GRAPHICS PERIPHERALS

The WHIZZARD 7200 family is supported by a full complement of intelligent, interactive graphics peripherals. An entire range of input and output graphics functions, from entering text to "picking"

vectors, is available through the use of these optional devices. All of the interactive graphics peripherals interface with intelligent microprocessor based control units to minimize host computer loading. The RASTERIZOR™ hardcopy generator, implemented entirely in hardware, needs no host computer

processing time at all. Many user inputs are processed locally, and the peripheral interfaces can modify Vector Memory or signal the Graphics Processor for visual feedback on the display screen.

The peripherals supported by the WHIZZARD 7200 family

include Keyboards, Function Keys, Joysticks, Digitizers and Tablets, the multi-function Function Switches and Control Dials, and Pick Modules with Light Pens or Digital Comparators. The interface modules and peripherals are described below.

Intelligent Peripheral Control Unit

The Intelligent Peripheral Control Unit (IPCU) is an advanced microprocessor-based controller that ties into the Graphics and Peripherals Busses to provide an interface between the WHIZZARD 7200 and several interactive graphics peripherals. Communication with IPCUs and with other peripheral devices occurs through the peripheral bus. A peripheral device code is specified identifying the device with which communication will take place. The peripheral device uses information stored in its control block in Vector Memory, yet it is enabled and disabled through the peripheral bus by passing a 16 bit data word.

Each IPCU can support a keyboard, a joystick, a data tablet/digitizer, and an

asynchronous console port (ACP). A scrolling text buffer (two without an ACP) may also be set up under local control of the IPCU. Parallel interfaced WHIZZARD 7200 graphics systems can be configured with up to four IPCUs. Thus, in a multiple workstation environment, each station may have its own set of peripherals.

The IPCU uses the Graphics Bus to maintain the control blocks containing peripheral status information and position information for joysticks and data tablets. Putting a cursor on the display screen and moving it requires no external control from the host computer. The IPCU eliminates the need to interrupt the host computer for tracking information updates, but at the same time the updated information is always available when needed. The IPCU can be programmed to provide 100 tracking interrupts a second or only when a tested state changes.

IPCU/Keyboard and Scrolling Buffers

Associated with each IPCU are two types of scrolling buffers, monitor and text. The keyboard attached to an IPCU generates ASCII character codes which may be interpreted by the host computer. The peripheral

bus or Asynchronous Console Port (ACP) are used to transfer data. If the keyboard has been enabled in auto-echo mode, characters are entered into the text buffer associated with the IPCU and displayed on the screen. The user can determine the buffer location, number
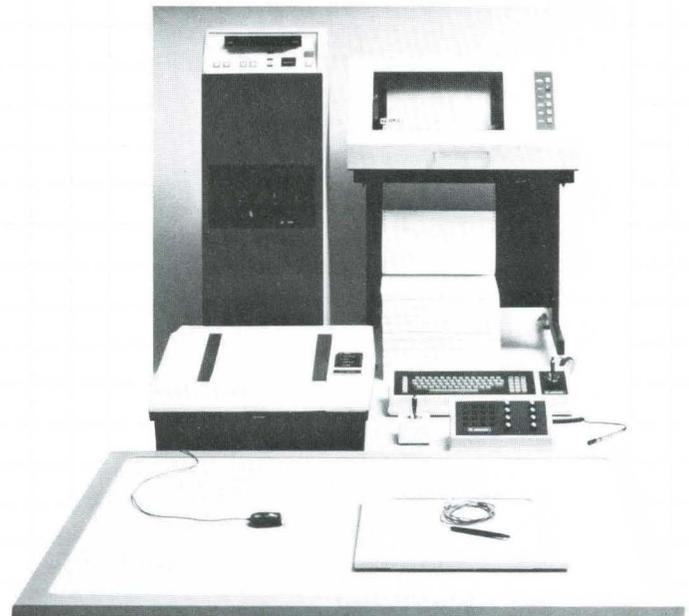
of lines, character options, and the text cursor.

The two types of scrolling buffer work identically; however, in systems with the optional ACP, the ACP uses the monitor buffer exclusively.

layout keyboard is designed for rapid entry of alphanumeric date. Real-time parameter entry can be initiated by using it in conjunction with program prompts on the screen. The keyboard has all 96

The buffers are circular and, if filled, the display of a buffer automatically scrolls up a line to free enough area for continued insertion of text.

The ACP is an RS-232 port available on the IPCU for WHIZZARD 7200 systems with parallel host computer interfaces. The ACP emulates an alphanumeric terminal by combining the scrolling text capability of the IPCU with the RS-232 line. When the WHIZZARD is powered up or reset, the ACP and a keyboard are associated with a display, together functioning as an alphanumeric terminal. Therefore, a user can immediately log on to the host computer without initializing the graphics system.

In graphics mode (not using the ACP), when the keyboard is enabled and a key is pressed on the keyboard, the IPCU generates an interrupt to the host computer. The peripheral data word sent to the host computer contains the ASCII code generated.

