EMS-286
SYSTEM BOARD
MANUAL
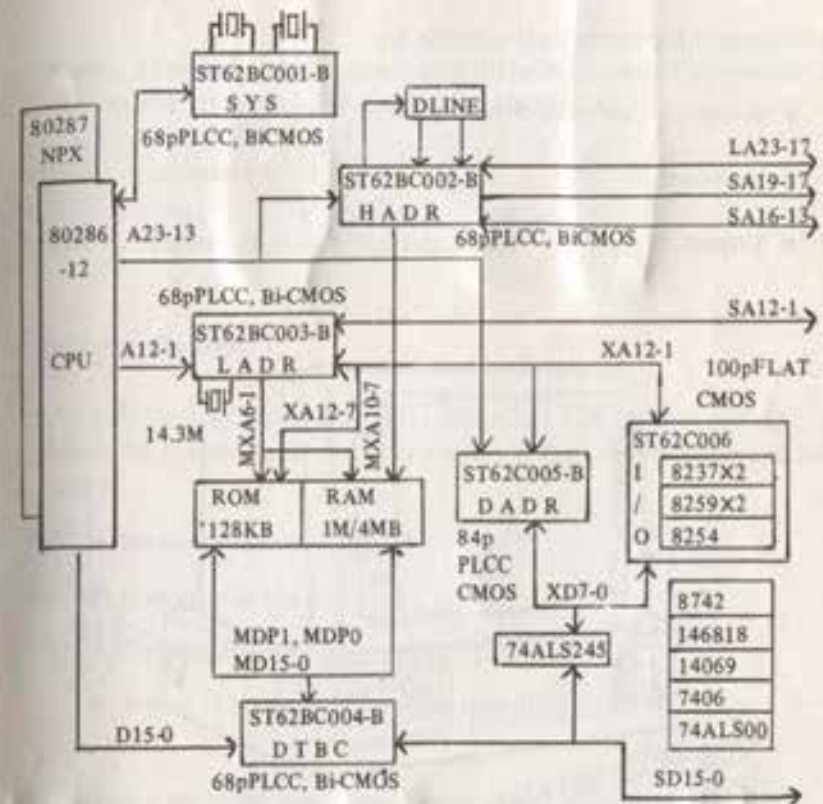
EMS-286
SYSTEM BOARD
MANUAL

CONTENTS

SYSTEM BLOCK DIAGRAM

25/20M 12M

ST62BC001-B
SYS
68pPLCC, BiCMOS

DLINE

80287
NPX

80286
-12

CPU

A23-13

ST62BC002-B
H A D R
68pPLCC, BiCMOS

LA23-17
SA19-17
SA16-13

68pPLCC, Bi-CMOS

ST62BC003-B
L A D R

A12-1

SA12-1

XA12-1

100pFLAT
CMOS

14.3M

MXA6-1

XA12-7

MXA10-7

ST62C006
I/O
8237X2
8259X2
8254

ROM
128KB

RAM
1M/4MB

ST62C005-B
D A D R
84p
PLCC
CMOS

XD7-0

8742
146818
14069
7406
74ALS00

MDP1, MDP0
MD15-0

74ALS245

D15-0

ST62BC004-B
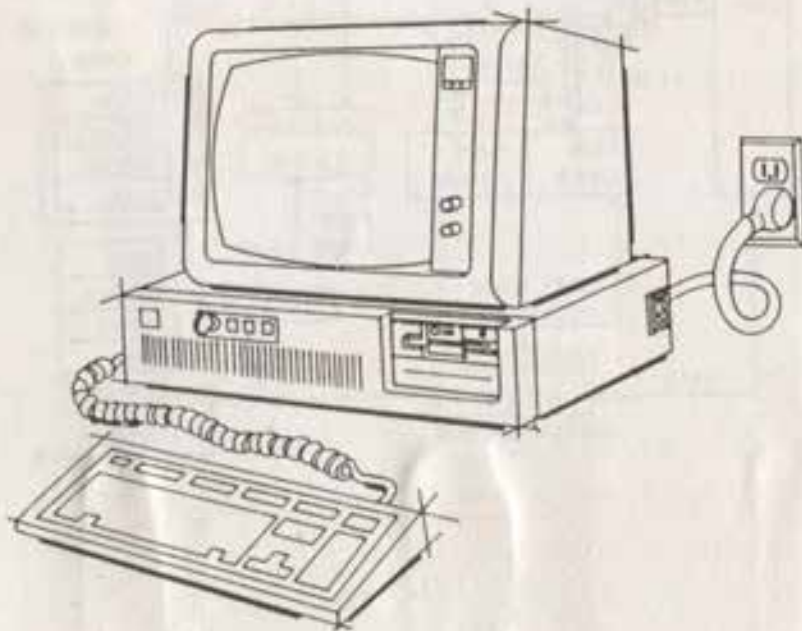D T B C
68pPLCC, Bi-CMOS

SD15-0

M-1

TCI-EMS 286 SPECIFICATION:

Hardware

Minimum hardware requirements are:

- System unit with one diskette drive

- Keyboard

- Display.

Installation

1. Have all your *internal* options been installed in your system unit?

Note: Internal options are parts installed *inside* the system unit such as the adapter your display is attached to.

YES   Continue with the next step.

NO   Reference the following steps.

Internal Options

Internal options are parts installed inside the system unit. Some of the internal options available for your system are listed below.

- Memory expansion options

- Display adapters

- Diskette drives

- Printer or communication adapters.

Some options come packaged with instructions written for you. If you are installing an option not listed in this book, use the instructions enclosed with that option. Install these options in any order that is convenient for you.

Before you begin installing any internal options, remove the cover using the procedure in this section.

Required Tools

- Medium-size, flat-blade screwdriver

- Small-size, flat-blade screwdriver.

Cover Removal

1. Turn off your system unit.

2. Turn off all external options (printer, display and others).

3. Unlock the key lock and remove the key.

Unlocked Position   Locked Position

Key Lock
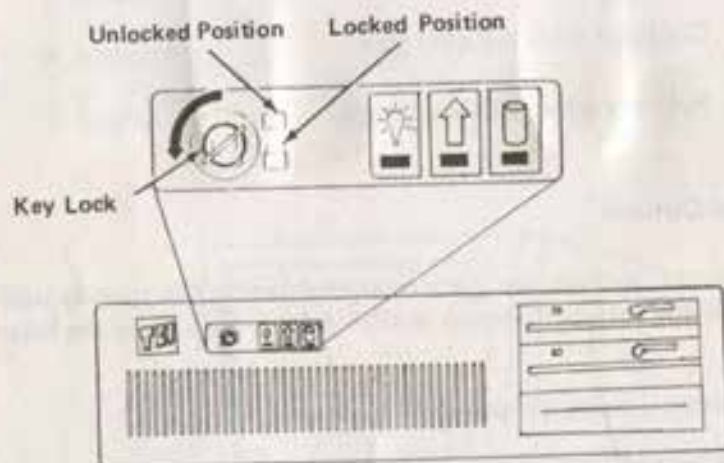
4. Remove the cover mounting screws.

Cover Mounting Screws

Monochrome
Display Power   Cover Mounting Screws
Cord   System
Power Cord   Keyboard
Cable   Other Cables
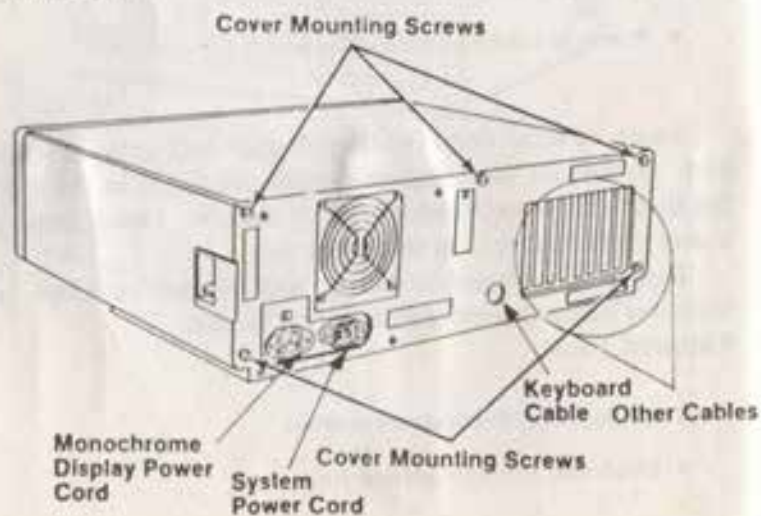
5. Remove the cover.

6. Connect the battery cable to the system board battery connector, as shown.

Rear Panel

Battery

Battery Cable
Connector   System Board
Connector
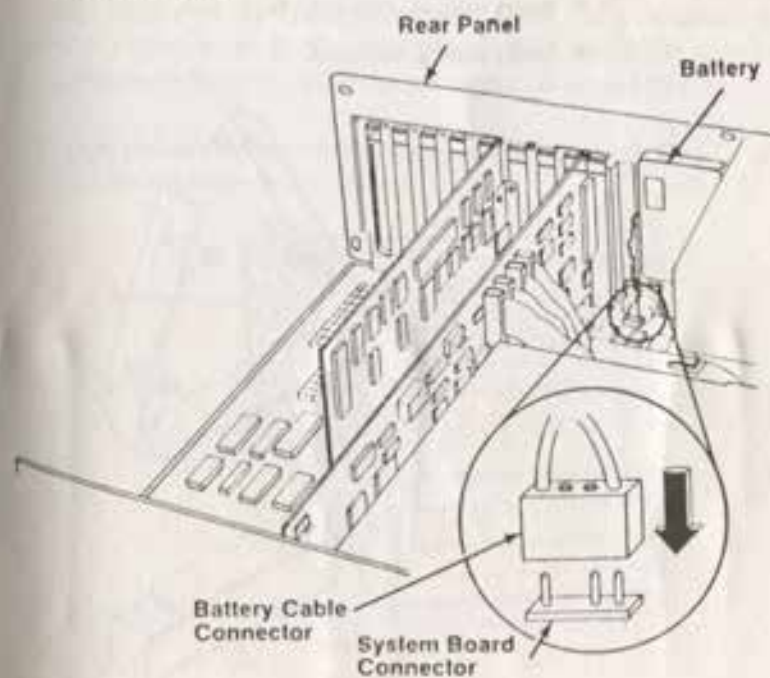
Personal Computer 80287 Math Corporcessor
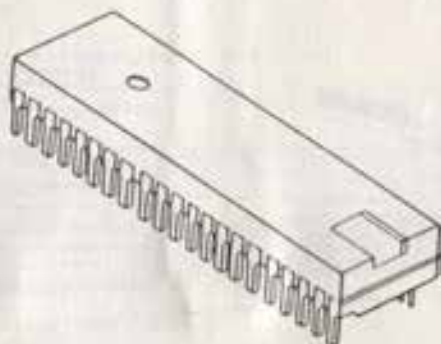
1. Assemble the safety protector as shown below.

