IP Device Integration Notes

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Applied to

GV-System version 8.5.8

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.

Summary

The document consists of three sections:

1. The total frame rate GV-System can support based on different CPU types, codec and resolutions
2. Workarounds to increase total frame rates supported by GV-System
3. The total frame rate supported by a single hard disk

1. Total Frame Rate Supported

The tables below show the total frame rates GV-System can support with CPU usage under approximately 70% to ensure performance and stability. The test results vary according to the CPU types (Core i7, Core i5 and Core i3), the resolution and compression method (codec) set on the connected IP camera.

Also shown in the table is the number of full-frame channels GV-System can support. Note that the maximum number of frames per channel differs at different resolutions. Full-frame at 1.3 ~ 5 MP resolutions are defined as follows:

- 1.3 MP: 30 fps per channel
- 2 MP: 30 fps per channel
- 3 MP: 20 fps per channel
- 4 MP: 15 fps per channel
- 5 MP: 10 fps per channel

[Table 1: Dual Streams with CPU Decoding]

When IP devices are set to **dual streams**, the total frame rate supported is increased because you can select lower resolution for live view and set the other stream to high quality video for recording. CPU usage is affected by live view decoding not recording.

[Table 2 and 3: Single Stream with CPU Decoding and GPU Decoding]

If your IP device does not support dual streams, refer to tables 2 and 3 for test results of single stream with CPU and GPU decoding. A higher total frame rate can be achieved if your CPU supports **GPU decoding**.

For Single Stream with GPU Decoding, data of 64-bit and 32-bit OS is listed. When using 32-bit OS, the total frame rate supported is reduced due to limited memory capacity. Note that GPU decoding only supports H.264 codec and that different chipsets have different resolution limitations:

- **Intel Sandy Bridge Chipsets** only support GPU decoding of 1.3 MP to 2 MP videos
- **Intel Ivy Bridge and Haswell Chipsets** support GPU decoding of 1.3 MP to 5 MP videos

Note: The test results below were obtained using a panel resolution of 1920 x 1080 and 32-channel screen divisions. The results may vary based on various factors, including actual environment and bitrates.

Table 1: Dual Streams with CPU Decoding

CPU	Resolution	Codec	Total FPS Supported	Full-Frame Channels Supported	CPU Usage (%)	Virtual Memory Usage (MB)
Core i7 4770	1.3 MP (1280 x 1024)	H.264	960	32 ch	17	2348
		MJPEG	960	32 ch	29	2333
	2 MP (1920 x 1080)	H.264	960	32 ch	29	2252
		MJPEG	960	32 ch	43	2349
	3 MP (2048 x 1536)	H.264	640	32 ch	18	2341
		MJPEG	640	32 ch	23	2377
	5 MP (2560 x 1920)	H.264	320	32 ch	11	2377
		MJPEG	320	32 ch	14	2363
Core i5 4670	1.3 MP (1280 x 1024)	H.264	960	32 ch	32	2454
		MJPEG	960	32 ch	47	2373
	2 MP (1920 x 1080)	H.264	960	32 ch	43	2492
		MJPEG	960	32 ch	68	2447
	3 MP (2048 x 1536)	H.264	640	32 ch	20	2434
		MJPEG	640	32 ch	41	2302
	5 MP (2560 x 1920)	H.264	320	32 ch	15	2340
		MJPEG	320	32 ch	32	2392
Core i3 3225	1.3 MP (1280 x 1024)	H.264	960	32 ch	50	2321
		MJPEG	930	31 ch	71	2396
	2 MP (1920 x 1080)	H.264	960	32 ch	70	2412
		MJPEG	600	20 ch	71	2275
	3 MP (2048 x 1536)	H.264	640	32 ch	37	2347
		MJPEG	640	32 ch	74	2362
	5 MP (2560 x 1920)	H.264	320	32 ch	21	2395
		MJPEG	320	32 ch	44	2465

