

MG-150
MONOGRAPHICS CARD
with 1 parallel port included
USER'S MANUAL

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-D02671106-

Thank you for purchasing the MG-150 MONOGRAPHICS CARD for your IBM PC, PC-XT, PC Portable or compatible. The MG-150 is high quality, high reliability monochrome graphics card designed to give you the flexibility and versatility needed for a wide variety of graphics application programs. The MG-150 uses a high resolution monochrome character set, similar to IBM, and includes a parallel port.

FEATURES:

1. Text mode 80 column x 25 lines
2. Graphic mode 720 x 348 pixels
3. 1 parallel printer port
4. Fully compatible with IBM monochrome display/printer and Hercules graphics card.

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- CONTENTS -

I. Fast Start with 1-2-3	Pg. 1
II. Introduction	Pg. 2
III. Installation	Pg. 5
IV. Technical Information	Pg. 8
V. Connector Pin Assignment	Pg.16
VI. Troubleshooting	Pg.18
VII. Update NOTE	Pg.19
VIII.Attachment	Pg.22

I. FAST START WITH 1-2-3

To get 1-2-3 running on your MG-150 monographics card use the following steps:

1. Install your MG-150 into your motherboard following the procedure described in section III of your User's Manual. Make sure that JUMPER switch J3 in your MG-150 was set as shown in Figure 2-1.
2. Edit 1-2-3's AUTOEXEC file by placing the 1-2-3 System Disk in drive A. With "A>" appearing on your screen, type:

```
COPY CON:AUTOEXEC.BAT      ENTER
DATE                        ENTER
TIME                        ENTER
LOTUS                       ENTER
F6 (function key F6)       ENTER
```

3. Repeat step 2 with the 1-2-3 backup System Disk.
4. You are now ready to start 1-2-3 by pressing the ALT-CTRL-DEL keys simultaneously.

NOTE: The Fast Start section is intended to give the experienced user a quick guideline for installation and operation of the MG-150 monochrome graphics card. It should not be considered as substitute for a thorough reading of the MG-150 user's manual.

II. INTRODUCTION

The MG-150 MONOCHROME GRAPHICS CARD includes a parallel printer port that is designed to work with the IBM dot matrix printer.

The following two display modes are available:

1. TEXT MODE: 80 columns x 25 lines
2. GRAPHICS MODE: 720 columns x 348 addressable dots

In TEXT mode, each byte in the buffer controls a character of 9 by 14 dots. The pattern of these characters are predefined and the user can specify an 8 bit code to call them to the screen. There is a byte to control the attributes of each character being displayed.

The attributes can be:

- NORMAL: a white character on a black screen.
- REVERSE: a black character on a white background.
- HIGHLIGHT: brighter color. (intensified body)
- BLINK: blinking at a rate of 0.5 second.
- UNDERLINE: underline the character being displayed.

In TEXT mode, the display buffer provides two independent pages of 80 columns by 25 lines each, only one of which is displayed at a time.

