

This technical note discusses the following topics:

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## 30.1 Overview

The KAD/VID/103 module is a video encoder module that converts one of three composite video (CVBS) inputs or one S-Video input into digital video and compresses it using an MPEG-4 encoding scheme. The module also accepts analog audio inputs and compresses them using an Adaptive Differential Pulse-Code Modulation (ADPCM) encoding scheme.

The video and audio are then placed into an MPEG-2 transport stream, which is output onto the Acra KAM-500 backplane.

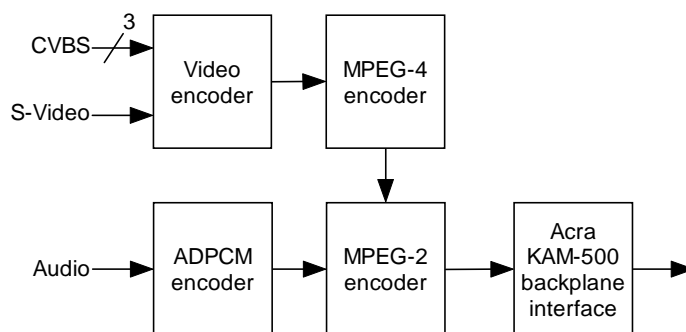


Figure 30-1: KAD/VID/103's compression of audio/video input

## 30.2 Compression methods

The KAD/VID/103 automatically compresses video and has an option to compress audio.

### 30.2.1 Video compression

The KAD/VID/103 compresses video using the MPEG-4 Simple Profile technique. This method encodes each received frame as either an I-frame (Intra coded) or a P-frame (PRedicted) depending on the module settings.

#### 30.2.1.1 I-frames

I-frames take all the information in the received picture and encode it using a lossy compression scheme to create a reference frame. This reference frame can be thought of as a stand-alone frame, that is, it does not need any information from other frames in the video stream to be viewed. This means that each I-frame is an accurate representation of the received analog picture.

#### 30.2.1.2 P-frames

P-frames encode only the changes from the previous frame. This means that P-frames need information from previous frames to be viewed. This results in a reduction of bandwidth needed to encode a moving picture. However, if the picture were to change quickly, an accurate representation would not be displayed until the next I-frame was processed.

#### 30.2.1.3 Group Of Pictures (GOP)

I-frames and P-frames are grouped together in a GOP. The setting used for GOP determines the image quality and bandwidth.

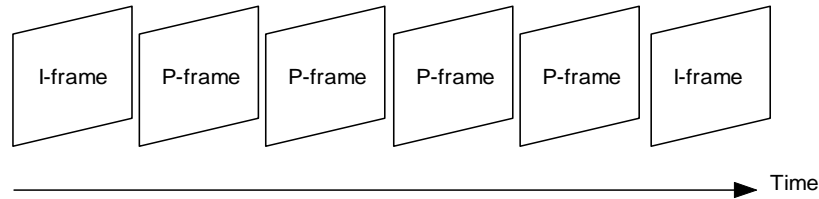


Figure 30-2: GOP with P-frame to I-frame ratio of 5:1

### 30.2.2 Audio compression

The KAD/VID/103 compresses audio using ADPCM. This uses an encoding philosophy similar to that used by MPEG-4 Simple Profile. ADPCM encodes the difference between a predicted sample and the current audio sample. The bit-rate for audio is fixed at 64 kbps per channel.

### 30.2.3 Video and audio encoding

The MPEG-4 video and ADPCM audio are then encoded in an MPEG-2 transport stream. An MPEG-2 transport stream is a fixed length (188 bytes) packet.

These packets are then fragmented into 16-bit words, which are output onto the Acra KAM-500 backplane on a FIFO basis. From there they can be inserted in a PCM frame, a UDP packet, logged to a memory module, or a combination of all three.

## 30.3 Setting up the KAD/VID/103

### 30.3.1 Hardware setup

The KAD/VID/103 occupies two slots in an Acra KAM-500 chassis and has two 52-way connectors as shown in the following figure.

