



Control Center 17.2 Performance Reference Guide

This guide provides information about the Control Center 17.2 components that may be useful when planning a system.

Control Center front-end application

This section provides guidance regarding configuration and performance of the Control Center front-end application. Guideline figures are provided for specific workstations. The actual performance achieved on a workstation, or PC, depends on a number of factors, such as:

- The actual processor type used.
- Use/availability of GPU hardware acceleration.
- PC configuration.
- De-interlacing settings.
- Stream configuration.
- Type of motion captured.

Performance test configuration

To test the Control Center front-end application, the following workstations were used:

- High-end. See "High-end PC" on the next page.
- Mid-range. See "Mid-range PC" on the next page.
- Low-end. See "Low-end PC" on the next page.

The workstation configuration in Table 1 was used when measuring performance.

Table 1 Workstation configuration

Control Center	17.2
Video windows per physical monitor	1
Hyperthreading	Enabled
Enhanced Intel SpeedStep Technology (EIST)	Enabled
Intel Speed Shift Technology (SST)	Enabled
Windows power option	High performance
Minimum processor state	100%
Maximum processor state	100%

- High-end PC**
 - Dell Precision 3640
 - Intel Core i9-10900K @ 4.77GHz CPU 32GB (4x8GB) 3200MHz RAM
 - Integrated Intel UHD 630 GPU with Intel Quick Sync Video:
 - 2 HD monitors (2x Display Port)
 - Driver version 27.21.14.6155
 - NVIDIA Quadro RTX 4000 8GB Graphics Card with dual NVDEC:
 - 4 HD monitors (3x Display Port, 1x USB-C)
 - Driver version 27.21.14.6155
 - Gigabit Ethernet 1000Base-T
 - Windows 10 IoT (LTSC), 64-bit
- Mid-range PC**
 - Dell Precision 3640
 - Intel Core i7-10700K @ 3.90GHz CPU 16GB (2x8GB) 3200MHz RAM
 - Integrated Intel UHD 630 GPU with Intel Quick Sync Video:
 - 2 HD monitors (2x Display Port)
 - Driver version 27.20.100.8935
 - NVIDIA GeForce RTX 3060 Ti 8GB Graphics Card with single NVDEC:
 - 3 HD monitors (3x Display Port)
 - Driver version 27.21.14.6137
 - Gigabit Ethernet 1000Base-T
 - Windows 10 IoT (LTSC), 64-bit
- Low-end PC**
 - Dell OptiPlex 7080
 - Intel Core i5-10600T @ 2.40GHz CPU 8GB (1x8GB) 3200MHz RAM
 - Integrated Intel UHD 630 GPU with Intel Quick Sync Video:
 - 2 HD monitors (2x Display Port)
 - Driver version 27.20.100.9510
 - Gigabit Ethernet 1000Base-T
 - Windows 10 IoT (LTSC), 64-bit

Workstation performance This section provides guideline workstation performance figures for when hardware acceleration is enabled or disabled in the Control Center front-end application.

Notice *The performance numbers represent the capabilities of different Control Center functionalities tested independently.*

Combining functionality, such as multiple GPUs, is possible, but overall system performance is not a simple summation of the columns below. Video decoded on a specific GPU must also be rendered to a display connected to that GPU.

These numbers can be used to guide optimum setup based on the intended usage and priorities of the customer.

High-end PC The guideline performance figures for the high-end PC with hardware acceleration enabled and disabled in the Control Center front-end application are given in Table 2.

Table 2 Hardware acceleration guideline performance

Resolution	Codec	Bitrate (Mbps)	FPS	Hardware acceleration enabled				Hardware acceleration disabled	
				Live (NVIDIA ¹)	Live (QuickSync ¹)	Playback ² (1x) (NVIDIA)	Playback ² (1x) (QuickSync)	Live ³	Playback ² (1x)
1080p	H.264	4	30	54	35	25	25	26	16
1080p	H.265	4	30	72	29	25	25	24	15
4MP	H.264	4	30	40	22	25	18	16	9
4K	H.264	8	30	15	9	12	8	7	4
4000*3000	H.264	12	15	20	10	17	9	8	7
4000*3000	H.265	12	15	25	9	21	11	6	4

¹ These numbers include some CPU-decoded streams, where a load-balancing algorithm aims to prevent the GPU decode resources from being overextended.

