



IP Device Integration Notes

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Applied to

GV-System version 8.4

Naming and Definition

GV-System	GeoVision Analog and Digital Video Recording Software. In the document, GV-System also indicates Multicam System , GV-DVR System , GV-NVR System and GV-Hybrid DVR System at the same time.
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Summary

The document is composed of three sections:

1. Total Frame Rate Supported and Windows Memory Limit:

This section gives you an idea of the total frame rate that GV-System can support with different resolutions and codecs. The maximum frame rate is limited by CPU capacity and usage, and the maximum number of connected IP cameras is restricted by Windows memory limit.

In addition, this section also describes the method to calculate the approximate number of IP cameras that you can connect to GV-System.

2. Workarounds to Minimize CPU Usage:

This section suggests the workarounds to lower CPU load and achieve the number of IP cameras you wish to connect.

3. Hard Disk Limitations:

This section describes the data transfer limit of a hard disk. Before recording, it is required to install a sufficient number of hard disks for securing GV-System's performance.



1. Total Frame Rate and Windows Memory Limit

1.1 Test Results for Total Frame Rate Supported and Windows Memory Limit

Core i7		2560x1920 (5M)	2560x1600 (4M)	2048x1536 (3M)	1600 x1200 (2M)	1280x1024 (1.3M)	640x480 (VGA)	320x240 (CIF)
H.264		130 FPS	150 FPS	110 FPS	150 FPS	290 FPS	780 FPS	960 FPS
Memory Limit	32-bit	16 CH	16 CH	23 CH	31 CH	32 CH	32 CH	32 CH
	64-bit	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH
MJPEG		220 FPS	255 FPS	345 FPS	560 FPS	750 FPS	960 FPS	960 FPS
Memory Limit	32-bit	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH
	64-bit	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH
MPEG4		-	-	-	-	420 FPS	960 FPS	960 FPS
Memory Limit	32-bit	-	-	-	-	32 CH	32 CH	32 CH
	64-bit	-	-	-	-	32 CH	32 CH	32 CH
Core 2 Quad		2560x1920 (5M)	2560x1600 (4M)	2048x1536 (3M)	1600 x1200 (2M)	1280x1024 (1.3M)	640x480 (VGA)	320x240 (CIF)
H.264		45 FPS	55 FPS	50 FPS	70 FPS	110 FPS	330 FPS	960 FPS
Memory Limit	32-bit	16 CH	16 CH	23 CH	31 CH	32 CH	32 CH	32 CH
	64-bit	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH
MJPEG		110 FPS	140 FPS	170 FPS	250 FPS	345 FPS	520 FPS	960 FPS
Memory Limit	32-bit	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH
	64-bit	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH	32 CH
MPEG4		-	-	-	-	150 FPS	540 FPS	960 FPS
Memory Limit	32-bit	-	-	-	-	32 CH	32 CH	32 CH
	64-bit	-	-	-	-	32 CH	32 CH	32 CH

Note:

1. The total frame rate is determined with the CPU usage not exceeding 60-70%; 2G RAM on 32-bit Windows, and 4G RAM on 64-bit Windows.
2. The total frame rates of 5M and 4M are higher than that of 3M because Arecont AV5155 camera (simple compression algorithm) is applied for 4M-5M test and GV-BX320D camera (high compression algorithm) is used for 3M to CIF test.
3. The test results may vary based on actual environmental factors, e.g. bitrates.
4. The PC specifications and bitrates used for the test are listed on the last page of this document.



The test results on the previous page provide you two types of information:

1. **Total frame rate supported.** The total frame rate varies among CPU types (e.g. Core 2 Quad or Core i7), resolution and codec of video sources. The total frame rate that GV-System can support is determined with the CPU usage not exceeding 60-70%. Under and with the CPU usage, GV-System's performance and stability can be ensured.
2. **Memory limit on Windows.** When running a program under Windows, you need to be aware of the memory limit that the program can use. Different memory limit on 32-bit and 64-bit Windows will restrict the number of IP cameras you can connect to.

Example:

When the IP camera is set to H.264 codec and 5M resolution, you can only connect up to 16 IP cameras on the 32-bit Windows, but up to 32 IP cameras on the 64-bit Windows.