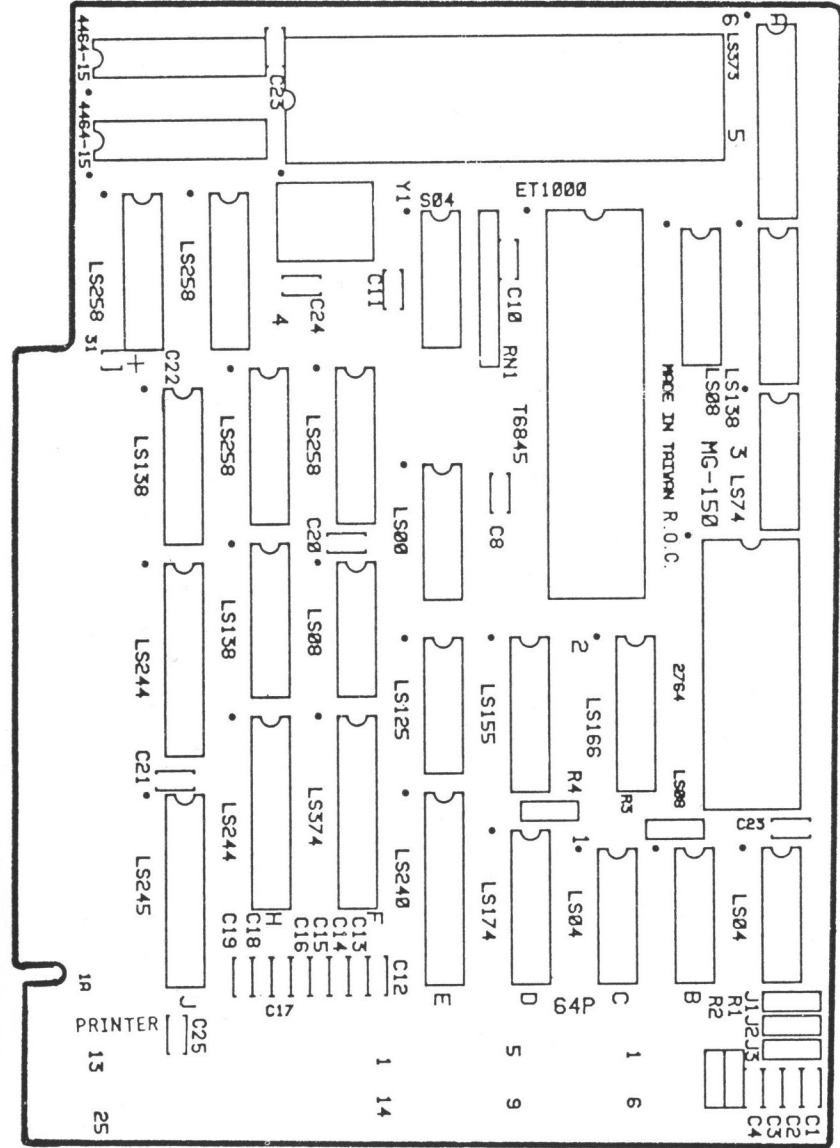
In GRAPHICS mode, the bits in the buffer control the actual dots on the screen. Screen patterns are formed by writing 1's and 0's to the buffer. The buffer is organized as two complete screens that can be alternately displayed. This feature makes it possible to compose one pattern while displaying another, which is particularly useful for animation.

The printing function is implemented using strictly input and output ports with a parallel interface printer. Handshake signals are provided from the I/O ports to allow the use of printers that operate at different speeds.

Your MG-150 MONOCHROME GRAPHICS CARD is directly compatible with the IBM Monochrome card in TEXT mode using the PRINTER port with an additional capability of 720 x 348 pixel graphics on a monochrome monitor.

Application software such as Lotus 1-2-3, SYMPHONY, H BASIC, S BASIC and many others can operate using the MG-150 MONOGRAPHICS CARD. Please contact your dealer for details concerning compatibility with other application software packages.

SILK SCREEN



III. INSTALLATION

Following these steps to install your MG-150 MONOCHROME GRAPHICS CARD:

1. Turn off your system power unit, remove the cover.
2. Make sure that there is not an IBM Monochrome Display/Printer Adapter, IBM Color Graphic Adapter, or any other video card in your system. Set the hardware configuration switch (J3) as shown in Figure 2-1. For systems which include an IBM Color Graphics Adapter, to avoid display memory conflict, please set the hardware configuration switch as shown in Figure 2-2.
3. Set JUMPER Switch J1 & J2 as shown in Figure 3 to select the proper PRINTER port.

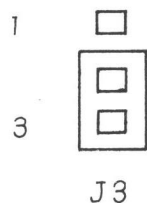


Figure 2-1

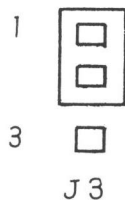
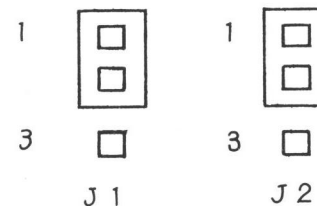
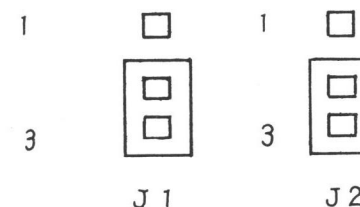


Figure 2-2



Select Primary Printer Port

Figure 3-1



Select Secondary Printer Port

Figure 3-2

4. Locate an empty expansion slot.
5. Remove the metal plate on the back panel of the system unit opposite the slot you have chosen for the Monochrome Graphics Card.
6. Snap the card guide into the hole on the front panel opposite the slot.

7. Firmly press the Monochrome Graphics Card downwards into the slot.
8. Replace the screw to secure the bracket and card.
9. Set the switch settings on the motherboard for the Monochrome display. (Consult your system manual for proper switch settings.)

IV. TECHNICAL INFORMATION

A. DISPLAY BUFFER

In TEXT mode, each 16 bit word represents one character with the character code in the even byte and the attribute code in the odd byte. Each line of text (80 characters) uses up to 160 consecutive bytes.

