

A

Data Sheet

Computer: IBM Personal Computer

Manufacturer: IBM Corporation Armonk,
New York

Size: 19.6" x 16.1" x 5.5"

Weight: 20.9 lb. without disk drive
installed

Power Required: 63.5 watts (maximum)
110/220 volts

CPU: 8088 Microprocessor

Data Word Size: 8 bits

CPU Clock Speed: 4.77 MHz

Memory Size: 40K ROM
16K-bytes on system board
1 Mbyte directly addressable
memory

Mass Storage Capability: Two disk drives
internally
Two disk drives
externally
160K bytes—
single density
320K bytes—
double density

Keyboard Size: 83 keys
256 character codes

Display: 25 lines of 40 characters,
16 colors
25 lines of 80 characters,
16 colors

Graphics Capability: 100 rows of 160 pic-
ture elements
(pixels), 16 colors
200 rows of 320 pixels,
4 colors
200 rows of 640 pixels,
black and white
32 special graphics
characters

Input/Output: Five 62-pin expansion slots
Auxiliary power connection
Cassette connector
Detachable keyboard
2¹/₄ inch speaker

Standard Software: Cassette BASIC

Optional Software: PC-DOS
MS-DOS
Cassette BASIC
Advanced BASIC

B

Chip Listing

IBM PC SYSTEM BOARD CHIP LISTING

| Label | Integrated Circuit | Description | Label | Integrated Circuit | Description |
|-------|--------------------|--|-------|--------------------|-----------------------------------|
| U1 | MC1741 | General purpose operational amplifier | U25 | SW2 | DIP switch |
| U2 | 8259 | Programmable interrupt controller | U26 | 74LS175 | Quad D flip-flop |
| U3 | 8088 | Microprocessor | U27 | 74LS02 | Quad 2-input NOR gate |
| U4 | 8087 | Numeric data processor | U28 | empty | Spare ROM socket |
| U5 | 74LS30 | 8-input NAND gate | U29 | 9264 ROM | 8K x 8-bit static ROM |
| U6 | 8288 | Bus controller | U30 | 9264 ROM | 8K x 8-bit static ROM |
| U7 | 74LS373 | Octal transparent latch | U31 | 9264 ROM | 8K x 8-bit static ROM |
| U8 | 74LS245 | Tristate octal transceiver | U32 | 9264 ROM | 8K x 8-bit static ROM |
| U9 | 74LS373 | Octal transparent latch | U33 | 9264 ROM | 8K x 8-bit static ROM |
| U10 | 74LS373 | Octal transparent latch | U34 | 8253 | Programmable interval timer |
| U11 | 8284 | Clock generator | U35 | 8237 | DMA controller |
| U12 | 74LS245 | Tristate octal transceiver | U36 | 8255 | Programmable peripheral interface |
| U13 | 74LS245 | Tristate octal transceiver | U37 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U14 | 74LS245 | Tristate octal transceiver | U38 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U15 | 74LS244 | Tristate octal buffer | U39 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U16 | 74LS244 | Tristate octal buffer | U40 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U17 | 74LS244 | Tristate octal buffer | U41 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U18 | 74LS373 | Octal transparent latch | U42 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U19 | 74LS670 | Tristate 4 x 4 register file | U43 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U20 | RN1 | 4.7K ohm DIP resistor network | U44 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U21 | SW1 | DIP switch | U45 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U22 | RN2 | 2K ohm DIP resistor network | U46 | 74LS138 | 1/8 decoder/demultiplexer |
| U23 | 74LS244 | Tristate octal buffer | U47 | 74LS138 | 1/8 decoder/demultiplexer |
| U24 | 74LS322 | 8-bit serial/parallel-in register with sign extend | U48 | 74LS138 | 1/8 decoder/demultiplexer |
| | | | U49 | 74LS08 | Quad 2-input AND gate |
| | | | U50 | 74LS02 | Quad 2-input NOR gate |
| | | | U51 | 74LS04 | Hex inverter |
| | | | U52 | 74LS00 | Quad 2-input NAND gate |
| | | | U53 | 4164 RAM | 64K x 1-bit dynamic RAM |
| | | | U54 | 4164 RAM | 64K x 1-bit dynamic RAM |

MONOCHROME MONITOR/ PRINTER ADAPTER CHIP LISTING

| Label | Integrated Circuit | Description |
|-------|--------------------|--|
| U55 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U56 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U57 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U58 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U59 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U60 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U61 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U62 | 74LS158 | Quad 2-input data selector/ multiplexer |
| U63 | 74LS38 | Quad 2-input NAND buffer |
| U64 | 74LS20 | Dual 4-input NAND gate |
| U65 | 74LS138 | 1/8 decoder/demultiplexer |
| U66 | 74LS138 | 1/8 decoder/demultiplexer |
| U67 | 74LS74 | Dual D flip-flop |
| U68 | RN3 | 4.7K ohm DIP resistor network |
| U69 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U70 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U71 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U72 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U73 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U74 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U75 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U76 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U77 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U78 | RN4 | 30 ohm DIP resistor network |
| U79 | 74LS158 | Quad 2-input data selector/ multiplexer |
| U80 | 74LS125 | Quad tristate buffer |
| U81 | 74S00 | Quad 2-input NAND gate |
| U82 | 74S74 | Dual D flip-flop |
| U83 | 74LS04 | Hex inverter |
| U84 | 74LS10 | Triple 3-input NAND gate |
| U85 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U86 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U87 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U88 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U89 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U90 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U91 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U92 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U93 | 4164 RAM | 64K x 1-bit dynamic RAM |
| U94 | 74LS04 | Hex inverter |
| U95 | 75477 | Relay driver |
| U96 | 74LS74 | Dual D flip-flop |
| U97 | 74S08 | Quad 2-input AND gate |
| U98 | 74LS175 | Quad D flip-flop |
| U99 | 74LS04 | Hex inverter |

Other Components

| Location | Device | Description |
|----------|---------|------------------------------------|
| D1 | Type FC | Silicon diode |
| X1 | Crystal | 14.31818 MHz crystal oscillator |

| Label | Integrated Circuit | Description |
|---------|--------------------|--|
| U1 | 74LS74 | Dual D edge-triggered flip-flop |
| U2 | 74LS04N | Hex inverter |
| U3 | 74LS08 | Quad 2-input AND gate |
| U4 | 74LS74 | Dual D edge-triggered flip-flop |
| U6 | 74LS10 | Triple 3-input NAND gate |
| U7 | 74LS139 | 1-of-8 decoder/demultiplexer |
| U8-U15 | 2114 | 1K x 4-bit RAM |
| U16-U18 | 74LS157 | Quad 2-to-1 multiplexer |
| U19 | 74LS244 | 3-state octal buffer |
| U20,21 | 74LS374 | 3-state octal D flip-flop |
| U22 | 74LS244 | 3-state octal buffer |
| U23 | 74LS245 | 3-state octal bus transceiver |
| U24 | 74LS153 | Dual 4-to-1 multiplexer |
| U25 | 74LS00 | Quad 2-input NAND gate |
| U26 | 74S11 | Triple 3-input AND gate |
| U27 | 74LS02 | Quad 2-input NOR gate |
| U28 | 74LS393 | Dual binary ripple counter |
| U29 | 74LS175 | Quad D type flip-flop with reset |
| U30 | 74LS273 | Octal D-type flip-flop with reset |
| U31 | 74LS273 | Octal D-type flip-flop with reset |
| U32 | 74LS166 | 8-bit parallel-in-serial-out shift register |
| U33 | MK36906 | 8k character generator ROM |
| U34 | 74LS273 | Octal D-type flip-flop with reset |
| U35 | MC6845 | CRT Controller |
| U36 | 74LS125 | Quad 3-state buffer |
| U37 | 74LS240 | Octal 3-state inverter buffer |
| U38 | 7405 | Open collector hex inverter |
| U39 | 74LS174 | Hex D flip-flop with reset |
| U40 | 74LS244 | Octal buffer (3-state) |
| U41 | 74LS347 | Octal D flip-flop (3-state) |
| U42 | 74LS139 | Dual 1-of-4 decoder/demulti- plexer |
| U43 | 74S32 | Quad 2-input OR gate |
| U44 | 74LS04 | Hex inverter |
| U45 | 74LS74 | Dual D edge-triggered flip-flop |
| U46 | 74LS08 | Quad 2-input AND gate |
| U47 | 74LS138 | 1-of-8 decoder/demultiplexer |
| U48 | 74LS138 | 1-of-8 decoder/demultiplexer |
| U49 | 74LS138 | 1-of-8 decoder/demultiplexer |
| U50 | 74LS138 | 1-of-8 decoder/ demultiplexer |
| U51 | 74LS138 | 1-of-8 decoder/demultiplexer |
| U52 | 74LS138 | 1-of-8 decoder/demultiplexer |
| U53 | 74LS00 | Quad 2-input NAND gate |
| U54 | 74S86 | Quad 2-input exclusive OR gate |
| U55 | 74LS174 | Hex D flip-flop with reset |
| U56 | 74LS04 | Hex inverter |
| U57 | 74LS02 | Quad 2-input NOR gate |
| U58 | 74LS175 | Quad D-type flip-flop with reset |
| U59 | 74LS125 | Quad 3-state buffer |
| U60 | 74LS244 | Octal buffer (3-state) |
| U61 | 74LS155 | Dual 1-of-4 decoder/ demultiplexer |