² Unsynchronized.

³ For testing performance without hardware acceleration enabled, all displays were connected to NVIDIA GPU

Mid-range PC The guideline performance figures for the high-end PC with hardware acceleration enabled and disabled in the Control Center front-end application are given in Table 3.

Table 3 Hardware acceleration guideline performance

Resolution	Codec	Bitrate (Mbps)	FPS	Hardware acceleration enabled				Hardware acceleration disabled	
				Live (NVIDIA ¹)	Live (QuickSync ¹)	Playback ² (1x) (NVIDIA)	Playback ² (1x) (QuickSync)	Live ³	Playback ² (1x)
1080p	H.264	4	30	34	25	24	25	24	16
1080p	H.265	4	30	34	23	25	25	22	14
4MP	H.264	4	30	23	15	14	17	14	9
4K	H.264	8	30	11	6	6	7	6	4
4000*3000	H.264	12	15	11	10	8	8	6	6
4000*3000	H.265	12	15	14	9	14	8	4	3

¹ These numbers include some CPU-decoded streams, where a load-balancing algorithm aims to prevent the GPU decode resources from being overextended.

² Unsynchronized.

³ For testing performance without hardware acceleration enabled, all displays were connected to NVIDIA GPU

Low-end PC The guideline performance figures for the high-end PC with hardware acceleration enabled and disabled in the Control Center front-end application are given in Table 4.

Table 4 Hardware acceleration guideline performance

				Hardware acceleration enabled		Hardware acceleration disabled	
Resolution	Codec	Bitrate (Mbps)	FPS	Live (QuickSync ¹)	Playback ² (1x) (QuickSync)	Live	Playback ² (1x)
1080p	H.264	4	30	20	20	6	5
1080p	H.265	4	30	18	20	5	5
4MP	H.264	4	30	11	13	3	3
4K	H.264	8	30	5	5	1	1
4000*3000	H.264	12	15	7	5	2	2
4000*3000	H.265	12	15	7	5	2	1

¹ These numbers include some CPU-decoded streams, where a load-balancing algorithm aims to prevent the GPU decode resources from being overextended.

² Unsynchronized.

General performance advice

There are a number of other general considerations regarding performance that can apply in some circumstances. These can be applied to get the best performance when running the Control Center front-end application.



Warning

Consult your PC manufacturer about running a PC at high or maximum CPU settings for extended periods of time.

Hyperthreading

Make sure that CPU hyperthreading is enabled when available. Enabling hyperthreading doubles the number of virtual cores, or logical processors, compared to the number of physical cores.

Go to **Task Manager > More details > Performance > CPU** to check the number of cores and logical processors that are available.

CPU clock frequency

Enhanced Intel SpeedStep Technology (EIST) and Intel Speed Shift Technology (SST) should be enabled from the BIOS for the Intel processors. This allows an Intel CPU to dynamically control the CPU clock and adjust power consumption based on usage. This allows the CPU to boost to its highest clock frequency, which can be more than the advertised CPU frequency.

Power options

The Windows power plan should be set to **High Performance**. Minimum and maximum processor states can be set to 100% for maximum performance.

Go to **Control Panel > Edit Power Plan > Change advanced power settings for power options**. These settings can allow the Intel processor to run at the maximum CPU boost frequency all the time.

Graphics card (GPU)

Intel Quick Sync Video technology is available for hardware accelerated GPU video decoding on some Intel processors. This technology can be used when hardware acceleration is enabled in the Control Center front-end application.

NVIDIA NVDEC technology, when available, can also be used for hardware acceleration on NVIDIA graphics cards. A minimum of 8GB of GDDR6 GPU memory with more than 50GB/s memory bandwidth is generally recommended.

It is not recommended to modify settings, including clock frequencies, on the GPU.