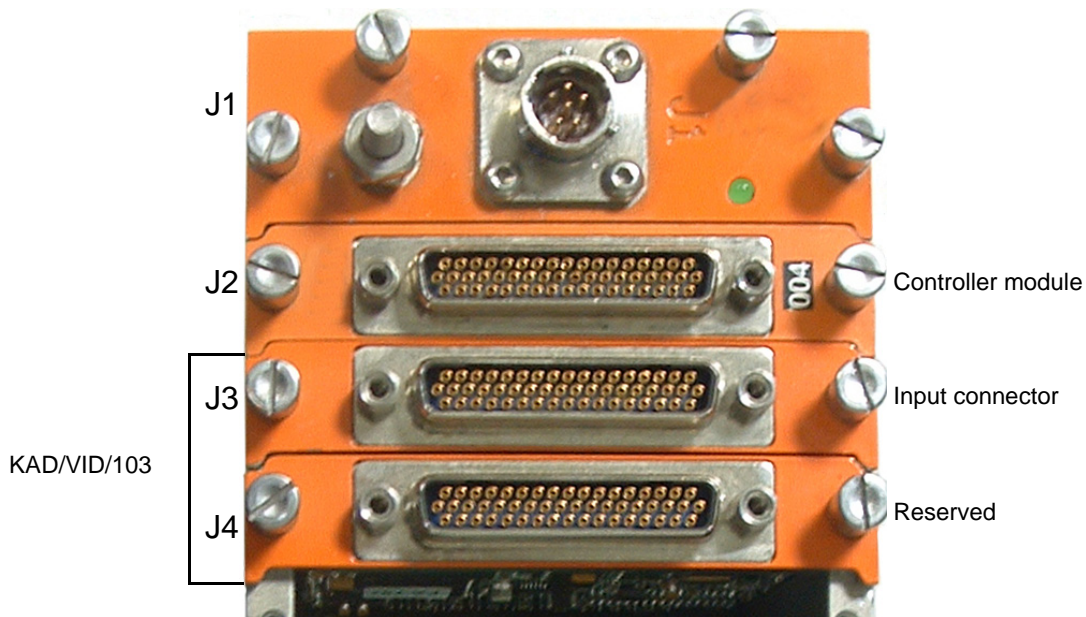


Figure 30-3: Positioning for a KAD/VID/103 module in a chassis

The connector nearest the controller module contains the I/O pins; the other connector is an interface for programming and debug and should not be used. When using the setup software, the connector that is furthest from the controller module determines the location of the module, in this case slot J4.

### 30.3.1.1 Pinout connections

Pinout connections are described in the following table.

Connection	Description
CVBS_0_IN CVBS_1_IN CVBS_2_IN	<p>These input connections allow up to three independent composite video sources to be connected.</p> <hr/> <p><b>NOTE:</b> The KAD/VID/103 can only process one video input at a time.</p>
Y_IN C_IN	<p>These two input connections are used for component (S-Video) inputs. Y_IN corresponds to luminance; C_IN corresponds to chrominance.</p>
CAM_2_GENLOCK_OUT CAM_3_GENLOCK_OUT	<p>Composite video waveforms output a regular sync pulse (every 64µs for PAL, every 63.5µs for NTSC) that can be used to synchronize multiple video inputs. When a video source is connected to CVBS_0_IN, its output waveform is available on both GENLOCK outputs. This allows up to two other composite video sources connected to CVBS_1_IN and CVBS_2_IN to be synchronized with the CVBS_0_IN input.</p>
AUDIO_RIGHT_IN AUDIO_LEFT_IN	<p>These are the inputs for audio.</p>
CAM_SEL_BIT_0 CAM_SEL_BIT_1 CAM_SEL_BIT_2	<p>If Input Select is set to CONNECTOR, these three inputs can be used to select the input video source.</p> <hr/> <p><b>NOTE:</b> These connections are internally pulled high; they must be tied to ground as shown in the following table to select the various inputs.</p>

#### Camera selection

CAM_SEL_BIT [2:0]			Selected Input
GND	GND	GND	Outputs a simple test pattern
GND	GND	NC <sup>1</sup>	CVBS_0_IN
GND	NC	GND	CVBS_1_IN
GND	NC	NC	CVBS_2_IN
NC	GND	GND	Y_IN, C_IN

1. NC = not connected.

### 30.3.2 Software setup

The KAD/VID/103 can be configured using kSetup.