   • Insert slot A into slot B
   • Insert slot C into slot D
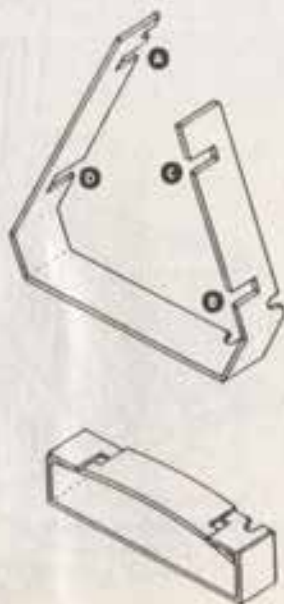
2. Insert the coprocessor into the safety protector as shown.
   Make sure that the notch in the safety protector is on the
   same end as the notch in the coprocessor. The overlapped
   portions of the safety protector should be on the top of the
   coprocessor.
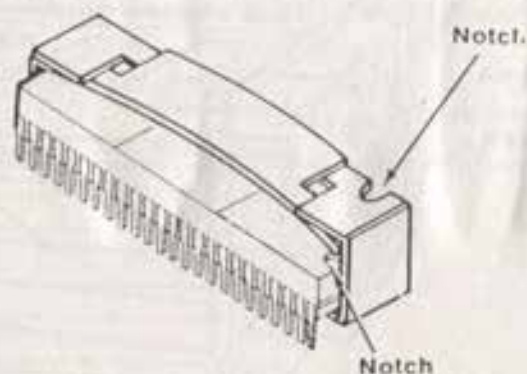
Align the pins of the coprocessor with the connector and
press the coprocessor firmly into place. Make sure the notch on
the coprocessor lines up with the notch on its connector.

3. Slide diskette drive A out approximately 50-75 mm (2-3 in.),
   but do not disconnect the cables.

50-75 mm (2-3 in.)

Side View
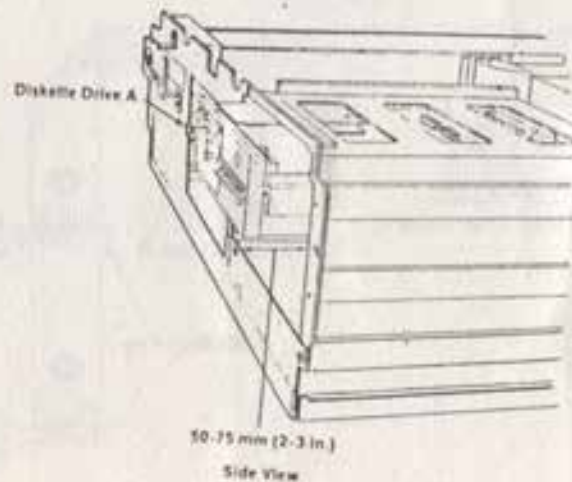
4. Slide drive B into the center slot of your system unit until it is oven with drive A.

Side View
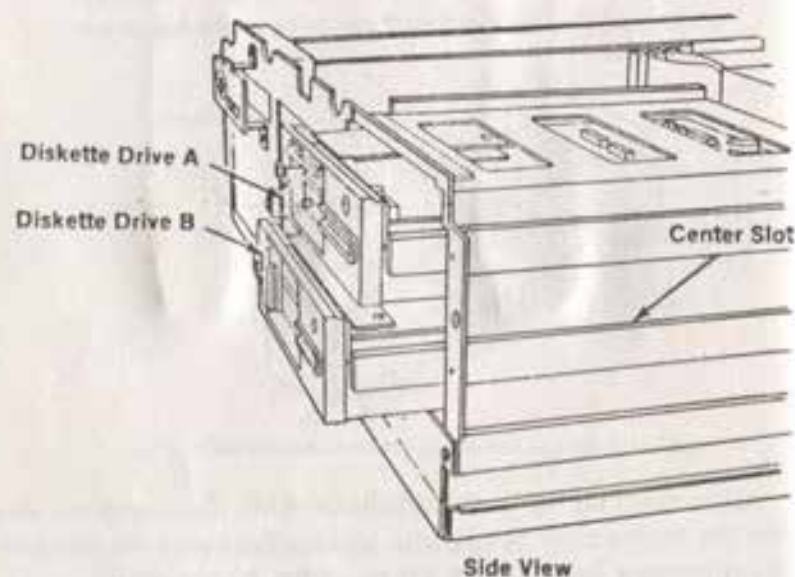
5. Find the connector labeled B, located behind the diskette drives.
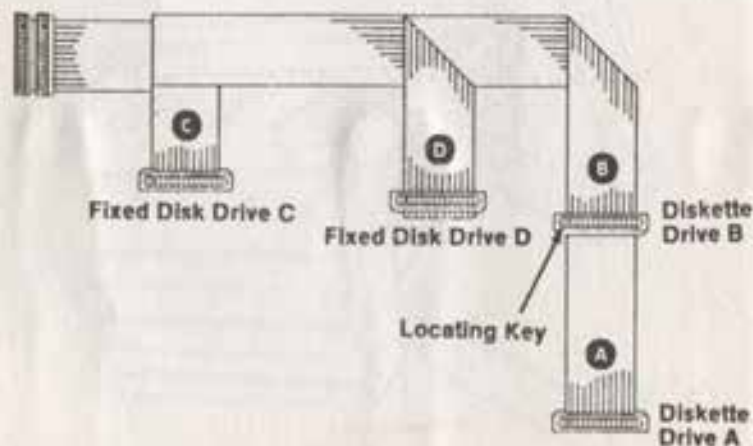
6. Align the locating key on connector B with the locating slot on diskette drive B, and press the connector firmly into place. Connector locations may vary.

Note: Depending on the number of drives you have installed in your system, you may have extra cable connectors.

Side View
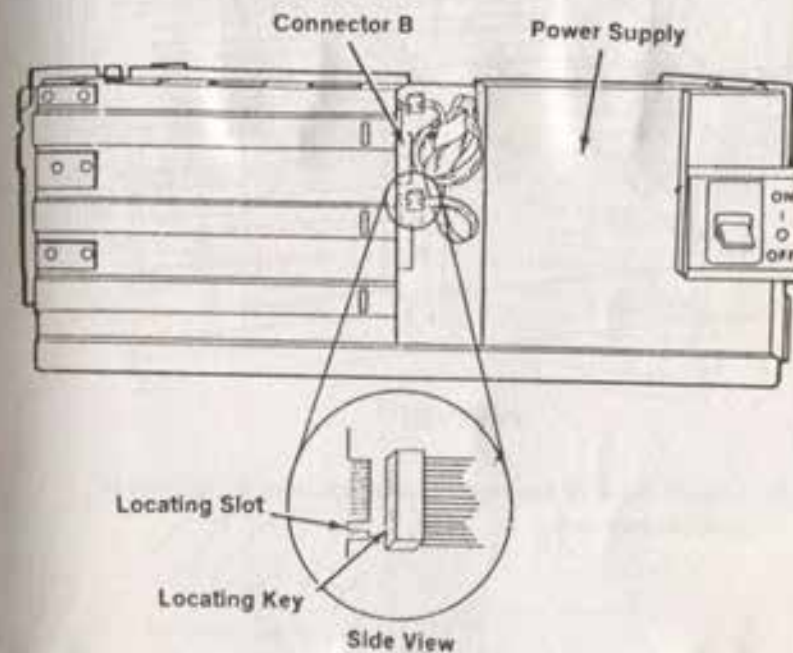
7. Find the connector labeled P12.
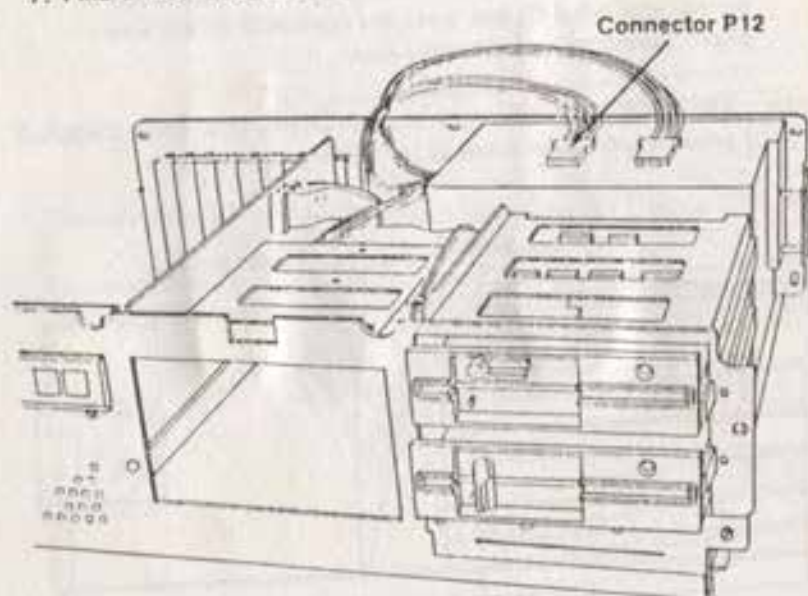
Front View

8. Connect the P12 connector to diskette drive B. Connector locations may vary.
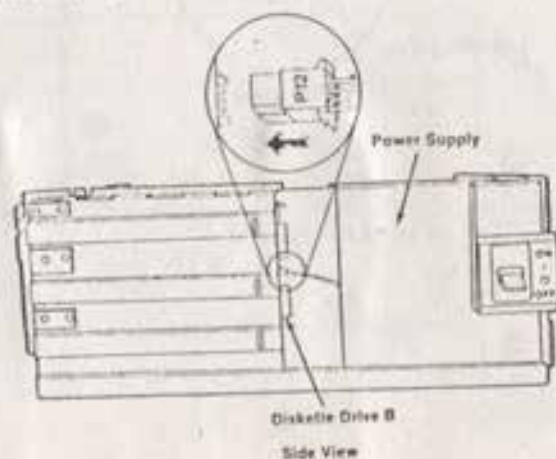
9. Connect a ground wire to diskette drive B.

