while running the following program and during the period when the Head is not moving unless noted.

```
10 OPEN "SAMS DAT" FOR OUTPUT AS #1
20 FOR X = 1 TO 300
30 PRINT #1, "THIS IS A TEST"
40 NEXT X
50 CLOSE #1
60 GOTO 10
```

Resistors are $\frac{1}{2}W$ or less, 5% unless noted.
Value in () used in some versions.
Measurements with switching as shown, unless noted.

Supply voltages maintained as shown at input.
Voltages measured with digital meter, no signal.
Controls adjusted for normal operation.
Terminal identification may not be found on unit.
Capacitors are 50 volts or less, 5% unless noted.
Electrolytic capacitors are 50 volts or less, 20% unless noted.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No light On)

- (1) Probe indicates H if diskette is write protected.
- (2) Probe indicates L if diskette is write protected.
- (3) Probe indicates P when Head Position motor is operating.
- (6) Probe indicates H when Head is moving in and L when Head is moving out from the center of the diskette.
- (7) Probe indicates L when Head is moving in and H when Head is moving out from the center of the diskette.
- (8) Probe indicates H when the Head is on Track 00 and L when off track 00.
- (9) Probe indicates L when the Head is on track 00 and H when off track 00.
- (10) Probe indicates P while holding SPACE bar down.
- (11) Probe indicates L while holding SPACE bar down.
- (12) Probe indicates H while holding SPACE bar down.
- (13) Use a scope with $\times 10$ probe, DC input and check for logic low while holding SPACE bar down. (A Logic Probe may cause pulses to appear).
- (14) Probe indicates a pulse when a key is first pressed and a pulse again when the key is released.
- (15) Probe indicates P when Head is moving toward the center of the diskette.

ADJUSTMENTS

HEAD CLEANING INSTRUCTIONS

The manufacturer of the Disk Drive cautions not to use cleaning diskettes or otherwise attempt to clean the Read/Write heads.

EQUIPMENT REQUIRED

A test program or a Disk Drive Tester is required which will turn On the Disk Drive and step the head to the track specified in the alignment procedures. Use a Dysan Analog Alignment Diskette 224/2A when an Alignment Diskette is specified in the alignment procedures. NOTE: This Alignment Diskette has only alignment patterns on it and does not contain any alignment programs.

The following Basic program can be used to step the Drive Head to the desired track and keep the Drive running.

```
10 CLS
20 OUT 242,1: OUT 242,129
30 S = INP(244)
40 GOSUB 190
50 OUT 245,7: S = INP(244)
60 OUT 245,1: S = INP(244)
70 GOSUB 190
80 GOSUB 190
90 INPUT "ENTER TRACK NUMBER"; TR
100 IF TR > 40 THEN 90
110 OUT 242,129
120 GOSUB 190
130 OUT 245,15: S = INP(244)
140 OUT 245,1: S = INP(244)
150 OUT 245,TR: S = INP(244)
160 FOR T = 1 TO 400: NEXT T
170 PRINT "PRESS ANY KEY TO STOP"
180 AS = INKEY$: OUT 242,129: IF AS = " " THEN 180 ELSE 90
190 OUT 245,8: S = INP(244): S = INP(245): S = INP(244)
200 S = INP(245): S = INP(244): RETURN
```

SPINDLE SPEED ADJUSTMENT

Position the Disk Drive on its side so that the strobe pattern on the flywheel is visible. Type in and run the following Basic program to keep the drive motor running:

```
10 OUT 242,1: GOTO 10
```

Adjust the Speed Control (R56) on the Disk Drive board until the 60Hz pattern appears to stand still under a 60Hz fluorescent light. If 50Hz fluorescent lighting is used, use the 50Hz pattern on the flywheel.

If a Disk Drive Tester that provides a spindle speed readout is used, adjust Speed Control R56 for a spindle speed of 300rpm \pm 5rpm.

RADIAL HEAD ALIGNMENT

Connect Channel A of a dual-trace scope to TP1A, Channel B to TP1B, and scope ground to TP2. Connect the external trigger input to TP7 (index sensor). Set the scope to add mode with Channel B inverted, AC input, voltage range to 50 millivolts/division, sweep time to 20mS, and external trigger on positive slope of the index pulse. Connect the Disk Drive to a Disk Drive Tester. Apply power to the Disk Drive, insert the Alignment Diskette. Select Side 0 and move the head

to track 16. Observe the cats-eye pattern shown in Figure 2. The amplitude of the two lobes in the cats-eye pattern must be within 70% of each other. Select Side 1 of the Alignment Diskette and repeat the above procedure, making sure that the two lobes in the pattern are within 70% of each other.