Table 2: Single Stream with CPU Decoding

CPU	Resolution	Codec	Total FPS Supported	Full-Frame Channels Supported	CPU Usage (%)	Virtual Memory Usage (MB)
Core i7 4770	1.3 MP (1280 x 1024)	H.264	420	14 ch	69	1872
		MJPEG	870	29 ch	70	2081
	2 MP (1920 x 1080)	H.264	270	9 ch	72	1741
		MJPEG	510	17 ch	71	1868
	3 MP (2048 x 1536)	H.264	200	10 ch	73	1971
		MJPEG	400	20 ch	70	1938
	4 MP (2048 x 1944)	H.264	165	11 ch	73	1978
		MJPEG	315	21 ch	68	2143
	5 MP (2560 x 1920)	H.264	180	18 ch	73	2603
		MJPEG	320	32 ch	73	2550
Core i5 4670	1.3 MP (1280 x 1024)	H.264	360	12 ch	67	1629
		MJPEG	570	19 ch	71	1787
	2 MP (1920 x 1080)	H.264	210	7 ch	68	1526
		MJPEG	390	13 ch	70	1613
	3 MP (2048 x 1536)	H.264	160	8 ch	70	1694
		MJPEG	300	15 ch	72	1739
	4 MP (2048 x 1944)	H.264	135	9 ch	73	1832
		MJPEG	195	13 ch	67	1719
	5 MP (2560 x 1920)	H.264	140	14 ch	71	2163
		MJPEG	180	18 ch	70	1957
Core i3 3225	1.3 MP (1280 x 1024)	H.264	210	7 ch	75	1508
		MJPEG	300	10 ch	73	1606
	2 MP (1920 x 1080)	H.264	120	4 ch	61	1462
		MJPEG	240	8 ch	70	1488
	3 MP (2048 x 1536)	H.264	80	4 ch	55	1528
		MJPEG	180	9 ch	64	1506
	4 MP (2048 x 1944)	H.264	75	5 ch	74	1573
		MJPEG	135	9 ch	73	1600
	5 MP (2560 x 1920)	H.264	90	9 ch	75	1906
		MJPEG	130	13 ch	73	1793

Table 3: Single Stream with GPU Decoding

CPU	Resolution	Codec	Total FPS Supported	Full-Frame Channels Supported	CPU Usage (%)	Virtual Memory Usage (MB)
64-Bit						
Core i7 4770	1.3 MP (1280 x 1024)	H.264	960	32 ch	22	6532
	2 MP (1920 x 1080)		720	24 ch	23	6628
	3 MP (2048 x 1536)		500	25 ch	23	8733
	4 MP (2048 x 1944)		390	26 ch	22	10051
	5 MP (2560 x 1920)		320	32 ch	55	10346
Core i5 4670	1.3 MP (1280 x 1024)		960	32 ch	55	6180
	2 MP (1920 x 1080)		660	22 ch	45	5702
	3 MP (2048 x 1536)		500	25 ch	45	8300
	4 MP (2048 x 1944)		360	24 ch	39	8972
	5 MP (2560 x 1920)		320	32 ch	66	11097
Core i3 3225	1.3 MP (1280 x 1024)		870	29 ch	65	6117
	2 MP (1920 x 1080)		600	20 ch	65	5999
	3 MP (2048 x 1536)		280	14 ch	26	5939
	4 MP (2048 x 1944)		180	12 ch	17	5863
	5 MP (2560 x 1920)		160	16 ch	17	8255
32-Bit						
Core i7 4770	1.3 MP (1280 x 1024)	H.264	960	32 ch	30	6015
	2 MP (1920 x 1080)		660	22 ch	26	5895
	3 MP (2048 x 1536)		320	16 ch	13	5786
	4 MP (2048 x 1944)		270	18 ch	26	6633
	5 MP (2560 x 1920)		250	25 ch	60	6491
Core i5 4670	1.3 MP (1280 x 1024)		750	25 ch	58	4256
	2 MP (1920 x 1080)		420	14 ch	25	4059
	3 MP (2048 x 1536)		240	12 ch	15	4567
	4 MP (2048 x 1944)		195	13 ch	15	5347
	5 MP (2560 x 1920)		200	20 ch	65	5442
Core i3 3225	1.3 MP (1280 x 1024)		330	11 ch	20	3015
	2 MP (1920 x 1080)		180	6 ch	11	2602
	3 MP (2048 x 1536)		100	5 ch	8	2890
	4 MP (2048 x 1944)		75	5 ch	8	3115
	5 MP (2560 x 1920)		120	12 ch	58	4224

1.1 Test Environment

The total frame rate and number of full-frame channels supported based on CPU usage were obtained using the following bitrate and test PC.