Core i7		2560x1920 (5M)
H.264		130 FPS
Memory	32-bit	16 CH
Limit	64-bit	32 CH



1.2 Calculation for the Maximum Number of Connected IP Cameras

With the understanding of the above test results, you can now calculate the maximum number of IP cameras that you can connect to GV-System.

Example 1: Calculated number NOT exceeding Windows memory limit

IP Camera Settings

Set an IP camera to 20 FPS, 3M resolution and H.264 codec.

Test Results based on Core i7

Total Frame Rates

Core i7	2048 x 1536 (3M)
H.264	110 FPS

Windows Memory Limit

Memory Limit	2048 x 1536 (3M)
H.264	32-bit 23 CH
	64-bit 32 CH

Calculation

$110 \text{ FPS} / 20 \text{ FPS} \approx 5 \text{ cameras}$

Conclusion

From this calculation, we know that you can connect up to 5 cameras to GV-System. The calculated number (5) does not exceed the channel limitation by Windows memory (which is 23 channels in 32-bit Windows and 32 channels in 64-bit Windows).



Example 2: Calculated number exceeding Windows memory limit

IP Camera Settings

Set an IP camera to 5 FPS, 5M resolution and H.264 codec.

Test Results based on Core i7

Total Frame Rate

Core i7	2560 x 1920 (5M)
H.264	130 FPS

Windows Memory Limit

Memory Limit		2560 x 1920 (5M)
H.264	32-bit	16 CH
	64-bit	32 CH

Calculation

$130 \text{ FPS} / 5 \text{ FPS} = 26 \text{ cameras}$

Conclusion

From this calculation, we know that you can connect up to 26 cameras to GV-System. However, you can eventually connect up to 16 cameras on 32-bit Windows as a result of the channel limitation by Windows memory.



2. Workarounds to Minimize CPU Usage

Using the test results mentioned in the earlier section, you can calculate the approximate number of IP cameras connected to GV-System before a real deployment. However, if your CPU capacity is behind either **Core i7** or **Core 2 Quad** but wish to connect more IP cameras, you will need to sacrifice the codec, resolution or frame rate as a workaround.

2.1 Changing Compression Method

The better compression method you use for video streaming, the higher CPU resource is required to perform **decoding** for live images. Therefore, changing the codec from H.264 to MJPEG or MPEG4 can then greatly reduce CPU load.

The CPU usage to **decode** live images based on the codec is: H.264 > MJPEG or MPEG4

2.2 Using Dual Streams

If the CPU usage cannot be decreased efficiently or you cannot connect the desired number of IP cameras even after you change the codec, it is highly suggested to use the dual-stream function if available on your IP device.

The **GeoVision H.264-series cameras** feature dual streams, capable of delivering two video streams in a different resolution, codec and frame rate. **Using the dual streams, you can lower the resolution and codec for live images, but still get the best recording quality at megapixel resolution and the smallest file size compressed with H.264 codec. The GeoVision H.264-series cameras** give you the best of both worlds.



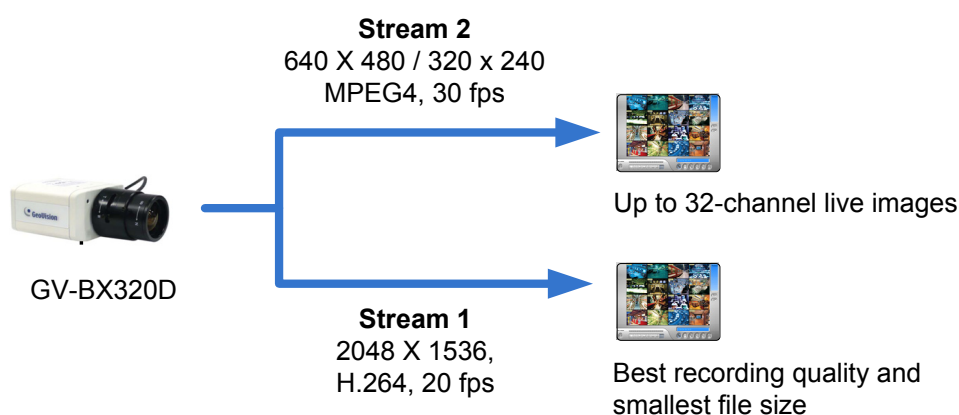
Here we take an example of GV-BX320D for dual streaming settings:

On GV-BX320D, you can configure the different settings on Stream 1 and Stream 2 to achieve the optimal live view and recording results.