If the lobes are out of tolerance, loosen the two screws that mount the stepper motor to the drive casting. Slowly rotate the stepper motor in small increments until the amplitudes of the two lobes are within 70% of each other. Note the direction in which the motor was moved. Alternately select Sides 0 and 1 of the diskette while carefully rotating the stepper motor in small increments. Balance the left lobe of Head 0 with the right lobe of Head 1 as close as possible while remaining within the 70% alignment specification for each side. Tighten the mounting screws when the adjustment is completed.

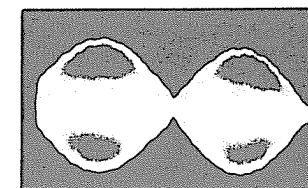


Figure 2

TRACK 00 ADJUSTMENT

Check the Radial Head Alignment before performing the Track 00 adjustment. Connect the Disk Drive to a Disk Drive Tester. Connect the positive lead of a DVM to TP8 and the negative lead to TP9 (ground). Apply power to the Disk Drive and insert the Alignment Diskette. Select Diskette Side 0. Move the head to Track 16. Next, step the head out to Track 01 in single step increments. The meter reading should be between 0.75 V and 1.25 V. Step the head back to Track 02 and note the meter reading. It should be less than 0.4 V. Step to Track 00 and note the meter reading. It should be greater than 4.0 V. Step back to Track 01 and note the meter reading. It should be between 0.75 V and 1.25 V. To adjust loosen the mounting screw of the Track 00 Sensor Assembly. Move the assembly in and out to obtain the correct voltage readings. Tighten the mounting screw. Check the alignment by stepping to Track 16, singlestepping from Track 16 to Track 01, and then stepping one track to each side of Track 01. Return to Track 01 each time and verify the proper voltage readings.

If the Track 00 position cannot be reached, the Track 00 Stopper bracket may be out of position. To adjust the Track 00 Stopper bracket, loosen its mounting screw on the underside of the drive. Step the head to Track 00 and verify its position through the correct voltage readings. Insert a .01 inch feeler gauge with a maximum width of .16 inch between the carriage and the front of the Stopper bracket. Tighten the mounting screw while gently resting the front of the bracket against the feeler gauge.

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.	ITEM No.	FUNCTION	MFGR. PART No.
L1 L2 L3	DISK DRIVE Peaking Peaking Peaking		L4 L5	Choke Choke	

CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
R56 R63	DISK DRIVE Speed Adjust Phase	100K 50K	3339P-1-104 (1)	

(1) Number on unit.

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
Head 0 Head 1 LED 1 M1 M2 M3 M4 Y1	DISK DRIVE Read/Write Head Read/Write Head Activity Indicator Drive Motor Head Position Motor Write Protect Sensor Track 00 Detector DISK DRIVE ADAPTER BOARD Crystal		Red 16MHz

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
CR1 thru CR6 CR7 thru CR10 D99(1) Q1, 2 Q3 Q4 thru Q6 Q7 thru Q11 Q12 Q13 Q99(1) U1 U2 U3 U4 U5 U7 U8 U9 U10 U11	DISK DRIVE		GE-514	NTE519	ECG519	SK3100/519	WEP925/519	103-131
			GE-504A	NTE116	ECG116	SK3311	WEP156	212-76-02
			GE-312	NTE312	ECG312	SK9157/312	WEP920/312	921-1067
			GE-312	NTE312	ECG312	SK9157/312	WEP920/312	921-1067
			GE-123AP	NTE123AP	ECG123AP	SK3854/123AP	WEP736/123A	121-Z9000A
			GE-82	NTE159	ECG159	SK3466/159	WEP62/159	121-Z9003
			GE-123AP	NTE123AP	ECG123AP	SK3854/123AP	WEP736/123A	121-Z9000A
			GE-349	NTE263	ECG263	SK3180/263	WEP736/123A	121-Z9086
			GE-123AP	NTE123AP	ECG123AP	SK3854/123AP	WEP736/123A	121-Z9000A
				NTE995	ECG995	SK9209/995		
				NTE995	ECG995	SK9209/995		
		NTE3470	ECG3470	ECG3470				
		NTE3470	ECG3470	ECG3470				
		NTE3470	ECG3470	ECG3470				
		NTE75452B	ECG75452B	ECG75452B		HE-443-74		
		NTE75451B	ECG75451B	ECG75451B		HE-443-74		
		NTE75452B	ECG75452B	ECG75452B		HE-443-74		
		NTE74LS10	ECG74LS10	ECG74LS10	SK74LS10	HE-443-797		
		NTE7414	ECG7414	ECG7414	SK7414	HE-443-858		
		NTE74LS74A	ECG74LS74A	ECG74LS74A	SK74LS74A	HE-443-730		
		NTE74LS221	ECG74LS221	ECG74LS221	SK74LS221	HE-443-730		
		NTE7438	ECG7438	ECG7438	SK7438	HE-443-77		