#### 30.3.2.1 Parameters tab settings

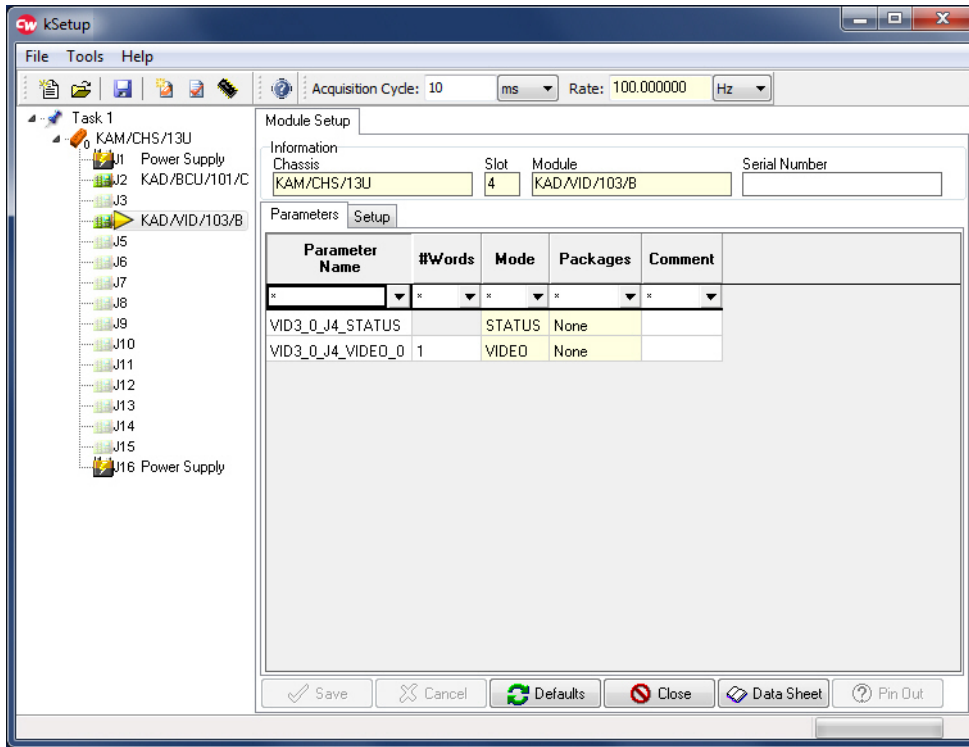


Figure 30-4: Parameters tab in kSetup

The Parameters tab has two Mode settings; the STATUS word and the VIDEO word. They are described in the following table.

Mode	Description
STATUS	<p>This word relates the status of the module. Three bits of the status word are defined.</p> <hr/> <p><b>NOTE:</b> The KAD/VID/103 STATUS word definitions are as follows:                      R(2) - Built-in self test passed.                      R(1) - Audio input signal connected.                      R(0) - Video input signal connected.</p>
VIDEO	<p>It is possible to specify more than one data word from the KAD/VID/103. The amount of video words specified should be chosen so as to optimize available bandwidth. For example, 10 video words placed at 10:1 commutation in the frame is equivalent to 1 video word placed at 100:1 commutation—the advantage lies in the fact that 10:1 commutation is usually easier to achieve than 100:1 commutation.</p>

30.3.2.2 Setup tab settings

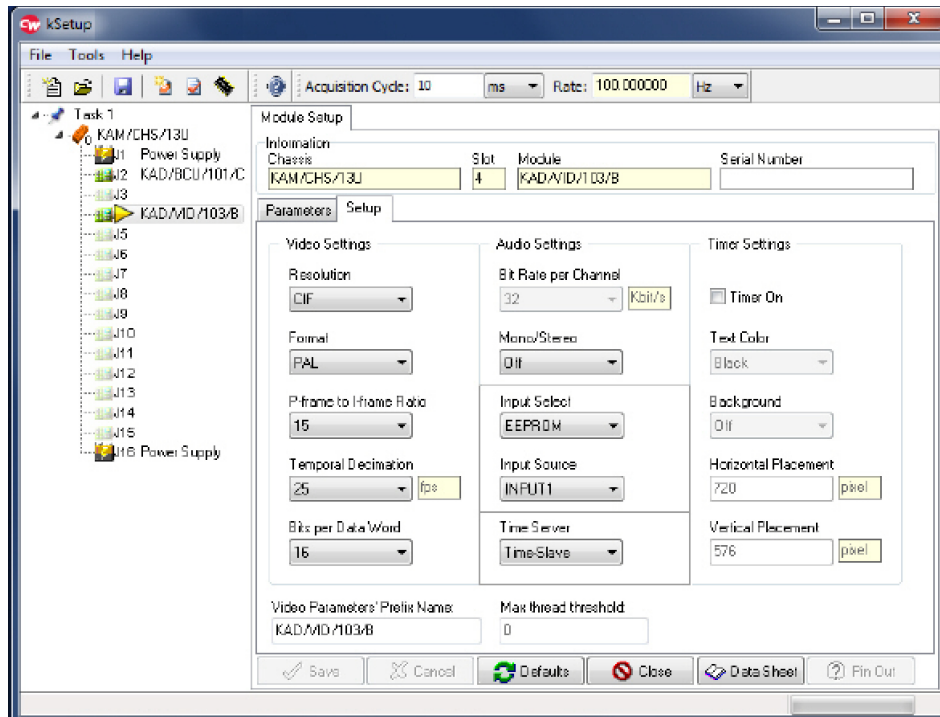


Figure 30-5: Setup tab in kSetup

The Setup tab covers video, audio and timer settings, which are described in the following table.