Notes:

a. You may have only one unused ground wire.

b. The ground wire slips over the ground lug.
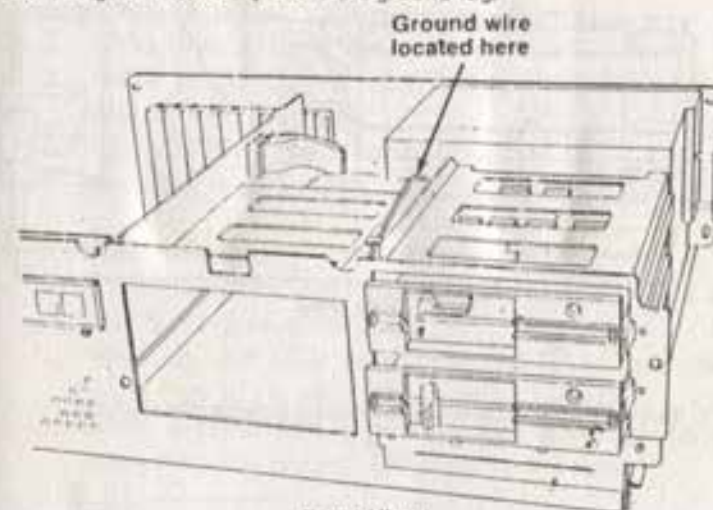
Front View
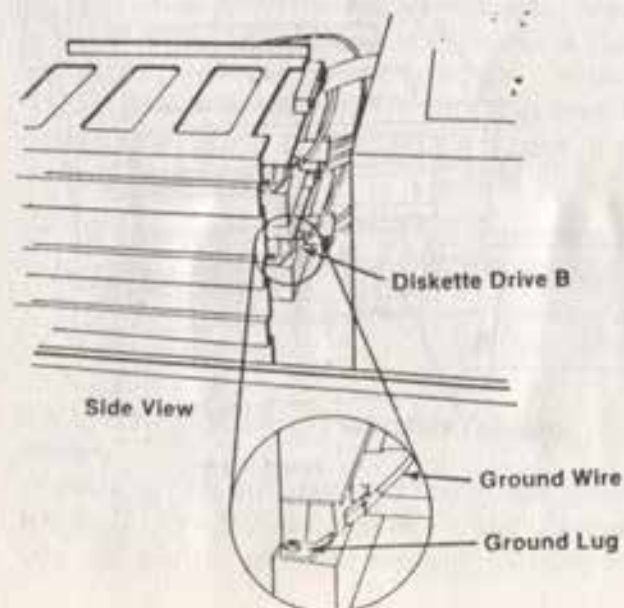
10. Push the cables down and out of the way. They should be no higher than the power supply.

Cables   Power Supply

Side View
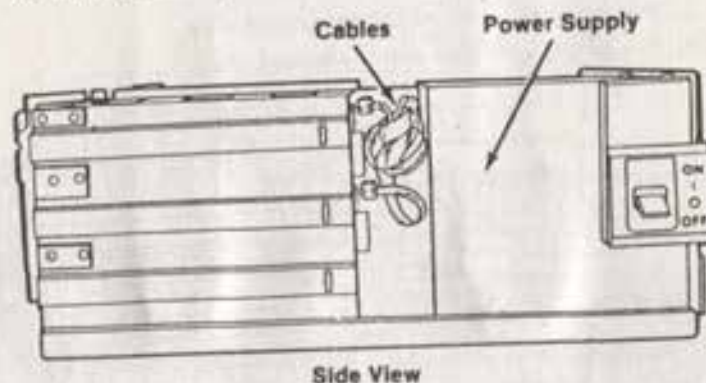
11. Rotate the diskette drive lever open (counterclockwise.).

Diskette Drive Lever

Front View

HOW TO SET UP AN EVALUATION MOTHERBOARD

A. BIOS ROM
1. BIOS ROM (Lo) is inserted into ROM1.
2. BIOS ROM (Hi) is inserted into ROM3.
3. When 27128 type is used, JP9 is set to 1-2 side, and DIP switch -5 is set to ON.
4. When 27256 type is used, JP9 is set to 2-3 side, and DIP switch -5 is set to OFF.

B. KEYBOARD BIOS
1. 8742 with keyboard BIOS programmed in it is inserted into 8742-marked location.
2. When an AWARD type keyboard BIOS (switchable by using Port 22) is used, JP7 is set to 2-3 side.
3. When a PHOENIX type keyboard BIOS (switchable by using Port 15) is used, JP7 is set to 1-2 side.

C. DRAM
1. A total of 8 (0 -7) modes are available, depending on memory sizes, for insertion of DRAMs. A figure below shows ways of the DRAM insertion. When 4164 or 41256 DRAM is used, either DRAM is inserted to the 16-pin side. When 411000 DRAM is used, it is inserted to the 18-pin side.
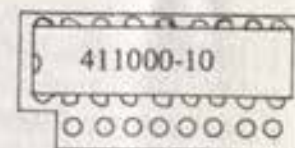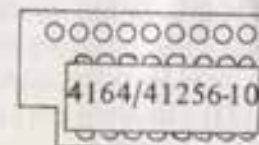
2. For base RAM setting, J18 is set to 2-3 side.
3. Mode 0
   A total of 18 DRAMs (41256-10) are inserted onto BANK 0. The DIP switches -6, -7, and -8 are each set to ON. In this instance, the memory location is 00000 –

7FFFFH and the memory size is 512KB.

4. Mode 1

A total of 18 DRAMs (41256-10) are inserted onto BANK 0, and a total of 18 DRAMs (4164-10) are inserted onto BANK 1. The DIP switches -8 -7, and -6 are set to OFF, ON, ON, respectively. In this instance, the memory location is 00000 - 9FFFFH, and the memory size is 640KB.

5. Mode 2

A total of 18 DRAMs (41256-10) are inserted onto BANK 0, and a total of 18 DRAMs (41256-10) are inserted onto BANK 1. The DIP switches -6, -7, and -8 are set to ON, OFF, ON, respectively. In this instance, the memory locations are 00000 - 9FFFFH, 100000H - 15FFFFH, and memory size is 640KB + 384KB.

6. Mode 3

A total of 18 DRAMs (41256-10) are inserted onto BANK 0, and a total of 18 DRAMs (41256-10) are inserted onto BANK 1. The DIP switches -8, -7, and -6 are set to OFF, OFF, ON, respectively. In this instance, the memory location is 00000 - 9FFFFH, and the memory size is 640KB + EMS (384KB). The EMS (384KB) memory can be used as an EXPAND memory with a capacity of 16KB x 24 pages, by using a SUNTAC EMS driver program.

7. Mode 4

A total of 18 DRAMs (411000-10) are inserted onto BANK 0. The DIP switches -8, -7, and -6 are set to ON, ON, OFF, respectively. In this instance, the memory locations are 00000 - 9FFFFH, 100000H - 25FFFFH, and the memory size is 640KB + 1,408KB.

8. Mode 5

A total of 18 DRAMs (411000-10) are inserted onto BANK 0. The DIP switches -6, -7, and -8 are set to OFF, ON, OFF, respectively. In this instance, the memory location is 00000 - 9FFFFH, and the memory size is 640KB + EMS (1,408KB). The EMS (1,408KB) memory

can be used as an EXPAND memory with a capacity of 16KB x 88 pages, by using a SUNTAC EMS driver program.

9. Mode 6

A total of 18 DRAMs (411000-10) are inserted onto BANK 0, and a total of 18 DRAMs (411000-10) are inserted onto BANK 1. The DIP switches - 8 -7, and - 6 are set to ON, OFF, OFF, respectively. In this instance, the memory locations are 00000 - 9FFFFH, 100000H - 45FFFFH and the memory size is 640KB + 3,456KB.

10. Mode 7

A total of 18 DRAMs (411000-10) are inserted onto BANK 0, and a total of 18 DRAMs (411000-10) are inserted onto BANK 1. The DIP switches -6, -7, and -8 are set to OFF, OFF, OFF, respectively. In this instance, the memory location is 00000 - 9FFFFH, and the memory size is 640KB + EMS (3,456KB). The EMS (3,456KB) memory can be used as an EXPAND memory with a capacity of 16KB x 216 pages, by using a SUNTAC EMS driver program.

D. MONITOR TYPE

1. When a color monitor is used, the SW1 is set to 2-3 side.
2. When a monochrome monitor is used, the SW1 is set to 1-2 side.

E. CLOCK SPEED SWITCHING

1. When fixing to High Speed:
   JP1 is set to 2-3 side, and DIP switch -1 is set to OFF.
2. When fixing to Low Speed:
   JP1 is set to 2-3 side, and DIP switch -1 is set to ON.
3. When switching speeds externally:
   JP1 is set to 1-2 side, and a mechanical switch is installed onto JP4. JP4 in state of OPEN provides Low Speed, and JP4 in state of CLOSE provides High Speed.
   When JP4 is OPEN, the clock speed can be switched by use of the keyboard. When using TCI BIOS, keys (Ctrl +

Alt + H) are pressed simultaneously to turn to High Speed, and keys (Ctrl + Alt + L) are pressed simultaneously turn to Low Speed.

When JP4 is OPEN and then power is turned on, it will turn to Low Speed. When JP4 is CLOSE and power is turned on, it will invalidate the keyboard operation and will turn to High Speed at all times.

F. I/O WAIT SELECTION

1. When fixing to 4 WAIT:
   JP3 is set to 2-3 side, and DIP switch -3 is set to ON.
2. When fixing to 6 WAIT:
   JP3 is set to 2-3 side, and DIP switch -3 is set to OFF.
3. When selecting WAIT in conjunction with external clock speed switching:
   JP3 is set to 1-2 side, At this point, 6 WAIT is selected when the external clock speed is switched to High Speed; 4 WAIT is selected when it is switched to Low Speed.

G. EMS PORT ADDRESS

1. When using 0E8 – 0EFH as EMS Port Address, DIP switch -4 is set to OFF. SUNTAC EMS driver program setting is used at this point.
2. When using 098 - 09FH as EMS Port Address, DIP switch -4 is set to ON. SUNTAC EMS driver program setting is used at this point.

H. EXTERNAL EMS SELECTION SWITCH

A mechanical switch is installed onto JP5. This will allow RAM size setting mode to be switched externally as follows: Mode 2 to Mode 3, Mode 4 to Mode 5, Mode 6 to Mode 7, respectively. In this instance, DIP switch -8 is set to OFF.

I. RESET SWITCH

A mechanical switch is installed onto JP6. When JP6 is OPEN, the CPU will run, and when JP6 is CLOSE, the CPU will be reset.

J. MAIN MEMORY 0 WAIT MODE

A following additional circuit needs to be installed when main memories are used at 0 WAIT mode:

1. An additional circuit to be needed for 0 WAIT when DRAM is in state of READ or WRITE:
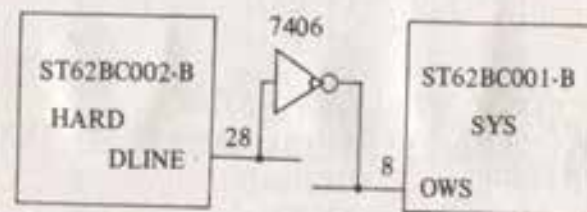
2. An additional circuit to be needed for 0 WAIT when DRAM is in state of READ:
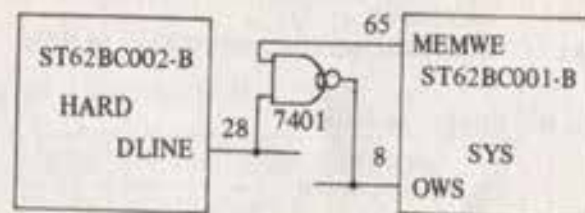
3. An additional circuit to be needed for 0 WAIT when DRAM is in state of READ or WRITE and when PROM is in state of READ:
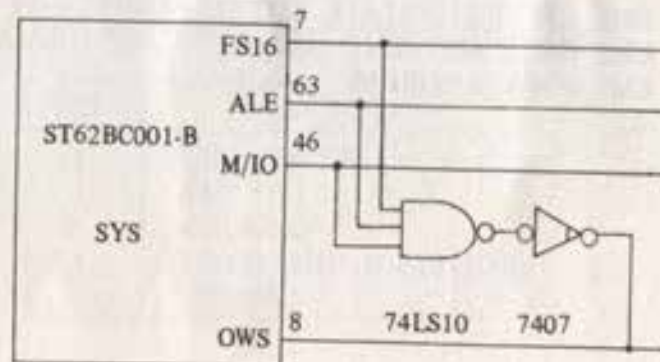
EMS DRIVER SET-UP

1. Boot PC system by using DOS and the system will prompt you with A>

2. Copy SEMS. SYS file on your DOS diskette.

3. Type:

   COPY CON CONFIG. SYS <ENTER>
   DEVICE=SEMS. SYS /M:xxx /P: xxxx /I: xxx <ENTER>
   ^Z<ENTER>

   where M:xxx : System memory size, defult is 640KB.
         P:xxxx: EMS Phygical page segment address, defult automatic.
         I:xxx : EMS Port address, defult E8H or 98H.

