THE EGA BOARD

IBM's EGA is versatile enough to work with IBM's monochrome and ordinary color monitors as well as with the new Enhanced Color Display.

IBM's Enhanced Graphics Adapter, because it is highly compatible with the older Monochrome Adapter and Color/Graphics Adapter, is at once both very versatile and somewhat confusing. What you can do with the EGA depends on the amount of memory installed on the board and the type of color monitor you connect to it.

ASSEMBLING THE PIECES The Enhanced Graphics Adapter ($524) comes with 64K bytes of memory already installed on the card. With this memory you can use all of the character and graphics modes available, but the highest-resolution graphics mode (350 lines down by 640 dots across) is limited to 4 colors instead of 16.

The Graphics Memory Expansion Card ($199) comes with another 64K of memory and piggybacks on the main board for a total of 128K. The board still takes up only one slot. This extra memory allows the adapter to display all 16 colors in the highest-resolution graphics mode. When using text modes, you can also upload an additional character set for a total of 512 displayable characters. For most normal uses of the EGA, 128K bytes is sufficient.

The Graphics Memory Module Kit ($259) contains 128K bytes of chips that plug into empty sockets on the Memory Expansion Card for a total of 256K. This is the maximum memory the adapter can hold. Programs can use the extra memory for multiple video pages.

If you will be using the card with the IBM Monochrome or IBM Color Display, you will probably only need the 64K on the main board unless you want to try out the 512-character set with 128K. If you also get the Enhanced Graphics Display, you'll probably want to increase memory to 128K with the Graphics Memory Expansion Card. You reap no advantage from going beyond 128K unless you have a specialized application that requires the extra video pages.

WRESTLING WITH HERCULES
When attached to the IBM Monochrome Display, the Enhanced Graphics Adapter can emulate the operation of the IBM Monochrome Adapter for the 25-line by 80-character display. (IBM calls this "video mode 7".) The display address is

■ Most programs that run on the Monochrome Adapter should run on the EGA/Monochrome Display combination with no problems.

the same, and most of the registers function similarly. Most programs that run on the Monochrome Adapter should run on the EGA/Monochrome Display combination with no problems. However, some of the attributes (high intensity, underlining, and reverse video) are different, so programs that use the same attributes for monochrome and color may not look the same.

Under this mode, the EGA can offer eight video pages instead of the one available with the normal Monochrome Adapter. By increasing memory to 128K bytes, you can upload another font to create a set of 512 characters. Even with 64K, the normal font is replaceable by software. Programs may also switch into a 43-line text mode using an 8 by 8 character box.

When attached to the Monochrome

Display, the EGA can also be set to video mode 15, unique to the EGA. This 350-line by 640-dot graphics mode has four "colors" (black, normal, high intensity, and blinking) and is *not* compatible with the Hercules monochrome graphics mode. However, you will find that most programs that specifically support the high-resolution modes of EGA will also support this monochrome graphics mode. The few programs I tried out that worked on the EGA/Monochrome Display combination are *Microsoft Word; Microsoft Windows;* Digital Research's *GEM Desktop; 1-2-3,* Release 2; and Lotus's new EGA drivers for *1-2-3,* Release 1A. Bringing the EGA up to 128K bytes of memory adds another video page in this graphics mode.

SAME DISPLAY, DIFFERENT ADAPTER When attached to the regular IBM Color Display (or compatible monitor), the EGA can emulate all modes of the Color/Graphics Adapter (CGA): the 40-character text modes 0 and 1, the 80-character text modes 2 and 3, the 200 by 320 four-color graphics modes 4 and 5, and the 200 by 640 two-color graphics mode 6. However, the EGA has only a direct-drive RGB output and does not duplicate the composite video output of the CGA.

Most programs that use CGA graphics will run on the EGA, but software that attempts to directly program the 6845 chip on the CGA may have some problems. The most notorious example is the original graphics driver with *1-2-3,* Release 1A. (Lotus has recently brought out new drivers for the EGA.) Games that do extensive adapter programming, such as Microsoft's *Flight Simulator,* will not run at all.

The EGA also has two new graphics modes that can run on the IBM Color Display. Mode 13 displays 200 lines of

faked on the EGA in the enhanced mode by combining a dark green and a bright red, and so the proper contrast setting is important. (However, on other Enhanced Color Displays I've seen, the preset contrast does not give a good brown. Perhaps a control to adjust the setting for the preset contrast would be a help. This would essentially give you two contrast ranges selectable by pulling out or pushing in the contrast knob.)

You can change vertical size (the height of the display area) with one of two knobs in the back, depending on the horizontal scan rate the monitor is using. On some Enhanced Graphics Displays, the display area is slightly off center, but there is no way to correct that problem.