Setting	Description
Resolution	Determines the resolution of the displayed image. For details of options available, see “Resolution options for the KAD/VID/103” on page 6.
Format	Determines the input format; PAL (Europe and Asia) or NTSC (the Americas). This setting must match the video source.
P-frame to I-frame Ratio	Determines the ratio of P-frames to I-frames in the output video. Allowed values range from All (all I-frames) to 1800’ (1 I-frame to every 1,800 P-frames). A higher P-frame to I-frame ratio reduces the amount of bandwidth needed for a given video application. However, the video stream takes longer to recover should any bit errors occur. We recommend using an initial setting of 5:1 and experimenting from there.
Temporal Decimation	Determines the number of frames per second (fps) displayed in the video output. This setting can be used as a crude method to reduce bandwidth. For example, displaying 12.5fps uses just over half the bandwidth needed to display 25fps.
Bits per Data Word	Determines the number of bits that the video words use; allowed values are 12 or 16 bits. We recommend that 16 bits is used whenever possible. If 12-bit words are to be used, ensure that there is an even number of video words defined in the parameters section.
Bit Rate per Channel	This is fixed at 32 kbps per channel.
Mono/Stereo	Determines which audio channels (if any) are to be used.
Input Select	There are up to three camera inputs. The module acts as a multiplexer so you can switch between cameras. The active channel can be pre-set in the EEPROM during configuration, or it can be read from the configuration of several pins on the connector. Use this option to select which method the module should use to select the camera input.

Setting	Description
Input Source	If Input Select is set to EEPROM this option specifies the video source. For details of options available, see “ Input source options” on page 6.
Time Server	This determines the time source for the KAD/VID/103. If Time-Slave is selected, the KAD/VID/103 gets its time from an IRIG source (such as a KAD/BCU/xxx or a KAM/TCG/xxx module). If Free-Running is selected, then the KAD/VID/103 counts its own time from power on, with no reference to outside clocks.
Timer On	The KAD/VID/103 can display BCD time in the video output. Checking this box enables this option.
Text Color	Determines the timer text color.
Background	Determines the background shading of the timer.
Horizontal Placement/ Vertical Placement	Determines the location of the timer in x y co-ordinates in pixels from the top-left corner of the screen.
Video Parameter's Prefix Name	Enables multiple words of video to be transmitted over Ethernet. For more information, see “30.3.2.3 Prefixing of the video parameter name” on page 6.
Max thread threshold	Advance option. Use 0 by default for the compiler to manage the video words on the backplane.

### Resolution options for the KAD/VID/103

Option	Resolution settings (in pixels)
CIF	352 × 288 (PAL) 352 × 240 (NTSC)
2CIF	704 × 288 (PAL) 704 × 240 (NTSC)
D1	704 × 576 (PAL) 704 × 480 (NTSC)

### Input source options

Option	Description
TEST	Outputs a simple test pattern
INPUT1	Channel 1 composite
INPUT2	Channel 2 composite
INPUT3	Channel 3 composite
YC	YC input (S-video)

#### 30.3.2.3 Prefixing of the video parameter name

The video parameter enables video to be transmitted over Ethernet. To enable multiple words of video to be transmitted over Ethernet, the video parameter is prefixed with its parameter name (see the Video Parameter's Prefix Name field in “Figure 30-5: Setup tab in kSetup” on page 5). To allow for more optimized backplane scheduling, we recommend using this naming convention rather than using one video word (and increasing the number of occurrences in the packet). For example, if the parameter name in the Parameters tab is VID3\_0\_J14\_VIDEO\_0, to enable multiple words of video to be transmitted over Ethernet, use VID3\_0\_J14\_VIDEO in the Video Parameter's Prefix Name field.