- **Stream 1 (recording) settings:** Select 2048 x 1536 (3M) resolution for the best recording quality, and H.264 codec for the smallest file size.
- **Stream 2 (live view) settings:**

Select either 640 x 480 (VGA) or 320 x 240 (CIF) resolution depending on your CPU capacity. The higher resolution is selected, the higher CPU load is required.

Selecting either MPEG4 or MJPEG is depended on your network condition. The higher compression ratio a codec has, the less bandwidth it needs. MPEG4 has higher compression ratio than MJPEG. Therefore, it is recommended to select MPEG4 for network (Internet or LAN) applications.



Note: No matter which resolution or codec you select for the Stream 1 (recording), the recording settings have no effect on CPU usage. The CPU usage is only influenced by Stream 2 (live view) settings.



2.3 Decreasing Resolution and Frame Rate

If your IP device does not support the dual-stream function, or you want to keep the current codec setting, you may consider decreasing the image resolution or frame rate.

- **Resolution:** The higher the resolution, the better the image quality and thus the higher the CPU load. Decreasing the image resolution can lower the CPU load and increase the number of connected IP cameras.
- **Frame Rate:** The higher the frame rate, the smoother the live image and thus the higher the CPU load. Decreasing the frame rate can lower the CPU load and increase the number of connected IP cameras.



3. Hard Disk Limitations

The hard disk performance can greatly affect GV-System's performance. When the size of transmitted data is quite large and reach beyond the transfer rate of a hard disk, you may encounter the problems such as time gaps, frame dropping, high failure rate of a hard disk and etc. To avoid these problems and have the maximum performance out of GV-System, you should note the total recording frame rate that you can assign to a single hard disk, as listed below:

Frame rate limit in a single hard disk when connecting to analog cameras

Software Compression		
Video Resolution	MPEG4	
	NTSC	PAL
CIF	480 FPS	400 FPS
VGA/D1	240 FPS	200 FPS
Turbo VGA	416 FPS	400 FPS
Turbo D1	352 FPS	320 FPS
Note: The above data was determined using the default codec MPEG4 and hard disks with average R/W speed above 80MB/s.		

Hardware Compression		
Video Resolution	H.264	
	NTSC	PAL
D1	240 FPS	200 FPS
Note: The above data was determined using the default codec H.264 and hard disks with average R/W speed above 80MB/s.		



Frame rate limit in a single hard disk when connecting to IP cameras

Video Resolution	MJPEG		H.264		MPEG4	
	Frame Rate	Bit Rate	Frame Rate	Bit Rate	Frame Rate	Bit Rate
2560x1920 (5M)	30 FPS	102.26 Mbit/s	240 FPS	21.24 Mbit/s		
2560x600 (4M)	60 FPS	73.49 Mbit/s	240 FPS	15.28 Mbit/s		
2048x1536 (3M)	60 FPS	64.73 Mbit/s	480 FPS	10.52 Mbit/s		
1600x200 (2M)	120 FPS	41.16 Mbit/s	480 FPS	9.16 Mbit/s		
1280x1024 (1.3M)	200 FPS	30.3 Mbit/s	480 FPS	5.8 Mbit/s	480 FPS	6.5 Mbit/s
640x480 (VGA)	480 FPS	11.42 Mbit/s	640 FPS	2.54 Mbit/s	640 FPS	3.27 Mbit/s
320x240 (CIF)	480 FPS	5.16 Mbit/s	640 FPS	0.75 Mbit/s	640 FPS	1.03 Mbit/s
Note: The above data was determined using the bit rate listed above and hard disks with average R/W speed above 80MB/s.						

The frame rate limit is based on the resolution and codec of video sources. The higher video resolution you want, the lower frame rate you can assign to a single hard disk. In other words, **the higher frame rate you wish to record, the more hard disks you need to install on your system.**

In terms of codec, H.264 has much better compression ratio and much smaller file size than MJPEG and MPEG4. Therefore, the video streaming compressed with H.264 has much lower bit rate and thus allows more frame rate.

Note: It is strongly recommended to use two separate hard disks for installing Windows operating system and for storing recorded files.



