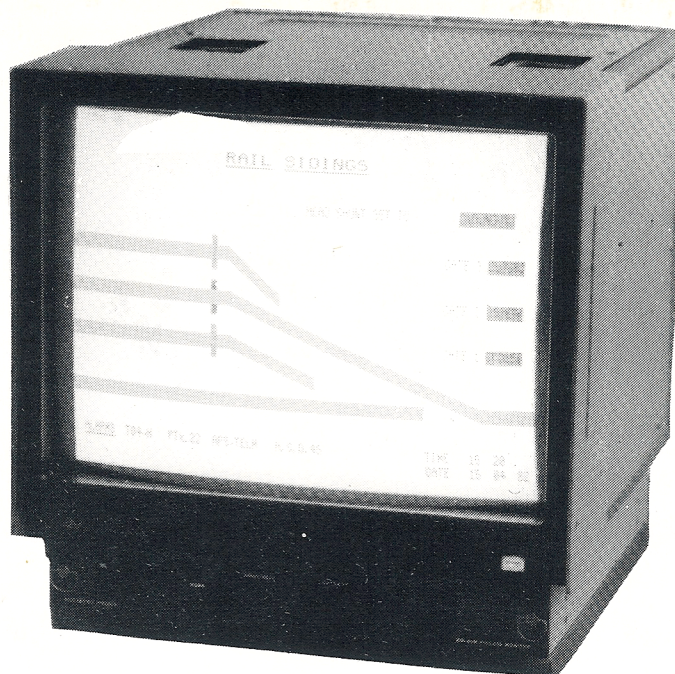


Video Monitors



INTRODUCTION

This data sheet gives you guidance on how to select a video monitor for use with GEM 80 video processors.

There are many types of video monitor available on the market, offering a variety of features at a variety of prices. Since new models are being introduced all the time, any recommendations for a specific model would quickly become out of date. The notes below therefore highlight the factors which you should consider when selecting a video monitor.

The notes that follow are written around the requirements for colour monitors. Exceptions applying to monochrome monitors are pointed out as they arise in the text, and also differences between the requirements for Graphic Video and those for Character Video.

Finally, recommendations are made for the types of co-ax cable and connectors which you should employ for the connections between GEM 80 video termination panels and video monitors.

ESSENTIAL FEATURES

1. Health and Safety

Video monitors must meet the health and safety regulations applying in the particular country where they are being installed. These regulations normally cover electrical safety, implosion proofing of the CRT, and X-ray dosage.

2. Signal Levels

The monitor must be able to accept RGB signals with sync on Green, 0.7V peak-to-peak positive going, with 0.3V sync pulses negative going, ± 6 dB.

(Some manufacturers simply state these levels as 1V peak-to-peak ± 6 dB)

For monochrome, monitors must be able to accept a signal as above with sync pulses, but there will be only a single channel.

3. Signal Connections

The monitor must have three individual BNC sockets, one for each colour. The termination resistance on each channel must be 75 ohms.

For monochrome, there will be only one socket.

4. Line and Frame Frequency

For Character Video, the monitor must be capable of 625 line operation at a line frequency of 15.625 kHz, or 64 μ s per line.

For Graphic video, the monitor can, as an alternative, be capable of 525 line operation at a line frequency of 15.75 kHz, or 63.5 μ s per line.

5. Bandwidth

The bandwidth of the video amplifier within the monitor must be 20 MHz or greater.

6. Sync Pulse Widths

For Character Video, the monitor must be capable of accepting and locking on to line sync pulses $4.3\mu\text{s}$ wide, and frame (field) sync pulses $180\mu\text{s}$ wide.

For Graphic Video, where line interlacing is used (i.e. alternate fields display odd and even numbered lines), the monitor must be capable of accepting and locking on to line sync pulses $4.8\mu\text{s}$ wide, equalization pulses $2.4\mu\text{s}$ wide, and frame (field) sync pulses $136\mu\text{s}$ wide.

7. Retrace Times

The horizontal retrace (line flyback) time of the monitor must be less than $15\mu\text{s}$. The vertical retrace (frame flyback) time of the monitor must be less than 2 ms.

8. Resolution

For Character Video, the screen of the monitor must have a resolution of greater than 640 dots horizontally and greater than 288 dots vertically.

For Graphic Video, the screen of the monitor must have a resolution of greater than 560 dots horizontally and greater than 448 dots vertically.

9. Phosphor Persistence

For Graphic Video, the monitor must have a CRT with a long persistence phosphor. This is because, with interlacing, lines displayed are only updated 25 times/second.

