Popular Electronics®

WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE NOVEMBER 1978/$1

PE Compares Audio "Click & Pop" Suppressors

How to Use Low-Cost Digital Test Equipment

Special Focus On Personal Computers

"CORONA" 256-COLOR PERIPHERAL + TIC-TAC-TOE PROGRAM

8085 SINGLE-BOARD COMPUTER + 16 BIT Vs. 8 BIT CPUs

Helvin

In This Issue

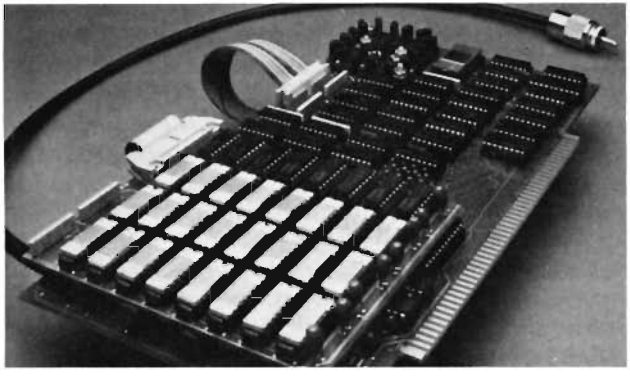
an R-1120 AM/FM Stereo Receiver

Pioneer CT-F900 Cassette Deck

Signet TK7E Stereo Phono Cartridge

0 14024 14278

Popular Electronics



"CORONA" 256-Color Peripheral

BY JEFF LOWENSON, ROBERT MARSH & JAMES SPANN

Upcoming S-100 bus compatible kit with full color graphics and alphanumerics.

EDITORS AT POPULAR ELECTRONICS are frequently privy to exciting new products that are in the final stages of pre-production design. This information includes all the details on how it works and "hands on" experience with custom-wired samples. One such product about which we'd like to share information with readers is Processor Technology's "Corona," a high-resolution, full-color graphics accessory for microcomputers. The Corona will provide 256 colors (or shades of grey in a 256-by-208 display with graphics and alphanumerics mixed—all under software control.

Note: on the cover is an artist's conception of a computer game using the Corona.

The Corona is designed to be fully bus compatible with the SOL-20 microcomputer and VDM-1 video display module, both made by Processor Technology. However, it can be modified as required to operate with other S-100 bus formats. The Corona-1K kit with 8K of memory will be marketed through computer stores in the near future for $395.

Technical Details. The display resolution of the Corona is 256 × 256, with a display size of 256 horizontal by 208 vertical. Its 53,248 pixels can be used with a selection of any 16 out of 256 possible colors (or grey levels). The alphnamerics can be mixed and overlaid with the graphics and/or external video input. The Corona uses 8K of 8-bit bytes in the low-color range and 24K of 8-bit bytes in the full-range version. (See Corona Specifications Table.)

In addition to game playing, this new graphics system is a powerful tool for business, artistic, scientific, and educational applications, since vivid graphics, poster-like displays, and full-color animation are available.

Since the Corona's signals can be mixed with video from a low-cost monochrome TV camera and with alphanumerics from a computer, the final video can display a scene from a camera with

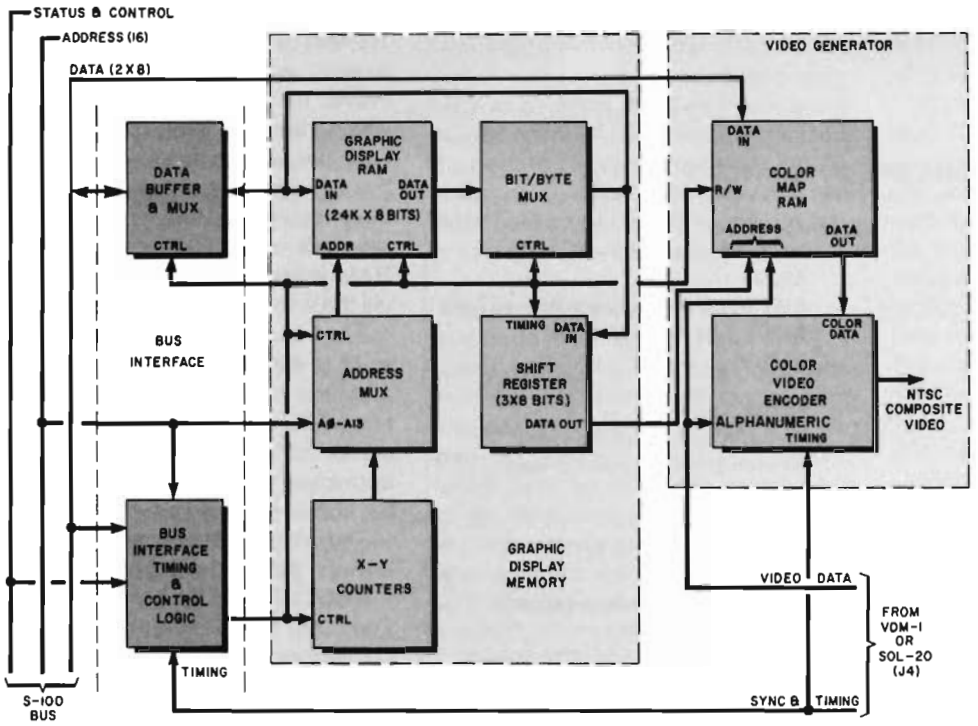


Fig. 1. Block diagram of Corona shows logic interconnections. The NTSC output means that it can be video recorded. Sync can also be obtained from an external source for interfacing to other video systems.

a set of color graphs superimposed on it. Scientific data can be transformed into a presentation that can be observed while an experiment is in progress. Alpha feedback experimenters will find this color approach valuable because of the wide range of its 256 colors.