For overall clarity, color, and display stability, the IBM was nearly the best of the displays for the EGA that PC Labs tested. On some other monitors, a light full-screen background will bounce in size as the brightness control is quickly turned up and down. On the IBM display, this bounce was negligible. The display generally recovered from a mode change very quickly without the type of screen flipping you often see on the IBM Color Display. (Again, however, I've seen other IBM Enhanced Graphics Displays that rolled a bit when the mode was changed.)

The distinct effects of the brightness and contrast controls help you set the display for clear and readable text. Even in the 43-line EGA mode using an 8 by 8 character box, text is more readable than it is on the old Color Display using the same 8 by 8 font. The contrast is good in 350-line modes and about the same as the Color Display's for 200-line modes. The 350-line modes' contrast only look deficient when compared side by side with the NEC JC-1401P3A Multisync, also reviewed here. Even with the brightness turned up all the way, the black background stays black.

In a colorbar display, the bright colors have a pastel glow that makes programs that use color extensively (like *Microsoft Windows*) look very pretty.

Overall, the IBM Enhanced Color Display is a fine companion to the IBM Enhanced Graphics Adapter. Of course, as with most of IBM's products, the price is really the only significant problem.

("The EGA Board" continued)
320 dots with 16 colors. Two video pages are available with 64K, four with 128K, and eight with 256K. Mode 14 displays 200 lines of 640 dots, also with 16 colors but half the number of video pages. The programs I mentioned above that specifically support the EGA will use mode 14 if the EGA is attached to a Color Display.

THE INEVITABLE STEP UP You'll eventually want to match the EGA to an Enhanced Color Display or compatible. It can do everything the EGA/Color Display combination can do and more. Because the Enhanced Display is capable of 350-line vertical resolution, the EGA displays existing text modes (0 through 3) with an 8 by 14 character box instead of the 8 by 8 character box. Thus, existing software that uses text modes will suddenly be a lot more readable on the EGA. Programs can also upload their own character fonts to the board in text mode.

If you don't mind an 8 by 8 character box, with a little effort and programming you can use the increased resolution to display 43 lines of text instead of the normal 25 lines. So far, I've seen this accomplished only with that masterpiece of malleable programming, *WordStar* (see Power User, Volume 4 Number 25). You can use PC-DOS in a 43-line text mode, but not if you have ANSI.SYS loaded.

Adding an Enhanced Color Display also makes available the EGA's highest-resolution graphics mode: 350 lines by 640 dots (mode 16). This is the mode that gives you nearly the resolution of the monochrome display with color and graphics. However, with the standard 64K on the board, you can only get 4 colors in this mode. If you have a 64K EGA with an Enhanced Color Display, programs such as *Microsoft Word* and *Microsoft Windows* will use mode 14, which has a lower resolution but the full 16 colors.

Adding the Memory Expansion Board to increase the total memory to 128K lets you use 16 colors in mode 16, and *Word* and *Windows* will then use it. Adding another 128K gives you a second video page.

STAY TUNED The EGA also contains a light pen interface (compatible with the one on the CGA) and a 32-pin connector referred to in the IBM documentation only as a "feature connector."

What feature is that? you may ask. Through the feature connector, an external device has access to the color and sync output of the EGA, the 2 video jacks on the back of the adapter (which serve no other purpose), and some internal register settings. The EGA can also be programmed to use the clock and sync signals from the external device instead of its own. In short, since the feature does not yet exist, it is limited only by your imagination.

THE NEXT-HIGHER STEP The Enhanced Graphics Adapter is not IBM's only high-resolution alternative to the Monochrome and Color/Graphics Adapters. About the same time it introduced the EGA, IBM also unveiled the Professional Graphics Controller (PGC) and Professional Graphics Display. This team offers the same horizontal resolution as the EGA does (640 dots) but increases the vertical resolution from 350 lines to 480 lines. An on-board 8088 microprocessor commands 320K bytes of memory for 256 colors out of a palette of 4,096.

With built-in pixel-crunching software, the PGC is best suited for graphic art, image processing, and engineering applications such as computer-aided design (CAD). Like the EGA, the PGC can emulate the Color/Graphics Adapter video modes. It uses two slots in an XT, AT, or expansion chassis (not a regular PC) and draws 5 amps of power.

For most business applications the PGC is overkill, but for potential EGA buyers, it serves a very important function: Since the Professional Graphics Controller costs $2,995 and the Professional Graphics Display costs $1,295, the PGC helps convince you that the EGA is a bargain.—**Charles Petzold**