| Label | Integrated Circuit | Description | Label | Integrated Circuit | Description |
|--|--------------------|--|---------|---------------------|---|
| U62 | 74S20 | Dual 4-input NAND gate | U27 | 74LS51 | Dual 2-wide 2-input AND-OR-inverter gate |
| U63 | 74LS157 | Quad 2-to-1 multiplexer | U28 | 74LS10 | Triple 3-input NAND gate |
| U64 | 74LS244 | 3-state octal buffer | U29 | 74S04 | Hex inverter |
| U100 | 74LS32 | Quad 2-input OR gate | U30 | 74LS32 | Quad 2-input OR gate |
| U101 | 74LS74 | Dual D edge-triggered flip-flop | U31 | 74S08 | Quad 2-input AND gate |
| COLOR GRAPHICS ADAPTER CHIP LISTING | | | U32 | 74LS166 | 8-bit parallel-in-serial-out shift register |
| | | | U33 | 8340 (MK36000) | 8k character generator ROM |
| | | | U34,U35 | 74LS273 | Octal D-type flip-flop with reset |
| | | | U36 | 74LS244 | Octal buffer (3-state) |
| | | | U37 | 74LS374 | Octal D-type flip-flop (3-state) |
| | | | U38 | 46505 (6845) | CRT controller |
| | | | U39,U40 | 74LS174 | Hex D-type flip-flop with reset |
| | | | U41 | 74LS08 | Quad 2-input AND gate |
| | | | U42 | 74LS86 | Quad 2-input exclusive OR gate |
| | | | U43 | 74S74 | Dual D edge-triggered flip-flop |
| U44 | 74S74 | Dual D edge-triggered flip-flop | | | |
| U45 | 74LS151 | 8-to-1 multiplexer | U46 | 74LS00 | Quad 2-input NAND gate |
| U47,U48,U49 | 74LS51 | Dual 2-wide 2-input AND-OR inverter gate | U50-U57 | MK4516N-12 (2118-4) | 16K X 1-bit RAM |
| U9,U10 | 74153 | Dual 4-to-1 multiplexer | U58-U61 | 74LS374 | 3-state octal D flip-flop |
| U11 | 74LS74 | Dual D-type edge-triggered flip-flop | U63 | 74LS175 | Quad D flip-flop with reset |
| U12 | 74LS393 | Dual binary ripple counter | U64 | 74LS164 | 8-bit serial-in-parallel-out shift register |
| U13 | 74LS08 | Quad 2-input AND gate | U65 | 74LS02 | Quad 2-input NOR gate |
| U14 | 74LS32 | Quad 2-input OR gate | U66 | 74LS245 | 3-state octal bus transceiver |
| U15 | 74LS00 | Quad 2-input NAND gate | U67 | 74LS244 | 3-state octal buffer |
| U16 | 74LS04 | Hex inverter | U68 | 74LS86 | Quad 2-input exclusive OR gate |
| U17,U18,U19 | 74LS138 | 1-of-8 decoder/demultiplexer | U101 | 74S174 | Hex D flip-flop with reset |
| U20 | 74LS04 | Hex inverter | | | |
| U21 | 74LS174 | Hex D flip-flop with reset | | | |
| U22 | 74LS51 | Dual AND-OR-invert gate | | | |
| U23 | 74LS32 | Quad 2-input OR gate | | | |
| U24 | 74LS244 | Octal buffer (3-state) | | | |
| U25 | 74LS00 | Quad 2-input NAND gate | | | |
| U26 | 74S04 | Hex inverter | | | |

C

Line Definitions

| Label | Location | Definition | Label | Location | Definition |
|------------|---------------|--|---------------|---------------|---|
| A0-A9 | Disk drive | Address line bits 0 through 9 | BACK-GROUND 1 | Color adapter | Color background one |
| A0-A11 | Monochrome | Address line bits 0 through 11 | BD0-BD7 | System board | Buffered data lines 0 through 7 |
| A0-A13 | Color adapter | Address line bits 0 through 13 | BLINK | Monochrome | Blink |
| A15-A19 | Color adapter | Address line bits 15 through 19 | BLUE | Color adapter | Color blue |
| A0-A19 | System board | Address line bits 0 through 19 | BMEMR | Color adapter | Buffered memory read |
| ACK | System board | Acknowledge | BUSY | System board | Busy |
| AD0-AD7 | System board | Buffered address/data bits 0 through 7 | BW,BW1,BW2 | Color adapter | Buffered write lines |
| ADSTB | System board | Address strobe | B/W VIDEO | Monochrome | Black/white video |
| ADDR SEL | System board | Address select | CA0-CA11 | Color adapter | Column address lines |
| AEN | System board | Address enable | CACS CCLK | Monochrome | Control address chip select control clock |
| AEN BRD | System board | Address enable board | CAS | System board | Column address strobe |
| ALE | System board | Address latch enable | CAS0-CAS3 | Color adapter | Column address strobe lines 0 through 3 |
| ALPHA DOTS | Monochrome | Alpha dots | CAS CC | System board | Column address strobe closed circuit |
| AT LATCH | Color adapter | Attribute latch | CASS DATA IN | Color adapter | Cassette data in |
| AT0-AT7 | Color adapter | Attribute bits 0 through 7 | CC LATC | System board | Closed circuit latch |
| AUTO FD XT | System board | Auto feed external lines | CC0-CC7 | Color adapter | Closed circuit character bits 0 through 7 |
| B(0),B(7) | Monochrome | Bits 0 and 7 | CCLK | Color adapter | Character code lines |
| BA0 | Color adapter | Buffered address bit 0 | CEROM | Monochrome | Control clock |
| BA0-BA3 | Monochrome | Buffered address bits 0 through 3 | CGB0 | Monochrome | Chip enable ROM |
| BA8-BA19 | System board | Buffered address lines 8 through 19 | CLK | System board | Clock |
| | | | | Color adapter | |
| | | | | Disk drive | |
| | | | | Monochrome | |

| Label | Location | Definition | Label | Location | Definition |
|-------------------------|---------------|---------------------------------------|---------------|---------------|--|
| CLK88 | System board | Clock 8088 | ENABLE | Disk drive | Enable drive (disk drive) |
| CLR | Disk drive | Clear | DRIVE (C & D) | | C, D |
| CLR S/R | Color adapter | Clear shift register | EN CPU | Color adapter | Enable central processing unit column address strobe |
| CLRVIDEO | Monochrome | Clear video | CAS ADDR | | adder |
| COLOR SEL | Color adapter | Color select | | | |
| CPI | Disk drive | Clock pulse | EN CPU | Color adapter | Enable central processing unit row address strobe |
| CPU MEM SEL | Color adapter | Central processing unit memory select | RAS ADDR | | adder |
| CPUMSEL | Monochrome | CPU memory select | EN CRT | Color adapter | Enable cathode ray tube column address strobe |
| CS | Color adapter | Chip select | CAS ADDR | | adder |
| CS2-CS7 | System board | Chip select lines 2 through 7 | | | |
| CURSOR | Color adapter | Cursor select | EN CRT | Color adapter | Enable cathode ray tube row address strobe |
| | Monochrome | | RAS ADDR | | adder |
| CURSOR BLINK | Monochrome | Cursor blink | EN I/O CK | System board | Enable input/output check |
| CURSOR DLY | Color adapter | Cursor delay | EN I/O CLK | System board | Enable input/output clock |
| CYAN | Color adapter | Color cyan | ENB RAM | System board | Enable RAM peripheral check |
| D0-D7 | System board | Data lines 0 through 7 | PCK | | check |
| | Color adapter | | ERASE | Disk drive | Erase |
| | Disk drive | | ERROR | System board | Error |
| | Monochrome | | | Monochrome | |
| DACK | Disk drive | DMA acknowledge | F(0),F(1) | Monochrome | |
| DACK0-DACK3 | System board | DMA acknowledge lines 0 through 3 | G | System board | Enable |
| DACK0 BRD | System board | DMA acknowledge 0 board | GRPDCD | Monochrome | |
| DACK 2 | Disk drive | DMA acknowledge 2 | GRPH | Color adapter | Graphics |
| DACK & TC | Disk drive | DMA acknowledge & terminal count | GRPH EN | Color adapter | Graphics enable |
| DATA0-DATA7 | Monochrome | Data lines 0-7 | H CLK | Color adapter | Horizontal clock |
| DATA GATE | Color adapter | Data gate | HIGH LIGHT | Monochrome | High light |
| DATA IN | Monochrome | Data in | HIGH RES | Color adapter | High resolution |
| DATA OUT | System board | Data out | HM | Disk drive | |
| DCLK | System board | Data clock | HOLDA | System board | Hold access |
| DIR | System board | Direction | HORIZ | Monochrome | Horizontal drive |
| DIR (A&B) | System board | Direction (disk drive) A & B | DRIVE | | |
| DIR (C&D) | Disk drive | Direction (disk drive) C & D | HORIZ SYNC | Color adapter | Horizontal synchronization |
| DISPEN | Disk drive | Display enable | HORIZ SYNC | Color adapter | Horizontal sync delay |
| | Color adapter | | DLY | | |
| DISPEN DLY | Monochrome | Display enable delay | HRES | Monochrome | High resolution |
| | Color adapter | | HSYNC | Monochrome | Horizontal synchronization |
| DMA | Monochrome | Direct memory access | HSYNC DLY | Monochrome | Horizontal sync delay |
| | Disk drive | | I(B),I(F) | Monochrome | Intensity (blink), (full) |
| DMA AEN | System board | Direct memory access address enable | INDEX | Disk drive | Index (mark) |
| DMA CS | System board | Direct memory access chip select | INDEX (A&B) | Disk drive | Index (disk drive) A and B |
| DMA WAIT | System board | Direct memory access wait | INDEX (C&D) | Disk drive | Index (disk drive) C and D |
| DOT CLK | Color adapter | Dot clock | INIT | System board | Initialize |
| | Monochrome | | | Disk drive | |
| DRIVE SELECT (A&B)(C&D) | Disk drive | Drive select (disk drive) A,B,C,D | INT | System board | Interrupt |
| DRQ0-DRQ3 | System board | DMA request 0 through 3 | INTA | System board | Initialize address |
| DRQ2 | Disk drive | Data request 2 | INTR CS | System board | Internal chip select |
| DT/R | System board | Data transmit/receive | INT WRT | Disk drive | Interrupt write busy |
| E | Color adapter | | BUSY | | |
| | Monochrome | | I/O CH CK | System board | Input/output channel check |
| ENABLE BLINK | Color adapter | Enable blink | I/O CH CLK | System board | Input/output channel clock |
| | Monochrome | | I/O CH RDY | Color adapter | Input/output channel ready |
| | | | | Monochrome | |
| | | | IOR | System board | Input/output read |
| | | | | Color adapter | |
| | | | | Disk drive | |
| | | | | Monochrome | |
| | | | IOW | System board | Input/output write |
| | | | | Color adapter | |
| | | | | Disk drive | |
| | | | | Monochrome | |