It is recommended that the Corona be used with a color monitor to take advantage of the better color and crisper images available.

Circuit Operation. As shown in Fig. 1, the heart of the Corona system is the Graphic Display Memory that stores information in three 256 × 256 × 1 bit planes, each of which represents a 256 × 256 CRT screen matrix. The three combined planes contain three bits of color information for each dot on the TV screen. The memory can be used in two ways—for color-picture storage or as conventional computer memory. This means that when the graphics are not used, the computer's memory is expanded by the amount of memory contained in the graphics interface (see Fig. 2 memory map).

Memory access by the computer is handled in two modes. In the *bit* mode, each full-color point can be individually read or written to by the computer. This mode simplifies interfacing with BASIC and FORTRAN to take advantage of their powerful trigonometric and matrix functions. (Matrix operations enable the programmer to write powerful software for scaling, translation, and rotation of graphic images.) In this mode, the graphics display area looks to the programmer like a 256 × 256 Cartesian coordinate system, with the origin at the lower left corner.

In the *byte* mode, graphics data is transferred from the computer to the Corona, eight bits at a time, with the RAM organized as conventional 24K by 8-bit memory. The byte mode permits very fast loading of complete screens from peripheral devices, such as a flop py-disk or a cassette-tape system.

The bus interface and control logic section (Fig. 1) controls the flow of data between the computer and the Graphics Display Memory. This logic synchronizes the TV scan and computer memory requests. This functional block also contains the command registers, memory timing, and fast erase logic.

The address multiplexer selects the source of the display memory address, which can originate either from the computer or from the X-Y logic. The X-Y counters generate the X-Y address coordinates that represent a point on the CRT screen. Data from the display memory is thus mapped on the TV.

The bit/byte multiplexer is used in the bit mode to change or read one bit into each of the three memory planes. The shift registers convert the eight and 24 bits of parallel data from the Graphics Display Memory into a serial address for the color-map RAM.

The video generator section can provide up to 256 different colors (or 32 shades of grey), eight of which can be displayed graphically at one time. Either SOL-20 or VDM-1 alphanumeric characters can be mixed under program control to interleave graphics and text information anywhere desired on the screen. All the video sync signals are provided by the SOL-20 or VDM-1.

Alphanumerics can be displayed in a distinct ninth color that is selected under software control to provide the best contrast with the eight graphics colors. There are also an additional eight colors where the graphics and alphanumerics intersect.

Any one or all of the displayed colors can be rapidly changed without rewriting the graphics memory contents (that is, without changing the form or shape of the picture). This unique feature can create a shimmering rainbow effect with very simple programming.

MEMORY MAP

FFFF	CORONA MEMORY
E000	NOT USED
D000	SOL/VDM-1 MEMORY
C000	PTDOS
8000	USER MEMORY SPACE
0000	

Fig. 2. Memory map shows RAM arrangement of Corona.

CORONA SPECIFICATIONS

Display resolution	256 × 256
Display size	256 horizontal × 208 vertical
Displayed pixels	53,248
Memory size	8192 8-bit bytes low version; 24,576 8-bit bytes full range
Memory access modes	bit/byte
Memory organization:	
Bit mode	53,248 3-bit pixels
Byte mode	Three 8K byte planes (can also be used for normal data storage)
S-100 bus memory space	8K maximum
S-100 bus I/O ports	Two input, two output
Possible colors	256 (or 32 levels of grey))
Displayed colors	Sixteen maximum.
Display options	Alphanumerics can be mixed and overlaid with graphics and/or external video input on color or monochrome displays
External video input	Software-selectable, accepts standard RS-170 video; external source must be synced to computer
One frame	Two identical fields (noninterlaced)
One field	16.667 ms (1/60 s)
Horizontal sweep cycle	64.1 μs
Horizontal blanking	From 6 to 14 μs
Active display	40.3 μs
Horizontal scanning frequency	15,600 Hz
Vertical scanning frequency	60 Hz
Color subcarrier	3.579 MHz
Scan lines per field (noninterlaced)	260
Vertical blanking field	833 to 1300 μs
Power requirements	+8 to +10 V dc, 2 A maximum +15 to +20 V dc, 0.2 A maximum −15 to −20 V dc, 0.2 A maximum

The color-map RAM is a high-speed 16-word by 8-bit RAM array. This organization permits the choice of 256 colors (more precisely, 64 colors, each of which has four intensities). Colors for each point on the screen are determined by the three-bit code stored in the Graphic Display Memory that addresses the color-map RAM. The color-map RAM is loaded under program control via the A register.

The function of the color-video encoder is to transform the red, green, blue, and luminance data from the color map into NTSC color signals. This encoder is comprised of timing, four two-bit D/A converter, and the actual color-encoder sections.

The timing section generates the color-burst flag and composite sync (from the SOL-20 or VDM-1 composite sync). The red/green/blue/luminance D/A converters accept digital data from their respective sections of the color map and convert it to analog color-difference signals (R − Y and B − Y). The encoder section is designed around an IC that modulates the color subcarrier with the color-difference signals and outputs the composite video that consists of the video, blanking, and sync signals.

Physical Details. The Corona's circuitry mounts on two large printed circuit boards. The larger board plugs directly into the S-100 bus of the computer and contains 73 ICs, four voltage regulators, and miscellaneous discrete components. The smaller board, which contains 32 ICs that include the RAM memory system and the data multiplexers, is then connected to a jack on the larger board. ◇