Warning

Consult your Intel processor and NVIDIA graphics card documentation to check whether hardware acceleration is available for your PC. There is currently no support for other GPU manufacturers, such as AMD, with Control Center.

Hardware acceleration support and performance varies from GPU to GPU.

Monitors

One or more monitors capable of 1280x1024 resolution or above are recommended. Features such as NVLINK and GPU Direct are not supported.

Notice

For hardware acceleration, monitors should be connected to graphics cards that support hardware acceleration. Video on a particular monitor will only be accelerated by the graphics card to which it is connected.

Non-Uniform Memory Access (NUMA)

Disable Non-Uniform Memory Access (NUMA) to get the full performance from a multi-processor PC.

The NUMA option can typically be disabled in the BIOS settings. If this option does not appear in the BIOS settings, then it is disabled by default.

When NUMA is disabled, the memory is configured into a single block that is interleaved between the available processors instead of allocated in blocks for each processor. Leaving this option enabled can, in some circumstances, decrease performance by 30-40%.

De-interlacing

If you use the deinterlacing filter in “Best image quality” mode, there is a 20-30% increase in CPU usage for a typical scene. Therefore, you will require a higher specification CPU to achieve the same number of video streams.

Notice

De-interlacing is currently only available when GPU hardware acceleration is disabled.

Monitor refresh rates

For optimal performance you should always set the refresh rate of your PC monitor to match an integer multiple of the video rate. Matching monitor refresh rate to video frame rate improves smoothness of the video. This is especially important for applications such as traffic monitoring. If the refresh rate does not match the video frame rate you may observe less than smooth video.

The smooth de-interlacer feature introduced in Control Center 4.3 doubles the effective video frame rate for 4SIF interlaced video. In order to achieve this the following conditions must be met:

- Video encoding resolution must be full frame rate 4SIF or D1 (704x480@30fps / 704x576@25fps or 720x480@30fps / 720x576@25fps)
- Video source (camera) must be interlaced
- Video source (camera) must have the correct field ordering. If this condition is not met the video will look very jerky. The correct field ordering is:
 - PAL: Top-field first, bottom-field second
 - NTSC: Bottom-field first, top-field second

When using smooth de-interlacing, the PC monitor refresh rate should match the effective video frame rate. For example, for a 25fps 4SIF stream you should use a refresh rate that is a multiple of 50Hz.

An example monitor refresh rate is given in Table 5.

Table 5 Example monitor refresh rate

Video (fps)	Refresh rate (Hz)	Notes
25	50/75/100..	PAL regions
30	60/90/120..	NTSC regions
25	50/100..	50 fields per second with CC smooth de-interlacer
30	60/120..	60 fields per seconds with CC smooth de-interlacer

Stream frame rates

If the framerate is dropped, more streams can be used. However, halving the framerate does not double the number of streams, it may only give a slight increase.

Site database

There are two configuration options for the site database:

- Unsegmented Site Database - all site information is stored in a single database. This option is suited to smaller sites.
- Segmented Site Database - information for each sub-site is stored in separate segments of the site databases (max. 250). This option is suited to large sites with multiple administrators who are responsible for different sub-sites.

NVR-AS

This section provides information about the IndigoVision Windows Network Video Recorder / Alarm Server (NVR-AS).

Recordings

Recorded footage is stored in the video library directory.

- Maximum number of recording files per NVR-AS: 1,000,000

If this number is exceeded, the NVR-AS deletes the oldest unprotected footage to create more storage space.

Alarms

Detectors and zones are stored on the Alarm Server, as well as the records of alarms and detector activations.

- Total number of detectors per Alarm Server: 10,000
- Total number of 3rd party camera motion detectors per Alarm Server: 5000
- Total alarms (zones) that can be active in one instance of Control Center: 10,000
- Total number of email actions per Alarm Server: 20,000
- Total number of actions (including email actions) per Alarm Server: 50,000
- Detector activations per second: 5
- Total historical alarms stored on the Alarm Server: 500,000

Integrated data

External data source and data records are also stored on the Alarm Server.