For Character Video, although lines displayed are updated at nearly 50 times/second, it is still preferable to use monitors with long persistence phosphors to reduce any flicker effects.

10. Power Input

Video monitors should have adequate protection against power transients. They should also be able to operate over a voltage range such that external voltage stabilization equipment will not be required. The required range will depend on the stiffness of the supply where the monitor is connected when other power loads are switched on or off the line, and on the supply voltage variations expected.

11. Picture Height Adjustment

Video monitors must have a picture height control which you can adjust. This allows you to match the display to the viewing area, and to make sure that, with Graphics Video, circles are truly circular.

DESIRABLE FEATURES

1. Degaussing

The monitor should automatically degauss itself on power up.

2. Loop Through

Many types of monitor have a second set of BNC sockets so that a second monitor can be daisy chained from the first one. In this case, the monitor should also have switched termination resistors, so that only the monitor at the end of the line has the 75Ω termination resistors in circuit.

3. Shadowmask

(This applies to colour monitors only).

Monitors should preferably have a circular hole type of shadowmask with electron guns arranged in delta, producing dots of the three colours in delta. Monitors using slotted shadowmasks, producing coloured stripes rather than dots, may, however, produce acceptably good displays.

TECHNICAL NOTE ON TIMING REQUIREMENTS

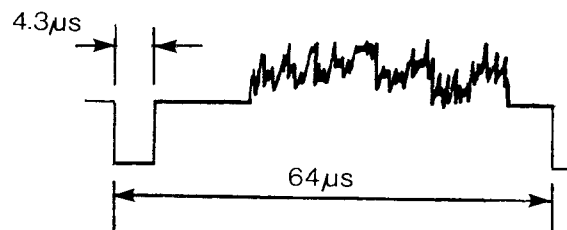
The requirements given above which involve times or frequencies are based on the output from the GEM 80 video processor, which is designed to be able to drive most types of industrial monitors.

Lines

The total time for a line (including retrace) is $64\mu\text{s}$. This time is divided into a number of equal intervals, each interval corresponding to one pixel.

For Character Video, each $64\mu\text{s}$ line period is divided into 832 pixel intervals, with each pixel interval therefore being 76.9 ns long. These intervals are used as follows:

- 1 to 56 : Line sync pulse ($4.3\mu\text{s}$)
- 57 to 160 : Dead time
- 161 to 800 : Pixels displayed
- 801 to 832 : Dead time



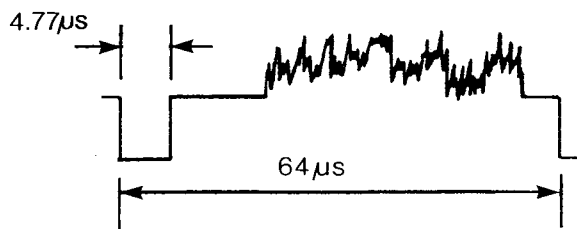
Each character displayed is 8 pixels wide, and the line length is 80 characters, or 640 pixels (intervals 161 to 800). The time available for retrace (flyback) is 192 intervals of 76.9 ns (intervals 1 to 160 + intervals 801 to 832), or $14.76\mu\text{s}$.

For Graphic Video, each $64\mu\text{s}$ line period is divided into 752 pixel intervals, with each pixel interval therefore being 85.1 ns long.

These intervals are used as follows:

- 1 to 56 : Line sync pulse ($4.77\mu\text{s}$)
- 57 to 156 : Dead time
- 157 to 716 : Pixels displayed (1 per interval)
- 717 to 752 : Dead time

The line length is 560 pixels (intervals 157 to 716). The time available for retrace (flyback) is 192 intervals of 85.1 ns , (intervals 1 to 156 + intervals 717 to 752), or $16.34\mu\text{s}$.



Pixels

Note firstly that the line length in pixels determines the minimum resolution necessary for all pixels to be displayed horizontally (640 for Character Video, 560 for Graphic Video) as given previously under "Essential Features", Section 8.

Since one pixel interval is of the order of 80 ns (76.9 ns for Character Video, 85.1 ns for Graphic Video), then, to produce a clear display, the video circuits must be capable of handling pulses of this width. The worst case is when pixels alternate between black and full brightness. Rise and fall times should therefore be less than 10 ns with negligible ringing, requiring a video amplifier with a bandwidth of 20 MHz or greater, as given previously under "Essential Features", Section 5.