### 30.3.3 Using video

There is no inherent difference between video data and other types of Acra KAM-500 data, except that video data generally uses far greater bandwidth. Video bandwidth (or MPEG-4 bit-rate) for a PCM stream can be calculated as follows:

MPEG-4 bit-rate = number of video words × number of bits per video word × commutation × number of minor frames × frame rate (bps)

A similar approach can be used to calculate the bandwidth for placement in a UDP packet or logging to a memory module (for example a KAM/MEM/103). The MPEG-4 bit-rate needed depends on the application (see the following table for guidelines).

#### Optimal KAD/VID/103 settings

Resolution	Frame rate (fps)		Bit-rate (bps) (minimum to maximum)
	PAL	NTSC	
CIF	1	1	64k - 100k
CIF	12.5	15	750k - 1.0M
CIF	25	30	1.0M - 1.5M
2CIF	12.5	15	1.0M - 1.5M
2CIF	25	30	2.0M - 2.5M
D1	12.5	15	2.0M - 2.5M
D1	25	30	4.0M - 4.5M

**NOTE:** If audio is to be used in the application, up to 64 kbps (32 kbps per channel) extra bandwidth is required.

The KAD/VID/103 is unique amongst Acra KAM-500 modules in that it does not support different sample rates. If video data is being sent to more than one destination in the system (such as a PCM frame, a UDP packet or a memory module) it must be sampled at the same rate by the destination modules. kProgram does not flag this as an error.

#### 30.3.3.1 Using video in PCM

Video data can be used in a PCM frame like any other type of data. The KAD/VID/103 is optimized to read and transmit two MPEG-2 packets (376 bytes, 188 video parameters) at a time. Thus to ensure minimum delay, no more than 188 video parameters are read at a time.

As video data generally uses more bandwidth than other data, we recommend placing the video data prior to placing any other data from the system and placing the first video word as close as possible to the beginning of the frame to ensure reliable operation.

#### 30.3.3.2 Using video over Ethernet

Video data can be placed in a UDP packet created by a KAD/ETH/xxx or networked KAD/BCU/xxx module. However, due to the different transmission mechanisms between Ethernet packets and PCM frames, care has to be taken when using video over Ethernet.

The KAD/VID/103 outputs the video words onto the backplane in an order which is transparent. This poses no problem when using PCM—each parameter is always read at a specific time by the controller module and then placed in a specific location in the PCM frame. However, when sampling using Ethernet, the UDP packet is not transmitted until it is *full*. This means that video parameters can appear out of order. Consequently, the MPEG-2 transport stream makes no sense to a decoding device. There are three methods to get around this constraint:

- Use only one video word and transmit it as many times as necessary in the UDP packet (see setup required in “Figure 30-6: Transmitting one video word many times in a UDP packet” on page 8).  
The disadvantage with this method is that the task may not compile due to timing considerations.

Parameters		Setup		
Parameter Name	#Words	Mode	Packages	Comment
*	*	*	*	*
VID3_0_J4_STATUS		STATUS	None	
VID3_0_J4_VIDEO	1	VIDEO	View...	

KAM/CHS/13U	KAD/BCU/101/B	STATUS_0_J2_0	Yes	No	N/A	1	16
KAM/CHS/13U	KAD/VID/103	VID3_0_J4_STATUS	Yes	No	N/A	1	16
KAM/CHS/13U	KAD/VID/103	VID3_0_J4_VIDEO	Yes	Yes	VID_packet	100	16

Figure 30-6: Transmitting one video word many times in a UDP packet

- Place the video parameters in a PCM frame to force the ordering in the UDP packet (even if the PCM frame is not going to be used).  
If this method is to be used, ensure video parameters do not occur more than 188 times in a single packet. The disadvantage with this method is that it uses up PCM bandwidth.
- Use the Video Parameter's Prefix Name field to allow multiple words to be transmitted over Ethernet. For more information, see "30.3.2.3 Prefixing of the video parameter name" on page 6.

### 30.3.3.3 Using video with a memory module

Video data can be logged to a memory module like any other type of data. The following two constraints apply:

- Video parameter names must follow the syntax <optional\_label>VIDEO<optional\_label>.
- Video words must be sampled at the same rate in the memory module as in the PCM frame (see setup required in the following figure).