   The screen will display as follows:

                 1 File(s) copied

       A>

4. Reboot your system. The screen will be display as follows:

   EMS DRIVER INSTALL TOTAL PAGES : xxxx
   EMS PAGE SEGMENT : xxxxH
   EMS PORT ADDRESS : xxxxH
   A>

CONNECTOR PINOUT

1. POWER SUPPLY CONNECTOR (P8)

| PIN	DESCRIPTION
1	POWER GOOD
2	+ 5V DC
3	+12V DC
4	-12V DC
5	GROUND
6	GROUND
7	GROUND
8	GROUND
9	- 5V DC
10	+ 5V DC
11	+ 5V DC
12	+ 5V DC

2. SPEAKER CONNECTOR (J19)

PIN	DESCRIPTION
1	SPEAKER DATA OUT
2	KEY
3	GROUND
4	+ 5V DC

3. KEYBOARD SWITCH & LED CONNECTOR (J20)

PIN	DESCRIPTION
1	LED POWER
2	KEY
3	GROUND
4	KEYBOARD INHIBITOR
5	GROUND

4. KEYBOARD CONNECTOR (J22)

PIN	DESCRIPTION
1	KEYBOARD CLOCK
2	KEYBOARD DATA
3	SPARE
4	KEYBOARD GROUND
5	+ 5V DC

5. BATTERY CONNECTOR (J21)

PIN	DESCRIPTION
1	BATTERY + 6V DC
2	KEY
3	GROUND
4	GROUND

6. RESET CONNECTOR (JP6)

PIN	DESCRIPTION
1	RESET IN
2	GROUND

7. HIGH SPEED LED CONNECTOR (JP5)

PIN	DESCRIPTION
1	+ ANODE
2	– CATHODE

NOTES:
1. XTAL SET 25MHz = LED ON
2. XTAL SET 12MHz = LED OFF

TROUBLE SHOOTING AND ERROR CODE

*If any "fail code" numbers appear on your screen, the chart below shows the area of operation where the problem is occurring.

ERROR CODES

Code	Operation	Fall Code
100	System Board	101
200	Memory	201
300	Keyboard	301
400	Monochrome and printer adapter	401
500	Color/Graphic Monitor Adapter	501
600	Diskette Drive and Adapter	601
700	Math Coprocessor	701
900	Printer Adapter	901
1100	Async Communication	1101
1200	Alt Async Communication	1201
1300	Game Control	1301
1400	Matrix Printer	1401
1500	SDLC Communication	1501
1700	Fixed Disk Drive	1701
2000	BSC Adapter	2001
2100	Alt BSC Adapter	2101

* If, for example, the error code 201 appeared on the screen when the system was powered up, there would be something related to the memory wrong with the chip. Either the RAM chip is bad or the switch setting is wrong.

Code	Description
2019	8251 Data set ready stuck on.
2020	8251 Clear to send stuck on.
2021	8251 hardware reset failed.
2022	8251 software reset failed.
2023	8251 software "error reset" failed.
2024	8251 transmit ready did not come on.
2025	8251 receive ready did not come on.
2026	8251 could not force "overrun" error status.
2027	Interrupt failure-no timeer interrupt.
2028	Interrupt failure-transmit, replace card or planar.
2029	Interrupt failure-transmit, replace card.
2030	Interrupt failure-receive, replace card or planar.
2031	Interrupt failure-receive, replace card.
2033	Ring indicate stuck on.
2034	Receive clock stuck on.
2035	Transmit clock stuck on.
2036	Test indicate stuck on.

Code	Description
2037	Ring indicate stuck on.
2038	Receive clock not on.
2039	Transmit clock not on.
2040	Test indicate not on.
2041	Data set ready not on.
2042	Carrier detect not on.
2043	Clear to send not on.
2044	Data set ready stuck on.
2045	Carrier detect stuck on.
2046	Clear to send stuck on.
2047	Unexpected transmit interrupt.
2048	Unexpected receive interrupt.
2049	Transmit data did not equal receive data.
2050	8251 detected overrun error.
2051	Lost data set ready during data wrap.
22xx	Cluster adapter errors.
24xx	Enhanced graphics adapter errors.
29xx	Color matrix printer errors.
2901	
2902	
2904	
33xx	Compact printer errors.

Code	Description
4xx	Monochrome monitor errors.
401	Monochrome memory test. horizontal sync frequency test, or video test failed
408	User-indicated display attributes failure.
416	User-indicated character set failure.
424	User-indicated 80 x 25 mode failure.
432	Parallel port test failed (monochrome adapter)
5xx	Color monitor errors.
501	Color memory test failed, horizontal sync frequency test, or video test failed.
508	User-indicated display attribute failure.
516	User-indicated character set.
524	User-indicated 80 x 25 mode failure.
532	User-indicated 40 x 25 mode failure.
540	User-indicated 320 x 200 graphics mode failure.
6xx	Diskette drive errors.
601	Diskette power-on diagnostics test failed.
602	Diskette test failed; boot record is not valid.
606	Diskette verify function failed.
607	Write protected diskette.
608	Bad command diskette status returned.
610	Diskette initialization failed.
611	Timeout-diskette status returned.
612	Bad NEC-diskette status returned.
613	Bad DMA-diskette status returned.
621	Bad seek-diskette status returned.
622	Bad CRC-diskette status returned.
623	Record not found-diskette status returned.
624	Bad address mark-diskette status returned.
625	Bad NEC seek-diskette status returned.
626	Diskette data compare error.

Code	Description
7xx	8087 or 80287 math coprocessor errors.
9xx	Parallel printer adapter errors.
901	Parallel printer adapter test failed.
10xx	Reserved for parallel printer adapter.
11xx	Reserved for parallel printer adapter.
1101	Asynchronous communications adapter test failed.
12xx	Alternate asynchronous communications adapter errors.
1201	Alternate asynchronous communications adapter test failed.
13xx	Game control adapter errors.
1301	Game control adapter test failed.
1302	Joystick test failed.
14xx	Printer errors.
1401	Printer test failed.
1404	Matrix printer failed.
15xx	Synchronous data link control (SDLC) communications
1510	8255 port B failure.
1511	8255 port A failure.
1512	8255 port C failure.
1513	8253 timer 1 did not reach terminal count.
1514	8253 timer 1 stuck on.
1515	8253 timer 0 did not reach terminal count.
1516	8253 timer 0 stuck on.
1517	8253 timer 2 did not reach terminal count.
1518	8253 timer 2 stuck on.
1519	8273 port B error.
1520	8273 port A error.
1521	8273 command/read timeout.
1522	Interrupt level 4 failure.
1523	Ring Indicate stuck on.

1524 Receive clock stuck on.
1525 Transmit clock stuck on.
1526 Test indicate stuck on.
1527 Ring indicate not on.
1528 Receive clock not on.
1529 Transmit clock not on.
1530 Test Indicate not on.
1531 Data set ready not on.
1532 Carrier detect not on.
1533 Clear to send not on.
1534 Data set ready stuck on.
1536 Clear to send stuck on.
1537 Level 3 interrupt failure.
1538 Receive interrupt results error.
1539 Wrap data miscompare.
1540 DMA channel 1 error.
1541 DMA channel 1 error.
1542 Error in 8273 error checking or status reporting.
1547 Stray interrupt level 4.
1548 Stray interrupt level 3.
1549 Interrupt presentation sequence timeout.

16xx Display emulation errors (327x, 5520, 525x).

17xx Fixed disk errors.
1701 Fixed disk POST error.
1702 Fixed disk adapter error.
1703 Fixed disk drive error.
1704 Fixed disk adapter or drive error.
1780 Fixed disk 0 failure.
1781 Fixed disk 1 failure.
1782 Fixed disk controller failure.
1790 Fixed disk 0 error.
1791 Fixed disk 1 error.

18xx I/O expansion unit errors.
1801 I/O expansion unit POST error.

1810 Enable/Disable failure.
1811 Extended card wrap test failed (disabled).
1812 High order address lines failure (disabled).
1813 Wait state failure (disable).
1814 Enable/Disable could not be set on.
1815 Wait state failure (disabled).
1816 Extender card wrap test failed (enabled).
1817 High order address lines failed (enabled).
1818 Disable not functioning.
1819 Wait request switch not set correctly.
1820 Receiver card wrap test failure.
1821 Receiver high order address lines failure.

19xx 3270 PC attachment card errors.

20xx Binary synchronous communications (BSC) adapter errors.
2010 8255 port A failure.
2011 8255 port B failure.
2012 8255 port C failure.
2013 8253 timer 1 did not reach terminal count.
2014 8253 timer 1 stuck on.
2016 8253 timer 2 did not reach terminal count, or timer 2 stuck on.
2017 8251 Data set ready failed to come on.
2018 8251 Clear to send not sensed.

01xx Undetermined problem errors.

02xx Power supply errors.

1xx System board errors.
101 System board error interrupt failure.
102 System board error Timer failure.
103 System board error Timer interrupt failure.
104 System board error Protected mode failure.
105 System board error Last 8042 command not accepted.

106   System board error Converting logic test.
107   System board error Hot NMI test.
108   System board error Timer bus test.
109   Direct memory access test.
121   Unexpected hardware interrupts occurred.
131   Cassette wrap test failed.
152
161   System Options Error-(Run SETUP) (Battery failure).
162   System options not set correctly-(Run SETUP).
163   Time and date not set-(Run SETUP).
164   Memory size error-(run setup).
199   User-indicated configuration not correct.

2xx   Memory (RAM) errors.
201   Memory test failed.
202   Memory address error.
203   Memory address error.

3xx   Keyboard errors.
301   Keyboard did not respond to software reset correctly,
       or a stuck key failure was detected.
       If a stuck key was detected, the scan code for the key
       is displayed in hexadecimal.
       For example, the error code
       49 301 indicates that key
       73 the PgUp key has failed
       (49 hex = 73 decimal).
302   User-indicated error from the keyboard test or AT key
       lock is locked.
303   Keyboard or system unit error.
304   Keyboard or system unit error. CMOS does not match
       system.