| Label | Location | Definition | Label | Location | Definition |
|-------------|---------------|---|-------------|---------------|---|
| IRQ | Disk drive | Interrupt request | PE | System board | Paper end |
| IRQ7 | Monochrome | Interrupt request 7 | PPICS | System board | |
| IRQ0-IRQ7 | System board | Interrupt request lines 0 through 7 | PWR GOOD | System board | Power good |
| IRQEN | Monochrome | Interrupt request enable | Q1,Q2,Q3,Q4 | Color adapter | Accumulator extension lines 1 through 4 |
| IRQ EN | System board | Interrupt request enable | Q5 | Monochrome | Accumulator extension line 5 |
| JUMPER | Monochrome | Jumper | QS0,QS1 | System board | Q... status bits 0 and 1 |
| LCC5-LCC7 | Monochrome | | RA0-RA2 | Color adapter | Read address lines 0 through 2 |
| L CLK | Color adapter | Light clock | RA0-RA3 | Monochrome | Row address lines 0 through 3 |
| L PEN INPUT | Color adapter | Light pen input | RAM ADDR | System board | RAM address select |
| L PEN STR | Color adapter | Light pen strobe | SEL | System board | |
| L PEN SW | Color adapter | Light pen switch | RAS | Color adapter | Row address strobe |
| LOCK | System board | Lock | RAS0-RAS3 | System board | Row address strobe bits 0 through 3 |
| LVIDEO | Monochrome | Line video | RD GATE | Color adapter | Read gate |
| MA0-MA6 | Color adapter | Memory address lines 0 through 6 | RDGATEAT | Monochrome | Read gate attribute |
| MA0-MA7 | System board | Memory address lines 0 through 7 | RDGATECC | Monochrome | Read gate character code |
| MA0-MA10 | Monochrome | Memory address lines 0 through 10 | RDY/WAIT | System board | Ready/wait |
| MD0-MD7 | System board | Memory data lines 0 through 7 | RDY TO DMA | System board | Ready to direct memory access |
| MD00-MD11 | System board | Matrix data lines 00 through 11 | READ DATA | Disk drive | Read data |
| MDP | System board | Memory data parity | READ DATA | Disk drive | Read data (disk drive) |
| ME | System board | Memory enable | (A&B)(C&D) | | A,B,C,D |
| MEMR | System board | Memory read | READY | System board | Ready |
| | Color adapter | | RED | Color adapter | Red |
| MEMW | System board | Memory write | REFRESH | System board | Refresh gate |
| | Color adapter | | GATE | | |
| | Monochrome | | REQIN | System board | Request in |
| MOTOR | System board | Motor control | REQOUT | System board | Request out |
| CNTRL | | | RESET | System board | Reset |
| MOTOR | Disk drive | Motor enable (disk drive) | | Disk drive | |
| ENABLE | | A,B,C,D | | Monochrome | |
| (A&B)(C&D) | | | RESET C | Color adapter | Reset control |
| MOTOR OFF | System board | Motor off | RESET DRV | System board | Reset drive |
| MOTOR ON | Disk drive | Motor on | | Color adapter | |
| MR | Disk drive | Memory read | RMA0- | Monochrome | Read memory address lines |
| MRQ DMA | System board | Memory request direct memory access | RMA9 | | |
| | | | ROMA 11 | Monochrome | ROM address line 11 |
| MUX A, | Color adapter | Multiplexer A, B | ROM ADDR | System board | ROM address select |
| MUX B | | | SEL | | |
| NMI | System board | Non-maskable interrupt | RPA | System board | Read printer data |
| NODSPLY | Monochrome | No display | RPB | System board | Read printer control |
| NP INSTL | System board | Numeric processor installation switch | RPC | System board | Read printer status |
| SW | | | RPA-RPC | Monochrome | Read printer data, control, status |
| NPNPI | System board | Numeric processor numeric processor interrupt | RQ/GT | System board | Request/grant |
| OSC | System board | Oscillator | RVV | Monochrome | Reverse video |
| | Color adapter | | S0-S2 | System board | Status bits 0 through 2 |
| OUT | Disk drive | Output | S0 | Disk drive | Side zero |
| OVERSCAN B | Color adapter | Overscan blue | S1 | Disk drive | Side 1 |
| OVERSCAN G | Color adapter | Overscan green | SA CLOSED | System board | |
| OVERSCAN R | Color adapter | Overscan red | S DOTS | Monochrome | Serial dots |
| OVERSCAN L | Color adapter | Overscan luminance | SEEK | Disk drive | Seek |
| PB6,PB7 | System board | 8255 port B bits 6 and 7 | SELECT0- | System board | Select lines 0 through 2 |
| PCK | System board | Peripheral check | SELECT2 | | |
| PCLK | System board | Peripheral clock | | | |

| Label | Location | Definition | Label | Location | Definition |
|------------------------|---------------|------------------------------------|--------------------------|---------------|--|
| SELECT HEAD (A&B)(C&D) | Disk drive | Select head (disk drive) A,B,C,D | VIDEO ENABLE | Color adapter | Video enable |
| SEL BLUE | Color adapter | Select color blue | VSYNC | Monochrome | Vertical synchronization |
| SEL 1 | Monochrome | Select line 1 | VSYNC DLY | Monochrome | Vertical sync delay |
| SEL1, SEL2 | Color adapter | Select lines 1 and 2 | WE | System board | Write enable |
| SENSE A-SENSE H | System board | Sense lines A through H | | Color adapter | |
| SERDATA | Monochrome | Serial data | WPA | Monochrome | Write printer data |
| SERIAL DATA | System board | Serial data | WPC | System board | Write printer control |
| SERIN | Monochrome | Serial in | WR DATA (A&B) | Disk drive | Write data (disk drive) A and B |
| S/L | Color adapter | Serial/line | WR DATA (C&D) | Disk drive | Write data (disk drive) C and D |
| SLCT | Monochrome | Select | WRITE | Disk drive | Write |
| SLCTIN | System board | Select input | WRITE DATA 00 | Disk drive | Write data 00 |
| SLCT IN | System board | Select input | WRITE DATA 01 | Disk drive | Write data 01 |
| SP/EN | System board | Slave program/enable buffer | WRITE GATE (A&B)(C&D) | Disk drive | Write gate (disk drive) A,B,C,D |
| SPKR DATA | System board | Speaker data | WRITE PROTECT | Disk drive | Write protect |
| STATUS SEL | Color adapter | Status select | WRITE PROTECT (A&B)(C&D) | Disk drive | Write protect (disk drive) A,B,C,D |
| STEP (A&B) | Disk drive | Step (disk drive) A,B | WRT DMA | System board | Write direct memory access page register |
| STEP (C&D) | Disk drive | Step (disk drive) C,D | PG REG | System board | Write non-maskable interrupt register |
| STR | Color adapter | Strobe | WRT NMI REG | System board | |
| STROBE | System board | Strobe | WRT TRAN | Disk drive | |
| T/C | Monochrome | Terminal count | XA0-XA12 | System board | Buffered address lines |
| TC | System board | Terminal count | XACK | Color adapter | Buffered acknowledge |
| TC CS | Disk drive | TC chip select | XD0-XD7 | Monochrome | Buffered data lines |
| TD0-TD7 | System board | Transceiver data lines 0 through 7 | XIOR | System board | Buffered I/O read |
| TIM2 GATE | System board | Timer 2 gate speaker | XIOW | Monochrome | Buffered I/O write |
| SPK | System board | Timer control 2 | XMEMR | System board | Buffered memory read |
| TIMER/CNTR2 | Disk drive | Trace 0 | XMEMW | System board | Buffered memory write |
| TRACK 0 | Disk drive | Track 0 (disk drive) A and B | YELLOW BURST | Color adapter | Yellow burst |
| TRACK 0 (A&B) | Disk drive | Track 0 (disk drive) C and D | 2 MHz | Disk drive | 2 MHz clock frequency |
| TRACK 0 (C&D) | Disk drive | Track 0 (disk drive) C and D | 3.58 MHz | Color adapter | 3.58 MHz color oscillator frequency |
| UNDERLINE | Monochrome | Underline | 7 MHz | Color adapter | 7 MHz oscillator frequency |
| VCO SYNC | Disk drive | Voltage controlled oscillator sync | 14 MHz | Color adapter | 14 MHz oscillator frequency |
| VERT DRIVE | Monochrome | Vertical drive | 16 MHz | Disk drive | 16 MHz system clock |
| VERT SYNC | Color adapter | Vertical synchronization | | | |
| VERT SYNC DLY | Color adapter | Vertical sync delay | | | |
| VIDEO | Monochrome | Video | | | |

D

Disassembly Procedures

SYSTEM UNIT DISASSEMBLY INSTRUCTIONS

These procedures apply to those repairs that require access to the internal subassemblies of the IBM PC system unit.

System Board Access

Tools and Equipment Required

- No. 2 flathead screwdriver
- Uncluttered workspace
- Container to hold screws until reassembly

Procedure for System Board Access

1. Turn the power off.
2. Unplug the power cord and any peripherals from the rear of the computer.
3. Position the system unit so the rear is facing you.
4. Using a flathead screwdriver remove the 5 screws from the rear plate (see Fig. D-1). (The older model IBM PCs have only two screws on the back plate.)



Fig. D-1. Remove these screws to disassemble the IBM PC.

5. Position the system unit so that the front is facing you.
6. Place your hands on either side of the cover and slide the cover off of the main unit pulling towards you as shown in Fig. D-2.