Acquisition Cycle: 100 ms Rate: 10.000000 Hz

IRIG PCM MAP : BCU\_VID\_frame

0	1	2	3	4	5
0	SFD	VID3_0_J4_VIDEO	VID3_0_J4_VIDEO_1	VID3_0_J4_VIDEO_2	VID3_0_J4_VIDEO_3
1	SFD	VID3_0_J4_VIDEO	VID3_0_J4_VIDEO_1	VID3_0_J4_VIDEO_2	VID3_0_J4_VIDEO_3
2	SFD	VID3_0_J4_VIDEO	VID3_0_J4_VIDEO_1	VID3_0_J4_VIDEO_2	VID3_0_J4_VIDEO_3
3	SFD	VID3_0_J4_VIDEO	VID3_0_J4_VIDEO_1	VID3_0_J4_VIDEO_2	VID3_0_J4_VIDEO_3

Chassis	Module	Parameter Name	Enabled	Placed	Word Index	Minor Frame	Desired Rate	Real Rate	Commutation
*	*	*VIDEO*	*	*	*	*	*	*	*
KAM/CHS/13U	KAD/MID/103	VID3_0_J4_VIDEO	Yes	Yes	1	0	100	4000.000	100:1
KAM/CHS/13U	KAD/MID/103	VID3_0_J4_VIDEO_1	Yes	Yes	2	0	100	4000.000	100:1
KAM/CHS/13U	KAD/MID/103	VID3_0_J4_VIDEO_2	Yes	Yes	3	0	100	4000.000	100:1
KAM/CHS/13U	KAD/MID/103	VID3_0_J4_VIDEO_3	Yes	Yes	4	0	100	4000.000	100:1

Module Setup

Information  
 Chassis: KAM/CHS/13U Slot: 6 Module: KAM/MEM/003/C Cycles/Block: 20.44 Card utilization: 97.83 %

Parameters | Setup | Sampling Strategy | Trigger Conditions

Protocols

Name	Samples/Cycle	Bits	Sample Rate(Hz)
*	*	*	*
VID3_0_J4_VIDEO	400	16	4000.000
VID3_0_J4_VIDEO_1	400	16	4000.000
VID3_0_J4_VIDEO_2	400	16	4000.000
VID3_0_J4_VIDEO_3	400	16	4000.000

Memory Logging Time

Overall Samples/Second: 16020.00 Strategy Filename: strategy.txt

Parameters Available Always overwrite:

Figure 30-7: Logging video data to a memory module at the same rate as it is sampled in PCM

## 30.4 Viewing KAD/VID/103 data

The data from the KAD/VID/103 can be viewed in real-time using gVideo, GS Works 8, or at a later date by using a memory module.

### 30.4.1 Using gVideo

gVideo can be used to decompress up to four separate video streams in one incoming PCM stream. The decompressed video streams can be viewed through either hardware (GTS/VID/001 PCI board) or software (Mplayer).

Mplayer is a third party program (<http://www.mplayerhq.hu/>) with several limitations. It does not support audio and it shows a noticeable latency in the end display. If a system contains a sink module, for example a memory module, that is used to sink video data then gVideo does work but Mplayer is not displayed. To get around this limitation, remove the sink module from the task to be used with gVideo. Due to these limitations we recommend using a GTS/VID/001 module.

**TIP!** Avoid placing the KAD/VID/103 status word in the video PCM stream as this degrades gVideo's performance.

### 30.4.1.1 Main tab settings

When gVideo is launched the Main tab displays.

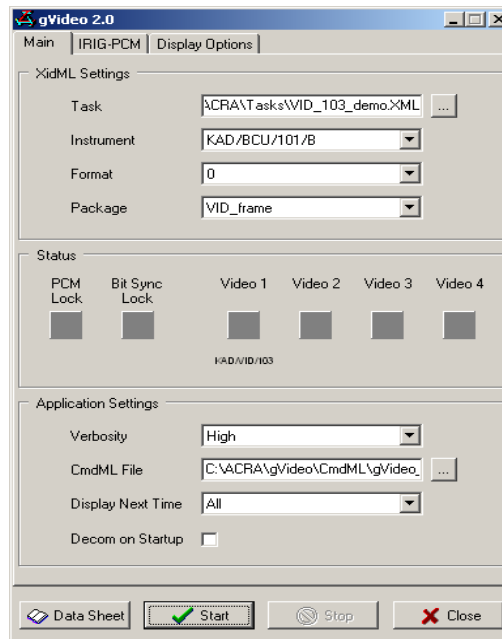


Figure 30-8: gVideo Main tab settings

Settings on the Main tab are described in the following table.