THEORY/TECHNICAL REFERENCE

If the number of floppies changes, the BIOS will send a warning message to the screen and ask the user for the new configuration. The BIOS can determine if a floppy has been added or deleted, but it can not determine if a high capacity drive has been subsititued for a normal floppy or vice versa. In such a case, a separate setup program must be used.

If the number of hard disk changes, the BIOS will send a warning message to the screen and ask the user for the new configuration. The BIOS can determine if a hard disk has been added or deleted, but it can not determine if one size hard disk has been subsititued for another. In such a case, a separate setup must be used. The hard disk configuration in the CMOS RAM is only valid for an AT type hard disk adapter. If an XT hard disk adapter is used, no setup need be done. When setup is done on a hard disk, it is necessary to enter the type of hard disk.

KEYBOARD

The keyboard contains a microprocessor which is connected to the main circuit board by a 5-pin cable.

FEATURES

84 keys
8 key rollover
Serial data output
Low-profile enclosure
Position adjustable from 7 to 13
Default auto repeat at 10 characters per second
Cable: 3.6 meters, 5 wires
Power dissipation: DC 5 V at 240 MA
Connection: 5-pin DIN connector
Weight: 4.2 lbs (1.9 kgs)
Dimensions: 19.96" x 7.6" x 1.46"

THE KEYBOARD

This section, which describes the keyboard functions, is intended for the user who is not familiar with the operating characteristics of a PC.

The keyboard is divided into three sections: the typewriter key area, the function keys, and the numeric keyboard.

You can raise the angle of the keyboard by pushing in and then turning the small round lever on either side of the keyboard.

The keys repeat as long as they are held down.

THE FUNCTION KEYS

The function keys, which are located at the left of the keyboard, let you enter a command using a single key. When the system is in BASIC Mode, each key will have the following value:

F1: LIST B	F6: "LPT 1
F2: RUN −	F7: TRON−
F3: LOAD"	F8: TROFF−
F4: SAVE"	F9: KEY B
F5: CONT	F10: SCREEN 0, 0, 0

with B = to a blankspace
and − = to the return key.

If, for example, you wanted LOAD FILE 1" to appear on the screen, then you would only need to push the F3 key and type in FILE1". LOAD" FILE 1" would appear on the screen.

THE NUMERIC KEYPAD

The numeric keys are located on the right side of the key board. When used with the program editor, these keys enable you to move the cursor up, down, right and left. You can also use the NUM LOCK key to set the numeric keypad so that it works more like a calculator key pad. Pressing the NUM LOCK key shifts the numeric keypad into its own upper-shift mode,

so that you get the numbers 0 through 9 and the decimal point, as indicated on the keycaps. Pressing NUM LOCK again will return the key pad to its normal cursor control mode. Like CAPS LOCK, you can temporarily reverse NUM LOCK by pressing one of the shift Keys. The NUM LOCK's LED indicator will light up when the keyboard is in the numeric key board state.

Cursor Up
Moves the cursor one line up.

Cursor Down
Moves the cursor one line down.

Cursor Left
Moves the cursor one position left. If the cursor mover beyond the left edge of the screen, it will appear to the right side of the screen on the line below.

Cursor Right
Moves the cursor one position right. If the cursor moves beyond the right edge of the screen, it will appear on the left side of the screen, one line down (In other words, it wraps).

Home
Moves the cursor to the upper left-hand corner of the screen. When the CTRL and HOME keys are pressed simultaneously, the screen clears and the cursor is in the upper left-hand corner of the screen.

End
Moved the cursor to the end of the line. When the CTRL and END keys are pressed simultaneously, the data from the current cursor position to the end of the line erased.

PgUp

When the CTRL and PGUP keys are pressed simultaneously, the cursor will move to the top of the document.

PgDn

Moves the cursor down 25 lines. When the CTRL and PGDN keys are pressed simultaneously, all data from the cursor position to the end of the screen will be deleted.

Ins

Turns on the insert mode. The insert key toggle on and off. In the insert mode, data typed in will be inserted into the existing text. As characters are moved off the right side of the screen, they will wrap around and form a new line below.
When the insert mode is off, any characters typed in will overwrite existing test.
You can also turn off the insert mode by pressing any of the cursor movements keys or the "<−" key.

Del

Deletes the character at the current cursor position. All characters to the right of the deleted character move one position left to fill in the empty space. Once again text will wrap to the line below.

The Main Keyboard

The keyboard responds like a standard typewriter keyboard. Capital letters and special characters show above the numbers on the number keys are displayed by holding down either of the shift keys and pressing the desired key. The functions of some special keys are described below.

Caps Lock

The CAPS LOCK key is similar to the shift lock key on a typewriter. The only difference is that it generates capital letters and not the special uppershift characters on the numeric keys. The key toggle so after it is pushed you will continue to get capital letters until it is pushed, again. To get lower case letters while CAPS LOCK is on, push the shift key while pushing a selected letter. The LED indicator will light when the CAPS LOCK is on.

Alt

The ALT key enables easy entry of BASIC statement keywords. This key enables you to type an entire BASIC keyword with a single stroke.
Simultaneously hold down to Alt key and one of the alphabetic keys, (A − Z), to type a BASIC keyword. Keywords associated with each letter are summarized below, Letters not having reserved words are noted by NO WORD.

A	AUTO	M	MOTOR
B	BSAVE	N	NEXT
C	COLOR	O	OPEN
D	DELETE	P	PRINT
E	ELSE	Q	NO WORD
F	FOR	R	RUN
G	GOTO	S	SCREEN
H	HEXS	T	THEN
I	INPUT	U	USING
J	NOT WORD	V	VAL
K	KEY	W	WIDTH
L	LOCATE	X	XOR

Shift

Make capital letters and the special characters shown above the numbers by holding down either of the Shift keys and pressing any key.

Ctrl

The CTRL key is used together with a standard key to perform a special command or function. Below are examples of these functions.

Ctrl-G

Tone. When these two keys are pushed, the speaker beeps.

Ctrl-Scroll Lock

Break. This stops your program while it is running.

Ctrl-Num Lock

Pause. This temporarily stops your program, press any key to continue.

Ctrl->

Next word. This moves the cursor right to the next word on the line.

Ctrl-<-

Previous word. Moves the cursor left to the previous word on the line.

Ctrl-Home

Clear screen. This command clears the screen and moves the cursor to the upper-left corner.

Ctrol-Alt-Del

System reset. Holding both the CTROL and the ALT keys simultaneously and then pressing the DEL key reloads the system or program diskette. (An error message will appear if a data diskette is loaded).

Alt-Esc

You will hear a buzzer whenever a key is pressed. If you do not wish this buzzer to sound, press down these keys. To reactivate the buzzer, push these same two keys down again.

Tab

Moves the cursor to the next tab stop. Tabs stops are already set every eight character positions.

When the insert mode is off, pressing the TAB key moves the cursor over characters until it reaches the next tab stop. When the insert mode is on, pressing the TAB key inserts blank spaces from the current cursor position to the next tab stop.

Esc

Pressing this key deletes the line the cursor is on. Therefore the line is not passed to BASIC for processing. If it is a program line, the line is not erased from the program in memory.

Backspace

This <- key is not only a backspace, but it also erases the letters that it is passing over. All characters to the right of the deleted character will move left one position to fill the deleted space. Subsequent characters and lines within the current logical line will move up as with the Del key.

If you wish to move to the left and not erase the letters which you are passing, use the CURSOR LEFT key in the Numeric pad section of the keyboard.

Enter <-

This is the CARRIAGE RETURN or ENTER KEY'

PrtSc *

Below the SYS REQ KEY is the * key. PRTSC stands for "Print Screen". When the key board is in lowershift, pressing this key causes the asterisks to be typed. In uppershift, this key causes a copy of what is on the screen to be printed on the printer (LPT1). So, if you ever need a hard (or printed) copy of what is currently being displayed, press the PRTSC key and a shift key simultaneously.

NOTE: Characters which cannot be recognized by the printer are printed as blank spaces.

Scroll Lock

When the SCROLL LOCK and CTRL keys are pushed simultane-

ously, instruction level BASIC is interrupted and program execution returns to command level BASIC. These keys are also used to exit the AUTO line numbering mode.

Keyboard Scan Codes

Each key is assigned a unique 8-bit, make, scan code, which is sent when the key is pressed. Each key also sends a break code when the key is released.

Scan codes, which are received from the keyboard, are converted by the keyboard controller before they are put into the controller's output buffer.

POWER SUPPLY

The system's power supply is contained inside the system unit and provides power for the system board, the adapters, the diskette drives, the fixed disk drives, the keyboard, and the IBM Monochrome Display.

The system power supply is designed for IBM PC/AT compatible computer use. Total output is 200 Watts with 115/230 Vac selectable switch at the rear of the power supply box.

Input Characteristics

The power supply can operate at a frequency of either 60 +/− 3 Hz or 50 +/− 2 Hz, and it can operate at 100 Vac to 130 Vac, 5.0 A or 220/260 Vac, 2.5 A. The voltage is selected with the switch above the power-cord plug at the rear of the power supply. The following figure shows the input requirements.

AC Input Voltage: 100V to 130V/200V to 260V selectable

AC Input Frequency: 47 to 63 Hz

Input Requirements

Range	Voltage (Vac)	Current (Amperes)
115 Vac	Minimum 100	Maximum 5
	Maximum 125	
230 Vac	Minimum 200	Maximum 3.0
	Maximum 240	

Power Supply Output

NORMAL OUTPUT	OUTPUT CURRENT
+5V	22.6A
+12V	8A
−5V	0.4A
−12V	0.6A

Output Characteristics

The power supply provides +5, −5, +12, and −12 Vdc. The following figure shows the load current and regulation tolerance for the voltages.

Note: The power supply also supplies either 115 Vac or 230 Vac for the IBM Monochrome Display.

DC LOAD Requirements

Output	Load	Tolerance	Ripple
+5V	20A	+−2%	50MV
+12V	7.3A	+−5%	100MV
−5V	0.3A	+−10%	100MV
−12V	0.3A	+−10%	100MV

Output Protection

If any output becomes overloaded, the power supply will switch off within 20 milliseconds. An overcurrent condition will not damage the power supply.

Dummy load

If no fixed disk drive is connected to the power supply, a dummy load must be connected to P10. The dummy load is a 5 ohm, 50 watt resistor.

Output Voltage Sequences

Under normal conditions, the output voltage levels track within 300 milliseconds of each other when power is applied to, or removed from the power supply, provided at least minimum loading is present.

No-Load Operation

No damage or hazardous conditions occur when primary power is applied with no load on any output level. In such cases, the power supply may switch off, and a power-on cycle will be required. The power supply requires a minimum load for proper operation.

Power-Good Signal

The power supply provides a "power-good" signal to indicate proper operation of the power supply.

When the supply is switched to OFF for a minimum of 1 second and them switches to ON, the "power-good" signal is generated, assuming that there are no problems. This signal is a logical AND of the dc output-voltage sense signal and the ac input-voltage sense signal.