Procedure for Removing System Board

1. Follow steps 1 through 6 in procedure for system board access.

2. Remove all peripheral cards from the system board.

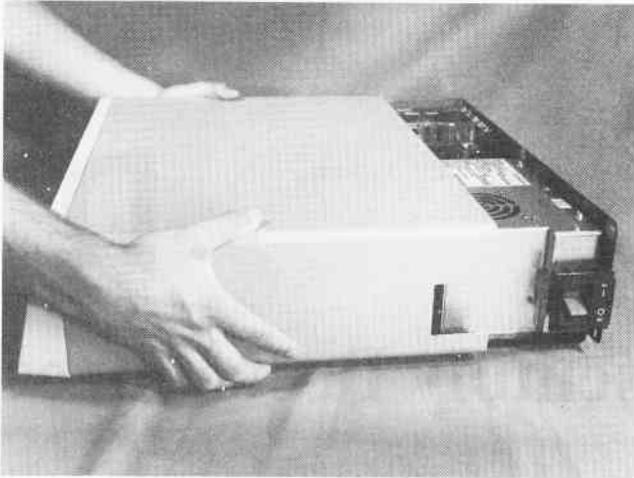


Fig. D-2. Gently slide the system unit cover forward.

3. Remove the power connector from the system board. (This is located in the back right side looking from the front.)
4. Remove the speaker cable from the connector on the lower middle section on the system board.
5. Remove the system board mounting screws as shown in Fig. D-3.
6. Slide the system unit board away from the power supply approximately 2 inches until

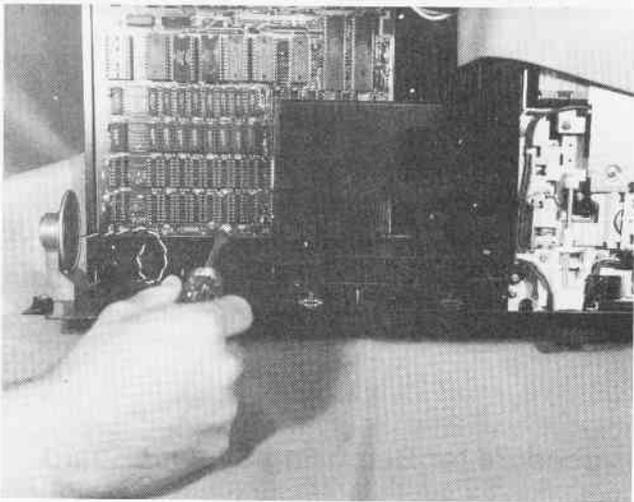


Fig. D-3. Remove the system board mounting screws.

standoffs can be lifted from their mounting slots.

7. Lift the system board from the system unit.

KEYBOARD DISASSEMBLY

This section covers the proper procedures for disassembling the keyboard.

Tools and Equipment Required

Small Phillips-head screwdriver
Uncluttered workspace
Container to hold screws until reassembly

1. Turn the system unit off.
2. Remove the keyboard from the connector in the back of the system unit.
3. Turn the keyboard upside down.
4. Remove the two Phillips-head screws from the bottom of the keyboard plate.
5. Lift the top of the plate up and out of the retaining slots in the chassis of the keyboard.
6. Disconnect the cable from the keyboard assembly.
7. Lift the rear of the keyboard out of the chassis.

POWER SUPPLY REMOVAL

This section describes the steps required to remove the power supply from the chassis.

Tools and Equipment Required

No. 2 flathead screwdriver
Uncluttered workspace
Container to hold screws until reassembly

1. Turn the power off.

2. Unplug the power cord and any peripherals from the rear of the computer.
3. Position the system unit so the rear is facing you.
4. Remove the system unit cover. (See procedure for system board access.)
5. Remove the power connector from the system board. (This is located in the back right side looking from the front.)
6. If you have drives hooked to the system, disconnect the power cables going to the drive analog cards.
7. Remove the four power supply screws on the back of the chassis.
8. Push the power supply forward about $\frac{1}{2}$ inch.
9. To remove the supply, lift up and pull the power supply away from the motherboard.

Abstract. This paper examines the ethical implications of the widespread use of mobile devices in the workplace. It discusses how mobile devices can both enhance and hinder ethical behavior, and offers strategies for organizations to manage these risks. The paper argues that while mobile devices provide new opportunities for productivity and communication, they also create new challenges for maintaining ethical standards. Organizations must implement clear policies and provide training to ensure that mobile device use aligns with their ethical values.

Keywords: mobile devices, workplace ethics, productivity, communication, organizational values, digital technology, mobile computing, workplace behavior, ethical implications, digital workplace, mobile devices, workplace ethics, productivity, communication, organizational values, digital technology, mobile computing, workplace behavior, ethical implications, digital workplace.

1. Introduction

The rapid adoption of mobile devices in the workplace has transformed the way we work. While these devices offer significant benefits in terms of productivity and communication, they also present new ethical challenges. This paper explores these challenges and offers strategies for organizations to manage them.

Mobile devices, such as smartphones and tablets, have become essential tools for many workers. They enable employees to stay connected and productive even when they are away from their desks. However, the constant connectivity provided by these devices can also lead to blurred boundaries between work and personal life, which can have negative effects on mental health and work-life balance.

One of the primary ethical concerns related to mobile devices is the issue of data privacy. Mobile devices often store sensitive information, such as emails, documents, and contact lists. If these devices are lost or stolen, this information can be accessed by unauthorized individuals, leading to potential data breaches and loss of confidentiality. Organizations must implement robust security measures to protect this data.

Another ethical concern is the potential for mobile devices to be used for inappropriate or unproductive purposes. For example, employees might use their mobile devices to browse social media or visit non-work-related websites during work hours. This can lead to decreased productivity and increased distractions. Organizations should establish clear policies regarding mobile device use during work hours.

Finally, the use of mobile devices can also raise issues of digital divide and accessibility. Not all employees have access to the latest mobile devices or the necessary internet connectivity. This can create disparities in productivity and access to information, which may lead to unfair advantages for some employees over others. Organizations should consider these issues when implementing mobile device policies and provide support for employees who may have limited access to technology.

E

Reassembly Procedures

SYSTEM UNIT REASSEMBLY INSTRUCTIONS

Now that the repair is complete, follow these steps to put the system back together.

Tools and Equipment Required

No. 2 flathead screwdriver
Uncluttered workspace
Container to hold screws until reassembly

REINSTALLING SYSTEM BOARD

1. Position all the standoffs hooked to the system board above the mounting holes.
2. Gently push the system board toward the power supply until you can see that the mounting screw holes line up.
3. Reinstall the mounting screws in the system board.
4. Reconnect the signal wires to the speaker.
5. Install the adapter cards.
6. Reconnect the system board power supply connectors.

REASSEMBLING SYSTEM UNIT CASE

1. Gently slide the system unit case forward over the system unit.
2. Reinstall the five flathead screws on the back of the chassis. (The older model IBM PC has only two screws on the back plate.)
3. Reconnect all peripherals and the power cord.

KEYBOARD REASSEMBLY

This section covers the proper procedures for putting the keyboard back together.

Tools and Equipment Required

Small Phillips-head screwdriver
Uncluttered workspace
Container to hold screws until reassembly

1. Position the front of the keyboard assembly into the front of the keyboard chassis.

2. Lower the back of the keyboard down into the chassis.
3. Reconnect the cable to the keyboard assembly.
4. Put the tabs on the front of the base into the slots on the front of the keyboard chassis.
5. Slowly lower the back down—don't forget to include the adjustable legs on the bottom of the keyboard.
6. Install the two Phillips-head screws into the mounting holes on the bottom of the keyboard.
7. Reconnect the cable to the system unit assembly.
8. Power up and test.

POWER SUPPLY INSTALLATION

This section describes the steps needed to reinstall a power supply in the chassis.

Tools and Equipment Required

No. 2 flathead screwdriver

Uncluttered workspace

Container to hold screws until reassembly

1. Hold the power supply unit approximately $\frac{1}{2}$ inch from the rear of the chassis, and push the supply toward the motherboard and then back to align the screw holes in the chassis.
2. Replace the four mounting screws for the power supply.
3. Reconnect the disk drive power supply connectors.
4. Reconnect the motherboard power supply connectors.
5. Reconnect the power cord.
6. Power up and test.

Note: Disk drive disassembly and reassembly instructions are covered in Chapter 3.

F

Replacing Surface Mounted Components

Desoldering and soldering on the IBM PC system board is not easy--the board construction is such that damage to the board traces and solder points can easily occur if you aren't extremely careful.

Caution: Proceed at your own risk.

1. Reread the section on soldering techniques found in Chapter 3.
2. Be sure you're using a temperature-controlled iron.
3. Disassemble the machine and remove the system board.
4. Place the board on its edge and locate the component to be replaced.
5. If possible, during chip removal, attach an extractor tool to the component to be replaced and use a DIP tip on your iron to heat the pins and remove the chip.
6. Or use a vacuum solder "sucker," or braided wick and the temperature controlled iron to heat the pins (start at the corners first, then desolder every other pin to avoid overheating one area of the board trace) until the component comes free.
7. Clean the solder holes using the techniques described in Chapter 3.
8. If a chip was removed, install an IC socket in its place on the system board. This lets you install a replacement chip into an already soldered connection eliminating the need to solder directly to the chip pins themselves.
9. If a transistor is being replaced, install a transistor socket in the system board connection holes.
10. If a resistor, diode, or capacitor is being replaced, solder the leads directly in the opened holes in the board.
11. Reinstall the system board in the computer's housing.
12. Reassemble the computer.
13. Reconnect the power cord.
14. Power up and test.
15. Return the computer to service (or break back down again to replace another possibly faulty component).

Note: If your efforts didn't solve the problem, and you've replaced all the suspected components with good components, you have little recourse—replace the entire system board assembly.