There are two text pages, with page 0 starting at &HB0000 to &HB0FFF and page 1 at &HB8000 to &HB8FFF. By writing a '0' to bit 7 of the display mode control port (&H3B8) will select page 0 for display and writing a '1' will select page 1.

The attribute is controlled by the attribute data byte as follows:

DATA BIT:

7	6	5	4	3	2	1	0	ATTRIBUTE
B	0	0	0	I	0	0	0	BLANK
B	0	0	0	I	0	0	1	UNDERLINE
B	0	0	0	I	1	1	1	NORMAL VIDEO
B	1	1	1	I	0	0	0	REVERSE VIDEO

WHERE:

I = 0 for normal body intensity
 = 1 for high body intensity

IF BLINK ENABLE = 0 (i.e. the display mode control port bit 5 = 0)

B = 0 for normal background intensity
= 1 for intensified background

If BLINK ENABLE = 1
 B = 0 for blink off
 = 1 for blink on

Display Buffer Address Calculation:

1. Text Mode:

Offset of the character code of a
character = $160 \times (\text{LINE} - 1) + 2$
 $\times (\text{COLUMN} - 1)$

Offset of the attribute of a
character = $160 \times (\text{LINE} - 1) + 2$
 $\times (\text{COLUMN} - 1) + 1$

Where LINE is between 1 and 25
 COLUMN is between 1 and 80

2. 720 x 348 Graphics Mode:

In graphics mode, each horizontal
line of 720 dots is stored in the
buffer as 90 consecutive bytes
with bit 7 as the leftmost bit on
the screen. The buffer stores
two full screens by putting page
0 at B0000 to B7FFF and page 1 at
B8000 to BFFFF. Each page is
divided into one line from field
0, and then goes to fields 1, 2
and 3. This sequence continues
for the entire screen so that
adjacent lines from the same
field are displayed 4 lines apart
on the screen.

Address Calculation:

The offset (into the page) of the
byte containing dot (X, Y) in
each page is:

$[2000H * (Y \text{ MOD } 4)] + [90 *$
 $\text{INTEGER } (Y/4)] + [\text{INTEGER } (X/8)]$
and the bit in the byte that
stores the dot is bit position 7
 $- (X \text{ MOD } 8)$

Where X is between 0 and 719
 Y is between 0 and 347

B. I/O INTERFACE

I/O PORTS:

3B4 6845 ADDRESS REGISTER
3B5 6845 DATA REGISTER
3B8 DISPLAY MODE CONTROL PORT
3BA DISPLAY STATUS PORT
3BC PRIMARY PRINTER DATA PORT
3BD PRIMARY PRINTER STATUS PORT
3BE PRIMARY PRINTER CONTROL PORT
3BF CONFIGURATION SWITCH
378 SECONDARY PRINTER DATA PORT
379 SECONDARY PRINTER STATUS PORT
37A SECONDARY PRINTER CONTROL PORT

1. 6845 REGISTER TABLE (3B5 WITH
REGISTER # WRITTEN TO 3B4)

REG.#	VIDEO PARAMETER	TEXT VALUE	GRAPHICS VALUE	UNIT
R0	HORIZONTAL TOTAL	61H	35H	CHAR
R1	HORIZONTAL DISPLAY	50H	2DH	CHAR
R2	HSYNC POSITION	52H	2EH	CHAR
R3	HSYNC WIDTH	0FH	07H	CHAR
R4	VERTICAL TOTAL	19H	5BH	ROWS
R5	VERTICAL ADJUST	06H	02H	LINES
R6	VERTICAL DISPLAYED	19H	57H	CHAR
R7	VSYNC POSITION	19H	57H	CHAR
R8	INTERLACE MODE	02H	02H	ROWS
R9	MAX. SCAN LINE ADDR	0DH	03H	----
R10	HORIZONTAL DISPLAY	0BH	00H	LINES
R11	HORIZONTAL DISPLAY	0CH	00H	LINES
R12	SCREEN START ADDR(H)	00H	00H	----
R13	SCREEN START ADDR(L)	00H	00H	----
R14	CURSOR ADDR (H)	00H	00H	----
R15	CURSOR ADDR (L)	00H	00H	----

NOTE: For more technical information about the 6845 CRT controller chip, please refer to the 6845 manual.

2. DISPLAY MODE CONTROL PORT (3B8)

BIT 1: GRAPHICS ENABLE

When cleared to 0, the video information comes from the character generator and the attribute decoding logic. The character codes are fetched from even bytes in the display buffer. The corresponding attribute codes are fetched from the next odd byte. When this bit is set to 1, video information comes from the graphic display buffer itself.