Here we give you examples of different recording solutions:

- **For users of two (2) hardware compression GV-4008 Cards, only connecting analog cameras:**

If you want to have a total of 480 FPS and make a record at D1 resolution, you will need at least 3 hard disks for recording. The calculation and hard disk assignments are given below:

Spec. of two (2) GV-4008 Cards	480 FPS for total 16 channels at D1 with H.264
Frame rate limit for one hard disk	240 FPS at D1 with H.264
No. of hard disks required	2 hard disks (480 FPS / 240 FPS)
Hard disk assignments	1 st hard disk for Windows OS 2 nd hard disk for 1-8 channel recording 3 rd hard disk for 9-16 channel recording

- **For users of two (2) software compression GV-1480 Cards, only connecting analog cameras:**

If you want to have a total of 480 FPS and make a record at D1 resolution, you will need at least 3 hard disks for recording. The calculation and hard disk assignments are given below:

Spec. of two (2) GV-1480 Cards	480 FPS for total 32 channels at D1 with MPEG4
Frame rate limit for one hard disk	240 FPS at D1 with MPEG4
No. of hard disks required	2 hard disks (480 FPS / 240 FPS)
Hard disk assignments	1 st hard disk for Windows OS 2 nd hard disk for 1-16 channel recording 3 rd hard disk for 17-32 channel recording

- **For users of connecting IP cameras:**

If you want to connect 32 units of GV-BX110D and make a record at 1.3 megapixel resolution, you will need at least 2 hard disks for recording. The calculation and hard disk assignments are given below:

Spec. of GV-BX110D	15 FPS at 1.3M with H.264
Frame rate limit for one hard disk	480 FPS at 1.3M with H.264
No. of hard disks required	1 hard disk [(15 FPS x 32 units) / 480 FPS]
Hard disk assignments	1 st hard disk for Windows OS 2 nd hard disk for 1-32 channel recording



- **For users of two (2) hardware compression GV-4008 Cards, connecting with a mix of analog and IP cameras:**

If you want to record 16 analog cameras at D1 resolution and connect 16 units of GV-BX110D, you will need at least 4 hard disks for recording. The calculation and hard disk assignments are given below:

Spec. of two (2) GV-4008 Cards	480 FPS for total 16 channels at D1 with H.264
Spec. of 16 units of GV-BX110D	240 FPS for total 16 units (15 FPS x 16), at 1.3M with H.264
Frame rate limit for one hard disk	240 FPS at D1 with H.264, and 480 FPS at 1.3M with H.264
No. of hard disks required	3 hard disks (480 FPS / 240 FPS + 240 FPS / 480 FPS)
Hard disk assignments	1 st hard disk for Windows OS 2 nd hard disk for 1-8 channel recording 3 rd hard disk for 9-16 channel recording 4 th hard disk for 17-32 channel recording



4. Test Environment

PC specifications used for the test	
Test Computer 1	
OS	64-bit Windows 7
Motherboard	Micro star P55-GD65 (MS-7583)
CPU	Core i7 860 2.8GHz
Chipset	i7 860 2.8GHz
RAM	DDR3 2GB x 2
S/W version	GV-System V8.4.0.0
Test Computer 2	
OS	64-bit Windows 7
Motherboard	Intel Bearlake
CPU	Core 2 Quad Q9400 2.66GHz
Chipset	Intel Q35
RAM	DDR2 2GB x 2
S/W version	GV-System V8.4.0.0

Bitrate applied for the test of total frame rate and Windows memory limit			
	H.264	MJPEG	MPEG4
2560 x 1920 (5M)	21.24 Mbit/s	102.26 Mbit/s	-
2560 x 1600 (4M)	15.28 Mbit/s	73.49 Mbit/s	-
2048 x 1536 (3M)	10.52 Mbit/s	64.73 Mbit/s	-
1600 x 1200 (2M)	9.16 Mbit/s	41.16 Mbit/s	-
1280 x 1024 (1.3M)	5.8 Mbit/s	30.3 Mbit/s	6.5 Mbit/s
640 x 480 (VGA)	2.54 Mbit/s	11.42 Mbit/s	3.27 Mbit/s
320 x 240 (CIF)	0.75 Mbit/s	5.16 Mbit/s	1.03 Mbit/s

Types of hard disk used for the test of hard disk limit
Seagate SV35.3 Series (SATA 2), 32 MB cache http://www.seagate.com/www/en-us/products/servers/sv35_series/sv35.3/
WD 500AACS (SATA 2), 16 MB cache http://www.wdc.com/en/products/products.asp?driveid=338