G

ASCII Code Chart

| Hexa- decimal | ASCII | Hexa- decimal | ASCII | Hexa- decimal | ASCII | Hexa- decimal | ASCII | Hexa- decimal | ASCII | Hexa- decimal | ASCII |
|------------------|----------------|------------------|-------------|------------------|-------|------------------|-------|------------------|-------|------------------|--------|
| 00 | ^@ (NULL) | 15 | ^U | 2B | + | 40 | @ | 56 | V | 6B | k |
| 01 | ^A | 16 | ^V | 2C | , | 41 | A | 57 | W | 6C | l |
| 02 | ^B | 17 | ^W | 2D | - | 42 | B | 58 | X | 6D | m |
| 03 | ^C | 18 | ^X | 2E | . | 43 | C | 59 | Y | 6E | n |
| 04 | ^D | 19 | ^Y | 2F | / | 44 | D | 5A | Z | 6F | o |
| 05 | ^E | 1A | ^Z | 30 | 0 | 45 | E | 5B | [| 70 | p |
| 06 | ^F | 1B | ^[(ESCAPE) | 31 | 1 | 46 | F | 5C | \ | 71 | q |
| 07 | ^G (BELL) | 1C | ^\ | 32 | 2 | 47 | G | 5D |]` | 72 | r |
| 08 | ^H (BACKSPACE) | 1D | ^] | 33 | 3 | 48 | H | 5E | ^' | 73 | s |
| 09 | ^I (TAB) | 1E | ^^ | 34 | 4 | 49 | I | 5F | ~ | 74 | t |
| 0A | ^J (LINEFEED) | 1F | ^ | 35 | 5 | 4A | J | 60 | · | 75 | u |
| 0B | ^K | 20 | SPACE | 36 | 6 | 4B | K | 61 | a | 76 | v |
| 0C | ^L | 21 | ! | 37 | 7 | 4C | L | 62 | b | 77 | w |
| 0D | ^M | 22 | " | 38 | 8 | 4D | M | 63 | c | 78 | x |
| 0E | ^N | 23 | # | 39 | 9 | 4E | N | 64 | d | 79 | y |
| 0F | ^O | 24 | \$ | 3A | : | 4F | O | 65 | e | 7A | z |
| 10 | ^P | 25 | % | 3B | ; | 50 | P | 66 | f | 7B | { |
| 11 | ^Q | 26 | & | 3C | < | 51 | Q | 67 | g | 7C | |
| 12 | ^R | 27 | ' | 3D | = | 52 | R | 68 | h | 7D | } |
| 13 | ^S | 28 | (| 3E | > | 53 | S | 69 | i | 7E | ~ |
| 14 | ^T | 29 |) | 3F | ? | 54 | T | 6A | j | 7F | DELETE |
| | | 2A | * | | | 55 | U | | | | |

(The symbol ^ represents a control character.)



ASCI Corp. Chart

| Year | Revenue | Profit | Assets | Liabilities | Equity | Notes |
|------|---------|--------|--------|-------------|--------|-------|
| 1987 | 100 | 10 | 100 | 100 | 0 | |
| 1988 | 110 | 12 | 110 | 110 | 0 | |
| 1989 | 120 | 15 | 120 | 120 | 0 | |
| 1990 | 130 | 18 | 130 | 130 | 0 | |
| 1991 | 140 | 20 | 140 | 140 | 0 | |
| 1992 | 150 | 22 | 150 | 150 | 0 | |
| 1993 | 160 | 25 | 160 | 160 | 0 | |
| 1994 | 170 | 28 | 170 | 170 | 0 | |
| 1995 | 180 | 30 | 180 | 180 | 0 | |
| 1996 | 190 | 32 | 190 | 190 | 0 | |
| 1997 | 200 | 35 | 200 | 200 | 0 | |
| 1998 | 210 | 38 | 210 | 210 | 0 | |
| 1999 | 220 | 40 | 220 | 220 | 0 | |
| 2000 | 230 | 42 | 230 | 230 | 0 | |
| 2001 | 240 | 45 | 240 | 240 | 0 | |
| 2002 | 250 | 48 | 250 | 250 | 0 | |
| 2003 | 260 | 50 | 260 | 260 | 0 | |
| 2004 | 270 | 52 | 270 | 270 | 0 | |
| 2005 | 280 | 55 | 280 | 280 | 0 | |
| 2006 | 290 | 58 | 290 | 290 | 0 | |
| 2007 | 300 | 60 | 300 | 300 | 0 | |
| 2008 | 310 | 62 | 310 | 310 | 0 | |
| 2009 | 320 | 65 | 320 | 320 | 0 | |
| 2010 | 330 | 68 | 330 | 330 | 0 | |
| 2011 | 340 | 70 | 340 | 340 | 0 | |
| 2012 | 350 | 72 | 350 | 350 | 0 | |
| 2013 | 360 | 75 | 360 | 360 | 0 | |
| 2014 | 370 | 78 | 370 | 370 | 0 | |
| 2015 | 380 | 80 | 380 | 380 | 0 | |
| 2016 | 390 | 82 | 390 | 390 | 0 | |
| 2017 | 400 | 85 | 400 | 400 | 0 | |
| 2018 | 410 | 88 | 410 | 410 | 0 | |
| 2019 | 420 | 90 | 420 | 420 | 0 | |
| 2020 | 430 | 92 | 430 | 430 | 0 | |
| 2021 | 440 | 95 | 440 | 440 | 0 | |
| 2022 | 450 | 98 | 450 | 450 | 0 | |
| 2023 | 460 | 100 | 460 | 460 | 0 | |

H

Hexadecimal to Decimal Conversion Chart

| Hex | Dec |
|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|
| \$00 | 00 | \$1D | 29 | \$3A | 58 | \$57 | 87 | \$74 | 116 | \$91 | 145 | \$AE | 174 | \$CD | 205 | \$EA | 234 |
| \$01 | 01 | \$1E | 30 | \$3B | 59 | \$58 | 88 | \$75 | 117 | \$92 | 146 | \$AF | 175 | \$CE | 206 | \$EB | 235 |
| \$02 | 02 | \$1F | 31 | \$3C | 60 | \$59 | 89 | \$76 | 118 | \$93 | 147 | \$B0 | 176 | \$CF | 207 | \$EC | 236 |
| \$03 | 03 | \$20 | 32 | \$3D | 61 | \$5A | 90 | \$77 | 119 | \$94 | 148 | \$B1 | 177 | \$D0 | 208 | \$ED | 237 |
| \$04 | 04 | \$21 | 33 | \$3E | 62 | \$5B | 91 | \$78 | 120 | \$95 | 149 | \$B2 | 178 | \$D1 | 209 | \$EE | 238 |
| \$05 | 05 | \$22 | 34 | \$3F | 63 | \$5C | 92 | \$79 | 121 | \$96 | 150 | \$B5 | 181 | \$D2 | 210 | \$EF | 239 |
| \$06 | 06 | \$23 | 35 | \$40 | 64 | \$5D | 93 | \$7A | 122 | \$97 | 151 | \$B6 | 182 | \$D3 | 211 | \$F0 | 240 |
| \$07 | 07 | \$24 | 36 | \$41 | 65 | \$5E | 94 | \$7B | 123 | \$98 | 152 | \$B7 | 183 | \$D4 | 212 | \$F1 | 241 |
| \$08 | 08 | \$25 | 37 | \$42 | 66 | \$5F | 95 | \$7C | 124 | \$99 | 153 | \$B8 | 184 | \$D5 | 213 | \$F2 | 242 |
| \$09 | 09 | \$26 | 38 | \$43 | 67 | \$60 | 96 | \$7D | 125 | \$9A | 154 | \$B9 | 185 | \$D6 | 214 | \$F3 | 243 |
| \$0A | 10 | \$27 | 39 | \$44 | 68 | \$61 | 97 | \$7E | 126 | \$9B | 155 | \$BA | 186 | \$D7 | 215 | \$F4 | 244 |
| \$0B | 11 | \$28 | 40 | \$45 | 69 | \$62 | 98 | \$7F | 127 | \$9C | 156 | \$BB | 187 | \$D8 | 216 | \$F5 | 245 |
| \$0C | 12 | \$29 | 41 | \$46 | 70 | \$63 | 99 | \$80 | 128 | \$9D | 157 | \$BC | 188 | \$D9 | 217 | \$F6 | 246 |
| \$0D | 13 | \$2A | 42 | \$47 | 71 | \$64 | 100 | \$81 | 129 | \$9E | 158 | \$BD | 189 | \$DA | 218 | \$F7 | 247 |
| \$0E | 14 | \$2B | 43 | \$48 | 72 | \$65 | 101 | \$82 | 130 | \$9F | 159 | \$BE | 190 | \$DB | 219 | \$F8 | 248 |
| \$0F | 15 | \$2C | 44 | \$49 | 73 | \$66 | 102 | \$83 | 131 | \$A0 | 160 | \$BF | 191 | \$DC | 220 | \$F9 | 249 |
| \$10 | 16 | \$2D | 45 | \$4A | 74 | \$67 | 103 | \$84 | 132 | \$A1 | 161 | \$C0 | 192 | \$DD | 221 | \$FA | 250 |
| \$11 | 17 | \$2E | 46 | \$4B | 75 | \$68 | 104 | \$85 | 133 | \$A2 | 162 | \$C1 | 193 | \$DE | 222 | \$FB | 251 |
| \$12 | 18 | \$2F | 47 | \$4C | 76 | \$69 | 105 | \$86 | 134 | \$A3 | 163 | \$C2 | 194 | \$DF | 223 | \$FC | 252 |
| \$13 | 19 | \$30 | 48 | \$4D | 77 | \$6A | 106 | \$87 | 135 | \$A4 | 164 | \$C3 | 195 | \$E0 | 224 | \$FD | 253 |
| \$14 | 20 | \$31 | 49 | \$4E | 78 | \$6B | 107 | \$88 | 136 | \$A5 | 165 | \$C4 | 196 | \$E1 | 225 | \$FE | 254 |
| \$15 | 21 | \$32 | 50 | \$4F | 79 | \$6C | 108 | \$89 | 137 | \$A6 | 166 | \$C5 | 197 | \$E2 | 226 | \$FF | 255 |
| \$16 | 22 | \$33 | 51 | \$50 | 80 | \$6D | 109 | \$8A | 138 | \$A7 | 167 | \$C6 | 198 | \$E3 | 227 | | |
| \$17 | 23 | \$34 | 52 | \$51 | 81 | \$6E | 110 | \$8B | 139 | \$A8 | 168 | \$C7 | 199 | \$E4 | 228 | | |
| \$18 | 24 | \$35 | 53 | \$52 | 82 | \$6F | 111 | \$8C | 140 | \$A9 | 169 | \$C8 | 200 | \$E5 | 229 | | |
| \$19 | 25 | \$36 | 54 | \$53 | 83 | \$70 | 112 | \$8D | 141 | \$AA | 170 | \$C9 | 201 | \$E6 | 230 | | |
| \$1A | 26 | \$37 | 55 | \$54 | 84 | \$71 | 113 | \$8E | 142 | \$AB | 171 | \$CA | 202 | \$E7 | 231 | | |
| \$1B | 27 | \$38 | 56 | \$55 | 85 | \$72 | 114 | \$8F | 143 | \$AC | 172 | \$CB | 203 | \$E8 | 232 | | |
| \$1C | 28 | \$39 | 57 | \$56 | 86 | \$73 | 115 | \$90 | 144 | \$AD | 173 | \$CC | 204 | \$E9 | 233 | | |

Routine Preventive Maintenance

Preventive maintenance (PM) is one of the least used techniques for operational cost reduction, yet the savings that result can be substantial. If the equipment doesn't fail, you can't evaluate the bottom-line savings in conducting proper PM. But after the first mind-boggling repair expense, the fact will sink in. This failure might have been prevented by doing some easy, routine maintenance.