CSCS8-A

IBM PCjr
MODEL 4860

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					ZENITH PART No.
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	
U12 U13 U14 U15A	DM7402N SN74LS86N SN74LS00N SN75452BP		GE-7402 74LS86 74LS00	NTE7402 NTE74LS86 NTE74LS00 NTE75452B	ECG7402 ECG74LS86 ECG74LS00 ECG75452B	SK7402 SK74LS86 SK74LS00	WEP7402/7402	HE-443-46 HE-443-891 HE-443-728 HE-443-74
U15B U16 U17 U18 VR1	SN75452BP SN74LS14N SN74LS74AN SN74LS221N		74LS14 74LS74A	NTE75452B NTE74LS14 NTE74LS74A NTE74LS221	ECG75452B ECG74LS14 ECG74LS74A ECG74LS221	SK74LS14 SK74LS74A SK74LS221		HE-443-74 HE-443-872 HE-443-730
DISK DRIVE ADAPTER BOARD								
ZM1 ZM2 ZM3 ZM4 ZM5	SN74LS175N SN74LS32N NE555N DM74LS04N uPD765AC		74LS175 74LS32 6E1C-269 74LS04	NTE74LS175 NTE74LS32 NTE955M NTE74LS04	ECG74LS175 ECG74LS32 ECG955M ECG74LS04	SK74LS175 SK74LS32 SK3564/955M SK74LS04	WEP2119/955M	HE-443-752 HE-443-875 221-Z9042 HE-443-755
ZM6 ZM7 ZM8 ZM9 ZM10	SN74LS245N SN74LS109AN SN74LS93N DM74LS08N DM74LS126AN		74LS245 74LS109 74LS93 74LS08	NTE74LS245 NTE74LS109A NTE74LS93 NTE74LS08 NTE74LS126A	ECG74LS245 ECG74LS109A ECG74LS93 ECG74LS08 ECG74LS126	SK74LS245 SK74LS109 SK74LS93 SK74LS08		HE-443-885 HE-443-839 HE-443-780 HE-443-919
ZM11 ZM12 ZM13 ZM14 ZM15	DM74LS367AN SN74LS112AN DM74LS161AN SN74LS175N SN74LS112AN		74LS367A 74LS112 74LS161A 74LS175 74LS112	NTE74LS367 NTE74LS112A NTE74LS161A NTE74LS175 NTE74LS112A	ECG74LS367 ECG74LS112A ECG74LS161A ECG74LS175 ECG74LS112A	SK74LS367 SK74LS161 SK74LS175		HE-443-857 HE-443-757 HE-443-752
ZM16 ZM17 ZM18 ZM19 ZM20	DM74S153N SN74LS153N 74LS191PC MC4044P MC4024P		74LS153	NTE74S153 NTE74LS153 NTE74LS191 NTE974	ECG74S153 ECG74LS153 ECG74LS191 ECG974	SK74LS153 SK74LS191 SK3965/974		HE-443-935
ZM21 ZM22	MC3487P DM74LS14N		74LS14	NTE74LS14	ECG74LS14	SK74LS14		HE-443-872

(1) Part of Index Sensor.

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.	ITEM No.	RATING	MFGR. PART No.
C18 C23	1uF 35V 4.7uF 16V		C24 C26 C32	4.7uF 16V 4.7uF 16V 4.7uF 16V	

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
R5 R6 R11 R12 R14 R15 R16 R17 R18 R19 R20 R24 R25 R26 R27 R28 R29 R32 R39 R40 R48 R54 RN2	DISK DRIVE 10K 1% 1/4W Metal Film 10K 1% 1/4W Metal Film 3010 1% 1/4W Metal Film 3010 1% 1/4W Metal Film 422 1% 1/4W Metal Film 422 1% 1/4W Metal Film 2210 1% 1/4W Metal Film 2210 1% 1/4W Metal Film 8660 1% 1/4W Metal Film 7150 1% 1/4W Metal Film 51.1 Ohm 1% 1/4W Metal Film 1400 1% 1/4W Metal Film 1620 1% Metal Film 1400 1% 1/4W Metal Film 1620 1% Metal Film 511 1% 1/4W Metal Film 511 1% 1/4W Metal Film 511 1% 1/4W Metal Film 511 1% 1/4W Metal Film 43.2 Ohm 1% 1/2W Carbon Film 18.2K 1% 1/4W Metal Film 32.4K 1% 1/4W Carbon Film 4220 1% 1/4W Metal Film 150K 1% 1/4W Metal Film Resistor Network	92061 (1)(2)		
R11 R14 R17	DISK DRIVE ADAPTER BOARD 2000 1% 1/4W Metal Film 2150 1% 1/4W Metal Film 2000 1% 1/4W Metal Film			

- (1) Number on unit.
(2) Contains four 4700 resistors.