- Total number of external data sources per Alarm Server: 10,000
- Data records per second: 1
- Total data records stored on the Alarm Server:
 - NVR-AS 3000: 250,000 records with an average size of 50 bytes
 - NVR-AS 4000: 3 million records with an average size of 50 bytes

If the average record size increases, the total number of records will decrease.

- Maximum data record length: 160 characters

Redundancy limits

An NVR-AS can only act as a failover for a maximum of 15 other NVRs.

Digital signatures

The NVR-AS can embed digital signatures in every recording file allowing the authenticity and integrity of that footage to be verified at any point in the future.



However, digital signing of footage has an impact on performance. Enabling this feature will increase CPU usage.

For systems specified to use Intel Xeon E3 or newer processors, digital signatures can be enabled without affecting system performance.

For existing systems with older processors, the current CPU usage must be evaluated before using digital signatures. Enabling digital signatures approximately doubles CPU usage. For reliable system operation, the total system CPU usage should be less than 70%. This means that digital signatures should not be enabled if the NVR-AS averages more than 35% CPU in normal operating conditions.

Camera Gateway™

This section provides guidance for specifying a system for use with Camera Gateway.

System specifications

The IndigoVision Camera Gateway can be installed on one of the following Windows operating systems:

- MS Windows 10 (64-bit)
- MS Windows Server 2012
- MS Windows Server 2012 R2
- MS Windows Server 2016

For systems with more than 16 streams it is recommended to use Windows Server 2016.

IndigoVision recommends that you install Camera Gateway on a server-style system, with a server network adaptor, and the following minimum requirements:

- Server class PC
- Current generation Intel Xeon processor
- 4GB RAM
- At least 5GB of disk space

IndigoVision recommends that for Camera Gateway installations on VMWare the minimum specification is:

- 4 vCPUs
- 4GB RAM
- VMXNET3 network adapter

For improved performance, configure the VMXNET3 network adapter with the following settings:

- **Receive Side Scaling:** Enabled
- **Tx Ring Size:** 4096
- **Rx Ring #1 Size:** 4096
- **Rx Ring #2 Size:** 4096

Performance

The Camera Gateway can achieve the following with appropriate hardware, such as a NVR-AS 4000:

- Maximum incoming bandwidth (cameras to Camera Gateway): 150Mbps
- Maximum outgoing bandwidth (Camera Gateway to other Control Center application): 450Mbps
- Maximum number of cameras: 100 cameras
- Maximum number of motion detectors configured to monitor cameras on the Camera Gateway: 100

Video Stream Manager

This section provides guidance for specifying a system for use with the IndigoVision Video Stream Manager (VSM) software.

IndigoVision recommends you install the VSM on a system with the following specifications:

- Intel Xeon E5-2620 v3
- 16GB RAM (4 x 4GB)
- Intel X520 10Gb Ethernet adapter
- Windows Server 2012 R2

Performance The VSM can achieve the performance details given in Table 6. when using the recommended system specification:

Table 6 Performance details

	RTSP cameras
Maximum number of cameras	1000
Maximum simultaneous live views and recordings from a single managed camera	10 unicast, unlimited multicast
Maximum incoming bandwidth	1.6 Gbps
Maximum outgoing bandwidth	7.2 Gbps

FrontLine

FrontLine recordings are temporarily stored in the FrontLine Manager footage directory before being moved to the NVR-AS video library.

The FrontLine import times are given in Table 7.

Table 7 FrontLine import time

Video Type	Time to import 1 hour of footage from 1 camera	Time to import 1 hour of footage from 7 cameras (1 full dock)
Normal Resolution	3 minutes	7 minutes
High Resolution	6 minutes	12 minutes

The FrontLine Manager footage directory default location is on the system drive and is limited to 10GB. This amount of temporary storage space is adequate when using a single FrontLine Camera. However, when using multiple FrontLine Cameras with the FrontLine Manager PC, the size of the FrontLine Manager footage directory must be increased according to the storage requirements given in Table 8.