Someone once said "Time is money." Failure to take the time to do routine preventive maintenance can indeed cost money. Do your PMs!

Many manufacturers are not sure what optimum PM should be. Others prefer you don't do any PMs. (The effect is to cause more equipment repair jobs for you.) Among those who recommend PMs, they vary in recommended PM schedules for similar hardware (for example, disk drives).

The listing that follows is a consensus of recommendations of manufacturers, dealers, users, and the author's own experience.

OPTIMUM PM SCHEDULE

Modify the schedule if intermittents occur frequently.

Daily

Log Operational Time

- Estimate disk drive "run-light-on" time.

- Estimate printer "printing" time.

- Estimate computer "power-on" time.

Monitor Humidity

This is a measure of static electricity.

Weekly

Clean Computer System Work Area

Pick up all loose trash, reshelve scattered books, restore magazines, toss out old printed paper,

toss those “bad” disks you’ve been saving, wipe down hardware with an antistatic, dust-absorbing cloth, wipe desk and bench space with antistatic cloth, and vacuum shelves, desk, and floor.

Clean Equipment Housings and Cases

Wipe chassis with antistatic cloth, “wash” with lightly soaped damp cloth.

Clean Display Screens

Use antistatic “dust-off” type spray or damp cloth of antistatic solution.

Clean Drive Read Head

Clean drive read head after 40 hours of “run-light-on” use.

Monthly

Some manufacturers recommend that the drive read head be demagnetized after 40 hours “run-light-on” use.

Clean Inside Computer

Disassemble according to the procedures in Appendix D.

Use soft brush and long narrow vacuum cleaner hose nozzle (it helps to spray the nozzle with antistatic first).

Clean Inside Printer

Use same technique as for cleaning inside computer.

Check Ventilation Filters in Equipment

Replace if cleaning is not practical (filter becomes worn or badly soiled).

Check Connector Contacts

Look for signs of corrosion, pitting, or discoloration.

Clean if necessary. The corrosion-removing wipes that also coat the surface with a lubricating coating to protect it from atmospheric corrosion are strongly recommended.

Every Other Month

Reseat All Socketed Chips on the Motherboard and Peripheral Cards

Disassemble according to the procedures in Appendix D.

Disconnect and Reconnect Cable and Connector Plugs

This removes corrosion buildup.

Apply Antistatic Treatment to Computer Work Area

Clean Inside Printer

Use nonmagnetic, plastic vacuum hose nozzle and soft camel hair brush. Spray or wipe nozzle with antistatic spray or solution first.

Every Six Months

Replace Vent Filters

Only if some of the equipment has filters. None are standard in the IBM PC.

Check Disk Drive Speed

Speed test programs are advertised in computer publications.

Remember the room light, strobe mark test (see Chapter 3).

Check Head Alignment

Do this only if you suspect a disk problem.

Clean Connector Contacts

If you haven't done this during earlier inspection checks, conduct this PM now. Do this PM more often if the computer system is used in a smoggy part of the country or near salty air.

Clean Disk Drive Read Head

If the system is used daily, the drive heads may need cleaning about now, but this depends very

much on the kind and quality of floppy disks that are used.

Conduct Printer Routine Inspection

Do this every six months or 500,000 lines of print. Check the tightness of the screws and connectors. Conduct a printer self-test as described in the printer owner's manual.

Annually

Take Routine Maintenance Infrared Photo (optional)

Only do this if you're into this form of PM or troubleshooting.

J

Bibliography

- Anderson, Garry J. "Designer's Guide to the CMOS STD Bus," *Electronic Products* (November 17, 1983), pp. 81-87.
- Archibald, Dale. "The Making of the Magnetic Media for Micros," *Softalk* (February 1982), pp. 160-164.
- Babcoke, Carl. "Practical Information About Testing and Replacing Capacitors," *Electronic Servicing* (July 1970), pp. 28-37.
- Babcoke, Carl. "Quick Testing of Transistors," *Electronic Servicing* (November 1970), pp. 26-33.
- Babcoke, Carl. "Simple Servicing Tips," *Electronic Servicing & Technology* (July 1983), pp. 44-49.
- Baker, Alan, and Mielke, Neal. "Detecting Quality and Reliability Defects in EPROMs," *Electronic Test* (November 1983), pp. 56-62.
- Barden, William, Jr. "Getting Your Micro Repaired," *Popular Computing* (May 1983), pp. 54-58.
- Bausell, James. "Desoldering Components From High Density PCB's," *Electronics* (February 1984), pp. 97-101.
- Bausell, James. "Desoldering Components, Using Continuous Vacuum Solder Extraction," *Electronic Servicing & Technology* (May 1987), pp. 13-18.
- Beenker, F.P.M. "Systematic and Structured Methods for Digital Board Testing," *VLSI Systems Design* (January 1987), pp. 50-58.
- Belt, Forest. "1-2-3-4 Servicing Simplifies Industrial Electronic Maintenance," *Electronic Servicing* (September 1979), pp. 21-27.
- Bohannon, George. "The ABCs of IBM Graphics," *Softalk* (February 1983), pp. 30-36.
- Boyd, Alan. "System Notebook," *Softalk* (January 1983), pp. 60-64.
- Boyd, Alan. "System Notebook," *Softalk* (February 1983), pp. 82-85.
- Boyd, Alan. "System Notebook," *Softalk* (March 1983), pp. 108-110.
- Brenner, Robert C. *IBM PC Troubleshooting & Repair Guide*. Howard W. Sams & Company, Indianapolis, Indiana, 1986.

- Bristol, Rod. "Believable Time Measurements With Oscilloscopes," *Electronics Test* (October 1986), pp. 49-47.
- Camenker, Brian. "The Making of the IBM PC," *Byte* (November 1983), pp. 254-256.
- "Caring for a Personal Computer," *Electronic Servicing & Technology* (June 1985), pp. 42-47.
- "Choosing and Using the Proper Soldering Iron," *Electronic Servicing & Technology* (December 1981), pp. 36-39.
- Crosby, Mark L. "Singin' the Disk I/O Blues," *Apple Orchard* (Winter 1981/82), pp. 63-68.
- Cunningham, John E. "Troubleshooting Digital Equipment," *Electronic Servicing* (September 1980), pp. 18-21.
- Curran, Lawrence J., and Shuford, Richard S. "IBM's Estridge," *Byte* (November 1983), pp. 88-97.
- Dale, Alan. "1-2-3-4 Servicing," *Electronic Servicing* (December 1970), pp. 26-30.
- Dash, Glen. "Understanding EMI Test Methods Eases Product Acceptance," *EDN* (May 1983), pp. 183-192.
- Davidson, Homer L. "Ten Dogs in TV Repair," *Electronic Servicing & Technology* (September 1984), pp. 12-23.
- Davis, Dwight B. "Diagnostics Improve as Computer Systems Proliferate," *Mini-Micro Systems* (August 1982), pp. 115-123.
- Develop Test Technology for VHSIC*. RADC-TR-83-148, Rome Air Development Center, Air Force Systems Command, Griffiss AFB, New York, September 1983.
- DeVoney, Chris. *IBM's Personal Computer*. Que Corporation, Indianapolis, Indiana, 1983.
- DeVore, John A. "To Solder Easily," *Circuits Manufacturing* (June 1984), pp. 62-70.
- Dvorak, John C. "Let's Modernize the Microcomputer," *PC Magazine* (October 28, 1986), pp. 77.
- Earle, A. Scott. "Taking a Closer Look at the RGB Monitor," *PC Magazine* (April 3, 1984), pp. 145-154.
- Engel, George M. "Line Cleaner—A Construction Project," *inCider* (August 1983), pp. 108-110.
- Fastie, Will. "The IBM Personal Computer," *Creative Computing* (December 1981), pp. 19-40.
- Field, Tim. "The IBM PC and the Intel 8087 Coprocessor," *Byte* (August 1983), pp. 331-374.
- Field, Tim. "Enhancing Screen Displays for the IBM PC," *Byte* (November 1983), pp. 99-116.
- Final Report: The Identification and Assessment of On-Chip Self-Test and Repair Concepts*. Naval Electronics Systems Command, September 1981.
- Freedman, David H. "Designing the Right Enclosure," *Mini-Micro Systems* (August 1983), pp. 229-242.
- Freitag, Walter D. "Lubricants for Separable Connectors," *IEEE Transactions on Parts, Hybrids, and Packaging* (March 1977), p. 32.
- Glasco, David B. "Using IBM's Marvelous Keyboard," *Byte* (May 1983), pp. 402-415.
- Glinert-Cole, Susan. "Upgrading a PC to an 'Xtra T,'" *PC Tech Journal* (February 1984), pp. 75-82.

