

Shift Register /SHR <9:0>
 Deflection Register /DFR <9:0>
 Scaling Register /SCR <2:0>
 Direction Register #1 /DIR1 <2:0>
 Direction Register #2 /DIR2 <2:0>
 Vector List Enable /VLE <0>

The display processor can display either a point, a vector, a list of vectors, or a list of lists of vectors. The last option can also be thought of as being a list of characters, each character being represented by a list of vectors. Loading XR and YR with the appropriate coordinates will cause the beam to be shifted to that location. Loading the VBR will cause a vector to be drawn; loading VPTR will set VLE and cause a list of vectors beginning at that address to be drawn. The list is usually terminated by a vector of 0 length. Loading CPTR with the beginning address of a list of characters will cause that list to be drawn. This constitutes a double loop in the normal programming terminology. The characters are accessed through CPTR and the location of its vector description is calculated by adding twice the character code to the contents of DTPTR and loading the result into VPTR. If VPTR<0> = 0 then a list of vectors representing that character will be drawn. If VPTR<0> = 1 then an interrupt will be generated. The interrupt vector for this type of interrupt is the word pair composed of VPTR and STAT where VPTR<0> is always read 0 by the Unibus. By using this escape mechanism one can provide special software functions as well as extending the looping capability to lists of lists of vectors by adding two more registers (not necessarily hardware).

The Control Status Register

The CSR consists of error indications of various types, the scaling factor, interruption control, format specification, and the Blank-Unblank Bit. The following is a map of the CSR:

Error /ERR := CSR <15>
 Scale Overflow /SV := CSR <14>
 Register Overflow /RV := CSR <13>
 Non-Existent Memory Access /NXM := CSR <12>
 RV Supress /RVS := CSR <11>
 Scaling Factor /SCL := CSR <10:8>
 Done Indicator /DONE := CSR <7>
 Done Interrupt Enable /DIE := CSR <6>
 Error Interrupt Enable /EIE := CSR <5>
 Character Mode Indicator /CM := CSR <4>
 Format Specification /FORM := CSR <3:1>
 Blank-Unblank Bit /BLK := CSR <0>

Data Formats

The X and Y Position Registers are 10 bits long and have the following format:

15	10	9	0
UNUSED		X or Y	

The point 0,0 is in the center of the display area. The Vector Buffer Register may contain data in four of the formats specified by FORM in the CSR. Formats 4-6 do not require use of VBR.

FORMAT	15	13	12	8	7	5	4	0
0	DIRECTION		LENGTH		DIRECTION		LENGTH	
1	15	13	12	10	9	0		
	DIRECTION		UNUSED		LENGTH			

For Formats 0 and 1 the direction is one of eight possibilities spaced each 45°.

2	15	12	11	8	7	4	3	0
	ΔX		ΔY		ΔX		ΔY	
3	15	8			7	0		
	ΔX				ΔY			
4A	15	14	10		9	0		
	0	ΔX		f(X)				
4B	15	14	10		9	0		
	1	ΔY		f(Y)				
5	15	8			7	0		
	CHARACTER CODE				CHARACTER CODE			
6	15	10			9	0		

When displaying data in Formats 0 and 1 a vector of length 0 is considered control functions and the direction field is decoded as follows:

- 0 - Vector list terminator; (\neg CM \wedge DIE) \Rightarrow INTERRUPT
- 2 - Beam \leftarrow 0
- 3 - Beam \leftarrow 1
- 4 - Intensify the present point (XR,YR)

Conclusion

In addition to wide availability of inexpensive character terminals, it is our belief that there is a growing need for a high performance graphics (vector display terminal which can be used remotely from the main processor. A fully general purpose minicomputer has to be an integral part of such a display terminal for sophisticated display generation. It is our hope that this effort will lead into considering production of such display terminals.

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