Table 8 FrontLine storage requirements

Number of Cameras	Storage Required
1	10 GB
7 (1 full dock)	106 GB
14 (2 full docks)	218 GB
21 (3 full docks)	330 GB

For instructions on how to increase the size of the FrontLine Manager footage directory, refer to the IndigoVision FrontLine Administrators Guide.

Control Center Web

This section provides guidance for specifying a PC for use with Control Center Web and the Media Server. The actual performance achieved depends on a number of factors such as processor type, RAM, and type of motion captured.

All specifications for Control Center Web are for BX Range HD cameras such as the BX420, BX520 and BX620. Other cameras are expected to produce similar performance results.

System specifications

The following tables show the performance of Control Center Web and Media Server running on different PC specifications.

The Enterprise NVR-AS 4000 1U, Enterprise NVR-AS 4000 2U and Hybrid NVR Workstation are all IndigoVision products which can be used with Control Center Web.

For these devices, the performance of Control Center Web depends on the amount of video being processed by Control Center and the NVR-AS. For the purposes of this guide, the background load on the device is indicated in each table.

Table 9 Enterprise NVR-AS 4000 1U

PC Specification	Intel Xeon E3-1220 v5, 8GB RAM DDR4 Windows Server 2012 R2		
NVR-AS	Recording 50 streams, 4SIF, 30fps @ 1.2Mbps, total recording throughput @ 60Mbps		
Installation Type	Control Center Web and Media Server (Hyper-V)		
Resolution	Input Bitrate	Frame rate	Total Streams (Live)
1080p	4Mbps	30fps	4
1080p	2Mbps	15fps	8
4SIF	1Mbps	30fps	11

Table 10 Enterprise NVR-AS 4000 2U

PC Specification	Intel Xeon E5-2620 v3, 16GB RAM DDR4 Windows Server 2012 R2		
NVR-AS	Recording 100 streams, 4SIF, 30fps @ 2.5Mbps, Total recording throughput @ 250Mbps		
Installation Type	Control Center Web and Media Server (Hyper-V)		
Resolution	Input Bitrate	Frame rate	Total Streams (Live)
1080p	4Mbps	30fps	9
1080p	2Mbps	15fps	14
4SIF	1Mbps	30fps	20

Table 11 Integra View Mid (G2) Workstation

PC Specification	Intel® Core™ i7-8700, 16GB RAM DDR4, 1 x 256GB SSD (PCIe NVMe Class 40), AMD Radeon Pro WX2100 2GB Graphics Card Windows 10 IoT 64bit		
Control Center	6 live streams, 1080p, 30fps @ 4Mbps		
Installation Type	Control Center Web and Media Server (Hyper-V)		
Resolution	Input Bitrate	Frame rate	Total Streams (Live)
1080p	4Mbps	30fps	4
1080p	2Mbps	15fps	14
4SIF	1Mbps	30fps	6

Third party hardware You can also install Control Center Web on third party hardware not sold by IndigoVision.

The following tables demonstrate the performance on a typical server configuration using two different approaches:

- Control Center Web and the Media Server are both installed on the same server using Hyper-V for the Media Server.
- Media Server is installed directly onto the server, with no need for virtualisation.

In this scenario, Control Center Web is hosted on a separate PC, where it will have a negligible performance impact.

Table 12 High end 1U server running Media Server in Hyper-V

PC Specification	Intel Xeon E5-2620 v4, 16GB RAM DDR4 Windows Server 2012 R2		
Sample PC	Dell PowerEdge R430		
Installation Type	Control Center Web and Media Server (Hyper-V)		
Resolution	Input Bitrate	Frame rate	Total Streams (Live)
1080p	4Mbps	30fps	14
1080p	2Mbps	15fps	24
4SIF	1Mbps	30fps	40

Table 13 High end 1U server running Media Server directly

PC Specification	Intel Xeon E5-2620 v4, 16GB RAM DDR4		
Sample PC	Dell PowerEdge R430		
Installation Type	Media Server installed directly on PC, separate Control Center Web installation		
Resolution	Input Bitrate	Frame rate	Total Streams (Live)
1080p	4Mbps	30fps	18
1080p	2Mbps	15fps	30
4SIF	1Mbps	30fps	46