- Goldblatt, Robert C. "How Computers Can Test Their Own Memories," *Computer Design* (July 1976), pp. 125-129.
- Goodman, Robert. "An Ounce of Prevention," *Electronic Servicing & Technology* (May 1983), pp. 24-39.
- Goodman, Robert L. "Techniques for Repairing Intermittents," *Electronic Servicing* (July 1979), pp. 33-39.
- Goodstein, Max. "Learning From a Tough Dog TV Repair," *Electronic Servicing & Technology* (April 1987), pp. 25, 57.
- Grolle, Carl G. *Electronic Technician's Handbook of Time-Savers and Shortcuts*. Parker Publishing Company, Inc., West Nyack, New York, 1974.
- Hancock, Earle. "A Man of Letters," *inCider* (December 1983), pp. 172-174.
- Hancock, Earle. "Do-It-Yourself Disk Drive Repair," *inCider* (November 1983), pp. 32-34.
- Harwood, Robert. "Diagnostic and Utility Software," *Personal Computing* (October 1981), pp. 47-54, 166-169.
- Hogan, Thom. "We're Not in Kansas Anymore," *The Portable Companion* (June/July 1982), pp. 11-14.
- Howson, Hugh R. "POKEing Around in the IBM PC," *Byte* (November 1983), pp. 121-131.
- Hunter, David. "The Roots of DOS," *Softalk* (March 1983), pp. 12-15.
- Illowsky, Dan, and Abrash, Michael. "Up, Down, Right, Left & Check," *PC Tech Journal* (February 1984), pp. 93-116.
- Izen, Bud. "Microcomputer Troubleshooting: Components of a Personal Computer," *Electronic Servicing & Technology* (November 1985), pp. 22-27.
- Jesson, Joseph E. "Smart Keyboards Help Eliminate Entry Errors," *Computer Design* (October 1982), pp. 137-142.
- Kaminer, David A. "What to Do When Your System Crashes," *Popular Computing* (April 1983), pp. 154-156.
- Kear, Fred W. "Board Warp: Causes and Prevention," *Circuits Manufacturing* (December 1983), pp. 95-98.
- Lafore, Robert. *Assembly Language Primer for the IBM PC*. Plume/Waite, San Rafael, California, 1984.
- Lancaster, Don. *CMOS Cookbook*. Howard W. Sams & Company, Indianapolis, Indiana, 1977.
- Lemons, Phil. "The IBM Personal Computer First Impressions," *Byte* (October 1981), pp. 27-34.
- Lemons, Wayne. "Streamlined Tests for Transistors," *Electronic Servicing* (August 1977), pp. 34-39.
- Lewis, Gordon. "Disks, Drives, and Dirt," *Pro/Files* (September/October 1983), pp. 59-61.
- Lieberman, David. "Data Input Alternatives," *Electronic Products* (June 6, 1983), pp. 47-55.
- Lieberman, David. "The Clean Connection," *Nibble*, Vol. 2/No. 8 (1981), pp. 159-165.
- Little, M. Andre. "System Security," *inCider* (December 1983), pp. 117-121.

- Littlefield, Patti. "What to Try Before Taking Your Microcomputer Into the Repair Department," *Educational Computer Magazine* (May-June 1983), p. 73.
- Loop, Roger. "Buying a Digital Scope," *Electronic Products* (May 15, 1987), pp. 38-47.
- Machrone, Bill. "How Boca Does It," *PC Magazine* (August 1983), pp. 111-115.
- Machrone, Bill. "User-to-User," *PC Magazine* (August 1983), pp. 565-566.
- Mann, Timothy J. "Disk Cleaner," *inCider* (October 1983), pp. 166-168.
- Margolis, Art. *Troubleshooting & Repairing Personal Computers*. Tab Books, Inc., Blue Ridge Summit, Pennsylvania, 1983.
- May, Larry. "Choosing a Keyboard Technology," *Electronic Products* (September 30, 1983), pp. 91-96.
- McCain, John. "Spikes: Pesky Voltage Transients and How to Minimize Their Effects," *Byte* (November 1977), pp. 54-56.
- McCann, Scott. "Using a Switch-type Joystick on the IBM PC," *PC Tech Journal* (May 1984), p. 195.
- McClain, Larry. "Servicing Your System: Be Prepared," *Personal Computing* (September 1982), pp. 50-55, 148-154.
- McLanahan, David. "Here are Some Sources for Parts and Information," *Electronic Servicing & Technology* (June 1985), pp. 25-28.
- McMullen, Barbare E., and John F. "How Blue Can You Get?" *PC Magazine* (April 3, 1984), pp. 112-113.
- Miastkowski, Stan. "A Close Look at the IBM Personal Computer," *Popular Computing* (December 1981), pp. 52-57.
- Microsystem Components Handbook: Peripherals Volume II*, Intel Corporation, Santa Clara, California, 1986.
- Miller, Beth. "Microsystem Reliability Testing," *Electronic Test* (November 1983), pp. 48-54.
- Milner, Edward J. "Fast Memory Test Checks Individual Bits," *EDN* (October 13, 1983), pp. 222-229.
- Morgan, Chris. "IBM's Personal Computer," *Byte* (July 1981), pp. 6-10.
- Morgan, Christopher L. *Bluebook of Assembly Routines for the IBM PC*. New American Library, San Rafael, California, 1984.
- Norton, Peter. "Snooping in ROM: The Software Interrupt," *Softalk* (February 1983), pp. 87-89.
- Norton, Peter. "Snooping in ROM: The Computer Musician," *Softalk* (March 1983), pp. 79-81.
- Norton, Peter. "Snooping in ROM: Which Version Did You Get?" *Softalk* (January 1983), pp. 86-88.
- Persson, Conrad. "Oscilloscope: The Eyes of the Technician," *Electronic Servicing & Technology* (April 1987), pp. 10-14.
- Petzold, Charles. "PC Tutor," *PC Magazine* (August 1986), pp. 439, 442.
- Pingry, Julie. "The Expanding Real World of the IBM PC," *Digital Design* (February 1984), pp. 80-88.
- Poole, Lon. "Under the Hood of the PC," *PC Magazine* (September 1982), pp. 50-58.
- Final Technical Report: RADC Testability Notebook*. RADC-TR-82-189, Rome Air Development Center, Griffiss AFB, New York, June 1982.

- Radding, Alan. "When Your Computer Breaks Down," *Popular Computing* (May 1983), pp. 196-198.
- Rampil, Ira. "A Floppy Disk Tutorial," *Byte* (December 1977), pp. 24-45.
- Rechsteiner, Emil B. "Keeping Power Clean and Steady," *Mini-Micro Systems* (August 1983), pp. 245-252.
- Riccio, Ronald. "How to Avoid Damage When Repairing PC Boards," *Electronic Servicing & Technology* (February 1983), pp. 38-42.
- Robinson, J. B. *Modern Digital Troubleshooting*. Data I/O Corporation, Redmond, Washington, 1983.
- Rosch, Winn L. "High-resolution Color Monitors," *PC Magazine* (June 1983), pp. 247-258.
- Sargent, Murry III and Shoemaker, Richard L. *The IBM Personal Computer From the Inside Out*. Addison-Wesley Publishing Co., Reading, Massachusetts, 1984.
- Schilling, Robert, Jr. "Hardware Diagnostics for the Home," *Popular Computing* (August 1983), pp. 204-210.
- Scovern, John L. "No Corrosion with Antistat," *Circuits Manufacturing* (January 1983), pp. 51-53.
- Signetics Logic-TTL Data Manual*, Signetics Corp., Sunnyvale, California, 1978.
- Sloop, Joe. "Troubleshooting Logic Systems Logically," *Electronic Servicing & Technology* (July 1983), pp. 26-37.
- Socha, John. "The Monochrome/Color Switch," *Softalk* (February 1983), pp. 31-33.
- Somerson, Paul. "Goblins, Gremlins & Glitches," *PC Magazine* (October 1983), pp. 111-129.
- Somerson, Paul. "User-to-User," *PC Magazine* (June 12, 1984), pp. 434-437.
- Somerson, Paul. "User-to-User," *PC Magazine* (October 28, 1986), p. 331.
- The Primer of High-performance In-circuit Testing*, FACTRON, Latham Company, New York, 1985.
- Updegraff, Stephen W. "Better Than Gold—Substrate Coating Surpasses Gold in Hi-Rel Connectors," *Circuits Manufacturing* (December 1983), pp. 54-59.
- Victor, Jesse. "Low Noise Topologies, Innovative Designs to be Spotlighted at Powercon 9," *EDN* (June 9, 1982), pp. 75-84.
- Wattson, Carolyn. "Desoldering Today's Circuit Components," *Electronic Servicing & Technology* (October 1984), pp. 26-28.
- Weissman, Ed. "Letters to PC Magazine," *PC Magazine* (August 1986), p. 15.
- Whitaker, Lewis A. "Maintenance Alternatives for Personal Computers," *Byte* (June 1982), pp. 452-459.
- Williams, Gregg. "A Closer Look at the IBM Personal Computer," *Byte* (January 1982), pp. 36-68.
- "Wohl Talks About Peanuts and Other PCs," *Government Computer News* (December 1983), p. 5.
- Zachmann, Mark. "PC Tutor," *PC Magazine* (June 1983), pp. 65-83.
- Zachmann, Mark. "PC Tutor," *PC Magazine* (July 1983), pp. 69-74.

Zachmann, Mark. "PC Tutor," *PC Magazine*
(October 1983), pp. 577-585.

Zachmann, Mark. "PC Tutor," *PC Magazine*
(May 29, 1984), pp. 393-397.