Setting	Description
Task	Specifies the XidML file that defines the system configuration.
Instrument	Specifies the sink module that is supplying the video data.
Format	Specifies the particular system format.
Package	Specifies the package (PCM frame, UDP packet) name containing the video data.
Status	Indicates the system status when gVideo is running: green indicates status OK; red indicates a problem.  <b>NOTE:</b> It is possible to have PCM lock (green) but no video (red) as shown in the following figure. This indicates a problem with the MPEG-4 bit stream (such as a the MPEG rate being too low).

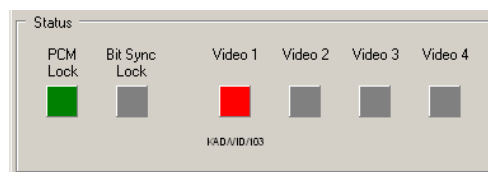


Figure 30-9: PCM frame in lock with no readable video stream

### 30.4.1.2 IRIG-PCM tab settings

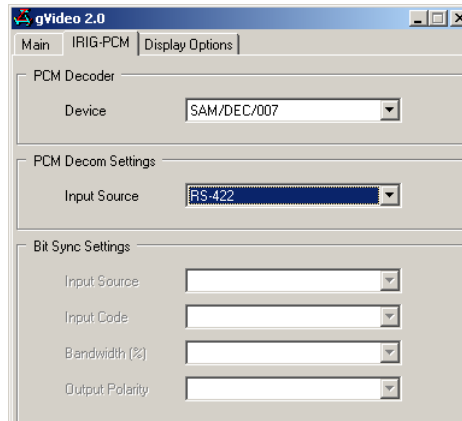


Figure 30-10: gVideo IRIG-PCM tab settings

Settings on the IRIG-PCM tab are described in the following table.

Setting	Description
Device	Specifies the device (SAM/DEC/007/C, GTS/DEC/001, GTS/BSC/001) to be used to decommutate the video data.
Input Source	Specifies the electrical signaling protocol (RS-422, TTL) that is used to transmit the PCM stream.

### 30.4.1.3 Display Options tab settings

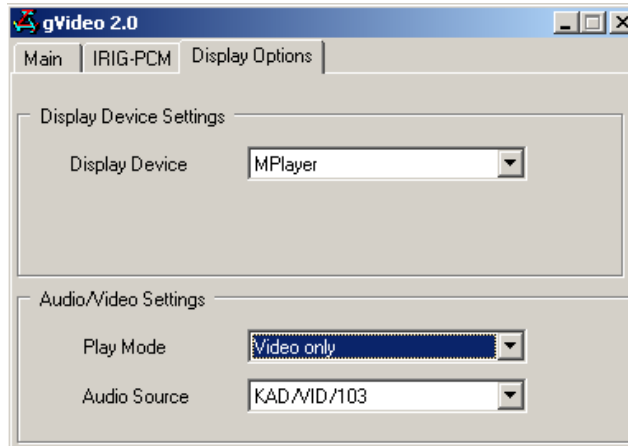


Figure 30-11: gVideo Display Options tab settings

Settings on the IRIG-PCM tab are described in the following table.

Setting	Description
Display Device	Specifies the method to be used (Mplayer, GTS/VID/001) to view the video stream.
Play Mode	Specifies the data to be decommutated: Video and audio; Video only; or Audio only.
Audio Source	If audio is required, specifies the name of the KAD/VID/103 module which is supplying the audio stream.

**NOTE:** gVideo is now an obsolete product.

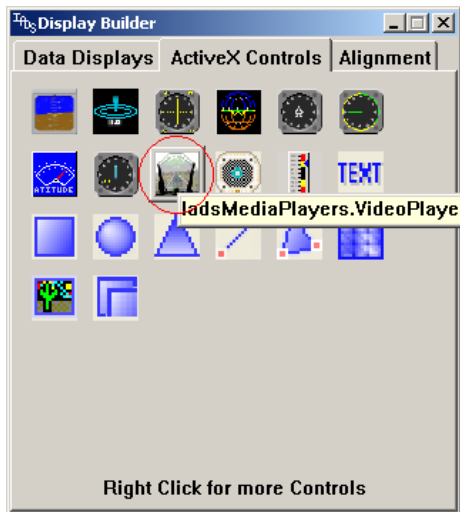
### 30.4.2 Using GS Works 8

Video data is treated the same as other types of Acra KAM-500 data by GS Works 8.

