GPI VERTICAL INTERVAL TRANSMISSION SYSTEM

1. OVERVIEW

The GPI Vertical interval transmission system provides a method of transporting simple 'contact closure' information along a video path in the user bits of vertical interval time code (VITC). In order for this system to operate correctly, there are three basic requirements, which need to be met in order to allow the receiving location to decode the information correctly AND accurately. The time code carrier for the GPI information must is standard SMPTE 12M vertical interval time code. Although the GPI information may also be encoded into longitudinal time code, the preferred carrier is vertical interval time code as it passed through along with the video signal, and can easily be routed around a video plant or from plant to plant via satellite.

Standard Video levels for VITC are required in order for the receiving devices to decode this information properly and reliably.

2. ENCODING

GPI information is encoded into the VITC using a method that increases the robustness and reliability of the overall transmission system. The encoding format includes the following three features:

1. The binary group flags of the timecode are set to the eight-bit character mode. (Binary Group 0 bit is set to 1 and binary group bits 1 and 2 are set to 0).

2. The most significant bit (msb) of each user bit byte pair of data is set to 1. As an example, each byte must be: 10000000, or displayed in HEX format: 80.

3. The byte formed by user bit groups 1 and 2 (normally shown on the right of user bits displays) is to set to the ASCII characters ^S or ^T (HEX values 13 or 14 respectively). With the msb set the resulting value HEX 93 or 94.

Evertz has two encoders and two decoders that can be used for this system. When encoding GPI information onto analog video, the model 621 VITC generator is used. When encoding GPI information onto SDI video, the model 8010 Time code generator is used. When decoding from analog video the 622 VITC reader is used. When decoding from SDI video the 7721GPI-D module is used. Care must be taken that the encoder is set to the correct mode for encoding GPI information, or the companion decoder will not be able to reliably recover the GPI information. The chart below shows the input and output pins for the various encoders and decoders, and the corresponding user bit values that will be encoded.

	Encoder Input Pins		Decoder Output Pins		Encoded User
GPI #	621	8010	622	7721GPI-D	Bit Data
1	5	4	2	4	81
2	9	5	1	8	82
3	4	8	3	3	84
4	8	7	8	1	88
5	3	6	4	13	90

The 621 VITC generator is always set to the GPI mode when the LTC option is not fitted, When the 621 has the LTC option fitted, DIP switch 1 of SW1 controls whether GPI information will be encoded or not. It must be set to the Off position to encode GPI information (for further information see the 621 manual)

The 8010 DVITC generator has several operating modes. In order to correctly encode GPI information the *GEN MODE* menu item must be set to the *Gmode time rctl* setting so that the three encoding requirements above are met. There are 5 GPI inputs on the *Parallel I/O* connector on the rear panel that will be encoded into the user bits when the 8010 is set to this mode. **Just setting the user bits manually from the front when the *GEN MODE* is set to *Gmode time data* will not meet the above requirements.** When the GPI inputs are open (high) the resulting user bits can be shown on the front panel as: 80 80 80 93. **Note:** There is no direct way of viewing the Binary group flags using the 8010. The transmitted VITC is now in the correct GPI encoding format and ready to be decoded by the companion decoders. When one of the GPI inputs is closed to ground, a corresponding bit is set in user bit groups 7 and 8 (the digit pair on the left of the user bit display). See 8010 Manual Change Sheet 1.3-3 for more information about GPI mode on the 8010.

3. TRANSMISSION METHODS

3.1. Live Transmission

The recommended method for transmitting GPI triggers is to have the 8010 placed as close possible to the transmission end. This prevents the possibility of other equipment removing, corrupting or otherwise modifying the encoded GPI's and the associated signal. This also provides a constant stream of data for downstream decoders to lock onto. The downstream devices do not have to search for the transmitted GPI line(s).

3.2. Recorded GPI Transmissions

Although not the most ideal method of transmission, this method is quite acceptable. There are a few things that should be done to assure reliable decoding of data at the receiving decoders.

1. Make sure that the video server or VTR is recording the lines that contain the VITC with GPI trigger events encoded. Also on playback, many video servers and VTRs blank of particular lines especially in the VBI. Be sure that the lines used to record the VITC with GPIs encoded are properly passed.

2. Make sure there are a few frames of the GPI encoded VITC signal recorded prior to the actual GPI event. This allows the decoders a chance to "lock" onto the signal before the GPI event occurs providing a clean trigger.

3. Make sure there are a few frames of the GPI encoded VITC signal recorded with the GPI bit cleared off after the actual GPI event. On the analog 622 decoder, the GPI outputs will automatically be released if incoming GPI encoded VITC is lost. On the 7721GPI-D digital decoder, there is a menu setting that determines if the last state of the GPI will be held ore released if the incoming GPI encoded VITC signal is lost. So, if a GPI is not specifically released before switching to another feed, the last state of the GPI may be held.

4. Compression through MPEG Encoders / decoders is acceptable as long the integrity of the GPI triggers is maintained. For bandwidth purposes, many MPEG encoders transmit only the active picture area. Our GPI encoders / decoders allow insertion in the active picture area. The 8010 and

7721GPI-D SDI devices allow the VITC to be up to line 31 in the active picture. The 621 and 622 analog devices require special firmware to allow lines up to 24 for NTSC and 25 for PAL.

4. DECODING

For the decoder device to properly decode the incoming encoded GPI information, the same 3 requirements are required by the decoder. Note: The older analog system **may** function without the use of the binary group flag being set but this flag **is** required in the SDI system. Both Analog and digital decoders have the capability of decoding selected lines, or being placed into **auto** mode. Depending on how the system is to be used, will depend on how the decoder is configured.

On the 7721GPI-D digital decoder, there is an on screen display that shows the decoded time and user bits and the states of the binary group flags. This can be used to verify that the signal has been encoded correctly. See the 7721GPI-D manual for further information.

4.1.1. Auto Mode

In this mode, the GPI decoder will scan the VBI looking for VITC. When it encounters an active line it will then “LOCK” onto this line and begin reading/ decoding this line. Auto mode is best suited for systems where the GPI encoded VITC line may occur in any area of the VBI. This may be the case when the decoder is receiving signals from different transmission locations are used **and** the GPI encoded VITC has been encoded on different lines for each of these sources.

NOTE: The analog decoder will lock onto the first line containing VITC even if it does not have the GPI encoding format present. If there is another set of VITC without GPI information encoded on a lower line number then the 622 will not properly decode the GPI information. For this reason, you **must** use manual line select mode when you are transmitting multiple sets of VITC and decoding using analog decoders. The 7721GPI-D digital decoder will only lock onto VITC lines that have a valid GPI encoding format present. Auto mode is suitable unless you are encoding multiple sets of GPI encoded VITC in the video signal.

4.1.2. Line Select Mode

With this mode, you can be line specific. For example, if multiple GPI triggers are required for various equipment downstream, multiple lines may be sent simultaneously in the video signal. By selecting a particular line to decode downstream the GPI decoder will ignore all other lines and data being sent and only deal with its selected line. This feature is available in both the digital and analog decoders.

An additional feature with the analog decoder is that it allows for line ranges. In this mode, the decoder can be set to watch at range of lines for a GPI trigger. This allows the decoder to exclude some lines where other VITC may be located while looking for GPI encoded VITC in a range of lines. (e.g. the GPI information may be on line 15 for one device, line 16 for another device, etc. or if the actual trigger line is unknown at the time of setup.)

5. SYSTEM LATENCY

The input to output latency between GPI closure on the encoder and GPI closure on the decoder is 2 to 3 frames, depending on when the GPI was closed with respect to the video frame.