BIT 3: VIDEO ENABLE

This bit gates the video information onto the screen.

BIT 5: BLINK ENABLE

This bit is used only when the graphics enable bit is cleared. It causes a character to blink if its attribute code has bit 7 set.

BIT 7: PAGE SELECT

This bit selects the display page in both text and graphics modes.

NOTE: BIT 0, 2, 4 & 6 are not used

3. DISPLAY STATUS PORT (3BA)

BIT 0: HORIZONTAL SYNC

This bit is set during the horizontal retrace period.

BIT 2: LIGHT PEN SWITCH MODE

Light pen switch status is set to on.

BIT 3: VIDEO OUTPUT

This bit echoes the video signal being sent to the screen.

BIT 7: VERTICAL SYNC

This bit is cleared during the vertical retrace period.

4. PRINTER CONTROL PORT (3BE & 37A)

BIT 0: STROBE-

A "0" in this bit causes the printer to read the data. The period must be 0.5 microseconds.

BIT 1: AUTOFEED+

Setting this bit causes the printer to line feed after printing.

BIT 2: INIT-

A "0" in this bit resets the printer.

BIT 3: SELECT+

Setting this bit selects the printer and enables subsequent data transfers.

BIT 4: IRQ7 ENABLE+

Setting this bit causes a level 7 interrupt to be generated each time the printer acknowledges a transfer of data.

5. PRINTER STATUS PORT (3BD & 379)

BIT 3: ERROR-

This bit is set if the printer shows no fault in operation.

BIT 4: SELECT STATUS+

This bit is set when the printer is in the selected state and ready to accept data.

BIT 5: PAPER OUT+

This bit is set when the printer is out of paper.

BIT 6: ACK-

This bit is cleared for about 5 microseconds when the printer is ready to accept another data transfer.

BIT 7: BUSY-

This bit is set when the printer is ready to accept data. It will be cleared during data entries, printing operations and error states. The printer will also clear this bit when it is offline.

6. SOFTWARE CONFIGURATION SWITCH (3BF)

BIT 0:

0 = prevents the setting of graphics mode (bit 1 of Display Mode Control Port).

1 = allows the setting of graphics mode bit (bit 1 of Display Mode Control Port).

BIT 1:

0 = mask page 1 (B8000-BFFFF) out of the memory map and prevent the setting of page bit (bit 7 of Display Mode Control Port).

1 = bring page 1 (B8000-BFFFF) into the memory map and allow the setting of page bit (bit 7 of Display Mode Control Port).

V. CONNECTOR PIN ASSIGNMENT

A. VIDEO PORT

PIN	SIGNAL NAME
---	-----
1	GROUND
2	GROUND
3	N. C.
4	N. C.
5	N. C.
6	HIGH LIGHT
7	VIDEO
8	HORIZONTAL DRIVE
9	VERTICAL DRIVE

B. PRINTER PORT

PIN	SIGNAL NAME
---	-----
1	-STROBE
2	DATA 0
3	DATA 1
4	DATA 2
5	DATA 3
6	DATA 4
7	DATA 5
8	DATA 6
9	DATA 7
10	-ACK
11	BUSY
12	PAPER EMPTY
13	+SELECT
14	-AUTO FDXT
15	-ERROR
16	-INIT
17	-SLCTIN
18	GROUND

PIN	SIGNAL NAME
19	GROUND
20	GROUND
21	GROUND
22	GROUND
23	GROUND
24	GROUND
25	GROUND

VI. TROUBLESHOOTING

Please check the following conditions in the event you experience difficulties using your MG-150 MONOGRAPHICS CARD:

- A. Make sure that your Jumper switch J3 setting as Figure 2-1. (i.e. page 0 and page 1 are in the display memory map) before attempting to run 1-2-3, SYMPHONY or HBASIC.
- B. Make sure that all software you plan to use is fully compatible with your MG-150 MONOGRAPHICS CARD (check with your dealer).
- C. If you are using an IBM Color Graphics Adapter in your system at the same time as you are using your MG-150 DIAMOND MONOGRAPHICS CARD, please check to make sure that your Jumper switch J3 setting as Figure 2-2 (i.e. only page 0 is in the display memory map).

VII. UPDATE NOTE

Now the mg-150 monographics card provides you the accompanying software package which contains three utility programs, mg.com and mg-150.com and pspool.com, to enhance your usage.

A. The MG Command

The mg command, providing three command syntax, specifies the various options to enable the 64k memory of the video display buffer. The commands are as following:

MG DIAG <enter>

This will enable the 4k bytes memory in text mode.