The WHIZZARD 7200 ANSI standard typewriter

printable ASCII characters, including both upper and lower case and all carriage control functions.

To enhance the keyboard's flexibility, there is a pad of fifteen user-programmable Function Keys to the right of the full alphanumeric keyboard, and five preprogrammed function keys to the left. The user-programmable function keypad produces 60 codes with CONTROL and SHIFT and has clear plastic top covers so the keys can be labeled to denote each key's special function. The function of the preprogrammed keys may also be redefined by the user.

The host computer can send characters to the device code of the IPCU/Keyboard; the characters are entered in an open text scrolling buffer.

A special function instruction directs the IPCU to clear, save, initialize, or reopen a scrolling buffer. Certain ASCII codes "erase" all characters from buffer and "toggle" the display (blanks the buffer if it is displayed, and displays the buffer if it is blanked.) A blanked display has no effect on the input of characters to the buffer.

IPCU/Joystick Control

The joystick, when enabled through the IPCU, will perform local tracking independent of the host computer. The joystick is enabled or disabled by writing a data word to the IPCU through the peripheral bus.

There are two joystick models available for use with the WIZZARD 7200 family, JOY and KEYJOY. JOY is mounted in its own console, and KEYJOY is mounted in the keyboard to the right of the keypad. Each model functions identically, providing a means of accurately and quickly positioning a cursor on the screen.

The joystick consists of a two-axis potentiometer with a spring-loaded center return. Analog signals developed by the joystick are converted into three-bit binary values

corresponding to the angular position of the joystick. The digital output controls the X and Y translation rates of the screen cursor.

The joystick includes a pushbutton switch to provide an operation-status input bit (button up/down) in the Vector Memory control block. This push-button is typically used to indicate locations on the screen for an application program by providing interrupt signaling; five interrupt modes are supported. The host computer may be interrupted to receive

updated converted position data, available in Vector Memory, at 100 Hz, while the button is up or down, or when the button changes state.

The user may set limits on cursor movement through software calls. One use of this feature is to restrict the cursor to a set of menu items to assure accurate response to prompts, another is to prevent wrap-around. When the system is initialized or reset, the entire screen is usable.

IPCU/Digitizer Control

The digitizer is controlled like the joystick, but by different blocks of Vector Memory and a different input data word to the IPCU. The resolution of the data tablet must be mapped to the resolution of the screen. Since data tablets are available in
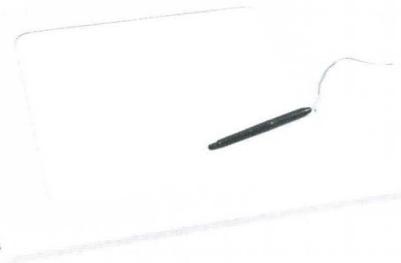
sizes from 11'' x 11'' to 42'' x 60'', returning up to 16 bits of position data, provisions are made to adjust the values returned to correlate with screen coordinates.

The digitizer is enabled or disabled by sending a data word to the IPCU. The microprocessor controlled digitizer performs self-calibration, permitting high accuracy and linearity. Magnetostrictive ranging

provides silent operation, as well as immunity to dust, drafts, humidity, and noise. This also makes a data tablet usable on metal tables and with drafting templates.

The data tablet comes with a stylus for inking or fast work, a free cursor for precision and zero parallax, or a magnifying cursor for fine detail—all without mechanical linkages or protrusions above the working surface. Position data is updated at 100 times per second with a pen tip (or cursor) to tablet proximity distance of up to 5/32 inch. No host computer interruption is involved since the IPCU handles all communications with a control block in Vector Memory.

Data word length varies with data tablet size. Resolution is 0.005'' (200 units per inch), accuracy 0.004'' ± 1 LSB, repeatability ± ½LSB. The IPCU provides both untransformed tablet data and data which is mapped to the addressing space of the WHIZZARD 7200 display surface.

Function Switches and Control Dials

The Function Switches and Control Dials (FSCD) is a general purpose interactive graphics peripheral containing sixteen function switches, sixteen lights, and eight continious turn dials, all completely programmable. An interchangeable plastic overlay front panel with a writable surface allows the user to indicate which functions have been assigned to particular dials, switches, and lights.

The FSCD contains a microprocessor that offers a number of features. Each valuator can be turned continuously without encountering stops or the "dead zone" inherent in simple potentiometers. Each turn contains 348 ± 6 discrete resolution elements which are used to calculate a current 16-bit value.

Data to and from an FSCD is stored in its control block. The way the FSCD is enabled through the peripheral bus determines the correlations between lights and switches, and the values generated by switches and valuators.

There are six programmable parameters associated with each dial: maximum value, minimum value, current value, interrupt threshold, valuator gain, and update rate. The microprocessor applies the proper scaling and limits to valuator data before it is output to the WHIZZARD 7200 and host computer.