The power-good signal is also a TTL-compatible high level for normal operations, or a low level for fault conditions. The AC fail signal causes power-good to go to a low level at least 1 millisecond before any output voltage falls below the regulation limit. The operating point used as a reference for measuring the 1 millisecond is normal operation at minimum line voltage

and maximum load.

The DC output-voltage sense signal holds the power-good signal at a low level when power is switched on until all output voltages have reached their minimum sense levels. The power good signal has a turn-around delay of at least 100 milliseconds but not longer than 500 milliseconds. The following figure shows the minimum sense levels for the output voltages.

Level (Vdc)	Minimum (Vdc)
+5	+4.5
−5	−3.75
+12	+10.8
−12	−10.4

Fan-Out

Fan-out is the number of inputs that one output can drive. The power-good signal can drive six standard TTL loads.

Connectors

The following figure shows the pin assignments for the power-supply output connectors.

Load Point	Voltage (Vdc)	Max. Current (A)
PS8–1	Power Good	See note
PS8–2	+5	3.8
PS8–3	+12	0.7
PS8–4	−12	0.3
PS8–5	Ground	0.0
PS8–6	Ground	0.0
PS9–1	Ground	0.0
PS9–2	Ground	0.0
PS9–3	−5	0.3
PS9–4	+5	3.8
PS9–5	+5	3.8
PS9–6	+5	3.8

P10−1	+12	2.8
P10−2	Ground	0.0
P10−3	Ground	0.0
P10−4	+5	1.8
P11−1	+12	2.8
P11−2	Ground	0.0
P11−3	Ground	0.0
P11−4	+5	1.8
P12−1	+12	1.0
P12−2	Ground	0.0
P12−3	Ground	0.0
P12−4	+5	0.6

THE HARD DISK CONTROLLER AND DISKETTE DRIVE

(A) HARD DISK CONTROLLER CARD DISCRIPTION

The hard disk controller card is designed to interface with two 5.25-inch (or 3.25-inch) Winchester hard disk drives. The Winchester hard disk drive signals are based on the interface compatible with the "Seagate Technology ST 506" and "ST 412". The drives need not be of the same capacity or configuration. All necessary receivers and drivers are included on the board to allow direct connection to the drive(s).

FEATURES OF THE HARD DISK CONTROLLER

PC/AT compatible hard disk controller
Controls up to two hard disk drives
Hardware design allows two Western Digital hard disk controllers in one system.
8-bit HI-directional bus HOST interface
16-bit high-speed PIO data transfers
32-bit ECC for hard disk error detection and correction

Multiple sector read/write commands (may cross head and cylinder boundaries)
Implied and buffered seek commands
Programmable format and error recovery algorithms
Read/write diagnostic and verify commands

INTERFACE CONNECTORS

The HDD/FDD controller has five interface connectors:

P1 62-pin card edge connector
    Component side: Pins A1 through A31
    Conductor side: Pins B1 through B31

P2 36-pin card edge connector
    Component side: Pins C1 through C18
    Conductor side: Pins D1 through D18

J1 control cable connector

J2 drive 0 data cable connector

J3 drive 1 data cable connector

(B) THE HIGH CAPACITY DISKETTE DRIVE

The 1.2MB high-capacity diskette drive is capable of reading and writing on diskettes in either the 160/180 KB, 320/360 KB, or 1.2 MB mode. The information writen on the diskettes, however, can only be read by a high capacity diskette drive.
NOTE: There are some diskettes which are designed specifically to be used in the 1.2 MB drive. These diskettes can not be used in a 160/180 KB or 320/360 KB drives as these drives are too slow.

Because of the way some diskettes have been copy protected, the high capacity diskette drive may not be able to read them. This may occur if the copy protection is based on one

of the following:

Rotation Speed: Copy protection using the time between two events on a diskette. Will not work on the high capacity diskette drive.

Access Speed: Diskette BIOS must set the track access time for the different types of media used on the 1800-AT PLUS.

Diskette Change Signal: Copy protection may not be able to reset this signal.

MOVING SYSTEM

Before you move your system, do the following four things: prepare the floppy disk drive, "park" the hard disk drive, turn OFF the system's power, remove all cables from the kit.

Whenever you need to move your system or hard disk, you should always lock the read/write head of your drive to the shipping zone area of the disk. This will protect the head an place it in a location where there is no data.

To prepare the floppy disk drive:

1. Remove the floppy diskette from the drive(s).
2. Insert the shipping cardboard which came with the unit originally (To protect the inside of the drive).
3. Close the floppy drive door. (To anchor the moving parts of the drive).

To prepare the hard disk drive, you will need to run a head positioning program. This program will secure the moving parts in the hard disk drive. Follow the instructions in the manual which accompanied your hard disk drive.

Once your drives are secured, you should turn OFF the system's power and remove all cables from the back of the unit.

1. Insert the AT-TURBO 286 Utility Diskette into the floppy drive.
2. Type: SHIPDISK <return>
3. The program will ask you for a drive number (1-8). Enter 1 if you only have one hard disk. If you have two hard disks,

Device Names

Device Name	Interpretation
CON:	This device name references keyboard input and screen output. To end CON: as an input device, press F6 followed by Enter. This sends the EOF (end-of-file) code.
AUX: or COMI:	These device names reference the first communications adapter port.
LPTI: or PRN:	These device names reference the line printer's usage as an output device.
NUL:	This device name is a dummy argument. It references a device name that does not exist. NUL: is generally used for testing purposes or in situations where a command requires a filename, but the programmer does not wish to create a file.

Dec	Hex	Character	Dec	Hes	Character
000	00H	NUL	030	1EH	RS
001	01H	SOH	031	1FH	US
002	02H	STX	032	20H	SPACE
003	03H	ETX	033	21H	!
004	04H	EOT	034	22H	"
005	05H	ENQ	035	23H	#
006	06H	ACK	036	24H	$
007	07H	BEL	037	25H	%
008	08H	BS	038	26H	&
009	09H	HT	039	27H	'
010	0AH	LF	040	28H	(
011	0BH	VT	041	29H	)
012	0CH	FF	042	2AH	*
013	0DH	CR	043	2BH	+
014	0EH	SO	044	2CH	,
015	0FH	SI	045	2DH	-
016	10H	DLE	046	2EH	.
017	11H	DC1	047	2FH	/
018	12H	DC2	048	30H	0
019	13H	DC3	049	31H	1
020	14H	DC4	050	32H	2
021	15H	NAK	051	33H	3
022	16H	SYN	052	34H	4
023	17H	ETB	053	35H	5
024	18H	CAN	054	36H	6
025	19H	EM	055	37H	7
026	1AH	SUB	056	38H	8
027	1BH	ESC	057	39H	9
028	1CH	FS	058	3AH	:
029	1DH	GS			

Dec	Hex	Character	Dec	Hex	Character
059	3BH	;	094	5EH	^
060	3CH	<	095	5FH	_
061	3DH	=	096	60H	`
062	3EH	>	097	61H	a
063	3FH	?	098	62H	b
064	40H	@	099	63H	c
065	41H	A	100	64H	d
066	42H	B	101	65H	e
067	43H	C	102	66H	f
068	44H	D	103	67H	g
069	45H	E	104	68H	h
070	46H	F	105	69H	i
071	47H	G	106	6AH	j
072	48H	H	107	6BH	k
073	49H	I	108	6CH	l
074	4AH	J	109	6DH	m
075	4BH	K	110	6EH	n
076	4CH	L	111	6FH	o
077	4DH	M	112	70H	p
078	4EH	N	113	71H	q
079	4FH	O	114	72H	r
080	50H	P	115	73H	s
081	51H	Q	116	74H	t
082	52H	R	117	75H	u
083	53H	S	118	76H	v
084	54H	T	119	77H	w
085	55H	U	120	78H	x
086	56H	V	121	79H	y
087	57H	W	122	7AH	z
088	58H	X	123	7BH	{
089	59H	Y	124	7CH	|
090	5AH	Z	125	7DH	}
091	5BH	[	126	7EH	~
092	5CH	\	127	7FH	DEL
093	5DH	]			

WARRANTY

The TCI-EMS 286 is warranted by the dealer. The warranty period begins on the date of purchase from the manufacturer and extends.

The terms of the warranty are as follows:

If the product is defective in material or workmanship, the Buyer shall have the right to return the product within ( ) days, or within ( ) days if the product was shipped overseas.

If the equipment fails during the warranty period. The Buyer must first notify the place of purchase and request return authorization. The defective product should then be returned in the original packaging with a failure report and purchase receipt attached, and with any freight charges prepaid. It will either be repaired or replaced at no charge.

If, however, the product is not returned in the original packing, any damage from shippment will void the warranty.

The Warranty shall not apply to defects which result from:

1. Unauthorized modification or service.
2. Shipping damage.
3. Buyer supplied interfacing.
4. Operation outside the range of environmental, physical or electrical specification for the product.
5. Damage by accident or misuse.
6. Seals which show evidence of tampering.