Bitrate used for the test		
	H.264	MJPEG
5 MP (2560 x 1920)	8.98 Mbit/s	30.48 Mbit/s
4 MP (2048 x 1944)	10.84 Mbit/s	41.50 Mbit/s
3 MP (2048 x 1536)	10.07 Mbit/s	38.73 Mbit/s
2 MP (1920 x 1080)	12.93 Mbit/s	44.96 Mbit/s
1.3 MP (1280 x 1024)	6.31 Mbit/s	32.36 Mbit/s

PC specifications used for the test	
Test Computer 1	
OS	32-bit and 64-bit Windows 8
Motherboard	Asus Z87-A
CPU	Intel Core i7 4770
Chipset	Intel Z87
RAM	DDR3 1333 2 GB x 2
VGA	Intel HD4600
S/W version	GV-System V8.5.8
Test Computer 2	
OS	32-bit and 64-bit Windows 8
Motherboard	Gigabyte GA-Z87X-D3H
CPU	Intel Core i5 4670
Chipset	Intel Z87
RAM	DDR3 1333 2 GB x 2
VGA	Intel HD4600
S/W version	GV-System V8.5.8
Test Computer 3	
OS	32-bit and 64-bit Windows 8
Motherboard	Asus P8B75-V
CPU	Intel Core i3 3225
Chipset	Intel B75
RAM	DDR3 1333 2 GB x 2
S/W version	GV-System V8.5.8

2. Workarounds to Increase Total Frame Rates

If your CPU capacity is lower than **Core i7**, **Core i5** or **Core i3** but wish to reach high frame rates, you can use dual streams or sacrifice the resolution as a workaround.

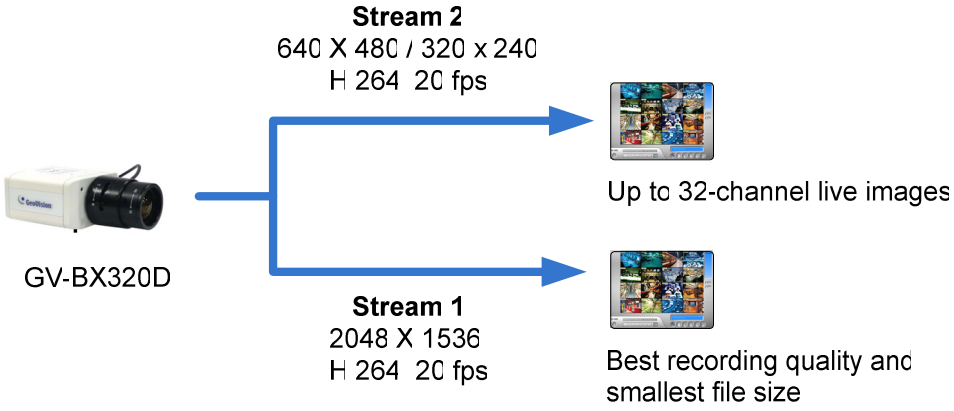
2.1 Using Dual Streams

If you are unable to reach the desired frame rate, 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 different resolution, codec and frame rate. Using dual streams, you can lower the resolution and codec for live images, but set the recording stream to mega pixel resolution for high quality recording and to H.264 codec for small file size.

Here we use GV-BX320D as an example. You can set Stream 1 and Stream 2 to different resolution.

- **Stream 1 (recording) settings:** Select 2048 x 1536 (3 MP) resolution for the best recording quality, and select 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. Higher resolution requires more CPU resource.



2.2 Decreasing Resolution

If your IP device does not support the dual-stream function, you may consider decreasing the image resolution. Decreasing the image resolution can reduce CPU usage and allows the GV-System to achieve higher frame rates.