Each switch can be programmed for momentary or toggle (push on, push off) modes of operation. Each switch has a position and a value. The position indicates whether the switch is actually up or down. The value is a logical variable (1 or 0) associated with the switch. In momentary mode, the value tracks the position. In toggle mode, each press of the switch causes the value to change to the opposite state.

The lights can be independently turned on or off, programmed to indicate the state of a corresponding switch, or set to blink at 1Hz or 8 Hz. A light and switch can be coupled together so that changing the value of the switch either programatically or by pressing it changes the state of the light. If the light is initially off when the coupling is enabled, then the light alternates between off and on as the switch value changes. If it is initially on, it alternates between on and off. If it is blinking, then it alternates between blinking and off. Programatically changing the state of a light that is coupled to a switch does not affect the value of the switch.

Data regarding switch and light state is always available upon request. It can also be sent automatically whenever there is a change, or continuously at a specified rate. Communications with the WHIZZARD 7200 are conducted over an RS-232C line, at rates up to 9600 baud.

The FSCD is completely under program control. In conjunction with an HCRST, the valuators can be used to transform graphic displays. Switches can be used to generate interrupts, and lights can indicate operating modes. Valuators may be operated in interrupt mode in which change in position greater than a pre-set threshold causes Automatic Data Generation (ADG). Switches programmed for interrupt mode will initiate ADG upon press, release, or both. Valuators may be operated in continuous mode in which data is sent to the host computer at a pre-set rate.

Pick Module

The pick module is an intelligent processor which interfaces a light pen or digital comparator to a WHIZZARD 7200 graphics system for the selection of graphics elements. The pick module reads vector information off the Graphics Bus and provides data which relates displayed vectors to the actual display list. Picking may identify all or just parts of a graphic element. On stroke refresh displays a light pen or digital comparator (or both) may be used. On raster displays digital comparators only are supported. Up to two pick modules may be configured in a system.

The pick module provides a highly intelligent, host computer independent, mode of interactive processing, interrupting only when a pick is accomplished. A variety of functions are performed under local control which supply vector information to the host computer. A nesting function maintains up to six label levels, including segment, sub-segment, and four levels of subroutines, which are returned on a valid pick.

PM/Light Pen

When a light pen is the pick device, pick functions are effected by pointing at the appropriate graphic display object or symbol with a light sensitive pen. Picking is accomplished by touching the pen switch. If tracking is initiated with the light pen in a blank area of the screen, a finding auto-raster flashes to reposition the cursor.

PM/Digital Comparator

The digital comparator is available using either a joystick or data tablet to move a picking "window" on the screen. Picking is accomplished by pressing or releasing the joystick button or digitizer cursor.
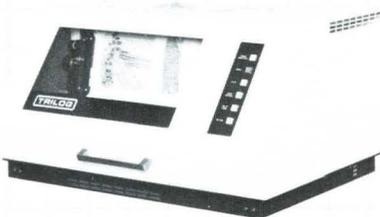
Pickable segments are determined by enabling or disabling their detectability attribute. A count of the number of vectors drawn (after clipping) from the last label to the picked vector, and the Vector Memory addresses of the labels are also made available to the host computer. Visual feedback is provided by blinking detectable items when in pick proximity of the cursor. In echoing a pick, graphics display items momentarily disappear. The echoing of a pick operation may be programmed to occur at any of the six available label levels.

A pick device can also function as a locator device without host computer intervention. A user defined cursor may be used for tracking and returning X-Y coordinate data. An optional "rubber-band" line may be tied to the cursor if desired. Display objects may also be moved under local control.

Hardcopy Output

The WHIZZARD 7200's RASTERIZOR™ is an advanced design, patented module which generates fast, clean black and white hardcopies. The output of the Graphics Engine is converted into a raster format capable of driving a variety of electrostatic and impact dot matrix printers. The RASTERIZOR requires no host computer processing time. A high speed, 32 bit bipolar, microcoded bit-slice microprocessor eliminates software sorting and host computer conversions by processing vectors as they occur in the display list. An unordered list of X-Y coordinate data is converted into a raster pattern fast enough to drive an electrostatic plotter running at full speed.

Unlike other peripherals, the RASTERIZOR is not controlled by a block in Vector Memory. The RASTERIZOR is always enabled and its functions are accessed through writing to one of four device codes. It supports the following: Printer Function, Plotter Function (using Versatec compatible binary plot data), Special Functions (form feed, carriage return, and so forth), and Screen Copy Function.

With Versatec electrostatic printers, the RASTERIZOR offers resolution of 100 or 200 dots per inch. In addition, a Trilog impact graphics printer is available to supply hardcopies on standard line printer paper. In multisystem environments, a hard-copy multiplexer allows up to four RASTERIZORs to access a single printer/plotter.

Automatic electronic cameras may also be connected. Utilizing the standard video output of the WHIZZARD 7200, these black and white or color cameras may be used to create 35mm slides or negatives, or 8 x 10 sheet film transparancies, negatives, or Polaroid® instant prints.

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