MG FULL <enter>

This will divide the 64k display buffer into two pages in graphic mode.

MG HALF <enter>

This will enable one page of the 32k display buffer in graphic mode.

B. The MG-150 Command

This mg-150 is a demo program and provides you options to test memory, video display, and printer port attachment.

C. The PSPPOOL Command

This program is a printer spooler which provides queued print_out data to a parallel or serial printer during concurrent processing of other programs. Files to be printed will be output to the PSPPOOL queue, and the PSPPOOL program will handle the output to the printer at printer speed.

PSPPOOL must be initialized each time you turn on your PC. This section describes the commands which you can use to install printer spooler or to clear the printer buffer.

To install PSPPOOL, use the command format as following:

PSPPOOL n # <enter>

Note: N must be between 1 and 7 to allocate n blocks, with 8,000 bytes each. "#" refers to printer # for output, and it must be 1, 2, or 3, and defaults to 1.

After PSPPOOL is installed, if you want to clear the printer buffer, terminating any printing in progress, type:

PSPPOOL <enter>

D. The COLOR Command

The COLOR command adds color graphics capability to your monochrome system. With this added feature, you do the following:

- You can emulate color graphics and switch back and forth between the emulation and the default monochrome graphics.
- The COLOR command also allows you to boot color games that require a system reset to run.

1. Invoking Color Graphics Emulation

Many software programs are written to run only with a color graphics adapter. Our COLOR.COM bypasses this barrier when using our monochrome graphics. The MG-150 can emulate a CGA, but only in black and white.

To start the CGA emulation, enter this command from the DOS prompt:

COLOR C <enter>

To shift from CGA emulation back to the default 80 x 25 monochrome mode, enter this command at the DOS prompt:

COLOR T <enter>

2. Booting Color Games

The COLOR command lets you load color games that require a system reboot. Enter the following command:

COLOR B <enter>

You will be prompted to insert your CGA game diskette into drive A and to press any key. The system will reset when a key is pressed, and the game will load into memory.

Note: Color emulation is provided only for 80 x 25 mode.

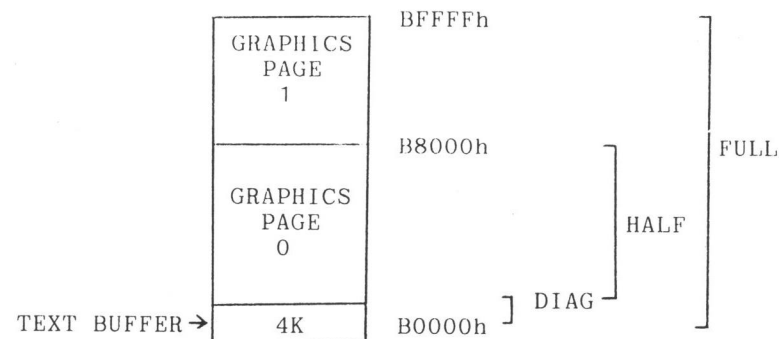
Please do not run monochrome graphics software in the CGA emulation mode, or the system may lock up.

VIII. ATTACHMENT

The graphics mode of the MG-150 is fully compatible with the Hercules Graphics card. As with the Hercules card, a software diskette is provided with the MG-150 containing files which allow you to configure the MG-150 in three different ways: FULL, HALF, or DIAG, according to your particular application.

The MG-150 contains 64K bytes of display memory which is divided into two 32KB pages, referred to as pages 0 and 1, that can each display a complete graphics screen. The text buffer resides in the lowest 4K bytes of page 0. Access to the display configurations is controlled by software using the FULL command, which displays both pages; the HALF command, which displays page 0 only; and the DIAG command, which displays only the text buffer. This is illustrated below.

Display Memory



To change display configurations, the commands are issued from DOS as:

```
A>MG FULL <Enter>
A>MG HALF <Enter>
A>MG DIAG <Enter>
```

The default mode is DIAG at power-up.

The MG-150 is designed to maintain a stable screen image when changing display modes. Therefore, the screen shifts very slightly when switching from text mode to graphics mode, and vice versa. The MG-150 is more sensitive, then, to the parameters sent to the MC6845 CRT controller chip. The MG-150 works properly with all popular BIOS (Basic Input/Output Systems) with the

exception of some from ERSO (Electronic Research and Service Organization, Taiwan). A firmware discrepancy has been found in the ERSO BIOS which causes the leftmost character on the display to disappear.

If your system reflects this symptom, it is likely that the ERSO BIOS needs to be modified. Please consult your dealer and request a modified ERSO BIOS. Dealers are equipped to respond to this free of charge.