Hardware Memo 6

Device 420 -- Assorted Switches & Color Scope

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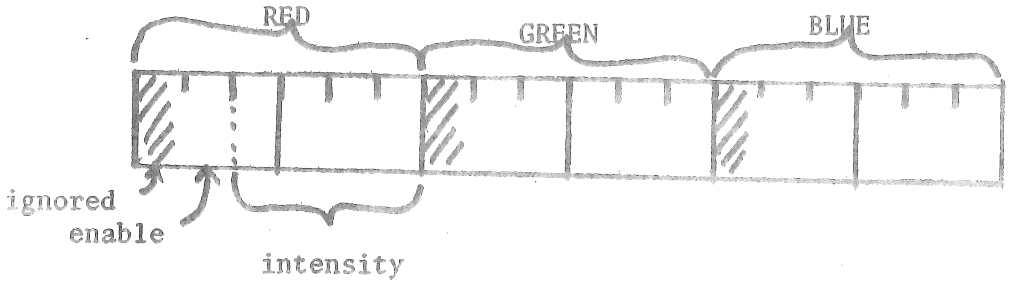
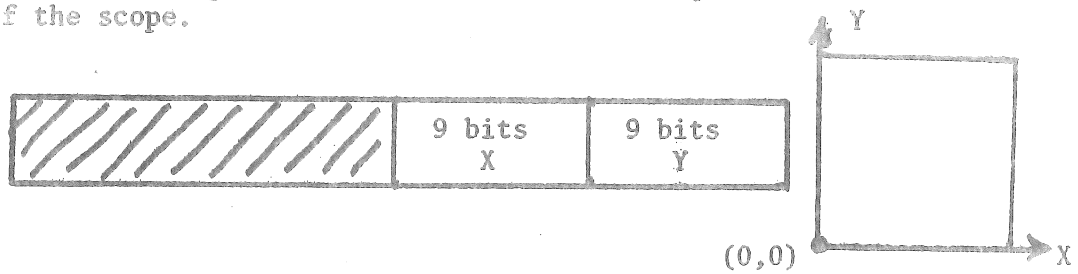
CONO 420, has two effects:
(1) to selectively enable various switch banks (see below), and
(2) to select a color with which the color scope will plot points.
There is no processor selection logic; either or both the PDP-6 and the PDP-10 can access device 420 at any time.

The color scope uses the CONO information as three six-bit fields: red, green and blue intensity. In each field the leftmost bit is ignored (by the color scope), the next bit is enable (0 = beam off), and the right four bits are intensity (0, 1 and maybe 2 are essentially beam off; 17 is brightest).



DATAO 420, causes the color scope to plot a point with whatever color its color register specifies at the time of beam intensification. The left half of the DATAO information is ignored; the right half contains two unsigned 9-bit fields, X and Y. The point (0,0) is at the lower right-hand corner of the scope.



When the DATAO 420, is executed by a computer, the color scope clears out its X and Y deflection registers, then, a microsecond or so later, loads in the new X and Y values specified by the DATAO. It then starts a delay of about 200 (decimal) microseconds to allow the magnetic deflection fields to settle to their final value. When the 200 microsecond delay times out, a 10 microsecond delay starts. While this delay is timing the red, green and blue beams are turned on, plotting the spot of light on the scope. When the 10 microsecond delay times out, the scope is once again quiescent and ready for another DATAO or CONO. Pecularities to note are:
(1) No DONE flag or Priority Interrupt exist for the color scope. Timing out DATAOs so they do not occur more often than about 210 microseconds is usually easy to do by program.

(2) All points plotted after a given CONO will appear in the color selected until a new CONO selects a new color. CONOs can be given arbitrarily fast; no delaying is necessary. A point's co-ordinates may be DATAOed and then its color CONOed while the 200 microsecond deflection settling delay is timing, and the point will appear with the correct color.

(3) If a computer executes a DATAO while the 200 microsecond delay is timing, the delay will be restarted at 200 microseconds; the deflection registers will get cleared and then jammed with the new X and Y; the beam will not be turned on until the newly reset 200 microseconds runs out; and in general, the fact that there had been a previous point about to be plotted will be entirely lost. This means, for instance, that plotting points every 100 microseconds will make no light appear on the scope.

(4) If a computer executes a DATAO while the 10 microsecond delay is timing (and therefore the beams are already turned on), the deflection registers will get cleared to zero; the deflection circuits (which are always following the command of the deflection registers) will start deflecting the (intensified) beams toward (0,0); the new X and Y will get jammed into the registers; and the beams will start heading toward the new (X,Y). Then, or sometime during this, the 10 microsecond delay will time out, and the beams will turn off. Thus the general effect is to smear the point previously being plotted. The new point should itself appear correctly about 200 microseconds later.

(5) NOTE: Be sure to hold the color scope's "OFF" button in until you hear it go shlunk when you're through using it. If left on for several hours, its slightly marginal deflection amplifiers may burn out.

DATAI 420, reads in the states of various banks of switches. If no switches are supplying data, one-bits (i.e., a word with value -1) will be read in. Switches impose their data by making their assigned bits zero.

There are three banks of switches. Each bank can be independently enabled by a CONO 420, instruction. If the bit in the CONO for a given switch bank is a zero, then that bank cannot impose its data on the word read in. The enabled/disabled status of all banks remains unchanged until a new CONO 420, is executed. The assignments are:

CONO 420,400000 = enable random assorted switches
CONO 420,4000 = enable bank of normally open pushbuttons (bits 28 through 35) in Knight's office
CONO 420,40 = enable remote data switches and spacewar consoles

The "random assorted switches" are:

BITS 1,2 = zero when AMF hand fingers are not touching anything

BIT 3 = zero when lever switch in minibox on floor near robot console is off-center

BIT 6 = zero when AMF wrist detent hinge is not opened

BIT 10 = zero when switch by Datel says "OFF"

The "remote data switches" are a bank of 36 switches living in the color scope room. For them to impose data on the word read in, the appropriately labeled enable switch on the left side of this switch bank console must be thrown in addition to the CONO 420,40. A bit will be zero if the side switch is up and the bit switch is down, or if the side switch is down and the bit switch is up. A helpful chart is on the right side of the switch bank console. The center position of the side switch disables all 36 bit switches. The center position of each bit switch will never impose a zero on the word read in. Note that if you wish to switch rapidly between two numbers whose IOR is -1, they can be conveniently keyed into the bit switches and the side switch used for selection.

The two spacewar consoles are identical and plug into either the jacks in the bottom of the device 420 interface bay or into the side of the remote data switches console. In the event of their being plugged into the console, the appropriate enable switch above the jacks must be thrown (in addition to the CONO 420,40). The left-hand plug is in either case the top 5 bits of the left half-word; the right is the top 5 bits of the right. All spacewar controls are normally open, spring-return switches and thus can impose zeros only when actuated.