SW1 : MONITOR TYPE

MONO
COLOR
3 □ 1
3 □ 1

J18 : RAMSIZE

256KB
512KB
3 □ 1
3 □ 1

JP7 : KEY BOARD BIOS

PHOENIX
AWARD
3 □ 1
3 □ 1

J21 : EXTERNAL BATTERY

1- +5V
2- .
3- GND
4- GND

JP10 : WAIT STATE

0 WAIT
1 WAIT

JP5: HIGH SPEED LED
1- ANODE
2- CATHODE

JP4: EXT. HIGH SPEED SWITCH
2 □ 1 OPEN - LOW SPEED
2 □ 1 CLOSE- HIGH SPEED

BIOS ROM-HI
ROM3

BIOS ROM-LO
ROM1

J20 :KEY LOCK
& LED CONNECTOR

1- LED POWER
2- .
3- GND
4- KB LOCK
5- GND

BANK0
0~3: 41256-10 × 18
4~7: 411000-10 × 18

BANK1
1 : 4164-10 × 18
3 : 41256-10 × 18
7 : 411000-10 × 18

B+384KB
B+EMS(384KB)
B+1,408KB
B+EMS(1,408KB)
B+3456KB
B+EMS(3456KB)
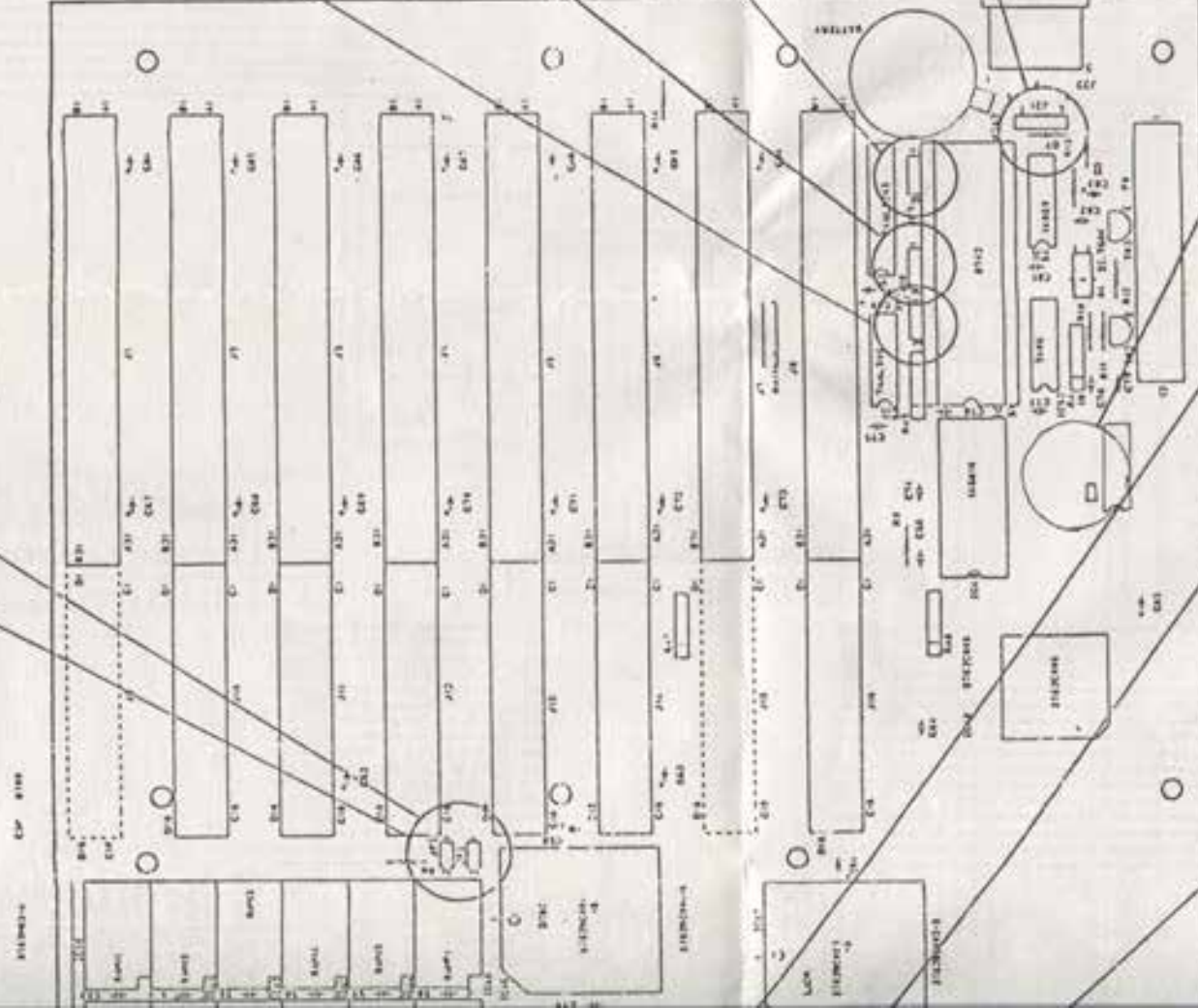
JP9 : PROM TYPE
27128-15
27256-15
NOTE: AT THE SAME TIME ADJUST DSP1 #5

I/O WAIT CNTR.
CNTL. BY KEYBOARD
CLOCK SPEED CNTR.
CNTL. BY KEYBOARD
CNTL. BY DIPSWITCH

8 : EXT. EMS SWITCH
1 OPEN- EXTEND MODE
1 CLOSE-EXPAND MODE (EMS)

J19 : SPEAKER CONNECTOR
1-SPEAKER
2-
3- GND
4- +5V

JP6 : RESET SWITCH
1 OPEN-RUN
1 CLOSE-RESET CPU

DSP1 : #1~#5

	ON	OFF
#1 :CLOCK SPEED	LOW	HIGH
#2 :TEST	NOMAL	-
#3 :I/O WAIT	4WAIT	6WAIT
#4 :EMSPORT ADDRESS	0E8H	098H
#5 :PROM TYPE	27128	27256

NOTE: #1, #3 ARE ENABLE WHEN JP1(2-3),JP3(2-3) ARE CLOSED.

DSP1 : #6~8 : RAM SIZE

#8	#7	#6	MODE	SIZE
ON	ON	ON	0	512KB
OFF	ON	ON	1	640KB
ON	OFF	ON	2	640KB+384KB
OFF	OFF	ON	3	640KB+EMS(384KB)
ON	ON	OFF	4	640KB+1,408KB
OFF	ON	OFF	5	640KB+EMS(1,408KB)
ON	OFF	OFF	6	640KB+3,456KB
OFF	OFF	OFF	7	640KB+EMS(3,456KB)

D-RAM BANK0
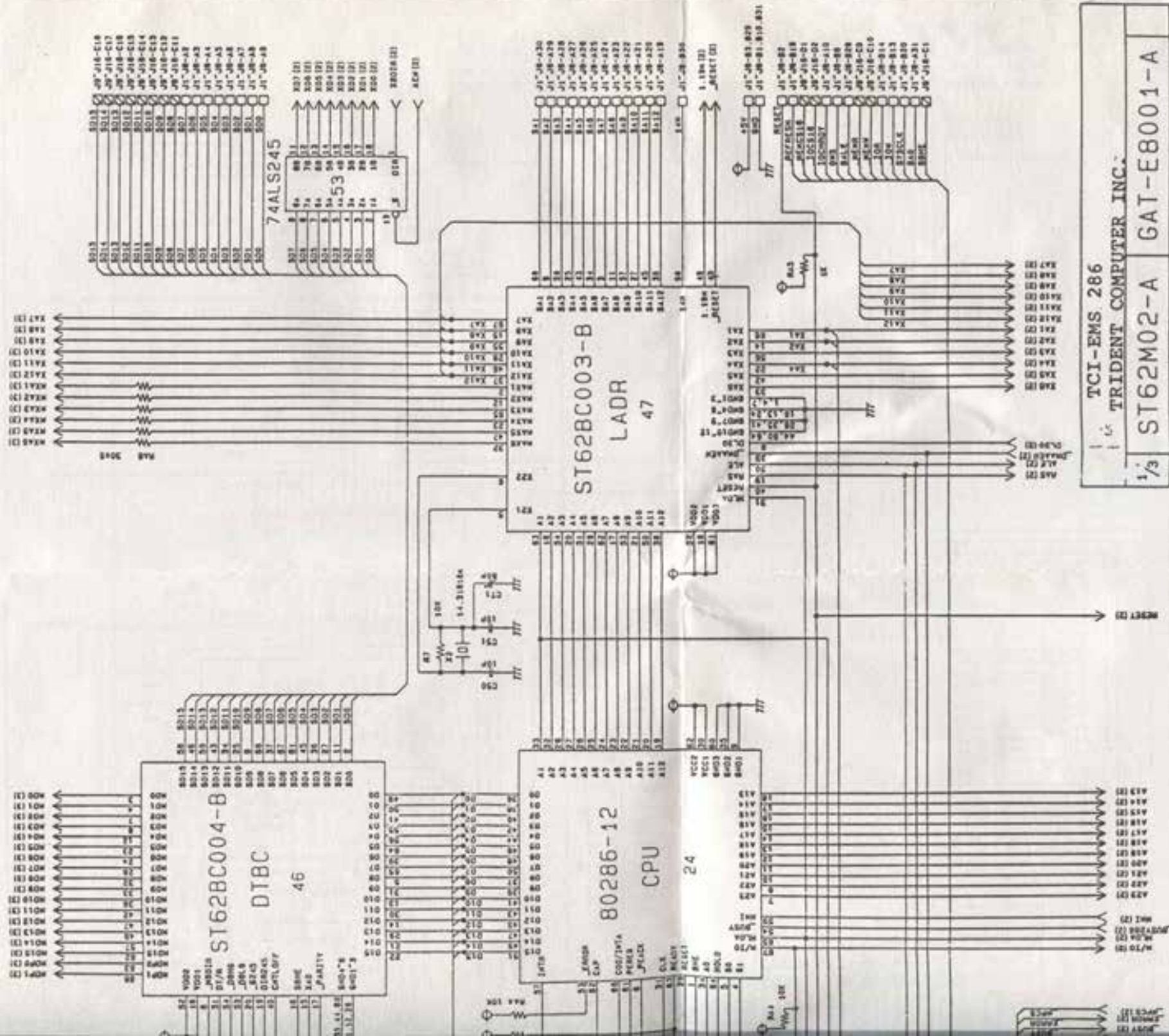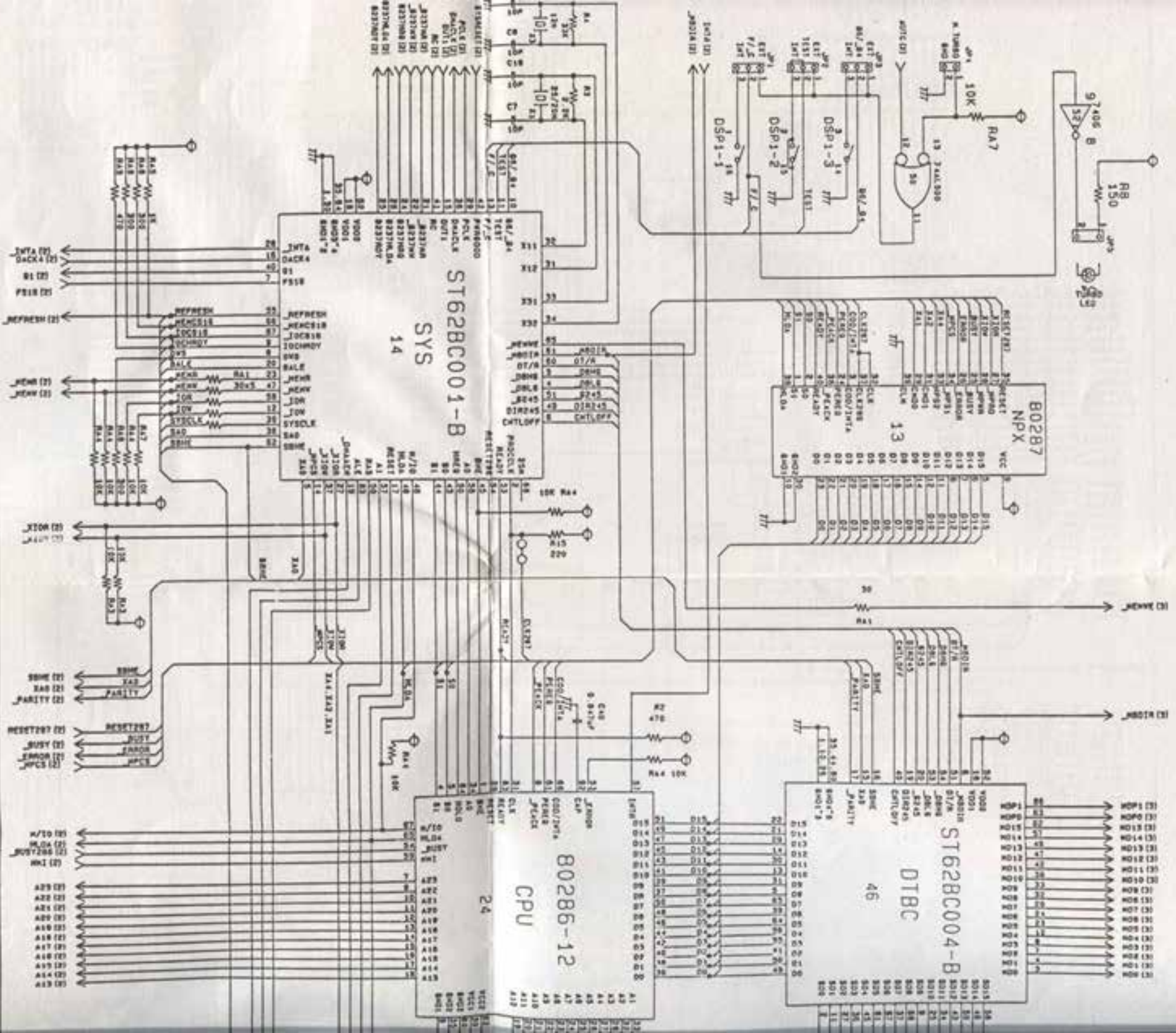MODE0~3: 41256-10 x 18
MODE4~7: 411000-10 x 18