Index

6845 chip select circuitry, 100
6845 clock generation circuitry, 100-102
6845 CRT controller (CRTC), 82-88
6845 enable circuitry, 100
8087 numeric data processor (coprocessor), 7
8087 numeric processor extension (NPX), 75-79
8087 system performance problems, intermittent, 79
8088 bus interface unit (BIU), 22
8088 CPU operation, 20-23
8088 execution unit, 21-22
8088 instruction pointer, 23
8088 instruction queue, 22-23
8088 segment registers, 23
8088-based IBM PC system, 15-20
8237 direct memory access (DMA) controller, 10
8237 programmable DMA controller (DMAC), 32-39
8253 programmable interval timer (PIT), 10, 29-31
8255 programmable peripheral interface (PPI), 10, 39-42
8259 interrupt circuitry, 63-65
8259 programmable interrupt controller (PIC), 8
8288 clock generator, 9
8288 outputs, 28-29

A

Adapter board clock circuitry, 119

Address bus multiplexing, 52-53
Adjust radial head, 192-193
Adjust track 00 switch, 190
Adjustment, index sensor, 193-194
Advanced troubleshooting techniques, 152-161
Alignment, disk drive, 189
Arithmetic logic unit (ALU), 1
Azimuth check, 194

B

Bad or no color but image correct, 226
Both drive lights come on, 182
Bus testing, 142-143

C

Cable hookup, improper, 140
Can't access either drive, 207-209
Can't read or boot DOS diskette, 183
Can't read from either drive, 182-183, 206
Can't read from one drive, 202-203
Can't write to either drive, 207
Can't write to one drive, 206-207
Capacitance measuring, 165-166
Capacitors, 134-135
Cassette
 can't load data from tape, 236
 can't write data to tape, 231, 236

Character is produced, wrong, 228-229
Chip listing
 color graphics adapter, 261
 monochrome monitor/printer adapter, 260
 system board, 259
Chip select circuitry, 51-52
Chips, 132-134
Circuit board repair, 172
Classical steps to successful troubleshooting, 128-131
Cleaning connections, 130
Clock generation circuitry, 16-19
Color
 no graphics but text works, 221
 no horizontal sync, 217-218
 no text but graphics works, 220-221
 no vertical sync, 219-220
Color adapter board 6845 CRTC, 99-100
Color adapter board reset circuitry, 105-106
Color display problems, 179
Color graphics adapter
 bad characters, 221, 224
 no display, 216-217
Color graphics adapter card, 99
Color graphics adapter chip listing, 261
Color selection, 103
Color/graphics mode, selecting, 102-103
Colors available in alphanumeric mode, 103-104
Common memory tests, 144
Composite video, 108-111
Computer locks up while running, 210-211
Connections, 4-5
 cleaning, 130

Control signals, 44-45
 Cool it, 163-164
 CPU bus cycle, 25-29
 CRT registers, loading, 90
 CRTC, reading information out of, 92
 Current tracer, 155-156
 Cursor missing or not blinking, 227
 Cursor problem, 180

D

Data recording technique, 116-117
 Data recovery circuitry, 124-126
 Diagnose to a section, 130-131
 Diagnostic software, 141-142
 Diodes, 134
 Disassembly instructions, system unit, 267
 Disk boots in drive A, no, 182
 Disk drive alignment, 189
 Disk drive disassembly, 187
 Disk drive electronics, 116
 Disk drive head cleaning, 183-184
 Disk drive head cleaning interval, 186
 Disk drive problems, 182
 Disk drive read circuitry, 123
 Disk drive write circuitry, 121-123
 Disk format, 117
 Disk speed program, 187-188
 Disk speed tests, 186-187
 Display problems, 179-187, 212-227
 DMA circuitry, 120
 Documenting your progress, 140
 DOS diskette, can't read or boot, 183
 Drive, can't read from either, 182-183
 Drive destroys data on write-protected disk, 209-210
 Drive destroys write-protected data, 182
 Drive light on but no data to memory, 183
 Drive lights come on, both, 182
 Drive motor control circuitry, 120-121
 Drive operates intermittently, 183
 Drive writes/erases data on write-protected disk, 183

E

Easter egg approach, 165
 Electrostatic discharge, 138-139
 Error code displayed, self-test, 177-179
 Error message, seek, 182
 External interrupts, 63

F

Fading, 180
 FDC electronics, 115-116

FDC operation, 113
 FDC operational phases, 113-115
 Floppy disk drive interface, 111-126

G

Get unwanted repeat key action, 182

H

Hardware approach, 145
 Heat it, 163-164
 Horizontal drive generation, 110
 Horizontal sync problem, 180
 How characters are produced, 92-111
 How disk drives fail, 136-137
 How displays fail, 137
 How to localize failures, 140-150

I

I/O interfaces, 6
 I/O logic, testing, 142
 I/O memory operation, 59-61
 IC testers, 156
 Improper cable hookup, 140
 Improper soldering/desoldering, 139
 Index sensor adjustment, 193-194
 Input/output problems, 231-239
 Installing wrong replacement part, 139-140
 Integrated circuits, 132-134
 Interface, floppy disk drive, 111-126
 Interference, noise, 140
 Intermittent 8087 system performance problems, 79
 Intermittent failures, 148-150
 Internal components, 5
 Internal interrupts, 63
 Interrupt logic, testing, 142
 Interrupt sequence, 65-66
 Interrupts, 61-68
 Introduction to troubleshooting, 127-128
 Isolate to a failed part, 131

K

Key won't work, one, 230
 Keyboard, 2, 68-74
 Keyboard disassembly, 268
 Keyboard problems, 181, 228-231
 Keyboard reassembly, 271
 Keyboard won't respond, 228-229
 Keys won't work, a few, 230

L

Light pen won't work, 236
 Loading CRT registers, 90
 Localize to a stage, 131
 Logic analyzers, 159-160
 Logic clip, 153
 Logic probe, 153-154
 Logic pulser, 154-155

M

Main status register, 113
 Memory and I/O access, 44-45
 Memory operation, RAM, 49-52
 Memory switch assignment, 58-59
 Memory tests, 143, 144
 Memory utilization, 104-105
 Meters, 152-153
 Microvolt measuring a piece of wire, 165
 Mode control port 1 (3B8H), 88-89
 Monitoring status of video, 104
 Monochrome adapter
 no display, 212-213
 no horizontal sync, 213
 no low or high resolution display, 215
 no vertical sync, 215
 Monochrome card installed, system shuts down, 180
 Monochrome display problem, 180
 Monochrome monitor/printer adapter, 82, 260

N

No disk boots in drive A, 182
 No fan and screen blank, 199
 No keys respond, 181-182
 No power, 176
 No video, 179-180, 180
 Noise interference, 140
 Non-maskable interrupt (NMI), 66-68

O

One key won't work, 230
 Optimum PM schedule, 279
 Oscilloscope, 156-159
 Other troubleshooting techniques, 163-165
 Output unit, 3-4

P

Parity, 55-58
 PC memory architecture, 42-43

Physical address generation, 23-25
 Piggybacking, 164
 Power good signal, 15
 Power supply, 11, 13-15
 Power supply installation, 272
 Power supply removal, 268
 Power turns off after running for a while, 212
 Printer card installed, system shuts down, 181
 Printer locks up or prints garbage, 237
 Printer problems, 180-181
 Printer won't print, 181, 236-237
 Prints garbage, 181
 Proper documentation of faults, 150

R

Radial head, adjust, 192-193
 Radial head alignment (tracking), 191-193
 RAM diagnostics, 143-145
 RAM memory operation, 49-52
 Random access memory (RAM), 10, 48-49
 Read cycle, 50
 Read only memory (ROM), 10, 45-48
 Reading information out of CRTC, 92
 Reassembling system unit case, 271
 Recommended safety precautions, 151-152
 Refresh, 54-55
 Reinstalling system board, 271
 Removing solder, 168-171
 Repair generated failures, 138-140
 Repeat action, unwanted, 230-231
 Replacement part, installing wrong, 139-140
 Replacing capacitors, 166
 Reset, 19-20
 Reset circuitry, color adapter board, 105-106
 Resistors, 135-136
 ROM diagnostics, 143
 Run problems, 201-212

S

Seek error message, 182
 Selecting color/graphics mode, 102-103
 Self-diagnosis, 145

Self-test error code displayed, 177-179
 Senses, use your, 163
 Set track 00 stop adjustment screw, 190-191
 Signal, power good, 15
 Signature analyzer, 160-161
 Single key won't work, 182
 Software, diagnostic, 141-142
 Software approach, 140-141
 Solder, removing, 168-171
 Soldering and desoldering techniques, 168-172
 Soldering tips, 171-172
 Soldering/desoldering, improper, 139
 Spare parts, 173
 Speaker won't work, 237, 239
 Special handling, 152
 Start-up problems, 198-201
 Status port (3BAH), 89-91
 Status register, main, 113
 Successful troubleshooting, steps to, 128-131
 Symptom analysis, 130
 System board, 5-6
 reinstalling, 271
 System board chip layout, 6
 System board chip listing, 259
 System board interface, 117-119
 System board problem, 176
 System shuts down with monochrome card installed, 180
 System shuts down with printer card installed, 181
 System unit case, reassembling, 271
 System unit disassembly instructions, 267
 System unit reassembly instructions, 271

T

Terminal count (T/C), 38-39
 Testing capacitors, 165
 Testing diodes, 166
 Testing I/O logic, 142
 Testing interrupt logic, 142
 Testing transistors, 166-168
 Tools required, 184-186
 Tools of trade, 152

Track 00 adjustments, 189-191
 Track 00 stop adjustment screw, set, 190-191
 Track 00 switch, adjust, 190
 Transistors, 134
 Troubleshooting, introduction to, 127-128
 Troubleshooting and repair equipment, 172-173
 Tuning lamp, 188-189

U

Understanding how components fail, 132-136
 Unwanted repeat action, 230-231
 Use your senses, 163
 Using tools to find failed components, 161-163

V

Validating the problem, 150-151
 Vertical drive generation, 110
 Vertical sync problem, 180
 Video, 79-91
 composite, 108-111
 monitoring status of, 104
 no, 179-180
 Video memory problem, 180
 Video output signals, 106-108
 Visual inspection, 130

W

Won't boot
 both drive lights on, 200-201
 fan works and screen blank, 199-200
 Write cycle, 50, 50-51
 Write enable circuitry, 52
 Write-protected data, drive destroys, 182
 Write-protected disk, drive writes/erases data on, 183
 Wrong character is produced, 228-229
 Wrong color, 180