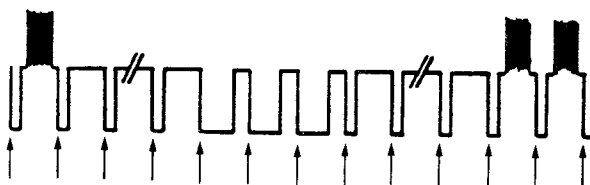
Frames

For character video the total number of lines in a vertical scan is 320, taking $320 \times 64 \mu s = 20.48$ ms. The frame frequency is therefore 48.83 Hz. The lines are used as follows:

- 1 to 3 : Vertical sync
- 4 to 24 : Dead time
- 25 to 312 : Lines displayed
- 313 to 320 : Dead time

The time available for retrace (flyback) is therefore 32 intervals of $64 \mu s$ (lines 1 to 24 + lines 313 to 320), or 2.048 ms.

Vertical sync is achieved on lines 1 to 3 by extending the line sync pulse which, on all other lines lasts up to the end of the 7th interval (4.3 μs), until the end of the 97th interval, making the sync pulse 59.7 μs long.



Since this extended sync pulse occurs on three successive lines, it is equivalent when integrated to a pulse $3 \times 59.7 \mu s = 179.1 \mu s$ long.

For Graphic Video, two options are available: 625 line 50 Hz operation or 525 line 60 Hz operation. The total picture is made up of 448 displayed lines. However, as line interlacing is used, alternate frames display 224 lines each. The vertical frame sync sequence is made up of five equalization pulses of 2.4 μs duration, five vertical sync pulses of 27.2 μs duration and a further five equalization pulses. The pulses begin at half line period intervals, and the sequence appears half a line period later on alternate scans.

Using the 625 line option, the total number of line intervals in each frame alternates between 313 and 312. These line intervals are used as follows:

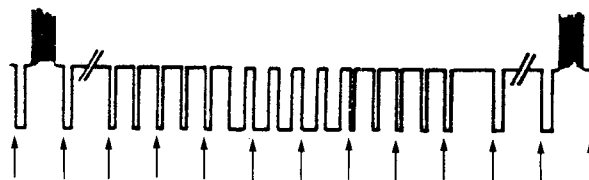
- 1 to 224 : Lines displayed
- 225 to 228 : Dead time
- 229 to 236 : Vertical sync sequence
- 237 to 312 : Dead time
- 313 : Dead time, alternate scans only

The time available for retrace is therefore 88 intervals of $64 \mu s$ (lines 225 to 312), or 5.63 ms.

Using the 525 line option, the total number of line intervals in each frame alternates between 261 and 260. These line intervals are used as follows:

- 1 to 224 : Lines displayed
- 225 to 228 : Dead time
- 229 to 236 : Vertical sync sequence
- 237 to 260 : Dead time
- 261 : Dead time, alternate scans only

The time available for retrace is therefore 36 intervals of $64 \mu s$ (lines 225 to 260), or 2.3 ms.



Note: A negative going edge occurs at the points indicated in order to maintain line synchronization.

CO-AX CABLE AND CONNECTORS

Recommended alternative types of 75 ohm co-ax are:

- URM70
- RG59B/U

(The former type is more readily available in Europe, and the latter type in America).

Both these types of cable give an attenuation to the video signal of about 3 dB per 100 m. Since monitors, as recommended above under "Essential Features", should be capable of accepting signals attenuated by 6 dB, it follows that the recommended cables are suitable for driving video monitors at a distance of up to 200 m from the termination panel. Where a number of video monitors are daisy chained, the distance of 200 m is the distance to the remotest one.

The recommended type of BNC connector is the Kings type KG-59-518. This type is recommended for the very practical reason that it consists of only three parts, and therefore has least chance of an electrician assembling it incorrectly. (This has been known to happen with other types of co-ax connector consisting of more parts, which cannot be checked without disassembling them).

The address is:

Kings Electronics Co. Inc.
40, Marbledale Road,
Tuckahoe,
New York 10707.

Kings connectors are available in the U.K. from:

ALD Components Ltd.,
Dalma House,
Kings Mill Lane,
South Nutfield,
Redhill,
Surrey,
RH1 5ND

Details of how to make up these connectors are given in the GEM/80 Installation and Maintenance Manual.

4 ID0200G/0016G

GEC Industrial Controls Limited.
Programmable Controllers Division,
Kidsgrove, Stoke-on-Trent,
Staffordshire ST7 1TW, England.
Tel: Kidsgrove (07816) 3511
FAX (Group 3) Kidsgrove (07816) 76329
Telex: 36293 GECICK

Also at:
Mill Road, Rugby,
Warwickshire CV21 1BD.
Tel: Rugby (0788) 2121

Registered at London No. 540682
Holding Company: The General Electric Company p.l.c.,
1 Stanhope Gate, London, W1A 1EH.

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