3. Hard Disk Limitations

The hard disk performance can greatly affect GV-System's performance. When the size of transmitted data is large and exceeds the transfer rate of a hard disk, you may encounter 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	960 FPS	800 FPS
VGA/D1	480 FPS	400 FPS
Turbo VGA	416 FPS	400 FPS
Turbo D1	352 FPS	320 FPS

Note:

1. The above data was determined using the default codec MPEG4 and hard disks with average R/W speed above 110 MB/s.
2. The data for Turbo VGA and Turbo D1 was determined using GV-1480A Card.

Hardware Compression		
Video Resolution	**H.264**	
	NTSC	**PAL**
D1	480 FPS	400 FPS

Note: The above data was determined using the default codec H.264, default quality level Q3 and hard disks with average R/W speed above 110 MB/s.

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

Video resolution	H.264		MJPEG	
	Frame Rate	Bitrate	Frame Rate	Bitrate
5 MP (2560 x 1920)	220 FPS	8.5 Mbit/s	80 FPS	30.4 Mbit/s
4 MP (2048 x 1944)	330 FPS	10.4 Mbit/s	105 FPS	40.53 Mbit/s
3 MP (2048 x 1536)	440 FPS	9.83 Mbit/s	140 FPS	38.67 Mbit/s
2 MP (1920 x 1080)	660 FPS	12.59 Mbit/s	210 FPS	44.93 Mbit/s
1.3 MP (1280 x 1024)	660 FPS	6.16 Mbit/s	300 FPS	32.26 Mbit/s
Note: The data above was determined using the bitrate listed above and hard disks with average R/W speed above 110 MB/s.				

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

Hardware Compression		
Video Resolution	H.264	
	NTSC	PAL
1080p	360 FPS	300 FPS
1080i	360 FPS	300 FPS
720p	720 FPS	600 FPS
Note: The above data was determined using the default codec H.264, default quality level Q3 and hard disks with average R/W speed above 110 MB/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. Therefore, the video streaming compressed with H.264 has much lower bitrate 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 are some examples of different recording solutions:

- **Using 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 2 hard disks. 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	480 FPS at D1 with H.264
No. of hard disks required	1 hard disk (480 FPS / 480 FPS)
Hard disk assignments	1st hard disk for Windows OS 2nd hard disk for 1-16 channel recording

- **Using 2 software compression GV-1480A 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 2 hard disks. The calculation and hard disk assignments are given below:

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

- **Connecting IP cameras only:**

  If you want to connect 32 units of GV-BX520D and record at 5 megapixel resolution, you will need at least 3 hard disks. The calculation and hard disk assignments are given below:

Spec. of GV-BX520D	10 FPS at 5 MP with H.264
Frame rate limit for one hard disk	220 FPS at 5 MP with H.264
No. of hard disks required	2 hard disks [(10 FPS x 32 units) / 220 FPS)]
Hard disk assignments	1st hard disk for Windows OS 2nd hard disk for channel 1-16 recording 3rd hard disk for channel 17-32 recording

- **Using 2 hardware compression GV-4008 Cards, connecting 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 3 hard disks. 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	480 FPS for total 16 units (30 FPS x 16), at 1.3 MP with H.264
Frame rate limit for one hard disk	480 FPS at D1 with H.264, and 660 FPS at 1.3 MP with H.264
No. of hard disks required	2 hard disks (480 FPS / 480 FPS + 480 FPS / 660 FPS)
Hard disk assignments	1st hard disk for Windows OS 2nd hard disk for 1-16 channel recording 3rd hard disk for 17-32 channel recording

3.1 Test Environment for Hard Disk Limitations

The Hard Disk Limitations were obtained using the following bitrate and hard disks.

Bitrate used for the test of hard disk limit		
	H.264	MJPEG
5 MP (2560 x 1920)	8.5 Mbit/s	30.4 Mbit/s
4 MP (2048 x 1944)	10.4 Mbit/s	40.53 Mbit/s
3 MP (2048 x 1536)	9.83 Mbit/s	38.67 Mbit/s
2 MP (1920 x 1080)	12.59 Mbit/s	44.93 Mbit/s
1.3 MP (1280 x 1024)	6.16 Mbit/s	32.26 Mbit/s

Type of hard disk used for the test of hard disk limit
WD Caviar Black, WD1002FAEX (SATA 6 GB/s), 64 MB cache For details, see http://wdc.com/global/products/specs/?driveID=792&language=1