D-RAM BANK1
MODE1 : 41164-10 x 18
MODE3 : 41256-10 x 18
MODE7 : 411000-10 x 18

J20 : KEY
& LED
1- LED PO
2-
3- GND
4- KB LO
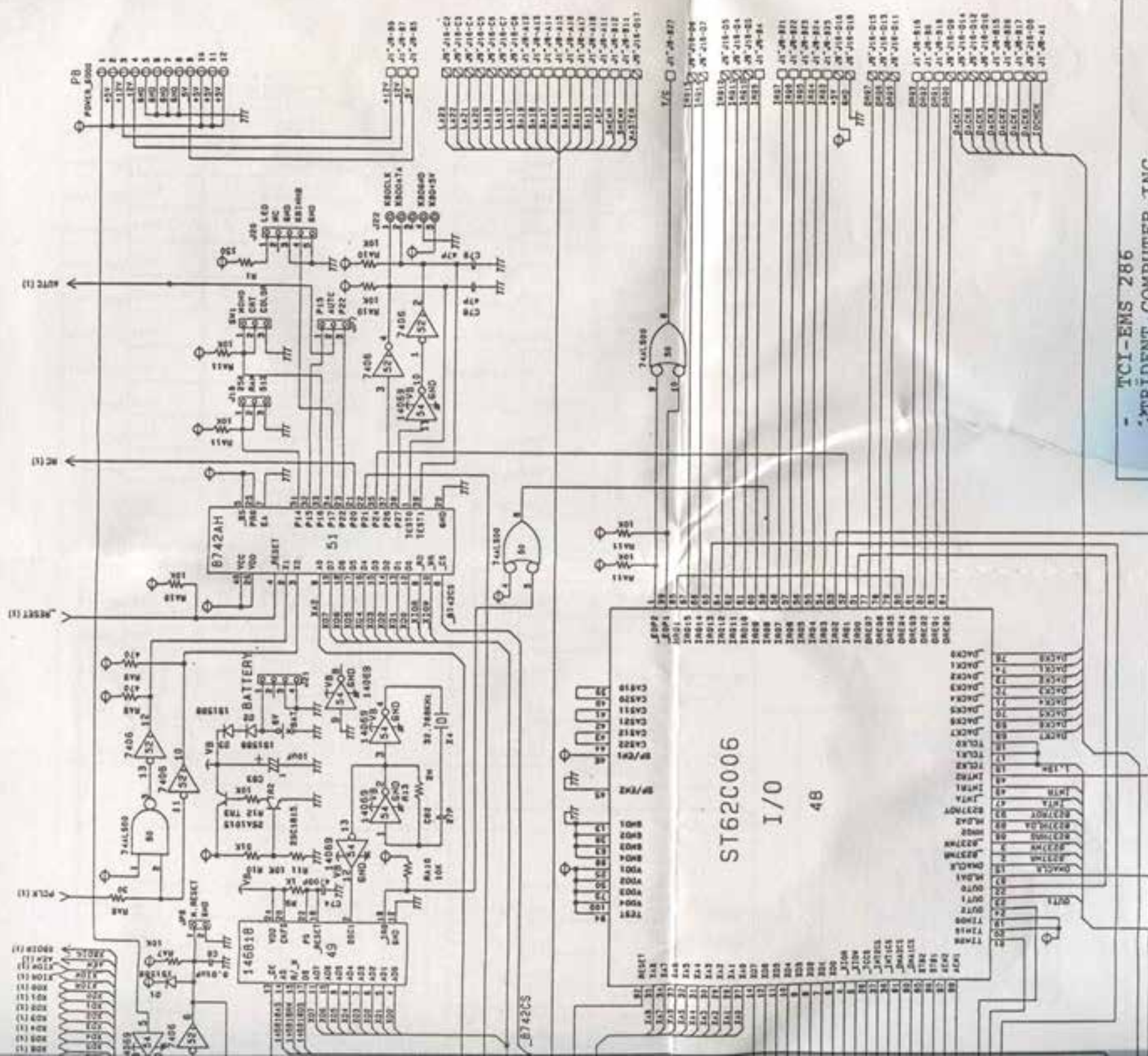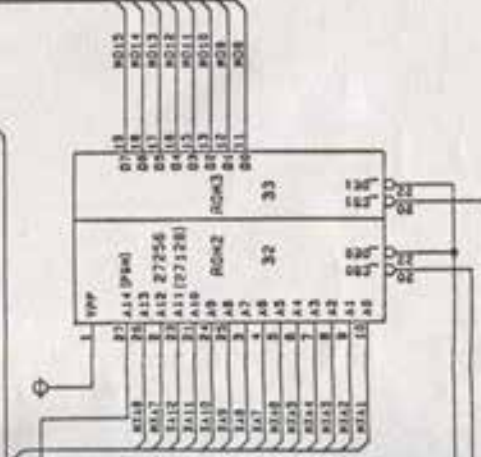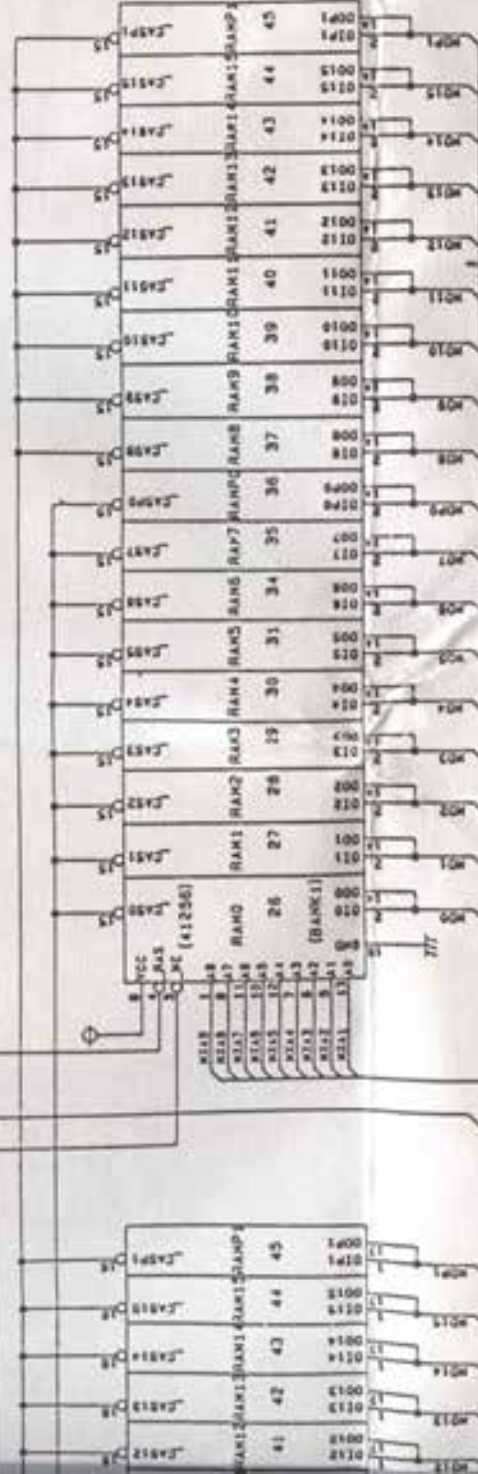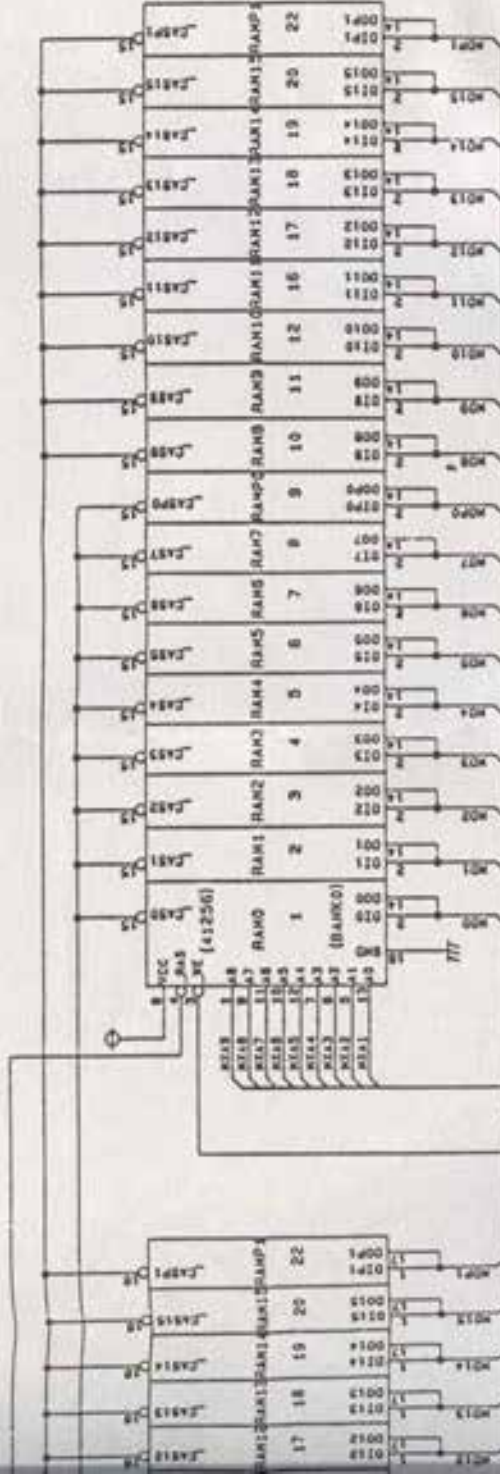5- GND

74ALS245
53

ST62BC003-B
LADR
47

ST62BC004-B
DTBC
46

80286-12
CPU
24

TCI-EMS 286
TRIDENT COMPUTER INC.

ST62M02-A | GAT-E8001-A

1/3