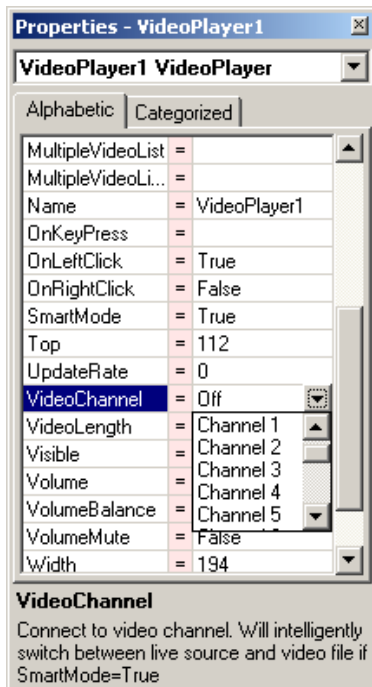
**NOTE:** To view video using GS Works 8, the ffdshow codec must be installed. Download **ffdshow-20041012.exe** from the following link (newer versions of the codec do not work with GS Works 8):  
[http://sourceforge.net/project/showfiles.php?group\\_id=53761&package\\_id=59355&release\\_id=274595](http://sourceforge.net/project/showfiles.php?group_id=53761&package_id=59355&release_id=274595)

After installing the codec, do the following to view video in GS Works 8.

1. Open GS Works 8 and follow the Start Wizard to load the data you want to view.
2. Click the **Display Builder** button on the dashboard to open the **Display Builder** window.
3. On the **Data Displays** tab, drag the **Analysis Window** icon to the desktop.
4. On the **ActiveX Controls** tab, drag the **VideoPlayer** icon to the **Analysis** window.



5. Right-click the **VideoPlayer** window and select **Properties**.
6. In the **Properties** window, scroll to the **VideoChannel** field and select the channel corresponding to the KAD/VID/103 output from the drop-down menu.



The video stream displays in the VideoPlayer.

### 30.4.3 Using a memory module

As with any data, video data can be logged to a memory module for later viewing. Ensure that the KAD/VID/103 parameters are named <label>VIDEO<label> for correct operation.

Once the video data has been logged to a CompactFlash® card, it can be extracted using kFlashCardXID. The output format must be Video (MPEG-2 Transport Stream) as shown in the following figure.

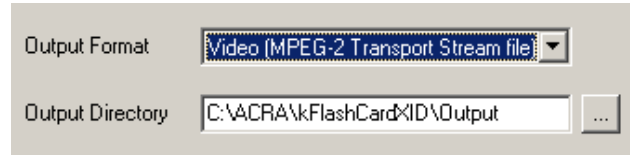


Figure 30-12: Selecting video output format in kFlashCardXID

The video is extracted as a transport stream file (<filename>.ts) to the specified output directory. This transport stream file can then be viewed by MPEG viewing software such as VLC (<http://www.videolan.org/vlc/>).

## 30.5 Troubleshooting

### 30.5.1 Only a blue screen is displayed

This means the KAD/VID/103 is operating correctly but it is not receiving a video stream.

- Ensure the correct 52-way connector is being used (see “30.3.1 Hardware setup” on page 2).
- If camera selection is through the connector ensure the correct pins are grounded (see CAM\_SEL\_BIT\_0, CAM\_SEL\_BIT\_1, and CAM\_SEL\_BIT\_2 described in “30.3.1.1 Pinout connections” on page 3).
- If camera selection is through EEPROM ensure the camera is connected to the correct input (see Input Select described in “30.3.2.2 Setup tab settings” on page 5).
- Ensure the camera is working.

### 30.5.2 gVideo (or GS Works 8) is in PCM lock but no video is displayed

This usually means there is either a problem with the KAD/VID/103 video data, or with destination modules.

- Ensure the correct output format is selected (PAL or NTSC) (see Format described in “30.3.2.2 Setup tab settings” on page 5).
- Ensure the MPEG bit-rate is adequate for the application. For information, see “30.3.3 Using video” on page 7.
- If more than one destination module is being used in the system, ensure that the KAD/VID/103 data is sampled at the same rate in each destination module. For information, see “30.3.3 Using video” on page 7.
- If a sink module (such as a memory module) is being used to sink video data, remove the sink module from the XidML task that gVideo uses. For information, see “30.3.3 Using video” on page 7.

### 30.5.3 The clock is not visible

- Ensure Timer On is enabled (see Timer On described in “30.3.2.2 Setup tab settings” on page 5).
- If CIF resolution is selected, the location of the timer may need to be altered; we recommend (x, y) = (100, 100). For information, see Horizontal Placement/Vertical Placement described in “30.3.2.2 Setup tab settings” on page 5.

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